Between Research and Standards: an Introduction to the IRTF

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Research and Standards: Different Worlds?
Why Should Researchers Contribute to Standards?

To help make the network work better

Because your research might be useful – and could change systems people actually use

Because you might learn something – making contacts with industry is a great way to find the real problems!

To keep industry honest – a neutral point of view to evaluate the technology, with no business agenda to promote
Internet Standards

- The Internet Engineering Task Force (IETF) is a large open international community of protocol designers, network operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet.

- The mission of the IETF is to make the Internet work better by producing high quality, relevant technical documents ("RFCs") that influence the way people design, use, and manage the Internet.

- The Internet Research Task Force (IRTF) promotes the evolution of the Internet through applied, longer-term, research on Internet protocols, applications, architecture and technology.
IETF Standards Activities

- About 130 working groups in 7 areas: general, operations and management, applications and real-time, transport services, security, routing, and internetworking
How to IETF?

- Solve a problem of relevance to the standards community
- Check if the IETF is interested in your work
- Develop your ideas in an IETF working group
  - ...
  - Profit…?
When to Bring Work to the IETF?

- Don’t start too early – **IETF is not a place to do research**

- Once you think you’ve solved problem that fits one of the IETF’s work areas and aligns with architectural principles of the Internet, **only then** bring the work to IETF
  - When the scope is well defined and the problem understood
  - When the research is largely complete, and engineering is needed
  - When you know your idea is sound, and want to see it used
Find your home in the IETF community (1/3)

- Read Tao of IETF: https://www.ietf.org/tao.html

- IETF is a large organisation, with its own rituals, culture, and process

- Don’t worry about all the details, but it helps to have an idea
Find your home in the IETF community (2/3)

• Does your idea fit into the charter of an existing group?
  • Do you want to extend, update, or improve an existing protocol?
  • Write-up your changes, then talk to the chairs of the working group developing that protocol

• Not sure where the work fits?
  • Join the working group email lists, watch the meeting recordings, read the drafts – see how they work, then participate
Find your home in the IETF community (3/3)

• If there is no suitable working group, does your idea fit in the scope of an existing IETF area?
  • e.g., you want to standardise a new protocol
  • Talk to the relevant Area Director → they’ll help you start a new working group, or direct you to an area working group that handles new work

• No suitable IETF area?
  • Is the IETF the right standards organisation for you?
  • Is your idea maybe still research → talk to the IRTF
The Working Group Process

Iterative, multi-stage, review process until **rough consensus and running code**
The Working Group Process

- Internet-Draft
- Discussion
- Implementation
- Peer Review
- Consensus?
- WG Last Call
Working Group Process

- Consensus is frequently slow, multiple rounds of review
- Your idea will be developed, modified, changed beyond expectation as it progresses through the process
- You’ll begin to understand the real deployment challenges & constraints
- Few research ideas survive the contact with deployment reality unscathed
IETF-wide Review

• After the working group completes its review, IETF-wide review takes place
• IETF-wide last call for comments
• Specialist review teams from different areas
• IESG review

• Working group process gives a focussed, in-depth, technical review
• Cross-area review gives wide coverage, and frequently catches unexpected concerns
Eventually, an RFC is published – your idea is now an Internet Standard
RFC Publication

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- Was it worth it?
RFC Publication

• Eventually, an RFC is published – your idea is now an Internet Standard

• Was it worth it?
  • If your goal was to improve the network – yes!
  • If your goal was to better understand the network – yes!
  • If your goal was increased impact from your research – yes!
  • As a way to get industry contacts – yes!

• As a way of directly improving your academic CV? No
  • You’ll likely do better and more useful research afterwards, because you understand how the network really works, but an RFC won’t directly enhance your academic CV
What About Research?

• The Internet Research Task Force (IRTF) promotes evolution of the Internet through applied, longer-term, research on Internet protocols, applications, architectures, and technology
IRTF Activities

- Organised around longer-term research groups
- A forum where researchers and engineers can explore the feasibility of research ideas
  - You have a good idea, and it works in simulations and in a lab testbed – will it work in the real-world Internet? Is it deployable? Implementable on real hardware?
  - How does the network really work? How does that affect your research?
- A venue where researchers can learn from the engineers who build and operate the Internet – and where the standards, implementation, and operations community can learn from research
Security, Privacy, and Human Rights

- Begin to understand how Internet protocols and standards impact human rights and privacy – at the Internet infrastructure level
- Discuss interplay between security mechanisms, privacy, and human rights; seek to raise awareness of broader societal and policy issues to the IETF community
Computation in the Network

- Speculative new architectures for an internet, emphasising named data or named functions
- Generalisation of content distribution networks and web caching infrastructure – mature work, with competing experimental implementations
- Generalisation of lambda functions and “server-less” computation; pervasive computation; new approaches content-centric routing – very early stage research
- Long-term replacements for the Internet?

- Does it make sense to re-architect the network around content or computation?
- Implications for the content provider/consumer relationship – democratisation or ossification of current roles?
Path Aware Networking

• Can we benefit from making applications and transport protocols aware of the network path taken – or by making the network path aware of the application or transport?

• Introduces a new control point for operators; questions around trust, privacy, and network neutrality are poorly understood

• IETF community seems determined to enter a standardisation phase: SRv6, APN, …

• IRTF considering broader questions around privacy, security, path definitions, incentives

Source: Brian Trammell, presentation at IETF 96 PLUS BoF

Current Open Questions in Path Aware Networking
https://datatracker.ietf.org/doc/draft-irtf-panrg-questions/

Path Aware Networking: Obstacles to Deployment (A Bestiary of Roads Not Taken)
Designing the Quantum Internet

- How to establish and control inter-domain paths that can distribute entangled quantum state?
  - Quantum key distribution for security
  - Distributed quantum computation
  - Quantum entanglement as a service

- Architecture and approach generally well defined
  - Classical control plane
  - Managed distribution of entangled quantum state

- Entering a phase of experimentation to validate the architecture, develop prototypes

Source: Axel Dahlberg, presentation at IETF 103 QIRG meeting

Architectural Principles for a Quantum Internet
https://datatracker.ietf.org/doc/draft-irtf-qirg-principles/

Applications and Use Cases for the Quantum Internet
Global Access and Sustainability

- How to address the global digital divide?
- To share experiences and best practices, foster collaboration, in building, deploying and making effective use of the Internet in rural, remote, or under-developed regions
- To create increased visibility and interest among the wider community on the challenges and opportunities in enabling global Internet access, in terms of technology as well as the social and economic drivers for its adoption
- To create a shared vision among practitioners, researchers, corporations, non governmental and governmental organisations on the challenges and opportunities
- Sharing expertise, raising awareness of global access challenges

Advanced Protocol Development

• Measuring and understanding network behaviour
• Interfacing between research and standards community to help:
  • Develop and validate congestion control and network coding algorithms in the real world
  • Develop intent-based and AI-based approaches to network management
  • Understand issues of trust- and identity- management, name resolution, resource/asset ownership, and resource discovery in decentralised infrastructure
  • Understand research challenges in IoT based on initial real-world deployment experience
• Fostering collaboration and interaction between industry and research
Supporting Applied Networking Research

• ACM/IRTF Applied Networking Research Workshop
  • A forum for researchers, vendors, network operators and Internet standards community to present and discuss emerging results in applied networking research
  • Peer-reviewed academic workshop – papers in ACM Digital Library
  • Co-locates with IETF meeting in July – travel grants available (when travel resumes, post-COVID)
  • https://irtf.org/anrw/
Supporting Applied Networking Research

• **Applied Networking Research Prize** is “awarded to recognise the best recent results in applied networking, interesting new research ideas of potential relevance to the Internet standards community, and upcoming people that are likely to have an impact on Internet standards and technologies, **with a particular focus on cases where these people or ideas would not otherwise get much exposure or be able to participate in the discussion**”

• Nomination deadline: 22nd 23 November 2020

• [https://irtf.org/anrp/](https://irtf.org/anrp/)
Why should network researchers care about protocol standards?

• To improve the network, while learning about real-world constraints
• To build contacts with industry and keep your research grounded in what’s possible
• IRTF provides a pathway from research to standards

• Further questions? irtf-chair@irtf.org

https://irtf.org/