Standardisation as a basis for information exchange and IT-services

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Abstract. The purpose with the research is to describe how the use of standards can contribute to information exchange and the development and delivery of IT-services. In this paper a theoretical framework for this research will by presented. This framework is based on a number of concepts, IT-services, information system, systems architecture, standardization and the relationships between these concepts.

1 Introduction

Today there is a development from an industrial society with focus on production of goods to a post-industrial society with focus on the delivery of services [1]. This development does also affect the subject fields of information systems, because today we speak of the delivery and use of IT-services, e.g. mobile positioning services, travel information services or banking services on the Internet. These services are based on channels like the Internet and mobile telecommunications. With the help of these channels information and functionality are delivered by service providers, and are used by customers with the help of IS.

The Transport sector is an example of an area where there is a fast development of new IT-services. The concept used in the transport sector to talk about these new IT-services is Intelligent Transport Systems and Services (ITS). The idea with ITS is that the services should bring extra knowledge to travelers and drivers in order to improve transport activities [2]. In cars, ITS is used for helping drivers navigate, avoid traffic hold-ups and collisions. On trains and buses ITS is used for managing and optimising fleet operations and to offer travelers automatic ticketing and real-time traffic information. At the roadside ITS is used for co-coordinating traffic signals, detecting and managing incidents and to display information for drivers and travelers.

An important aspect of the development of ITS is that a number of general IT-based services are developed which support mobile activities, and the possibility to provide targeted information to mobile actors based on time and location so called

Location Based Services (LBS). LBS are services for mobile users that take the current position of the user into account [3]. This implies that users can obtain driving directions and see local traffic conditions based on their actual time and location.

An important feature of these IT-services are their strong dependency on infrastructure in order to be developed, delivered and used. The reason for this is that it should be possible to deliver IT-services anywhere and anytime based on the customers time and location, e.g. in the home, in the car or on the street. This infrastructure consists of both a *technical part* and a *soft part*.

- The technical part consists of a wide range of equipment.
- The soft part of the infrastructure includes public databases and information systems (e.g. payment systems) which are necessary to provide IT-services [4]

This implies that the notion of infrastructure can be described as a Systems Architecture in this context. The Systems Architecture is an important prerequisite for the development of IT-services because in order to develop and provide IT-services information from different IS and databases have to be combined which means that a number of IS and actors have to be able to exchange information.

One important prerequisite for an effective information exchange is standardisation. Standardisation is important because there is a need for standards that promote high quality and effective communication between actors, companies and information systems.

An important aim with the research is to describe the role that standards play in the information exchange and the delivery of IT-services. In this paper the theoretical framework for the research will be presented. This framework is based on the concepts listed below and the relationships between these concepts:

- IT-services.
- Information system.
- Systems architecture.
- Standards.

2 IT-services

The perspective of the service concept presented in the paper is based on Edvardsson [5] definition of the service concept. Edvardsson is part of the internationally well known “Nordic School of service research”. Edvardsson defines services as:

> *”… a chain of (sequential, parallel, overlapping and/or recurrent) value creating activities or events, which form a process. In this process customer often takes part by performing different elements in interaction with the employees of the service company (other customers or equipment) for the purpose of achieving a particular result.”*

From the definition we can see that a service consists of a number of value creating activities that are performed in the interaction between the customer and the service provider (service company). The customer may also interact with other customers or equipment during the service process. One important aspect stressed by ”The Nordic School” is that the service concept is described as *situated interaction*, i.e. the service

is delivered and produced within the actual service encounter when the customer (physically) meets the actors who represent the service provider.

Edvarsson [6] presents a structural model which can be used for service analyses and development. The model consists of three components: *the service concept*, *the services process* and the *service system*. The *infrastructure* connects these concepts and constitutes a basic prerequisite and resource for the development and the delivery of services (figure 1).

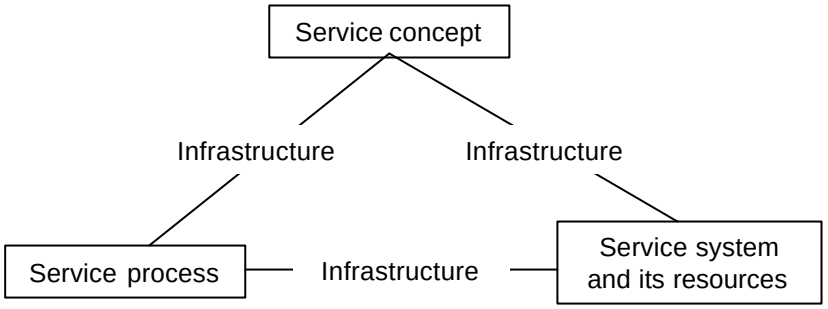

Figure 1. A structured model for services [6].

According to service theory, *the service concept* is a description of customers' needs and the service offer [5].

The *services process* contains a chain of the activities that are needed to realize the service.

The *service system* describes (see figure 2 below) the resources needed to develop and deliver the service and these resources are used in the services process. The resources needed are management and staff (including collaborators of the service provider), organizational structure and systems (e.g. information systems and other support systems), technical and physical resources. The customer is seen as a resource in the role of co-producer.

The service system resources can be divided into a visible (interactive) part and an invisible part (back-office) in the eyes of the customer [5].

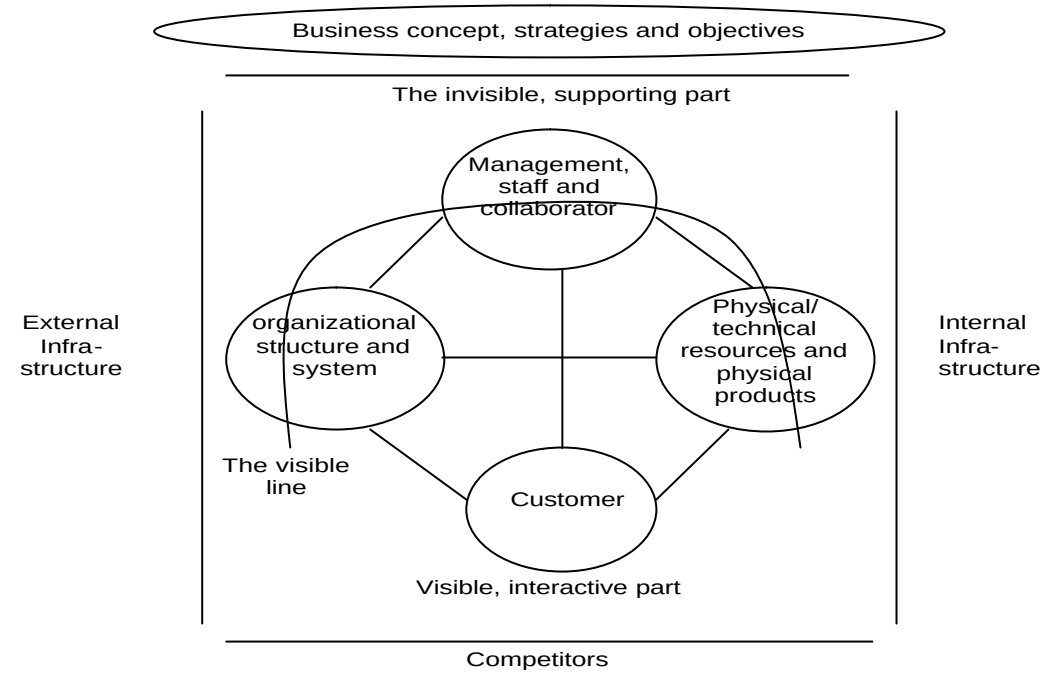

Figure 2. Resource model for the service system [6].

If we adjust the model described in figure 2 into the context of IT-services, we can present the IS as the main resource which is visible for the customer (see figure 3 below). The reason for this is that in the context of IT-services the customer interacts with an IS through the user interface. The IS contains the functionality and information available to the customer, and the user interface constitutes the major part of the visible line between the customer and the service resources. In this context the IS cannot only be considered as a support system within the service system. The IS is the key resource. It is the IS which provides the functionality and information of the IT-service through the user interface, and information and functionality is provided with the help different distribution channels and technology, e.g. the Internet and mobile telecommunication. The customer interacts with the IS and in this interaction communication between the customer and the system is performed.

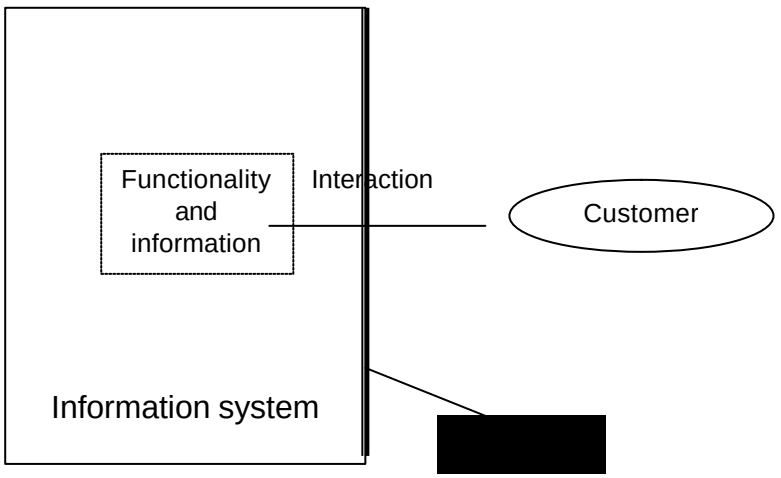

Figure 3. The customer interacts with an IS through the user interface.

3 Information system

In the section above the IS was described as the main resource in the service system in the context of IT-services. This implies that in order to talk about IT-services it is important to describe the notion of IS. However, the problem is that there is not just one definition of the concept, there are many, and we have to choose a perspective of IS which is in line with the definition of the service concept presented by Nordic School i.e. as *situated interaction*.

A frequently used perspective of IS, which is based on *situated interaction*, is the tool perspective, and in the tool perspective the concept of usability is central. For example in HCI-research the User-Tool-Task model [7] is used. According to this model usability is something that is created in a *use situation* where the *user, tool* and *task* are brought together. The tool is the computer together with the functionality of the system. The idea is that there is a functionality built into the system (the tool) that can be used by the user to accomplish user tasks. This implies that it must be possible for the user to do the right things with the tool. The tool must also be flexible and it must be easy for the user to learn how to use it. The tool should also contribute to the efficiency and productivity of the user. The discussion of usability is focused on the inter-action between the user and the system.

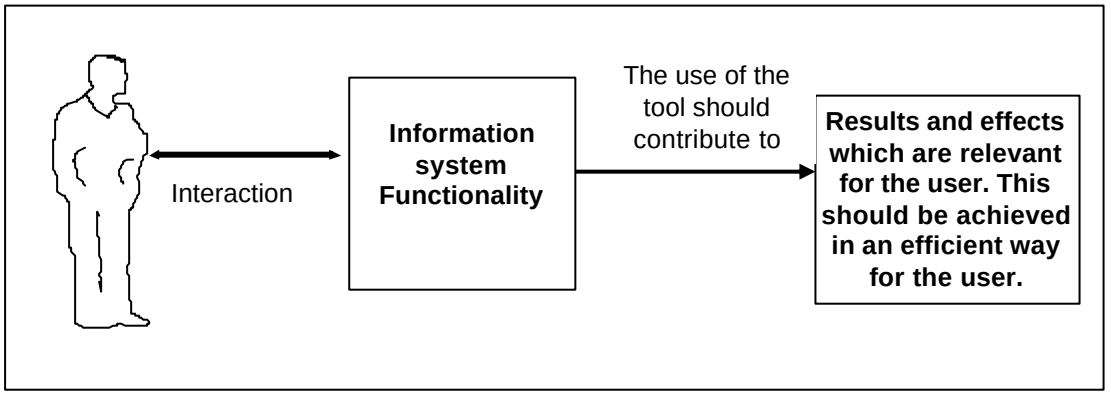

Figure 4. A tool perspective of information systems

The advantage with the tool perspective is that it:

- is focused upon the situated interaction between the user and the system;
- describe the IS as a personal flexible tool that should be adjusted both to the actor and the context where the system is used,
- shows that the system is used for activities in order to accomplish a result (a task).

This is in line with the view of the definition of the service concept as *situated interaction*. However there are also some problems with the tool perspective. One big problem is that the tool perspective is not focused upon concepts like *information* and *communication*, which are central in the context of IT-services. This is a problem because IS are not only technical tools that are used by individual users, they are also social tools used for communication in a social interaction context. This implies that we have to look elsewhere for a view of IS that is based on a social interaction perspective.

A social interaction perspective of IS is represented by the authors of speech-act theory [8, 9, 10]. In these definitions IS are regarded as systems used for *performing speech acts* (communication acts).

Ågerfalk et. al. [11] has presented an actability view of information systems, based on the idea that IS are action systems used for performing speech acts. The definition of actability is described like this:

> *"An information system's ability to perform actions and to permit, promote and facilitate users to perform their actions both through the system and based on messages through the system, in some business context"*.

According to actability the IS has a dual action character; it can be used:

1. for performing *automatic* communication actions independently of the users, but on assignment of the users;
2. to *interactively* perform communication actions.

This dual action character of IS is related to two different types of use situations: automatic and interactive use situations.

An actability perspective of information systems is in line with our view of the service concept as situated interaction and furthermore it is based on the idea that IS are used for performing communication. However the actability perspective of IS has to be adjusted to the IT-service context.

Dahlbom [1] is a researcher who has described how the IS can be viewed in an IT-service context. Dahlbom claims that IS, in this context, are used for providing occasional services to be bought and consumed. The idea is that information and functionality should be delivered at the time the customers need it. Dahlbom writes:

"It is the idea of having a servant who does all the hard work of collecting information, having overview, etc, so that you don't have to worry about that. All you have to do is ask for and receive the services".

This implies that the IS is described as a service provider, or means for providing IT-services. If we combine the idea of the IS as action systems (like in actability) used in a social interaction context with the idea of the system as a service provider, or the means for providing IT-services (like Dahlbom). We can describe this with the help of the figure below.

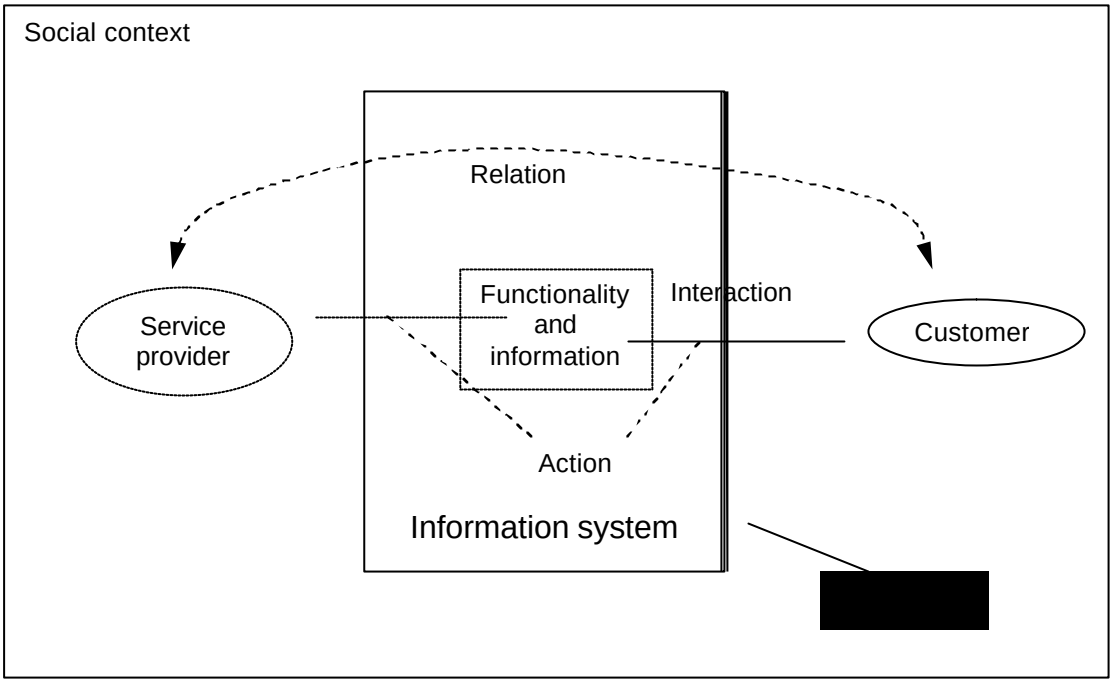

Figure 5 Information systems in a service context.

The fact that the service interaction between the service provider and the customer takes place through the system implies that the concept of service interaction has to be reinterpreted in an IT-service context. In service theory, it is assumed that the service encounter between the service provider and the customer is face-to-face. In the context of IT-services, the interaction between the service provider and the customer is performed *through* the IS. This implies that the service provider and the customer do not have to meet in time and space. This also means that an IT-service is less situated (to place and time) compared to services which are not based on IS. This implies a number of challenges. One challenge is to create adaptable interfaces and functionality in order to suit a specific customer's actual needs for the interaction. According to service theory, a service provider and a customer perform this adaptation interactively in the service encounter. Such adoptions are based on an assumption of face-to-face interaction.

4 Systems architecture

An important feature of IT-services is their strong dependency on infrastructure in order to be developed, delivered and used. The infrastructure needed to accomplish this consists of both a *technical part* and a *soft part*. The technical part consists of a wide range of equipment, e.g.:

- mobile units for communication, e.g. cellular phones and PDAs;
- distribution networks, e.g. the Internet, mobile telecommunication and radio networks;
- positioning technologies, e.g. Global Positioning Systems (GPS) and cellular phone triangulation;
- GIS-technology.

The soft part of the infrastructure consists, for example, of:

- information and databases;

- functionality that is used for accessing, manipulating and organising information;
- standards that facilitate the communication between different actors and information systems.

This infrastructure can be described as an systems architecture because it consists of a number of databases, information systems and actors that exchange information using a number of different distribution channels. The concept of systems architecture concerns questions of how information, functionality and responsibilities should be divided, and how communication between different systems, actors and business units could be achieved [12, 13].

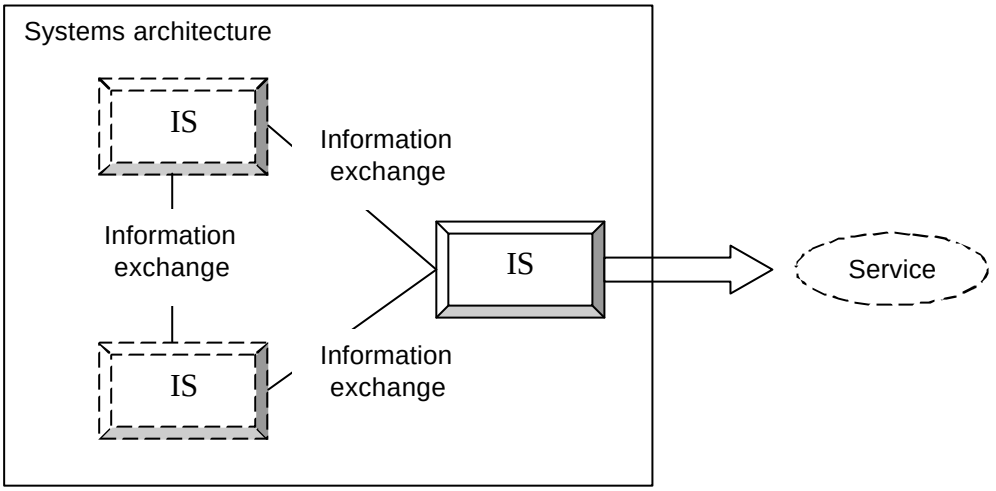

Figure 6 The context and parts of a systems architecture

A systems architecture can from an implementation perspective be described as a number of IS which contain information and exchange information in order to produce IT-services as described in figure 6 above.
A systems architecture consists of different parts, and relations between these parts. The systems architecture can be divided into:
1. a technical architecture (TA);
2. an information systems architecture (ISA).

The technical part of the systems architecture (TA) is focused on which technologies that are or should be used to implement the ISA, and the ISA consists of information and the functionality of the applications. The applications are used to perform activities that provide services in a business context. The applications are used for information processing and to communicate information between different systems, actors and business units.

5 Standards

The concept of systems architecture and IT-service [12, 13, 14] is closely related to information exchange and communication, and one important prerequisite for an effective information exchange is standardisation.

5.1 Standards definition

A standard can be seen as a type of rule that describes how to act in certain situation. A rule defines what's appropriate or allowed to do. Standards are a source of knowledge, aid, a tool or a method for voluntary use. The contents of a standard could be used in many contexts. ISO (International Organisation for Standardisation) is an international well-know and recognized organization that works with standard and standardization. ISO [15] defines the notion of standard as:

> *" document, established by **consensus** and approved by a recognized **body**, that provides, for common and repeated use, roles, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context"*

Consensus means that that the standard is (Ibid) "a general agreement, characterized by the absence of sustained opposition to substantial issues by any important part of the concerned interests and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting argument". With Body ISO (Ibid) means a legal or administrative entity that has specific tasks and composition.

The process of developing a standard is called standardization and is often done by special organisation like ISO that will result in a published document called standard. The purpose with this work is to rationalize (make efficient, financial improve and avoid misunderstanding) and solve constantly recurring problem.

5.2 The RDS-TMC standard

The standards which are in focus in our research are standards in the ITS-sector. In the ITS-sector the use and implementation of standards are important, this is also the reason why a lot of money and work have been spent on developing standards in the ITS-sector [16, 17]. In order to develop ITS it will be important to be able to combine information from different systems and databases, and to communicate this information between service providers and customers. This means that it will be necessary to standardize the information exchange between different IS, databases and actors. Standardisation of information exchange implies that central concepts have to be defined and identified and that the formats for the information exchange have to be decided.

A standard which particularly has been in focus in our research is the standard for the RDS/TMC service. The RDS-TMC standard [18] is a European standard for a mobile traffic information service distributed with the help of the RDS radio channel. RDS-TMC is an abbreviation for **R**adio **D**ata **S**ystem-**T**raffic **M**essage **C**hannel. In the standard the RDS-TMC service is described and characterised in a number of documents [18, 19, 20, 21] and a short summary of this description is presented below.

Description of the service, its use and customers

The aim with RDS-TMC service is to provide drivers and travellers with dynamic information about congestions, accidents and road conditions in order to make better and more informed decisions during the trip, based on dynamic traffic information.

The users of the RDS-TMC service are travellers and drivers who can use the information when they are on the road.

Message structure and content: The RDS-TMC traffic message is divided into two parts: a traffic event and a location part (se figure 7 below).

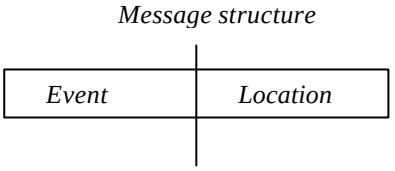

Figure 7. A traffic message can in principle be divided in two parts, an event and location part.

The event part of the message is some kind of traffic related information. This can be information about accidents, road conditions and so on. The event presented in the message is based on an event list which consists of a number of pre-defined traffic events. In the standard the entries in the list are defined and these entries are approved by the standardization organization (CEN). This implies that the entries in the event list are the same for all countries in Europe. However the event list is translated into different national languages.

The location part of the message contains information that describes the location of the event. The location can be a specific point on the road, for example an accident can happen at a crossroad. But the location can also have an extension, e.g. a roadwork which starts at one point of the road and finishes at another. The standard gives guidelines for how places should be coded and named.

Distribution of message: The messages that are sent through the RDS-TMC channel have a limited and fixed size. In a RDS-TMC message the event and location is described with numerical codes to fit into the limited size of the message. When the message is received the numeric codes have to be matched with the location code table and a pre-defined event list which is stored in the RDS-TMC receiver of the car (see figure 8 below).

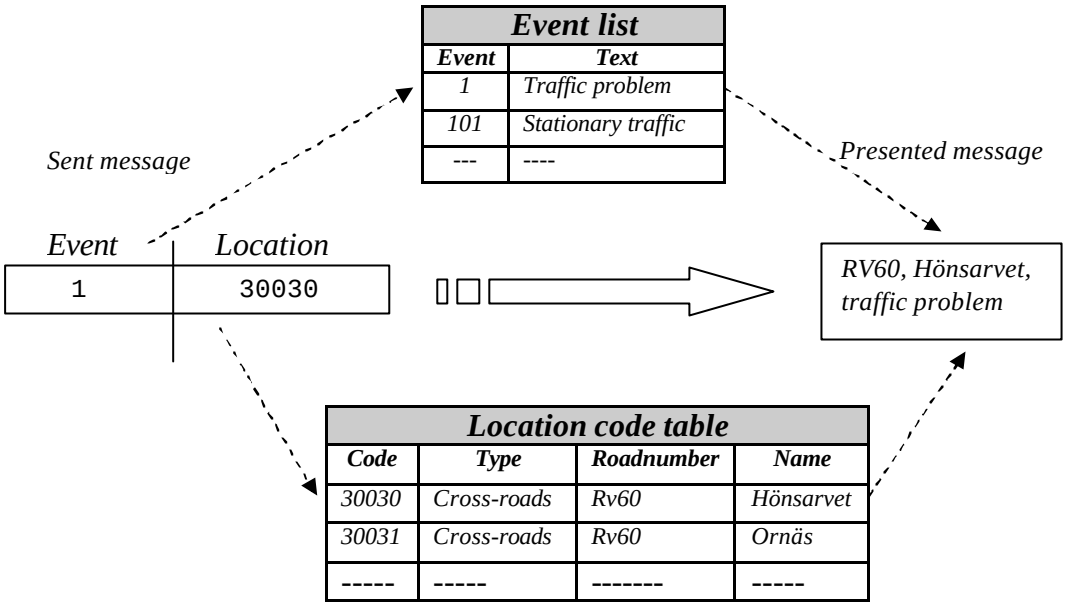

Figure 8. The transfer of an RDS-TMC traffic message

The location code table contain pre-defined places which are used for translating the code into a textual description, and the pre-defined event list is used for the translation of the event code. The standard describes how this distribution process should be performed.

Conceptual model: In the standard a conceptual model is presented which describes entities, the relationship between the entities and business rules which should be implemented in the database which stores the traffic information. The standard also describes the tables (the event list and location code table) that have to be installed in the RDS-TMC receiver so that the message could be translated.

Roles and responsibilities: In the standard different roles and responsibilities in the distribution process are described, e.g. motorist (customer), data service provider, programme service provider, broadcaster, network operator, transmission operator.

5.3 The RDS-TMC standard a service and systems specification

According to Brunsson and Jacobsson [22] can standards on a general level be described as guidelines for the users of the standard. Standards can also be classified into three major types:

1. Classification standards which describes things or actors, i.e. standards that describe concepts. For example a standard that describes a scientific classification system.
2. Standards for how to do things. These standards describe which type of products and services the users of the standard should produce and deliver.
3. Standards that describes what actors (persons, organizations, countries) should have. For example an organization should have goals and a country democracy.

If we classify the RDS-TMC according to the taxonomy above, it belongs to type 2, because the standard is a specification for a service and an information system. The RDS-TMC standard describes and gives guidelines for how service providers, who are the users of the standard, should act in order to develop and deliver the service. The standard also describes the aim of the service and how it should be used in a business context. This implies that the RDS-TMC standard can be seen as service and systems specification, and also as a method for how to develop the IS used for delivering the service.

In order to produce and distribute and use the service is it essential with effective and high quality information exchange between different IS and actors, and the purpose with the standard is to contribute to this information exchange. This information exchange is based on a business language, and the business language consists of messages and concepts which concern traffic events and the location of these events. This implies that the success of the service is dependent of how the service is specified in the standard, and how the service providers have been able to implement the standard.

6 Summary

In this paper we have made a presentation of a theoretical framework based on four central concepts IT-service, information system, systems, architecture and standards and their relationships. This framework is used in our research to describe the role that standards play in the information exchange and the development and delivery of IT-services. In the context of IT-services the standards are used as systems and services specifications and as guidelines for how to develop and use IT-services and IS. This implies that the standards affects:

- the systems development process;
- the information exchange between different IS and actors;
- the usability of IS and IT-services in a business context.

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