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International Standards: The Mother of Interoperability

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Agenda

- What is a Technical Standard?
- Why Participate in Standards Development?
- Major International Standards Organizations
- Consensus Standards body Example: IETF (Internet Engineering Task Force)
- IETF Major Work Areas
- Selected Cloud and Data Tagging/Labeling Standards
- How does Standards Participation Benefit US/Coalition Partners?
- Tips and Tricks
- Conclusions

What is a Technical Standard?

"Standards documents provide technical requirements, specifications, guidelines or characteristics that can be used consistently to ensure materials, products, processes and services are fit for their purpose" [https://www.iso.org/standards.html]

- Standards are fundamental to todays electronic technologies we rely on and ensure the quality and interoperability we expect

Standards create a common language and foster a common understanding and reference point when discussing, implementing or testing the standardized technology

Standards are grouped into two broad types:

- Defacto standards are created by a market leader and users and other vendors are often not consulted as the standard is developed
  - Examples include the PC and GPS
- Dejure standards are formal standards, developed via the consensus process by a recognized standards body
  - Dejure standards typically define which capabilities are mandatory and thus imply which capabilities are optional
  - Many dejure standards bodies require operational prototypes before a standard is approved
  - Examples include Ethernet and Voice over IP

Why Participate in Standards Development?

- Standards developers acquire an intimate knowledge of the technology they are standardizing
- Engineers on standards bodies discuss the technology in question with their peers and learn of problems, nuances and details often not generally available in the public domain
  - Standards developers thus become a source of corporate knowledge and are aware of solutions to solve common problems, reducing time to market
- Standards developers learn which features are mandatory, which are optional and which are undocumented

Standards participation requires strong personal and corporate commitment in time, $$ and dedicated personnel with the necessary technical skills

Major International Standards Organizations - Computers, Networks, Communications

International Organization for Standards (ISO)

- Overarching international industry standards body that allows only one member organization per country (the US Member is ANSI)
- Founded 1946 with representatives from 25 countries with headquarters in Geneva, Switzerland
- Responds to a request from industry or other stakeholders such as consumer groups via its national members
- ISO operates via consensus among multiple stakeholders
- Developer of ISO 9000 series of Quality Management System standards
- ISO/IEC JTC 1*
    - Responsible for development of worldwide Information and Communication Technologies (ICT)
    - Standardizes multimedia (Motion Picture Experts Group or MPEG series), Internet of Things (IoT), Cloud Computing and database queries and IT security among other technical areas

Major International Standards Organizations (con't)

International Telecommunication Union (ITU) is the United Nations specialized agency for information and communication technologies – ICTs

- ITU membership consists of 193 nations and over 800 private-sector and academic institutions
- Founded in 1865 to facilitate international interoperability of communications networks, the ITU allocates global radio spectrum and satellite orbits
- ITU develops the technical standards that ensure networks and technologies interconnect
- ITU has three main areas of activity referred to as "Sectors"
  - ITU-T, Telecommunications Standardization Sector standardizes communications protocols, telephony, video and audio compression (e.g. H.264) and emerging areas such as IPTV
  - ITU-R, Radiotelecommunication Sector standardizes radio frequency (RF) communications spectrum use, satellite orbits, mobile broadband communications and emerging Ultra-HDTV
  - ITU-D, Development Sector standardizes developing technologies for emerging markets, seeks to bridge the "digital divide" and publishes comprehensive ICT statistics

Major International Standards Organizations (con't)

International Electrotechnical Commission (IEC)

- Headquartered in Geneva, IEC prepares and publishes standards for all electrical, electronic and related technologies – collectively known as "electrotechnology"
- IEC standards covers many technologies from power generation, smart grid, worldwide electric plugs, electricity transmission to fiber optics and solar energy and IoT

World Wide Web Consortium (W3C)

- The W3C is an international consensus-based community that develops open standards to ensure the long-term growth of the Web including web design and services, including Hyper Text Markup Language

Telecommunication Industry Association (TIA), ANSI Accredited

- TIA works across a variety of industries related to communications technologies, including cable labeling, cable types and fire ratings and data center standards, satellite equipment, mobile networks among others

Major International Standards Organizations (con't)

American National Standards Institute (ANSI)

- Oversees the creation and use of thousands of standards and guidelines from acoustical devices to construction equipment, energy distribution, telecommunications and more
- ANSI also accredits or assesses the competence of organizations that determine conformance to standards
- Coordinates development of many US consensus standards
- ANSI is the sole U.S. representative and dues-paying member of the two major non-treaty international standards organizations, the ISO and the IEC
- Membership includes standards organizations, companies and government agencies
- ANSI does not write standards, it accredits standards developers that establish consensus among qualified groups

Internet Engineering Task Force (IETF)

- The largest and most influential consensus-based international standardization body for the Internet and Internet-related protocols and services
- Participants include network designers, operators, vendors, and researchers
- Details to follow…

Major International Standards Organizations (concluded)

Institute of Electrical and Electronics Engineers (IEEE), ANSI Accredited

- IEEE is the world's largest technical professional organization, standardizing electronics, computer and electrical technologies
- IEEE Members collaborate to standardize technologies, from computing and sustainable energy systems to aerospace, communications, robotics and healthcare
- Notable examples include local and metropolitan area networks (i.e. Ethernet, IEEE 80x.x), telephony quality and RF interference measurement among many others

Alliance for Telecommunications Industry Solutions (ATIS), ANSI Accredited

- Umbrella organization for telephony, cable and cellular companies
- Focus areas include standardization of cellular 5G networks, transition to an all-IP network, cybersecurity threats, emergency communications and wide area network time and frequency references and dissemination

IETF: Detailed Example

IETF (Internet Engineering Task Force) is the standardization body for the Internet and Internet-related protocols and services

The IETF is a large open international organization that formally meets three times a year

- There are constant discussions via e-mail

The IETF was formally established by the IAB (Internet Architecture Board) in 1986

- Most attendees at the meetings are network designers, operators, vendors, and researchers involved in the evolution of the Internet
- The IETF is open to anyone who is interested, not companies (although companies may join ISOC)

The home organization of the IETF is the ISOC (Internet SOCiety)

- ISOC promotes the open development, evolution, and use of the Internet worldwide
- ISOC is a non-profit, non-governmental, international, professional membership organization
- ISOC has more than 150 organization and 16,000 individual members in over 180 countries

IETF Overview (continued)

The technical work of the IETF is divided into 7 Operating Areas (routing, transport, security, etc.) each with an Area Director

- The Operating Areas are broken down into more than 100 WGs, with each WG having a Chair and Vice-Chair
- Much of the work is handled via mailing lists and meeting attendees are expected to be prepared- ready to discuss the relevant draft documents
- Unlike other standards organizations, WGs make progress on their documents through the process of rough consensus, not formal voting

IETF Overview – IAB and IANA

The IAB (Internet Architecture Board) is responsible for defining the overall architecture of the Internet, providing guidance and broad direction to the IETF

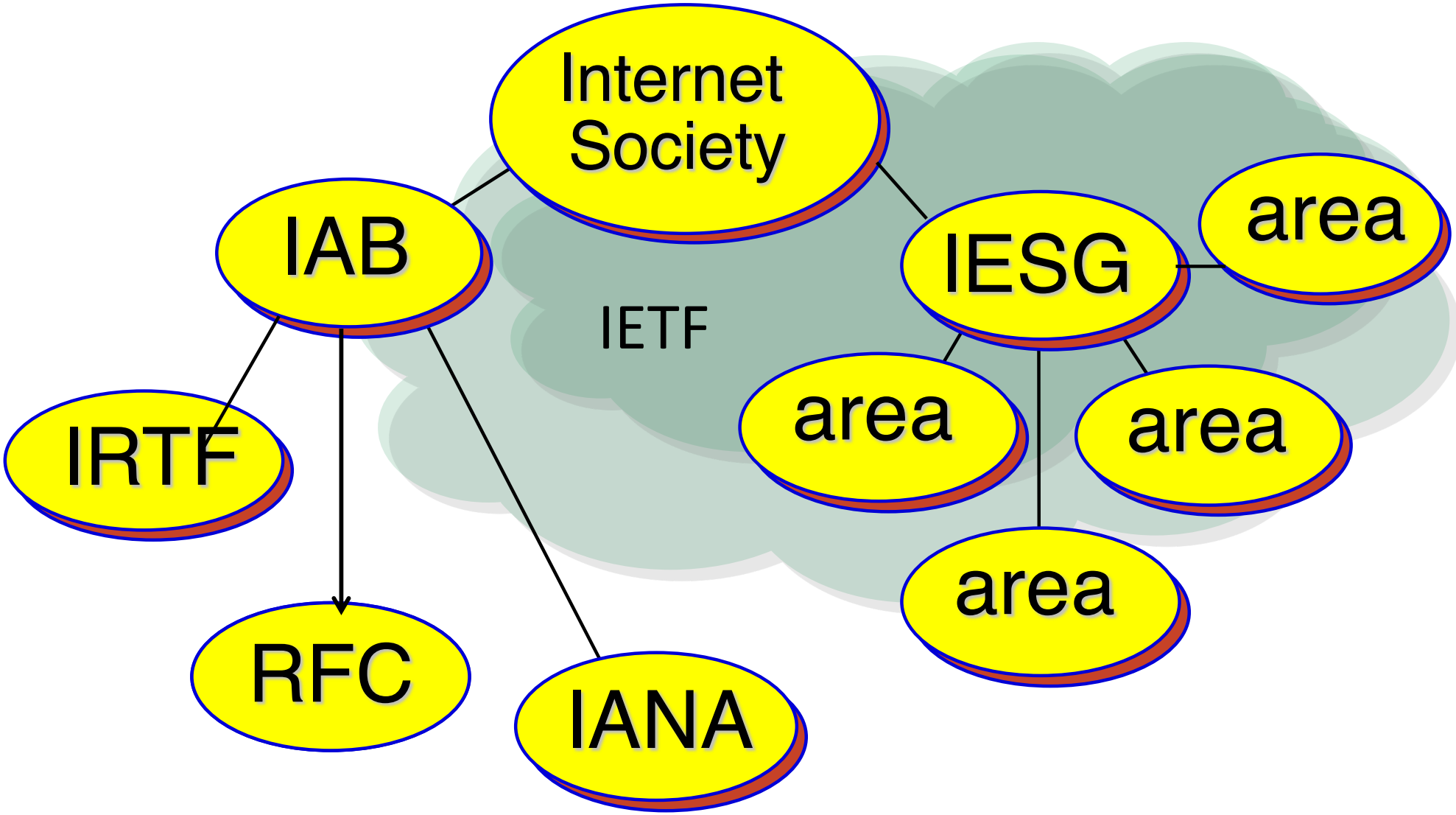
The IAB oversees a number of critical activities to support the Internet

- As an example, one IAB document is titled "*Concerns Regarding Congestion Control for Voice Traffic on the Internet*"

IANA (Internet Assigned Numbers Authority) is the central coordinator for the assignment of IP addresses and other operating parameters

- IANA is chartered by ISOC to act as the clearinghouse to assign and coordinate the use of numerous IP parameters
- IANA's role is to allocate IP addresses from the pools of unallocated addresses

IETF Structure



IETF Overview – IRTF (Internet Research Task Force)

The IRTF performs long term Internet-related research in technical areas that are immature or too far from market realization for the IETF standardization process

There are currently 14 Internet Research WGs

WGs include

- Crypto Forum
- Network Management
- Quantum Internet (Proposed)
- Internet Congestion Control
- Thing to Thing

What is an IETF/IRTF "RFC"?

RFC used to stand for Request for Comments

- Now its just a name

Current RFCs tend to be more formal than early RFCs

There are now over 8500 RFCs

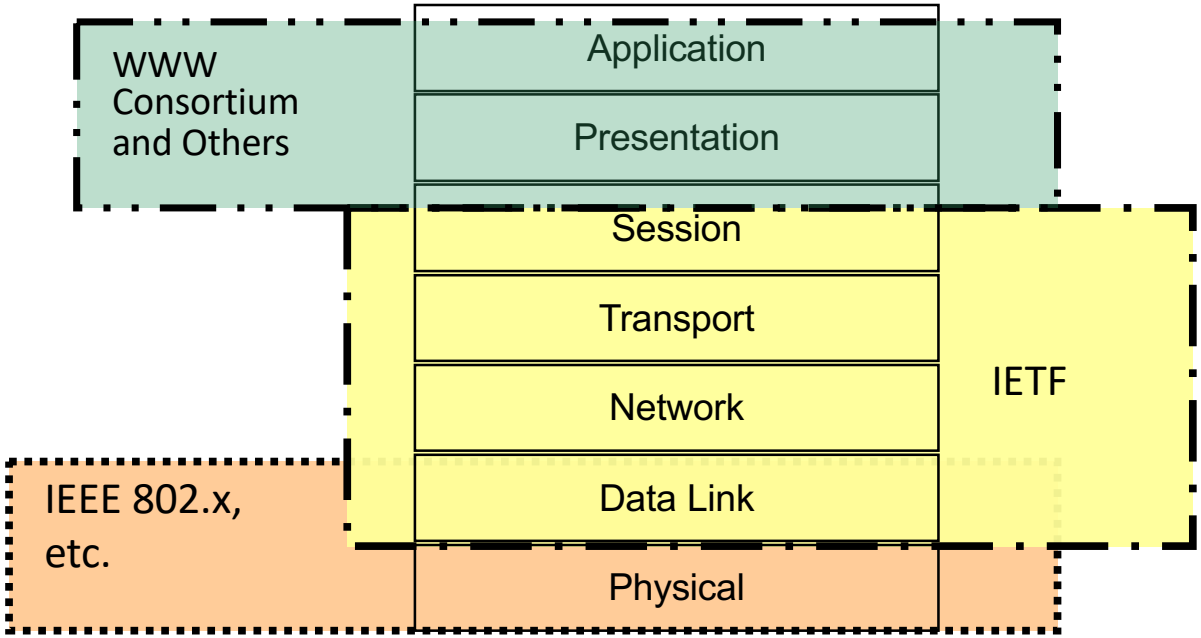
- However, not all RFCs are Internet standards!

There are many types of RFCs

- Standards Track: Best Current Practices (BCP; policies/ procedures)
- Proposed Standard (PS; good idea, no known problems)
- Draft Standard (DS; stable with multiple interoperable implementations)
- Internet Standard (STD; in wide use)
- Non-standards track:
  - Informational
  - Experimental
  - Historical

IETF Protocol Area of Responsibility

- IETF Typically works above the Physical Layer (OSI Layer 1) and below the application layer
  - Examples include IP, TCP, email, routing, IPsec, HTTP, FTP, ssh, LDAP, mobile IP, ppp, streaming video & audio
- IETF's lower layer boundary is not well defined; ex: MPLS, GMPLS, pwe3, VPN (selected RFCs are SONET/ATM/FR related)
- It is hard to clearly define IETF's scope - there is constant exploration of the edges



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WG Example: Delay/Disruption Tolerant Networking (dtn)

dtn is both an IETF WG and a related DARPA research area (also referred to as dynamic networking)

dtn documents describe an architecture for delay-tolerant and disruption-tolerant networks, and is an evolution of the architecture originally designed for the Interplanetary Internet

- The architecture addresses a variety of problems with internetworks having operational and performance characteristics that make conventional (Internet-like) networking approaches either unworkable or impractical

WG Example: Network Time Protocol (NTP) WG

Network Time Protocol (NTP) is widely deployed and used in the Internet and in Intranets

NTP allows synchronization of computers and other connected equipment to an accurate time source, usually within several hundred milliseconds

- The standardization status of this protocol has lagged in the IETF
  - NTPv4, RFC 5905, updated to RFC 7822 was published in May 2017 and updates NTPv3 (maintains backwards compatibility)
  - NTPv4 adds optional fields to enable time-of-day (TOD) authentication and originator certification

A number of topics are under development including support for IPv6, advanced security considerations, automatic configuration, and algorithm improvements and best current practices

Selected Cloud and Data Tagging/Labeling Standards

- ISO 15489-1:2016 defines concepts and methods for creation, capture and records management including metadata for records systems
  - Developed by Technical Committee 46, working archive and records management issues
- ISO 23081-2:2007 defines structured information enabling the creation, management and use of records within and across domains
- ISO 30300-2011 defines migration or moving records from one software or hardware configuration to another without format changes
- ISO 23081-1:2006 defines a schema or logical plan showing relationships between data elements, defines allowable syntax

How does Standards Participation Benefit US/Coalition Partners?

Disseminate advance knowledge of industry direction, intentions and future products to participants

- Helps keep involved organizations at the technologies' cutting edge
- Allows accurate shaping of defense policies and future direction
- Helps shape procurement decisions
- Allows DoD and coalition partners to collaborate with industry in shaping its S&T program

Formally and informally influence the standards process to benefit DoD and coalition partners

Features can be added to the Standard that benefit the coalition interoperability

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Standards Development Tips and Tricks

Realize that development of a specific standard can take between 18 months (VMEbus backplane hot swap standard) and 5 years (IETF's NTPv4) and plan accordingly

Determine desired technical focus area

Research which SDO (Standards Development Organization) operates in the desired technical area and determine if their technical goals align with yours

- Discuss desired focus with SDO WG (Working Group) Chair to help determine if there's a good fit
- Today, many SDOs create conflicting and/or overlapping standards, thus selection of the "best fit" SDO is critical

Assign sufficient resources to include cognizant personnel, fiscal and administrative for the duration of the effort

- Allocate sufficient travel budget to attend all (sometimes worldwide) meetings
- Ensure engineers understand that WG participation and standards development could take up to 75% of their time
- Participating engineers should understand that "socializing" the proposal to build the needed consensus is part of the work.

Conclusions

Participation in standards development allows the US and our Allies to use knowledge of emerging technologies and standards to promote a common approach and enhance interoperability across many programs

- Many standards efforts are relevant to military users
- The insider knowledge gained may be worth as much as gaining a technical understanding the standard

Selection of the best-fit SDO is critical as is dedicating the required personnel and fiscal resources to complete the standard

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