



Standards and Innovation: Driving Technological Progress and Global Innovation

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ABSTRACT

Necessity is the mother of all inventions- goes a saying! The same applies to technology and particularly things produced by companies which have the entire world as its audience. This paper reviews and explores the role of standards and emphasize on how they benefit the society and help spur innovation in the various fields resulting in making life easier for the common man. It begins by defining standards and explaining their need, various types and how standards and innovations have formed a mutual relationship over the years to help maintain and develop each other. Furthermore, the paper focuses on two of ANSIs main standards followed by several other standards that served as a milestone for US economy. Thus, what is eye protection and smart grid standard, how it came into use and how it finally helped the whole globe collectively are been illustrated Standards are often derived from innovative technologies and innovations are spurred by standards, thus making it a mutual relationship, the profiteer of which is none other than the consumer, The presence of standards helps benefit the industry and society at large. This paper focuses on how standards in the industry have helped develop a competitive atmosphere where companies look to outclass their competitors in terms of their products, with the aim of securing a higher market share. Benefits of standards on innovations are much higher as compared to the limitations imposed by them. To strongly assert the points presented, practical survey was conducted and the final assessment of these were jotted on the paper. In sum, this paper helps demonstrate how competitiveness has led to new innovations and how pre-defined standards have motivated this globe to look for new avenues of research in terms of the technologies, thus contributing to innovations in technology and helping make life easier.

Keywords: OSI, ANSI, Standards, Innovation, Smart Grid technology, Internet

INTRODUCTION

The credit of development of new technologies and the advancement in the preexisting has been duly • attributed to Innovation. As innovation takes place giving rise to several new technologies and advancement in the preexisting one, there is a need for a standard which will help overlook this advancement and thus set a benchmark for performance, safety and conformity of the newly invented products or processes. Standards promote the use of an open architecture thus making the consumer independent of the brand of the product they are using and allowing him to opt for the best type of product or system depending on their requirement and budget. The very first thing that a person in the networking profession learns is the Open System Interconnection (OSI) model. ANSI's major contribution in developing this standard was remarking. There have been several standards developed by ISO after the OSI model which were much more advanced in comparison, and which are widely used today as compared to the 051 model.

So why does the OSI model still remain such an important aspect in the networking domain? The answer is - It has a simple layered approach [1]. Every step of data flow is studied and explained so well that over time it has gone on to become the backbone of the networking profession; A simple technology which has contributed to several major endeavoring tasks and inventions. Standards make a positive contribution to the world we live in. They facilitate trade, spread knowledge, disseminate innovative advances in technology, and share good management and conformity assessment practices.

Standards provide solutions and achieve benefits for almost all the sectors of activity, including agriculture, construction, engineering, manufacturing, distribution, transport, medicine, information and communication

technologies, the environment, energy, quality management, conformity assessment and services. ISO only develops standards for which there is a clear market requirement.

Standards benefit end consumers by safeguarding their interests and by ensuring that the products and services they purchase are safe and reliable. In general there are 3 different types of standards [2].

A. Fundamental

This is a primary tool for measurement, measurement are done against it.

B. Perspective

This standard is used to perform tests and process in a consistent and repeatable way.

C. Inter-operative

This standard follows a fixed format in which the result and the method are not fixed.

There are few categories in which the standards are divided [2]:

A. De-Facto Standard

Such a standard lacks formal approval from an authorizing body but is widely recognized and followed.

B. Regulatory Standard

They are created by regulatory agencies to ensure uniformity.

C. Consensus Standard

Standards developed voluntarily by organizations.

Likewise, ANSI has played a tremendous role in forming some efficient standards like ANSI C, FORTRAN, Page standards, etc...[3]. But out of these the Eye Protection standard and Smart Grid technologies were remarkable.

FROM OSI TO TCP/IP: A STORY OF INNOVATION IN NETWORK COMMUNICATION

The OSI model was introduced in the late 1970s by the International Organization for Standardization as a model of communication between various computers and networks [4]. It was the modular nature of the OSI model with seven levels that made it very useful and was what spurred industry innovation [5].

The OSI framework was intended to create a unified way to talk between different computer systems and networks to help create interoperability and support the creation of a fully interconnected digital world. The modular focus of the model and the separation of network functionalities into layers enabled layer-level customization in every layer, without distorting the overall flow of communication. This modularity enabled the expansion and development of the internet because new technologies and protocols could be built into the existing system without disrupting the whole.

After its release, the OSI model had become a critical foundation of standardized network communications, by setting forth an easy to understand and formatted way that computers and networks could communicate with one another [4]. In defining what each layer was responsible for, OSI made it possible to build proprietary protocols and technologies that could be integrated into the flow of communications. This modularity allowed for creativity and enabled the internet to adapt to new technological demands over time.

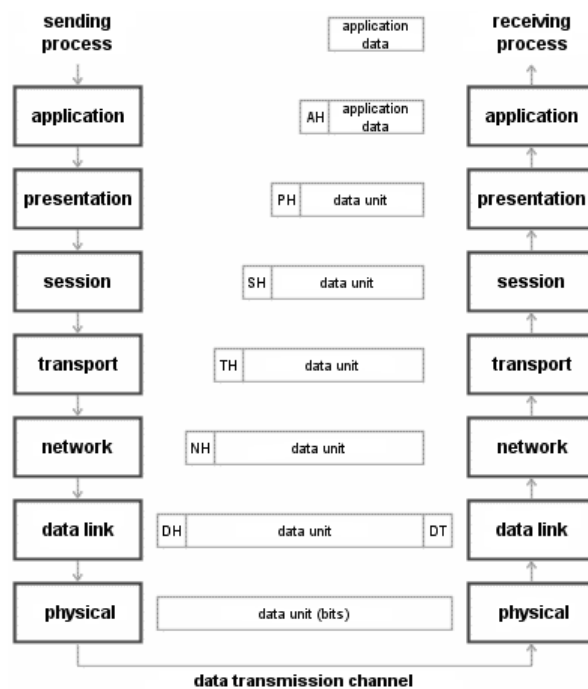


Fig 1. Open Systems Interconnection (OSI) Model [6]

A. OSI Model Layers

The OSI model has 7 layers, which have different functions and tasks. The Physical Layer will be handling physical traffic over a physical transport mechanism like cable or fiber, while the Data Link Layer is responsible for the secure movement of data frames. The Network Layer handles data packet routing and addressing that make them connect to multiple networks [7]. The Transport Layer handles the entire transmission of data across the transport and ensures the integrity and trustworthiness of the data.

The Session Layer creates, stores and synchronizes the communication between applications, and Presentation Layer formats and encodes data to facilitate cross-system interoperability. Finally, the Application Layer is where end-user applications interact with the network resources and services [7].

B. The innovativeness of the OSI model

The modularity of the OSI model with the transparent separation of functions over seven layers made the OSI model a key driver for industry innovation. By facilitating dedicated development within each layer, the OSI model was able to quickly bring forth new protocols, technologies and applications without having to replace the whole communications system.

This modularity allowed new technologies and protocols to be woven into the existing network environment in a way that could be adapted and evolved over time as user requirements and technology evolve. The OSI framework also enabled strong and scalable network design, since the modular architecture enabled the use of specialized solutions at each layer. This created an open, competitive landscape, in which engineers and scientists could focus on specific network improvements without being held to the standards of monolithic system [8].

C. Innovation enabled by OSI Model

The invention of the TCP/IP protocol suite: The TCP/IP protocol suite, inspired in part by the OSI model of network communication, enabled a world of true interconnection to exchange information and enable the spread of the digital economy.

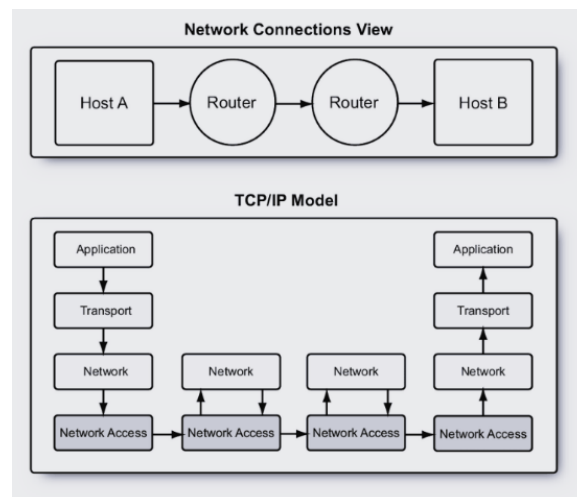


Fig 2. TCP/IP Reference Model [9]

One other area in which the OSI model has made a significant contribution is wireless sensor networks [10]. This is made possible through the modularity of the OSI model that enabled us to create such networks and integrate specialized protocols and technologies within each layer without losing overall consistency of communication.

The OSI model's innovation accomplishments are even manifest in modern network security protocols, including SSL/TLS, which harness the layered nature of the model to deliver safe communication between applications and end users [11].

EYE PROTECTION STANDARD

Way back in the pre 19th century when there were no goggles, people use to work in all types of threatening environments like radio rooms, with naked eyes. Even if one needs to study astronomy, the thickness or the index of the telescope lens was not at all defined. This served a major problem as proper calculation of the glass index; type was not defined for a particular use.

A. ANSIs role in defining the standard

Eye protection is protective gear for the eyes, which comes in many types depending upon the threat that is to be reduced [12]. The threats can be particles, light, wind blast, heat, sea, spray anything that can cause an injury. But every protective gear needs to be checked before use as it should sustain the dangerous rays' one looking to resist. Thus ANSI defined a standard for eye protection in each type of environment possible [13][14].



Fig 3. ANSI approved goggle [14].

Depends upon the ray intensity it specifies a time limit after what you need to again check the gear. Every lens undergoes specific predefined tests in order to verify the quality and the protective shield it can generate. After its approval the product is released in the market.

B. Verification tests

The current edition of the standard is X87.1–2003 [12]. They define two levels of protection for basic and high impact lenses. Basic Impact lenses must pass the "drop ball" test where a 1" diameter steel ball is dropped on the lens from 50 inches. High Impact lenses must pass "high velocity" testing where 1/4" steel balls are "shot" at different velocities [12]. According to the standard velocities defined for Spectacles and Goggles are 150 ft./sec and 250 ft./sec respectively [12]. Though the standards do not define a minimum thickness limitation, a small thickness is always kept even for an extreme high performance index lenses.

C. Standards benefits

The radiations are so harmful that they produce a DS break in the DNA cell to kill the cell. It interacts with c-water to form hydroxyl ion which is unstable compound [13]. Acute direct radiation may cause permanent loss of vision. According to the statistics it reveals that there is a sudden improvement in the injury ratio from the year 2006 to 2012 after this standard came into existence. This led to a sudden improvement in number of workers working in various radio—active industries thus helping the US economy to grow.

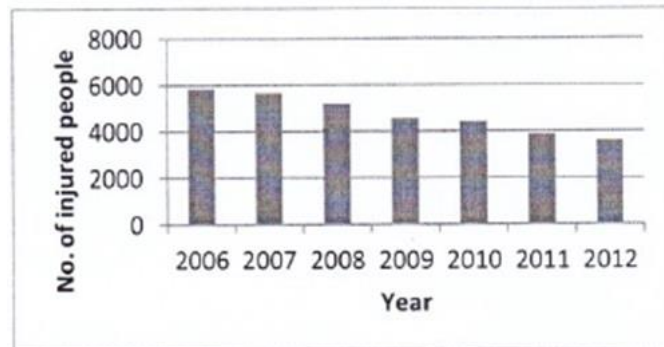


Fig 4. Total Fatal injuries from the year 2006- 2012

SMART GRID STANDARD

A smart grid is an interconnecting - electrical web that uses computers and other technology to gather and share information. It includes information about the behaviors of consumers and suppliers, in a well-organized fashion to improve the efficiency, reliability, distribution of electricity and sustainability of the production [15].

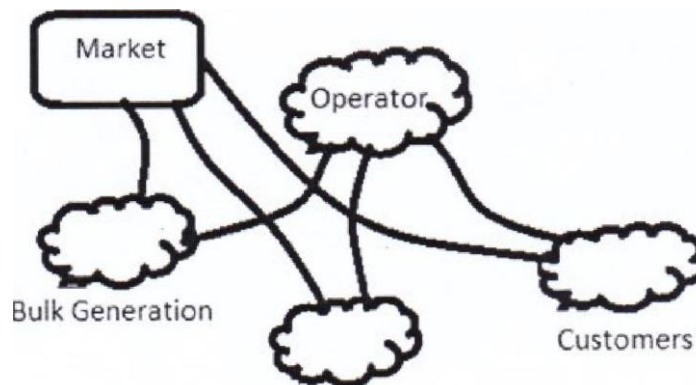


Fig 5. Smart Grid technology

Earlier in 1860s when the grid concept came into force it was just centralized unidirectional power control system. Later on, after further revisions, this unidirectional power control was upgraded into bidirectional. This led in building of lot more interconnected central control stations near the power generating hubs like hydroelectric power station. Finally, metering made the human life more comfortable, as it defined day and night fixed tariff for the electric usage.

This grid was finally termed as "smart grid" later in 1998 when the meter actually helped recognize the actually tariff by analyzing the electric usage per customer.

A. Benefits to the society and US economy collectively

This metering helped both the customers as well as the grid operators. Customers are able to see their electrical usage in detail as well as the current price of electricity, so they naturally remain aware and can have full control on their usage [16]. Also, it helps the grid operators, as metering helps them to find out if there is some problem in the connectivity. This has overall improved stability. Finally, the world requires a sustainable global outlook to tackle problems which are not specific to a certain economy or a certain region, such as Global Warming, deficient supply of food-water, shelter and health care facilities [17]. It would require the economies of the entire world, which would include governments and companies to come together to make a social impact on a global stage so as all the citizens of the world can benefit from it.

US ECONOMY STEPPED UP

There are a total of 132 companies in USA which are listed as fortune 500. Companies such as Apple, Microsoft, Google, and Cisco are companies for who research and development is a backbone to success. Each of these companies are leaders in their respective domains, still they end up crossing each other's way because of the competitive environment. American's are at the forefront when it comes to using the best of technology - from a smart phone to high speed internet. The average internet speed in the United States is 14.15Mbps whereas economies which are less developed such as India, have an average internet speed of 2.34Mbps, based on a survey conducted from 2010-2012 [18]. The same trend can be observed in the graph below. The development of an economy is proportional to the amount of money the country is able to put into developing new technologies. Standardization increases competition which may or may not results in profitability for all companies, but it leads to the overall development of the economy.

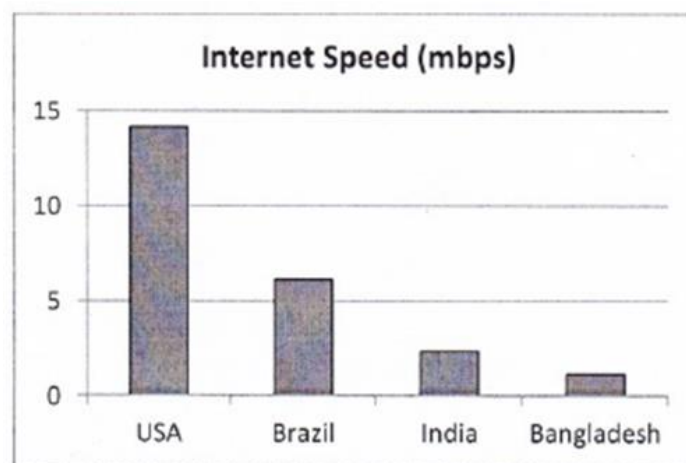


Fig 6. Comparison of Internet speed in various countries

Mr. Joe Bhatia, President and CEO of the American National Standards Institute have described how US industries have adopted standards in the following way "It is the market itself, through an open, consensus-based process that determines when a standard should be developed [19]." It is a vicious cycle wherein the economic growth of a country empowers its citizens to better facilities which in turn helps in development resulting in increased productivity.

CONCLUSION

The paper studies how standardization has given a new perspective to this technological world. The analysis highlights insightful features of the two main ANSIs standards smart grid technology and Eye protection standard as well as the OSI standard by International Organization for Standardization. Furthermore, after careful examining the survey results, it is found that the various loopholes which were present earlier are overcome. To conclude, international standards promote economic growth irrespective of the region by providing the world with a common benchmark for research and development which helps in increasing global productivity.

ANALYTICAL ASSESSMENT

I have made a practical research on the standardization needs by personally visiting the ISI Institute, Mumbai. After getting known to the concept, I further investigated the impact of the ANSI standards in bringing up the society out of which Eye protection and Smart grid were found to be extraordinary. I have analyzed the influence of OSI model in internet protocol, by exploring the evolution and development of networking technologies. The insights I have gained, support the fact that the OSI model has created a lot of innovation in applications across the enterprise and has made the current internet. Last but not the least, standardization have progressively helped US in strengthening their economy in such a way that the citizens of the economy lead a life made easier with the use of technology.

REFERENCES

- [1]. Ray Denenberg, "Open systems interconnection; A special issue of Library Hi Tech", Library Hi Tech, Vol. 8 Iss: 4, pp.7 —14, Oct 11, 2008.
- [2]. "Standard," Wikipedia, July 2012.
- [3]. Robinson, G.S., "ANSI's role in standards development", Journals & Magazines, Volume 17 Issue 6, Nov/Dec 1997.
- [4]. C. Ware, "The OSI network layer: Standards to cope with the real world".
- [5]. G. Ellis, S. Dillon, S. Stritter and J. Whitnell, "Experiences with a Layered Approach to Local Area Network Design".
- [6]. S. Koo and S. Kwong, "Teaching Computer Communication Networks: Top-down or Bottom-up?," S2H - S2H, 2005
- [7]. R. DesJardins, "ISO open systems interconnection standardization status report".
- [8]. S. Ratnasamy, S. Shenker and S. McCanne, "Towards an evolvable internet architecture".
- [9]. I. Anantavrasilp, "Supervised Machine Learning Assisted Real-Time Flow Classification System," 2010.
- [10]. D. D. Clark, "The design philosophy of the DARPA internet protocols".
- [11]. T. Buffenoir, "Security in the OSI model".
- [12]. Summary of ANSI Z87.1-2003 Industrial Eyewear Impact Standard, <http://ww-w,safetyglasse.susa.comiansiz8712003.html>, 2003.
- [13]. Occupational Safety and Health Standards, United States Department of Labour, http://www.osha.gov/p1s/oshaweb/owadis/show_document?p_table=STANDARDSdcp_id=9778, April 6, 1994.
- [14]. EyeSmart Protective eyewear, <http://www.geteyesmart.org/eyesmarilliving/protective-eyewear.cfm>, 1996.
- [15]. Erich W. Gunther and Aaron Snyder, "Smart Grid Standards Assessment and Recommendations for Adoption and Development", February 2009.
- [16]. Smart Grid Features, <http://ansidotorg.blogspot.in/2011/11/smart-grid-features.html4axzz22BnECZ2o>, Nov. 23, 2011.
- [17]. Household Download Index, <http://www.netindex.corrildownloadiallcountries/>, Jan. 29, 2010.
- [18]. "Smart grid," Wikipedia, July 25th, 2012.
- [19]. Voluntary Consensus-Based Standards Promote Competition, Economic Growth, Witnesses Say, <http://science.house.gov/press-release/voluntary-consensus-based-standards-promote-competition-economic-growth-witnesses-say>, Feb 29, 2012.