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https://ciscolive.ciscoevents.com/ciscolivebot/#BRKOPS-1656

Session Objectives

- In a world where technologies and architectures are in constant evolution, how can you trust technologies specified by the IETF, or the IEEE? Are those technologies mature enough? Are they widely accepted? Do they guarantee freedom of choice among vendors?

- How can you, as a customer, influence standards being developed?

- This session will explain the publication processes at the IETF & the IEEE, then will describe the different maturity levels of 'standards'. Finally, some important topics being currently specified will be presented (e.g., IEEE Randomised MAC address, IETF DNS over HTTP).

- After this session, you will understand the maturity level of standards and when to trust that they will be widely deployed.

Your Speaker: Éric Vyncke

- Lives in Belgium
  - IPv6 leading country for many years
- Member of Cisco Global Technology Standards team
- Loves SW engineering
- Motto: Open, secure, and end-to-end Internet

- ~ 1984 first RFC read RFC 791 (IP)
- 1988: first IP packet sent
- 1997: joined Cisco
- 2000: first IETF-49 meeting in San Diego, CA, USA
- 2003: first RFC 3585 published
- 2015: OPSEC WG chair
- 2019: Internet Area Director
- https://datatracker.ietf.org/person/evyncke@cisco.com

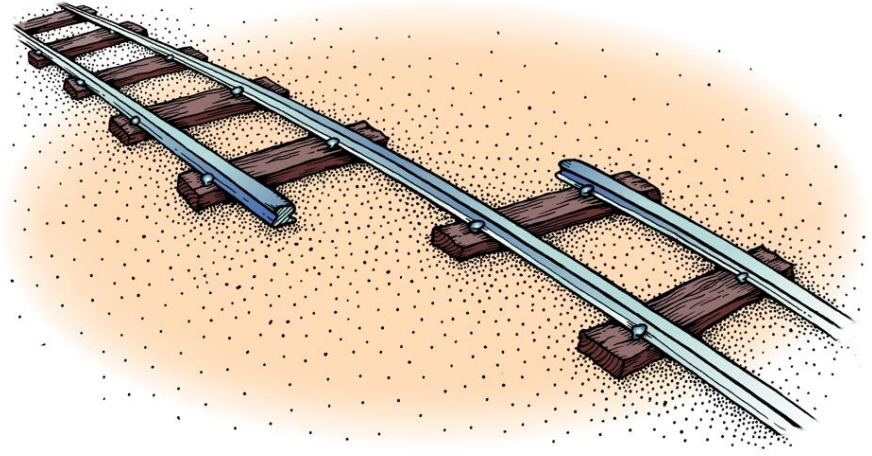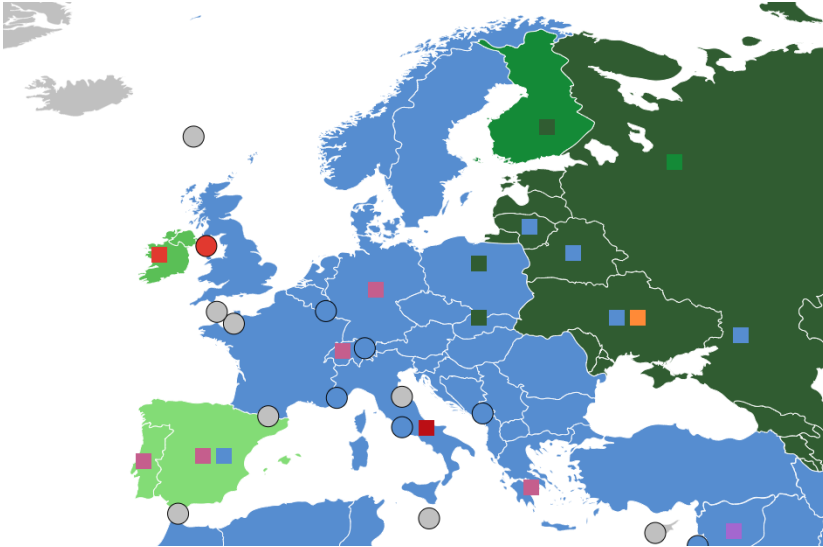# Agenda

- Where do standards come from?

- IETF
  - Organizational Structure
  - Publications
  - Some New Work

- IEEE
  - Organizational Structure
  - Publication Process
  - Some New Work

- Conclusion

Where do standards come from ?

Without Standards

Different railway track standards

Sources: memedrop.io and King 724
https://commons.wikimedia.org/wiki/File:Rail_gauge_world.svg

20+ Years Ago

CISCO DOES IT !

TCP/IP
DECnet IV and V
Novell IPX
AppleTalk I and II
ISO CLNS (OSI)
SDLC Transport
Banyan VINES
Ungermann-Bass Net/One
3Com 3+/3+Open
Xerox XNS
Apollo Domain
Xerox PUP
CHAOSnet
SNA
NETBIOS
HDLC
PPP
X.25
DDN X.25
Frame Relay
SMDS 802.6
Multiprotocol Routing
Source Route Bridging
Translation Bridging
Encapsulation Bridging

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Vendor Lock-In

- Without standards, networks are locked to a vendor... Because there are no alternatives

- Remember SNA 30 years ago ?
  - Or perhaps EIGRP... ;-)
  - RFC 7868 since 2016 only and 'informational independent stream'

Different Develoment Organisations (SDOs)

- Open (with enterprise sponsoring)

- Country or region-oriented

- Vertical Market

IETF
Organizational
Structure

IETF vs. Other Standard Development Organizations (SDOs)

- IETF
  - No formal voting
  - Self-selected individual participants;
    No formal government role;
    Market-based adoption
  - Focused on Internet technologies;
  - Bottom-up

- Traditional SDOs
  - Formal voting
  - National members or organizational members – rarely individuals; Sometimes treaty-based; Sometimes legally mandated adoption
  - Wide range of technical, process & physical standards
  - Often top-down

The IETF

- Organized activity of the Internet Society

- A voluntary Standards Development Organization

- Consists of !many! Working Groups (WGs)
  - Organized by Areas of related WG

- Most standards work is done by the Working Groups

- Internet Architecture Board (IAB) is a related organization

Acronym Decoder

- Internet Architecture Board (IAB – www.iab.org):
  - long-range technical direction
  - ensuring the Internet continues to grow and evolve

- Internet Engineering Steering Group (IESG):
  - technical management of IETF activities and the Internet standards process.

- IETF Administration LLC: corporate legal home
  - supporting the ongoing operations
  - IETF's finances and budget

- IETF Trust:
  - acquire, hold, and maintain intellectual property and other property

More Acronyms

- Internet Research Task Force (IRTF – [www.irtf.org]( ))
  - Focused on long term research topic
  - No Working Groups (WG) but Research Groups (RG)
  - E.g., Information-Centric Networking ICNRG, Quantum Internet QIRG
- Internet Assigned Number Authority (IANA – [www.iana.org]( ))
  - Registry for all port numbers, MIME types, …
- RFC Editor www.rfc-editor.org
  - Last editorial and consistency review of drafts before publication
  - Assign RFC numbers
  - Publish them and maintain errata as RFC are never modified

Working Group

- Where the main work of the IETF takes place

- Bottom-up formation
  - Generally proposed by IETF participants to meet a perceived need, i.e, bottom-up
  - Often preceded by (usually one) Birds of a Feather session(s)
  - Negotiates a charter with the AD (with advice and consent of IESG and IAB)

- Has an agreed work plan and schedule

- "F2F" or interim meetings ideally focused on key issues

- Lives on between IETF Meetings (ironing details)

WG are Aggregated into Areas

- 7 areas:
  - GEN: general, AD = IETF chair
  - ART: Application and Real-Time
  - TSV: Transport and services
  - INT: Internet
  - RTG: Routing
  - OPS: Operation and Management
  - SEC: Security
- 1, 2 or 3 'selected' Area Directors per area for a 2-year term
- https://www.ietf.org/topics/areas/

WG Mailing List

- Every WG has one mailing list
  - https://www.ietf.org/mailman/listinfo
  - Archives are always public
  - Subscription is always open and free
- The only 'official' media for adopting or for 'last calls'

- GitHub also starts to be used
  - E.g., https://github.com/IETF-OPSAWG-WG
  - "Opening issues in github" vs. "email discussion" ?

IETF Publications

Document Names and Categories

- IETF draft = work in progress = <mark>not an IETF standard</mark>
  - E.g., draft-grant-tacacs-00 (1996) no WG
  - draft-author-wgname-title: individual draft hoping to be adopted (ex draft-dahm-opsawg-tacacs-01)
  - draft-ietf-wgname-title: draft adopted by a working group, i.e., the WG has control of the content (ex draft-ietf-opsawg-tacacs)
- RFC Categories
  - Standards Track
  - Informational (ex RFC 8907), not a standard
  - Experimental, not a standard
  - Best Current Practice (BCP)

How to Check ?

Internet Engineering Task Force (IETF)
Request for Comments: 8907
Category: Informational
Published: September 2020
ISSN: 2070-1721

T. Dahm
Google Inc.
A. Ota
Google Inc.
D.C. Medway Gash
Cisco Systems, Inc.
D. Carrel
IPsec Research
L. Grant

**The Terminal Access Controller Access-Control System Plus (TACACS+)
Protocol**

Operations
Internet Draft
Intended status: Information
Expires: September 21, 2020

Cisco Systems, Inc.
D. Carrel
vIPtela, Inc.
L. Grant
March 20, 2020

The TACACS+ Protocol
draft-ietf-opsawg-tacacs-18

Operations
Internet Draft
Intended status: St
Expires: April 4, 2

L. Grant
October 2, 2015

The TACACS+ Protocol
draft-dahm-opsawg-tacacs-01.txt

Publication Streams

Source: Microsoft Stock Images

- IETF:
  - WG (or AD sponsorship) then IETF consensus and approved by IESG
  - Only stream with 'standards track' category

- IAB
  - informational only
  - https://datatracker.ietf.org/stream/iab/

- IRTF:
  - RG consensus, informational/experimental, IESG to detect potential conflicts, approved by IRSG
  - https://datatracker.ietf.org/stream/irtf/

- Independent Submission Stream:
  - informational/experimental, no IETF consensus, IESG to detect potential conflicts, approved by Independent Stream Editor (ISE)
  - https://datatracker.ietf.org/stream/ise/

How to Check the Streams ?

Internet Architecture Board (IAB)
Request for Comments: 9075
Category: Informational
Published: July 2021
ISSN: 2070-1721

J. Arkko
S. Farrell
M. Kühlewind
C. Perkins

Report from the IAB COVID-19 Network Impacts Workshop 2020

Internet Research Task Force (IRTF)
Request for Comments: 9217
Category: Informational
Published: March 2022
ISSN: 2070-1721

B. Trammell
Google Switzerland GmbH

Current Open Questions in Pat

Independent Submission
Request for Comments: 9230
Category: Experimental
Published: June 2022
ISSN: 2070-1721

E. Kinnear
Apple Inc.
P. McManus
Fastly
T. Pauly
Apple Inc.
T. Verma
Cloudflare
C.A. Wood
Cloudflare

Network Working Group
Internet-Draft
Intended Status: Informational
Expires: 10 February 2023

Hewlett-P

Oblivious DNS over HTTPS

Deterministic Nonce-less Hybrid Public Key Enc
draft-harkins-cfrg-dnhpke-02

A Long-Standing Tradition

The high-order bit of the IP fragment offset field is the only unused bit in the IP header. Accordingly, the selection of the bit position is not left to IANA.

Network Working Group   S. Bellovin
Request for Comments: 3514   AT&T Labs Research
Category: Informational   1 April 2003

                                                 IPv4 Header

                The Security Flag in the IPv4 Header

Status of this Memo

    This memo provides information for the Internet community. It does
    not specify an Internet standard of any kind. Distribution of this
    memo is unlimited.

                                                 s follows:

    0x0 If the bit is set to 0, the packet has no evil intent. Hosts,
         network elements, etc., SHOULD assume that the packet is
         harmless, and SHOULD NOT take any defensive measures. (We note
         that this part of the spec is already implemented by many common
         desktop operating systems.)

    0x1 If the bit is set to 1, the packet has evil intent. Secure
         systems SHOULD try to defend themselves against such packets.
         Insecure systems MAY chose to crash, be penetrated, etc.

Most Active Organization in 2023

Number of Authors per Company
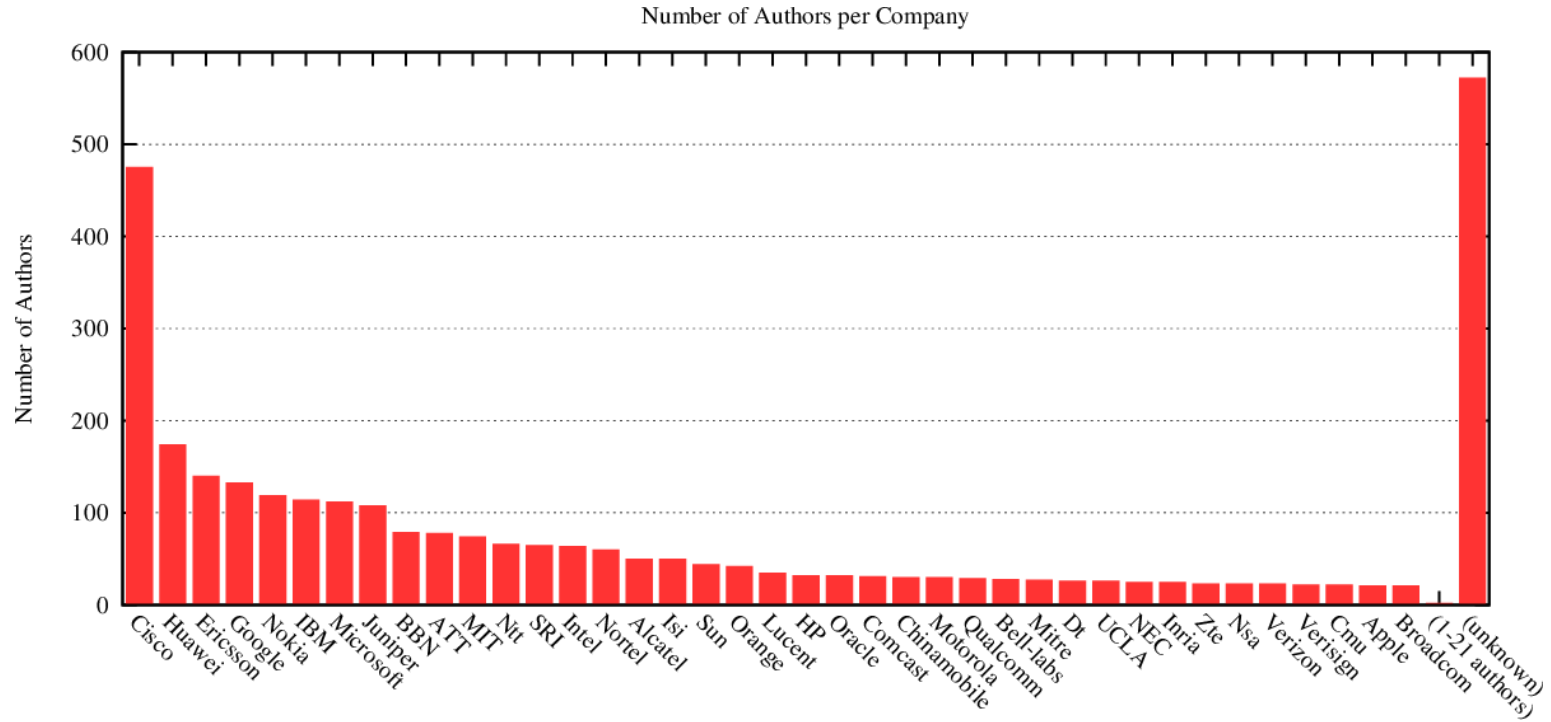
Patents and Intellectual Property Rights (IPR)

- Most of the IETF documents do not have patents or IPR

- Some have though… This could prevent other vendors implementing a standard if the IPR is associated to royalty fees…

- Common case: Reasonable And Non-Discriminatory (RAND) licensing or similar
  - Cisco often uses "free to any party if the other party gives theirs free to Cisco", e.g., https://datatracker.ietf.org/ipr/5816/

https://en.wikipedia.org/wiki/Reasonable_and_non-discriminatory_licensing

Importance for Customers ?

1. A published RFC standard track in the IETF stream is real, stable, reviewed by many people, and probaby be implemented by many vendors

2. A WG draft with a high revision number and more than one author with an intended status of standard track, will probably become a published RFC, but may not be stable

3. Any individual draft, or IRTF, or ISE documents will probably not widely be implemented or deployed

Some New Work at the IETF

MAC Address Device Identification for Network and Application Services (madinas WG)

- Host OS vendors and IEEE want to randomize and change MAC addresses

  - Currently: when changing network

  - Later: periodically

- Outside of IETF but impacting IETF protocols

  - NDP/ARP cache

  - Captive Portal

  - ....

# Stub Network Auto Configuration for IPv6 (snac WG)

- How to connect IEEE 802.15.4 IPv6 network to the Internet via the residential/home Wi-Fi ?
  - Different MAC address lengths 16/64 vs. 48 for Wi-FI
  - IPv6 is a must as 'stub' networks are IoT

- Challenge
  - Not a single change in the existing residential/home Wi-Fi
  - Must work with IPv4-only, dual-stack, IPv6-only Wi-Fi

Multiple Key Exchanges in IKEv2

- draft-ietf-ipsecme-ikev2-multiple-ke

- Quantum Computers render (elliptic curve) Diffie-Hellman key exchange unsecure

- Post-Quantum Crypto : new algorithms immune to quantum computer
  - Alas not well-tested / understood yet...
  - So, combine entropy from classical (EC)DH with post-quantum crypto to get enough entropy

- Can also be used when initiator and responder do not have a single key exchange algo in common => let's use both of them ;-)

Time-Variant Routing
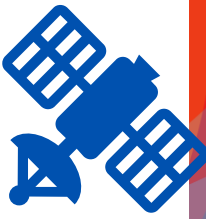
- <mark>Brand new WG</mark>

- Routing protocols are reactive: adjency loss detected, rerouting

- But, some events are scheduled:
  - Maintenance
  - PoP/router power down (e.g., no more solar/wind energy)
  - Satellites have very predictable orbits

- TVR WG will 'enhance' existing routing protocols with above info
  - => routing protocols will be proactive
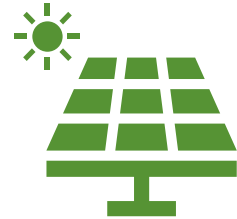
IPv6 is still Worked On ;-)

- Registering IPv6 address with DHCPv6
  - From the people not implementing DHCPv6 on Android

- Unique prefix per device in broadcast network
  - Replace NDP by routing

- Extension headers processing
  - Measurements over the Internet
    - E.g., draft-vyncke-v6ops-james
  - Hop-by-hop: adding limits ?

IEEE
Organization
Structure

Institute of Electrical and Electronics Engineers (IEEE)

The Standard Development Part

All electrical/electronics engineers
470,000 members !

Standard

Members

Publications — IEEE Spectrum

Conferences

IEEE Standards Association (SA)

- The Standard Development Organization part of IEEE

- Consist of several working groups

- Mixed Entity / Individual Standards Development Process
  - Entities are corporations, governments, non-profits, associations, ...

  https://standards.ieee.org/develop/mobilizing-working-group/wg/

IEEE SA Publication Process

- WG are created based on a Project Authorization Request (PAR)
  - The PAR includes voting procedure: entities or individuals
  - E.g., https://ieee802.org/PARs.shtml
- Draft standards are prepared and reviewed by WG
- Submitted to the Standards Committee for the SA Ballot
- Submitted to the Review Committee (RevCom)
- Submitted to the Standards Board for approval

- Then, standards can be amended

PAR Example

P802.11bi

Type of Project: Amendment to IEEE Standard 802.11-2020
Project Request Type: Initiation / Amendment
PAR Request Date: 30 Nov 2020
PAR Approval Date: 10 Feb 2021
PAR Expiration Date: 31 Dec 2025
PAR Status: Active
Root Project: 802.11-2020

1.1 Project Number: P802.11bi
1.2 Type of Document: Standard
1.3 Life Cycle: Full Use

2.1 Project Title: Standard for Information Technology--Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks--Specific requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications
Amendment: Enhanced Service with Data Privacy Protection

3.1 Working Group: Wireless LAN Working Group(C/LAN/MAN/802.11 WG)

Amendment ?

- IEEE standards can be modified by adding a new chapter

- Amendments are done based on a PAR

- Usually identified by a letter a, b, ...
  - IEEE 802.11 had so many amendments, that it went from 802.11z to 802.11aa

Important WGs/Committees

- IEEE 802: everything about LAN and WLAN

- IEEE 1003: POSIX (*Portable operating system interface*)

- IEEE 1284: the good old parallel port ;-)

- IEEE 1588: PTP *(Precision Time Protocol)*

- IEEE 1901: PLC *(Power-Line Communication)*

How to Read an IEEE Reference ? 1/2

- Std 802.11-2020
  - Std = standard, could also be a P for Project (= draft)
  - 80 = project started in 1980
  - 2 = 2nd project started in 1980
  - 11 = subworking group
  - 2020 = the standard year (if omitted, then the latest one)

How to Read an IEEE Reference ? 2/2

- P802.11bi
  - P for Project (= draft)
  - 80 = project started in 1980
  - 2 = 2nd project started in 1980
  - 11 = subworking group
  - bi = subsubworking group on amendment 'bi'
    - Lowercase: amendment to a baseline spec, in this case Std 802.11-2020
    - Uppercase (not shown): standalone amendment, i.e. whole new doc, e.g., 802E (privacy recommendations)

IEEE New Work

Faster Links are Coming: P802.3df

- Amendment: Media Access Control Parameters for 800 Gb/s and Physical Layers and Management Parameters for 400 Gb/s and 800 Gb/s Operation

Privacy over Wi-Fi: P802.11bh and P802.11bi

- Providing privacy in addition to confidentiality, prevent doing correlation among sessions

- 802.11bh Amendment: Enhanced service with randomized MAC addresses

- 802.11bi Amendment: Enhanced service with Data Privacy Protection

Conclusion

Conclusion

- IETF is not about superpower of Gods, and everyone is welcome to participate, please bring your voice

- IEEE is more structured and mainly entity-based

- Deploying on IETF individual draft or IEEE draft amendments should be done with care

    48

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- Visit the On-Demand Library for more sessions at www.CiscoLive.com/on-demand

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More references

- The Tao of the IETF – "Everything you always wanted to know about the IETF, but were afraid to ask"
https://www.ietf.org/tao.html

- See also https://www.ietf.org/about/participate/tutorials/

- The list of mailing lists – https://www.ietf.org/meeting/email-list.html

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