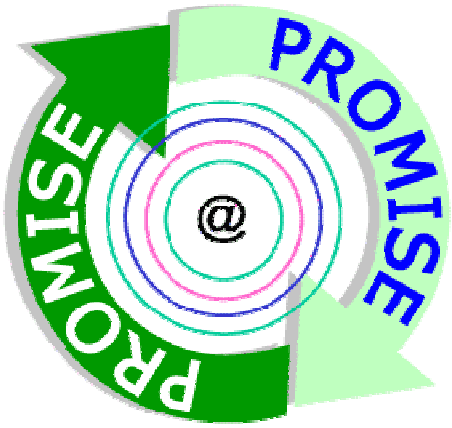

Promise related Standardisation activities

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ABSTRACT:	Standards are necessary to harmonise developments and guarantee a high degree of interoperability between different systems. They harmonise development for any single system by providing a common framework against which all sub-components of a system can be checked against, and a common vocabulary that allows developers to communicate precisely. In addition, they provide for interoperability between systems that may be produced by different manufacturers. The following document is a summary of international standards that are considered relevant to the EU PROMISE project. A list of the standardisation bodies and useful web pages are included.

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1 Purpose

Generally standardisation activities are initialised by the industry through national and international standardisation-organisations. Main goal of this work package is to identify the existing standards and standardisation activities that are relevant within the PROMISE project. Within PROMISE a wide range of PEIDs will be used in the different application scenarios. The use of well established standards or the promotion of emerging standards created within PROMISE will lead to higher acceptance of the developed technology in the market and lead to reasonable costs. In this deliverable, an overview of the PROMISE-relevant standards, their significance to PROMISE, standardisation working groups and status of the standards is given.

2 Introduction

2.1 Motivation for standardisations

Standards are necessary to harmonise developments and guarantee a high degree of interoperability between different systems. They harmonise development for any single system by providing a common framework against which all sub-components of a system can be checked against, and a common vocabulary that allows developers to communicate precisely. In addition, they provide for interoperability between systems that may be produced by different manufacturers. Interoperability not only means that different systems might work together, it also means that they will not negatively interfere with each other. In this sense, interoperability is particularly important when dealing with radio frequency technology, where the medium is shared, and thus the potential for negative interference is high.

Active participation in standardisation committees is a necessary part of the development of novel technology, and thus is important to the PROMISE project. By participating in standardisation efforts, we may influence them to ensure that those standards do not preclude PROMISE technology. In addition, by learning more about emerging standards, we can ensure that PROMISE technology is made as interoperable as possible with these standards and thus with other technologies based on these standards.

Standards, such as those developed by ISO/IEC and JTC1 working groups, have a six stage lifecycle. In the first stage a work item is proposed. In the second, preparatory, stage a working draft of the standard is developed. The third stage involves putting a draft to the committee, which is followed by the final committee draft stage. The fifth stage is for it to be approved as a final draft international standard. The final and sixth stage involves publishing as an ISO standard. Each stage other than the second involves a voting round, which varies in duration depending on the stage.

2.2 Promise information chain

The objective of PROMISE is to develop a new generation of Product Information Tracking and Flow Management system. This system will allow all actors that play a role during the lifecycle of a product to track, manage and control product information at any phase of its lifecycle, at any time and anywhere. Figure 1 shows the information chain between the PEID, the service terminal and the producer (backend). Information may be retrieved and updated both at PEID and backend.

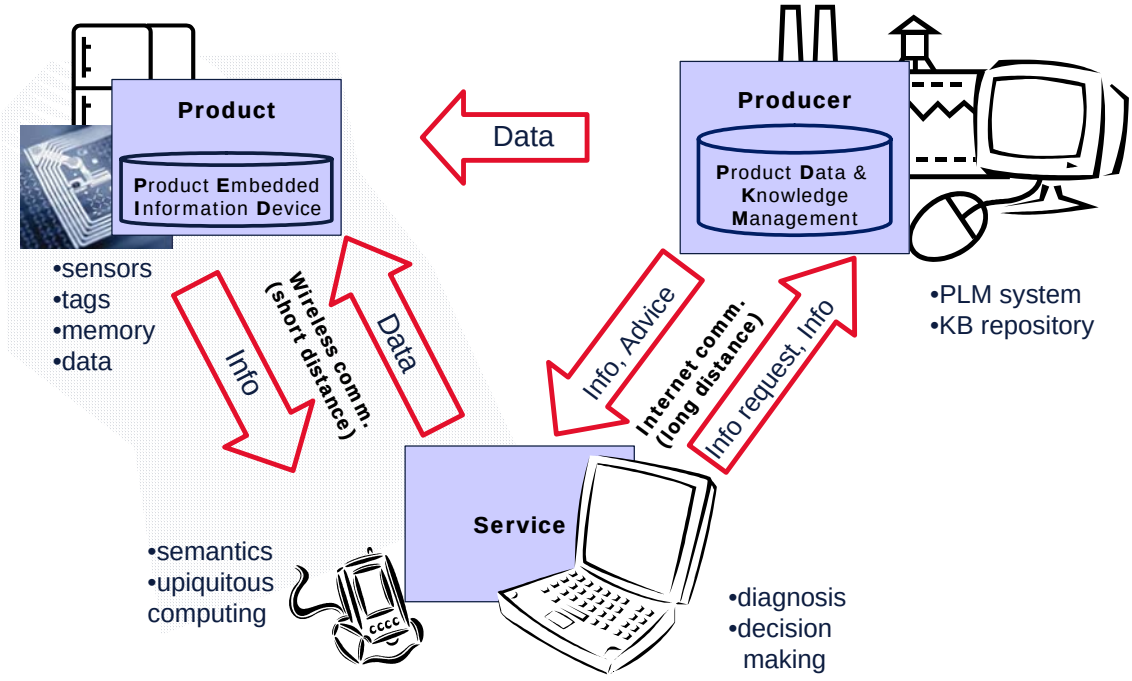

Figure 1: PROMISE product information tracking and flow management system

3 Standards relevant to PROMISE

This chapter describes the different standards identified by partners in WP I1 as potentially relevant for the PROMISE system architecture. The standards are listed in order of the layers as depicted Figure 2, starting at the highest level.

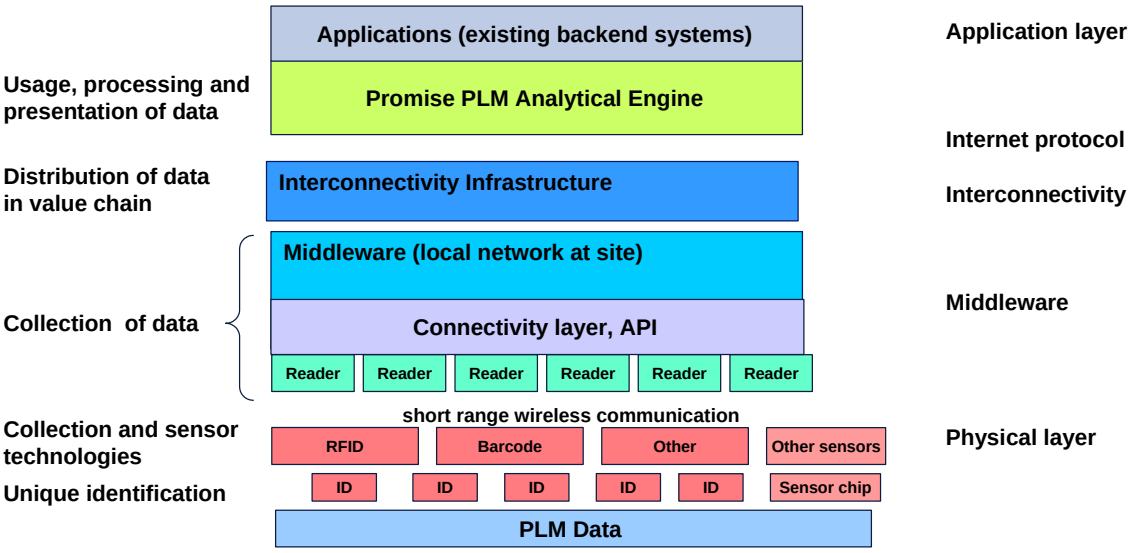

Figure 2: PROMISE layer model

3.1 Application layer

3.1.1 STEP Standard Series

ISO 10303 is an International Standard for the computer-interpretable representation of product information and for the exchange of product data. The objective is to provide a neutral mechanism capable of describing products throughout their life cycle. This mechanism is suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases, and as a basis for archiving.
The parts listed below specify the representation, management and configuration of both mechanical and electrical products, and thus these standards are relevant to PROMISE.
On the basis of the application protocol ISO 10303-214 a framework for a file-based exchange of PDM data has been specified within the PDTnet project (www.pdtnet.de). The combination of STEP and XML in the “PDTnet STEP AP214/XML Schema” permits the PDM systems of different companies to be integrated, taking into account product structure data, administrative parts data (approvals, validities, etc.) and document data (CAx models, drawing data, etc.).
References: http://www.steptools.com/impforum/faq.html; http://www.iso.ch

Standard Name	Description	Status
ISO 10303-44:2000	Industrial automation systems and integration – Product data representation and exchange – Part 44: Integrated generic resources: Product structure configuration	Published Standard
ISO 10303-203:1994	Industrial automation systems and integration – Product data representation and exchange – Part 203: Application protocol: Configuration controlled 3D designs of mechanical parts and assemblies	Published Standard
ISO 10303-212: 2001	Industrial automation systems and integration – Product data representation and exchange – Part 212: Application protocol: Electro technical design and installation	Published Standard
ISO 10303-214: 2003	Industrial automation systems and integration – Product data representation and exchange – Part 214: Application protocol: Core data for automotive mechanical design processes	Published Standard
ISO 10303-239	Industrial automation systems and integration -- Product data representation and exchange -- Part 239: Application protocol: Product life cycle support	Under Development

3.1.2 EDI (Electronic Data Interchange)

EDI is the computer-to-computer interchange of strictly formatted messages that represent documents other than monetary instruments. EDI implies a sequence of messages between two parties, either of whom may serve as originator or recipient. The formatted data representing the documents may be transmitted from originator to recipient via telecommunications or physically transported on electronic storage media.
EDI is currently the most used standard for inter-company data communication and is therefore relevant to PROMISE.
Working group: NIST (National Institute of Standards and Technology
Status: Well-established standard.
Reference: http://www.itl.nist.gov/fipspubs/fip161-2.htm

3.1.3 RosettaNet

RosettaNet is a not-for-profit consortium that provides standards in the area of business-to-business transactions. Specifically, they focus on "public" business processes (that is, those that are visible to more than one business) and they standardise (a) the sequence of operations in the business process, (b) the business documents themselves, and (c) the system that communicates those documents. The RosettaNet standards use XML as the basic language for all communication between businesses.
The RosettaNet standards may be relevant to PROMISE as a model for dealing with any inter-business communication. References:
http://www.rosettanet.org/RosettaNet/Rooms/DisplayPages/LayoutInitial

3.1.4 Universal Data Element Framework (UDEF)

The Universal Data Element Framework (UDEF) (see http://www.udef.org) is a “cross-industry metadata identification strategy designed to facilitate convergence among e-business and other

standards." Specifically UDEF tries to provide interoperability for standards such as STEP, X12/EDIFACT, RosettaNet, OAGIS.

STEP (ISO 10303) is the "Standard for the Exchange of Product Model Data" and focuses on geometric characteristics of products to allow CNC machining to be performed.

X12/EDIFACT is a merger between ANSI X12 and UN EDIFACT (Electronic data interchange for administration commerce and transport).

3.1.5 ebXML (Electronic Business using eXtensible Markup Language)

ebXML, is a modular suite of specifications that enables enterprises of any size and in any geographical location to conduct business over the Internet. Using ebXML, companies now have a standard method to exchange business messages, conduct trading relationships, communicate data in common terms and define and register business processes.
The ebXML standards may be relevant to PROMISE as a model for dealing with any inter-business communication.
Working group: UN/CEFACT and OASIS
Status: Most relevant ebXML standards are published/finalized
References: ebXML, 2003, ebXML - Enabling A Global Electronic Market, available online (October 14th, 2003): http://www.ebxml.org/

3.1.6 RDF (Resource Description Framework)

RDF is an approach to unifying meta-data / names of things. RDF expresses "subject-predicate-object" relations. The *subject* may be the identity of the object. The *predicate* is usually more like a verb or expresses the type of relationship between the subject and object. It can also express "has an attribute *X*". The *object* may be the value of that attribute or property. In RDF, all nodes (*subject*, *object* and *predicate*) are expressed in URI format. A URI (Uniform Resource Identifier) is simply a unique name. It does not necessarily have to be resolvable (e.g. in the way that an http URL (Uniform Resource Locator) is).

However, there are projects such as Dublin Core http://dublincore.org/ that attempt to provide unambiguous definitions for the meta-data identified by these URIs.

RDF is a key component of the Semantic Web http://www.w3.org/2001/sw/.

3.1.7 GDSN (Global Data Synchronization Network)

The GDSN was developed in partnership with the global business community to address the high costs associated with inaccurate data. The GDSN vision, conceived by the Global Commerce Initiative (GCI), is based on a centralized, global registry that connects to numerous data pools around the world, enabling data to be standardized and synchronized for trading partners on a near-real-time basis. In order to ensure the GDSN meets the business needs of the user community, EAN International and the UCC established a GDSN Oversight Committee as the foundation of its governance structure. The Oversight Committee, which currently includes seventeen senior executives from manufacturing, retailing, and EAN Member Organizations, has been appointed to govern the GDSN, promote global adoption, and address strategic issues related to the rollout of the GDSN.
References: http://www.uccnet.org/

3.2 Internet protocol

The World Wide Web Consortium or W3C is responsible for standards relating to HTML, but also, the Extensible Markup Language XML. Specifically, the following standards may be relevant.

3.2.1 HTTP (Hypertext Transfer Protocol)

Standard Web protocol, can also be used for exchanging messages (e.g. HTML forms).
Most or all Internet-related communication in PROMISE will use HTTP as the transport protocol.
Working group: W3C and IETF
Status: Well-established standard
References: http://www.w3.org/Protocols/

3.2.2 XML (Extensible Markup Language)

"XML Schemas express shared vocabularies and allow machines to carry out rules made by people. They provide a means for defining the structure, content and semantics of XML documents."
XML markup allows for exchange and communication of self-describing data in a format that is open, transparent and ideally human-readable, rather than closed, proprietary and opaque, as is the case for files produced by many commercial computer application programs, such as word-processing software. XML facilitates multi-vendor interoperable solutions, whereas closed opaque formats tend to favour monopolistic practices by software vendors.
In the context of PROMISE, XML provides a more open framework for exchanging data among supply chain partners, without requiring them to purchase a particular piece of commercial software merely in order to read the data; there is already much existing free or open source technologies for processing the XML data and converting it into other formats as required.
Reference: http://www.w3.org/XML

3.2.3 XML Schema (XML Schema Definition)

In the context of PROMISE, XML schema are used for ensuring that XML markup for exchanging data about products and processes is correctly and consistently formatted and can therefore be understood and correctly interpreted by all the parties who share the XML-encoded information.Furthermore, XML Schema can be automatically converted to object-oriented code in various programming languages, so that XML documents conforming to a particular schema can automatically be converted into machine-readable data objects with complex, hierarchical data structures.
XML Schema are defined with reference to a large, complex standard that has two parts. One part specifies structure relationships. (This is the largest and most complex part.) The other part specifies mechanisms for validating the content of XML elements by specifying a (potentially very sophisticated) *datatype* for each element. The good news is that XML Schema for Structures lets you specify any kind of relationship you can conceive of. The bad news is that it takes a lot of work to implement, and it takes a bit of learning to use. Most of the alternatives provide for simpler structure definitions, while incorporating the XML Schema datatype standard, Reference: http://www.w3.org/XML/Schema

3.2.4 XSL Transformations (XML Stylesheet Language Transformations)

The XML standard specifies how to identify data, not how to display it. HTML, on the other hand, told how things should be displayed without identifying what they were. The XSL standard has two parts, XSLT (the transformation standard, described next) and XSL-FO (the part that

covers *formatting objects*, also known as *flow objects*). XSL-FO gives you the ability to define multiple areas on a page and then link them together. When a text stream is directed at the collection, it fills the first area and then "flows" into the second when the first area is filled. Such objects are used by newsletters, catalogs, and periodical publications.

Reference: http://www.w3.org/TR/xslt

3.2.5 WSDL (Web Services Description Language)

WSDL is an XML format for describing network services as a set of endpoints operating on messages containing either document-oriented or procedure-oriented information. The operations and messages are described abstractly, and then bound to a concrete network protocol and message format to define an endpoint. Related concrete endpoints are combined into abstract endpoints (services). WSDL is extensible to allow description of endpoints and their messages regardless of what message formats or network protocols are used to communicate, although , the commonly used protocols are SOAP 1.1, HTTP GET/POST, and MIME.
In PROMISE, WSDL is relevant for describing middleware interfaces based on XML and web services.
Working group: W3C
Status: Published/final (remark: “final” here means that there is a “stable” version published but new versions can of course be published in the future)
References: www.w3.org/TR/wsdl

3.2.6 Internet Engineering Task Force

IETF publish standards as RFCs (Requests for Comment). They, together with IANA (Internet Assigned Numbers Authority), define usage of URIs (Uniform Resource Identifiers) of which URLs (Uniform Resource Locators) and URNs (Uniform Resource Names) form a part.

1. RFC 3986 Uniform Resource Identifier (URI): Generic Syntax. Also: Berners-Lee, T., Fielding, R., Irvine, U.C., Masinter, L. (1998). Uniform Resource Identifiers (URI): Generic Syntax. Available online (March 5th 2004): http://www.ietf.org/rfc/rfc2396.txt
2. RFC 1737 Functional Requirements for Uniform Resource Names (URNs)
3. RFC 2141 URN Syntax

URNs may be of specific interest to PROMISE since they refer to names that are assigned uniquely and not reused even if the resource in question ceases to exist. However, URNs need a resolution service in order to locate information related to a particular URN.

3.2.7 Secure communication

3.2.7.1 SSL

The standard used for secure payments, banks etc. This is currently the most used standard for secure communication over the Internet and is relevant for all confidential data transfer over Internet in PROMISE.
Working group: IETF (Netscape)
Status: Final/operational.
References:
Netscape, 1996, SSL 3.0 Specification, available online (December 2nd, 2003):
http://wp.netscape.com/eng/ssl3/index.html

3.2.7.2 DSS, DSA, RSA etc.

Authentication and encryption standards for secure standard for secured communications. Used in SSL and other protocols for secured communication over the Internet, i.e. relevant for most data transfer over Internet in PROMISE.
Working group: NIST
Status: Final/operational.
References:
NIST, 2002, Digital Signature Standard (DSS) and Secure Hash Standard (SHS), (National Institute of Standards and Technology), available online (December 13th, 2002): http://csrc.nist.gov/cryptval/dss.htm

3.3 Interconnectivity

3.3.1 OMG PDM Enablers (Object Management Group Product Data Management)

The OMG PDM Enablers is intended to provide access to the services of product data management systems from various application software systems in a manufacturing enterprise. Activities supported by such “client” applications encompass product conception and planning, product design, manufacturing engineering, production, delivery, and maintenance. The emphasis is on providing interfaces for the management of product data. References:
http://www.omg.org/docs/formal/00-11-11.pdf

3.3.2 ODBC (Open DataBase Connectivity)

Standard database access method developed by the SQL Access group in 1992. The goal of ODBC is to make it possible to access any data from any application, regardless of which database management system (DBMS) is handling the data. ODBC manages this by inserting a middle layer, called a database driver, between an application and the DBMS. The purpose of this layer is to translate the application's data queries into commands that the DBMS understands. For this to work, both the application and the DBMS must be ODBC-compliant -- that is, the application must be capable of issuing ODBC commands and the DBMS must be capable of responding to them. Since version 2.0, the standard supports SAG SQL.
ODBC is a generally used protocol for data access between middleware and backend systems, which is a part of the PROMISE information chain.
Working group: SQL Access group
Status: Final/operational
References: Microsoft Open Database Connectivity (ODBC), available online:
http://msdn.microsoft.com/library/default.asp?url=/library/en-us/odbc/htm/dasdkodbcoverview.asp

3.3.3 JDBC (Java DataBase Connectivity)

Copied: "JDBC technology is an API (included in both J2SE and J2EE releases) that provides cross-DBMS connectivity to a wide range of SQL databases and access to other tabular data sources, such as spreadsheets or flat files. With a JDBC technology-enabled driver, you can connect all corporate data even in a heterogeneous environment."
JDBC is a generally used protocol for data access between Java-based middleware and backend systems, which is a part of the PROMISE information chain.
Working group: Sun microsystems
Status: Final/operational

References:
Sun Microsystems (2002), “JDBC™ Data Access API”, http://java.sun.com/products/jdbc/

3.3.4 Field Buses

Field buses serve for communication between device in all levels of the information architecture (field, process and business management) in a factory. Different field buses are on the market and each one has a special purpose. Examples for field buses are:

- LonWorks
- EIB
- Konnex
- Profibus
- DeviceNet

For a detailed list of these and others, please see http://read-out.net/signpost/fieldbus.html.

3.4 Middleware

3.4.1 OSGi (Open Services Gateway Initiative)

OSGi defines a standardized, component oriented computing environment for networked services. The core is a framework that provides a standardized environment to all applications. Applications must be written in Java and are run as so called bundles in one virtual machine. See http://www.osgi.org/ for details.

3.4.2 UPnP (Universal plug and play)

A set of standards for interoperability of networking devices from Microsoft and the UPnP Forum. Announced in mid-1999 as a counter to Sun's Jini technology, UPnP extends the Plug and Play concept to network devices so that they can be installed and set up without manual intervention. For example, the UPnP Internet Gateway specification enables residential Internet gateways to be automatically configured to handle multiple PCs in a home network. IP communication methods like Ethernet, Bluetooth, WLAN, Fire Wire, etc. can be used. Standard technologies like IP, UDP, Multicast, TCP, HTTP, XML, SOAP are used.
References: www.upnp.org

3.4.3 UDDI (Universal Description, Discovery and Integration)

The Standard creates a platform-independent, open framework for describing services, discovering businesses, and integrating business services using the Internet.
UDDI makes it possible to dynamically look up WSDL-based services. In PROMISE this can be useful for enabling PEIDs to contact their backend system or to contact various service providers at their current location (e.g. maintenance, repair).
Working group: OASIS
Status: Final/operational
References: http://www.uddi.org/

3.4.4 Jini

Jini is the name for a distributed computing environment that can offer “network plug and play'”. A device or a software service can be connected to a network and announce its presence, and clients that wish to use such a service can then locate it and call it to perform tasks. Jini can be used for mobile computing tasks where a service may only be connected to a network for a short time, but it can more generally be used in any network where there is some degree of change. Jini can be used in PROMISE for the same purposes as UDDI mainly in Java-based environments.
Working group: Jini Community
Status: Final/operational

References: http://www.jini.org/; Oaks, S., Wong, H. (2000), “Jini in a Nutshell”, O’Reilly & Associates, USA, 400p.

3.4.5 JMS (Java Message Service)

Standard for "safe" message forwarding (message persistence, publish/subscribe models etc.). Many commercial middleware products use JMS for message passing especially in inter-enterprise communication where reliability is an issue as in many PROMISE application scenarios.
Working group: Sun microsystems
Status: Final/operational
References: http://java.sun.com/products/jms/ Monson-Haefel, R., Chappell, D. (2000), “Java Message Service”, O’Reilly & Associates, USA, 220 p.

3.4.6 XML-RPC (Remote Procedure Calling)

XML-RPC is a protocol that works over the Internet, using HTTP as the transport and XML as the encoding. XML-RPC is designed to be as simple as possible, while allowing complex data structures to be transmitted, processed and returned. The reference lists the accomplishments of the community, a set of compatible XML-RPC implementations that span all operating systems, programming languages, dynamic and static environments, open source and commercial, for Perl, Python, Java, Frontier, C/C++, Lisp, PHP, Microsoft .NET, Rebol, Real Basic, Tcl, Delphi, WebObjects and Zope, and more are coming all the time.
For PROMISE, XML-RPC provides a light-weight XML-based messaging protocol.
Working group: XML-RPC Community
Status: Final/operational
References: Winer, Dave (1998). XML-RPC Specification. Available online (March 5th 2004): http://www.xmlrpc.com/spec

3.4.7 SOAP (Simple Object Access Protocol)

SOAP provides the definition of the XML-based information which can be used for exchanging structured and typed information between peers in a decentralized, distributed environment. A SOAP message is formally specified as an XML Infoset, which provides an abstract description of its contents. SOAP is fundamentally a stateless, one-way message exchange paradigm, but applications can create more complex interaction patterns (e.g., request/response, request/multiple responses, etc.) by combining such one-way exchanges with features provided by an underlying protocol and/or application-specific information.
For PROMISE, SOAP provides a commonly used XML-based messaging protocol.
Working group: W3C
Status: Final/operational
References:
W3C (2000), “Simple Object Access Protocol (SOAP) 1.1”, http://www.w3.org/TR/SOAP/ Last visited 14 March 2002 .

3.4.8 Corba (Common Object Request Broker Architecture)

OMG's open, vendor-independent architecture and infrastructure that computer applications use to work together over networks. Using the standard protocol IIOP, a CORBA-based program from any vendor, on almost any computer, operating system, programming language, and network, can interoperate with a CORBA-based program from the same or another vendor, on almost any other computer, operating system, programming language, and network. Corba is used in distributed applications of all kinds, including one of the PROMISE application scenarios.
Working group: OMG (Object Management Group)
Status: Final/operational

References: http://www.corba.org/
Orfali, R., Harkey, D., Edwards, J., 1997, Instant CORBA (John Wiley & Sons, New York).

3.4.9 JXTA

JXTA(tm) technology is a set of open protocols that allow any connected device on the network ranging from cell phones and wireless PDAs to PCs and servers to communicate and collaborate in a P2P manner. JXTA peers create a virtual network where any peer can interact with other peers and resources directly even when some of the peers and resources are behind firewalls and NATs or are on different network transports. P2P technology is interesting also for PROMISE as it supports ad-hoc identification of peers and pieces of data and the related communication.
Working group: JXTA Community, IETF
Status: Final/operational
References: http://www.jxta.org/

3.4.10 OASIS

Organization for the Advancement of Structured Information Standards (OASIS) have produced a number of standards in web-services and e-business domain. The following may be particularly relevant to PROMISE:

1. OASIS Web Services Security (WSS) TC.
2. Universal Description, Discovery and Integration (UDDI)

3.5 Physical layer

3.5.1 ISO and other officially accredited standardization bodies

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.
In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.
There are several standards regarding the air interface, some of them have been in use for years (e.g. the ones out of SC17/WG8), References: http://usnet03.uc-council.org/sc31/sc31_wg4.cfm

Denominator	Name	Working Group
ISO/IEC 15459	Unique identifier for transport units	
ISO/IEC 10536	Contactless Integrated Close-coupled Cards (CICCs)	JTC1 / SC17 / WG8
ISO/IEC 14443	Proximity Integrated Close-coupled Cards (PICCs)	JTC1 / SC17 / WG8
ISO/IEC 15693	Vicinity Integrated Close-coupled Cards (VICCs)	JTC1 / SC17 / WG8
ISO/IEC 18000	Information Technology AIDC Techniques-RFID for Item Management Air Interface. There are several subparts of ISO 18000 for different frequencies, each of which might contain multiple modes or (incompatible) protocols: **-1**, Generic Parameters for Air Interface Communication for Globally Accepted Frequencies **-2**, Parameters for Air Interface Communication below 135 kHz. **-3**, Parameters for Air Interface Communication at 13.56 MHz. **-4**, Parameters for Air Interface Communication at 2.45 GHz. **-5**, Parameters for Air Interface Communication at 5.8 GHz. (discontinued) **-6**, Parameters for Air Interface Communication - UHF Frequency Band	JTC1 / SC31 / WG4
ISO/IEC 18001	Application requirements Profiles	
ISO/IEC 18092	Near Field Communication at 13.56MHz. The new standard specifies the modulation schemes, coding, transfer speeds, and frame format of the RF interface of NFC devices, as well as initialization schemes and conditions required for data collision-control during initialization - for both passive and active NFC modes. Furthermore it also defines the transport protocol, including protocol activation and data exchange methods.	IEC JTC1
ISO/IEC 24710	Elementary tag licence plate functionality for ISO 18000 air interface	

Other standards deal more with the protocols for readers and/or the data on the tags:

Denominator	Name	Working Group
ISO/IEC 15961	RFID for Item Management -Host Interrogator-Tag functional commands & other syntax features	JTC1 / SC31 / WG4
ISO/IEC 15962	RFID for Item Management – Data Syntax	JTC1 / SC31 / WG4
ISO/IEC 15963	RFID for Item Management - Unique Identification of RF Tag and Registration Authority to Manage the Uniqueness	JTC1 / SC31 / WG4

The following ANSI standard contains both air interface protocols (which have partly been adopted by ISO 18000) as well as a C-level API how applications can talk to readers.

Denominator	Name	Working Group
NCITS 256	Radio Frequency Identification (RFID)	ANSI/NCITS T6

3.5.2 EAN/UCC

The EAN/UCC has defined several standards for identifying different types of objects (see table) Except for the GTIN, which only identifies object classes (e.g., “can of coke”), all other identifiers identify individual objects.
The listed EAN/UCC coding schemes can be used within an EPC tag – but that in all cases, it is a serialized version of the scheme which is embedded, i.e. serialized SGTIN and serilized SGLN and existing SSCC, GRAI, GIAI, subject to a restriction on the serial number being all numeric and wihthin a numeric range which can be accommodated within a 64-bit or 96-bit tag. At this stage, EPC tag Data Standards does not follow the approach of EAN-128 in using Application Identifiers – instead the EPC Header identifies the coding scheme.
In addition, the **EAN-128** allows to flexibly encode multiple data fields about an object into a single “code” by using an *Application Identifier* for each data field specifying the content of the field. References: http://www.ean-ucc.org/, http://www.gs1.org/index.php?http://www.ean-int.org/128.html&2

Standard name	Description	Status
ISBN-10	The book industry standard for identifying books using 10 digits (until January 1, 2007), defined by ISO	ratified
ISBN-13	The book industry standard for identifying books using 13 digits (starting January 1, 2007)	ratified
GTIN	Global Trade Item Number – a global 14-gdigit version of the old 13-digit EAN and 12-digit UPC codes use in conventional retail barcodes	ratified
GTIN Compliant Data Base	EAN.UCC standard for data base design that allows any and all EAN/UCC 8 to14 digit numbers to be uniquely stored in the same data base by converting each number into it’s 14 digit EAN/UCC form	ratified
SSCC	The Serial Shipping Container Code provides an unambiguous identification for logistic units and is the only mandatory field on the UCC/EAN Logistics Label. The SSCC can be used by all parties in the supply chain as a reference number to the relevant information held in computer files	ratified
GLN	Global Location Number The identification of locations is required to enable an efficient flow of goods and information between trading partners through: - EDI messages; physical location marking (rooms,...); routing information on logistic units, identifying parties on Payment Slips	ratified
GRAI	Global Returnable Asset Identifier	ratified
GIAI	Global Individual Asset Identifier	ratified
SGTIN	Serialized Global Trade Item Number is a binary based standard	ratified

3.5.3 Wireless communication for readers

Several technologies for wireless communication in Wide Area Networks (WANs), Local Area Networks (LANs) and Personal Area networks (PANs) have been developed. Examples for WANs are cellular networks for mobile telecommunications. The family of IEEE 802.11-standards, also known as WiFi, addresses LANs. Bluetooth is a well-known PAN, originally developed to wirelessly link computers with components like printers, keyboards, etc. A non-exhaustive list of standards see table below. References: http://www.wi-fi.org, http://www.bluetooth.com and http://www.zigbee.org.

Denominator	Name	Working Group
Digital 2G	Global System for Mobile Communications - GSM	
Digital 2,5G	General Packet Radio Service - GPRS	
IEEE. 802.11a	**(Wi-Fi)** transmits at a frequency of 5 GHz with data rates of 54 Mbps using Orthogonal Frequency Division Multiplexing [**OFDM**]	
IEEE. 802.11b	(**Wi-Fi**) transmits at a frequency of 2.4 GHz with data rates of 11 Mbps using direct sequence spread spectrum modulation.	
IEEE. 802.11g	Transmits at a frequency of 2.4 GHz with data rates of 54Mbps. IEEE 802.11b and 802.11g are compatible so devices can coexist in the same network.	
IEEE 802.15.1	**Bluetooth** transceivers operate in the 2.4GHz ISM band. The frequency range is 2400MHz to 2483.5MHz [in most countries]. The channel spacing is 1MHz, with an upper and lower guard band. Output power is also specified. Bluetooth uses GFSK [Gaussian Frequency Shift Keying] as its modulation. The symbol rate is 1Msps	
IEEE 802.15.4	**Zig-Bee,** low-data-rate WPAN technology, with multimonth to multi year battery life and very low complexity. 802.15.4-2003 will operate in an unlicensed, international frequency band. Potential applications are sensor, interactive toys, smart badges, remote controls and home automation.	

3.6 Existing architectures

3.6.1 EPCglobal / Auto-ID Center

EPCglobal is a subsidiary of GS1 (previously EAN (European Article Numbering) in Europe and UCC (Universal Code Council) in America). In October 2003, the Auto-ID Center transitioned into two organizations – EPCglobal, who are responsible for the ongoing standards development process and commercialization of the EPC Network – and Auto-ID Labs, the worldwide network of academic laboratories who continue the research in the latest Auto-ID technologies.

EPCglobal has inherited a number of standards from the Auto-ID Center:

1. 900 MHz Class 0 Radio Frequency (RF) Identification Tag Specification. This document specifies the communications interface and protocol for 900 MHz Class 0 operation. It includes the RF and tag requirements and provides operational algorithms to enable communications in

this band.

2. 860MHz – 930 MHz Class 1 Radio Frequency (RF) Identification Tag Radio Frequency & Logical Communication Interface Specification. This document specifies the communications interface and protocol for 860 - 930 MHz Class 1 operation. It includes the RF and tag requirements to enable communications in this band.
3. 13.56 MHz ISM Band Class 1 Radio Frequency (RF) Identification Tag Interface Specification. This specification defines the communications interface and protocol for 13.56 MHz Class 1 operation. It also includes the RF and tag requirements to enable communications in this band.
4. Reader Protocol. This specification defines the communications messaging and protocol between readers and EPC compliant software applications. (To be replaced by a new reader protocol specification.)
5. Savant Specification. (Now obsolete – see ALE specification below.)
6. Physical Markup Language (PML) Core Specification. (Now obsolete – see ALE and EPCIS below).
7. Object Name Service (ONS) Specification. This document specifies how the ONS is used to locate authoritative meta-data and services associated with a given Electronic Product Code (EPC). (Version 1.0 published.)

The EPCglobal body has ratified two standards, namely:

1. EPC Tag Data Specification Version 1.1 – This EPCglobal Board Ratified specification identifies the specific encoding schemes for a serialized version of the EAN.UCC Global Trade Item Number (GTIN®), the EAN.UCC Serial Shipping Container Code (SSCC®), the EAN.UCC Global Location Number (GLN®), the EAN.UCC Global Returnable Asset Identifier (GRAI®), the EAN.UCC Global Individual Asset Identifier (GIAI®), and a General Identifier (GID).
2. UHF Class 1 Generation 2 Air Interface – Defines the physical and logical requirements for a passive-backscatter, Interrogator-talks-first (ITF), radio-frequency identification (RFID) system operating in the 860 MHz – 960 MHz frequency range for use with passive tags. This specification is intended to replace the inherited UHF Class 0 and Class 1 specifications which were mutually incompatible. It also provides several improvements over UHF Class 0 and 1 in terms of performance and security. Now ratified by EPCglobal board and being considered as Type C of ISO 18000-6.

The following specifications are in draft form and are expected to be published Q3/Q4 2005:

1. ALE (Application Level Events) Specification – Given the need to minimize bandwidth requirements, encapsulate complexity, respond to events in a timely fashion, and facilitate the distribution of processing, the Application Level Events (ALE) specification is for a software application programming interface (API), associated data specifications, and reporting mechanisms, through which clients may obtain filtered, aggregated tag read data from a multiplicity of tag read sources.
2. EPCIS (EPC Information Services) Specification – A set of specifications for a software application programming interface (API), associated data specifications, and security mechanisms, through which various clients may capture, secure, and access EPC-related data and the business transactions with which that data is associated.
3. Reader Protocol Specification. Specifies how data and commands are exchanged between hosts and readers. It will support reading tags, writing to tags and killing tags.

4. Reader Management. Defines a set of standard functions that enable configuration, provisioning, monitoring, and alarm notification of individual RFID readers. It will leverage the standard communication protocol defined by the Reader Protocol specification where applicable.
5. Tag Data Translation – Specification to express the current EPC Tag Data Standards encoding and decoding rules in an unambiguous machine-readable format, which will allow any component in the EPC Network technology stack to automatically convert between the binary and tag-encoding and pure-identity URN formats of the EPC as appropriate.
6. ONS (Object Name Service) – (New revision.) Specification describes a framework for obtaining authoritative information services for a given EPC identifier.

EPCglobal are considering starting a new workgroup during 2005 on Discovery Services (serial level tracking).

3.6.2 WWAI (World Wide Article Information)

The World Wide Article Information protocol is an open protocol specification for managing distributed object centric information in a networked environment. WWAI specifies a generic language for systems to communicate about objects in the WWAI network.

Standard employed	Description	Status
WWAI	Open protocol specification for managing distributed object centric information	Open Protocol
CODING	Any accepted coding schema with a unique prefix	Depending status schema used
HTTPS	Used for WWAI communication	Ratified
SOAP	Used for WWAI communication	Ratified
XML	Used for WWAI communication	Ratified

Relevant Products	Description	Status
Trackway™	WWAI Implementation and development platform (API&SDK) providing data management and delivery for development of applications such as product lifecycle management, authentication and track and trace.	Proprietory
Device interface	Interfaces for connecting diverse hardware devices (readers, sensors etc.)	Open interface
Component interfaces	Interface for creating diverse software components to run on Trackway	Open interface
Data processor interface	Interface for creating diverse data processors to run on Trackway	Open interface
Database connectivity	SQL connectivity	Ratified

3.6.3 Infineon Sindrion™-Platform

Sindrion sets up a wireless link between peripheral devices and dedicated computing terminals. The peripheral devices contain small smart Sindrion transceivers, which are attached to sensors or actuators. They bear limited or no computing power. The terminal is equipped with a compatible RF transeiver. Data and protocal processing are done in the terminal.

Standard Name	Description	Status
ISM 868MHz	Defines RF link/communication. It is valid for passive tags that receive energy and information from the interrogator. Although tag data are partially specified they are not used in the Sindrion™ technology.	Ratified Specification
Sindrion™ MAC Protocol	Low-Power MAC protocol using Carrier Sense Multiple Access (CSMA) with data acknowledge. Similar to the IEEE 802.15.4 draft standard for Wireless Personal Area Networking.	Proprietary
TCP/IP	Transmission Control Protocol / Internet Protocol	IP v4
Sindrion™ Control Protocol	Sindrion™-hardware specific, non-semantic control protocol	Proprietar
UPnP™	UPnP™ technology defines an architecture for pervasive peer-to-peer network connectivity of intelligent appliances, wireless devices, and PCs of all form factors. It is designed to bring easy-to-use, flexible, standards-based connectivity to ad-hoc or unmanaged networks. UPnP™ technology provides a distributed, open networking architecture that leverages Web technologies to enable seamless proximity networking in addition to control and data transfer among networked devices.	Standardized Device Architecture V1.0

3.6.4 OPC (Object Linking and Embedding for Process Control)

OPC (OLE for Process Control) provides a standard mechanism to communicate between devices or data source e. g. in factory automation. OPC devices can also be connected to SAP manufacturing applications. OPC is based on Microsoft's COM technology.
OPC can serve to interface different fieldbuses. Reference: http://www.opcfoundation.org

3.7 Others

3.7.1 Test and Diagnosis

Standards have been defined for performing system tests and for exchanging diagnostic information between applications. It must be checked with the Promise end-users which if any of the standards listed below are relevant for Promise:

- IEEE Std 1232 (Standard for Artificial Intelligence Exchange and Service Tie to All Test Environments - AI-ESTATE)
- IEEE P1522 (Standard Testability and Diagnosability Characteristics and Metrics)
- IEEE P1598 (Standard for the Test Requirements Model - TeRM)

- IEEE P1636 (Standard Interface for Maintenance Information Collection and Analysis - SIMICA)

3.8 Standards and Quasi-Standards unconsidered within PROMISE

Several standards concerning the representation of geometrical data (IGES, VDAFS, etc.) and the transmission of data (ENX, ODETTE, etc.) do not influence the PROMISE developments, thus they will not be considered within the PROMISE project in detail. However, in particular applications these standards may become relevant and have to be incorporated.

3.9 Other regulations

In addition to the standards listed above, other regulations and mandates may substancially influence the development of RFID and PEIDs in general. We list the regulations imposed by the

- US Department of Defence (DoD)
- US Food and Drug Administration (FDA)
- Recommendations of VDA (German Association of the Automotive Industry)
- The German Association of the Automotive Industry (VDA) has compiled guidelines and recommendations with regard to different topics related to automotive industry. The following recommendations can be considered relevant to PROMISE.
- VDA 4956: Product Data Exchange; Part 1: Assembly Data Exchange
- VDA 4961: Checklist for the Coordination of Data Logistics in Simultaneous Engineering Projects

3.9.1 ATA Spec 2000

The Air Transport Association (ATA) administer a set of e-business specifications referred to generally as Spec 2000. Spec 2000 (E-Business Specification for Materiels Management) – includes ATA CSDD – Common Support Data Dictionary and more recently, iSpec 2200 (Information Standards for Aviation Maintenance) which incorporates and supersedes ATA Spec 100 and ATA Spec 2100.

More information on Spec 2000 is available from their web page: http://www.spec2000.com.

3.10 Memberships of PROMISE partners within standardisation bodies

The following table shows in which standardisation bodies or working groups PROMISE partners are participating.

Company	Standardisation bodies or working groups
EPFL	ISO TC184/SC1/WG7
INFINEON	ISO/IEC JTC 1 SC 17 ISO/IEC JTC 1 SC 17 WG 1 ISO/IEC JTC1 SC 17 WG 4 ISO/IEC JTC1 SC 17 WG 8 ISO/IEC JTC 1 SC 31, WG 4. ISO/IEC JTC 1 SC 37 IEC SC 3D: ISO/IEC JWG 1 Bluetooth SIG DLNA (Digital living network alliance) IEEE WIFI-Alliance
SAP	OASIS UDDI W3C SOAP/XMLP EPCglobal Auto-ID WSDL OMG

4 Conclusion

As shown in this deliverable, there are a lot of standards which apply to the different layers of the PROMISE Product Information Tracking and Flow Management system. There are also quite a lot of competing standards. Main task within this project in the next months will be to choose the most suitable and promising ones for PROMISE and achieve an agreement among the participating partners.

Appendix

Naming Authorities

- IEEE Registration Authority manage registration of OUI (organizationally unique identifiers) and IAB (Individual Address Block) used for ethernet MAC addresses.
- Defense Logistics Information Service (DLIS) (US Government Department of Defense) manage a registry for Unique Identifiers (UID) used for supply of goods to the DoD.
- GS1 (EAN.UCC) manage naming for bar-coded products.
- EPCglobal manage EPCs (electronic product codes) and distribute blocks of codes.
- ICANN (Internet Corporation for Assigned Names and Numbers) / IANA (Internet Assigned Numbers Authority) manage top-level domains (TLDs), IP addresses and port numbers.
- Dun and Bradstreet provide a unique D-U-N-S numbering scheme to identify businesses.
- CAGE (Commercial and Government Entity) and NATO CAGE are the US and non-US numbering schemes for manufacturers supplying to the US Government.

4.1 Standard Bodies

AIAG	Automotive Industry Action Group
AIM	Association for Automatic Identification and Mobility
ANSI	American National Standards Institute
DUNS	Dun & Bradstreet
EIA	Electronics Industries Association
EPCglobal	Joint venture between UCC and EAN Int'l
IANA	Internet Assigned Numbers Authority
ICANN	Internet Corporation for Assigned Names and Numbers
IEC	International Electrotechnical Commission
IETF	Internet Engineering Task Force
ISO	International Standards Organization
UN	United Nations (e.g. UNSPSC codes)
US DOD	US Department of Defense
W3C	World Wide Web Consortium

4.2 Useful Web Pages

www.iec.ch	International Electrotechnical Committee
www.ansi.org	American National Standards Institute
www.dodrfid.org	U.S. Department of Defense - RFID adoption
www.epcglobalinc.org	EPCglobal Inc.
www.aimglobal.org	AIM Global
www.w3.org	World Wide Web Consortium
www.ietf.org	Internet Engineering Task Force
www.iana.org	Internet Assigned Numbers Authority
www.icann.org	Internet Corporation for Assigned Names and Numbers
www.unspsc.org	United Nations Std Products & Services Code
www.openapplications.org	OAGIS - Open Applications Group
www.eccma.org	Electronic Commerce Code Management Assoc.
www.udef.org	Universal Data Element Framework
www.w3.org/rdf	W3C Resource Description Framework
www.dublincore.org	Dublin Core Metadata Initiative

GLOSSARY

ALE	Application Level Events
API	Application Programming Interface
ATA	Air Transport Association
CICC	Contactless Integrated Close-coupled Cards
CNC	Computer Numeric Control
DBMS	DataBase Management System
DSA	Digital Signature Algorithm
DSS	Digital Signature Standard
EAN	European Article Numbering
EIB	European Installation Bus
ebXML	Electronic Business using extensible markup language
EDI	Electronic Data Interchange
ENX	European Network Exchange
EPC	Electronic Product Codes
GFSK	Gaussian Frequency Shift Keying
GIAI	Global Individual Asset Identifier
GLN	Global Location Number
GRAI	Global Returnable Asset Identifier
GPRS	General Packet Radio Service
GSM	Global System for Mobile communication
GTIN	Global Trade Item Number
HTML	Hyper Text Markup Language
HTTP	Hypertext Transfer Protocol
ID	Identification
IEC	International Electrotechnical Commision
IP	Internet Protocol
IGES	Initial Graphics Exchange Specification
ISO	Internation Organization for Standardisation
ITF	Interrogator talks first
JDBC	Java Data Base Connectivity
JMS	Java Message Servic
LAN	Local Area Network
MAC	Media Access
OAGIS	Open Applications Group Interoperability Standard
ODBC	Open DataBase Connectivity
OFDM	Orthogonal Frequency Division Multiplexing
OLE	Object Linking and Embedding
OMG	Object Management Group
ONS	Object Name Service
OPC	OLE for Process Control
ODETTE	Organization for Data Exchange by Tele-Transmission in Europe
PAN	Personal Area Network
PDM	Product Data Management
PEID	Product Embedded Information Device
PML	Physical Markup Language
PICC	Proximity Integrated Close-coupled Card

PLM	Product lifetime monitoring
RDF	Resource Description Framework
RFC	Request for Comment
RFID	Radio frequency identification
RSA	public key encryption method used in PGP
SDK	Software Development Kit
SGML	Standard Generalized Markup Language
SGLN	Serialized Global Location Number
SGTIN	Serialized Global Trade Item Number
SHS	Secure Hash Standard
SOAP	Simple Object Access Protocol
SQL	Structured Query Language
SSCC	Serial Shipping Container Code
SSL	Secure Socket Layer
TCP	Transmission Control Protocol
UCC	Uniform Commercial Code
UDDI	Universal Description, Discovery and Integration
UDEF	Universal Data Element Framework
UDP	User Datagram Protocol
UpnP	Universal Plug and Play
XML	eXtensible Markup Language
XML-RPC	eXtensible Markup Language Remote Procedure Calling
XSL	Stylesheet Language
VDA	German Association of the Automotive Industry
VDAFS	Verband Deutscher Automobilhersteller FlaechenSchnittstelle
VICC	Vicinity Integrated Close-coupled Cards
WAN	Wide Area Network
Wi-Fi	Wireless Fidelity
WP	Work package
WLAN	Wireless Local Area Network
WSDL	Web Services Description Language
WSS	Web Service Security
WWAI	World Wide Article Information