Environmental Impact of Internet Applications and Systems Workshop

Report & conclusions & next-steps?

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Report draft-iab-ws-environmental-impacts-report

Workshop page

IETF e-impact list page

What & Why

An IAB workshop with 73 participants from the IETF, research, and adjacent communities

- Participation was through submission of position papers – 26 accepted ones

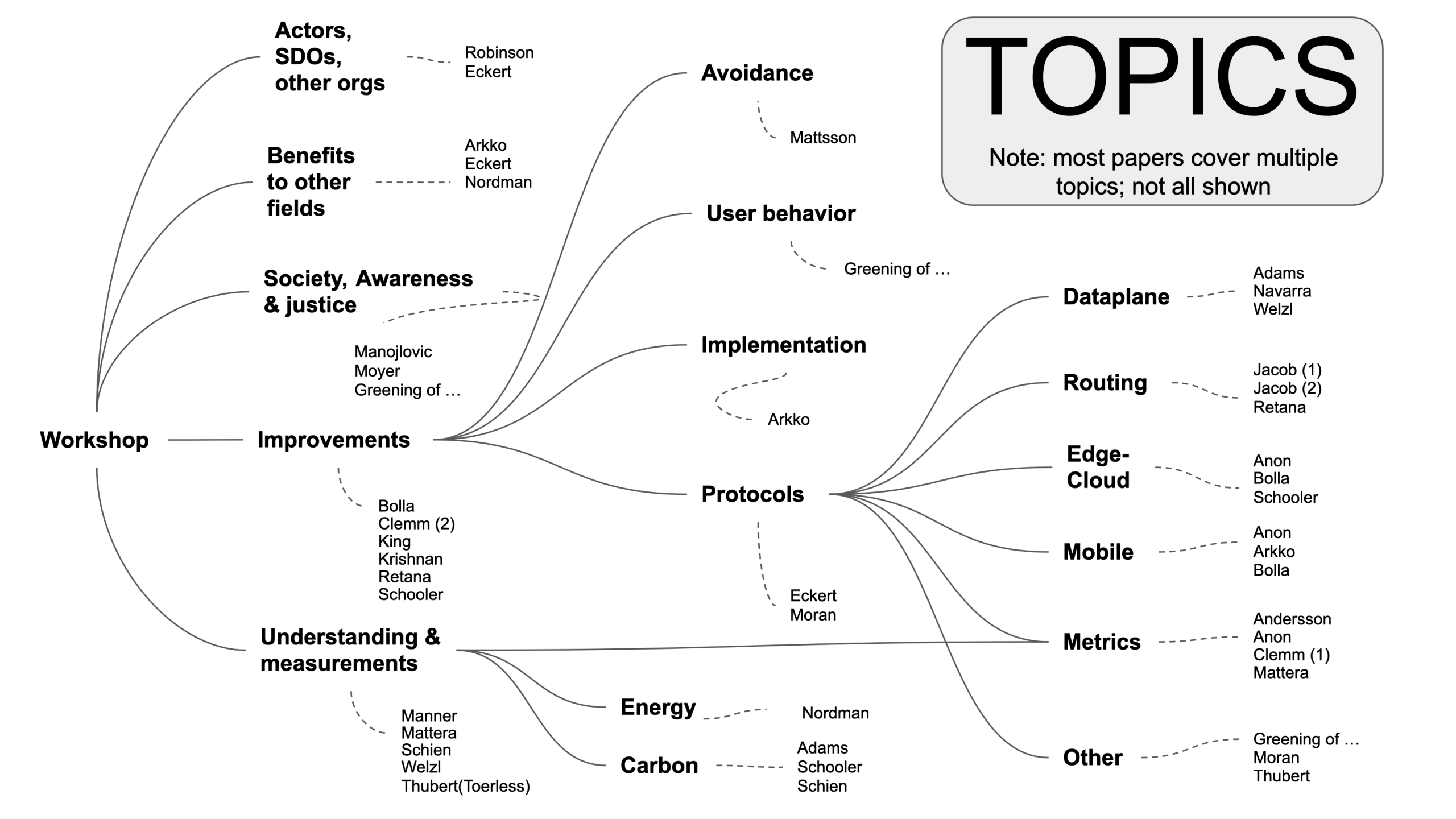
Ensuring a good environment for humans is clearly a worthwhile, shared goal

- Reduced environmental impact is in many cases also a business requirement

The Internet is a powerful tool, helps our societies, but it can also amplify harmful issues

Can we help with the costs or benefits, better understanding, or start useful research?

- Workshop sessions: big picture, what we [don’t] know, improvements, and conclusions


TOPICS
Note: most papers cover multiple topics; not all shown
Workshop
Improvements
Bolla
Clemm (2)
King
Krishnan
Retana
Schooler
Understanding & measurements
Manner
Mattera
Schien
Welzl
Thubert(Toerless)
Actors, SDOs, other orgs
Robinson
Eckert
Benefits to other fields
Arkko
Eckert
Nordman
Society, Awareness & justice
Manojlovic
Moyer
Greening of …
Avoidance
Mattsson
User behavior
Greening of …
Implementation
Arkko
Protocols
Eckert
Moran
Energy
Nordman
Carbon
Adams
Schooler
Schien
Dataplane
Adams
Navarra
Welzl
Routing
Jacob (1)
Jacob (2)
Retana
Edge-Cloud
Anon
Bolla
Schooler
Mobile
Anon
Arkko
Bolla
Metrics
Andersson
Anon
Clemm (1)
Mattera
Other
Greening of …
Moran
Thubert

Workshop Conclusions

Internet needs to both help the society and reduce its own environmental impacts

This is not entirely new for the Internet or the IETF (video conferencing etc.)

The problems are large, complex, and go far beyond Internet technology itself – we need to build better understanding

It is crucial also to understand the different tradeoffs and constraints, e.g., jitter, peak capacity, etc.

Detailed technical directions include

- Beyond protocols: implementations, green energy, etc.
- Metrics, measurements, and data
- Enable a more dynamic ability to slow down, sleep, or be awareness of energy availability
- Data format choices
- Multicast (?)
- Designing for low-power systems may be beneficial in general
- Avoid proof-of-work crypto assets
- “Environmental Considerations” (?)

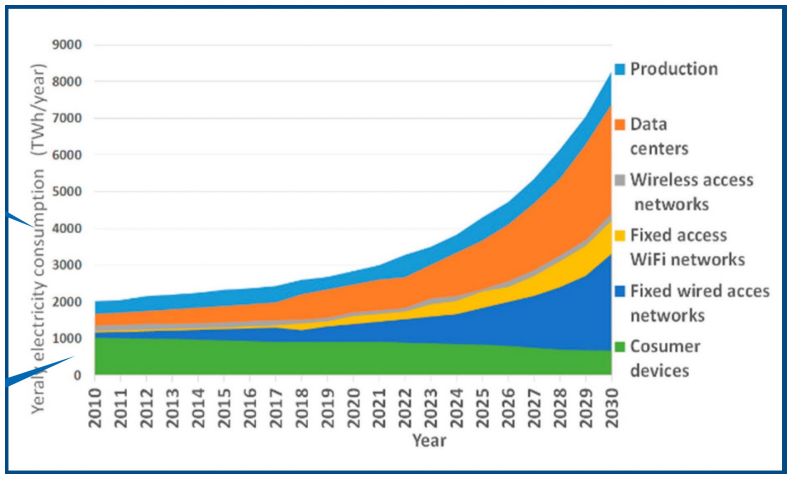
Workshop example: Welzl, Alay, Teymoori, Islam
CO2 Footprint of the Internet

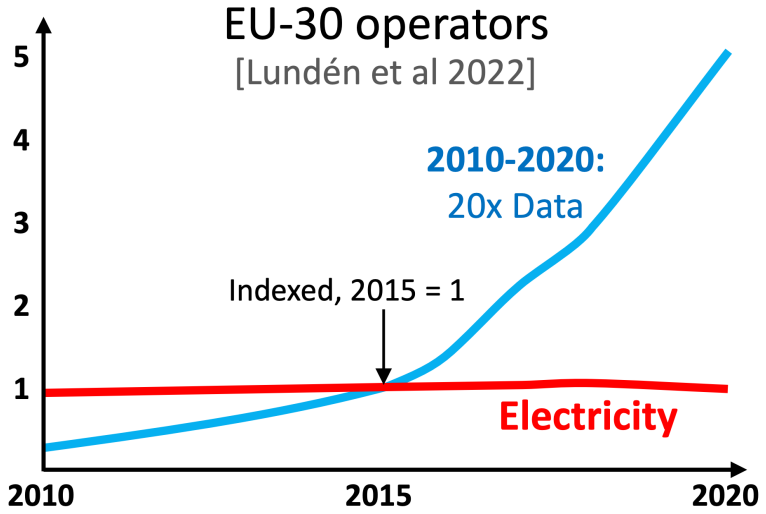
- What is “the Internet”? Studies differ widely
  - Age; considerations of: CPE; UE; embodied energy; data centers
- Our IAB paper uses a few sources to arrive at a range of: **0.5% – 1.17%**

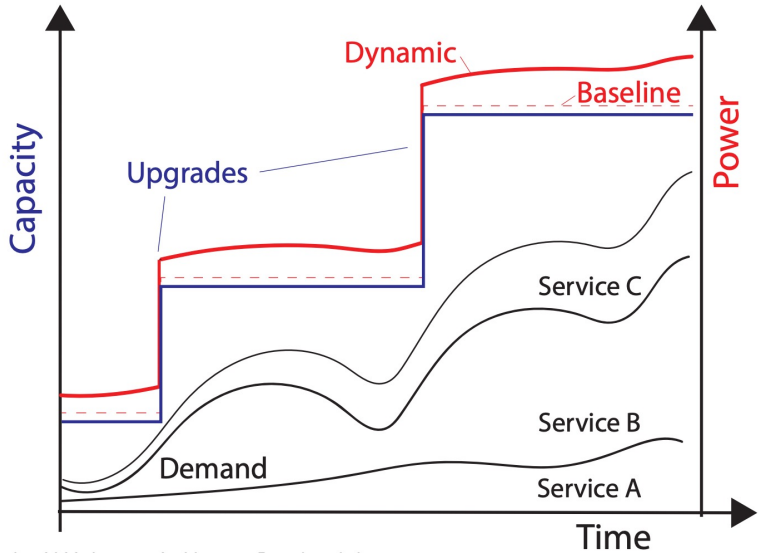
- One possible derivation:
  “SMARTer2030 report” states that ICT has a CO2 “footprint” of 2.7% of global emissions in 2020
  - **Numbers from 2012: telecom electricity = ICT / 3**
    [S. Lambert et al, “Worldwide electricity consumption of communication networks”. Opt. Express, 20(26), Dec 2012.]
  - If this relationship still holds, then roughly, worldwide 2020 GHG emissions from telecom: **0.9%**

Workshop example: Schooler; Malmodin; Schien

Growth



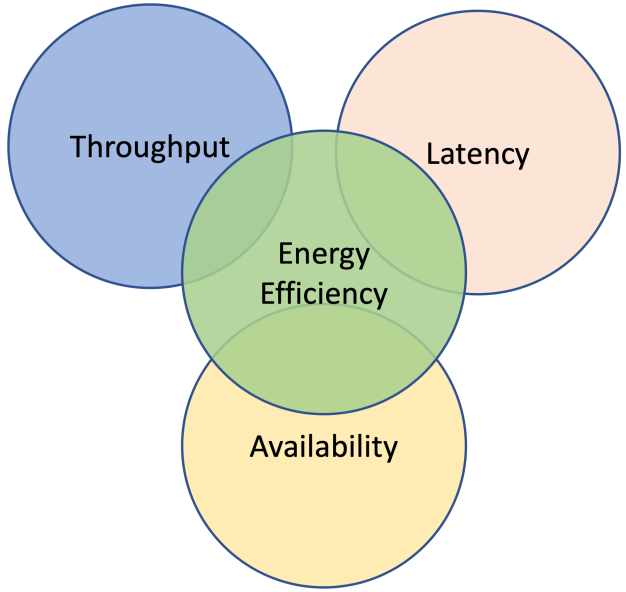




Workshop example: Krishnan & Pignataro

Sustainability considerations for networking equipment

Optimizing for:



Phase 1
Visibility

Phase 2
Insights and Recommendations

Phase 3
Self-Optimization & Automation

Workshop example: Moran & Bormann

Energy impact of data size by encoding

Energy comparison of JSON vs CBOR

- SenML example
- LoRa overhead reduces impact
  - Sensitive to packet count
  - Quantized to 127 bytes
  - Per-packet overhead
    - Favors reduction across packet count
- Energy reduction in all cases
  - Often 30% or better