POSSE

Promoting Open Specifications and Standards in Europe

Good Practice Guidelines on the Implementation and Development of Open Specifications and Standards for Intelligent Transport Systems

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Good Practice Guidelines on the Implementation and Development of Open Specifications and Standards for Intelligent Transport Systems

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Chapter 1. Introduction – The purpose of this Guide

The purpose of this Good Practice Guide (GPG) is to share best practice and encourage the wider European adoption of Open Specifications and Standards (OSS) for Intelligent Transport Systems (ITS) through knowledge exchange.

ITS are widely implemented in cities and regions to manage traffic and to influence travel behaviour. Systems such as area-wide adaptive traffic control, real-time travel information, bus priority at traffic lights, smart card ticketing, and car park management and guidance, have all been employed among others. ITS have largely been implemented in an un-coordinated and incremental way, due in part to the multitude of organisations involved, the absence of a common set of open ITS standards and specifications in Europe, and the prevalence of closed, proprietary systems within the market.

Closed systems are commonplace resulting in technologies produced by different suppliers that cannot (easily) inter-operate within a system due to the specific way in which a technology has been designed. Closed systems have also led to a situation of vendor lock-in for public authorities, and perpetuate the monopoly that some suppliers have in a number of European countries. This has implications in terms of higher cost, loss of operational efficiency and lack of incentive to innovate.

This Guide builds upon the experiences of two long standing frameworks for OSS developed for ITS/ Traffic Management Systems: UTMC (Universal Traffic Management and Control) framework in the UK and the OTS (Open Traffic Systems) framework/ OCIT® (Open Communications Interface for Road Traffic Control Systems) specification in the German-speaking part of Europe. While there are a number of differences between the two frameworks, both initiatives have succeeded in defining specifications which are widely implemented (more than 200 in the UK, Germany, Switzerland and Austria).

Where there are common approaches between UTMC and OTS/OCIT® these have been brought together in the Guide as a common way forward.

It should be noted that there are a variety of Open Standards and Specifications in use across Europe and further afield. Some of these have originated in individual countries or locations ie DVM Exchange - Netherlands and, RSMP – Sweden.

Other established standards have been developed through international co-operation such as SIRI (Service Interface for Real Time Information) a CEN technical specification, developed with initial participation by France, Germany, Scandinavia, and the UK, and DATEXII a specification for the exchange of traffic and travel information developed by an EC sponsored European task force.

This document however focuses on sharing UTMC/OCA experience. These frameworks include elements of established standards such as DATEX/DATEXII.

It provides an overview of the process from conception to procurement of Open ITS Systems. This takes us from the initial stages of system development where the needs of the system are identified and an ITS deployment plan is created, onto the implementation of existing OSS, or the development of new OSS, and finally to the full implementation of the ITS system itself. The main focus of the Guide though is on the development of new OSS when appropriate.

The GPG shares good practice on:

- How to proceed - under the constraint of public procurement – with system modernisation / system redesign and procurement of a complex system in the traffic environment?
- How to deal with a vendor mixed environment as a way of flexible adaptation?
- How to set up organisational structures and procedures to enable stakeholders to work towards the same goal?
- How to develop the technical specification for a tender, without violating public procurement law; what procurement packages / lots are useful?
- In order to ensure that the guidelines are not too theoretical they give examples of the practical applications of OSS. These include:
- **Case studies of UTMC and OCA.** These have been undertaken covering 6 UTMC cities, industry representatives and National Bodies, along with 6 OCA cities. The case studies identify how OSS are being applied, their benefits / limitations, how integrated they are into policy and how the questions addressed in the GPG are answered in real-life. These case studies were based on a standard case study questionnaire and supporting interviews, where required, and also form the good practice examples on the website.
- **Transfer Sites Experiences.** Through developing their Implementation Plans the Transfer Sites have provided valuable insight into the challenges of introducing OSS into their cities / regions. These experiences have helped to ensure that the GPG is practical and relevant across Europe.

Who is the guide for?

The Guide is written for a range of different actors involved in strategy, planning, design, specification and implementation of ITS. It is recognised that the public bodies, whether national, regional or local, in their role as contracting body are likely to be the main drivers of OSS and this guide has been written to aid decision makers in the process. Whilst the specifications and standards are very technical, this guide does not focus on this detail but instead focuses on the processes involved. The specific ITS technologies do not form part of this guide.

In addition to addressing public bodies, the guide also addresses the private sector, the system suppliers and integrators, whose involvement is critical to the success of OSS. Without the full involvement of suppliers and integrators it is not possible to build an OSS marketplace.

POSSE Project

This Guide has been funded through the POSSE Project. POSSE (Promoting OSS in Europe) is a €1.8m ERDF funded INTERREG IVC knowledge exchange project, which runs from January 2012 to December 2014.

The POSSE project is a knowledge exchange project led by Reading Borough Council (United Kingdom), with the lead knowledge exchange partners being UTMC Ltd (United Kingdom) and OCA e.V (Germany, Austria and Switzerland). There are 6 Transfer Sites from across Europe including; City of Klaipeda (Lithuania); City of Burgos (Spain); City of Pisa (Italy); La Spezia (Italy); Norwegian Public Roads Administration (Norway); and the Czech Transport Research Centre (CDV) (Czech Republic). POLIS (Belgium) is also a project partner and leads Communication and Dissemination.

POSSE was set up to raise awareness of the need for OSS for road-based transport management, and to share the experiences of existing open system frameworks in Europe. A central objective of the project is to build the capacity of European transport authorities to implement OSS.

In addition to delivering these good practice guidelines, POSSE will also deliver implementation plans for each of the project partners, with the exception of POLIS. These plans set out how each partner will implement and develop OSS.

Policy Content

Across Europe, national, regional and local authorities are tasked with encouraging more sustainable patterns of travel to meet the EU's greenhouse gas emissions targets in addition to addressing more local issues such as Air Quality Management Areas. Within Europe, urban mobility represents around 40% of all road transport CO^2 emissions and around 70% of other pollutants.

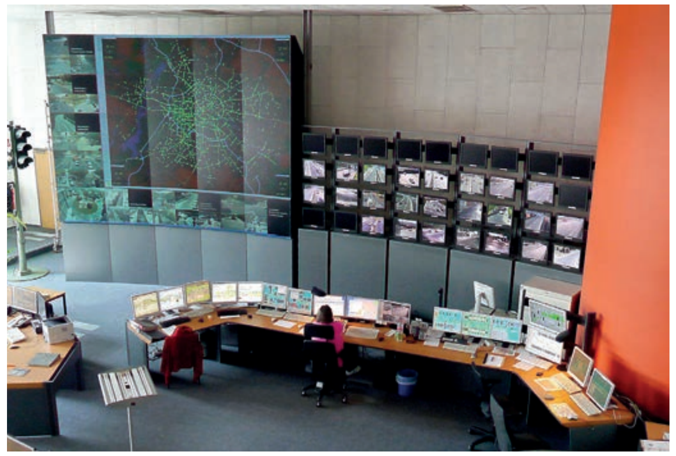
EU Member States have agreed to cut greenhouse gases by 20% by 2020, compared with 1990 levels. It is understood some Members would like to increase the target to 30%.

The EC Urban Mobility Action Plan is promoting a number of actions including the take up of sustainable urban mobility plans (SUMP). There is an obligation on authorities to take action to reduce the environmental impacts of transport and encourage modal shift. This is a particular challenge in the light of tight economic conditions as Europe recovers from recession.

The EC has adopted a roadmap of 40 concrete initiatives for the next decade to build a competitive transport system that will increase mobility, remove major barriers in key areas, and fuel growth and employment. At the same time, the proposals will dramatically reduce Europe's dependence on imported oil and cut carbon emissions in transport by 60% by 2050.

Urban ITS are a critical element in the delivery of urban mobility plans as they support policy delivery through aspects including:

- better management of the network to improve public transport journey times and journey time reliability which is important in encouraging and sustaining modal shift;
- intelligent prioritisation of network capacity between vehicles and walking and cycling to reduce real and perceived barriers to movement and encourage modal shift;
- better management of traffic to reduce congestion and accidents, tackle local air quality issues and reduce overall CO2 emissions; and
- more sustainable patterns of travel through providing good quality multimodal travel information, enabling travellers to make informed choices about how, when and whether they travel. This is a particular objective of both the ITS Action Plan and Urban Mobility Action Plan.



Overview of the Guide

This Guide brings together the expertise from OCA and UTMC and this is set out in the following chapters.

Chapter 2 sets out the reasons for implementing OSS. It gives an overview of what OSS are, it sets out the benefits to the highway authorities and the suppliers, and the motives for these parties being involved. Finally it summarises the approaches by UTMC and OCA to delivering OSS.

Chapter 3 describes UTMC. It provides an overview of its history, a detailed description of its approach, gives examples of UTMC in action, and identifies lessons learnt and future developments.

Chapter 4 collates the UTMC case study summaries.

Chapter 5 describes OCA. It provides an overview of its history, a detailed description of its approach, gives examples of OCA in action, and identifies lessons learnt and future developments.

Chapter 6 collates the OCA case study summaries.

Chapter 7 sets out the stages of implementing and / or developing OSS, drawing on UTMC and OCA experiences.

Chapter 8 uses the experience gained from the development of the implementation plans identified by each of the Transfer Sites to give examples of how the UTMC and OCA approaches set out in Chapter 7 could be applied.

Chapter 9 provides further information which may be use to anyone looking to utilise or develop OSS.

Chapter 2. The Reasons for Open Specification and Standards

Introduction

Recent years have seen an explosion in the evolution of ITS, and along with this there has been an explosion of ITS standards (open and otherwise). These can be daunting for even an experienced professional to track, particularly since they will vary in relevance, maturity, force and market support.

The term "Standard" or more fully "formal standard" is taken to refer to a technical standard developed by consensus, specifying requirements which have been published by a widely recognised Standards Development Organisation (SDO). A technical standard is an established norm or requirement. It is usually a formal document that establishes uniform engineering or technical criteria, methods, processes and practices. This, of course, says nothing about who created the standard, how it is maintained and whether it is widely accessible.

In the ITS domain, there are different forms of widely accepted open standards of relevance; formally acknowledged standards, produced by consensus and adopted through one of the numerous SDOs. These SDOs all have some process of consensus forming and voting that recognises the rights of its members and typically the National Standards Bodies (NSB). In some instances the member organisations are the NSBs.

Although not a fully comprehensive list, the prime SDOs for ITS open standards in Europe are:

- CEN – the European Committee for Standardisation and notably its Technical Committee TC278 – Advanced Transport and Traffic Telematics.
- ISO – the International Organisation for Standardisation and notably its Technical Committee TC204 – Intelligent Transport Systems.
- ETSI – the European Telecommunications Standards Institute and notably its Technical Committee TC ITS – Intelligent Transport Systems.
- Other SDOs are also active:
- IEC – International Electrotechnical Commission.
- CENELEC – the European Committee for Electrotechnical Standardisation.
- IEEE-SA – the Institute of Electrical / Electronic Engineers Standards Association.
- ITU – the International Telecommunications Union.

Many of the formally acknowledged standards become national standards. For example, CEN standards typically become German standards through adoption by Germany's National Standards Body (DIN) and simultaneously become, for example, British Standards (BS) through adoption by the UK's National Standards Body, the British Standards Institution (BSI).

European Norm (EN) created by CEN, ETSI and CENELEC must be adopted as national standards; other products are subject to the discretion of the NSB.

Standards are characterised, especially in Europe, by having very clear preferential positions in places like procurement law. All formal standards are openly accessible to any organisation (though not necessarily free of charge).

It is however also possible to refer to “informal”, “industry” or “de facto” standards, which merely reflect widespread common practice. Microsoft Windows might be considered one of these. These may or may not be open.

POSSE technical partners make use of both. In the UK, the UTMC initiative has strong input from industry and can therefore make effective use of de-facto standardisation. Within the OTS-Initiative, the OCA involves mainly the public sector, and focuses more strongly on de jure standards.

A “specification” is any reference description of how a product, system or process works. It may be anything from purely proprietary to a published legal requirement. In this sense all standards are specifications.

Legislators are, *ceteris paribus*, more likely to look to standards when imposing legal obligations. However, without such imposition, no standard in itself imposes an obligation on anyone. The ITS Directive, and other European policy documentation, makes this clear.

What are the Benefits of Implementing Open Specifications and Standards?

The delivery of cost effective and efficient network management systems is restricted across Europe. This is in part due to the lack of widely used specifications, based on open standards, which would allow interoperability between systems and facilitate information exchange. This restriction impacts on the effectiveness and delivery of Urban Mobility Action Plans. The five key areas which are impacted by the adoption of OSS and systems based on their use include:

1. **Operational efficiency** – it can be difficult or even impossible to develop an effective integrated approach to policies when urban ITS systems, such as those for traffic control, variable message signing and real time passenger information, are all separate entities.

   OSS allow a better integration of ITS which in turn enable:

   - A more holistic view of the traffic situation.
   - A greater use of automatic responses during key events (sporting events, concerts, etc).
   - A better understanding of how systems work together and how to resolve problems as they occur (introduction of distributed systems, avoidance of traffic information silos, etc).
   - Greater flexibility in terms of mixing and matching solutions.

   The use of OSS therefore enable such systems to be integrated through, for example, a common database. Combined data provides a platform for more effective delivery of multimodal real time travel information to the public, and to better manage the network and deal with incidents. The overall benefit of a combined system is greater than the sum of benefits of its parts.

2. **Cost** - with disparate systems, an authority may be able to ensure best value through competitive tender for the initial implementation, but is then usually ‘locked in’ to the same supplier for any subsequent system extensions. These system extensions may then not necessarily represent the best value in terms of cost and functionality. The need for bespoke systems to share information usually results in additional cost. Open standards can address these problems.

   The impact of adopting open standards has actually been measured in financial terms within the OCIT® / OTS community. A fall in the cost of buying traffic signals of up to 80% in the beginning has been recorded and in recent years this is generally around 40%.

   Within the UTMC community, savings on capital investments and annual revenue costs have been estimated as follows:

   - Capital investment savings per authority for establishment of the core regional UTMC system is in the region of 30%..
   - Ongoing annual revenue savings per authority for maintenance of a UTMC system of around 40%.
   - Potential staff savings for operations in the region of 1.5-3.5 persons.

3. **Simplified and structured procurement** - the technical specifications are impartial and readily available for use in procurement, which can simplify greatly the tendering procedures.

   - Tendering procedures are common to all; therefore, an authority can make use of another authority’s specifications and tendering document, where applicable.

4. **Better customer / supplier relationship** - traffic managers know what is technically reasonable and available and can better articulate the solutions sought from industry.
    - Industry has a better understanding of the traffic managers' needs.
    - Clarity of technical requirements helps dialogue between buyer and suppliers – they can talk the same language in procurement specifications.
5. **Barrier to the development of new technologies** - the lack of open standards restricts the market potential of new technologies and systems, and the new policy opportunities they could bring. There are many new developments such as Cooperative Vehicle-Infrastructure Systems (CVIS), personalised navigation devices, and transport related phone apps which bring new opportunities and threats to traditional urban ITS systems and services.

    Open systems have scope for flexibility and evolution to keep up with technology and policy developments.
    - An open systems framework provides a simple structure for the addition of new technology.
    - By working together, local authorities can create enough market pull to drive industry developments, which is not achievable alone, except in the case of very large authorities.
    - The market can increase in size, especially among new suppliers, and in new business areas generated by OSS.

It is clear that the lack of OSS in ITS has a direct bearing on the effectiveness of development policies. The wide ranging knowledge transfer and open standards activities in POSSE will deliver an effective practical approach to realising the benefits of open standards.

Motives and Vendor Mixed Environments

The implementation of OSS require the ability to deliver vendor mixed environments. A vendor mixed environment can be delivered with different levels of cooperation between the parties but is essentially one where: *'the technology vendors cooperate to develop equipment which meets OSS and which is interoperable with other vendors' equipment".* This can be demonstrated through the main objectives set out for OCA and UTMC, and for the authorities expectations, which include:

- Fostering competition;
- Fostering economic efficiency and quality assurance in terms of tender and operation;
- Simplification of tender processes;
- Promotion of information exchange between concerned authorities on a national or international level; and
- Bundling of authorities' requirement profiles.

Authorities' / Operators' expectations:

- Implementation of open and future-proofed systems;
- Application of components at any point of a system that have the best price/performance ratio;
- Effort reduction (staff and costs) for the operation of ITS;
- Avoidance of vendor lock-in;
- Integration of traffic control into current and future information systems;
- Infrastructure to vehicle and vehicle to infrastructure information exchange;
- Use of new technologies by migration of the current stock of equipment; and
- Decrease of complexity for system operators.

The inclusion of OSS as part of public tenders, for example, in traffic control systems, can and has shown to lead to vendor mixed environments. In the past the traffic signal control centre and the traffic signal controllers had to be provided in one contract by the same supplier. Separate tenders for traffic control centres and traffic signal controllers using common open standards have enabled costs of procurement to decrease. In the short term this can sometimes result in increased complexity in control centres through the introduction of multiple vendors' equipment, with an associated increase in resource required, either in terms of knowledge or labour.

However in the longer term this harmonisation of approach across vendors should lead to simplified operation.

The ability to mix vendors' systems requires a further level of detail: systems and their sub-systems have to be designed in a way that sub-systems can be supplied by various manufacturers and can be exchanged at a later time by third-party systems without any problems.

Hence, the ability to mix vendors' systems implies flexibility for the future with the aim to also reduce the cost of the subsequent operation of such systems. This can be achieved:

- by using open standards; and
- by using a standardised process model for system tendering and development.

The opportunity for having a vendor mixed environment does not necessarily lead to mixed implementation, however, the possibility should always be considered.

UTMC and OCA Approaches – Experience to Share

POSSE builds upon the experiences of two long-standing initiatives for OSS for ITS/traffic management systems: the broad-based UTMC initiative in the UK, and the more focused OCIT®/OTS initiative in Germany, Austria and Switzerland. Both of these initiatives have existed for a considerable number of years and they have established active marketplaces in their home territories, and remain under active development.

UTMC and OCIT®/OTS had separate origins and have evolved in response to different national pressures. The origins of UTMC date back to the early 1990s, when the initiative was launched by the UK Department for Transport, to help traffic managers make effective use of modern information and communication technologies. The first open specification, published in 1997, was tested and thoroughly revised in a £6M research programme (1997-2004), and further enhancements have been developed continually since then. In 2003 the UTMC Development Group (UDG) was created as a community body to steer the further development of UTMC. In 2006 it opened up to include both public authorities and system suppliers and in 2008 it became a subscription organisation though the UTMC specifications and standards are freely available.

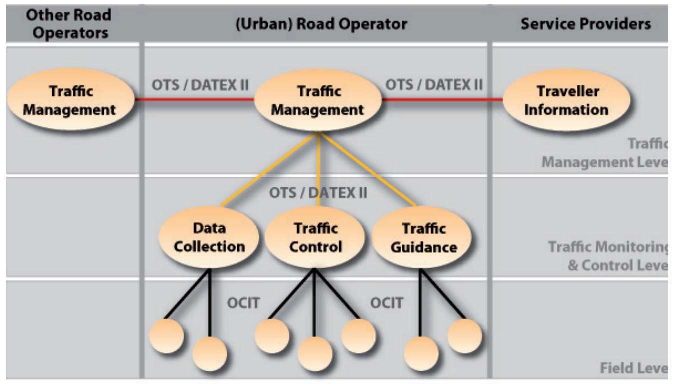
Starting in 1999, OCIT® was initiated by the vendor organisation ODG (OCIT Developer Group) to develop an open industry communication standard for traffic control systems. The stakeholder organisation OCA continuously bundles requirements and negotiates them with the ODG. OCIT® did not fully meet the users' traffic management requirements and hence since 2006 the OCA have initiated and coordinated the process of development of OTS. The open communication standards OTS 1 and OTS 2 are part of the OTS Framework. In 2011 OTS 2 was standardised by Germany's National Standards Body "DIN" and became a Publicly Available Specification (DIN SPEC 91213).

Although there is good programme-level communication between UTMC and OCIT®/OTS2, the two frameworks retain very different structures. As a consequence of this, they provide case studies on the ability of different approaches to deliver benefits, including mitigating the risks and problems that may arise.

For instance, the management body for UTMC (the UTMC Development Group or UDG) includes both public and private sectors; the stakeholder organisation for OCIT®/OTS (the OCA) is public sector only.

The communication standard OTS2, for example, is much more closely tied to the European specification DATEX II than UTMC, much of which predates DATEX II development. There are many other differences of detail.

Both, however, adopt the philosophy that transport authorities – and their ITS supply industries – can benefit from technical guidance by improving system interoperability, reducing costs and risks associated with procurement, and facilitating more effective traffic and network management. Both assume that different cities will have different needs, and that the supply market will actively innovate and compete. The following sections of this Guide describe UTMC and OTS/OCIT® in much more detail.



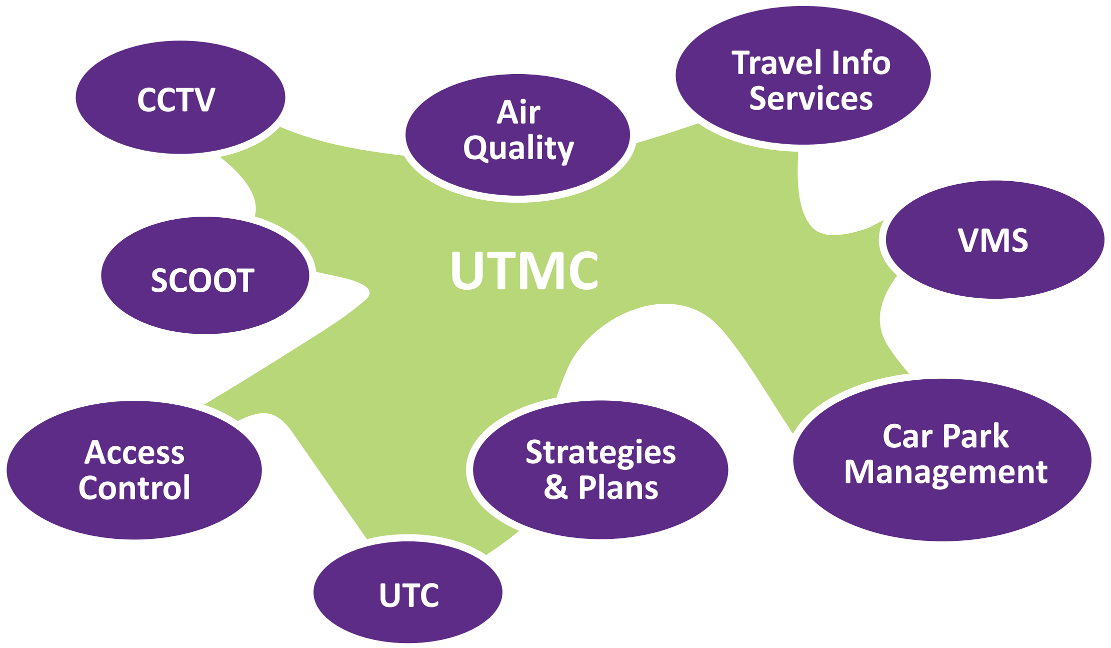
History of UTMC

Traffic managers have a wide range of roles and responsibilities, and an increasing range of technology systems to help them to deliver those responsibilities. However, as with any use of technology, there are challenges of getting an effective system for an acceptable cost. Moreover, where different systems need to work together, procurement and engineering issues arise such as:

- How to achieve an effective competitive marketplace, and avoid supplier "lock in".
- How to sustain technical innovation.
- How to ensure that different authorities align their demands on systems suppliers where practical.
- How to ensure systems can exchange data quickly, simply and cheaply.

In the early 1990s, the UK Department for Transport (DfT) initiated the UTMC research programme in order to address these problems. A basic review of existing traffic systems led to the understanding that an open technical standard was required, and the first draft UTMC Technical Specification was published in 1997.

This was well received by both policymakers and practitioners, and the DfT was encouraged to invest some £6M to facilitate the deployment of such systems. Between 1997 and 2004, the UTMC research programme worked with many different public and private sector organisations to refine the Technical Specification and prove its practicality in the marketplace.



UTMC as a connectivity initiative

The primary goal of UTMC is to deliver better tools to support the pro-active management of the urban traffic mix, which is essential if wider ranging local transport objectives are to be met.

Increasingly, policy aims now include, for example:

- giving priority to public transport;
- improving conditions for vulnerable road users;
- reducing traffic's impact on air quality;
- improving safety;
- restraining traffic in sensitive areas; and
- managing congestion.

The UTMC Research Programme offers a framework for collaboration between users, industry, and researchers in the development and implementation of UTMC systems which meet these aims.

The approach emphasises... *"securing the widest and most active involvement of industry, researchers, local authorities and other users in the programme..."*

The Research and Development programme was extremely successful, and since 2004 UTMC has provided the *de facto* framework for the traffic management systems marketplace across the UK.

There remain, of course, legacy systems in many UK local authorities, and new systems are occasionally acquired which (for specific local reasons, or because of limitations in the Specification) are not compliant with the UTMC Technical Specification. However the momentum remains behind a continual accumulation of compliant systems. Because of UTMC, the competitive supply marketplace and the interoperability of systems in the UK have been significantly boosted.

Detailed Description

Technical approach

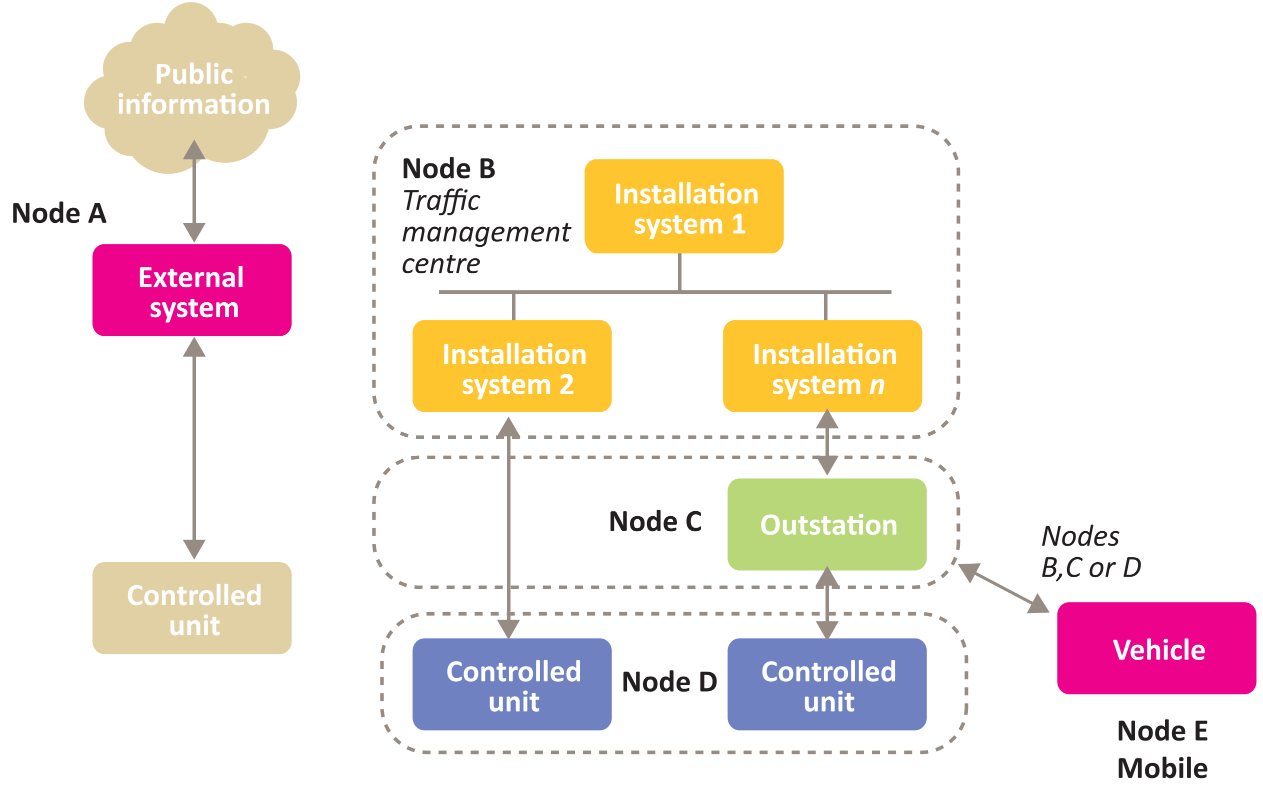
At the core of the UTMC initiative is the UTMC Technical Specification. This is a substantial, complex and evolving library of documentation, but the philosophy behind it is rather simple and straightforward.

- *To make use of mainstream technology as far as practical.* Traffic management is a small market, and cannot hope to compete efficiently with the global ICT industry in terms of efficient system design. For instance, UTMC adopts the Internet Protocol suite (for most purposes) rather than inventing a separate, traffic-specific, data communications standard.
- *To set standards only where useful.* The biggest potential problem with standards is that they can unnecessarily constrain design innovation. UTMC actively holds back from setting restrictions unless there is a good reason within the marketplace. For instance, it allows any communication channel to be used, provided only that it has adequate capacity, security, timeliness and reliability for its purpose. It also allows suppliers to innovate on algorithms, on user interface, etc. The primary focus of the specification is on interfaces that enable data exchange between applications and systems.
- *To be created and maintained by consensus.* Centrally developed ICT standards can sometimes be generated by a small group of self-selected people, and engagement with the intended users is not always good. In UTMC, systems companies develop the specifications, usually through some form of industry working group. The function of the secretariat is to ensure that all suppliers (and potential buyers) can participate in the development on an equal basis, and to publish the agreed results.
- *To be open and readily available.* A specification cannot be effective in improving the marketplace if it is difficult and expensive to obtain or to use. Unlike many standards and specifications, UTMC is fully open and available free of charge, through its website. There are no licensing restrictions on its use. However IPRs are retained in order to prevent third parties from seeking to exploit them.

Using this approach, UTMC has evolved specification elements to cover a wide range of traffic management functions, including the following:

- Access Controls
- Vehicle Detection
- Traffic Signals
- Roadworks
- Accident
- Air Quality
- Incident
- Transport Link
- ANPR
- Meteorological
- Transport Route
- Car Park Occupancy
- Journey Time Prediction
- VMS
- CCTV

These cover both roadside-to-centre communications (eg between a roadside VMS and the VMS management system at the traffic control centre) and centre-to-centre communications (eg between the VMS management system and the traffic signal control system). They are also usable as format for data which is exported to other systems, eg traveller information systems.



Management approach

UTMC is a national activity within the UK, now managed directly by its user community, the UTMC Development Group (UDG). The UK Department for Transport continues to participate and to be actively interested in UTMC developments.

The UDG was formed in 2003 and took over the management and maintenance of the UTMC Technical Specification in 2004. In addition, the UDG works to spread good practice guidance to local authorities around the UK, and to their suppliers, through a range of events and publications. Commercial work for the UDG is managed through a not-for-profit company, UMTC Ltd.

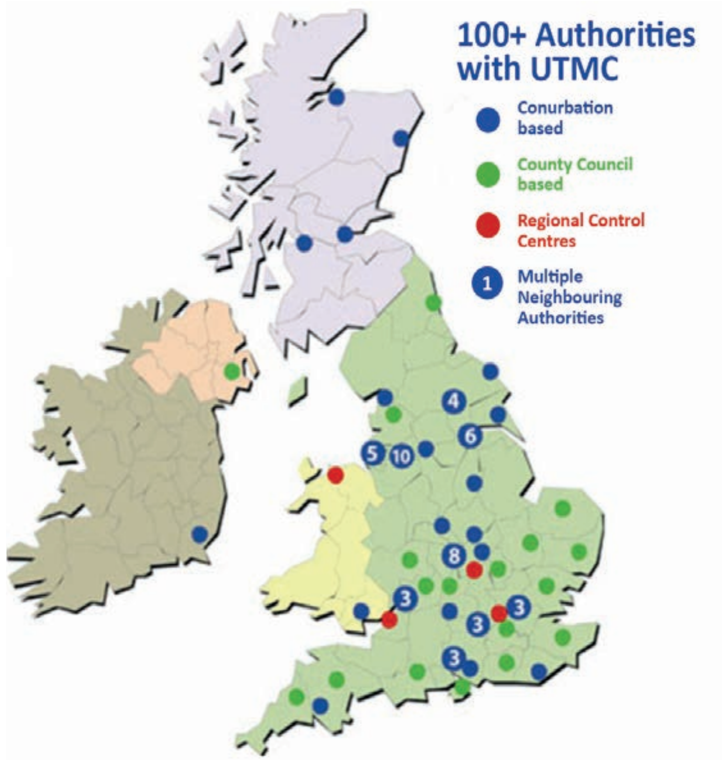
The UDG is a membership organisation. Its members elect a Management Group consisting of up to seven UK local authorities and up to three supplier representatives. Two standing Working Groups (the Specifications & Standards Group and the Marketing & Member Services Group) deliver the UDG's technical and outreach functions respectively.

UTMC in action

UTMC is now in widespread use around the UK, and is seen as the de facto basis for traffic management systems across the community (ie by both local authorities (LA's) and systems suppliers).

However there is considerable variation in how far suppliers use it in the design and marketing of products, and in how far LA's have deployed and integrated systems using UTMC protocols. UTMC has also been implemented in a few cities overseas, namely in; Ireland, South Africa, Brazil and UAE.

The map below, taken from UTMC records, shows how extensively UTMC is used around the UK. It is based on a survey of key suppliers of which authorities have actually been supplied with systems based on UTMC protocols – specifically, UTMC compliant Common Database products. Note though, that in these "UTMC authorities" there are still likely to be many existing systems which are not UTMC-compliant, and they may still be purchasing and integrating non-UTMC systems.



To explore the impact of UTMC in more detail, various users were contacted. This included six experienced UK authorities as well as representatives from industry and UK national bodies. Organisations contacted by POSSE include: Liverpool City Council, Transport for Greater Manchester, Coventry City Council, Reading Borough Council, Hampshire County Council and Cambridgeshire County Council, Atkins, Mott Macdonald, Variable Message Signs Ltd, Department for Transport, Highways Agency and UTMC Development Group. They provide a broad and representative sample of UK authority parameters: two medium sized towns/cities, two larger (and more autonomous) metropolitan areas, and two counties (with several towns and a significant rural region). They also present a variety of local features: some are coastal, some inland; their economies have different mixtures of industry, public sector and culture; and their local politics vary. Feedback from industry and national bodies also provide a useful alternative perspective on the benefits and drawbacks of UTMC implementation.

The authorities shared the majority of their policy goals: to reduce congestion/improve flow, to increase road safety, to improve environment quality, to support public transport, etc.

However some policy areas are local: for example Liverpool is a major port, but Cambridgeshire is inland and freight traffic is much less of an issue; on the other hand Cambridgeshire has to manage a much higher density of bicycle traffic than Liverpool.

In addition, LA's vary in management style. For some authorities, reliable technology was worth the cost, while others were more willing to take risks with less expensive systems. Similarly, some focus more on traffic control, while other focus more on monitoring the network and providing information. There is therefore inevitably a lot of variation in the specific systems that different authorities have deployed, how old those systems now are, which are currently being replaced, etc.

Based on this study, UK LA's agree on the following:

- The financial squeeze is placing huge pressure on the ability of traffic managers to operate their network, and even to maintain existing ITS assets.
- There is an increasing need to guide and inform travellers, so that traffic management is about much more than just optimising traffic signal settings. This includes through mobile devices.
- Modern networked technologies are much easier to develop, install, connect, and operate than they have ever been. However the skills needed to specify them and manage a supply contract are not those that traffic managers have traditionally had.
- UTMC standards make it easier to specify and procure systems, and they facilitate competition in the supply market. They do make interconnection easier, although it is rarely possible to "plug and play".
- There is a general expectation that new systems will make use of relevant UTMC protocols where available, in order to be able to integrate with existing systems. However non-UTMC systems would not be ruled out if they were seen as providing better value for money.

Lessons Learnt

The experience of UTMC has important general lessons for OSS in traffic management.

Above all, local authorities want systems that work efficiently – they are not interested in standards for their own sake. Standards are only helpful if they make systems cheaper to acquire, easier to use or more reliable. Standards which are too technically complex to understand will be counterproductive: the ICT world is full of "technically inferior" solutions that are pervasive because they are easy to use (IP vs X.25, Windows™ vs Unix).

While there is a lot of overlap among local authority needs, there are also differences in detail: London is not the same as Reading or Hampshire. Standards based on a "one size fits all" philosophy are not going to be efficient for all authorities.

Many of the similarities and variations are contextual, rather than national, and this means that commonalities exist across the continent of Europe. The problems, and viable solutions, for London as a large metropolis are quite similar to those of Paris and Rome; the issues for Liverpool as a port city will mirror those of Genoa and Gdansk; and Cambridge as a university city will share experiences with Leiden and Uppsala. Of course this does not apply to all traffic management challenges: Helsinki has more snow and less air pollution than Athens, because of their difference in latitude.

One of the problems of traffic management is that there is no standard (or set of standards) that has acquired a “critical mass”. Instead, there is a patchwork of relevant standards, which are not compatible. Local authorities find this confusing, and a deterrent.

But local authorities need to know, not merely what standards apply to their traffic management systems, but how they apply. Many of the problems that people have cited (both with UTMC and with other specifications and standards) have been related to this point. For example, non-technical people struggle to understand how two systems can both be “compliant” with the same standard, and yet cannot interoperate without specific adapters.

Future Developments

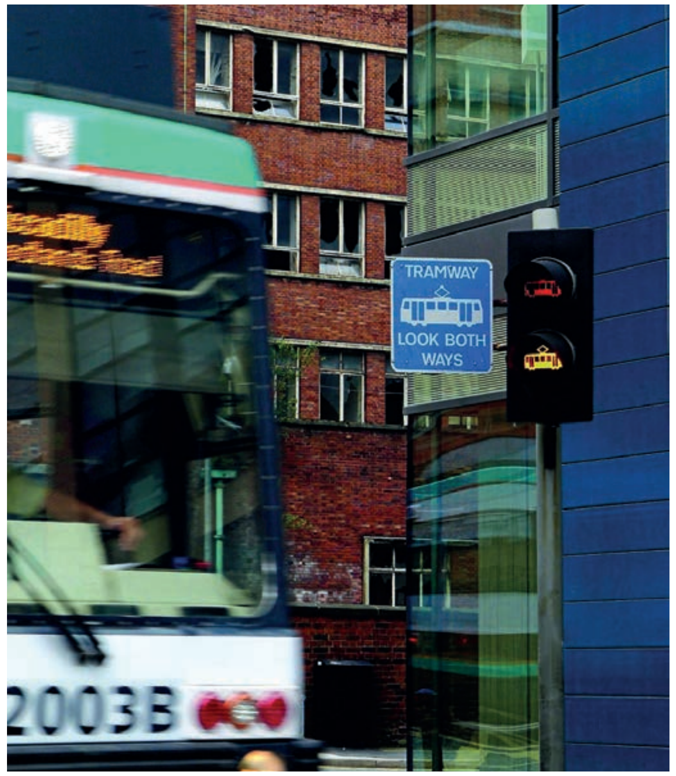
UTMC has now been an active part of the marketplace for more than a decade, and in that time there have been many changes. Policies have been refined and become more subtle, for instance regarding the management of emissions or the incorporation of cycle/foot traffic.

Technology has continued to develop, both incrementally (eg in general computing and communications speeds) and disruptively (eg the invention of smartphones and tablets). User expectations have changed, especially to require more (and better) traffic and travel information. And, of course, public finances – which have never been enough to carry out desired activities – have been dramatically squeezed.

UTMC aims to respond to all of these challenges and these are further discussed below:

- **Refined policy.** Fortunately UTMC has always been recognised as “policy neutral”, so this is quite practical – although of course new policy areas do require new technical components to be developed. Its principal policy aim, therefore, is to become technically and operationally better aligned with European initiatives such as DATEX. (Its involvement in POSSE is a key part of that response.)
- **Depleted finances.** As noted above, LA’s require value for money. UTMC has never been a mandatory standard, and has therefore always acted only where standardisation is likely to increase value for money. Moreover, the involvement of the systems industry in its work ensures the technical practicality, and therefore cost-effectiveness, of its output. LA’s certainly acknowledge that the “shared development” approach of UTMC has the potential to make the most of limited resources.
- **User expectation.** The shift from network control to public information is a major change, which requires a significant extension of the traffic manager’s function. UTMC is actively involved in the UK’s “open data” initiatives. Technically, it is exploring how to incorporate elements of public-facing standards such as In-Time and TPEG, as well as mechanisms for cooperative vehicle systems.
- **Technology developments.** UTMC is outcome-driven, and its use of new technologies therefore follows largely from its context. For instance, its approach to public information and CVIS will reflect the existence of smartphones and in-vehicle telematics. However there is a need to refresh the “core” of UTMC too, for instance along the principles of service-oriented architectures. This will certainly require some care and is likely to take several years.

In addition, UTMC has expanded its scope of operations. Functions such as air quality monitoring, incident management, and electromobility networks have now been included within the UTMC objects registry.



Case Study – Greater Manchester, UK

Greater Manchester (GM) is a metropolitan county in North West England. It covers an area of 1276 km^2 with a population of nearly 2.7 million (2011). Intelligent Transport Systems (ITS), including adaptive traffic signal control, car park management system, variable message signs and strategy supervisor, play an important part in the management of traffic and travel in GM.

UTMC has been used to integrate ITS for greater efficiency of operations and procurement. In January 2013, GM placed a tender for a £15M contract to procure a UTMC compliant Dynamic Road Network Efficiency and Travel Information System Solution, which will be developed over a period of three years, and designed to facilitate the delivery of initiatives to further improve the management of transport in GM.

The open framework of UTMC provides GM with greater innovation and reduced costs. The solution will offer real-time updates on road conditions, including travel hotspots, and provide management systems and a control platform. Both the static and dynamic data will be offered on an open-source information exchange, and will be accessible through online journey planning tools, internet media and mobile phone platforms

Case Study – Liverpool, UK

Liverpool is the 6th most populous city (pop 466, 400 in 2011) in England. It is at the centre of a wider urban area which has a population of around 2 million people. Liverpool has significant road and rail networks and also an international airport and port.

It actively manages its road network and traffic using an adaptive Urban Traffic Control system, supplemented with variable message signs for displaying journey times on key corridors and for showing car parking spaces status and availability.

A UTMC Common Database links a number of systems together to provide real time car park guidance, VMS control, road works information, and interfaces with the national motorway traffic control system. Work has been ongoing to provide real time information throughout the region to bus users.

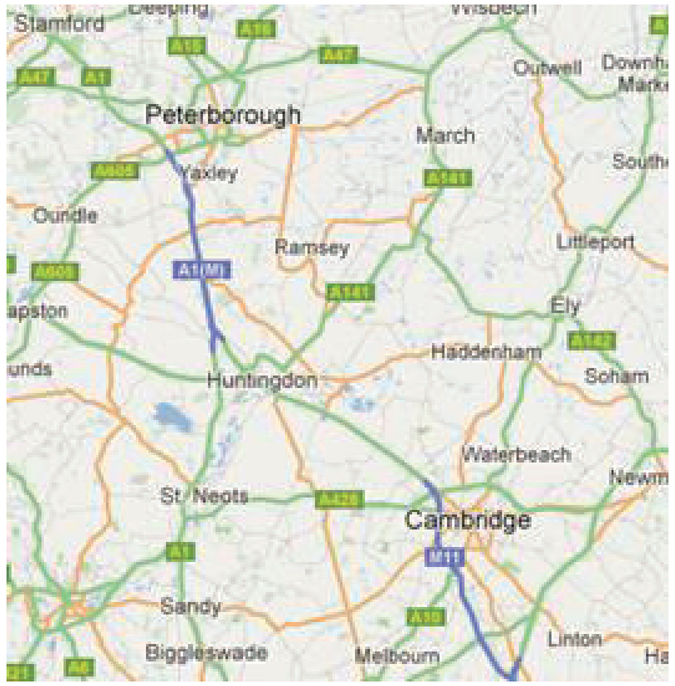
The UTMC database allows for easier control room operation, improved management of accidents, events, incidents and road works, improved view of the network status, journey time monitoring of key corridors, and car park management. It also allows for enhanced strategic management, providing operators with the ability to implement automatic responses to manage traffic during football matches and concerts.

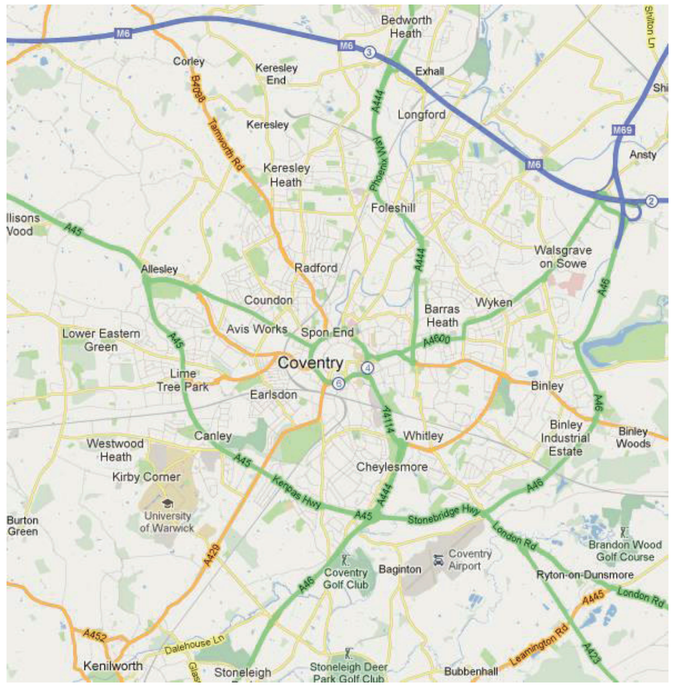
Case Study – Cambridgeshire, UK

Cambridgeshire is a medium-sized inland county in the east of England. It has an area of 3,389 km^2 and a population of approximately 612,000 (2011). The principal city, Cambridge, has a population of 122,000. Cambridgeshire has a total road network of 4,342km and is well connected by road to London and the south east by the M11 motorway.

Existing Intelligent Transport Systems include adaptive signal control, variable message signs, car parking systems, CCTV, bus priority at signals, and real time passenger information. A UTMC compliant common database receives data from signal control and journey time data acquired from a navigation system supplier. It also contains a strategy manager and provides an export of data for public use, via the web, the mobile web services and, in time, Social Media.

Cambridgeshire has seen significant benefits from adopting UTMC, in two specific areas. Firstly, during procurement allowing for the purchase of, for example, UTMC compliant variable message signs from different suppliers. Secondly, the easy integration provided by UTMC allows operations to be delivered more effectively, more intelligently, and at less cost than would otherwise be the case.





Case Study –Coventry, UK

Coventry is the 2nd largest city in the county of West Midlands with a population of 316,900 (2011). It has excellent connections with the motorway network bordering the city. The Coventry City network includes over 230 traffic signal installations within the city boundary, which are controlled by a mixture of adaptive signal control and remote monitoring. Bus Priority at signals is provided throughout the network.

Variable Message Signs and car park signs inform motorists of traffic and car park availability status. A number of Automatic Number Plate Recognition cameras are used to monitor journey time along strategic links. A UTMC Common Database links the systems together, and enables integrated fault management. The systems are operated using a combined fibre and wireless communication network.

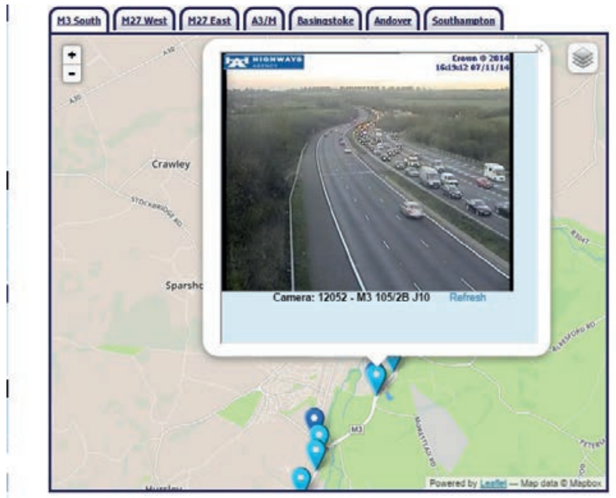
Coventry's adoption of the UTMC specifications and standards allowed the use of multi-vendor systems, integration of various traffic management tools, and provided a simple structure for the addition of new technology. At the heart of Coventry's UTMC is the Common Database which receives data from individual systems, pools the relevant information, and sends outputs to the appropriate systems or operators.

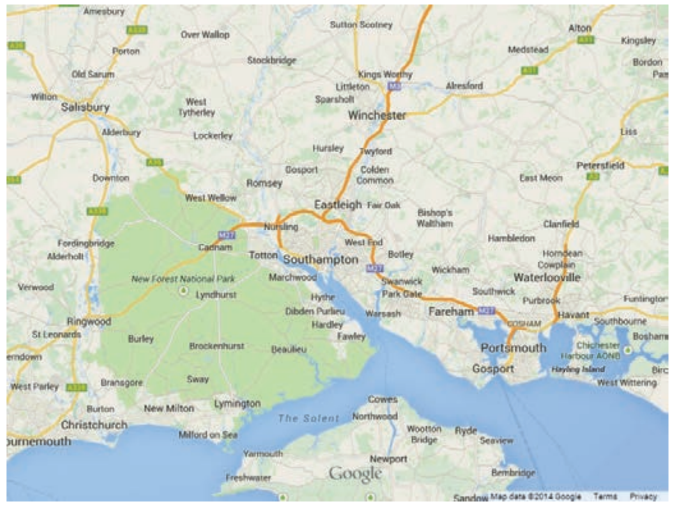
Case Study – Hampshire, UK

Hampshire is a coastal county in the south of England. It has an area of 3,679 km^2 and a population of 1,320,000 (2011). Hampshire has several urban centres, including Basingstoke, Havant, Fareham, Eastleigh, and Winchester, with substantial rural and agricultural land. In order to manage its 7,200 km long road network, including 200 signalised junctions, Hampshire uses a mix of ITS including adaptive signal control, variable message signs for traffic and car park information, CCTV, automatic number plate recognition and access control.

A UTMC database collates and processes data from various systems for decision making. Hampshire's ROMANSE is a partnership which aims to influence travel behaviour by providing up-to-the-minute traffic and travel information.

Hampshire has a long history in ITS and benefits from an unusually large and stable team of staff, with strong technical skills. This enables it to do more in-house than other authorities of its size. UTMC has been helpful in the integration of variable message signs and other systems from multiple suppliers.





Case Study – Reading, UK

Reading is a large town in the south of England. It has a population of 155,000 (2011), and a larger urban area population of 370,000 (2011). Reading is strategically located to offer its businesses and citizens good access to London and the UK's main international airport at Heathrow. It relies heavily on its ITS, which include adaptive traffic signal control, car park guidance, variable message signs, passenger information systems, and CCTV, to manage its road network. The systems are inter-linked using UTMC open specifications.

The UTMC facility provides for automatic control of the strategies applied to traffic signal controlled junctions and variable message signage in the absence of an operator, and live traffic and travel information via the Council's website. Reading was one of the four UTMC demonstrators of the UTMC initiative launched by the UK Department for Transport.

UTMC is key to Reading's ambitions for a step change in monitoring the road network situation and informing road users accordingly. In particular, UTMC's openness has helped with easier integration of systems, provided greater flexibility to mix and match solutions as necessary, and given Reading greater insight into understanding how its systems work together and how to resolve problems when they occur.

Case Study – UTMC Development Group, UK

The UTMC Development Group (UDG) is the national body responsible for managing the UTMC Technical Specification. It is an independent association of stakeholders from public and private sectors. The UDG was established in 2003 and is governed by an elected Management Group. At its foundation, funding for the UDG activities came from the Department for Transport (DfT), however since February 2010 central funding has been withdrawn, because of the tight public finance environment. Funding is now drawn from membership subscriptions and income from events such as the annual conference. The scope of UTMC has evolved over time as more activities have come into the area of integrated traffic management.

The DfT's key role as initiator and lead funding authority of UTMC was further supported by clear policy guidance to LAs to consider UTMC specifications when procuring ITS. This holistic approach was key to the take-up of UTMC in the UK.

The UTMC Technical Specification is published free of charge on the UTMC website – www.utmc.uk.com.

UTMC provides users with a wider choice of systems at potentially lower overall cost through the competition that open standards encourage; a greater choice of communications networks; and the facility to integrate a wide variety of information from currently separate sources to support traffic and network management. In 2010, more than 100 authorities, some overseas, had installed UTMC databases.

Case Study – National Bodies, UK

The UTMC framework is a UK national initiative. As well as its local impact on highways authorities, or on individual technology companies, it needs to be judged on a holistic basis. (Indeed, some of the perspectives above make the point that it is this consistency and holistic view that has been beneficial.)

Three key UK national bodies are involved in, and affected by, the UTMC initiative:

1. The Department for Transport launched the process with a specific policy goal.
2. The Highways Agency is the English national operator of motorways and trunk roads, and needs to work with local highways authorities.
3. The UTMC Development Group is responsible for managing the UTMC initiative and sustaining the process.

Each was approached and asked to give their assessment of the success of UTMC as well as its challenges and problems.

The national bodies all agree that:

- It makes sense for LA's to define their needs collectively, and to streamline the procurement process wherever possible. This reinforces the need for a good, user-led, widely-accepted standards framework such as UTMC.
- UTMC has made significant progress in helping UK local authorities manage their traffic more intelligently, and has improved the responsiveness, cost-effectiveness and cooperation of the supply market.
- UTMC is still a "work in progress". Not every relevant function is yet included in the Specification.
- The Specification needs to be kept up to date with other activities both within and outside the UK. At present the marketplace is still fragmented, with numerous standards in existence internationally.
- The actual impact of UTMC on local authorities is variable: there are some "leaders" who know exactly what they are doing and drive the market, and some less advanced authorities who maybe still struggle.
- The most significant strategic problem for UTMC is the lack of a coherent supply of resource (people and/or funding). It is very difficult to see how this can be addressed, because the benefits are so dispersed among stakeholders.

Case Study – Supply Industry, UK

To gain an insight into the experiences of UTMC implementation from the point of view of suppliers, three representatives were contacted. All of them are UDG members and long-time UTMC supporters: Mott Macdonald (a provider of central systems), VMS Ltd (a provider of roadside systems) and Atkins (a provider of professional services).

Across all of the suppliers there was a general agreement that UTMC has been substantively beneficial to them. It was found that it is not hard for staff to become familiar with the relevant parts of UTMC and that it greatly aids the dialogue between buyer and supplier as they can "talk the same language" in their procurement specifications. It was also noted that having UTMC as a national framework helps to make the marketplace more aware of the capabilities of ITS and less worried about the risk of implementation, as buyers see the use of national standards as evidence of supplier quality. Integrating products into client systems or upgrading existing UTMC products is also easier.

However, UTMC is less helpful for products which need to integrate with legacy (non-UTMC) systems. Other issues highlighted were:

- People sometimes place excessive trust in the strength of the UTMC Technical Specification. Buyers can produce poor quality procurement specifications, and suppliers sometimes claim UTMC compliance when this is not justified. The lack of standardised tender documentation is part of the problem.
- The use of "custom extensions" to UTMC, which have not been submitted for adoption, can cause problems. The nature of the scheme means that there is little incentive for suppliers to submit such extensions.
- The costs of developing, deploying and maintaining systems were generally reduced by adopting a common open standard, but the extent of this depends on the nature of the products/services supplied.
- In some cases there is a slight reduction in the flexibility of a suppliers offering, imposed by the need to be compliant; this has not, however, been a problem.

Suppliers are commercial organisations: their aim is to sustain and grow a source of profit. Their participation in UTMC will be conditioned by their expectations of how far it will contribute to this profitability.

Where the ITS buyers (in UK, the local authorities) perceive the benefits of UTMC and specify it within their procurements, companies will aim to supply within this framework. They will then endeavour to position themselves as knowledgeable, innovative and efficient – as well as well-priced – UTMC suppliers. Automatically, this generates a dynamic marketplace for buyers to select from, and a virtuous circle is established.

The UK has not reached this level of maturity yet, and suppliers are therefore still quite varied in how vigorously they adopt UTMC.

No supplier offers fully and only UTMC-compliant equipment, because:

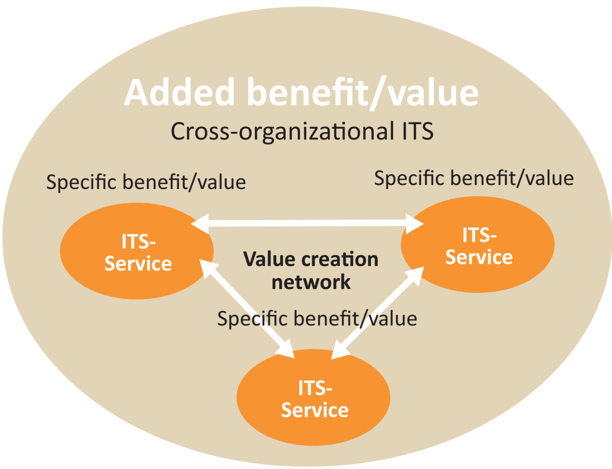
- Some clients have legacy equipment that needs maintaining, or whose systems they need to integrate with.
- Some prospective clients, especially outside the UK, may specify alternative standards.

Nevertheless, it is possible for both large and small companies to justify adopting UTMC within their core services, and to sustain that over the long term.

OCA Motivation and Objective

The renewal or extension of existing traffic management systems or their upgrade to local, regional or national ITS are tasks that can vary, to a greater or lesser extent, for each case. Those responsible for such a task have to develop a concept solution which takes into account all the requirements. The concept solution must be sufficiently developed and detailed to enable the component parts to be specified for inclusion in the procurement documentation. The procurement needs to be undertaken fully in accordance with EU and local procurement law.

In addition to the technical specification of the systems and services, which are required to fulfil the traffic and transportation policies, the issue of creating a vendor mixed environment through the specification of appropriate interoperability is of increasing importance. Increasingly, user expectations cannot be met by a single system but only by the establishment of greater networks of systems. Furthermore, the creation of added value in terms of the ITS-directive needs cross-organizational interworking and hence it is important to ensure that sub-systems or components, which may be supplied by different vendors, interoperate not only among themselves but also with an existing system environment.



The OCA started the OTS initiative (Open Traffic Systems) in 2004 to promote a vendor mixed environment with the aim of actively supporting those individuals in public bodies who are responsible for renewing or extending their existing systems. It is from this that the OTS concept has been developed.

The objective and purpose of the OTS-concept is to support the entire process from conception through to procurement of Open Traffic Systems. The main focus is on the conceptual design process which serves as the basis for the "input" and realisation of the procurement.

The OCA process is built around the OCA-procurement process model (O-model) in which the concept (partial) solutions can be mapped against specific documents (quality documents, Q-artefacts, etc).

This transfer of the concepts into a verifiable specification is critical as whatever is misinterpreted or omitted at this stage can be very difficult to correct at a later stage.

The OTS concept is essentially focused around the modernisation or redesign of systems and the key role typically associated with such a task is that of a system architect. The concept solution can therefore be seen as a system architecture[1].

Standards to enable the barrier-free or untroubled aggregation of sub-systems, which may be supplied by different vendors, is considered a key requirement of the concept solution. For the interpretation of these standards the concept of "distributed systems" is taken.

[1] With ***architecture*** a design concept for a design area is addressed where concepts of the design area are set in relation based on superior rules. A ***system architecture*** focuses on the identification of system components and relationships between them which are based on superior rules or regulations.

This means a system solution should comprise the characteristics of a "distributed system" independent of whether it is a mixed vendor implementation or from the same manufacturer. The feature to be emphasized is the loose link-up of sub-systems in a sub-system network, which means that exchange of information and thus communication is an essential part of the specification.

The OTS-concept therefore provides answers to the following questions, which in practice often come up again:

- How to proceed, within the constraint of public procurement rules and regulations, with system modernisation/system redesign and procurement of a complex system in the traffic environment?
- How to deal with a vendor mixed environment as a way of flexible adaptation without the associated negative effects?
- How to produce the technical specification for a tender in accordance with OTS, without violating public procurement law; what lots are useful?

The OTS-concept addresses people in public administrations in their role as a contracting body who are involved in different ways and with different powers, skills and responsibilities in the design, planning and implementation of the renewal or extension of existing systems in the transport sector. But it also addresses people;

- who are entrusted with the implementation of certain interests of entities; or
- who are contractors with the wish to satisfy the customers' desires, and therefore need to better understand what is meant by terms of Q-artefacts from the customers point of view.

The motivation for a vendor mixed environment and the possible respective implementation is derived directly from the main objectives and expectations of the OCA and its members:

- implementation of open, future-proof systems;
- use of components that have the best value for money throughout the system;
- Reduction of expenses (personnel costs and investment) for the system operation;
- Achieve a greater independence from specific vendors, so that a replacement of components or a change of supplier is possible at any time;
- integration of traffic control in the current and future information systems;
- application of new technologies for legacy systems with the possibility of migration; or
- reduction of complexity for the operator.

Competition in the public procurement of traffic signal control systems leads, and has led to implementation of systems from different vendors: With the German communication standard OCIT®, which entered the market in 2004, it was the first time that it was possible to separately procure the central system and the field controllers of a traffic light system. This subsequently led to a significant reduction in prices for the contract award but also led to increased expenses in the operation of mixed systems.

Having a vendor mixed environment goes one step further – systems and sub-systems are designed so that the various sub-systems can be supplied by different manufacturers and can be exchanged without any problems by sub-systems from other manufacturers at a later date. The mixed environment therefore leads to further opportunities to use open specifications at the system level, eg:

- via standardised interfaces (eg: OCIT® and OTS2) and
- a standardised procedure model for system procurement and development (eg: O-model).

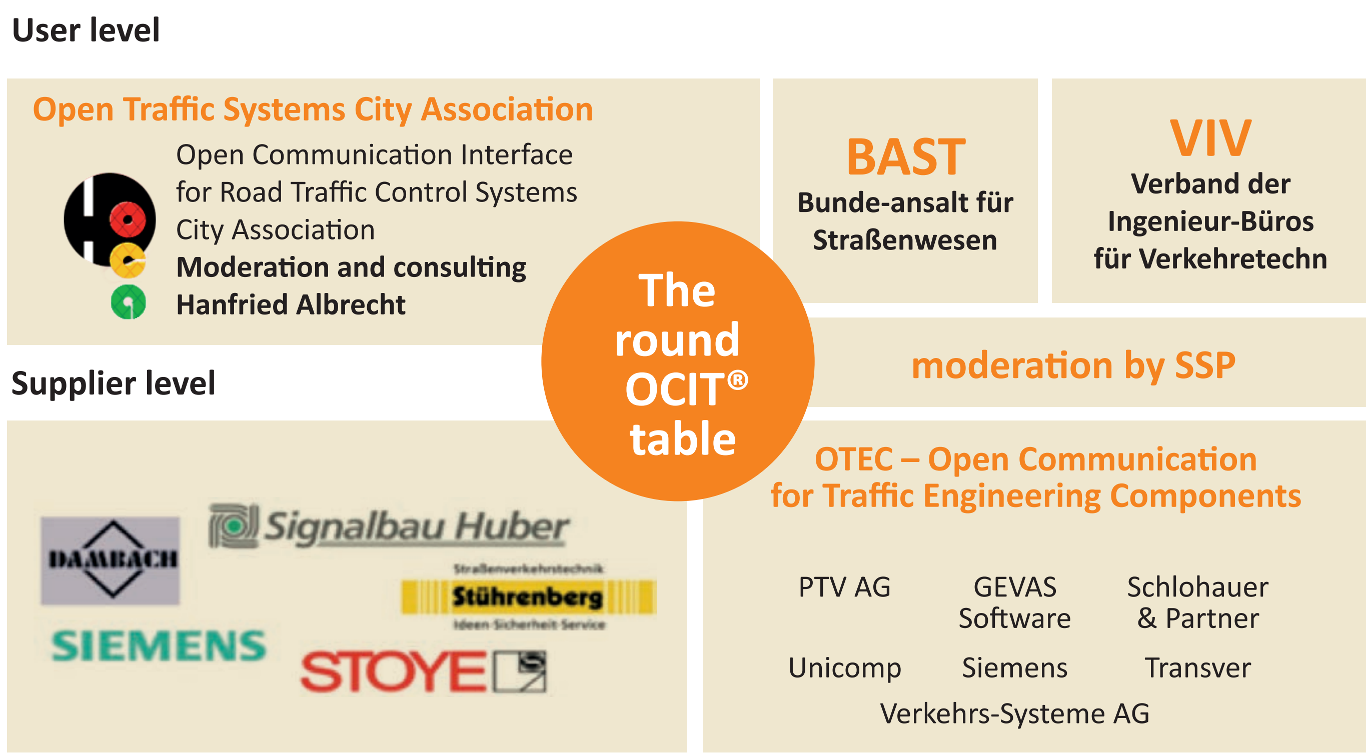
The opportunity for having a vendor mixed environment does not necessarily lead to mixed vendor implementation, however, the opportunity should be there to enable cost effective procurement.

OCA Motivation and Objective

Local Authorities in the DACH area (German, Austrian and Swiss) were already under pressure in the early nineties to bring down costs for traffic signal system procurement by opening up the traffic controller market to competition. As an appropriate tool the use of interface/ communication standards were considered thus breaking up so called monolithic silo-systems into several parts, which then could be tendered and procured separately as different procurement lots. As no one single interface standard was available on the market at that time the initial reaction of the people responsible for public procurement was to establish and specify interface standards which related to their own local authority.

As this would have incurred incalculable risks in terms of costs for interface development and maintenance a group of five German system suppliers initiated the OCIT®-initiative in 1999 (OCIT® stands for Open Communication Interface for Traffic Systems, see www.ocit.org), which aimed at replacing specific local authority standards with a single, open industry standard, named OCIT®.

As a result of this industrial effort a group of local authorities, initially ten larger cities, founded an association named OCA (Open Traffic System City Association e.V., see www.OCA-eV.org) to determine their interests and to play a role alongside industry in the standardisation process.



Today the OCA has grown to an international association of about 40 German, Austrian and Swiss public road authorities. The majority of OCA's members represent metropolitan areas and cities; some are regional bodies and city associations themselves.

The purpose of the OCA, membership of which is open to any municipality and all other public road authorities, is on the one hand to encourage competition between suppliers through the creation and application of standards and open interfaces between ITS-systems and components and on the other hand to improve the efficiency and quality of procurement and operation. These goals are also reflected in the articles of the German law-registered association. OCA's members commit to:

- improve efficiency through open interfaces and technologies;
- create more competition in the procurement and operation of systems;
- simplify the tendering procedure;
- encourage the direct exchange of information between municipalities on a national and international level; and
- consolidate user needs and requirements to be in a stronger position vis-à-vis industry.
- At the same time as local authorities teamed up two other OCIT®-stakeholder groups were formed:
- OTEC – Open Communication for Traffic Engineering Components (a supplier consortium for the standardization of communication between traffic engineering software-components); and
- VIV – Association of traffic engineering consultants were established and - together with the German Bundesanstalt für Strassenwesen as representative of the German ministry of transport - joined the OCIT®-initiative.

Finally in order to bring all these stakeholders together the "OCIT®-Round table" was formed which can be divided in two major groups representing on one hand the user side (OCA, BASt and VIV) and on the other hand the supplier side (ODG and OTEC) and which was moderated by a public financed moderator.

After the foundation of the OCIT®-Round table it took several years, before the first OCIT®-specification, OCIT®-Outstations 1.1, was available and could be used for tendering. As a consequence the resulting competition led to significantly lower prices with savings on average of about 50% and up to 80% at its peak in terms of investment and maintenance costs for signal controllers.

Now, nearly 15 years after the beginning of OCIT® - a set of several OCIT® communication standards is available to facilitate the implementation of vendor mixed traffic light systems and it can be stated that financially OCIT® is a real success story for both the client side and for system suppliers and in particular for some minor system suppliers, for which OCIT® was the tool to win contracts in larger cities, where up to then the big suppliers dominated the market.

In the meantime OCIT® is not only applied in the DACH market. Many manufactures from different European countries have acquired OCIT®-licenses (see www.ocit.org/Nutzungsrechte.htm) and for many cities and counties the OCIT®-Standard was used to build up vendor mixed traffic light systems.

Although all members of the OCIT®-Round Table contributed with significant effort and considerable resources to set up the requirements and deliver specifications for OCIT® it is important to note that the five founders of OCIT® (Siemens, Dambach and Signalbau Huber (both today part of Swarco), AVT Stoye and Stührenberg) have the final decision on the content and the layout of the standard. This was agreed, as OCIT® itself was registered as a trade mark owned by these companies.

Furthermore the right to use OCIT® specifications within products is bound to the payment of a licence fee, which is used to maintain and to further develop the Standard. A version 3.0 of OCIT-Outstations is planned to include further specifications for planning data supply and also to cover the first step requirements for the application of cooperative systems.

Suppliers who have purchased the right to use the OCIT® interfaces may use the trade mark OCIT® in product names. Details are regulated in the user agreements. All manufacturers that have rights of use of OCIT® interfaces can use, "OCIT® integrated". This means that one or several OCIT® interfaces are integrated. It is not a quality seal and no statement about the range of the implementation.

Going beyond: the OTS-initiative

Despite the broad acceptance in greater parts of central Europe and despite its financial success for the user side, OCIT® also has some weaknesses. On one hand they result from the resistance of the industry to fulfil important user requirements, which were setup in the beginning of the OCIT®-round table but are still not covered by the current OCIT®-specification. On the other hand they are based on the fact that the OCIT® initiative exclusively targeted the domain of traffic signal control and that the OCIT®- communication standard is not designed to respond to requirements that go beyond those first and most economically motivated aspects of facilitating vendor mixed traffic light systems.

Such requirements result from projects which go beyond signal control and have the political aim of delivering an integrated network management system. As a consequence, traffic light control systems have to be extended beyond their original purpose in order to be part of greater traffic management approaches eg re-routing in overloaded urban/inter-urban networks or in order to support entirely new services such as contributing to traffic situation analysis and reports by delivering online traffic data. Such objectives can only be reached if conventional traffic control systems are integrated into so called "traffic management and traffic telematics systems". In Germany examples of such systems were already developed in the late nineties through the initiative "mobility in conurbations" and later in the "traffic management 2010" programme.

One major finding of these projects is the fact that interconnectivity, which is necessary for network wide traffic management functionality, calls for the interoperability of every sub system participating in such integrated vendor mixed environments. This includes interfaces between urban traffic systems, and also beyond, on the urban/inter-urban interface as well as on the interface to public transport. Furthermore it was found that the sole concentration on interfaces is not sufficient but rather an increased consideration of communication technology in general, especially open data communication, for distributed systems is necessary.

However, due to established practices, local authorities and manufacturers were, and are still, not prepared for the new demands they face in introducing open specifications and standards. Consequently, they can find the process of setting up a vendor mixed environment for a task difficult to achieve. Hence, as a representative of the purchasing authorities, the OCA saw itself in a leading role to take over responsibility of supporting their members in the re-design and procurement of their systems by creating a vendor mixed system design framework and delivering an appropriate communication standard and hence going far beyond OCIT®.

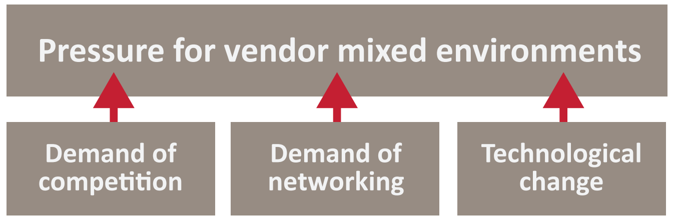
In light of this in 2004 the OCA-board started a forward strategy and as a consequence of a restriction preventing the use of the OCIT®-brand the OCA used its own label and launched the "OTS-initiative" where OTS stands for Open Traffic Systems and is derived from the name of the OCA. This decision was made with the clear intention to release, in some way, the role of the industry which has dominated the OCIT®-process and is intended to give importance to its role as the representative for the contracting entities. This decision was later confirmed via "OTS decisions" at several OCA meetings of members (2005, 2006, 2007 and 2008).

Vendor mixed environment as a problem

A vendor mixed environment is a result of the demand for and the introduction of competition. This requirement leads to the need to separate the tender into various lots to achieve the best price/performance ratio. The separate lots must be specified in a way that enables potential suppliers to offer a solution, even if the lot has a functional dependence on other lots or to existing systems.

By extending an existing system with systems from different vendors, like traffic management or ITS systems for instance or integration of other system components from other manufacturers, the complexity of the system environment increases.

However, the mix of systems of different manufacturers is also a result of technological change. Established companies can suddenly find themselves in competition with new companies that exploit technological changes to access their market. These technological changes can result in lower cost products and/or improved functionalities for sub systems in the context of renewal cycles.



A vendor mixed environment is not a goal but a (usually troublesome) way to adapt local system structures to the current local and strategic OSS during the course of renovation or alteration. This means existing systems of one manufacturer, which due to various mostly historical reasons have very different functional and technological characteristics, need to be distributed appropriately and combined with new parts in accordance with local circumstances and opportunities.

Interoperability and data exchange, which previously took place within the manufacturer's monolithic systems, almost like in a black box, must now be realised via open interfaces. Only where such interfaces can be implemented using existing standards and existing implementations of such standards can the realisation of systems from different manufacturers be possible with manageable effort.

The problem is also to integrate existing systems, often from different manufacturers, with new systems, often from other manufacturers, into a composite system. Systems must be specified to form independent lots for sub systems and their services as parts of the tender so that as a result various manufacturers may calculate, offer and deliver their products without any "problems". Problems often arise from inadequate specification of lots. This creates the risk of challenges to the procurement process or a difficult consensus building with delays and further supplementary claims by suppliers.

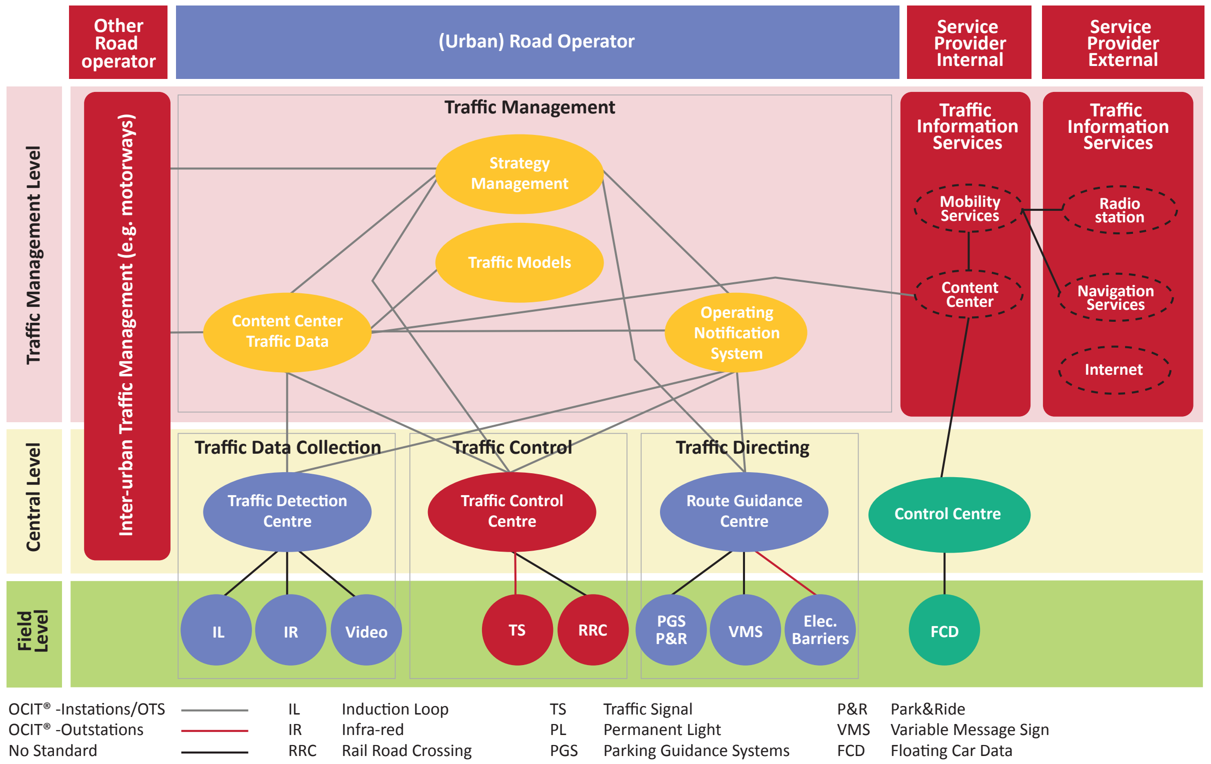
Another consideration is the geographical distribution of the systems. Where various parts of a network spread over various jurisdictional borders (public and private) different objectives can become an issue, for example in terms of system philosophy, operational framework etc.

The OTS initiative aims to help authorities address these issues.

Case-study: City of Stuttgart, Germany

Stuttgart is located in southern Germany and is the capital of the federal state of Baden-Wuerttemberg. It has a population of approximately 578,000 with a road network length of 1,500 km. It has a total of 805 traffic signal installations with 259 of them having OCIT® compliant controllers. Stuttgart is at the heart of one of the strongest industrial regions in Germany. The city is a major location for the automotive industry, as well as for science and technology. Within the City of Stuttgart as well as the Stuttgart Region public transport has already reached a very high level, but is still being improved constantly. Stuttgart is also very active in the field of information and communications technologies, particularly with its integrated traffic management centre IVLZ in view of traffic management, signalling, incident handling and traffic information.

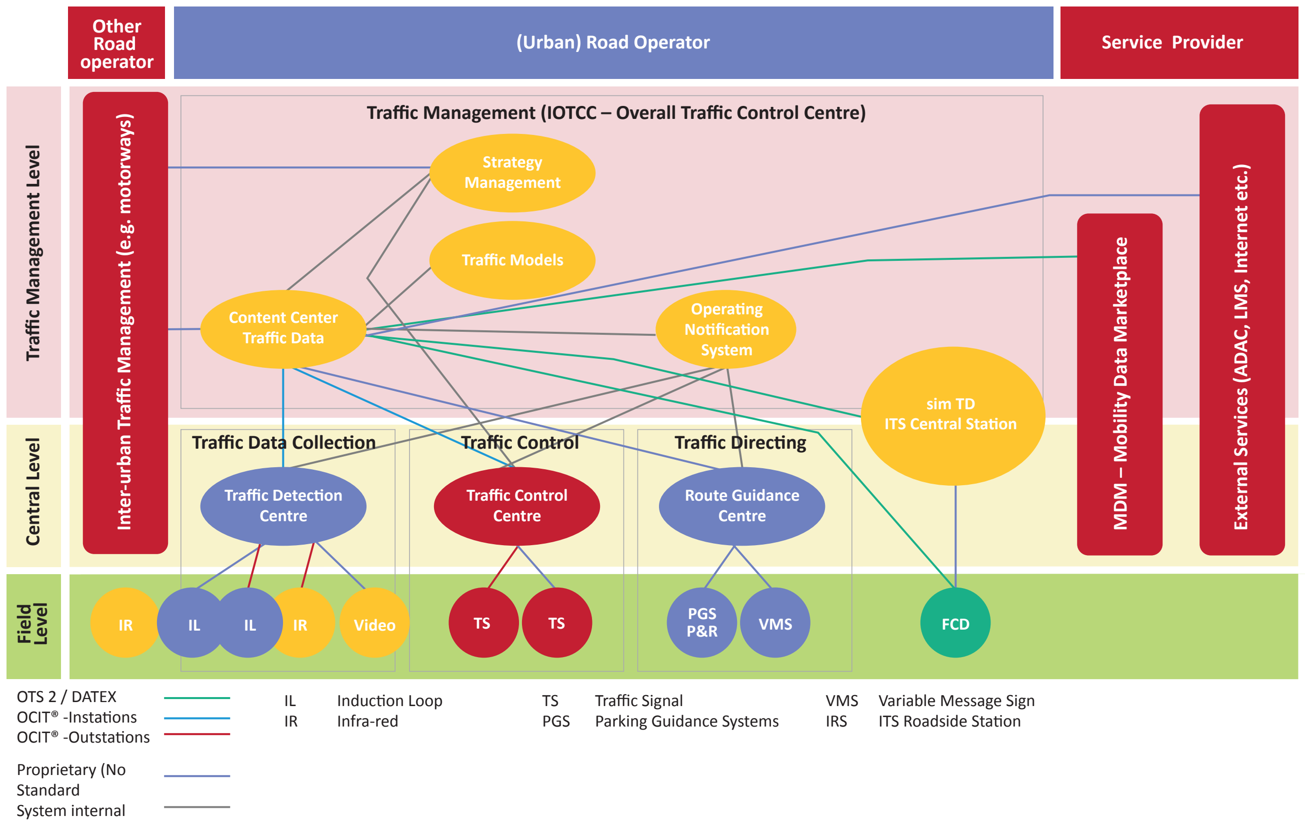
The use of open standards in the form of OCIT®-0 and OCIT®-1 has been adopted with the intention of fostering competition, economic efficiency, quality assurance and simplification in terms of public procurement procedures. Through the implementation of systems based on open standards the risks of vendor lock-in have been minimised and the goal of connected ITS-Systems of different vendors in one main traffic management system with open interfaces has been brought closer. While this implementation has not been free from challenges, especially with regard to interpretation of the interface description within the standards, there have been measurable benefits in terms of reduced costs and the provision of a mixed vendor system.



Case-study: City of Frankfurt am Main, Germany

Frankfurt is located on both sides of the river Main south-east of the Taunus mountain range. It is the largest city in the federated state of Hessia in the south-western part of Germany. The city area is 248.31 km² with a population of 700,000. It has a road network length of 1400 km with a total of 861 traffic signal installations, 180 of them having OCIT® compliant controllers. Frankfurt am Main is the fifth largest city in Germany, following Berlin, Hamburg, Munich and Cologne. Today Frankfurt is a modern, service-oriented society, a place maintaining innovative residential and industrial concepts as well as an energy-efficient and environment-friendly outlook. Frankfurt is active in the field of information and communication technologies, with its Integrated Overall Traffic Control Centre (IOTCC) linked to traffic management, signalling, incident handling and traffic information.

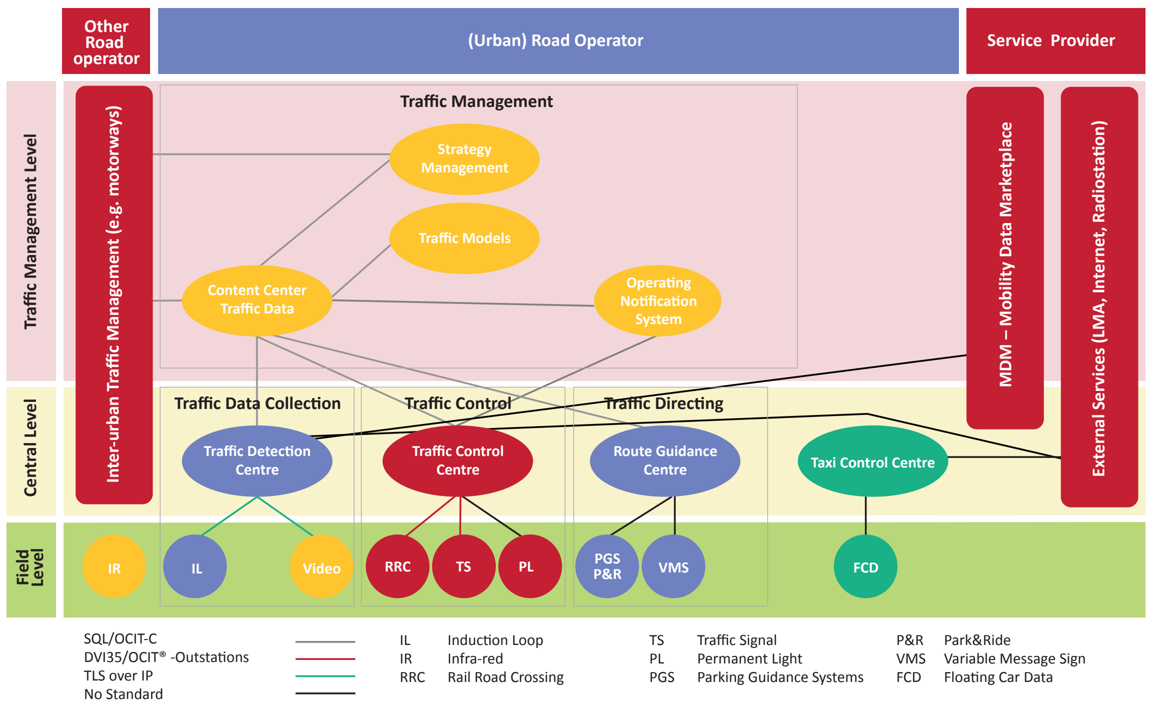
The adoption of open standards (OCIT®-I,OCIT®-0,0TS1,0TS2), and open interfaces in the ITS-domain was intended to provide savings in procurement, long term protection of infrastructure investment, and to avoid vendor lock-in. It has enabled urban ITS systems (traffic control centre, information panels, signal controllers etc.) to be integrated through a common data model. Combined data provides a platform for more effective delivery of multi modal real time travel information to the public and to better manage the network and deal with incidents. The use of open standards have provided measurable benefits in terms of cost reductions in the procurement of field level systems through greater competition, although some issues have arisen through differences in interpretation and gaps in system and functional coverage of the standards.



Case-study: Free and Hanseatic City of Hamburg, Germany

The Free and Hanseatic City of Hamburg, one of the 16 states of the Federal Republic of Germany, is the second largest German city with its 1.7 million inhabitants. In this sense, it is a city as well as a state. Economically and culturally, Hamburg is also the centre of Northern Germany. 3.5 million people live in the 755 square kilometre metropolitan region of Hamburg. Hamburg is the second largest container harbour in Europe and seventh world-wide. It's only 120 km from the sea and is able to accommodate the largest container ships the world offers. Transport in Hamburg comprises an extensive road network, rail system, subway system, airports and maritime services. The key element to Hamburg's public transport system is the network of rapid transit and regional rail services focused on the city centre. At the same time there is a network of buses, consisting of many metro buses and some town bus lines which connect up with the rapid transit and rail services. The length of road network in Hamburg is about 4,000 km. The Hamburg road network includes 1186 signalised junctions and 568 pedestrian crossings many of which are connected to adaptive systems, along with parking guidance and traffic information systems. All field level devices being connected to the traffic control centre using an open interface standard (DVI 35, OCIT®-2.0).

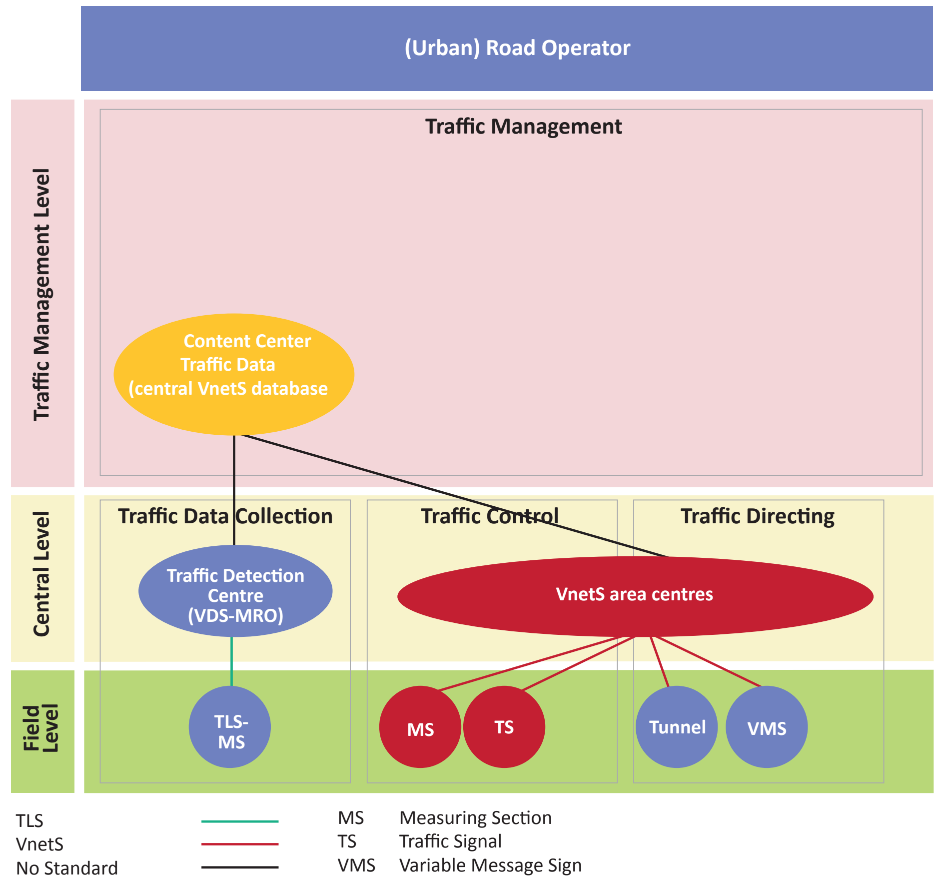
The use of open standards has been adopted with the intention of fostering competition, economic efficiency, quality assurance and simplification in terms of public procurement procedures. Through the implementation of systems based on open standards the risks of vendor lock-in have been minimised and the goal of connected ITS-Systems of different vendors in one main traffic management system with open interfaces has been achieved. Challenges have occurred during the implementation, especially with regard to interpretation of the interface description by different vendors within the standards. There have however been measurable benefits in terms of reduced costs and the provision of a mixed vendor system.



Case-study: City of Munich, Germany

Munich is the capital and the largest city of the German state of Bavaria. It is located on the River Isar north of the Bavarian Alps. Munich is the third largest city in Germany, behind Berlin and Hamburg. Munich lies about 50 km north of the northern edge of the Alps, at an altitude of about 520 m. With a population of about 1.42 million people living within the city limits the city has an area of 310.71 km^2 and a length of road network of 2300km. It has a total of 1100 signalised installations all connected to the traffic control centre using the VnetS open standard developed by Munich in 1999. Of the 1100 controllers, 700 have full functionality and 400 have a reduced functionality. Munich is active in the field of information and communication technologies, with a modern well equipped Traffic Control Centre, monitoring traffic conditions and systems on the main roads able to respond to traffic conditions through links to signalling, incident management and traffic information.

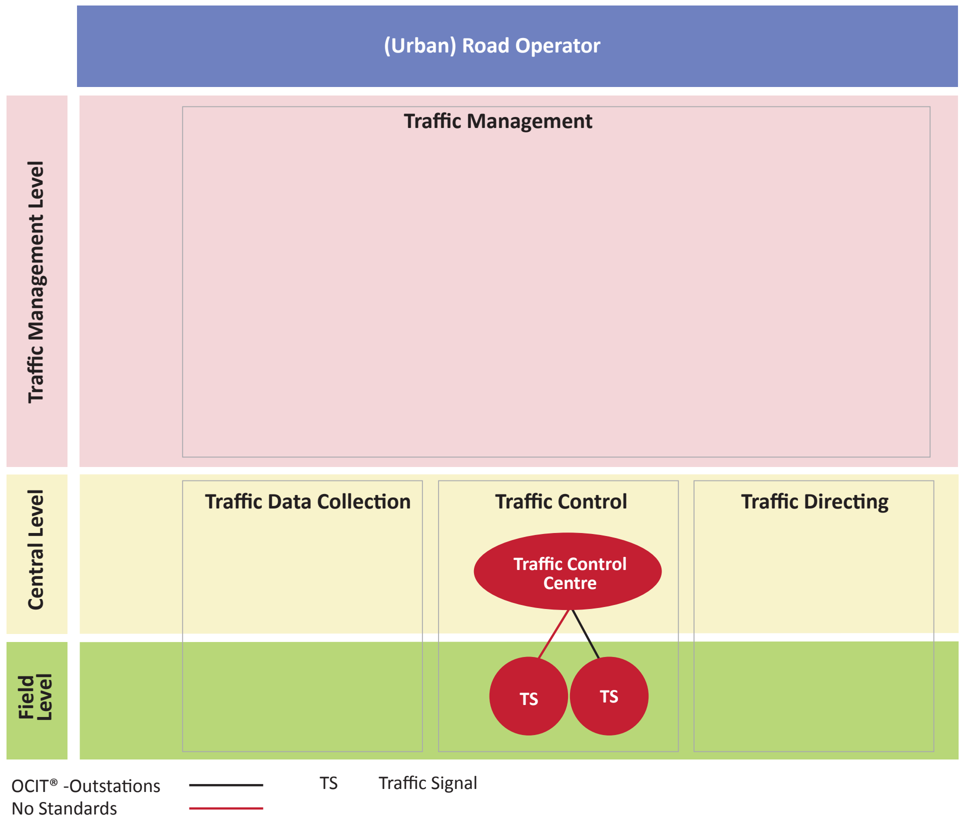
The use of open standards has been adopted with the intention of fostering competition, economic efficiency, quality assurance and simplification in terms of public procurement procedures. Through the implementation of systems based on open standards the risks of vendor lock-in have been minimised and the goal of connected ITS-Systems of different vendors in one main traffic management system with open interfaces has been achieved. Challenges have occurred during the implementation, especially with regard to interpretation of the interface description by different vendors within the standards, there have however been measurable benefits in terms of reduced costs and the provision of a mixed vendor system.



Case-study: City of Kassel, Germany

Kassel is located in the heart of Germany close to major freeways and high velocity rail tracks. The economy of Kassel covers machine construction (railway locomotives, arms industry, car manufacture), solar technology, university and administration. Every sixth year Kassel is the world capital of modern art during the "documenta"-exposition. It has a population of 196,526 inhabitants (ca.450.000 inhabitants in the urban agglomeration) and an area of 106.8 km^2. It has a length of road network of 672 km with 113 junctions + 99 signalized pedestrian crossings, with 187 of them having OCIT® compliant controllers. Its public transport provision consists of railway, regional tram lines, local trams and buses. Kassel is active in the field of information and communication technologies, with its Traffic Control Centre monitoring traffic conditions, and systems able to respond to traffic conditions through links to signalling, incident management and traffic information.

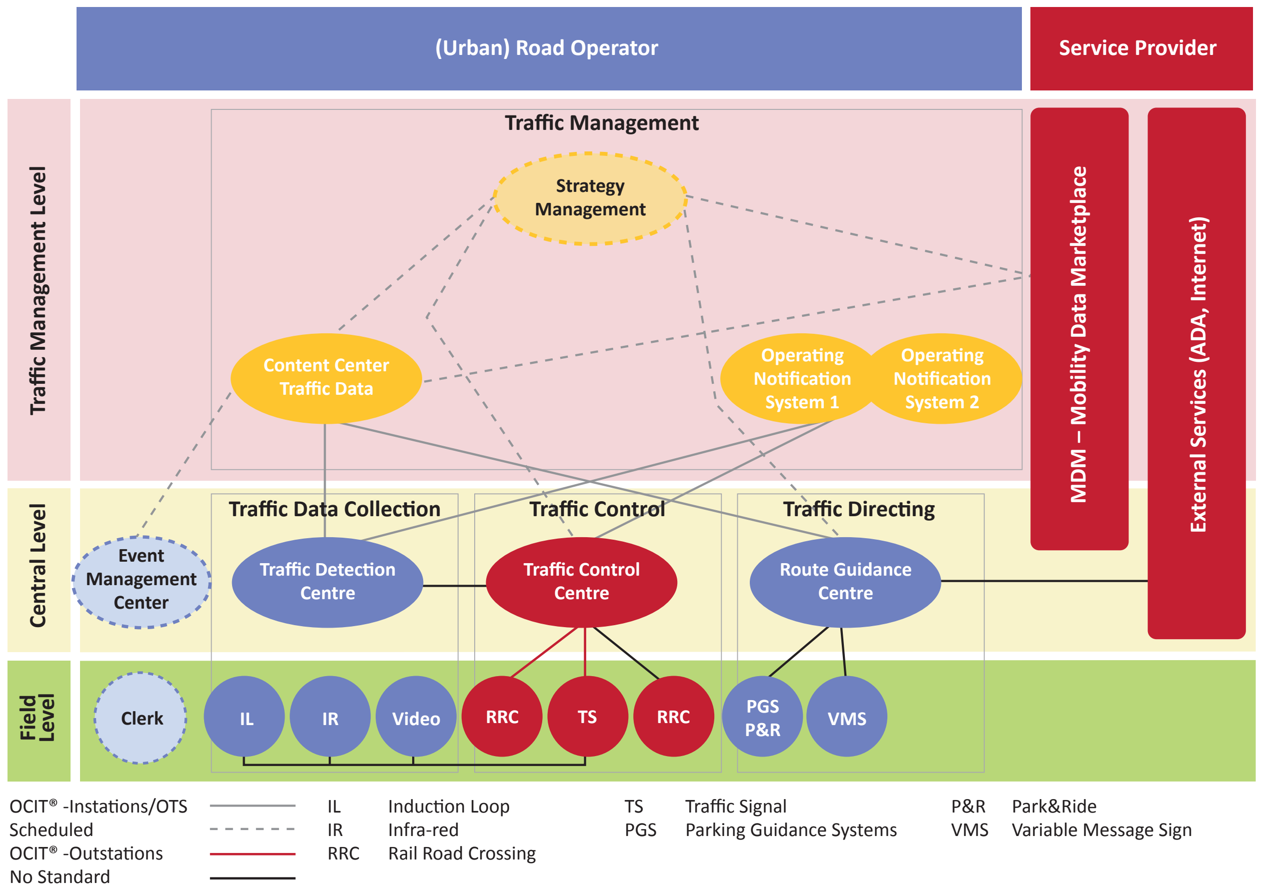
The use of open standards has been adopted with the intention of fostering competition, economic efficiency, quality assurance and simplification in terms of public procurement procedures. Through the implementation of systems based on open standards (OCIT®-1, DATEX II) the risks of vendor lock-in have been minimised and the goal of connected ITS-Systems of different vendors in one main traffic management system with open interfaces has been achieved. Challenges have occurred during the implementation, especially with regard to interpretation of the interface description by different vendors within the standards, there have however been measurable benefits in terms of reduced costs and the provision of a mixed vendor system.



Case-study: City of Russelsheim, Germany

Russelsheim is located south west of Frankfurt in the German state of Hessen in the Rhein-Main-Region. It consists of three settlements — Russelsheim and the suburbs Bauschheim and Konigstadten. The city area is 58.3 km^2 with a population of 61,074. It has a road network length of 183.3 km with a total of 71 traffic signal installations, 37 of them having OCIT® compliant controllers. The river Main lies north of city centre, with motorways east, south and west of Russelsheim. The motorway BABA 60 separates Russelsheim from Konigstadten and Bauschheim. There are three radial main routes to city centre and one route surrounding the city centre. There is a railroad between Frankfurt and Wiesbaden/Mainz in direct vicinity of the city centre, which splits Russelsheim in half with the city centre lying in the northern half. The signal installations on the four main routes are operated in a coordinated regime through the Traffic Control Centre.

The use of open standards has been adopted with the intention of fostering competition, economic efficiency, quality assurance and simplification in terms of public procurement procedures. Through the implementation of systems based on open standards (OCIT®-1.1) the risks of vendor lock-in have been minimised and the goal of connected ITS-Systems of different vendors in one main traffic management system with open interfaces has been achieved. Challenges have occurred during the implementation, especially with regard to interpretation of the interface description by different vendors within the standards, there have however been measurable benefits in terms of reduced costs and the provision of a mixed vendor system.



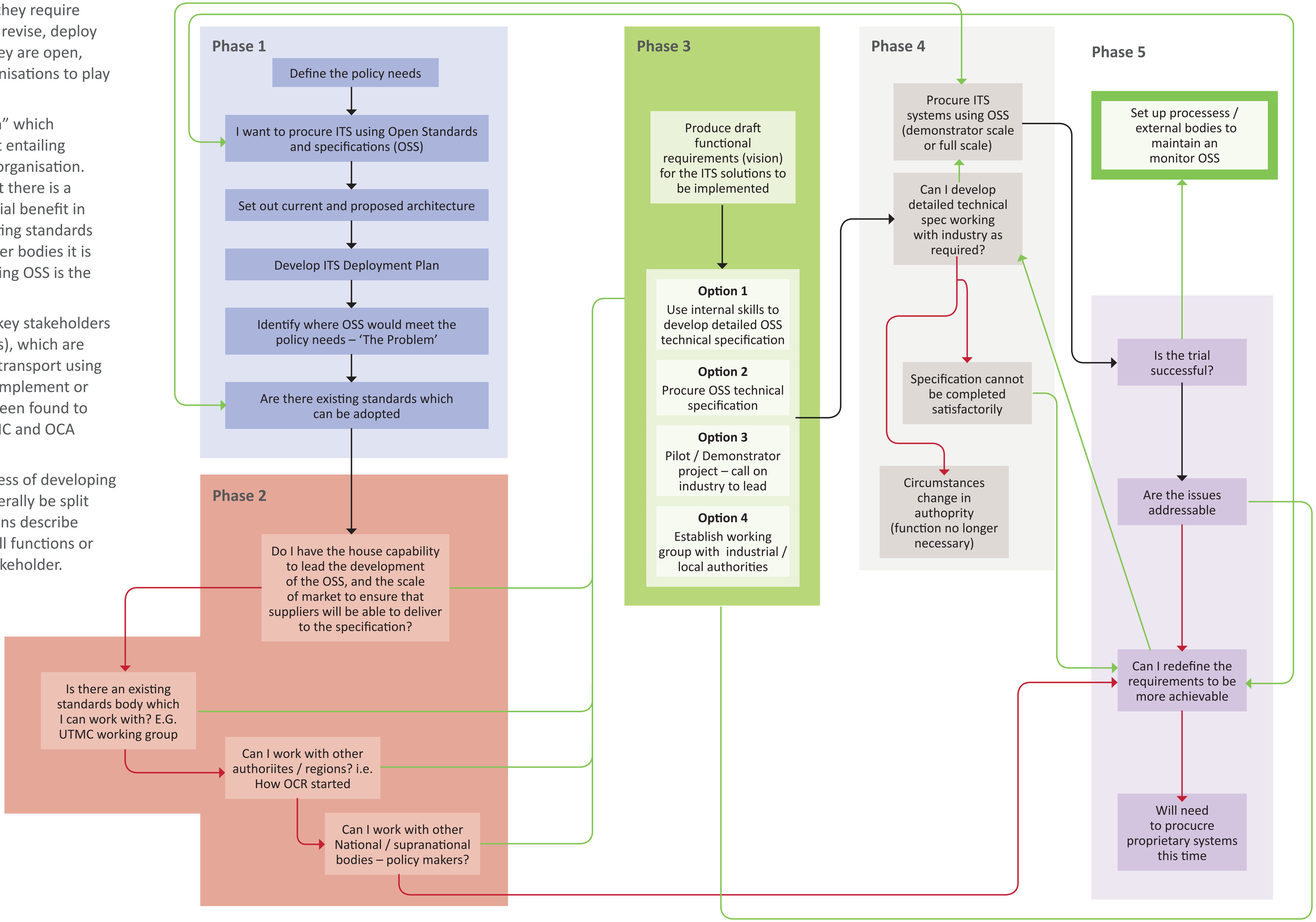
Chapter 7. Guidelines for how to Implement and Develop Open Specifications and Standards

The benefits of OSS are clear, but they require effort to draft, review, implement, revise, deploy and use. Furthermore, because they are open, they require a lot of different organisations to play their part.

The goal is a standards “ecosystem” which is of benefit to everyone – without entailing unreasonable cost or risk to each organisation. It is therefore useful to ensure that there is a clear operational and/or commercial benefit in developing new OSS and that existing standards cannot be implemented. For smaller bodies it is likely that implementation of existing OSS is the only realistic option for their use.

This section provides guidance to key stakeholders – particularly local authorities (LA’s), which are directly responsible for managing transport using a local road network – on how to implement or develop OSS, based on what has been found to work well (or less well) in the UTMC and OCA initiatives.

The functions involved in the process of developing and using open standards can generally be split into 5 phases. The following sections describe in more detail these phases. Not all functions or phases will be relevant to each stakeholder.



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INTERREG IVC

Phase 1 Defining Needs and System Requirements

Defining Policy Needs and the Local Architecture

The need for new OSS is fundamentally driven by the need for a new ITS or expansion of an existing one. As such clearly defining the policy needs which are behind the ITS requirements is the first step.

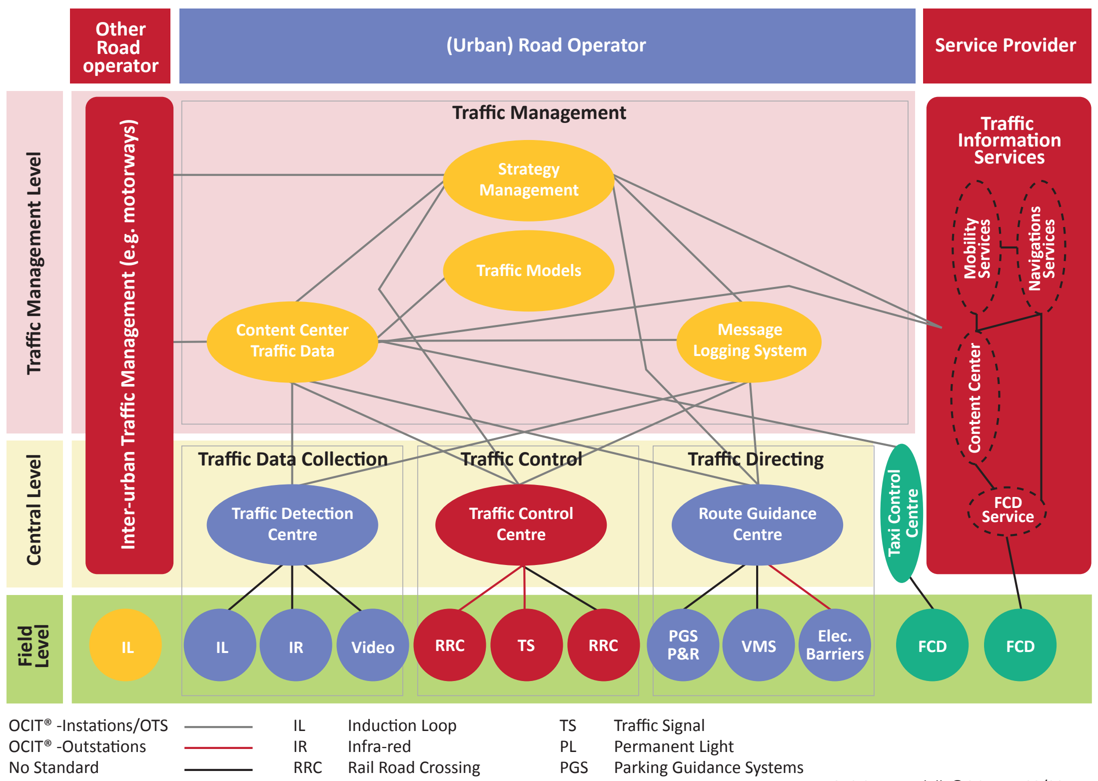
To make effective use of specifications, you need to:

- Define your authority's transport and mobility needs in the short to medium term (next 2 to 5 years?). If you do not already have plans then the Sustainable Urban Mobility Plan (SUMP) approach provides a good example.
- Understand the ITS you have and that you require, and how they connect together (the "local architecture") to meet your current to medium term needs. The OTS system model figure provides a good example of how to illustrate system architecture.

Developing an ITS Deployment Plan (Defining the problem and potential solutions)

Once an understanding of policy needs and system architecture/requirements has been achieved it is useful to develop an ITS deployment plan. This process should bring together all the relevant issues and requirements along with implementation and resource planning. In this way informed decisions can be made at an early stage as to the most appropriate route to deployment.

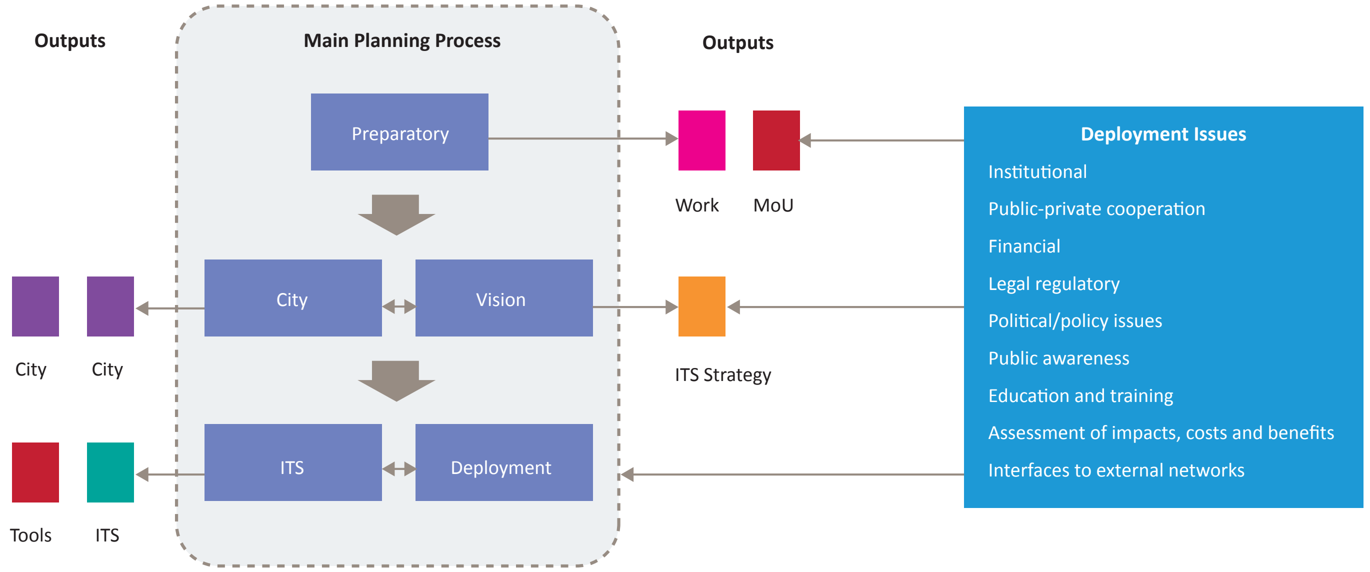
The process also provides an ideal opportunity to compare the goals of the system to be deployed with current OSS to identify any opportunity to adopt those. This is especially important for smaller authorities where the cost and resource requirements involved in the development of new OSS can be prohibitive. The adoption of an existing Open Specification or Standard should however be considered by all authorities as it is likely to be significantly more cost effective than developing new.



OTS-Systemodell, ©OCA e.V. 03/2014

In adopting a specification framework, the key questions should be:

- Does the framework cover the ITS functions already present in your systems? Is there a framework which is common to all of your current systems?
- Does the framework cover the ITS functions that you need? (If not, it will be of limited benefit.)
- Is the framework well established and actively supported? Is there an active user community driving development?
- Is your likely supply market familiar with the framework? (If not, there will be major risks when you use the framework in procurement.)



If at this stage an appropriate Open Specification or Standard is identified as appropriate for adoption then the next stage can be to progress the procurement using this standard.

To adopt and make effective use of specifications, you need to:

- Identify a specification framework which best matches your needs, and adopt it as the "default" for future procurements and developments. Cite the relevant elements of the specification framework in procurements, and require suppliers to demonstrate compliance to a suitable level of rigour.
- Understand how to ensure that suppliers' claims of compliance are accurate.
- External advice may be needed for some of these steps.

If however it is identified that no appropriate standard exists and indications are that the economics/resources make it practical then the next stage is to identify clearly what you hope to achieve through the development of OSS.

Define the problem(s) which you believe that new OSS should address and prioritise those which you believe to be of greatest benefit to your system.

Defining the problem to be addressed should bring together:

- Policy Objectives, which are the primary systems required to meet these objectives.
- The local architecture – which are new systems, and which are legacy systems – which sub-systems are already linked by proprietary links and how viable is it to change these / connect to open interfaces, is legacy equipment modern and expensive to replace or could some systems be switched out to enable OSS?
- The suppliers market – are there viable alternative products and services which would enable you to obtain real benefits such as reduced cost or improved functionality?

The need for Open Standards and Specifications can be highlighted at different levels. At a local level new ITS system requirements may demonstrate the need. Alternatively a national/supranational policymaker may watch for market failures (eg suppliers with excessive market power) and consider responding to them through developing or strengthening the open specification framework.

An open specification needs to be well-researched. The following are typically required:

- The need for an open specification must be clear. If LA's and suppliers agree that a published standard would assist in linking, say, car park monitors to traffic signals, there is a good chance that it will be worthwhile.
- The technical basis for the specification needs to be robust and sustainable. There is no point in developing a standard approach using obsolete technologies.
- The development of the requirements and of the technical specification need to have the support of a significant percentage of the marketplace. Ideally, all key suppliers should be involved.
- The specification should be usable. It should not rely on features which most LA's are not going to have for the next twenty years (say, full video coverage of the road network).
- The specification should be unambiguous (or at least, options should be clear and explicit). It is critical that interactions between systems should be defined sufficiently to remove the possibility of different interpretations and thus different implementations.

To achieve these factors, some research will be necessary. This could be sponsored by either "leader" authorities or by national policymakers. Either way, it will need the involvement of the supply industry and a number of participating LA's.

A useful way of addressing many of these issues is to convene a working group which contains representatives of key stakeholders.

The working group should be open in principle to all participants, and chaired by someone independent of the supply industry.

The research required for an open Specification should be distinguished from:

- Preliminary research, which aims to determine the technical feasibility of a specific ITS concept. (This kind of research is undertaken by universities etc, as well as in initiatives such as the EC's Framework Programme.)
- The production of formal standards, which determine an approach to a specific technical issue, but may be well ahead of their need by the marketplace. (However, the library of formal standards provides a valuable source of material for open specifications.)
- Market research for a specific product. (One aspect of such market research might be the importance of compliance with an open specification.)

Phase 2 determining the best working approach

Organizational Scale and Compatibility Assessment

Many local authorities will not have the technical skills or human resource to take an active role in developing standards and specifications. These LA's will be primarily **adopters**.

In some areas, it may be that there is no suitable framework. In this case, you could press for action at a higher political level. It may also be helpful to work with other LA's in a similar position, to adopt, sponsor, support or create such a framework (see the following sections).

Larger LA's (typically, cities and regions with a population of well over 1M) may have more capability to be involved in creating standards and specifications. The largest will have very significant purchasing power, and will be able to drive the supply market into new directions of innovation and competition. These LA's will be primarily **leaders**.

Clearly there is no fixed point at which an LA becomes large enough to be a "leader". The very largest authorities will have strong market power and may have the technical depth to create their own standards frameworks. Slightly smaller authorities may prefer to concentrate on a few areas of specification leadership.

In either case, there is a strong incentive to work with other authorities. This shares the cost of leadership and creates a larger, stronger and more competitive supply marketplace.

Suppliers have an important role to play in the development of specifications. Not only do they have the technical skills for systems development that most LA's lack, but they are also responsible for putting a price on the products they sell. They are the specification builders. Unless suppliers are actively involved in the specification process, the result may be something which is very expensive, or even impossible to deliver.

To achieve this, suppliers must see a commercial benefit in supporting the development and adoption of the specifications.

At the national and supranational level, policymakers have an important role to ensure that the ITS marketplace is working effectively and efficiently. This means ensuring that there is fair competition, creative innovation, and effective deployment of ITS products and services. Standards and specifications can form an important basis for this.

If LA's and the supply industry have sufficient leadership, technical and operational skills, then there may be no need for policymaker intervention. However it is likely that this will not be the case and that national or supranational intervention may be required.

To lead specifications, you need to:

- Understand what existing specification frameworks already apply to current systems and where there are gaps in the areas covered by these frameworks when compared to any proposed system architectures identified in Phase 1.
- Be aware of the activities of similar "leader" authorities, and explore the potential to cooperate for mutual benefit.
- Determine and document what you want the specification to do, ie the specification requirements.
- Decide whether the specification should be independent (ie owned and published by you), or sponsored within an existing specification framework (ie owned and published by a third party). The former leaves you more control and flexibility, but the latter provides better market coherence.

- Have a vision and action plan for how the standard will be supported and developed in the longer term.
- If you are a **systems / service supplier**: In order to participate profitably in the specification business, you need to:
- Determine which specification frameworks are preferred by your current and potential customers.
- Consider where your products might, by adopting a standardised approach, become attractive to a larger market.
- Ensure that your staff is familiar with the specifications and the technologies they adopt.
- Ensure that you participate in the development of relevant technical specifications.
- Ensure that the marketing and sales for your product exploit fully its ability to claim compliance.
- Where possible, promote the framework(s) in conjunction with your LA clients at events such as conferences, which are attended by potential clients.

National and Supranational bodies: policymakers

As with LA's, there is a difference between the market power of a large nation and a small nation. In practice, there are already commercial and cultural links between Member States that can assist:

- A smaller country may pay particular attention to a larger neighbour, especially if they share a language (eg Belgium → France, Austria and Switzerland → Germany, Ireland → UK).
- Groups of smaller countries may work together (eg Benelux, the Baltic States, Scandinavia, the Slavic States of Central Europe).

Collaborative working

Ensuring alignment with related initiatives

One of the main problems with ITS specifications and standards at present is that there are multiple different "coordination initiatives", which often do similar things in different ways. In practice, there are often considerable technical similarities between them, but it is not surprising that this is confusing to potential users.

A single global (or even European) specification framework is unlikely to emerge soon. There is a lot of historical development within localised markets and within existing specifications frameworks, and there are serious institutional, legal and financial challenges to merging them in the short term.

Any open specification initiative should, however, incorporate a strong direction to align with related initiatives, through:

- Joint research;
- Joint development of technical specifications;
- Mutual information sharing and review of documents; or
- Adoption (or adaptation) of elements from each other.

Where local needs or market forces are failing to drive the production of suitable open standards national/supranational bodies can potentially facilitate the collaborative working necessary. To do this, a review of the relevant open specifications that are in use can highlight issues which can then be resolved by taking steps such as:

- Making open specifications adoption a policy (can be a mandatory requirement if necessary) especially if LA's receive funding from the national organisation.
- Helping LA's to work together, to create a suitable "critical mass" among *leaders*.
- Ensuring that *adopters* in particular have access to advice and guidance on the use of specifications.
- Monitoring, encouraging and supporting the integration of ITS between LA's.
- Working with neighbouring national bodies on joint specification frameworks.

In exceptional circumstances, it may be necessary to take more direct action to address market failure, for example where an incumbent provider is blocking the entry to market of innovative competitors.

Phase 3 OSS Production – "Project"

Draft Functional Requirements (Vision) and Options Assessment

The next step – producing a technical specification from the requirements – depends on the context, and could include one of (or a combination of) the following:

- Use your internal technical skills to develop the technical specification, and test it (for example, with a prototype) before publication.
- Establish a working group to which industry and other LA's are invited, which will develop a technical specification collectively. The more widespread the support the more successful the framework is likely to be in the long term.
- Call on industry for a pilot/demonstrator project, based on the requirement, with a validated technical specification as one of the deliverables. If the project covers a variety of areas then the greater the engagement with industry the more likely it will be to succeed. Manufacturer buy-in is key to the long term success of any specification framework, even if you potentially have the purchasing power to drive the market to comply with your framework.
- Establish a joint authority to procure the required open specification framework. For this approach to be successful, it is critical to understand the detailed interactions of the proposed ITS system and its components.

A leader authority should consider how its specifications activities are going to be coordinated, managed and published. There may be benefit in creating an internal "specifications team" – not necessarily new employees, but existing managers working together.

Development of detailed specification

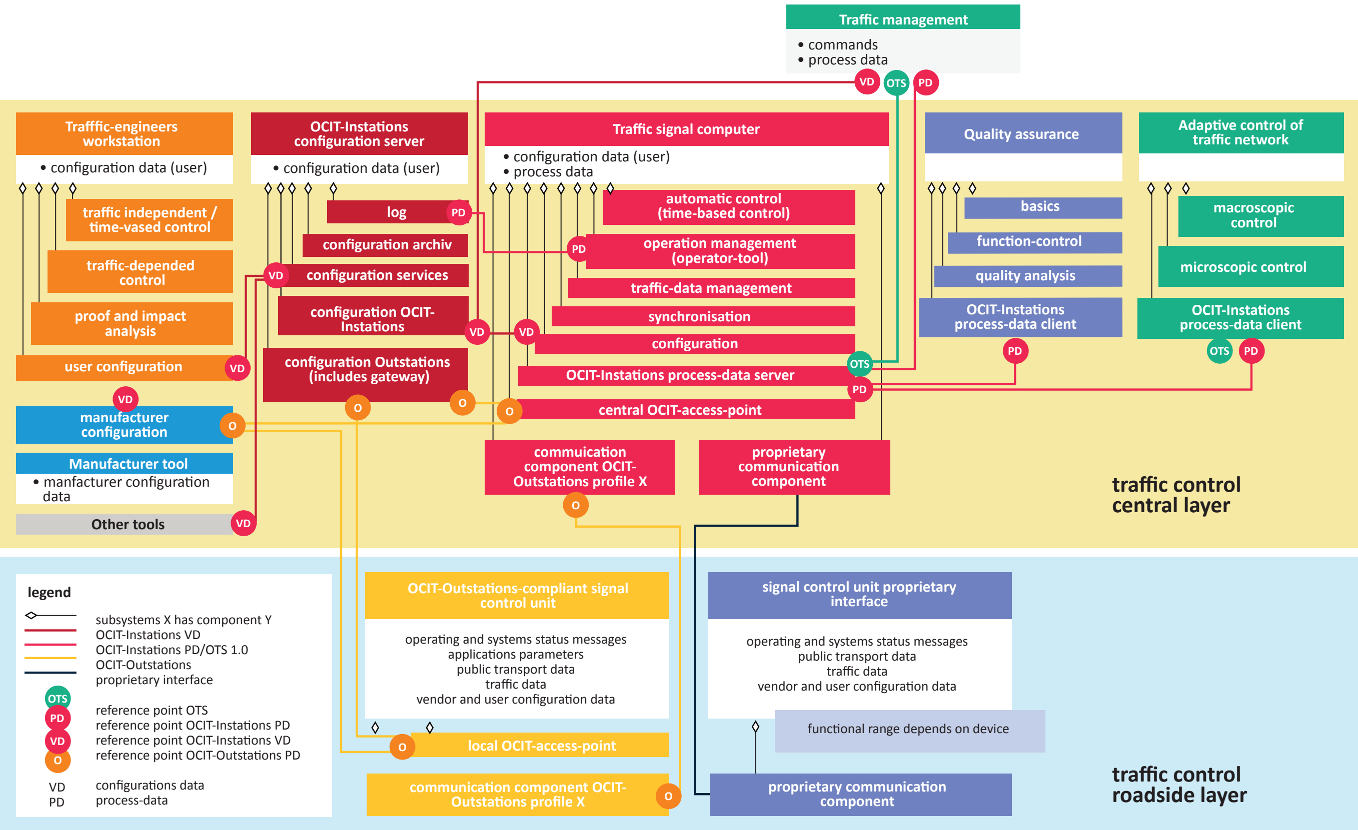
Participation in the specification development process by industry can be beneficial in a number of ways:

- It can provide useful training for your technical staff.
- It ensures that your design approach is taken into account when the specification is developed, and makes it easier for you to comply.
- It gives you early sight of draft specifications, enabling you to make (in parallel) any appropriate changes to your product development and support.
- It makes you look constructive and forward looking, which may help to persuade reluctant customers of your commitment and capability.
- It minimises the difficulties in complying with technical specifications by standardising approaches to system interactions.

If there is no suitable specification framework, you could consider issuing your own specification openly. This makes it easier for a third party to integrate with your products. Many powerful ICT organisations have adopted this approach with great success (from Microsoft and Google downwards).

Sharing specifications in this way can greatly increase the potential for innovation and add value to existing systems, as other suppliers can potentially provide innovation as the need to develop bespoke interfaces/ communication links is removed.

The OCIT® system model below provides a good example of a detailed system diagram and how it can be used to map system interactions.



Phase 4 Project Evaluation

Potential Project Alterations

The promoting authority should also be acting as an *adopter* of the specifications it has brought into existence. However this need not be automatic: some specifications may never get adopted, if for example:

- Circumstances change within the authority (eg a function becomes no longer necessary).
- The specification cannot be completed satisfactorily. Technical issues may prevent the successful development of the OSS. There may be insurmountable differences between vendor systems or approaches.
- Pilots and demonstrators suggest that the specification does not deliver the expected benefits.
- The market may not be sufficiently large to justify the potential costs of fully developing the OSS.

In the event of problems in successfully completing the OSS or trial ITS system, then consideration should be given to the potential for redefining requirements to make them more achievable. If this is not feasible then the only options remaining are to abandon the project/OSS or if the function the ITS system is to fulfil is still required then it may be necessary to procure a proprietary system at this time.

Consultation and publication

Once a draft open specification has been developed, it needs to be published. It is usually beneficial to have a period of open consultation prior to publication, in case there are useful perspectives that have not been captured by the people producing the draft. (If all relevant organisations have been involved in the draft, say as members of a working group, there is less need for this step.)

Public consultation is widely used in standards making and in the development of policy, and similar considerations apply here:

- The responsible managers should attempt to ensure that all interested people are made aware of the consultation. The more widespread the engagement with the development of the standard the greater the chance it will be fully adopted by both users and suppliers.
- The time allowed for consultation should be sufficient for the document.
- Responses to the consultation should be acknowledged and answered, preferably publicly and with reasons.

The conduct of the consultation process is therefore an important one, and needs to be kept impartial.

Phase 5 OSS Maintenance

Future OSS development and maintenance

Education of users

The preparation and publication of an open specification is only a step towards achieving their usage in practice, to benefit authorities. Typically, the time an LA needs to learn about the specification is exactly when it is seeking to buy new systems.

Therefore, it is necessary for there to be a support channel which helps LA's to:

- Become aware of the specifications;
- Understand how they might be of benefit;
- Understand how the supply market has adopted them; and
- Understand how to minimise risk during the procurement.

Similarly, suppliers need help at the point where they are considering new product developments. They need support to learn about:

- The existence and scope of the specifications;
- The technical content of the specification (ie how they might be incorporated into a product);
- How the use of specifications might affect their competitive position, compared to other suppliers; and
- Whether there are opportunities to extend or revise the specification, and if so how.

Institutional framework and resourcing

To ensure stability and therefore credibility, any open specification initiative needs to have a sound institutional framework. This must be independent of the system supply market or be able to demonstrate sufficient cross vendor support to ensure impartiality in how the standards are developed and maintained.

It must nevertheless be capable of engaging effectively and constructively with suppliers and not restrict access to potential new suppliers.

This institutional framework requires a certain amount of resourcing. How this can best be achieved will depend on the local context. Options include one or more of the following:

- A standards unit in the Transport Ministry (or equivalent).
- A standards unit in the national Transport Research Centre (or equivalent, if one exists).
- A committee of the national Local Authorities Association (or equivalent, if one exists).
- A joint venture among suppliers.
- Funding the development of new specification elements by national bodies, where the cost of innovation cannot be justified by any single LA.
- National bodies coordinating, administering and publishing the specifications developed by *leaders*, and supporting *adopters* in using them.
- National bodies coordinating and collating the perspectives of both *leaders* and *adopters* for input to the EC and other national/supranational agencies.

Financial support could come from:

- Grant from national Government, LA's or suppliers on a continuing basis.
- Subscription or licence income.
- Project income, eg for research projects.
- Fees for specification-related services, such as training or product certification.

Such an institution could be established at national or supranational level. It could even operate at a level below national (for example in England rather than UK, or Cataluña rather than Spain) if this provides a better match with existing institutional structures.

If none of this is practical, there may be scope for joining an existing external institution as a participating member, or even simply adopting its outputs as a matter of policy. While these approaches provide less control, they do provide a degree of clarity and stability for the local marketplace, at much lower cost.

Compliance and policing

Compliance to a specification framework may occur at two levels:

- A supplier's product/service may be compliant – which might help an LA as it chooses whether to buy or not.
- An LA's traffic management system may be compliant – which might help a national Government ensure that its road network is being operated coherently.
- Compliance can be established in a number of ways. In approximately increasingly order of both reliability and cost, these include:
- A simple declaration of general compliance by the provider.
- A statement of compliance with reference to specific elements of the specification.
- A record of tests undertaken to validate compliance.
- Independently monitored compliance testing.
- Independently conducted compliance testing.
- Certified independent compliance ("type approval").

The most suitable mechanism will depend partly on the nature of the system. ITS with a strong safety component may justify a greater level of compliance testing than those which are merely informative.

Partner Backgrounds

Klaipeda

Klaipeda is the third largest city of Lithuania and is located on the coast of the Baltic Sea. It has a population of 161,300, and area of 110 km^2 (40 sq mi). Klaipeda is now Lithuania's gateway to the world and the capital of the western part of the country. It is the only Lithuanian seaport with a multipurpose, universal, deep-water port, with the annual port cargo handling capacity up to 40 million tones and operates 24/7 all year round.

Klaipeda is in strategic location because of its direct links with other European and world-wide ports and because it is a sea transport centre, where regular shipping lines and fast modern motorway routes merge together. The transport and distribution hub connects sea, land, rail and air routes and has created opportunities for logistics, transport and warehousing providers.

Due to the various historical and strategic conditions, Klaipeda has been an important commercial centre since ancient times. Klaipeda has been one of the fastest growing municipalities in Lithuania. The city generates approximately 12 percent of Lithuania's GDP and almost 80 percent of Western Lithuania's GDP.

Klaipeda appears exclusive among the other Lithuanian regions by its unique landscape and its recreational surroundings, such as Palanga or Curonian Spit, which is on the UNESCO World Natural Heritage List.

In the past few years, Klaipeda has implemented a range of ITS linked to a traffic information centre. Information is provided 24/7 about the weather on the roads, road surface conditions, road works, traffic restrictions, traffic accidents and traffic problems, assisted by a network of video cameras for traffic monitoring. There are also systems to provide speed monitoring and weigh-in-motion points on the network and an E-ticket system for public transport (the first such system in Lithuania).

Klaipeda is developing their ITS and network management systems and as such was looking for good practice advice on how to deliver this. POSSE therefore provided an ideal opportunity to achieve this.

Klaipeda has been responsible for mobilising its local and national stakeholders in order to facilitate the take-up of open ITS specifications and standards. It is looking forward to developing ITS and Network Management Systems, and using the knowledge, experience and good practices of UTMC and OTS. POSSE provides an ideal opportunity for the organisation to implement and deliver more ITS services.

Burgos

Burgos is a medium-sized city with 180,000 inhabitants, situated in north-western Spain in the Autonomous Region of Castilla-León. Burgos was at points the capital of Spain and in the middle age was one of the most important cities in Europe, in terms of business, due to its location on strategic trade routes.

Situated at 990 meters over the sea level, Burgos is one of the coldest cities in Spain with snowfall being common in winter.

Burgos' total area is 107,08 km² with a population density of 1.673,99 inhab./km² which means that it is a quite compact city. It is flat in general; with only the northern part surrounding the castle being higher.

The industrial areas are: Villalonquéjar (north-west), Gamonal (east) and some little industrial areas in the west and south (the road to/from Madrid) Burgos offers a rich historic and cultural heritage and an active cultural life around its flourishing university with the bustling presence of 6,500 students.

Its new airport was inaugurated in July 2008 and its future service area and industrial zone will have a great impact on the city, with important factories from several multinational companies, and it is therefore defined as an industrial and logistic related city.

In 2006, the City of Burgos started a process of city modernisation: the new traffic control room was opened, offering one of the most innovative systems in Europe and using fixed and mobile cameras for vehicle detection as well as cameras for monitoring the pedestrian area which constitutes more than 2.5 sq km.

At the same time, the City implemented new ITS for the management of traffic, including panels offering real-time traffic information and signs showing the real-time availability of underground parking. In addition, some panels giving travel advice have been installed at the main entries to the city, including traffic conditions and providing alternatives in the event of traffic jams or road works.

Bus management and control has been improved, and real-time information panels have been installed at the main bus stops with oral and visual information inside the buses.

The city of Burgos is also relevant at a national level as it counts among the cities with the youngest public transport fleet, the use of the bicycle is the second highest in the country, and only 27% of the people (one of the lowest percentage in Europe) use private vehicles as a daily means of transport, thanks to the campaigns and facilities offered to its citizens. The city is in charge of the urban mobility development and control, including traffic and ITS.

Despite Burgos' position as one of the most advanced cities in Spain in terms of ITS, the situation regarding standardisation at a national level can still prove challenging. Each city tends to develop different systems which are unable to communicate. The city of Burgos, as a paradigmatic city at Spanish level in terms of urban mobility, will try to collect good practice from the POSSE project and elsewhere in Europe and offer this knowledge at national level.

Pisa

Pisa is a city in Tuscany, Central Italy. It is the capital city of the Province of Pisa. Although Pisa is known worldwide for its leaning tower (the bell tower of the city's cathedral), the city of over 88,332 residents (around 200,000 with the metropolitan area) contains more than 20 other historic churches, several palaces and various bridges across the River Arno. The city is also home of the University of Pisa, the "Scuola Normale Superiore di Pisa" and "Sant'Anna School of Advanced Studies", two of the three Superior Graduate Schools with "University Status" in Italy.

Pisa experiences a Mediterranean climate characteristic of Central and Southern Italy.
The economic system in the province of Pisa is characterized by a variety of activities: industrial sectors (marine, footwear, mechanical, chemical and pharmaceutical), tourism and its varied offering (sea, mountains, enogastronomic tourism, cultural tourism, rural tourism) and agriculture.

The territory of Pisa stretches to 2450 square kilometers, with more than 390,000 inhabitants, about 50,000 enterprises and a system of infrastructure including roads, railway, the presence of 'international airport "Galileo Galilei" of Pisa for passengers and cargo, and the proximity of the ports of Livorno and Piombino. The territory of Pisa has its strength in a high scientific and cultural tradition characterized by the presence of three prestigious universities, art Research Centres, a Polo Hospital, and scientific research through the use of technology parks and business incubators.

Pisamo Spa is the leading urban authority of Pisa for traffic management and policies. A Smart City Plan integrates all relevant projects into a coherent framework, plans and regulatory instruments along four axes - city of quality of life (quality of buildings, security, sport, city branding); city of knowledge (research and innovation, creativity); accessible city (participation, e-services); sustainable city (environment, energy, mobility, development). Pisa is nationally recognised as a leader authority with regard to sustainable transportation, energy efficiency and renewable energy. Pisa organises and hosts the annual event "Green City Energy Forum" bringing together research, industry and local authorities. The city also signed up to the Covenant of Mayor thereby committing to meet and exceed the European Union 20% CO2 reduction objective by 2020.

Pisa is using POSSE to raise awareness of open ITS at local, regional and national levels, studied and adapting POSSE good practice guidelines for the city's network management projects; and have developed an implementation plan for the eventual use of open standards for selected network management projects.

La Spezia

La Spezia is a town of 95,000 inhabitants located in a strategic geographical position. Thanks to its location the Gulf of La Spezia has been chosen as privileged place to install military settlements and to develop commercial trades. The Port of La Spezia is today one of the most important mercantile ports in Italy (exceeding 1 million of Teus).

La Spezia is also a centre of excellence in Marine Technologies with primary research centres of European level (ENEA - Research Centre on sea environment - CNR - National Research Centre and the Sacland Undersea Research Centre managed by NATO) and with the Marine Technology Regional District participated by private companies and public bodies as local public administrations.

La Spezia is a fast growing city with regard to ITS and wants to bring existing ITS together with new systems and services. Some of them are already in operation, (the Urban Traffic Management Centre since 1996) and some are quite new and innovative: access control, infoparking with on road parking slots controlled by specific sensors, a new info-mobility platform for traveller information services, and a contactless smart card including bike sharing, park and ride, and public transport. The overall objective of the city is to use OSS in future ITS development, specifically in relation to the open data concept (making the most of the data in the ITS systems available for further public use).

POSSE has so far assisted in kicking off the open ITS and the open data concepts, gathering the vast experience of some of the project partners. The city is designing its own open ITS and open data implementation plan including awareness-raising measures about open ITS and open data concepts, setting up the basic requirements of the future open ITS and open data city strategy, undertaking feasibility analysis about existing infomobility systems in order to assess their potential to become open and to make their data open, and developing the "open" reference specifications for the future ITS tenders.

It is responsible for mobilising its local and national stakeholders in order to facilitate the take-up of open ITS specifications and standards. La Spezia Municipality expects to use POSSE and the open ITS paradigm as an essential tool in order to improve the management of the network as a result of the expected benefits of system interoperability and system integration, and an intelligent prioritisation of the new systems.

The Norwegian Public Roads Administration (NPRA)

Norway has a population of 5 million, with around 2.8 million cars and lorries, and in total 95000 km of public roads. In addition, there are about 0.8 billion trips annually with public transport.

NPRA is responsible for the planning, construction and operation of the national and major urban road networks including information services and all traffic management. Management of the national legal framework and recommendations for road transport are also the responsibilities of NPRA.

The main, concrete, activities for the NPRA in POSSE should be to define and specify the functionality of an ITS station with the help of ARKTRANS, the Norwegian Framework for Interoperability in the transport sector. In addition to that, to study similarities with specifications and frameworks made by UTMC and OCIT®/OTS. The main goal is that specifications for the ITS station, made by means of ARKTRANS, should be compatible/in line with UTMC and OCIT®/ OTS specifications.

The activity in POSSE will be coordinated with the general, initial work in the NPRA about development of an ITS station. The ITS station shall cover a wide range of uses: from quite simple data collection at the road to being an element in data distribution in cooperative systems. The expectation is that the ITS station will work well with open standards like OPC - UA, Open Processing Communication – Unified Architecture, and DATEX II, standards/ specifications for data exchange between traffic centres, service providers, traffic operators and media partners. The POSSE activity is one of three core activities in the development of the ITS station. The other two main activities are the definition of technology specifications inside the ITS station and the establishment of a structure/methodology linking architecture/ framework and technology/ specifications closer together.

The work has included workshops coordinating the core activities and especially, with relevance for the POSSE project, workshops directly focusing on the framework/architecture. UTMC and OCIT®/ OTS have been involved in some of these workshops and presented at the national ITS conference in Oslo in 2014.

Within the POSSE project the objective of NPRA has contributed to the development of common European open ITS specifications.

NPRA hopes that this will lead to the development of a competent and competitive ITS industry and better solutions for the public sector. NPRA will assist in the implementation of the results of POSSE in the national legislation and recommendations for ITS.

The Czech Transport Research Centre (CDV)/Brno

CDV is a research institution established by the Ministry of Transport but funded by its own projects. CDV has 4 divisions covering the transport sector's needs: transport development, environment, traffic safety and sociology and traffic simulations. 210 employees work in CDV. Its section on transport telematics is involved in the POSSE project with the aim of investigating ways for implementing open specifications. POSSE is supported by a team of specialists covering the domains of standardisation, traffic and telematics technologies, transport planning (SUMP) and hardware and software developers.

CDV's team has concentrated its efforts on major local needs. As the most significant problem of Czech and Slovak cities is parking, and the basic application of the smart cities concept is smart on-street parking, the team focused its work on how to provide such a system as an open system. Besides promoting the OCIT® and UTMC open specification concept, the team has been inspired to create an open specification for parking. As such, the work requires deeper knowledge from different layers. CDV has been looking at the technology itself, the possibility for a standardised data model and the integration of the system in cities' planning and investments.

CDV has developed a draft technical specification for a smart on-street parking system as a first step in contributing to an Open Specifications movement.

Brno by population and area is the second largest city in the Czech Republic, the largest Moravian city. Brno is the administrative center of the South Moravian Region where it forms a separate district Brno-City District. The city lies at the confluence of the Svitava and Svratka rivers and has about 400,000 residents; its greater metropolitan area (230 km^2) is regularly home to more than 800,000 people while its larger urban zone had population about 730,000.

The city of Brno is planning several investments in traffic infrastructure to build up its integrated traffic control system in accordance with the adopted strategy. The integrated system consists of, traffic control and priority including a significant number of new junction controllers, a traffic control and information centre linking tunnel control, VMS and parking management, and centralised control of the strategic network.

The POSSE project has come at the right time for Brno whose strategy for open specifications is being built. The two key issues to be solved are traffic control and parking management.

CDV have developed an implementation plan for open ITS standards and specification and are promoting it to relevant city authorities. It hopes to gain from the knowledge and experience of the good practice sites that have implemented UTMC and OCIT®/OTS. CDV hopes POSSE will help initiate the sustainable development, delivery and use of ITS technologies in the Czech Republic.

Lessons Learned

Through the development of the Transfer Sites Implementation Plans, various issues have been highlighted which pose problems for any project looking to develop open standards or specifications. The standards process is not always helpful or easy to adopt.

It can be obscure and is often highly technical. It is not always market-neutral, as much of the development of standards depends on the volunteer involvement from a few key suppliers, which will tend to promulgate their own approach. It can be very slow, and may struggle to keep pace with today's project requirements; and, in respect of ITS, it often evolves a huge range of confusing options which need to be carefully considered before they can be adopted. Moreover, even where a good standard exists, suppliers may not support it, or may offer standards-based solutions at a price premium over proprietary products. There is a widespread feeling among the POSSE partners – including both the lead partner, knowledge exchange partners and the Transfer Sites is that the effective use of OSS can be held back by the prevailing institutional structures.

Therefore if open standards and specifications are to be utilised, there are key issues which need consideration:

- Suppliers have a commercial incentive to try to capture as much of the market for themselves and to make it as profitable as possible. Established large suppliers therefore tend not to favour developments that open the market. This may be less of an issue when dealing with new emerging technologies, but when dealing with established technologies is likely to require significant influence to effectively re-align the market.
- Small, new and niche companies, who generally favour open standards as a way to break in, struggle to gain a foothold without sufficient existing evidence of capability. This can be particularly challenging to overcome through standard procurement routes as the potential benefits are unlikely to be taken into account when evaluating proposed solutions.
- Cities and regional authorities operate under public sector procurement rules and procedures, which emphasise the value for money of individual projects and enforce supplier neutrality. Output specifications are increasingly the norm. Most authorities do not have the technology skills, or the time, to challenge suppliers' design choices.
- Cities and even regional authorities rarely have a sufficiently strong, stable, standards strategy to constrain procurement, with the result that system integration remains difficult and ad hoc with each new project. Proven, off-the-shelf products are favoured by this process, and there is therefore little procurement pressure on suppliers to develop standards-based products.
- National authorities vary greatly in the extent of their involvement in the process. Some Member States have a national technical "authority" with some power to affect the supply market (for example, Norway's National Public Roads Administration). Others have a national research centre with recognised ITS competence but few powers – for example the Czech CDV and, to some extent, the UK's TRL (which was privatised a number of years ago).
- National city forums, like the OCA and the UDG, do not always exist and where they do exist they may have limited capacity in ITS and standards. Even where there is an interest, they have no formal authority and may still be constrained by procurement rules.

The importance of these issues is apparent from the experiences of the Transfer Sites. The benefits of national authorities using the tools at their disposal to drive a more open ITS marketplace is clear. The input of national/international bodies providing more explicit guidance on good practice examples in the use of specific technologies and standards, could provide a stronger encouragement to suppliers to have due regard to the need for open specifications, and to the strategic need of cities to integrate individual products into their networks. Alternatively it falls to user based groups such as the OCA, UDG, or equivalents to try to steer development through joint market share.

The technical challenges of open standards and specifications also differ according to both location and scale. The approaches of the lead knowledge exchange partners UTMC and OCA provide useful insights for those pursuing open standards and specifications, although it is likely that either approach will need to be modified according to local requirements. The experiences of the Transfer Sites therefore are especially useful in highlighting issues of transferability for future adopters.

- Transfer sites' response to the technical approach of UTMC/OCA was highly dependent on their local circumstance. Generally the overall concepts and mechanisms were supported, especially:
- The ways in which collective requirements were gathered and collated into a common approach.
- In the case of UTMC, the way in which suppliers had been encouraged to pool their technical skills in response to city needs, but with an impartial coordination and publication function.
- The use of mainstream ICT approaches, such as IP networking and XML-based data exchange.
- The focus on finding simple, practical steps which could be used in specific project circumstances.

However the approach of the two lead partners differs in detail and neither fully meets the local needs of all Transfer Sites. In some cases this has resulted in a new national drive to initiate or steer a national activity, building on some of these generic technical lessons but geared specifically to local circumstances. Examples of this are:

- CDV has initiated a Czech project to bring together some leading suppliers in a neutral space, to consider (a) the existing UTMC/ OCA technical resources and (b) the creation of a national specification for smart on-street parking.
- In Spain there is a city community pooling its approach to open data publication from ITS, in which Burgos is taking a leading role, and which links to the national open-data programme of the Spanish Government, Red.es.
- In Italy and Lithuania, the focus is much more on what is practical for the small cities involved in the project. The pivotal role of the Regio Toscano has been cited by Pisa as very helpful as a larger-scale (but still sub-national) drive towards strategic integrated systems. Klaipeda similarly has been exploring the opportunity to share lessons on ITS implementation with other cities (in particular Vilnius and Kaunas) within its traffic management feasibility study.
- In Norway the situation is different again. NPRA does have direct authority over the country's roads management and is currently focussing on a medium-term project to standardise cooperative ITS roadside units. It has an existing high-level national architecture, Arktrans, but recognises that this needs to be deepened and complemented by a more technical architecture. A recent procurement using NPRA's developed OSS has demonstrated the benefits of OSS by generating a cost saving of around 40% to 50%.

Chapter 9. Further Information

Hopefully you have found these guidelines a useful overview of the processes involved in the Development and Implementation of OSS. If you are planning on taking things further you may find it useful to review the more detailed information on the POSSE website or those of the project Partners. Below are links to the POSSE website along with the UTMC and OCA websites. Contact details of the project partners are available through the POSSE website.

POSSE website –
http://www.posse-openits.eu/en/Home/Home/

UTMC Website –
http://www.utmc.uk.com/

OCA Website –
http://www.oca-ev.info/oca-orig/

POLIS Website –
http://www.polis-online.org/

The links below are to some of the international standards bodies which may be of use:

CENELEC Website –
http://www.cenelec.eu/

IEC Website –
http://www.iec.ch/

ETSI Website–
http://www.etsi.org/

ERDF Website –
http://ec.europa.eu/regional_policy/thefunds/regional/index_en.cfm

Chapter 10. Glossary

ANPR: Automatic Number Plate Recognition

Authority: local or central government or other body responsible for an ITS system or management of a highway network.

BS: British Standards

BSI: British Standards Institution, the UK's national standards body. Copies of European and international standards may be obtained through BSI.

CCTV: Closed-Circuit Television.

CEN: Comité Européen de Normalisation, the European Standards body. CEN functions via a series of Technical Committees (TC), with TC278 being responsible for transport telematics.

CENELEC: – European Committee for Electrotechnical Standardization

Component: Any equipment connected to the ITS infrastructure. Components can be either instation or outstation components. Components in an ITS system may be supplied by more than one manufacturer.

CVIS: Cooperative Vehicle-Infrastructure Systems, a generic term for systems which involve communications between in-vehicle and on-street components.

DATEX: A European initiative to standardise information exchange between Traffic

Management centres. Two voluntary standards were published in 2000 but these have since been overtaken by DATEX II (qv).

DATEX II: A European project to update the DATEX specifications, initiated by the European Commission.

DIN: Germany's National Standards Body

EN: European Norm

ERDF: European Regional Development Fund

ETSI: European Telecommunication Standards Institute, a European standards body which serves the general telecoms industry.

ICT: Information and Communication Technology

IEC: International Electrotechnical Commission

IEEE-SA: Institute of Electrical / Electronic Engineers Standards Association.

Interface: The technical means by which one application, component or element of ITS infrastructure connects to others, through communications and information exchange.

IOTCC: Integrated Overall Traffic Control Centre

IP: Internet Protocol, the network protocol used within the internet and most private systems networks. IP provides for addressing as well as the structure of the "packets" into which data is split prior to communication.

ISO: International Standards Organisation, the global body for general standards. In Europe (including the UK), CEN standards have primacy over ISO standards. Other global bodies manage standards in specific areas (eg ITU, IETF).

ITS: Intelligent Transport Systems, ie any information or communications systems used in a transport context.

ITU: International Telecommunications Union, the world telecommunications standards body.

NSB: National Standards Bodies

OCA: Open Traffic System City Association, is an association of public road authorities and operators founded in 1999 in the course of the emergence of the OCIT®-standards.

ODG: OCIT® Developer Group

OCIT®: Open Communications Interface for Traffic Systems

Open standards: Standards in the public domain. Two kinds of 'standards' are distinguished:

de jure (created in a formal legal manner by standardisation body, eg ISO, CEN, or BSI)

de facto (specifications that gain near-universal adoption, eg Microsoft Windows). Some standards are administered to be open by a user group or committee rather than a legal standards body – see under IETF, W3C, and OMG.

OSS: Open Specifications and Standards

OTEC: Open Communication for Traffic Engineering Components

OTS / OTS2: Open Traffic Systems framework developed by the OCA

Outstation: ITS components and applications based in the field. Outstations will not normally be manned.

POSSE: Promotion of Open Specifications and Standards in Europe

SDO: Standards Development Organisation

SUMP: Sustainable Urban Mobility Plan

TPEG: Transport Protocol Experts Group

Traffic Management System: Any collection of components and applications deployed for the purposes of managing and controlling road traffic in a specific area, whether or not it complies with the UTMC Technical Specification.

UDG: UTMC Development Group, the organisation responsible for day to day management of the UTMC Technical Specification and associated support activities. The UDG is a community body including both highways authorities and private sector suppliers of systems/services.

VMS: Variable Message Sign, a controlled sign usually fitted to the roadside, and giving dynamically controlled information to road users.

XML: eXtensible Markup Language – a language for describing data in a simple ASCII Text document. XML, like HTML, is a specific implementation of SGML.

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