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Open by Design: The OpenDocument Format Standard for Office Applications

Erwin Tenhumberg, Donald Harbison, and Rob Weir

This article describes the history of the Open Document Format (ODF) which is now published as the ISO standard ISO/IEC 26300. It covers subjects like the value of openness in file formats, its short and long-term benefits, interoperability and innovation. It is a collaborative essay written by some outstanding members of the OASIS OpenDocument Format Adoption Committee whose purpose is "to create awareness and demand for a new class of applications and solutions designed specifically to support and promote the OpenDocument Format".

Keywords: Document Format, ECMA, OASIS, ODF, Office Applications, Office Open XML, OpenDocument, Open Standard, XML File Format.

1 Why an Open File Format Matters

In a world where paper documents are increasingly being replaced by electronic records, ensuring that long term access and usability of these records is critical. This is especially the case for legal contracts and government documents, which stay valid and relevant over decades, or even centuries. But it is no less the case for personal documents.

Just as paper and pens have been available from multiple vendors and not just one single source, document file formats and the applications creating these file formats need to be supported by and available from multiple vendors. This guarantees long-term access to data even if companies cease to operate, change their strategies, or dramatically raise their prices. In effect, with choice, the user retains control

Authors

Erwin Tenhumberg is a member of the Open Source Group at Sun Microsystems which is led by Sun's Chief Open Source Officer Simon Phipps. Among his roles and responsibilities are community development and marketing for OpenOffice.org. In addition, Erwin focuses on open source business models and open source in the public sector. Besides his role in the Open Source Group, he also co-chairs the OASIS OpenDocument Format (ODF) Adoption TC (Technical Committee). As part of his work, Erwin is involved in various ODF efforts such as at the Commonwealth of Massachusetts in the US or within the European Union. In addition, he collaborates with the OASIS OpenDocument Format TC, the ODF Alliance and the OpenOffice.org open source community. <erwin.tenhumberg@sun.com>.

Donald Harbison co-chairs the OASIS ODF Adoption Technical Committee with Erwin Tenhumberg. Donald has been with IBM for 10 years and has worked in the software industry for over 25 years. He has extensive industry experience in software business development in technical publishing, document and content management, collaboration services including enterprise messaging, and object oriented application communications services. In addition to these roles, Donald was a member of the core strategy team that developed and led the development and execution of IBM's Linux middleware strategy beginning in 1998 through 2004. He is currently Program Director, Emerging Standards, in the IBM Software Group. <donald_harbison@us.ibm.com>.

Rob Weir is a 16-year veteran of IBM and Lotus Development Corporation. He has extensive experience working with office file formats, from the old binary formats in Lotus SmartSuite and Microsoft Office, to the new generation of XML formats undergoing standardization. He is a member of the OASIS ODF TC, Metadata and Formula Subcommittees, and ODF Adoption TC. He is also a U.S. delegate to ISO/IEC JTC1 SC34. <robert_weir@us.ibm.com>.

OASIS (Organization for the Advancement of Structured Information Standards) is a not-for-profit, international consortium that drives the development, convergence, and adoption of e-business standards. Members themselves set the OASIS technical agenda, using a lightweight, open process expressly designed to promote industry consensus and unite disparate efforts. The consortium produces open standards for Web services, security, e-business, and standardization efforts in the public sector and for application-specific markets. OASIS was founded in 1993. More information can be found on the OASIS website at <http://www.oasis-open.org>.

The purpose of the **OASIS OpenDocument Format Adoption Committee** is to create awareness and demand for a new class of applications and solutions designed specifically to support and promote OpenDocument XML (commonly referred to as the OpenDocument Format or ODF). The Adoption Committee dedicates its energy and resources to creating wide-scale understanding of the benefits of OpenDocument Format support within organizations and governmental bodies through education and promotion. The Adoption Committee aligns and supports the activities of the OASIS OpenDocument Technical Committee by providing market-based requirements. These requirements help guide future development of the OpenDocument specification by the OASIS OpenDocument Technical Committee.

over and ownership of the documents she authors; she is no longer dependent on a single vendor to read and edit her work.

Open standards that are equally accessible and do not favor one particular vendor can help maintain a diverse ecosystem of vendors. This also fosters competitive pricing, thus creating the conditions for the best use of money from investors to tax payers.

In the case of public documents that governments provide to their nation's citizens, it is also important that no resident be excluded from data access. Public data should be accessible to citizens independent of their income and their physical abilities.

Accessibility in this case, has an entirely different meaning for Persons with Disabilities (PwD). An open standard dealing with document data must also be designed to enable the addition of a range of assistive technologies such that a person with no vision, or low vision, paralysis and even severe motor skill limitations have sufficient access to the software and document data to be able to author and read effectively. The recent ODF v1.1 Committee Specification 1 addresses these requirements.

In the tradition of open standards development, the OASIS ODF Technical Committee established a Sub-Committee of technical experts skilled in the field of accessible technology. The Accessibility SC set an ambitious goal to meet and exceed the accessibility support currently available in the industry's dominant file format, as well as what is specified in the W3C Web Content Accessibility Guidelines 1.0.

The Accessibility SC also recognized the need to provide application developers with implementation guidelines to ensure that their ODF supporting solutions fully meet the needs of people with disabilities by including the full range of requirements. The result is the "Accessibility Guidelines for Implementations of OpenDocument Format v1.1." [1].

Open standards lower the barrier to entry, allowing new companies to join the ecosystem. For example, the SQL standard for relational databases allowed the emergence of various implementations, including free and open source and very specialized high-end database management systems. As long as only standard SQL features are used, data stored in database management systems can be exchanged without much effort. A user may choose a SQL implementation that includes unique, vendor-specific elements in addition to the basic, but that is her choice. Thus, vendor lock-in becomes a choice, not an unfortunate necessity.

2 Approved by OASIS and ISO: An Overview of ODF

The OpenDocument Format (ODF) is an open, XML-based document file format for office applications that create and edit documents containing text, spreadsheets, charts, and graphical elements. The file format makes transformations to other formats simple by using and reusing existing standards wherever possible.

ODF is defined via an open and transparent process at OASIS (Organization for the Advancement of Structured Information Standards) and has been approved unanimously by the Joint Technical Committee 1 (JTC1) of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) as an International Standard (IS) in May 2006. In November 2006 ISO/IEC announced the publication and availability of ISO/IEC 26300:2006. It is available for implementation and use free of any licensing, royalty payments or other restrictions.

By providing an alternative to proprietary technologies, OpenDocument allows end users to embrace an open-standards approach to managing vital documents. It helps assure that end users, such as governments and their citizens, are able to access and share information now and for generations to come without having to continue to pay unnecessary licensing fees to view or edit information stored in proprietary formats. Organizations or individuals can deploy any word processing application, thereby giving them greater control of their documents by decoupling file formats from the applications used to create them, especially proprietary formats with accompanying limitations and restrictions.

OpenDocument promotes long-term information retrieval by entrusting the format to an independent standards body that operates as a community. This is in contrast to a history of single vendor control, wherein backward file format compatibility has not been guaranteed. Adoption of OpenDocument avoids reliance on the life span of a piece of software to maintain access to vital information. Unfortunately, experience has shown the life span of a software application to be only a small fraction of the life span of critical documents, such as birth or financial records.

In technical terms, the OpenDocument Format specification defines an XML schema for office applications and their semantics. The schema is designed to be suitable for a range of office documents including text documents, presentation documents including charts, drawings, animations, spreadsheet documents for financial calculations and access to external datasets.

The schema provides for high level information enabling interactive editing of the document data. It defines supporting XML structures for the full range of office documents and is easily transformed using XSLT or similar XML-based tools.

The ODF specification itself describes the structure of documents, the meta data information possible to store in such documents, text and paragraph content, text fields, text indices, table content, graphical content, chart content, form content, content common to all document types, integration of SMIL (Synchronized Multimedia Integration Language) animation markup content, style information, formatting properties used within styles, and data types used by the OpenDocument schema. It is complete, mature, simple and elegant, and designed to be implemented and supported by multiple vendors serving a range of customer requirements.

From a packaging perspective, ODF is a ZIP archive

Date / Time Frame	Event / Milestone
1999	The Development of an XML default file format begins at StarDivision. Limitations of the old binary format and a need for Unicode support trigger the change. The goal is to create an open, interoperable file format that can be used and implemented by other vendors as well.
August 1999	Sun Microsystems, Inc. acquires StarDivision.
13 October 2000	Sun Microsystems, Inc., releases the source code to StarOffice under open licenses to the recently founded (July 2000) OpenOffice.org project.
13 October 2000	The XML community project is set up in OpenOffice.org with the goal of defining the specification of the OpenOffice.org XML file format as an open community effort.
2002	Definitions for CJK (Chinese, Japanese, Korean) and complex text layout languages are added to the OpenOffice.org XML file format specification.
2002	Collaboration with the KOffice project begins.
16 December 2002	The OASIS Open Office Technical Committee (TC) has its first conference call.
May 2002	OpenOffice.org 1.0 and StarOffice 6 are released, both using the OpenOffice.org XML file format as the default file format.
August 2003	KOffice decides to use ODF as its default file format.
2003 / 2004	The original OpenOffice.org XML file format specification is modified to reflect recent developments in the XML and office application area, e.g.: * Introduction of XML namespaces that conform to the OASIS naming rules * Switching from XML DTDs to Relax-NG as the schema language * Improvements of the schema to better support the validation of documents * Adaptation of the schema to new versions of standards * Adaptations for additional office applications (KOffice) * Adaptations for new office application versions (OpenOffice.org 2.0) * Removal of inconsistencies in the specification * Error corrections
December 2004	A second committee draft is approved, and the title of this draft is changed from “OASIS Open Office Specification” to “OASIS Open Document Format for Office Applications (OpenDocument)”
January 2005	The TC is renamed to OASIS Open Document Format for Office Applications (OpenDocument) TC.

March 2006	The ODF Alliance is founded with 35 initial members in order to promote ODF in the public sector.
March 2006	The OASIS ODF Adoption TC is founded with the aim of educating the marketplace of the value of ODF.
April 2006	KOffice 1.5, which uses ODF as the default file format, is released.
May 2006	ISO approves ODF as ISO/IEC 26300.
June 2006	The ODF Alliance already has more than 200 members including companies, organizations, and municipalities such as BBC, Corel, EDS, EMC, IBM, Novell, Red Hat, Oracle, Software AG, Sun Microsystems, and the City of Vienna.
September 2006	ODF 1.0 Second Edition completed bringing in editorial changes identified in the ISO review process.
October 2006	ODF 1.1 approved as Committee Specification; to be submitted for an OASIS Standard vote in January 2007 Continuing development of formula, accessibility and metadata deliverables planned for publication in 2007 as ODF 1.2. ODF Alliance membership surges past 300 members from over 40 countries .

Table 1: The History of ODF

that contains a collection of XML files that describe the document's content and presentation. Binary files are only used for such things as embedded images. The use of XML makes accessing the document content simple, because content can be opened and changed with simple text editors, if necessary. In contrast, the previously used proprietary binary-only file formats were cryptic and difficult to process.

The ZIP compression guarantees relatively small file sizes, which reduce file storage and transmission bandwidth requirements; this makes it easier to exchange files, regardless of bandwidth. (ODF was the first broadly used document file format that used a ZIP package containing different XML files.) ODF uses the same set of XML files for different application types. In addition, definitions for elements like tables are consistent across application types.

3 A Long Tradition of Openness: The History of ODF

The OpenDocument Format has a long tradition of openness. The first work on the file format started as early as 1999. Right from the beginning, ODF was designed as an open and implementation neutral file format.

The open specification process started in 2000 with the foundation of the OpenOffice.org open-source project and the community efforts within its XML development project. An even higher level of openness was established in 2002 with the creation of the OASIS Open Office Technical Committee (TC).

During the last seven years, an increasing number of organizations and companies have joined the ODF specification process. In addition, a growing number of applications implement the OpenDocument file format. Table 1 provides an overview of the history of the OpenDocument Format.

4 Open by Design: The Benefits of ODF

The OpenDocument Format was designed to be vendor neutral and implementation agnostic. It was designed to be used by as many applications as possible. In order to simplify transformations and to maximize interoperability, the format reuses established standards such as XHTML, SVG, XSL, SMIL, XLink, XForms, MathML, and Dublin Core. ODF files of different application types (e.g., the word processor, spreadsheet) include the same set of XML files within the ZIP packages.

Figure 1 shows a simple ODF text document and the contents of the corresponding ZIP package. Figure 2 shows a simple ODF spreadsheet document and its ZIP archive contents. Both the text document and the spreadsheet document have the same structure, e.g., both contain a content.xml, a styles.xml, and a meta.xml file.

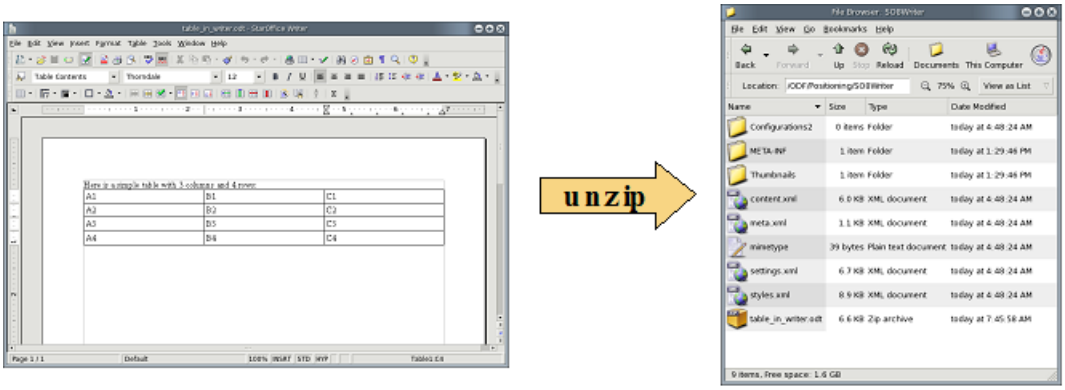

Figure 1: An ODF Text Document unzipped.

Figures 3 and 4 illustrate that tables within text documents are defined by the same XML elements as tables within spreadsheet documents. Using the same set of XML files within ODF documents as well as defining similar document elements across application types with the same XML elements makes transforming and processing ODF documents simple.

Figure 3 shows the content.xml file with a table definition of a text document.

Figure 4 shows the table definition of a spreadsheet document. The same XML elements are used to define tables in spreadsheet documents as in text documents.

Table 2 highlights the key features and benefits of the OpenDocument Format.

5 Innovation Opportunities with OpenDocument

5.1 Integration through Programming

Today, programming with document data is too complex and platform dependent. Microsoft® Office software requires developers to use Microsoft Visual Basic for Applications, or Visual Studio Tools for Microsoft Office (now in it's 2nd edition), both of which only support proprietary Microsoft Windows® and Microsoft Office software. Alternatively, developers working with StarOffice or OpenOffice must rely on the Universal Network Objects (UNO) application programming interface, that is only available within those office application suite applications; e.g. Writer, Calc, Impress, but supported on multiple operating systems supporting multiple programming languages such as C++, Python, etc. However, none of these technologies interoperates well with independently developed third-party technologies, in the open standards sense of the Internet; e.g. HTML, CSS, DOM and JavaScript.

The Document Object Model (DOM) used by all modern Web browser applications is a powerful way to functionally (not just visually) integrate various kinds of documents. It is also widely used in the context of Web applications on the server side in languages such as Java™. Thus, it is one of the few interfaces known and understood by browser script-based programmers as well as by traditional programmers who use procedural languages such as Java.

A new, simplified DOM-based programming model for ODF is emerging. It uses the ODF XML format but, more importantly, it uses a DOM as the document's run-time model. This means that it's now possible to dynamically control an ODF document using a variety of scripting and other languages. It is also possible to programmatically integrate run-time behavior of an ODF document with other DOM-based open-standard documents such as XForms and Scalable Vector Graphics (SVG). And all browser-based technologies such as Cascading Style Sheets (CSS) can be used for personalization or accessibility. Moreover, with a truly open format that has open access to document elements at all levels, accessibility itself becomes open and

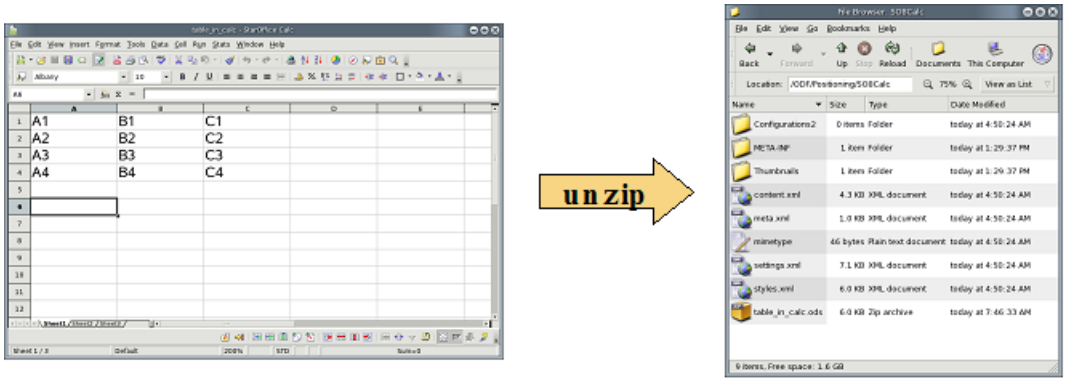

Figure 2: An ODF Spreadsheet Document unzipped.

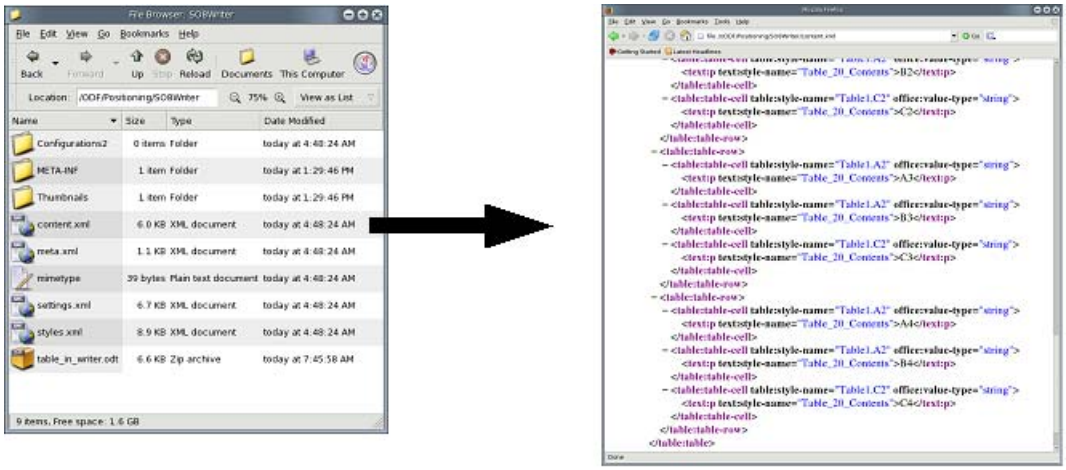

Figure 3: Content.xml File of a Text Document viewed in the Mozilla Firefox Browser.

programmable — no longer constrained by a static realization of predetermined policies. This will truly enable ODF documents to participate in and contribute to a wide ecosystem of documents and deliver an enriched user experience obtained via easy, open composition of standard elements.

5.2 Document-centric Collaboration

There is an emerging trend toward online rich document-based collaboration. Google Docs and Spreadsheets, Zoho Writer, ajaxWrite and social networking and content management startups Zimbra, Socialtext, and Alfresco are moving in this direction. In the past, commercial document processing systems (e.g., Microsoft Office, IBM Lotus SmartSuite® software) supported some forms of collaboration. Today, wikis and blogs are beginning to represent new approaches to collaboration on the so-called "Web 2.0" platform. However, wikis and blogs do not have a structured information model below them. Without this foundation, it is difficult to support content-based access control, history, versions, views and live collaboration.

Coupled with the integration technology above, ODF's XML-based document model can unlock new paradigms in document-based collaboration on the Web. This easily allows multiple authors to interact in real time with the document and its information, allowing role-based access control, views, versions and history. Combine this concept with specific business templates for documents, spreadsheets and presentations, and the document lifecycle model evolves to one where interaction and collaboration over content or information (data) in the context of a business document are radically different.

For example, authoring teams can easily come together and edit their documents in real time over the network using their preferred ODF editor(s) in any combination. Or teams can simply edit within the Web browser. To facilitate this editing, the ODF document is treated as a shared data model and is "rendered" into different forms: one used by the native ODF editor and the other into HTML for the rich text editor.

Modifications to the content flow both ways and users can productively collaborate on the content freed from the

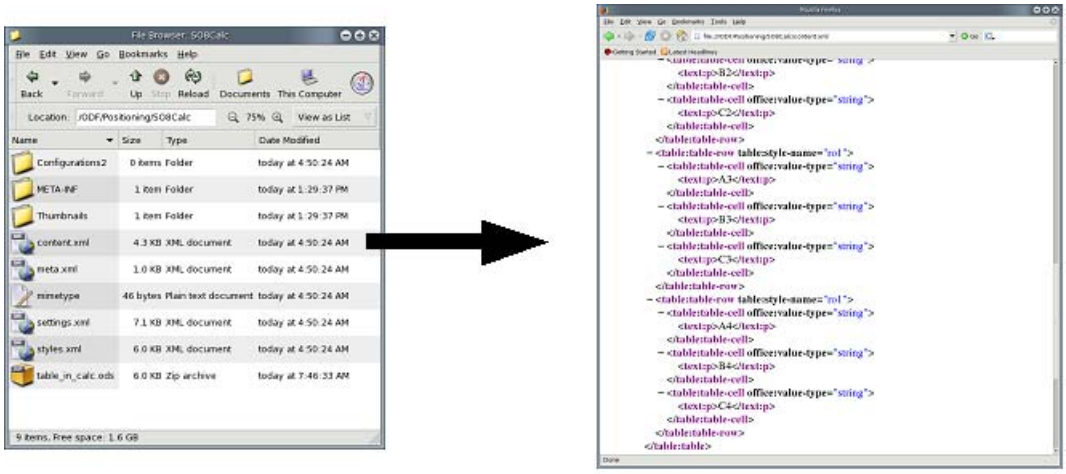

Figure 4: Content.xml File of a Spreadsheet Document viewed in the Mozilla Firefox Browser.

Feature	Benefit
OASIS standard	Open, transparent specification process with multi-vendor participation
Approved by ISO as ISO/IEC 26300	Well known and broadly accepted standard
ISO standard Relax-NG schema types (ISO/IEC 19757-2:2003)	Well known and broadly accepted standard
Supported by multiple applications	Choice between free, open-source and commercial implementations including OpenOffice.org, StarOffice, KOffice, IBM Workplace, Textmaker, Abiword/Gnumeric, Google Docs & Spreadsheet, and AjaxWrite.
Broad industry support	ODF guarantees long-term viability. The OASIS ODF TC, the OASIS ODF Adoption TC, and the ODF Alliance include members from Adobe, BBC, Bristol City Council, Bull, Corel, EDS, EMC, GNOME, IBM, Intel, KDE, MySQL AB, Novell, Oracle, Red Hat, Software AG, Sun Microsystems, and the City of Vienna. As of December 2006, the ODF Alliance already has more than 350 members.
Shipping products since September 2005	ODF files can already be created and used today. The first products with ODF support started shipping in September 2005.
Free open source “reference” implementations	ODF is supported by multiple free, open-source office applications including OpenOffice.org, KOffice and Abiword/Gnumeric. OpenOffice.org, for example, is developed by a large community including vendors like Sun Microsystems, Novell, Intel, and Red Hat. Because the source code is available, anyone can add support for additional platforms.
ODF implementations available for all major desktop platforms	Applications with ODF support are available for Microsoft Windows, Linux, the Solaris OS, Apple Mac OS X, and FreeBSD.
Open standard W3C XForms technology is used for forms	The forms concept integrated into ODF is based on the W3C XForms standard which is supported by multiple applications and vendors.
Reuse of existing standards where possible	In order to make interoperability as simple as possible, ODF reuses established standards such as XHTML, SVG, XSL, SMIL, XLink, XForms, MathML, and Dublin Core.
Well established	The first work for the ODF file format started as early as 1999 (see the ODF history in Table 1).

Table 2: Benefits of ODF.

document format. This is possible because open standards are developed and specified with the help and contributions of multiple stakeholders in an open community. The open-standards process plays an important role. As standards are defined and evolve, developers increasingly recognize the opportunity for new marketplaces for these tools and run times. With this revolution in the open-document standards domain, industry leaders will pave the way for content-based collaboration across different types of users, editors and devices. This is the same phenomenon that accelerated the development of the Internet and its subsequent adoption in commerce and daily life.

5.3 Implications for Enterprise Document and Content Management Systems

Today's enterprise document and content management solutions manage large repositories of all types of information documents, images and multimedia. Banking and insurance companies depend on these systems for mission-critical business processes such as claims processing and credit approval. Business information does not always appear in machine-readable structured forms; often, it exists as semistructured templates, such as claim documents and loan documents. Document information must be indexed to be efficiently searched. Indexing technology typically depends on the degree of metadata associated with the document, since search engines are challenged to crawl and retrieve meaningful information when the internals of a document or image are stored in opaque, binary data form.

With the advent and anticipated wide-scale adoption of ODF, and the view of the future where document data will be stored in XML format , these systems will be much more effective in terms of their ability to programmatically index, query, search, retrieve and assemble through transformation operations into new compound documents. These new techniques and methods open up new horizons for developing business solutions distinctly set apart from yesterday's office application suite model.

More significantly, they create the opportunity for the development of new software that will programmatically converge many different data sources into a new document, further automating business processes and creating new efficiencies.

An open-standards format is critical because it enables the creation of relational or XQuery-type operators on a document; it also guarantees the document's semantics. For example, in an insurance scenario you could select all claim documents where the claim was about US$20,000 — or, join a set of auto claims and home claims documents to create a document with claim amount, claim type and customer name; then assemble the new compound document on the fly.

In fact, document management systems can provide mini-search/relationship mining engines and can suggest new links between projects or assets within the organization, and contribute to the overall efficiency of the enterprise.

6 The Future of the OpenDocument Standard

It's important to note that ODF is currently in its first-version form. As a *de jure* open standard, ongoing stewardship and development of the ODF specification continues at OASIS with many vendors and individuals from diverse organizations participating and providing leadership. Significant new work in three subcommittees concluded before the end of 2006 and moved through the open standards ballot and submission processes resulting in an update to the ISO/IEC 26300:2006 in the second half of 2007.

Accessibility, formula and metadata extensions will update the ODF specification and continue to support ongoing creative innovation. Therefore, we are just seeing the first entry of the specification with much more to look forward to in the near future. An open standard, with multivendor stewardship in a *bona fide* open standards consortia ensures the technology will evolve and continue to provide value for years to come.

6.1 Twenty Things you Can Do with the OpenDocument Format

Robert Weir, a member of the OASIS ODF Technical Committee enumerated a variety of usage patterns for ODF, demonstrating that it has wide applicability beyond the traditional heavy-weight office-like editors. We include it here to stimulate your imagination and continued curiosity.

1. Interactive creation in a heavy-weight client application. This is the traditional mode of operation in KOffice, OpenOffice.org, etc.
2. Interactive creation in a light-weight web-based application. We are starting to see this in Google Docs Spreadsheets.
3. Collaborative (multi-author) editing. This includes the traditional "comment and merge" style of collaboration as well as real-time, multi-user editing where multiple authors edit the same document at the same time.
4. Automatic creation of document in response to a database query. This is the report generation model of use. Data source could be a web service rather than a database.
5. Indexing/scanning of document for search engine.
6. Scanning by anti-virus software.
7. Other types of scanning, perhaps for regulatory compliance, legal or forensic purposes.
8. Validation of document, to specifications, house style guidelines, accessibility best practices, etc. This goes beyond RELAX NG validation, beyond Schematron, into content validation that is beyond XML structure.
9. Read-only display of document on machine without the full editor, for example a lightweight viewer as a browser plugin or extension.
10. Conversion of document from one editable format to another, i.e., convert ODF to OOXML.
11. Conversion of document into a presentation format, such as PDF, PS, print or fax.
12. Rendering of a document via other modes such as sound or video (speech synthesis).
13. Reduction/simplification of document to render on a sub-desktop device such as cell phone or PDA.

14. Import of ODF into a non-office application, i.e., import of spreadsheet data into statistical analysis software.
15. Export from a non-office application into ODF, such as an export of a spreadsheet from a personal finance application.
16. An application which takes an existing document and outputs a modified version of that presentation, e.g., fills out a template, translates the language, etc. This has some nice benefits since it allows separation of concerns, where a business user can control the look of the document, but leave place holders that can be filled in by automation, perhaps based on a web service query.
17. Adds or verify digital signatures on a document in order to control access (DRM).
18. Software which uses documents as part of a workflow, but treats the document as a black box, or perhaps is aware of only basic metadata. This is the way most current systems work.
19. Software which treats documents as part of a workflow, but is able to inspect the document and make decisions based on the content. This relies on the transparency of the ODF format, and the ability of software to see what is inside.
20. Software which packs/unpacks a document into relational database form, i.e. XML-relational mapping.

7 Summary

History has demonstrated that by adopting common standards, society achieves uncommon results. Standardization in electricity, train switches, emergency firefighting equipment and maritime applications have transformed our world. The Internet, based on broad participation and availability of the standard specifications, has opened peoples' lives and created boundless opportunities for growth, exploration and innovation, creating new value far beyond what any single vendor is capable of. As reflected by this experience, open standards provide vital benefits in the areas of:

- ***collaborative innovation*** - where communities of organizations, governments, and individuals come together to address serious problems such as providing relief after natural disasters;
- ***flexibility*** - standards provide more technology options for citizens, users, and implementers to easily configure information systems, procure technology from a competitive marketplace, and more easily adapt to ever-changing requirments and procedures;
- ***interoperability*** - eliminating the barriers that inhibit communications and information sharing, within and across governments, especially in healthcare, public safety and education;
- ***cost effectiveness*** - where the adoption of policies in support of open standards avoids single vendor lock-in, increases competitive choice while lowering prices; and
- ***freedom of action*** - where users are empowered to benefit from a level playing field, lessening the risk that a single vendor can pace, control, or block technology.

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- ODF Information Web Site, <http://www.opendocument.xml.org/>.
- ODF Alliance Homepage, <http://www.odfalliance.org/about.php>.
- ODF Wikipedia Page, <http://en.wikipedia.org/wiki/OpenDocument>.
- OASIS OpenDocument Essentials (Online book), <http://books.evc-cit.info/>.
- ODF Perl Module, <http://search.cpan.org/dist/OpenOffice-OODoc/>.

Abbreviations

CJK = Chinese, Japanese, Korean
CSS = Cascading Style Sheets
DOM = Document Object Model
DRM = Digital Rights Management
DTD = Document Type Definition
HTML = HyperText Markup Language
IEC = International Electrotechnical Commission
INdT = a research group belonging to Nokia
ISO = International Organisation for Standardisation
OASIS = Organization for the Advancement of Structured Information Standards
ODF = OpenDocument Format
OOXML = Object-Oriented Extensible Markup Language
PDA = Personal Digital Assistant (an electronic device)
PDF = Portable Document Format
PS = PostScript
PwD = Persons with Disabilities
SC = Sub-Committee
SMIL = Synchronised Multimedia Integration Language
SQL = Structured Query Language
SVG = Scalable Vector Graphics
TC = Technical Committee
UNO = Universal Network Objects
XHTML = Extensible Hypertext Markup Language
XML = Extensible Markup Language
XSL = Extensible Stylesheet Language
ZIP = a format for compressed files