E-FRAME

Extend FRAMEwork architecture for cooperative systems

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Executive Summary

This document forms part of the FRAME Architecture deliverable (D15) that has been produced by the E-FRAME project. The deliverable consists of the following parts:

Part 1: Overview – this document;

Part 2: FRAME Browsing Tool – enables the contents of the FRAME Architecture to be viewed and is only available for downloading from the FRAME website at www.frame-online.net, in the Folder named The Architecture;

Part 3: FRAME Selection Tool Database – enables sub-set ITS architectures to be created through the use of the FRAME Selection Tool and is only available for downloading from the FRAME website at www.frame-online.net, in the Folder named The Architecture;

Part 4: FRAME Architecture Changes Document – describes the changes made to the FRAME Architecture since its previous version.

Part 5: The FRAME Methodology – describes how ITS architectures can be created using the FRAME Architecture as a starting point.

Part 6: Function, Data Flow, Data Store and Terminator Descriptions – the Function, Data Flow, Data Store, plus Terminator and Actor descriptions taken from the Access Database used by the FRAME Selection Tool. (Note the same text will also appear in the FRAME Browsing Tool.

Parts 2, 3 and 6 will be updated every time a new version of the FRAME Architecture is produced. Part 5 should remain constant with each version of the Architecture and therefore not be updated. Part 4 will be replaced with each new version of the Architecture.

Part 1 (this document) provides an overview of the FRAME Architecture, including what it contains, who has been using it and a brief history of its evolution. It is intended for use by potential FRAME Architecture users who will be unfamiliar with the background to its creation and what it contains. They may also need re-assurance that they will not be the only people using the Architecture, so a chapter on its use, and who has been using it is included. This document should only need to be updated when a substantially different version of the Architecture has been created.

1 Introduction

1.1 The Aim of this Document

The aim of this deliverable document is to provide an overview of the FRAME Architecture. This will include the history behind it, its contents and examples of its use. It is intended to act as a "primer" for potential Architecture users who will be unfamiliar with its contents. They may also need re-assurance that they will not be the only people using the Architecture, so some information on its use, and who has been using it is included.

1.2 Assumptions behind this Document

It is assumed that readers will have some knowledge of the basic principles and the methodology behind the FRAME Architecture and its use. If needed a more detailed description of this methodology is available in Part 5 of this deliverable.

Readers who want to explore the FRAME Architecture in more detail should use the FRAME Browsing Tool, which again is available from the FRAME website. To actually use the FRAME Architecture, a copy of the FRAME Selection Tool and its database are needed. Both of these together with instructions for their use are available from the FRAME website at: http://www.frame-online.net/.

1.3 Document Plan

This document has been organised into 4 chapters including this one. Each of the subsequent chapters contains the following:

Chapter 2: provides a brief history of the evolution of the FRAME Architecture from its initial development by the KAREN project to the latest update produced by the E-FRAME project.

Chapter 3: provides an overview of the contents of the FRAME Architecture and a brief guide to the FRAME Browsing Tool through which it can be viewed.

Chapter 4: describes some examples of the use to which the FRAME Architecture has been put and looks to the future after the end of the E-FRAME project.

1.4 Why is D15 in separate parts?

This E-FRAME project deliverable document (D15) has been divided into five parts, which are as follows:

Part 1: Overview – (this document;

Part 2: FRAME Browsing Tool – enables the contents of the FRAME Architecture to be viewed and is only available from the FRAME website in electronic format for downloading and use;

Part 3: FRAME Selection Tool Database – enables sub-set ITS architectures to be created through the use of the FRAME Selection Tool and is only available for downloading from the FRAME website;

Part 4: FRAME Architecture Changes Document – describes the changes made to the FRAME Architecture since its previous version.

Part 5: The FRAME Methodology – describes how ITS architectures can be created using the FRAME Architecture as a starting point.

Parts 2, 3 and 4 will be updated every time a new version of the FRAME Architecture is produced. Part 5 should remain constant with each version of the Architecture and therefore not be updated.

The alternative of providing completely separate deliverable documents was rejected because of the close linkage between what is in the Architecture and the methodology behind its use.

2 History of the FRAME Architecture

2.1 Introduction

This chapter provides a history of the development of the FRAME Architecture. It highlights the fact that the Architecture is not something new and has been available for use as one of the tools for ITS implementations for over 10 years.

2.2 Beginnings – the KAREN Project

The FRAME Architecture (originally called the European ITS Framework Architecture) was developed at the request of the High Level Group on Transport Telematics and approved by the European Council of Ministers. It was created and first published by the EC funded project KAREN in October 2000. The underlying aim of this initiative was to promote the deployment of (mainly road-based) ITS in Europe by producing a framework which would provide a systematic basis for planning ITS implementations, facilitate their integration when multiple systems were to be deployed, and ensure inter-operability, including across European borders.

2.3 Further development – the FRAME projects

After its creation, and in order to enable others to use the FRAME Architecture, it was recognised that a centre of knowledge would be required to which potential users could put questions, from which they could receive training in its use, and which would keep the Architecture up-to-date with the evolution of ITS. This was provided very successfully from 2001 until 2004 by the EC funded FRAME projects (FRAME-NET and FRAME-S). The FRAME-NET project provided User Forums and collected and collated the experiences of FRAME Architecture users. The FRAME-S project maintained the FRAME Architecture, produced two tools to assist with its use, and provided many nations and projects with advice, as a result of which they were then able to make, or are making, plans to use it.

2.4 Continuing Support – the FRAME Forum

Towards the end of the FRAME projects it became obvious that the FRAME Architecture would need further support. This support would be needed to make sure that the services it supports continue to be relevant to the continual evolution of ITS and to provide a source of expertise, as the FRAME projects had done. The result was the creation of the FRAME Forum, which from 2005 to 2008 provided support for existing and potential users. This support included promotion and training in the use of the Architecture, a limited amount of advice to users and the creation of new version of the Architecture (3.2) containing minor changes.

2.5 Extension for cooperative systems – the E-FRAME project

With the advent of cooperative systems and the work of the European Commission (EC) funded Integrated Projects (COOPERS, CVIS and SAFESPOT) it was quickly appreciated that the FRAME Architecture needed to be extended. However the required scope of this work was beyond the resources of the FRAME Forum. Therefore the EC funded E-FRAME support action was launched, with the objective of creating a new version of the FRAME Architecture that supports the deployment of cooperative systems as part of ITS implementations across Europe. E-FRAME was also given the task of promoting the use of the FRAME Architecture as a tool to support for the deployment of cooperative system.

The task of extending the FRAME Architecture with the defined new Functions to support the cooperative systems services identified by the first round of cooperative systems FP6 R&D projects was huge and underestimated by all experts involved. In total **over 250 Functions** have been updated or added to create the current version (4.1) of the FRAME Architecture. The total number of Functions in the Architecture has increased by **over 70%**. The figures for **Data Flows** are even larger as the total number in the Architecture has increased by **over 100% to more than 2200**.

Part of the results of the E-FRAME project is this deliverable, D15. Other results include studies of deployment issues plus a review of ITS and cooperative systems related standards activities. All of these deliverables are available from the FRAME website.

3 The FRAME Architecture – its contents

3.1 Introduction

This chapter provides a guide to the contents of the FRAME Architecture. It is intended as a guide to those that are looking for particular parts of the Architecture and should be used as an initial step before using the FRAME Browsing Tool.

3.2 FRAME Architecture Contents

3.2.1 Introduction

The FRAME Architecture contents are divided into two parts: User Needs and the Functional Viewpoint. In simple terms the User Needs describe what ITS can provide and the Functional Viewpoint shows how it can be done. Details of the User Needs are in deliverable D13, available from the FRAME website at: http://www.frame-online.net.

3.2.2 What is in the Functional Viewpoint

In its current incarnation (Version 4.1) the FRAME Architecture covers the areas of ITS shown in Table 1 on the following pages. As can be seen from this table, each area of ITS is assigned to its own part of the Functional Viewpoint, called a "Functional Area".

Within each Functional Area there is a set of functionality in the form of Functions that are linked to each other using Data Flows. The Data Flows also link the Functions to Data Stores that contain data that is used by two or more Functions. Within each Functional Area, its Functions are arranged in a hierarchy. The structure of the hierarchy in each Functional Area is different and depends on the number of Functions needed for each area of ITS and their complexity. Generally speaking the hierarchical structures are driven by the following two main factors:

- The need to identify the functionality required for different purposes, e.g. car parking, urban traffic management, creating schedules for regular Public Transport schedules and managing on-demand Public Transport.
- The need to enable the functionality to be assigned to different physical locations in each sub-set ITS architecture. So for example it should be possible for some functionality to be assigned to the roadside in a sub-set architecture, but to a central system, or the vehicle in another. This will enable different overall system configurations to be explored so that there is more chance of finding the optimal one.

Other factors that influence the hierarchical structures are the need make the functionality easy to understand and the need to minimise the flow of data between Functional Areas.

Table 1 - Functional Viewpoint contents

Part of ITS		Functional Area in FRAME Architecture Functional Viewpoint		
Name	**Extra Information**	**Number**	**Name**	**Description**
Electronic Fee Collection		1	Provide Electronic Payment Facilities	This Area shall provide functionality that enables the acceptance of payment for services provided by other Functional Areas within the Architecture. It shall have an interface with the Financial Clearinghouse terminator to enable actual payment transactions to be made. If payment violations are detected, any details that are available shall be passed to functionality in the Law Enforcement Area.
Emergency Notification and Response	Notification of emergencies from the roadside and in-vehicles, plus management of emergency vehicle response and stolen vehicles.	2	Provide Safety and Emergency Facilities	This Area shall provide functionality that enables the Emergency Services to respond to incidents. The Functions in this Area shall have links with the Manage Traffic Area to enable the reporting and detection of incidents, the management of their impacts and the granting of priority to Emergency Vehicles. It shall be possible for priority to be provided either locally at each controlled point on the road network, or as a "route" through the network. There shall be links to the Provide Traveller Journey Assistance Area to enable priority routes for Emergency Vehicles to be produced.

Part of ITS		Functional Area in FRAME Architecture Functional Viewpoint		
Name	**Extra Information**	**Number**	**Name**	**Description**
Traffic Management	Management of urban and inter-urban parts of the road network, plus modelling, parking, tunnel, bridge and road maintenance management	3	Manage Traffic	This Area shall provide functionality enabling the management of traffic in urban and inter-urban environments. Functionality shall be included to detect and manage the impact of incidents, produce and implement demand management strategies, monitor car park occupancies and provide road transport planning. Links shall be provided to the Provide Safety and Emergency Facilities and Manage Public Transport Areas so that their vehicles are given priority through the road network and to enable assistance to be provided in the implementation of incident and demand management strategies. The External Service Provider terminator shall be sent data about traffic conditions and strategies.
Public Transport Management	Preparation and management of schedules and fares for regular PT, plus management of on-demand services and car pooling.	4	Manage Public Transport Operations	This Area shall provide functionality to enable the management of Public Transport. It shall include the scheduling of services and the generation of information that can be made available to travellers. The Area shall have links with the Manage Traffic Area to provide priority for its vehicles, and to provide data on the use of services so that an assessment can be made of demand for different modes of transport. The Manage Traffic Area shall also provide requests for service changes to enable a move towards a better balance in the use of transport modes. There shall also be links to other Areas to provide information about fraud and incidents that have been detected in the Public Transport network.

Part of ITS		Functional Area in FRAME Architecture Functional Viewpoint		
Name	**Extra Information**	**Number**	**Name**	**Description**
In-Vehicle Systems	Collection of data about vehicle operation, plus some aspects of cooperative systems	5	Provide Support for Host Vehicle Systems	This Area shall provide functionality that enables data to be collected from the Vehicle and inputs provided for possible use by its management functionality. Functionality shall also be included in this Area to enable the output within the Vehicle of traffic and travel information provided by the Manage Traffic Area, plus warning messages to Drivers produced from a variety of sources, the exchange of data with other nearby Vehicles and the detection of objects in the vicinity of the Vehicle. This Functional Area shall provide Drivers with functionality that shall enable trip planning to be done from within the Vehicle. Data that has been collected from the Vehicle about its operation is distributed to functionality in other Functional Areas. Interfaces shall be provided to the Provide Safety and Emergency Facilities Area to provide a speedy response to e-Calls that have been received from Vehicles. Vehicle identities shall be provided by the functionality when requested by other Areas for payment collection and the identification of fraud.

Part of ITS		Functional Area in FRAME Architecture Functional Viewpoint		
Name	**Extra Information**	**Number**	**Name**	**Description**
Traveller Assistance	Pre- and on-trip multi-modal journey planning for private and commercial vehicle drivers, plus provision of travel information	6	Provide Traveller Journey Assistance	This Functional Area shall provide functionality that enables the provision of information to all types of Travellers about traffic conditions and about other modes of transport. The functionality shall also provide pre-trip journey planning, including special routes for Emergency Vehicles and Goods Vehicles. On-trip route guidance shall also be provided, together with the ability to change a trip itinerary due to Traveller input, or the occurrence of events that affect the flow of Vehicles through the road network. As part of the trip planning process, the functionality shall provide access to other services such as accommodation and to other transport modes.
Law Enforcement		7	Provide Support for Law Enforcement	This Area shall provide functionality to enable the provision of an interface to Law Enforcement agencies. This interface shall be used to provide information about frauds and violations that have been detected by functionality within other Areas. Examples of frauds and violations shall include but not be limited to invalid or missing payment, speeding, incorrect use of lanes in the road, incorrect observance of other commands sent to drivers. Over-weight vehicles shall be detected by functionality within the Area itself and the details passed to the Law Enforcement Agency.

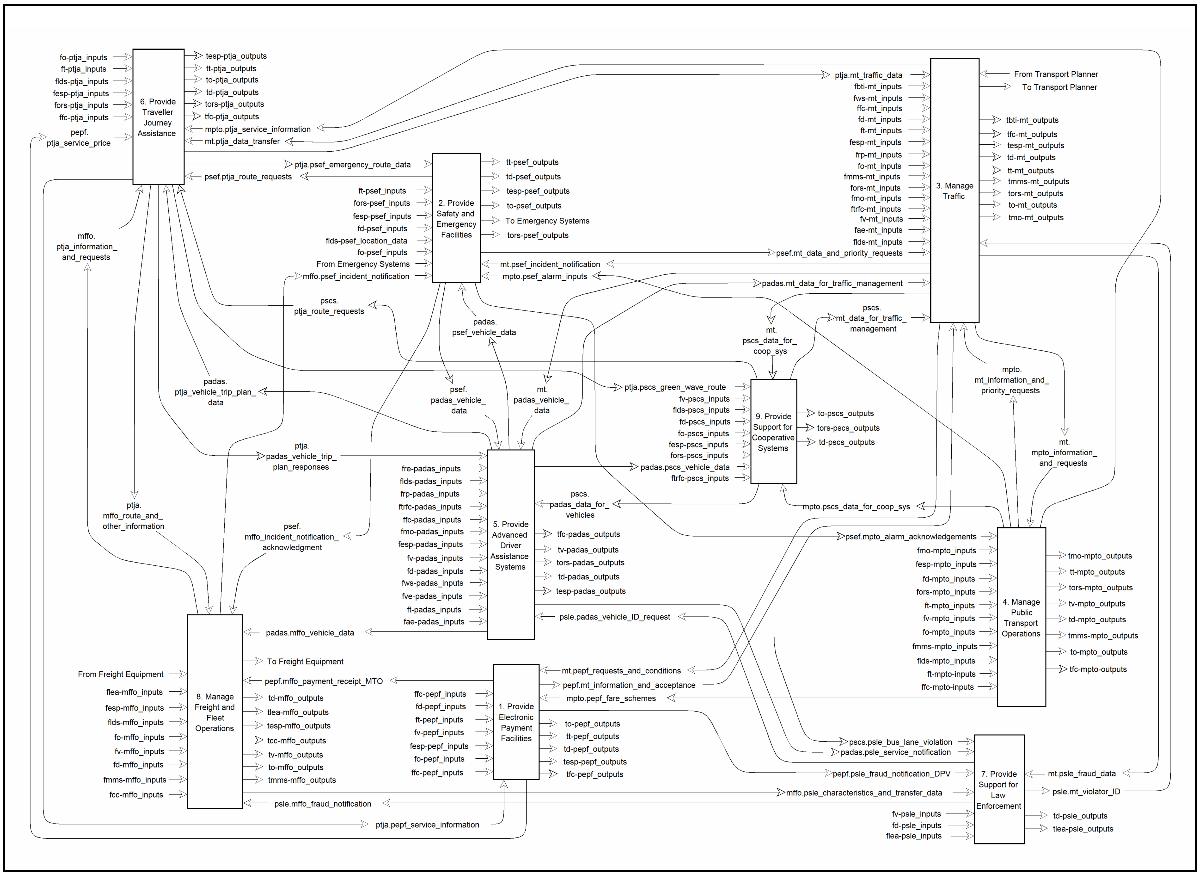
Part of ITS		Functional Area in FRAME Architecture Functional Viewpoint		
Name	**Extra Information**	**Number**	**Name**	**Description**
Freight and Fleet Management	Provides both fleet management organisations and "owner drivers" and includes multi-modal freight movements.	8	Manage Freight and Fleet Operations	This Area shall provide functionality that enables the management of Freight and Fleet Operations. This shall control the use of freight vehicles and their transportation of goods. The use of other modes of freight transport shall also be supported. An interface to the Provide Safety and Emergency Facilities Area shall also be included to enable the provision of information about hazardous goods. Route planning for this and other types of goods shall be provided through the interface to the Provide Traveller Journey Assistance Area.
Support for Cooperative Systems	Includes specific aspects such as bus lane use.	9	Provide Support for Cooperative Systems	This Functional Area shall provide the functionality that is needed to support the implementation of some cooperative systems services that cannot be wholly assigned to parts of other Functional Areas. The particular services that shall be supported by this Functional Area include the management of priority for Other Vehicles, the use by non-Public Transport Vehicles of any spare capacity in Bus Lanes, Vehicle access to sensitive geographic areas within the road network, special routes for Hazardous Goods Vehicles and Urban Loading Zones.

A distinctive feature of the FRAME Architecture is that it is designed to have sub-sets created from it, and is thus unlikely to be used in its entirety. In fact using the Architecture in its entirety will create some functional redundancies since in places it contains the functionality for performing a service in different ways. When creating a sub-set ITS architecture the user can select the most appropriate set of functionality to deliver the required services. Thus the FRAME Architecture is not so much a model of integrated ITS, as a framework from which specific models of integrated ITS can be created in a systematic and common manner.

3.2.3 Communication between Functional Areas

Some of the functionality in each of the Functional Areas needs to communicate with functionality in other Functional Areas. An example of this is the sharing of traffic data collected by functionality in the Manage Traffic Area, which is used by functionality in other Areas, e.g. to plan journeys. Similarly some of the data collected in vehicles is distributed to functionality in other Functional Areas. This is shown by the highest level of Data Flow Diagram (called DFD0), which is shown in Figure 1 below.

Figure 1 - DFD0 the highest level of Dat Flow Diagram

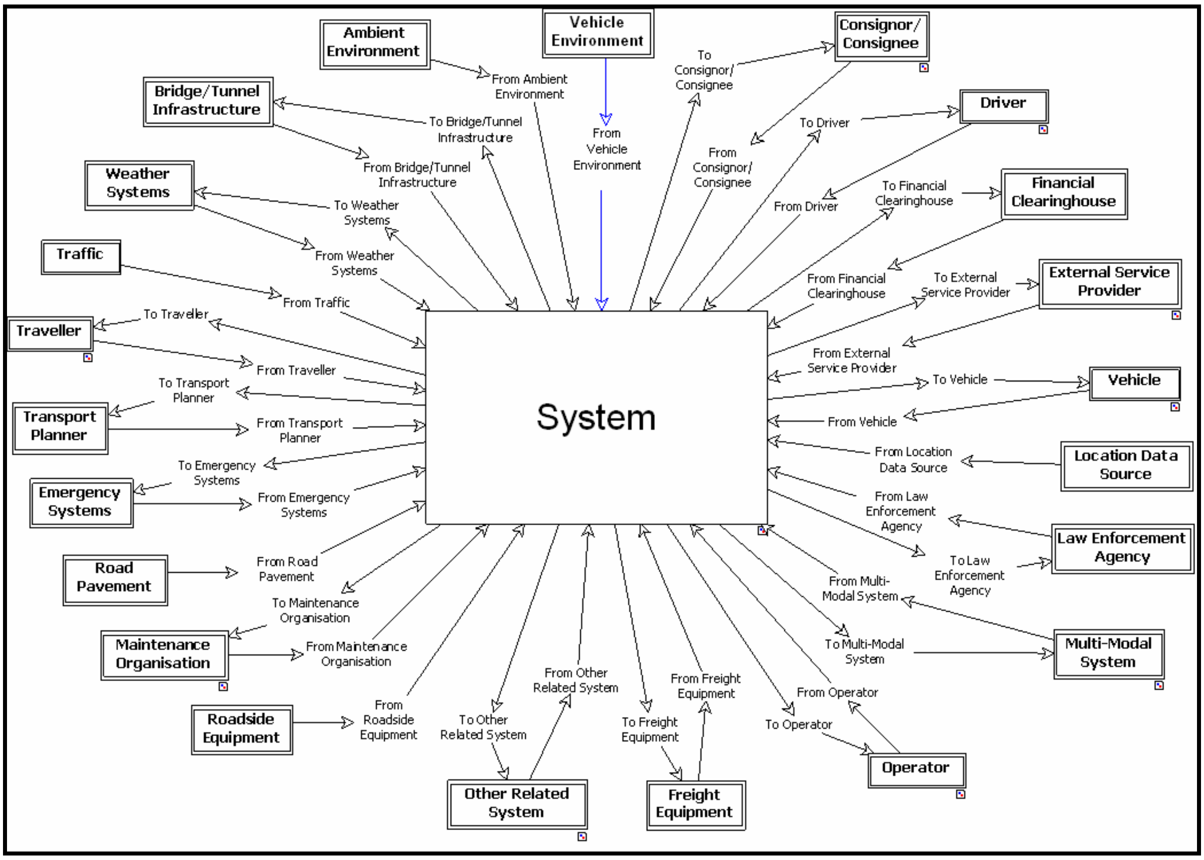


Each of the nine "boxes" in DFD0 represents the functional hierarchy in one of the Functional Areas. The lines that connect the "boxes" are showing the Data Flows that transfer data between the Areas, with each usually containing several items of data. Each one has a unique name that gives some idea of what is in the Data Flow. All of the "boxes" have a number of Data Flows that enter and leave, and these provide the communication with the outside world that is discussed in the next section.

3.2.4 Communication with the outside world

In order for the functionality in each of the Functional Areas to work, it needs to be able to collect data from the outside world and to provide either that data, or a processed version of it back to the outside world. This is done by specific dedicated parts of the functionality in each Functional Area. The links with the outside world that this functionality needs are illustrated by what is called the "Context Diagram" which is shown in Figure 2 below.

Figure 2 – FRAME Architecture Context Diagram



The System "box" in the middle of the diagram represents the functionality that is inside the Functional Areas (the system functionality) and their functional hierarchies. This is shown by DFD0 – see Figure 1. Each of the other "boxes" represents an aspect of the outside world and is called either a Terminator. A Terminator may consist of a number of Actors, each of which represents a specific sub-set, e.g. the Driver Terminator has an Actor to represent a driver of each type of Vehicle such as Private Car, Public Transport, Emergency, Goods, etc. Each Terminator and Actor has its own descriptions, which defines what the system functionality expects each of them to do.

3.3 Other Possible Viewpoints

Because the FRAME Architecture is intended for use within the European Union it conforms to the precepts of subsidiarity, and thus does not mandate any physical or organisational structure on a Member State. Hence it does not include any Physical, Communications or Organisational Viewpoints. However the FRAME Selection Tool does enable users to create their own Physical Viewpoints, based on a sub-set of the FRAME Architecture created from the User Needs and Functional Viewpoint. These Physical Viewpoints can take into account the organisational setting of the ITS system and the stakeholders involved.

3.4 Studying the FRAME Architecture

As might be expected from Table 1 the FRAME Architecture is quite large. When originally produced by the KAREN project it was documented in paper form, resulting in several large documents that were not easy to navigate. As part of the work of the FRAME projects the Functional Viewpoint is now available in HTML format. This is known as the FRAME Browsing Tool and can be viewed using Internet Explorer. A copy can be downloaded from the FRAME website at: http://www.frame-online.net/.

The FRAME Browsing Tool provides an interactive interface through which it is possible to move from one part of the FRAME Architecture to another and to follow through the relationships between all of the functional elements. It includes the diagrams shown in Figure 1 and Figure 2, plus Data Flow Diagrams for all the hierarchies in each of the Functional Areas. It also includes the descriptions of all of the elements in the functionality, i.e. Functions, Data Stores and Data Flows, the Terminator and Actor descriptions, plus the identity and description of each User Need that is defined in E-FRAME deliverable document D13.

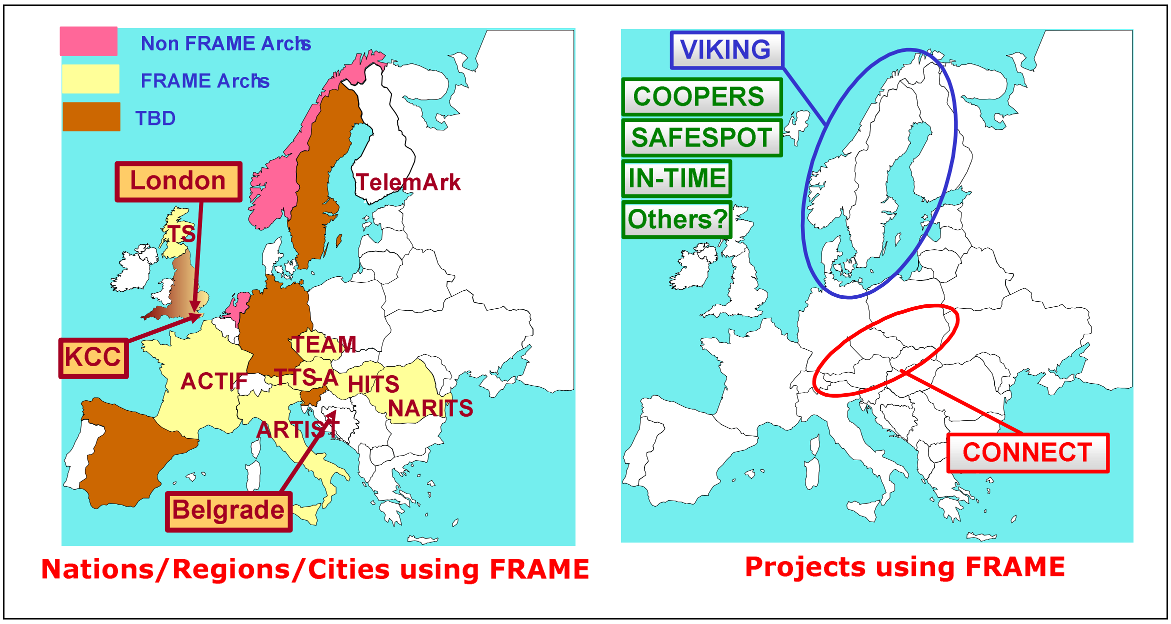
4 Using the FRAME Architecture

4.1 Introduction

This chapter looks at the uses to which the FRAME Architecture has been put and the results that have been obtained. It does not attempt to give a detailed analysis of the results, as these can more properly be obtained from the individual activities that are mentioned.

The diversity of users of the FRAME Architecture is illustrated by the two European maps shown in Figure 3 below.

Figure 3 - Maps of Europe showing FRAME Architecture users



The users have been divided into nations/regions/cities and projects because their ITS architectures have different uses. Generally speaking those ITS architectures created by nations/regions/cities will have a longer useful life than those created by projects. They may also support a wider range of services.

In the following sections, the users are arranged in rough historical order. The title of each section provides guidance on whether the ITS architectures were created by nations, regions, cities or projects.

4.2 First use of the Architecture – national architectures

The FRAME Architecture was first used in 2000 at the end of the KAREN project to provide the starting point for the creation of the French National ITS Architecture, ACTIF. Since then ACTIF has been refined and developed to improve its ease of use. There have also been changes to the scope and content of services it supports that have reflected the continual evolution of ITS. ACTIF has been successfully used in several case studies in France that have helped in the implementation of ITS services across the country. Experience gained from using ACTIF has shown that it enables the system boundary and functionality to be defined through the building of consensus between the Stakeholders. As a result the time taken to deploy ITS services has been reduced, which in the case of a speed camera project may have led to a saving of several lives.

The next National ITS Architecture to be developed was that for Italy. Called ARTIST and based on both the FRAME and ACTIF architectures, it has also been used in case studies of ITS implementations various locations in Italy and also in the preparation of tenders for major ITS initiatives, including a multimodal "freight village" near Naples. Another national ITS architecture developed from an early version of the FRAME Architecture and ACTIF was that for the Czech Republic. The project was called TEAM and the architecture was completed by 2005.

4.3 Recent uses of the Architecture – national architectures

Other national ITS architectures developed from later versions of the FRAME Architecture include those for Hungary (HITS) and Romania (NARITS). NARITS is still being developed through an on-going activity. Other European nations such as the Germany, Spain and Slovenia are considering or are actively following these other examples. The FRAME Architecture has also been selected by ITS Arab as the starting point for development of ITS architectures in the Middle East and North Africa.

A different approach to the development of a national ITS architecture has been adopted in Austria. Due to its relatively central geographic position in Europe with major transport corridors passing through the country, there need to be many interfaces and links for the ITS implementations involved. The decision has therefore been taken that Austria will work actively to contribute to the future development of the FRAME Architecture instead of creating an Austrian national ITS architecture. The use of the ITS Framework Architecture has also been promoted as part of the national ITS implementations with the Austrian Telematics Master Plan and at R&D project level.

4.4 Recent uses of the Architecture – regions and cities

In the last few years number of specific ITS architectures have been created across Europe. These include architectures for Transport for Scotland, the County of Kent and part of Transport for London in the UK, plus the City of Belgrade. The latter provided a unique opportunity for its Stakeholders to study an integrated system that represented the functionality required to support the ITS services they wanted to implement.

Within the UK, given the absence of a National Architecture or Framework, Transport for London (TfL) has taken the lead and developed an ITS Architecture for London, based on an up to date version of the FRAME architecture. It was initially developed in 2009, and following a recent expansion within the Traffic Directorate, TfL has refreshed its architecture to represent the required changes in functionality. This refreshed architecture now enables TfL to consider future ITS developments, including Vehicle to Infrastructure (V2I) functionality, and allows it to move towards a full Enterprise Architecture for ITS.

As a result of this work, TFL found that the main benefits of creating the ITS architecture were that it was possible to put the scope of the services that the Traffic Directorate provides into the context of ITS as a whole. In addition other potential TfL stakeholders could be identified by looking at the interaction with entities outside the Traffic Directorate ITS architecture. The FRAME Architecture also provided a terminology for the User Needs and a standard set of functionality to which future reference can be made to aid future investment decisions.

One of the main benefits that Stakeholders in the Kent County Council ITS architecture received was the ability to identify the physical components needed by each of their aspirations. This was done by creating a "look-up" table in which each component had a column and each aspiration a row. A "Y", or similar indication, against a component meant that it is required for the particular aspiration as shown by the example in Table 2 below.

Table 2 - Example of a look-up table for Aspirations and their Components

Aspiration	Manage Traffic	Provide Planning	Provide Trip Planning	Manage PT Vehicles	Produce PT Information	Provide Tunnel Management	Provide Environmental Data	Display Current Status	Provide On-Trip Information	Provide Pre-trip Information	Provide Book Ahead	Collect Traffic Data	Collect Car Park Occupation	Assess Car Park State	Detect Traffic Violations	Provide Emergency Services	Provide Inter-urban Traffic Control	Process Violations
There is a need to make better use of the existing road network and reduce congestion by providing improved traffic management, e.g. street enforcement, improved traffic information and signage and reviewing parking restrictions.	Y	Y	Y			Y		Y	Y	Y		Y	Y	Y	Y		Y	Y
There is a need to optimise the use of the existing road infrastructure, improve Public Transport services, and other road users.	Y			Y	Y			Y	Y			Y					Y	

Other aspirations may require different selections of components. Using such a table it is possible to build up a picture of the components needed by the most important aspirations and those that should be considered for implementation at the start of the deployment programme. The table can also be used in other ways: for example if it is known that particular aspiration must be implemented first, then it is possible to see if its components can also provide other services for "free".

4.5 Recent uses of the Architecture – projects

ITS architectures have also been created by some R&D projects such as VIKING, IN-TIME and CONNECT, plus the cooperative systems Integrated Projects, COOPERS and SAFESPOT (one sub-project only).

The COOPERS project was one of the three Integrated Projects launched as part of the EC funded Framework 6 Programme in February 2006 to provide "proof of concept" for cooperative systems deployment, plus user acceptance testing. It used the FRAME Architecture as the starting point for the development of the functionality needed to demonstrate its cooperative systems services for the inter-urban road environment. The FRAME Architecture provided the "common language and the tool to discuss state of the art system functionalities" that gave the project partners big advantages when they were adapting their ITS reference architecture to the demonstration sites. It also supported the identification and definition of new functions, which will be integrated into the future products of some of its industrial partners.

In the European project In-Time, "Delivering intelligent and efficient travel management for European cities", six cities from different member states and four Traffic Information Service Providers, (TISP´s) have teamed up for developing one Common Agreed Interface (CAI) for the exchange of real-time multimodal traffic information between them for personal delivery on Smartphones. This CAI has been defined, developed, installed in the six participating cities and is running under an extensive public user test since January 2011. For detailed information about the project see http://www.in-time-project.eu/. The FRAME Architecture has been used to specify the CAI with the support off all the industrial and public partners involved in the project. The final version of the project results is publicly available from its website. The FRME Architecture also supported the development process of the interfaces to the single systems installed in the cities.

These are just some of the known examples of the use of the FRAME Architecture by projects. There may of course be others of which the E-FRAME project is unaware.

4.6 Using the FRAME Architecture today

The main way to use the FRAME Architecture is through the FRAME Selection Tool, which can be downloaded from the FRAME website at: http://www.frame-online.net/. It enables the creation of ITS architectures that are sub-sets of the FRAME Architecture, starting from the selection of the User Needs that will support the services that are to be included. Full guidance on its use is provided by the User Reference Handbook that is also available from the FRAME website, together with a brief summary guide. The Handbook also includes guidance on the addition of new User Needs and functionality when the Architecture does not include what is required to support a particular service.

4.7 Lessons learned from using the FRAME Architecture

During the FRAME projects and from experience with other ITS architecture activities in Europe and elsewhere, a number of important lessons have been learned. The most important ones are:

- It provides an integrated approach that uses a common language and definitions for the functionality that will be needed to provide the services that the Stakeholders want from ITS.
- This integrated approach is even more important with the inclusion of cooperative ITS, because the interactions between stakeholders at various levels are more complex than before.
- It provides a starting point for the development of components that will be used to deliver the services that Stakeholders want from ITS implementations. This has been shown to apply even when this development work will be carried out using a different methodology, e.g. Object Oriented.
- If it is to remain useful, an ITS Architecture must be updated to reflect the continuing evolution of the services that ITS can provide. As an example of this the US National ITS Architecture is now on Version 6.1 after over 11 years of existence and has been supported by continuous funding from the US Government.

4.8 The Future

The E-FRAME project has expanded the Architecture to include the services available through cooperative systems and made it available for use. For the future it is planned that its continued support and maintenance will be provided by the FRAME Forum. The Forum is expected to assume responsibility for the Architecture when the E-FRAME project finishes later in 2011 and will update the Architecture as ITS services continue to evolve.