NATIONAL ENTERPRISE ARCHITECTURE FRAMEWORK
KINGDOM OF BAHRAIN

Technology Standards and Guidelines

Data Domain

Kingdom of Bahrain
eGovernment Towards a Better Life

DOCUMENT INFORMATION AND HISTORY

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2.0	04/12/2013	ICTGC	Formal approval by ICTGC

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1. INTRODUCTION

This document covers tools, technologies and standards used in the Data domain. The process of arriving at these standards has been outlined in the NEAF - Technology Standards Methodology & Process document in Section 3 - Methodology and Approach. Some of the tools, technologies and standards have been identified as potential requirements and hence been incorporated in this document. These may be considered as recommendations for current and future use.

This document shall be considered for revision in conjunction with the NEAF - Technology Standards Methodology & Process document at appropriate intervals of time as decided by the ICT Governance Committee. Any addition or upgrade to these tools and standards may be incorporated by following the process described in the NEAF - Technology Standards Methodology & Process document in Section 6 - Review and Maintenance of Technology Standards and Guidelines.

2. Summary of Technology Standards/Specifications and Tools

This section contains a summary of standards and tools applicable to the Data domain. These have been grouped into sub-sections (categories), with each category addressing one aspect of the related standards and tools. Further details and links to these standards and tools have been provided in the following sections of this document.

The rationale for selection of these standards and tools are :
- Based on the usage across ministries as captured in the internal survey.
- Technology best practices.
- References from international standards bodies.

2.1. Modelling, Design and Development

Introduction to Sub-Category	▪ Modeling, design and development products are software applications that provide comprehensive facilities to computer programmers for software development, designing and data modeling. Sometimes a version control system and various tools are integrated to simplify the construction of a GUI. Many modern tools also have a class browser, an object inspector, and a class hierarchy diagram, for use with software development.
Applicable Standard(s)	▪ Design 　o Microsoft Visio Version 2003 or higher (Current version 2010) – (Details) 　o Quest Software TOAD DBA Suite – (Details) ▪ Data Modeling 　o CA ERwin Data Modeler (Version r7.3) – (Details) 　o IBM InfoSphere Data Architect (Version 7.5.2 or higher) – (Details) 　o Quest Software TOAD Data Modeler – (Details) ▪ Development 　o Oracle Developer Suite – Oracle Forms, Reports and JDeveloper (Version 10g,11g or higher) – (Details) 　o Quest Software TOAD Development Suite – (Details) 　o Quest Software TOAD for Data Analytics – (Details) 　o Quest Software TOAD Extension for Eclipse – (Details) 　o PL/SQL – (Details)
Remarks	
Exceptions	

2.2. Character Set and Encoding

Introduction to Sub-Category	▪ Character Set and Encoding is necessary for allowing computers to consistently represent and manipulate text expressed in most of the

	world's writing systems. The system required both - character sets, a repertoire of character and an encoding scheme such as a sequence of natural numbers, octets or electrical pulses, in order to facilitate the transmission of data (generally numbers and/or text) through telecommunication networks or storage of text in computers.
Applicable Standard(s)	▪ UNICODE (Details) ▪ ISO/IEC 10646:2003 (Details) ▪ UTF-8 (Details)
Remarks	▪ None
Exceptions	▪ None

2.3. DATA EXCHANGE FORMATS	
Introduction to Sub-Category	▪ Data Exchange is concerned with the sending of data over a communications network and the definition of data communicated from one application to another. Data exchange formats provides the communications common denominator between disparate systems.
Applicable Standard(s)	▪ PDF - accessible, non-editable documents (Details) ▪ TIFF/IT - facsimile and scanned documents (Details) ▪ GIF 89a and JPEG - raster based colour documents, drawings, or photographs. (Details) ▪ RTF - editable word processing documents interoperable across platforms (Details) ▪ DOC/DOCX - editable word processing documents (Details) ▪ PPT/PPTX - presentation file type for collaborative editing (Details) ▪ XLS/XLSX - presentation file type for collaborative editing (Details) ▪ HTML and XHTML - hypertext web content (Details) ▪ IGES - computer aided design documents (Details) ▪ MPEG - moving images and audio (Details) ▪ CGM and SVG - editable vector based graphics such as line drawings (Details) ▪ XML - mark-up of documents containing structured information (Details) ▪ CSV – (Details) ▪ TXT – (Details)

Remarks	▪ RTF and DOC are both standards for editable word processing documents. However, RTF should be preferred where the document has to be utilized across platforms.
Exceptions	▪ None

2.4. GEOSPATIAL DATA STANDARDS

Introduction to Standard	▪ A geographic information system (GIS), or geographical information system captures, stores, analyzes, manages, and presents data that is linked to location. Technically, GIS is geographic information systems which includes mapping software and its application with remote sensing, land surveying, aerial photography, mathematics, photogrammetry, geography, and tools that can be implemented with GIS software. ▪ GIS data represents real objects (such as roads, land use, elevation, trees, waterways, etc.) with digital data determining the mix. Real objects can be divided into two abstractions: discrete objects (e.g., a house) and continuous fields (such as rainfall amount, or elevations). Traditionally, there are two broad methods used to store data in a GIS for both kinds of abstractions mapping references: raster images and vector. Points, lines, and polygons are the stuff of mapped location attribute references. A new hybrid method of storing data is that of identifying point clouds, which combine three-dimensional points with RGB information at each point, returning a "3D color image". GIS thematic maps then are becoming more and more realistically visually descriptive of what they set out to show or determine. ▪ The following standards pertain to the capture, storage, sharing and usage of the GIS data.
Applicable Standard(s)	▪ OGC Geography Markup Language (GML) – (Details) ▪ OGC City Geography Markup Language (CityGML) – (Details) ▪ OGC GeoSPARQL – (Details) ▪ OGC KML – (Details) ▪ OGC network Common Data Form (netCDF) – (Details) ▪ PUCK – (Details) ▪ Geospatial eXtensible Access Control Markup Language (GeoXACML) – (Details) ▪ OGC Web Service (OWS) – (Details) ▪ OpenGIS(r) Web Map Service Interface Standard (WMS) – (Details) ▪ OpenGIS Web Feature Service Interface Standard (WFS) – (Details) ▪ OGC Open GeoSMS – (Details)
Remark(s)	▪ None

Exception(s)	▪ None

2.5. DATABASE CONNECTIVITY AND ACCESS TECHNOLOGIES

Introduction to Sub-Category	▪ Database connectivity and access technologies are concerned with providing for technologies to connect to and access the data stored in databases. They allow for client software to talk to database server software, whether on the same machine or not. A connection is required to send commands and receive answers, usually in the form of a result set.

Applicable Standard(s)	▪ Industry or de facto standards for database connectivity such as
	    • JDBC ([Details](#))
	    • ODBC ([Details](#))
	    • OLE-DB ([Details](#))
	▪ Framework and models
	    • Hibernate – ([Details](#))
	    • Oracle Toplink – ([Details](#))
	    • iBATIS – ([Details](#))
	    • ADO.NET ([Details](#))

Remarks	▪ Other industry or de-facto standards for database connectivity can also be utilized.
Exceptions	▪ None

2.6. DATABASE MANAGEMENT SYSTEM TECHNOLOGY

Introduction to Standard	▪ A database is an integrated collection of logically related records or files which consolidates records into a common pool of data records that provides data for many applications. A database is a collection of information that is organized so that it can easily be accessed, managed, and updated. ▪ A relational database management system (RDBMS) is a database management system (DBMS) that is based on the relational model. Data

	query, update, schema creation and modification, and data access control are important aspects of any RDBMS. Standard based query language that provides all these features should be adopted.
	▪ Relational Data Base Management Systems should be utilized for Information Systems.
Applicable Standard(s)	Relational Database Management System should be used for Information Systems and they must meet ANSI SQL Standards ([Details](#))
Remark(s)	▪ None
Exception(s)	▪ None

2.7. DATABASE MANAGEMENT SYSTEMS	
Introduction to Standard	▪ A database is an integrated collection of logically related records or files which consolidates records into a common pool of data records that provides data for many applications. A database is a collection of information that is organized so that it can easily be accessed, managed, and updated.
	▪ A relational database management system (RDBMS) is a database management system (DBMS) that is based on the relational model. Data query, update, schema creation and modification, and data access control are important aspects of any RDBMS. Standard based query language that provides all these features should be adopted.
	▪ Relational Data Base Management Systems should be utilized for Information Systems.
Applicable Standard(s)	▪ Oracle DB – ([Details](#)) ▪ IBM DB2 DB– ([Details](#)) ▪ Microsoft SQL Server DB – ([Details](#)) ▪ MySQL DB – ([Details](#))
Remark(s)	▪ None
Exception(s)	▪ None

2.8. DATA WAREHOUSE DATABASE MANAGEMENT SYSTEMS

Introduction to Standard	▪ Data warehouse is a repository of an organization's electronically stored data. Data warehouses are designed to facilitate reporting and analysis. In contrast to data warehouses are operational databases that support day-to-day transaction processing. The data warehouse is a mission-critical system, with data warehouses serving in an increasingly mixed workload capacity, including as a data source for online applications.
Applicable Standard(s)	▪ Teradata – (Details) ▪ Oracle DW 11g – (Details) ▪ IBM Infosphere – (Details) ▪ Microsoft DW Builder – (Details)
Remark(s)	▪ None
Exception(s)	▪ None

2.9. STORAGE TECHNOLOGIES

Introduction to Standard	▪ Storage devices are designed to provide information to direct attached servers or provide non-volatile digital storage media to support information processing in a local and a network environment. These devices provide extended storage capabilities to the network with reduced costs compared to traditional file servers.
	
	▪ Storage technologies may be sub-divided into -
	    o Storage Systems Technologies
	    o Storage Interface Technologies
	    o Storage Media

Applicable Standard(s)	▪ Storage Systems Technologies
	    o Local RAID – (Details)
	    o SAN – (Details)
	
	▪ Storage Interface Technologies
	    o Fibre Channel – FC / FICON / FCIP – (Details)
	    o SCSI / iSCSI – (Details)
	    o 10GigE – (Details)
	    o PCI Express – (Details)
	    o SAS – (Details)
	    o USB – (Details)
	    o SATA – (Details)
	    o InfiniBand – (Details)

	▪ Storage Media
	    o Optical Disks
	        • CDs – ([Details](#))
	        • Standard Definition DVDs – ([Details](#))
	        • Blu-ray Disc – ([Details](#))
	    o Tapes
	        • LTO – ([Details](#))
	        • DLT / SDLT – ([Details](#))
	        • Virtual Tapes – ([Details](#))
	        • 3590/9840/10000 – ([Details](#))

Remark(s)	▪ None
Exception(s)	▪ None

3. Details of Standards / Specifications and Associated Guidelines

This section provides a brief description of the relevant standards listed in section 2 along with links for references to these standards.

3.1. ANSI Standard SQL

Description	▪ SQL, often referred to as Structured Query Language, is a database computer language designed for managing data in relational database management systems (RDBMS). Its scope includes data query and update, schema creation and modification, and data access control. SQL is the most widely used language for relational databases.
Applicable to	▪ Database Management System Technologies
Reference(s)	▪ http://www.iso.org/iso/catalogue_detail.htm?csnumber=34132
Remarks:	▪ ANSI SQL is the American National Standards Institute standardized Structured Query Language. ANSI SQL is the base for several different SQL languages such as T-SQL and PL/SQL. ANSI SQL is used to Create, Alter, and View data stored within a database.

3.2. Unicode

Description	▪ The Unicode Standard is the universal character encoding scheme for written characters and text. It defines a consistent way of encoding multilingual text that enables the exchange of text data internationally and creates the foundation for global software. ▪ As the default encoding of HTML and XML, the Unicode Standard provides a sound underpinning for the World Wide Web and new methods of business in a networked world. ▪ Required in new Internet protocols and implemented in all modern operating systems and computer languages such as Java, Unicode is the basis of software that must function all around the world.
Applicable to	▪ Character Set and Data Encoding
Reference(s)	▪ http://www.unicode.org/unicode/uni2book/u2.html

	▪ http://www.unicode.org/versions/
Remarks	▪ Unicode is a global, matured and widely adopted standard for character set.

3.3. ISO/IEC 10646:2003	
Description	▪ ISO/IEC 10646:2003 specifies the Universal Multiple-Octet Coded Character Set (UCS). It is applicable to the representation, transmission, interchange, processing, storage, input and presentation of the written form of the languages of the world as well as additional symbols. ▪ ISO 10646 is an ISO standard to encode the characters of the major languages of the world into a single character set. ▪ ISO 10646 is code-for-code compatible with Unicode which can be considered as an implementation of 10646.
Applicable to	▪ Character Set and Data Encoding
Reference(s)	▪ http://www.iso.ch/iso/en/ISOOnline.frontpage ▪ http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=39921
Remarks	▪ The information technology industry gains data stability, greater global interoperability and data interchange. ISO/IEC 10646:2003 has been widely adopted in new Internet and W3C protocols and mark up languages such as XML and HTML, and implemented in modern operating systems and computer programming languages. This edition covers over 96 000 characters from the world's scripts. ▪ It is widely supported by a broad range of products, including databases, fonts and printing tools, internationalization libraries and office productivity tools.

3.4. UTF-8	
Description	▪ The Unicode Standard [UNICODE] and ISO/IEC 10646 [ISO- 10646] jointly define a coded character set (CCS), hereafter referred to as Unicode, which encompasses most of the world's writing systems.

	▪ The Internet Engineering Task Force (IETF) requires all Internet protocols to identify the encoding used for character data, and the supported character encodings must include UTF-8. The Internet Mail Consortium (IMC) recommends that all e-mail programs be able to display and create mail using UTF-8.
Applicable to	▪ Character Set and Data Encoding
Reference(s)	▪ http://www.utf8.com/
Remarks	▪ UTF-8 is the standard encodings for Unicode text in HTML documents and the preferred and most used encoding.

3.5. PL/SQL

Description	▪ PL/SQL is an imperative 3GL that was designed specifically for the seamless processing of SQL commands. It provides specific syntax for this purpose and supports exactly the same datatypes as SQL. Server-side PL/SQL is stored and compiled in Oracle Database and runs within the Oracle executable. It automatically inherits the robustness, security, and portability of Oracle Database.
Applicable to	▪ Design, Modelling and Development Technology
Reference(s)	▪ http://www.oracle.com/technetwork/database/features/plsql/index.html
Remarks:	

3.6. XML

Description	▪ XML is a markup language for documents containing structured information. It is a W3C Recommendation for marking up data that cannot be marked up using the HTML. It is a simple dialect of the Standard Generalized Markup Language (SGML) defined in ISO Standard 8879. ▪ The goal of XML is to enable SGML coded data to be served, received, and processed on the Web in the way that is as easy as that currently made possible by the use of the fixed SGML tag set provided by HTML.

	▪ XML has been designed for ease of implementation and for interoperability with both SGML and HTML. XML is based on the ISO 10646 Universal Multiple-Octet Coded Character Set (UCS) so that it can be used in all major trading nations.
Applicable to	▪ Data Exchange between Information Systems
Reference(s)	▪ http://www.w3.org/TR/REC-xml ▪ http://www.w3.org/XML/
Remarks	▪ XML is a global, matured and widely adopted standard on data integration. ▪ XML is extensively supported by a broad range of application development, software infrastructure, business application and industry-specific schema initiatives.

3.7. CSV

Description	▪ A comma-separated values (CSV) file is a simple text format for a database table. Each record in the table is one line of the text file. Each field value of a record is separated from the next with a comma. Implementations of CSV can often handle field values with embedded line breaks or separator characters by using quotation marks or escape sequences. CSV is a simple file format that is widely supported, so it is often used to move tabular data between different computer programs that support the format. For example, a CSV file might be used to transfer information from a database program to a spreadsheet.
Applicable to	▪ Data Exchange between Information Systems
Reference(s)	▪ http://tools.ietf.org/html/rfc4180
Remarks	▪ The CSV file format is very simple and supported by almost all spreadsheets and database management systems. Many programming languages have libraries available that support CSV files. Even modern software applications support CSV imports and/or exports because the format is so widely recognized. In fact, many applications allow .csv-named files to use any delimiter character.

3.8. TXT	
Description	▪ A text file (sometimes spelled "textfile": an old alternate name is "flatfile") is a kind of computer file that is structured as a sequence of lines. A text file exists within a computer file system. The end of a text file is often denoted by placing one or more special characters, known as an end-of-file marker, after the last line in a text file. ▪ "Text file" refers to a type of container, while plain text refers to a type of content. Text files can contain plain text, but they are not limited to such.
Applicable to	▪ Data Exchange between Information Systems
Reference(s)	▪ http://www.unicode.org/charts/PDF/U0000.pdf
Remarks	▪ Most Windows text files use a form of ANSI, OEM or Unicode encoding. What Windows terminology calls "ANSI encodings" are usually single-byte ISO-8859 encodings, except for in locales such as Chinese, Japanese and Korean that require double-byte character sets. ANSI encodings were traditionally used as default system locales within Windows, before the transition to Unicode. By contrast, OEM encodings, also known as MS-DOS code pages, were defined by IBM for use in the original IBM PC text mode display system. They typically include graphical and line-drawing characters common in full-screen MS-DOS applications. Newer Windows text files may use a Unicode encoding such as UTF-16LE or UTF-8.

3.9. PDF - ACCESSIBLE, NON-EDITABLE DOCUMENTS	
Description	▪ The Portable Document Format (PDF), developed by Adobe Systems Inc., is a computer file format designed to publish and distribute electronic documents. PDF is related to the Postscript language, and may be used with text, image, and/or multimedia files. PDF files may be created and used on most any type of computer e.g. Windows, Macintosh, UNIX, or OS/2. ▪ Unlike other electronic file formats such as HTML or XML, the PDF captures all of the elements of a printed document as an electronic image and preserves the exact layout, font attributes, and formatting of the document from which it was created, ensuring that the electronic version of a document appears just like the original. Users can view, navigate, print and forward to other users.
Applicable to	

	• Data Exchange Formats
Reference(s)	• http://www.iso.org/iso/pressrelease.htm?refid=Ref1141 • http://www.adobe.com/products/acrobat/adobepdf.html
Remarks	• PDF is a dominant format for document publishing which is extensively used on the Internet. It is supported by freely available Acrobat Reader and browser plug-ins. • The ISO 32000-1:2008 PDF open standard was published by the ISO on July 1, 2008. PDF is now a published ISO standard. • Access controls and permissions can be defined in PDF documents, so that only authorized people will be able to view, modify, repurpose, or even print documents.

3.10. TIFF/IT - FACSIMILE AND SCANNED DOCUMENTS

Description	• Tag Image File Format (TIFF) was developed by Aldus and Microsoft Corp, and the specification was owned by Aldus, which in turn merged with Adobe Systems, Incorporated. Consequently, Adobe Systems now holds the Copyright for the TIFF specification. • TIFF is a common format for exchanging raster graphics (bitmap) images between application programs. It is a *de facto* standard of particular benefit for images that will not tolerate information loss.
Applicable to	• Data Exchange Formats
Reference(s)	• http://partners.adobe.com/asn/developer/pdfs/tn/TIFF6.pdf. • http://www.iso.org/iso/catalogue_detail.htm?csnumber=34342
Remarks	• TIFF is a de facto standard of particular benefit for images that will not tolerate information loss. • Version 6 is the current version and a matured standard. It was published in June 1992. • It is widely supported by browsers through freely-available plug-ins and the majority of image processing, graphics design, photo processing and scanner accessory software.

	3.11. GIF AND **JPEG -** RASTER BASED COLOR DOCUMENTS, DRAWINGS, OR PHOTOGRAPHS	
Description	GIF	
	▪ Graphic Interchange Format (GIF) is one of the most common formats for graphics images on the Web.	
	▪ The Graphics Interchange Format (GIF) is a bitmap image format that was introduced by CompuServe in 1987 and has since come into widespread usage on the World Wide Web due to its wide support and portability.	
	JPEG	
	▪ The term "JPEG" is an acronym for the Joint Photographic Experts Group which created the standard. JPEG compression is used in a number of image file formats. JPEG/Exif is the most common image format used by digital cameras and other photographic image capture devices; along with JPEG/JFIF, it is the most common format for storing and transmitting photographic images on the World Wide Web. These format variations are often not distinguished, and are simply called JPEG.	
	▪ Joint Photographic Experts Group (JPEG) is an ISO graphic image file format standard (ISO 10918).	
Applicable to	▪ Data Exchange Formats	
Reference(s)	GIF	
	▪ http://www.w3.org/Graphics/GIF/spec-gif89a.txt	
	JPEG	
	▪ http://www.w3.org/Graphics/JPEG/	
Remarks	GIF	
	▪ Graphic Interchange Format is a *de facto* standard widely supported by browsers and the majority of image processing, graphics design, photo processing and scanner accessory software.	
	▪ GIF still remains a popular choice for storing lower resolution image data.	
	JPEG	
	▪ JPEG standard is widely supported by browsers and the majority of image processing, graphics design, photo processing and scanner accessory software.	

	▪ Fundamental advantage of JPEG is that it stores full color information: 24 bits/pixel (16 million colors).

3.12. RTF - EDITABLE WORD PROCESSING DOCUMENTS

Description	▪ The Rich Text Format (RTF) specification provides a format for text and graphics interchange that can be used with different output devices, operating environments, and operating systems. ▪ RTF uses the American National Standards Institute (ANSI), PC-8, Macintosh, or IBM PC character set to control the representation and formatting of a document, both on the screen and in print. ▪ With the RTF specification, documents created under different operating systems and with different software applications can be transferred between those operating systems and applications.
Applicable to	▪ Data Exchange Formats
Reference(s)	▪ http://msdn.microsoft.com/library/?url=/library/enus/dnrtfspec/html/rtfspec.asp?frame=true.
Remarks	▪ RTF is a *de facto* standard for text and graphics interchange, available in the public domain. ▪ RTF is matured and well supported by all of the market leading word processing packages. ▪ RTF version 1.6 is the latest version of the specification. It provides support for all new control words introduced by Microsoft Word for Windows 95 version 7.0, Word 97 for Windows, Word 98 for the Macintosh and Word 2000 for Windows and thus ensures maximum compatibility with the dominant word processing package.

3.13. DOC - EDITABLE WORD PROCESSING DOCUMENTS

Description	▪ DOC document file type is the proprietary Microsoft Word document format. This format is to be used in inter-departmental information interchange between users of Microsoft Word.

Applicable to	▪ Data Exchange Formats
Reference(s)	▪ http://www.microsoft.com/office/word/default.asp. ▪ http://www.microsoft.com/interop/docs/officebinaryformats.mspx#EFB
Remarks	▪ It is one of the major word processing applications both in public and private sector. ▪ It is supported by open source alternatives. ▪ MS Office is the product of choice in Kingdom of Bahrain

3.14. PPT - PRESENTATION FILE TYPE FOR COLLABORATIVE EDITING

Description	▪ PPT presentation file type is the proprietary Microsoft PowerPoint presentation format. This format is to be used in inter-departmental information interchange between users of Microsoft PowerPoint.
Applicable to	▪ Data Exchange Formats
Reference(s)	▪ http://www.microsoft.com/interop/docs/officebinaryformats.mspx#EOB ▪ http://www.digitalpreservation.gov/formats/intro/specifications.shtml
Remarks	▪ Microsoft PowerPoint is one of the major presentation applications both in public and private sector. It is supported by open source alternatives. ▪ MS Office is the product of choice in Kingdom of Bahrain

3.15. XLS - PRESENTATION FILE TYPE FOR COLLABORATIVE EDITING

Description	▪ XLS spreadsheet file type is the proprietary Microsoft Excel spreadsheet format. This format is to be used in interdepartmental information interchange between users of Microsoft Excel.
Applicable to	▪ Data Exchange Formats

Reference(s)	• http://www.microsoft.com/office/excel/default.asp. • http://www.microsoft.com/interop/docs/OfficeBinaryFormats.mspx#EXB
Remarks	• Microsoft Excel is one of the major spreadsheet applications both in public and private sector. • It is supported by open source alternatives. • MS Office is the product of choice in Kingdom of Bahrain

3.16. HTML AND XHTML - HYPERTEXT WEB CONTENT

Description	• HTML is a simple markup language used to create hypertext documents that are platform independent. It is the set of markup symbols or codes inserted in a file intended for display on a World Wide Web browser page. The markup tells the Web browser how to display a Web page's words and images for the user. • W3C describes XHTML (eXtensible Hypertext Markup Language) as "a reformulation of HTML v4.0 as an application of the XML." XHTML v1.0 reproduces and extends HTML v4 as XML and promises, with the advent of XHTML modularization, to simplify future extensions and to enable support for multiple devices. XHTML v1.0 was designed to enable easy migration of HTML content to XHTML and XML.
Applicable to	• Data Exchange Formats
Reference(s)	• http://www.w3.org/TR/html401. • http://www.w3.org/TR/xhtml1.
Remarks	• HTML is a global, matured and widely adopted standard. It has been in use by the World Wide Web (WWW) global information initiative since 1990. • XHTML is a matured and widely adopted standard. The latest version of XHTML (v1.0) was recommended by W3C in January 2000. • It is widely supported by the dominant web browsers such as Microsoft Internet Explorer (IE), Netscape Navigator, Opera and Mozilla.

3.17. IGES - COMPUTER AIDED DESIGN DOCUMENTS

Description	▪ The IGES format serves as a neutral data format to transfer the design to a dissimilar system. Translators, developed to the IGES Standard, are used to export a design into an IGES file for exchange and for importing the IGES file into the destination system.
Applicable to	▪ Data Exchange Formats
Reference(s)	▪ http://ts.nist.gov/standards/iges/
Remarks	▪ IGES files provide a way to access data from decades from now. Today, plug-in viewers for Web browsers allow IGES files created 20 years ago to be viewed from anywhere in the world.

3.18. MPEG - MOVING IMAGES AND AUDIO

Description	▪ MPEG-4 is a patented collection of methods defining compression of audio and visual (AV) digital data. It was introduced in late 1998 and designated a standard for a group of audio and video coding formats and related technology agreed upon by the ISO/IEC Moving Picture Experts Group (MPEG) (ISO/IEC JTC1/SC29/WG11) under the formal standard ISO/IEC 14496 - Coding of audio-visual objects. Uses of MPEG-4 include compression of AV data for web (streaming media) and CD distribution, voice (telephone, videophone) and broadcast television applications.
Applicable to	▪ Data Exchange Formats
Reference(s)	▪ http://mpeg.chiariglione.org/standards/mpeg-4/mpeg-4.htm ▪ http://www.digitalpreservation.gov/formats/fdd/fdd000035.shtml
Remarks	▪ MPEG-4 is an ISO/IEC standard developed by MPEG (Moving Picture Experts Group), the committee that also developed the Award winning standards known as MPEG-1 and MPEG-2. ▪ MPEG-4 absorbs many of the features of MPEG-1 and MPEG-2 and other related standards, adding new features such as (extended) VRML support for 3D rendering,

	object-oriented composite files (including audio, video and VRML objects), support for externally-specified Digital Rights Management and various types of interactivity. AAC (Advanced Audio Coding) was standardized as an adjunct to MPEG-2 (as Part 7) before MPEG-4 was issued.

3.19. CGM AND SVG - EDITABLE VECTOR BASED GRAPHICS SUCH AS LINE DRAWINGS

Description	▪ CGM provides a means of graphics data interchange for computer representation of 2D graphical information independent from any particular application, system, platform, or device. As a metafile, i.e. a file containing information that describes or specifies another file, the CGM format has numerous elements to provide functions and to represent entities, so that a wide range of graphical information and geometric primitives can be accommodated. Rather than establish an explicit graphics file format, CGM contains the instructions and data for reconstructing graphical components to render an image using an object-oriented approach. ▪ Scalable Vector Graphics (SVG) is a family of specifications of an XML-based file format for describing two-dimensional vector graphics, both static and dynamic (i.e. interactive or animated).
Applicable to	▪ Data Exchange Formats
Reference(s)	CGM ▪ http://xml.coverpages.org/cgmStandardsNISTList.html SVG ▪ http://www.w3.org/Graphics/SVG/
Remarks	CGM ▪ Computer Graphics Metafile (CGM) is a long-standing data interchange standard that defines a neutral computer interpretable representation of two-dimensional (2-D) graphic information independent of any particular application or system. ▪ A CGM file can contain vector graphics, raster graphics and text. Most industry available graphics applications support export and import of CGM formatted graphics. SVG ▪ Scalable Vector Graphics (SVG) is the open XML standard developed by the W3C to describe 2D content that may contain vector graphics, raster images and font text. This new format brings the inherent benefits of vector graphics to the Web, combining them with all

	the capabilities offered by XML and related technologies.
	▪ SVG is an entirely text based file format based on XML. Key advantages include smaller file sizes, indexable and searchable text elements, and high-resolution scan, zoom, and pan features.

3.20. JDBC

Description	▪ The Java Database Connectivity (JDBC) API is the industry standard for database-independent connectivity between the Java programming language and a wide range of databases – SQL databases and other tabular data sources, such as spreadsheets or flat files. The JDBC API provides a call-level API for SQL-based database access.
	▪ JDBC technology allows you to use the Java programming language to exploit "Write Once, Run Anywhere" capabilities for applications that require access to enterprise data. With a JDBC technology-enabled driver, you can connect all corporate data even in a heterogeneous environment.
Applicable to	▪ Database Connectivity Access Technology
Reference(s)	▪ http://java.sun.com/javase/technologies/database/ ▪ http://jcp.org/en/jsr/detail?id=221
Remarks	▪ Since JDBC is included with the Java Platform, it is available everywhere Java is available. This makes the Java application that uses the JDBC API portable to a lot of platforms. ▪ The JDBC API encourages Java applications to be designed into multiple tiers, separating business logic from presentation logic. This will aid the scalability, reliability and maintainability of the application tremendously. ▪ Robustness, security, automatically downloadable code, and other Java pluses. By virtual of being written in Java, the JDBC application automatically enjoys these benefits that Java offers.

3.21. ODBC

Description	▪ Open Data Base Connectivity. ODBC is based on Call-Level Interface and was defined by the SQL Access Group. Microsoft was one member of the group and was the first company to release a commercial product based on its work (under Microsoft Windows) but ODBC

	is not a Microsoft standard.
Applicable to	▪ Database Connectivity Access Technology
Reference(s)	▪ http://www.openlinksw.com/info/docs/odbcwhp/open.htm ▪ http://msdn.microsoft.com/en-us/library/ms714177(VS.85).aspx
Remarks	▪ Open Database Connectivity (ODBC) is an Application Programming Interface (API) that allows a programmer to abstract a program from a database. When writing code to interact with a database, you usually have to add code that talks to a particular database using a proprietary language. If you want your program to talk to an Access, Fox and Oracle databases you have to code your program with three different database languages. This can be quite the daunting task causing much grief.

3.22. OLE-DB

Description	▪ OLE DB (Object Linking and Embedding, Database, sometimes written as OLEDB or OLE-DB) is an API designed by Microsoft for accessing data from a variety of sources in a uniform manner. It is a set of interfaces implemented using the Component Object Model (COM); it is otherwise unrelated to OLE. ▪ It was designed as a higher-level replacement for, and successor to, ODBC, extending its feature set to support a wider variety of non-relational databases, such as object databases and spreadsheets that do not necessarily implement SQL.
Applicable to	▪ Database Connectivity Access Technology.
Reference(s)	▪ http://msdn.microsoft.com/en-us/library/ms722784(VS.85).aspx ▪ http://publib.boulder.ibm.com/infocenter/idshelp/v10/index.jsp?topic=/com.ibm.oledb.doc/oledb24.htm
Remarks	▪ Business components can excrete data change events, consume OLE DB data, and provide OLE DB data. This way, business components can perform very complex processing, and synchronize with other components, yet expose simple, table-like interfaces. ▪ OLE DB data consumer tools and languages have full access to all ODBC drivers and ODBC-

	based data.

3.23. ADO.NET	
Description	▪ ActiveX Data Objects for .NET (ADO.NET) provides a clean data access model for .NET that is both familiar to the users of ADO and addresses the .NET world with new objects like the ADO.NET Dataset. ▪ ADO.NET has been designed to be the single data access model used by all server processes and applications running on the Microsoft platform.
Applicable to	▪ Database Connectivity Access Technology.
Reference(s)	▪ http://msdn.microsoft.com/en-us/library/ms675532(VS.85).aspx ▪ http://msdn.microsoft.com/en-us/library/h43ks021(VS.71).aspx
Remarks	▪ ADO.NET provides a rich set of components for creating distributed, data-sharing applications. It is an integral part of the .NET Framework, providing access to relational data, XML, and application data. ▪ ADO.NET supports a variety of development needs, including the creation of front-end database clients and middle-tier business objects used by applications, tools, languages, or Internet browsers.

3.24. ɪBATIS	
Description	▪ iBATIS is a persistence framework which automates the mapping between SQL databases and objects in Java and .NET
Applicable to	▪ Database Connectivity and Access Technologies
Reference(s)	▪ iBATIS http://ibatis.apache.org
Remarks	

3.25. SAN

Description	▪ A Storage Area Network (SAN) is a storage model typically characterized by a use of switching and transmission facilities that are separate from the local area network where the server of data to be stored and retrieved resides. The network communications for a SAN may include fibre channel, iSCSI, Ethernet or other technologies. The SAN also includes the storage management, storage device and storage access technologies.
Applicable to	▪ Storage Technologies
Reference(s)	▪ SAN - http://en.wikipedia.org/wiki/Storage_area_network
Remarks	

3.26. RAID

Description	▪ RAID (Redundant Array of Independent Disks) is used as an umbrella term for computer data storage schemes that can divide and replicate data among multiple hard disk drives. The different schemes/architectures are named by the word RAID followed by a number, as in RAID 0, RAID 1, etc. RAID's various designs involve two key design goals: increased data reliability or increased input/output performance.
Applicable to	▪ Storage Technologies
Reference(s)	▪ RAID - http://en.wikipedia.org/wiki/RAID
Remarks	

3.27. FIBER OPTIC CHANNEL

Description	▪ Fiber Channel (FC) is a gigabit-speed network technology primarily used for storage networking. ▪ FICON (Fibre Connectivity) is the IBM proprietary name for the ANSI FC-SB-3 Single-Byte Command Code Sets-3 Mapping Protocol for Fibre Channel (FC) protocol. ▪ Fibre Channel over IP (FCIP) is an Internet Protocol (IP)-based storage networking technology developed by the Internet Engineering Task Force (IETF) and defined in RFC 3821. FCIP mechanisms enable the transmission of Fibre Channel (FC) information by tunneling data between storage area network (SAN) facilities over IP networks.

Applicable to	▪ Storage Technologies
Reference(s)	▪ Fibre Channel http://www.fibrechannel.org ▪ FICON http://www-01.ibm.com/common/ssi/rep_ca/7/897/ENUS109-417 ▪ Fibre Channel over IP http://tools.ietf.org/html/rfc3821
Remarks	

3.28. SCSI / ISCSI

Description	▪ Small Computer System Interface (SCSI), is a set of standards for physically connecting and transferring data between computers and peripheral devices ▪ Internet Small Computer System Interface (iSCSI), an Internet Protocol (IP)-based storage networking standard for linking data storage facilities. By carrying SCSI commands over IP networks, iSCSI is used to facilitate data transfers over intranets and to manage storage over long distances.
Applicable to	▪ Storage Technologies
Reference(s)	▪ Small Computer System Interface http://www.t10.org ▪ Internet Small Computer System Interface http://tools.ietf.org/html/rfc3720
Remarks	

3.29. 10GIGE

Description	▪ The 10 Gigabit Ethernet (10GigE) standard was first published in 2002 as IEEE Std 802.3ae-2002 and is the fastest of the Ethernet standards. It defines a version of Ethernet with a nominal data rate of 10 Gbit/s
Applicable to	▪ Storage Technologies
Reference(s)	▪ 10 Gigabit Ethernet http://standards.ieee.org/getieee802/802.3.html
Remarks	

3.30. PCI EXPRESS

Description	▪ Peripheral Component Interconnect Express (PCI Express) is the latest standard for expansion cards that is available on mainstream personal computers.
Applicable to	▪ Storage Technologies
Reference(s)	▪ PCI Express http://www.pcisig.com/home
Remarks	

3.31. SERIAL ATTACHED SCSI (SAS)

Description	▪ Serial Attached SCSI (SAS) moves data to and from computer storage devices such as hard drives and tape drives. SAS depends on a point-to-point serial protocol that replaces the parallel SCSI bus technology
Applicable to	▪ Storage Technologies
Reference(s)	▪ Serial Attached SCSI http://www.t10.org
Remarks	

3.32. UNIVERSAL SERIAL BUS (USB)

Description	▪ Universal Serial Bus (USB) is a serial bus standard to connect devices to a host computer. USB was designed to allow many peripherals to be connected using a single standardized interface socket and to improve plug and play capabilities by allowing hot swapping.
Applicable to	▪ Storage Technologies
Reference(s)	▪ Universal Serial Bus http://www.usb.org
Remarks	

3.33. SERIAL ATA (SATA)

Description	▪ The serial ATA (SATA) computer bus is a storage-interface for connecting host bus adapters to mass storage devices such as hard disk drives and optical drives. Serial ATA was designed to replace the older ATA (AT Attachment) standard
Applicable to	▪ Storage Technologies
Reference(s)	▪ Serial ATA http://www.sata-io.org
Remarks	

3.34. INFINIBAND

Description	▪ InfiniBand is a switched fabric communications link primarily used in high-performance computing. Its features include quality of service and failover, and it is designed to be scalable.
Applicable to	▪ Storage Technologies
Reference(s)	▪ Infiniband http://www.infinibandta.org
Remarks	

3.35. COMPACT DISCS (CD)

Description	▪ A Compact Disc (CD) is an optical disc used to store digital data.
Applicable to	▪ Storage Technologies
Reference(s)	▪ ISO 9660 standards for CD http://www.ecma-international.org/publications/standards/Ecma-119.htm
Remarks	

3.36. Digital Versatile Disc (DVD)

Description	▪ Standard Definition Digital Versatile Disc (DVD) is an optical disc storage media format. Its main uses are video and data storage. DVDs are of the same dimensions as compact discs (CDs), but store more than six times as much data.
Applicable to	▪ Storage Technologies
Reference(s)	▪ ISO DVD Standards http://standards.iso.org/ittf/PubliclyAvailableStandards/index.html ▪ Universal Disk Format for DVDs http://www.osta.org
Remarks	

3.37. Blu-Ray Discs

Description	▪ Blu-ray Disc is an optical disc storage medium designed to supersede the standard DVD format. Its main uses are for storing high-definition video, PlayStation 3 games, and other data, with up to 25 GB per single layered, and 50 GB per dual layered disc.
Applicable to	▪ Storage Technologies
Reference(s)	▪ Blue-ray Disc http://www.blu-raydisc.com
Remarks	

3.38. Linear Tape Open (LTO)

Description	▪ Linear Tape Open (LTO) is an open standard for a backup tape system, which provides formats for both fast data access and high storage capacity, developed jointly by Hewlett-Packard, IBM, and Seagate
Applicable to	▪ Storage Technologies
Reference(s)	▪ Linear Tape Open http://www.ultrium.com
Remarks	

3.39. DIGITAL LINEAR TAPE (DLT) / SUPER DIGITAL LINEAR TAPE (SDLT)

Description	- Digital Linear Tape (DLT) is a form of magnetic tape and drive system used for computer data storage and archiving. A special compression algorithm, known as Digital Lempel Ziv 1 (DLZ1), facilitates storage and retrieval of data at high speeds and in large quantities - Super Digital Linear Tape (SDLT) is variant of DLT technology, called SuperDLT, makes it possible to store upwards of 100 GB on a single cartridge. The SuperDLT drive can transfer data at speeds of up to 10 megabytes per second
Applicable to	Storage Technologies
Reference(s)	- Digital Linear Tape - http://en.wikipedia.org/wiki/Digital_Linear_Tape - Digital Linear Tape - http://www.ecma-international.org/publications/standards/Stnindex.htm#DataInterchange - Super Digital Linear Tape http://www.ecma-international.org/publications/standards/Ecma-320.htm
Remarks	

3.40. 3590, 9840 AND 10000 TAPE STORAGE

Description	3590 is a series of tape drives and corresponding magnetic tape data storage media formats developed by IBM. 9840 and 10000 are magnetic tape data storage formats, created by Storage Technology Corporation (now acquired by Sun Microsystems), commonly used with large computer systems, typically in conjunction with a robotic tape library.
Applicable to	Storage Technologies
Reference(s)	- IBM 3590 http://www-03.ibm.com/systems/storage/media/3590/index.html - Sun StorageTek 9840 http://www.sun.com/storage/tape_storage/tape_media/9840/datasheet.pdf - Sun StorageTek 10000 http://www.sun.com/storage/tape_storage/tape_media/t10000/datasheet.pdf
Remarks	

3.41. VIRTUAL TAPE STORAGE

Description	Virtual tape is the use of a special storage device that manages less-frequently needed

	data so that it appears to be stored entirely on tape cartridges when some parts of it may actually be located in faster, hard disk storage.
Applicable to	▪ Storage Technologies
Reference(s)	▪ Virtual Tape Library - http://en.wikipedia.org/wiki/Virtual_tape_library
Remarks	

3.42. OGC GEOGRAPHY MARKUP LANGUAGE (GML)

Description	▪ Geography Markup Language is an OGC Standard.The Geography Markup Language (GML) is an XML encoding in compliance with ISO 19118 for the transport and storage of geographic information modelled in accordance with the conceptual modelling framework used in the ISO 19100 series of International Standards and including both the spatial and non-spatial properties of geographic features. The GML 3.3 standard is defined in OGC document 10-129r1.
Applicable to	▪ Geospatial Data Standards
Reference(s)	▪ http://www.opengeospatial.org/standards/gml
Remarks	

3.43. OGC CITY GEOGRAPHY MARKUP LANGUAGE (CITYGML)

Description	▪ Encoding Standard CityGML is an open data model and XML-based format for the storage and exchange of virtual 3D city models. It is an application schema for the Geography Markup Language version 3.1.1 (GML3), the extendible international standard for spatial data exchange issued by the Open Geospatial Consortium (OGC) and the ISO TC211. The aim of the development of CityGML is to reach a common definition of the basic entities, attributes, and relations of a 3D city model. This is especially important with respect to the cost-effective sustainable maintenance of 3D city models, allowing the reuse of the same data in different application fields.
Applicable to	▪ Geospatial Data Standards
Reference(s)	▪ http://www.opengeospatial.org/standards/citygml

Remarks	

3.44. OGC GeoSPARQL

Description	▪ A Geographic Query Language for RDF Data. This standard defines a set of SPARQL extension functions [W3C SPARQL], a set of RIF rules [W3C RIF Core], and a core RDF/OWL vocabulary for geographic information based on the General Feature Model, Simple Features [ISO 19125-1], Feature Geometry and SQL MM.
Applicable to	▪ Geospatial Data Standards
Reference(s)	▪ http://www.opengeospatial.org/standards/geosparql
Remarks	

3.45. OGC KML

Description	▪ KML is an XML language focused on geographic visualization, including annotation of maps and images. Geographic visualization includes not only the presentation of graphical data on the globe, but also the control of the user's navigation in the sense of where to go and where to look.
Applicable to	▪ Geospatial Data Standards
Reference(s)	▪ http://www.opengeospatial.org/standards/kml
Remarks	

3.46. OGC Network Common Data Form (netCDF)

Description	▪ This standard specifies the network Common Data Form (netCDF) core standard and extension mechanisms. The OGC netCDF encoding supports electronic encoding of geospatial data, specifically digital geospatial information representing space and time-varying phenomena. NetCDF is a data model for array-oriented scientific data. A freely distributed collection of access libraries implementing support for that data model, and a machine-independent format are available. Together, the interfaces, libraries, and format support the crea-tion, access, and sharing of multi-dimensional scientific data.
Applicable to	▪ Geospatial Data Standards

Reference(s)	▪ http://www.opengeospatial.org/standards/netcdf
Remarks	

3.47. PUCK

Description	▪ This standard defines a protocol for RS232 and Ethernet connected instruments. PUCK addresses installation and configuration challenges for sensors by defining a standard instrument protocol to store and automatically retrieve metadata and other information from the instrument device itself.
Applicable to	▪ Geospatial Data Standards
Reference(s)	▪ http://www.opengeospatial.org/standards/puck
Remarks	

3.48. GEOSPATIAL EXTENSIBLE ACCESS CONTROL MARKUP LANGUAGE (GEOXACML)

Description	▪ The OpenGIS® Geospatial eXtensible Access Control Markup Language Encoding Standard (GeoXACML) defines a geospatial extension to the OASIS standard "eXtensible Access Control Markup Language (XACML)" [www.oasis-open.org/committees/xacml/]. This extension incorporates spatial data types and spatial authorization decision functions based on the OGC Simple Features[http://www.opengeospatial.org/standards/sfa] and GML[http://www.opengeospatial.org/standards/gml] standards. GeoXACML is a policy language that supports the declaration and enforcement of access rights across jurisdictions and can be used to implement interoperable access control systems for geospatial applications such as Spatial Data Infrastructures. GeoXACML is not designed to be a rights expression language and is therefore not an extension of the OGC GeoDRM Reference Model
Applicable to	▪ Geospatial Data Standards
Reference(s)	▪ http://www.opengeospatial.org/standards/geoxacml
Remarks	

3.49. OGC WEB SERVICE (OWS)

Description	▪ This standard specifies many of the aspects that are, or should be, common to all or multiple OGC Web Service (OWS) interface Implementation Standards. These common aspects are primarily some of the parameters and data structures used in operation requests and responses. Of course, each such Implementation Standard must specify the additional aspects of that interface, including specifying all additional parameters and data structures needed in all operation requests and responses.
Applicable to	▪ Geospatial Data Standards
Reference(s)	▪ http://www.opengeospatial.org/standards/common
Remarks	

3.50. OPENGIS(R) WEB MAP SERVICE INTERFACE STANDARD (WMS)

Description	▪ The OpenGIS(r) Web Map Service Interface Standard (WMS) provides a simple HTTP interface for requesting geo-registered map images from one or more distributed geospatial databases. A WMS request defines the geographic layer(s) and area of interest to be processed. The response to the request is one or more geo-registered map images (returned as JPEG, PNG, etc) that can be displayed in a browser application. The interface also supports the ability to specify whether the returned images should be transparent so that layers from multiple servers can be combined or not.
Applicable to	▪ Geospatial Data Standards
Reference(s)	▪ http://www.opengeospatial.org/standards/wms
Remarks	

3.51. OPENGIS WEB FEATURE SERVICE INTERFACE STANDARD (WFS)

Description	▪ The OpenGIS Web Feature Service Interface Standard (WFS) defines an interface for specifying requests for retrieving geographic features across the Web using platform-independent calls. The WFS standard defines interfaces and operations for data access and manipulation on a set of geographic features.
Applicable to	▪ Geospatial Data Standards

Reference(s)	▪ http://www.opengeospatial.org/standards/wfs
Remarks	

3.52. OGC OPEN GEOSMS

Description	▪ The OpenGIS® Open GeoSMS standard defines an encoding for location enabling a text message to be communicated using a Short Messages System (SMS). The OGC Open GeoSMS Standard provides developers with an extended Short Message Service (SMS) encoding and interface to facilitate communication of location content between different LBS (Location-Based Service) devices or applications. SMS is the open text communication service standard most commonly used in phone, web and mobile communication systems for the exchange of short text messages between fixed line or mobile phone devices. The lightweight and easy to implement Open GeoSMS Standard facilitates interoperability between mobile applications and the rapidly expanding world of geospatial applications and services that implement OGC standard interfaces, encodings and best practices.
Applicable to	▪ Geospatial Data Standards
Reference(s)	▪ http://www.opengeospatial.org/standards/opengeosms
Remarks	

4. DETAILS OF TOOLS SUPPORTING RECOMMENDED STANDARDS

This section provides a brief description of the relevant tools listed in section 2 along with links for references to these tools.

4.1. ORACLE TOPLINK

Description	▪ Oracle TopLink delivers a proven standards based enterprise Java solution for all of your relational and XML persistence needs based on high performance and scalability, developer productivity, and flexibility in architecture and design. ▪ TopLink Essentials [1] is the reference implementation of the EJB 3.0 Java Persistence API (JPA) and the open-source community edition of Oracle's TopLink product. TopLink Essentials is a limited version of the proprietary product. For example, TopLink Essentials doesn't provide cache synchronization between clustered applications, some cache invalidation policy, and query Cache.
Applicable to	▪ Database Connectivity and Access Technologies
Reference(s)	▪ Oracle Toplink - http://www.oracle.com/technetwork/middleware/toplink/overview/index.html
Remarks	

4.2. HIBERNATE

Description	▪ Hibernate is an object-relational mapping (ORM) library for the Java language, providing a framework for mapping an object-oriented domain model to a traditional relational database
Applicable to	▪ Database Connectivity and Access Technologies
Reference(s)	▪ Hibernate https://www.hibernate.org
Remarks	

4.3. ORACLE DB

Description	▪ The Oracle Database (commonly referred to as Oracle RDBMS or simply Oracle) consists of a relational database management system (RDBMS) produced and marketed by Oracle Corporation. As of 2009, Oracle remains a major presence in database computing. Oracle only supports version 10g and higher. Premium support for Oracle 9i Release 2 has ended. Extended support for Oracle 9i Release 2 ends in July 2010.
Applicable to	▪ Database Management Systems
Reference(s)	▪ Oracle http://www.oracle.com/database/index.html
Remarks	

4.4. IBM DB2 DB

Description	▪ DB2 is one of IBM's families of relational database management system (RDBMS) software products within IBM's broader Information Management Software line. IBM DB2 Version 8.X support ended in April 2009.
Applicable to	▪ Database Management Systems
Reference(s)	▪ IBM DB2 http://www.ibm.com/db2
Remarks	

4.5. MICROSOFT SQL SERVER DB

Description	▪ Microsoft SQL Server is a relational model database server produced by Microsoft. Its primary query languages are T-SQL and ANSI SQL. Support for Microsoft SQL Server 2000 with Service Pack 3a ended in July 2007. However SQL Server 2000 with Service Pack 4 is still supported under extended support.
Applicable to	▪ Database Management Systems
Reference(s)	

	▪ Microsoft SQL Server http://www.microsoft.com/sql/default.mspx
Remarks	

4.6. MYSQL DB

Description	▪ MySQL is a relational database management system (RDBMS). MySQL stands for "My Structured Query Language". The program runs as a server providing multi-user access to a number of databases. MySQL is an open source DBMS and will be considered as Strategic for NEAF only when it has vendor or equivalent level quality support. MySQL is not considered as Strategic for critical applications.
Applicable to	▪ Database Management Systems
Reference(s)	▪ MySQL http://www.mysql.com
Remarks	

4.7. ORACLE DATA WAREHOUSE

Description	▪ Oracle remains a leader in data warehousing. Oracle now has four distinct data warehouse solutions: Oracle Database 11g (the DBMS stand-alone); Oracle Reference Configurations (certified server and storage configurations); Oracle Optimized Warehouse (off-the-shelf appliances from its hardware partners); and HP Oracle Database Machine (a data warehouse appliance with storage optimized for data warehouses [HP Oracle Exadata Storage Server] based on the Oracle Database 11g RAC, ASM and HP hardware, sold and serviced by Oracle).
Applicable to	▪ Data Warehouse Database Management Systems
Reference(s)	▪ Oracle http://www.oracle.com/solutions/business_intelligence/dw_home.html ; ▪ http://www.oracle.com/us/products/database/datawarehousing/overview/index.html?or igref=http://www.oracle.com/us/solutions/business-analytics/business-intelligence/index.html ; ▪ http://www.oracle.com/us/solutions/ent-performance-bi/performance-management/index.html

Remarks	

4.8. IBM DATA WAREHOUSE

Description	▪ IBM remains a leader in data warehousing DBMSs. IBM's InfoSphere Warehouse (a data warehouse offering based on IBM DB2) is a software-only solution. Its data warehouse appliance solution, the IBM InfoSphere Balanced Warehouse, is a combined server and storage hardware solution complete with service and support.
Applicable to	▪ Data Warehouse Database Management Systems
Reference(s)	▪ ▪ IBM http://www-01.ibm.com/software/data/infosphere/warehouse/, http://www-01.ibm.com/software/data/infosphere/balanced-warehouse/
Remarks	

4.9. MICROSOFT DATA WAREHOUSE

Description	▪ Microsoft continues to offer value for the price paid, giving high value with a low total cost of ownership. The purchase of SQL Server 2008 Enterprise Edition includes SQL Server Analysis Services (SSAS), SQL Server Reporting Services (SSRS) and SQL Server Integration Services (SSIS).
Applicable to	▪ Data Warehouse Database Management Systems
Reference(s)	▪ Microsoft SQL Server 2008 www.microsoft.com/sql/default.mspx ; http://pinpoint.microsoft.com/en-gb/applications/clearview-intelligence-builder-data-warehouse-generation-tool-4294985417
Remarks	

4.10. TERADATA DATA WAREHOUSE

Description	▪ Teradata offers several data warehouse appliances combining hardware, operating system and DBMS. Its offerings include entry-level-priced solutions, data marts and data

	warehouses.
Applicable to	▪ Data Warehouse Database Management Systems
Reference(s)	▪ Teradata http://www.teradata.com
Remarks	

4.11. QUEST TOAD SOFTWARE

Description	▪ The Toad® DBA Suite for Oracle is a complete set of Oracle DBA tools that enable you to become more proactive by automating maintenance, ensuring optimal performance, and mitigating the risk of change. TOAD DBS Suite is also available for other DB such as IBM DB2 and MS SQL Server ▪ Toad® Data Modeler helps you create high-quality data models and easily deploy accurate changes to data structures. This is a cross-platform database modeling software. ▪ Toad® for Data Analysts is a cross-platform query and data integration tool that simplifies data access, analysis, and provisioning for data management professionals. This data analysis tool provides nearly limitless data connectivity, desktop data integration, visual query building, and workflow automation. ▪ Toad® Extension for Eclipse gives you the power to perform essential Oracle database development tasks directly within the Eclipse IDE. This free Eclipse plug-in makes it seamless to work with Oracle databases and eliminates the need for multiple tools. Toad Extension for Eclipse helps you deliver better quality applications and expands your skill set by helping you learn Oracle PL/SQL. ▪ Toad® for Oracle is unrivaled for ensuring the greatest possible productivity in development and administration of Oracle databases. Only Toad combines the deepest functionality available with extensive automation and intuitive workflows.
Applicable to	▪ Modelling, Design and Development
Reference(s)	▪ Toad http://www.quest.com/products/#BySolutionDatabaseManagement ▪ Toad DBA Suite - http://www.quest.com/toad-dba-suite-for-oracle/ ▪ Toad® Data Modeler - http://www.quest.com/toad-data-modeler/ ▪ Toad® for Data Analysts - http://www.quest.com/toad-for-data-analysts/ ▪ Toad extension for Eclipse - http://www.quest.com/toad-extension-for-eclipse/ ▪ Toad for Oracle - http://www.quest.com/toad-for-oracle/
Remarks	

4.12. MICROSOFT VISIO

Description	

	- Microsoft Visio, marketed as Microsoft Office Visio, is a diagramming program for Microsoft Windows that uses vector graphics to create diagrams.
Applicable to	- Modelling, Design and Development
Reference(s)	- Microsoft Visio http://office.microsoft.com/en-gb/visio/default.aspx
Remarks	

4.13. CA ERwin

Description	- CA ERwin Data Modeler (ERwin) is a software tool for data modeling (data requirements analysis, database design etc) of custom developed information systems, including databases of transactional systems and data marts.
Applicable to	- Modelling, Design and Development
Reference(s)	- CA ERwin Data Modeler http://www.ca.com/us/data-modeling.aspx
Remarks	

4.14. Oracle Developer Suite

Description	- Oracle Developer Suite is a suite of development tools released by the Oracle Corporation. The principal components were initially Oracle Forms and Oracle Reports, although the suite was later expanded to include JDeveloper amongst others.
Applicable to	- Modelling, Design and Development
Reference(s)	- Oracle Developer Suite http://www.oracle.com/technology/products/ids/index.html - IBM InfoSpehere Data Architect http://www-01.ibm.com/software/data/studio/data-architect -
Remarks	

4.15. IBM Infosphere Data Architect

Description	- IBM InfoSphere Data Architect is a collaborative data design solution that can be used to

	discover, model, relate, and standardize diverse and distributed data assets.
Applicable to	▪ Modelling, Design and Development
Reference(s)	▪ IBM InfoSpehere Data Architect http://www-01.ibm.com/software/data/studio/data-architect
Remarks	

5. APPENDICES

5.1. APPENDIX A: ABBREVIATIONS AND ACRONYMS

Abbreviation / Acronym	Definition
3DES	Triple Data Encryption Standard
AES	Advanced Encryption Standard
ASCII	American Standard Code for Information Interchange
CAD	Computer-Aided-Drafting
DES	Data Encryption Standard
DNS	Domain name services
DSA	Digital Signature Algorithm
DTD	Document Type Definition
EPC	Electronic Product Code
EPSF	Encapsulated PostScript File
ETO	Electronic Transactions Ordinance
FTP	File Transfer Protocol
HTML	Hypertext Markup Language
HTTP	Hypertext transfer protocols
ICMP	Internet Control Message Protocol
IE	Internet Explorer (Microsoft)
IEEE	Institute of Electrical and Electronics Engineers
JPEG	Joint Photographic Experts Group
MIME	Multipurpose Internet Mail Extensions
MPEG	Moving Picture Experts Group
PDF	Portable Document Format
PEM	Privacy Enhanced Mail
PGP	Pretty Good Privacy
PKCS	Public Key Cryptography Standards
PKI	Public Key Infrastructure
POP	Post Office Protocol
RSA	Rivest-Shamir-Adleman
RTF	Rich Text Format
S/MIME	Secure Multipurpose Internet Mail Extensions
SGML	Standard Generalized Markup Language
SHA	Secure Hash Algorithm
SMTP	Simple Mail Transport Protocol
SOAP	Simple Object Access Protocol
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
TIFF	Tag Image File Format
TLS	Transport Layer Security
UCS	Universal Multiple-Octet Coded Character Set
UDDI	Universal Description, Discovery and Integration
UDP	User Datagram Protocol
UML	Unified Modeling Language
UTF	UCS Transformation Format
VPN	Virtual Private Network

WMP	Windows Media Player
WSDL	Web Services Description Language
WWW	World Wide Web
XHTML	Extensible Hypertext Markup Language
XML	Extensible Markup Language
RAID	Redundant Array of Independent Disks
SAN	Storage Area Network
SCSI	Small Computer System Interface
iSCSI	Internet Small Computer System Interface
PCI	Peripheral Component Interconnect
SAS	Serial attached SCSI
USB	Universal Serial Bus
SATA	Serial AT Attachment
CD	Compact Disc
LTO	Linear Tape-Open
DLT	Digital Linear Tape
SDLT	Super Digital Linear Tape
OGC	Open Geospatial Consortium
SMS	Short Message System
LBS	Location Based Service
GML	Geography Markup Language
OWS	OGC Web Service
KML	Keyhole Markup Language
netCDF	network Common Data Form
RIF	Rule Interchange Format
RDF/OWL	Resource Description Framework/Web Ontology Language
SPARQL	SPARQL Protocol and RDF Query Language
CityGML	City Geography Markup Language
WMS	Web Map Service
WFS	Web Feature Service
GeoXACML	Geospatial eXtensible Access Control Markup Language

5.2. APPENDIX B: RELATED DOCUMENTS / LINKS

Acknowledgement of major references for international technology standards and Specifications:

- Internet Engineering Task Force (IETF)
  http://www.ietf.org

- International Standards Organization (ISO)
  http://www.iso.org

- World Wide Web Consortium (W3C)
  http://www.w3c.org

Acknowledgement of other references for international technology standards and specifications:

- American National Standards Institute (ANSI)
  http://www.ansi.org

- ECMA International
  http://www.ecma-international.org

- Institute of Electrical and Electronics Engineers (IEEE)
  http://www.ieee.org

- National Institute of Standards and Technology (NIST)
  http://www.nist.gov

- Object Management Group (OMG)
  http://www.omg.org

- Open Mobile Alliance (OMA) and WAP Forum
  http://www.openmobilealliance.org
  http://www.wapforum.org

- Organization for the Advancement of Structured Information Standards (OASIS)
  http://www.oasis-open.org

- Unicode, Inc.
  http://www.unicode.org