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Natalia Dorontsova
Swiss Federal Statistical Office
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Technology

SBER and its new Business Architecture Solution

1 Abstract

The technological solution of today's Swiss Business and Enterprise Register (SBER) dates back to the year 2000. Like many other business registers, the SBER refers to multiple data sources and has multiple statistical and administrative users. Gradually, the current solution, which was very substantial and sophisticated at the time it was implemented, is reaching its limits both from a data management and technological point of view. Today, tailor-made accesses to the data system (.txt files, xml, web services, database links, etc.) are offered to different partners. This approach leaves room for improvement primarily in terms of work and cost-efficiency as well as data quality.

To meet the challenges ahead, the FSO has decided to conduct a reengineering of the SBER's software infrastructure in order to modernise and optimise the IT system. The project focuses on aspects such as data management, business architecture and technology as well as data storage and data sharing.

The objective is to create an integrated system based on a service-oriented architecture (SOA) that satisfies all business and technical requirements and eliminates today's weaknesses. An important part of the project is the implementation of a "Data Integration Service" which allows to centralise every mutation announcement from internal or external partners.

This service will be mainly used for two purposes. Firstly, to act as a service bus that distributes the information between different services or registers. Secondly, to load, process and validate data received from partners in order to update the SBER's content.

To split and reduce the complexity of business processes, the new integrated system will rely on harmonised methods and is designed according to separation of concerns principles. The benefits of this approach are, amongst other things, the enhancement of automatic validation rules and the traceability of business transactions.

2 Introduction

The Swiss Business and Enterprise Register (SBER) contains all the local units and enterprises with an economic output in Switzerland. Key information about them is updated on a permanent basis through various sources.

The SBER is used as a repository of addresses for the FSO's data collection from enterprises and institutions. Other agencies of the federal administration and many cantons use the SBER for statistical or administrative purposes.

From a functional standpoint, the SBER fulfils its current objectives, and the quality of the data is deemed to be good. However, from an operation point of view, the SBER's current technical solution is difficult to use, requires intensive maintenance, and is both unstable and costly.

Because of the rising number of interfaces, an external audit was carried out on the SBER system. This pinpointed a range of problems in terms of security and data integrity. Documentation was either obsolete or simply non-existent. Hence, plans to reengineer the SBER were launched. The venture aims to:

- Put in place a new architecture
- Optimise and standardise data transfers between the SBER and its partner registers, including the UID
- Increase the reliability of information updates in the SBER to avoid the propagation of errors to external partners, and improve the quality of sent data

3 Current system

Figure 1 provides a simple overview of the various systems (or system clusters) peripheral to the SBER and how they interact with it.

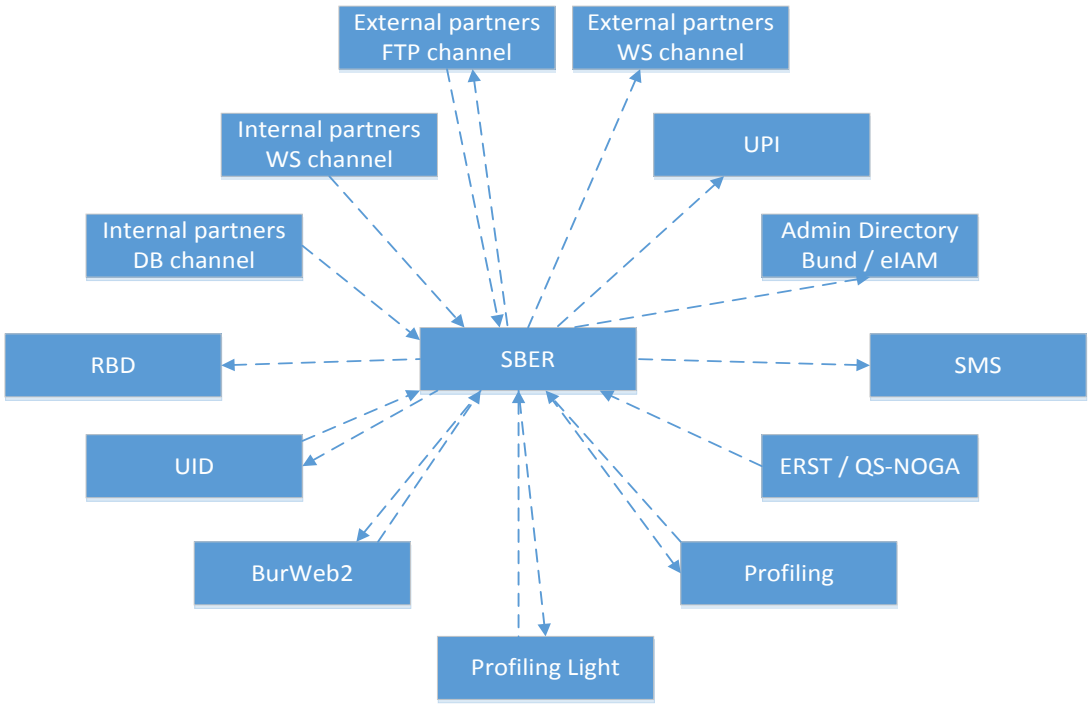

Figure 1 – Overview of the SBER and its partner systems

To interpret the diagram, the direction of each arrow indicates whether the SBER uses a service, e.g. the services supplied by SMS or RBD (Federal Register of Buildings and Dwellings), or whether it provides a service, e.g. for internal partners. In this diagram:

- The external partners are mainly the various public administrations as well as private enterprises that supply administrative and statistical data.

- The internal partners are the various departments of the FSO that use the data as the basis for surveys and statistics (e.g. wage statistics).

Amongst these partners, the UID and RBD registers are currently two major stakeholders in the process for updating SBER data. The UID is even the primary source of data relating to the SBER's administrative units. As this diagram shows, the SBER is not only a data provider but also a consumer of many internal and external services.

From a technological standpoint, data exchange is also highly disparate. The following services are used most often (the list is not exhaustive):

- Transferring of .txt and .csv files via FTP (File Transfer Protocol): Unix programmes are run regularly (at least once daily) to retrieve files from a central FTP server. Next, Oracle jobs (stored procedures in PL/SQL) are run to upload file contents to the database.

- Replicator: a Windows service installed on a server within the intranet area, used for exchanging data between BurWeb2 and the SBER, and between Profiling Light and the SBER. This service has read/write rights to the register's database and uses the web services of client applications (BurWeb2 and Profiling Light)

- Database link: the link between the SBER database and partners' databases, thanks to which:

    - RBD address data can be replicated directly in the system, tables automatically synchronised and SBER data modified

    - Data can be made available to various internal partners

- Oracle jobs (stored procedures in PL/SQL): manually or automatically run jobs that:

    - Make blanket changes to the register's data

    - Export register data to files for distribution to partners

4 Architecture – Enterprise view

Having outlined the current system and its limitations, together with the broad reengineering aims of optimising data transfers between the various partners, we will now look more in detail at the technical solution selected for achieving the aforementioned goals. Of course, several solutions were analysed, but detailing them falls outside the scope of this presentation.

Given the pivotal role played by the SBER in managing and exchanging business and enterprise-related data within the federal administration, the new solution is built on a service-oriented architecture (SOA)

that supports standard information-exchange formats such as eCH[1]. This allows for the standardisation of communication interfaces between the SBER and its partners.

The most important part of this architecture is the service bus, which is the backbone of any SOA architecture because it acts as the communication interface with clients (the GUI, or internal and external partners). In this case, this is not a representation of an ESB-type product (Enterprise Service Bus). Rather, it consists of a collection of services, each of which is a processing unit corresponding to a usage scenario.

The service-bus concept for the FSO's enterprise architecture can be summarised as follows:

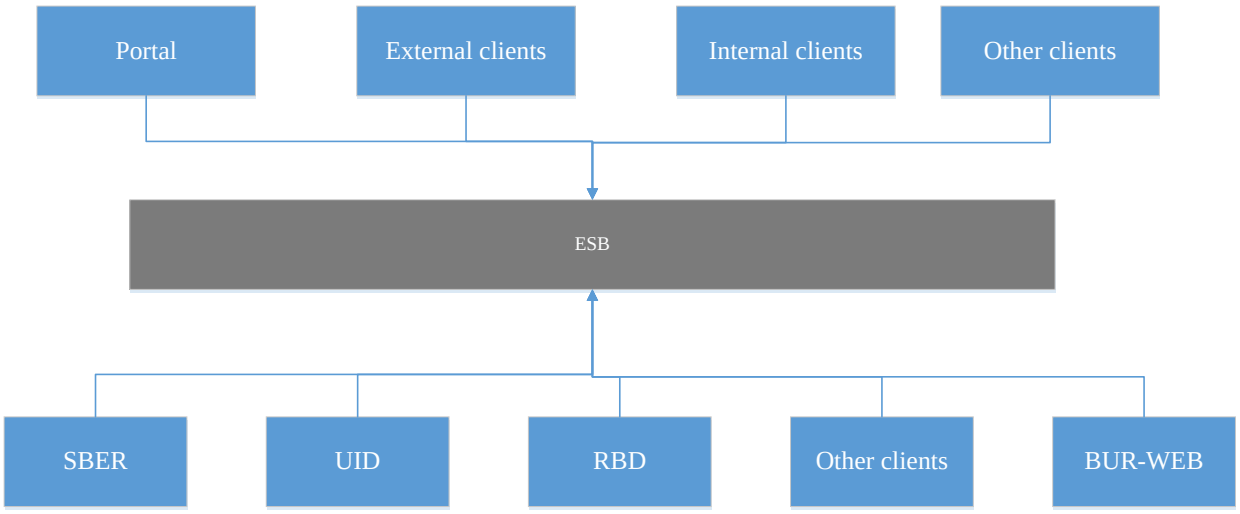

Figure 2 – Overview of the service bus in the FSO's architecture

This solution was initially envisaged at FSO level. Its implementation would have enabled applications that do not necessarily have the same objectives or the same way of working to communicate.

However, despite considerable interest in the component, it could not be implemented centrally for several reasons, namely the availability of personnel and time constraints as well as the obvious costs.

As these three factors represent a high risk for the project, it was decided to focus on the links between the SBER and its partners and to implement a service-centralisation solution directly within the new SBER architecture.

The overriding advantage offered by this decision is that it holds the project to its planned timeframe. The solution can also be tested on the basis of usage scenarios that are clearly defined by the project's scope. When the time is right, it can then be presented to other partners and FSO users.

[1] eCH standards are a set of common rules that embody Switzerland's e-government strategy. They were designed as recommendations for collaborating through electronic channels. Where required, eCH rules can be designated as mandatory for the federal government or the cantons, or nationwide.

5 Architecture and service centralisation

The following diagram shows how the SBER interacts with its technological environment. Each notification (to write, edit or delete data) originating from internal or external partners is centralised in the Data Integration Service (DIS). This component has the following roles:

- It acts as the service bus between (internal and external) partners, the UID and the SBER, saving notifications and disseminating processed and validated data
- It mirrors the current solution's Mutaboxes[2], i.e. it enables the loading (via job), processing and validation of notifications, the end stage being the updating of the UID and SBER registers

Each interface in the diagram is described further below, next to its two-character identifier.

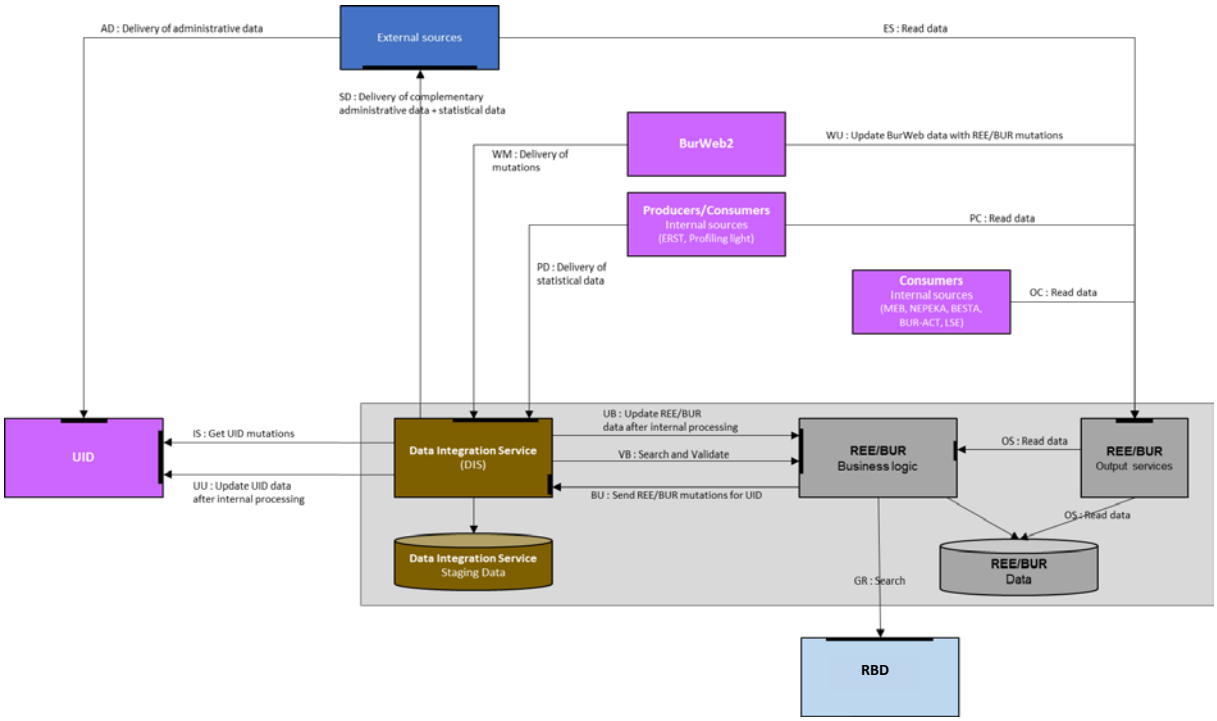

Figure 3 – Diagram of interfaces

The following table details the various interfaces shown in the above diagram.

ID	Description
AD	This interface is used by UID partners to deliver administrative data on Swiss enterprises for which UID registration is mandatory (UID office).
IS	This interface enables the DIS to retrieve UID notifications for processing and validation.
SD	Each external source provides an interface enabling the DIS to collect information supplementing UID-provided notifications, or simply information that is required for updating the SBER register.
UU	DIS-processed and validated notifications that are applicable to the UID are sent back to the UID, thus updating the register.

[2] The Mutabox concept denotes a procedure for processing data from the time they are received until (automatic or manual) mutations are applied in the register.

ID	Description
UB	Each notification processed and validated in the DIS is sent to the SBER, thus updating the register.
VB	Used during the processing and validation phase of notifications received by the DIS, this interface – exposed by the logic layer of the SBER – enables the DIS to utilise validation and search services.
BU	When data relating to enterprises in the UID register are modified directly in the SBER using the SBER client, the mutations are pushed to the DIS. The DIS is responsible for notifying the UID (UU interface) of the mutations. Mutations refused by the UID are kept in the DIS for manual processing.
PD	This interface enables internal sources (ERST, Profiling Light) to deliver survey data for the purpose of updating the SBER.
WM	This interface enables BurWeb2 to deliver notifications of recorded mutations.
WU	This interface enables BurWeb2 to update data based on the latest mutations recorded in the SBER.
ES	This interface enables external partners to query the SBER to obtain the most up-to-date information on register units.
OC	This interface lets partners and internal FSO statisticians utilise SBER data.
PC	This interface gives statisticians updating the SBER access to SBER data when launching surveys.
OS	This interface gives output services access to the register data required for the dissemination of information to internal and external partners. This interface can be offered in two forms: As OData web services provided by the service layer of the SBER (and which consequently cross the application logic layer) Or as an external component (along the lines of Microsoft SQL Server Reporting Services) that can access register data directly
GS	This interface enables the DIS to search for addresses in the Federal Register of Buildings and Dwellings in Switzerland (RBD).

Table 1 – Description of interfaces

The DIS, once incorporated into the SBER system, will make it possible to:

- Integrate and process notifications from internal and external partners (job engine, DIS)
- Transfer information from SBER partners to the FSO through register updates. (In the long run, it is planned for the DIS to expose standardised services. Meanwhile, in the short term, it will provide for the transfer of data over established channels)
- Retrieve new notifications for analysis and processing by the system
- Deliver data updated through notifications that have been analysed and processed in the system
- Standardise procedures for delivering data updates from the UID and SBER registers
- Validate the coherence of processed data
- Search for existing SBER units corresponding to processed units
- Consult existing SBER information linked to processed units

- Update UID data based on all UID-relevant mutations that have been input directly into the SBER register, i.e. any mutations that were not carried out automatically via the interface with the DIS system

The following explains how notifications from or to the UID are expected to be processed.

In the first case, the UID office connects to the UID (AD interface) to provide new administrative data. Periodically (once a day), the DIS requests the latest notifications from the UID (IS interface). These notifications are processed and analysed using automated validation rules and manually by FSO employees (UID Mutabox, VB and GR interfaces).

Once the notifications have been processed, validated and approved, the DIS supplies the new information to the UID (UU interface) and to the SBER (UB interface) in order to update the registers.

In the second case, certain UID units may be directly modified in the SBER/BUR through a batch download of mutations or individually by a staff member. In that instance, the updated data are supplied to the DIS (BU interface), which then is responsible for transferring the notifications to the UID (interface UU).

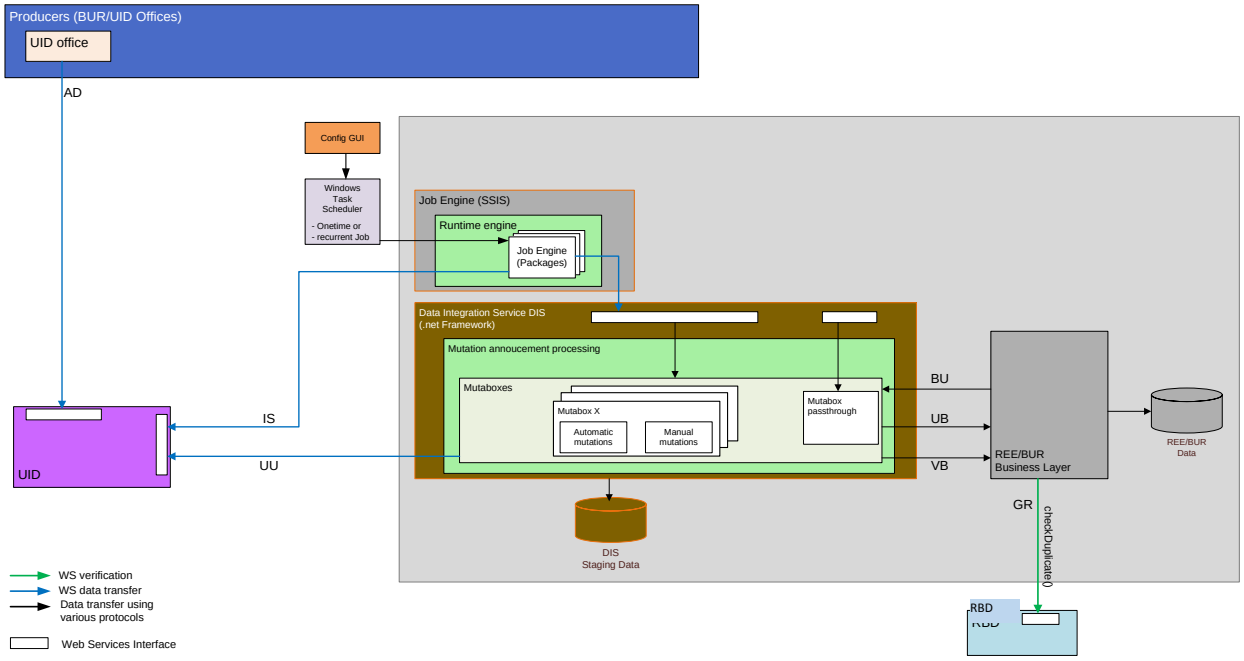

Figure 5 – Integration and processing of UID notifications

The data-exchange format for external partners is kept as it is because the FSO does not want to oblige partners to migrate their data-transmission platforms. Consequently, their notifications are communicated through flat files in filesystem-type storage locations or through partner web services (SD interfaces). This information is then transferred to the DIS (by the job engine), where it can be processed and analysed using automated validation rules and manually by FSO employees (Mutaboxes, VB and GR interfaces).

Once the notifications have been processed, validated and approved, the DIS supplies new information to the SBER/BUR (UB interface) so that the register can be updated. Information pertaining to units stored in the UID register may also be sent to the UID (UU interface).

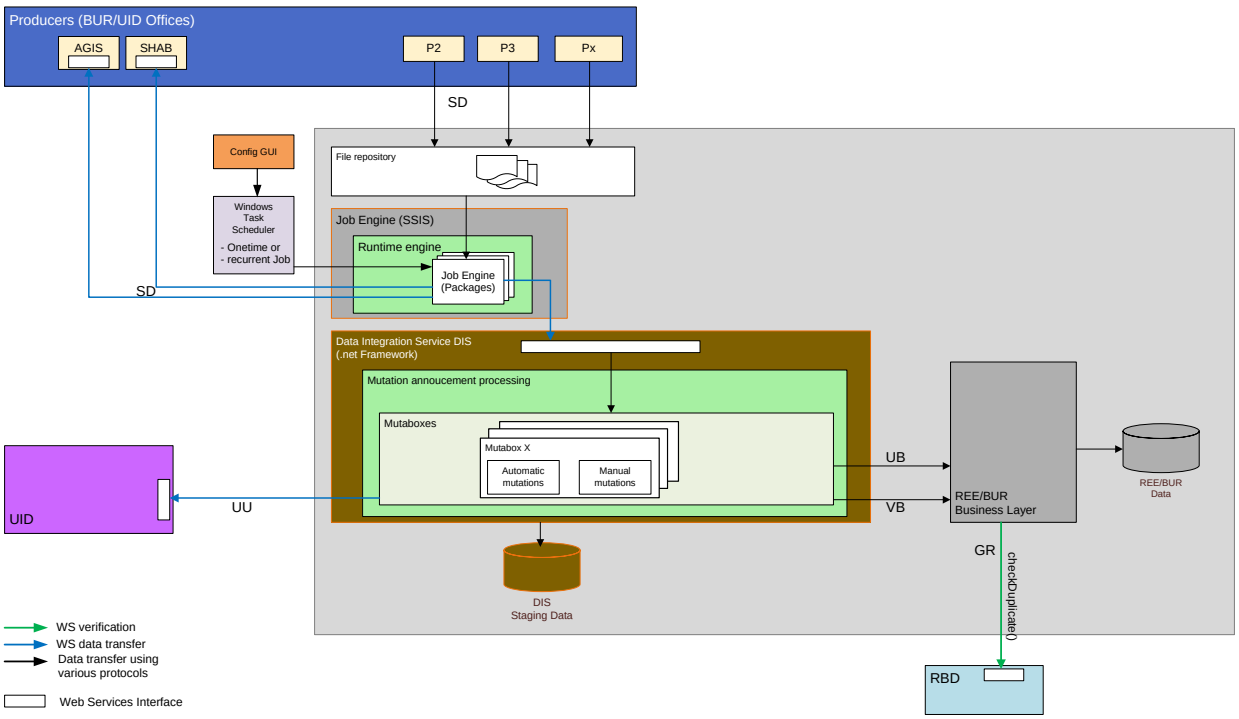

Figure 6 – Integration and processing of external partner notifications

Similar processes will be applied to the whole system.

6 Technology decisions

The new architecture is based on current best practices, which recommend a physical separation of responsibilities (logical layers). The new system consists of three physical layers (client + application server + database) supporting the following application layers:

- Presentation layer (client installed on users' workstations)
- Logical layer (main code run on the application server)
- Cross-layer or infrastructure layer (code bringing together cross-level functions such as security (authentication and authorisation), where logging takes place on the application server)
- Resource layer (relational model in the database and access to external services such as IIR research, the SMS naming system, the RBD address repository, etc.)

The new solution is based entirely on Microsoft tools/languages:

- The operating system hosting the application server is Microsoft Windows 2012 R2
- Data are stored in a Microsoft SQL Server 2014 database
- The application is developed using the Microsoft C# .Net language:
    - The application server is developed using ASP.Net

    - The client is developed using Windows Presentation Framework (WPF)
- Web services are provided in REST format according to the Open Data Protocol (OData)
- Jobs are carried out as Microsoft SQL Server Integration Services (SSIS) packages
- Data analysis by quality agents is conducted using Microsoft SQL Server Reporting Services (SSRS)

7 Conclusion

To summarise, the benefits offered by the chosen solution are relatively clear to see. The first advantage is the centralisation and standardisation of services and interfaces; the second is that its modular architecture separates the system into different modules (database, GUI, logical layer) whose lifecycles may vary and whose technological progress is independent from one another. Furthermore, centralising modifications of enterprise data makes them easier to share between the various internal and external partners. It also limits the number of transactions and improves processing.

The reengineering project is currently in progress. However, its architectural design as shown in this document has been approved and validated by all stakeholders. Since the project uses an agile development methodology, architecture-related requirements are met and detailed architecture descriptions are written in incremental stages, in line with development needs.

However, it is still too early to discuss results or hurdles, as the project is due for completion only in mid-2018.

Glossary

Abbreviation	Description
Admin Directory Bund/eIAM	Confederation/Identity and Access Management (centralised personal identification used by the Swiss Confederation)
BurWeb2	Swiss Business and Enterprise Register accessible over the internet
DB	Database
DIS	Data Integration Service
ERST	Survey for updating the Swiss Business and Enterprise Register
ESB	Enterprise Service Bus
FTP	File Transfer Protocol
OData	Open Data Protocol
FSO	Federal Statistical Office
Profiling	Survey of multi-unit enterprise groups, used to update the SBER
Profiling Light	Survey of multi-unit enterprises, used to update the SBER
QS-NOGA	General Classification of Economic Activities
REE / BUR	Swiss Business and Enterprise Register
RBD	Federal Register of Buildings and Dwellings
SBER	Swiss Business and Enterprise Register
SMS	Statistical Metadata System
SOA	Service Oriented Application
UID	Unique Identification Number for businesses
UPI	Unique Person Identifier
WS	Web Services