The Importance of and a Comparison of Standards Development Organizations in the Ubiquitous Society

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Abstract
The growth of the number of places where technology standardization takes place, and the complex relationships among them, pose challenges for participating actors such as companies and governments. Additionally, it takes considerable resources and capabilities to participate in all Standards Development Organizations (SDOs). Some SDOs have been more effective and efficient in standardizing technologies than others. For this reason, actors need to evaluate and analyze different SDOs to select the appropriate SDO(s) for them and to strategically position themselves in standardizing technologies, so that they can gain more competitive positions in the ubiquitous market. However, it is surprising that there have been relatively few studies analyzing different SDOs. Thus, this study aims to gain insight into the differences and similarities between the methods used at four important international SDOs – IEEE, IETF, OMA, and ETSI – and how these methods are judged by participants. These insights can help governments and companies to develop policies and strategies for SDOs in this changing environment.

Keywords: Standards Development Organization, ICT standards

Introduction

There is little doubt that Information and Communication Technologies (ICT) have been a backbone of the ubiquitous society. Due to the complexity of technologies and systems, many actors from different industries, including consumer electronics, telecommunications, and information technology networks, as well as governments must work together to standardize components, technologies, and systems. In this way, they can provide seamless products and services as a whole in a ubiquitous society. For this reason, the demand for standardization processes increases and became more and more heterogeneous, because the actors involved have different (and at times conflicting) aspirations and interests. As a result, the number of consortia and forums for technology standards has increased over the years.

Standardization institutions have different procedures and regulations, and thereby answer to more or less variable demands. This study aims to gain insight into the differences and similarities between the methods used at four important standardization bodies, and how these methods are judged by (potential) participants. These insights can contribute to the development of good government policy and competitive organizational strategies in standardizing ICT.

Methods

This study was conducted between December 2007 and February 2008. Data collection was done by desk research, focusing on academic and non-academic papers discussing the functionalities and structures of the various SDOs. In addition, six semi-structured interviews were held with Heads of Standards of ETSI members, in the Netherlands, Brussels, and the United Kingdom. We asked our interviewees to talk frankly, not as representatives of their firms, in order to get a genuine view on how SDOs work and how they can be improved.

This study is a quick scan. Best practices are, to a large degree, determined by what people think. Given the number of interviews we did, we cannot claim to be complete or representative. Still, having chosen stakeholders from different actor groups (equipment manufacturers, network operators, public bodies) and including firms with a different background of technological preferences (both ‘bellheads’ and ‘netheads’), we believe we include the most relevant perspectives and do not give preferential treatment to one perspective at the expense of the others – except, possibly, for smaller firms. It is also useful to note that there was a surprising degree of consensus about many of the issues discussed in this report, despite differences in perspective.

Being a quick scan, this research heavily relies on a limited set of interviews. We do not aim to present a fully representative or authoritative view, we rather aim to provide interesting and valuable views about the current state of affairs of SDO’s in the field of ICT.

Brief introduction to four major SDOs

This chapter introduces four SDOs in the field of ICT standardization, namely IEEE, IETF, OMA, and ETSI. Although there is a very large number of standards bodies working in ICT (some firms are members of more than 150 of these), we selected these four because they are often seen, in their own ways, as presenting interesting and successful approaches towards standardization. All four have a track record of producing at least some widely adopted standards. We also aimed at having variety in our sample of SDOs.

Below, we will give a short introduction of these bodies. In the next section, we will see how these bodies are valued by stakeholders and in the literature. We do not use a fixed format, but instead focus on the issues that are particularly interesting for the SDOs in question. For the same reason, some SDOs will be discussed more extensively than others.

IEEE

Originally called the Institute of Electrical and Electronics Engineers, the organization broadened its activities in such a way that it no longer uses this name but has kept its initials. It was founded in the 1960s, but its ancestors date back to the late 19th century. IEEE's Constitution defines the purpose of the organization as *"scientific and educational, directed toward the advancement of the theory and practice of electrical, electronics, communications and computer engineering, as well as computer science, the allied branches of engineering and the related arts and sciences.*[1] *"*

IEEE is not only a standards body, but also conducts various other activities. Arguably, it is best known as a journal publisher: the organization claims that it produces 30 percent of the world's literature in the electrical and electronics engineering and computer science fields, publishing over 100 peer-reviewed journals.[2] It also sponsors or co-sponsors more than 300 international technical conferences each year.

Formal rules are defined in the IEEE Constitution, the IEEE Bylaws and the IEEE Policies [1]. This set of documents was last updated by the IEEE Board of Directors in November 2000. More detailed information is also available in the IEEE Standards Association Operations Manual [2].

Standards-making in IEEE takes place in the so-called IEEE Standards Association (IEEE-SA). In 2005, IEEE had about 900 active standards, with 500 standards under development.

IETF

The Internet Engineering Task Force, originally a U.S. government activity, develops and promotes Internet standards, in particular the TCP/IP protocol suite. It was established in 1986. Initially only government-funded researchers participated in its activities, but in 1991 its doors were opened to any interested party. The TCP/IP protocol is possibly one of the most widely used and successful protocols in the world, and is also the basic building block for many other system standards, such as 3GPP.

In many respects, IETF is completely different from other SDOs in the field of ICT. One such example is its membership rules. Involvement and contribution to the IETF processes is on an individual basis. There is no such thing as a formal membership or membership environment. People become active in IETF by participating in discussions on mailing lists, contributing drafts on technology, or simply showing up at meetings. As put by some: "Technical competence is the only requirement for contributing; there is no such thing as membership". Also, there is no formal voting mechanism: IETF uses the principle of 'rough consensus.' IETF's current shape and practices are, in large part, the result of the rather specific culture and attitude of the individuals that were involved in the early development of the Internet.

OMA

The Open Mobile Alliance was created in 2002 as the consolidation of the WAP forum and the Open Mobile Architecture initiative. Since then, six other (smaller) fora that also aimed at developing applications protocols have merged into OMA, including the Location Interoperability Forum (LIF), the Wireless Village (focused on instant messaging and presence), the SyncML Initiative (focused on data synchronisation), the Mobile Games Interoperability Forum, and the Mobile Wireless Internet Forum. OMA clearly positions itself to be technology-agnostic: the protocols it develops should run on any type of network, such as GSM, WCDMA and CDMA2000 [3]. By also being independent of any specific Operating System (OS), OMA strives for true interoperability.

Membership is limited to companies, and OMA defines four categories here: Mobile Operators, Information Technology Companies, Wireless Vendors, and Content Providers. With some 400 members, OMA attracts considerable attention. More importantly, it gathers a rather fair representation over the full value chain (including content providers, for instance), making it distinct from many other SDOs [4]. There are several membership levels (sponsor, full member, associate member, and supporter). The sponsor level secures a position in OMA's board, though this comes with a US$140 yearly fee.

ETSI

As the body that produced the successful GSM standard and one of three SDOs officially recognized by the European Commission, ETSI is probably the best-known

[1] Source: http://en.wikipedia.org/wiki/Ieee.

[2] See http://www.ieee.org/web/aboutus/today/index.html.

ICT-related standards body in Europe. It was established in 1988. At the time, the standardization of GSM was in fact already well on its way within CEPT, the European body of telecommunications administration, but it was desirable to take GSM development out of CEPT and bring it into a newly established body. This would allow for a balanced involvement of all stakeholders (industry, for instance, was formally not allowed to participate in CEPT) and could serve as a basis for future European ICT standardizations.

Nowadays, ETSI has approximately 700 ETSI member organizations, from some 60 countries world-wide. The institute focuses on *'[...] Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies.'*[3]

Analysis and findings

In this section, we discuss the findings from our interviews, complemented with evidence from the literature. This chapter is topic-based, where the selection of topics was prompted by the issues that were deemed most relevant during the interviews.

The topics include:

- Overall assessment of performance, quality and relevance of output
- Membership, admission, and joining decision by actors
- Role of interoperability (testing)
- Initiating new work
- Third-party specifications as input to standard-setting processes
- Organization and secretarial support
- Decision-making structure and sensitivity to 'gaming' or abusing the system
- IPR policies
- Services provided to consortia and fora and collaboration with other SDO's.

However, in this short version, we will just include the first two topics due to the page-limit.

Overall assessment of performance, quality and relevance of output

Performance is a multi-faceted construct, and there are many different dimensions in evaluating the performance of one body compared to another. Also, performance might not only be related to factors that are endogenous (internal) to the SDO, but also may be affected by exogenous (external) factors such as features of the application area the body is focusing on. Finally, it must be noted that the assessment by any member may be strongly influenced by the type of actor (operator, supplier, public body) that it is and by the individual positioning of that actor in the field.

Nevertheless, we did look both in the literature and the interviews for the way the four bodies are assessed by users.

Relevance of the work of the standards body

All the bodies we studied have, at least at one point in time, been of very high relevance to the telecommunications community (in fact, this was an implicit element in their selection for this study), which is the backbone of ubiquitous society. It is interesting, however, that this relevance is currently changing. Overall, our interviewees stressed the current high relevance of IEEE and OMA, which are developing the standards and technologies that are of high importance in the next few years. More negative signals were given about the relevance of IETF. Although no one denied the importance of its TCP/IP protocol stack, it was generally believed that not many new, important things were happening there. This is possibly the result of many incumbent players – especially the 'bellheads' – feeling uncomfortable with this body and their relative lack of influence in it, and therefore bringing their activities elsewhere. Whatever the reason, IETF was regarded as becoming less important, even by the more 'nethead' firms we talked to. *"Other bodies are producing more relevant things that complement the existing IETF standards."*

ETSI is a somewhat special case here. Although all the people we interviewed are strongly involved in ETSI, their view on the current relevance of ETSI was highly critical. One large operator, in the course of planning a NGN network, even commented that ETSI has become a tier-2 SDO for them. Others also argued that, looking at their current needs for standards, ETSI was not particularly relevant and its pipeline did not seem important to the market either. 3GPP is still relevant, but not so many ETSI activities are of focal interest to its members and stakeholders. The perception of losing importance is a worrying sign.

Academic input in the standardization process

Academic input in the standardization process can be valuable and is generally considered a plus. IEEE is generally seen as *the* example for this, whereas ITU and ETSI are recently taking action to improve academic input.

However, the role of academic input should not be over-estimated. It is often overlooked that participation by academics is also often problematic. They embrace academic arguments, which may result in solutions that are elegant from an academic viewpoint but are not necessarily pragmatic or cost-effective. Also, academics often do not care about the speed of development, and can favor their own designs or ideas at all costs, coming in with totally new designs or ideas, when it might be more rational to build on or integrate into existing things (even if they are not as optimal as something designed from scratch). The knowledge of academics (and often, for that matter, also of the research labs of suppliers) is pretty far from the practical technical issues that are at stake when developing

[3] Source: http://www.etsi.org/WebSite/AboutETSI/AboutEtsi.aspx.

standards. It has also been stressed that the very strong academic role of IEEE as a conference organizer and a journal publisher does not necessarily mean that the academic contribution to the standardization activities of IEEE is equally high.

Of course, there are exceptions. Our interviewees mentioned positive examples of individuals such as Scott Bradner (professor at Harvard, and very active in IETF), and institutions such as the University of Texas that has conducted valuable work in the IEEE context on the behavior of radio LAN systems at the edge of radio coverage.

The more critical views of the interviewees on academic input is in line with recent studies on the link between academic research and standardization. The FP6 INTEREST study has shown that academic input is valuable in some specific situations, but generally hard to realize due to several incompatibilities [5].

Speed of process

It is an often-heard claim that formal SDOs are slow in delivering. That is – at least in part – the explanation why firms go to other types of standard-setting organizations, such as fora and consortia. Although our interviewees considered speed (or better: good timing) very important, the often-heard claim of the 'old', formal SDOs being slower in developing standards than consortia and other newer type of organizations has become a myth. A good example is the Session Initiation Protocol (SIP); its development in IETF took longer than many comparable standards in formal SDOs. Particularly for IETF, it has been commented that it is '[...] claimed to suffer from low speed when either (1) the number of volunteers is too low and (2) when there are too many volunteers, with too many different opinions.'[4] One interviewee explained: '*Consortia allow you to make speed, which is very important: the timing of the SDO's output is key to the business success. However, this does not mean that consortia are always made of like-minded organizations. Also in consortia, you have many different types of actors, representing different interests. However, the risk is considerably lower that there are participants who deliberately try to delay or block the standardization effort. There is really less gaming (instead, groups already divide before and join different consortia).*' Others attribute differences of speed not to being a formal SDO or not, but instead to cultural aspects: '*Americans just run harder.*'

Interestingly, IEEE's qualities in this respect were highly regarded by our interviewees. IEEE makes technically solid standards. Its expert model attracts high-level knowledge, and by focusing on component standards more than system standards, IEEE has had great successes. A lot of high-level, academic knowledge flows into IEEE, and IEEE is very technically oriented, resulting in high-quality, solid technical output.

Still, some mentioned that IEEE was limited to rather specific application areas. Also, IEEE was not always the place most appreciated by people. In the case of wireless standards in the 60 GHz band, ECMA (with its TC32-TG20 task group) seemed to get momentum at the expense of IEEE, that was working on a similar technique.

Membership, admission, and joining decision by actors

SDOs exist by the grace of its stakeholders, which are usually – but not always – its members. For this reason, membership levels and distribution (balance between various categories), member admission rules, and decisions of actors to become members or not, are of high relevance. In this section, we will discuss four aspects:

I) Membership type (firm membership, individual membership, and no membership)
II) Membership balance
III) Membership restrictions (particularly, distinction between geographic origins)
IV) Membership costs and contribution model

Note that this section will not discuss the level of influence (and possible abuse) of individual firms.

I) Membership type: firm membership, individual membership, and no membership

The studied SDOs have different membership structures. ETSI and OMA offer membership to firms (and organizations), IEEE to individuals (but recently introduced an additional company membership) whereas IETF does not have the concept of membership at all.

Individual membership, on the positive side, results in more discussions that are not so much in black and white terms and attempt to judge what is good for a standard in general, not only from a particular firm's perspective. The discussion is more nuanced, less contentious. Particularly when dealing with a new technology, this is favorable. Individual membership stimulates high-quality, expert contributions.

However, IEEE, a body based on individual membership, can be observed to have serious struggles with this. As Carl Cargill (a famous standardization scholar and now Director of Standards at Sun Microsystems) puts it: "[...] in IEEE, virtually every individual is paid by a company and is sent there to serve specific company interests" [6]. IEEE's individual membership model is seriously counteracted because of firms increasingly trying to manipulate this body. One example is the way in which Qualcomm (and Kyocera) were accused of trying to game the system with their Wimax-competing proposal. In this example, the whole standard-setting process was revamped and re-started (for more details, see Luna, 2007). The new IEEE Corporate Membership model tries to deal with this challenge, but it is too early to tell how successful it will be. Corporate membership is also more appropriate in dealing with bigger 'system standards', as there is a large set of interests that

[4] http://en.wikipedia.org/wiki/IETF

need to be aligned, between firms as well as within a firm.

A particular case, of course, is IETF that has no membership at all. Interviewees were rather critical about this.

II) Membership balance

Within almost every standard and standardization body, there is a wide array of stakeholders. In ICT we can think of infrastructure equipment suppliers, end user equipment suppliers (handsets, but increasingly all sorts of devices that communicate), operators and service providers, public bodies, test houses, intermediate users / integrators, and, last but not least, end users). Some of them are typically represented in the standardization process, others not. In this subsection, we discuss membership balance, and (presumed) imbalance between different stakeholder groups.

All interviewees strongly applauded OMA's broad membership. *"The positive sides of OMA are the industry-wide backing and a merge of multiple standard-setting bodies, partly overlapping SDOs. This reduced fragmentation."* OMA has a very broad membership, broader than other organizations in this industry. In fact, the members represent the widest possible range in the value chain (e.g. IT companies, content providers, tool vendors, etc.) [7]. It has been noted, however, that there is some tension because of the different cultural backgrounds (telecom versus IT).

ETSI has reasonably wide membership footage, too. This is positive, although in some cases firms do not want such wide representation (and therefore go somewhere else). Also, ETSI has been commented to have many 'passive members' (e.g. Microsoft, Intel). They sit at ETSI, but do not really do anything and take their resources and projects somewhere else. As such, ETSI's 'real' membership may be more limited than what the numbers seem to show.

Telecom firms make rather critical remarks about the membership balance of IETF. Although many (individuals from) telecom firms participate in IETF, they feel that they are not actually heard and their interests are marginalized. In addition, there is not only the issue of telecom versus IT-focused companies, but also the issue of vendors versus operators. Vendors (with probably around four times as many representatives as from operators) dominate IETF. Operators and their requirements are not very valued there. When one of the technologies developed in IETF started to be more and more key to the business of operators, they tried to increase their involvement but with little success. *"IETF does not sufficiently take operators' requirements such as fault management into consideration. It also intentionally does not include standards for interfaces between operators, charging mechanisms, real-time performance information for effective network management and QoS maintenance. These things are key to operators"* (pp. 295-296) [8].

Finally, in terms of membership balance, IEEE is dominated by the US, as 50% of total funds for IEEE are from that country. On the other hand, one could probably make similar claims for other bodies.

III) Membership restrictions (particularly: distinction between geographic origins)

A significant view in all interviews was about the ETSI membership ruling regarding geographic origin.[5] The common opinion was that it is understandable why the distinction between European and non-European members developed this way, and that the abolishment of such a distinction is not easy (there may be risks towards ETSI's role in the EU and the support of the European Commission). However, it is nevertheless considered necessary – and, to many, inevitable – that ETSI give up such a distinction if it wants to retain its role as an important SDO. Here is what some interviewees stated about this issue:

> *"The European versus global issue is not yet solved by ETSI. Currently, ETSI tries to be both, maybe resulting in the worst of two worlds. ETSI indeed has a global membership, but especially when it concerns the non-European members, it's a passive global membership. ETSI is still seen as a place that predominantly serves European interests and is therefore unsuitable for other projects. With 3GPP, an ad-hoc solution was found by establishing a partnership which was truly international in its functioning. It bought ETSI time, but did not result in the necessary changes to ETSI itself."*

> *"The current distinction within ETSI between full members and associate members is hard to defend. Though it is understandable that there needs to be some distinction in the context of the Europe-specific Public Enquiry Process (ETSI may lose this competence if it did not meet the necessary requirements), it is harder to understand why board positions are reserved for full members only. Even an associate member of the largest membership category (45 units) is currently not allowed to have its representatives voted for board member. This shows that ETSI does the splits when it comes to balancing its European and its global identity."*

> *"It is desirable that ETSI becomes truly global and abolishes the membership policy – among other things, the difference between associate members and full members. Also, rules related to the constitution of the board would need to be changed. There should be a simpler structure. However, it is not sure that current members will agree with such a change. Moreover, it seems that such changes will put the EU recognition of ETSI as an ESO at risk (if this recognition is lost, ETSI would not be able to produce standards that have a formal status in Europe any more, and would also no longer receive mandates for studies from the EU)."*

[5] In ETSI's current rules, full members '[must be] established in a country falling within the geographical area of CEPT'. See http://www.etsi.org/WebSite/Membership/eligibility.aspx.

"One possible future way for ETSI is to extend its 3GPP partnership to other areas. By doing this, it overcomes the problems related to the dual European/global identity of ETSI, and the disadvantages of weighted voting. (Note that, unlike ETSI itself, 3GPP uses a one-company-one-vote system). In fact, this extension already seems to take place, by broadening the scope to a common IMS (IP Multimedia Subsystem), next generation technologies (such as IMT-advanced), and an increasing interest in fixed transport technologies such as cable network (think of the cooperation with Cable Labs for the PacketCable technology). However, the relationship between ETSI and the other participating SDOs in 3GPP is reportedly not so well any more as it once was. By contributing not only 70% of all 3GPP members but also hosting the 3GPP secretariat, the partners feel that ETSI dominates 3GPP."

IV) Membership costs and contribution model

Even if a party is formally eligible for membership, the actual costs for joining may be a barrier. Here, specific criticism was aimed at OMA. Although OMA is open, membership fees – especially for the sponsor category – are very steep and result in de facto exclusion of smaller players.

ETSI uses a system in which membership contribution is based on so-called 'units of contribution,' which refers to a member's 'telecom-related turnover relating to ETSI standards'[6]. According to some interviewees, the ETSI membership contribution model is becoming obsolete and will cause more and more problems over time. The most pressing problem is that it is increasingly difficult for a member to determine what (and what not) can be seen as telecom-related turnover relating to ETSI standards. While this question might have been relatively easy to answer for most ETSI members a decade ago, the grey area is becoming larger and larger. For instance, what about a PDA with communications capabilities? A camera or music player in phones? Network management activities? And do ADSL products qualify? As we move towards a more integrated world, where communications services truly converge with each other and with other capabilities, the ETSI definition is becoming more and more problematic. Since this is self-declared, members will have the incentive to report higher relevant turnover in good times (increasing their influence and being prepared to pay for that). In times of misfortune, however, they will have incentives to report low turnover. Whereas membership contribution fees have until now only resulted in incidental problems, they are expected to become a structural problem in the future.

[6] For more information, the reader is referred to ETSI's 'Members' contribution assessment' and 'Electronic Communications Related Turnover – Definition', available from http://www.etsi.org/WebSite/Membership/memberContributionAssessment.aspx and http://www.etsi.org/WebSite/Membership/ECRTDefinition.aspx respectively.

Conclusion

The aim of this study is to gain insight into the differences and similarities between the methods used at four important standardization bodies, and how these methods are judged by (potential) participants.

Again, we emphasize that this is a quick scan. We do not intend our findings to be representative or authoritative, but to gain useful insights, especially in the context of improving ETSI. Although we attempted to include a variety of different types of stakeholders for the interviews, the views expressed here did certainly not include all views. We also asked our interviewees to talk frankly, not as representatives of their firms, in order to present a genuine view on how SDOs work and how they can be improved.

There is quite a variety in procedures and ways of working among SDOs. Each of the bodies under study here has its own qualities, and to some degree is optimized to the market it is serving – in terms of application areas, technologies, geographical setting, and membership. The strengths of one body cannot always be easily copied to another.

There is an overall need for diversity, not 'one size fits all'. In some situations, wide membership is essential, in others, firms require a more homogeneous group.

The **performance and quality** of the produced standards of all bodies are considered to be good. In terms of relevance, however, there are substantial differences. Overall, our interviewees stressed the current high relevance of IEEE and OMA, whereas over the last few years the relevance of IETF and ETSI has decreased.

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