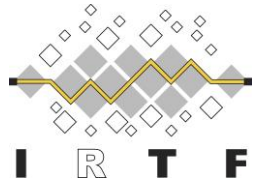
SUSTAIN RG
Sustainability and the Internet

Ali Rezaki, Eve Schooler, Michael Welzl

IETF 122 - Bangkok

Tuesday, 18 March 2025

Note Well – Audio and Video Recordings



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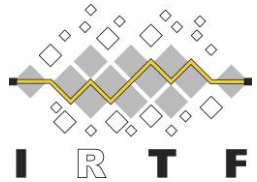
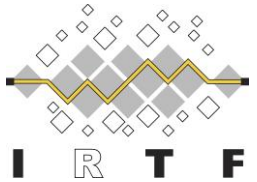
This session is being recorded

Note Well – Privacy & Code of Conduct



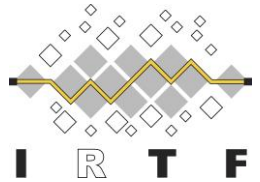
- As a participant in, or attendee to, any IRTF activity you acknowledge that written, audio, video, and photographic records of meetings may be made public
- Personal information that you provide to IRTF will be handled in accordance with the Privacy Policy at https://www.ietf.org/privacy-policy/
- As a participant or attendee, **you agree to work respectfully with other participants**; if you have questions or concerns, please contact the ombudsteam (https://www.ietf.org/contact/ombudsteam/)
- See RFC 7154 (Code of Conduct) and RFC 7776 (Anti-Harassment Procedures), which also apply to IRTF

Note Well – Intellectual Property



- **The IRTF follows the IETF Intellectual Property Rights (IPR) disclosure rules**
- By participating in the IRTF, you agree to follow IRTF processes and policies:
  - If you are aware that any IRTF contribution is covered by patents or patent applications that are owned or controlled by you or your sponsor, you must disclose that fact, or not participate in the discussion
  - The IRTF expects that you file such IPR disclosures in a timely manner – in a period measured in days or weeks, not months
  - The IRTF prefers that the most liberal licensing terms possible are made available for IRTF Stream documents – see RFC 5743
  - Definitive information is in RFC 5378 (Copyright) and RFC 8179 (Patents, Participation), substituting IRTF for IETF, and at https://irtf.org/policies/ipr

Goals of the IRTF



- The Internet Research Task Force (IRTF) focuses on longer term research issues related to the Internet while the parallel organisation, the IETF, focuses on shorter term issues of engineering and standards making

- **The IRTF conducts research; it is not a standards development organisation**

- While the IRTF can publish informational or experimental documents in the RFC series, its primary goal is to promote development of research collaboration and teamwork in exploring research issues related to Internet protocols, applications, architecture, and technology

- See **“An IRTF Primer for IETF Participants”** – RFC 7418

IETF 122 Meeting Tips

- **In-person participants**
  - Make sure to sign into the session using the Meetecho Onsite Tool from the Datatracker agenda
  - Use Meetcho to join the mic queue
  - *Keep audio and video off if not using the onsite version*
- **Remote participants**
  - Make sure the audio and video are off unless you are chairing or presenting during a session
  - Use of a headset is strongly recommended

Administrivia

Local participation:
https://meetings.conf.meetecho.com/onsite122/?session=34005
Remote participation:
https://meetings.conf.meetecho.com/ietf122/?session=34005
Meeting materials:
https://datatracker.ietf.org/meeting/122/session/sustain
Shared notes: https://notes.ietf.org/notes-ietf-122-sustain

Mailing list: sustain@irtf.org
Chairs: sustain-chairs@irtf.org
Datatracker: https://datatracker.ietf.org/rg/sustain/about/

Agenda

1) **Chair Slides - Administrivia, Intro, Vision, Charter** –
   Eve Schooler (University of Oxford) & Ali Rezaki (Nokia)

2) **The Full Lifecycle** – Jukka Manner (Aalto University)

3) **Energy Proportionality** – Jukka Manner (Aalto University)

4) **Sustainable Network Architecture** –
   Jari Arkko (Ericsson) & Suresh Krishnan (Cisco)

5) **Dagstuhl Seminar: Greening Networking Towards a Net Zero Internet**
   Dirk Kutscher (The Hong Kong Univ. of Science & Technology)

6) **Open Discussion**

Note: Last 5 mins of each speaker slot are for questions.

Potential Future Agenda Topics

- GHGP / SBTi – Why we need to engage
- Carbon-aware networking – SOTA
- Sustainable subsea networks – Internet Society sponsorship
- *Sustainability research in industry – e.g., snapshot of a Telecom*

Why Participate in SUSTAIN RG?

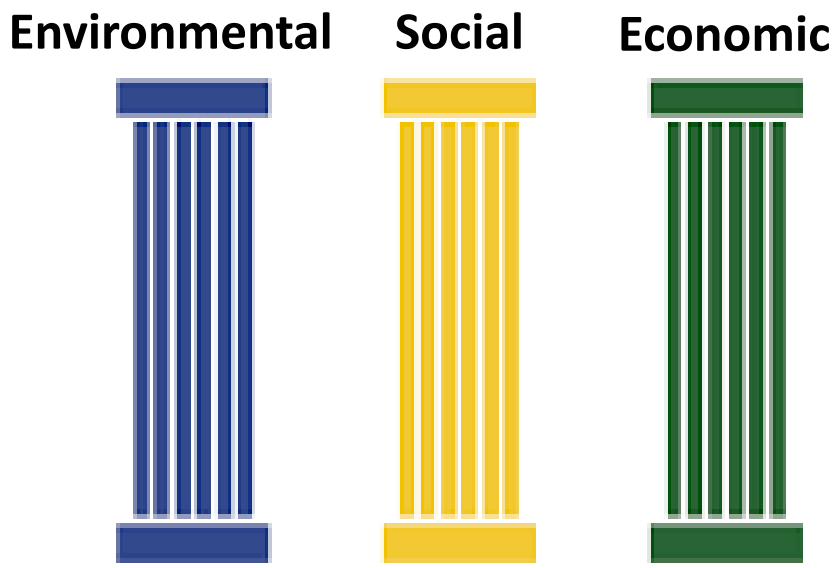
- Urgency to address UN IPCC recommendations
  - 1.5C degree threshold - minimize climate change impact
- Timeline to reduce GHG emissions
  - 50 % by 2030
  - 100 % by 2050
- ICT contribution to GHG emissions sizeable & growing
  - Network impact rivals Data Center
  - Network impact on par with developed nations
- Exacerbated by exponential growth of AI
  - (Renewable) Electricity scarcity

SUSTAIN RG Vision

Contribute to the advancement of the Internet as a fundamental part of sustainable and resilient societies and the planet, through conceptual and evidence-based multi-disciplinary research collaboration

Sustainability Defined

"Meet the needs of the present without compromising the ability of future generations to meet their own needs."



Scope of SUSTAIN RG

- Long-term research challenges in developing and operating an environmentally, socially and economically sustainable Internet,
- Networking perspective, mindful of overall impact to systems & services (considering user side, as well as data centres (source),
- Critical view on evidence and data (trustworthiness of research results and their dissemination),
- Architectural and policy implications, without going into advocacy.
- Focus on the Sustainability of the Internet (env, social, econ. footprint), & appreciation of the Internet for Sustainability (handprint).
- Multidisciplinary, systems perspective with lifecycle and supply chain considerations.

A word on SUSTAIN RG ambition

- We want to build a lasting research community:
  - Community -> common vision, goals, understanding & methods
  - Research -> in depth, experimental, diverse, evidence based
- First and foremost, we are after research questions*:* we want to debate and understand the questions together before innovating on their solutions
- We encourage scientific publications
- We will build a network internally, connecting researchers to implementors and with other organizations externally.

SUSTAIN RG early focus

Level set:

- Level set on the broader Sustainability community
- Understand adjacent network standards orgs' research efforts
- Create a navigational map of IETF/IRTF efforts

Research focus:

- Topics that are long-standing gaps, are controversial, about which we are passionate, for which there are champions, most timely to address, that promise an outsized impact, easy win, notable reductions and savings

Community building:

- Provide early review of emerging research
- Give visibility to advanced research ("Best of" papers, ANRW)
- Sponsor surveys
- Establish a pool of reviewers for IETF/IRTF
- Invite cross-disciplinary partnership

Research Areas - Footprint

Characterization and reduction of the Internet environmental, social and economic footprint:

- working with quantitative and qualitative indicators, their baselines and targets, measurements and assessments, sharing related data and evidence,
- conceptual and policy frameworks,
- considering lifecycle as well as supply chain issues,
- adopting a holistic system perspective on impact.

Research Areas – Environmental Footprint – 1/2

- Investigate and experiment with novel approaches to greenhouse gas (GHG) emissions reductions:
  - explore innovations in energy proportionality, savings and efficiency,
  - increase the role of renewables in powering Internet infrastructure,
  - advance GHG-aware networking,
  - balance the supply and demand of renewables and computing,
- Materials/resource efficiency/use, equipment upgrade cycles, circularity, total-cost-of ownership (TCO).

Research Areas – Environmental Footprint – 2/2

- Investigate the relationship between environmental sustainability and the Internet architecture (e.g., distributed, centralized, edge computing, cloud, virtualized, overlaid, including caching and in-network computation, as well as the impact of service delivery methods) to understand the implications and impact of differing approaches to network design and the trade-offs.
- Investigate environmental limits and boundaries within which the Internet and its applications should operate safely and the corresponding policy implications.

Research Areas – Social & Economic Footprint

- While we recognize the importance of the social and economic footprint of the Internet, we are lagging in our understanding of the topics due to the increased multidisciplinary nature of the challenges.
- SUSTAIN RG aims to bridge this gap, by attracting researchers from different disciplines and by collaborating with other RGs like GAIA, HRPC, DINRG to develop further these perspectives.
- Social and economic footprint aspects have a strong relation to policy and regulation aspects as well.

Research Areas – Policy & Regulation

- Understand the role of policy and regulation in the environmental, social and economic sustainability of the Internet, as complementary to technological and operational factors, for example to incentivize sustainability.
- Identify and explore sustainability policy-relevant research domains, not policy advocacy work.

Research Areas – Rebound Effect

- Understanding the impacts of different strategies for managing the potential rebound effects (Jevon's paradox) of Internet sustainability gains, including technical, policy and regulatory aspects.

Research Areas – Climate Change Adaptation

- Understanding new methodologies, architectures and strategies to ensure Internet resilience in the face of climate change impacts that are already taking place,
- Considering resource impacts and operational complexity in creating a more environmentally resilient Internet.
- A distinct topic from footprint reduction efforts (climate change mitigation).

Mode of Operation - 1/2

- Attract research contributions from academia, government and industry with a multi-disciplinary outreach, prioritizing research publications in journals and conferences,
- Hold regular meetings – during IETF weeks and on-line, co-location with sustainable networking conferences, workshops and other events to be considered.
- Coordinate with other IRTF RGs, like GAIA, HRPC, NMRG and DINRG, with IETF WGs like GREEN, TVR, OPSWG and IAB E-impact, as well as with the Internet Society, and the sustainability efforts of other SDOs, industrial consortia, and research organizations

Mode of Operation - 2/2

- Organize awareness-raising activities, such as invited talks from sustainability experts, including from systems, environmental, social and economic sciences and practitioners that work on sustainability target setting, policy, assessments and strategy, to clarify the linkages.
- Organize and promote a special session on sustainability at the ACM/IRTF Applied Networking Research Workshop (ANRW), working with the ANRW Programme Committee.
- Publish RFCs to transfer research results and feedback to the IETF community, deferring to the IETF for technology standardization.

https://www.irtf.org/anrw/2025/

- Co-located with IETF-123 in Madrid the week of July 19-25, 2025
- **Paper submission deadline: 15 April 2025**
- CFP includes sustainability-focused topics:
  - Design of energy-efficient protocols, devices, and network architectures
  - Characterization of the Internet footprint
  - Analysis of environmental limits within which the Internet and its applications should operate
  - And many other topics relevant to IETF/IRTF groups, including SUSTAIN

Discussion:

- What would you like to **bring** to SUSTAIN RG?
- What would you **expect** from others in SUSTAIN RG?
- What is your **favourite** sustainability research topic?

Thank You!

Questions? Feedback?