Managing a UTMC implementation project

A UTMC Technical Guide
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1 Introduction

1.1 About this document

1.1.1 UTMC is a UK-led initiative which provides and maintains a technical framework for traffic management and related systems. It is geared to producing open specifications geared to the needs of real world projects, delivered through an efficient and innovative supply market. UTMC specifications are endorsed by the UK Department for Transport and are published on the UTMC website at: http://www.utmc.uk.com.

1.1.2 To help users get the best out of the UTMC Technical Specification, we provide a set of guidance documents addressing some of the associated issues, ranging from non technical aspects such as procurement policy and operations, to technical aspects such as database design and communications network configuration.

1.1.3 This document offers advice and guidance for UDG members on the successful management of a UTMC implementation project, and covers:

- Planning (section 2);
- Finance (section 3);
- Procurement (section 4);
- User engagement (section 5);
- Streetside equipment (section 6);
- Traffic Management Centre equipment (section 7);
- Communications services (section 8);
- Data (section 9);
- Project closure and on-going systems management (section 10).

1.1.4 It is recommended that this document is used in conjunction with TR006 on procurement.

1.2 Status of this document

1.2.1 This document is based on the experiences of UDG members in the project management of a UTMC implementation, focussing particularly on a local authority project officer perspective. It is based on the experience of a range of implementations around the country.

1.2.2 Special note: this document is modelled on the project management guidelines produced by RTIG in the context of passenger transport real time information systems. We gratefully acknowledge this debt.

2 Planning

2.1 Introduction

2.1.1 UTMC projects typically involve balancing a complex mix of high-level stakeholder requirements and the need to understand technical detail. Careful planning, therefore, plays a critical part in the success of any implementation project. This section introduces some of the areas that require planning before commencing implementation and how a project manager may go about approaching some of the multi-faceted aspects of any implementation.

2.2 Scoping the project

2.2.1 Initially a project may develop from a local highways authority identifying a business need to be fulfilled. This may be simply a system refresh (eg current systems are obsolete); it may be a new operational goal (eg need to improve car park management or tackle air quality problems in an area); or it may be part of a wider policy goal (eg reviewing the approach to managing congestion or passenger transport); or it may simply be an opportunity to get better value for money from newer systems.

2.2.2 At an early stage, other key stakeholders should be identified, and they should be engaged as soon as possible, preferably during preliminary discussions prior to the project taking further shape. Some common stakeholders are:

- Neighbouring highways authorities (including in England the Highways Agency).
- Major local groups affecting network demand, eg industrial parks, shopping centres, universities, hospitals.
- Other parts of the local authority, eg passenger transport, highways maintenance.

2.2.3 Scoping of the project should be done in partnership with stakeholders and may be assisted by reference to any neighbouring systems and plans, other established systems within the authority, and UTMC technical documentation. Establishing an achievable scope that delivers the business objectives will be a major factor in the ultimate success of the project.

2.2.4 The business requirements will need to be determined for each stakeholder. As stakeholders will have different business objectives it will be useful to clearly identify the measure of success for the project from the perspective of each stakeholder. It should be made clear as to what are necessary requirements for the project compared with other items that could be provided through future development.

2.3 Project stakeholders' roles

2.3.1 It is worthwhile documenting who the project participants actually are and which specific roles and responsibilities each shall hold. Whilst there is always likely to be a local authority and a principal system supplier/integrator involved, there may also be other organisations with key roles in developing the system: the authority's consultants, IT department, communications companies, etc.

2.3.2 In some projects, the stakeholders identified in section 2.2 may continue to have an active role in the project, eg neighbouring authorities who wish to connect traffic systems or developers who are contributing towards equipment on their site.

2.3.3 One of the largest initial challenges to the project is normally the selection of suppliers. User stakeholders (led by the key local authority project manager) may gain much coherence from working together to agree the mechanisms and criteria for this selection.

2.3.4 Trust must be nurtured between the stakeholders at an early stage in the project. Seemingly small matters, like showing all the stakeholders logos on the same piece of paper, will help to encourage unity within the project.

2.4 Formalising project management processes

2.4.1 Once stakeholders have been identified and roles defined, a list of the key personnel and their authority to make decisions within each stakeholder is useful with their contact details and likely involvement in the project.

2.4.2 At this stage it will be possible to start formalising project management processes within the project. This may include the formation of a project board with stakeholder members. Each board member should each have defined responsibilities and remit. Management processes and reporting should be declared. This may include the creation of issues and risks logs and a review of enablers and blockers may highlight areas to be addressed during the project.

2.4.3 Some individuals may represent a risk to the project due to their 'approach'. Such individuals should be identified and their cooperation gained through persuasive reasoning at an early stage.

2.5 Skills and resource audit

2.5.1 Once the stakeholders and key personnel have been identified it is useful to determine who is capable of doing what. Skill gaps may be identified and technical assistance or management assistance in specific areas may be brought in from elsewhere to the project. At this stage, the requirement for any consultancy services may be identified.

2.6 Use of consultants

2.6.1 When selecting consultants, it is important to consider the experience that an individual or organisation will bring to a project and to develop a clear remit of what they are expected to contribute. The role of the consultant within the project should be clear. Are they being employed merely for technical guidance or as a project manager?

2.6.2 The 'approach' of a consultant is equally important. For instance, the consultant should be capable of working with each of the stakeholders and seeking consensus on difficult decisions. A good consultant can be invaluable in building trust among stakeholders.

2.6.3 No consultant will hold 'perfect knowledge' and it may be worthwhile pursuing alternative points of view from contacts in the industry or other consultants. However, this needs to be done openly, or you may risk damaging the project. If you don't trust your consultant to do his job, there is little point in having him/her.

2.7 Architecture

2.7.1 When developing the architecture for your UTMC system, it will be useful to give consideration to the architectures of other UTMC systems that have already delivered for other authorities and how effective they are. A stakeholder should be tasked with gathering this information and presenting it in a clear unbiased manner. The UTMC Technical Specification contains a framework for this, but local implementations will have much more specific architectures based on the specific set of functions and products they have included.

2.7.2 Once complete the architecture should be represented diagrammatically to allow all parties to understand what will be achieved by the roll-out of the system, and should offer a transparent picture of how the separate components of the system will be connected. Before agreeing a final architecture for your project, it is important to understand the cost structures associated with providing different architectures and whether they suit your particular funding model (see section 3).

3 Finance

3.1 Introduction

3.1.1 Investing in UTMC may require significant expenditure, especially for street devices which may be required in large numbers. This section discusses different types of financial models and which funding sources are likely to fulfil different roles most adequately.

3.2 Funding models

3.2.1 The availability of funds will differ across stakeholders and will be dependent on the strength of business case. Possible funding models will be determined partly from what each stakeholder stands to gain from a project. However, while private sector support may be helpful (especially through developer contributions via Section 106 agreements), it is likely that the great majority of the project will fall to the highways authority.

3.2.2 It is worth stating clearly that the value of traffic management technology is delivered only if the technology is maintained and operated well. The lifetime of information technology systems is lower than that of asphalt! You need to take a realistic position on the longer term costs of UTMC:

- Revenue costs for communications, software update, maintenance and repair, etc
- The capital replacement programme
- Staff costs for operation of the system

3.2.3 It is of course possible (and cheaper) to "install and ignore" a UTMC system, and rely on simple network automation (eg vehicle activated signals). Indeed it is likely that this option will be part of your business case paper. Which choice you make will depend on the value the authority puts on being an active network manager, rather than a passive network maintainer.

3.3 Project scalability and expansion

3.3.1 UTMC systems are scaleable and it is very likely that investment will be spread over a number of phases. It is not uncommon for local authorities to take a corridor by corridor approach to rollout. More likely, you will take a function by function approach.

3.3.2 For a project to be viable, it is likely to be necessary to plan a project lifespan of between 5 to 15 years. This enables skills to be built up, lessons learned, and future technology options to be taken up as and when they prove robust and cost-effective.

3.3.3 Getting a clear long-term financial plan is essential. The plan needs to have safe breakpoints in it to prevent the claim that starting will commit the authority to an unknown future spend profile.

3.3.4 Inevitably with a project of this scale, equipment purchased early on will look "clunky" by the end of the project. This is not necessarily a bad thing!

3.3.5 The need to sustain multiple systems can be a headache. This will give rise to additional costs but is usually more practical (and less risky and more affordable) than a "big bang" would be, except perhaps for a small unitary context where dividing into phases would yield unviably small projects.

3.3.6 Securing the funds for extension of projects may well depend on how well the first phase of a project has been executed, how well stakeholders have worked together, and what benefits have been achieved by the users. It is therefore important that the planning and management of any project is competently performed.

4 Procurement

4.1 Introduction

4.1.1 Procurement of a UTMC system is a complex process which involves multiple stakeholders, and the development and review of sometimes complex technical documentation. In fact, the procurement process can be considered a project in itself. This section outlines the processes to be undertaken during the procurement stage and how good project management can smooth this sometimes difficult procedure.

4.2 Procurement strategy

4.2.1 Most UTMC systems are based on traditional supply contracts, ie the acquisition by the authority of specific goods and services by a supplier.

4.2.2 It is worth considering alternative models: even if they are unattractive for the moment, they may become more attractive later as the market evolves (technology improves and risks diminish). Other possibilities, in increasing order of novelty, include:

- A bureau approach, in which one authority "piggy backs" onto another authority for some or all of its UTMC operations (out of hours response, management of strategic corridors, functional specialisation eg for passenger transport liaison or air quality monitoring).

- A collaborative approach, in which multiple authorities pool their programmes to create a traffic management centre for a larger area. As well as improving buying power and reducing duplication in procurements, this could provide the "critical mass" to create a genuine centre of expertise.

- A DBFO/PPP approach, in which network management is outsourced to a service provider, under an output specification. (In this case, of course, the specification of systems as UTMC or otherwise may not be under the authority's control.)

4.3 Procurement process

4.3.1 The procurement of UTMC takes place at two levels.

- A programme level which outlines the full range of functions to be implemented, and phases them in. This is usually supported by a consultant and often achieved using a specialist system integration partner.

- A project level which acquires specific applications, devices and/or services. The project will involve not only the supply of these items, but also their integration into the emerging UTMC complex of systems. Also relevant at this level are training and support arrangements.

4.3.2 It is helpful to have different "customers" within the authority for each of these.

4.3.3 The levels are not necessarily distinct in procurement terms – specifically, the system integration partner is often (though need not) be the same as the supplier of the common database, and the services are likely to be obtained through the same contract.

4.4 Specification compilation

4.4.1 If stakeholders have chosen the simple option of procurement through one single specification, compilation should involve all stakeholders from the start. Some tips are as follows:

- one stakeholder could take responsibility for coordinating formulation of a specification but seek the detail for specific sections from appropriate stakeholders, for instance legal requirements;
- to minimise the length of the process, stakeholders should be given the opportunity to comment within a given timeframe and a first draft 'discussion document' produced at an early stage. Several different versions will likely be created before it is finally issued;
- if possible the specification should define the requirements rather than the implementation methodology. This allows flexibility in the delivery, innovation or alternative approaches;
- appendices can be produced specifically relating to each stakeholder to ensure that everyone's requirements are catered for;
- if the procurement covers multiple users, the specification could be in the form of a 'call off contract' from which each stakeholder can have a separate contractual relationship with the chosen supplier;
- clear system performance criteria and targets should be defined within a specification. A penalty and reward regime should be considered.

4.5 Choice of supplier

4.5.1 Different projects will have different priorities in terms of the functionality desired. Within tender bids, suppliers will describe as to what they have delivered to date in other systems. It is often beneficial for stakeholders to take the effort to see examples of working systems from each short-listed bidder before making a choice. This will give them a better understanding of what they may be purchasing. The opportunity should be taken on visits to speak to authority and operator personnel that use the system to understand how the system works in practice.

4.5.2 Some tips on how to evaluate tenders are as follows:

- evaluation of a tender is best performed by grading strictly against specific criteria, for instance project management and delivery, systems functionality, system maintenance etc;
- if a bid comes from a consortium, care should be taken to understand how the consortium will operate to deliver all aspects of the project, both at supply time and in service;
- a defined set of tests should be undertaken during site visits to clarify issues that are unclear in tender submissions;
- evaluators should be realistic on assessing risks when an aspect of system is said to be 'under development'.

4.6 Following award of contract

4.6.1 For many projects, the awarding of a supply contract represents a key milestone in an implementation. Before commencing with installation, it is well worth reviewing the management processes for the project, because a key new stakeholder (the supplier) has been brought into the project. The review should include:

- the method for convening, chairing and inviting people to project meetings;
- the extent of delegated authority to the project manager;
- key milestones and measurement of project delivery;
- escalation routes and expected actions;
- change control procedure;
- the review processes for identified risks and issues.

4.6.2 Specifically, at this stage the authority will be able to be clearer to the supplier about the specific local challenges. It is important to be as open as possible at this stage: a supplier cannot mitigate or work round a problem if it is hidden from him. During procurement, these may only have been alluded to obliquely ("how would you handle a hypothetical situation where..." rather than "the south side of the High Street is a nightmare because...")

4.6.3 Following management review, it may well be appropriate to perform a detailed review of the project prior to the start on any works. This should include a 'due diligence' exercise to identify clearly and openly what is required from each stakeholder and how they intend to deliver these in line with the plan. In addition, if not already set, the acceptance criteria (FAT & SAT) should be established at this stage in the project.

4.6.4 Long lead time items should be reviewed as part of this process. These may include:

- date sources and availability;
- application features requiring development;
- planning permissions;
- communications links to street (wireless has an advantage);
- power supply to street (solar/wind has an advantage, though may struggle to provide enough);
- civil works being undertaken outside the UTMC project, eg bus lanes or ducting runs;
- projects within the authority and outside to which the UTMC needs to connect, and which might be running to different timelines.

5 User engagement

5.1 Introduction

5.1.1 In order to get the best out of the UTMC system to be installed, it is essential that key operations personnel are aware of what the project is aiming to achieve and are consulted to ensure that their needs are addressed. This section details some of these personnel and why and how they should be approached.

5.2 Senior staff

5.2.1 Traditional UTC systems are principally tools for moment to moment control of the network. Obviously senior management need to be convinced that they deliver value for money, and may become involved in the event of a serious incident, but normally they will leave UTC operation to technical staff.

5.2.2 This is not true with UTMC. One of the key opportunities with a full-fledged UTMC system is that it provides a platform for genuine strategic monitoring and management of the network, following the obligation of local authorities under the Traffic Management Act 2004. Authority staff at senior manager and director level should, therefore, be seen as direct users: what does the Traffic Manager get out of the UTMC system?

5.2.3 Questions to ask of these staff are:

- What information reports do you want to be available on network conditions, and how frequently?
- How would you like them presented – anything from traditional officer papers up to a live "executive dashboard"?
- Under what circumstances would you need to have direct input into management strategy, and how would you like to do this?

5.2.4 Of course, this needs to avoid institutionalising micromanagement. Clear rules of engagement need to be set and followed.

5.3 External users

5.3.1 Some of the most important users of the UTMC system may be from organisations external to the authority – this should be clear from the system architecture and operations concepts. These users need to have their requirements captured, and to be involved in the procurement process to ensure that what is delivered is worthwhile.

5.3.2 This engagement will happen naturally if the external party is contributing funding, but even if they are not, there is no point in implementing a system feature unless you can be confident that it is optimised for its intended users.

5.3.3 Typical external users are:

- The emergency services, particularly the police – most obviously for managing incidents but also for surveillance (CCTV, ANPR, etc) or information (VMS).
- The media, for the provision of broadcast travel information.

- Neighbouring highways authorities, including for the interurban network, especially where there is joint control of equipment.

- The passenger transport community, for tactical information such as bus priority or probe vehicle information, as well as for strategic information such as general network loading.

- Business, leisure and community organisations. Most may be happy with published transport information but some may have more specific requirements.

5.4 IT

5.4.1 A UTMC system is typically a complex network of integrated host systems, devices and applications. In line with the design philosophy of UTMC, these will be constructed using mainstream technology. There will usually, therefore, be some involvement with the authority's IT department.

5.4.2 A good relationship with the relevant IT people can be immeasurably helpful. They can save work and money by providing server space, communications networks and staff to do "housekeeping" such as backups and virus protection. They can also provide advice and guidance on the technical aspects of integration. It is well worth taking advantage of this expertise and support. Above all, avoid conflicts between your system integrators or consultants and the authority's IT staff.

5.4.3 Where problems have arisen, they have almost always done so because of poor communication:

- IT don't understand some of the technical challenges of UTMC. Explain the environmental factors to them (don't buy streetside equipment in a High Street shop), and the 24/7 nature of operations (don't shut the servers down on Christmas Eve).

- Traffic management staff don't understand some of the operational challenges of IT. Firewalls are there for a reason; so is authority policy on sourcing.

5.4.4 Suppliers of software-based products often offer long-distance support services. Some of these require fairly deep and high-privilege access to the product. Check with IT that this is acceptable, and put in place any measures needed to ensure secure operations.

5.5 Traffic management staff

5.5.1 While these are likely to be the most obvious and frequent users of the UTMC system, they will probably be the easiest to capture requirements for. The concept of UTMC begins with a traffic manager's perspective, and most system providers have aimed their products squarely at them.

5.5.2 However, UTMC should not simply replicate what is in place already. Users should be stretched to think about their real business needs. Is it the congestion on the morning peak? Air quality? Dealing with a new development? Inappropriate freight behaviour? Safety?

5.5.3 Often, users cannot pin this down clearly up front. Many projects have yielded most value only once the UTMC integration was in place, and the relevant staff were able to "play" with the data. Make sure that users have the opportunity to be a little bit creative with the UTMC system.

6 Streetside equipment

6.1 Introduction

6.1.1 The rollout of streetside equipment is often the most expensive and time consuming aspect of the programme, and the one which is most subject to external factors. This section covers how the rollout process should be undertaken and what steps should be carried out to make this process as smooth as possible.

6.2 Streetside architecture

6.2.1 UTMC is IP based. This means that many different devices can, potentially share a communications link to the centre. In principle this could save a dramatic amount of money spent on communications links.

6.2.2 To achieve this, there needs to be a means on the streetside to collect together communications from nearby devices. There are many ways of doing this (local wiring, short-range radio LANs etc). However it requires careful thought to ensure that individual device requirements are met.

6.3 Rollout programme

6.3.1 Rollout is likely to be dependent on the financial programme (see section 3.3). Within these constraints, there are some useful principles that may be adopted.

- Collect data before you use it. For instance, deploy your detectors first, then your control algorithms and signal controllers, then your VMS and web services.
- Give enough time to bed in each phase of the project before going live with the next.
- Think about the density of deployment. Do you really need some form of detection every 50m, or could this be eased?
- Consider portable and mobile equipment too, where there is no requirement for permanent siting. There may be value in linking roadworks signals, observation CCTV, temporary rising barriers etc into the UTMC system.

6.4 Installation

6.4.1 Installation and acceptance are a key part of the project. Although some of this will be for the supplier to programme, you should be aware of the following:

- A site survey is needed to determine how long each installation requires – bearing in mind that each junction is different.
- There may need to be scope for an installation to be “unrolled” if problems occur during installation (eg card failure) but the junction needs to be back in working order for the morning peak.
- Which installations can be undertaken safely during the daytime?

- Installations may require the services of multiple agencies. For instance, if a power supply is required before the controller box is configured, make sure it's there before despatching the control box installer.

- How are installations verified and accepted as installed and operational?

- How is the configuration management done, ie who records (and checks) the version, location and status of deployed equipment?

6.4.2 It is worth checking that installation and acceptance plans are practical. Is there a major event the weekend you have earmarked for rollout? Are the staff needed for acceptance testing (including potentially staff from other suppliers) all going to be available?

7 Traffic Management Centre equipment

7.1 Introduction

7.1.1 The core of the UTMC system is the network of computers and applications at the traffic management centre. This section identifies some of the pitfalls in this area and makes recommendations of how to avoid them.

7.2 Procurement and integration

7.2.1 Unlike traditional systems, UTMC systems are unlikely to be bought and implemented all at once. Instead, a new component is likely to be acquired – often from different suppliers – every year or two, and need integrating into the system.

7.2.2 It is crucial that in doing this, the effectiveness of current proven systems is not compromised. There are a number of things that can be done to achieve this:

- Prove the new system standalone as far as possible first, through factory acceptance tests (FATs) and site acceptance tests (SATs).
- Operate (or create when necessary) a “development system”: an off-line replica of your operational system, ideally receiving live data but not in control of actual street equipment etc. Integrate the new system with this development system first.
- Stress test the integrated development system with simulated data – perhaps a recording of a previous Christmas peak.
- Pay particular attention to resources that may be stretched by the integration: memory, communications, processor power etc.
- Ensure that information security is not compromised.

7.2.3 The first three should, if they are to be used, be included in tender documentation. For the last two it will usually be important to get your IT team’s advice.

7.3 System management

7.3.1 A UTMC system is likely to require considerably more management than an autonomous application. Care should be taken to identify:

- An operational regime – consider developing a “flowchart” guide.
- A data management regime – identify what data archives are required, and how they are to be stored.

7.3.2 It is particularly important to document these for business processes that involve interoperation with external organisations. For instance, when an incident occurs near the authority boundary, what information is passed to neighbouring authorities and how?

7.4 Facilities

7.4.1 Autonomous applications can be relegated to a server room. Conversely, a reasonably rich UTMC system must be designed and implemented in a space which fulfils the needs of its human operators.

7.4.2 Usually there will, of course, need to be a compromise in terms of what space is available. A full CCTV video wall may not be possible!

7.4.3 Once the requirements are clear, take advice from colleagues in other authorities. Some pointers are:

- Are the sightlines good? Does each operator have ready access to keyboards, screens and other devices?
- Are the acoustics good? Do those who need undisturbed telephone or radio communications (eg for incident control or broadcast media) have the quiet spot they need?
- Is the layout efficient? Are operators likely to be crossing each other in the course of their daily activity?
- Is there adequate space for third party liaison officers, either permanently or on an occasional basis? Examples might include public transport, emergency services, media, and VIPs.
- Is there sufficient personal space to make it a pleasant working environment – family photos, etc – without creating operational risk?
- Do staff have the opportunity to move around enough while at work, or are they desk bound? A ten minute break every hour is recommended. Some authorities actively advise staff not to collect coffee for colleagues, so they have to do it themselves!

7.4.4 Consider also that the operations space includes staff available remotely, from desks elsewhere in the building, from remotely logged-in laptops, or even at the end of a phone.

7.4.5 Invest in high quality user PCs. The marginal cost of a large screen, extra memory or utility applications is extremely modest, and the operational benefit large. Some staff may need specialist peripherals – drawing tablets, scanners, etc.

7.5 Dissemination

7.5.1 A key role of many UTMC systems is the communication of information about the network out to interested stakeholders. This is likely to be valuable politically as well as in pure traffic operations! It is worth, therefore, thinking carefully about how this is done.

7.5.2 If your team is large enough, you might consider appointing someone as a “communications officer”. If this is unrealistic for just the UTMC unit, it may be worth doing so jointly with related teams (eg bus information, roadworks, etc).

7.5.3 There is no hard and fast line between stakeholders who are simply provided with information and those who are actively engaged in cooperative delivery. For instance, the local business

community may be happy with a web feed on current congestion, car park status etc; or they may wish to discuss more operational activities such as optimisation of freight/deliveries. Similarly, Council stakeholders will include some who want simply to monitor the situation information, and others who have specific business needs (eg for air quality management).

7.5.4 It is likely that the majority of information provided to these groups will be based on the web or, possibly, mobile internet. However other channels (eg call centres or printed material) may be relevant. This is another area where you can collaborate with other authority services.

8 Communications services

8.1 Introduction

8.1.1 Communications is often an issue that causes concern amongst implementers of UTMC systems. This is partly due to the complexity of some of the technology involved, partly due to the increasing choice in the marketplace and partly due to frequently changing price structures which may alter business cases.

8.1.2 This section covers the two principal types of networks used in UTMC systems and the issues surrounding their use.

8.2 Link-based systems

8.2.1 In link-based systems, communication links are set up between pairs of nodes in order to exchange information. Links may be wireline or wireless.

8.2.2 Communications links may be of many sorts, and range from those which are fully owned and controlled by the authority (eg microwave radio or pulled-fibre), to those which are provided under contract (eg leased lines or dial up connections). The common thread is that the authority or its supplier has to make sure that is can make use of the link, and that the pattern of linkage is kept under control.

8.2.3 Fully owned links are popular as, once installed, they require little ongoing revenue to maintain them. However, telecoms operators are often able to provide a more cost-effective service. As with all communications choices, stakeholders should look to fully understand installation and ongoing costs at an early stage in the project

8.2.4 Wireline links tend to be preferred as they are usually more robust and resilient and have higher capacity. However they also need to be installed and this can be time consuming and expensive. It may be more convenient to use radio where ducting is not readily available or unreasonably expensive, eg remote rural sites, temporary signals, “clusters” of nearby items around a junction.

8.2.5 For radio links:

- infrastructure such as base stations requires planning permission, which can be time consuming;
- radio spectrum is not all free-to-use, and there are costs associated with obtaining a radio licence from Ofcom;
- whether owned or commercially provided, coverage needs to be sufficient at the available frequencies; this may be particularly problematic in hilly regions and needs specialist expertise;
- radio links need power at both ends; unless this can be provided onboard (batteries, solar, wind) it will require a power feed and this can be expensive.

8.3 Network services

8.3.1 Managed networks are a newer concept but are now widespread. The concept is well suited to UTMC projects: UTMC builds almost wholly on Internet Protocol (IP) networking, which is a "network-level" protocol.

8.3.2 What this means is, in principle, simple. It means that by adopting IP, the project manager merely needs to identify the devices that need to be communicated with, and assign them an individual "IP address". It is then the responsibility of the network provider to ensure that the connection happens. This is similar to how the Internet operates: a person can use their browser to "hop" from one site to another, without worrying about whether their PC has a link to each site host – the network does it all.

8.3.3 In the case of UTMC (and indeed the Internet), this is a slightly simplistic view. The user needs to be assured, for instance, that the network is adequately secure, has sufficient capacity, and doesn't impose too much delay on messages getting through. To achieve this requires a close dialogue and it is often most appropriate to use the authority's IT department as the network provider. They will, in turn source specific communications capacity from telecoms operators, and devices from network products suppliers, to meet the system's needs.

8.3.4 For a managed network, the key issue is how to agree and enforce a "Service Level Agreement" (SLA) with the network provider. This will cover aspects such as:

- Where the responsibility of the network provider stops (and, often, what limitations are imposed on the user so as to protect the network)
- How fast and reliable the network will be
- How quickly the provider needs to respond for new connections, faults etc

8.3.5 It is also worth considering what happens when something goes wrong. Is the answer "sorry, we're doing our best" enough? If not, do you need a fallback?

8.4 Newer communications technologies

8.4.1 As with all innovative areas, communications technology is rapidly advancing. Stakeholders may wish to examine how less conventional methods can be incorporated into their system to help to deliver their requirements.

8.4.2 Communications is a specialist subject and expert guidance is valuable. However the normal rules of project management apply: weigh the benefits against the costs and risks before proceeding.

8.4.3 A good example of this is the use of 'wireless fidelity' (Wi-Fi) networks in systems. The term Wi-Fi is used generically to refer to any type of wireless network based on the IEEE802.11 protocol series, which is aimed at short range, high capacity links. These can be used in principle to create a local network within a building, or around a junction; they can also be used in an 'ad hoc mesh' architecture to create a virtual network which includes links from vehicle to vehicle, streetside or centre.

8.4.4 However, the way in which each kind of WiFi network behaves, and the impact it has on the rest of the system, varies dramatically. So, it is easy to buy a WiFi adapter for a home PC for around

£10 that yields 54Mbps capacity; but it would be totally inappropriate to use this as the basis for an environmentally challenging, managed capacity environment such as UTMC. WiFi implementations have suffered because of inadequate prior planning.

9 Data

9.1 Introduction

9.1.1 The accuracy and integrity of data will directly impact on system performance. It is important not to under-estimate the time and resource required to get the necessary data streams in place for a UTMC system. This section describes some of the more commonplace issues encountered when tackling data issues.

9.2 Data integrity

9.2.1 It is essential that the way data flows round the system and between organisations is understood by all. This should be represented diagrammatically to stakeholders. At the same time it should be agreed who is responsible for passing what data to whom, when data changes, and who authorises and checks any changes.

9.2.2 It is important that the outputs required are reviewed at the same time as the data availability is reviewed. For example, if a car park operator wishes to review the ingress/egress by time of day, detector data must be available at relevant points on the road network.

9.2.3 Primary data sources should be used where possible, as secondary data sources may have been created using manual data entry and may be susceptible to human error. For instance it is preferable to take roadworks information direct from the EToN source, or trunk road information direct from HA.

9.2.4 Information is often used from geographical information (mapping) systems. The accuracy of this data will need to be checked as well as how regularly updates have been performed. A review at this level may catalyse a review of a range of other systems in use by the local authority or by an interworking third party.

9.2.5 When considering data integrity, consider the following:

- How robust, reliable and complete are the data sources?
- How does data get checked and what automated checks can be conducted on the data prior to commissioning?
- What checks can be made during operation and who does them?
- What level of inaccuracy is acceptable to the system?
- How often does the data change or need to be updated?

9.3 Manual input

9.3.1 Manual inputting is a time-consuming task, susceptible to human error; however, there may not be a ready-to-use fully automatic data feed from the outset of the project. An example might be in the case of incident management, where relying solely on automated data input is not realistic.

9.3.2 The level of detail of data required for a system will differ from case to case, and this will have a direct impact on the level of resource required for the task. Therefore, it is important to determine how much data needs to be manually inputted and how long will this take.

9.3.3 Project stakeholders need to consider who is to be responsible for inputting data. If the local authority is to be inputting the data but does not own it or have primary access, the relevant stakeholder must fully assist to ensure they have up to date, accurate information. (Incidents, for example, rely on police input.) Co-locating or embedding staff may be necessary, either permanently or on an as-and-when basis.

9.3.4 One of the few benefits of manual inputting is the understanding of the data structure that the user gains. This proves invaluable when troubleshooting at a latter date in order to rectify possible errors in the data.

9.4 Automated data feeds

9.4.1 All projects should explore the means by which an automatic data feed can be provided because of the potential reduction in labour this requires; however automated systems are not always easy to use and can be expensive.

9.4.2 Awareness should be gained of national/international initiatives such as TIH and DATEX, or project opportunities arising through EC or regional funding. While UTMC tries to maintain alignment with all relevant initiatives, local managers will inevitably need to respond to these.

9.4.3 If a direct data feed is being considered, how ‘automatic’ will this feed actually be? If it takes as much time checking data as it took inputting data, the ‘automatic’ feed might not represent value for money.

9.4.4 Always remember that any data feed can only be as good as the data it is feeding. An automated data feed speeds the transfer of data but does not validate the completeness or the accuracy of what is transferred.

10 Project closure and on-going systems management

10.1 Introduction

10.1.1 Closure of a project involves several stages. These include the testing and any formal evaluation of the system. This section details closure of a UTMC implementation project and the on-going management of the system.

10.2 FAT and SAT tests and sign off of system

10.2.1 FATs (Factory Acceptance Tests) and SATs (Site Acceptance Tests) are important procedures and usually have a formal contractual impact as well as allowing a supplier to achieve financial closure. It is recommended that the authority for FAT and SAT is clearly within the project plan and FAT and SAT criteria should be detailed within the tender specification. As this stage represents the delivery of business deliverable, all stakeholders should be considered.

10.2.2 Delays to FAT and SAT may be experienced as equipment may not be in place or as more is added previously working parts of the system may no longer do so. Also, implementers may experience issues with software upgrades and installations.

10.3 Project evaluation

10.3.1 All stakeholders of any UTMC project should be interested in the measured benefits from the system. An evaluation process should be identified at the early stages of the project. This should include clearly identified benefits that the stakeholders desire to be monitored; this will help ensure that any required “before” data is identified and captured.

10.3.2 Evaluation of an ITS intervention is not trivial and has been the subject of numerous studies[1]. In short, evaluation needs to reflect the policy goals that justified the investment in the first place. Approaches used include:

- using system data to measure changes in relevant parameters over time (peak period queue length or transit time, air quality, accident rate etc);
- conducting before and after surveys of different classes of stakeholders to measure perceived improvements (eg crossing safety for pedestrians, car park access for motorists, incident response for the police);
- undertaking a financial review, including both costs and savings;
- obtaining information from system or service suppliers (eg website hit rates).

10.4 On-going management of the system

10.4.1 Implementation is not an instant process, and one of the more difficult periods is likely to be when some equipment is deployed, some being installed, and some still to be delivered. The management of the project through this phase will be critical to the perception of the project by operational users and the public alike.

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1 For example the European project ITS City Pioneers, the International Benefits Evaluation Committee (IBEC) and the DfT’s ITS Toolkit, as well as a number of case studies in the UTMC demonstrator programme.

10.4.2 In many cases, a phased approach will be taken. A close relationship between project manager and the ongoing management (including aspects such as marketing) will need to be arranged.

10.4.3 Once the implementation project is formally closed after completion of FAT and SAT tests, the UTMC system now moves into operational mode and a new management structure will be required to accommodate this, even if personnel remain the same. At the very least, stakeholders (local authority traffic managers, other LA units, key private sector stakeholders such as shopping centres or ports, system suppliers, neighbouring authorities) should identify roles and responsibilities for the on-going management of the system including who will be in charge and who and will manage day to day operations. Responsibility for the ongoing operation of the system should be clear amongst the stakeholders and stakeholders must consider how they wish to continue to be engaged.

10.4.4 Areas which need to be considered include:

- maintenance of data sets and flows;
- review of system performance:
  - How is this measured, service availability and accuracy?
  - What remedial action is possible?
  - Who does the remedial action and pays who pays for it?
- management of communications infrastructure/contracts;
- review and delivery of business benefits;
- resolving snag list issues from SAT;
- maintenance of the hardware and components should be considered:
  - Who is responsible for maintaining what equipment?
  - Is this contracted to a third party if so how is this funded and who manages and reviews this contract?
  - How is performance to the contract measured?
- the process by which new components can get added to the system, including considerations of information security