OCARINA
("Optimizations to Compel Adoption of RINA")

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Project overview

• 5-year project funded by Norwegian research council, started 1 October 2016; 1 postdoc + 3 Ph.D. students
  – Focused on performance. Assumptions:
    1. RINA needs to show fantastic performance,
    2. RINA can show fantastic performance!

• 3 main WPs: cong. control, routing, Internet deployment
  – RINA forces us to think differently about network algorithms such as routing and congestion control
  – E.g., Internet-like "end-to-end" congestion control could be implemented in a RINA network, but that would be a very strange configuration
Issues of Internet CC.

• Two major mistakes:
  1. First produce congestion, then react to it
     • Solution: create a meaningful "load" signal that does not embed a very specific algorithm (give some freedom to designers)
  2. Clueless about underlying infrastructure, by design
     • Solution: use per-DIF loops, work with back-pressure

• ECN is broken
  – Cost incurred in the network is additive per hop (see NUM theory), but can't re-mark a marked packet
  – Better "load" signal in DCTCP-style usage: instantaneous queue marking, count marks / RTT, or before a queue even grows (virtual Q)
Problems of using ECN as “load”

• Modern controllers such as DCTCP converge at high marking probabilities.

• The theory (e.g. Network Utility Maximization (NUM)) needs an additive signal; a product value deviates much in high marking probabilities ( > 0.04)!
Our Solution

• Extending the Theory
  – With a lot of math and stability analysis of course …

• Results: (assuming a logarithmic utility)

Advantages:
1. New signal is a pretty general solution; just conveys "load", and could (relatively) easily be extended to multi-bit
2. New signal is probably good input to load-based routing too
3. RED as an already-deployed solution can be used; only small changes at senders and receivers
Per-DIF loops: PRISTINE background

• A sequence of DIFs doing TCP CC. is much like a sequence of split-TCP PEPs \(\rightarrow\) can be beneficial [1]
• However, controls using recursive queue based feedback can have stability issues (+ delay from multiple queues) [2]
• Envision to address this with logistic growth based control [3] + new "fixed" ECN

WiFi uplink (e.g. video conference)

• TCP's "sawtooth test" does not make much sense here
  – 802.11 MAC is this hop's congestion control... but focused on sending 1 frame, not telling us a send rate

• Could use buffer drain rate
  – perhaps BBR would work well here?

• However: knowing buffer drain rate requires to always send → working on a model-based approach
Deployment

• We can consider RINA-under-IP, RINA overlay, and RINA-IP gateways...

• But we can also consider "switching over"!
  – Once a host discovers that the whole path to the other end is RINA-enabled, switch
  – Today, often, paths are short (Google, FB, ... are not far away from you)
  – TCP/IP are only rendez-vous protocols
  – Some recent IETF standards could help
    • A little ironic 😊
Relevant IETF work
not strictly OCARINA, but still...

• **Transport Services (TAPS) WG:**
  makes apps protocol-independent
  – *Finished* surveying and condensing services provided by:
    TCP, MPTCP, UDP, UDP-Lite, SCTP, LEDBAT
  – Now working on API + implementation guidance, with Apple
    among others; implementations: Apple, NEAT (open source)

• **Provisioning Domains (PvDs) (INTAREA WG):**
  – Router Advertisement (RA) option from first-hop router
    conveys FQDN that host can use to retrieve extra info about
    network access characteristics via HTTP over TLS query
  – Applications then select (via local IP address) which PvD to use,
    and can learn config. params for transport layer and above
Conclusion
You have now safely shutdown the Internet.
Thank you!