Trying to Keep the Internet's Standards Setting Process in Perspective

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Abstract:
The Internet is emerging as a crucial part of the Global Information Infrastructure. This is not least due to the remarkable longevity and versatility of some of its protocols. Accordingly, many claim that the standards setting process adopted by the Internet community is vastly superior to those of the more 'traditional' standards setting bodies, such as ISO and ITU. An adequate standards setting process would indeed be most desirable to ensure the Internet's future usefulness. Yet, in the light of the massive financial interests that are at stake here, this paper voices some concerns A brief general description of the process adopted by the IETF is followed by a discussion of some of the more noteworthy characteristics of this process. This discussion, related observations and the subsequent conclusions are largely based on interviews with long-standing IETF 'members'.

Keywords: Internet, Standardisation, IETF

1 INTRODUCTION AND MOTIVATION

The tremendous success of the Internet has been considered by many as an indication of the superiority of the underlying standards setting process, compared to the processes adopted by the 'classical' international standards setting bodies such as ISO and ITU - "*The Internet standards development process is by far the best in the business.*" [12]. At first glance, this view appears to be legitimate. After all, the Internet (together with its predecessor, the ARPA-Net) has been with us for almost thirty years, and has managed to transform itself from the initial four-node network of 1969 to the multi-million-node ubiquitous infrastructure it is today. What's more, its core protocols (i.e. IP and TCP) have largely remained unchanged throughout this transformation process, thus again demonstrating the flexibility and adaptability of the output of the Internet's standards setting process (i.e. the protocol specifications).

A network's ability to cope with application's requirements is becoming increasingly important. On the other hand, ongoing globalisation implies that open, globally agreed-upon standards will need to be in place - no national or regional specifications, let alone proprietary ones, will be able to cope. Today, it looks very much as if the Internet is going to be at least a major constituent of the 'Global Information Infrastructure' (GII). Thus, it is vital to ensure that the standards setting process adopted by the Internet community continues to produce adequate specifications. In particular, it will be essential that these standards deliver what will actually be needed by the market.

The IETF process differs considerably from those adopted by e.g. ITU and ISO, due to its lesser degree of formality and, probably more important, a different

underlying design paradigm. In fact, many single aspects make the Internet standards setting process stand out. These include the extensive use of e-mail distribution lists for discussions, which everyone with an interest in the topic can join, specifications which are openly available throughout all stages of the process, and the requirement for demonstrated interoperability of different implementations. Individual participation, as opposed to e.g. ITU's organisational participation, is considered by many as another major difference.

The most important distinction, however, is the Internet's evolutionary and modular design approach. Unlike ISO and ITU, the IETF does not normally attempt to produce all-embracing specifications, but prefers to design relatively small modules that are able to interoperate. This approach enables even dated communication protocols to adapt to a fast changing environment, and allows quick reaction to emerging new requirements. Moreover, this way an 'installed-base hostility', which may easily be the kiss of death for an otherwise promising new technology, and for which e.g OSI has been blamed by many (see, for example, [4], [10], [11]), is avoided. The fact that so far the Internet has been able to scale may largely be attributed to this approach (as suggested e.g. in [6]).

For all that, I do see a need for an unbiased analysis and discussion of some aspects of the Internet's standards setting process (for examples of what I would consider somewhat less than objective discussions see e.g. [3], [12], [13], [14]). I should stress, however, that I do not wish to denigrate this process, but to give a more balanced account of its strengths and weaknesses. The observations reported and the resulting comments are largely based on a survey of active members of several of the IETF's Application Area work groups.

The remainder of the paper is organised as follows: chapter two outlines the standard setting process adopted by the Internet community. Subsequently, chapter three discusses some of its more noteworthy characteristics, and finally, chapter four gives some concluding remarks.

2 THE INTERNET'S STANDARD SETTING PROCESS

The Internet's standardisation process has changed over the years, from very informal ad-hoc implementations driven by a few enthusiasts to a reasonably - some would say overly - formal procedure today. There are, however, quite a few things that survived this transformation, most notably the openly available Request for Comments (RFC) series of documents, which provides a forum for discussion on new protocols, mechanisms, and ideas. RFCs are not necessarily standards (see e.g. [7]), but approved Internet standards remain part of this series as well. Categories of non-standard RFCs include 'Experimental', 'Informational', and 'Historic'.

The process has been designed to provide quick solutions to immediate problems. Obviously, this approach tends to produce specifications with a possibly somewhat limited scope. However, extension mechanisms exist in most specifications, enabling integration of, or co-existence with, future standards.

2.1 Entities Involved in the Process

"*The Internet Society (ISOC) is an international organization concerned with the growth and evolution of the worldwide Internet and with the social, political, and technical issues that arise from its use.*" [5]. ISOC's trustees charter the Internet Architecture Board

(IAB), which provides architectural oversight, does the final technical review of Internet standards, and provide leadership in the IETF, based on skills and years of experience [6]. The IAB also approves appointments to the Internet Engineering Steering Group (IESG). The IESG is responsible for technical management of the Internet Engineering Task Force (IETF), its members include the IETF chair and the directors of the IETF technical areas.

The actual technical standardisation work is done within the IETF Working Groups (WGs), which are chartered by the IESG. A working group may be established through the initiative of an Area Director (AD), or it may be initiated by an individual or a group of individuals. See Fig. 1 for an overview of the organisations involved in the IETF standards process.

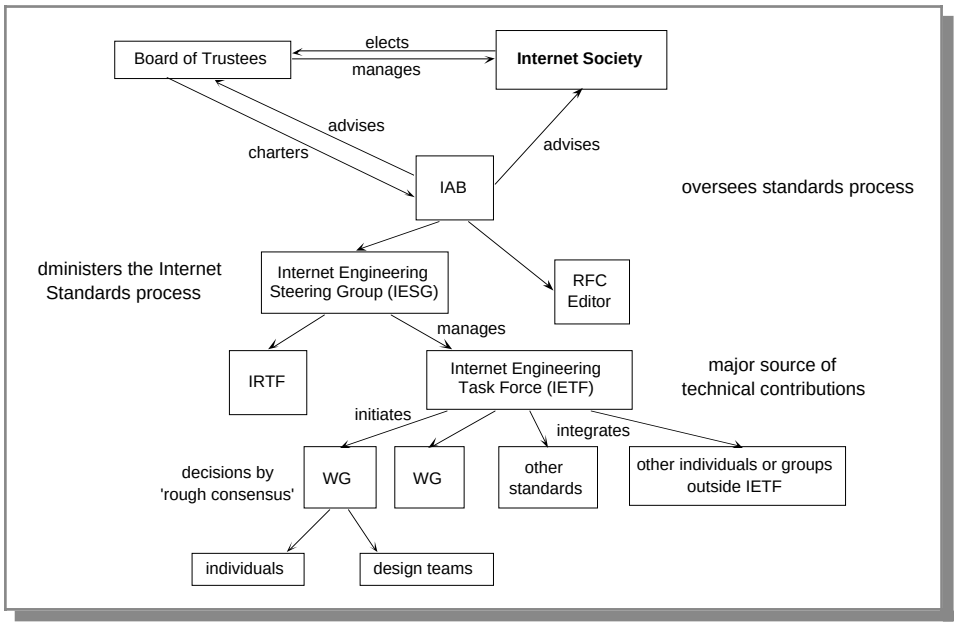

Figure 1: Entities involved in the IETF standards process

The goals of the standards process, as pursued within the WGs are [2]:

- technical excellence,
- prior implementation and testing,
- clear, short, and easily understandable documentation,
- openness and fairness,
- timeliness.

Membership of WGs is open to all interested individuals, with e-mail distribution lists being used as the major communication medium. In fact, an IETF ‘member’ is someone whose address appears on one of the IETF’s distribution lists. In addition, there are three annual IETF meetings. A ‘rough consensus’ of all WG members is required before a specification can proceed on the standards track (as opposed to ‘consensus’ required by ISO and ITU). In particular, there is no formal voting procedure. If ‘rough consensus’ cannot be achieved, the IESG will undertake to solve the problem. If this fails, the IAB will be the final authority for an appeal and may, for instance, establish a new working group to consider the matter.

2.2 The Documents

To become an Internet Standard a specification has to follow the procedure outlined in Fig 2. First, it has to be made available for comments as an Internet Draft for a certain time, typically resulting in a number of revisions. Eventually, the specification may be submitted to the IESG for elevation onto the standards track. Upon approval the specification is published as a 'Proposed Standard' in the RFC series. It remains at this level for at least six months, thus allowing sufficient time for public consideration and, very likely, revision. After this period, if at least two independent and interoperable implementations exist, the specification is considered generally stable. Upon approval the procedure outlined above is repeated, and the specification will become a Draft Standard for at least four months [2]. Finally, when significant operational experience has been gained, the specification is raised to the Internet Standard level. If a specification fails to reach this level after two years, it will be reviewed and possibly withdrawn. All decisions relating to advances along the standards track, including final approval and withdrawal, are under IESG responsibility. In the following, I will concentrate only on the IETF.

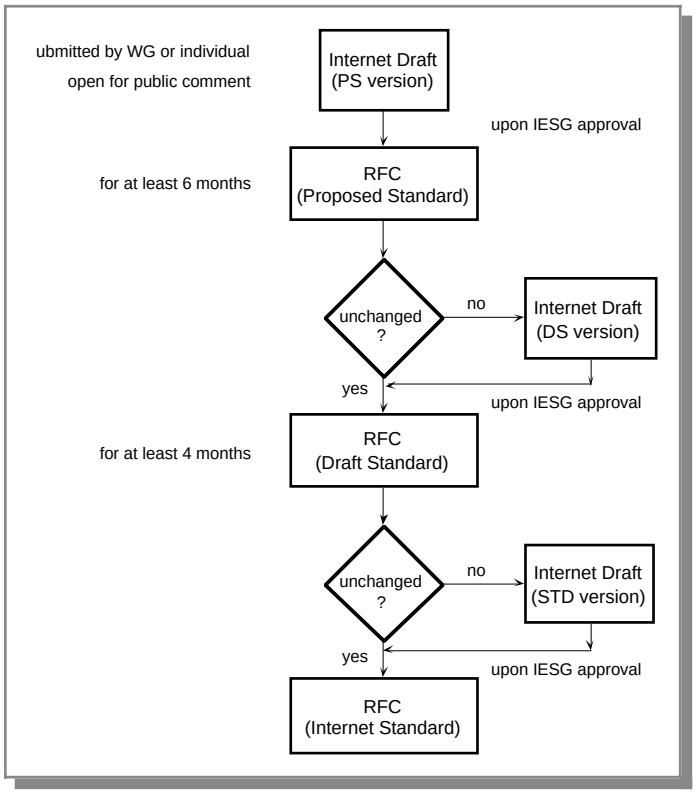

Figure 2: A rough flow chart of the IETF standards process

3 SOME NOTEWORTHY CHARACTERISTICS OF THE IETF'S PROCESS

Probably the most prominent distinction between the IETF process and those adopted by other bodies is its lesser degree of formality. Most notably, there is no formal balloting involved, neither within the committee nor by any of the other entities that have a say in the process (as e.g. the IAB or the IESG). As one consequence of this little formalism involved, standards tend to materialise more quickly. This is, however, not necessarily the result of a well-designed process. It is well possible for a specification to go through numerous versions over lengthy periods of time while still being an Internet-Draft, i.e. before being elevated to RFC level. Likewise, no hard upper time limits exist for a document to remain at any

given stage of the standards track. Yet, a review of the activity will be initiated "... *when a standards-track specification has not reached the Internet Standard level but has remained at the same maturity level for twenty-four (24) months, and every twelve (12) months thereafter ...*" [2]. Still, the fact remains that until now the IETF seems to move faster than other standards setting bodies.

The need to achieve only 'rough consensus' as opposed to 'consensus' may be considered a major contributor here. Consensus, and due process, are widely considered as the fundamental cornerstones of ITU's and ISO's processes. The latter, which is a pre-requisite for the former, was designed to limit arbitrary use of power by some (governing) entity. When applied to the standards setting process, due process means *"... that any person (organisation, company, government agency, individual, etc.) with a direct and material interest has the right to participate by a) expressing a position and its basis, b) having that position considered, and c) appealing if adversely affected."* [1]. It guarantees that everyone who might potentially be affected by a standard has the right to participate in the process on equal terms. The latter is achieved when substantial agreement has been reached by all participants. This signifies more than a simple majority, but not necessarily unanimity.

The IETF process makes no mention of 'due process', yet the elements appearing in the definition above apply. Things look slightly different as far as 'consensus' is concerned; the IETF works by the principle of 'rough consensus', which is not quite the same, and very much open to individual interpretation. In particular, which majority is required for acceptance / rejection of a specification has not been defined. Rough consensus has been designed to allow for greater flexibility, but at the same time it is a big help for 'obstructionists' (see below).

The openness of the IETF process - *"everyone can speak"* - is widely held as one of the major characteristics of the work groups. Yet, this is also associated with a weakness; "naysayers" and "loudmouths" stand a good chance of delaying and possibly even obstructing the work; the process does not foresee any mechanisms for how to deal with such individuals. With roughly ten per cent such 'obstructionists' on a typical committee (according to [15]) this is a potentially disastrous situation, especially in the light of the increasingly high stakes that may be at risk for some participants' employers.

Along a similar line, individual participation, as opposed to participants directly representing companies or organisations, is another characteristic of the IETF process. Its proponents argue that this helps the process to focus on technical excellence rather than (company) politics or strategies. However, this perception seems to be a bit naive. For one, about twenty per cent of the IETF-WG members in our survey admitted to assuming the role of 'company rep' (this is a comparably low figure; the average percentage of members from ITU, ISO, ANSI and the IETF assuming this role was forty-one per cent). Moreover, in most cases participating individuals need some form of support from their employers (at least they must tolerate such activities). It may therefore be concluded that these individuals are far more likely to be employed by either vendors or service providers, or academia. The former may hope to maybe push proposals within the work groups, to be aware of the latest developments and to capitalise on the gained knowledge and experience. The latter have traditionally been closely associated with the Internet, and will normally find it comparably easy to justify standardisation activities. Users, on the other hand, will need to have a particularly strong business interest before actually being prepared to tolerate someone on their payroll working on standards specifications. Likewise, a lack of adequate support by employers implies that this

process is even more dependant on single individuals doing the bulk of the work. Quoting [15] again, only a handful of people on a committee will typically do the bulk of the work. Without these people the process will no longer work.

Another crucial aspect, which is unique to the IETF process, is its requirement for two independent, interworking implementations as a necessary condition for a proposal to proceed on the RFC standards track. This is an important step, and one that makes the IETF process stand out from its 'competitors'. Yet, I feel it stops halfway through, as this requirement aims primarily at checking the correctness of the specifications and their interoperability[1], rather than exploring e.g. the degree to which it matches user requirements, or its usability within a real-world environment. As a consequence, these implementations will be close to prototypes. In particular, they need not be employed in a real production environment. Yet, to define real requirements it is important to employ the implemented system in commercial working environments; experiences gained there will contribute to a more usable revised version of the underlying standard (as opposed to only demonstrate interoperability; see e.g. [8]).

The valuable contribution of the IETF's modular design approach has already been mentioned above. In contrast, the - largely failed - OSI initiative attempted to develop all-embracing specifications catering for all eventualities (and probably for many company preferences). Breaking a complex problem down into several, manageable bits which are then addressed separately by different working groups definitely contributes to the speed of the process. However, at the same time this implies the risk of losing the big picture.

By and large, it emerged that IETF 'members' are pretty much content with the adopted process. There were very few improvements suggested from those members that participated in our survey. Typically, identified problems that would need to be addressed were related to scaling; with the Internet continuously growing at a rapid pace, this is becoming a major issue. Unsolved problems included the need for recruiting more volunteers, definition of rules how to decide when 'rough consensus' is reached, as well as the development of mechanisms to address more complex problems. Yet, no solutions were suggested.

However, one recommendation was at least astonishing, as it represents a clear contradiction to the valued openness of the IETF process. This respondent stated that it would be necessary to introduce*"Core groups and specific listings. There is too much dead wood on the mailing list and so on."*. If this became reality, the IETF would be more elitist than any of the other bodies .....

4 SOME CONCLUDING REMARKS

Despite some very favourable characteristics, one should be careful with an overly enthusiastic evaluation of the Internet's standardisation process, and a few rather more critical remarks should be in order.

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1 *"A specification from which at least two independent and interoperable implementations from different code bases have been developed, and for which sufficient successful operational experience has been obtained, may be elevated to the "Draft Standard" level. [....] "interoperable" means to be functionally equivalent or interchangeable components of the system or process in which they are used."* [9].

Prior to the WWW, the Internet had by and large been a research network, with its governing bodies dominated by people from academia and research. On should think it was a comparably simple and straightforward task to identify the needs of this rather homogeneous community, and to specify protocols that actually address these needs. Standards setting work strived primarily to achieve technical excellence, and was hardly influenced by politics and corporate strategies.

The Web, on the other hand, enabled wide-spread commercial utilisation of the Internet, and brought it to the homes, thus opening up completely new markets. Indeed, the advent of the World Wide Web represented a major - if not the - turning point in the Internet's history, the effects of which are already noticeable in standards setting as well.

As commercial interest in the Internet has been growing, so has the number of members of the IETF work groups, including especially representatives form service providers and vendors. Against this background it may be anticipated that corporate strategies are playing an increasingly important role, and that 'individual participation' will (unofficially, unannounced and maybe even unnoticed) turn into 'organisational representation', yielding a situation not unlike the one within ISO and ITU.

Similarly, the process' dependence on the availability of 'right people' to do the work - and the chronic lack of them - bears the risk that strong, knowledgeable individuals, backed by interested companies and supplied with sufficient funding, can easily move into dominating positions within the groups (e.g. by volunteering to do specification and editing work, or by demonstrating working implementations). Ultimately, this could turn an IETF WG into something akin to a corporate R&D group (or maybe a marketing group). These trends have been confirmed, and indeed stressed, by the IETF interviewees, who also noted that the current process is ill equipped to address the problems that come with such increased participation and commercial interests[2].

Moreover, without formal mechanisms in place to safeguard the process from delaying tactics, from being dominated by actively participating disruptive people, and/or domination of commercial interests, there is a real risk that what has been considered the strengths of the process in a strictly technically oriented environment (e.g. rough consensus, no voting, openness to anyone) will prove to be major obstacles in an environment influenced by politics.

A recent development in the IETF may serve to underpin this view. It relates to SNMP. Work on SNMPv2, to become the successor to the original and increasingly inadequate SNMP, started in 1992. The core specification was granted Proposed Standard status in 1993. However, it was not accepted by the industry, and very few vendors actually implemented it. Complaints were voiced primarily about the

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[2] The increasing commercialisation may well have consequences well beyond standards setting, and effect the very nature of the Internet as such. The preliminary results of a currently ongoing Delphi survey , for example, suggest that most experts belief that the Internet will split up into different topical segments, including those for commerce and education, respectively, within the next ten years. The current debate on the proposed Internet II for academic purposes moves along the same line. It remains to be seen how standardisation will be organised within these segments.

complexity of the design of the security and administrative framework[3]. The WG was rechartered in late 1994, and two competing proposals emerged, complemented by two additional positions, including the 'silent majority', representing those who apparently were put-off by the hostile environment that had become the norm in this group, which was monopolised by a few individuals. Eventually, the group was abandoned and the SNMPv3 group was chartered in 1997. In early 1998, SNMPv3 specifications were submitted to the IESG for consideration as Proposed Standards. Today, there is a number of related Draft Standards. This brief example shows that the IETF is beginning to experience major problems in cases when 'rough consensus' cannot be reached. This may turn out to be a major problem, especially if stakes are high, as they are in the field of network management.

The claim that "everyone can speak", made by several IETF WG members is as true for the IETF as it is at least for ISO. However, this does not imply that everyone actually does speak (or is indeed listened to, for that matter).

By and large, vendors, service providers and, to a lesser extent, academia dominate the lists and the meetings, and little, if anything, is being done to change this situation. On the contrary, IETF WGs are experiencing problems as the Internet is becoming commercially more interesting. The IETF's process provides no mechanisms how to deal with 'naysayers' and 'loudmouths', and it does not scale well. These facts may be explained by the history of the Internet, where in the early days some enthusiasts would sit down and do the specification of a standard and the hack some time late at night, and that was about it. These days, the process suffers from its legacy; it simply has not been designed to address large, complex problems that come with today's complex IT infrastructure, to deal adequately with the commercialisation of the Internet, and to cope with the increasingly high business interests that are at stake.

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