The Meaning of Open Standards[1]

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Abstract: The personal computer revolution and the following Internet explosion have resulted in a large influx of new technical standards stakeholders.[2] These new stakeholders are making new demands on the standardization processes, often with the rallying cry of "Open standards." As is often the case, a rallying cry means many different things to different people. This paper explores what are the different meanings of Open Standards. Perhaps when everyone understands what Open Standards mean, it will be possible to achieve them.

Openness, open standards, open architecture sound appealing, but what do they mean? It is relatively easy to gain agreement that the openness of standardization which includes the processes of creating, implementing and using standards, creates these forms of openness. However, almost all modern standardization processes are complex and varied. As formal SSOs[3] developed in the early to middle of the 20th Century, they focused, often with government approval, on supporting the open creation of standards. This paper proposes that the implementers and users of standard have a growing interest in seeing the concept of openness address their additional requirements also.

Through most of the 20th Century larger development organizations[4] had engineers who functioned, sometimes on a full time basis, as the developer's standards creators. These standards engineers supported the specific formal SSOs necessary for the broad aims of the developer organization. In the late 1980s larger development organizations began supporting many different SSOs. [5] This movement to proliferate standardization marks the rise of the implementers' interest in standardization.

Now many large development organizations even support overlapping SSO standardization efforts. This occurs because individual product development groups (implementers) directly support standardization and the use of the development organizations standard's engineers has declined significantly. Individual product development groups have no history or allegiance to a specific SSO and choose to support any SSO that best fits their specific product development

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[1] This is a revised and updated version of The Principles of Open Standards, published in Standards Engineering, vol. 50, no. 6, November/December 1998. http://www.csrstds.com/openstds.html

[2] Stakeholders are those individuals and organizations that have a material interest in the technical standards development or use.

[3] The term Standards Setting Organization (SSO) refers to any and all organizations that set, or attempt to set, what the market perceives as standards. The term "formal SSO" refers to SSOs formally recognized by a government.

[4] In this paper "development organization" refers to companies that bring together research and development, production and distribution of their products or services.

[5] Andrew Updegrove, Consortia and the Role of the Government in Standards Setting, Standards Policy for the Information Infrastructure, edited by Brian Kahin and Janet Abbate, The MIT Press, Cambridge MA, 1995.

needs. Often such a fit is made by sponsoring a new SSO to address the standardization requirements of a specific developer's product implementation. As this paper attempts to explain product implementers have very different interests than standards creators. What a product implementer considers an open standard is quite different from what a standards creator considers an open standard.

Open Standards within a few formal SSOs:

The Institute of Electrical and Electronic Engineers (IEEE) web site states "For over a century, the IEEE-SA has offered an established standards development program that features balance, openness, due process, and consensus." < http://standards.ieee.org/sa/sa-view.html>

The European Telecommunications Standardization Institute (ETSI) web site explains: "The European model for telecom standardization allows for the creation of open standards:" < http://www.etsi.org/%40lis/background.htm>

The American National Standards Institute (ANSI) National Standards Strategy for the United States (2002) also uses the term, "The process to create these voluntary standards is guided by the Institute's cardinal principles of consensus, due process and openness ...." <http://www.ansi.org/standards_activities/overview/overview.aspx?menuid=3>

Many other regional and world-wide SSOs' websites refer to the desirability of openness of standardization. There is wide interest among SSOs in open standards.

Currently, formal SSOs have rules to ensure that the standards creation process supports procedures that are deemed open. As this paper will show, the same formal SSOs have few rules to ensure that procedures for the implementation or use of a standard are open. The habits formed over the last century in formal SSOs still have impact. Most formal SSOs are comfortable addressing only the standardization needs directly associated with the creation of standards and have yet to address the needs of standards implementers and users.

Exclusive Definitions of Open Standards

Joel West[6] defines ""open" for a standard as meaning rights to the standard made available to economic actors other than the sponsor." While this definition appears correct in an economic view it may be too high a level to provide useful guidance to SSOs.

Bruce Perens, author of the Open Source definition, offers a software development perspective in Open Standards Principles and Practice (http://perens.com/OpenStandards/Definition.html). He

[6] Joel West, What are Open Standards? Implications for Adoption, Competition and Policy, paper presented at the Standards and Public Policy Conference, Federal Reserve Bank of Chicago, May 13, 2004.

offers six principles and related practices. The principles proposed are: availability, maximize end-user choice, no royalty, no discrimination, extension or subset and predatory practices.

This paper attempts to identify and understand all the different types of rights that may be desired by creators, implementers and users of standard to understand what open standards means.

Open Standards, an Inclusive Definition

Open Standards is an evolving concept, molding itself to the changing needs of an open, consensus based society. Currently ten concepts are considered, at least by some, to be important parts of Open Standards. Standards are a multi-disciplinary field. The definition of open standards should function for each of the disciplines likely to use it - economics, law, engineering and social sciences. From the legal perspective, each of these ten concepts is a right for a specific group. From an economic perspective each of these rights has a cost and a benefit to specific stakeholders. This list of ten different concepts is a current one. It is likely that this list will continue to evolve in the future.

1. Open Meeting - all stakeholders may participate in the standards development process.
2. Consensus - all interests are discussed and agreement found, no domination.
3. Due Process - balloting and an appeals process may be used to find resolution.
4. Open IPR - holders of Intellectual Property Rights (IPR) must make available on reasonable and non-discriminatory (RAND) terms their IPR.
5. One World - same standard for the same function, world-wide.
6. Open Documents - all may access committee drafts (creation), completed standards documents freely available (implementation and use).
7. Open Change - all changes are presented and agreed in a public forum (allows implementers to maintain implementations) and changes may not be charged (use).
8. Open Interface - supports proprietary advantage (creation); the standard is not hidden or controlled (implementation); the standard supports planned migration (use).
9. Open Use - objective conformance mechanism (implementation) may be used without charge (use).
10. On-going Support - standards are supported until user interest ceases rather than when developer interest declines (use).

Translating this list to the six principles proposed by Mr. Perens (an engineering user perspective) gives the following:

Availability is addressed by Open Meeting, Open Documents and Open Change.
Maximum end-user choice is addressed by Open Use and the total concept of Open Standards.
No royalty is addressed by Open Change and Open Use.
No discrimination is addressed by Open Meeting, Consensus and Due Process.
Ability to create extension or subset is addressed by Open Interface.

Ability to prevent predatory practices is addressed by Open Change.

Since Mr. Perens is only addressing royalty free implementations he does not address the issue of Open IPR. Nor does he address the issue of On-going Support. The six principles proposed by Mr. Perens map well onto ten concepts of Open Standards proposed, offering one affirmative test of the applicability of the meaning of Open Standards proposed.

There are three basic areas of influence in standardization: creation, implementation and use. Each of the ten Open Standards concepts relates to one or more Areas of Influence (AoI) on standardization. There are specific economic drivers in each area of influence:

- The creation of standards is driven by potential market development and IPR issues.
- The implementation of standards is driven by production/distribution cost efficiencies.
- The use of standards is driven by the potential efficiency improvement ,due to the standard, on the user organization.

While there is some overlap among these economic drivers, e.g., market development and distribution cost efficiency, each area of influence has a distinct economic motivation. This makes it necessary to consider each area separately. The relation of the ten concepts to the areas of influence is shown in the table below and will be developed further in the remainder of this paper.

	Openness\AoI	Creator	Implementer	User
1	Open Meeting	x		
2	Consensus	x		
3	Due Process	x		
4	One World	x	x	x
5	Open IPR	x	x	x
6	Open Documents		x	x
7	Open Change		x	x
8	Open Interface		x	x
9	Open Use		x	x
10	On-going Support			x

Table 1. Creators, Implementers and Users see Openness Differently

The first four concepts are at the heart of the World Trade Organization (WTO) Agreement on Technical Barriers to Trade, Code of Good Practice.[7] The ANSI open standards concept requires the first three concepts for all ANSI accredited standards organizations.[8] The fourth concept,

[7] http://www.wto.org/english/tratop_e/tbt_e/tbtagr_e.htm#Annex%203
[8] American National Standards Institute, *Procedures for the Development and Coordination of American National Standards*, April 1998.

One World, is supported by ANSI but not required. The fifth concept, Open IPR, has been formally added to the US standards development process by ANSI and many international standards development organizations. As Table 1 identifies, these first five openness concepts are oriented to the process of standards creation. The additional five represent open standards concepts which are emerging, but not yet supported by most formal SSOs. These concepts are more oriented to standards implementation and use.

1. Open Meeting

"All stakeholders can participate," is a mantra of many formal SSOs. But this mantra does not address all desires for Open Meetings. Some formal SSOs (e.g., ITU) and many consortia have a pay-to-participate policy. Economic barriers, unless quite low (such as in the Internet Engineering Task Force, IETF, the standardization organization for the Internet) are real barriers to participation for students, many users and even start-up companies in the field. Further, as technology has become more complex, user participation in standards creation has declined. As Table 1 indicates, it is difficult for a user organization to see a greater than one benefit/cost ratio for participation in the creation of a standard. This is even more obvious when there is a significant cost to just attend a standardization meeting.

Currently openness of meetings is deemed to be met if all current stakeholders can participate in the standards creation process. This may present the appearance of a closed committee to those who are not current stakeholders - a subtle but real way that incumbent stakeholders dissuade potential future stakeholders. Too often, new or future stakeholders in a new technology are reticent to bring their ideas to a standards committee they have no experience with, or easy access to.

Ultimately, as technology use expands everyone becomes stakeholders in technical standards. Using the Internet, access to committee documents and discussion can be opened to almost all. Possibly standards development meetings should be open to all (which the IETF offers) as well as their providing open access to all committee documents. In this way, informed choices may be made about bringing new work to such a standards committee and any disenfranchised participants would feel more welcome.

Without some form of reporting, the public cannot be assumed to be aware of the standardization work. Open meetings also requires that reports of the meetings be publicly available. Supporting Open Meetings may require new rules. The news press participation in standards committee meetings has sometimes in the past been divisive, not solely due to the actions of the news press but more to the posturing of the stakeholders. Perhaps news press participation could fairly be limited to passive monitoring, rather than active participation. This appears to have worked for the IETF.

2. Consensus, and 3. Due Process

Like Open Meetings, Consensus and Due Process are considered basic by formal SSOs to the openness of the standards creation process. These concepts may even be seen as a necessary expansion of the open meeting concept. Surprisingly the IETF, which many find to be an example of a more open SSO, does not meet these criteria as the IETF Area Directors have a dictatorial level of power over the standards creation process in their area.

It is also interesting to note that the three basic requirements for open standards (as seen by formal SSOs) only address the creation phase of standardization. Formal SSOs have not addressed concepts of open standards beyond the creation phase. This is a significant omission that can only be viewed negatively by those who are more interested in the implementation and use of standards. It should not be surprising that participation in formal SSOs by those focused on implementation and use has declined precipitously.

4. Open World

Open World is the principle of unified world-wide standards. Most formal SSOs currently support, but do not require, coordination of their standards work with world-wide standards. Certainly, unifying different regional standards can be a very lengthy effort. Consider the limited progress on metrification in the USA since the passage of the "Metric Act" in 1975. A more positive, but very lengthy, example is the June 1998 approval of European Telecommunications Standards Institute (ETSI) TBR 21. TBR 21 in combination with two ETSI Guides defines the different European country variations of analog telephone systems. In Europe, for more than a century, at least 20 separate national telephone equipment markets have existed, each with 1 million to 100 million consumers. ETSI's completion of TBR-21A is now creating a single market of more than 500 million consumers. While definition of the variation is not in itself compatibility, it is a start after 100 years!

Realistically the rise of consortia, the decline of publicly funded research, aggressive commercialism and short sighted SSO management make it more difficult to achieve a single standard for a single function world-wide. The five different incompatible versions of the 3G cellular standards are an example of these effects. Considering the power of these effects, it appears likely that standardization organizations will continue to proliferate and create overlapping standards. This is less an indication of disaster, as some have suggested,[9] and more an indication of the need to increase support of Open Interfaces and the concept of adaptability (see below).

5. Open IPR

Most formal SSOs and many consortia consider that Open IPR refers to the fact that holders of Intellectual Property Rights (IPR) must make available on RAND (Reasonable And Non-

[9] Carl Cargill, Sherrie Bolin, Standardization: a Failing Paradigm, paper presented at the Federal Reserve Bank of Chicago, Standards and Public Policy conference, May 13 - 14, 2004.

Discriminatory) terms their IPR (implementation). This is only part of the issue of Open IPR as RAND is not sufficient to allow other implementers to determine the impact of standards based IPR on their costs. Other implementers must have a means to determine the exact cost of IPR before they can support its inclusion in a new standard. This effect has caused considerable delays in many standards where IPR is identified.

Jonathan Band[10] offered four different descriptions of openness relating to IPR:

> 1. Microsoft believes that interface specifications should be proprietary, but will permit openness by licensing the specifications to firms developing attaching (but not competing) products.
>
> 2. The Computer Systems Policy Project (CSPP) also believes that interface specifications can be proprietary, but will permit openness by licensing the specifications on RAND terms for the development of products on either side of the interface.
>
> 3. The American Committee for Interoperable Systems (ACIS) believes that software interface specifications are not protectable under copyright, and that therefore reverse engineering (including disassembly) to discern those specifications does not infringe the author's copyright.
>
> 4. Sun Microsystems believes that critical National Information Infrastructure (NII) software and hardware interface specifications should receive neither copyright nor patent protection.

This fourth approach is discussed further under Open Use, below

The lack of procedures in formal SSOs to support the desire of implementers to determine the cost of IPR before implementers agree to include such IPR in a new standard, is striking. The author is of the opinion that this specific issue bears some responsibility for the rise of consortia, as many consortia do require joint licensing as a condition of joining the consortia.[11]

6. Open Documents

Open Documents is the principle that all may see any documents from an SSO. In standardization practice, this is closely related to Open Meeting, above. All standards documentation falls into two classes: standards work-in-progress documents and completed formal documents (e.g., standards, test procedures, reports, etc.). Different stakeholders need to

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[10] Jonathan Band, Competing Definitions of "Openness" on the NII, *Standards Policy for Information Infrastructure*, editors: Brian Kahin and Janet Abbate, MIT Press, Cambridge, MA, 1995.

[11] Ken Krechmer, Market Driven Standardization: Everyone Can Win, *Standards Engineering*, Volume 52 #4, July/August 2000, p.15 - 19. http://www.csrstds.com/fora.html

access these different classes of documents. Standards creators do not need Open Documents as they are creating the standard document. Standards implementers who wish to support emerging markets need access to standards work-in-progress. Implementers who wish to serve the middle and later stages of the market need access to the completed standards and similar documents. Users also need access to completed documents.

The Internet Society (ISOC) supports a non-accredited standards making organization, the IETF, which has pioneered new standards development and distribution procedures based on the Internet itself. While the IETF does not meet the ANSI criteria for consensus and due process, in some ways it offers a very open standards development process. Using the Internet, the IETF makes available electronically both its standards, termed RFCs, and the drafts of such standards at no charge. In fact using the facilities of the Internet, committee discussion of the draft standards can be monitored by anyone and response offered. This rapid widespread development, deployment and implementation of IETF standards has been extremely successful.

The IETF example offers some new ideas to accredited standards development organizations. Certainly free and open access to standards work-in-progress as well as the final standards is only part of the IETF success. But it is a sufficient part that some other formal standards organizations are now doing the same.[12]

7. Open Change

Controlling changes is a powerful tool to control interfaces when system updates are distributed over the Internet and stored in computer memory. Even with the most liberal of IPR policies (Sun's recommendation in Open IPR above), Microsoft would still be able to control its operating system Application Programming Interfaces (APIs) by distributing updates to users that update both sides of the API interface. Without similar distribution at the same time, competing vendors' products that utilized the same API interface could be rendered incompatible by the update.

Realistically the only way that interfaces in such an environment can remain "open" is when all changes are presented, discussed and approved in Open Meetings. Considering today's environment of computers connected over the Internet, identifying and requiring Open Change is vital to Open Standards.

8. Open Interface

Open Interface is an emerging technical concept applicable only to more complex compatibility standards. The idea that open standards should embody such a principle is relatively new. But interest in Open Interfaces has been increasing due to the considerable success of Open Interfaces

[12] In July, 1998 ETSI announced that its technical committee TIPHON (Telecommunications and Internet Protocol Harmonization Over Networks) will make available at no charge all committee documents and standards drafts.

in facsimile (T.30), telephone modems (V.8 and V.32 auto baud procedures) and Digital Subscriber Line transceivers (G.994.1).

One way of achieving Open Interfaces is to implement a new technique termed an "etiquette."[13] Etiquettes are a mechanism to negotiate protocols. While a protocol terminates an X.200 (OSI) layer, an etiquette which may negotiate multiple OSI layer protocols, does not terminate (replace) any protocol layer function. An etiquette is used only for negotiating which protocol, options or features to employ. The purpose of etiquettes is connectivity and expandability. Proper etiquettes provide:

- Connectivity, negotiating between two devices in different spatial locations to determine compatible protocols.
- Means to allow both proprietary and public enhancements to the interface that do not impact backward compatibility.
- Adaptability, so that a communications device can offer compatibility with a different communications device.
- Easier system troubleshooting by identifying incompatibilities.

As long as the etiquette is common between the equipment at both ends, or in the middle, it is possible to receive the code identifying each protocol supported by the equipment at a remote site. Checking this code against a data base of such codes on the web or in a manual, the user can determine what change is necessary in his system or the remote system to enable compatibility.

One of the earliest etiquettes is ITU Recommendation T.30 which is used in all Group 3 facsimile machines. Part of its function includes mechanisms to interoperate with previous Group 2 facsimile machines while allowing new features (public as well as proprietary) to be added to the system without the possibility of losing backward compatibility. In another case the V.8 etiquette was used to select among the V.34 and higher modem modulations. More recently G.994.1 was used to provide a similar function in Digital Subscriber Line equipment.

9. Open Use

Open Use can have two meanings, one functional and the other economic. Further the functional meaning of Open Use has a range of meanings to the implementers and to the users. To the implementer, some means is required to assure that their implementation works as intended in a system. To support this requirement on a small scale, an interoperability event may be held (plug-fest). On a market wide scale a more objective conformance mechanism is necessary. As example, in the European Union (EU) CE marking is the manufacturer's claim that the product meets the essential requirements of all relevant EU Directives. This specific marking indicating conformance saves the user from testing an implementation in their system.

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[13] Technical Standards: Foundations for the Future, by Ken Krechmer, *ACM StandardView* March 1996

Looking at the economic aspect of Open Use, the users and implementers (independent from standards creators) have an economic interest in supporting public standards that do not promote private gain, that is, which do not require private IPR. There has been vocal support of this concept in the IETF and W3C. Yet this is a difficult concept to support. The difficulty is that innovation has been shown to be closely related to private gain. Currently innovation appears more valuable to society than private gain from public standards is repulsive.

Remuneration for the use of IPR is supported by law to motivate innovation, yet costly IPR, and the overhead associated with acquiring IPR, dissuades developers, especially smaller companies. This appears to be an area where compromise approaches are needed. A number of avenues of compromise are possible:

1. Require an independent IPR arbitration function during the creation of each standard where IPR is identified. Such an independent arbitration function could be provided by the World Trade Organization. [14]

2. Preclude IPR claims on interface standards (which define compatibility). This is basically the Sun position noted under Open IPR, above.

3. Preclude IPR claims on basic interfaces but allow IPR on proprietary extensions. This could be practical using the concepts of Open Interfaces, above.

As an example of the third compromise, consider Microsoft APIs. Assume that a basic standard PC Operating System (OS) API is created. Then any vendor could create an OS to work with Microsoft applications or create applications to work with Microsoft OS. If any vendor (including Microsoft) identified a new function (e.g., spell checking, video conferencing, etc.) that was not supported across the basic API, that vendor could then offer the new function to users that purchased the new vendor's OS and applications. Since an Open Interface supports proprietary extensions each vendor controls the way the new function is accessed across the API, but does not impact the basic compatibility of the API. In this manner a vendor is able to maintain control and gain value, based on the desirability of the new function.

As another example of the third compromise, if one vendor offers spell checking and another video conferences and most users desire both, there is incentive for these vendors to cross sell their technologies (using a cross licensing strategy perhaps) and then each vendor could create yet another desirable new function. In this manner innovation is sustained and rewarded.

10. On-going Support

[14] This use of WTO arbitration is discussed in greater detail in the Communications Standards and Patent Rights: Conflict or Coordination by Ken Krechmer in 1997 *Standards and Technology Annual Report* (STAR) from Telecommunications Industry Association (TIA). http://www.csrstds.com/star.html

On-going Support of accredited standards is of interest to standards users as it may increase the life of their capital investment. The support of an existing standard consists of four distinct phases after the standard is created:

Phase	Activity	Description
0.	Create standard	The major task of SSOs
1.	Fixes	Rectify problems identified in initial implementations
2	Maintenance	Add new features and keep the standard up to date with related standards work
3.	Availability	Continue to publish, without continuing maintenance
4.	Rescission	Removal of the published standard from distribution

It is difficult to interest users in the first phase of standards development.[15] Even the second phase of support may be of more interest to the developers than the users. The next three phases, however, are where users have a clear interest in maintaining their investment. Possibly with the advantages of the Internet to distribute standards and allow users to keep abreast of the work in standards meetings, greater user involvement in the on-going support of standards would be practical. Providing an incentive to increase users' involvement with some aspects of the standardization process may also represent new opportunities for formal SSOs. The branding from different SSOs would be more valuable to users, if the users understood that the longevity of standards they had invested in were under their control. Users might even be willing to pay SSOs for such a privilege.

Conclusions

Open standards is a basic concept deserving of more active support by all SSOs. Sometimes non-accredited organizations like to term their work "open standards"[16] when they meet few of the ten criteria identified. But most formal SSOs only meet five of the ten criteria noted. So it should not be surprising that implementers and users have taken their business elsewhere. Some industry organizations develop their specifications and procedures, etc. in an open process. That is, they allow any to participate in the process who can pay the fee, although not necessarily as equals. Microsoft developers' conferences and the Universal ADSL Working Group each offer some level of open process but certainly do not create open standards. The full gamut of open standards concepts needs greater support from formal SSOs and consortia.. Standards implementers and users deserve more support from formal SSOs.

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[15] Kenji Naemura, User involvement in the life cycles of information technology and telecommunications standards, *Standards, Innovation and Competitiveness*, edited by R. Hawkins, R. Mansell and J. Skea, Edward Elgar Publishing Limited, 1995.

[16] Compete, Don't Delete, Bill Gates, *The Economist* June 13, 1998.

The ten concepts presented here are the broadest view of the meaning of open standards visible today. Achieving lofty principles requires tireless effort. Total openness is probably impossible. But the task of open standards should be to strive towards that impossible perfection, "Where ask is have, where seek is find, Where knock is open wide."[17]

[17] *A Song to David*, Christopher Smart, 1763. This is a paraphrasing of an earlier work "Ask, and it shall be given to you; seek, and ye shall find; knock, and it shall be opened unto you." Matthew 7:7