Open Standards and Security

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Outline

- Stories (examples)
- Definitions: Key terms open systems & open standards
- Two ways open standards support security
  - Open standards support key technical approaches for security
  - More importantly: Open standards create economic conditions necessary for creating secure components
- Notes about open standards
  - Market changes, OSS, miscellaneous,open systems
- Conclusions

Open standards are necessary for security

A few stories...

- **Magic food (independence from supplier)**
  - **Only need food 1/year, all vitamins & minerals, first 1 $1**
  - **... but you can eat ONLY it from now on (others poison), and there's ONLY ONE manufacturer. Think the prices will go up? What's social cost of crack? Dependence is a security problem!**
  - **Not attacking MS/RH/etc. Need suppliers; not dependence on 1**
  - **Two IT independence strategies: Open standards & OSS (differ!)**
- **Firehose couplings (so defenders can cooperate)**
  - **1904 Baltimore fire: cities' couplings differ, 2,500 buildings lost**
  - **Multiple "standards" NOT good; multiple *implementations***
- **Railroad gauge – Contributed to Confederacy's loss**
  - **Eliminate unnecessary costs/time, freeing up money/time**
  - **Plug&play (cars/engines with tracks) allows innovation & improvement (steam→diesel). *No one organization* does all innovation. See also audio equipment**

Firehose couplings: Massive incompatibility

Glamorgan Pipe & Foundry (Pat 1897)

Hamilton Water Works 1859

Kennedy Valve 1890s

Crane Company c. 1900

Holyoke Iron Works 1890s

Source: http://www.firehydrant.org/pictures/oldermodels.html included as fair use (Transformative: changed purpose of work from focus on hydrants; Nature of work: non-fiction, non-art display of objects; Amount: small, not heart; Market: Non-commercial use, photos already displayed without fee, subset does not reduce value of original site.)

Open systems and open standards

- Goal isn't standards per se—goal is (modular) *open systems*
  - Open System = "A system that employs modular design, uses widely supported and consensus based standards for its key interfaces, and has been subjected to successful V&V tests to ensure the openness of its key interfaces". Open systems *depend* on open standards [DoD OSJTF]
  - ***Competing marketplace of replaceable components***. "Standards exist to encourage & enable multiple implementations" [Walli]
- Governments widely view open systems as critically necessary
  - Extensive network of people with know-how (talk to them!)
  - U.S. DoD (serious emphasis: DISA, DISR, OSJTF...)
    - "shall be employed, where feasible." [DoD Directive 5000.1]
  - European Commission – major policy thrust
    - "guidance needs to focus on open standards"
- Advantages: Greater interoperability & flexibility, lower costs... focus today: security

What are open standards?

Not just "open mouth". Merged Perens'/Krechmer's/EC's definition:

1. **Availability: available for all to read and implement**
2. **Maximize End-User Choice: Create a fair, competitive market for implementations; NOT lock the customer in. Multiple implementors**
3. **No Royalty: Free for all to implement, with no royalty or fee**
4. **No Discrimination: Don't favor one implementor over another (open meeting, consensus/no domination, due process)**
5. **Extension or Subset: May be extended or offered in subset form**
6. **Predatory Practices: May employ license terms that protect against subversion of the standard by embrace-and-extend tactics**
7. **One World: Same standard for the same capability, world-wide**
8. **On-going Support: Supported until user interest ceases**
9. **No or nominal cost for specification (at *least*; open access?)**

See http://www.dwheeler.com/essays/opendocument-open.html

Two ways open standards support security

1. Open standards support key technical approaches for security
2. More importantly: Open standards create economic conditions necessary for creating secure components

Saltzer & Schroeder (1975): How open standards support security

- **Open design (open review)**
  - **Availability: Available for all to read and implement**
  - **Worldwide review can eliminate key problems**
- **Psychological acceptability / Easy to use**
  - **Familiarity is key**
  - **One world, maximize end-user choice**
- ***Modularity* helps with Economy of mechanism/Simplicity, Least privilege, Complete mediation, Separation of privilege, Least common mechanism (unshared)**
  - ***Any* standard defines a boundary, creating modularity**
  - **Maximize end-user choice, no discrimination**

Modularity: Key for security, and has other benefits too

- **“[MS' OS project] was restarted in the summer of 2004... it became clear [Longhorn] would not work. Two years' worth of work was scrapped... The new work, Microsoft decided, would take a new approach... [build] more in small modules that then fit together like Lego blocks.” -- NY Times, March 27, 2006, Lohr & Markoff, “Windows is So Slow, but Why?”**
- **“Complexity kills. It sucks the life out of developers, it makes products difficult to plan, build, and test, it introduces security challenges and it causes end-user and administrator frustration.” -- Ray Ozzie, CTO Microsoft**
- **Infrastructure managers have an even greater need for modularity (because an OS is only one small piece)**
- **“Composibility” issue, but that's a problem for monoliths too**

Open standards create necessary economic conditions for security

- **Without open standards, security evaporates**
  - **If high transition costs→stuck with supplier**
  - **Supplier raises profits by increasing prices while providing fewer benefits (inc. security)**
  - **Dependency→vulnerability→insecurity ("magic food")**
- **Open Standards make security *possible***
  - **Competing suppliers (continuously competing)**
  - **Can choose based on security & switch if security inadequate**
  - **Suppliers compete on their security, so improve**
  - **Allow connecting in new ways, so can cooperate for security ("firehose couplings")**
  - **Lowers costs over time (freeing budget), enables / encourages innovation (inc. security innovation) ("railroad gauge")**
- **True for COTS, custom, & mixed**

Leaders note the value of competition

- **Microsoft (MS)**
  - **"We welcome competition in the marketplace and believe it is healthy for the industry as a whole and good for customers." Erik Ryan, Senior marketing manager, March 2006**
  - **“There's a lot of industry competition... Openness to me means that anything can be cloned... no patents... no IP that stands in the way of somebody creating something that's compatible but better. And the beauty of that is that it forces you to keep prices extremely low and listen to the customer feedback about how you can do better” Bill Gates, 1996**
- **Red Hat (RH)**
  - **“with someone pushing us, we're going to have to leapfrog back and come up with a new set of technology. It's that competition in the marketplace that's causing [us to] innovate faster”... “If Novell does better job... than Red Hat... those customers will go to Novell...” Bob Young, co-founder RH, 1999 & 2005**

Standardization sometimes causes market lead changes

- Standards sometimes led by secondary suppliers
  - Dominant vendor often resists commoditization
  - Secondary competitors willing to standardize, innovation from competition can leapfrog past
  - “It is not necessarily the dominant vendor's product that is to be standardized, but the product market space” [Walli]
- Larger vendor, dominant position, and/or (initial) technical superiority typically not enough to resist standardization
  - Sony Betamax (lost to VHS)
  - DEC VAX VMS (lost to POSIX)
  - IBM SNA & Novell IPX/SPX & MS MSN/Blackbird & ... (lost to TCP/IP)

Relationship of open standards with open source software

- Open standards do not require use of OSS
  - Neutral on OSS vs. proprietary software
  - Yet there is a relationship between open standards & OSS
- Open standards aid OSS projects
  - Makes it easy for users to adopt an OSS program, because users not locked in – eases migration & integration
  - Simplifies OSS development (developers know what to do)
  - Open standards aid proprietary projects same way
- OSS aids open standards
  - OSS implementations help create & keep open standards open (reference model demos implementability & how, clarifies spec)
  - Rapidly increases use of open standard. "Implement by downloading" makes standard widespread, & downward cost pressure reigns in price of proprietary (increasing use)
  - Practice: Successful open standards have OSS implementation

Miscellanous

- Security is a process; need continuous deployment process
- Transition costs real but only happen once (tracks, hydrants)
  - Look at multi-year ROI (competitive bidding pressures costs!)
  - How long do you plan to be in business & doing that? Governments typically last a LONG time, needs don't go away
  - Tracks & hydrants: expensive & worth it
- Be pragmatic while transitioning from legacy
  - Strategize long-term (architectures that identify key interfaces, implementation plan); plan beyond this year's budget
  - Spec open standards, test for them, roll-out incrementally, DO IT
  - Web-based systems: Spec open standards, test with validators & multiple browsers (esp. Firefox) & platforms
  - For security, concentrate on replacing insecure with secure (old Sendmail/Exchange→Postfix, IE→Firefox, Outlook→anything), inc. security tests (fuzz, injection, cleartext passwd, etc.), secure "inside" systems, reuse tests!

Open standards key enabler for the larger goal: Modular open systems

- **OSJTF identified 5 principles of (modular) open systems:**
  1. **Establish an enabling environment – supportive requirements, strategies, business practices. DoD reviews programs, lose funding if don't support it!**
  2. **Employ modular design – develop architectures based on modular design tenets (don't just "buy stuff")**
  3. **Designate key interfaces – identify interfaces impacting performance/cost/support**
  4. **Use open standards – consensus based, wide support**
  5. **Certify compliance – assure openness (test replaceability)**
- **Must create a plan to do this; focus on *goal***
- **Balance: top-down *and* bottom-up**

Source: Open Systems Joint Task Force (OSJTF)
http://www.acq.osd.mil/osjtf/

Conclusions

- **Two ways open standards support security:**
  1. **Open standards support key technical approaches for security**
  2. **More importantly: Open standards create economic conditions necessary for creating secure components and systems (in the long run)**
- **Remember the stories**
  - **Magic food (independence from supplier)**
  - **Firehose couplings (needed so defenders can coop)**
  - **Railroad gauge (eliminate unnecessary costs/time, competition via modularity yields innovation/ improvement inc. security)**

Open standards are necessary for security

Acronyms

COTS – Commercial Off-The-Shelf
CTO – Chief Technical Officer
DISA – Defense Information Systems Agency
DISR – DoD IT Standards Registry (DISR)
DoD – Department of Defense
IP – Intellectual Property (aka Intellectual Rights)
IT – Information Technology
MS – Microsoft
MSN – Microsoft Network
OS – Operating System
OSS – Open Source Software (aka FLOSS)
OSJTF – Open Systems Joint Task Force
RH – Red Hat
ROI – Return on Investment
V&V – Verification and Validation

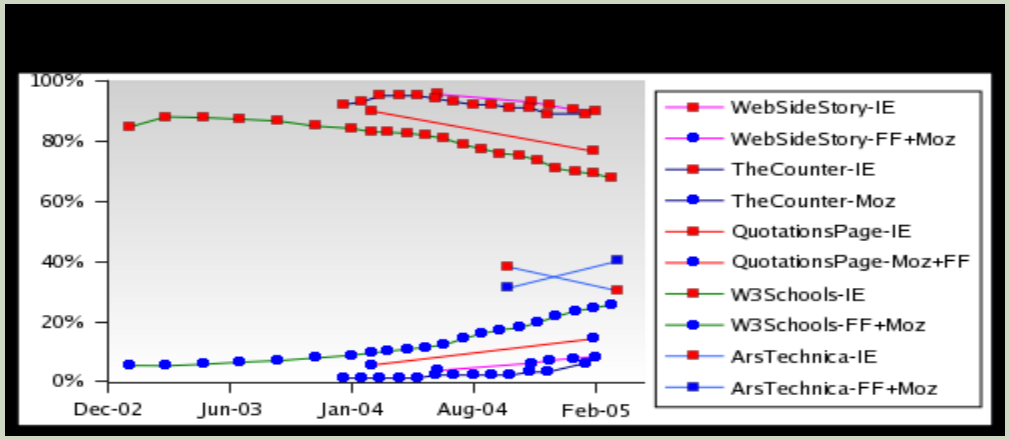
For More Information

- ANSI, “Through History with Standards” http://www.ansi.org/consumer_affairs/history_standards.aspx
- European Commission, *European Interoperability Framework.* http://europa.eu.int/idabc/en/document/3761
- Lohr & Markoff, “Windows is So Slow, but Why?”, NY Times, March 27, 2006
- Open Systems Joint Task Force (OSJTF) Web site, http://www.acq.osd.mil/osjtf/
- Perens, Bruce. “Open Standards: Principles and Practice”. http://perens.com/OpenStandards/Definition.html
- Puffert, Douglas. “Path Dependence in Spatial Networks: The Standardization of Railway Track Gauge”
- Walli, Stephen R. “Under the Hood: Open Source and Open Standards Business Models in Context” *Open Sources 2.0*. Ed. Chris diBona et al. O'Reilly. 2005.
- Wheeler, David A. *Is OpenDocument an Open Standard? Yes!* http://www.dwheeler.com/essays/opendocument-open.html

Backup

Case Study: Mozilla Firefox vs. Internet Explorer

- Leading web browser has been Internet Explorer (IE)
- IE serious security problems; Mozilla Firefox released. HTTP, HTML
  - Browser "unsafe" days in 2004: 98% IE, 15% Firefox* [Scanit]
  - IE 21x more likely to get spyware vs. Firefox [U of Wash.]
  - Faster response: Firefox 37 days, Windows 134.5 days [W. Post]
- "Stronger Security" key supplier pitch & switching rationale
- Firefox costs more (both free, but IE pre-installed), yet use grown
- IE development restarted, a stated focus is security. Competition!



Red: IE
Blue: Mozilla (inc. Firefox)

*1/2 Mac-only

OpenDocument

- What is it?
- Standardization
- Adoption
- Is it an open standard?
- Security and office implementations

Who owns your data? A vendor, or you?

What's OpenDocument (ODF)?

- **Fully open standard for exchanging office documents between arbitrary programs**
  - **Word processing (.odt), presentation (.odp), spreadsheet (.ods), graphics (.odg), ...**
  - **Full capabilities (formatting styles, charts, math formulas, templates, Ruby, etc.)**
  - **Zip-compressed XML format: Small & easily processed**
  - **Reuses standards (MathML, SVG, SMIL, XForms, etc.)**
- **Goal: Users can own & control their own information**
  - **Proprietary formats: Vendor owns your data**
  - **ODF: can use different office suites, store long-term**
  - **"we cannot have our public documents locked up in [a] proprietary format, perhaps unreadable in the future, or subject to a ... license that restricts access." [Kriss]**

OpenDocument Standardization

- OASIS OpenDocument group begins 2002-12-16
  - Chose OpenOffice.org 1 format as base; only featureful office suite with native XML (2000)
- Participants: Many implementors & users, inc.:
  - Adobe, Arbortext, Corel (WordPerfect), IBM (Lotus 1-2-3, Workplace), KDE (Koffice), Sun (StarOffice/OpenOffice.org)
  - Boeing & Intel (complex large documents), National Archives of Australia & NY Attorney General (long-term storage), Novell, Society of Biblical Literature (multilingual, long-term), Sony
- Universal intermediate data format for legacy systems (inc. MS Office, and more)
- ODF becomes OASIS standard: 2005-05-01
- ISO/IEC 26300 approved 2006-05-03

OpenDocument Adoption

- EU analysis, tells MS to join OpenDocument group 2004-04
- ODF becomes OASIS standard: 2005-05-01
- OpenOffice.org/StarOffice, Koffice: ODF as native format
- MA adopts ODF (not MS) on 2005-09 for deployment 2007-01
  - Nasty big-money political infighting fails to stop
- Microsoft creates ECMA group to create competing standard 2005-12-09 as ODF derail attempt
- National Archives of Australia selects ODF 2006-03-31
- ISO/IEC 26300 approved 2006-05-03
- Belgium adopts ODF 2006-06-23, rejecting MS format; all docs in ODF by 2008-09 (readable 2007-09)
  - Other EU countries expected to follow
- Microsoft caves 2006-07-06, announces it will create OpenDocument implementation for MS Office (caveats!)

OpenDocument an Open Standard? YES.

1. Availability: Yes, any can implement
2. Maximize End-User Choice: Yes, competing implementations; multiple implementors created it
3. No Royalty: Yes
4. No Discrimination: Yes, no favored vendor*
5. Extension or Subset: Yes
6. Predatory Practices: Yes (vacuously)
7. One World: Yes
8. On-going Support: Yes, not one vendor
9. No or nominal cost for specification: Yes, no cost

* As shown by open meetings, due process, & consensus processes, as well as evidence of technical changes created by all that affect implementors

Security is irrelevant for office software, right? :-)

- **“A hole in Microsoft Excel has been identified that could allow attackers to take control of a computer, a security group said Thursday--the third vulnerability affecting the popular spreadsheet program to surface in less than a month.” *ZDNet*, 2006-07-06, “Another security hole found in Excel”**
- **“Microsoft plans to issue patches for critical Windows and Office security problems as part of a regular update scheduled for Tuesday”, *ZDNet*, 2006-07-06, “Windows, Office to get 'critical' fixes”**

Security and Document Format Standards

- Open standard lets users choose
  - HTML is an open standard
  - IE lost significant market share as users switched to Firefox to get its better security
- Competition via open standards force improvements
  - IE languished for 5 years, endless vulnerabilities; Firefox caused IE security reviews & design changes
- Closed standard prevents choice
  - Users constantly patch Office, hoping that they'll get ahead of the attackers this time
- Text formats also show we can agree on formats
  - Nobody cares which text editor you use; “just works”
  - ASCII etc. isn't the original market leader (EBCDIC)

OpenDocument

- **Who owns your data?**
  - **Can you easily switch and interchange between different competing vendors?**
  - **If not, you have a problem. OpenDocument's purpose is to solve it**