IRTF Proposed Research Group: Sustainability and the Internet Research Group (SUSTAIN RG)

Draft Charter Proposal v1.0 (31 October 2024)

Vision:

The long-term goal of the SUSTAIN RG is to contribute to the advancement of the Internet as a fundamental part of sustainable and resilient societies and planet, through conceptual and evidence-based research collaboration.

Scope:

The Sustainability and the Internet Research Group (SUSTAIN RG) will explore research challenges in developing and operating a sustainable Internet, from a networking perspective. It will provide a venue for discussion, collaboration and development of longer-term Internet research on sustainability and its trustworthy dissemination. Grounded in the practical operation of the Internet, the RG will work to bring greater understanding of architectural and policy implications relating to environmental, social and economic sustainability challenges of internetworking, without going into advocacy actions.

Recognizing their interconnectedness, the SUSTAIN RG will focus on the Sustainability of the Internet (footprint), while fostering an appreciation of the Internet for Sustainability (handprint). The SUSTAIN RG adopts a multidisciplinary, systems perspective, considering the interdependencies between different types of networks as well as different research disciplines.

Background:

The Internet is a global critical infrastructure, on which societies, individuals and businesses depend. It is expected to play a positive role in tackling global challenges such as climate change, decarbonization, and environmental degradation. Yet at the same time, there is growing concern about the negative impacts. Internet technologies are part of value chains that are driving increased energy, materials and natural resource use, and increasing carbon emissions. It is imperative to minimize these negative impacts, to support global sustainability goals, as per the UN Sustainable Development Goals (SDGs).

There are numerous research challenges for a sustainable Internet and its applications. Characterization, monitoring, management and mitigation of the Internet environmental footprint, as well as the timely collection, distribution and sharing of accurate measurement data and assessments are open challenges. Additionally, there are considerable hurdles in linking the Internet to sustainability outcomes in real-life use cases in a causal way, due to the absence of practical methodologies and examples to do so. SUSTAIN RG will systematically work to frame these challenges for the benefit of the Internet community – architects, developers, operators, users, and policy makers alike.

Research areas:

SUSTAIN RG will invite contributions on topics relating to the long-term sustainability of the Internet:

- Reduction of the Internet footprint (environmental, social, economic), working with quantitative and qualitative indicators, their baselines and targets, measurements and assessments, sharing related data, conceptual and policy frameworks, considering lifecycle as well as supply chain issues, including circularity and materials use.

    - Investigate environmental limits and boundaries within which the Internet and its applications should operate safely and the corresponding policy implications.
    - Investigate the relationship between 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 environmental impact of differing approaches to network design and the trade-offs.
    - Investigate novel approaches not only to energy efficiency, energy savings and energy proportionality, but also to overall greenhouse gas emissions reductions, like increasing the role of renewables in powering Internet infrastructure, carbon-aware routing, traffic steering, data transmission, and synergistic balancing of supply and demand of renewables and computing.
- Understanding 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.
- 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.
- Understanding new methodologies, architectures and strategies to ensure Internet resilience in the face of sustainability challenges, considering resource impacts, carbon efficiency and operational complexity.

Mode of operation:

The SUSTAIN RG will solicit academic, governmental and industrial research contributions to enhance the state of the art and our understanding of the relationship between the Internet network infrastructure and applications and sustainability from long-term conceptual, systems and policy perspectives.

The SUSTAIN RG will hold regular meetings, encouraging hybrid modes of attendance to reduce the environmental impact of travel, and will organize interim meetings as needed that might align with sustainable networking conferences, workshops and other events. It will coordinate with other IRTF RGs, like GAIA, HRPC and DINRG, with IETF WGs like GREEN, TVR, OPSWG, as well as with the Internet Society, and the sustainability efforts of other SDOs, industrial consortia, and research organizations. Since the IAB E-impact program is the venue for Internet architecture and environmental sustainability-related guidance and coordination among various IETF & IRTF groups, SUSTAIN RG will inform the E-impact program about its research activities and collect corresponding feedback from it.

The group will 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. It will work to create a focused topic area during the ACM/IRTF Applied Networking Research Workshop (ANRW) on sustainability and invite contributions, to develop a broader publication stream for research in this space.

The group may publish RFCs to transfer research results and feedback to the IETF community but defers to the IETF for technology standardization. The aim of the RFC series output would be to take stock of state-of-the-art research results, making recommendations on standardization gaps, policy concerns, and strategy opportunities with the broader Internet community.

Authored by Ali Rezaki and Eve Schooler. V1.0 on 31 October 2024.

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Please share your feedback with the authors: Ali Rezaki (ali.rezaki@nokia.com) and Eve Schooler (eve.schooler@gmail.com). Thanks!