Computer networks and standardisation*

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* based on http://www.ietf.org/edu/process-oriented-tutorials.html#newcomers
Computer networks

- Network:
  - set of nodes (e.g., hosts, routers) exchanging information and interconnected with links.
  - Information are exchanged according to a set of common communication rules.
Communication Protocols*

- Set of rules to allow entities to exchange information.

- Protocols define:
  - syntax (e.g., data format),
  - semantic,
  - operations (e.g., error recovery).

- Independent of the implementation.

* Inspired from https://en.wikipedia.org/wiki/Communications_protocol
Communication Protocols*

- Set of rules to allow entities to exchange informations.
- Protocols define:
  - operations (e.g., error recovery).
  - Independent of the implementation.

* Need of a reference for these conventions.

* Inspired from https://en.wikipedia.org/wiki/Communications_protocol
Standards*

- A **standard** is a reference document officially supported by a **standard developing organization (SDO)**.
  
  - SDO: organization in charge of producing and managing standards and their revisions.

- **De facto** standards are products/rules implicitly accepted by the market (e.g., MS Word format).

The SDO of the Internet technologies

- Internet Engineering Task Force (IETF)
  - formed in 1986 (expansion of ARPANET).
  - Open: not owned, directed, approved, or funded by a government.
  - IETF is not a legal entity, it is an organised activity.

- Group of people: attendees are considered as individuals, not by their company.
The IETF SDO

- No membership, just participants.
- All decisions base on consensus.
  - No need of unanimity.
  - No voting (no count) because no constituency.
- Discussion to resolve issues.
- All decisions verified on the public mailing lists, open for comments.
The IETF SDO

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- All decisions base on **consensus**.

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“Rough consensus and running code”

- Discussion to resolve issues.
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Role of IETF

- Develop and maintain standards used to make the Internet or to provide services over the Internet.

- Focus on technique (functionality, scaling, operations).

- Economics, politics, or laws matters are not discussed at IETF.

- Published in RFCs.

- IETF does not work on physical layers (e.g., IEEE 802.11) neither display or rendering (e.g., CSS).
IETF “workers”

- Anybody! (open and free)
- Document editors.
- Working group chairs.
- Area Directors (ADs).
- IETF Chair.
- Internet Engineering Steering Group (IESG)
  - ADs + IETF chair.
- Internet Architecture Board (IAB).
IETF decomposition in Working Areas

- Standardization efforts grouped in 7 specialised working areas.
  - Decomposed in many Working Groups (WG)
    - working on a specific problem of the area.
  - Lead by up to 3 Area Directors (ADs)
    - setting direction in Area,
    - managing process in Area,
    - review working group documents prior to IESG review.
Working Areas

- Applications and Real-Time Area (art)
  - standards for applications using the Internet technology (e.g., email, HTTP, MIME types, codecs).

- Internet Area (int)
  - deals with the IP layer (IPv4, IPv6, DNS, DHCP, VPN… ) and adaptation to new link layers.

- Transport and Services Area (tsv)
  - deals with data transport questions (e.g., UDP, TCP, DiffServ, NAT… )
Working Areas (contd.)

- Routing Area (rtg)
  - works on the general problem of routing (e.g., OSPF, BGP…)

- Security Area (sec)
  - deals with security questions (e.g., confidentiality, authentication…)

- Operations and Management Area (ops)
  - deals with operational considerations (e.g., SNMP, NETCONF).

- General Area (gen)
  - supports, updates and maintains the IETF standards development process.
Working Groups (WG)

- “The Place” where work is really done,
  - mostly via the WG mailing list,
  - short, focused, face-to-face meetings.
- Proposed by (any) IETF participants.
- Chaired by 2-3 voluntary chairpersons.
- Driven by a restrictive public charter with milestones.
- The WG is closed when the charter is accomplished.
Birth of a Working Group
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refine with community: chair, description, goals and milestones
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BOF

Area Director
Birth of a Working Group

refine with community: chair, description, goals and milestones

BOF → Area Director → IESG
Birth of a Working Group

1. BOF
2. Area Director
3. IESG
4. WG creation

Refine with community: chair, description, goals and milestones.

Check IAB + IETF
Work in a WG

- The WG tools are the **mailing list** (list) and **Internet-Drafts** (I-Ds).
  - The WG’s list is public, open, and free.
  - I-Ds are public, open, and free and developed to fulfil the charter.
- The WG produces **Request For Comments** documents (RFCs).
  - When consensus is reached on the quality of an I-D, it is proposed for RFC publication.
  - RFCs are archival publications
    - never changed once published,
    - updates are issued in new RFCs.
Short face-to-face WG meetings during IETF meetings to address specific issues rose on the mailing list.

Assume people read the mailing list and I-Ds before the meeting.

Sessions are streamed (for remote participation) and recorded (for archive).

Attendees sign the “blue sheets”

essential for openness.
Internet-Drafts (I-Ds)

- I-Ds are submitted with a fully automated process
  - i.e., no selection at entrance.
- Formatted in ASCII, (even figures), 72 columns.
  - first documents are still perfectly readable after 48 years!
- I-Ds files follow the draft-<source>-<document name>-<version> naming convention.
- I-Ds are versioned to track changes
  - any change requires a new version.
- An I-Ds expires 185 days after its posted date
  - unless a new version is provided.
- Any Intellectual Property Right (IPR) element must be disclosed.
Wording

- Documents and discussions are in technical english.
- Specific key words to indicate requirement levels (defined in RFC2119):
  - MUST/REQUIRED/SHALL (NOT)
    - absolute requirement.
  - SHOULD (NOT)/(NOT) RECOMMENDED
    - Can be not followed in some particular situations.
  - MAY/OPTIONAL
    - purely optional.
Anatomy of an RFC*

Some required sections:

- Boilerplate
  - with licence (Simplified BSD License).
- Security Considerations.
- IANA Considerations.
- References
  - split into normative and informative sections.
- Author’s address.

Not all RFCs are standards (e.g., jokes, historical, process…).

* as of this date
Standards Track RFCs

- Best Current Practices (BCP)
  - policies and procedures corresponding to the best known way to do.

- Proposed standard (PS)
  - good idea.

- Internet standard (STD)
  - good idea proven to be stable and to benefit the Internet community.
  - Multiple interoperability tests to attest the document clarity.
Other RFCs

- Informational.
- Experimental.
- Historical.
- Some RFCs are not from IETF (e.g., IRTF)!
The long road to RFC
The long road to RFC
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Individual I-D.
draft-ietf-doe-protocol-name-vv
The long road to RFC

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refine with  
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WG consensus  
for adoption
The long road to RFC

- Individual I-D.
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  refine with
  WG discussions

  → WG consensus for adoption

  → WG I-D.
  draft-ietf-wg-protocol-name-vv
The long road to RFC

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WG last call
The long road to RFC

1. Individual I-D. (draft-ietf-doe-protocol-name-vv)
   - Refine with WG discussions

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4. Technical and process review by AD

5. WG last call
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Takes between 1 and 3 years

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RFC ZZZZ
Around IETF

- Internet Research Task Force (IRTF)
  - aims to explore long term work related to Internet technologies,
  - composed of Research Groups.

- Internet Assigned Number Authority (IANA)
  - assigns number and keep track of them (e.g., ports, top level domains...)
  - RFCs MUST include an IANA Considerations section.
The software networking approach is changing everything!

Standardisation vs Softwarisation

- Standards Development Organization (SDO) (e.g., IETF, ITU-T) drive networking industry since 40 years.
  - Well established gouvernance.

- Open Source Software (OSS) projects produce softwares.
  - No gouvernance.
Time scales

- 2+ year to draft paper specifications in SDOs.
  - Consensus is hard to get,
  - validation is tedious.
- 1 year to think, design and implement a software in OSS.
  - Focus on one technical objective.
The risks with SDOs

- SDOs governance provides
  - efficient integrated development and maintenance processes,
  - broad and long term vision of the problem
  - concentration of efforts.
- SDOs are old gigantic institutions
  - averse to changes,
  - slow to react,
  - hard to enter for new actors.
The risks with OSS

- OSS are agile and quickly respond to needs.
- OSS lack of governance causes security flaws,
  small fragmented communities (little funding, dogmatic vision),
  uncertainty of maintenance.
SDN pushes towards OSS

- Without SDN:
  - network algorithm implementations are bound to the device supporting them,
  - hardware and software producers are the same companies.
    - Hard for new actors to enter the market.

- With SDN:
  - network algorithm implementation are independent of the hardware,
  - hardware and software producers are different companies.
    - Any innovative actor can enter the market easily.

 ➤ Costs reduction.
SDN pushes towards OSS

- Without SDN:
  - network algorithm implementations are bound to the device supporting them,
  - hardware and software producers are the same companies.

SDOs and OSS must form a collaborative loop

- hardware and software producers are different companies.
  - Any innovative actor can enter the market easily.

⇒ Costs reduction.
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