DATEX 2

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Executive Summary



1. Executive Summary

1.1. Introduction and Document Structure

This document is mainly targeted towards decision takers and non-IT personnel at the relevant organisations who wish to understand what DATEX 2 is and which advantages it offers compared to DATEX.

Although some deeper technical knowledge might be required to understand some passages of this document, it shall, together with a detailed cost estimate and migration plan to be provided by each centre, provide means to the relevant actors in the organisations to take well-based decisions when and how to migrate from DATEX to DATEX II.

The document is structured into five chapters with the following content:

- Chapter 1 “Executive Summary” gives a brief overview on DATEX II and the content of this document.
- Chapter 2 “Introduction” provides background information and a short description of the results of DATEX II.
- Chapter 3 “DATEX II in general” provides detailed information on the features of DATEX 2 and the DATEX II profiles.
- Chapter 4 “DATEX and DATEX II” holds information on DATEX and improvements by DATEX II.
- Chapter 5 “Technical analysis on existing DATEX networks and node types” provides means to assess an existing DATEX network and the existing DATEX nodes within a common schema.

An additional issue of this study will be released in 2007 which will provide the experiences learned from the Low Cost Profile and the Regular Profile demonstrators .

1.2. General Features of DATEX II

DATEX II is the successor to DATEX, a widely implemented pre-standard for the exchange of traffic information and traffic data in Europe.

DATEX II offers an

- accurate,
- reliable,
- modern and
- future proof

solution for traffic data exchange between

- Traffic Control Centres (TCC),
- Traffic Information Centres (TIC) and

other **entities** such as the police or service providers which can take advantage of this technology despite the initial focus on TIC/TCC data exchange.

DATEX II allows most software companies to participate in DATEX II related tenders due to the use of today´s **main stream IT technology platforms** such as XML/XSD and HTTP. A **large number of suppliers** from several fields of expertise can now compete. It can be used for a **wide variety of requirements** and for **all budget sizes** due to the profiling and **extensibility** features

1.3. Details

The DATEX II specifications provide an extensible framework allowing for a robust and reliable data exchange to support today’s requirements and market standards. The DATEX II platform independent content model is accurate and includes new data, such as travel times and meteorological data, according to the requirements provided by the Member States.

The DATEX II exchange mechanism comprises an improved delivery mode, the periodical snapshot of situations. Furthermore already known delivery modes for requesting data and for event driven approaches are included in DATEX II. These three delivery modes together with a new subscription mechanism provide the basis for a data exchange.

The dynamical UML modelling provides the basis for an accurate and unambiguous specification of the data exchange mechanisms.

The platform independent modelling guarantees, that new IT platforms can easily be integrated and a change in platforms can be mastered with a limited budget. The specifications for the data exchange are clearly separated from the content avoiding misinterpretation.

Due to the large step forward compared to DATEX, DATEX II is not fully backwards compatible. This means, that certain restrictions must be applied to the data to be exchanged between DATEX and DATEX II systems. For example, the range of information described in the Content Platform Independent Model (content PIM) of DATEX II may not be used to its full extent, meaning that, for example, not all features can be applied and not all defined elements may be used when connecting to a DATEX system.

Introduction



2. Introduction

2.1. Background

Delivering European Transport Policy in line with the White Paper issued by the European Commission requires co-ordination of traffic management and development of seamless pan European services. With the aim to support sustainable mobility in Europe, the European Commission has been supporting the development of information exchange mainly between the actors of the road traffic management domain for a number of years. In the road sector, the DATEX standard was developed for information exchange between traffic management centres and constitutes the reference for applications that have been developed in the last 10 years. With DATEX II the DG TREN now also pushes the door wide open for actors of the traffic and travel information sector.

Much investment has been made in Europe both, in traffic control and information centres over the last decade and also in a quantum shift in the monitoring of the Trans European Network. This is in line with delivering the objectives of the Tempo projects for safer, better-informed travellers.

Collecting information is only part of the story – to make the most of the investment data needs to be exchanged both with other centres and, in a more recent development, with those developing pan-European services provided directly to road users.

DATEX was designed and developed as a traffic and travel data exchange mechanism by a European task force set up to standardise the interface between traffic control and information centres. It has been the reference for applications that have been developed and implemented in Europe.

The DATEX technical documents namely the data dictionary (pre-standard ENV13106:2000) and the DATEX-net specifications for data exchange (pre-standard ENV13777:2000) now need to evolve to reflect technological evolutions, the experience gained in data exchange implementations that were achieved between the European countries and the new needs that have been identified by the market.

Alongside the DATEX pre-standards, a Data Exchange Memorandum of Understanding (DATEX MoU) covering international exchange of traffic data was formally established in October 1997. The MoU confirmed in a formal manner that the development of international traffic data exchange would be based on the DATEX technical specifications, and it established an organisational framework that enabled users to influence and participate in the developments. Different organisations were created under the umbrella of this MoU.

- a **Supervisory Management Committee** (SMC) in charge of the strategic orientation of the deployment of DATEX,
- a **Technical Committee** (TC) in charge of providing technical support to the SMC.
- a **User Forum** provides the platform for DATEX users to discuss and even influence the developments within the DATEX domain

The signatories of the current DATEX MoU decided to work on a revised MoU which is more focused on the availability of traffic and travel data to third parties.

It should be noted that many of the original signatories are participants in the Euro-Regional projects which form the EU deployment programme for ITS, know as the TEMPO Programme1, involving more than 80 organisations from 14 Member States and three neighbouring countries.

Around April 2003, the European commission launched the invitation to tender for the evolution of the DATEX technical specifications. Faber Maunsell (one of the most experienced and respected transportation consultancies in UK) won this tender. The project “D2 evolving DATEX”. was covering the time period from January 2004 to March 2005.

The D2 Project has driven the evolution of the DATEX specifications to meet new technical and user needs and to help further deliver transport policy.

2.2. DATEX II Results

The DATEX II results delivered so far:

[1] EU Funding Programme 2001-2006 for the deployment of ITS (**T**rans-**E**uropean Intelligent Transport Syste**m**s **P**r**o**jects). The TEMPO Programme was adopted by the European Commission on 19 September 2001 as part of the Multi-annual Indicative Programme for the Trans-European transport network 2001-2006. The programme is managed by the Directorate General for Energy and Transport

- a platform independent data model for content and exchange, the Content PIM and Exchange PIM;
- a new data dictionary;
- a tool to automatically generate the new data dictionary;
- an automated tool to generate the XML Schema;
- a study concerning a PSM for the selected demonstrator platforms

The DATEX II specifications provide an extensible framework allowing for a robust and reliable data exchange to fulfil today's requirements and support market standards. The DATEX II platform independent content model is aiming on being accurate and logical. It includes new data, such as travel times and meteorological data, according to the requirements provided by the Member States.

The DATEX II exchange mechanism comprises a new delivery mode, the periodical snapshot of situations. Furthermore already known delivery modes for requesting data and for event driven approaches are included in DATEX II. These three delivery modes together with a new subscription mechanism provide the basis for a data exchange.

The DATEX User Forum on 20 January 2005 resulted in the choice of "webservices over http" as the technology for the DATEX II regular profile. The CENTRICO and SERTI projects volunteered to build two demonstrators with different profiles to show the adequacy of the study results and the platform choice and interoperability among them before starting the standardisation process within the CEN.

2.3. Migration Issues

A high level comparison between DATEX and DATEX II shows that:

- The DATEX II data model consists of more than 100 detailed classes, DATEX consists of 10 general classes.
- DATEX II allows Alert C and TPEG Loc as well as PointByCoordinates as location referencing at the users discretion.
- DATEX II provides an XML schema for the exchange messages description.
- The XML Schema and the DATEX II data dictionary uses explicit names instead of trigrams.

The existing DATEX network consists of 50 to 60 operational nodes organised in different network and node types throughout Europe. The majority of nodes are used for national exchange of data, but some of them support international exchange. To allow the existing users of DATEX to migrate to DATEX II, a detailed migration path needs to be described in the form of a roadmap. Different Member States will have different requirements for migration. Thus the need for a migration study was identified by the European Commission and the TC who entrusted ARTS and CORVETTE with this task.

Migration can be defined as a means of overcoming technological obsolescence by transferring digital resources from one hardware/software generation to the next.

The purpose of migration is to preserve the intellectual content of digital objects and retain the ability for clients to retrieve, display and otherwise use them in the face of constantly changing technology. Migration differs from the refreshing of storage media in that it is not always possible to make an exact digital copy or replicate the original features or appearance while still maintaining the compatibility of the resource with the new generation of technology.

Migration leads to dedicated forms of maintenance for existing solutions. In the first instance, there is a need for adaptive maintenance. This changes software to allow it to work in an altered environment, such as when an operating system, hardware platform, compiler, software library or database structure changes.

Adaptive maintenance is followed by enhancement, which allows a new capability/capabilities to be added to software or a system.

2.4. Scope of the Migration Study

The scope of Migration study is to

- enable a smooth migration while safe-guarding investments
- provide information on the DATEX II results and advantages
- provide guidelines to the strategic level to enable decision makers to understand the issue well and manage innovation
- provide an overview on the state of art in Europe at technical level
- provide an instrument to define a strategy for long lasting success of DATEX II

In short, the Migration study is set to support decision takers in the task of migrating the current DATEX network to DATEX II and to define a strategy for the migration for their centres.

DATEX II in general



3. DATEX II in General

3.1. Important Features

The DATEX II technology development has been organised into six workpackages (WPs):

WP 1: generate a platform independent model (PIM) for exchanged data
WP 2: upgrade the data dictionary
WP 3: provide a mapping of the abstract content PIM to the the XML technology platform via the automated generation of a XML schema definition
WP 4: modelling of the exchange mechanism at PIM Level and generate a platform specific model (PSM)
WP 5: definition of the low cost profile
WP 6: study the migration from DATEX to DATEX II

After the completion of the survey concerning the demonstrators this chapter will be extended with information based on the results of those demonstrators.

3.1.1. PIM - Modelling of Data in UML

The DATEX II development focussed on the production of a set of reference documents which make a very clear distinction between data (content) and exchange mechanisms. The main part of the work has been focused on the subject of Traffic and Travel Data Models.

As shown in figure 1, the technical description provides a very clear distinction between platform independent modelling aspects (PIM) and platform specific modelling aspects (PSM). PIM aspects are described in UML.

In each case, a clear distinction between the data modelling (referring to traffic domain) and the data exchange specifications (referring to information and communication technology) were introduced.

	Modelling of data (traffic domain)	Modelling of exchange (ICT domain)
Platform independent models (PIM)	X	X
Platform specific models (PSM)	X	X

Figure 1 – aspects to distinguish in the new descriptions

This approach has been chosen, as it provides several advantages:

The seperation of the aspects provide better understanding of the standard to the users and make it easier to apply.

the platform independent aspects can be considered as more stable than the platform (and technology) specific aspects.

The project has produced explicit models in Unified Modelling Language (UML), which define the contents of DATEX Traffic and Travel publications independent of the exchange mechanism or implementation technology.

The former DATEX specification was a ‘closed’ standard, i.e. a potential user could use the data concepts provided by the Data Dictionary, but if the application required data concepts that could not be found in the Data Dictionary, there was no way for this user to extend the data model without breaking the standard. Many potential users thus ignored DATEX entirely and produced non-interoperable solutions. It is one of the major requirements for the evolution of DATEX to overcome this problem.

3.1.1.1 The core model – “Level A” data model

The deliverables of the D2 project include an extensive data model (named “level A”), that will be suitable for most data exchange scenarios. This model already contains a vast amount of options that users can choose from when assembling data publications. Nevertheless, there will be situations where data concepts required by a particular user are missing in the Data Dictionary, for example because they only make sense in a National context. In this case, these users are

expected to provide an extension to the model (named “level B”), that provides the missing concepts. Users are allowed to apply a limited set of well defined UML mechanisms for these level B extensions, which then still maintain technical interoperability with standard DATEX II systems. This means that standard (i.e. level A) compliant systems will still be able to process publications generated from an extended model, of course without being able to process the extension content. Specialised clients can process the full content – including the extension – but of course can also process standard (i.e. level A) publications.

The main principle of level B is thus that users find the level A model appropriate for a large part of their publication. This may not be the case if entirely new concepts outside the scope of the level A model are introduced. In this scenario, DATEX II users are still expected to apply the modelling rules and the UML profile described in this report, which will provide them with a basic level of interoperability. These models are denoted as “level C”. Implementations that provide publications according to level C extensions can not expect to be interoperable with standard level A systems.

3.1.1.2 The extended core model – “Level B” extension mechanisms

Although the “A” model will be fully rich, over time there will always be cases where new applications, both at national and international level, will want to add additional concepts and attributes to the existing models. To cater for this future proofing aspect of the modelling it is desirable to have a formal mechanism by which the “A” model can be extended.

For these new applications requiring extensions to the “A” model the concept of Level B compliance is envisaged. This will allow the development of specific models that will enrich the “A” model with additional, application specific information.

These models/applications will remain interoperable with “A” model compliant suppliers/consumers: they can exchange objects structured according to these enriched models.

Suppliers/consumers that want to make full use of the information defined by these extensions to the “A” model will need additional software or metadata driven software to handle the additional application specific information.

It is anticipated that there should be a registration process for level B model extensions, whereby a registry is maintained of current approved extensions (possibly under the authority of the Datex TC). Once an extension achieves a major degree of consensus it would become a candidate to be absorbed into the formal DATEX II core models.

3.1.1.3 Using the DATEX II concept within different contents – DATEX II “Level C” Users and Models

After consideration of Level A and Level B compliance rules some users within the ITS domain may still find that there is no way that their specific data models can be accommodated. They are just too different from the Level A model or else cover completely different contents.

Nevertheless, there is still a lot of benefit to be gained by including this type of user within the DATEX II Community (i.e. a common meta-model and the common data exchange mechanisms).

Therefore, in DATEX II a third level of compliance is offered, Level C, which will allow users to be included in the DATEX II Community.

Level C implementations are to be considered as not compliant with the DATEX II Level A/B content models. However, they are to be compliant in all other aspects of the DATEX II specifications.

Obviously these Level C compliant systems would not be interoperable with Level A compliant systems, but at least they would use common modelling rules and common exchange protocols.

This would allow opportunities for the exchange of ideas and modelled concepts which may in the future lead to common model elements facilitated via some sort of model registration process. It will also permit many helpful software tools to be used with Level C compliant contents.

3.1.2. Data dictionary

The DATEX standard provides a data dictionary which is readable by traffic engineers and IT experts alike. As the content is stored within the UML model in DATEX II which is not simply accessible for reading by non-IT professionals a readable data dictionary is still to be provided prior to the launch of the CEN standardisation procedure. The data dictionary can be generated from the PIM automatically by a conversion tool developed within the D2 project.

3.1.3. XML Generation

The DATEX pre-standard contains specifications about how to exchange traffic information based on the pre standard ENV13106:2000 (Data Dictionary). The specifications for data exchange are a pre standard called ENV13777:2000 (Specifications for data exchange) prescribing the use of EDIFACT.

This way of exchanging information was often used in commercial applications in the 1990's. Today there is a growing market and use of XML for information exchange. A fundamental part of this approach is the XML Schema. Based on a data model and a data dictionary the XML Schema is designed to fit a certain area of applications. The schema is the tool to understand the content of the exchanged data.

A conversion tool has been developed to convert the XMI file derived from the UML model into the XSD.

XMI (XML Metadata Interchange) is an OMG standard for exchanging metadata information via XML. It can be used for any metadata whose metamodel can be expressed in MOF (Meta-Object Facility). The most common use of XMI is as an interchange format for UML models, although it can also be used for serialization of models of other languages (metamodels).

The following figure shows the work flow for an automated conversion process.

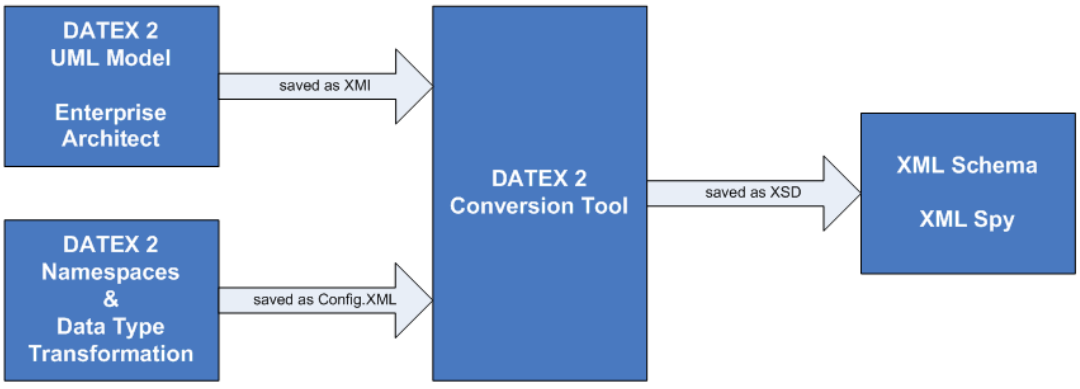


Figure 2 - conversion work flow

3.1.4. Exchange Mechanism for DATEX II Messages

Generally speaking, DATEX II offers a push and a pull mode for information exchange. The push mode (as in DATEX) allows the supplier to send information to the client while the pull mode allows the client to look up the information on the suppliers systems. In detail, DATEX II provides the exchange mechanisms as described below.

Static attributes are included to enable a DATEX II message exchange as well as a dynamic view of the exchange mechanism. There are three exchange types. These comprise a "fire & forget", filter type exchange and a catalogue type exchange. In a "fire & forget" type exchange the Client

receives a “snapshot” of the information the Supplier has agreed to provide. Within the filter type exchange one or more filters are provided to the Supplier for implementation on the Client’s behalf. A catalogue type exchange is one where the Supplier initially provides one or more catalogues containing lists of available information. The Client can then build one or more subscriptions comprising items from those catalogues. This is then returned to the Supplier, who then implements the Client’s subscription requests.

A subscription is a necessary pre-condition for the exchange of data. Without a subscription delivery of data is not possible.

3.1.5. HTTP and Web services

To enable a common understanding the following definitions of key words are given.

Implementation: In the context of this chapter, ‘implementation’ is understood to mean only the communicative connection between two DATEX II-compliant systems. How these connections are manifested in terms of hardware and software is not part of this deliverable; data exchange is the sole issue.

Platform: For the purposes of this chapter, ’platform’ relates to the technology used for transmitting information, in particular communication technologies based on the TCP/IP protocol. ‘Technology’ and ‘protocol’ are adequate synonyms for ‘platform’ in this particular context

During the evaluation, three technologies have been identified as suitable for an implementation. Beside FTP and HTTP, Web Services appear able to fulfil all requirements derived from the content and the exchange PIM.

Whereas Web Services are a sophisticated solution with their own, well-specified exchange layer, simpler protocols like FTP and HTTP do not have such a layer. If choosing one of those protocols, a separate layer for session management has to be built. Therefore, simpler protocols were taken into account only for implementation of the low-cost profile.

As an outcome of the PSM Workshop held in Brussels on January 20th 2005, a clear mandate has been given to Web Services for the regular profile and HTTP for the low-cost profile.

Web services are software-powered resources or functional components whose capabilities can be accessed via the Internet. Standards-based web services use XML to interact with each other, which allows them to link up on demand. Web Services use HTTP as their communications medium.

For an all-inclusive approach to the DATEX II exchange mechanism, the need for a session layer is obvious. Therefore, a more sophisticated protocol has to be used.

Web Services, also known as XML Web Services, are a synthesis of XML as a content container and HTTP as a transportation layer. They are an ideal means with which to exchange structured data.

SOAP (Simple Object Access Protocol) is a specification that describes how the XML data shall be distributed using HTTP. Thus, SOAP can be seen as the basis for a sophisticated DATEX II exchange.

With WSDL (Web Services Description Language), a specification for metadata is given. It can be described as an extension to SOAP because metadata are not specified in SOAP. WSDL describes how services, messages, parameters and data types are structured.

SOAP and WSDL in combination enable implementers to realise a DATEX II exchange. Furthermore, a couple of SOAP implementations are available on the market that could help to speed up the development of DATEX II systems.

3.2. DATEX II Profiles

DATEX II allows for several methodologies for information exchange, namely:

Operating Modes: an Operating Mode is a set of rules and conditions that stipulate the physical transmission of data between supplier and client(s)

- Operating Mode 0 – Subscription Management Mechanism - a specialized Operating Mode to handle subscriptions
- Operating Mode 1 – Publisher Push on occurrence - data delivery initiated by the publisher every time data is changed

- Operating Mode 2 – Publisher Push periodic - data delivery initiated by the publisher on a cyclic time basis
- Operating Mode 3 – Client Pull - data delivery initiated by the Client, where data is returned as a response.

Each Operating Mode can be both on- and offline.

Update Methods: differing amounts of data can be delivered within a Publication. Dependent on the type of Publication the following Update Methods are possible:

- singleElementUpdate - if a part of the data has been changed the related element , and only this element , will be exchanged.
- allElementUpdate - if a part of the data has been changed the data complex associated with this part will be exchanged.
- Snapshot - a snapshot contains all information that is available for a subscription..

Not all of those methodologies have necessarily to be implemented in every DATEX II node and not for all data content. Thus DATEX II allows for the implementation of profiles maintaining the interoperability on the side of clients and suppliers if the .

3.2.1. What is a Profile?

A DATEX II system is composed of different publications which can be delivered with different operating modes. Each DATEX II system builder chooses to implement the subset of (publications, operating modes) he needs. This subset is called a « DATEX II profile ».

The need is to have profiles and options to allow DATEX II users to choice their implementation in order to give more or less functionalities/facilities and to use them not being forced to implement all the features.

“Profiling” aims to define a customised subset of options offered by a standard for a particular need. The first step should focus on establishing the actual requirements to ease a later selection amongst the options and conditional parts of the DATEX II Specifications.

Because different needs for different use cases of DATEX II may come to define different profiles, this step would require close stakeholder involvement to elicit their requirements.

Moreover, profiling would require assessment of the cost/benefit trade-off of particular:

- standard features/services;
- implementation platforms; and
- level of service that must be achieved.

Additionally the stakeholders should provide their own perspective.

The following requirements must be met:

- ensure the consistency with the DATEX II Content PIM and
- ensure the interoperability with the DATEX II Regular Profile

3.2.2. Low cost profile exchange model

The low-cost profile will be developed by the Euro-Regional Project CENTRICO and is based on the results of the OTAP initiative.

The low-cost profile shall provide an easy way for implementing a well-defined set of functionalities of DATEX II. HTTP was chosen to serve as protocol for the low cost profile. Furthermore, the OTAP project amassed knowledge about the distribution of travel- and traffic-related data using a “fire-and-forget” mechanism based on HTTP.

Derived from those experiences, HTTP can be used at the client side to gain a complete snapshot of information.

From the supplier’s point of view, different content could be provided using different URLs. These URLs have to be communicated to the clients who want to get the data.

Using an HTTP Get method, clients are able to download the information provided.

3.2.3. Regular profile exchange model

The regular profile exchange model comprises more exchange methodologies foreseen in the DATEX II model than the low cost profile.

3.2.4. Exchange models with other profiles

Datex II allows every user to define a profile according to his own requirements.

3.3. Standardisation of DATEX II

The standardisation of DATEX in CEN was considered a prerequisite for successful deployment at that time. The rational for this still holds: adoption by CEN demonstrates the stability and acceptance of a specification, which stimulates stakeholders to invest in its implementation. As opposed to the CEN periods of 2-5 years for fixing (pre)standards and its rather static procedures for consensus building (enquiries, formal voting etc), DATEX II may benefit from a more flexible and dynamic maintenance process. Concepts for such a process exist and must be further explored. Consequently the standardisation of DATEX II nowadays is less trivial than in the past, also because DATEX II consists of numerous and complex specifications, compared to the two rather straightforward DATEX pre-standards (ENV's) mentioned before. Prior to standardisation of DATEX II some basic questions need to be addressed first, such as;

- What are the expected benefits of DATEX II standardisation in CEN, i.e. is there still a need for standardisation?
- And if yes, what parts of DATEX II are eligible for standardisation, and at what level should DATEX II be standardised?

Not forgetting to mention traditional CEN issues such as the scope and position of DATEX II in the context of other ITS standards. Such issues may have legal impact and must be resolved. As for the level of standardisation, DATEX was fixed at a detailed level where each data element, model, and message was prescribed. The structure of DATEX II leaves a possible option to standardise at a higher level where just the methodologies, constraints and rules for extension would be fixed in standards.

To conclude the path of DATEX II standardisation is fully open, with a minimum requirement at the moment to produce a data dictionary. There are several ways to continue, but the options are yet to be explored and agreed.
Due to the complexity and instability of the DATEX II specifications in 2004, it was then decided to postpone further standardisation and await validation results in the E/R-projects. It is expected that in the end of 2007 will be an appropriate time to catch up the issue of standardisation and maintenance of the DATEX II specifications. This will be canalised through TC278 WG8 in liaison with members of DATEX TC. It is obvious, that input from all stakeholders will then be appreciated.

DATEX and DATEX II



4. DATEX and DATEX II

This chapter is to be extended within the next issue of this study based on the results of the DATEX II demonstrators to be built by CENTRICO and SERTI within WP 4 and 5.

4.1. Summary on DATEX 1

DATEX is a methodology for the electronic exchange of traffic- and travel related data. A set of specifications was developed within a R&D project co-funded by the European Commission. After an intense revision cycle two documents, the DATEX Data Dictionary (CEN ENV13106:2000) and the DATEX NET Specification (CEN ENV13777:2000), were submitted to the CEN and defined as a pre-standard.

The DATEX Data Dictionary defines terms used for data and information in the fields of traffic and travel. The standard is applicable to traffic and transport engineering in general, and particularly data and information exchange. DATEX NET Specification defines the methodology, functions and message structures for the exchange of data between traffic and travel information centres.

4.2. DATEX Flaws in General

The main flaws of DATEX are based on its age. 10 years ago the DATEX technological solutions were up-to-date, but due to the increasing speed of the IT revolution the technological prerequisites changed and a widely used data exchange interface has to react to these developments.

Some flaws were becoming evident over the long time DATEX is now used for data exchange within Europe. Apart from some technical problems one major flaw is that no extensive data model is defined.

On the organisational side the DATEX MoU organisation and the CEN TC278 WG8 are managing DATEX without substantial resources for constant development.

The European Commission DG TREN decided to launch the D2 study in order to support the technical development of DATEX according to today´s IT environment.

4.3. Improvements by DATEX II

DATEX II is based on a standardised approach within IT technology development by featuring a data model described in UML (universal markup language) for easy implementation of the interface on any given platform. DATEX II also is applying powerful standardised technology (XML) which is used in various industries with great success. DATEX II now features, in the contrary to DATEX, a complete binding description of all functionalities such as data content and transmission methodologies.

Additionally DATEX II features a high level of flexibility due to its **extensibility option**. This allows a user to exchange data content which is relevant for his special case and still be DATEX II compliant, since DATEX II offers a methodology for its own extension. This methodology guarantees that any centre applying any extensions according to the defined methodology will be able to communicate with any other DATEX II node without limitations.

4.4. Drawbacks in DATEX II

DATEX II went a huge step forward in technology, openness, accuracy and reliability.

Unfortunately the drawback of this strategy is that DATEX II is not fully compatible with DATEX. This means, that the existing DATEX nodes will not be able to “just built up a connection” with a new DATEX II node and are thus not able to communicate with the latter.

However, this report shall, with its two issues, facilitate the responsible entities to take a well-based decision on the migration of the respective node from DATEX to DATEX II. It is also foreseen that proposals for solution strategies will be depicted within the issue 2007 of this report which enable existing DATEX nodes to take part in a heterogeneous network of DATEX and DATEX II nodes, for example by applying restrictions to the range of the information to be transmitted.

Nevertheless, the reader should be aware, that DATEX nodes will at no point of time be fully compatible with all the functions of a DATEX II node and that the migration from DATEX to DATEX II should be strongly considered once the demand for functionalities offered by DATEX II is appearing.

Technical Analysis on existing DATEX networks and node types



5. Technical Analysis on existing DATEX networks and node types

The existing DATEX networks vary to a great extent between the different countries and regions in Europe. In some regions proprietary data exchange technologies are used for the regional centre-to-centre communication and DATEX is used mainly for cross-border connections while complex DATEX networks were erected in other regions such as Italy or France. Also the DATEX node architectures are equally different over Europe: they range from simple stand-alone computers into which the messages are entered by an operator and sent in DATEX format to highly complex systems automatically computing the DATEX data.

This issue of the study is only concerning the DATEX networks and node types from Spain, Italy and southern German region of Bavaria. Issue 2 will hold information on all regions participating in EuroRegional projects.

The migration path will be different for different types of networks due to the interdependencies of the nodes among each other and also different for different node types. While it is out of scope of this report to define detailed migration paths for each centre – this shall be done by the operator of each centre - it shall provide an up-to-date overview on the different DATEX network and node types currently active in Europe in order to support a harmonised migration from DATEX to DATEX II.

5.1. DATEX node types

Three different node types were defined as “prototypes” for the existing European DATEX networks:

DATEX Simple Node

DATEX Gateway

Complex DATEX Based Legacy Node

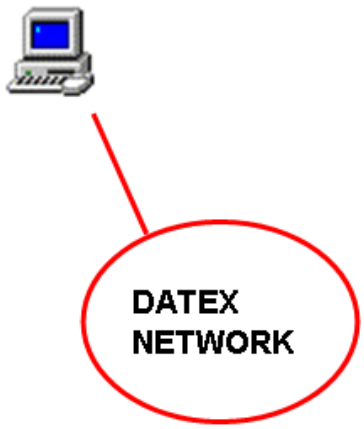
The following chapters describe the three node types:

5.1.1. DATEX Simple Node

The **DATEX simple node** is a computer which allows the user to manually enter DATEX messages and send them into the DATEX network. Also the simple node is capable of receiving and displaying DATEX messages. The DATEX simple node may also feature a database, where the messages to be sent or the received messages are stored. It is, as the name indicates, the most simple type of DATEX node defined within this study.

The DATEX simple node is characterised by the fact, that it is, apart from the DATEX network, not connected to any other computer.

As example several simple node systems can be found within the Italian DATEX network.



Characteristics

- Self contained PC based with onboard database.
- Data are manually entered into the system by TCC/TIC operators and sent to the clients on the Network
- The database is normally based on old DATEX with tables that contains old DATEX codes and concepts (phrases, DOB, attributes, use of trigrams)
- For some implementations entities are mapped as in DATEX1 data model

Migrations tasks

- Take a new DATEX II simple node keeping the previous just for Historic Report Purposes

- Migrate the historical data to the new system with a conversion tool if needed

Compatibility issues with DATEX

- Switching to new system will lead not having any Backward Compatibility

5.1.2. DATEX Gateway

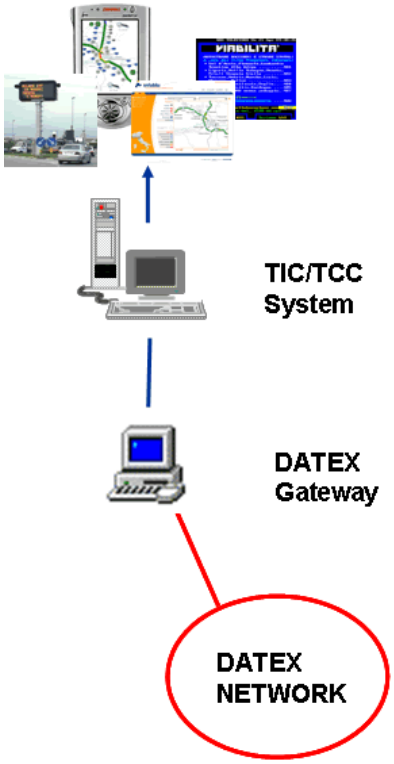
The **DATEX gateway** is a computer which translates incoming electronic messages, mostly from a database, from a proprietary format into the DATEX format and sends this into the DATEX network. Also the gateway translates received DATEX messages into the proprietary format, those messages are also mostly stored back into a database. However the computer only acts as a gateway or "translator" and does not compute the received data or the data to be sent in any way – mostly the data in proprietary format originate from a TCC and its systems, the received data are sent back to the TCC. Of course, the messages can also be created or edited manually as with the DATEX simple node.

The DATEX gateway is characterised by the fact, that it is, apart from the DATEX network, connected to another computer (mostly a TCC) which is computing the data to be sent or received but is only acting as a "translator".

The Bavarian and the Spanish DATEX networks feature good examples for the DATEX gateway node type.

Characteristics

- A legacy system manages information for internal purposes
- For Exchange purposes information are transferred (and translated) to a DATEX Gateway in order to be sent by the network
- The gateway may have onboard database in DATEX format



Migrations tasks

- A new gateway must be provided.
- The migration should not need to modify some management logic on the legacy system.
- Some implementation could prefer to modify legacy systems in order to be more close to DATEX II system models and management rules

Compatibility issues with DATEX

- A new gateway should be provided keeping the old one for BC issues. In this way the same system could be used for DATEX1 or DATEX2 exchanges. Depending on the Client/Supplier need to be interoperable with both kind of nodes.

5.1.3. Complex DATEX based legacy node

The **complex DATEX based legacy node** (or better DATEX based legacy application server) is, as already the name indicates, the most complex DATEX system found in current DATEX networks. It is working with the DATEX data it is sending and receiving on the very same computer/platform. It not only translates proprietary messages to and from DATEX – as the DATEX gateway – but is also heavily interwoven with other applications. The result is, that, when migrating the system, the migration will be much more complex than in case of a DATEX gateway since all interrelations with connected applications have to be taken into account.

The complex DATEX based legacy node is characterised by applications which are using the DATEX data for their own operations and which are running on the very same computer.

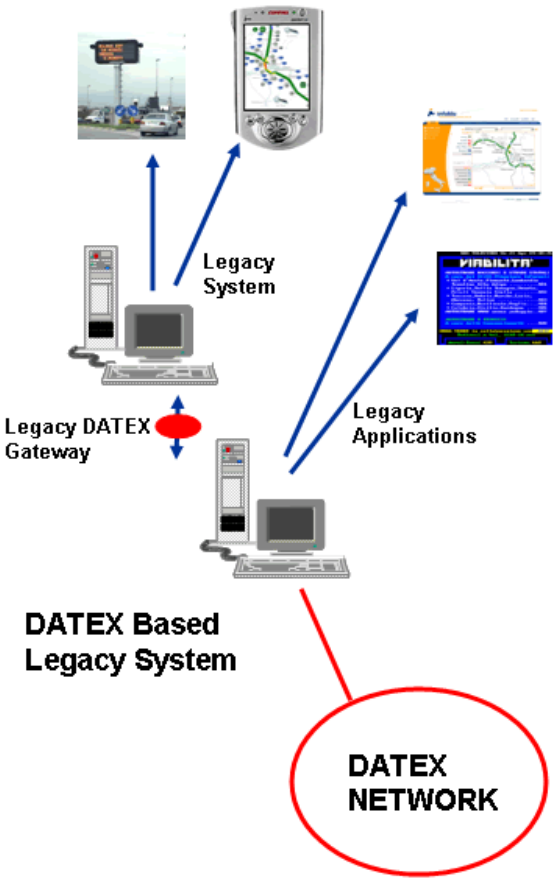
The Italian DATEX network is featuring some good examples for the DATEX complex legacy system node type, e.g. the SUS.

DATEX Based system

- A legacy system manages information for internal purposes
- Information is exchanged with other TCC/TIC via DATEX
- Application Based on DATEX1 Database are used for deploying information directly to media or via internal Legacy systems gateways

Migrations tasks

- The DATEX based Legacy systems normally are expensive to be updated
- A Protocol adapter would be needed to convert from DATEX2 to DATEX1 entities in order to preserve investments
- Some implementation sites could prefer to modify legacy systems in order to be more close to DATEX II system models and management rules



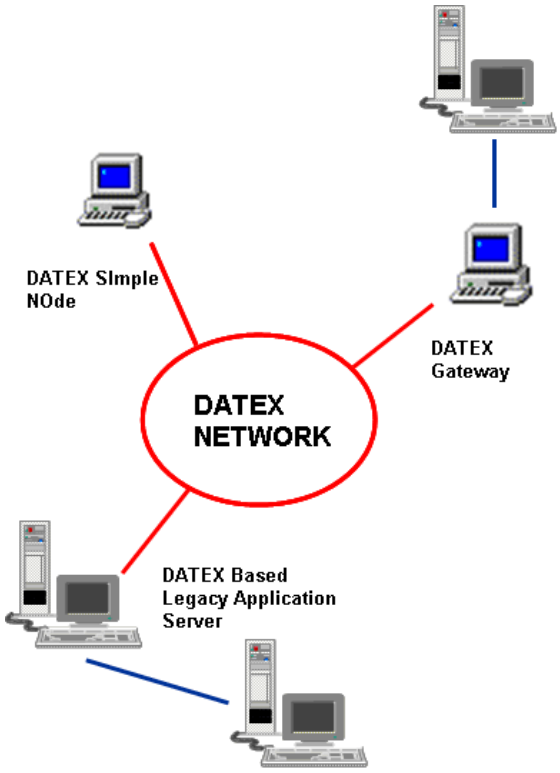
Compatibility issues with DATEX

- If the new gateway will be provided keeping the old one for BC issues, the same system could be used for DATEX1 or DATEX2 purposes. Depending on the Client/Supplier needs to be interoperable with both kind of nodes.

5.2. DATEX general Network configuration

In general, a DATEX network consists of two or more of the node types mentioned above. Two network types were identified which have significant impact on the migration from DATEX to DATEX II.

- Common Node Type Network (e.g. only DATEX gateway nodes)
  - Same manufacturer → Easier migration of multiple nodes
  - Different manufacturers
- Multi Node Type Network



The following considerations have to be honoured when discussing the migration from DATEX to DATEX II within a network:

- Any single node can be upgraded to DATEX2 level (but it will not be able to communicate to other systems in the subnet if alone)
- Any node connected to more than 1 subnet could have a need to upgrade to DATEX2 level. In this case a new DATEX2 node will be available in the subnet for other sites willing / needing to upgrade
- No self contained DATEX subnet will have the need to migrate
- A chance for upgrading is the need for one node to connect to any other D2 subnets so that a first D2 node will exists in the subnet
- Other needs could be for D2 major improvements: security, reliability, performance, new content..
- D2 Profiles to be considered

5.3. DATEX Subnets

The existing DATEX networks hold many different DATEX nodes to exchange information. Thus also concluded subnets can be defined as subgroup to a given DATEX network. Since subnets may have own requirements for migration they have also to be taken into account. The DATEX systems in Europe allow to identify several DATEX subnets.

Definition:

A DATEX subnet is a set of DATEX nodes [2..n] sharing common scopes and functionalities

Several aspects have to be considered concerning the migration of subnets:

- Some nodes are connected to more than one subnet
- Subnets could have own requirements not shared amongst the others:
- Union core model vs. Intersection core model
- Locally specialized usage could lower migration task

The Annex of this document provides information on the identified subnets types including the definition of the similarities in terms of DATEX usage. Also information is to be considered on the different set of phrases and concepts.