European ITS framework architecture

Historical background

The FRAME Architecture (officially called the European ITS Framework Architecture) was developed as a result of recommendations from the High Level Group on transport telematics, which were supported by a resolution of the Council of Ministers. It was created by the EC funded project KAREN (1998-2000) and first published 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 help to ensure inter-operability, including across European borders.

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. It comprises a set of User Needs and a Functional View only (the User Needs providing a form of requirements for the functionalities contained within the Functional View). Most users will only use a sub-set of the FRAME Architecture and a methodology, now supported by computer-based tools, was developed to do this effectively by the EC funded FPV project FRAME-S (2001-04).

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 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, they were then able to make, or are making, plans to employ the Architecture. Between 2005 and 2008, the start of the E-FRAME project, some limited support for existing and potential users of the FRAME Architecture was provided through the FRAME Forum.

At the time of the KAREN project, the FRAME Architecture had already been adopted as the basis for the French national ITS Architecture (ACTIF), and was subsequently adopted as the basis for the Italian national ITS Architecture (ARTIST). Other nations that have used FRAME since then include Austria (TTS-A), the Czech Republic (TEAM), Hungary (HITS) and Romania (NARITS). In addition a number of specific ITS Architectures have been created in the UK including one for Transport for Scotland and another for the County of Kent. More recently, part of Transport for London has been using the FRAME Architecture to plan its future ITS deployments. In a few cases, e.g. VIKING and the COOPERS IP, it has also been used by R&D projects.

Although the User Needs were updated during the early part of the FRAME projects (2002/3), the FRAME Architecture contains only a few references to more recent ITS developments, such as those associated with the Intelligent Vehicle or eSafety initiatives. One particular and highly significant area – in which the European Commission has invested very heavily since 2006 – is called “Cooperative Systems” (as they involve vehicle-vehicle and/or vehicle-to-infrastructure communication), and it was not covered by the original FRAME Architecture.

FRAME Architecture

The European Intelligent Transport Systems (ITS) Framework Architecture, often now known as **The FRAME Architecture**, was created to provide a minimum stable framework necessary for the deployment of integrated and inter-operable ITS within the European Union.

The FRAME Architecture comprises the top level requirements and functionality, or the Use Cases, for almost all the ITS applications and services that have been considered for implementation somewhere in the European Union. It is at a “level” such that it can be used as a reference by all ITS architects, and is intended to be the foundation for building the other types of architecture that will be necessary. It will enable them to guarantee compliance at the interfaces of other systems so that seamless services can be provided to cross-border travellers, and an open European market of compatible components can be established.

FRAME – the **FR**amework **A**rchitecture **M**ade for **E**urope

The FRAME Architecture is not intended to be used in its entirety, instead users select the applications and services that they want for their Nation, Region, City, etc. and create a sub-set that conforms to their requirements. Using the FRAME Architecture to do this has two big advantages:

- Most of the work has already been done, and there are FREE Tools available from this website to help you do the rest.
- If adjacent authorities both have ITS Architectures based on FRAME then it is easy to identify commonalities so that common services can be integrated to provide inter-operability.

The FRAME Architecture does ***NOT*** provide detailed designs for equipment. It only describes ***what*** is required and ***not how*** to make it. It has already been used by a number of Nations, Regions, Cities and Projects.

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. Indeed, on occasions, it contains more than one way of performing a service and the user can select the most appropriate set of functionality to deliver it in that environment. 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.

The FRAME Architecture now covers the following areas of ITS:

- Electronic Fee Collection
- Emergency Notification and Response – Roadside and In-Vehicle Notification

- Traffic Management – Urban, Inter-Urban, Parking, Tunnels and Bridges, Maintenance and Simulation, together with the Management of Incidents, Road Vehicle Based Pollution and the Demand for Road Use
- Public Transport Management – Schedules, Fares, On-Demand Services, Fleet and Driver Management
- In-Vehicle Systems – includes some Cooperative Systems
- Traveller Assistance – Pre-Journey and On-Trip Planning, Travel Information
- Support for Law Enforcement
- Freight and Fleet Management
- Provide Support for Cooperative Systems – specific services not included elsewhere, e.g. bus lane use, freight vehicle parking
- Multi-modal interfaces – links to other modes when required, e.g. travel information, multi-modal crossing management

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. It comprises only a set of User Needs which describe what ITS can provide, and a Functional View showing how it can be done. The Methodology, which is supported by computer-based tools, assists the creation of logically consistent sub-sets of the FRAME Architecture Functional View, and the creation of subsequent Physical Views.

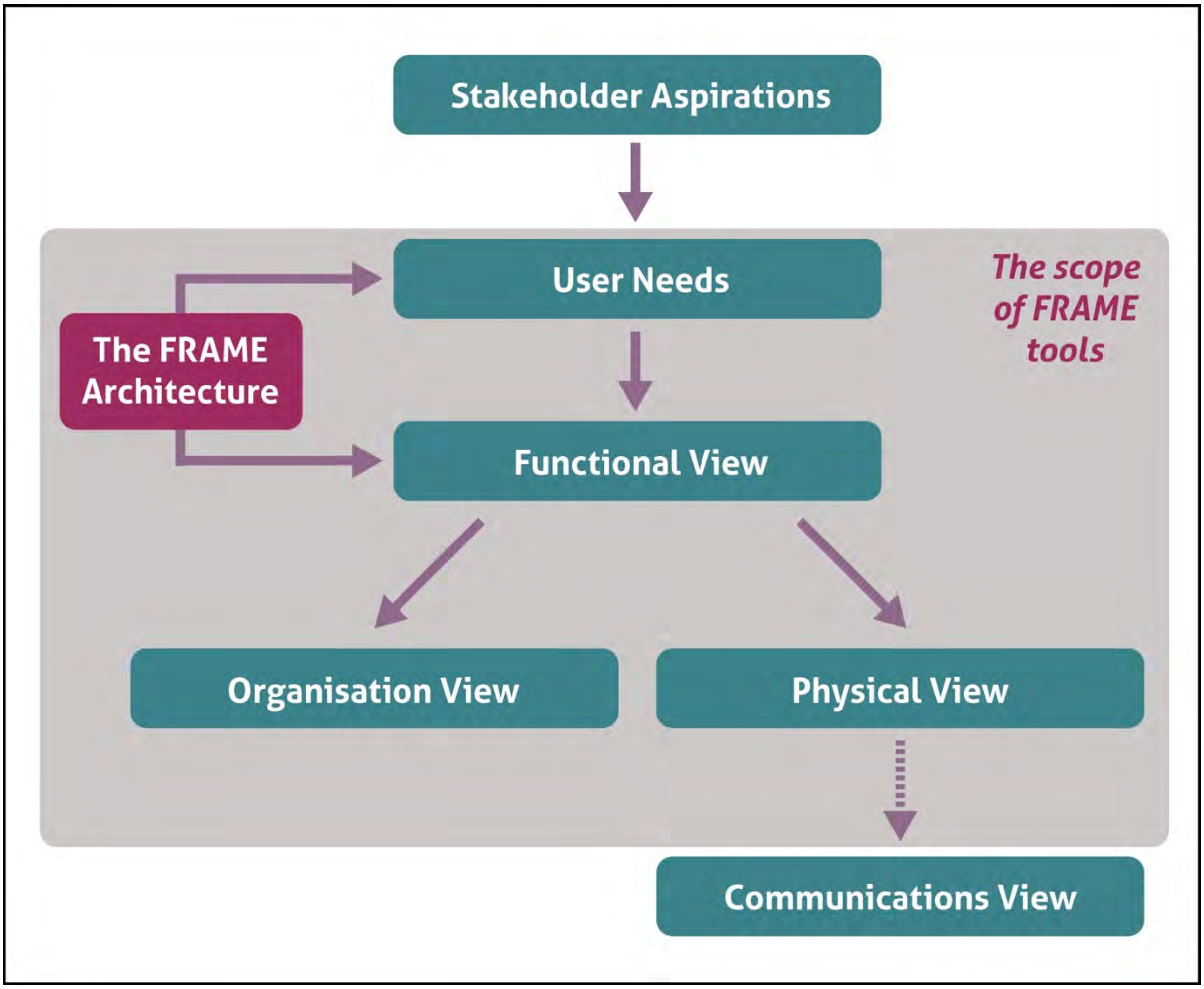
FRAME Next

FRAME NEXT is a project that extends the European ITS Framework Architecture (the FRAME Architecture), with the activities of the different member states in Europe, within the priority areas of the ITS Directive (Directive 2010/40/EU) and with the methodologies and tools that make a modern ITS architecture attractive and appealing for its users.

The result of the project will be an ITS environment for Europe which emphasizes conditions for system interoperability and supports transport policy goals of seamless multimodal mobility, enhanced road safety and lower emissions. In order to take into account current developments this environment will be able to change and adapt to the respective needs.

Methodology for creating an ITS Architecture

The simplified methodology for creating an ITS Architecture from the European ITS Framework Architecture is illustrated in the figure below.



Source: own elaboration on the basis of the FRAME Team materials

Stakeholder Aspirations

Stakeholder Aspirations are statements that express the expectations and desires of the various stakeholders for the services that the ITS implementation will provide. They should be written by the stakeholders, but experience has shown that help is often needed from the architecture team.

European ITS Framework Architecture – User Needs

It is normal to find that the Stakeholder Aspirations will have been written in a variety of styles. Sometimes they can also be obscure and inconsistent. It is thus necessary to re-write them in a consistent manner that is suitable for the next stage in the process. The result is a set of User Needs that express the Stakeholder Aspirations in a consistent and stylised manner whose meaning is clear and whose properties are testable.

European ITS Framework Architecture – Functional View

A Functional View (sometimes called a Logical View) shows the functionality that will be required to fulfil the User Needs, and hence the Stakeholder Aspirations. When using the European ITS Framework Architecture the Functional View is shown as Data Flow Diagrams that contain functions, data stores and terminators, and the data that flows between them. Each of these is provided with its own description which, in the case of functions, includes statements explaining what they do. Since the European ITS Framework Architecture comprises a Functional View that satisfies all of its User Needs, the architecture team only has to select those parts of it that serve the User Needs that have been mapped to the Stakeholder Aspirations.

European ITS Framework Architecture – Physical View

Once the Functional View is complete, the architecture team allocates each item of functionality to a location, either within a sub-system, or within a module that is part of a sub-system. Once this has been completed the component (sub-system or module) specifications can be created from the definitions of the functions and data stores contained within them.

European ITS Framework Architecture – Organisation View

The Organisational Viewpoint is usually a derivative of the Physical Viewpoint. It is used to show the organisations that will own, and/or operate, and/or maintain the Sub-systems and Modules in the Physical Viewpoint. This is very useful for highlighting the relationships between different organisations and any conflicts that may arise. It can also be used to look at how data will have to be, or could be, shared between organisations.

Communications View

A consequence of allocating the functionality to sub-systems (and modules), is that it is immediately clear which Functional Data Flows lie within a sub-system (or module), and which pass between one sub-system and another, or between one module and another. Those that pass between sub-systems or modules make up the Physical Data Flows, and represent a communication channel between sub-systems, and/or between modules.

Since sub-systems are, by definition, located in different places (e.g. in a traffic management centre, at the road side, in a vehicle) it is possible to produce communications specifications by analysing the contents of each Physical Data Flow. This analysis may elicit that an existing Standard may be used for the communications. Alternatively it can be used as the basis for defining a new Standard if the need for one can be agreed.

Relationship with the ITS Action Plan and ITS Directive

Action Area 2.3 of the EU ITS Action Plan requires the use of ITS Architectures to support the European objectives of the Plan. This booklet explains how the European ITS Framework Architecture, also known as the FRAME Architecture, provides a suitable basis for this task. The principal reasons are:

- The FRAME Architecture covers almost all of ITS. Most of the applications and services mentioned in the ITS Action Plan are contained within the FRAME Architecture.
- The FRAME Architecture does not impose any technical or organisational assumptions on the way things are done – it is thus suitable for use within the ITS Action Plan
- The FRAME Architecture enables a system structure to be described in a technology independent way so that, as technology evolves, all the higher level requirements can remain unchanged.
- The FRAME Architecture was first published in 2000 and has been used to create ITS Architecture subsets for Member States, their regions, as well as for RTD projects.

What is an ITS Architecture?

- A high-level design that defines the structure, behaviour and integration of a given system in its surrounding context.
- A description which forms the basis for a class of systems and hence for a set of low-level designs.
    - Different low-level designs can be created by different manufacturers;
    - Adherence to the ITS Architecture ensures inter-operability.
- It ensures an open-market for services and equipment, because there are "standard" interfaces between components.
- It ensures consistency of information delivered to end users

Structure of the FRAME Architecture

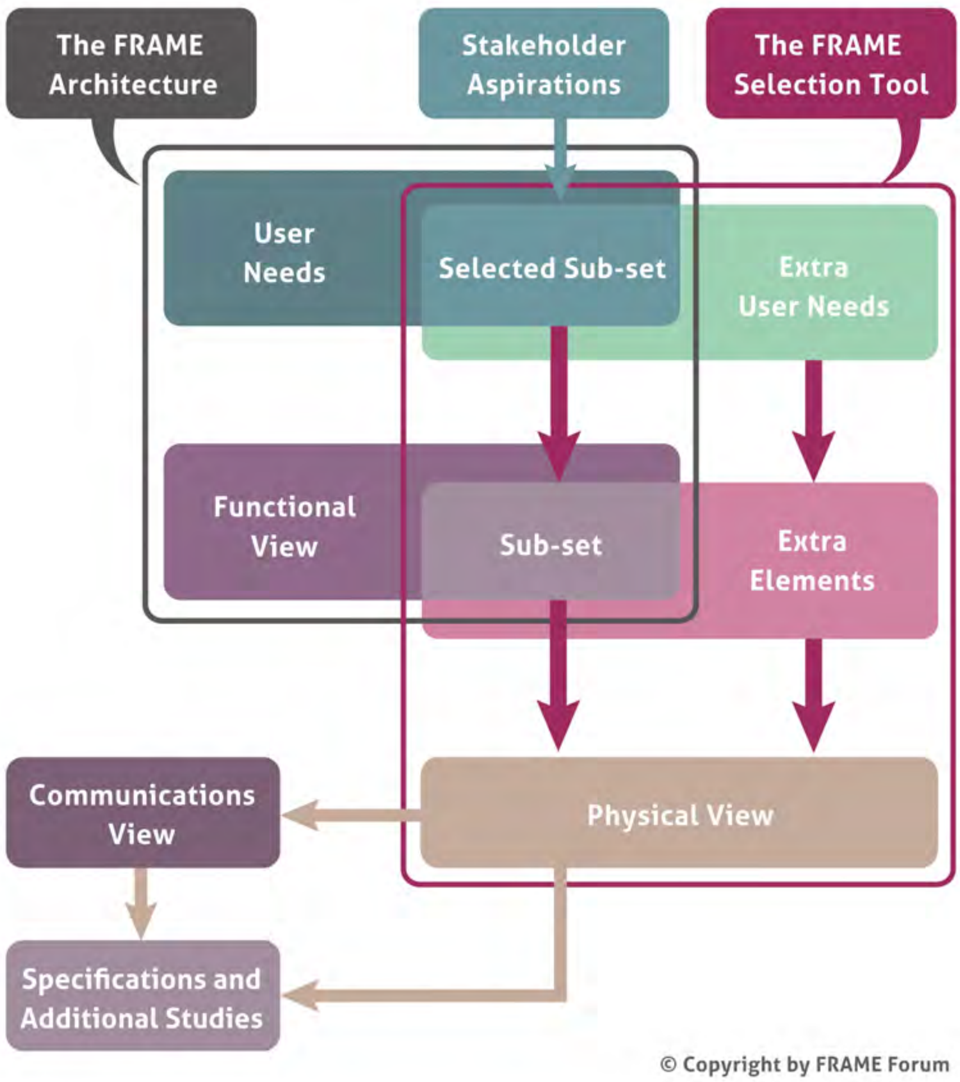
Following the recommendation of the High Level Group on Telematics, and a resolution of the Transport Council, the European ITS Framework Architecture, colloquially known as "The FRAME Architecture", was produced by the EC funded project KAREN (1998-2000). It has been maintained and enhanced continuously since then – with cooperative systems being added by the current project E-FRAME (2008-11). Clearly this architecture is a candidate for use by those who are implementing the ITS Action Plan.

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 structures on its users. Hence the FRAME Architecture makes no assumptions about the way that things are done.

The FRAME Architecture was created to provide a common approach, or "language", for use throughout the EU so that the implementation of integrated and inter-operable ITS can be planned.

It is a framework architecture from which logically consistent sub-sets can be created, which can then be used on their own. The methodology is supported by computer-based tools, and begins with the wishes, or aspirations, of the various stakeholders for ITS applications and services. These are identified within the

FRAME Architecture and a sub-set is selected. The sub-set is then customised to fit the region in which they are to be deployed. See below for further explanations.



The process of creating an ITS Architecture Sub-set

Scope of the FRAME Architecture

The FRAME Architecture now covers the following areas of ITS:

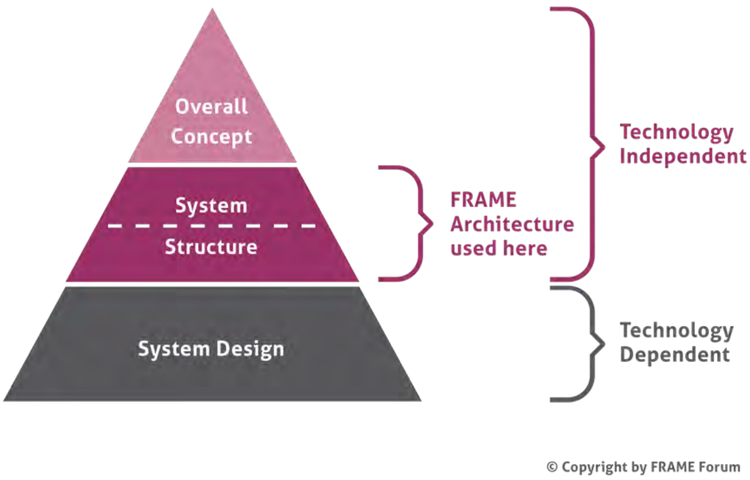
- Electronic Fee Collection;
- Emergency Notification and Response – Roadside and In-Vehicle Notification;
- Traffic Management – Urban, Inter-Urban, Simulation, Parking, Tunnels and Bridges, Maintenance, together with the Management of Incidents, Road Vehicle Based Pollution and the Demand for Road Use;
- Public Transport Management – Schedules, Fares, On-Demand Services, Fleet and Driver Management;
- In-Vehicle Systems – includes Cooperative Systems;

- Traveller Assistance – Pre-Journey and On-Trip Planning, Travel Information;
- Support for Law Enforcement;
- Freight and Fleet Management;
- Provide Support for Cooperative Systems – specific services not included elsewhere such as bus lane use, freight vehicle parking.
- Multi-modal interfaces – links to other modes when required, e.g. travel information, multi-modal crossing management

Using the FRAME Architecture

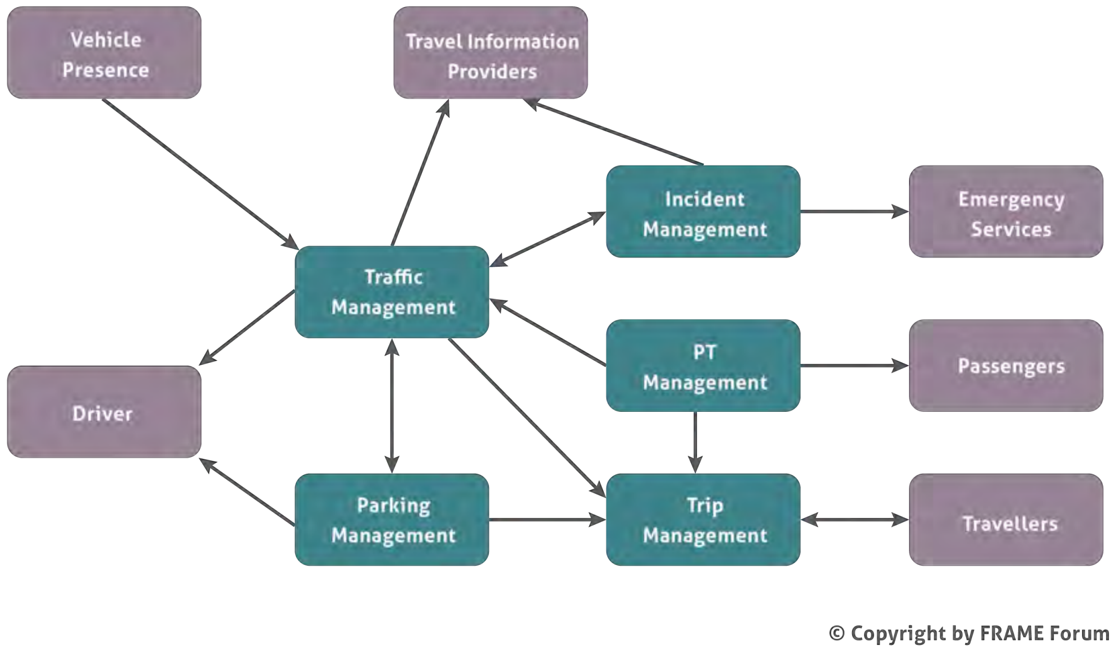
The FRAME Architecture is intended to be used within a top down approach to the planning and deployment of integrated ITS. The overall concept may, or may not, be represented in a formal (reference) model. Since the creation of a reference model requires a number of decisions or choices to have been taken by those implementing and/or regulating ITS, the FRAME Architecture does not provide one.

The overall concept and the system structure should be described in a technology independent way so that, as technology evolves, all the higher level requirements remain unchanged. The information contained within the system structure enables the ITS industry to produce the equipment and systems that will provide the services wanted by the stakeholders, each with their own distinctive features, but conforming to the purposes expressed in the overall concept and system structure. Thus integrated and/or inter-operable ITS services can be provided across the EU.



The use of the FRAME Architecture in the planning process

The system structure contains a number of views. The functionality needed to implement ITS Services is provided by the **Functional View**; which does not impose any specific technical solutions on its users. Each specific implementation requires choices to be made by the stakeholders, in particular which components will be used for the ITS implementation and the links between them (the **Physical View**).



Components of an ITS implementation – The Physical View

Further analysis, also based on specific choices or decisions, can then provide:

- **Communications View** – the requirements for communications between the components.
- **Organisational View** – who owns, manages and operates each components and other organisational issues;
- **Information View** – information that is used, its attributes and relationships;

The content of the **Physical View** and the **Communications View** can be included in Calls for Tender to enable the components and communications to be procured and deployed. The **Organisational View** is used to enable the correct management structure, plus rules and regulations, to be put in place so that the services can be correctly provided.

FRAME AND THE ITS ACTION PLAN

Although a number of other ITS Architectures do exist, most of them include certain technical or organisational assumptions and none has been used as extensively around the EU as the FRAME Architecture. It is a mature and proven product with an ever increasing number of users, and hence an increasing knowledge base. It can therefore be used immediately to support the ITS Action Plan:

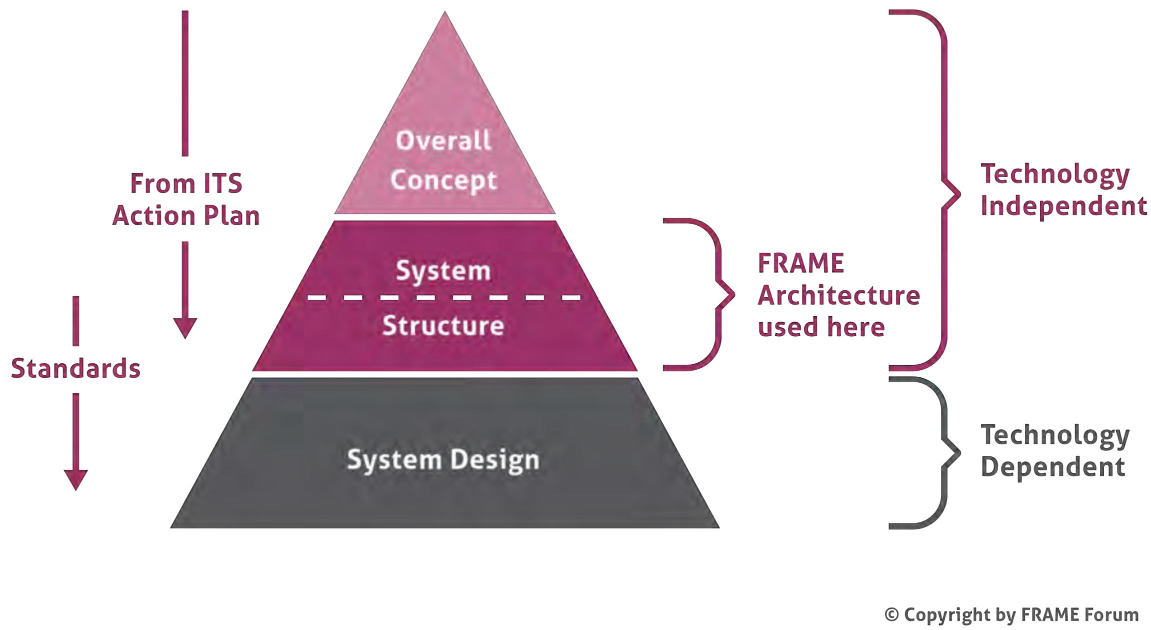
- Most applications and services mentioned in the ITS Action Plan are also mentioned in the FRAME Architecture.
- New ideas are a feature of ITS, and the FRAME Architecture methodology enables them to be included immediately in a sub-set ITS Architecture. It has thus been used successfully in RTD projects such as COOPERS. When such new ideas become established they can be included in a later version of the FRAME Architecture, as has already been done for Cooperative Systems by the E-FRAME project.

Multimodality

The FRAME Architecture includes functionality to support data exchanges with other modes.

System Design – Technologies

In many places the ITS Action Plan refers to specific technologies, e.g. the EGNOS/Galileo positioning system, RFID and open in-vehicle platform architecture. Such technology dependent issues should not be visible within an ITS Architecture, but the functionality they provide should be, and most – if not all – is already within the FRAME Architecture. The ITS Architecture defines the various interfaces that exist between components, and the use of specific technology at those interfaces needs to be covered by standards, whose use may be mandated through the ITS Directive.



Architecture Layers and the EU ITS Action Plan

Supporting the ITS Action Plan

Once the European Specification for each ITS application and service has been agreed, an ITS architecture for it can be created using a sub-set of the FRAME Architecture. This will enable the required standards to be identified and, if necessary, their creation initiated. It will also provide a technology independent description of each application and service so that manufacturers and suppliers can ensure their products will work together as required. This creation of each European Specification should be done by a team of experts in the topic under consideration, with the addition of a small ITS Architecture team who will also ensure a common "look and feel" to the result.

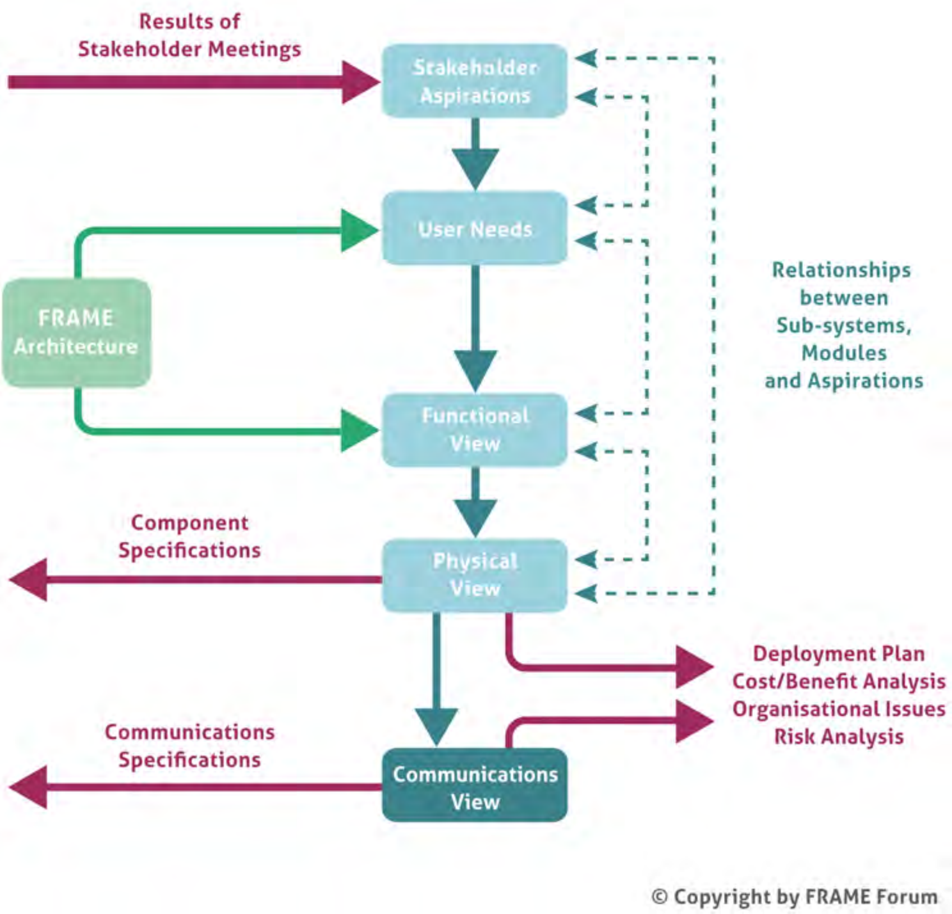
This process will inevitably result in the creation of Physical, and possibly other, Views for use throughout the EU. These can then be used directly by, for example, application developers allowing them to respond to a quickly changing market but preserving the links to the overall structure. Thus, over time, the need for separate bespoke ITS Architectures within Member States, or parts of Member States, may diminish.

Advantages of this Approach

- **Common Language** – Each resulting ITS Architecture will be based on the FRAME Architecture, and thus use the same terminology.
- **Common elements** will be easy to identify, as will be the merging of two or more ITS Architectures. Thus will be important as Member States with their own ITS Architectures need to include those that result from the ITS Action Plan or ITS Directive.
- **Efficient** – The FRAME Architecture already exists and contains about 80% of the work that will be needed to be done to create the ITS Architectures.

Creating an ITS Architecture using FRAME

The methodology for creating an ITS Architecture from the FRAME Architecture is illustrated in the figure below. The use of particular technologies or supplier products is not included in the FRAME Architecture. This is important for two reasons. Firstly the ITS Architectures created using the methodology will not become obsolete through advances in technology, or product development, and secondly it opens up the possibility for the development of new technologies to enable particular functionality to be provided.



Stakeholder Aspirations

Stakeholder Aspirations are statements that express the expectations and desires of the various stakeholders for the services that the ITS implementation will provide. They should be written by the stakeholders, but experience has shown that help is often needed from the architecture team. There are four classes of stakeholder, as follows:

- **Want ITS** – this class comprises organisations that need ITS services to enable their road networks to be used safely and efficiently. It also includes public transport operators and freight operators where ITS can enable them to improve the efficiency with which they move people and goods.
- **Use ITS** – this class comprises the end users who make use of the ITS services and/or operate the equipment. It includes travellers on a multi-modal journey as well as all classes of vehicle driver; freight shippers; pubic transport mangers and specialist system operators.
- **Rule ITS** – this class represents those who provide regulations and standards. It includes national governments and the various Standards making bodies.
- **Make ITS** – the class comprises the equipment and system manufacturers, communications providers and the system integrators.

Service providers, e.g. travel information and trip planning, may be in one or more of the Want, Use and Make ITS classes.

User Needs

It is normal to find that the Stakeholder Aspirations will have been written in a variety of styles. Sometimes they can also be obscure and inconsistent. It is thus necessary to re-write them in a consistent manner that is suitable for the next stage in the process. The result is a set of User Needs that express the Stakeholder Aspirations in a consistent and stylised manner whose meaning is clear and whose properties are testable.

The KAREN project produced a set of about 550 User Needs to cover the ITS applications and services being considered for implementation at the end of the 1990's. The FRAME projects have then added to them with, most recently, the E-FRAME project adding about 230 User Needs for Cooperative Systems. Thus, when using the FRAME Architecture, the architecture team needs to write new User Needs only very occasionally. Most of the time the User Needs required can be selected from the existing list.

Functional View

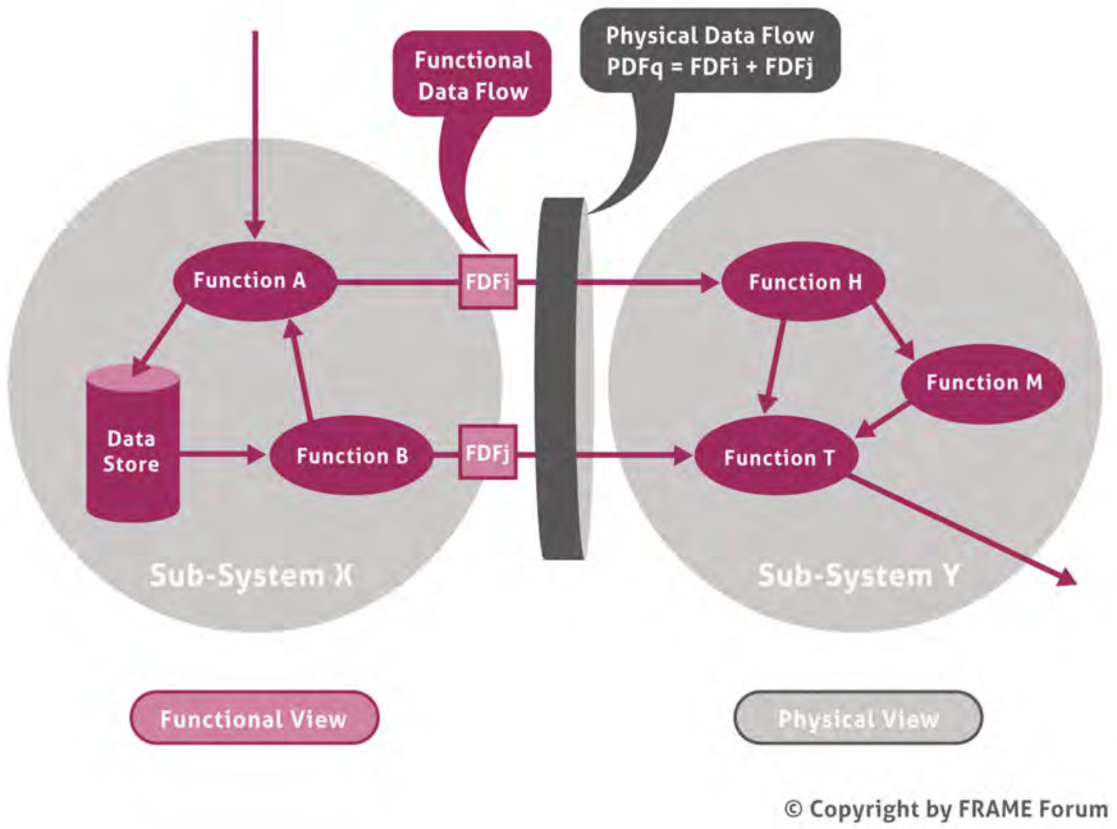
The FRAME methodology uses the term "Views" for the parts that make up the FRAME Architecture and its resultant ITS Architectures. This follows the recommendations of IEEE 1471. The alternative term of "Architecture" is still used elsewhere, but we feel that an architecture made up of views is more comprehensible than one that is made up of architectures.

A Functional View (sometimes called a Logical View) shows the functionality that will be required to fulfil the User Needs, and hence the Stakeholder Aspirations. When using the FRAME Architecture the Functional View is shown as Data Flow Diagrams that contain functions, data stores and terminators, and the data that flows between them. Each of these is provided with its own description which, in the case of functions, includes statements explaining what they do. Since the FRAME Architecture comprises a Functional View that satisfies all of its User Needs, the architecture team only has to select those parts of it that serve the User Needs that have been mapped to the Stakeholder Aspirations. New functions etc. are only needed for Stakeholder Aspirations that have required new User Needs to be added.

Another important part of the Functional View is the Context Diagram. This shows the ITS as a single item and the links needed by the functionality contained within it to communicate with the entities outside it. It is useful for two reasons. Firstly it enables the system boundary to be defined showing what is inside the ITS and what is not, and thus what is the responsibility of the ITS Engineers (and hence what its not!). Secondly it enables definitions to be produced of the way in which the functionality inside the ITS expects the outside entities to behave. These outside entities are called Terminators, and either obtain data for the ITS or provide outputs to end users. The same Context Diagram is also part of the Physical View.

Physical View

Once the Functional View is complete, the architecture team allocates each item of functionality to a location, either within a sub-system (see diagram below), or within a module that is part of a sub-system. Once this has been completed the component (sub-system or module) specifications can be created from the definitions of the functions and data stores contained within them.



The Context Diagram produced as part of the Functional View also applies to the Physical View. It again shows the ITS as a single item and the links needed by the functionality within it to communicate with the entities outside it.

Communications View

As can be seen from the diagram above, a consequence of allocating the functionality to sub-systems (and modules), is that it is immediately clear which Functional Data Flows lie within a sub-system (or module), and which pass between one sub-system and another, or between one module and another. Those that pass between sub-systems or modules make up the Physical Data Flows, and represent a communication channel between sub-systems, and/or between modules.

Since sub-systems are, by definition, located in different places (e.g. in a traffic management centre, at the road side, in a vehicle) it is possible to produce communications specifications by analysing the contents of each Physical Data Flow. This analysis may elicit that an existing Standard may be used for the communications. Alternatively it can be used as the basis for defining a new Standard if the need for one can be agreed.

Analysis of the Physical Data Flows that pass between the ITS and the Terminators can also lead to "standard" interfaces for end users, which can play an important part in making sure that the ITS implementation can be used in the same way, everywhere that it is deployed.

Traceability

An important feature of the FRAME Architecture methodology is the ability to provide traceability all the way through the process. It should be noted that the services contained in most ITS Architectures cannot normally be deployed all at the same time, both for reasons of cost, as well for reasons of dependability (i.e. one service may have to be established before another can be introduced). Thus those planning to implement components and communications links identified by the ITS Architecture need to take account of any financial and dependability constraints that the proposed deployment may have.

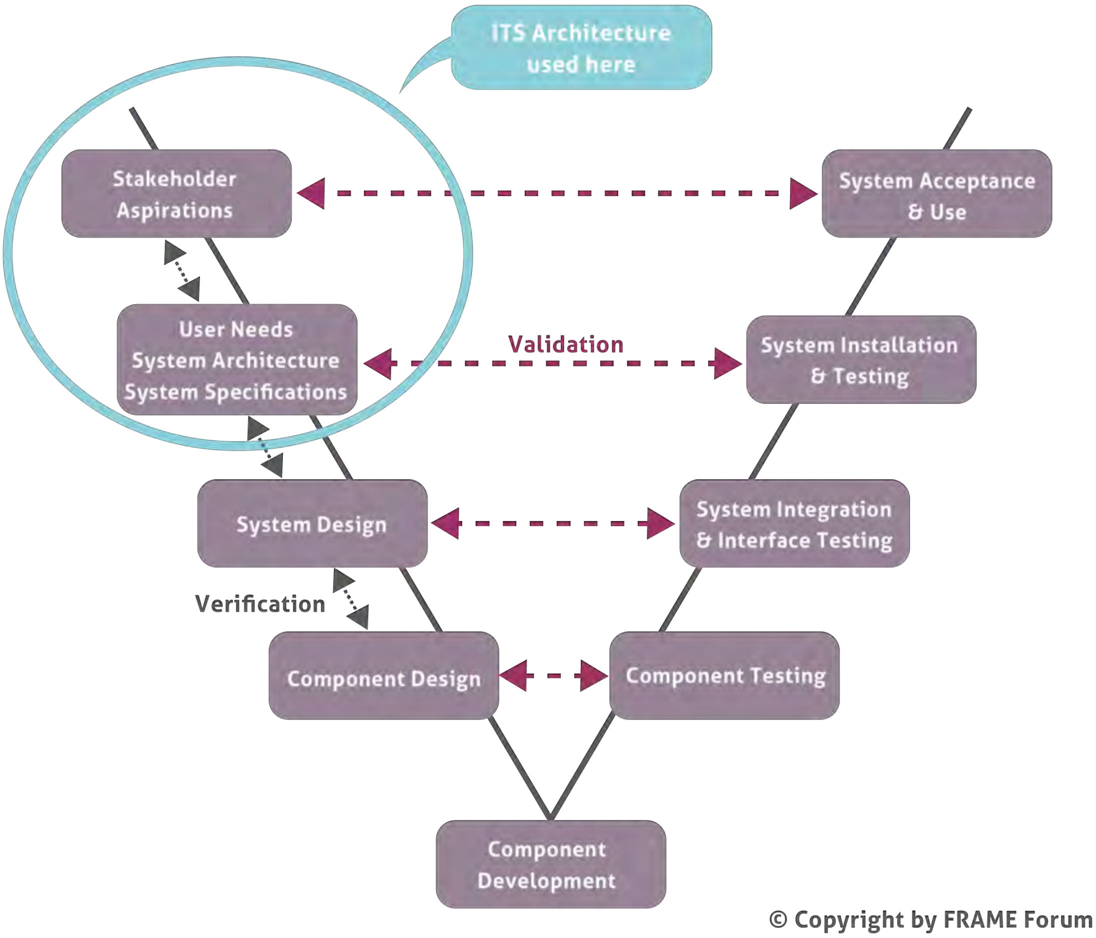
A traceability matrix can be used to show the relationship between the Stakeholder Aspirations and the sub-systems and modules in the Physical View. This enables the ITS Architecture owners to identify quickly those components that are needed to satisfy a given set of Aspirations, and thus meet their immediate goals. Such a matrix can also show whether certain Aspirations can be satisfied "for free", i.e. having identified the sub-systems and/or modules needed to satisfy a given set of Aspirations, it may be found that it is possible to satisfy some other Aspirations without the need for extra sub-systems and/or modules.

ITS Architecture as part of Systems Engineering

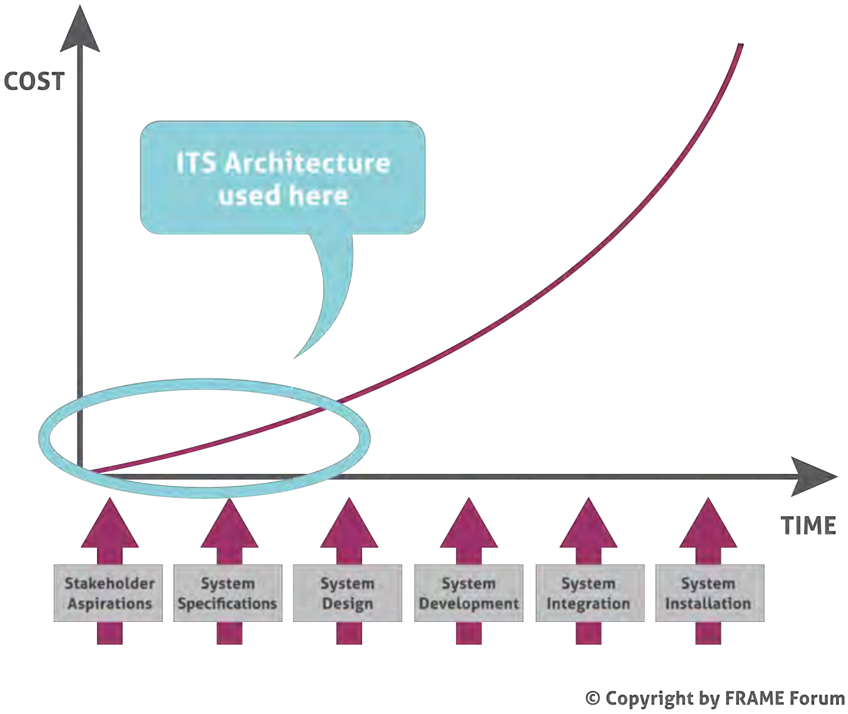
Systems engineering is an interdisciplinary field of engineering that focuses on how complex engineering projects should be designed and managed over the life cycle of the project. Whenever complex integrated systems are being designed it is normal for one of the first design products to be the System Architecture. Thus an ITS architecture is a System Architecture for integrated Intelligent Transport System (ITS).

A system architecture, or systems architecture, is the conceptual model that defines the structure, behavior, and more viewpoints of a system. An architecture description is a formal description of a system, organized in a way that supports reasoning about the structural properties of the system. It defines the system components or building blocks and provides a plan from which products can be procured, and systems developed, that will work together to implement the overall system. This may enable one to manage investment in a way that meets business needs.

The systems engineering process is often depicted using the V-model system lifecycle (see below). This model emphasises the need to ensure that the system is both built correctly, and that it satisfies the aspirations of all its stakeholders.



The early part of a system lifecycle is sometimes glossed over quickly so that the "more exciting" stages of design and implementation, and the use of (often new) technology can be reached as quickly as possible. The danger of taking this approach is that the early products (Stakeholder Aspirations, User Needs, System Architecture and System Specifications) will not be complete and/or correct. Thus the resulting System Design, which will be verified against them, will also be incomplete and/or incorrect, and the development may be some way up the right hand side of the V-model lifecycle before the discrepancies begin to appear, making them much more expensive to rectify. This effect is illustrated below, and is sometimes called "The 10:100:1000 Rule" because the cost of correcting faults in a system increases exponentially (by about a factor of 10) during each successive stage of a lifecycle.



References

These are various articles and papers that have been published and/or presented at various conferences. They are contain a useful summary of various topics on aspects of ITS Architecture in general, and the FRAME Architecture in particular.

Using the FRAME Architecture for Planning Integrated Intelligent Transport Systems (EATIS 2009)

The potential complexity and size of Intelligent Transport Systems (ITS) requires that they be implemented through a systems engineering approach based on the use of ITS Architectures. These enable a high level set of “views” of the proposed ITS to be obtained early in its lifecycle so that many of the details and implications can be checked and, if necessary, changed at significantly less cost than if the need for a change is only found when some/all of the development work has been completed. The FRAME Architecture has been created for use as the starting point for any deployment of ITS, and a methodology for its use has been developed. This methodology is now supported by two FRAME Architecture Tools. The FRAME Architecture is currently being extended to include cooperative systems.

Download (230kB pdf file)

Using the FRAME Architecture for Planning Integrated Intelligent Transport Systems (ITS Spain 2009)

The potential complexity and size of Intelligent Transport Systems (ITS) requires that they be implemented through a system engineering approach based on the use of ITS Architectures. These enable a high level set of "views" of the proposed ITS implementation to be obtained early in its lifecycle so that many of the details and implications can be checked and, if necessary, changed at significantly less cost than if the need for a change is only found when some/all of the development work has been completed. The FRAME Architecture has been created for use as the starting point for any deployment of ITS, and a methodology for its use has been developed. This methodology is now supported by two FRAME Architecture Tools. The FRAME Architecture is currently being extended to include cooperative systems.

Download (130kB pdf file)

Using the European ITS Framework Architecture (ITS World Congress 2006)

This paper describes a use that has been made of the European ITS Framework Architecture, and the FRAME Browsing and Selection Tools, in a project to create a regional ITS Architecture. It describes the processes that were used, from the definition of the Stakeholder Aspirations to the creation of the descriptions of the physical entities and the links that are needed to fulfil them. Examples of the results are presented, together with an evaluation of them. The evaluation confirmed both the usefulness of the resulting regional ITS Architecture, and the effectiveness of the FRAME methodology to create it.

Download (75kB pdf file)

Different Types of ITS Architectures and their Uses (ITS World Congress 2005)

This paper looks at how one should choose the best type of Architecture to create for an ITS deployment. There are three main Architecture types, comprising Framework, Defined and Specific. They all contain the User Needs and the functionality supporting them, but they differ in what else they comprise. A Framework ITS Architecture contains guidance for the creation of the other outputs and is most suitable for (inter-)national ITS Architectures. Both the Defined and the Specific ITS Architectures contain the actual created outputs. A Defined Architecture is most suitable for regional ITS Architectures. A Specific ITS Architecture only supports one or two Services and is best used by manufacturers as the basis for their product ranges. The choice of which ITS Architecture to create depends on the starting point, plus how and where it will be used.

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How Can an ITS Architecture be Created – A European View (ITS World Congress 2004)

This paper provides an overview of the ITS architecture creation process and how the results can be used in ITS development and deployment. It starts by looking at the Stakeholders and their rôle in the ITS architecture creation process. The results of the process are then described and their use in ITS deployment explained. The use of the two basic types of ITS Architecture is then explained, and the paper finishes with a discussion on how Multi-modal ITS Architectures can be created.

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Why Do You Need an ITS Architecture – European and National Perspectives (ITS World Congress 2004)

ITS is becoming more complex and difficult to produce and deploy successfully. One way of alleviating this situation is to create an ITS Architecture. This provides a top-level framework that contains the minimum top-level assumptions necessary. Once created, an ITS Architecture can be used to produce a variety of management products to guide the future ITS deployment. An architectural approach provides benefits for the ITS Stakeholders, with End Users, Authorities and Operators as well as Manufacturers and Suppliers all gaining from a long term planned approach.

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Configuration Management in the European ITS Framework Architecture Environment (ITS World Congress 2003)

This paper provides the background and description of the Configuration Management practices being implemented by the FRAME Project for the European ITS Framework Architecture. The challenges that this presents arise from the flexibility of use that is built into the Framework Architecture and the freedom that its Users have to modify it when creating their own ITS Architectures. Therefore Configuration Management practices have been developed for both the Framework Architecture maintainers and its Users.

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Involving Stakeholders in ITS Architecture Creation (ITS World Congress 2003)

Part of the planning process for the deployment of integrated ITS services should be the creation of an ITS Architecture. This architecture will contain the solutions to the problems and aspirations of the various stakeholders. This paper describes a process, based on experience, for use by ITS architects to capture the Stakeholders Aspirations and then create the corresponding User Needs. It highlights the distinction between a problem and its solutions, and also provides advice for how to write, structure and use the User Needs.

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