STANDARDS AND THE INTERNET

BY

SCOTT R. DELWICHE

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Contents

Introduction

Information technology exchange is a very important facet of life to many people in the world today. The biggest contributor to information exchange today is the Internet. The Internet has grown by leaps and bounds during recent years. People around the globe are using the Internet for entertainment, information exchange, and commercial transactions. For example, Figure 1 shows the increase in the use of the Internet by adults in the United States from 1995 until the present. The worldwide trend of Internet use follows the American trend and is increasing at a rapid rate. The worldwide growth in the Internet can be seen in Figure 2. Throughout its growth, standards have been developed to help with interoperability between users throughout the world. The importance of the Internet is growing on a daily basis and therefore, some guidelines should be developed with respect to Internet standards development. Standards provide the commonality across international lines that are required for effective
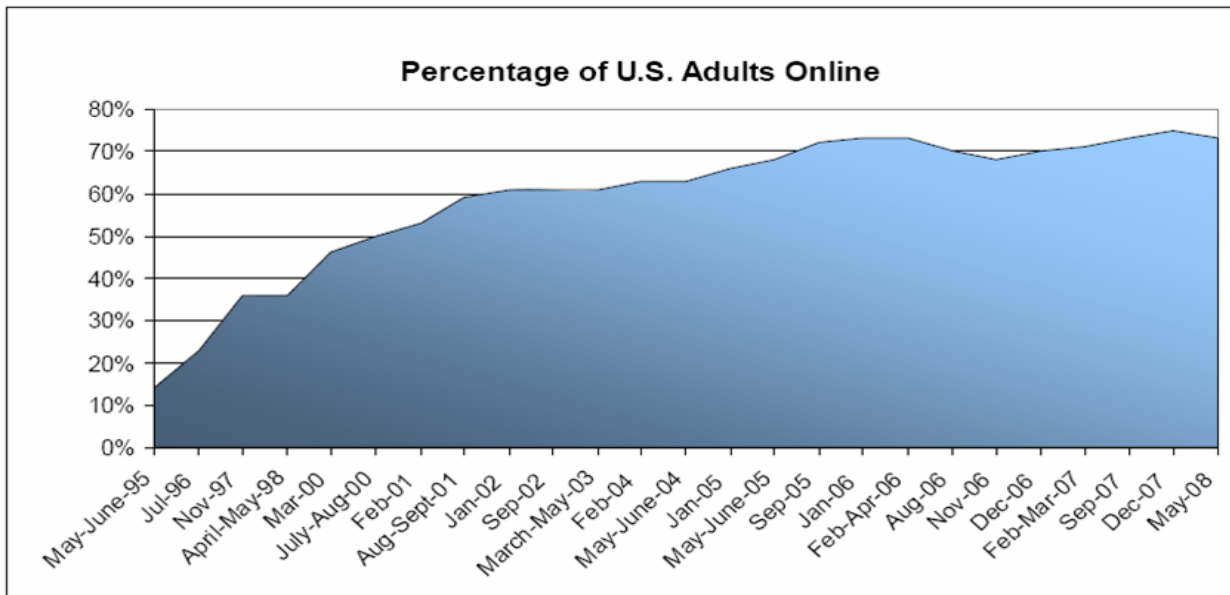

Figure 1: Percentage of US Adults Online.
Source: PEW Internet and American Life Project. "Internet Adoption." PEW Internet, July 22 2008.
http://www.pewinternet.org/trends/Internet_Adoption_7.22.08.pdf, (accessed July 23, 2008).

information exchange.

With the development of standards comes competition. It does not matter the type of product or service, standards play an important role in the world of business. The VHS vs. BETA[1] and the HD-DVD vs. Blu Ray debates were two different standards issues that were seen by everyday consumers. These two issues cost consumers in the United States millions of dollars when one standard was chosen over the other. Tho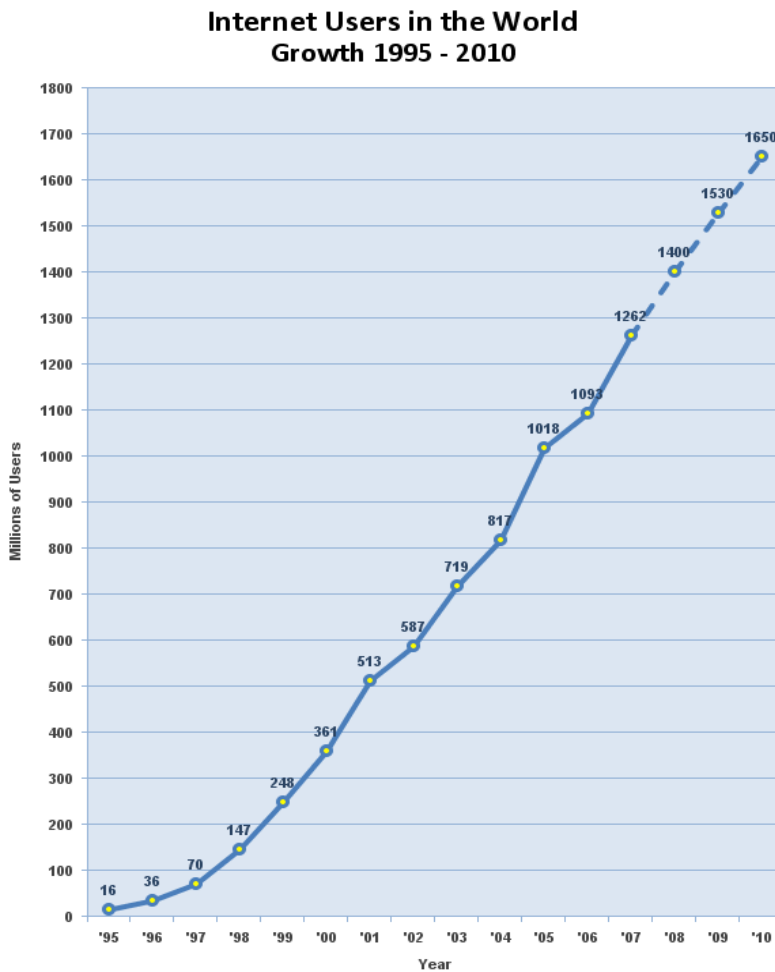se two standards issues were focused on format issues, which is at the heart of the Internet standardization issue. Standardization of the Internet is a similar situation that has the potential to cost billions of dollars, and it is one that will be felt by computer users all over the globe. On a commercial level, these standardization issues are a major concern for software developers. On a global level, these issues are important to developing nations. The

Figure 2: Internet Users in the World
Source: Miniwatts Marketing Group. "Internet Growth Statistics." Internet World Stats, January 2008. http://www.internetworldstats.com/emarketing.htm (accessed August 02, 2008).

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[1] Total Rewind. "The Format Wars." http://www.totalrewind.org/fmt_war.htm (accessed July 26, 2008).

international community must come together to formulate a standardization plan that will help ease the use of the Internet all around the world.

Types and History of Internet Standards

In the information technology industry, there are two basic categories or definitions of standards. The first category of standard is a very broad, strategic look at Internet standards. Within this category are the "de jure" and the "de facto" standards. The "de jure" type of standard is a conventional type of standard where an official body has set the rules to implement a type of technology or format.[2] An example of this is the standard used in the computer industry to display Roman characters. The standard is the American National Standard Code for Information Interchange (ASCII). The "de facto" standard is one that has become a standard by virtue of marketplace success.[3] The most relevant example of a "de facto" standard is the use of Windows as a standard desktop operating system. The "de jure" and "de facto" standards can be used to categorize all other standards.

The other category of Internet standards is at the heart of the standards debate. This type of standard is the one that affects all users of the Internet, across the globe. This is the format standard. The format standards are the ones that govern aspects of computing such as the character type displayed on a screen to the format of music that will play in a certain program. The various formats are causing software companies and developers across the world to gain a competitive advantage with the best format for a given software application.

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[2] Seltzer, Larry. "The Standards Industry." *Internet World*. April 15, 2001. http://www.internetworld.com/041501/04.15.01internettech1.jsp (accessed July 15, 2008).

[3] Ibid (accessed July 15, 2008).

The format standard can be a "de jure" standard, such as ASCII. A format can also be a "de facto" standard as in the case of the Portable Document Format (PDF). When the PDF was first created in 1990, it was designed to, "to reliably view, print, and share information… regardless of the computer's operating system."[4] Adobe Systems created the PDF format without the help of any standards organization, and people began to use this format to store digital copies of their documents. Adobe was able to control the market for digital documents by offering their PDF reader, Adobe reader, for free. This allowed for the widespread use of PDF files. From its creation in 1990 until 2005, it was the "de facto" standard for digital documents. In 2005, the PDF became an ISO standard.[5] This is a case where the market drove the standard.

Standards Bodies Currently in Existence

Like all types of industry, the Internet has competing bodies that are trying to develop and implement global Internet standards. There are government agencies, non-profit organizations, consortia bodies, standards development bodies, and multinational bodies that are contributing to Internet standards development.

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[4]   Adobe Systems Incorporated. "Portable Document Format (PDF)."
          http://www.adobe.com/pdf/about/history/ (accessed July 23, 2008).

[5]   Adobe Systems Incorporated. "PDF and Industry Standards."
          http://www.adobe.com/pdf/about/standards/ (accessed July 23, 2008).

One of the major players in the Internet standardization world is the Internet Society (ISOC). They are a multinational, nonprofit organization that was founded in 1992. Their major goal is to ensure the open development, evolution and use of the Internet for the benefit of people throughout the world.[6] Within the ISOC are different activities that work with various issues related to the Internet. There are many different bodies and groups within the ISOC such as the Internet Architecture Board (IAB), the Internet Engineering Task Force (IETF) and the Internet Research Task Force (IRTF). The hierarchy of these groups can be seen in Figure 3. The group within ISOC that deals with Internet standards is the IETF. The IETF has a very specific process for developing, researching and implementing Internet standards. The process will be discussed in depth later in this paper.
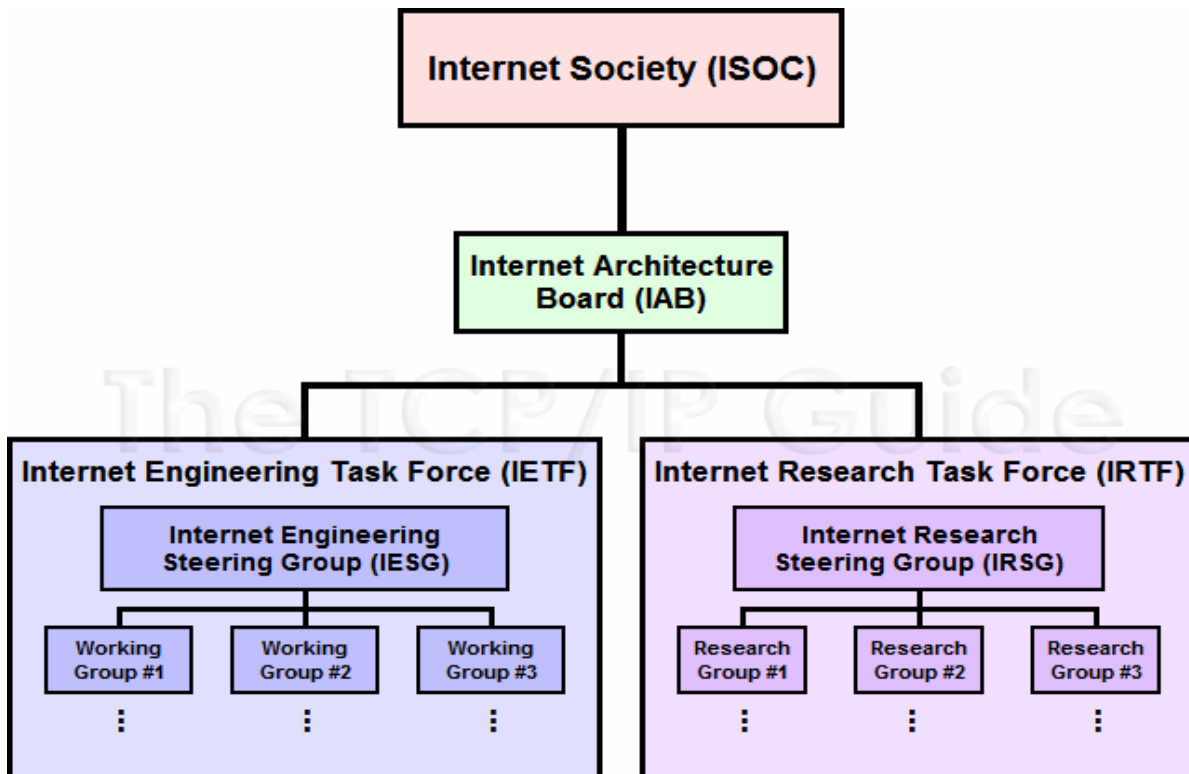
- **Figure 3: Internet Society Hierarchy**
  Source: Kozierok, Charles M. "The TCP/IP Guide: Internet Standards Organizations." TCP/IP Guide. http://www.tcpipguide.com (accessed 24 July 2008).

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[6]   Internet Society. "About the Internet Society: Introduction to ISOC." http://www.isoc.org/isoc/ (accessed July 23, 2008).

Another organization that is involved with Internet standards is the World Wide Web Consortium (W3C). Tim Berners-Lee, the inventor of the World Wide Web, created W3C in 1994 to help standardize his invention.[7] W3C is "an international consortium where Member organizations, a full-time staff, and the public work together to develop Web standards. W3C's mission is: To lead the World Wide Web to its full potential by developing protocols and guidelines that ensure long-term growth for the Web."[8] W3C
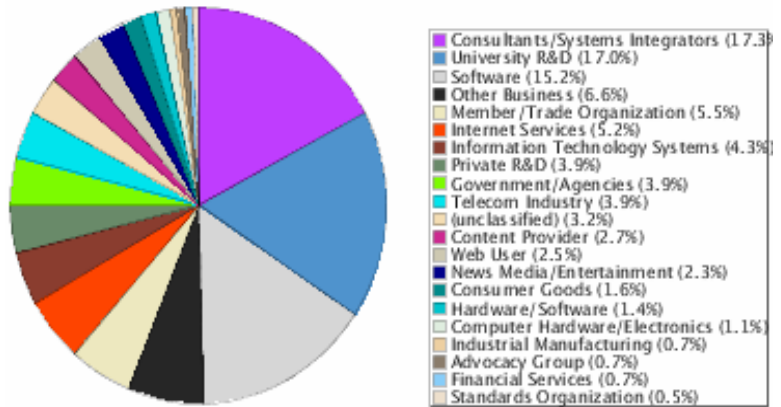
Figure 5: W3C Membership by Country Sector
Source: Jacobs, Ian. "About W3C: Organization." World Wide Web Consortium, April 12, 2008. http://www.w3.org/Consortium/org (accessed August 2, 2008).
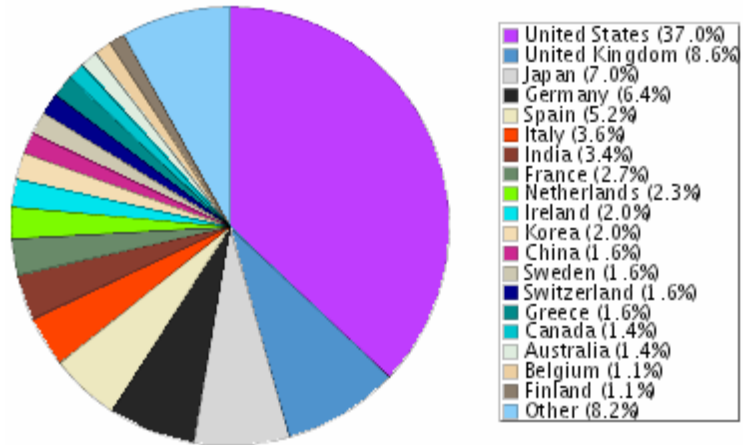
Figure 4: W3C Membership by Commercial Sector
Source: Jacobs, Ian. "About W3C: Organization." World Wide Web Consortium, April 12, 2008. http://www.w3.org/Consortium/org (accessed August 2, 2008).

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[7] World Wide Web Consortium. "About W3C: History." http://www.w3.org/Consortium/history (accessed 23 July 2008).

[8] Jacobs, Ian. "About the World Wide Web Consortium (W3C)." World Wide Web Consortium, http://www.w3.org/Consortium/ (accessed July 23, 2008).

accomplishes its mission through the creation of various web standards and guidelines. Their guidelines are known as W3C recommendations. Various companies from around the globe participate in the W3C standards development process. A breakdown of the W3C membership can be seen in Figure 4 and Figure 5.

One of the major standards bodies that deals with Internet standards in Europe is the European Telecommunications Standards Institute (ETSI). The ETSI is a not-for-profit organization that consists of members from approximately 700 organizations throughout 60 countries. The ETSI focuses on fixed, mobile, radio, converged, broadcast and Internet technologies.[9]

Another major European standards body is the European Association for Standardizing Information and Communication Systems (EMCA). The EMCA was originally created in 1961 because of the growing use of computers "showed the necessity for standardization in operational techniques."[10] The standards that are created by EMCA are accepted by many members of the European and the international communities. The EMCA works closely with other standards bodies such as ISO and IEEE. The EMCA is a "fast track" standardization organization whose motto is "Standards@Internet Speed."[11]

A major international standards body is the International Telecommunication Union (ITU). The ITU began in 1865 as the International Telegraph Union and they focused on

[9] European Telecommunications Standards Institute. "About ETSI: Introduction." http://www.etsi.org/WebSite/AboutETSI/Introduction/introduction.aspx (accessed July 23, 2008).

[10] European Association for Standardizing Information and Communication Systems. "History of ECMA." http://www.ecma-international.org/memento/history.htm (accessed July 24, 2008).

[11] Ibid (accessed 24 July 2008).

methods of communication to connect the globe. They took on their current name in 1934, and in 1947 they became a specialized agency of the United Nations.[12] One of the major mission areas of the ITU is to build an information and communication infrastructure.[13] In order to make the mission area a reality, they need to be actively involved in the standards development of the Internet, which is the newest means of global communication. Two of the ways that the ITU plays an active role is through their standardization section, the Telecommunication Standardization Sector (ITU-T), and through their involvement with the World Summit on the Information Society (WSIS).

The WSIS was an international summit that was mandated by the United Nations in 2001 by Resolution 56-183. The WSIS was to be held in two phases. The first phase was in Geneva, on 10 to 12 December 2003. The second phase was held in Tunis, on 16 to 18 November 2005. The objective of the WSIS was to, "to develop and foster a clear statement of political will and take concrete steps to establish the foundations for an Information Society for all, reflecting all the different interests at stake."[14] Government and industry representatives from over 175 countries attended the two phases.[15] A body known as the Internet Governance Forum (IGF)

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[12] External Affairs and Communication Division. "ITU's Role in Global Communications." International Telecommunications Union, http://www.itu.int/net/about/global-communications.aspx (accessed July 23, 2008).

[13] External Affairs and Communication Division. "The ITU Mission: Bringing the Benefits of ICT To All the World's Inhabitants." International Telecommunications Union, http://www.itu.int/net/about/mission.aspx (accessed July 23, 2008).

[14] World Summit on the Information Society. "Basic Information: About WSIS." International Telecommunications Union, http://www.itu.int/wsis/basic/about.html (accessed July 23, 2008)

[15] Ibid (accessed July 23, 2008).

was created by actions of the WSIS to deal with various Internet issues.[16] The IGF will act as an important body with respect to Internet standards development.

The International Organization for Standards (ISO), the American National Standards Institute (ANSI), and the Institute of Electrical and Electronics Engineers (IEE) are all major standards bodies that deal with a whole spectrum of standards issues. They all contribute to the development and implementation of Internet standards, but it is a small part of what each of those organizations perform.

Developing Internet Standards

Due to the large number of standards development bodies in existence, there are many different methods used to create Internet standards. Each standards development body develops a process that best suits its need to develop standards. This process is driven by factors such as the country that that body resides in, the number of private businesses with the organization, and the number of members within the organization.

One simple way to see a sample of how an Internet standard is created can be found by using the Internet as a tool. By using a search engine such as Google to search for "Internet Standards Process," one can perform "de facto" research on the topic. The first source of information to appear is the ISOC's Internet Standards Process. This process is performed by the IETF group within ISOC, and it is a very systematic one that encompasses the virtues of proper standards development.

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[16] World Summit on the Information Society. "WSIS Implementation Mechanism." International Telecommunications Union, http://www.itu.int/wsis/implementation/igf/index.html (accessed July 23, 2008).

The Internet Standards Process set forth by the IETF in theory is straightforward, but in practice it can be difficult and complicated. The complications arise due to creating standards of high technical quality, ensuring all interested parties come to a consensus, and ensuring that the proposed standard has utility for the Internet community as a whole.[17] These complications must be overcome to ensure that a useful standard is created. To help guide the process, the IETF has the following goals:[18]

1. Technical excellence
2. Prior implementation and testing
3. Clear, concise, and easily understood documentation
4. Openness and fairness
5. Timeliness.

These goals help to prevent the complications that arise during the standards writing process.

The development of an Internet standard using the IETF method begins when an individual or a working group writes an Internet Draft. This draft is an informal document that is placed in an Internet-Draft directory. This Internet Draft directory allows the draft to be reviewed by a wide audience of Internet users. Once in the Internet-Draft directory, it can published as a part of the non-standards track Request For Comments (RFC) series, it can be chosen to be placed in the RFC standards track, or it can be removed from the Internet-Drafts series if its status remains unchanged for more than six months.[19]

If an Internet Draft contains enough useful information to be put into the RFC standards track, then it begins to transitions through a series of maturity levels. The first level is the

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[17] Bradner, Scott O. "The Internet Standards Process." *Internet Engineering Task Force:RFC 2026*. October 1996, 2.

[18] Bradner, Scott O. "The Internet Standards Process." *Internet Engineering Task Force:RFC 2026*. October 1996, 3.

[19] Ibid, 10.

Proposed Standard. Specific action by the IESG is required to move a draft to the Proposed

Standard level. Proposed standards are treated as immature specifications, and it is required to

implement them in order to validate, test and clarify the specifications.[20] Proposed Standards

can be changed at this stage of the process.

The next stage of the Internet Standards process is the Draft Standard stage. This is a

very mature stage where at least two independent and interoperable implementations of all

options and features of the specification must occur.[21] If any features or options are not tested,

they must be removed before the specification can enter the Draft Standard stage. Once in this

stage, changes are only made to solve specific problems.[22]
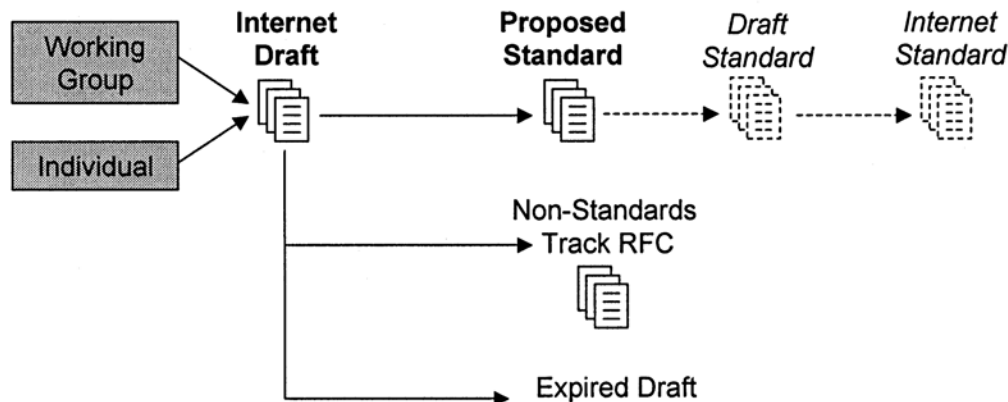
Figure 6: Internet Standard Process
Source: Simcoe, Timothy S. "Three Essays on de jure Standard Setting and Internet Standards." Ph.D. diss, University of California, Berkeley, 2004.

A specification that has been sufficiently tested and implemented is then becomes an

Internet Standard. The Internet Standard is one that has a high technical maturity and the

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[20] Ibid, 11.

[21] Bradner, Scott O. "The Internet Standards Process." *Internet Engineering Task Force:RFC 2026*. October 1996, 12.

[22] Ibid, 13.

specified protocol or service developed provides a benefit to the Internet community.[23] A figure showing this process can be seen in Figure 6.

Current Standards in Place

As previously stated, the major standards bodies throughout the world have implemented various standards that have helped determine the structure of the Internet. One of the most important standards to the functionality of the Internet is the HyperText Markup Language (HTML). HTML is the computing language that allows text documents to have a structure that can be read by various Internet browsers. The first version of HTML was written by Tim Berners-Lee during the early 1990's. HTML 2.0 and HTML 3.0 were developed by the IETF. These drafts never received an industry consensus. The newest integration of HTML, HTML 4.0, has reached an industry consensus and become a "de jure" standard by virtue of becoming an ISO Standard.[24] HTML 4.0 was developed as a W3C standard.

Another major standard used on the Internet is the Extensible Markup Language (XML). This standard, developed by W3C and later approved as an ISO standard, is one that is used for data exchange through various different software applications. It is an important standard for companies that use databases because it allows them to exchange data easily.

The Extensible HyperText Markup Language (XHTML) is a new standard for developing web pages that is currently in development. XHTML consists of all the elements in HTML 4.01

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[23] Ibid, 13.

[24] W3C Recommendation. "A Brief History of HTML." World Wide Web Consortium,http://www.w3.org/TR/REC-html40/intro/intro.html#h-2.2.1 (accessed July 23, 2008).

combined with the syntax of XML.[25] This was done in order to "cleanup" the web pages and to eliminate "bad" web pages. "Bad" web pages are ones that do not load properly in various web browsers. XHTML is a standard that is designed to be fully compatibility with all current web browsers and backwards compatible to previous versions of the major web browsers.[26] XHTML is a standard that is a current W3C recommendation.

The Cascading Style Sheet (CSS) standard is another standard developed by W3C. This standard is used to add style, such as colors, fonts and spacing, to a web page.[27] By using the CSS standard, a web page developer will make a more attractive page that is more likely to be viewed by somebody that is surfing the Internet. Additionally when developers program use the CSS standard, their work has a better chance of being viewed by someone that is using a small, handheld Internet device such as a PDA, Blackberry, or smart phone. CSS 2.1 is the current standard and CSS 3.0 is under development.[28]

Benefits of Standardizing the Internet

There are many different reasons to standardize the Internet. Some standardization bodies have financial reasons to standardize the Internet. Other standardization bodies have "good will" reasons to standardize the Internet. Each reason leads to a different type of benefit of standardization.

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[25] W3C Schools. "XHTML –Why?" World Wide Web Consortium, http://www.w3schools.com/xhtml/xhtml_why.asp (accessed July 24, 2008).

[26] W3C Schools. "XHTML –Why?" World Wide Web Consortium, http://www.w3schools.com/xhtml/xhtml_why.asp (accessed July 24, 2008).

[27] Bos, Bert. "Cascading Style Sheets: Home Page." World Wide Web Consortium, http://www.w3.org/Style/CSS/ (accessed July 24, 2008).

[28] Ibid (accessed July 24, 2008).

As the use of the Internet grows globally, the number of web browsers increases at a high rate. Currently there are over 100 different web browsers in use.[29] This is in part due to users around the world and an increasing numbers of electronic devices that can access the Internet. One of the ways to ensure that the maximum number of users can view and use your webpage is through the use of standards. Standardization will help accessibility and compatibility issues. If software developers around the globe use certain standards when developing websites and other Internet tools, then it is more likely that users of the Internet around the world will be able to use the websites that have been built regardless of the Internet browser that they use.

One tool that software developers and web page designers can use to help ensure maximum compatibility is the .html validation tool supported by the W3C. This validation tool will look at the .html code and compare it to the current Internet standards in place.[30] This will help programmers of all skill levels to design web pages with the minimum amount of compatibility issues. Michael Bloch sums up Internet compatibility by saying:

> The truth is, tailoring a site for cross browser compatibility is a pain. "Compliancy" by W3C standards by no means indicates compatibility with all browsers. But the benefits of taking that bit of extra time can pay off in the long run by allowing you to get your message across, or to secure sales from a wider customer base.[31]

Security is an important area of the Internet in which standardization is vital. As the Internet grows, the number of hackers grows in similar proportions. For example, in the first six months of 2008, 60 percent of the top 100 most popular Web sites have either hosted or been

[29] Bloch, Michael. "Articles – Cross Browser Compatibility." Taming the Beast, http://www.tamingthebeast.net/articles/crossbrowercompatibility.htm (accessed July 30, 2008).

[30] W3C Markup Validation Service. "W3C: Markup Validation Service." World Wide Web Consortium, http://validator.w3.org/docs/why.html (accessed July 29, 2008).

[31] Bloch, Michael. "Articles – Cross Browser Compatibility." Taming the Beast, http://www.tamingthebeast.net/articles/crossbrowercompatibility.htm (accessed July 30, 2008).

involved in malicious activity.[32]   Since security is a major concern for computer users, many major companies are actively involved in efforts focused on creating standards to increase security on the Internet. Microsoft noticed the need for security within programming in 1996 and stated that one of their security goals is to work "with standards bodies to ensure adoption of the best technology to meet customer needs and ensure interoperability."[33]   If the major software companies in the world work with the major standards organizations, then the Internet has a better chance of becoming more secure.

Another reason and benefit to standardization is to minimize stability issues.   As technology improves, the software that uses the technology improves as well.   Software programmers need to ensure that as they write code for web pages, it needs to be both forwards and backwards compliant. When major companies develop web pages, one programming team may develop the web page and another team may update the webpage. Standards for the Internet "offer a set of rules that every Web developer can follow, understand, and become familiar with: When one developer designs a site to the standards, another will be able to pick up where the former left off."[34]

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[32] Websense Security Labs. July 29, 2008. *State of Internet Security, Q1-Q2, 2008.* Websense. http://www.websense.com/securitylabs/docs/WSL_Report_1H08_FINAL.pdf (accessed August 2, 2008).

[33] Microsoft Corporation. "Microsoft's Support for Open Security Standards." Microsoft Corporation Technical Articles. July 12, 1996. http://msdn.microsoft.com/en-us/library/ms995340.aspx (accessed August 2, 2008).

[34] The Web Standards Project. "Frequently Asked Qusetions (FAQs): What are Web Standards and Why Should I Use them?" http://www.webstandards.org/learn/faq/#p31 (accessed July 24, 2008).

In general, standardization of the Internet will save all webpage designers both time and money due to the acceptance of their product by a multitude of web browsers. Standardization is a benefit to both the producers and the consumers.

Future of Internet standardization

The future of standardization for the Internet is an important topic worldwide. Recently in a seminar in Brussels, Neelie Kroes, the European Commissioner for Competition Policy discussed standards. Kroes stressed the important of standards in the technology sector. In order to make effective standards, the world needs, "an approach to standards that is based: on evidence, on economics, and on experience."[35] This type of approach will lead to standards that are ultimately driven by the market. Additionally, Kroes states that a well established open standards system is the key to success in the technological realm. "No citizen or company should be forced or encouraged to choose a closed technology over an open one, through a government having first made that choice."[36] Current standards bodies, such as ISOC and W3C, favor the open standards approach.

Another major issue in the world of Internet standardization that will be an ongoing challenge in the future is the standardization gap between developed and underdeveloped nations. The ITU is one of the standardization organizations that is currently working on this issue. The ITU defines the standardization gap as, "disparities in the ability of representatives of developing countries, relative to developing ones, to access, implement, contribute to and

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[35] Kroes, Neelie. "Being Open About Standards." OpenForum Europe – Breakfast Seminar. June 10, 2008.

[36] Ibid.

influence international ICT standards."[37] To shrink the ICT divide between developed and

developing nations, the ITU argues that there needs to be more developing country

representatives actively involved in the standardization process.[38] To facilitate this process, a

"Ladder of Development" was created. The "Ladder of Development can be seen in Figure 7.

The ITU feels that a well represented standards body will develop better and more applicable

global standards.

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[37] International Telecommunications Union. "Bridging the Standardization Gap (Res. 123)."
http://www.itu.int/dms_pub/itu-t/oth/06/0A/T060A0060060001PDFE.pdf (accessed July 23,
2008).

[38] Ibid (accessed July 23, 2008)..

Consequences for socio-economic development ↓ | **ICT Standardization Ladder** ↑ | **Indicators for measuring the gap** ↓

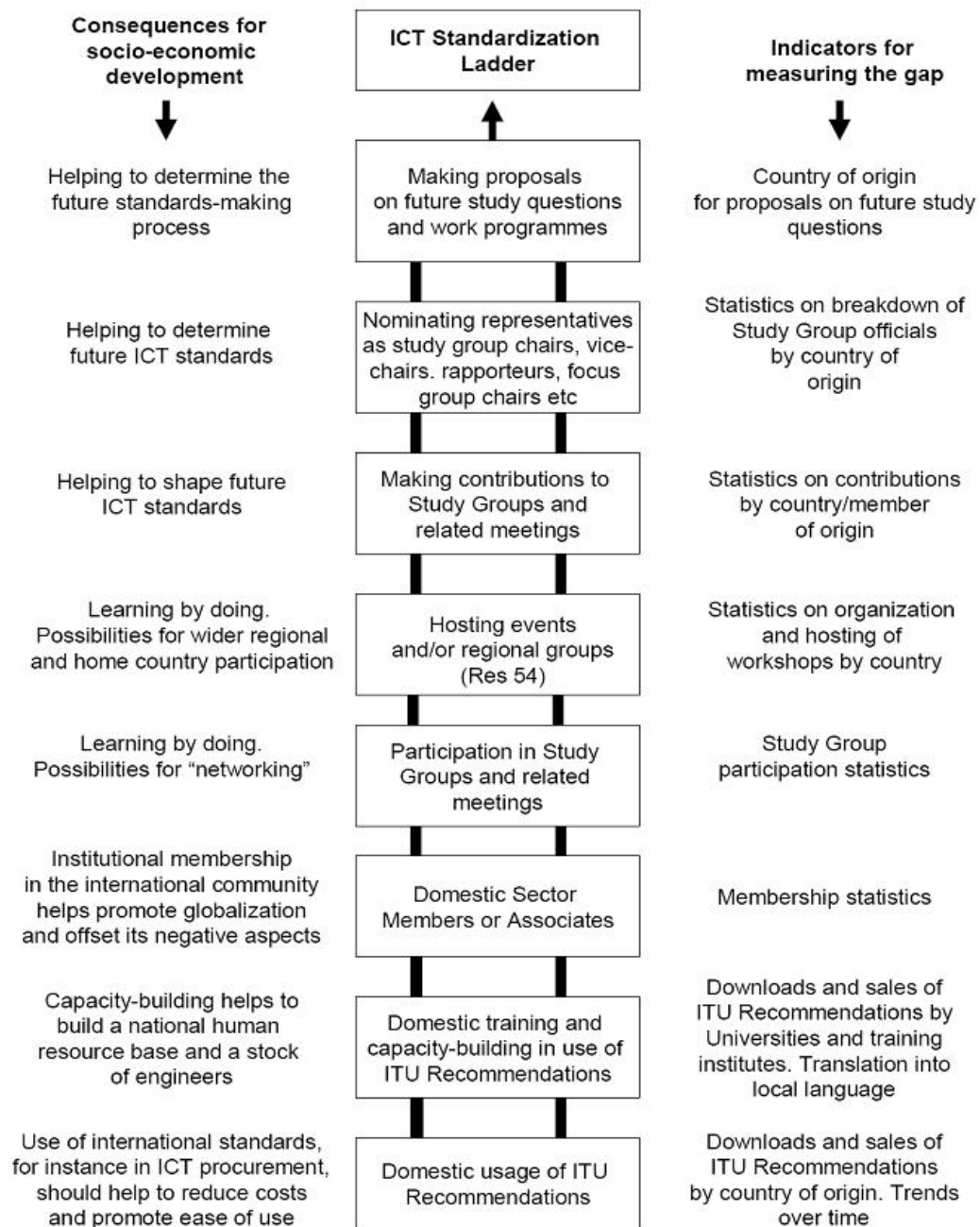| Consequences for socio-economic development	ICT Standardization Ladder	Indicators for measuring the gap
Helping to determine the future standards-making process	Making proposals on future study questions and work programmes	Country of origin for proposals on future study questions
Helping to determine future ICT standards	Nominating representatives as study group chairs, vice-chairs. rapporteurs, focus group chairs etc	Statistics on breakdown of Study Group officials by country of origin
Helping to shape future ICT standards	Making contributions to Study Groups and related meetings	Statistics on contributions by country/member of origin
Learning by doing. Possibilities for wider regional and home country participation	Hosting events and/or regional groups (Res 54)	Statistics on organization and hosting of workshops by country
Learning by doing. Possibilities for "networking"	Participation in Study Groups and related meetings	Study Group participation statistics
Institutional membership in the international community helps promote globalization and offset its negative aspects	Domestic Sector Members or Associates	Membership statistics
Capacity-building helps to build a national human resource base and a stock of engineers	Domestic training and capacity-building in use of ITU Recommendations	Downloads and sales of ITU Recommendations by Universities and training institutes. Translation into local language
Use of international standards, for instance in ICT procurement, should help to reduce costs and promote ease of use	Domestic usage of ITU Recommendations	Downloads and sales of ITU Recommendations by country of origin. Trends over time

Figure 7: ICT Development Ladder
Source: International Telecommunications Union. "Bridging the Standardization Gap (Res. 123)."
http://www.itu.int/dms_pub/itu-t/oth/06/0A/T060A0060060001PDFE.pdf (accessed July 23, 2008).

Internet governance is a standards issue that can have effects around the globe. When the Internet was first invented, there was little thought towards the standards that would shape its course. The use of the Internet up to this point in time has grown rapidly with little or no

governance. The Working Group on Internet Governance (WGIG) is a working group that was

formed by a United Nations charter in 2004. The WGIG was developed to deal with the

following issues:

1. Develop a working definition of Internet governance
2. Identify the public policy issues that are relevant to Internet governance
3. Develop a common understanding of the respective roles and responsibilities of governments, existing international organizations and other forums as well as the private sector and civil society from both developing and developed countries.[39]

Throughout 2004 and 2005, the WGIG had a series of meetings to discuss Internet

governance. A background report was written covering the issues discussed at their meetings.

In this report the WGIG stated four different Internet governance "mechanisms." These

"mechanisms" are: the forum function, global public policy and oversight, institutional

coordination, and regional and national coordination.[40] One or more of these mechanisms could

be used in effective global Internet governance. Many recommendations and opinions have

come from the WGIG document.

One specific response to the WGIG report was from EUROLINC. In their response

entitled, "Opening the Internet Standard Making," they argue that many standards are not

properly developed and that there are inherent weaknesses in the standards making process.

They believe that standards created by the IETF are screened by technical experts and require an

additional screening process for "other domain than technical."[41] The other issue that

EUROLINC has with the IETF is that the IETF is represented by mostly American companies.

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[39] Working Group on Internet Governance. "Report of the Working Group on Internet Governance." United Nations Secretary General, June 2005: 1. http://www.wgig.org/WGIG-Report.html (accessed July 23, 2008).

[40] Ibid, 10-16.

[41] EUROLINC. "Opening the Internet Standard Making." World Summit on the Information Society. August 17, 2005, 1.

This leads to technical competent standards that do not meet the needs of other regions of the world and thus "it maintains and reinforces an unfair dominant market position."[42]

Conclusions

I believe that the issue of Internet standards is one that is very important to the global market. There are many different organizations that are currently dealing with the various standards issues. The best type of standards system for this arena is an open standards system. This coupled with demand-driven standards created by the fast moving standards bodies, such as EMCA and W3C, will lead to a technologically sound Internet realm. Some form of global Internet governance is needed, but the representation at the global level should be based on the number of Internet users a country has, not just the pure size of the country. This will help the Internet become a major means of commerce throughout the world.

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[42] EUROLINC. "Opening the Internet Standard Making." World Summit on the Information Society. August 17, 2005, 2.

Appendix A: Websites of Internet Standards Bodies

American National Standards Institute (ANSI)   www.ansi.org

European Association for Standardizing Information and
Communication Systems (ECMA)   www.ecma-international.org

European Telecommunications Standards Institute (ETSI)   www.etsi.org

Institute of Electrical and Electronics Engineers (IEEE)   www.ieee.org

International Organization for Standardization (ISO)   www.iso.org

International Telecommunications Union (ITU)   www.itu.int

Internet Society (ISOC)   www.isoc.org

World Wide Web Consortium (W3C)   www.w3c.org