



Subject	Travel Information Publication for Local Authorities	Date	19/12/05	Ref.	216875/TN/04
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1 Introduction and Scope

This note, requested by the Travel Information Highway (TIH) Executive, contains guidance for local authorities on how best to provide travel information publication services following TIH principles.

The scope under consideration is the system interface used by a local authority to provide travel information to other systems in external organisations. These may include the National Traffic Control Centre (NTCC), neighbouring local authorities, or perhaps other organisations such as commercial information service providers.

Given the wide set of contexts and applications for this system interface, it is difficult to state a precise set of requirements. Nevertheless, we have used our experience in travel information and ITS to suggest high-level characteristics of the requirements, and these are used to justify the guidance.

The requirements are split into aspects:

- the behaviour and technology of the system interface
- the kinds of data that should be exchanged.

2 Behaviour and technology of the system interface

There are currently two main interfacing technologies recognised in TIH Principles:

- For most requirements, provide XML on a webserver so clients can reach with HTTP GET.
- If there are more sophisticated requirements, CORBA may be used.

Experience suggests the simple HTTP GET of XML will be sufficient for the majority of local authority travel information publication services. This method has the advantage of being extremely simple and therefore inexpensive for the local authority to deploy and also easy for receivers to access.

The TIH principles also recommend that the local authority:

- Defines the XML format with XML Schema.
- Publicises this by submitting to the ITS metadata registry www.itsregistry.org.uk which supports the TIH directory service on the TIH website www.tih.org.uk.

These help ensure that the XML format and underlying meaning are easy to discover, clear and unambiguous, so that implementations are interoperable.

The “OTAP” exchange specifications¹ go into more detail than TIH principles and identify good rules about exactly how HTTP should be supported, and how XML files should be made available to ensure

¹ “Data Exchange for OTAP/EL” v1.0, 23 August 2003, Centrico OTAP Demonstrator Project, see www.itsproj.com/otap.

efficient services that also provide information about the health of the server. These exchange rules are sensible and well proven and we recommend that local authority travel information publications follow them.

3 Schema for Data Content

TIH Principles do not yet mandate a single preferred data model. So which standard or specification should local authorities use?

Before answering this question, it's worth re-emphasising that many recent specifications have made a clear separation between data exchange behaviour and data content. This means that it is possible to use the “exchange behaviour” part of a specification, but with a different information model. For example, it's possible to implement a service that complies with the “OTAP” data exchange specification, but uses a data model that is based on UTMC.

3.1 Candidates

This note considers three candidates:

- **UTMC** – designed for local authority needs and particularly attractive if local authorities already have UTMC systems.
- **Unified Centrico OTAP model** – well proven in use in European deployments.
- **DATEX II** – European Commission are supporting the development of this specification which is likely to be submitted to CEN for standardisation. Highways Agency are supporting its development and NTCC would be happy to receive information in this format.

A local authority could create its own custom format, but it would need a very good reason for rejecting all of the candidates listed above.

However, none of the three candidates are perfect at the time of writing:

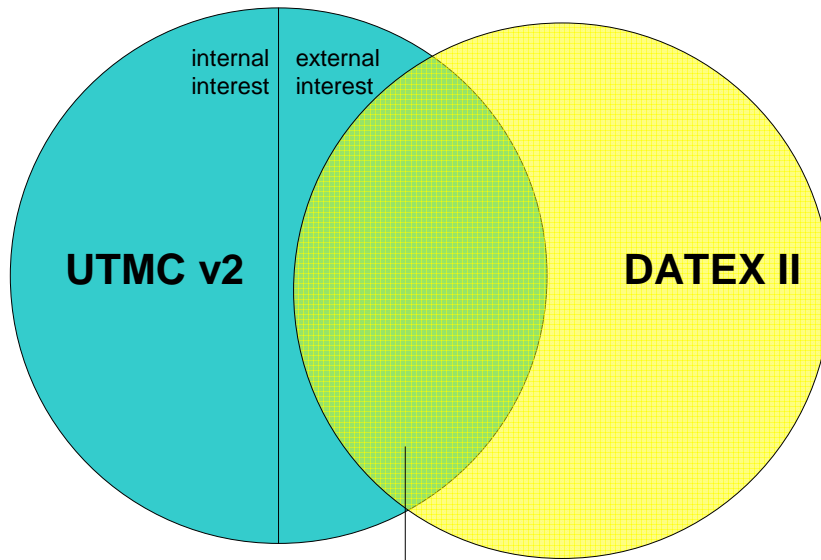
- **UTMC** - There is no agreed XML Schema for UTMC. A schema could be systematically derived from UTMC data object definitions, but these have been designed to suit internal operational UTMC needs, not necessarily information publication.
- **OTAP** – Has a focus on traffic events and so may not be suitable or capable of expressing other kinds of local authority data.
- **DATEX II** is under development and is not yet stable. There is a substantial overlap in data content with UTMC, but there are many aspects of UTMC which are not included in DATEX II.

This note therefore considers whether the parts of UTMC data **worth publishing to external organisations** are covered in the DATEX II models.

3.2 UTMC publication requirements and DATEX II coverage

We used our experience in travel information and ITS to make assumptions about the content that a local authority may have a requirement to publish, and then analysed the coverage within DATEX II. The analysis is based on UTMC v2. Although this version is not yet widely deployed, the level of standardisation across UTMC v1.X deployments is lower, so it would be harder to make any general analysis on that version. The full analysis is given in Appendix 1.

Summary of analysis: There is enough overlap between UTMC v2 and DATEX II for a local authority to produce a useful publication service based on DATEX II. However, not all of the useful information a local authority might want to publish can be represented, as depicted in the figure below. In some cases the information could be added to future versions of DATEX II without significant changes to the DATEX II infrastructure. In other cases the models are quite far apart and a larger effort would be needed if DATEX II is to accommodate these areas.



A useful service – but missing some useful UTMC content

A more detailed version of the coverage analysis will be supplied to the technical organisation responsible for the development of DATEX II, to give the best chance of support in future. The Highways Agency are considering the production of UTMC to DATEX II / OTAP translation software in 2006, initially for traffic events and possibly other areas in future, but this is not yet available.

How about OTAP?

The unified CENTRICO OTAP model is similar to DATEX II in coverage of UTMC traffic event data and meteorological data, but is poorer in the areas of air quality, car parks and detector data, and has nothing on journey time and sign settings. If only traffic events and weather are required then the model may be suitable and is proven in existing implementations, but for other requirements it can be ruled out. However, that doesn't affect the advice that the OTAP *exchange rules* are highly suitable for new publication services and are recommend.

Note: This analysis work would not have been practical without the ITS metadata registry www.itsregistry.org.uk which supported efficient navigation through models and searches for content across the models.

3.3 So what should a local authority do now?

Consider requirements; especially define who is going to need what kinds of data. If the DATEX II coverage described above is sufficient, then it would be a good idea to wait for the Highways Agency

conversion toolkit, which could be deployed alongside an existing UTMC system² and a webserver to produce an operational publication service.

If external users will be neighbouring local authorities who also have UTMC systems, and if there are requirements to exchange data which is not currently supported in DATEX II, then an XML schema based on the UTMC data model should be used. Note that this does not seriously disadvantage receivers preferring DATEX II feeds as they can deploy components of the Highways Agency translation software at their side of the interface. Appendix 2 offers some guidance on deriving XML Schemas from UTMC definitions.

² Note that lack of standardisation across UTMC deployments means there will be an inevitable requirement for tailoring for a specific UTMC system.

Appendix 1: UTMC publication requirements and coverage in DATEX II

We examine each category of UTMC v2 Data Object in turn. Detailed mappings to DATEX II v47 have been examined, though in this note they are only summarised.

A recurring general issue is that there are many areas in which UTMC has freedom but where DATEX II requires a much more specific representation, making it difficult to convert. Two typical scenarios in UTMC are the use of free text strings where DATEX II has defined all the possibilities, and the use of type codes where the actual codes are outside the UTMC specification and up to the supplier to define. The UTMC approach here is fine for human readers and internal systems, but makes it difficult for external systems to operate on the outputs.

NetworkSupport

Location mapping should be possible, but would require a certain amount of work - coordinate conversion, and possibly static data preparation to be able to ensure support of details of DATEX II location referencing.

Planned & Unplanned Occurrences (i.e. Traffic Events)

We assume a requirement to publish all kinds of UTMC traffic events.

A UTMCv2 Accident maps to a DATEX II Accident. A mapping can be found for several useful attributes. Some attributes have no equivalent; of these many seem non-essential for external publication, while a few useful text attributes could be concatenated in one DATEX II field.

UTMCv2 Incidents are more difficult. “An incident is an unplanned occurrence that may have a direct affect on the traffic flow in an area or may need to be recorded for other purposes even if it has no impact on the traffic flow.” If there’s no impact on traffic flow, there’s probably no need to publish. If there *is* an impact on traffic flow, it becomes a problem to work out which DATEX II object to use. The type of Incident can only be defined in UTMCv2 in a supplier-defined type Id or in the free text descriptions. There is no corresponding general “Incident” concept in DATEX II. A further convention would have to be adopted to identify the UTMCv2 Incident types.

UTMC v2 Roadworks map to DATEX II RoadMaintenance. As with Accident, some useful information can be mapped, other information can be concatenated in a text field. Some useful information would be missing, for example the mapping of planned vs actual start and end times is not ideal, and there is not a satisfactory way of saying whether traffic signals are in operation at the roadworks. In general a useful publication could be issued, but it would not capture all of the useful information.

Where UTMC v2 has Planned Events, DATEX II has a number of “Activity” classes including “Public Event” and “Authority Operation” (e.g. police check point). As with Incident, if an accurate mapping is needed there would need to be further conventions to identify the type of Incident. It may be acceptable to always map to Public Event, depending on the uses for the UTMC Planned Events table. Useful information can be mapped, but again some would be through concatenation in a general text field.

Access Control

This concept is missing in DATEX II, but we consider that there is currently no significant cross-boundary requirement to publish – although applications may arise in the future.

Air Quality

There may be a requirement to publish Air Quality.

The concept maps to DATEX II “PollutionInformation”. This has to appear in the context of a “Measurement” which has a mandatory clearly identified MeasurementPoint. This table would have to be simulated from UTMC data which has transport link reference and distance - possible but requires work with static data in advance. Most but not all of the actual UTMC pollutants are also present in DATEX II. A few pollutants are not present (but could easily be added to future versions of the DATEX II model without otherwise changing its structure). Units are problematic – UTMCv2 allows units to be defined in free text, whereas DATEX II uses fixed units. Conventions would need to be adopted to allow conversion. Other UTMC v2 details such as air quality equipment commands and configuration data are for internal UTMC purposes and we see no requirement to publish. Air quality equipment fault details are similarly unnecessary, except that some way is needed to avoid issuing faulty values with no faults to explain them. DATEX II doesn’t include fault information (except on VMS) so an alternative convention would have to be adopted, such as withholding data associated with a faulty sensor.

Car Parks

We assume a requirement to publish basic dynamic car park information such as occupancy and number of spaces available. Static information (such as opening times) is also of interest, although this could be published by a different method because it is so static.

DATEX II “CarParks” is strangely a kind of OperatorAction. DATEX II CarParks can represent status, occupancy and number of spaces. Other UTMC information such as fill rate, exit rate, occupied spaces, queue time, and configuration cannot be represented, but may not be essential. However DATEX II may be incomplete in this area because it’s not clear how to identify individual car parks other than by location.

CCTV

We assume a requirement of images associated with static locations. The image data would be outside the scope of the XML supplied of a publication service, but the service should be able to supply URLs for the images which can then be retrieved using HTTP GET.

There is no equivalent in DATEX II.

Common Support and Common Subsystem Support

These are for internal UTMC purposes and we see no requirement to publish.

Detector

We assume a requirement for basic dynamic data.

DATEX II has the TrafficMeasurement class which includes flow, occupancy and speed. Other detector details such as the eight flow classes defined in UTMC are not supported in DATEX II.

Fault Support

Fault details are for internal UTMC purposes and we see no requirement to publish, as long as conventions are adopted to prevent the publication of faulty data.

Meteorological

We can imagine applications, but suspect that these will not be a priority.

Most of the meteorological concepts in UTMCv2 can be represented in DATEX II. In a few cases UTMCv2 is free where DATEX II is more precise, and extra conventions would be required to convert.

Prediction & Profile

These are for car parks, detector data, link-related quantities, and route-related quantities, and would potentially be useful publications. However, UTMCv2 does not specify what the values actually mean – that is left to free text data at runtime. Further conventions would have to be defined before a conversion could be considered.

Traffic Signal

We can envisage an occasional requirement for dynamic data across boundaries. Often, two local authorities with urban boundaries would integrate via single UTMC system, however there may be exceptions such as Bristol – Bath.

Traffic Signals are not a focus in DATEX II which can only indicate a few broad classes of signal faults and cannot provide operational data values.

TransportLink

This is UTMC’s other method of location referencing, tied closely to SCOOT or ANPR network definitions. Dynamic SCOOT and ANPR data hangs off the network definitions. We envisage a requirement for the publication of dynamic speed and flow and static speed limit and capacity information, but not for ANPR details such as number plate match figures.

DATEX II can represent dynamic speed and flow associated with a MeasurementPoint. UTMC has these data at a link level, and an assumption would have to be made to be able to convert. For static speed and capacity data we do not initially see a mapping to DATEX II, but these static data items could be published through a separate mechanism.

TransportRoute

For route-level concepts such as journey time. A mapping to DATEX II ElaboratedData should be possible but we have not analysed this area in detail.

VMS

We assume a requirement only to publish actual messages, plus faults if required to explain messages. UTMCv2 details such as lantern state, luminescence level and relationships to car parks are not required. The basic essential attributes can be mapped to DATEX II VariableMessageSignSetting class.

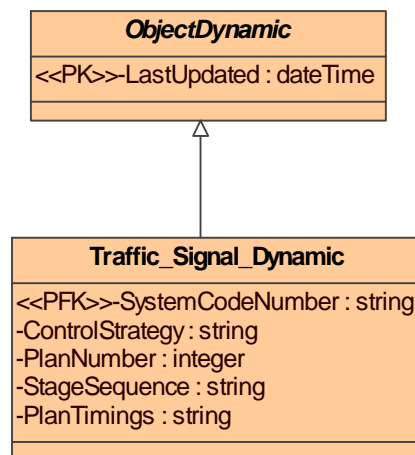
Appendix 2: Deriving UTMC XML Schemas

There is currently no agreed XML Schema for UTMC. However, a UTMCv2 UML model was created for the ITS Metadata Registry from UTMC data object definitions, and it is possible to systematically derive XML Schemas from this UML model.

The output from a systematic generation may not be perfect for because (i) UTMC includes internal details not required for external publication and (ii) there is an underlying understanding that the UTMC data objects are exchanged in a database environment, which may mean minor changes are required for a publication schema.

However, any changes made from systematically generated XML Schema elements should be minimised and should be only for one of the above reasons. Then the job of creating a publication service from a UTMC common database is made as simple as possible, and in the unfortunate case of parallel developments by multiple local authorities the chances of compatibility are maximised.

Dynamic data on traffic signals are used here as a small example. The UML class diagram below shows a small extract of the UTMCv2 UML model in www.itsregistry.org.uk, which in turn was derived as systematically as possible from the UTMC data object definitions spreadsheet, though it had to be supplemented by our knowledge of intended meanings where the spreadsheet fell short.



Systematic rules can be applied to generate XML schema definitions corresponding to these UML elements. We hope that in 2006 the UTMC community agrees a set of UML-to-XML Schema mapping rules to produce agreed XML Schemas. The XML Schema fragment below was derived using rules similar to those defined in the OTAP exchange specification, for example:

- UML class becomes XML Schema complex type
- UML generalization becomes XML Schema extension
- UML attributes become XML Schema elements in a sequence
- UML documentation becomes XML Schema annotation documentation element.
- Names map exactly

```

</xs:complexType>
<xs:complexType name="Traffic_Signal_Dynamic">
  <xs:annotation>
    <xs:documentation>Details of traffic signal status.</xs:documentation>
  
```

```
</xs:annotation>
<xs:complexContent>
  <xs:extension base="ObjectDynamic">
    <xs:sequence>
      <xs:element name="SystemCodeNumber" type="xs:string">
        <xs:annotation>
          <xs:documentation>Unique identifier for the object.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="ControlStrategy" type="xs:string">
        <xs:annotation>
          <xs:documentation>Mode of control, e.g. SCOOT.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="PlanNumber" type="xs:integer">
        <xs:annotation>
          <xs:documentation>Currently active plan.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="StageSequence" type="xs:string">
        <xs:annotation>
          <xs:documentation>The order of stages in the plan.</xs:documentation>
        </xs:annotation>
      </xs:element>
      <xs:element name="PlanTimings" type="xs:string">
        <xs:annotation>
          <xs:documentation>The duration of each stage in the
plan.</xs:documentation>
        </xs:annotation>
      </xs:element>
    </xs:sequence>
  </xs:extension>
</xs:complexContent>
</xs:complexType>
<xs:complexType abstract="true" name="ObjectDynamic">
  <xs:annotation>
    <xs:documentation>Dynamic data - This is where you define the data which
changes frequently for the object type.</xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element name="LastUpdated" type="xs:dateTime">
      <xs:annotation>
        <xs:documentation>Time/date of last change of this data.</xs:documentation>
      </xs:annotation>
    </xs:element>
  </xs:sequence>
</xs:complexType>
```

```
</xs:annotation>  
</xs:element>  
</xs:sequence>  
</xs:complexType>
```

This fragment illustrates the point made earlier that some UTMC v2 definitions are fine for human readers or internal systems but make it difficult for external systems to process unless further conventions are defined. The PlanTimings for example are a free text string, and without further refinement it is impossible for an external system do anything useful with these except display the unprocessed text to a human reader.