Klaus Stranacher, Bernd Zwattendorfer - "Efficient Public Administration Procedures Across Borders" - Proceedings of 10th Central and Eastern European eGov Days, 2014, pp. 317-327

Efficient Public Administration Procedures Across Borders

Klaus Stranacher, Bernd Zwattendorfer[1]

In the past years, public administration procedures have turned out to be an important element of digital society. Many citizens and businesses are used to benefit from the provided services. The number of users of public services is still increasing – especially for cross-border applications – as the mobility of citizens and enterprises rises. Nevertheless, administrative procedures still lack on efficiency and effectiveness as indicated by a study of the EU Directorate General for Internal Market and Services. For instance, manual interactions with citizens or businesses are currently still needed in case competent authorities miss specific data to proceed an application. This matter of fact applies for national applications and for cross-border applications in particular. Therefore, in this paper we identify requirements to implement efficient public administration procedures to reveal their full capability. We further propose a flexible public administration process model, which enables data pre-processing and eliminates the necessity of manual interactions. This pre-processing unit bases upon a modular and adaptable architecture for data validation, data extraction out of available sources, and data re-integration. In addition, our proposal takes into account the findings of the EU large-scale pilot projects. Furthermore, our approach follows the principles of the European Interoperability Framework. Finally, we evaluate our proposed architecture and process model against the pre-defined requirements.

1. Introduction

According to EuroStat[2], 44% of all individuals [4] and 87% of all enterprises [5] in the euro area have interacted with public authorities using the Internet in the year 2012. So, electronic public administration procedures have evolved as an important element of e-Administration – on national as well as on international level. They also have proven their time- and cost-savings potential compared to paper-based procedures. Nevertheless, administrative electronic procedures still lack on efficiency and effectiveness, e.g. because if insufficient data are provided by individuals or enterprises, manual interactions of public administration staff are still required. To bypass these issues, we present a flexible process model and a modular architecture for increasing efficiency of public administration procedures on national level and across borders in particular.

The remainder of this paper is structured as follows. Section 2 gives an overview about the status quo of electronic public administration procedures. Thereby, we elaborate on the common structure of administrative procedures and treat cross-border procedures especially within the context of the EU Services Directive [12]. In addition, we discuss issues and challenges to increase the efficiency and effectiveness of these electronic procedures. Finally, concrete requirements to achieve this are identified. In Section 3 we present our general architecture and extended process model. This model makes use of a pre-processing unit eliminating manual interactions in most cases and incorporates the findings of the EU large-scale pilot projects. Section 4 contains detailed information about the pre-processing unit. Finally, in Section 5 we evaluate our process model and architecture against the identified requirements.

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[2] http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/.

2. Status Quo of Public Administration Procedures

This section gives an overview about the status quo of public administration procedures. First, the common structure of such procedures is presented. Second, cross-border procedures are discussed especially within the context of the EU Services Directive. In the following issues and challenges concerning efficiency and effectiveness are discussed. Finally, requirements to increase the efficiency and effectiveness of public administration procedures are identified.

2.1 Common Structure

Public administration procedures cover a lot of different applications. Nevertheless, a common structure for such procedures can be defined. Figure 1 illustrates the structure of a typical electronic public administration procedure. According to [7], such a procedure can be subdivided into three basic stages: (a) application, (b) processing, and (c) delivery.

The *application* stage constitutes the first step in a public administration procedure. The applicant[3] requests an application at a portal. For this purpose, the applicant fills out an online form and attaches the required electronic documents[4]. This can be done via direct file upload, upload via an eSafe, or via any other resource (depending on the portal's functionalities and general infrastructure). These form data and the uploaded documents are then sent to the back-office. In the back-office, the *processing* takes place. That means, the application is processed in the particular competent authorities (CAs). At the end of this stage, the last CA issues the decision concerning the application. Finally, in the *delivery* stage this decision is sent to the applicant. Depending on the legal regulations for the application, the decision can be delivered informally via e-mail, a portal-internal delivery system, or via an electronic delivery system.

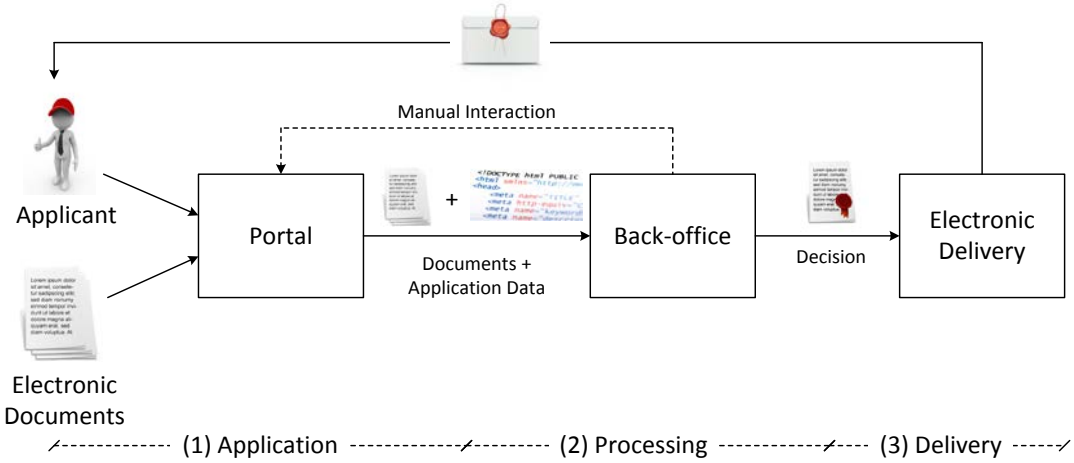

Figure 1: Typical electronic public administration procedure

2.2 Procedures Across Borders

Public administration procedures across borders are addressed by the EU Digital Agenda [2] and the EU Services Directive [12]. This Directive requires the establishment of point of single contacts (PSCs), which serve as one-stop shops for citizens and businesses. At such a PSC, citizens and businesses can apply for an application and do not need to contact the different competent authorities in the background. The EU large-scale pilot SPOCS[5] particularly focused on that scenario. Among other things, SPOCS has developed an interoperable e-Document framework for exchang-

[3] An applicant can be a citizen or business or even a public official (in G2G or G2E applications for instance).
[4] Also other forms of application are possible, e.g. via e-mail.
[5] See [11] and http://www.eu-spocs.eu/.

ing documents and – similar to the EU large-scale pilot STORK[6] – a cross-border e-Delivery solution.
The e-Document framework, called Omnifarious Container for e-Documents (OCD), is a multi-layered container format consisting of the following layers: *payload layer* (containing electronic documents), a *meta data layer* (for achieving semantic interoperability), and an optional *authentication layer* (to ensure authenticity of the container by using electronic signatures). Details on the OCD container and its implementation can be found in [9, 10].

2.3 Issues and Challenges

Although electronic public administration procedures are already implemented in the field, they still are not perfect yet. The EU Services Directive requires the establishment of PSCs in the individual EU Member States. In 2012 the Directorate General for Internal Market and Services[7] has published a study [6] on functioning and usability of the Points of Single Contact under the Services Directive. This study provides *"a preliminary assessment of the implementation of the Points of Single Contact in the Member States […]"*. Main findings of this study are that the establishment of PSCs has increased the interoperability, but still gaps have been identified, that *"need to be overcome in order to unleash the full potential of the Points of Single Contact"*. Amongst other, these gaps are: (a) simplification of administrative procedures is still not reached, (b) administrative procedures still base on conventional paper-based processes, and (c) 41% of the examined focus group had difficulties to complete the procedure. In addition, this study published a list of policy recommendations for PSCs and policy makers. A major set of recommendations focuses on administrative simplifications and completion of electronic procedures across border.
Hence, issues and challenges for current public administration procedures can be divided into two categories: (a) efficiency and (b) (cross-border) interoperability[8]. Concerning efficiency, the main reasons for delayed application processing are missing data and provisioning of non-machine-readable data. In the first case, application data and supplementary documents are usually sent through a web form from the PSC to the CA (or even to several CAs). There, the responsible official processes the application and may notice that data or documents are missing or are incomplete. At this point, a manual interaction with the applicant is needed, which delays the application and thus reduces efficiency of the whole procedure. For sure, CAs or the PSC have implemented basic data validation processes. Nevertheless, current validation implementations are very simple and do not support complex validations [6]. Hence, there is need to establish sophisticated data validation processes.
Another reason for inefficient electronic procedures is the absence of appropriate machine-readable data during application. Therefore, the authors of [8] propose a basic concept to extract machine-readable data out of previously non-machine-readable data. However, the authors do not give details on such data extraction facilities.
The second challenge for current public administration procedures is interoperability. Cross-border interoperability focuses on interoperable services between different countries. Main issues are data exchange and delivery between countries. This concerns mainly the data exchange between PSC and CAs as well as the delivery of the CA's decision to the applicant. Hence, elaborating appropriate data exchange and delivery mechanisms are the main challenges for interoperability according to the European Interoperability Framework (EIF) [3].

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[6] https://www.eid-stork.eu/.
[7] http://ec.europa.eu/dgs/internal_market/index_en.htm.
[8] In this paper we refer to technical interoperability as defined by [1] only.

2.4. Requirements

Based upon the recommendations given in the PSC study [6] and the discussed challenges in the previous subsection, we have identified following requirements, which must be fulfilled to ensure efficient public administration procedures:

- *Interoperability and cross-border services*: Public administration procedures must rely on the established PSCs. Although PSCs need to be established in the context of the EU Services Directive only, an extension of the area of application into other domains seems reasonable. In addition, findings of the large-scale pilots SPOCS and STORK should be integrated, namely the OCD container for (cross-border) exchange of electronic documents and the e-Delivery framework for the delivery of administrative decisions.
- *Modularity and adaptability*: Software components modelling public administration procedures electronically must be designed in an easy extensible and adaptable way. That means, needed functionalities must follow a modular and adaptable approach to ensure easy integration and extension of existing facilities.
- *Clear and usable interfaces*: The communication between affected parties and involved modules and components must base on clear and usable interfaces.
- *Integration into existing infrastructures*: PSCs are already deployed in different countries. That means, (basic) infrastructures exist. To facilitate the take up and to protect the past investment costs, the extended public administration procedure must be easily and smoothly integrable into existing infrastructures.
- *Automatic processing*: A public administration process must ensure automatic processing. This means that manual interactions between applicants and administrations as well as between administrations amongst each other must be avoided as much as possible. Therefore, comprehensive data validation and data extraction facilities are needed.

Following section elaborates on our proposed general architecture and process flow for efficient and interoperable public administration processes, which aims to meet the identified requirements.

3. General Architecture and Process Model

3.1 General Process Architecture

Figure 2 shows the general process architecture, which bases upon the common administration procedure structure. This structure has been amended by a *pre-processing unit*, whereas the other components (portal, back-office and electronic delivery) are untouched. The pre-processing unit is deployed in the domain of the PSC and acts between the request for application (at the PSC) and the processing in the back-office (at the CA). It pre-processes the given data to ensure that no incomplete data are sent to the CA, which may cause delays and additional work on the CA's side.
The main purpose is to avoid a manual interaction with the applicant at a later process stage and thus concerning the affected CAs. In case the pre-processing unit fails, a manual interaction backup exists. However, this interaction takes place on PSC side and thus is still more effective than manual interactions at the CAs.

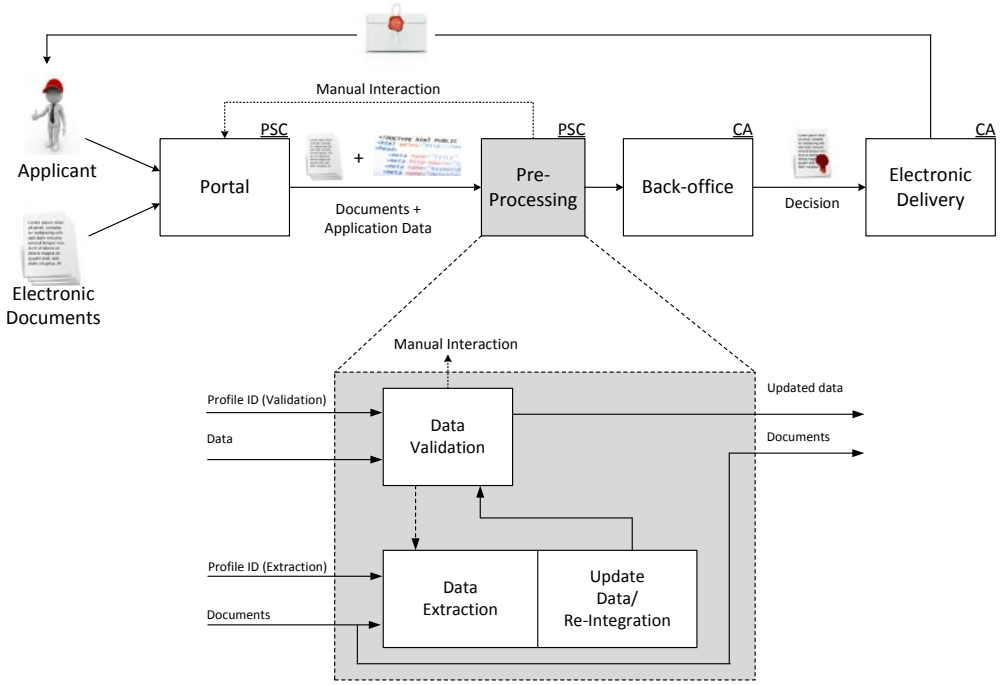

Figure 2: General process architecture

The pre-processing unit consists of the following subunits: a comprehensive data validation unit, a data extraction unit, and a data update (data re-integration) unit. These subunits are explained in detail in Section 5. Beforehand, Section 4.2 elaborates on the process flow incorporating the pre-processing unit.

3.2 Process Model

Figure 3 illustrates the general process model for increasing efficiency and interoperability of public administration procedures. The process model bases upon the common structure for a public administration procedure and follows the rules of the European Interoperability Framework. To ensure interoperability for cross-border applications, it incorporates the findings of the large-scale pilot projects SPOCS and STORK. The process model consists of following actors: (a) the applicant, who wants to apply for an application, (b) the PSC as contact point for the applicant, and (c) the CAs responsible for processing the application.
The detailed process flow is: The applicant wants to apply for an application at the PSC. Therefore, she fills in the corresponding forms and attaches the required documents. Before sending the data to the CA, the PSC executes a data validation process of the application data and the attached documents. This validation must be tailored to the specific application to ensure a reasonable result[9]. This customization has to be configured initially. Of course, this customization causes additional work in the setup phase, but amortises over time because of having more automatic processes and thus reducing manual interactions.

[9] That means the validation must validate if all data and documents are available, which are needed for the further processing at the CA. Depending on the complexity and kind of the application, the validation requires a structural validation (certain data fields are available) and an additional content validation (certain data fields must have certain values).

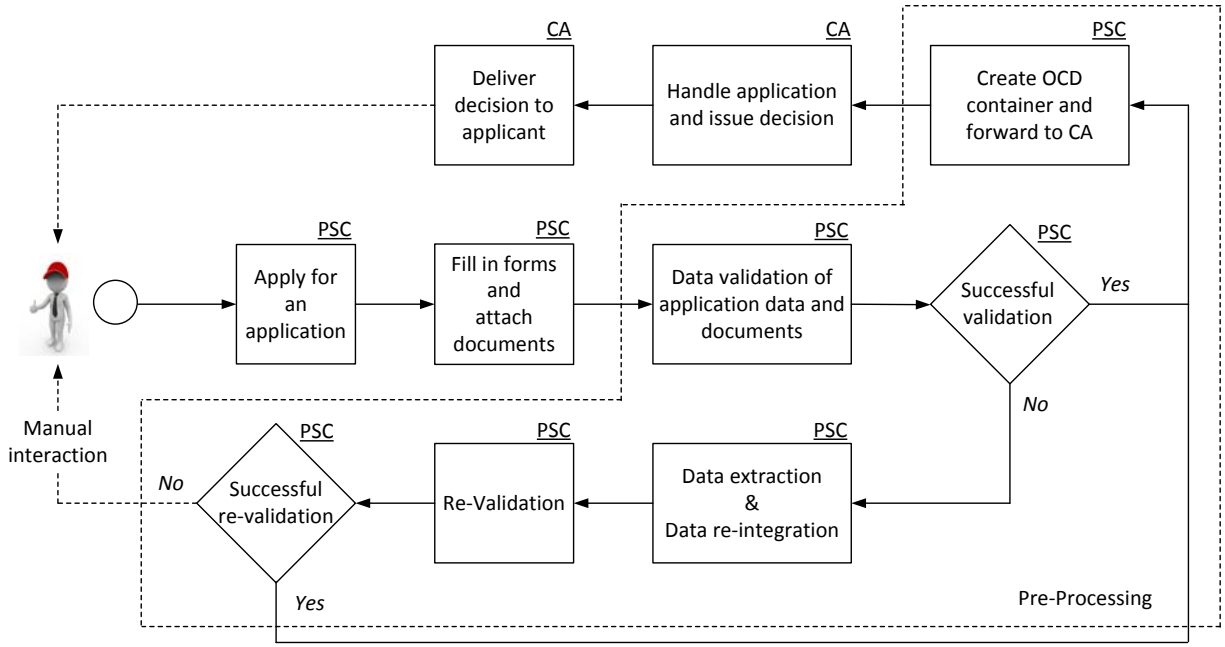

Figure 3: Process model for efficient public administration procedures

If data has been successfully validated (i.e. all needed data are available), the data can be sent to the CA. Before doing that, the PSC creates an OCD container based upon the application data and attached documents[10]. This is done to ensure interoperability especially for cross-border applications, e.g. an applicant from country A applies for an application in country B. This generated OCD container is then handed over to the CA, where processing is easy and less time-consuming as all needed data are already available. After processing, the CA delivers the decision to the applicant. This (cross-border) delivery is done by using the e-Delivery framework developed by SPOCS and STORK.

In case the validation was not successful, the PSC tries to extract the missing information from the available application data and documents. Therefore, the PSC forwards these data to the data extraction unit. This unit extracts or tries to extract the needed data. As for the data validation, also the data extraction mechanism must be tailored to the specific application to ensure a reasonable result[11]. The extracted data are added (re-integrated) to the present application data. The entire data are then re-validated. In case re-validation was successful, the entire data are forwarded as OCD container to the CA. If re-validation fails, i.e. the data extraction was not successful, the applicant must be informed and a manual interaction backup is required.

4. Pre-Processing Unit

This section comprises the architectural implementation of the pre-processing unit and gives details on the involved units.

4.1 Data Validation

Data validation in context of public administration procedures have only been slightly discussed so far. The authors of [8] present a basic architecture for the validation of data in this context. In this section, we extend and generalize the basic architecture of [8] to be applicable for our context. Fig-

[10] Besides the application data, the attached documents are added to the payload layer of the OCD container. However, the application data can also be included in the metadata layer.

[11] That means the data extraction should extract all data which are needed. Depending on the complexity, various document formats must be supported. As for the data validation, the additional configuration effort amortises over time.

ure 4 illustrates the architecture of the data validation unit. Inputs are a *profileId* for selecting a pre-configured validation profile and the *data* to be validated. Output is the respective *validation result*. The architecture consists of following core components:

- *Configuration*: The configuration defines validation *Profiles*, whereas each profile has a unique identifier (=profileId). Each profile includes details about the validation process and consists of required and optional information. First, it contains information about the structure which the data has to follow. Second, it optionally contains further information about the content of the data. Such content information contains a path and a value, or a regular expression. The value or regular expression defines which content a data field must have and the path defines the location of this data field in the entire data.
  For illustration, suppose we have a profile for an Austrian birth certificate. The structural information may specify that the data must contain the name of the mother, father, and child. Optional content information may be that the child's name must be John Doe.
  Concrete validation profiles are defined in this configuration. This is usually done by or on behalf of the PSC[12], which wants to query the data validation unit.
- *Structure Validation*: This unit takes the validation request (including the profileId and the data) as input and is responsible for the structural validation. It consists of the S*tructure Broker*, which gets the required structural information from the configuration (using the profileId) and triggers the *Parser/Validator*. The parser parses and validates the data against the structural information. Finally, the parser produces the structural validation result, which is sent to the *Result Generator*. In case the validation was successful and the content validation is activated in the configuration, the parsed data and the profileId are sent to the content validation unit.
- *Content Validation*: The (optional) content validation takes the profileId and the parsed data as input. The *Content Broker* obtains the content information from the configuration and hands them over to the *Content Verifier*. For each content information, the path is evaluated to get the concrete data field. The content of this data field is verified against the given value or regular expression and produces a content validation result. Finally, all content validation results are sent to the result generator.
- *Result Generation*: The result generator collects the structural validation results (*Structural Result Mapping*) and content verification results (*Content Result Mapping*). These parser and verifier specific results are mapped to common result codes, which are finally composed to a common validation result in the *Common Result Generator*.

[12] The data validation unit can be deployed in the domain of the PSC or at an external service provider.

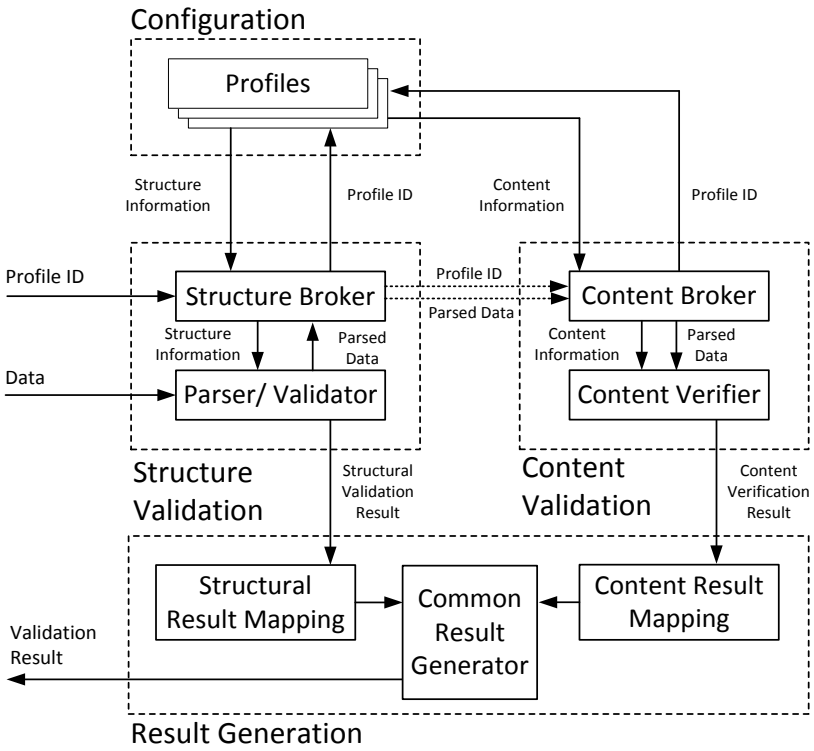

Figure 4: Architecture data validation

4.2 Data Extraction and Data Re-Integration

Figure 5 shows the architecture of the data extraction unit. Inputs are a *profileId* for selecting a pre-configured extraction profile, the *application data* and the *documents*, which contain data to be extracted. Output is the respective *updated application data*. The architecture consists of following core components:

- *Configuration*: The configuration specifies information about the supported document formats (*Formats*) and extraction profiles (*Profiles*). The extraction profiles contain general and specific information about the extraction facilities of the supported document formats. In addition, it includes concrete data fields that are intended to extract. Here, simple template matching mechanisms or more sophisticated approaches such as ontologies can be used (*Template/ontology information*).
  Extraction profiles and supported document formats are defined in the configuration. This is usually done by or on behalf of the PSC[13], which wants to query the data validation unit.
- *Format Detection*: This unit gets a data extraction request (including the profileId and the document to be extracted). The *Format Analysis* unit verifies the request and receives the supported document formats from the configuration. Then it triggers the *Hierarchic Assessment* unit to assess the document format. The result of the assessment (format information) is then sent to the central *Broker* including the document itself, the application data and the profileId.

[13] Equally to the data validation unit, the data extraction unit can be deployed in the domain of the authority or of an external service provider.

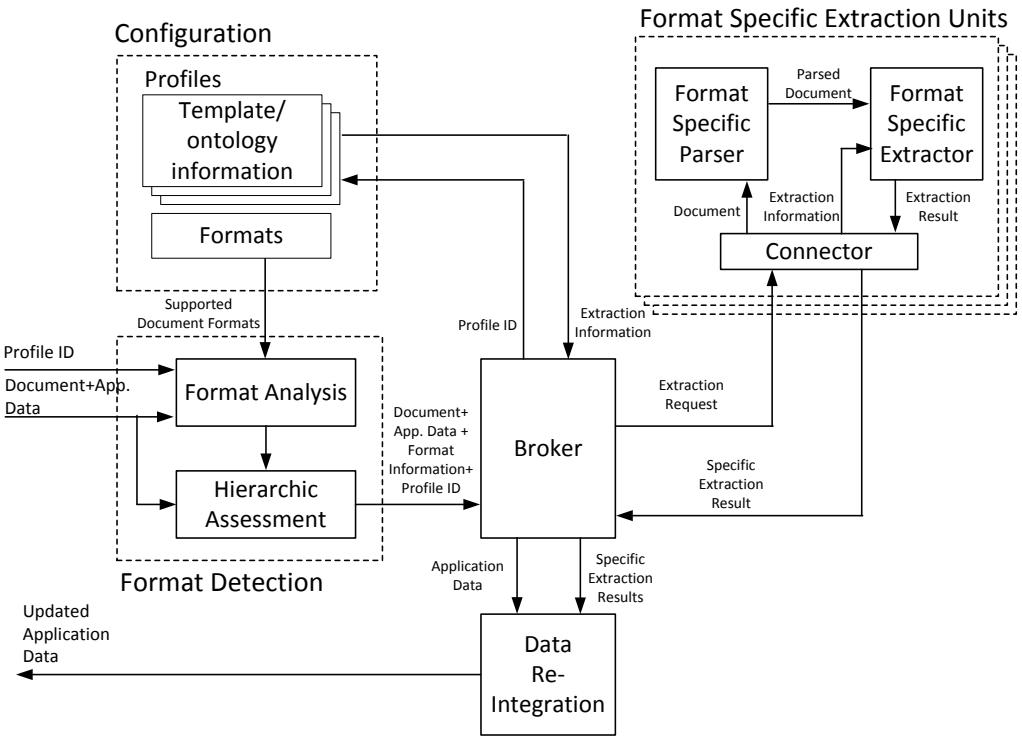

Figure 6: Architecture data extraction

- *Broker*: The main objective of the central broker is to create an extraction request for the specific document. This request includes the document itself as well as the general and format-specific extraction information. Thereby, the extraction information is gathered from the configuration. The request is sent to the *Format Specific Extraction Unit* via a common *Connector* interface. After the broker has received the specific extraction result from the extraction unit, the broker forwards the result and application data to the *Data Re-Integration*.
- *Format specific Extraction Units*: These units are responsible for data extraction out of the document. For each supported document format such an extraction unit exists. Each of these units must implement the common connector interface. In general, such a unit consists of a *Format Specific Parser* to parse the document and a *Format Specific Extractor*. The extractor extracts the requested data and returns a specific extraction result to the central broker.
- *Data Re-Integration*: The data re-integration receives the specific extraction result and the application data. It re-integrates (updates) the application data with the extracted information and returns these updated application data to the requester.

5. Evaluation and Conclusions

The presented process model and architecture have been implemented on a proof of concept basis. Based upon concrete life events our proposed approach has been evaluated. Therefore specific life event processes (e.g. application of child-care allowance) have been analysed and a demo PSC and demo CA haven been setup together with the proposed pre-processing unit. The pre-processing unit has been configured to validate and extract the required documents and forms. Finally, this has shown that the identified requirements can be met:

- *Interoperability and cross-border services*: This is fulfilled by using PSCs as one-stop shops and CAs in the back-office. In addition, the interoperable eDocument exchange format OCD of the EU large-scale pilot project SPOCS and the e-Delivery solutions of SPOCS and STORK are used and guarantee electronic data exchange especially in cross-border applications.

- *Modularity and adaptability*: The pre-processing unit is adaptable and can be easily integrated into existing PSCs. The architecture of this unit and the included functionalities are modular. That means additional validation and extraction profiles can be easily added.
- *Clear and usable interfaces*: All modules have clear interfaces and hide the complexity of the processes behind.
- *Integration into existing infrastructures*: Based upon the modular architecture and the clear interfaces the integration into existing infrastructures of the PSCs is easy possible.
- *Automatic processing*: Thanks to the data validation and data extraction units, manual interactions are minimized which increases the efficiency of electronic public administration procedures.

In addition, our implementation has shown that for setting up the pre-processing unit (namely the configuration of the validation and extraction profiles) additional effort is required. Nevertheless, this effort has to be done only once and amortises over time thanks to a reduced amount of manual interactions. Even if a manual interaction cannot be avoided, this interaction takes place in the domain of the PSC. This increases the efficiency anyhow, as a manual interaction at a later stage in the process and on CA's side is prevented.

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