SCHC Applicability To IP in Deep Space

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What are interplanetary communications?

- Earth-Moon
- Earth-Mars, Moon-Mars
- Any asteroid to any spaceship anywhere in the galaxy not that far away

Communication/Traffic characteristics – point-to-point links:

- Very long RTT (~2.56s Earth-Moon, up to 45min to Mars, up to 11h to Pluto)
- Throughput (Moon: 1-10 Mbps, optical up to 622 Mbps, Mars: 2 Mbps, optical needs work, could be 100Mbps, outer planets <50kbps)
- Packet loss: Moon <1%, Mars 1-5%, Outer planets: 5%-30%

Long, variable RTTs

TIPTOP WG meeting on Thursday, 17:00 - 19:00

- Currently defining requirements, protocols (e.g. QUIC, running DNS, mail, addressing (e.g. a single prefix for a planet)

Why is SCHC interesting for TIPTOP?

- Static Context Header Compression - A header compression & fragmentation framework - RFC8724
  - Adopted by several SDOs: DLMS, IEC, ISO, Lora Alliance
  - Several industrial and open-source implementations, deployed in critical infrastructure since 2021
- It’s a framework
  - Generic, defined for highly asymmetric, constrained networks (4 different LPWAN tech)
  - Today, multiple applications: satellite, delay and disruption tolerant networks, energy-harvesting ambient IOT, underwater acoustic, ultra-low latency communications, PPP, IPsec, 6LO, etc.
- Stateless compression
  - Based on static contexts shared by communicating end-points
  - Datagram based - one lost datagram, or million lost datagrams, don’t affect operation
  - RTT-agnostic
- Low computational complexity – could be applied to Tbps traffic

Why do it?

- Depending on traffic, expect 2%-10% gains
  - IPv6/UDP header (48B) can be compressed
    - Down to 1-2B, or 20B-30B in worst-case scenarios
  - IPv4/UDP header (28B) can be compressed
    - Down to 1-2B, or 15B-20B in worst-case scenarios
  - That is before FEC -> gains are bigger “on the wire”
    - If no compression rule exists for a traffic, it will be sent “as is”. That should be a rarity, but it means no service interruption or runtime complexity
- Current work
  - Work from Joerg Ott on traffic simulation for TIPTOP
  - Work on SCHC for QUIC (draft-sirohi-schc-quic-compression)

Next steps

- If interest – work on a profile for SCHC for TIPTOP
  - As it is a Framework, we can optimize for requirements coming from TIPTOP (e.g. implementation complexity, features, ...)
  - Work on quantifying expected gains (e.g. for TIPTOP traffic)
  - Specify how SCHC is integrated in the TIPTOP framework
  - Management for TIPTOP
- If possible, support in the TIPTOP meeting