

Conceptual Tool-Development for the Associative Enquiry of National Legal Regulations and Corresponding EU Directives

DIPLOMARBEIT

zur Erlangung des akademischen Grades

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im Rahmen des Studiums

Business Informatics

eingereicht von

Markus Brandstötter

Matrikelnummer 0625091

an der
Fakultät für Informatik der Technischen Universität Wien

Betreuung
Betreuer/in: Thomas Grechenig
Mitwirkung: Bernhard Horn

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Markus Brandstötter

Registration Number 0625091

to the Faculty of Informatics
at the Vienna University of Technology

Advisor: Thomas Grechenig
Assistance: Bernhard Horn

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0625091

ausgeführt am

Institut für Rechnergestützte Automation

Forschungsgruppe Industrial Software

der Fakultät für Informatik der Technischen Universität Wien

Betreuung: Thomas Grechenig

Wien, 04.12.2012

Erklärung zur Verfassung der Arbeit

Markus Brandstötter
Stockerauer Straße 99
2100 Leobendorf

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Markus Brandstötter

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Kurzfassung

Das Ziel einer EU-Richtlinie ist die Harmonisierung des Europarechts. Zu diesem Zweck werden grundlegende Ziele festgelegt. Die nationalen Behörden haben bei der Umsetzung einen gewissen Spielrahmen bei der Ausgestaltung der Umsetzung. Ein Nachteil dieses legislativen Instruments ist, dass die Nachverfolgung der Umsetzung einer Richtlinie besonders in fremden Ländern nur erschwert möglich ist. Bestimmte Teile einer Richtlinie können auf unterschiedliche Weise umgesetzt werden. Ebenso kann ein Teil einer Richtlinie in verschiedenen Gesetzen implementiert sein. Ziel dieser Arbeit ist es daher, ein Konzept zur Realisierung einer Web-Applikation zur Nachverfolgung der Umsetzung von EU-Richtlinien im Kontext der Europäischen Union zu entwickeln.

Zu Beginn wurden Rahmenbedingungen und grundsätzliche Designentscheidungen analysiert. Beispielsweise geht es um die Frage, wie die 23 offiziellen Unionssprachen genutzt werden können, um eine größtmögliche Anzahl an Nutzern anzusprechen. Ebenso wurde evaluiert, wie die Daten gewartet und deren Aktualität gewährleistet werden kann. Ein Datenmodell, das die spezifischen Eigenheiten der verschiedenen Rechtssysteme kombiniert, wurde entwickelt. Die Dokumente werden dabei in einer Baumform dargestellt. Auf diese Weise können die Umsetzungen einer Richtlinie auf der jeweiligen Hierarchieebene des Dokuments gespeichert werden. Subparts als Knoten und Textparts als Blätter des Baums wurden als die zentralen Elemente eines Dokuments definiert.

Im nächsten Schritt wurden die Gesetzesdatenbanken der EU und von Österreich analysiert, um Anforderungen an eine EU-weite Rechtsdatenbank zu definieren. Dokumente müssen importiert und Umsetzungen von Richtlinien in nationale Gesetze festgelegt werden können. Geeignete Suchfunktionen für Dokumente und für Rechtstexte werden implementiert werden. Ebenso muss es ein Berechtigungskonzept geben, um sensible Daten vor unerlaubter Veränderung zu schützen. Aktualität und Richtigkeit der Daten ist ebenso ein wichtiger Faktor für die Akzeptanz der Applikation.

Basierend auf den gewonnenen Erkenntnissen wurde ein Prototyp entwickelt, um die Umsetzbarkeit zu demonstrieren. Ein entscheidender Teil dessen ist das Einlesen der Dokumente von bestehenden Rechtsdatenbanken. Für jede Datenbank wurde ein eigener Algorithmus entwickelt, um die Informationen zu extrahieren. Die Dokumente werden in der Baumform in eine XML-Datei und in der Datenbank abgespeichert. Die Web-Applikation wurde basierend auf den Anforderungen umgesetzt und abschließend auf Funktionalität und Performance getestet. Aufgrund der detaillierten Speicherung eines Dokuments stellte sich der Datenbankzugriff als Engpass heraus und kann speziell bei großen Dokumenten zu längeren Wartezeiten führen. Generell wurde gezeigt, dass unter Berücksichtigung diverser Rahmenbedingungen die Entwicklung einer EU-weiten Rechtsdatenbank machbar ist.

Keywords: *Rechtsdatenbanken, EU-Richtlinien, Umsetzung von Richtlinien, Web- Applikation, Softwareentwicklung, Web Data Extraction*

Abstract

The purpose of the directive as a legislative act adopted by the EU (European Union) is to harmonize the European law by setting basic objectives to be met. The national authorities have the possibility to adjust the law within a given scope.

One drawback of this legislative instrument is that no trivial traceability of implementations of directives exists. Certain aspects of such an act can be implemented differently in different member states of the EU. Furthermore, the implementation of one part of a directive may be spread over several national acts. Therefore, a concept for the realization of an (web) application enabling the traceability of directive implementations across the European Union is the central aim of this thesis.

At the beginning, boundary conditions and necessary basic decisions were evaluated. This includes issues like how the 23 official Union languages can be used to reach the biggest user community, how the content can be maintained and how up-to-dateness can be ensured.

One data model combining specific peculiarities of the different law systems was defined. The decision was to construct documents in a tree-based manner for enabling the representation of implementations at different hierarchical layers. For this purpose, subparts for tree nodes and textparts for leaves were identified as major document elements.

In a next step, legal databases of Austria and the EU were analyzed to define requirements a Europe-wide legal database has to fulfill. Documents have to be imported to the system and implementations of directives in national acts have to be defined. To offer a usable application, efficient search possibilities for document and text search need to be available. Additionally, an authentication concept has to be developed to restrict the access to sensitive data. Up-to-dateness and correctness of data is of major importance for the acceptance in the public.

Based on the gained information, a prototypical implementation as a proof-of-concept was developed. One central part of this prototype was the extraction of data from existing legal databases. For each law source, another algorithm was developed to gather information presented at the national institutions web pages. The extracted documents are stored in a tree-based format as XML-files and are stored in the database. A web application was implemented fulfilling the identified requirements. Afterwards a concise testing on functionality and performance identified high database resources needed due to the detailed data model as a bottleneck for the overall application performance.

Keywords: *Legal database, EU directives, Directive implementation, Web application, Software development, Web Data Extraction*

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1 Introduction

By means of the increasing globalization, the globally emerging markets and problems like the current financial crisis, the EU¹-wide tendency to a European legislation is recognizable. In order to approach occurring problems efficiently and to face critical developments, it is necessary to give a Europe-wide homogenous legal framework for the design and development of new acts. The main mechanisms of the European Union on that account are directives and regulations. Basic goal of the regulations and especially the directives is to harmonize the Europe-Wide legislation.

On the one hand, there are the regulations. These regulations are immediately enforceable in the addressed member countries and automatically become part of their national law. In this case, a given paragraph is to be seen as a part of the approached member country's legal system.

On the other hand, there are directives which provide a general framework for the enactment of an act and therefore are to be implemented by the national legislator. Each country develops so called "national execution measures" which fulfill the required results. The main problem in this context is that the countries are flexible within a given scope and therefore deviations with respect to the same act or paragraph in different member states arise.

1.1 Nature of the Problem

Over the years, the legislation of Austria and all other EU member states became more and more extensive and complex. In addition to the extension of existing paragraphs and the amendment of law, a new way of lawmaking arose in Austria due to the entry in the European Union in 1995. With this accession, the mechanisms of EU-Regulations and EU-Directives (besides others) were also included in the Austrian judicial system.

One major problem is that one directive, consisting of many articles and paragraphs can be implemented in many different national acts. One article of the directive can be part of e.g. the Consumer Protection Act while one paragraph of the same article may be implemented in the General Civil Code. This impedes the tracing. Furthermore, it occurs that directives are not implemented within the given timeframe.

These problems are especially hard for law experts as well as the citizens of EU-nations and Europe-wide operating enterprises. Owing to the increasing internationalization and the arising of the internet, people/enterprises often are faced with law orders of other

¹ European Union

member countries. If a person buys goods or services via an online shop that is situated in another European country, he has to deal with the laws of the specific country. For instance, as the EU-directive on the protection of consumers in respect of distance contracts (97/7/EC) does not give an exact period of time for the cancellation of a concluded agreement, this timeframe varies in various EU member states. In Germany, a cancellation can be done within 14 days² whereas in Austria, the cancellation can be done only within seven workdays³.

Beside the uncertainty that is generated in the population due to these differences, the effect of an international legislation and the success of the internal market are weakened.

One approach to encounter this problem is to enable transparency and to show the dependencies between national legislation and corresponding EU-Directives by developing a web-based tool that enables this illustration. It is especially important to enable the exploration of how and where a given (known) paragraph/article/clause is implemented in another member country.

This tool therefore should help citizens as well as legal experts and enterprise persons in charge in comparing and tracing directives/part of the directives as well as specific acts based on directives. Therefore clarity on the national execution measures in different countries is established.

1.2 Motivation

The scientific challenge of this thesis is to define a concept and develop a prototype for a tool able to represent the associations between EU-Directives and national law of different member states. A particular appealing aspect of the work is to find a common denominator for the large number of different countries and therefore large number of different law sources for the system. Furthermore, a way for integrating the sources and representing them in the tool has to be determined.

The topic of the thesis is situated somewhere at the interface between two fields always in motion: law and computer science. This constellation is very interesting but also challenging. Another especially interesting aspect of the thesis is the international context. The context and basic conditions for such a system have to be investigated. Additionally, a basic tool has to be developed as a proof of concept to explore the feasibility of such a project. By establishing this work, a base for a tool which potentially finds application in the whole European Union can be created.

² § 355 BGB

³ § 5e Abs. 2 KSchG

1.3 Objectives

The main target of this thesis is to develop a feasibility study, containing a conceptual analysis and a prototypical implementation of an application for the representation of national acts and corresponding EU-Directives (or parts of them) which enables the traceability of the implementation of directives.

Answered will be the question of the determination of correlation between European and different national legislations.

The central hypothesis is that through adequate techniques, existing laws, paragraphs and articles can be read and converted to electronically applicable data. This data can be used to establish the relatedness between (parts of) EU-Directives and (parts of) national acts. This is related with the assumptions that the directives and national acts displayed underlie a certain structure which can be read out by means of Web Data Extraction methods. This structure then can be transformed to a certain representation scheme that has to be developed. Furthermore it is assumed that the different schemes developed (one for the national law of the countries, one for the directives) can be associated. The hypothesis will be verified by the development of a tool implementing the given requirements and showing the desired functionality.

The basic conditions for such an application have to be explored. This implies the question if such a project may be supported by the European Union, how the data can be kept up-to-date and how data can be represented.

The focus of the work is on finding national law in different granularity (paragraphs, articles) and to investigate underlying paragraphs of EU-Directives. With this, in the sense of international traceability, a possibility to determine the wording of the implementation of the same paragraph of the directive in other countries is developed.

A comprehensive documentation of a software project for the prototype will be developed. On the basis of the developed recommendations, another research question, the specification and implementation, will be approached. A Java-Web-Application is developed which emphasizes the stated assumptions and decisions and, in further consequence, the central hypothesis stated in the beginning. The tool allows searching for a specific national paragraph and showing the relations to the underlying part of the EU-Directive as well as the implementation of this part in another member country. The user has the possibility to upload links or HTML-files containing the documents to the application. For the prototype, EU-Directives and the law of two countries (e.g. Austria and Germany) are used. All read-in documents can be selected and displayed. The user has the possibility to explore the implementation of the given paragraph in another country.

The complexity of these relations is given by the fact that one paragraph of an article of a directive may be implemented in different national acts as well as different layers (like paragraph/subparagraph/literal) of these acts.

1.4 Structure of the thesis

Chapter 2 deals with the theoretical background of the thesis. Basics and definitions on the European Union and eGovernment serve as a base for the context of the work.

Chapter 3 discusses the problems approached by this thesis as well as the methodologies used to encounter them.

The concept for developing a project to realize such a system is explored in Chapter 4. Basic assumptions are given and general conditions investigated.

In Chapter 5, the requirements for such an application are identified and existing systems are analyzed.

Chapter 6 covers the design of the prototypical software project including use cases and further design decisions.

Chapter 7 explains the implementation of the prototype. The software components and screenshots are described to give an overview on the developed application.

In Chapter 8, the prototype is tested and possible problems identified during testing are approached.

Subsequently, the most important findings are summarized and an outlook for the possible roll-out of such a system is given in Chapter 9.

2 Theoretical Background

This chapter deals with the basic theoretical aspects of the underlying thesis. Therefore, the context of the European legislation is described. Beginning with the history and evolution of the European Union, the structure of the EU and the basics of the European law are explained. Besides the policy interests, the legal sources and the EU means of action are evaluated. To conclude the chapter, e-government basics are described.

2.1 History and evolution of the European Union

The following chapter gives a short introduction to the history of the European Union. It's founding and evolution over time are shortly described to give an overview of the needs of the EU.

[Ucak12] mentions that the political systems of the member states and the political system of the European Union differ diametrically. The EU is a union of states; its legal system is absolutely independent. The EU has several sovereign rights, but does not have the possibility to create such rights themselves. This missing jurisdiction over jurisdiction means that the EU has no possibility to establish new areas of responsibility. The European Union sees itself as a union of states for creating a political union. This was realized by the Treaty of Maastricht in 2002.

The development of the EU involved several evolutionary steps, which are described in [Stre08].

As described in the cited source, the first predecessor of the European Union was founded as the European Coal and Steel Community in 1951. The countries Belgium, Germany, France, Italy and Luxemburg were the founding members of this Community. These countries six years later also signed the Treaties of Rome on the founding of the European Economic Community and the European Atomic Energy Community.

According to [Stre08], the merger treaty to create the European Community (EC) was signed in 1967. In 1973, three members joined the EC: United Kingdom, Ireland, Denmark, followed by Greece (1981), Spain and Portugal (1986). In 1986, the Single European Act was signed with the target of creating a single market.

In 1992, the Treaty of Maastricht was signed and the European Union founded (cf. [Stre08]). The treaty also led to the development of a single European currency, the Euro in 2002. In 1995, Finland, Austria and Sweden joined the Community.

In 2001, the Treaty of Nice was signed. With this treaty, the current legal base of the European Union was established (cf. [Stre08]) Three years later, Estonia, Latvia, Lithu-

ania, Malta, Poland, Slovakia, Czech Republic, Hungary and Cyprus joined the European Union followed by Bulgaria and Rumania in 2007.

In the same year, the Treaty of Lisbon was signed (cf. [Ucak12]). This Amendment Agreement to the existing Treaties led to the extension of the principle of qualified majority to political areas where unanimity was required before. Additionally, a catalogue of competency was created to enhance transparency on the competencies of the European Union. Furthermore, exit-clauses for member states were implemented and the structure of the EU revised (detailed view in the next chapter).

2.2 Structure and Construction of the European Union

This chapter explores the structure of the EU and explains the most important concepts including the pillar-system.

[Ucak12] points out that the EU was based on a three-pillar-system until the year 2009. According to [Jach02], the EU was officially partitioned into three pillars with the Treaty of Maastricht.

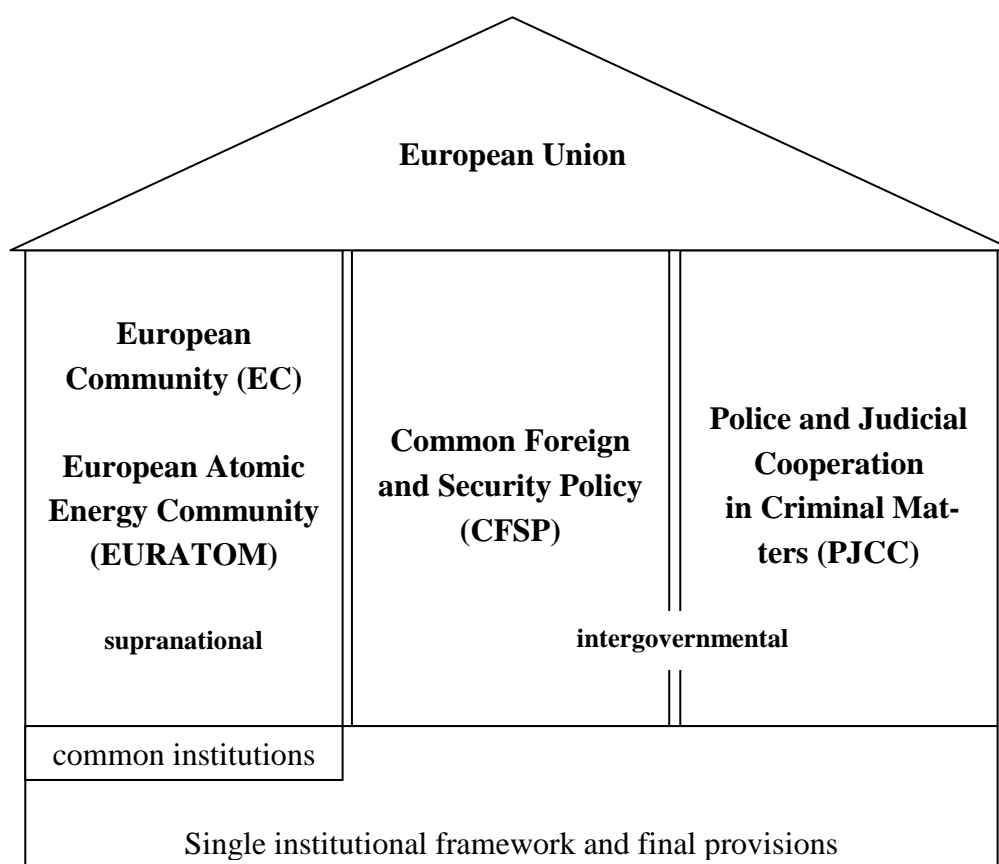


Figure 1 – Three pillar model of the EU after Maastricht Treaty (cf. [Ucak12])

As Figure 1 in accordance with [Ucak12] shows, the first pillar is the European Communities pillar which was originally established in 1957. It includes the European Community (EC) and the European Atomic Energy Community (EURATOM). This pillar is the only one with a legal personality. The European Coal and Steel Community (ECSC) was also part of this pillar until its expiry in 2002 (cf. [Uber04]).

[Crem08] describes the Union as being founded on base of the European Communities and as being supplemented by the other pillars.

As listed in [Ucak12], the second pillar is made up of the Common Foreign and Security Policy (CFSP) which is concerned with the protection of shared values and the promotion of international cooperation. The third pillar contains the Police and Judicial Cooperation in Criminal Matters (PJCC).

[Ucak12] summarizes the changes through the Treaty of Lisbon. The Treaty of the EC is renamed into “Treaty on the functioning of the European Union”. The European Community does not longer operate under this name as all functions are taken over by the European Union and all names in the Treaties are replaced. One major amendment implemented by the Treaty of Lisbon is the integration of the third, former intergovernmental pillar into the first supranational pillar (cf. [Hell09]).

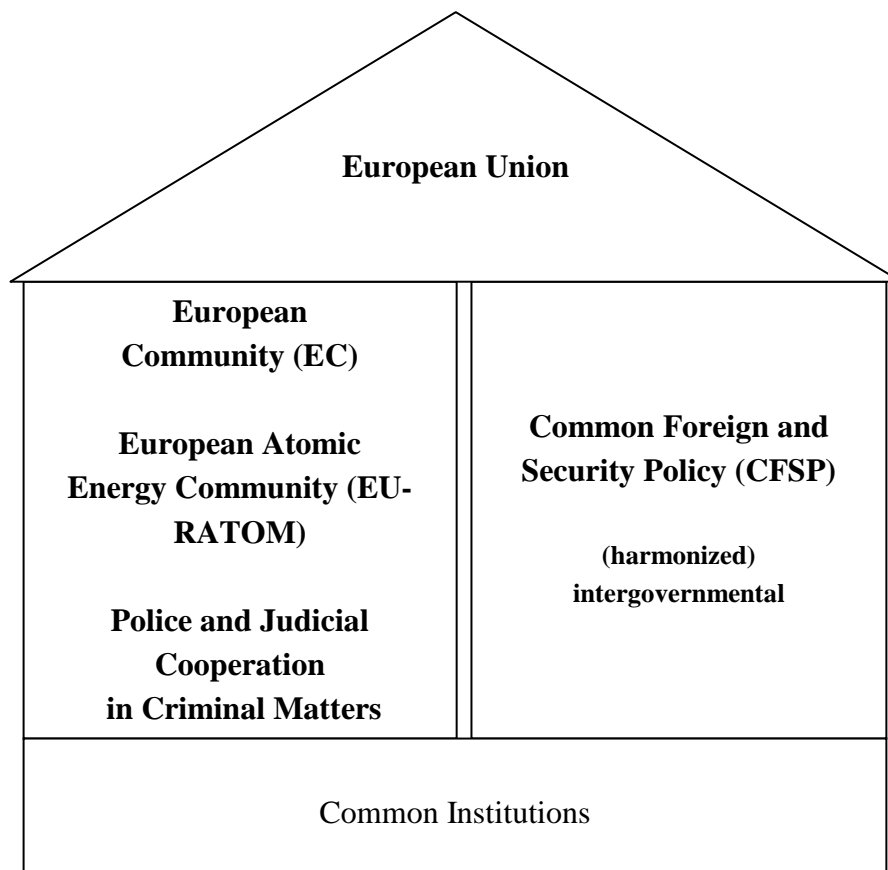


Figure 2 – Two pillar model after Treaty of Lisbon (cf. [Ucak12])

Figure 2 describes the new structure of the European Union implemented with the Treaty of Lisbon. The PJCC is integrated into the EC/EURATOM pillar, the CFSP is harmonized.

2.3 Background of European Union Law

This chapter explores the background of EU-law. Therefore, the need for law is examined at the beginning, followed by the interests driving the development of the EU and the resulting responsibilities.

2.3.1 Necessity of EU Law

[Nuge94] gives a concise description about the need for European Union law. He points out that the European Union is more than just another international organization where countries cooperate with each other to gather mutual benefit. According to the cited source, the EU is an organization where states voluntarily surrender their right across several sectors to be independent in determining and applying public policy. For this reasons, despite the fact that it is not a state, the European Union needs, as democratic states do, an enforceable legal framework as a basis for decision-making and decision-application.

[Nuge94] also mentions that without law declaring the powers and responsibilities of the institutions and without authorities providing independent ruling on the law, no effective decision making in the EU would be possible. Law is not the only factor of decision-making-processes but it builds the base for it.

2.3.2 Policy interests and responsibilities

[Nuge94] clusters the main policy interests and responsibilities to five groups which are described in this chapter(s). Namely, these groups are: establishment of a single market, economic and financial policies, functional policies, sectoral policies and external policies.

- *Establishing the Single European Market*

According to [Dina05], the Treaty establishing the European (Economic) Community in 1957 already sought to establish a common or single market for the free movement of goods, capital services and persons within the created community.

[Nuge94] points out that in the 1980's after years of little progress the European Commission produced in 1985 the White Paper on "completing the internal market

in 1992". The Paper identified about 300 measures to be taken to reach the goal of the completion of the internal market. Furthermore it suggested the deadline for the adoption of the measures should be set to the 31st December 1992. The paper was accepted by the council and measures and deadline were included in the Single European Act. This also implied the amendment of the EC-Treaty.

[Nuge94] describes that the White Paper sought to establish the conditions in which several market activities could be done on Community level as easy as on national level. As the author states, it was hoped that this could be promoted by removing the barriers and obstacles of physical, technical and fiscal nature which fragmented the Community market. The author mentions four pillars on which the continuing process of the establishment of the single market rests.

1. *Free movement of goods, persons, services and capital*

[Nuge94] points out that one of the main objectives is the free movement between the member states. The greatest attention gained the free exchange of goods which was seen as more easy to achieve than the others. For the removing of obstacles like custom duties or quantitative restrictions a central part of the White Paper was constituted and a lot of secondary legislation created. For the free movement of persons, also a lot of secondary legislation was created to serve employed and self-employed persons. Especially discrimination of people of other member states with regard to remuneration or employment had to be avoided. The free movement of capital was the hardest goal to achieve as it was an important economic and monetary instrument for the countries which were trying to keep as much political power as possible in their own hands.

2. *Harmonization of legal provisions in the member states*

The second pillar involves according to Article 100, Treaty on the Functioning of the European Union the "*approximation of such laws, regulations or administrative provisions of the member states as directly the establishment or functioning of the common market*". [Nuge94] sees the need for the approximation as the removing of barriers itself is not sufficient to guarantee free movement. Many examples in the years before the White Paper was issued showed that producers in one member state could not compete with producers from another country on the same legal base. For this reasons, the harmonization or approximation is necessary to enable the success of the first pillar.

3. *Competition Policy*

In this pillar, the basic rules for competition are stated. [Nuge94] mentions three aspects. The first one is that all agreements that may have a negative influence on the competition have to be avoided. Another aspect is that any abuse by an undertaking of a dominant position influencing the competition is prohibited. The last aspect is that aid which possibly distorts competition by favoring certain

undertakings is incompatible with the common market. All of these mentioned aspects have been clarified by Council legislation and Court judgments.

4. *Common External Tariff (CET)*

As [Nuge94] explains, the main purpose of this Tariff, also known as Common Customs Tariff (CCT), is the further course of fair and equal trading by surrounding all the member states with common trade barriers so that the goods entering the EU do so on the exact same conditions in every country. By enabling this policy, it is assured that no member state can gain a competitive advantage by accessing cheaper raw materials. The CET takes the EU beyond being a free trade area and makes it a customs union.

- *Macroeconomic and financial policies*

According to [Nuge94], despite the creation of a European Monetary System (EMS) in 1979, the trend for moving towards an Economic and Monetary Union (EMU) started in the late 1980s. The EMS only provided relatively weak policy instruments. Several factors led to the progress in the context of the creation of the EMU. The benefits of economic and financial integration for the SEM gained an increasing appreciation of the governments and the amendment of the EC-Treaty for including “Co-operation in Economic and Monetary Policy” brought the project on track. Although discrepancies regarding the concrete elements and timetable remained, all countries subscribed to the scheme provided by the Delors Committee in April 1989.

[Nuge94] describes the main features as increasing coordination and convergence of the economic and monetary policies of the member states, leading to the creation of an European Central Bank and a single currency. The timetable set the date for the adoption of the single currency between 1997 and 1999, but was soon questioned as many member states did not fulfill the conditions.

Finally, it was decided to introduce the Euro by the January 1st 1999 in eleven countries. (cf. [Weid98])

- *Functional Policies*

Many functional policies are subject to EUs interests. The most important ones are listed by [Nuge94]:

1. *Justice and home affairs policy*

This policy evolved according to [Nuge94] in the 1970s as member states of the EC began to cooperate with each other and exchange information on matters regarding crime like drugs or terrorism. Several mechanisms which were not covered by the Treaties of the EC were developed in the Trevi process. The issues developed over the years, in the late 1980s the process included beside the drugs and terrorism issues also topics regarding immigration, visas, public order, com-

puter systems and customs controls. These interests were strengthened by the Treaty on the functioning of the EU and therefore made up the third pillar. Furthermore, the Treaty extended the EU's responsibilities in this area where the foundations were laid for a common visa, asylum and immigration policy, increased police cooperation and the establishment of a European information system.

2. *Social Policy*

According to [Nuge94], the base for a social policy was given in the EC-Treaty. It requested a closer cooperation between the member states in the social field, laid the foundation for a European Social Fund (ESF) and stated the principle that men and women should receive equal pay for equal work. In 1989, a charter of fundamental social rights was produced in accordance with the SEM which contained the fundamental principles that should apply to twelve themes like improvement of living and working conditions, employment on the base of fair remuneration and several others.

3. *Energy Policy*

[Nuge94] describes that until the 1980s, only policies for particular energy sectors existed despite the existence of the Euratom Treaties, the centrality of energy and the identified potential for savings by establishing a common energy market. Since that time, the efforts for creating this market were increased. These issues gained appreciation as the EU imported about half of the energy requirement from non-member states. The efforts focus on three major objectives. The first one is the development of an internal market in energy. The second one is developing external energy relations and ensuring security of supply. These objectives are complemented with minimizing the negative impact on the environment of energy use and production.

[Nuge94] also mentions Research and technological development policy and environmental policy as major parts of the functional policy.

- *Sectoral Policies*

This type of policies consists, as explained by [Nuge94], of EU policies that are directed towards specific economic sectors. Beside the policies provided in the Founding Treaties (for coal and steel, atomic energy, agriculture and transport), other policies driven by factors like adjusting to changed trading conditions or effective political lobbying by interested parties exist. The sectoral policy where most policy-making responsibilities have been transferred from the member states to the EU is the Common Agricultural Policy.

- *External Policies*

External policies build an important part of the overall EU policy agenda. The aspects to external policies can be grouped under these headings: external trade policies, foreign and security policy and development cooperation policy. The importance of this group of policies is growing within the framework of the CFSP (cf. [Nuge94]).

2.4 Legal sources of European Union Law

The sources of law in the European Union are divided into several parts. The most important ones are listed and shortly explained in this chapter.

2.4.1 Primary Legislation

[Poll06] notes that all activities that are performed on EU-level are traceable on a contractual base. This means that the EU and the EC are based on treaties (mainly the Treaty on the functioning of the EU).

According to [Borc10], the EU founding Treaties which are created directly by the member states represent the first source of law, referred to as “Primary Legislation”. Together with interrelated instruments they set up a basic framework consisting of the objectives, mode of operation and organization of the European Union.

2.4.2 Secondary Legislation

By the enforcement of the acts of the secondary legislation, the primary legislation is vitalized. The secondary legislation is created by the institutions of the European Union and includes according to [Borc10]

- *Legislative Acts*

This type is adopted by ordinary or special legislative procedures that are described later on can be divided into ([Borc10])

1. *Regulations*
2. *Directives*
3. *Decisions*

- *Non-legislative acts*

This second group consists of

1. *Delegated Acts*

Such acts are adopted by the European Commission. Delegated acts are non-legislative acts supplementing or amending non-essential parts of a legislative act.

2. *Implementing Acts*

Implementing acts which are used to define conditions needed for the implementation of legally binding acts.

- *Other acts*

These acts subsume all remaining actions that can be taken by the institutions of the European Union to define non-binding measures and statements. Also agreements for the regulation of internal workings of the EU (and institutions) can be other legal acts ([Borc10]):

1. *Recommendations and opinions*

2. *Interinstitutional agreements*

3. *Resolutions, declarations and action programs*

[OpCl09] states a hierarchical priority of primary legislation over the secondary legislation. [Poll06] puts it in concrete terms and describes the relevance of the distinction between primary and secondary legislation with the fact that the secondary legislation must not be in contradiction to the higher-ranked primary legislation.

2.4.3 EU's international agreements

To be internationally competitive, the European Union concludes agreements in international law with non-member countries and international organizations in the industrial, technical or social areas. [Borc10] mentions the following agreements:

- *Association agreements*

These agreements can be done according to the cited source in several ways

1. *Agreements that maintain special links between certain member states and non-member countries*

[Borc10] describes that due to former colonial territories, several EU-countries have close economic relations to non-EU-countries. To maintain the relations

and to establish the link not only to the former colonial power but to the whole European Union, association agreements are developed. These agreements enable the importing of goods at low or even zero customs rates. The currently largest agreement is the EU-ACP (Africa, the Caribbean and the Pacific) Partnership Agreement where the European Union cooperates with 70 states.

2. *Agreements as preparation for accession to the Union or for the establishment of a customs union*

Possible future member states can conclude agreements as a preliminary step for the accession of the European Union to establish economic relations to get familiar with the EU-economy. (cf. [Borc10])

3. *Agreement on the European Economic Area*

With this agreement, the countries of the European Free Trade Association which are not members of the European Union (like Iceland, Liechtenstein and Norway) are added to the internal market. According to [Borc10], this agreement enables similar to the member states, free movement of goods, persons, services and capital. Also policies on environment, research and development and education are included.

- *Cooperation agreements*

As [Borc10] states, the main target of these agreements is the close economic cooperation. These agreements are not as tight as the association agreements are. Current Cooperation agreements exist with besides others with Israel, Morocco and Egypt.

- *Trade agreements*

These agreements are concluded with non-member countries, groupings of them or within international trade organizations like the Agreement for the establishment of the World Trade Organization. (cf. [Borc10])

2.4.4 General Principles of law

In addition to the already mentioned law sources which are of written form, [Borc10] describes the unwritten laws as the general principles of law and justice that have to be respected by any legal system. Amongst others, these are the basic rights, the right to a proper hearing, the principles of direct applicability, autonomy, the primacy of Union law, the principle of proportionality and the principle that the member states are liable for infringements of Union law.

Also included in the cited source are the so called legal customs, a practice which has been followed and accepted that finally became legally established. Such a legal custom

is possible in the European Union but underlies certain criteria which are hardly fulfilled.

General principles are used to fill gaps and answer questions on the interpretation of existing law. The principles are given effect with the application of law, especially in judgments of the Court of Justice which is responsible for ensuring the law in accordance to the underlying acts. (cf. [Borc10])

2.4.5 Conventions between the member states

As described in [Borc10], such agreements are concluded if the issues are related to activities of the European Union but where the institutions of the European Union have no power. Especially in the field of private international law several examples for such full-scale international agreements exist.

2.5 The EU's means of action

In this chapter, the means of action of the European Union are explored. The main instruments are listed and the differences between them analyzed.

When the system of legislative acts was defined, the main target was according to [Borc10] to effectively align the different economic, social and environmental conditions in the member states so that the best possible living conditions for the citizens are created. Another important issue was not to interfere with the law systems of the member states.

In general, as mentioned in [Borc10], the legislative system of the European Union is based on the principle that where arrangements have to be applied, the national arrangements have to be replaced or amended to meet the Union legislation. On the other hand, where this is not necessary, the existing legal orders of the countries have to be considered.

To fulfill this needs, several instruments were introduced which enable the European Union to influence the national legal systems in different degrees and to address different institutions.

The definition of these instruments of actions can be found in article 288 of the Treaty on the functioning of the European Union:

“To exercise the Union's competences, the institutions shall adopt regulations, directives, decisions, recommendations and opinions.”

The general definition is followed by a definition of the instruments themselves. The following table gives according to [Borc10], a short overview on the instruments of the EU.

Instrument	Addressees	Effects
Regulation	All member states, natural and legal persons	Directly applicable and binding in their entirety
Directive	All or specific member states	Binding with respect to the intended result Directly applicable only under certain circumstances
Decision	Not specified – all or specific member states; specific natural or legal persons	Directly applicable and binding in their entirety
Recommendation	All or specific member states, other EU bodies, individuals	Not binding
Avis	All or specific member states, other EU bodies	Not binding
	Not specified	Not binding

Table 1 – EU means of actions ([Borc10], p.88)

Table 1 summarizes the means of action of the EU as well as their effects and addressees as listed in [Borc10]. The range of influence varies between directly applicable and binding regulations and not binding avis.

2.5.1 Regulations

The legal instrument of the EU with the highest (direct) impact on the national legal systems is the regulations. The following features characterize the regulations as stated in [Borc10]:

- *Community Nature*
Regulations lay down the same law in all member states. All states have to apply the act as a whole and with all details.

- *Direct applicability*

Legal acts impose obligations or confer rights to all citizens of the EU in the same way national law does but does not need to be transposed into national law. The regulation is also directly binding on governing institutions and courts of member states.

2.5.2 Directives

Together with the regulations, the directives represent the two main legislative instruments of the European Union. The purpose of the directive as described by [Borc10] is to harmonize the European law which is the main difference to the regulations with the main purpose to unify the law. By means of the directives, conflicts between laws of different countries or inconsistencies within the laws should be removed. Therefore the directive aims to build equal material conditions in the different member states.

With a directive, a basic objective is stated. According to the author of the cited source, the national authorities have the possibility to adjust the law within a given scope. They are free to choose their own way to incorporate the goal. In other words: The “what” is defined but the countries are flexible for the “how”.

This instrument is incorporated as stated in [Borc10] in a process consisting of two main stages:

- *Initial stage*

The directive lays down the goal to be achieved by a certain number of addressed member states and a timeframe for the implementation. Especially when it comes to technical standards or environmental issues, the goals can be rather clearly stated leaving hardly any possibilities for adjustment. In other cases the range for adjustment can be larger.

- *National stage*

At this stage, the national authorities have to translate the directive into national law. Basically, the member states can choose the form and methods for the transposition but the European Union uses specific criteria to assess if the national implementation fulfills the objectives of the directive. Principally it is done the following way: A legal situation has to be generated where the rights and obligations given by the implementation of the directive have to be clear and certain to enable citizens of the EU to refer to it in national courts. Usually, this implies the enacting of mandatory provisions or the repealing or amending of existing ones.

[OpCl09] describes another interesting fact of directives. After national implementation, they develop a barrier effect for the field of application. This means that for the national

lawmaking authority it is forbidden to develop national law contradicting to a directive for the whole period of validity.

Directives are only addressed to member states, never directly to citizens. Rights and obligations for the citizen arise only from the implementation measures by the country. As long as the objectives of the directives are fulfilled, this point is of no importance for the citizens. But if inadequate measures are taken or the timeframe for the enacting exceeded, disadvantages for the citizens may arise (cf. [Borc10]).

In such cases, the cited source states that citizens of addressed member states can plead that the directive has direct effect in actions in the national courts if (cf. [Borc10])

- the provisions of the directive states the rights of the citizens clear and precise enough
- the exercise of the rights is not conditional
- the national authorities have no scope for adjustment of the content of the rules to be enacted
- the implementation timeframe for the enacting has expired

The direct effect of a directive has the effect of penalizing the specific member state. The Court of Justice decides in such cases according to [Borc10] that the state acts unlawfully by applying the old national law instead of adapting it according to the requirements of the directive. This is interpreted as an abuse of rights by the member state and therefore the direct effect is applied by the European Union to ensure that the member state does not benefit from not adapting the national law. As mentioned before, this direct effect is only established in cases between citizen and member state and only if the citizens gains positive effects of the directive. This case is referred to as “vertical direct effect”. The so-called “dual-effect directive” where another citizen suffers from the vertical direct effect is also possible.

[Borc10] points out that on the other hand, in relations between citizens themselves, the direct effect is not established. The Court of Justice argues that individuals cannot be held liable for the consequences of the member states failure to act. Therefore the direct effect cannot be applied to relations between private individuals.

As the author mentions, in recent cases, the Court of Justice tempered this basic rejection of the direct effect between two private individuals. If one contracting party invokes a right stemming from the directive while the other party stemming from national law, the direct effect also is enforceable.

According to [Borc10], the provisions of the directive have the effect of objective law. This effect applies under the same conditions as the direct effect for individuals with one difference – instead of a clear law for a citizen or enterprise, clear obligations for member states are established.

This means, according to the author, that the institutions of a country (legislator, administration as well as courts) have the obligation to interpret national law in accordance with directives or to prefer Union law over conflicting national law.

The next logical step concerning the validity of unimplemented directives is given due to a principal decision by the EU Court of Justice. As described by [Borc10], the judgments in *Francovich* and *Bonifaci* in 1991 held that member states are liable for paying damages where loss is sustained due to not correctly transposed directives.

Additionally to the above mentioned measurements, [BoPa05] describes infringement proceeding as a legal action by the European Union. Article 226 of the EC-Treaties entitles the EU to start such a proceeding against member states violating European law.

Directive number

A directive is identified by an individual number that is assigned to it. The basic structure of this number is given in the following figure.

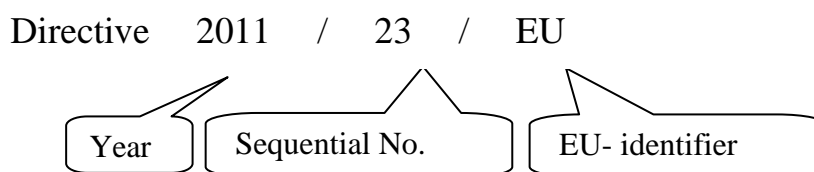


Figure 3 – Structure of directive number

As visualized in Figure 3, the directive number consists of the year of enactment (4 digits, whereas directives from the last century only use two digits, e.g. 99), the sequential number and an identifier referring to the EU as institution. Former directives also use the sign EC for European Community.

Problems

The nature of directives causes several problems. One major point causing uncertainty in terms of implementation of directives in other countries is the problem of not or not correctly implementing a directive.

According to [Ekst94], the European Commission has considered unimplemented directives as the main obstacle to efficient enforcement of Community Law.

[Tall02] explores the overall situation of implementation deficits. In the 1990s, the rate of legal implementation of directives in the EU rose from about 90% to 96%. This seems to be a high number but the cited source describes, considering the large number of directives that this means each state has more than 50 directives left to implement by the end of each year.

Possible reasons were explored in several studies. [Tall02] explains as one of the main reasons the non-compliance as a preference. He subsumes the results as greater legal and behavioral adjustments needed lead to less compliance to the given directives. Another reason the author describes is the non-compliance caused by Capacity Limitations.

Varying results were explored for the parliamentary involvement. This area was explored by [BeGa06]. The study covered the areas of utilities and food safety. A relation between parliamentary involvement and delay could not be found. Same results apply for a study explained in [HaRo07] for social policies. In contrast to these findings, a significant negative relation between legislative participation and delay was determined by [KoLu09]. This leads to the assumption that different results apply for different areas and different countries.

The reasons for high implementation rates were also explored. According to [Lamp98], the factors are on the one hand stable political culture and on the other hand flexible institutional political-administrative design.

2.5.3 Decisions

Besides the directives and regulations, the decisions represent the third category of legal aspects. As in some cases the institutions of the European Union are responsible for implementing treaties and regulations, [Borc10] describes that they need to have the possibility to take measures binding on member states, individuals or undertakings. This is similar to the situation in the national legal systems. The authorities apply the legislation in an individual case by using an administrative decision.

The European Union means fulfilling this functionality are the decisions. As [Borc10] mentions, they are normally available to the institutions of the Union to order that a measure has to be taken in an individual case. By using such decisions, the Union institutions can confer rights or impose obligations on member states or individuals or require them to perform an action or refrain from it.

Decisions can be characterized according to [Borc10] by the following properties:

- *individual applicability*

In contrast to the regulation, a decision is of individual applicability. The decision directly addresses the persons – they must be named and are the only ones bound by the decision. This condition is met if the category of addressees can be identified at the time the decision is issued and cannot be extended afterwards.

- *Binding*

In contrast to the directive where the objective is set, a decision is binding in its entirety.

- *Directly*

The decision is directly binding on the addressed persons/institutions. The same direct effect like a directive in relation to the citizen can be given by a decision addressed to a member state.

2.5.4 Recommendations and Opinions

The group of recommendations and opinions complement the EU means stated in the Treaties. According to [KoHa96], the institutes of the EU are enabled to express their views to member states or also individual citizens. In contradiction to the already mentioned measures, they are not binding and are not defining any obligations. The main relevance of opinions and recommendations is political and moral. [Borc10] further describes the differences between Recommendations and Opinions.

- *Recommendations*

Recommendations tell the addressee how to behave in a certain way without posing the obligation to do so. [Borc10] mentions an example where the amendment of a provision in a member state would cause a distortion of competition in the European internal market. In such cases, the commission could address a recommendation to the relevant country measures that are appropriate to avoid this distortion.⁴

- *Opinions*

[Borc10] points out that opinions are used by the European Union institutions to assess a given situation or development in the Union or member states. Opinions may also prepare the way for binding acts or serve as a prerequisite for a process before the Court of Justice.⁵

2.5.5 Resolutions, Declarations and Action Programs

Besides the legal acts mentioned in the EU Treaties, a lot of other forms of actions for influencing the legal order of the Union exist. Amongst others, the most important ones are resolutions, declarations and action programs.

- *Resolutions*

⁴ See Article 117(1), second sentence, Treaty on the Functioning of the European Union

⁵ Articles 258 and 259, Treaty on the Functioning of the European Union

Resolutions are issued either by European Council, the Council or the European Parliament. [Borc10] points out that they set out joint opinions and purposes for the whole process of integration and specific tasks inside (monetary/economic union) and outside the Union borders. One main function of the resolutions is to give a political direction for future work of the council.

- *Declarations*

[Borc10] distinguishes between two types of declarations. If the declaration is issued in the context of the Council's decision making process, it sets out the view of all or individual members of the Council regarding the interpretation of decisions by the Council. If the declaration deals with further development of the Union, it is handled similar to the resolutions.

- *Action Programs*

The Council and the Commission can draw up such programs on their own or by recommendation of the European Council and serve to put the legislative programs and objectives as stated in the Treaties into practice (cf. [Borc10]).

2.6 Electronic Government

This chapter describes the theoretical basics of the field of electronic government and how this topic is related with this thesis. After a definition of the term "Electronic Government", the expectations in this field and the important role of trust in its context are described.

2.6.1 Definition

The term "Electronic Government", shortly addressed as "eGovernment" involves a large field of possible application. Therefore several definitions focusing on different aspects of the topic exist. In the following, some definitions are explored to show the range of eGovernment. In further consequence, the important aspects with respect to this thesis will be derived.

Von Lucke and Reiner mann describe Electronic Government as the "*processing of business processes in connection with government by means of information- and communication technologies via electronic media.*" ([LvRe00], p.1)

Another broad description was given by the European Commission. As mentioned in [EuCo98], eGovernment involves the "*usage of Information- and Communication-Technologies in the public sector both internally and for transactions with citizens.*" ([EuCo98], p.9)

A third definition by [Sche06] approaches related topics. „*Electronic Government is a form of organization of a state where the interactions and interrelations between the state and the citizens, private companies, customers and public institutions are integrated by means of modern information- and communication technologies*”. ([Sche06], p. 251)

As the definitions show, electronic government involves a variety of different areas. All three listed definitions focus on the administrative aspects of eGovernment. The basic aspect mentioned in all above stated definitions also applies to the tool under development. According to the definition, information- and communication technologies are used for supporting the interaction between government and citizens. For the accessing of law documents as an objective of the thesis, this is the central statement of the definitions.

In the context of this work, the related principle of “non-stop government” is also important. This term stands for 24/7 access to public administration. [PrSa02] refines the definition as „*ranging from actual administration services to the permanent availability of information and the possibility of initiating actions*”. ([PrSa02], p.32)

As the above definitions show, eGovernment is strongly related with the usage of information- and communication technologies. Although it is nowadays usual, the possibility of supporting public processes by technology arose only in recent years. [Mehl02] visualized the technological progress:

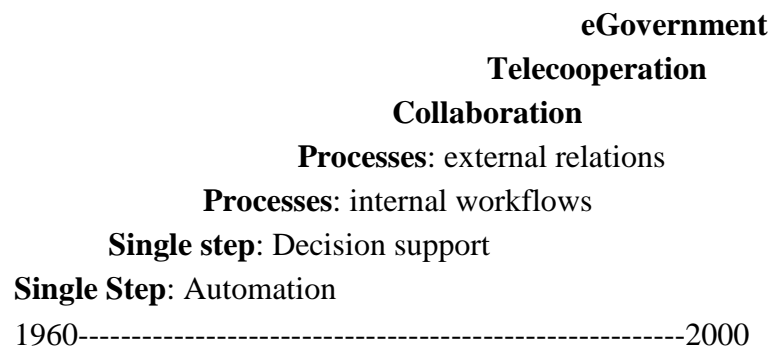


Figure 4 – technological progress according to [Mehl02]

Figure 4 illustrates the technological progress of information- and communication technologies as described by [Mehl02] and the related arising of ICT⁶-supported public administration. With the development of the TCP/IP protocol, the basic protocol of the

⁶ Information- and Communication-Technologies

internet, the foundation for information exchange between public institutions and individuals was build.

2.6.2 Expectations regarding eGovernment

When governments use eGovernment solutions for their information, several expectations of the involved parties arise. [Müll04] describes two categories of expectations, namely an improvement of efficiency and an improvement of effectiveness.

- *Improved effectiveness*

The author describes the advantages of improved effectiveness as

1. *Service-function of eGovernment*

The increase, the extension of the scope and the improvement of quality of the services build the first potential advantage.

2. *Participation-function of eGovernment*

An improved transparency of governmental actions and extended possibilities for participation in governmental decision making is also expected.

3. *Image-function of eGovernment*

Expected is also the improvement of the image of public institutions, their representatives as well as the assessment of locations as a secondary effect of service- and participation function.

- *Improved efficiency*

The improved efficiency expectations according to [Müll04] are either an identical number of tasks performed at lower costs or at the same costs improved service and/or more service.

2.6.3 Trust as a crucial factor of eGovernment-success

eGovernment offers a lot of possibilities for public institutions. According to [Davi08], this also implies several challenges. As the mentioned study analyzed, the success of the activities depend to a great extend on how well the targeted group (users) make use of them. Furthermore, a large number of users remain skeptical when it comes to IT-supported governmental activities. The study of [WaLö08] showed that only about 59%

of European users which use the internet on a regular base also use eGovernment services while 41% do not.

[Gata08] identified trust as a crucial factor of eGovernment efforts. Therefore the author advises that citizen characteristics have to be understood before an effective eGovernment strategy can be adopted.

The trust of citizens leading to the adoption and use of eGovernment services is determined by roughly two dimensions. On the one hand, trust in the internet and on the other hand, trust on the governments. Therefore, citizens at first have to trust the government to implement and secure the systems before accessing the online information provided by them. (cf. [Wark02]).

2.6.4 Legal Databases

One particular instrument of eGovernment is the usage of legal databases. [Stau03] describes that due to the high number of new legal documents adopted each year, legal databases are an essential and indispensable tool for legal experts. By using complex query combinations, existing law can be analyzed in a way that would not be possible without the usage of databases. Legal databases can also be used to get familiar with a particular area of law without previous knowledge.

[Stau03] distinguishes between the following types of classification for legal databases:

- *General/specific databases*
Depending on the topic, general and specific databases can be distinguished. General databases offer an unrestricted field of law while specific databases focus on a certain topic.
- *Full-text/index-databases*
Depending on the scope, one can differentiate between full-text and index databases. Full-text databases offer all of their documents with the complete text. Index databases offer already extracted information in keywords-manner.
- *Online/offline databases*
Based on their accessibility, a distinction between online and offline databases can be made. As the name already implies, online databases offer data and search functionality in a network while offline databases can only be accessed locally (e.g. CD or DVD).

According to these classifications, the tool under development is designed to be a general full-text online legal database.

3 Problem description and methodologies used

In the context of the theoretical foundation given in the last section, this chapter explores the reasons for developing such a tool. Beginning with a problem analysis, the relevance for such a project is described. Furthermore the methodologies used to develop the thesis are given. These include basics of feasibility studies, software documentation and development.

3.1 Problem analysis

As shortly addressed at the beginning of this thesis, the *directivetracer-tool* is developed to enable a new way of querying law documents. Currently, each country hosts its own law documents and no common Europe-wide system exists. This is especially interesting as the EU uses a lot of instruments to directly or indirectly influence the national legislation.

The two instruments with the highest impact on national legislations are EU-regulations and directives. While regulations are enforced the same way in each country, directives only state basic conditions that have to be fulfilled. National institutions can implement the same directive in different ways. As described above, it may also happen that directives are not implemented at the defined time or in a correct way. Due to this reasons, a lot of insecurity in the context of directive implementations arise in the public.

As the tendency to a more and more centrally controlled EU is ongoing, more and more regulations and directives are created and people are more and more faced with European legislation.

Number of acts adopted in the year

	2012	Total number of acts
Regulations	783	78058
EP and Council	28	644
Council	67	16944
Commission	688	60309
Other	0	161
Directives	22	5584
EP and Council	8	913
Council	0	2822
Commission	14	1841
Other	0	8
Decisions	410	28498
EP and Council	9	326
Council	204	7449
Commission	181	19833
Other	16	890
Total	1215	112140

Figure 5 – adopted acts in the European Union by 2012-09-07 [OnlEU2]

Figure 5 shows the relevance of regulations and directives in the European Union. In the year 2012 (due date 07th September 2012), a total number of 783 regulations and 22 directives were adopted. In total, 5584 directives exist.

Beside the growing number of EU-directives, the ongoing globalization and extensive use of the internet that supports the networking between the member states also leads to the fact that people are faced with the legislation of other EU-countries.

One possible example was mentioned in the introduction-part of this thesis. When buying goods or services in an online shop situated in another EU-country, the legislation of this country applies to the transaction. The “Directive on protection of consumers in respect of distance contracts” (97/7/EC) deals with the topic of online shops. The directive only gives a timeframe for possible cancellation of a concluded agreement. Therefore this timeframe may be implemented differently in different countries. Citizens and also enterprises often are not aware of such details arising of directives.

And even if one is aware that one topic is based on a directive additional problems may arise. The national institutions are free in the choice of where to implement the directive. That means that one directive may be implemented in several different acts. To describe the full complexity of this problem, even the content of one article of the directive can be split to different acts. This fact makes it almost impossible for enterprises and especially for citizens to explore the implementation of a directive in another EU country without expert knowledge or extensive time effort.

Basic goal of this system therefore is to develop a system that visualizes the relations between EU directives and national acts to enable the traceability of the implementation of directives in different countries.

3.2 Methodologies

This chapter describes the methodologies used to develop the project and the software tool described in this thesis. Therefore the methods used for the feasibility study as well as for software development and documentation are described.

3.2.1 Literature research

The first central part of the thesis was to perform a literature research on EU law and the underlying context of this work. An extensive research was done and the relevant aspects for this thesis were summarized above.

3.2.2 Feasibility Study

The thesis is designed to contain an analysis based on the feasibility study-principle. The first phase of the thesis dealt with a comprehensive literature research to analyze

the underlying theoretical aspects. The next step, an analysis of necessary steps to develop such an application is one large part of the work. Besides this, the development of a prototype represents the third major task of this analysis.

The term „feasibility study“ is frequently used when it comes to the development of new ideas or technical solutions. A feasibility study may be defined as “*an engineering study based on test work and engineering analysis, which represents enough information to determine whether or not the project should be advanced to the final engineering and construction stage*”. ([Pinc04], p. 1) The cited source describes the result as a go/no-go decision point.

Similar results are described by [OnIPM1]:

- *Analysis and evaluation of possible solutions*
- *Decision possibilities with documented chances and risks*
- *Suggestion for a decision*

The above given definitions already include the central purpose for using this type of analysis in this thesis. Based on the test work - the prototype - and an analysis of the necessary boundary work and conditions, the thesis will show possible alternatives and come to a suggestion whether such a project may be realized or not.

Additionally, [OnIPM1] lists the purposes of feasibility studies:

- *Avoidance of bad investments*
- *Identification of optimal solutions*
- *Identification of risks*

3.2.3 Software development

As the tool was developed mainly by one person, software development methods and project management efforts were used only at a limited amount. The development process was not strictly handled according to a specific method, an adapted version was used.

According to [GrBe09], some steps are included in all software process models. These steps were also included in the adapted process model used for the prototype development. The author mentions that all steps have to be performed in a sequential order at least once:

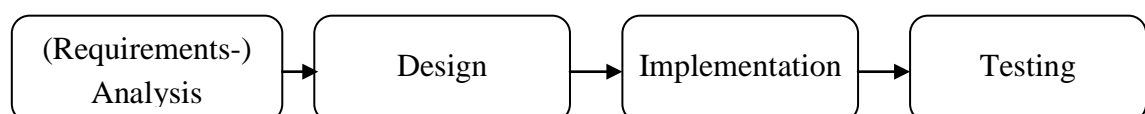


Figure 6 – Software process steps according to [GrBe09]

These steps as described in Figure 6 were also included in the development process used. Furthermore, the whole software development process followed agile characteristics as described in [AbSa02] and [CoLi03].

One agile aspect was the frequent release of new versions of the software where new functionalities were developed and tested. Agile elements were also used as the tool is developed for a currently not existing system where the functionalities and goals had to be slightly adapted due to detected characteristics.

The following methods used in the agile software development method of “extreme programming” according to [HrRu09] are also used in the context of the prototype-development:

- *Refactoring*
The source code is continuously improved and simplified if possible. A certain amount of time has to be defined for improvements.

- *Simple design*
The design has to be kept as simple as possible. Design is not an end in itself.

- *Programming standards*
During the programming process, consistent standards and conventions are taken. By using them, project-specific definitions are made easier.

3.2.4 Software documentation

The documentation of the software project follows the MVC⁷-principle as described in the design chapter. The software components and architectural aspects are explained in a detailed way. The textual explanation is supported by the following UML⁸-diagrams further described in [HiKa99] and [ArNe05].

- *Use Case- diagram*
This type of diagrams shows how the different types of actors interact with the system. Actors may be human or other systems. The diagram illustrates which functionalities are available for which actors. Furthermore the relations between the functionalities or between the actors are shown.

⁷ Model-View-Controller

⁸ Unified Modeling Language

- *Class diagram*

The classes of a software system are represented with their attributes and operations. The diagram illustrates the dependencies and relationships between the involved classes.

4 Concept

In this chapter, the basic concepts related to the creation of the desired application are analyzed. Therefore several boundary conditions have to be considered. These conditions are identified and their influence on the feasibility explored.

4.1 *Type of system*

The program under development has to be implemented as an integrated system. For the future users of the application, one key value added is besides the querying of linkages the consistent integration of different law systems into one tool. Several countries therefore have to be integrated by mapping them to the system.

4.2 *Language selection*

Currently, the European Union has 27 countries and 23 official languages [Phil10]. Officially, they are all equal but [Ammo09] describes inequality of the languages as confirmed by the Commission with English, French and German as internal procedural languages. Furthermore, a hierarchy between them is established.

The topic of language is therefore a very difficult one. Basically, the first decision step is if one central language should be chosen or if each country should remain with its own language. This question is also closely coupled with the topic of the responsibility for maintaining the data (cf. 4.3 and 4.4).

One main advantage of choosing one representation language is that a central maintenance is possible. If all languages are maintained, data can only be maintained from persons with good skills of the country's language. When choosing this solution, the preferred language would be English as it is the language understood by the largest number of people in the European Union.

One major drawback of the one-language solution is the problem of limited data availability. While directives are available in several languages, national acts often are not. Therefore a selection of one language would lead to a limitation of the amount of data represented in the system as the language may not be supported by national law publications. Nevertheless, the directive would also have to be stored in one of the languages available. For potential future users, prerequisites are the same as for expert users. When searching for an implementation of a directive in another country, the corresponding language has to be understood to understand the implementation.

To sum up, both aspects have advantages and disadvantages. The main drivers for a decision are the two major problems of only limited data amount for a one-language-

solution versus problems of understandability for implementations in other countries and their languages.

When examining the importance of both solutions in this case is that the data available is more important than the understandability. The understandability depends from person to person while the data topic is a general one. For countries not providing their law in the chosen language, the whole country would be excluded from the system. It has to be avoided that only few countries remain in the system and only selected acts are present. All countries would have to be encouraged to publish their acts in the language the system is designed for.

As this is no ideal solution, another approach may be considered. Both approaches can be combined to a hybrid approach of importing the authentic document to the system while additionally providing an (non-authentic) translation in the official language. By choosing this solution, all countries could be integrated into one system with their authentic documents. Furthermore, the understandability for other countries is also given through the translations.

One problematic fact about this solution is that the translations are not authentic if they aren't provided by the national authority. Therefore the validity of the translated document cannot be granted which has to be clearly communicated to the user community. Another problem arising of this approach is an additional overhead for the translation of the documents (see also 4.3).

In the context of the prototype, the one language solution will be implemented. For the roll out of the system, the hybrid approach is suggested.

4.3 Maintenance activities

For the users' trust in the system, the up-to-dateness of the data is of major importance. It has to be ensured that the documents in the system are the currently valid versions. The ideal version would be that the application state is equal to the current state of the corresponding national law system(s).

Especially in such a distributed area of information where different law systems of different countries from different sources and different languages have to be integrated into one system, the topicality of data is a very challenging task and hard to achieve. A certain amount of personnel resources (explored in the next chapter) is needed to ensure the actuality of the documents by performing following operations:

4.3.1 Import of new law

Newly adopted directives or acts have to be imported to the system. During the import-process, metadata will be assigned and the correctness of the imported data has to be verified.

4.3.2 Update of existing law

In the planned system, the currently valid version of the document is a basis for the consistency and trust for users. Existing law may be updated. Especially national acts may get amended several times. This can be caused by EU measures like directives or decision as well as by national needs. These changes also have to be considered in the system.

For approaching this question of how to map such amendments, several possibilities exist:

- *Update a document in the system*
An existing document can be updated via a user interface. With this approach, existing information like metadata or connections (cf. 4.3.5) can be maintained. In the sense of reusability of existing data, this solution would save resources on the long term. One drawback would be a higher effort for implementation. Several functions and screens would have to be implemented to enable removing or adding new sections to existing documents.
- *Replacing the whole document*
When considering the implementation effort, this approach has a big advantage compared to updating the system. This way of deleting an existing document and re-importing the new version does not need additional implementation time as the update process is delegated to the user. A major shortcoming of this solution is the loss of the already stored information like metadata and connections. Especially for large acts having several connections this approach would cause a significant maintenance overhead.
- *Versioning*
A third approach would be to support versioning of documents. This would cause a considerable storage overhead compared to the other solutions but would enable a histories search, for example the version of a law on date x. Another overhead caused by this approach is that national acts often get amended and therefore a lot of versions have to be imported. For each version, all links to directives would have to be established for each version. Therefore, this solution would cause personnel

overhead for persons performing the versioning. Additionally, storage overhead is generated.

In terms of the prototype creation, the replacing of the whole document is desired. For the roll-out of such a project, the versioning-approach is suggested.

4.3.3 Repealing of existing law

Some directives may lead to the repealing of whole acts in national law systems. In such cases, this repealing also has to be mapped to the system. The most proper way would be to store two dates for each document – one for the commencement of the document and one for the repealing of it. Therefore, the current state of a document can easily be determined. This approach would also be compatible with the versioning-approach described in 4.3.2.

4.3.4 Translation of law documents

When choosing the hybrid approach as described in 4.2, the documents from national law systems imported to the system have to be translated to English language. Ideally, this could be done by the person/institution uploading the document. This would ensure that always both versions (the authentic in original language and the translated one) exist.

Another possibility is that this work is done by another person or institution. The advantage would be that more authentic documents would be imported to the system as there is no additional overhead when adding a document. One shortcoming would be that documents won't be readable to the overall community for an undefined time period.

The suggestion is that the translation should be done by the same institution uploading the document to the system.

4.3.5 Determination of connections

One of the central features of the application is the connection between directives and national acts. A connection in the context of this thesis is the implementation of a specific part of the directive in a specific part of a national act. The information about the implementation of directives already exists as the member states have to report on their proceedings. The information can be queried as described in [Onl01]. In the information available online, only the acts are quoted. As no assignment of concrete sections is given, the existing data is not available at the desired granularity.

In an automated manner, this operation cannot be processed. To establish the connections, the manual determination is the only way possible. This task is especially hard to be done as expert knowledge for the underlying directive as well as for the corresponding national acts of the affected countries is required.

Furthermore, it has to be traced who determined which connection and why. To enhance the trust in the application, it is suggested to add the source of information and a description of the user determining the connection.

4.3.6 User administration

As many different possible users are involved in the system administration, the authorization and user administration topics have to be handled. The question is who ensures access for all involved people according to their desired authorization and who is responsible for the creation of new and the deleting of old users. This topic is closely related to the question of ongoing servicing described in the next chapter.

4.4 Ongoing servicing

As already explored in the last chapter, the servicing of the application is a very complex and distributed task. As one would have to be familiar with the national legal systems, a single-person-servicing seems to be impossible.

If a single institution was responsible for the maintenance, it would be also very hard to accomplish the correct maintenance of the documents.

4.4.1 Public institutions

The most meaningful approach would be to assign the task to national institutions familiar with the national legal systems. The most desirable way would be to acquire public institutions as partner. As the application would serve as an EU-wide tool for the integration of all member states, a partnership with the European Union would be an objective. The European Commission may take over the responsibility of entering data or take over the whole tool. It may also be possible to get a funding by the European Union if national law-making institutions would serve this application. Another approach is to acquire universities as partners.

One main advantage of such solutions would be that a lot of problems like the correctness of data and the public support would be solved. A drawback is that the establishment of a partnership with such public institutions is hard to accomplish. Therefore other alternatives also have to be considered.

4.4.2 Crowdsourcing

The term “crowdsourcing” represents a connection of the terms “crowd” and “sourcing”. According to [Paps09], it is the “*strategy of outsourcing tasks usually performed by employed in return for payment by an organization or individual using an open-outcry to an undefined number of unknown actors where the outsourcer can freely use the generated content and gain direct economic benefits from it*” ([Paps09], p. 69).

The trend to more and more crowdsourcing projects is ongoing and [Warn11] shows that even governmental organizations use crowdsourcing in several areas including expert collaboration.

For the underlying project, the crowdsourcing approach is a very interesting one. If the EU or the national institutions are not willing to support the project, the work could be done in this way. As other studies have shown, one major advantage of crowdsourcing is that on the one hand the costs can be kept low while on the other hand high quality is provided (cf. [Carv10]). One critical point is that this quality has to be ensured. The purely open crowdsourcing process cannot be applied because the correctness of data is a major requirement for the application. Therefore, legal experts have to be acquired for the assignment of connections. The process of acquiring experts can also be a challenging task as most or all member states should be represented.

One drawback of all solutions is the scattering of tasks to many different institutions or persons. Therefore traceability and consistency across all parts of the systems becomes a very challenging task.

4.5 User Concept

Another central topic in terms of realizing such a project is the concept of users and their authorizations. It has to be ensured that not all users can access all functionality and each user group can access their desired functions.

For this project, three major roles were identified. The first one, described as “basic users” are represented by all consumers. This means they only query information but cannot add or edit data. As a user registration always causes some kind of inhibition threshold, such users do not need to be created. The functionality of this user group can freely be accessed by all people.

Another identified user group is the group of “law experts”. This role is thought to be for users that have the knowledge of determining connection between law documents. Therefore their authorization enables them to define this linkage.

The third user group with the largest field of accessible functions is the role of “administrators”. They can access all pages. Besides the linkage pages, they are also able to import documents to the system.

Depending on the type or realized servicing, different additional restrictions may occur. If the realized project is implemented in a decentralized manner in different countries, authorizations may be assigned to only importing documents of the specific country and to assigning connection to directives only from the origin country. This would support security policies.

4.6 Document Type

The first step of analysis deals with the exploration of the underlying documents. One major use case of this project is the import and display of existing legal provisions. Therefore documents have to be taken from an existing source and have to be transformed to the system structure. As the import can only be done with digital data, two possibilities arise.

The first possibility is to import PDF-documents and parse them. The second possibility is to include HTML-documents and parse them. One major advantage of HTML-documents is that the data is already structured in a similar structure which allows direct access to data and associated metadata. Furthermore, several libraries for the effective crawling of HTML-sites exist. One shortcoming of the HTML-approach compared to PDF is that PDF-documents cannot be altered that easy. PDF-files usually follow a read-only policy while in HTML-files text can be forged.

For the context of this project, the suggestion is to work with HTML-documents for the above mentioned reasons. The provided libraries allow an efficient and tested way for parsing documents and metadata information can also be gained from this type of documents.

4.7 Correction of read-in errors

An important step of ensuring correct system data represents the correction of read-in errors. As the system will read in documents from existing web sites, the quality of the system data directly depends on the provided data from different providers. Possible solutions for occurring problems have to be considered to provide a tool with the best possible quality. Possible read-in-errors and how they should be handled are:

- *Text incorrect*

One possibility to encounter the problem of mistakes in provided text (e.g. typos) is to enable a manual editing of the document text. This approach can cause several problems like the traceability of the changes. It should be tracked if an original document data is changed.

Furthermore, it would have to be ensured that the taken changes are correct. As the correctness of data is crucial for the trust in the system, the suggestion is to not allow a manual alteration of law text. Another argumentation to handle the problem with this solution is that it can be assumed that data is provided correctly as it represents implemented acts published by public institutions. Furthermore, the extraction of text from a web site is usually very robust and won't cause errors when reading text.

- *Provided structure incorrect*

For the structure, it can also be assumed that the provided data is correct for the above mentioned reasons. In contrast to the text, the possibility for read-in errors is higher as the structure will be determined by using an own algorithm. To counteract such problems, a check should be included in the system for initially checking and correcting the structure of a HTML-document.

- *Other formatting problems/corrupt file*

Another type of problem is represented by formatting issues. It may occur that HTML-files are corrupt or that a specific formatting is not readable by the read-in algorithm. Such problems are hard to approach and hard to prevent. Therefore the recommendation is that no specific action needs to be taken.

- *Change of web page structure*

The approach of extracting data directly from web pages relies on a specific underlying structure. The algorithm is developed to read specific HTML-tags to determine the document structure. If a public institution decides to redesign their document representations, the documents are no longer importable. The specific algorithm then has to be adapted to the new structure.

4.8 XML generation

One major problem that arises is that each country stores and represents their legal provisions in different formats. As the source data has to be gained from digital archives, one is dependent on the data provided by the national institutions responsible for the access of digital legal provisions. Due to the fact that each country has its own institution for providing the files, the files of each country will be provided in another structure. This is one reason for the complexity of this project.

A standardized European XML-structure for legal provisions would therefore be very helpful for the project. Currently, no official standard exists although some efforts were made to create one⁹.

Until such an XML-structure is standardized, this additional layer will be simulated for this project. An XML-layer following a defined structured is introduced to create a similar representation of legal provisions of different countries. Before importing documents to the system, the documents are transformed to the same structure. Only this transformed structure is afterwards imported to the database.

This approach provides several benefits: The complexity of adding new countries and associated law systems is lower. New types of documents do not have to be trimmed and imported to a database-scheme. They only have to be transformed to the defined XML-scheme. The program itself afterwards takes the provided XML-data and prepares it for the storage in the system. Another advantage of the XML-layer is that the generated files can also be used to store an “as-was” version of the read file for historical purposes. While the document can be edited and altered by the system, the XML-file still keeps the original structure and wording determined from the original document.

One drawback of the XML-approach is the overhead that is generated in terms of implementation. This shortcoming can be invalidated when taking a closer look on the structure of the problem. On the short term, there is an overhead for the implementation of the XML-creation of the document data as well as the additional reading of the XML-file and transformation to the database. If the focus is set on the integration of countries, one can see the major enhancement of the XML-layer. As the transformation from the original document to an XML-document is easier and less time consuming than transforming it to Java- and database-objects, this approach saves resources for each added law system.

4.9 Representation of law

The following section deals with the representation of law that serves as an input. With that information a structure for the representation of the system is developed.

4.9.1 Structure of legal provisions

For displaying the documents in an appropriate way, a consistent representation for the system has to be found. Therefore, the online provided data is analyzed to develop a common denominator for the application. As a representative for national law, the Aus-

⁹ <http://www.lexml.de/> (last accessed: 15th October 2012)

trian data is analyzed. The structure of directives is also analyzed to explore the counterpart.

The structure of EU-acts is described in [OnlEU1]. A document in general starts with the title. The title contains all information that serves for identifying the act. Afterwards, some technical data may be inserted. This is followed by a preamble-part that may contain citations or the recitals and solemn forms which precede and follow the enacting terms.

The enacting terms follow the preamble and contain the legislative part of the act. They are composed of articles that may be grouped in titles, chapters and sections (cf. Figure 7). Additionally, annexes may follow. (cf. [OnlEU1])

[Ste11] describes the structure of Austrian communal law. This source is used together with an analysis of documents from the web page to describe the structure of the representation of law in the context of the application.

The first elements are, like in the EU-documents, introductory elements. In the case of Austrian Law, these are full title, amendment references and promulgation clause. Afterwards, a content listing may be included, followed by the enacting terms. As [Ste11] further describes, they have to be grouped into paragraphs. If further groupings are necessary, sections, numbers and literae can be used (cf. Figure 7). If more than 20 paragraphs are used, chapters have to be introduced to group the paragraphs. After the enacting terms, annexes can follow.

§1
- (1)
-- 1.
--- a)
---- aa)

Figure 7 – Visualization of hierarchy of enacting elements

Figure 7 gives a short overview on the hierarchy of enacting law elements according to [Ste11]. The problem is that the tree-like structure of specific sections does not necessarily have to follow this strict hierarchy. Some steps of the hierarchy may be skipped which has to be considered in the implementation.

EU Directives follow a similar structure with the difference of using Articles instead of §.

4.9.2 Basic mapping structure

In total, several different elements exist. As the most important parts in the context of this project are the enacting terms, the main focus of mapping the documents to the system lies on the representation of this lawmaking parts.

Documents contain several parts which again can consist of several parts. Therefore, and in terms of considering a way to represent connections, the suggestion is to represent directives as well as national acts in a tree-like hierarchical order. Basically, two types of elements for representing the structure will have to be used, visualized in the following figure.

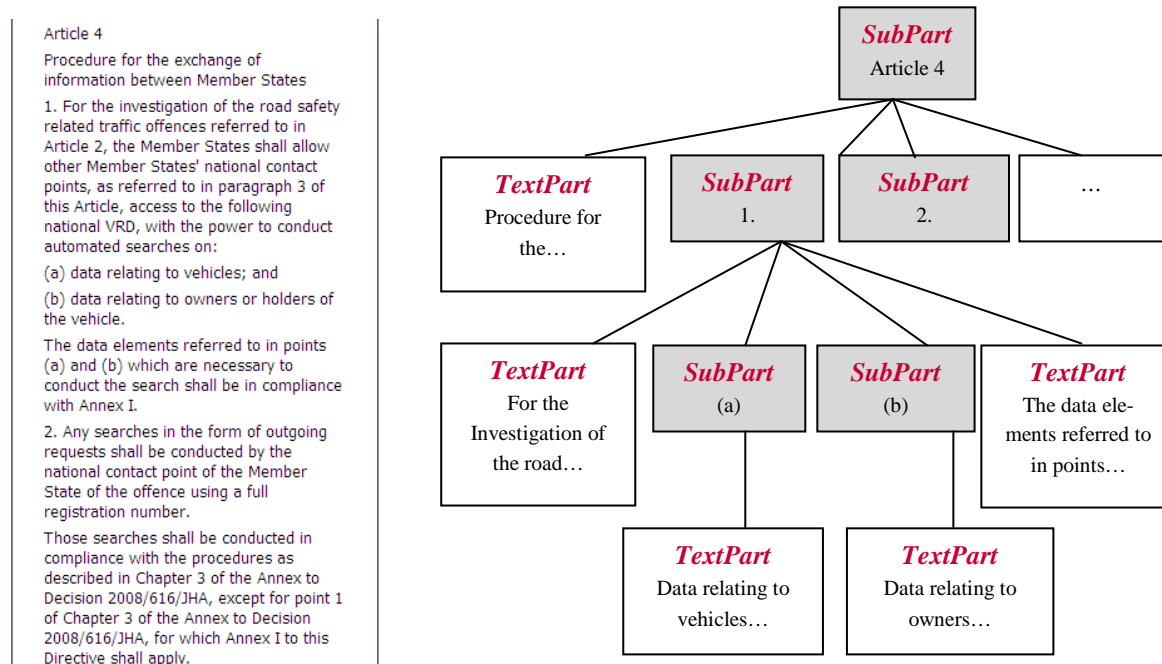


Figure 8 – Hierarchical document order (Eur-Lex document¹⁰ vs. own drawing)

Figure 8 shows a part of a directive from the Eur-Lex-System and shows a hierarchical structure determined from the shown snippet.

The first type is a structuring element (“SubPart”). Elements of this type are used to set up the basic structure of a law and do not contain real information, just information about the current hierarchy (e.g. paragraph number). They usually have a number of different sub-elements representing the parent-child relationship. The other type is used to store the document text. A textual element (“TextPart”) which does not contain sub-elements complements the Sub-Part.

¹⁰ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:288:0001:01:EN:HTML> (last accessed: 09th October 2012)

4.9.3 Law document representation

As the above mentioned structure of Sub-Parts and Text-Parts is sufficient for the representation of enacting terms but not for representing whole documents, additional elements have to be introduced. As several different document structures due to different member states occur, the focus lies on finding a minimum number of different element types while maintaining all important information. Considering this, the following element types were identified:

Type	Class	Description
Sub-Part	Sub-Part	This part represents an enacting element and holds the information about the identification of the section (e.g. paragraph number, number, section)
Text-Part	Text-Part	This part represents the text of the legal regulation.
Intro-Part	Text-Part	This part represents text listed in the beginning of an act like promulgation clause, amendment information and citations.
Content-Part	Sub-Part	This part is used for representing content listings.
Heading-Part	Text-Part	Headlines are represented using this type of element. Headlines can appear in the introduction or between paragraphs announcing chapters.
Appendix-Part	Sub-Part	Annexes are represented using this element-type. Appendix-Types are similar to Sub-Part with the difference of representing an annex.
National Act	Sub-Part	National Acts represent the top-level on national side and may contain all possible sub-elements.
Directive	Sub-Part	Directives represent the top-level on EU-side and may contain all possible sub-elements

Table 2 – Elements of law document

Table 2 gives an overview on all identified elements of a law document. Besides the element type the element class is listed and a short explanation is given. As identified before, the difference between both classes is that sub-parts are structure-giving and may contain several other types (except for national acts/directives) as child-elements while text-elements only contain text and no other sub-elements.

5 Requirement analysis

In this chapter, the basic requirements for the users of the underlying program are identified. Beginning with the initial situation and analysis of existing systems, the functional and non-functional requirements are explored. Therefore, technical aspects are not taken into account. The focus lies on the desired functions. These requirements include beside the ones essential for the prototype to be developed also functions that are desirable for a whole application.

5.1 *Initial situation and existing systems*

Currently, an application covering the issues of this thesis does not exist. Several web sites for querying law are available in the internet. These sites serve as a base for the investigation of basic requirements. If one would like to explore the implementation of a directive, he/she can only search for it at (the law of) one specific country via the existing national web pages. If the pendant of a national implementation in another country has to be explored, the other law system and therefore other web sites have to be used. In the following chapters, existing systems are analyzed. For the directives, the EU-system for law is described, as a representative for national systems, the Austrian one is explored.

5.1.1 EUR-LEX¹¹ system

The EUR-LEX-system was introduced in 2001 (cf. [Opne01]), based on a project initiated by the European Commission (cf. [Stau03]). It offers free access to legal provisions of the European Union and other public documents. The Eur-Lex page offers simple and complex search. Furthermore, documents can be listed and downloaded in PDF-, HTML-, DOC- and TIFF-format. Documents also hold analytic metadata. The information is available in all 23 official languages of the member states. Currently, more than 2.8 million documents exist.¹²

Search functionality

In the following, the functionality in terms of searching for directives or, in general, legal provisions, is examined to gain insights about the desired functionality for the system to be developed.

¹¹ <http://eur-lex.europa.eu/de/index.htm> (last accessed: 1st October 2012)

¹² <http://eur-lex.europa.eu/de/tools/about.htm> (last accessed: 1st October 2012)

As the extended search is only recommended for experienced users having complex needs, this analysis focuses on the simple search.

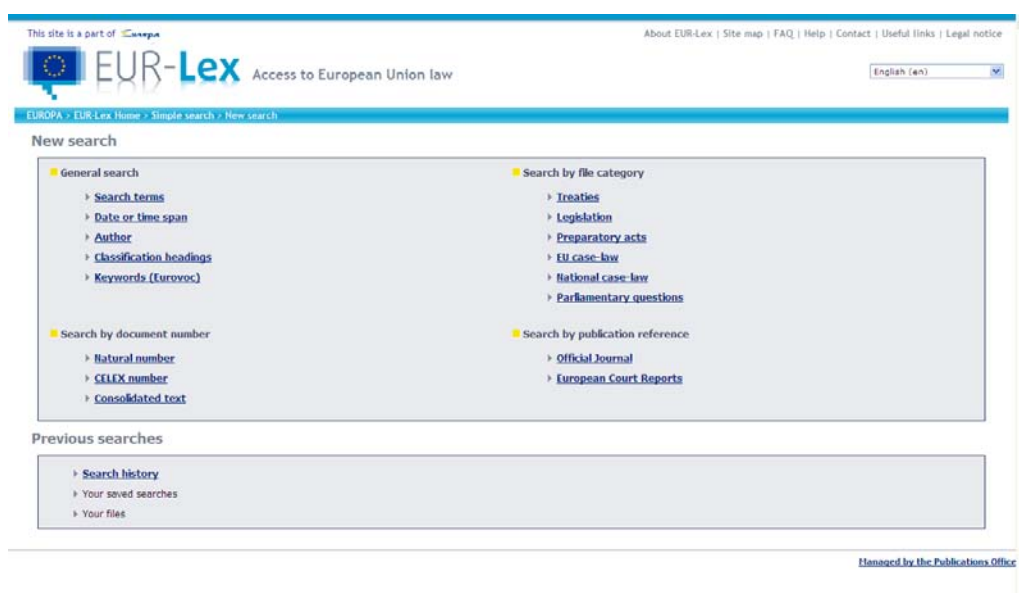


Figure 9 – Eur-Lex simple search¹³

The simple search as listed in Figure 9, explores all documents available in the Eur-Lex system. A user can perform a general search, a search by entering a document number, a search by category or a search by publication reference. For the general search, the properties search term, date or time span, author, classification heading and keywords can be used.

When searching by document number, a natural number can be entered. Additionally, the search can be restricted to directives. In this way, a specific directive can be queried by number. Furthermore, CELEX¹⁴-numbers and consolidated text (documents with amendments and corrections included) can be queried by document number.

Beside the search by publication reference, the file category can also be used. In that case, several possibilities exist. When analyzing directives, the legislation link has to be selected.

In the following screen, the general search properties (term, date or time span, author, classification, keyword) can be applied to directives.

¹³ http://eur-lex.europa.eu/RECH_menu.do?ihmlang=de (last accessed: 1st October 2012)

¹⁴ Communitatis Europae Lex

This site is a part of **EUR-Lex** Access to European Union law

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English (en)

EUROPA > EUR-Lex Home > Simple search > Search terms

Search using search terms

Legislation: Directives (Restrict your search to acts in force)

Search for

WITH

EXCEPT

Options

Title (search limited to document titles)

Title and text (full-text search)

EU English

Search

Guidelines for good results

- To widen the search for a term or a date use the symbols ? or *. ? replaces one character, * replaces 0 to n characters. These two symbols can only be used in the middle or at the end of the searched word, never at the beginning.
Example: ?transport* will find transportation, transporting, etc.
- A search term can be a single word or a string of words.
- Use a comma ',' between the terms or expressions in a search to get the documents that contain at least one of those terms or expressions.
Example: transport, energy returns documents that contain either the word 'transport', the word 'energy' or both of these words.
- Use WITH to restrict the search to documents that contain all the terms or expressions specified.
Example: transport WITH energy restricts the search to documents that contain both these terms.
- Use EXCEPT to exclude from the search documents that contain certain words.
Example: transport EXCEPT energy allows the documents to be found that contain the word 'transport' but not the word 'energy'.

Managed by the Publications Office

Figure 10 – Eur-Lex directive search¹⁵

Figure 10 shows the search possibilities when trying to search for directives. Fields for entering two search terms included in the document and also one for text that should not be included exist. Beside this, the query can be applied only for title or for title and full text.

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English (en)

EUROPA > EUR-Lex Home > Simple search > Search results

Search

Query 1 - Title: transport - 6025 Hit(s) Refine

New search

Search history

Search results

Complementary data: Dates Languages and formats available Classifiers

Display results: ordered by date

GO

Page 1 of 603 > < >>

JOL_2012_248_R_0033_01
Decision of the EEA Joint Committee No 95/2012 of 30 April 2012 amending Annex XIII (Transport) to the EEA Agreement
OJ L 248, 13.9.2012, p. 32–33 (BG, ES, CS, DA, DE, ET, EL, EN, FR, IT, LV, LT, HU, MT, NL, PL, PT, RO, SK, SL, FI, SV)
Bibliographic notice
pdf

JOL_2012_247_R_0016_01_DEC.EEA_2011_104_16
Compendium to Decision of the EEA Joint Committee No 104/2011 of 30 September 2011 amending Annex XIII (Transport) and Protocol 37 (containing the list provided for in Article 101) to the EEA Agreement (OJ L 318, 1.12.2011)
OJ L 247, 13.9.2012, p. 16–18 (BG, ES, CS, DA, DE, ET, EL, EN, FR, IT, LV, LT, HU, MT, NL, PL, PT, RO, SK, SL, FI, SV)
Bibliographic notice
pdf

COM/2012/0501 final
/* COM/2012/0501 final */
COMMUNICATION FROM THE COMMISSION TO THE COUNCIL AND THE EUROPEAN PARLIAMENT Research and innovation for Europe's future mobility_Developing a European transport-technology strategy

Figure 11 – Eur-Lex directive search results¹⁶

¹⁵ http://eur-lex.europa.eu/RECH_mot.do (last accessed: 1st October 2012)

¹⁶ <http://eur-lex.europa.eu/Result.do> (last accessed: 1st October 2012)

Figure 11 displays the search results containing document number, text part with highlighted search term and a link to the whole document where the search result is included. Additionally, the search results can be ordered.

5.1.2 RIS¹⁷-System

The Austrian „RechtsInformationssystem“ (RIS) is an electronic database administrated by the Austrian Federal Chancellery. The system was introduced in 1997 and contains both full-text and index documents of federal law, state law, communal law, judicature and decrees. Beside actual data, the system also contains selected legal regulations starting from 1780.¹⁸ It also acts as a portal to other Austrian eGovernment applications (cf. [Stau03]).

Search functionality

When searching for Austrian acts, users have the possibility to choose between several databases. Amongst others, federal law gazettes and consolidated federal law can be queried. When focusing on consolidated federal law, several search possibilities exist.

The screenshot shows the RIS search interface for consolidated federal law. The page is in German and features a search form with the following fields:

- Suchworte (Keywords)
- Titel, Abkürzung (Title, Abbreviation)
- Paragraf von (Paragraph from) and bis (to)
- Artikel von (Article from) and bis (to)
- Anlage von (Attachment from) and bis (to)
- Kundmachungorgan (Official Journal)
- Typ (Type)
- Index
- Unterzeichnungsdatum (Signature date)
- Fassung vom (Version from) - currently set to 23.07.2012
- Neu/geändert im RIS seit (New/changed in RIS since)
- Trefferanzahl pro Seite (Number of hits per page) - currently set to 100

Buttons for "Suche starten" (Start search) and "Zurücksetzen" (Reset) are located below the form. The page also includes a sidebar with "Webseiten" (Websites) and "Informationen" (Information) sections, and a footer with "© 2012 Bundeskanzleramt Österreich" and "Offenlegung".

Figure 12 – RIS search federal law page¹⁹

Figure 12 shows the query page in German language as the search in English language can only query search term, title, source and available since data. The search page in German language offers more functionality.

¹⁷ <https://www.ris.bka.gv.at/default.aspx> (last accessed: 1st October 2012)

¹⁸ <https://www.ris.bka.gv.at/UI/Info.aspx> (last accessed: 1st October 2012)

¹⁹ <https://www.ris.bka.gv.at/Bundesrecht/> (last accessed: 1st October 2012)

In the first field, a search term can be entered. This term is used for a full text search in this type of documents. The second field can be used to query full/short title or abbreviation of act titles. Furthermore, ranges for paragraphs, articles and appendixes can be given. The legal publishing body can also be queried as well as type and index of the act. In terms of dates, the date of signature and the current version from a specific date can be used to search for law.

The screen shown above also implicitly allows combined search. One or more fields can be queried. The resulting screen is shown in the following figure.

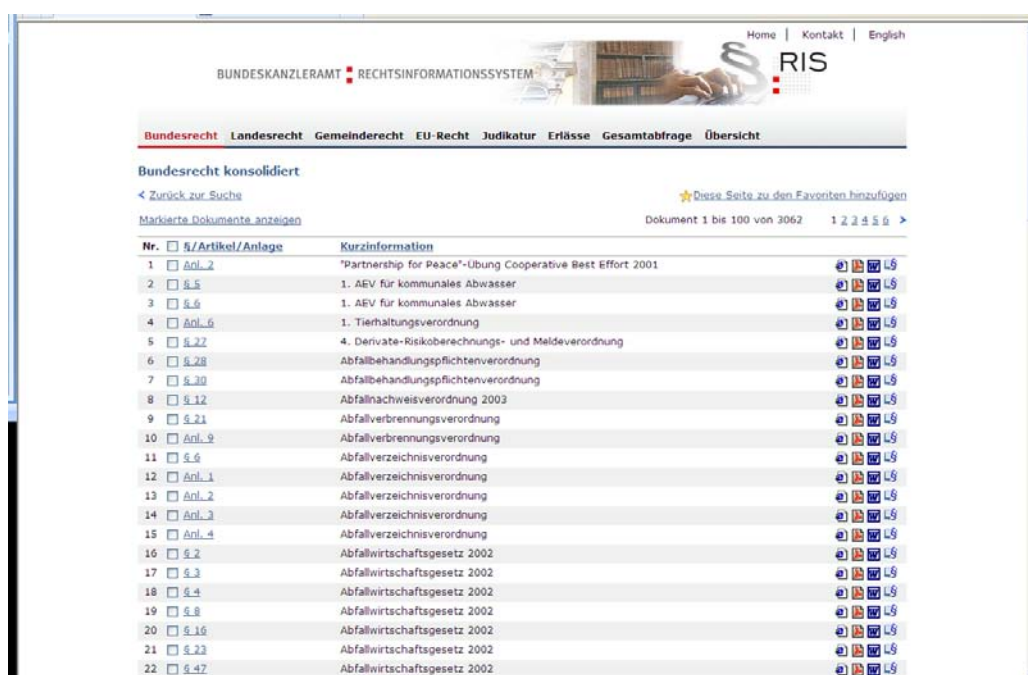


Figure 13 – RIS search results page²⁰

As Figure 13 shows, the search results are listed by identifier of the section and short name of the act where the searched term was found. Additionally, the underlying document can be viewed or downloaded.

²⁰

<https://www.ris.bka.gv.at/Ergebnis.wxe?Abfrage=Bundesnormen&Kundmachungsorgan=&Index=&Titel=&Gesetzesnummer=&VonArtikel=&BisArtikel=&VonParagraf=&BisParagraf=&VonAnlage=&BisAnlage=&Typ=&Kundmachungsnummer=&Unterzeichnungsdatum=&FassungVom=01.10.2012&NormabschnittnummerKombination=Und&ImRisSeit=Undefined&ResultPageSize=100&Suchworte=Richtlinie&Position=1> (last accessed: 1st October 2012)



Figure 14 – RIS document view page.²¹

One sample document is displayed in Figure 14. Besides the wording of the law, the introductory part contains references to CELEX-numbers. Via these references, European law documents that were implemented in this document can be accessed.

5.2 Functional Requirements

In the following chapter, the gained insights from the analysis of the existing systems are used to formulate functional (high-level) requirements and to identify additional needs. The so developed requirements are clustered into groups of related objectives. Each of them is comprehensively described by the desired functionality.

- *Representation*

In this chapter, basic requirements regarding the representation of the directives and national acts in the system are analyzed.

1. *Distinction between national acts and EU directives*

The national acts and the directives strictly have to be separated and kept in different tables/menus.

²¹

<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20003119>
(last accessed: 16th November 2012)

2. *Interoperability for different law systems*

One main goal of the tool is to enable the tracing of a given directive in various member states. Therefore it has to be ensured that legal provisions of different nations can be loaded to the system.

3. *Maintain document structure*

The structure of the documents has to be recognized and transformed to the system. This applies to structuring elements (like article/paragraph/subparagraph) as well as to text belonging to them.

- *Legal provisions*

This chapter describes the requirements for the handling of legal provisions in the system.

1. *Upload*

The upload of a document can be done in two ways.

- a. *File*

An existing file with an act/directive has to be uploaded and therefore imported to the system. The system has to be able to read files in HTML-format.

- b. *URL*²²

Alternatively to the file upload, it should also be possible to enter an URL of an act or directive. By entering such an URL, the system automatically has to import the legal text to the system.

2. *Manually added metadata*

To further identify the uploaded legal provision, metadata will be added by the uploading user. Additionally, the metadata also has to enable adequate search possibilities for the searching and grouping of acts/directives. Furthermore, it has to be traceable if an act is based on a directive or if the act is amended or repealed by the directive.

3. *Structure review*

As the structure of an act (regarding paragraphs, articles and other grouping elements) has to be equal to the original document, a manual review of the automatically determined hierarchy is required to enable a correct representation of

²² Uniform Resource Locator

the original hierarchy. As analyzed before, the full title and the document structure have to be revised.

4. *Storage of acts*

The uploaded documents have to be stored in a persistent database to enable the access and usage on a long term.

5. *Delete/ repeal acts*

If no versioning is chosen as suggested in the concept chapter (cf. 4.3.2), stored documents in the system have to be deleted if required. With the deletion, all existing linkages of the document have to be deleted as well. If an act is repealed due to the implementation of a new directive, this also has to be mapped to the system and the linkages have to be kept.

- *Display legal provisions*

Beside the requirements regarding the input of documents, it is also desired to display them.

1. *Listing of existing documents*

All acts/directives that are currently in the system have to be displayed in a clear view. In a certain structure, the existing documents and associated information have to be shown.

2. *Sort displayed documents*

In the listing of the legal provisions, there also has to be the possibility of ordering the documents according to certain properties. The defined metadata will have to provide several properties that may be useful for this function.

3. *Display of a specific document*

There has to be the possibility to display a specific document selected in the listing. During the process of importing a new one, the document needs to be displayed.

4. *Display of related elements*

The connections between directives and national acts (stating which part of the directive is implemented in which part of the act) have to be visualized by a symbol to enable the exploration of the implementations in the member states. For directives, the possibility of defining a standard country has to be available. By selecting such a country, only connections to acts of this country are visua-

lized. There should also be the possibility to display all related elements from one document and two linked documents.

- *Connect legal provisions*

The connection is used to establish a relation between a directive and an act.

1. *Establishment of connection*

To establish the concrete connection, a directive and a national act to be connected have to be selected. For each part of the national act there has to be the possibility to enter one or more parts of the directive to connect to.

2. *Storage of connections*

The established connection has to be stored in the database. The connection has to be accessible for the directive as well as for the national act.

3. *Remove connection*

Existing connections may be removed.

4. *Related documents*

Additionally to the connection of specific document elements, links to all related documents for an act/directive have to be stored for each document.

5. *Connection metadata*

Additional metadata holding information about the source of connection and the person determining the connection has to be used.

- *Search functions*

Due to the large number of existing acts and directives, an efficient search is a major requirement for the tool. The search has to be possible in several ways:

1. *Text*

The “classical way” of searching for a specific word or several words in the documents is a basic requirement.

2. *Metadata Search*

Each metadata property defined at upload time has to be searched to find documents matching the search term.

3. *Combined Search*

When searching for acts or directives, the search functionality has to support all combinations metadata properties to enable a flexible search procedure.

- *User administration*

As the tool offers different critical functions that should not be accessed by every user, there is a need of defining privileged users that are allowed to perform critical tasks.

1. *Creation of a new user*

For authorized users, there has to be the possibility to create new users for the system and assigning roles to them.

2. *Display of existing user*

Existing users and assigned roles are to be displayed to the administrator.

3. *Delete user*

Existing users can be removed from the system.

4. *Change Password*

Existing user have the possibility to change their password.

5. *Access control*

As the tool will be accessible for a large number of users while providing a lot of different functions, a role concept is necessary to ensure access to the right functions for the designated user group. Basically, three roles were identified in the concept-chapter above:

a. *Basic User*

The basic user needs no credentials or a specific user login. This user group has only reading functionality. In concrete terms, they are allowed to display legal provisions and their connections. Furthermore, all search functions can be performed.

b. *Law Expert*

The role as a law expert extends the basic user functions by allowing the user to establish connections between directives and national acts.

c. *Admin*

The administrator role authorizes the user to access the full functionality of the tool. Besides the functions of the other roles this includes the user administration and import of legal provisions.

5.3 Non-functional requirements

In addition to the different functions analyzed in the previous chapter, the following section deals with basic criteria regarding the quality of software that the tool has to fulfill.

- *Performance*

A major requirement for the tool is performance. For a large number of users the search functionality is the central point of interaction with the tool. Therefore search performance is an essential requirement for the success of this application.

In general, the performance of the whole web application has to behave like expected for this type of software. The response time is expected to be within two seconds.

- *Documents up-to-date*

Amendments to directives and especially to national acts occur at regular intervals. To be usable and authentic to the user community, it has to be ensured that these amendments are also integrated in the tool and the documents are kept up to date.

- *Trust*

Trust is an important requirement for the application. Beside the need for up-to-date documents it is essential that the stated connections are correct. Without trust, users will not be willing to use the platform. Therefore the success of this application is tightly coupled with the concept of trust.

- *Robustness*

As the system also uses Web-Data-Extraction-methods, it depends to a certain degree on the underlying document that is read in. Nevertheless, the program has to be designed to be as robust as possible. This applies to structural errors as well as changes in the document representation.

6 Design

Based on the requirements identified in the last chapter, the following one contains a concise system design for the desired directive-tracer- software tool. At the beginning, the basic software architecture is described followed by basic design decisions about the prototype development. With these decisions, the use cases are described and an XML-mapping of the underlying documents is defined.

6.1 Software Architecture

The software architecture is planned and designed to follow the MVC-pattern as described in [Dust03]. The abbreviation MVC stands for model-view-controller and describes according to [Kras88] an architecture design for the clustering of a software system into three pillars. Goal of this partitioning is an adaptive design to improve maintainability and reusability.

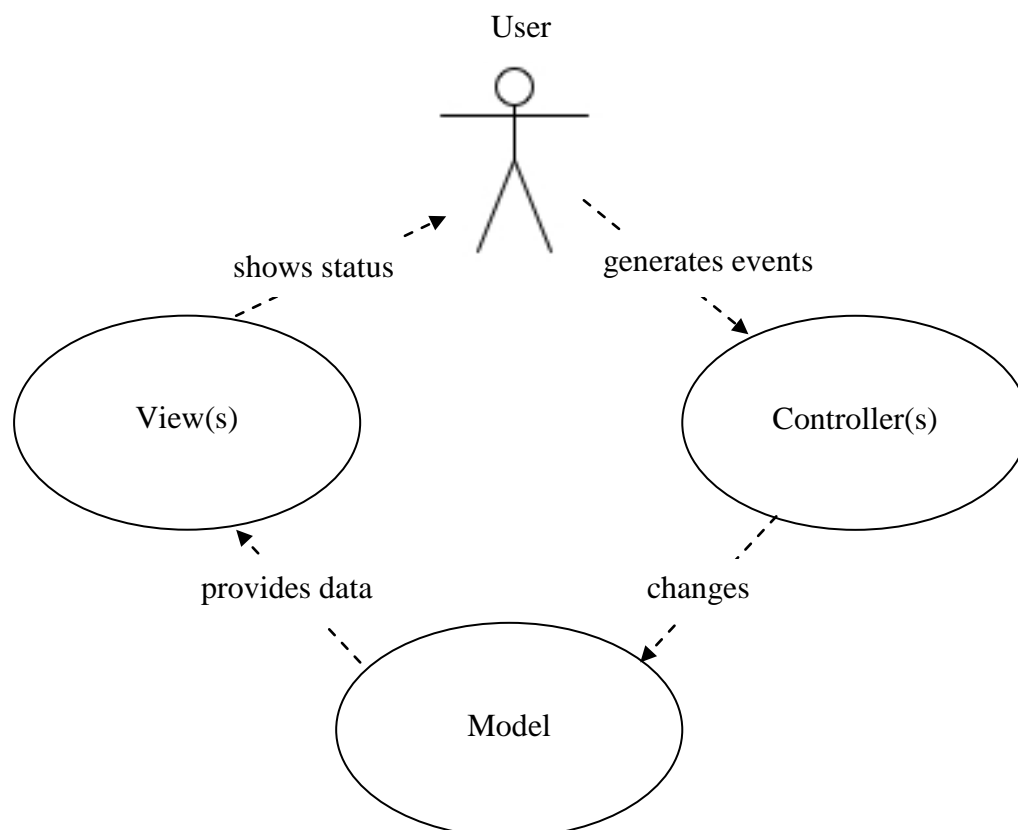


Figure 15 – MVC-pattern according to [Scha10]

Figure 15 gives an overview over different components of the MVC-pattern. As mentioned in [Scha10], the model holds the data and defines logic for manipulating it. The

view represents elements visible on the user interface while the controller acts as a mediator between view and model.

As the tool is designed to be a web application, the MVC-concept is adapted to web application development. [CaDa09] explains the web application approach for MVC-applications.

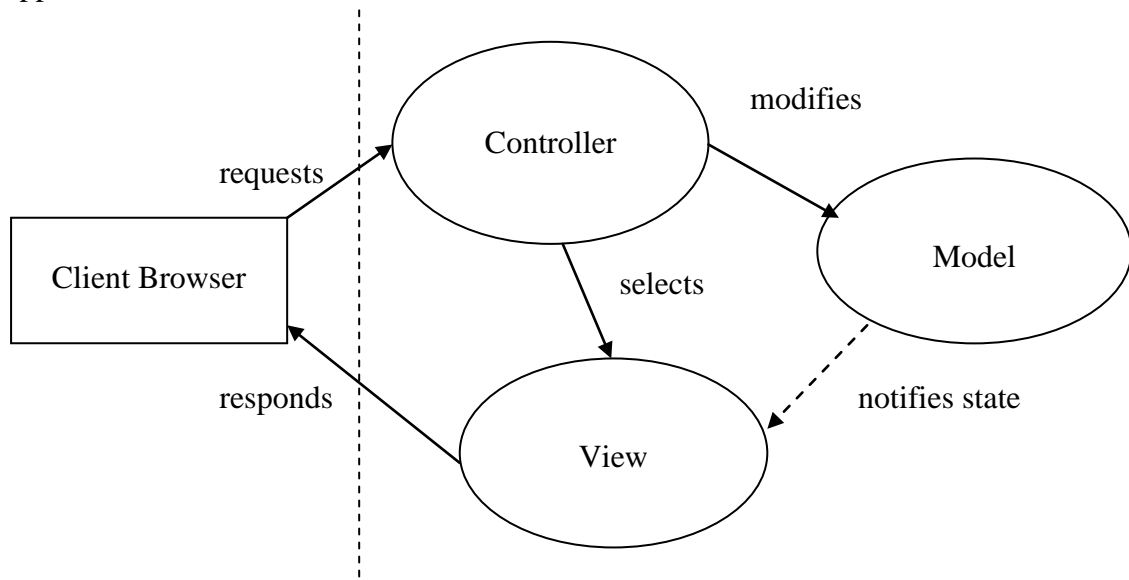


Figure 16 – MVC-pattern for web applications according to [CaDa09]

Figure 16 shows the MVC-principle for web applications. As [CaDa09] describes, a user usually issues a page request to the application. The controller intercepts the request and decides which operations need to be performed. The controller invokes the right component of the model which executes the requested action. The state of the application is updated and the data to be presented to the user assembled. The view is updated according to the changed state. The generated document is sent as a response to the user.

6.2 Basic design decisions

The following sections describe basic design decisions taken to show how certain topics are addressed in the context of the prototype.

6.2.1 Metadata Properties

According to the requirements analysis, metadata will be assigned to further specify legal provisions and to enable effective search mechanisms. Therefore, the properties to be used have to be defined.

- *General properties for all legal provisions*

Some properties apply to directives and national acts and can therefore be used for both document types.

 1. *Short title*

As many acts do not contain a short title by default, the manual assigning of a short title can improve the search process and the clarity. The short title has to be a concise description of the content of the underlying act.
 2. *Category*

The uploaded act has to be categorized to enable a fast detection of corresponding or similar acts.
 3. *Tag*

Additionally to the metadata mentioned before, several keywords can be entered to enable, besides the category, further groupings of acts.
 4. *Commencement Date*

As it is also desired to explore the state of an act/directive at a given date, the commencement date of a document also has to be considered.
 5. *Repealing Date*

As it is desired to know if an act is still valid or if the act/ directive is eliminated, this metadata property is used for the validation state of an act or directive.
- *Directive-specific property: directive number*

The European Union assigns specific identifiers to their directives. As there is no national pendant in member states, this property is only useable for the directive metadata.
- *National law-specific property: country*

As the software tool has to deal with law systems of different countries, a property holding the nation of an act is useful to clearly separate between acts of different countries.
- *National law-specific property: European law status*

As an act can be based on a directive or amended or repealed by a directive, a property for storing this information is used.

6.2.2 Law Type

Another basic question in terms of implementing the prototype is the question of what kind of law should be displayed. Basically, two approaches can be identified: Each directive or act is imported without changing actual law. As amendments are often adapted, these are published as separate documents and would therefore also have to be considered as separate documents in the system.

As the focus of this tool lies not on fully mapping all governmental actions and the versioning will not be fully supported in the prototype. Only consolidated law will be considered. The main difference is that amendments to existing acts change the act itself, the existing act gets consolidated with the taken amendments. A repealing of a document is also possible by defining an repealing date for the document. As this approach is sufficient for the context of the tool and supports traceability, consolidated law that is either repealed or still valid is considered.

6.2.3 Update of existing law

When considering the update possibilities mentioned in the conceptual part of the thesis, the prototype version will be implemented by not supporting versioning of law as suggested for the roll-out version. Due to simplicity reasons, the update of existing law has to be performed by removing or repealing the old document and importing the new one.

6.2.4 Representation of connections

For a connection between a national act and a directive, several interpretations of this linkage are possible.

The connection can be stated for all subparts of the actual selected element. By using this approach, several sections of a paragraph may be connected to the same element of a directive. One advantage of this solution would be that the linkage is inherited and not every element has to be linked on its own. One major drawback is that this functionality would to a certain degree interfere with the objectives of the application as subparts of one element could not be implemented in other acts any more. Therefore this approach cannot be taken.

The better approach is to manually add each link; no automatic inheritance of connections is possible. This approach may cause an overhead in some cases but full flexibility in representation of implementations can be maintained.

A connection can be stated between Subparts or Appendixparts of each document type. Introparts cannot be linked due to the fact that usually, introduction text is not directly based on a directive.

Connection metadata is not in the scope of the prototype as the focus is on the right representation of the connection between elements.

6.2.5 Tables

When considering the HTML source-code of law documents the topic of tables becomes a specific problem. As it is very hard to automatically determine whether the table is only used for representation purposes or the table is part of the document, the decision is to not store the table explicitly. Nevertheless all data has to be kept and the table data has to be stored using text elements.

6.2.6 Search

For the search, several fields have to be available. Basically it has to be distinguished between metadata-search and text search. Metadata-search is performed on the properties category, full title, short title and directive number while text-search focuses on the text of the document itself.

One basic design decision is how to perform the search. One decision was to model the search as case-insensitive. This means that a word is matched no matter if some letters are capital letters or not. Furthermore, an exact search is preferred. This means that typos in the search or in the document lead to no match for the given part. Wildcard search will be enabled for the metadata fields. That means that search terms can be extended via “*” or “?” where “*” replaces an arbitrary number of symbols and “?” replaces exactly one symbol. An example is that “Article*” as search term matches the text “Article 1” as well as “Article 2” or “Article 27”. As this may cause a high number of search results, the wildcard search for text search disabled.

Elements covered by a text search are text parts, introduction parts and headers.

6.3 Use Cases

The following chapter discusses the derived use cases explaining the business cases for potential users. The basic relations between the functions are explored and give a concise overview over the processes supported by the system.

- *Package Directive*

This package subsumes the functionality regarding directives. Each business case is shortly described with the important features.

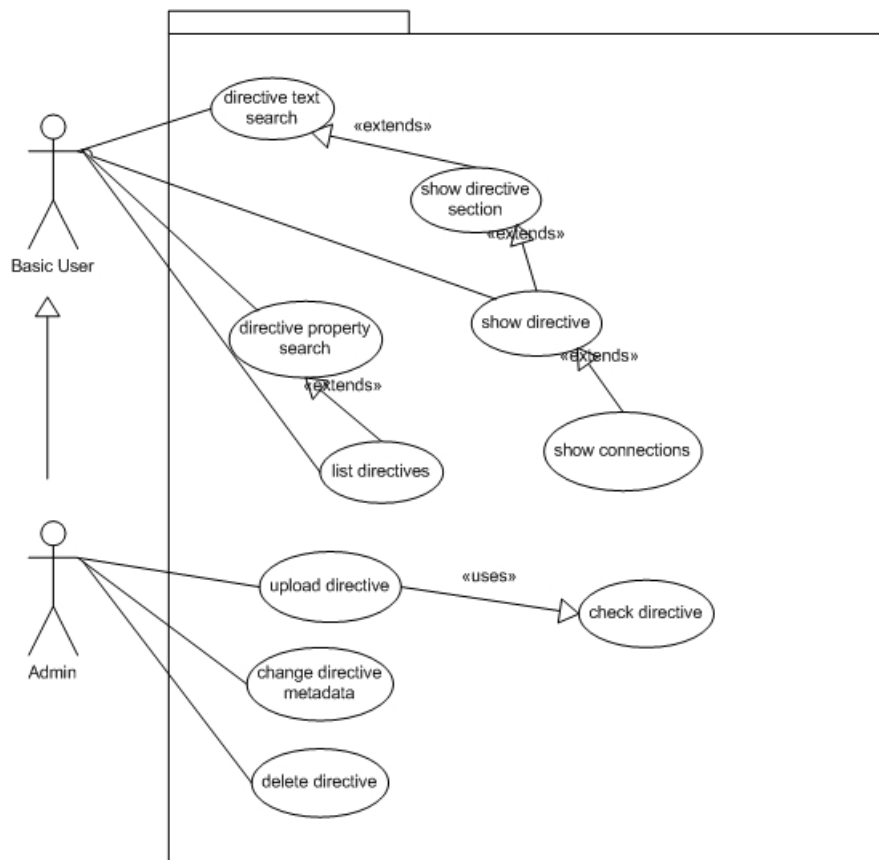


Figure 17 – Use Cases directive package

Figure 17 shows the use cases that can be grouped as belonging to directives. The actors directly involved are of role user and admin. The use cases are described in the following section.

1. *Directive Text Search*

By entering a search term, the actor user searches for sections containing the search word(s). If an invalid or no term was entered, the user will be notified and redirected to the same page again. The same process applies for searches where

no matching section was found. If the system determines matching parts, they are displayed (-> Use Case “*Show Directive Sections*”).

2. *Directive Property Search*

When searching for documents related with specific properties, the user has a lot of different possibilities. The actor can query the defined metadata properties for a full title, a short title, a directive number, a category, one or more key words and a date when the specific directive(s) were valid. The search functionality offers a lot of space for specific search desires. If one is looking for a specific document, he can address it by entering the full title, if he would like to browse documents, only one word of the title can be entered. By combining search terms for different properties, the system offers a large variety of different possibilities for finding directives is given.

If the search led to no (valid) result, the actor is redirected to the same search page again, otherwise the directives fulfilling the queried terms determined by the system are displayed (-> Use Case “*list directives*”)

3. *Show Directive Section*

After performing a text search, a listing of sections containing the queried term is displayed by the system. Besides the section containing the text with the highlighted matching word(s), the path of the section is shown by the system. This path informs about the location of the displayed section and contains the short title of the corresponding directive as well as the parent elements in the document hierarchy. Via the path, the parent section of the displayed one can be queried (-> Use Case “*Show Directive Section*”). If the section has already defined connections to national acts, the system displays the existing connections for this text (-> Use Case “*Show Connection*”).

4. *Show Directive*

The whole document is loaded by the system and displayed in its defined structure. The actor can explore the directive and read relevant sections of the document. If sections of the directive have a connection to national acts defined, this is shown at the concerned sections and can further be investigated (-> Use Case “*show Connection*”).

5. *List Directives*

An overview of all (or all according to the search terms) directives in the system is displayed. A table shows the metadata properties of the directive. Several columns can be sorted in ascending or descending order. Additionally, one search field for each column is given to further limit the number of displayed directives.

A specific directive can be selected to be displayed. (-> Use Case “*show Directive*”)

6. *Upload directive*

For the upload of a new document, an existing HTML-file wrapped from the EUR-Lex system can be imported. Alternatively, an URL-link can be entered. Additional fields are used to add metadata to a directive. This is the directive number, a short title, a category, several key words and a commencement date. If an incorrect file or URL is provided or invalid metadata properties are entered, a notification message is shown. Otherwise, the system parses the entered file and stores the directive and its assigned metadata in the database. During this process, the generation of an XML-file is triggered.

7. *Check directive*

The check-screen is shown if a directive has been imported successfully by the system. The system lists the document as detected. At each structuring element (like paragraph, section or number), a dropdown box is shown. By using this dropdown-box, the user can change the structure of the directive by selecting a new parent element from the dropdown-list where all detected structuring elements are selectable. If adjustments were taken, these changes are forwarded to the database.

8. *Change Directive Metadata*

For users having the admin role, a small symbol is displayed in the directive overview screen. The symbol is placed in every row and is directly assigned to a directive. By clicking this symbol, the system redirects the user to the change metadata-screen where the entered metadata for the directive is displayed. For the values short title, category, tags and commencement date, a text field holding the current value is shown and can be altered by overwriting this text.

9. *Delete directive*

The show directive screen displays for admin-role-users a symbol for deleting directives. Each row holds on symbol. By clicking the symbol, the corresponding directive gets removed from the database.

10. *Show Connections*

To visualize the connection between national acts and directives, a table with two columns is displayed. The first column shows an element of a directive (including sub-elements), the second one a connected one from a national act (in-

cluding sub-elements). If one section of a directive is connected with several national acts, the section is displayed in the column several times. The path of the displayed section is also displayed. Each section is also marked as connected. Via this mark, the connections of this element are shown using the same use case.

- *Package National*

In this chapter, the functionality regarding national acts is explained.

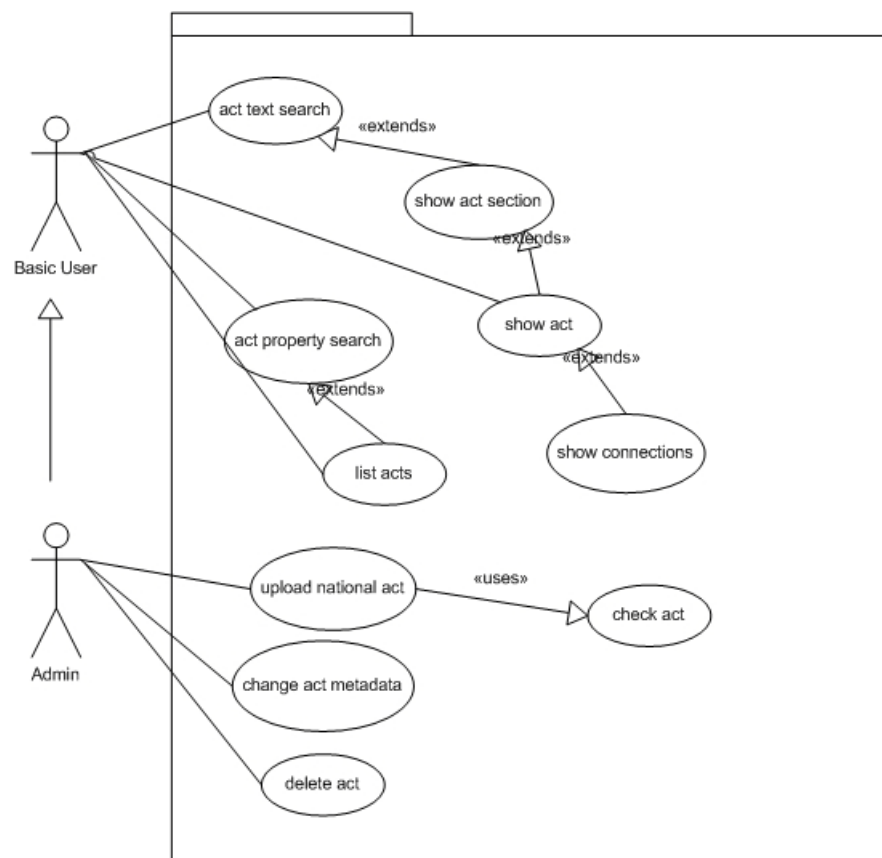


Figure 18 – Use Cases national act package

Figure 18 gives an overview on the use cases related to national acts. The involved actors have the roles basic user and admin. Details are given in the following sections.

1. Act Text Search

By entering a search term, the actor user searches for sections of acts containing the search word(s). Additionally, he has to define a country. All acts of the chosen country are explored by the system to find matching sections. If an invalid or no term was entered, the user will be notified and redirected to the same page again. The same process applies for searches where no matching section was

found. If matching parts are found, they are displayed by the system (-> Use Case “*Show Act Section*”).

2. *Act Property Search*

When searching for documents fulfilling specific metadata property search terms, a lot of different possibilities are provided by the system. The actor can query the defined metadata properties for a country, a full title and a short title, a category, one or more key words and a date when the specific act was adopted. The search functionality offers a lot of space for specific search possibilities. If one is looking for a specific document, he can query it by entering the full title, if he would like to browse documents dealing with similar issues, just one word of the title or a category can be entered. By combining search terms for different properties, a large variety of different possibilities for finding directives is given. If the search leads to no (valid) result, the actor is redirected to the same search page again, otherwise the acts fulfilling the queried terms are displayed (-> Use Case “*List Acts*”).

3. *Show Act Section*

After performing a text search on national acts, the system lists all sections containing the queried term. In a table, the section containing the text with the highlighted matching word(s) and the path of the section is given. This path informs about the location of the displayed section and contains the short title of the corresponding act as well as the parent elements in the document hierarchy. Via the path, the parent element of the displayed section can be queried (-> Use Case “*show Act Section*”). If the section has already defined connections to directives, the existing connections for this text can be shown (-> Use Case “*show Connection*”).

4. *Show Acts*

The whole act is displayed in its defined structure. The actor can explore the document and read relevant sections of the document. If parts of the act have a connection to directives defined, this is shown at the concerned sections and can further be investigated (-> Use Case “*show Connection*”).

5. *List Acts*

An overview of all (or all according to the search terms) acts in the system is displayed. A table shows the identifier, the country, the short and full title of the act, the category, tags and the date of commencement. The columns X,Y,Z can be sorted in ascending or descending order. Furthermore, search fields for the columns exist to select specific documents from the list.

6. *Upload national act*

The use case of uploading a new national act to the system involves the selection whether the user wants to import a local saved file or if he wants to add an URL-link that points to such a document. Additionally, metadata has to be assigned to the act. By filling fields, the user can assign the country, a short title, a category, some key words, a date of commencement, a date of repealing and the European law status (based on EU-law, amended or repealed). If some errors occur, the user is informed about the underlying problems. Otherwise the system parses the provided file, creates an XML-representation and stores the act in the database.

7. *Check Act*

After importing a document to the system, the check-screen is displayed. On this screen, the document is displayed. At the structuring elements like paragraphs, sections and so on, a dropdown list is shown. This list contains all detected structuring elements and enables the user to select another parent element for the current part. If changes are entered, they are propagated to the database.

8. *Change act metadata*

For users having the admin-role assigned, a small symbol for changing metadata is displayed in the overview-screen of national acts. The system redirects a user clicking on the symbol to a screen where the metadata assigned to the act is displayed. For the values short title, category, tags and commencement date a text field is displayed holding the current values of the corresponding properties. The properties can be overwritten and saved.

9. *Delete act*

The deletion of acts can be accessed via the overview screen. For each act, a delete-symbol is shown to admin-role users. By clicking this symbol, the corresponding acts are removed from the database.

10. *Show Connections*

See use case description package directive, 10.

- *Package General*

This package subsumes all use cases that cannot be directly assigned to directives or national acts.

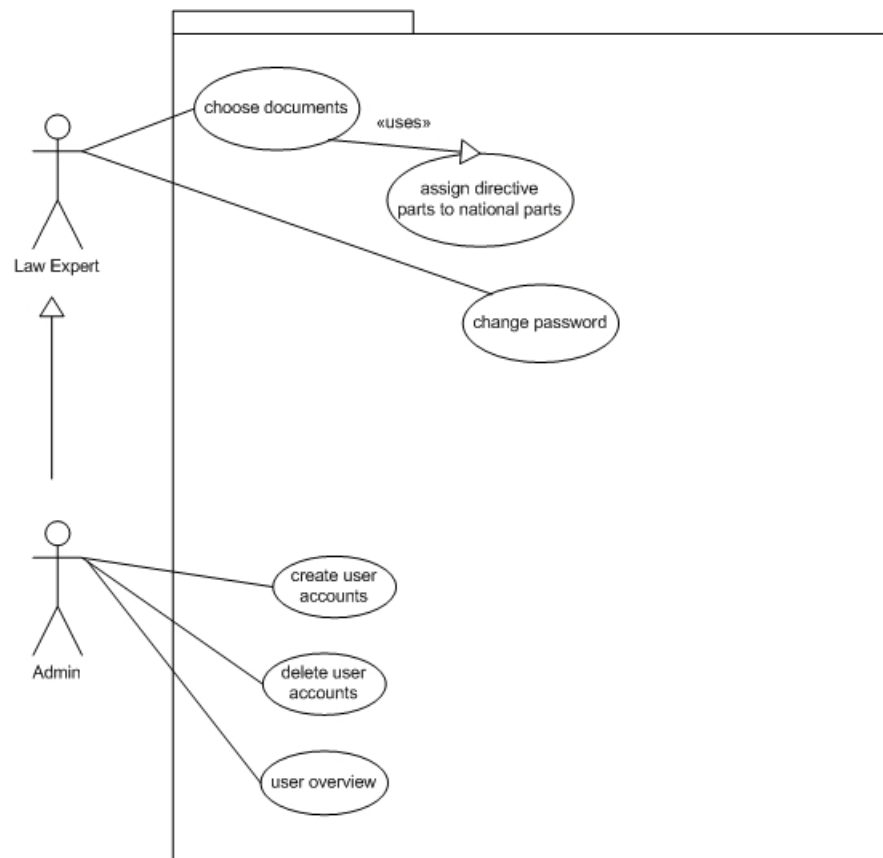


Figure 19 – Use Cases general package

Figure 19 shows the use cases that cannot be directly related to either directives or national acts. The actors involved in this package are of role law expert and admin.

1. *Choose documents*

The system displays two lists – one containing directives and one containing national acts. From each list, one document can be selected for the assigning of a connection (-> Use Case “*assign directive parts to national parts*”).

2. *Assign directive parts to national parts*

The system provides a split screen showing on the one side the selected directive. On the other side, the selected act is displayed and allows assigning the corresponding directive part(s) for each section. The actor has the choice of selecting existing parts of the related document via a list. The assigned connections are stored in the database. For the selected act, the use case “*show Connections*” is processed.

3. *Change Password*

For ensuring a secure user policy, there is the possibility to change the password for the current user. Therefore the old and the new password have to be provided

to the system. To avoid typos, the new password has to be entered twice, both have to be similar.

4. *Create user accounts*

Users having the administrator-role assigned have the possibility to create new users. Therefore the system takes name, password and user role and creates the new user. The system redirects the user to the overview of existing user (-> Use Case “*user overview*”)

5. *Delete user accounts*

Existing user accounts can be removed from the system. The system displays a list of existing users and a column holding a symbol for the deletion. If the symbol is clicked, the user is removed from the system and from the database.

6. *User overview*

The currently existing users of the system can be displayed. Therefore a table holding user name and assigned role is displayed.

ID	Use Case Name	Basic	Expert	Admin
<i>Package Directive</i>				
Dir.01	Directive Text Search	X	X	X
Dir.02	Directive Property Search	X	X	X
Dir.03	Show Directive Sections	X	X	X
Dir.04	Show Directive	X	X	X
Dir.05	List Directives	X	X	X
Dir.06	Upload Directive			X
Dir.07	Check Directive			X
Dir.08	Change Directive Metadata			X
Dir.09	Delete Directive			X
Dir/Nat.10	Show Connection	X	X	X
<i>Package National</i>				
Nat.01	Act Text Search	X	X	X
Nat.02	Act Property Search	X	X	X
Nat.03	Show Act Parts	X	X	X
Nat.04	Show Acts	X	X	X
Nat.05	List Acts	X	X	X
Nat.06	Upload National Act			X
Nat.07	Check National Act			X
Nat.08	Change National Act Metadata			X
Nat.09	Delete/Repeal National Act			X
<i>Package General</i>				
Gen.01	Choose Documents		X	X
Gen.02	Assign Directive Parts to National Parts		X	X
Gen.03	Change Password		X	X
Gen.04	Create new User Accounts			X
Gen.05	Delete existing User			X
Gen.06	User Overview			X

Table 3 – Use Cases and corresponding authorizations

Table 3 describes the identified requirements and the user roles to give an overview about the overall and role-specific desired functionalities.

6.4 Directive-XML mapping

Existing directives have to be mapped to the system. Therefore, information from the HTML-representations of the documents has to be extracted. According to the defined process, this data is transformed to an XML-structure that is developed in this chapter. The so generated document representation serves as an input to the system. The system extracts the relevant information from the XML-file and stores the document in the database.

XML-structure of directives

Under consideration of the above identified types, an XML-structure for the directives has to be created. In the prototypical implementation, the German terms are used for section names as some differences between German and English representation exist. The following XML-elements for a directive were developed for the prototype:

Name	Type	Description
Directive	Sub-Part	<p>Directive represents the root element of a directive. It is the document node of the directive XML-file and holds the following properties:</p> <ul style="list-style-type: none"> • Category holding the entered category by the user • CommencementDate with the date of commencement entered by the user • Dirnumber holding the directive number entered by the user • ShortTitle holding the short title of the document entered by the user • tagText holding the tags of the user as entered in the form • title holding the full title of the document as automatically determined from the input file • repealingDate holding the date of repealing of the act – null if the act is still active

Intro	Text-Part	Elements of type intro hold textual information about the directive, like promulgation clauses. Basically, all text occurring before the first article is declared as intro-elements.
Artikel	Sub-Part	This element named after the German term for article, represents this elements. The XML-element has one attribute called identification holding the id of the article (e.g. article 2 has id 2). All structuring elements starting with "Artikel" are determined as article.
Absatz	Sub-Part	All structuring elements having the structure "<number>" are marked as "Absatz" (e.g. (2)). "Absatz"- elements hold an attribute called identification representing the id of the element (e.g. (2)).
Nummer	Sub-Part	All structuring elements of the structure "<number>." Are marked as "Nummer" (e.g. "1."). The element has one attribute called identification with the element id (e.g. "1.")
Literal	Sub-Part	Structuring elements of the structure "<lower-case-character>" are marked as "Literal" (e.g. "a"). The literal-element has one attribute named identification with the element id (e.g. "a")
Ziffer	Sub-Part	Structuring elements with Roman numerals like "i)" are stored in "Ziffer"- elements. The Ziffer-element holds one attribute named identification containing the numeral (e.g. "iv)").
Spiegelstrich	Sub-Part	Structuring elements of the structure "-" are marked as "Spiegelstrich". This element also holds an attribute named identification containing "-"
TextElem	Text-Part	Plain text in the documents is put inside "TextElem" tags marking them as plain text. The TextElem is sub-element of the Sub-Part it belongs to.
Heading	Text-Part	Headings in the document are represented using this type. Headings can appear in the whole document.

Appendix	Sub-Part	Elements starting with “Anhang” are marked as Appendix. The elements also hold an attribute called identification which holds the identification of the appendix in the document (e.g. “I”)
----------	----------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Table 4 – XML-elements for directives

Table 4 summarizes all elements of an XML-file representing a directive. The input file is converted to a format containing the above mentioned elements.

The XML-file contains exactly one “Directive”-element. This element may have several sub-elements of the above defined element types “Heading”, “Intro”, “Article”, “Appendix”. Heading- and Intro-Parts do not have child elements while Article- and Appendix- elements can have several child elements of type “Absatz”, “Nummer”, “Literal”, “Ziffer”, “Spiegelstrich” and “TextElem”. The child elements can also follow a hierarchy.

```

...
<Intro>HABEN FOLGENDE RICHTLINIE ERLASSEN:</Intro>
<Artikel identification="1">
  <Absatz identification="(1)">
    <TextElem>Gegenstand dieser Richtlinie ist die Umweltverträglichkeitsprüfung bei öffentlichen und privaten Projekten, die möglicherweise erhebliche Auswirkungen auf die Umwelt haben.
    </TextElem>
  </Absatz>
  <Absatz identification="(2)">
    <TextElem>Im Sinne dieser Richtlinie gelten folgende Begriffsbestimmungen:
    </TextElem>
    <Literal identification="a">
      <TextElem>"Projekt" :</TextElem>
      <Spiegelstrich identification="-">
        <TextElem>die Errichtung von baulichen oder sonstigen Anlagen,</TextElem>
      </Spiegelstrich>
      <Spiegelstrich identification="-">
        <TextElem>sonstige Eingriffe in Natur und Landschaft einschließlich derjenigen zum Abbau von Bodenschätzen;
        </TextElem>
      </Spiegelstrich>
    </Literal>
    <Literal identification="b">
      <TextElem>"Projektträger" : Person, die die Genehmigung für ein privates Projekt beantragt, oder die Behörde, die ein Projekt betreiben will;
      </TextElem>
    </Literal>
    ...
  </Absatz>
  ...
</Artikel>
...

```

Figure 20 – XML-file sample snippet for directive testfile “effects of projects”

Figure 20 shows a part of an XML-file for a directive. After some “Intro”-parts, the first “Artikel” appears. This element contains several sub-elements of type “Absatz” which themselves have “Literal”-elements. “Spiegelstrich”-elements represent “-“-bullets and belong to a “Literal”-element.

All directives are structured in such a hierarchical order. Therefore the traceability of which element belongs to which parent element and in further consequence to which document is ensured.

6.5 National act – XML mapping

Existing national acts also have to be mapped to the system. Therefore, information from the HTML-representations of the acts is extracted. According to the defined process, data is transformed to an XML-structure as defined in this chapter. The so generated document representation serves as an input to the system. The system afterwards extracts the relevant information from the XML-file and stores the document in the database.

XML-structure of acts

National acts are structured similar to directives. They also have to distinguish between different bullet types like paragraph or section. Furthermore, the German descriptions are again used to determine the XML-element names.

Name	Type	Description
National Act	Sub-Part	<p>The national act element exists once for each file and represents the root element of an act. It is the document node of the XML-file and holds the following properties:</p> <ul style="list-style-type: none"> • Category holding the value assigned by the user • CommencementDate with the date of commencement entered by the user • Country holding the country entered by the user during the upload process • ShortTitle holding the short title of the document entered by the user • tagText holding the tags as entered by the user • title holding the full title of the document as automatically determined from the input file • repealingDate holding the repealing date of the act – null if still active) • EUlawStatus holding the information if the act is based on a directive or amended/repealed by it

Heading	Text-Part	Headings in the document are represented using this type. Headings can appear in the whole document.
Intro	Text-Part	Elements of type intro hold text occurring in the introduction part of an act and not determined as a heading. One example is the promulgation clause.
ContentListing	Sub-Part	When a table of contents is included in the act, one “ContentListing” element is created to indicate the position of the listing.
ContentHeader	Sub-Part	Headings in table contents are represented with “ContentHeader” elements. They are child elements of “ContentListing” and hold text elements as child elements representing the chapters of the document.
Paragraph	Sub-Part	This element represents the paragraphs of an act. The XML-element has one attribute called identification holding the id of the paragraph (e.g. paragraph 2 has id “§ 2”). All structuring elements starting with “§” are determined as paragraph.
Absatz	Sub-Part	All structuring elements of structure “(<number>)” are marked as “Absatz” (e.g. (3)). “Absatz”- elements hold an attribute called identification representing the id of the element (e.g. “(3)”).
Ziffer	Sub-Part	All structuring elements of the structure “<number>.” Are marked as “Ziffer” (e.g. “1.”). The element has one attribute called identification with the element id (e.g. “1.”)
Literal	Sub-Part	Elements of the structure “<lower-case-character>”) are marked as “Literal” (e.g. “b”). The literal-element has one attribute named identification with the element id (e.g. “b”)
Spiegelstrich	Sub-Part	Structuring elements of acts having the structure “-“ are marked as “Spiegelstrich”. This element also holds an attribute named identification containing “-“
Ueberschrift	Sub-Part	In Austrian appendixes, elements are not assigned according to the usual naming convention of the Austrian documents. Therefore “Ueberschrift”-elements are created to represent these element types.
TextElem	Text-Part	Plain text in the documents is put inside “TextElem” tags marking them as plain text. The TextElem is a sub-element of the Sub-Part it belongs to.

Anhang	Sub-Part	Elements starting with “Anhang” are marked as Appendix. The elements also hold an attribute called identification which holds the identification of the appendix in the document (e.g. “I”)
--------	----------	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Table 5 – XML-elements of national acts

Table 5 shows the elements of an XML-document representing a national act. The input document is transformed to this XML-structure and stored at a given location.

The XML-file of an act contains exactly one “National Act”-element. This element may have several sub-elements of the above defined element types “Heading”, “Intro”, “Content Listing”, “Paragraph”, “Appendix”. Heading- and Intro-Parts do not contain child elements. “Content Listing” has several child elements of “ContentHeader” and “TextElem” type while Article- and Appendix- elements can have several child elements of type “Absatz”, “Nummer”, “Literal”, “Ziffer”, “Spiegelstrich” and “TextElem”. The child elements can also follow a hierarchy.


```

...
<Heading>Sonstige Begriffsbestimmungen</Heading>
<Paragraph identification="§ 2a.">
  <Absatz identification="(1)">
    <TextElem>Oberflächengewässer sind alle an der Erdoberfläche stehenden und fließenden Gewässer, so-
      fern es sich nicht um Kleinbadeteiche handelt.
    </TextElem>
  </Absatz>
  ...
  <Absatz identification="(4)">
    <TextElem>Das Badegewässerprofil ist eine Beschreibung eines Badegewässers und umfasst
    </TextElem>
    <Nummer identification="1.">
      ...
    </Nummer>
    ...
    <Nummer identification="6.">
      <TextElem>folgende Angaben, wenn die Bewertung nach Z.3 die Gefahr einer kurzzeitigen
        Verschmutzung (Abs. 10) erkennen lässt:
      </TextElem>
      <Literal identification="a)">
        <TextElem>voraussichtliche Art, Häufigkeit und Dauer der erwarteten kurzzeitigen
          Verschmutzung,
        </TextElem>
      </Literal>
      <Literal identification="b)">
        <TextElem>Einzelangaben zu allen verbleibenden sonstigen Verschmutzungsursa-
          chen einschließlich der ergriffenen Bewirtschaftungsmaßnahmen und
          dem Zeitplan für die Beseitigung der Verschmutzungsursachen, und
        </TextElem>
      </Literal>
      ...
    </Nummer>
    ...
  </Absatz>
  ...
</Paragraph>

```

Figure 21 – XML-file sample snippet for Austrian act Testfile “Spa hygiene”

Figure 21 shows a part of an XML-file generated by the system. The “Heading”-element represents the header for §2a of the act. The paragraph is represented by an element and has several “Absatz”- elements as child elements which themselves have a number of “Nummer” elements below them. The “Literal”- elements belong to a specific “Nummer”.

The example shows how the hierarchical grouping of the document is realized and permanently stored in an XML-file.

7 Implementation

This chapter describes the implementation of the software tool according to the design decisions and requirements defined above. The used technologies and tools are explained and reasons for their choice given. Furthermore, the developed system is described. The explanation of the tool is structured according to the design mentioned in the last chapter. According to the three pillars model-view-controller, several aspects are analyzed and the functionality is shown.

7.1 Development

During the planning process for the application, possible technologies were analyzed to find a suitable one for the implementation. Based on the nature of the tool and the identified requirements, the decision was to develop a web application. The basic advantage of this solution is that no installations are needed for using the tool. The tool can centrally be maintained on the server, all users can therefore access the actual data using their web browser. As web applications usually have the drawback of offering bad usability, additional technologies for enhancing the user experience had to be found.

Some aspects and functionalities were not implemented due to low relevance for the prototype. The security mechanism used is a simple user authorization with manually created users. Functionalities like encryption of the data connection or further user checking were not implemented.

7.2 Basic Technologies

When considering all relevant aspects, the chosen technology for the implementation is Java²³. As access for a large community is desired, the major advantage of Java is that it is platform-independent in contrast to other technologies (cf. [Ulle12]). Java can be combined with a lot of different tools and libraries, a lot of them open source and therefore up to date and well maintained.

For web application development, the concept of Java-Servlets and JSP²⁴ are used. According to [Wöhr04], one main advantage is that these concepts enable the separation between presentation and application control. This fact supports the MVC-design explained above. JSP-elements are responsible for the layout of the user interface. The

²³ <http://www.java.com/>

²⁴ Java Server Pages

application logic is handled by Servlets. Another difference is that JSP files are written in HTML-notation while Servlets are represented by Java files.

The web server used for this web application is Apache Tomcat²⁵. This server was chosen due to several reasons. One advantage is, that Tomcat is widely used and open-source. [ChBa04] describes it as a free, feature-complete Servlet container for developers of Servlet and JSP. Furthermore, it is Oracles (creator of the Java programming language) reference implementation of a Servlet container and therefore the interoperability with Java and the used technologies can be assumed.

As Integrated Development Environment (IDE), Eclipse²⁶ was chosen. Eclipse is an open source tool and offers a lot of supporting functionalities for developers. Different plug-ins can be installed or integrated functions like auto-completion of code used. Beside the support of Java programming, other technologies can also be used and therefore the tool for most parts of the implementation used.

7.3 Model

This chapter describes the database model, storage and accessing of the stored data. In a first step, the requirements for the model are identified and suitable technologies analyzed. Then the usage of the technologies in the context of the application is explained.

7.3.1 Model-specific technologies

Basically, three requirements for the database implementation were identified. It was desired to decouple the DBMS²⁷ from the system. The second requirement was to use an ORM²⁸ system. An ORM system comes with an integrated mapping engine that transforms the object-structure of java into a relational structure for databases. The use of such a system enables the fast and stable accessing of stored data. Furthermore, efficient search functionality has to be integrated or supported.

The decoupled DBMS was needed due to database problems. First, a MySQL-database was used. As the application was growing, the response time for database transactions became unsatisfying. The response times exceeded the desired values and therefore the decision was to migrate to a PostgreSQL. This database exchange lead to a significant performance improvement resulting in satisfying response times.

²⁵ <http://tomcat.apache.org/>

²⁶ <http://www.eclipse.org/>

²⁷ Data Base Management System

²⁸ Object Relational Mapping

As ORM-tool, the open source framework of Hibernate²⁹ was chosen. As [BaKi07] describe, Hibernate takes over the paradigm mapping between Java and database representation.

The search functionality is realized by the Hibernate Search³⁰ framework that is closely related to Hibernate and is based on the Apache Lucene search engine³¹. According to [BeGr09], Hibernate complements the basic Hibernate functionality with the functionality of full-text search queries on Java objects.

7.3.2 Database mapping

To implement a database, the corresponding objects have to be created. The class declaration of objects used in the system can be kept. The Hibernate-configuration can easily be added to enable the database functionality.

```
@Entity
public class NationalSubPart extends NationalActElement implements
Serializable {

    private String characters;

    @OneToMany(cascade = CascadeType.ALL)
    @OrderBy()
    @Cascade(value=org.hibernate.annotations.CascadeType.DELETE)
    protected List<NationalActElement> subElements;

    @ManyToMany(fetch = FetchType.LAZY)
    @JoinTable(
        name="Sub_NationalSub",
        joinColumns=@JoinColumn(name="Nat_ID"),
        inverseJoinColumns=@JoinColumn(name="Sub_ID")
    )
    protected Collection<SubPart> relatedDirectiveParts;
```

Code snippet 1 – Hibernate mapping of java objects

Code snippet 1 shows the adding of a database mapping to a java class. The annotation @Entity marks the class as a database object. Without further coding, the NationalSubPart- table is created.

Attributes of the class are mapped to columns. For this step, no further annotations are necessary. Non-annotated attributes are mapped to columns having the same name. The

²⁹ <http://www.hibernate.org> (last accessed: 01st October 2012)

³⁰ <http://www.hibernate.org/subprojects/search.html> (last accessed: 01st October 2012)

³¹ <http://lucene.apache.org/> (last accessed: 01st October 2012)

list of sub-elements is realized as a one-to-many relation. Hibernate automatically realizes the relation by a foreign-key mapping. The many-to-many collection between national subparts and directive subparts is realized via a join table. The code snippet above shows how the join-table “sub_nationalsub” is defined and which columns the table holds. The collection is defined as lazy. This means that related objects are not automatically loaded when the object is loaded. Therefore the speed for querying such an object increases.

By annotating all classes that have to be stored in the database, the table structure is defined. For the configuration of Hibernate, a separate file in XML-format is necessary. In this file, the path to all annotated classes has to be entered and several other options like the connection to the used database have to be entered.

If the configuration file is successfully created, Hibernate automatically generates the defined table structure in the associated database.

7.3.3 Database access

For the manipulation of data with the desired functions (create, read, update, delete), an additional layer was introduced. The advantage of that approach is that the accessing of a database-table is centrally handled by a responsible class. This class is responsible for the connection to the database and the necessary steps for a successful manipulation of data. The controller classes that need information from the database call the responsible DAO³²-class which process the database transaction and forward the result to the calling class.

As Hibernate provides methods for the database-access, the data manipulation can also be implemented without SQL³³-knowledge.

```
public NationalSubPart getInclChildren(Long id) {
    Session s = sessionFactory.getCurrentSession();
    Transaction tx = s.beginTransaction();
    NationalSubPart returnParam = (NationalSubPart)
        s.get(NationalSubPart.class), id);
    tx.commit();
    return returnParam;
}
```

Code snippet 2 – Simple hibernate queries

Code snippet 2 illustrates the querying of a specific national subpart according to a given id value. A transaction is started. By using such transactions, changes in the database

³² Data Access Object

³³ Structured Query Language

are only taken if all queries are successful. If an error occurs, the database is rolled back to the state before the transaction was started. The method for the querying of an element is called with the respective class and the id-value. The get-method automatically queries for the id value of the given class. Hibernate translates the method calls to SQL-queries and transforms the result back to a Java object. This object is returned by the method to the calling class. Similar methods exist for updating, deleting or saving objects and are not listed here.

For all classes of the database, these basic methods for creating, saving, updating and deleting objects exist.

If objects hold elements of a lazily defined relation, they also have to be loaded from the database. This can be realized with the method call of `Hibernate.initialize (objects)`. As the hierarchy may contain several layers, this initialization is called in a recursive manner. The initialization-call is transformed by hibernate into SQL queries that are used for loading the related objects.

7.3.4 Search mapping

The search functionality of hibernate search can also be defined via annotations. The fields used for the search are the metadata attributes of directives, the metadata attributes of national acts, the text of directive text elements and the text of national text elements (including Intro- and Header-parts). For each of the fields, a separate search index is created.

```
@Indexed
public class NationalTextPart extends NationalActElement implements
Serializable {
...
    @Field(name="nattext", index=Index.YES, analyze=Analyze.YES,
        store=Store.NO)
    @Analyzer(definition = "customanalyzer")
    private String text;
...
}
```

Code snippet 3 – Hibernate search configuration

Code snippet 3 shows how data can be added to the search index. The `@Indexed` annotation marks the class as containing search elements. The `@Field` annotation marks a property as searchable. The name-property defines the name of the index for the given field. In the above mentioned code snippet, the text of a national text part is added to the “nattext”-index. The `@Analyzer` annotation is used to define a custom analyzer which defines the handling of additional settings like case sensitivity.

To configure the search index for the whole project, two properties have to be added to the hibernate configuration-file. The storage place of the index and the directory provided are defined in the file to enable the search indexing.

7.3.5 Search access

Similar to the database access, the search is also accessed via DAO-classes for the same reasons. One DAO-class for national search and one DAO-class for directive search are used to query the information. The structure of text search is explained in the following code snippet.

```
public List<TextPart> searchTextContent(String searchTerm) {
    Session session = sessionFactory.getCurrentSession();
    FullTextSession fSession = Search.getFullTextSession(session);

    fSession.beginTransaction();

    SearchFactory searchFactory = fSession.getSearchFactory();

    QueryBuilder mythQB = searchFactory.buildQueryBuilder().forEntity(
        TextPart.class ).get();

    Query luceneQuery = mythQB.keyword().onField("dirtext").
        matching(searchTerm.toLowerCase()).createQuery();

    org.hibernate.Query fullTextQuery = fSession.createFullText-
        Query( luceneQuery, TextPart.class );

    fullTextQuery.setMaxResults(10); //return 10 elements

    List<TextPart> results = fullTextQuery.list(); //execute query
    fSession.getTransaction().commit();

    return results;
}
...
```

Code snippet 4 – Hibernate search text queries

Code snippet 4 creates a `FullTextSession` based on the regular hibernate `session` and uses the transaction-principle. Via a `search-factory-object`, a `query-builder` for the underlying entity is created. This `query builder` can be used to a `keyword-query` on the “`dirtext`”- index. This query is applied to the `FullTextSession`. The framework performs the search query and returns the corresponding objects to the querying class.

One requirement for the tool was to enable a combined search for document properties. Therefore a `hashmap` of entered search terms and fields to be queried is created by the controller class. This list is processed as shown in the following code snippet.

```
Set<String> searchers = searchTerms.keySet();
BooleanQuery outerBooleanQuery = new BooleanQuery();
if(searchers.size() > 0) {
    for(String s : searchers) {
        Query luceneQuery = mythQB.keyword().wildcard().on-
            Field(s).matching(searchTerms.get(s).toLowerCase()).
            createQuery();
        outerBooleanQuery.add(luceneQuery, Boolean-
            Clause.Occur.MUST);
    }
}
...
```

Code snippet 5 – Hibernate search combined query

Code snippet 5 shows how queries are combined for the document search. A query is created for each search term for one property of the list. This query is added to an empty outer query. The outer query therefore combines all other queries. With this outer query, the search can be processed as described in Code snippet 4. The results can then be used to display the search results.

7.3.6 Class model

The following section deals with the class model of the system that is mapped to the database model. The overall class diagram is shown, the tables are explained and the relations explained. For clarity reasons, setter- and getter methods are not shown.

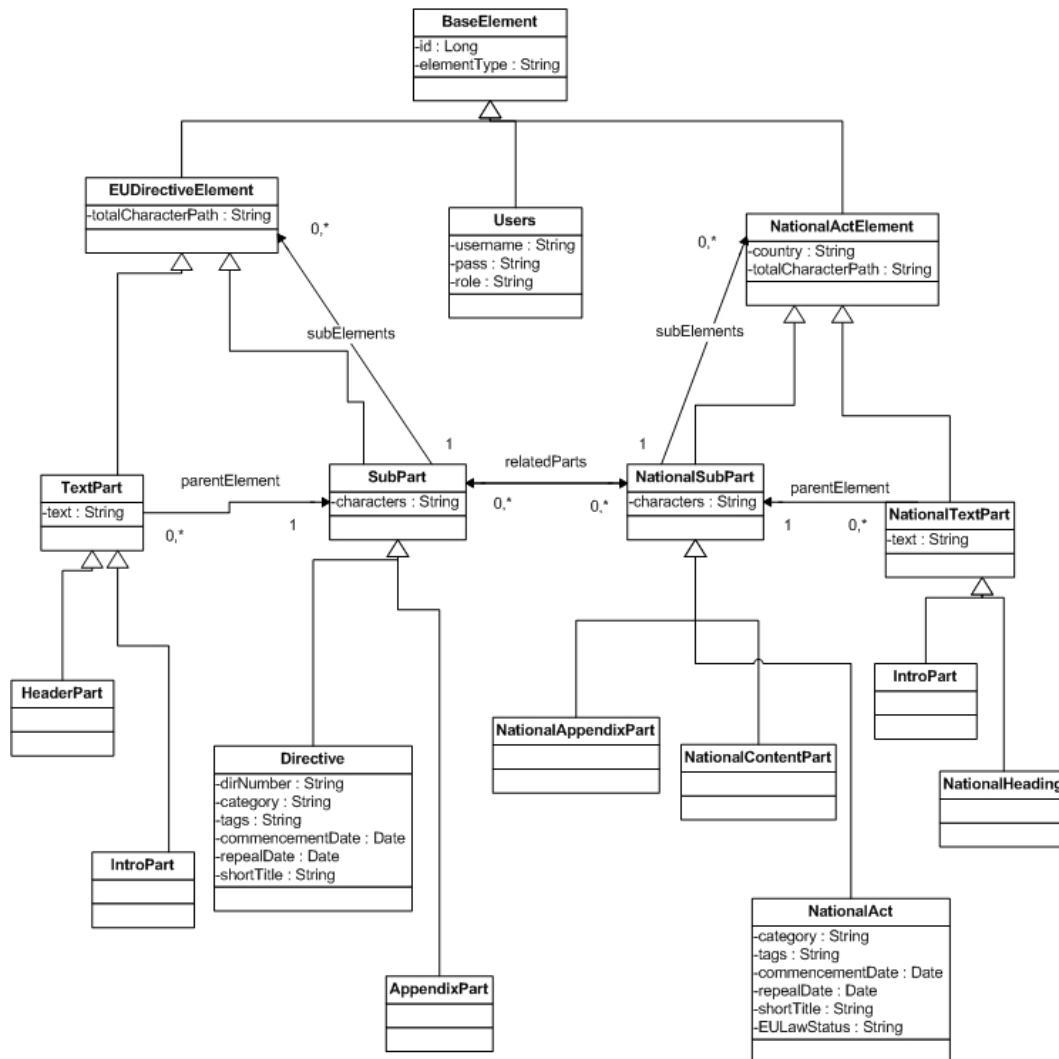


Figure 22 – Class Model for directive tracer entities

Figure 22 shows the class diagram for the entities used in the database. The class diagram is used to explain the entities due to the complex relationships.

One distinction that has to be taken is the difference between the XML-description described above and this class diagram used for the database. While the directive and national act-elements were the root element in the XML-declaration, they now are subtypes of subtypes of the top element. The explanation lies in the different usage. The XML-structure represents the document-layout while the class model describes the system representation. The directive or national act entity is a specialization of the subpart elements which themselves are specializations of type directive-/act-element.

The root element of the class hierarchy is the base element that declares basic fields used in all entities. For the base element, no table is created but the other tables inherit the fields from the base model. Subtypes of the base model are the users which are represented by one table. The other subtypes are directive- or national act-elements. These elements are further specified by either subparts or text-parts. Subparts adminis-

ter a list with other elements (subparts, textparts or subclasses of them). Textparts hold a reference to the parent subpart. This field is necessary for search functionality.

The linkage for the implementation of a directive is represented by a bidirectional relation between directive- and national act-subpart. Header and intro-parts are subclasses of text-parts, appendix, content part and directive/national act are subtypes of subpart.

The following table describes the object properties that are used for database storage. All classes except “BaseElement”, “EUDirectiveElement” and “NationalActElement” are transformed to database tables.

An overview on the columns of the tables is given in the following Table 6.

Column	Tables	Description
Id	All tables	Identification of an element
elementType	All tables	Declaring the type of element to further describe them. Especially important for subparts where elementType declares the type of the document hierarchy (e.g. paragraph, section)
totalCharacterPath	All directive and national elements	The total character path shows the reference of the element in its document context. Path consists of nation (for acts), short title of the document and subpart characters of parent elements. Field is important for the displaying of a search result.
Country	All national elements	The country declares to which nation the element belongs to. Field is used for text search in specific countries.
Characters	All subparts	Each subpart owns characters identifying it in the document context. These are the section identifiers like (2) or 1.
Text	All textparts	The text of the document part that is extracted from the original document.
Category	Directive, National act	Field holding the metadata property of category for the document.
Tags	Directive, National act	Field holding the metadata property of tags for the document.
CommencementDate	Directive, National act	Field holding the metadata property date of commencement of the document.

repealingDate	Directive, National act	Field holding the metadata property of repealing date (field is empty if act is still valid)
shortTitle	Directive, National act	Field holding the short title of the document. Short title is used for determining the document a part belongs to and can therefore not be altered.
dirNumber	Directive	Field holding the official number of the directive declared by the EU.
EUlawStatus	All national elements	Information on the EU-source. Act can be based on/ amended/ repealed due to a directive
Username	User	The username is stored in this field and can only be given once.
Pass	User	The password of the user is stored in this field.
Role	User	The role type for the user. Role types can be "ADMIN_ROLE" or "EXPERT_ROLE" declaring the rights for the user.

Table 6 – Columns used in the database

One big advantage of Hibernate or in general ORM-mappings is given by this class diagram. The inheritance principle of Java can be applied to database-relevant objects. Entities can be declared in a more concise way. Another major advantage can be described by the recursive relationship of subparts. Subparts have a list of sub-elements that can be of several class types. In pure SQL-language, this declaration would be hard to accomplish. ORM-tools map the java declaration that can be easily described via inheritance to SQL.

7.3.7 Comparator Classes

To enable an efficient sorting of documents, additional comparator classes were implemented. These classes define how to sort the objects in a given scenario. Depending on the property to be sorted, a different comparator class is used. For each property, the comparator defines the order of sorting. The fields are sorted in alphabetical order, only the commencement date is sorted after the date.

7.4 View

The view-elements are basically made up by the user interface. Elements of this section are responsible for the logic of designing the layout of the user interface. In this chapter, the used technologies are explained. Furthermore, an overview about the designed user interfaces is given. The application look & feel is described using screenshots and textual explanations. The data displayed is mainly created in the Servlet-classes redirecting to the shown pages.

7.4.1 View-specific technologies

The view-components contain several technologies. On the one hand, the layout of web pages can be improved by several technologies. On the other hand, useful functionalities are added by additional frameworks.

As already mentioned above, JSP-files represent the main part of the view-component. JSP relies on HTML-notation and includes additional functionality for accessing java-objects. HTML focuses on the representation not on the presentation, the same applies to JSP. This is why both technologies are widely used in combination with CSS³⁴. In this application, CSS is also used to improve the design of the pages. By using CSS, HTML-elements can be selected and presentation parameters like color and size changed.

One technology adding additional functionality is JavaScript. As [Wenz10] describes, JavaScript is an additional scripting language that can be embedded in HTML and therefore also JSP files. The scripting language directly accesses HTML-elements and therefore manipulations on the site can be done without concerning the server. One problem when using JavaScript is that this functionality is not always desired and therefore JavaScript may be deactivated in some cases. If it is deactivated, the affected functionality cannot be performed. Due to this reason, the usage of JavaScript in the context of this work is restricted to an absolute minimum.

The technology for realizing the role concept for different user authorization hierarchies is also included in the view components. The tool Apache Shiro³⁵ is a Java security framework. It is used in this application in the context of authorizing users and the related concept of session management. The framework provides a method for the login of users. If the login is successful, Shiro “remembers” the logged in user until he is logged out. The authorization is done via specific tags that are integrated in the JSP files. By using such tags, every user can only access the pages he is authorized for.

³⁴ Cascading Style Sheets

³⁵ <http://shiro.apache.org/> (last accessed: 01st October 2012)

```
<li id="directiveSelect">
  <span>Directives Menu</span>
  <ul>
    <li>
      <a href="...DirectiveSearch.jsp">Search</a>
    </li>
    <li>
      <a href="...showDirectives=true">Overview</a>
    </li>
    <shiro:hasRole name="ADMIN_ROLE">
      <li>
        <a href="...DirectiveStart.jsp">
          Add Directives
        </a>
      </li>
    </shiro:hasRole>
  </ul>
</li>
```

Code snippet 6 – Apache Shiro usage

Code snippet 6 visualizes how Apache Shiro can be used to display restricted content only to authorized users. The corresponding tag is placed around the content to be restricted. In that case, the menu entry “Add Directives” is only displayed to users with an admin-role assigned.

7.4.2 User Interfaces

In the context of this prototype, three types of users were defined. This chapter shows the different user interfaces for the different authorizations and explains their functional relations.

The page layout is designed in a three-section screen. The upper part of the page is made up by a page header containing the menu structure and additional visual elements. The menu entries vary for the different authorizations. The design of this part is defined in an own CSS-definition file.

The lower part of the page is made up by the footer. This small section displays the university faculty data it was designed for. The layout is again defined in a separate CSS file. While header and footer stay the same for all pages (except for the menu entries), the main part of the screen varies for the different pages.



Figure 23 – Blank page with admin user authorization

Figure 23 illustrates the three basic parts of the page layout. Furthermore, all available menu entries are shown. The connect- and options-menu is only available for expert- or admin users, the user menu can only be accessed with admin-authorization.

National act

The first menu entry is called “national act”. By selecting it, the menu possibilities for the current role are displayed. The possible pages are:

- **Search**

The search screen can be accessed by every user. From the end users perspective, the search functionality is the central function of the prototype. The search screen for national acts (Figure 24) therefore represents the starting page of the application.

Search national act

Country

Search full title

Search category

Search tag

Search valid at date

Search short title

Search text of a specific country

Country

Search national act text

Maximum number of results

Figure 24 – National act search screen

Figure 24 shows the search page for national acts. The page offers two different types of search. Either a text search or a document search can be performed.

1. Text Search

For the text search, a search term can be entered and a country can be selected. If a country is selected only matching document text of this country is listed. If no country is selected, text of all matching act documents is listed. Additionally, possible links are visualized.

Search results for national acts- search for "durch Verordnung". Results:

Document	Context	Text
working rest	Header	Ausnahmen durch Verordnung des Landeshauptmannes
working rest	Header	Ausnahmen durch Verordnung für bestimmte Tätigkeiten
working rest	Header	Ausnahmen durch Verordnung im öffentlichen Interesse
working rest	Austria working rest § 12 (1)	Durch Verordnung sind für Arbeitnehmer in bestimmten Betrieben Ausnahmen von der Wochenend- und Feiertagsruhe für Arbeiten zuzulassen, wenn diese
working rest	Austria working rest § 14	Durch Verordnung sind Ausnahmen von der Wochenend- oder Feiertagsruhe für die Arbeitnehmer bestimmter Betriebe zuzulassen, wenn es das öffentliche Interesse infolge besonders schwerwiegender Umstände erfordert.
working rest	Austria working rest § 33 (2)	Mit Inkrafttreten der Änderungen durch das Bundesgesetz BGBl. I Nr. 5/1997 tritt Abschnitt XVII Z 1 der Arbeitsruhegesetz-Verordnung, BGBl. Nr. 149/1984, außer Kraft.
aids protection	Austria aids protection § 1 (2)	Der Bundesminister für Gesundheit, Sport und Konsumentenschutz kann durch Verordnung dem jeweiligen Stand der Wissenschaft entsprechend nähere Bestimmungen hinsichtlich des Infektionsnachweises und der Indikatorerkrankungen (insbesondere Falldefinition) erlassen.
working rest	Austria working rest § 13 (1)	Der Landeshauptmann kann neben den gemäß § 12 Abs. 1 und 2 zulässigen Ausnahmen nach Anhörung der zuständigen gesetzlichen Interessenvertretungen der Arbeitgeber und Arbeitnehmer durch Verordnung weitere Ausnahmen zulassen, wenn
working rest	Austria working rest § 22f (2)	Arbeitnehmer in Betriebseinrichtungen von Dienstleistungsbetrieben, die mit Betriebseinrichtungen gemäß § 1 Öffnungszeitengesetz 2003 vergleichbar sind, dürfen an Samstagen bis 18 Uhr, mit Arbeiten gemäß § 3 Abs. 2 bis 19 Uhr beschäftigt werden, soweit nicht durch Verordnung nach § 5 12 oder 13 oder Kollektivvertrag nach § 12a weiter gehende Ausnahmen zugelassen sind.
agricultural fundings	Germany agricultural fundings § 2 (1)	Europäischen Fischereifonds nach Maßgabe des Artikels 31 Buchstabe d der Verordnung (EG) Nr. 498/2007. Satz 1 gilt im Fall einer Gemeinde oder eines Gemeindeverbandes nur, wenn der Gemeinde oder dem Gemeindeverband die Aufgaben nach diesem Gesetz durch Landesrecht übertragen worden sind.
aids protection	Austria aids protection § 3 (3)	Soweit dies zur Gewährleistung der Einheitlichkeit der Meldungen geboten ist, hat der Bundesminister für Gesundheit, Sport und Konsumentenschutz unter Bedachtnahme auf die Erfordernisse einer eingehenden und raschen Information durch Verordnung nähere Bestimmungen über die Präzisierung der relevanten anamnestischen und klinischen Daten, über den Umfang und die Form der Meldungen sowie der zu verwendenden Vordrucke zu erlassen.
aids protection	Austria aids protection § 6 (3)	Der Bundesminister für Gesundheit, Sport und Konsumentenschutz kann durch Verordnung nach dem jeweiligen Stand der Wissenschaft nähere Bestimmungen über Qualitätskontrolle und -sicherung sowie die bei der Vornahme von HIV-Tests einzuhaltende Vorgangsweise einschließlich der Durchführung von Bestätigungs- und Wiederholungstests erlassen. Dabei sind insbesondere Regelungen über die Produktkontrolle und Qualitätskontrolle der Labors zu treffen.

Figure 25 – National act text search results

As Figure 25 illustrates, the search results are shown in a table-like structure. The left column shows the short title of the document where the textpart is located. The document can directly be accessed via the displayed link. The second column contains the path of the text part. This path contains the country and the short title of the act as well as the identifiers of the subparts in the hierarchy of the search result. This column is also designed to link to the document. The path can be clicked and the textpart with its parent object called. The third column displays the actual text part with the highlighted search term. If a connection to a directive exists, the EU-flag is displayed. In directive search, connections to specific countries are visualized by the country's flag.

Source: [aids protection § 1 \(2\)](#)

(2) Der Bundesminister für Gesundheit, Sport und Konsumentenschutz kann durch Verordnung dem jeweiligen Stand der Wissenschaft entsprechend nähere Bestimmungen hinsichtlich des Infektionsnachweises und der Indikatorerkrankungen (insbesondere Falldefinition) erlassen.

Figure 26 – National act search screen selected result

Figure 26 presents the text part with the desired search term in its document context. The path to the document is shown. Below the headline the text part is listed with the highlighted search term. A link to the whole document is included

in the path. The short title of the document is displayed as a link to the whole document. Connections are again represented by the corresponding flag. By clicking the flag, the current connection is displayed in a split screen.

Directive	National Act	Options
Austria_aid protection_§ 1.	europeansafety__artikel4	
(1) Jeder Mitgliedstaat kann eine zentrale Behörde oder, wenn seine Rechtsordnung dies vorsieht, mehr als eine zentrale Behörde benennen, die seine zuständigen Behörden unterstützt.	(2) Der Bundesminister für Gesundheit, Sport und Konsumentenschutz kann durch Verordnung dem jeweiligen Stand der Wissenschaft, entsprechend nähere Bestimmungen hinsichtlich des Infektionsnachweises und der Indikatorerkrankungen (insbesondere Falldefinition) erlassen.	show relations between documents show both documents

Figure 27 – Connections for one element

As shown in Figure 27, the connection screen displays for a selected element the existing connections to other elements. For the given national act element, the corresponding directive element is shown. The options column enables user to show all connections between the two documents involved in this connection. Furthermore, the whole documents can be chosen for a split screen view.

<p>Rahmenbeschlusses 2009/521/ET übermietet wurde.</p> <p>Artikel3 Benennung der zuständigen Behörden</p> <p>(1) Jeder Mitgliedstaat teilt der Kommission mit, welche Justizbehörde oder Justizbehörden oder welche entsprechende Behörde oder Behörden nach seinem nationalen Recht für den Erlass einer Europäischen Schutzanordnung und die Anerkennung einer solchen Anordnung gemäß dieser Richtlinie zuständig ist beziehungsweise sind, wenn dieser Mitgliedstaat der anordnende Staat oder der vollstreckende Staat ist.</p> <p>(2) Die Kommission macht die erhaltenen Angaben allen Mitgliedstaaten zugänglich. Die Mitgliedstaaten unterrichten die Kommission über alle Änderungen der Angaben gemäß Absatz 1.</p> <p>Artikel4 Befassung einer zentralen Behörde</p> <p>(1) Jeder Mitgliedstaat kann eine zentrale Behörde oder, wenn seine Rechtsordnung dies vorsieht, mehr als eine zentrale Behörde benennen, die seine zuständigen Behörden unterstützt.</p> <p>(2) Ein Mitgliedstaat kann, wenn sich dies aufgrund der Organisation seines Justizsystems als erforderlich erweist, seine zentrale(n) Behörde(n) mit der administrativen Übermittlung und Entgegennahme der Europäischen Schutzanordnungen sowie des gesamten übrigen damit verbundenen amtlichen Schriftverkehrs betrauen. In der Folge können alle Mitteilungen, alle Konsultationen, sämtlicher Austausch von Informationen, alle Nachfragen und alle Notifizierungen zwischen den zuständigen Behörden mit Unterstützung der benannten zentralen Behörde(n) des betreffenden Mitgliedstaats abgewickelt werden.</p> <p>(3) Ein Mitgliedstaat, der von den in diesem Artikel vorgesehenen Möglichkeiten Gebrauch machen möchte, übermittelt der Kommission die Angaben über die von ihm benannte(n) zentrale(n) Behörde(n). Diese Angaben sind für alle Behörden des anordnenden Staats verbindlich.</p> <p>Artikel5 Voraussetzung des Bestehens einer Schutzmaßnahme nach nationalem Recht</p> <p>Eine Europäische Schutzanordnung kann nur dann erlassen werden, wenn zuvor eine Schutzmaßnahme im anordnenden Staat angeordnet wurde, mit der der gefährdenden Person ein/eine oder mehrere der folgenden Verbote oder Beschränkungen auferlegt wurden:</p> <p>a) das Verbot des Betretens bestimmter Räumlichkeiten, Orte oder festgelegter Gebiete, in beziehungsweise an denen sich die geschützte Person aufhält, oder die sie aufsucht;</p>	<p>AIDS-Gesetz 1993 StF: BGBl. Nr. 728/1993 (WV)</p> <p>Langtitel AIDS-Gesetz 1993 StF: BGBl. Nr. 728/1993 (WV)</p> <p>Änderung StF:</p> <p>BGBl. I Nr. 112/1997 (NR: GP XX RV 110 AB 652 S. 70, BR: 5429 AB 5430 S. 626.) (CELEX-Nr.: 392L0109, 393L0046)</p> <p>BGBl. I Nr. 78/1998 (NR: GP XX RV 1077 AB 1147 S. 118, BR: AB 5674 S. 641.) BGBl. I Nr. 117/1999 (NR: GP XX RV 1778 AB 1983 S. 174, BR: AB 5984 S. 656.) (CELEX-Nr.: 398L0079)</p> <p>BGBl. I Nr. 98/2001 (NR: GP XXI RV 621 AB 704 S. 75, BR: 6298 AB 6424 S. 679.)</p> <p>Text</p> <p>§ 1. (1) Ein erworbenes Immundefektsyndrom (AIDS/Acquired Immuno Deficiency Syndrome) liegt vor, wenn nach dem jeweiligen Stand der Wissenschaft</p> <ol style="list-style-type: none"> 1. ein entsprechender Nachweis für eine Infektion mit einem Human Immunodeficiency Virus (HIV) und 2. zumindest eine Indikatorerkrankung vorliegen. <p>(2) Der Bundesminister für Gesundheit, Sport und Konsumentenschutz kann durch Verordnung dem jeweiligen Stand der Wissenschaft entsprechend nähere Bestimmungen hinsichtlich des Infektionsnachweises und der Indikatorerkrankungen (insbesondere Falldefinition) erlassen.</p>
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Figure 28 – Show two related documents

Figure 28 shows the split screen view for two related documents. User can easily compare the national act and the corresponding directive part in its context.

2. Document Search

When performing a document search, the assigned metadata properties can be queried. Values for country, full title, category, date and short title can be entered. All entries of the fields are combined to one query and the resulting documents fulfill all entered search criteria. The resulting elements are shown in the Overview screen explained in the following section.

- **Overview**

The overview page can be accessed via the menu entry in the national-acts menu or by performing a document search. Admin users get additional fields for editing the documents. The resulting screen for basic users is shown in Figure 29, the screen for admin users in Figure 30.

Search category tag valid at date short title EU law status

View	ID	Country	Title	Category	Tags	Commencement Date	Repealing Date	EU law status	short Title
View	32788	Austria	Bundesgesetz vom 25. Juli 1956, betreffend die Durchführung einzelner Bestimmungen des IV. Teiles des Staatsvertrages (1. Staatsvertragsdurchführungsgesetz). StF: BGBl. Nr. 165/1956 (NR: GP VIII RV 26 AB 31 S. 6. BR: S. 118.)	national treaty	national treaty, basic rights	25.7.1956	31.12.3499	amended	national treaty
View	33167	Austria	Bundesgesetz vom 3. Feber 1983 über die wöchentliche Ruhezeit und die Arbeitsruhe an Feiertagen (Arbeitsruhegesetz - ARG) StF: BGBl. Nr. 144/1983	Working	working rest, working hours	3.2.1983	31.12.3499	amended	working rest
View	65536	Austria	AIDS-Gesetz 1993 StF: BGBl. Nr. 728/1993 (VV)	Disease	aids, protection	11.12.1993	31.12.3499	based	aids protection
View	98304	Austria	Bundesgesetz über Umwelthaftung zur Vermeidung und Sanierung von Umweltschäden (Bundes-Umwelthaftungsgesetz - B-UHG) StF: BGBl. I Nr. 55/2009	Environment	environment, liability	22.2.1993	21.3.2011	eliminated	environment liability
View	131072	Germany	Gesetz über die Rechtsverhältnisse der Mitglieder des Deutschen Bundestages	Politics	representative, bundestag	18.2.1977	12.11.2011	repealed	bundestag representatives
View	131685	Germany	Gesetz zur Veröffentlichung von Informationen über die Zahlung von Mitteln aus den Europäischen Fonds für Landwirtschaft und Fischerei	Agriculture	agriculture, fishing, funding	26.11.2008	31.12.3499	based	agricultural fundings
View	131739	Germany	Gesetz über den militärischen Abschirmdienst	Military	counterintelligence, military	20.12.1990	10.9.2005	repealed	counterintelligence
View	131884	Germany	Gesetz über den Auswärtigen Dienst	Working	foreign countries, work	30.8.1990	31.12.3499	amended	foreign countries work

Figure 29 – National act overview basic user

Figure 29 shows the overview page for national acts for basic users. Several search fields are shown for defining new filters to adapt the overview to find desired documents. Below these fields, current filters are displayed. The table below this informal field holds all relevant information about the document. The first column shows a reference to the whole document. By clicking this reference, the document is displayed. The following columns hold the id, country, full title, the category, tags, commencement- and repealing date, the European law status as well as the short title of the document.

Search category tag valid at date short title EU law status

View	Edit	ID	Country	Title	Category	Tags	Commencement Date	Repealing Date	EU law status	short Title	Delete
View	<input checked="" type="checkbox"/>	32788	Austria	Bundesgesetz vom 25. Juli 1956, betreffend die Durchführung einzelner Bestimmungen des IV. Teiles des Staatsvertrages (1. Staatsvertragsdurchführungsgesetz). StF: BGBl. Nr. 165/1956 (NR: GP VIII RV 26 AB 31 S. 6. BR: S. 118.)	national treaty	national treaty, basic rights	25.7.1956	31.12.3499	amended	national treaty	<input checked="" type="checkbox"/>
View	<input checked="" type="checkbox"/>	33167	Austria	Bundesgesetz vom 3. Feber 1983 über die wöchentliche Ruhezeit und die Arbeitsruhe an Feiertagen (Arbeitsruhegesetz - ARG) StF: BGBl. Nr. 144/1983	Working	working rest, working hours	3.2.1983	31.12.3499	amended	working rest	<input checked="" type="checkbox"/>
View	<input checked="" type="checkbox"/>	65536	Austria	AIDS-Gesetz 1993 StF: BGBl. Nr. 728/1993 (VV)	Disease	aids, protection	11.12.1993	31.12.3499	based	aids protection	<input checked="" type="checkbox"/>
View	<input checked="" type="checkbox"/>	98304	Austria	Bundesgesetz über Umwelthaftung zur Vermeidung und Sanierung von Umweltschäden (Bundes-Umwelthaftungsgesetz - B-UHG) StF: BGBl. I Nr. 55/2009	Environment	environment, liability	22.2.1993	21.3.2011	eliminated	environment liability	<input checked="" type="checkbox"/>
View	<input checked="" type="checkbox"/>	131072	Germany	Gesetz über die Rechtsverhältnisse der Mitglieder des Deutschen Bundestages	Politics	representative, bundestag	18.2.1977	12.11.2011	repealed	bundestag representatives	<input checked="" type="checkbox"/>
View	<input checked="" type="checkbox"/>	131685	Germany	Gesetz zur Veröffentlichung von Informationen über die Zahlung von Mitteln aus den Europäischen Fonds für Landwirtschaft und Fischerei	Agriculture	agriculture, fishing, funding	26.11.2008	31.12.3499	based	agricultural fundings	<input checked="" type="checkbox"/>
View	<input checked="" type="checkbox"/>	131739	Germany	Gesetz über den militärischen Abschirmdienst	Military	counterintelligence, military	20.12.1990	10.9.2005	repealed	counterintelligence	<input checked="" type="checkbox"/>
View	<input checked="" type="checkbox"/>	131884	Germany	Gesetz über den Auswärtigen Dienst	Working	foreign countries, work	30.8.1990	31.12.3499	amended	foreign countries work	<input checked="" type="checkbox"/>

Figure 30 – National act overview admin page

Figure 30 shows the overview table for admin users. Two additional fields are displayed to them. The delete column on the right side of the table removes the document from the system. The edit symbol enables the editing of document metadata properties.

Edit national act details

Country of the act (not editable)

full title

short title (not editable)

category

keywords, separated by ','

commencement date (dd.mm.yyyy)

elimination date (dd.mm.yyyy - empty if still valid)

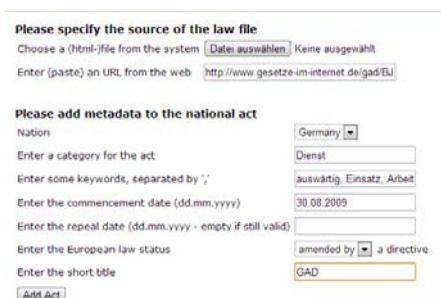
European law status a directive. Currently: amended

Figure 31 – National act edit details page

The edit-details-page seen in Figure 31 is only displayed to users having the admin-role assigned. The national details full title, category, keywords, commencement- and repealing date as well as European law status can be altered. The country cannot be altered as each country has its own representation and therefore for the correct document load, the correct country had to be selected during the document upload. The short title cannot be altered as it is used to correctly align the search results to the documents.

- *Upload act*

The menu entry for the upload of acts is only displayed to admin users. They are the only user group allowed to import documents to the system.



The screenshot shows a web form titled "Please specify the source of the law file" and "Please add metadata to the national act". The form includes the following fields and options:

- Please specify the source of the law file**
 - Choose a (html-)file from the system: Keine ausgewählt
 - Enter (paste) an URL from the web:
- Please add metadata to the national act**
 - Nation:
 - Enter a category for the act:
 - Enter some keywords, separated by ',':
 - Enter the commencement date (dd.mm.yyyy):
 - Enter the repeal date (dd.mm.yyyy - empty if still valid):
 - Enter the European law status: a directive
 - Enter the short title:
 -

Figure 32 – Upload national act: start-screen

The start screen for the act-import is shown in Figure 32. Locally stored HTML-documents can be used or the URL to the web page of the document entered. The metadata values for country, category, keywords, commencement- and repealing date, short title have to be entered manually and the European law status has to be selected. The system then parses the document to an XML-file and stores the document in the database. Then this document is displayed for checking purposes.

(2)

Für Beamte auf Lebenszeit des Auswärtigen Dienstes bildet der Ablauf des 30. Juni des Kalenderjahres, in dem sie die Regelaltersgrenze des § 51 Abs. 1 und 2 des Bundesbeamtengesetzes erreichen, die Altersgrenze. Liegt der Zeitpunkt der Versetzung in den Ruhestand damit erst nach Vollendung des 67. Lebensjahres, können sie auf Antrag bereits mit dem Ende des Monats in den Ruhestand treten, in dem sie das 67. Lebensjahr vollenden.

Personalreserve

§ 6

(1)

Der Auswärtige Dienst verfügt über eine angemessene Personalreserve. Sie gewährleistet eine sachgerechte Personalplanung unter den besonderen Bedingungen des Auswärtigen Dienstes.

(2)

Die Personalreserve dient insbesondere folgenden Zwecken:

- vorübergehende Verstärkung bei besonderen Belastungen infolge auslandsbezogener politischer Entwicklungen, internationaler Konferenzen oder aus sonstigen Gründen.
- angemessene fachliche und fremdsprachliche Aus- und Fortbildung.
- Vorbereitung auf Versetzungen und persönliche Einführung in die Dienstgeschäfte durch den Amtsvorgänger.

Organisation und Ausstattung

§ 7

(1)

Organisation und Ausstattung des Auswärtigen Dienstes sind seinen Aufgaben und Erfordernissen regelmäßig anzupassen.

(2)

Das Auswärtige Amt kann im Benehmen mit dem Bundesminister des Innern Abweichungen von der regelmäßigen Arbeitszeit festsetzen, wenn es besondere Bedürfnisse am jeweiligen Dienstort erfordern. Im übrigen gelten die Vorschriften über die Arbeitszeit der Bundesbeamten.

(3)

Die entsandten Angehörigen des Auswärtigen Dienstes erhalten im Ausland für die Pflege dienstlicher Kontakte eine Aufwandsentschädigung, für die der Haushaltsplan Mittel zur Verfügung stellt.

Inspektion

§ 8

Figure 33 – Upload national act: check-screen

Figure 33 shows the check screen for national acts. As defined in the design-chapter, the full title automatically determined and the document hierarchy can be changed. The full title is displayed in a text-field and can be altered. For each subpart element, one drop-down-box is displayed. In this box, the parent element can be selected. The taken changes are used by the system to update the database-entries.

Directives

The directive pages are similar structured than the national acts. Basically, the same logic is applied to this type of documents. One small difference is that the directive number is used as an additional field instead of the country. The respective pages are therefore not explained here.

Connect

The connect menu is responsible for the linkage between directive-elements and act-elements. Expert-users and admin-users can access this functionality.

Please choose a directive for Connection

directive number category tag valid at date short title

Select	No ▼▲	Title	Category ▼▲	Tags	Commencement Date ▼▲	Repealing Date ▼▲	short Title ▼▲
<input type="radio"/>	2011/92/EU	Richtlinie 2011/92/EU des Europäischen Parlaments und des Rates vom 13. Dezember 2011 über die Umweltverträglichkeitsprüfung bei bestimmten öffentlichen und privaten Projekten	Project	environment, public projects, private projects	28.1.2012	31.12.3499	publicprivateenvironmentprojects
<input type="radio"/>	2011/98/EU	Richtlinie 2011/98/EU des Europäischen Parlaments und des Rates vom 12. Dezember 2011 über ein einheitliches Verfahren zur Beantragung einer kombinierten Erlaubnis für Drittstaatsangehörige, sich im Hoheitsgebiet eines Mitgliedstaats aufzuhalten und zu arbeiten, sowie über ein gemeinsames Bündel von Rechten für Drittstaatsangehörige, die sich rechtmäßig in einem Mitgliedstaat aufhalten	Workers	foreign countries, rights	13.12.2011	31.12.3499	foreigncountriesworkersrights
<input type="radio"/>	2011/99/EU	Richtlinie 2011/99/EU des Europäischen Parlaments und des Rates vom 13. Dezember 2011 über die Europäische Schutzanordnung	Safety	european safety, protection	13.12.2011	12.12.2012	europeansafety
<input type="radio"/>	2009/156/EG	Richtlinie 2009/156/EG des Rates vom 30. November 2009 zur Festlegung der berseuchenrechtlichen Vorschriften für das Verbringen von Equiden und für ihre Einfuhr aus Drittländern (kodifizierte Fassung) (Text von Bedeutung für den EWVR)	Animals	animals, diseases, import	30.11.2009	31.12.3499	animaldiseases
<input type="radio"/>	2008/120/EG	Richtlinie 2008/120/EG des Rates vom 18. Dezember 2008 über Mindestanforderungen für den Schutz von Schweinen (kodifizierte Fassung)	Animals	minimum standards, pig protection	18.2.2009	18.3.2012	pig protection
<input type="radio"/>	2008/119/EG	Richtlinie 2008/119/EG des Rates vom 18. Dezember 2008 über Mindestanforderungen für den Schutz von Kälbern (kodifizierte Fassung)	Animals	calves, protection	18.12.2008	31.12.3499	calves protection

Figure 34 – Connect page: directive selection screen

Figure 34 displays the start screen of the connect-process. In a first step, one directive has to be chosen for the linkage. Therefore the page layout known from the document overview screen is displayed. Metadata-properties can be used to clarify the displayed directives. Only one document of the list can be marked.

Afterwards, the next screen is shown. In the next step, one act has to be selected that will be used to connect to the directive. Therefore a screen similar to the directive selection in Figure 34 is shown for national acts. One document can be selected.

The selected directive and the selected act are prepared in the next step by the system to allow the determination of related parts. To achieve this, all subparts of the directive are determined with their path. For each subpart of the directive, two selectboxes are created. One represents the possible directive parts, one the selected ones for connection.

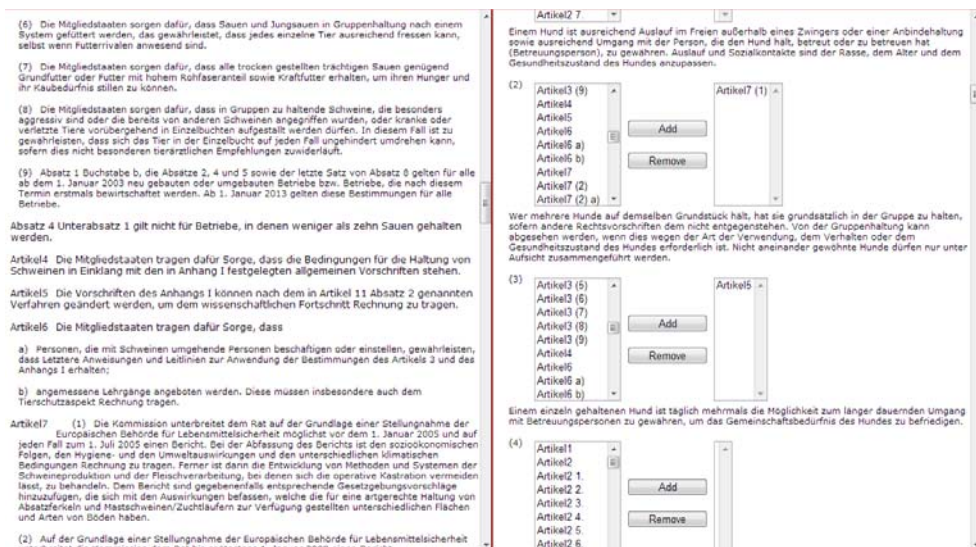


Figure 35 – Connect page: connect screen

As shown in Figure 35, the directive and the national act are shown in a split screen. The user therefore has the possibility to see the both documents and to explore possible connections. By selecting an element of the selectbox for a specific act subpart, the selected part can be connected to this subpart by adding it to the right-hand-side selectbox. If connections between both documents exist before, they are shown on the right selectbox. By removing them from the box, the connection can be deleted.

Directive	Directive	National Act	National Act	Options
<p>Directive</p> <p>europansafety_Artikel4</p> <p>(1) Jeder Mitgliedstaat kann eine zentrale Behörde oder, wenn seine Rechtsordnung dies vorseht, mehr als eine zentrale Behörde benennen, die seine zuständigen Behörden unterstützt.</p>	<p>Directive</p> <p>europansafety_Artikel9</p> <p>(4) Ist die zuständige Behörde des vollstreckenden Staats der Auffassung, dass die mit der Europäischen Schutzanordnung gemäß Artikel 7 übermittelten Angaben unvollständig sind, so unterrichtet sie die zuständige Behörde des anordnenden Staats unverzüglich in einer Form, die einen schriftlichen Nachweis ermöglicht, und setzt ihr eine angemessene Frist für die Übermittlung der fehlenden Angaben.</p>	<p>National Act</p> <p>Austria_aids_protection_5_1.</p> <p>(2) Der Bundesminister für Gesundheit, Sport und Konsumentenschutz kann durch Verordnung dem jeweiligen Stand der Wissenschaft entsprechend nähere Bestimmungen hinsichtlich des Infektionsnachweises und der Indikatorerkrankungen (insbesondere Falldefinition) erlassen.</p>	<p>National Act</p> <p>Austria_aids_protection_5_8.</p> <p>(4) Vor Gewährung von Zuschüssen hat sich der Empfänger dem Bund gegenüber zu verpflichten, zum Zweck der Überwachung der widmungsgemäßen Verwendung der Zuschüsse Organen des Bundes die Überprüfung der Durchführung durch Einsicht in die Bücher und Belege sowie durch Besichtigung an Ort und Stelle zu gestatten und ihnen die erforderlichen Auskünfte zu erteilen. Ferner hat sich der Empfänger zu verpflichten, bei nicht widmungsgemäßer Verwendung von Zuschüssen diese dem Bund zurückzuzahlen.</p>	<p>show relations</p> <p>show relations between documents</p> <p>show both documents</p> <p>show relations between documents</p> <p>show both documents</p>

Figure 36 – Connect page: show connections

The established connection is represented by a flag of the corresponding document as visualized in Figure 36. In a national act, the EU-flag represents the connection. In the directive, the Austrian or German flag is displayed according to the documents of the connected countries. The options of showing relations between the two specific documents as well as showing both documents can again be accessed via the displayed link.

Options

The option menu offers two sites. On one page, registered users can change their password. On the second page, all users can select a country for directive connections. This means that connections for directives are only displayed if they are from the selected country. The screen offers additional functionality for admin users as displayed in Figure 37.

Figure 37 – Options screen for admin users

Figure 37 shows the options page for admin users. Admin users can define a connection country and additionally enter a folder for the storage of XML-files. Furthermore, admin users can also manually update the search indexes of national acts or directives.

Users

The user's page involves the creation and deletion of users as well as the overview on existing ones. Only admin-users can access this page.

ID	Name	Role	Delete
9999	admin	ADMIN_ROLE	X
1	Expert1	EXPERT_ROLE	X

Figure 38 – User menu screen

As shown in Figure 38, the upper part of the page can be used to create new users. The role type (admin or expert) can be selected. A username and a password can be as-

signed. Below, the overview is displayed where id, name and role of the users are shown. A user can be deleted by clicking the symbol in the right column.

7.5 Controller

The controller classes make up the central control of the application. As a large number of processes and Java classes are involved, the description is given on an abstract base explaining the basic concepts of the implementation.

This chapter describes the general functions, the algorithms used to extract information from the HTML-pages of directives and national acts and the related transformation of the information into the described XML-structure as well as the transformation of the data into database objects for the persistent storage. Afterwards, the concept of the output creation is explained.

7.5.1 Controller specific technologies

A controller specific library used is the Jsoup³⁶- library. It is an easy-to-use Java library for working with HTML-files. These files can be loaded via provided methods and are automatically transformed into a DOM³⁷-tree structure. With this structure, they can be handled like XML-documents that are also created in a DOM-like structure.

```
private Document loadDoc(String fileName) throws IOException {
    File input = new File(fileName);
    Document doc = Jsoup.parse(input, "UTF-8", "");
    return doc;
}

private Document loadUrl(String urlName) throws IOException {
    Document doc = Jsoup.connect(urlName).get();
    return doc;
}
```

Code snippet 7 – Loading HTML document via Jsoup

Code snippet 7 shows how HTML-documents can be loaded. The first method explains the parsing from an existing file. Therefore a file-object has to be created from the input path. This file is then parsed in with an UTF-8 encoding.

³⁶ <http://jsoup.org/> (last accessed: 01st October 2012)

³⁷ Document Object Model

The second method shows the creation of the document from a HTML-file located in the World Wide Web. The library connects to the URL and thereby creates the document to work with.

The JSoup-library is used for the input of directives as well as of German and Austrian acts.

7.5.2 General Controller functions

As controller elements, several Servlets were used. These Servlets are responsible for the correct system behavior. As described above, the Servlets in their role as controller are called if the user submits any action to be performed. Depending on the action and the page where the action was taken, the corresponding Servlet is called. The classes then take the submitted parameters and perform the requested action. Usually, this involves changes in the database system done by calling the DAO-classes described by the model-elements. Afterwards, the user interface is updated according to the next related step.

7.5.3 Data extraction and XML-transformation for directives

The document hierarchy is manually parsed from the input sites. Therefore, the underlying HTML-structure of the documents needs to be explored. The central element of the directive-documents is a <div>-container with the class attribute "TexteOnly". This element holds the whole document and displayed text. As a first step, this element is identified. As all text elements are placed within <p>-tags, a collection of <p>-elements of the "TexteOnly"- container is build. This collection now holds the whole textual information from the directive.

At the same time, an XML-file is created. The name of the file is assigned according to the defined directive-number (e.g. "97-97-EG.xml"). The root element of the XML-document is a "directive"-element. The attributes defined above are set according to the entered input of the user; the full title is created from the first elements.

The first elements out of the <p>-elements-collection hold the full title of the directive. The algorithm concatenates the textual input of the elements until the text "der Rat" appears. This text indicates the beginning of the introduction part of the directive.

As a next step, the article and appendix positions are evaluated. All <p>-element numbers representing the beginning of an article are identified and written to a list. The same applies to appendix declarations.

In a first step, all textual elements of the document appearing before the first article are used to build intro-elements or heading elements for the XML-document. When the first article is reached, an XML-element for the article is created and the algorithm for de-

testing the document hierarchy is started. This algorithm is based on the concept of regular expressions. The beginning of each section is compared to specific regular expressions. If the first symbols of a section match such an expression, an XML-element of the corresponding element type is created.

Regular expression	Example	Hierarchy layer	Element type
"[(][0-9][+])]"	(1), (2)	1	Absatz
"[0-9][+].]?" "[0-9][+])]"	1, 1. 1)	2	Nummer
"[a-z][+])]"	a), b)	3	Literal
"[i][+][v]?[x]?[)]]?" "[v][+][i][+])]"	i), ii), x)	4	Ziffer
"[-]"	-	5	Spiegelstrich

Table 7 – Directive Subpart element mapping

Table 7 shows the mapping of subpart elements of directives. The regular expression for the first symbols of a section is given. Illustrated by an example, the table shows how the element type for the XML-file is assigned to the section.

To realize the desired document tree hierarchy, a hierarchy layer was introduced. The hierarchy layer of a new element is compared to the last processed element. If a new hierarchy layer of a higher layer number is detected, the element is created as a child element of the last Subpart element. If the hierarchy layer is similar to that of the last subpart, a sibling element is created. If the hierarchy layer has a lower number than the last element, all open elements with a higher hierarchy layer value than the new one are closed.

If no expression is matched, a textpart-element is created and added to the last open subpart element. Appendix parts are processed in a similar way with the difference that “appendix”-elements are created instead of “article”-elements.

7.5.4 Data extraction and XML transformation for national acts

The types for the different law systems of the prototype are explored in two different ways which is related to one aspect of the complexity of this thesis. HTML-representations of law are used and each institution represents their documents in another way. The different ways of representing the structure enables different ways of ex-

tracting it. These possible approaches were implemented to evaluate which one suits best for such an application. In contrast to the directive documents, German and Austrian acts are structured by the national institutions into institution-specific structures. These structures are used to reverse engineer the basic document.

After extracting the data, an XML-file is created. The filename is given according to the country and the short title assigned to the document (e.g. "DE-BGG.xml").

The Austrian law documents provided by the RIS-system already include a document hierarchy in the HTML-document. Each element of a law text is represented using tags holding a class attribute for the hierarchy of the sections. By using this included hierarchy, one major advantage is that no new algorithm needs to be generated; the hierarchy can more easily be created by using the class- attributes. Drawback of this approach is that faults in the class attributes are taken over to the system. Another problem may arise if the name of the class attributes change. Then the algorithm would no longer create a right hierarchy. An alternative way of determining the hierarchy is to manually extract the section identifier and create the hierarchy out of the identifiers. As this approach is used in the German crawler, the decision was to use the class attribute-extraction to get empirical results of what approach generates better results.

During the testing process (cf. 8.2.1), it could be determined that the Austrian documents which relied the most on the underlying structure generated the highest error-rate of all documents. Therefore the decision was to adapt the Austrian approach to also manually extract the session identifiers.

Germany

The German acts are parsed in a combined way. The subparts are directly parsed from the textual elements of the acts. The other parts are structured according to the class-attributes of HTML-elements.

The full title is extracted from an element with the class attribute "jnlange" and is used together with the other metadata entered by the user to build the basic "National act" element of the XML-file.

The introductory parts of the act are contained in the container with class attribute "jnheader". The contained elements of this container are transformed into "Intro"-elements for the XML-file. If an attribute "jurAbsatz" is found, a "ContentListing" element is created.

The paragraphs of the acts are grouped into containers with the class attribute "jnnorm". These containers are extracted from the web page. For each container, all elements are explored to generate the document-hierarchy. The attribute "jnenbez" and "jnentitel" are regarded as "Heading"- elements. "jurAbsatz" attributes indicate the text of a paragraph, "dl"-tags used for enumerations hold child elements of the paragraph. Regular expressions are used to match the first symbols of a child element section. If one of the regular expressions is met, the corresponding XML-element is created.

Regular expression	Example	Hierarchy Layer	Element type
"([0-9]+[a-z]?)"	(1), (2a)	1	Absatz
"[0-9]+[.]?"	1, 1.	2	Ziffer
"[a-z]+()"	a), b)	3	Literal
"[i]+[v]?[x]?()"?" "[v]+[i]+"	i), ii), x)	4	Subliteral
"[-]"	-	5	Spiegelstrich

Table 8 – Subpart- element types of German acts

Table 8 shows the regular expressions for checking the element type of German acts. Examples for the expressions are given and the corresponding element types are listed. The elements follow a hierarchy, the order is given by the hierarchy layer column. The hierarchy is realized in a way that elements with a higher hierarchy layer value are child elements of (open) elements of lower value.

Elements not matching a regular expression are marked as “TextElem” and are added to the last subpart-element.

Austria

The HTML-representation of the Austrian documents is grouped into <div>-elements with a class-attribute “textContentBlock”. Therefore, the first step is to create a list of all such elements. The system then iterates over all of these elements and checks for several conditions.

If a text is grouped into -tags indicating a bold style in the representation, this section is regarded as a “Heading”-element and the corresponding XML-element created. If an element contains the class attribute “Inhaltueberschrift”, a content listing is detected and a corresponding XML-element created. Other textual elements appearing before the first paragraph are transformed into “Intro”-elements.

If an element with the attribute “AnlagenBez” is found, an appendix is detected and therefore the “Appendix”-XML-element created.

If a paragraph-object is detected, all <p>-elements are extracted from the HTML-page as the text is grouped into <p>-elements. If a class-attribute is contained, this attribute was originally checked for the following text patterns.

Class attribute	Hierarchy layer	XML-element name
ErlText UeberschrG1 UeberschrG2	1	Ueberschrift
Abs	2	Absatz
ZifferE1	3	Ziffer
LiteraE1 LiteraE2	4	Literal
SubliteraE3	5	Subliteral
E4	6	Sub-Subliteral

Table 9 – Sub-element types of Austrian acts

Table 9 shows the former mapping between class attributes of <p>-Elements and their corresponding XML-element names.

Due to inconsistencies in the underlying import-data, this approach was skipped and the element hierarchy was manually created similar to the pattern matching used in German acts (according to Table 8).

These XML-element types are child elements of the current paragraph-element. A hierarchy can also be contained and was assigned according to the hierarchy layer indicated in the table above. The hierarchy is represented in a way that elements of higher hierarchy layer value are child elements of the last element of lower value.

Elements not matching such a pattern are regarded as text and put into “TextElem”-XML-elements. These elements are assigned to the last open sub element type.

7.5.5 Database storage

For the storage in the database, the XML-file of the document is explored. Basically, the XML-elements are read in, converted to Java objects and then stored in the database. For each element type, a table in the database is created. Each attribute is transformed into a column, for the relations, additional mapping tables are created. The only exceptions are the subpart-types. Due to the high number of different types, the database would become more and more complex and clarity would suffer. Therefore the decision was, as for directives, to group all Subpart-Elements (like “Paragraph”, “Absatz”, “Ziffer”) into one table. The element type is kept as a column in the Subpart-table.

7.5.6 Output creation

The creation of output in this context means the preparation of a (sub-) tree of a document to be displayed on a page. This creation for documents or part of it is a functionality that is needed in several different use cases. For the checking of new inserted documents, the displaying of search results or of whole documents as well as for the connection of acts and directives, slightly different requirements for the output creation exist.

The decision in that context was to build one central class responsible for the creation of this output instead of creating the same output with additional functionality in several classes. Main reason for that decision was that changes in the document structure would lead to the adaption of the output creation in several classes. One central class for the preparation with several dummy methods of different parameters was defined. In addition to that, one method per document type (directive/act) handling the output creation with its different options was implemented. For each of the different use cases, a dummy method exists. This method takes the parameters set by the calling class and sets the missing parameters for the other functions with dummy values. The creation method then creates the document output and adds the optional elements according to the calling class. Due to the defined document structure, the creation follows a recursive process.

8 Testing and results

By means of testing the developed prototype, the correctness of the implemented functions can be evaluated. Furthermore critical topics like usability and performance can be explored. This chapter describes how the testing was performed, the resulting output from the tests and the impact of the results on the feasibility of the whole project.

8.1 Testing methodology

According to the ISTQB³⁸, the following four levels of testing were identified in [ISTQ11]:

- *Component Testing*
The aim of component testing is the detection of defects in software modules that are separately testable. These tests are performed according to the component specification.
- *Integration Testing*
This level is used to test the interfaces between and the interplay between different software components.
- *System Testing*
System testing focuses on the overall system behavior. This level may include tests based on requirement specifications, use cases or business processes.
- *Acceptance Testing*
These test level aims to establish a confidence in the system, parts of it non-functional characteristics. Customers or other stakeholders may also be involved.

Component tests were continuously performed manually during the development process without further documentation. The same applies for integration testing.

The system testing is used to determine if the developed software fulfills the defined requirements. As the developed software only represents a prototype, these tests are valid on a limited base. Nevertheless, the prototype was tested on all desired functions as described in the prototype description. To achieve this, ten arbitrary chosen documents per document type (directive, German acts, Austrian acts) were chosen and imported to the system. These documents were used to cover all possible functionalities

³⁸ International Software Testing Qualifications Board

provided by the developed system. A detailed description is given in the following section.

As the testing is performed on a prototype, an acceptance testing is also of limited relevance as a possible roll-out of the system would go hand-in-hand with further development. Therefore the usability was not tested in the large, only personal thoughts and basic design aspects were considered.

Further tests were defined according to web application-specific topics. One important criterion for this type of application is the performance. Performance is also an important issue as during the development process, the database had to be migrated due to bad query response times. According to [Fran07], performance tests are used to analyze the runtime performance, mass processing and the consumption of resource of a system in its regular environment.

Therefore, the performance testing tool Apache JMeter³⁹ was used. Via this tool, a definable number of users performing actions in the web application can be simulated. For the prototype testing, several functions will be tested with a considerable number of users to identify possible performance bottlenecks.

Another important type of testing for web applications is the browser testing. As mentioned in [Fran07], browser tests check the correct presentation and usability of a web application with different browser (and versions). Especially in the possible field of application, the whole European Union, different browser constellations may occur and therefore the correct functioning is an important criterion for the success of this project. Although this is just a prototype for such a project, a basic browser test was performed to show the basic compatibility of such a solution in the different browser versions.

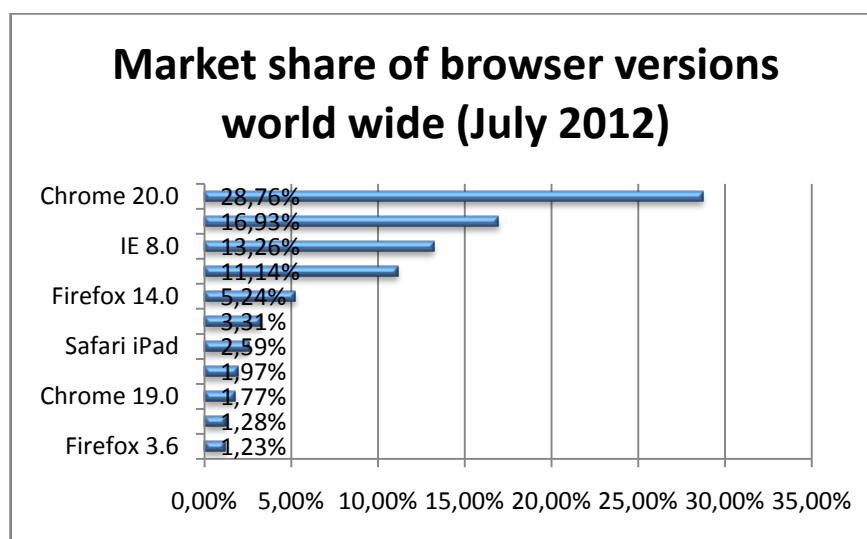


Figure 39 – Market shares of browser versions according to [OnlSt01]

³⁹ <http://jmeter.apache.org/> (last accessed: 10th October 2012)

Figure 39 shows according to [OnlSt01] the market shares of the different browser versions worldwide by July 2012. The browsers most used are Google Chrome 20, Internet Explorer 8 and 9 as well as Firefox 13.0 and 14.0. As it is only a prototype under consideration, the decision is to perform the browser check on the most used version of each browser.

8.2 Testing results

The results of the tests are presented in three subchapters. The first one deals with the test of the functionality, the second one is about the results of performance tests and the third one about the browser tests performed.

8.2.1 System test results

In the system tests, all implemented functions of the application were tested on their correct behavior. As some inconsistencies in the underlying documents were detected, the correct behavior in any case cannot be guaranteed. The system was tested with the documents listed in Annex 1 to ensure that the system works correctly.

Authentication

In a first step, the authentication was tested. Therefore all accessible sites for each role were checked. All role types got the links displayed they are authorized to access. In the course of these checks, the user administration was also tested. Therefore three users for each role were created and their accessible functions explored. The results were conforming to the requirements defined.

Import/Check

As mentioned above (cf. 8.1), the system functionality has been tested with ten arbitrary chosen directives, Austrian acts and German acts.

The test documents were added to the system including the testing of the check process. Therefore the functionality of altering the full title and assigning parent elements were tested in different ways. The testing included the assignment to a parent object before the current parent object as well as after the current object. Additionally, two elements were added to the same new parent element. All of these tests succeeded and the documents were stored in their new construction. The database entries were also adapted correctly.

During the import-tests, the XML-documents were also checked. One fact that was detected is that changes taken in the document structure did not result in changes of the

XML-document. This is explained by the decision to store the XML-file without changes to enable a “as-was”-view on the document. All files fulfilled the defined document structure.

One interesting result that could be explored was that nearly all directives were correctly imported to the system while few German and especially Austrian acts were imported with some errors.

After a concise examination, it could be detected that not all documents fulfill the assumptions taken for the implementation of the crawlers. The crawler for Austrian and German documents rely on specific tags and class attributes from the web page. The examination showed that in some cases, new class attributes and other tags are used for the same element types. This inconsistency in the data of the original documents results in a smaller number of correctly imported documents. Other inconsistencies were rarely detected in the marking of bullets that are for this reason in some cases not correctly assigned by the prototype. The same applies for the table of content in German acts.

One approach to encounter this problem was to change the document type causing the highest number of errors, the XML-creation algorithm for Austrian acts. Originally, the algorithm was completely based on the assigned tags and classes in the provided file. The algorithm was adapted in a way that the document structure is still taken from the provided tags while the determination of the element types is based now based on an own algorithm similar to that of German acts (cf. 7.5.4).

One problem detected was that a considerable number of Austrian acts and also some German acts contain tables that are only imported as text. This restriction defined in 6.2.5 leads to a loss of information. But for directives, this restriction does not apply as the original directive documents display table contents only as text similar to the prototype. Nevertheless, this functionality will need to be implemented for the rollout of such a project.

It was also detected that no date restrictions were implemented. This means that acts could be imported with an impossible commencement date. To encounter this problem, all date inputs are now only valid if a date between 1900 and 2015 is entered.

Another problem solved was that the appendixes without number were holding no identifier in the database. As this could lead to some identification problems, an external counter for appendix-numbers was introduced.

What was also recognized during the system tests was that for large files, performance problems occur. For large acts with hundreds of bullets, the preparation of the check screen is very time consuming. A detailed performance evaluation is done in 8.2.2.

Edit metadata

The editing of document metadata was also tested for several of the documents. All changes were propagated to the database and presented correctly in the application.

With the overall list of documents, the sorting functionality was tested for the possible fields and showed correct results.

Connections

In a next step, the connection functionality was tested. One directive was linked to a few national acts of both countries and one act per country was linked to different directives. The deleting of existing connections was also checked as the assignment of one part to several parts of the other document and the display of the relation by the country flag. No faults could be detected during these tests.

Options

The options screen for changing the password and setting a standard country for the displaying of directive relations were also successfully tested. Additionally, the tests for XML-folder determination and the update of the search indexes succeeded.

Search

In a next step, the search functionality was checked. Therefore combined wild card searches for directives and acts were performed as well as simple searches. The resulting number of search results was manually checked with the overall data.

The text search was also tested on the correct functionality. Due to the large amount of data, it could not be determined for sure if all text parts containing the search term were detected. But it was checked for all search results that the search term was contained. Two small errors were detected. A search term gets only highlighted if it matches the word in the text in a case sensitive manner while it is detected in a case insensitive manner. This is caused by the fact that the search index is created in a way that it only contains lowercase letters while the highlighting is checked in the real document where uppercase letters can also appear. As there is no trivial way for highlighting all combinations of lower- and uppercase letters for one word, this small error was not corrected in the system.

Delete

As a last step, the correct delete functionality was tested. Therefore, a national act with connections to different directives was deleted. Via checking the database, it was tested that the whole document was removed from the database and all connections containing this act were removed. The no longer symbolized connection was also successfully checked in the user interface.

Error

To check for the right determination of errors, several possible fields were tested for their wrong input. This included the import of wrong files, prohibited symbols in input fields, invalid dates and unselected selectboxes. No system error occurred; each error was presented to the user.

All in all, the system tests led to satisfying results. Some problems were identified that are mostly caused by inconsistencies in the provided documents. This shows that the component tests carried out during the development process were very effective and therefore a lot of effort for subsequently performed changes in the system could be avoided.

8.2.2 Performance Tests results

During system tests, problems with the application performance could be identified. For small documents, the response time of importing and querying acts was acceptable. But with larger document size, the response times increased to several seconds. When considering the fact that the application should be used all over Europe, this leads to the assumption that large response times could appear. While the number of users importing documents will be restricted, documents may be queried by a large number of users. Therefore the performance tests will focus on the two main functionalities each user can perform: the search (for text and documents) as well as the display of documents.

Search

For testing the text search, a number of 100 users within 20 seconds querying the search term “und” for all acts of all countries were simulated. As database-data, the documents imported during the system tests were used (cf. Annex 1)

Label	# Samples	Average	Median	90% Line	Min	Max	Error %	Throughput	KB/sec
HTTP Request	100	10	10	12	9	43	0,00%	5,0/sec	66,0
TOTAL	100	10	10	12	9	43	0,00%	5,0/sec	66,0

Figure 40 – Performance results text search “und” for acts of all countries

Figure 40 visualizes the performance results for the text search. On the overall number of 100 samples within 20 seconds, the average response time was 10ms. The minimum response time was 9ms, the maximum response time 43ms. No errors occurred. The results of this test are satisfying. The short average response time shows that the indexed search works effectively and a high number of users performing this action do not cause performance problems.

The testing of the document search led to similar results with response times below 100ms and is therefore not further described.

Display document

For testing the querying of documents, a directive of medium size was chosen. The parameters for the users remained the same. 100 users within 20 seconds querying the display of the directive were simulated.

Label	# Samples	Average	Median	90% Line	Min	Max	Error %	Throughput	KB/sec
HTTP Request 2	100	6800	7737	11265	730	12928	0,00%	3,7/sec	191,4
TOTAL	100	6800	7737	11265	730	12928	0,00%	3,7/sec	191,4

Figure 41 – Performance results querying a medium-sized directive

The response times as shown in Figure 41 indicate a performance problem for the displaying of documents. For the sample size, the average response time was 6.8 seconds. The response time varied between 730ms and 12.9 seconds. The reason for the large variation lies in the fact that the first (and fastest) response consumes 730ms while on average, all 200ms a new user started a request. Therefore the response time increases with every request.

The performance was tested with larger documents leading to the result of larger response times. During a closer investigation of the reason for the large response times per document request, the database access could be identified as the performance bottleneck. Because of the defined document structure, a large number of database elements are created for each document. When querying it from the database, each element has to be queried leading to hundreds or even thousands of database queries for large requests.

To encounter this problem, the most obvious approach is to revise the document structure. But when changing the structure for grouping several elements into one new element to reduce the number of database queries, the possibility of defining implementations of directive-parts in act-parts may be lost.

Other approaches that may be used for improving the performance are the change of the database connector or changing the infrastructure to high-performance server.

8.2.3 Browser Tests results

The browser tests were performed during the system tests where the functionality was tested in different browser. During the development process, Firefox was used as the main testing browser. Therefore, all functions and design aspects were correctly implemented in Firefox.

For Google Chrome, all actions could be performed adequately. One small design problem could be detected. For the Filechooser like that used for importing documents, the button appears before the Textfield for displaying the selected document. As this does not influence the usability, this fact does not need to be changed.

For the Internet Explorer, some design issues already known due to not supported CSS-properties were considered during the development of the CSS-style. Therefore, all functions could be performed and no design problems occurred.

9 Outlook

This chapter summarizes the work done in the thesis by explaining the crucial points and suggested approaches for critical issues that need to be considered for the roll-out of such a project.

The first central problem identified was the question of which language to choose for the Java-Web-Application. Approaches like a one-language solution and a solution of importing all documents in their original language were analyzed. Currently 23 official languages exist in the European Union but the law is in most cases only available in the national language that not all citizens of the other member states understand. The analysis identified a hybrid approach of importing the authentic original national acts while providing a non authentic English translation for citizens of other countries for encountering the problems of limited data availability (one language version) versus bad understandability in the overall Union (original languages version).

HTML-documents of consolidated law text from the official national institutions publishing pages were identified as the suitable source of documents to be imported to the system.

The maintenance of the application is another crucial factor. As documents often get amended or new documents get adopted, the up-to-dateness of the application can only be achieved with continuous maintenance. The most desirable way is to find national institutions, ideally the operators of the law sites or universities for maintaining the data. Alternatively, a crowdsourcing-approach for law experts of different countries may be used. For all approaches, the correctness of the taken actions has to be ensured.

Additionally to the import of documents, the document structure may be corrected manually. This is necessary as the document structure is an important feature of the law documents and the desired functionality of tracing the implementation of directives directly depends on the right document structure.

To further keep an “as-was” version of the read-in version, the decision was to add an additional XML-layer. XML-files are structured in a hierarchical order similar to the document-tree approach and are a suitable choice for persistent document representations. Therefore a stored document in tree-like representation is a reasonable step during the import processing. Acts of all different countries therefore need to be transformed to the defined XML-structure which in turn is used to store the document in the database.

Three user groups using the system were identified. Basic users are user without authentication and can access the text searches, the document searches and can also display existing documents.

Expert user rights extend the functionality accessible by basic users by determining implementation references of directives in national acts.

Admin users can access all functionality. In contrast to the expert users, they can also delete documents and administer the user data.

Caused by the document structure, one directive/act consists of a large number of subparts and textparts (respectively defined subtypes of them like intro-, headerparts or appendixes). This is why the storage and retrieval of information is very resource-consuming. Performance tests showed that the retrieval of whole documents may lead to large response times especially for larger documents and large user numbers. For the roll-out of the system, the performance has to be improved to offer acceptable services to the users. Possibilities to enable this are high-performance-server or other database access technology. Another approach that may be considered is the splitting of documents into sub-documents. If a document is queried via search, only the sub-document containing the selected search term is displayed. If the document is queried via document search, only the first sub-document may be displayed, linking to the other ones.

For the extraction of information, several approaches were compared. Directives were available in plain text elements without further groupings. This is why an algorithm was developed that constructed the document structure from scratch. Text patterns were used to identify subparts. To each bullet type (e.g. paragraph, number, literal) a subpart and a number representing the hierarchy layer was assigned. With this information, the overall document hierarchy could be created.

German and Austrian documents were already prepared for design reasons by the national institutions and therefore could not directly be used like the directive texts. The given structure (separated elements for each paragraph, several HTML-tags and class attributes) was taken to construct a subtree for each element. Afterwards, all of them are combined to construct the overall document tree.

When comparing both approaches, the extraction of directive information led to a more satisfying outcome resulting in a very low error-rate for not correctly detected elements. The Austrian and German extraction resulted in a higher error-rate. The already included design structure was identified as a reason for that. When extracting information from prepared HTML-documents, one is already dependent on the provided structure. If errors occur in the original document, these are forwarded to the system. Furthermore, the design-orientation of the national law sites resulted in problems regarding tables and images while directives did not use such elements. Tables were used to style the document output but also as information elements. No direct distinction could be made for the prototype and all information was imported as text elements.

These problems could be encountered by removing all design aspects and only extracting plain text from the national sites. This approach would solve the problem of taking over errors in style-tags from provided documents. The information of tables would also be lost.

Another problem of the information extraction used is an inflexible implementation. Keywords like special HTML-tags or words in the text were used to separate the elements from each other. If these tags or elements would be changed by the law sites, the extraction would not work anymore. This is why the information-extraction-step is identified as the weakest point of the software project.

The most desirable approach would be to directly cooperate with national institutions providing the law documents to get access to the raw data. The general resource efforts could be significantly reduced by connecting the system with the systems provided by national institutions. Therefore one main task in terms of facilitating the realization of the project is to start co operations with the institutions providing the information. The documents could be provided in XML-manner that could directly be imported to the system. Therefore a Europe-wide XML-format for law representation would need to be developed.

What were not explicitly approached in this thesis are security aspects. Authentication is used as one concept but for ensuring the security additional measures need to be taken. It has to be ensured that the user data is protected efficiently and that no person other than the authorized ones can alter data. For enabling this, encryption may be used. For communicating between authorized users and the application, the HTTPS⁴⁰ protocol is suggested.

⁴⁰ Hypertext Transfer Protocol Secure

10 Summary

Within this thesis, a concept for the development of a software application enabling the international traceability of directive implementations in member states was developed. Main goal of this work was to identify problems and necessary conditions for approaching the question of how to realize such a project.

The complexity of the problem lies in the fact that one part of a directive can be implemented in different acts of a country. Furthermore, the nature of directives is that it gives a scope for the implementation and can therefore be implemented different in different member states.

In a first step of the work, the basic conditions for such a project were analyzed. Especially interesting were questions like which language(s) to use or how to maintain the data. After exploring crucial issues for planning such a project, major requirements were identified and existing systems were analyzed.

Afterwards, a more practical part followed. The concrete requirements were identified analyzing the existing legal databases of EU and Austria.

Major requirements are the import and storage of directives and law documents of several EU member states, the manual determination and tracing of which part of a directive is implemented in which part(s) of national acts. Furthermore search functionalities for text search and, caused by the large number of expected documents, an efficient search for documents as well as an authorization system is needed.

Non-functional requirements that need to be considered are the up-to-dateness of data for new and amended documents, the performance and the correctness of data.

With the so gained information, a concrete implementation of a prototypical software project was planned.

In the context of implementing such an application, one important issue was to develop a common structure for the representation of law documents. The developed structure follows a tree structure. Two basic element types for the construction of a document tree were identified. A “textpart” serves as a leaf holding the text of the corresponding act section. A “subpart” serves as a node holding several child elements of either subparts or textparts. By the use of these two main element types, all documents can be represented. All needed element types are either a subtype of a subpart or a textpart. The tree representation of law documents enables the traceability of the information on which section belongs to which article/paragraph and in further consequence to which document. Implementations of directives in national acts can then easily be represented by a relationship between subparts of directive representations and subparts of national act representations.

The first step of implementation dealt with the database storage of the documents, realized in the prototype with Hibernate and PostgreSQL. Caused by the resource-consuming tree-structure of documents, a lot of database queries are generated for the querying of a document. This can lead to bad response times especially for large documents and a high number of users.

The web application was developed using JSP and Servlets as representation technologies. For enabling user authentication and limiting access to specific functionalities, Apache Shiro was used. The search was realized using Hibernate search. For headings, intro- and textparts of each type (directive/act) one search index per type was used. For each of the document-metadata-properties, a separate search index was used.

The definition of directive element implementations is designed to select a directive and a national act. The system offers for each national act subpart a list of subparts from the directive. From this list, elements can be chosen and marked as implementation.

An additional XML-layer was introduced to build a central interface for the import of law documents. Efforts for providing law as XML-documents were already made by several institutions but no official structure exists.

This is why crawlers for the extraction of information from the HTML-documents were developed. This functionality was identified as a weak spot of the project. The developed algorithm needs to rely on certain keywords and elements of the underlying HTML-structure of the documents. Each national legal database uses own structures and if such a structure is changed, the algorithm and therefore the import of document does not work anymore. A common XML-format for law representation in the European Union would significantly improve the reliability and would also remove the resources needed to maintain the application.

All in all, the thesis showed that there is a large potential for such an application. No comparable system exists. If the crucial factors analyzed in this work are considered and the functionality is successfully implemented, the application can also act as a Europe-wide legal database.

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Annex

Test Files

Tested directives

- **assessment of the effects of certain public and private projects on the environment**
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:026:0001:01:DE:HTML>
- **single application procedure for a single permit for third-country nationals**
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:343:0001:01:DE:HTML>
- **European protection order**
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:338:0002:01:DE:HTML>
- **animal health conditions**
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:192:0001:01:DE:HTML>
- **minimum standards for the protection of pigs**
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:047:0005:01:DE:HTML>
- **protection of consumers**
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:033:0010:01:DE:HTML>
- **textile names**
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:019:0029:01:DE:HTML>
- **minimum standards for the protection of calves**
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:010:0007:01:DE:HTML>
- **emporary provisions concerning rates of value added tax**
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:346:0013:01:DE:HTML>
- **common standards and procedures in Member States for returning illegally staying third-country nationals**
<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:348:0098:01:DE:HTML>

Tested Austrian acts

- **Spa hygiene**
<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10010382>
- **State treaty**
<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10000285>
- **Working time**⁴¹
<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10008238>

⁴¹ Large file, large response times

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- **Work and rest**
<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10008541>
 - **Aids**
<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10010768>
 - **Unfair competition**
<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10002665>
 - **Consumer authorities**
<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20004891>
 - **Environment**
<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20006304>
 - **Remote financial services**
<http://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20003383>
 - **Audiovisual media services**
<https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20001412>

Tested German acts

- **Members of parliament**
<http://www.gesetze-im-internet.de/abgg/BJNR102970977.html>
- **Publishing of information on payment of funds**
<http://www.gesetze-im-internet.de/afig/BJNR233000008.html>
- **Military counterintelligence**
<http://www.gesetze-im-internet.de/madg/BJNR029770990.html>
- **Batteries**
<http://www.gesetze-im-internet.de/battg/BJNR158210009.html>
- **External Action Services**
<http://www.gesetze-im-internet.de/gad/BJNR018420990.html>
- **Dangerous substances**⁴²
http://www.gesetze-im-internet.de/gefstoffv_2010/BJNR164400010.html
- **Tax on land acquisition**
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- **National Socialist persecution**
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- **Tobacco**
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- **Protection of dogs**
<http://www.gesetze-im-internet.de/tierschhuv/BJNR083800001.html>

⁴² Large document, large response time