

Managing Access to Distributed Resources

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Abstract

In the year 2003 the administration portal for Switzerland, www.ch.ch, went live. This portal is based on a powerful meta-database of available resources and services of the public administration and allocates a unique name, a URN (Uniform Resource Name), to every resource. The URN:Technology, adapted to the requirements of www.ch.ch, became an open standard and a building block of the Swiss eGovernment platform. This article sketches the URN:Technology. Here one establishes why URN:Technology represents nowadays a key factor in the success of building and operating large portals with decentralized responsibility for the resources and interlinking in vast and established federal structures. Search engines which are based on this URN:Technology enable searches on subject-specific areas of information as well as new forms of navigation. The present meta-database of URN:Technology is already similar to UDDI in terms of structure. A vision for the Virtual Desk Switzerland is presented extending the resource registry into a transaction hub interconnecting processes that cross administrative boundaries.

1. Introduction

After several years of concept design and development work, Switzerland's administration portal, the Virtual Desk Switzerland, with the address www.ch.ch, was opened to the public in January 2003. During a nine month test phase until fall, the system will be improved and expanded continuously. The information presented, analyzed by subject (mostly life events), leads the user finally to the relevant place in each instance of public administration, be this in the confederation, in one of the 26 cantons or one of the 2,880 municipal

administrations. From the user's perspective, the portal itself is to be understood primarily as a guide providing explanatory texts in all four national languages (German, French, Italian and Rhaeto-Romanic) and routing the user by these texts through more than 600 hierarchical structured subjects to the decentralized resources of the public administration in Switzerland. The number of links needed for this is enormous. Thus, for instance, each of the 2,880 municipal administrations responsible has to maintain links at the local level to all relevant subjects provided by the central portal authority.

The Virtual Desk Switzerland is one of the many government portals worldwide – a comprehensive list of government portals is presented in [1]. The goal of these portals is to provide an intuitive integrated view of available resources. Together with the links to internal and external resources, a search engine offering more exact and specific requests and a classification schema of in-



Fig. 1. The Virtual Desk Switzerland

formation categories for easy retrieval are common portal features. One of the key challenges of government portals is the provision of classification schemas not based on governmental hierarchical structures [2] but on life-events [3].

But the core problem of the Virtual Desk Switzerland was the federal structure: the Swiss cantons have remained to a large extent sovereign entities. Thus, administrative procedures, mandatory regulations, responsibilities and even the wording of legal texts vary to a large extent from canton to canton, even from municipality to municipality. Therefore, the central portal authority has to delegate the responsibility of interlinking local resources to the subjects (or life-events) given, since citizens need government portals providing information that is relevant, reliable and timely, as a recent study [4] pointed out.

The URN:Technology solves the problem of federal structures with the aid of a central meta-database in which all portal partners (here confederation, cantons and municipal administrations) independently maintain the description of the resources they offer on the relevant subjects, in particular providing the current valid address (URL) of the resources. On this point, resources can be both simple information provision, forms and also web applications and web services. Resources also keep a unique name that serves to identify them. The URN:Technology is particularly suited for managing access to distributed resources in complex and federally structured portals with decentralized responsibility for the resources and interlinking but is in no way limited to eGovernment in its application.

The Swiss Federal Chancellery, as the project leader with its Virtual Desk Switzerland, decided to implement the URN:Technology adapted to its own unique requirements for its portal. In this article the URN:Technology is outlined and illustrated by its implementation in this Virtual Desk.

2. URN:Technology

The URN:Technology has been developed in order to manage access to distributed resources by naming them. As the next section outlines, a uniform resource name is a persistent resource identifier. Thus, a portal like the Virtual Desk Switzerland designs its own namespace.

2.1. Naming Resources

For access to resources available via the Internet, various partly overlapping approaches exist under the title Uniform Resource Identifier (URI) [5, 6]: a distinction is made between Uniform Resource Locator (URL) and Uniform Resource Name (URN). URL designates an addressing scheme for finding resources on the Internet.

URLs represent the most familiar approach because of their use in the worldwide web.

The URN:Technology is based by contrast on the concept of the URN [7], whose aim is the allocation of a globally unique and permanent name to resources. The referencing of such resources thus becomes independent of the place of storage. In addition, opportunities arise for the preparation of different data formats (e.g. HTML, PDF, RTF) and language versions of a resource.

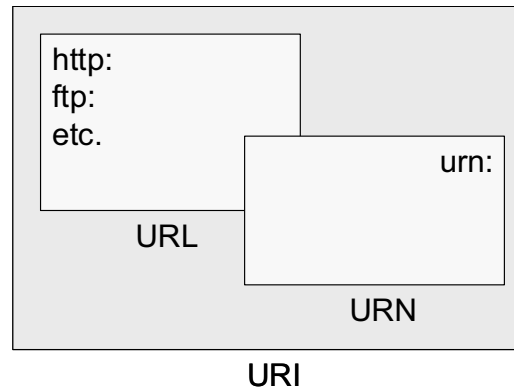


Fig. 2. Uniform Resource Identifier URI

2.2. Namespace Design

Resources can be described by numerous attributes. Some of these attributes are particularly suited to reference resources. The URN:Technology of the Virtual Desk Switzerland uses the four following attributes for referencing:

- Language e.g. de "German"
- Partner e.g. ch.be.6509 "Urtenen/BE"
- Subject e.g. ch.01.01.02.01 "Passport"
- Data format e.g. 01 "HTML"

In combination these four attributes are sufficient for the identification of resources by a URN and thus build the namespace. For the Virtual Desk all valid values of the identifying attributes were coded [8]. Open standards were used in this as far as possible. Since English is not one of the national languages, the examples given here are translated by the author and might change when the Virtual Desk Switzerland will publish its own English version later.

Figure 3 shows the URN for the above example. The prefixed urn:ch indicates the URN's namespace name ch, the country code for Switzerland according to ISO 3166-1:1997 [9].

Following RFC 2611 [10], The Internet Assigned Numbers Authority (IANA, <http://www.iana.org>) maintains the list of globally reserved namespace names.

The language is determined by `de` (German). Then follow the hierarchical codes `ch.be.6509` to indicate the municipality of Urtenen (which is in the canton of Bern: BE) and the subject “passport”, (accessible via the subjects “private life”, “proof of identity” and “identity cards and passports”). The final `01` stands for the data format HTML. The individual attributes are separated by a single colon.

```
urn:ch:de:ch.be.6509:ch.01.01.02.01:01
```

Fig. 3. Example of an URN

3. URN:Resolver

In order to access resources via URNs on the worldwide web, the portal partners must put each URL into the description of the resources stored in the central meta-database. So that portal users can access resources via the URN with the widespread technology of the worldwide web, hence with almost any browser just by embedding the URN into an URL, the URN:Technology brings the URN:Resolver to bear. The URN:Resolver has the task of turning a URN into a URL. A unique assignment can then only take place if the correct URL was assigned to the URN in the central meta-database by a portal partner.



Fig. 4. The URN:Resolver turns a URN into a URL

3.1. Primary Task of the URN:Resolver

The user puts the URN into a URL and thus sends a

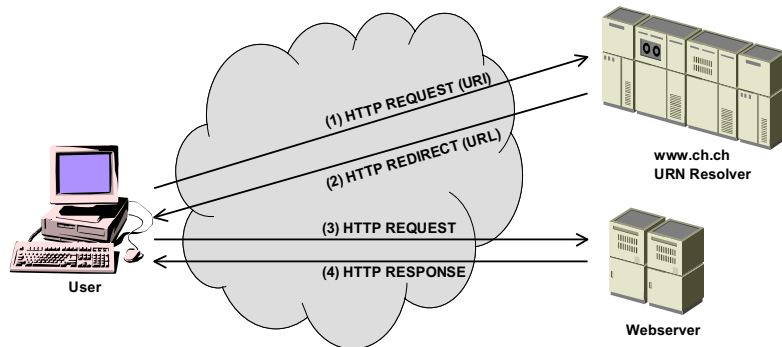


Fig. 6. URN:Resolver using HTTP Redirect

request to the URN:Resolver. In the case of the Virtual Desk Switzerland for the example in figure 3, only the address of the URN:Resolver is prefixed to the URN.

```
http://www.ch.ch/urn:ch:de:ch.be.6509:ch.01.01.02.01:01
```

Fig. 5. URN embedded within a URL for resolving

Two possible modes of operation of the URN:Resolver can be visualized. Either the URN:Resolver can redirect the client’s request to the desired URL or it loads the resource filed under the URL itself on behalf of the client calling it up and delivering it to that client. In this function the URN:Resolver acts as a proxy server. For the time being the implementation for the Virtual Desk Switzerland envisages only the first mode of operation: the client with the enquiry passes a URN embedded in a URL (hence as a URI) to the URN:Resolver in the form of an HTTP request. It extracts the URN from the URI and searches for the URL that corresponds to a URN in its database. It sends an HTTP response (content: HTTP Redirect) back to the client’s browser. The client then directs a request to the URL supplied and so accesses the desired resource.

3.2. Further Tasks of the URN:Resolver

The URN:Technology tries to ensure that the most appropriate resource is actually transmitted to the user even if:

1. no resource at all was recorded by the relevant portal partner for the URN sought,
2. the supplied URN proves to be not unique or
3. instead of a URN, natural language search terms are used.

In the first case, that is when absolutely no resource was recorded by the desired portal partner for the URN sought, the URN:Resolver searches with a complex procedure for the most suitable resources on the basis of the descriptions recorded in the central meta-database. Thus for instance it checks whether resources are available in other languages or on lower or higher level subjects instead of on the subject sought. In this the URN:Resolver follows the hierarchical structures of both the subjects and the partners and thus leads the user to an appropriate target. This complex procedure has been carefully designed with a set of rules for the special requirements of the Virtual Desk Switzerland.

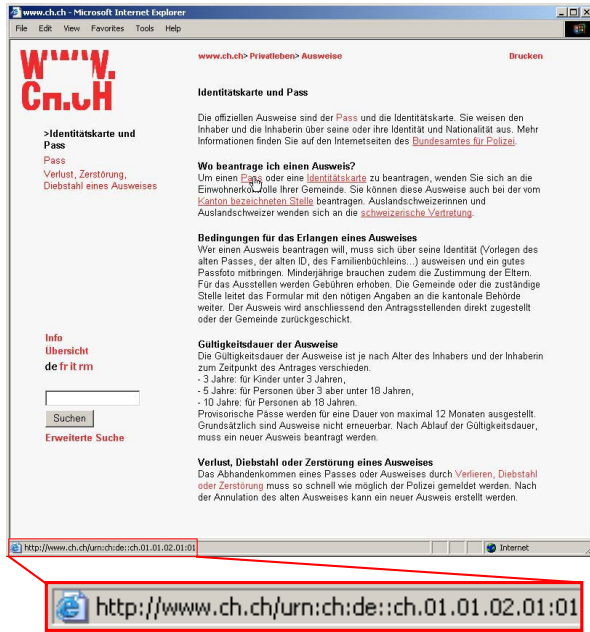


Fig. 7. URNs are used in the Virtual Desk Switzerland

In the second case, the use of URNs which are not unique is only permissible and logical if the expression for an attribute e.g. the language or the portal partner, is omitted. This function is particularly important for the direction to resources, for instance, for which the partner providing them can only be determined after determination of the residential municipality or canton of the user. The omission of the partner in the URN (e.g. when being

urn:ch:de::ch.01.01.02.01:01) allows the URN:Resolver to ask the user for his residential canton or municipality - based on the assignment of responsibility to each subject in the meta-database - and then to guide him correctly.

Alongside the omission of individual attributes, the use of wild cards is also permitted. Searching for example for the same subject as with the URN in figure 3, but replacing the language and only a part of the partner ID with wild card "*", e.g. urn:ch:*:ch.be.*:ch.01.01.02.01:01, the URN:Resolver will come up with a list of all available resources from municipal administrations in the canton of Berne written in any language.

In the last case even natural language terms are permissible instead of coded expressions for attributes and they allow a free-form query. It is not in this instance a typical full text search but an intelligent-as-possible algorithmic transformation of a URN based on the list of all valid values of all attributes. The example in figure 8 shows the transformation for the very short URN "urn:urtenen,pass". The URN:Resolver derives the desired language *de* from the language of the chosen subject "pass" (passport). The code of the appropriate municipality is determined from the municipality identifier, which proves to be unique in this example. Further assumptions relate to the domain *ch* and the data format HTML which are provided as default by the Virtual Desk Switzerland. In the conversion to a URN the order of the attributes input is not important. The URN:Resolver automatically recognizes the individual attributes. As shown in figure 8, multiple levels of URNs are handled by the URN:Resolver. Given a complete vocabulary, thus the list of all valid values of all attributes in all four languages (German, French, Italian and Rhaeto-Romanic)

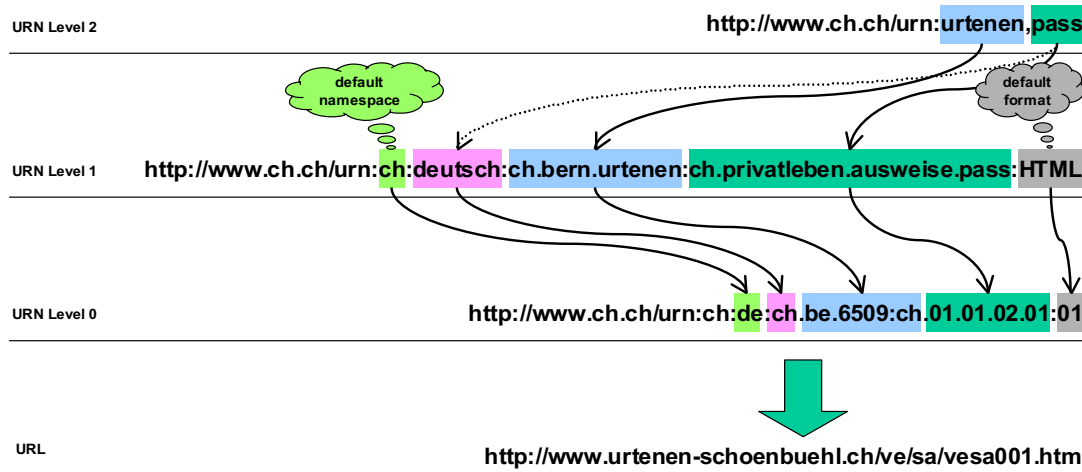


Fig. 8. Complex URN resolving

directed to check the resident's municipality in

used within the namespace, the URN:Resolver is able to transform even free-form natural language terms (URN level 2) or URNs in valid syntax but with natural language values (URN level 1) to a single URN or – if natural language terms prove to be not unique – a set of valid and unique URNs (URN level 0) presented to the user.

4. Resource Description

For the description of resources the URN:Technology applies a further open standard, the Resource Description Framework, RDF [11]. RDF is based on XML and offers a syntax that contains consistent rules for the generation of metadata. RDF gives website authors the opportunity to describe resources with the help of metadata [12]. Future search engines that support RDF are capable of answering enquiries by this means and guiding the user much more accurately to the targeted resource. Hence the resource descriptions are not only recorded in the central database but also made available to the portal partners in RDF format; the partners can publish the descriptions on their own websites in a manner accessible to the search engines. Variants of this with different advantages and disadvantages are available to date e.g.:

- The descriptions of all resources of a website are published as a single RDF document as part of the website.
- For each individual resource of a website the description is published as an RDF document. Within the resources, for instance within HTML documents, there is a reference to the descriptive RDF document.
- In HTML documents the description is embedded as an RDF sequence.

The attributes used by the Virtual Desk Switzerland to describe the resources have been selected with several recommendations in mind, especially with the Dublin Core Metadata Element Set [13] (e.g. title, author, subject, contributor, language, format, date, rights) and include further domain specific attributes (e.g. validity date, codes identifying the separation of powers).

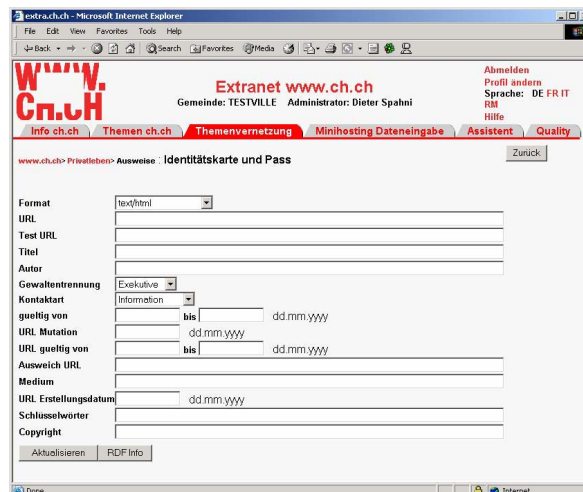


Fig. 9. Extranet: resource registry for portal partners

5. Contribution to Current Knowledge

Switzerland is the first country to have not only a comprehensive guide and portal but also a standardized national resource registry, visited by several thousands of users per day. The success of such a portal is heavily dependant on the support of all partners, because they maintain all the links to the resources available: at the end of September 2003, more than 165,000 URNs were recorded in the central meta-database. Organizational and technical aspects proved to be of great importance for a project spanning institutions in federal structures not previously working together alike.

5.1. Organizational Aspects

In order to build and run the Virtual Desk Switzerland, the Federal Chancellery established a cooperation between the confederation, the 26 cantons and municipal administrations [14]. The federal project team is supported by the consultation group with more than 50 representatives from the confederation, all cantons and selected municipal administrations. This group is responsible for the roll-out within the administration and acts as a sounding board to the project team. Strategic decisions are made by a small management committee with about ten members from the federal administration, the cantons and a representative from the association of cities and of the association of municipal administrations. This cooperation proved to be crucial for the chosen approach with a central meta-database maintained locally by all the portal partners with respect to information flow and motivation.

To achieve a balance between effort and benefit for portal partners working for the Virtual Desk, organiza-

tional and technical support is provided centrally. A hotline offers technical support for webmasters in most national languages and relevant documents are available in an extranet. Moreover, a quality-assurance team audits manually the links in the meta-database and verifies that they point to proper resources. Of course all links are repeatedly checked for availability by a spider. In any event of fault, notifications are sent to the persons in charge. Furthermore, a set of reports shows how relevant subjects are actually interlinked with the resources provided by the portal partners.

For portal partners with no information online yet, the Virtual Desk offers a small website hosting based on restricted templates. Thus, even very small municipal administrations, typically with a population of less than 1,000 people, were enabled to participate actively from the beginning.

The central meta-database provoked requests from the private sector for detailed information about the system and especially for interfaces connecting local content management systems directly to the central database. A basic interface is now available and will be improved when shifting to a new and web services enabled platform.

The URN:Technology has become generally accepted by all portal partners, because of its decentralized responsibility for resources and interlinking, matching the political structures of Switzerland. All partners – including all webmasters linking to public resources – benefit today from the URN:Technology, due to the fact that the responsibility for accurate links using URNs has shifted on to the providers.

Several portal partners now intend to use the URN:Technology for their own purposes independently too, but interlinked with the subject structures provided by the Virtual Desk Switzerland.

Other non-governmental portals (e.g. www.guichet-schweiz.ch) already started using the same meta-database to provide access to selected resources with their own navigational structures meeting special requirements of their users. New search engines, such as the eFinder [15] dynamically integrate the meta-database to sort the results by governmental structures or other attributes. As the central meta-database of the Virtual Desk improves in terms of quality and quantity, more applications using this database will show up.

5.2. Technical Aspects

The Virtual Desk has become the central registry of public administration in Switzerland. Interestingly, the Virtual Desk has already shown itself in its structure to be a registry conforming to UDDI [16] in its approach. All the partners are listed in it (white pages) and their resources described (green pages) if these fall within the portal's subject structure (yellow pages). However, fur-

ther research and development is necessary in order to evaluate if a registry with strong UDDI conformity might fulfill the special requirements of portals for intelligent searching and navigating through the spanned information space. The concept of UDDI has to be extended to reference not only web services but resources of any kind.

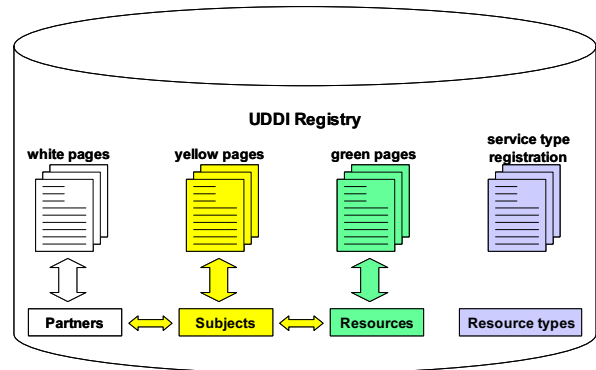


Fig. 10. URN:Technology versus UDDI

Further research will focus for instance on comparing the URN:Technology to emerging standards like the Extensible Resource Identifier (XRI, [17]). XRI is addressing a similar goal, building a third layer of abstraction in identifying resources, overlaying the binary IP address as the first and the Domain Name System as the second layer.

Beyond the pure identification of resources, the URN:Technology enables the creation of topic maps [18] based on rich metadata fostering the development of semantic search engines [19].

5.3. Conclusions

With regard to the success of the Virtual Desk project the importance of organizational aspects outperform technical aspects by far. Such a common portal requires an intensive collaboration of all partners involved but separated by the frontiers of a federal state with a strong direct democracy and cantons with more responsibilities than the confederation. The key success factor is the support of decentralized responsibility for resources provided by the partners and the central mechanisms for interlinking them e.g. by the means of the URN:Technology.

6. Vision Switzerland

This section outlines the authors personal vision for the Virtual Desk Switzerland actually being evaluated by the Swiss Federal Chancellery.

The Virtual Desk as an eGovernment platform of the confederation is the prerequisite for secure and frictionless cooperation within the federal administration as well as between it and the canton and municipal administrations. As a central registry and hub of processes extending beyond the authority it increases their efficiency. It also integrates the varied systems of decentralized authorities irrespective of the transmission medium used with open, standardized interfaces and thereby actively promotes cooperation between the state and its client groups. This platform-supported integration of the tasks of the government and administration units improves the information flows significantly and creates the desired transparency.

6.1. Resource Registry: Locating, Accessing and Integrating Processes

The Virtual Desk Switzerland is, together with improved functions for locating and accessing business processes, the place to turn for both users and application developers. Via the portal both client groups find the desired information for the approach to a process or to building web services into their own applications.

All partners can publish the description of their client processing, irrespective of the interface technology used, in the resource registry so that automatic access to processes and, in connection with that, transmission of electronic data between linked processes across the boundaries of authorities, irrespective of the communication medium used, is made possible.

Support for carrying out processes requires the publishing of process descriptions and examples. The resource registry must be conceived in such a way that this can be developed in corresponding stages.

The portal guides the user, right through from navigation structures with the support of explanatory text, not only to the information but also to the entry points of the relevant processes. Then, depending on each particular service provided by the administration units, one is referred by the URN to the related website or online form, whose content is approved and transmitted, securely and with regard to appropriate data protection regulations, via the most suitable communication channel.

By the same route application developers find the descriptions of the technical interfaces (per WSDL [20]) for the integration of available web services. The resource registry becomes thus a complete implementation of a UDDI registry.

6.2. Transaction Hub: Processing, Combination, Synchronisation and Running of Processes.

The individual transactions of the processes, which cross administrative boundaries, are combined by the transaction hub. The exchange of information inside the

administration as well as between it and the parties from society and economy is thus noticeably simplified. This approach allows a large number of those involved to build their own solutions as required and at the same time to connect with each other across authority boundaries. The data to be passed between the transaction partners can be automatically converted on demand into a suitable target format by the transaction hub. The portal provides various communication channels transparently to the partners.

The synchronisation tools needed for batching individual transactions into higher-level transactions are also part of the transaction hub.

With the transaction hub the Virtual Desk becomes the central backbone of business processes extending beyond the authority. The transaction hub is seamlessly integrated into the pre-existing navigation system of the Virtual Desk, whilst alongside the information resources of the partner, the location, access, handling, combination, synchronisation and running of its business processes are also actively supported by the portal for all those involved.

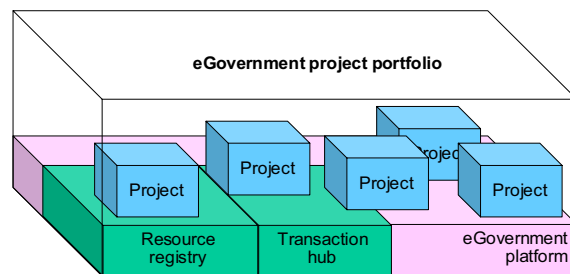


Fig. 11. Transaction hub as a part of the eGovernment platform.

The data to be transmitted between the processes can be automatically converted on demand by the transaction hub. The portal provides the partners transparently with varied and secure communication channels.

The realisation of the vision of a transaction hub is characterized by technical as well as organisational complexity. It is precisely because of the ongoing technological development in the area of business-to-business integration (in this case also government-to-government integration) that an ongoing review of the technology used is necessary.

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