Chapter 3, Internal governance of the IETF, W3C and IEEE: structure, decision-making and internationalisation, of the author accepted version of Harcourt AJ, Christou G, Simpson S (2020). *Global Standard Setting in Internet Governance*, Oxford University Press. The full book can be found at https://global.oup.com/academic/product/global-standard-setting-in-internet-governance-9780198841524?cc=gb&lang=en&.

Chapter 3: Internal governance of the IETF, W3C and IEEE: structure, decision-making and internationalisation.

This Chapter outlines the key features of SDOs involved in Internet governance. Crucially, these fora are voluntary in nature with no formal state representation. The Chapter outlines their governance structures and most salient areas of work. To this end, it charts the evolution of each SDO, their main purpose, function and central decision-making processes. The latter can be affected by matters such as the number of actors involved in the process and the degree of difference in viewpoints expressed, the complex and interdependent nature of the technologies under examination, the range of technical alternatives put forward, and the technical and economic significance of the standard in question (Simcoe, 2007: 262). The chapter highlights the differences as well as the degree of synergy and collaboration between each of the SDOs.

The Chapter's central purpose is to provide a governance context through which to understand the decision-making process in each of the standards investigated in the case study chapters. It also explains how procedures differ between the fora and how moving goal posts and high barriers to entry make it difficult for civil society to participate. The Chapter identifies differences in EU vs US approaches to self-governance and key drivers of current policy development such as internationalisation and the Internet of Things. It explores how problems of security, capacity, the pace of technological development, internationalisation and IPR cut across all on-going work. The focus is on the principal SDOs engaged in the development of the Internet's architecture, namely the IETF, IEEE, W3C and OASIS (the Organization for the Advancement of Structured Information Standards).

Organisations involved cross-national Internet governance

Registries	Intergovernmental for a	EU and national organisations	**Key Standard Developing Organisations (SDOs)**
APNIC, ARIN, CENTR, ICANN, LACNIC, RIPE-NCC, national registries (Nominet, Verisign etc)	CoE, EU, ePol-NET, ISO, ITU, OECD, UN, WIPO, WTO	CEN, CEPT, ECTRA, ETNO, ENISA, ETSI, NATIA	**IAB, IEEE, IETF, Internet Society, IRTF, OASIS, 3GPP, WHATWG, WC3**

Source: compiled by authors.

In the 1980s, the computer networking market was dominated by either governments (ARPANET, DARPA, CYCLADES at the French Institut de Recherche en lnformatique et en Automatique (IRIA)), academia (Computer Science Network (CSNET)), or large firms such as IBM with its System Network Architecture (SNA) and DECnet of Digital Equipment Corporation (Bing, 2009:33; Alverstand and Lie, 2009:127). Lawrence Roberts created ARPANET by moving away from circuit switching to package switching technology in 1969 linking up computers at four universities: UCLA, Stanford, UC Santa Barbara and the University of Utah (Lee and Bing, 2009; Brown and Marsden, 2009; Brown, 2013:7; DeNardis 2014, Contreras, 2016:867; Musiani and DeNardis, 2016:33). Robert Kahn from DARPA working together with Vint Cert from Stanford built upon this technology to create the Transmission Control Protocol (TCP) and Internet Protocols (IP). TCP/IP became the main standard for Internet[1].

TCP/IP use was facilitated in particular by the SUN Microsystems UNIX operating system in the early 80s, and its use in the linking of local area networks (LANs) to ARANET for the communication of personal computers. IBM dominated the market in the early 1980s with launch of the personal computer (PC). PCs used Intel chips and were linked up by Ethernet developed by Xerox. Local area networks pioneered by Cisco.

An attempt to provide an international standards framework for interoperability was launched by the International Organization for Standardization (ISO) and the Telecommunication Standardization Sector (ITU-T) of the International Telecommunication Union (ITU) in 1977. Most specifications at that time were proprietary in nature (Brown, 2013:17; Besen and Sadowsky, 2016:212). The main alternatives to TCP/IP were the Open Systems Interconnection (OSI), DECnet and SNA/APPN protocols. The IAB's initial decision to adopt the OSI's ConnectionLessNetwork Protocol in place of IP at the IETF in 1992 met with opposition within the IETF. As detailed by Yates and Murphy Vint Cerf "became a hero by stripping off his jacket, vest and shirt during his talk to reveal a T-shirt reading 'IP on Everything'" and David Clark gave his time honoured talk "We reject: kings, presidents and voting. We believe in: rough consensus and running code"" (2019:250). The take up of TCP/IP, which was open source software and free to use, was so widespread that it became the standard networking protocol for the Internet (Bing, 2009: 27; Besen, and Sadowsky, 2016:216). This was important for establishing the principle of interoperability and the delineation between the different protocol layers.

The Internet is made up of layers. IP defines how data should be packaged and addressed and how it should travel through the Internet stack. Lessig identified three layers: the code layer, the content layer, and the physical layer (2001). Benkler refers to three layers: physical infrastructure layer, logical layer and the content layer (2006). Bing and Lee referred to six layers for the Internet

[1] TCP/IP was standardised formally in RFC 791 and RFC 793 in 1981.

(Content, Application, Transport, Internet, Link and Physical). This book refers to four layers as using the model offered by Contreras (2016).

Layer 1 comprises of the network, which refers to physical transmission and data link technologies. This consists of wired (i.e. Ethernet, SDL and ISDN) and wireless (2G/3G/4G/5G) connection standards. Layer 2 constitutes Internet protocols (IPv4/6, etc) which enable the identification and location of computers and devices on networks and route traffic across the Internet. Layer 3 incorporates Internet protocols (TLS, QUIC) which govern handshaking and the transmission of IP packets. In Layer 3, TCP and UDP come into play which provide host-to-host connectivity. The top layer 4 handles HTML descriptor language and software interfaces.

Each layer has corresponding SDOs, which are associated to them that ensure interoperability. Interoperability is crucial for the Internet to function properly. Standards within SDOs are agreed via broad consensus and often technical merit. However, consensus, transparency and procedures differ from one forum to the next. There are a wide range of SDO fora involved in Internet governance including those at national (e.g. UK National Standards Body), regional (e.g. European bodies such as CEN, CENELEC and ETSI) and international (e.g. the ISO, the International Electrotechnical Commission (IEC), IEEE, IETF, and W3C) levels to smaller specialised consortia such as the 3GPP. The IETF, the W3C and the IEEE are the main self-regulatory fora operating at the international level underpinning interoperability for the Internet (Table 3:1).

Table 3:1: Internet Standardisation Stack

Layer	**Standards**	**SDOs**
4. Application	XML, HTTP, HTML, IMAP, POP, MIME, SMTP, Telnet, TLS/SSL	IETF, OASIS, IETF, W3C
3. Transport	TCP, UDP, TLS, QUIC	IETF
2. Internet	IPv4, IPv6, ICMP, ECM, Seamoby	IETF
1. Network	Ethernet, IEEE 802. 11, ISDN, DSL, Wi-Fi, 3G/4G/5G	IEEE ETSI 3GPP

Source: (adapted from) Contreras, 2016:856.

The Internet Engineering Task Force

The IETF is the most active organisation in Internet standard development (RFC 4677) and arguably the most important within the first three layers. It standardised TLS, SSL, QUIC, IPv4 and IPv6 protocols. A key goal of the IETF is to provide an organisational context and support for Internet standards making. Established in 1986, from humble beginnings when its first meeting was attended by 21 people (Alvestrand and Lie, 2009:127; Simcoe, 2007: 260; DeNardis 2015:74), the IETF and IAB (Internet Architecture Board) developed out of the initial collaborative work of DARPA and universities. In its early days, the IETF subsequently catalogued most Internet standards produced before its inception (Gencher, 2012). However, its roots go further back in time to the 1970s and work of engineers in ARPANET where Vint Cerf and David Clark founded the Internet Configuration Control Board which later became the Internet Activities Board and thereafter the IAB (DeNardis, 2014).

Reflecting its academic roots, the IETF's focus was built around technical merit, transparency and broad consensus. Simcoe argues that the lack of commercial presence in the earlier years of the IETF's history was to some degree due to the US National Science Foundation's acceptable use policy (ended in 1991) which excluded commercial use of the network (2009). This continued even though members from the commercial sector quickly greatly outnumbered academics and government representatives from the mid-1980s onwards (Simcoe 2007:264). According to the IETF's mission statement, work is based upon "engineering quality"[2]. Participants are viewed as individual representatives, not representatives of corporations or organisations, and technical progress is valued over the organisational priorities. There are no fees for membership. The Internet Society (ISOC) was created some years later in 1992 as the administrative arm of the IETF (see below).

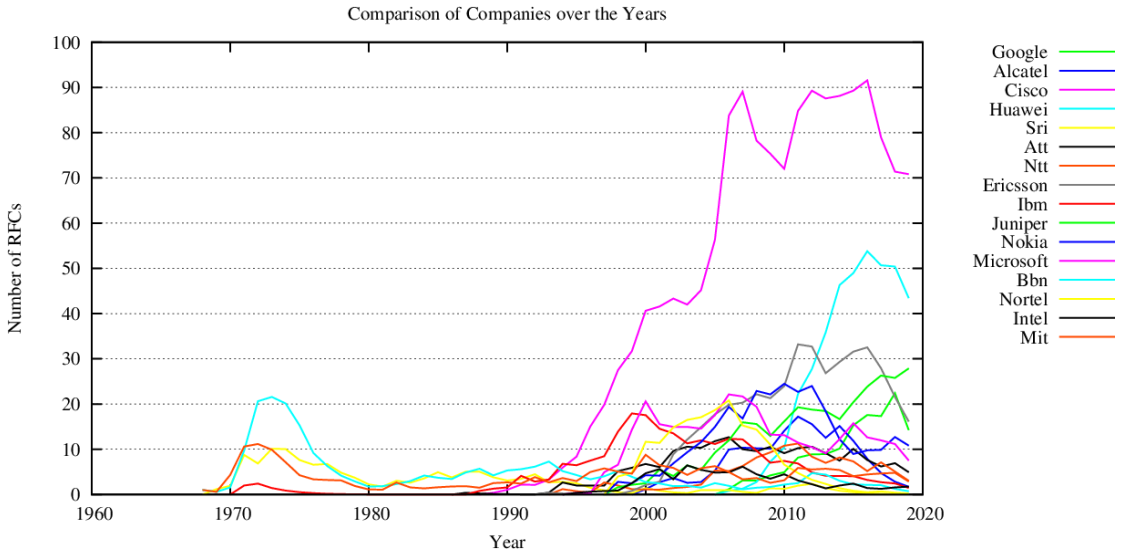
The IETF's current mission was last updated in 2015 (RFC 3935). It states 'the mission of the IETF is to produce high quality, relevant technical and engineering documents that influence the way people design, use, and manage the Internet in such a way as to make the Internet work better. These documents include protocol standards, best current practices, and informational documents of various kinds.' A core concern is to ensure that standards produced are tested in advance to minimise risk to the efficient functioning of the Internet. For this reason, the IETF encourages Hackathons at IETF meetings for developers to collaborate, share code and practice different implementations of IETF standards. Otherwise participation is mainly organised on-line and involves open exchange within working groups. Most documents and all standards and protocols are available on the IETF website. Anyone is welcome to join a working group. In this way, the IETF is more open than the W3C and IEEE, which demand fees and operate less accessible working groups.

[2] https://www.ietf.org/about/mission/.

Nonetheless, most IETF participants are from large corporations and key proposals are concentrated into a small group of companies which sponsor individuals' participation in the form of time and travel to annual meetings. There are circa experts from 130 companies represented at the IETF but the leading participants are from Huawei, Ericsson, Juniper, Cisco and Google. Cisco, Huawei and Cloudfare work on content delivery networks (CDNs). Cisco specialises in LAN technology and VoIP. It publishes the most Request for Comments (RFCs) annually with circa 70 – 90 per year with Huawei second with circa 50 proposals per year.

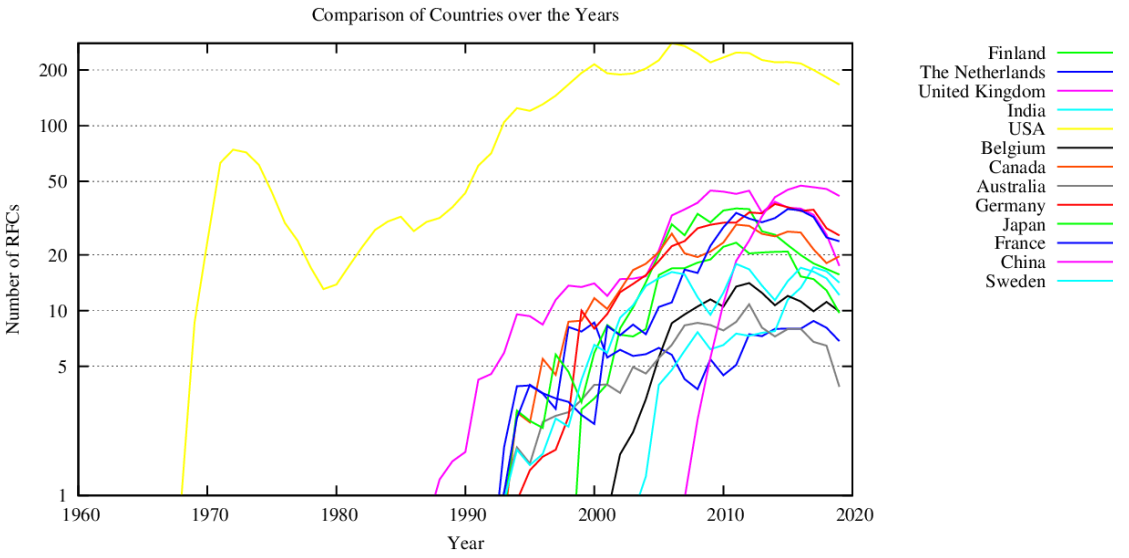
Company presence within SDOs does not necessarily mean that they are the most influential within the Internet stack. Standards are only valid if implemented. Some companies send many representatives to IETF meetings annually and produce a high number of technical standards. Other companies hardly send any but it doesn't correlate necessarily to lack of sinfluence. Facebook sends three or four people per year to the IETF. Amazon does not send anyone however it affects the process in the standards it adopts. These groups arguably have representation in SDOs via other companies. Intel, Google, Amazon and Microsoft are most dominant in licensed spectrum (Greenstein, 2017). Google and Amazon are active in Wifi particularly Amazon which, in many interviews, was alleged to not be transparent about its AWS technology.

Figure 3.1: IETF RFC production: comparison of companies over the Years.



Source: Jari Arkko http://www.arkko.com/tools/rfcstats/companydistrhist.html

Figure 3.2: IETF RFC production: comparison of countries over the Years.



Source: Jari Arkko https://www.arkko.com/tools/rfcstats/countrydistrhist.html

An IETF standard is created when a specification undergoes development and review. The process is typically complex where a number of factors such as ensuring high technical quality, catering for a wide range of interests, securing broad consensus and calculations of the overall benefits to the Internet community are important (IETF RC 2026, section 1.2). The IETF is interesting in that it does not have a board of directors nor any official members. Rather, it describes itself as 'a loosely self-organized group of people who contribute to the engineering and evolution of Internet technologies' (IETF 2012: 2). In so doing, it specifies the development or usage of protocols; recommends protocol standardisation and usage to the Internet Engineering Steering Group; assists with technology transfer from the Internet Research Task Force (IRTF) to the Internet community; and provides an information exchange forum between a diverse range of commercial players, users and researchers.

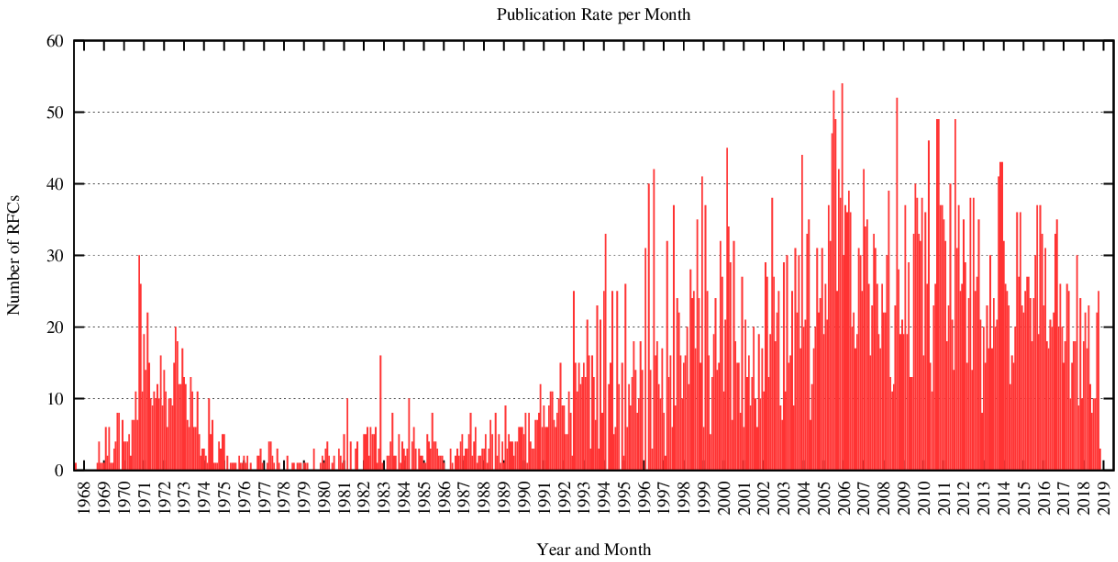
The IETF is composed of technical areas led by Area Directors (Ads) who provide guidance to the working groups and sit on the Internet Engineering Steering Group (IESG)[3]. They serve 2 years terms and their backgrounds tend to be broad. In 2019, work was divided into six technical areas. Area Directors were representatives from (Applications and Real-Time Area) Huawei, Isode and Mozilla; (Internet Area) Kaloom and Cisco (Operations and Management) Equinix and Google; (Routing Area) AT&T, Huawei and Nokia; (Security) CERT/SEI[4] and Akamai Technologies; (Transport Area) Ericsson and (Liaison and Ex-officio) members from Google, USC/ISI, Association Management Solutions and IANA.

[3] https://www.ietf.org/about/groups/iesg/members/

[4] For example the Area Director for security works for the Software Engineering Institute, the primary mission of which 'is to support the defense of the United States' https://www.sei.cmu.edu/about/what-we-do/index.cfm. The Area Director for security leads IETF working groups on: Security Dispatch, Automated Certificate Management Environment (acme), the Internet of Things, Public Notary Transparency, Token Binding, the Web Authorization Protocol, Interface to Network Security Functions, EAP Method Update, Security Automation and Continuous Monitoring, Limited Additional Mechanisms for PKIX and SMIME, Remote ATtestation ProcedureS (rats), Security Area Open Meeting (saag), Security Area Directorate (secdir), The Tools Team (tools), Privacy and Security (privsec), the Internet of Things and the Security Area Directorate.

The IESG approves proposals to create new working groups and plays the key role in approval of proposed standards and their advancement from "Proposed Standard", "Draft Standard", and "Standard"[5]. Standards once reviewed by the IESG and published never change. Instead, they become obsolete if the specification is replaced by a subsequent Standard. The most fundamental standards for the Internet are TCP, IP, BGP, UDP, DNS, SMTP and HTTP (Alverstand and Lie, 2009:133). However, there are dozens of standards agreed per year. The IETF has published around 300 RFCs annually over the last 10 years peaking with 459 RFCs in 2006[6]. Jari Arkko, who was chair of the IETF from 2013 – 2017 ran an IETF statistics tool which tracked the number of RFCs published by the IETF over time.[7] The tool documented for example the production of RFCs between 2013-2018. RFCs (Request for Comments) are not necessarily finalised standards. A commonly heard phrase at the IETF is 'the Internet runs on Proposed Standards' (Alverstand and Lie state, 2009: 130).

Figure 3.3: RFC publication per month



Source: Jari Arkko http://www.arkko.com/tools/rfcstats/pubdistr.html

The IESG takes charge of the technical management of IETF activities through rules and procedures ratified by the ISOC Board of Trustees. It is the central coordinating body of the organisation made up of ADs selected by the Nominations Committee (NomCom) and plays an important role in reviewing RFC proposals. The IESG decides whether an IETF Working Group has produced an outcome which has secured the famous 'rough consensus' on which IETF decision making is based. In 2019 there were 20 IESG Members.

[5] https://datatracker.ietf.org/doc/rfc2026/ last accessed May 3, 2019.
[6] https://www.ietf.org/standards/rfcs/.
[7] http://www.arkko.com/tools/rfcstats/pubdistr.html.

The NomCom is established annually by requesting volunteers from the membership followed by a random selection process[8]. The Chair of NomCom is appointed by the Internet Society President. The NomCom is critical to the IETF in that it selects potential members for the IESG, IAB and Administrative Oversight Committee (IAOC). In addition to NomCom, the IETF has a Secretariat which, among other things, ensures the accurate maintenance of the organisation's Internet-Drafts directory and a Trust responsible for licensing the IETF's intellectual property. The IAB is both a committee of the IETF and an ISOC advisory body. It has a long term planning and new activities monitoring role in respect of the IETF. It has an additional role of implementing 'IANA considerations' within the IETF[9]. Beyond this the IAB runs the RFC Series Oversight Committee (RSOC) and has oversight of IETF external liaisons. Then there is the IETF's Administrative Oversight Committee is a voluntary body chosen by the IETF Nominating Committee (NomCom), appropriate ex-officio members of ISOC and the IETF leadership[10].

The IETF holds meetings three times per year in order to undertake face to face progress on ongoing work which take place according to its designated charter provisions regarding the organisation's scope and objectives. WGs tend to form as a result of so-called Birds of a Feather (BOF) meetings (approved in advance by an Area Director) wherein individuals experts get together to consider a group charter and work agenda. BOF meetings are held at IETF meetings which are held to garner interest in proposals. BOF meetings are official and listed in meeting programmes.

For example, at the IETF 104 in 2019, the IETF Chair, Alissa Cooper, approved six BOF sessions proposed by the IESG: the Predictable and Available Wireless (PAW); Collaborative Automated Course of Action Operations (CACAO); Broadband Network Gateway Control-Plane And User-Plane Separation (BCAUSE); Key Signing Key Futures (KSKF); Brand Indicators for Message Identification (BIMI); and Stopping Malware and Researching Threats (SMART). BOFs are also organised remotely. Interviews and IETF attendance revealed that there are an increasing number of 'pre-BOFS' organised on an informal basis and side meetings which lead to 'flexi-BOFs'. This informal style of governance is not new however to the IETF as 'corridor' networking has long been prevalent.

Most of the business of WGs is conducted through mailing lists where consensus on anything agreed at face to face meetings must be secured. Securing rough consensus is when "the chair of a working group determines that a technical issue brought forward by an objector has been truly considered by the working group, and the working group has made an informed decision that the objection has been answered or is not enough of a technical problem to prevent moving forward, the

[8] https://datatracker.ietf.org/doc/rfc7437/ last accessed May 3, 2019.
[9] https://tools.ietf.org/html/rfc8126. last accessed May 3, 2019.
[10] https://tools.ietf.org/html/rfc4071. last accessed May 3, 2019.

chair can declare that there is rough consensus to go forward, the objection notwithstanding" [11]. The IETF also engages in the peculiar process of humming consensus during meetings, developed to guard against the over-representation of parties with the loudest voices. More broadly, changes in IETF procedures for setting standards are derived through the activities of a Working Group. The fluid membership nature of the IETF is a key feature of its governance procedures.

After a WG has agreed on a standards document a so-called Document Shepherd takes it forward who is normally, but not necessarily, the working group chair or secretary of the group. An IETF standard (which can sometimes also come from individuals as well as WGs) is published as a Request for Comment (RFC). The journey to this point involves a multi-stage process of discussion and review. The Internet-Draft document[12] (which has a six month life) receives comments and is amended subsequently. Then an AD brings the draft to the IESG after reviewing it.

The IESG then creates an organisation wide Last Call. After any concerns expressed by IESG and organisation wide members are addressed to the IESG's satisfaction, the document can be published by the RFC Editor as a proposed standard. Further adjustment to the standard can occur after this point. An interesting feature of the IETF is that most standards in use do not move forward from Proposed Standards to Standards (or 'Internet Standards').

To become an Internet Standard, a specification must be "stable and well-understood, is technically competent, has multiple, independent, and interoperable implementations with substantial operational experience, enjoys significant public support, and is recognizably useful in some or all parts of the Internet"[13]. Not all RFCs are standards. There are five types of RFCs: 'standards track', 'best current practice', informational, historic and experimental[14].

Core issues under discussion at the IETF in 2019 included the web protocol stack (HTTP2, QUIC); security and privacy; real-time communications in browsers; management, orchestration, virtualisation, software-and data-model driven networking; IoT and running code and open source. Interviews showed that civil society groups were most interested in the work on APP, DMARC, DANE, DNS, IEEE wifi standards, IPPG, TLS 1.3 and EPP privacy implementation.

As the Internet has grown and become of prime strategic commercial significance, inevitably the workload of the IETF has become weightier, more complex and higher staked in character. Interviews revealed that there is an internal understanding that the IETF only publishes 1 specification for 1 requirement. This means that, if there are two competing groups, only one specification is adopted. Often competing standards revolve around IPR issues.

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[11] https://datatracker.ietf.org/doc/rfc7282/. last accessed May 3, 2019.
[12] https://www.ietf.org/standards/ids/. last accessed May 3, 2019.
[13] https://datatracker.ietf.org/doc/rfc2026/?include_text=1
[14] https://www.ietf.org/standards/rfcs/

The IETF has also shown reluctance to work on protocols not operable for devices not using TCP. An example of this is when it dealt with an extension for the IETF protocol TCP called Q.FlowstateSig[15]. Unable to find AD support within the IETF, the consortium took Q.FlowstateSig to the ITU-T. However, a compromise was sought via the IESG and ITU-T Q5/SG11 liaison committee in that the protocol had a lowest common denominator implementation so only those who wanted to use it had to employ it.

The Internet Society

There is a close relationship between ISOC and the IETF. ISOC houses the IETF, the IAB, the Internet Engineering Steering Group (IESG), and the IRTF. It is registered as a non-for-profit organisation in the US. ISOC was initially created in 1992 to provide financial support for the IETF. Previous to this time it had been funded by the National Science Foundation at the Corporation for National Research Initiatives (CNRI) founded by Robert Kahn. There were concerns at the time of the IETF's establishment surrounding its ability, as non-legal entity, to cope with legal challenges arising from the increasingly strategically important Internet standards setting process. ISOC was viewed as the organisational answer in terms of both providing an appropriate legal standing and generating financial revenue (Alverstand and Lie, 2009: 128; DeNardis, 2014: 70). ISOC generates most of its funding via the Public Interest Registry (PIR) which has allocated the .org top level domain (TLD) since 2002.

Discussion in IETF and IAB meetings in 1991 led to the establishment of ISOC. Vint Cerf served as the first President of ISOC's Board of Trustees. A key moment in the development of ISOC's core relationship with the IETF occurred in June 1992 when the ISOC Board of Trustees decided to accept the IAB invitation to bring the IAB and its activities into ISOC so that the IAB became a technical advisory group of ISOC. Cerf argued that round this time 'it appeared that long term support for the standards making activity of the IETF, which had come primarily from research supporting agencies of the US government (notably ARPA, NSF, NASA and DOE) might need to be supplemented in the future'[16]. ISOC was proposed as an organisation that could draw together and extend the IETF's funding. This meant that the IETF's activities came under this new arrangement. In the second half of 1992, the POISED working group 'reallocated responsibilities for standards decision-making' and made recommendations which became the basis for the working relationships between the IAB, the IESG, ISOC and the IETF. ISOC's support for the IETF standards process was affirmed at a 1995 ISOC Board of Trustees meeting.

[15] https://www.iab.org/documents/minutes/minutes-2011/iab-minutes-2011-08-24/.
[16] https://www.internetsociety.org/internet/history-of-the-internet/ietf-internet-society/

In 2003, an ad hoc advisory committee of the IAB made recommendations on the future administrative needs of the IETF (IETF, RFC 3716). The IETF asked for ISOC's support in a subsequent restructuring which resulted in the establishment of the IASA (see above) within ISOC. This led to a streamlining of the IETF's administration and greater individual control of its budget (IETF RFC 4071) which has hovered around $5 million annually over the last 20 years[17]. Alongside this, the US Corporation for National Research Initiatives and ISOC established a trust for the IETF. This ensured that the IETF (with the IAB and RFC Editor) developed within the remit of ISOC. Since this time, ISOC has established a voluntary relationship with the ITU.

ISOC was incorporated as a non-profit organisation in order to 'facilitate and support the technical evolution of the Internet as a research and education infrastructure and to stimulate the involvement of the scientific community, industry, government and others in the evolution of the Internet; to educate the latter parties in the technology, use and application of the Internet and to promote educational applications of it; and to 'provide a forum for exploration of new Internet applications, and to stimulate collaboration among organisations in their operational use of the global Internet'[18]. ISOC's board of directors is the Board of Trustees (originally made up of 13 people), which takes action on a majority vote basis (or unanimity in the case of an electronic vote) and four of whom are appointed by the IETF. ISOC had four declared priority areas in 2019: building trust, connecting the world, improving technical security and shaping the Internet's future. With respect to connecting the world, ISOC declared in 2019 that it aims to 'promote policies and build communities to sustain an Internet that is a universally accessible platform for innovation, creativity, and economic opportunity...[and to]… advance the development and application of Internet infrastructure, technologies, and open standards to enable an open Internet for all'.

In 2016, ISOC developed a 'Policy Framework for an Open and Trusted Internet'. An important element of this is to improve the security of IoT devices. Encryption, collaborative security, user trust and Internet restrictions, identity and privacy are also key concerns within this framework. The goal of improving technical security is one where developing technical standards is particularly important for ISOC through the work of the IETF. One stated priority is to 'contribute to the development of best practices or technical standards resulting in standards that are secure and deployable in global setting…by…assess[ing] potential deployment issues in the deployment of new standards such as Transport Layer Security (TLS) 1.3, and Domain Name System (DNS) over TLS and HTTPS'[19]. With respect to shaping the Internet's future, ISOC undertakes analysis of key global Internet developments. Its 2019 Global Internet Report highlighted the Internet's potential in

[17]ISOC contributes circa half of the IETF annual budget. Other IETF funding is derived from conference registration fees, meeting sponsorships, in-kind Sponsorships, event sponsorships, Bits-N-Bites, Hackathons and hotel commissions.
https://iaoc.ietf.org/budget-and-finance.html.
[18] https://tools.ietf.org/html/rfc2134
[19] https://www.internetsociety.org/key-issues/

terms of its technical evolution and use, but also its problems, arising from a discernible consolidation of the Internet economy.

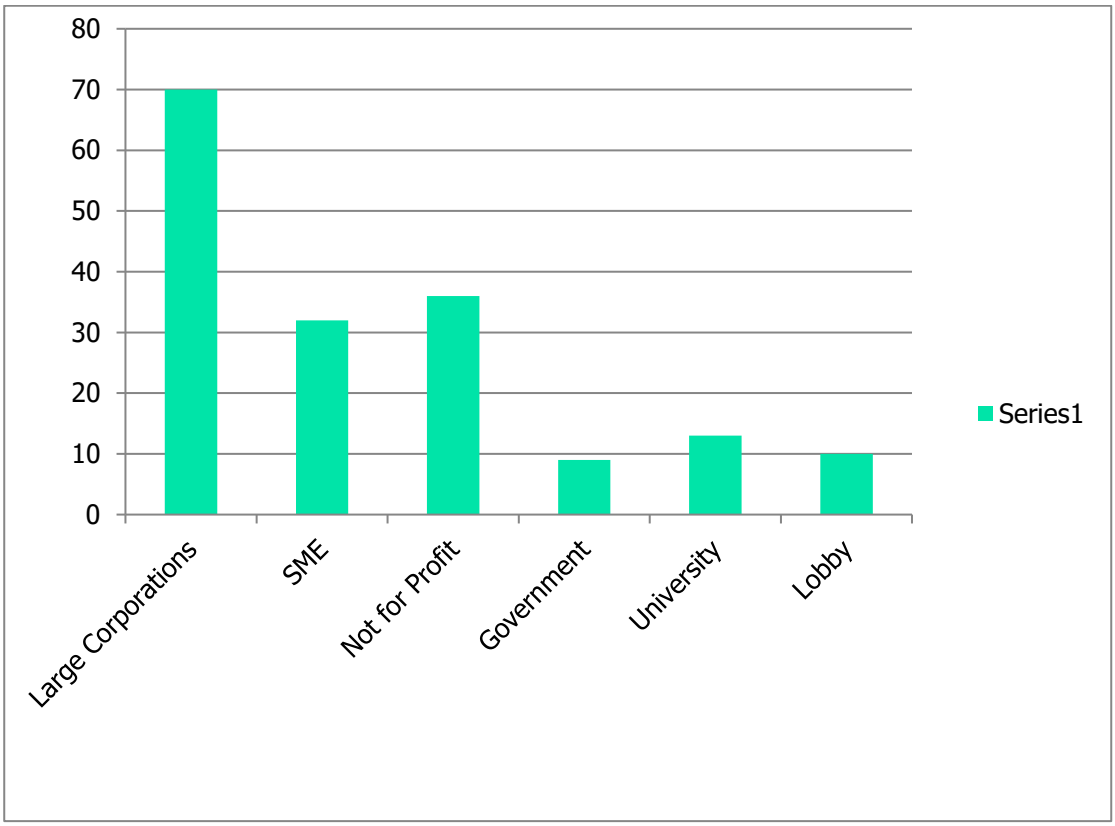
Unlike the IETF, ISOC membership is organisational. Members are defined as 'any organization that shares an interest and belief in the Society's principles and mission, and meets Organizational Membership dues requirements. Each Organizational Member shall act through its duly authorized representative(s).'[20] Although anyone can join ISOC, its membership is overwhelmingly made up of large corporations (Table 3.2). Organisational members meet at least once per year. Fees ranged between $5,000 (professional) to $100,000 (platinum) membership annually providing different levels of representative and weighted voting in 2019[21]. The Internet Society is organised into national Chapters and was comprised of 110 Chapters in 2019[22]. Chapters are permitted to pronounce on any matter as long as they advance the purposes of ISOC, do not conflict with a Board of Trustees position and are unlikely to raise issues of legal or juridical liability.

ISOC meetings contain three different types of sessions. Open forum sessions allow physically present and remotely connected participants to ask questions and undertake discussions with the board. Open to Observers sessions allow physically present and remotely located listening to occur. Closed Executive sessions which are restricted to Board members and invited guests, by contrast, deal with matters in which sensitive information is likely to be discussed.

In 2019, ISOC noted the importance of scale in the process of Internet standards development where it 'is not just a source of efficiency, but also a source of power'[23]. On the one hand, the 'open, collaborative, and interoperable Internet is influenced by a small number of large companies, and organisational scale and market share play a significant role in the development and deployment of the open technical standards on which the Internet depends' (ISOC 2019 Annual Report). On the other, it was noted how large organisations could play a positive role in promoting, developing and testing new standards for the general benefit of the Internet. Interestingly however, ISOC's 2019 annual report which cited the role of Google in QUIC protocol development which allowed analysis, of usage, experimentation, development and testing to take place, also noted 'how its significant browser and content provisioning market share provides it with unique resources that few can match'. A similar point was made by Mathiason when reflecting on the experience of the Microsoft Internet Explorer browser, noting more generally that whilst standards have been a feature of industrial development for centuries 'the Internet has made them more controversial, since they can affect how well the Internet functions' (2008: 40).

Table 3.2: Internet Society membership

[20] https://www.internetsociety.org/about-internet-society/governance-policies/by-laws/.
[21] https://www.internetsociety.org/about-internet-society/organization-members/membership-levels/
[22] https://www.internetsociety.org/chapters/
[23] https://future.internetsociety.org/2019/key-features-of-the-consolidation-of-the-internet-economy/ accessed April 11, 2019.



Source: compiled by Francesca Farmer from the Internet Society membership page https://www.internetsociety.org/about-internet-society/. (Accessed November 2017).

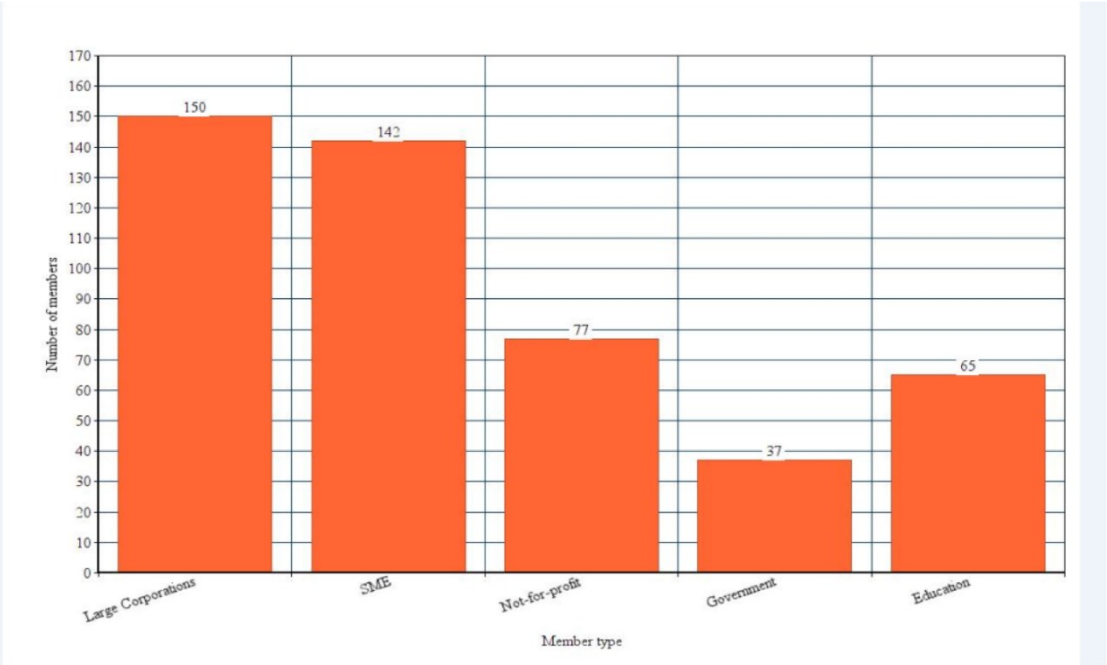
The World Wide Web Consortium (W3C)

The W3C originated from the work of Tim Berners-Lee who developed the hypertext transfer protocol (HTTP) and hypertext mark-up language (HTML) in 1989 when working at CERN in Switzerland. These protocols underpin the functioning of the World Wide Web. The new graphics interface had wider user appeal to previous file-to-file based systems such as Gopher developed at the University of Minnesota and the File Transfer Protocol (FTP). Berners-Lee had the foresight to release HTTP and HTML as open source protocols to increase use and operability. This followed wide user concern about potential patent development of the web when, before the development of HTTP, Gopher began to demand royalties for commercial use.

In order to prevent fragmentation, Berners-Lee sought to standardise protocols within the IETF. As Russell comments "Berners-Lee recognized that, absent some sort of institutional effort to coordinate … divergent projects, the Web might balkanize into a variety of incompatible standards" (2011:163). Whilst HTML 1.0 was standardised within the IETF, Berners-Lee grew frustrated with the slow speed of decision-making, and established the W3C in 1994 at the MIT initially to further the development of HTML, then Cascading Style Sheets (CSS) which describe webpage layout and the WWW more generally. HTTP remained at the IETF. The MIT consortium was cloned from older industry consortia. The W3C has since linked up with global 'host institutions' in France,

Japan and China[24]. A key difference between the W3C and the IETF and IEEE is that it operates on an open standard basis.

Table 3.3: W3C membership



Source: compiled by Francesca Farmer from W3C membership page https://www.w3.org/Consortium/Member/List. Accessed (November 2017).

The W3C was initially financed by DARPA and the European Commission but developed a fee-paying member system over time. By November 2017, the W3C had 471 Members, 150 of which were large corporations, 145 SMEs, 77 non-for-profit, 65 academic members and 37 from regulatory authorities. Fees ranged from 2,250 USD for non-for-profit members with 10 or fewer employees to $77,000 for large private groups in 2019. Individual membership of the W3C is charged on a sliding scale from $300 for non-affiliated individual members to $10,000 in 2019 for large corporate representatives, which represents a high financial barrier to entry.

Like ISOC most membership comes from large corporations but the W3C demonstrates more diverse membership than ISOC which supports the IETF with a greater proportion of SME, academic and third sector group membership. The W3C also runs a series of 2 -3 workshops annually inviting representatives from industry and academics for discussion determined via its "strategy function".

The W3C operates differently to the IETF as much of the work is done face to face within working groups which are scheduled 1 or 2 times per year. Working groups also meet circa once per week via telephone conferences. Some groups meet more frequently. Interviews with one group's

[24] The regional hubs are namely the European Research Consortium for Informatics and Mathematics (ERCIM) in France, Keio University in Japan and Beihang University (in China). https://www.w3.org/Consortium/facts#org.

participants found that a working group met once per week then the Chairs met on Thursdays in addition to WG phone calls. The W3C also holds annual meetings.

Standards are agreed in formal W3C working groups which include paid members, invited experts (invited by the Director Tim Berners Lee and approved by W3C staff) and core staff. The W3C operates with a relatively small number of 25 core staff, 12 of whom are located at MIT in Boston. There are 2 legal agreements 1) between the 4 hosts which cover employment practices and harmonisation rules. 2) the membership agreement between each host company and the W3C. In addition, there is an Advisory Board and a Technical Advisory Group (TAG) both elected by the Advisory Committee. The Advisory Committee is composed of representatives from W3C member organisations. The Advisory Committee consists of 9 - 11 members and has been chaired by Jeff Jaffe since 2010[25]. It reviews W3C charters. The TAG was set up in 2001 and consists of 11 people. Chaired by Berners-Lee, it concentrates on technical scrutiny but also discusses wider issues[26]. Examples of these include TAG discussion of the Battery status API and the Google application format. The TAG launched a Self-Review Questionnaire: Security and Privacy in 2019[27].

Working groups permit only one vote per organisation. There can be two members from each company present in a WG but only one can vote. The W3C Director Tim Berners Lee then decides whether a proposal goes to final standard which is called a W3C Recommendation and publicised in the Technical Report space. A standard is formalised after 2 implementations and, if successful, becomes a Recommendation. Before a working group is nominated, there is a wide review phase wherein the wider W3C community is consulted.

There is also a horizontal review[28] with four measures 1) security which ensures that there is no cross leaking from application code and everything is encrypted 2) privacy for information security 3) accessibility to ensure usage for all users across the web and 4) internationalisation to establish that there is global use. In this respect, proposals are overseen by the Web Security Interest Group (for security), Privacy Interest Group (for privacy), WAI Accessible Platform Architectures (APA) Working Group (for accessibility) and Internationalization Technical Architecture Group (for technical architecture principles). The horizontal review areas must be considered in all W3C standard making.

[25] In January 2019, Advisory Board members were Michael Champion (Microsoft), Jay (Junichi) Kishigami (NTT), Charles McCathie Nevile (ConsenSys) ,Florian Rivoal (W3C Invited Expert), Natasha Rooney (GSMA), Tzviya Siegman (Wiley), David Singer (Apple), Léonie Watson (TetraLogical), and Hongru (Judy) Zhu (Alibaba).

[26] In January 2019 members of the TAG were Daniel Appelquist (Samsung Electronics) (co-Chair), David Baron (Mozilla Foundation), Hadley Beeman (W3C Invited Expert), Tim Berners-Lee (W3C) (Chair), Alice Boxhall (Google), Kenneth Rohde Christiansen (Intel Corporation), Yves Lafon (W3C) (staff contact), Peter Linss (W3C Invited Expert) (co-Chair), Sangwhan Moon (Odd Concepts), Theresa O'Connor (Apple, Inc.) and Lukasz Olejnik (W3C Invited Expert).

[27] https://www.w3.org/TR/security-privacy-questionnaire/.

[28] https://www.w3.org/Guide/process/charter.html#horizontal-review.

There is liaison with the IETF, ICANN, IGF and the W3C. Most W3C liaison is with the IETF. Whereas the IETF and IEEE develop protocols, the W3C mainly agrees on APIs. Sometimes it deals with protocols e.g. for USGTP header definitions. In these cases, the IETF is aware and informed of W3C developments. There are other overlapping areas with the IETF such as the delivery of on-demand television from CDNs. For example, the BBC is working with both the IETF and the W3C to standardise delivery systems[29]. In 2019, the W3C had agreed 1175 Candidate Recommendations[30]. It divided work into 7 main areas: web architecture (e.g. OWL, URL, URI, IRI); web design and application (e.g. HTML, CSS, DOM, SVG, Ajax, WCAG and WebApp technologies); the Semantic Web (e.g. RDF, SPARQL, OWL, and SKOS); web of services (e.g. HTTP, XML, SOAP, WSDL); Browsers and Authoring Tools, XML Technology; and the Web of Devices which includes Mobile Web, Voice Browsing (VoiceXML, PLS, SISR, SRGS, SCXML, and CCXML) Multimodal Access (EMMA, InkML) and Web and TV (e.g. EME) standards. Digital rights groups have been most concerned with EME as will be discussed in Chapter 5.

The W3C also works on accessibility which is supported in legislation for example in the US GSA's Government-wide IT Accessibility[31]. This is flanked in Europe by ETSI guidelines[32]. The W3C's Web Accessibility Initiative (WAI) was established in 1997. Its key aim was to make the web accessibility to users with disabilities. It publishes a series of Content Accessibility Guidelines (WCAG) for developers[33]. The last WCAG 2.1 was published in 2018.

Simcoe notes that the W3C can 'move faster than the IETF because it requires formal membership…and places more authority in the hands of a few directors' (2007: 270). Most salient work within the W3C is led mainly by browser companies such as Google and Microsoft, manufacturers like Intel, and user companies such as Facebook. Facebook is particularly active within W3C with use case studies. Comcast and Netflix are also important actors particularly within specifications for television.

Although the W3C runs on a fee basis, it takes its main principles from the IETF including endorsement by W3C and the 'broader community', 'due process' and interoperability which can be found in its Process Document. There are no formal consultation procedures for the wider public. However, the Process Document[34] states "consensus is a core value of W3C. To promote consensus, the W3C process requires Chairs to ensure that groups consider all legitimate views and objections, and endeavour to resolve them, whether these views and objections are expressed by the active participants of the group or by others (e.g. another W3C group, a group in another organization, or the general public)".

[29] https://www.bbc.co.uk/rd/projects/dynamic-adaptive-streaming-ip-multicast-dasm.
[30] For a full list of W3C standards see https://www.w3.org/TR/.
[31] https://www.section508.gov/.
[32] ETSI (2018) Accessibility requirements for ICT products and services. EN 301 549 V2.1.2 (2018-08). https://www.etsi.org/deliver/etsi_en/301500_301599/301549/02.01.02_60/en_301549v020102p.pdf
[33] https://www.w3.org/WAI/standards-guidelines/wcag/.
[34] https://www.w3.org/2018/Process-20180201.

The W3C has 4 stages of consultation: the Working Draft (WD) stage, Candidate Recommendation (CR), Proposed Recommendation (PR) and Recommendation (REC). Consensus is considered to take place when a significant number of members support a Recommendation and there is no Formal Objection raised. Formal Objections can be raised directly with the W3C Director, Tim Berners-Lee, who may decide to return a standard back to a Group for reconsideration or let it pass to final Recommendation.

All W3C standards are published openly. However, most standards are brought to the W3C when they have been developed and rolled out in the market and the need for interoperability arises. Rarely is it the case that the W3C or even academia develops a standard before the market has developed a proprietary one. Normally once development reaches this stage and a proposal is made, 2 – 3 different submissions come through at the same time.

Once common ground has been established, a business group or community group is created to develop a CG or FB final draft. Anyone can join a community group. Community groups are held by the W3C largely to encourage wider participation which are seen as incubators for standards[35]. Groups range in size membership. Community groups present windows of opportunity where civil society can influence proposals and or alternative technologies can be assessed before a closed Working Group is established. The number of specifications for open source web platforms is increasing within community groups.

However, only W3C Members or Business Group subscribers can join business groups. Usually, only a small set of a community group joins a WG. Members must sign the contributor agreement and the final report agreement. They also include invited experts. The CG or BG draft is the basis for the establishment of a Working Group. Members of a working Group must act in the capacity of individuals (as Individual Experts) or on behalf of one company or organisation only. Participants can be: W3C member representatives, experts appointed by the WG Chair for their expertise and team representatives. There is only one vote per organisation. So if there are two members from the same company within the same WG, there can be only one vote between them. Company representatives are bound to the W3C's Conflict of Interest Policy.

Development within the W3C means that standards are agreed jointly between different market players meaning a sharing of technology and often that which has already been patented. Participants must agree to W3C royalty-free licensing before joining a Working Group. The final product is an open source standard so companies agreeing a standard must publish an open source result, even if patented standards come into the mix. For this purpose, the Advisory Committee establishes a charter. The AC also votes on who will be on the Working Group.

[35] https://www.w3.org/community/groups/.

After a WG is authorised, a Chair and team contact are assigned who govern the progress of the WD. The Resource Description Framework[36] is utilised to produce a relatively complex map for identifying resources and interdependences between one working group and another. The WD is made publicly available and the WG continues work until it produces a Candidate Recommendation. Until 2003, the W3C used to make a last call for comments similar to the IETF. However, since 2003, finalised Candidate Recommendations have been submitted as Proposed Recommendations to the W3C Advisory Committee for approval. The AC votes to accept or reject the proposal then the W3C Director, Tim Berners-Lee, declares it as a standard: a W3C Recommendation after which is it is published in the Technical Report (TR) space. A standard is finalised after 2 implementations. The W3C differs from the IETF in that there is much more at stake given the high level of membership fees. The IETF process involves many more false starts and incomplete work. The incentive to finalise a standard within the W3C as quickly as possible is higher. The success of proposed standards to final Recommendation (REC) in the W3C is therefore greater than in the IETF.

The Organisation for the Advancement of Structured Information Standards (OASIS)

OASIS is an international, non-profit, consensus based open standards body. It was created in 1993 to address interoperability among products supporting the Standard Generalized Markup Language (SGML), the precursor to Extensible Markup Language (XML). It declares that it is 'dedicated to the development, adoption, application, and implementation of structured information standards' and as a result its function is to provide an 'open forum to discuss market needs and directions, and to recommend guidelines for product interoperability. The consortium receives, coordinates, develops and disseminates information describing structured information standards and related specifications, methods, recommendations and technologies'[37]. Its main areas of activity in 2019 were security, Cloud computing, IoT, the Smart Grid, content technologies, emergency management and eGovernment.

OASIS has a five strategic goals: provision of an 'effective, efficient, open and transparent environment for the development, coordination and maintenance of high quality standards'; to be broad and international in terms of membership; to 'support all stages of the standards lifecycle'; to develop 'productive relationships with policy setters, analysts, and decision makers affected or potentially affected' by its work; to scan the horizon to spot areas in need of standardization in order to pre-empt market fragmentation[38].

[36] https://www.w3.org/RDF/.
[37] https://www.oasis-open.org/policies-guidelines/bylaws.
[38] https://www.oasis-open.org/org/strategy.

Head-quartered in Boston, OASIS had over 5000 members from more than 600 organisations and individuals in 100 countries in 2019. The organisation is led and supervised by a president working under the control of a Board of 11 directors, each of whom serves in an individual capacity (though he or she must be a member or employee of an OASIS member organisation), half of whom are elected annually for a term of two years and is assisted by a Technical Advisory Board. Any organisation or individual is permitted to become an OASIS member, meeting once per year and of which there are two categories: voting and non-voting. Similar to the W3C, fees are tiered according to organisation type and size ranging from academic contributors ($1,350 annually) to companies employing more than 500 people ($54,000 annually) in 2019. Also similar to the W3C, there is a broad constituency of membership in OASIS including commercial players, researchers, users, government agencies, and academic institutions. OASIS is in turn a member of the W3C.

Each member has one vote on each matter considered. Voting can take place by voice or ballot. In the latter case, it is possible to take an action outside of a formal meeting through written or email ballot. Here 'any action required or permitted to be taken by the members may be taken without a meeting, if all members shall individually or collectively consent in writing by paper, facsimile, or by email to the action'[39]. The OASIS board can create Member Sections, governed by a steering committee. The latter address 'particular structured information standards or families of standards as designated by its Rules of Procedure' which are created by its members.

OASIS allows member organisations to have as many members as they wish participating in its Committees approved through the organisation's Primary Representative. However, committees specify Voting Members and operate on the basis of one member-one vote irrespective of the number of persons from a single organisation that are in a committee.

The organisation had developed over 80 standards by 2019 and has an IPR policy which contains four modes specifying licensing requirements which are selected by Technical Committee members. For the most part, Non-Assertion or Royalty-Free modes are employed by the organisation. OASIS antitrust guidelines state that its policy is 'to comply with all antitrust and competition laws and regulations' and it 'may not…in any way restrict competition in OASIS member industries'[40]. These guidelines emphasise that members 'may compete with one another in various lines of business and that it is therefore imperative that they and their representatives act in a manner that does not violate any applicable antitrust or competition laws and regulations'. The organisation has established formal relations with the ISO, ISO/IEC JTC, ITU, UN/ECE, ANSI, CalConnect, the European ICTSB, Korean NIPA, NAESB, TM Forum, and the W3C among others. OASIS also has a community dimension involving the provision of a websites related to its standards (XML.org, OASIS News and Interoperate IoT).

[39] https://www.oasis-open.org/policies-guidelines/bylaws.
[40] https://www.oasis-open.org/policies-guidelines/antitrust.

The Institute of Electrical and Electronics Engineers (IEEE)

The IEEE is another important SDO which develops standards for wireless networking such as Ethernet (IEEE 802.3 set of standards), Bluetooth (IEEE standard 802.15.1) and WiFi (IEEE standard 802.11). It is a global body with more than 426,000 members in 2019 from 160 states that provides global technical fora 'serving the professionals working on emerging and disruptive technologies' in the process using the acquired insights 'to provide governments, NGOs, and other organisations and the public with innovative, practical recommendations to address pubic policy issues' (IEEE 2015 Strategic Plan).

The IEEE consists of an Assembly and Board of Directors (BoD) selected from its membership. The BoD is crucial in that it has direct responsibility for a raft of boards related to the IEEE's core activities (Figure A), only one of which is developing technical standards. The latter is headed by the Standards Association Board of Governors and Standards Board. The Standards Board presides over a series of committees which undertake the detailed technical standards making work of the organization (Figure B). Here, there are as many as 31 Societies developing standards. Committees on Radio Frequency (RF) Techniques, Audio and Visual Techniques, Access and Core Networks Standards, Dynamic Spectrum Access, Mobile Communications Networks, Virtualised and Software Defined Networks and Services and Local Area Network/Metropolitan Area Network standards are particularly noteworthy with respect to the subject matter of this book. The IEEE Constitutional change needs the support of all IEEE voting members whereas approval by the Board of Directors is sufficient to alter its bylaws (Kanevskaia, 2018).

The Standards Board aims to 'encourage and coordinate the development and revision of IEEE standards; to approve the initiation of IEEE standards projects; and to review them for consensus, due process, openness and balance' as well as to give final approval to standards before publication[41]. It is interesting to note the assertion that its 'membership shall reflect the current standards needs of societies that are developing standards, industry sectors, international interests, and selected organisations (e.g. government, consumer)'. IEEE standards making is underpinned by the five principles of due process, openness, consensus, balance and right of appeal. The IEEE SA New Standards Committee, alongside the Standards Review Committee, recommends the approval of new and revised standards requests made to the Standards Board. The Procedures Committee makes recommendations on procedural changes to improve IEEE SA SB efficiency. The Patents Committee has oversight of patents conformity and use and information on IEEE standards. The Audit Committee overseas standards development in the IEEE's Societies, their standards-development entities and the Standards Coordinating Committees of the IEEE SA SB.

[41] https://standards.ieee.org/about/policies/sa-opman/sect5.html

The approval by the IEEE Standards Association of a new standard endorses it as 'consistent with good engineering practice' with 'a consensus of representatives from materially affected industries, governments or public interests'[42]. The IEEE SA aims for 'open and innovative' deliberations in the standards development process and is the only part of the IEEE authorized to represent the organization on external standardization matters. The IEEE SA Board of Governors undertakes to 'establish policy, provide for financial oversight, and conduct standards-related activities within the technological fields of the IEEE'. Within this remit, one of its key responsibilities is to 'establish and maintain a constituency of IEEE-SA members representative of all basic interests' comprising technical societies, industry, government and the general public. It also has financial oversight and operational management responsibility for IEEE SA.

The IEEE Standards Association specifies membership criteria in IEEE Bylaw 1-403.1. The IEEE levies membership fees, which for so-called entity members (corporations) vary according to annual revenue. The operations manual outlines that membership of the organisation allows voting on 'an unlimited number of proposed IEEE draft standards and on the withdrawal from active status of existing IEEE standards that have reached the Standards Association ballot stage'. The process of development of a new IEEE standard commences with the proposal of a new work area to an IEEE SA Sponsor. The latter then forms a Study Group, which can be individual member or entity member based, to explore the proposal in more detail. The Group becomes a sub-group of the Sponsor. The Sponsor should consider the potential market demand and technical feasibility of the proposed project; how it would relate to existing standards; whom might lead and participate in its development; its scope and objectives; and the extent to which it could broaden the expertise base of the sponsor. Sponsors are usually IEEE Societies or Committees.

IEEE SA guidelines stipulate that each Study Group should have a Chair and a Secretary, the former of whom circulates a call for participation in the Group's activities. The Study Group should follow the IEEE-SA's antitrust policies. If sufficient interest and resources are present, a Project Authorization Request (PAR) is developed in relation to the proposed standard development project. A project will not be considered to exist until this point, even though in practice members of the working group may have met to work on the PAR. A Study Group can exist for up to six months before a PAR needs to be submitted. Existing working groups may create new PARs.

The IEEE stipulates that in Individual Study Groups members should act on the basis of their individual expertise whereas in Entity Study Groups, it is stated that at least three separate entities should take part. It is recommended that Study Group decision taking occurs consensually, though otherwise on a majority basis when needed. In the latter case, for Individual Study Groups, the recommendation is that at least 5 people are needed in each vote and that 75% percent approval is required for the issue at hand to be resolved. In relation to Entity based Study Groups, it is

[42] https://standards.ieee.org/about/policies/sa-opman/sect1-3.html.

recommended that a minimum of 3 entities should take part in a vote where 75% approval should be gained for the proposal in question to be accepted. When a Study Group recommends the development of a new standard (after which it is disbanded), it should provide its sponsor with a draft PAR, available intellectual property details, a draft project schedule and budget, and any recommendations regarding external organisational liaison in the development of the project in question. At this point, the process of formal balloting occurs. Post ballot, the draft standard is submitted to the Review Committee which submits it subsequently to the SB for approval. After review and acceptance the standard is published and can be distributed and purchased[43].

The IEEE provides guidance on the conduct of its standards meetings, where the objective is to secure consensus between government, industry and the public and in which any party 'interested in a standards activity or potentially affected by it is permitted to attend any IEEE standards meeting'. It is interesting to note that specific mention of the need to consider any relevant patent issues, pricing or other anti-trust matters and any current litigation is made in the guidelines. The New Standards Committee requires PARs sent to it for ratification to have been reviewed by a Sponsor Chair or Liaison. It is usual that Sponsors and Working Group Chairs respond to NesCom requests within the space of two of its meetings. The normal maximum period to complete a PAR is 4 years. It is expected that a project which has received PAR approval should open a PAR ballot within 8 years.

A key issue for the IEEE, as for all standards bodies, is the role and position of patents in its standards making processes. The Patent Committee (PatCom) oversees the use of patents and patent information in IEEE standards. In 2015, a key set of changes to IEEE patent policy were approved after a period of amendments to proposals. Under these, IEEE members commit to license patents to users of IEEE standards on fair, reasonable and non discriminatory (FRAND) terms. The move was in response to a rise in litigation which is discussed in Chapter 11.

Conclusion

Understanding the organisational context within which private technical standards for the Internet takes place is a vital part of determining their overall socio-political significance. The philosophical origins of the Internet as an open and growing global communications network pointed to the innate logic of pursuing standardising behaviour to sit in service of the pursuit of access and ubiquity of use. The informal, communitarian, consultative and deliberative characteristics of the early stage Internet were reflected in the organisational features of the IETF. As the Internet grew and became more commercial in its characteristics and strategic significance, these features have come under some strain. The private technical standards organisational landscape has developed consequentially.

[43] https://standards.ieee.org/develop/govern.html.

As shown, the Internet Society was created to provide the IETF with a degree of financial succour and legal assurance necessary as a result of the removal of public financial support and heightening commercial consequences entailed in standards making. Subsequent organisational contexts for web standards development, such as the W3C and OASIS have been conscious of the need to take decisions as expeditiously as possible. Long standing, more hierarchically structured private technical standards bodies, notably the IEEE, have become influential in core aspects of Internet standards development.

Yet, the fundamental characteristic of technical standards making of the need to pursue consensus is still recognisably important. However, the extent to which the pursuit of consensus is underpinned by strategic organisational self-interest over the development of electronic communication for broad human development is an open question and one which underpins much of the content of the remaining chapters of this book. The core concern is that, whilst private technical standards development of the kind explored in the chapters are largely led by commercial actors or their representatives, they can serve the public interest. As echoed by DeNardis, it is important to consider 'the sources of legitimacy for this privatized governance, how the public interest can be reflected, and what is the responsibility of governments, if any, to encourage the promotion of certain types of standards' needs to be considered' (2014: 83-84).