Integrated systems – a generic approach

This leaflet is one of a series of documents from the ITS Assist Project. ITS Assist is a Department for Transport (DfT) initiative that aims to encourage and promote across the UK the use of Intelligent Transport Systems (ITS) as tools to implement local transport policy objectives.

The leaflet provides an overview of the likely benefits associated with the adoption of integrated systems for traffic management and control in the urban environment. It also outlines the approach and relevant standards that will be required as well as the likely migration paths available to local authorities.
BACKGROUND
Traditionally local Authorities have invested in traffic signals as the primary means to manage the traffic network. Over the past two decades substantial improvements have occurred to improve the efficacy of signals including remotely controlled signals, linked signals and adaptive control - Split Cycle and Offset Optimisation Technique (SCOOT). Concurrently local transport policy makers have been charged with trying to meet an increasingly wide range of demanding objectives, each requiring better traffic management. Policies currently being supported include:

- Giving priority to public transport and other selected vehicles;
- Improving the conditions for pedestrians, the disabled, cyclists and other vulnerable road users;
- Reducing the impact of traffic on air quality;
- Improving safety;
- Reducing traffic in sensitive areas;
- Providing improved congestion and demand management.

Adoption of such wide-ranging objectives has led to the procurement of additional systems by local authorities that supplement the existing network of traffic signals. Accordingly many local authorities now have a solid baseline of applications that commonly include:

- Fixed time and adaptive signal control
- Remote fault monitoring
- Selected vehicle priority
- Real-time information systems for buses
- Car park management
- Variable message signage
- CCTV
- Traffic information systems

Procurement of new systems has invariably occurred on case-by-case basis in line with the development of local policy objectives. The ability to pass data between such systems has rarely been a priority and as a result it has therefore proven difficult to evolve or functionally extend such systems. At worst, local authorities may have a legacy of isolated bespoke systems that are unable to communicate with other applications. Consequently the joined-up management of the traffic network in its entirety, rather than simply controlling traffic flow on a citywide scale, has not proven easy to implement.
**Benefits**

Migration to integrated systems will help to solve many of the transport issues faced by local authorities – although it is not always easy to quantify the value of integration. Among the benefits that may be achieved are:

- The ability to meet a more complex set of traffic policies relatively simply, cheaply and quickly – for example, linking air quality and car park information can help improve both signal control and travel information services;

Provided the integration is done well, and architecture design and migration paths are carefully planned, it can also:

- Reduce the cost of implementing a particular set of applications and policies – for example, by sharing telecommunications links between cameras and signal controllers;
- Improve flexibility for the future, by providing a ‘baseline’ onto which additional components can readily be attached.

**System Design**

Local authorities seeking to integrate their traffic management systems face a number of critical decisions regarding the future system design and available migration paths. Typically local authorities will need to be mindful of the following issues:

- How will future procurements enhance the current offering?

Whilst substantial benefits are offered by more integrated systems, most local authorities have a substantial quantity of legacy systems that continue to provide significant benefits. In considering the migration path the following questions will need to be addressed:

- What timescale is envisaged for improvements in integration, and what budget is available to achieve this?
- In what order should systems be integrated – for instance, should new systems be integrated at procurement and others connected in, or should priority go to integrating existing systems?
• How will the migration occur – is it most sensible to adopt a gradual migration path as part of existing procurement cycle or is initial investment in infrastructure followed by connection of integrated systems preferred?

Designing an integrated system architecture and a suitable implementation/migration strategy is a specific skill, to be treated separately from the implementation of individual systems.

**AVAILABLE TECHNOLOGIES**

There are different ways of achieving integrated systems, but these broadly fall into two types:

- **Infrastructure based** integration, where different systems are developed for connection to a ‘generic’ integration framework (e.g., a communications network); and
- **Direct integration**, where systems are connected on a machine to machine basis, via an adapter if necessary.

Historically much integration has followed the second path, which has the benefit of minimising disruption to existing systems. However as the number and type of systems to be integrated grows larger, it becomes more appropriate to develop an infrastructure. Ideally, the infrastructure will offer ‘standard’ connections, and systems will be available to connect to them.

At the lowest level, this means the establishment of a suitable communications network. There is a wide range of wireline and wireless technologies that have potential use here; fortunately, there is a general move in mainstream systems to adopt the Internet Protocol (IP) as a mechanism that can ride over almost all communications links, and serious consideration must therefore be given to adopting IP as an ‘infrastructure protocol’ for any integrated systems.

At a higher level, the applications used to exchange information are important. Here the situation is less clear cut, and it is more a case of ‘horses for courses’ – typical applicable technologies would include HTML for websites, SNMP for remote monitoring, CORBA for inter-organisational exchange where ‘push’ and ‘pull’ connection is required, and so on.
**REPORTED BENEFITS**

Due to the relative youth of the integrated systems approach it is often difficult to appraise the empirical benefits of integrated systems. Initial anecdotal evidence suggests that the linkage of car park management and VMS signage systems reduces the time taken by motorists to locate parking spaces and may lead to lower levels of congestion and associated pollution. Likewise, the linkages of air quality monitoring to selective access measures can lead to local reductions in key pollutants.

Some changes to the organisational approach brought about the integration of systems are subtler. For example York City Council have found that adoption of IP networking has enabled many of their communication problems have been solved by teaming up with the council’s “in-house” broadband roll out.

**EVALUATION**

Evaluation of integrated systems should be continuous. Local authorities will need to appraise how well their system meets policy objectives on a regular basis, to determine whether additional integration would be beneficial (or, less likely, whether reducing the level of integration would be helpful).

There is no mechanistic way of doing this, but good practice in other industries suggests that a ‘lightweight’ annual review should be combined with a full 5-year architecture and strategy refresh project. This fits the LTP timetable process well.

**STANDARDS**

There are few formal standards for integration, in the transport area or outside it, but a number of frameworks are emerging that may be of use.

- For traffic management systems such as signalling, VMS, car park management, etc, the Urban Traffic Management and Control (UTMC) programme has developed a coherent and evolving framework.
- For interurban and police systems the Highways Agency’s Traffic Control Centre project, and the Travel Information Highway service, provide de facto standards for centre-to-centre integration.
- For public transport systems the ‘umbrella’ initiative Transport Direct is beginning to develop a series of best practice documents, and a framework of standards is likely to emerge from this in due course.
- For bus information systems specifically, there is a framework under development by the industry’s Real Time Information Group. This is at an earlier stage than UTMC.
- Finally, for road user charging systems the DfT is in the process of developing an ‘open preliminary minimum interoperability specification suite’ (OPMISS) which could be embedded in LA procurement specifications to enable interoperability between charging systems.

All these initiatives propose a set of consistent standards, based on mainstream approaches and technologies, and all of them acknowledge the need for integration both within and outside their own areas.
FURTHER INFORMATION

The following references provide further information about some of the topics discussed in the text.

Urban Traffic Management and Control (UTMC) programme
UTMC Programme Office
Mouchel Consulting Limited
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Traffic Control Centre
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Travel Information Highway
Highways Agency
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Tollgate House
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Email: helpdesk@tih.org.uk
http://www.tih.org.uk

Transport Direct
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Great Minster House
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Email: transportdirect@dft.gov.uk
http://www.dft.gov.uk/itup/transdirect/index.htm

Real-time Information Group
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To find out more about the wide range of ITS-related initiatives and projects supported by DfT, and the development of ITS policies to encourage and promote greater deployment of ITS, please contact Transport Technology and Telematics division of the Department for Transport at: its@dft.gsi.gov.uk

DfT WEBSITE www.dft.gov.uk

Details of Traffic Advisory Leaflets available on the DfT website can be accessed as follows:
From the DfT homepage, click on the Local Transport icon and then on Traffic Advisory Leaflets. Lastly, click on one of the themes to view material.

The Department for Transport sponsors a wide range of research into traffic management issues. The results published in Traffic Advisory Leaflets are applicable to England, Wales and Scotland. Attention is drawn to variations in statutory provisions or administrative practices between the countries.

The Traffic Advisory Unit (TAU) is a multi-disciplinary group working within the Department for Transport. The TAU seeks to promote the most effective traffic management and parking techniques for the benefit, safety and convenience of all road users.

Requests for unpriced TAU publications to:
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Within Wales, enquiries should be made to:
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Published by the Department for Transport © Crown copyright 2002.
Printed in the UK March 2003 on paper comprising 75% post consumer waste and 25% ECF pulp. Product code ITS 3/03.