HOW MANY STANDARDS IN A LAPTOP? (AND OTHER EMPIRICAL QUESTIONS)

Brad Biddle, Andrew White and Sean Woods

Arizona State University Sandra Day O'Connor College of Law

ABSTRACT

An empirical study which identifies 251 technical interoperability standards implemented in a modern laptop computer, and estimates that the total number of standards relevant to such a device is much higher. Of the identified standards, the authors find that 44% were developed by consortia, 36% by formal standards development organizations, and 20% by single companies. The intellectual property rights policies associated with 197 of the standards are assessed: 75% were developed under "RAND" terms, 22% under "royalty free" terms, and 3% utilize a patent pool. The authors make certain observations based on their findings, and identify promising areas for future research.

Keywords— standards, SDOs, consortia, intellectual property rights (IPR), RAND, royalty free

1. OVERVIEW

Our effort began with some simple questions: how many standards are embodied in a modern laptop computer? How many of these standards are developed by formal standards development organizations and how many by consortia? What type of intellectual property rights policies – e.g. "RAND" or "royalty-free" – apply to each of these standards?

Answering these seemingly-simple questions proved dauntingly complex. Nonetheless, subject to the limitations and qualifications described in this paper, we were able to reach the following conclusions:

- We identified 251 interoperability standards that are embodied or directly utilized in a modern laptop computer. We focused only on standards that facilitate technical interoperability, and did not count quality, safety, performance, measurement, environmental, accessibility, design process, manufacturing process or electromagnetic compatibility standards. Further, our count of interoperability standards is not comprehensive: we have become aware of significant omissions. Accordingly, we believe our count sets only a floor: a modern laptop embodies or utilizes *at least* 251 interoperability standards, but the actual number is certainly much higher (the authors would be unsurprised by a total number of 500 or more). Including other types of relevant standards, such as environmental or safety standards, in addition to interoperability standards would further raise the count dramatically.
- Of the 251 standards we identified, 112 (44%) were developed by consortia, 90 (36%) by formal standards development organizations, and 49 (20%) by individual companies (see Figure 1).
- We were able to allocate 197 of the 251 standards into one of three broad intellectual property model categories: RAND, RF or patent pool (we lacked sufficient information to categorize the remaining 54 standards). Of the 197 we categorized, 148 (75%) were RAND, 43 (22%) were RF, and 6 (3%) utilized a patent pool (see Figure 2).

In order to meaningfully assess our data it is imperative that readers understand our terminology and our methodology. These are described in Section 2, below. Section 3 highlights some limitations of our approach, and identifies some gaps in our research. Section 4 explores some preliminary observations and conclusions based on our data. Section 5 identifies opportunities for further research. Finally, the appendix contains a table listing the particular standards we identified and the values we assigned to each.

2. TERMINOLOGY AND METHODOLOGY

We began by examining the specifications of various current-generation laptop computers produced by different manufacturers, and developing a vision of a composite, hypothetical laptop that drew from the features of each. We also gave ourselves some flexibility to include a few features that are widely expected to be included in laptops in the imminent future (e.g. hi-definition wireless display capabilities).

Brad Biddle is an Adjunct Professor at ASU and Standards Counsel for Intel Corporation; Andrew White and Sean Woods are law students. This article reflects the authors' personal views. The authors thank Steve Balogh, Carl Cargill, Wayne Carr, Kevin Cornelius, Bob Grow, Earl Nied, Ken Salzberg, Kim Turner, Steve Whalley and Andrew Wilson for their invaluable input. Errors are solely the responsibility of the authors.

Paper accepted for presentation at the ITU-T "Beyond the Internet? – Innovations for future networks and services" Kaleidoscope Conference, Pune, India, http://itu-kaleidoscope.org/2010, and will be published in the conference proceedings. This version of the paper is considered final. It was completed on September 10, 2010 and supersedes a draft dated May 7, 2010. Suggested citation: "Biddle, Brad, White, Andrew and Woods, Sean, How Many Standards in a Laptop? (And Other Empirical Questions) (September 10, 2010). Available at SSRN: http://ssrn.com/abstract=1619440."

Next, we created a set of broad categories – display, graphics, sound, storage, BIOS, input device, processor, power, file system, networking, wireless, I/O ports, memory, software, codecs, content protection, security and "other" – and sought relevant standards. Using a variety of methods, including interviews with experts and extensive primary research, we identified standards in each category that would be embodied in or directly utilized by our hypothetical laptop computer.

For our purposes, "standards" included not just standards developed by formal standards development organizations like ISO, but also industry specifications developed by consortia like PCI-SIG. We also encountered a number of specifications intentionally promulgated by a single company for broader industry adoption, and we counted these as "standards" as well. We limited our count of company-promulgated standards to those that a company intentionally and specifically made available for adoption as an industry specification; we did not include proprietary technologies that have significant market share but that are not otherwise intentionally made available for industry adoption.

As noted in the introduction, we focused only on standards that facilitate technical interoperability, and did not count quality, safety, performance, measurement, environmental, accessibility, design process, manufacturing process or electromagnetic compatibility standards.

We identified the developer/promoter of each standard as either (a) a formal standards development organization or "SDO," (b) a consortium, or (c) an individual company. For this step we utilized the taxonomy suggested by the IPO Standards Setting Committee in their 2009 "Standards Primer" document. [1] We counted as SDOs: (a) the "Big I" international standards organizations (ITU, ISO, IEC), (b) the "Little I" international organizations (IEEE, ASTM), (c) government-sanctioned regional bodies such as ETSI, (d) government-sanctioned national bodies, such as BSI, and (e) organizations sanctioned or accredited by a national body, such as all of the ANSI-accredited organizations (e.g., JEDEC, TIA). All other group-focused specification-development efforts were classified as "Consortia." The consortia category contains a wide variety of different groups, ranging from formal organizations like the W3C to very informal open source development efforts. We called specifications created by single commercial entity "Company" standards.

Assessing the intellectual property rights (IPR) policies associated with each standard proved difficult. Many IPR policies were extraordinarily complex. Further, IPR policies for some organizations were not publicly available, leaving us to rely on second-hand accounts or draw inferences. Noting some risk of oversimplification or error, we allocated each standard to one of four broad categories:

- *RAND.* This category included standards that were developed under RAND or F/RAND terms – (fair,) reasonable and non-discriminatory patent license commitments, without precluding the option of patent owners collecting patent royalties for essential patent claims. If a SDO or Consortia permitted a RAND option, even if it contemplated other options as well, we included it in the RAND category. We note that the fact that an IPR policy *permits* collection of royalties does not mean that parties *in fact* collect royalties. (IETF provides an example: the IETF IPR policy permits RAND, and thus we categorized all IETF standards as RAND, but in practice parties attempt to collect royalties on few, if any, IETF standards.)
- *RF.* This category included standards that were created under terms that prohibit the participating companies or individuals from collecting patent royalties for essential patent claims (usually subject to important limitations). For our purposes, IPR models such as "RF-RAND" (royalty-free RAND) and "RAND-Zero" (RAND with zero royalties) fall into this category. We also included standards with IPR policies that rely on promises not to assert essential patent claims here. Note that our designation of a standard as RF does not mean that the standard is in fact royalty free to implement, as entities not bound by the IPR policy could assert patents, for example.
- *Patent pool.* The term "patent pool" is sometimes defined in a way that would sweep in virtually any RAND or RF IPR policy, but for our purposes we adopted a narrow definition. We focused on the scenario where a specification is made available subject to execution of a license agreement, and that license agreement conveys a license to patents pooled by multiple parties. The DVD specifications provide an example.
- *NA ("not available").* In 54 of our 251 cases we simply could not determine the intellectual property policy associated with a particular standard. Figure 2 below includes only the 197 bodies that we were able to categorize.

We should emphasize that our taxonomy glosses over a great deal of complexity, including the key issue of whether the RAND or RF promise extends from participants in the standards development process to all implementers or only to those implementers that join the relevant consortia or SDO. For our categorization purposes, either approach sufficed: e.g., if a group required that participants promise to license on RAND terms only to members of that group, with no other license obligation, we counted that group as RAND.

3. LIMITATIONS AND GAPS

Our hypothetical/composite laptop approach potentially allows some ambiguity or duplication. For example, we include file systems standards for both Linux and Windows computers, even though in many cases they would not co-exist in a single machine. Likewise, we include wireless display standards that might be competitive rather than coexisting. Focusing on a single, specific "real world" machine would have mitigated this risk. However, our composite approach enabled us to avoid singling out a specific vendor, and enabled us to anticipate soon-to-be implemented standards.

A related point: while our primary focus was on standards that would be fully implemented in our hypothetical laptop, we also included some standards that would be directly *used by* our hypothetical machine, but that are not necessarily fully implemented on the client side (e.g., basic Internet standards like IPv4, DNS or TCP). This involved some judgment calls and line drawing. Similarly, we included standards related to some basic software applications (e.g., OpenXML), but tried to avoid expanding too far "up the stack" into the software application world.

Another issue: our data are imperfect. The authors bring legal expertise to the table rather than deep technical expertise. Understanding each of our various technical focus areas – display, graphics, sound, storage, BIOS, input device, processor, power, file system, networking, wireless, I/O ports, memory, software, codecs, content protection, security – sufficiently to assess the relevant standards in each area proved challenging. We suspect there are errors of both under-inclusion and over-inclusion in some of our focus areas. Further, we have realized that our focus areas may have been too narrow. For example, battery technologies, biometrics, camera hardware, solid state drives and docking systems standards are currently underrepresented in our list. We will continue to refine and improve the quality of our data set. However, we do not believe that this refinement will dramatically change our observations or conclusions.

4. OBSERVATIONS

The focus of this stage of our effort has been primarily on collecting empirical data rather than interpreting it. However, a set of fairly obvious conclusions are immediately apparent:

- *The critical role of standards in ICT.* The fact that a modern laptop computer implements or relies on over 250 (and probably closer to 500, we estimate) interoperability standards is remarkable. While certainly no one doubted the importance of standards to the information and communications technology (ICT) industry in the absence of this data, quantifying the volume of standards embodied in a common ICT device is striking. We believe that as technological convergence continues, and ICT devices increasing include elements from the computing, telephony and consumer electronics sectors, the number of relevant standards will only increase.
- *The importance of consortia for ICT standards development.* Of the 251 standards we indentified, only about one-third were developed by formal SDOs. Consortia developed 44%, and single companies developed 20% (see Figure 1). We suspect the dominant role played by the private sector in at least this aspect of ICT standardization will come as a surprise to some policymakers and other standardization stakeholders.

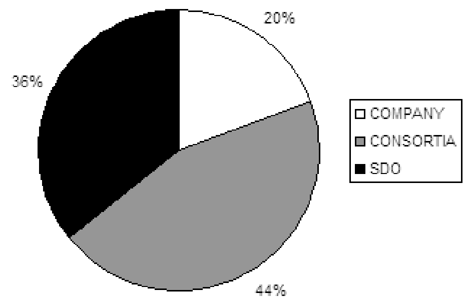

Figure 1: TYPE OF STANDARD/SPEC DEVELOPER

- *The preponderance of RAND as IPR model.* The merits of RAND and RF IPR models are fiercely debated by their respective proponents. Our data suggests that historically RAND has been effective in the computing sector, if measured by implementation of associated standards: we see that 75% of the standards we examined were developed under RAND terms (see Figure 2). Conceivably the financial industry axiom that "past performance is not indicative of future results" may be applicable, given the emergence of open source, increasing patent litigiousness, or other factors. Further, the practical impact of RAND policies seems to be different in different contexts (e.g., IETF standards, while nominally RAND, appear to be largely RF in practice; other RAND standards, such as the IEEE's 802.11 standards, are the subject of licensing and patent litigation). Nonetheless, the strong dominance of RAND in our set of successful (i.e., implemented) standards is notable. Our data also suggest that patent pools, to date, have not played a significant role for at least the computing sector of the ICT industry.

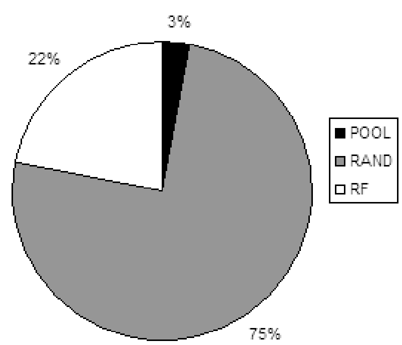

Figure 2: IP MODELS

5. NEXT STEPS AND CONCLUSION

As noted in Section 3 above, a key next step for us is to expand our data set and refine our data. We welcome constructive input and will happily make our spreadsheets available to interested parties.

While we utilized a single RAND category, we have noted that in the ICT environment there seems to be two broad subcategories of RAND standards: those for which the de facto reality seems to be a RF environment, and those for which there are active royalty-collection efforts. We believe that it would be interesting to attempt to count the number of standards in each subcategory.

Another promising focus area for additional empirical analysis is an assessment of consortia. For our purposes consortia occupied a single category, but in fact we saw a bewildering variety of approaches among consortia in the course of our research. Identifying different types of consortia, and analyzing the implementation of standards produced by different types, strikes us as a fascinating research question.

Additionally, assessing each of our identified standards against various criteria of "openness," along the lines of Per Anderson's recent study [2], could prove quite interesting. Our working theory is that the development and distribution processes associated with a significant percentage of the successfully-implemented standards we identified would *not* meet typical definitions of openness, transparency or consensus decision-making. If true, this would be an interesting data point to bring into, e.g., current policy debates over "good practices" for consortia, such as the current BSI PAS 98 effort. Further, it would be interesting to consider whether the empirical data could demonstrate either a positive or negative correlation between the "openness" of a standards development effort and its effectiveness as measured by widespread implementation of that standard in the commercial marketplace.

* * *

The academic literature on standardization often bemoans the dearth of empirical analysis of standards. Our hope is that the analysis documented in this paper helps to fill this gap, and enables policymakers, academics, commercial stakeholders and others to better understand ICT standards and industry specifications.

REFERENCES

[1] IPO Standards Setting Committee, *Standards Primer: An Overview of Standards Setting Bodies and Patent-Related Issues that Arise in the Context of Standards Setting Activities*, 2009 IPO Articles & Reps., Pats. Sec. No. 16 (10/09/2009). Available to IPO members via http://ipo.org; excerpts publicly available at <http://standardslaw.org/seminar/class-2/excerpts-from-ipo-standards-primer/>.

[2] Per Anderson, *Evaluation of Ten Standard Setting Organizations With Regard to Open Standards*, IDC Study commissioned by the Danish National IT and Telecom Agency, January 2008. Available at <http://www.itst.dk/it-arkitektur-og-standarder/standardisering/abne-standarder/baggrundsrapporter/Evaluation%20of%20Ten%20Standard%20Setting%20Organizations.pdf>.

APPENDIX:
LIST OF STANDARDS/SPECIFICATIONS

Name of standard/specification	Developer	Developer type	IP type
.NET	Microsoft	COMPANY	NA
16x9 Notebook Panel ver. 1a	VESA	CONSORTIA	RAND
3GP	3GPP	SDO	RAND
8P8C/"RJ-45" IEC 60603	IEC	SDO	RAND
AC'97 v2.3	Intel	COMPANY	NA
ACS-2 [ATA/ATAPI Command Set 2]	T13 INCITS	SDO	RAND
Advanced Configuration and Power Interface Spec 3.0	ACPI	CONSORTIA	RAND
Advanced eXpress I/O Module [AXIOM]	ATI	COMPANY	NA
AES (U.S. FIPS PUB 197)	NIST	SDO	NA
AGP	Intel	COMPANY	NA
AIFF	Apple	COMPANY	NA
ALC889	RealTek	COMPANY	NA
Allegro 4.9.19	open source project	CONSORTIA	RF
ANSI INCITS 207-1991[R2007]	ANSI	SDO	RAND
ANSI INCITS 346-2001[r2006]	ANSI	SDO	RAND
ANSI INCITS 407-2005	ANSI	SDO	RAND
ANSI INCITS 417-2006	ANSI	SDO	RAND
APM	Microsoft	COMPANY	NA
ASF	Microsoft	COMPANY	NA
Atom	IETF	CONSORTIA	RAND
AVI	Microsoft	COMPANY	NA
Bluetooth spec.	Bluetooth Sig	CONSORTIA	RF
Blu-ray Disc Read-Only Format ver. 1	Blu-ray Disc Association	CONSORTIA	POOL
Blu-ray Disc Recordable Format ver. 1	Blu-ray Disc Association	CONSORTIA	POOL
Blu-ray Disc Rewrittable Fromat ver. 2	Blu-ray Disc Association	CONSORTIA	POOL
C	ANSI/ISO	SDO	RAND
C++ (ISO/IEC 14882:2003)	ISO/IEC	SDO	RAND
CD audio ("Red book") - IEC 60908	IEC	SDO	RAND
CDROM	ISO/IEC	SDO	RAND
CIM [Common Information Model] 2.250	DMTF	CONSORTIA	RAND
Cinepak	SuperMac Technologies	COMPANY	NA
COLLADA 1.5	Khronos	CONSORTIA	RF
Compact Flash	Compact Flash Ass.	CONSORTIA	RAND
CSS (Cascading Style Sheet)	W3C	CONSORTIA	RF
CSS (Content Scramble System)	DVD Forum	CONSORTIA	NA
DDR3	JEDEC	SDO	RAND
Dirac	BBC Research	COMPANY	RF
Direct Drive Monitor [DDM] v1	VESA	CONSORTIA	RAND
Direct3D 11	Microsoft	COMPANY	NA
DirectCompute API	Microsoft	COMPANY	NA
DirectX	Microsoft	COMPANY	NA
Display Identification Data [DisplayID] Structure v1.1	VESA	CONSORTIA	RAND
Display Port Panel Connector	VESA	CONSORTIA	RAND
Display Subsystem Power Management	VESA	CONSORTIA	RAND
DisplayPort Interoperability Guidline v1.1	VESA	CONSORTIA	RAND
DLNA	Digital Living Network Alliance	CONSORTIA	RAND
DMI2 [Direct Media Interface]	Intel	COMPANY	NA
DNS	IETF	CONSORTIA	RAND
DOM	W3C	CONSORTIA	RF
DVB-H/EN 302 304	DVB/ETSI	SDO	RAND
DVD Multi	DVD Forum	CONSORTIA	POOL
DVI	DDWG	CONSORTIA	RAND
DVI 1.0 Spec	Digital Display Working Group	CONSORTIA	NA
ECMA 262 3rd edition	ECMA	CONSORTIA	RAND
ECMA C#	ECMA	CONSORTIA	RAND
ECMA CLR	ECMA	CONSORTIA	RAND
ECMA-378	ECMA	SDO	RAND
ECMA-384	ECMA	SDO	RAND
EDD-4 [Enhanced Disk Drive - 4	T13 INCITS	SDO	RAND
EHCI	Intel	COMPANY	NA
Embedded DisplayPort Standard (eDP)	VESA	CONSORTIA	RAND
Ethernet [802.3]	IEEE	SDO	RAND
EXT4	open source	CONSORTIA	RF
Fat16	ECMA	SDO	RAND
Fat32	Microsoft [Open Spec]	COMPANY	NA
Firewire/1394	IEEE	SDO	RAND
Flash (FLV, F4V)	Adobe	COMPANY	NA
FMOD	Firelight Technologies	COMPANY	NA
FTP	IETF	CONSORTIA	RAND
Guidline for transmission and control for DVD-video/audio through IEEE1394 Bus	DVD Forum	CONSORTIA	POOL
Guidline for Transmission and Control for DVD-video/audio through Most Bus	DVD Forum	CONSORTIA	POOL
H.263	ITU-T	SDO	RAND
H.264	ITU-T/ISO/IEC JVT	SDO	RAND
HDCP	DCP	COMPANY	NA
HDMI	HDMI	CONSORTIA	RAND
HFS	Apple	COMPANY	NA

HFS+	Apple	COMPANY	NA
HTML5	W3C	CONSORTIA	RF
HTTP	W3C	CONSORTIA	RF
HTTPS	W3C	CONSORTIA	RF
HuffYUV	Rudiak-Gould	COMPANY	NA
IEC 60320	IEC	SDO	RAND
IEC 60958 type II (S/PIF)	IEC	SDO	RAND
IEEE std. 1212.1-1993	IEEE	SDO	RAND
IEEE std. 1680.1-2009	IEEE	SDO	RAND
IETF RFC 5545 iCalendar	IETF	CONSORTIA	RAND
IMAP	IETF	CONSORTIA	RAND
INCITS 370-2004(1510D): ATA Host Adapter Standards	T13 INCITS	SDO	RAND
INCITS 437-2008	ISO	SDO	RAND
INCITS 452-2008(D1699): AT Attachment 8 ATA/ATAPI Command Set	T13 INCITS	SDO	RAND
Intel 64 architecture x2APIC Spec	Intel	COMPANY	NA
Intel AHCI	Intel	COMPANY	NA
Intel High Definition Audio	Intel	COMPANY	NA
Intel Platform Innovation Framework for UEFI	Intel	COMPANY	RAND
IPSEC	IETF	CONSORTIA	RAND
IPv4	IETF	CONSORTIA	RAND
ISO 8601 is dates and time	ISO/IEC	SDO	RAND
ISO 9241-300:2008	ISO	SDO	RAND
ISO 9241-302:2008	ISO	SDO	RAND
ISO 9241-303:2008	ISO	SDO	RAND
ISO 9241-304:2008	ISO	SDO	RAND
ISO 9241-305:2008	ISO	SDO	RAND
ISO 9241-306:2008	ISO	SDO	RAND
ISO 9241-307:2008	ISO	SDO	RAND
ISO 9241-400:2007	ISO	SDO	RAND
ISO 9241-400:2007	ISO/IEC	SDO	RAND
ISO 9241-410:2008	ISO	SDO	RAND
ISO 9241-410:2008	ISO/IEC	SDO	RAND
ISO/IEC 1064 is Unicode (and uft-8, utf-16)	ISO/IEC	SDO	RAND
ISO/IEC 11002:2008	ISO	SDO	RAND
ISO/IEC 11989:2010	ISO	SDO	RAND
ISO/IEC 13170:2009	ISO	SDO	RAND
ISO/IEC 14772-2:2004	ISO	SDO	RAND
ISO/IEC 14776-150:2004	ISO	SDO	RAND
ISO/IEC 15412:1999	ISO	SDO	RAND
ISO/IEC 15948:2004	ISO	SDO	RAND
ISO/IEC 19774:2006	ISO	SDO	RAND
ISO/IEC 19775-1:2008	ISO	SDO	RAND
ISO/IEC 19775-2:2004	ISO	SDO	RAND
ISO/IEC 19776-1:2008	ISO	SDO	RAND
ISO/IEC 19776-2:2008	ISO	SDO	RAND
ISO/IEC 19776-3:2007	ISO	SDO	RAND
ISO/IEC 19777-1:2006	ISO	SDO	RAND
ISO/IEC 19777-2:2006	ISO	SDO	RAND
ISO/IEC 24739-1:2009	ISO	SDO	RAND
ISO/IEC 24739-2:2009	ISO	SDO	RAND
ISO/IEC 24739-3:2009	ISO	SDO	RAND
ISO/IEC 24757:2008	ISO	SDO	RAND
ISO/IEC 26300:2006 Open Document Format	ISO/IEC	SDO	RAND
ISO/IEC 29121:2009	ISO	SDO	RAND
ISO/IEC 29171:2009	ISO	SDO	RAND
ISO/IEC 29171:2009 [iVDR spec]	ISO	SDO	RAND
ISO/IEC 29500 Office Open XML	ISO/IEC	SDO	RAND
ISO/IEC 9995-1:2009	ISO	SDO	RAND
ISO/IEC 9995-2:2009	ISO	SDO	RAND
ISO/IEC 9995-3:202	ISO	SDO	RAND
ISO/IEC 9995-4:2009	ISO	SDO	RAND
ISO/IEC 9995-5:2009	ISO	SDO	RAND
ISO/IEC 9995-7:2009	ISO	SDO	RAND
ISO/IEC 9995-8:2009	ISO	SDO	RAND
ISO/IEC TR 24784:2009	ISO	SDO	RAND
ISO/IEC TR29106:2007	ISO/IEC	SDO	RAND
ISO 32000-1:2008	ISO	SDO	RAND
JCP JSR 270 Java SE 6	Java Community Process	CONSORTIA	RF
Magsafe	Apple	COMPANY	NA
MATHML	W3C	CONSORTIA	RF
Matroska	open source project	CONSORTIA	RF
MD5 (RFC 1321)	IETF	CONSORTIA	RAND
Micro SD	SD Association	CONSORTIA	RAND
MIDI	MIDI Manufacturer s Ass'n	CONSORTIA	NA
MIME	IETF	CONSORTIA	RAND
Mini Displayport	VESA	CONSORTIA	RF
MINI-DVI	Apple	COMPANY	NA
MiniSD	SD Association	CONSORTIA	RAND
MJPEG (RFC 2435)	IETF	CONSORTIA	RAND
MMS	Open Mobile Alliance	CONSORTIA	RAND
Monitor Control Command Set [MCCS] Standard v2.2	VESA	CONSORTIA	RAND
MP3 (MPEG-1 Layer 3)	ISO/IEC	SDO	RAND
MP4 (ISO/IEC 14496-14:2003)	ISO/IEC	SDO	RAND
MPEG-2	ISO/IEC	SDO	RAND
MPEG-2 (ISO/IEC 13818)	ISO/IEC	SDO	RAND
MPEG-4 Part 2 (ISO/IEC 14496-2)	ISO/IEC	SDO	RAND
MSFT Silverlight	Microsoft	COMPANY	NA
MXF	SMPTE	CONSORTIA	NA
MXM Graphic Module Software Spec 3.0 revision 1.1	MXM Group/SIG	CONSORTIA	RF
MXM Graphics Module Mobile PCI Express Module Electromechanical Spec version 3.0 rev 1.1	MXM Group/SIG	CONSORTIA	RF

Net2Display Remoting Standard (N2D)	VESA	CONSORTIA	RAND
NTFS	Microsoft [Closed Spec]	COMPANY	NA
NTP (time synchronization)	IETF	CONSORTIA	RAND
OGG	Xiph.Org Foundation	CONSORTIA	RF
OpenAL	Creative Technology	COMPANY	RF
OpenCL	Khronos	CONSORTIA	RF
OpenGL 4.0 Compaitbility Profile Specification	Khronos	CONSORTIA	RF
OpenGL 4.0 Core Profile Specification	Khronos	CONSORTIA	RF
OpenGL ES	Khronos	CONSORTIA	RF
OpenGL SC 1.0	Khronos	CONSORTIA	RF
OpenGL Shading Language 4.00.7 Specification	Khronos	CONSORTIA	RF
OpenKode	Khronos	CONSORTIA	RF
OpenMAX	Khronos	CONSORTIA	RF
OpenML	Khronos	CONSORTIA	RF
OpenSL/ES	Khronos Group	CONSORTIA	RF
OpenVG	Khronos	CONSORTIA	RF
OpenWF	Khronos	CONSORTIA	RF
PCI Express Base Specification 2.0 [x8,x16]	PCI-SIG	CONSORTIA	RAND
PCI Local bus Spec 3.0	PCI-SIG	CONSORTIA	RAND
PCI Local Bus Specification 3.0	PCI-SIG	CONSORTIA	RAND
PCMCIA/PC Card	USB-IF	CONSORTIA	RF
PGA-989 socket	Intel	COMPANY	NA
PGP (RFC 4880)	IETF	CONSORTIA	RAND
PNG	W3C	CONSORTIA	RF
POP	IETF	CONSORTIA	RAND
Quicktime	Apple	COMPANY	NA
RealVideo 3&4	RealNetworks	COMPANY	NA
RJ-11 (TIA-968-A)	TIA	SDO	RAND
RSS	Various	CONSORTIA	NA
RSVP	IETF	CONSORTIA	RAND
RTMP	Adobe	COMPANY	RF
RTP	IETF	CONSORTIA	RAND
RTSP	IETF	CONSORTIA	RAND
S/MIME	IETF	CONSORTIA	RAND
SATA	Serial ATA Int'l Org.	CONSORTIA	RAND
SD	SD Association	CONSORTIA	RAND
SDL 1.3	open source project	CONSORTIA	RF
SDP	IETF	CONSORTIA	RAND
SDRAM	JEDEC	SDO	RAND
SHA-1 (FIPS PUB 180)	NIST	SDO	NA
SIP	IETF	CONSORTIA	RAND
SmartMedia	Toshiba	COMPANY	NA
SMTP	IETF	CONSORTIA	RAND
SOAP	W3C	CONSORTIA	RF
SODIMM	JEDEC	SDO	RAND
Sorenson	Sorenson	COMPANY	NA
SQL - ISO/IEC 9075	ISO/IEC	SDO	RAND
SVCD (IEC 62107)	IEC	SDO	RAND
SVG	W3C	CONSORTIA	RF
TCG EFI Platform Spec 1.2	UEFI	CONSORTIA	RAND
TCG EFI Protocol Spec. 1.2	UEFI	CONSORTIA	RAND
TCG Physical Presence Interface Spec	Trusted computing Group	CONSORTIA	RAND
TCP	IETF	CONSORTIA	RAND
Theora	Xiph.Org Foundation	CONSORTIA	RF
TKIP	IEEE	SDO	RAND
TPM 1.2 Protection Profile	Trusted computing Group	CONSORTIA	RAND
TSR jack 3.5mm (PCXX version)	Intel	COMPANY	NA
UDP	IETF	CONSORTIA	RAND
UEFI Platform Initilization Distribution Packaging Spec 1.0	UEFI	CONSORTIA	RAND
UEFI Platform Initilization Specification 1.2	UEFI	CONSORTIA	RAND
UEFI Shell Spec 2.0	UEFI	CONSORTIA	RAND
UEFI Specification Version 2.3	UEFI	CONSORTIA	RAND
Universal Audio Architecture	Microsoft	COMPANY	NA
UPnP	UPnP Forum	CONSORTIA	RF
USB	USB-IF	CONSORTIA	RF
VC-1 (SMPTE 421M)	SMPTE	CONSORTIA	NA
VCD ("White Book")	Various companies	CONSORTIA	NA
VESA DDC2/E-DDC	VESA	CONSORTIA	RAND
VGA	IBM	COMPANY	NA
VOB	DVD Forum	CONSORTIA	NA
VP5	On2 Technologies	COMPANY	NA
VP6	On2 Technologies	COMPANY	NA
VP8	Google	COMPANY	NA
WAV	MSFT and IBM	COMPANY	NA
WebGL - OpenGL ES 2.0	Khronos	CONSORTIA	RF
WIGIG 1.0	Wireless Gigabit Alliance	CONSORTIA	RF
WiMax (IEEE 802.16)	IEEE	SDO	RAND
Wireless 802.11 [a/b/g/n]	IEEE	SDO	RAND
Wireless HD 1.0	Wireless HD Consortium	CONSORTIA	NA
WMV	Microsoft	COMPANY	NA
WSDL	W3C	CONSORTIA	RF
x.509	ITU-T	SDO	RAND
x86-64 Instruction Set	Intel/AMD	COMPANY	NA
XHCI	Intel	COMPANY	NA
XML	W3C	CONSORTIA	RF