(Not yet quite) Proposed

SPACE RG

Systems and Protocol Adaptations for Circumstellar Environments Research Group

Juan A. Fraire, Jörg Ott, Nishant Sastry

Side meeting 2025-03-18

Note well

This is a reminder of IETF policies in effect on various topics such as patents or code of conduct. It is only meant to point you in the right direction. Exceptions may apply. The IETF's patent policy and the definition of an IETF "contribution" and "participation" are set forth in BCP 79; please read it carefully.

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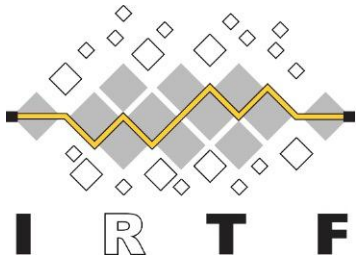
Definitive information is in the documents listed below and other IETF BCPs. For advice, please talk to WG chairs or ADs:

- BCP 9 (Internet Standards Process)
- BCP 25 (Working Group processes)
- BCP 25 (Anti-Harassment Procedures)
- BCP 54 (Code of Conduct)
- BCP 78 (Copyright)
- BCP 79 (Patents, Participation)
- https://www.ietf.org/privacy-policy/(Privacy Policy)



Agenda

1. Introduction (7min) [Jörg]
2. Short talks for background (clarifying questions only)
   a. Juan Fraire: Models and Methods for Near-Earth and Deep Space Networking (7min)
   b. Ulrich Speidel: How fast can Starlink really be? A quick summary (7min)
   c. Nishanth Sastry: LEOscope-A global measurement testbed for LEO Satellite Networks (7 min)
3. Round table:
   Where would you see opportunities and gaps to explore in the RG? (20min) [all]
4. Charter discussion and next steps (10min) [all]

Motivation

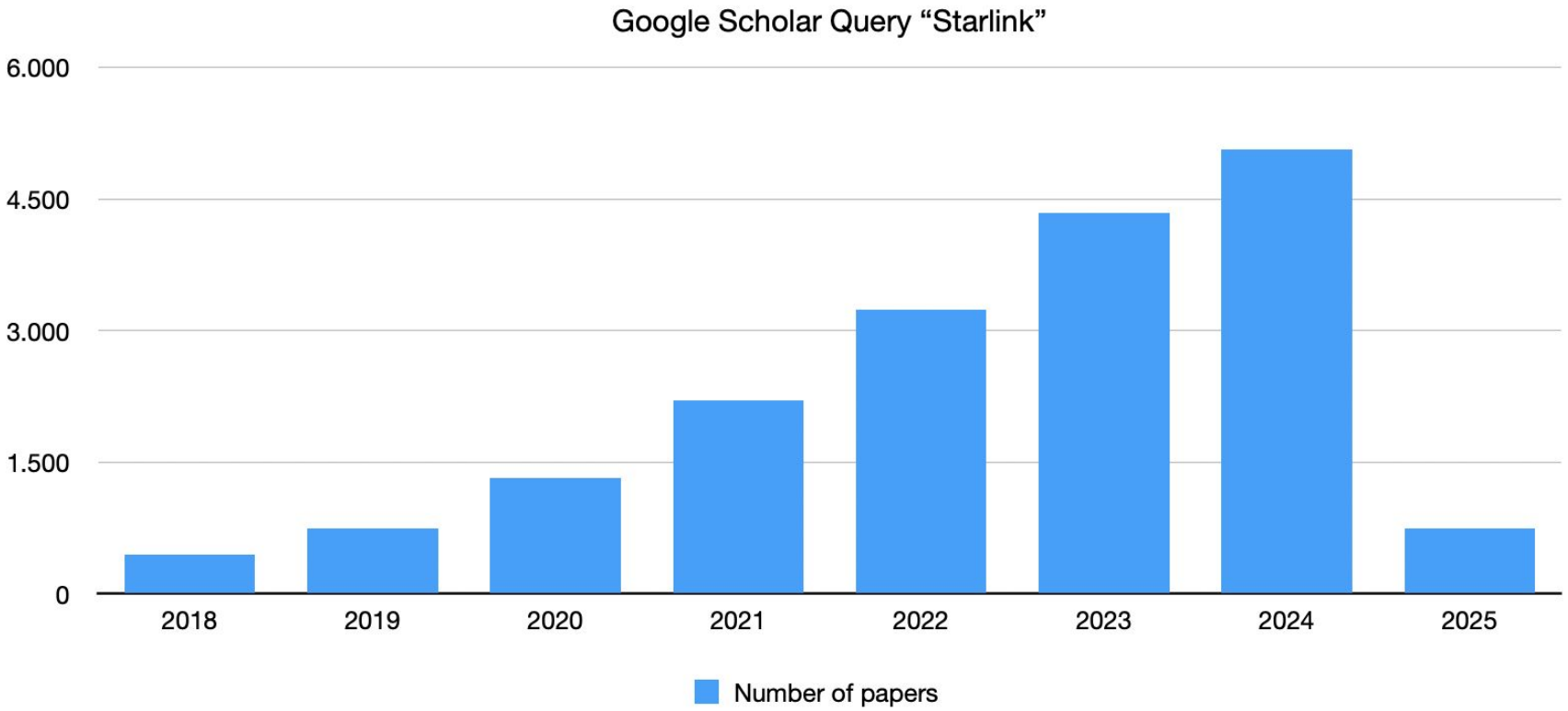
Existing engineering solutions (IETF WGs, CCSDS, 3GPP) focus on **standardization**, not fundamental research.

SPACE RG is proposed to draw boundaries, identify overlaps, and connect interfaces across architectures (e.g., Bundle Protocol/IP), different variants of the space domain (LEO/Deep Space), phenomena (latency to delay/disruptions down to relativistic effects), and entities (IETF, CCSDS, IOAG, but also the private players in the space, like Starlink).

NOT intended as an IETF Working Group (no protocol standardization), but, **research and experimentation** (papers, testbeds, simulations, prototypes).
Cooperation with DTNWG, TIPTOP [was: DEEPSPACE], TVR, CCSDS, 3GPP.

Charter https://github.com/ekline/ntnrg/blob/main/charter.md

Motivation by example



Scope [we will come back to this for bashing]

- **Simulation**, **measurement**, or **testing** techniques.
- **Analysis** of any impact on **transport protocols** as paths experience regular changes in characteristics like latency, jitter, and loss.
- Investigation of the challenges and benefits of **optimizing** existing **network**, **transport**, and **application protocols and practices e.g., CDNs**.
- Researching applicability of **traffic engineering** techniques for optimizing data flows, considering **dynamic topologies**, high **latency**, limited **bandwidth**, and **store-and-forward** networking.
- **Management** approaches considering functional and operation requirements.
- **Application models** and **interfaces** considering human and robotic systems.
- **Interoperability** of different operators and **intra- and inter-operator routing**

Charter https://github.com/ekline/ntnrg/blob/main/charter.md

Out of scope

Specifications: Architecture, protocols, management, …

- Not DTN WG
  - Won’t do bundle protocol or other delay-tolerant networking architectures and specs
- Not TIPTOP WG
  - Won’t to tweaks to protocols and their configurations / operational parameters

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Round table

Some questions to think about:

- Where would you see opportunities and gaps to explore in the RG?
- What “deliverables” could serve the community best?
- How to best ensure continued interaction to learn from each other?

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Charter (1)

The Systems and Protocol Adaptations for Circumstellar Environments Research Group (SPACE RG) is chartered to explore and investigate research questions related to architecture, protocol design, manageability considerations, and approaches to operationalize several categories of non-terrestrial networks. Specifically, the research group focuses on networking among differently-owned nodes with highly dynamic connectivity imposed by their non-terrestrial deployment environment. This includes High Altitude Platforms (HAPS), typically in the stratosphere, satellites in Low, Medium, and Geostationary orbits (LEO, MEO, GEO), as well as platforms in other trajectories -- cislunar and beyond. For brevity, these are collectively referred to below as "aerospace networks".

Previous IRTF work (DTNRG) focused on the delay and disruption tolerance required to communicate effectively in extreme connectivity-challenged scenarios (vis. RFC 4838). That effort led to the creation of the IETF DTNWG, which standardized BPv7 (RFC 9171) and BPSec (RFC 9172). Since then, network nodes on aerospace platforms in cislunar regimes have rapidly risen in deployment and scale. This regime poses less extreme time constraints on connectivity, but the rapid change and variability of topologies that might be built among nodes moving through this environment present new challenges.

Charter (2)

The intended work products of the SPACE RG include an evaluation of the impact of inter-networking imposed by these deployments, as well as possible mitigation of adverse effects. Of specific interest are:

- Simulation, measurement, or testing techniques particularly well suited for aerospace networks.
- Analysis of any impact on transport protocols as paths experience regular changes in characteristics like latency, jitter, and loss associated with nominal platform behavior.
- Investigation of the challenges and benefits of tuning existing network, transport, and application protocols in emerging aerospace network architectures.
- Researching applicability of Traffic Engineering techniques for optimizing data flows in aerospace networks, considering unique challenges such as dynamic topologies, high latency, limited bandwidth, and the challenges of store-and-forward networking.
- Exploration of management approaches that take into account functional and operation requirements specific to aerospace-networks.
- Conception of application models and interfaces considering human and robotic aerospace networks.

Charter (3)

SPACE RG may also consider the implications and requirements for aerospace nodes from different administrative domains dynamically providing connectivity. The control plane requirements and trust model design parameters are especially relevant.

The group will consider related architectures and protocols from academia, industry, and organizations such as CCSDS and 3GPP.

An explicit non-goal is to propose changes to existing IETF protocols. The research group may explore ideas that require such changes and is uniquely placed to discuss their implications with the IETF community. Still, the potential incorporation of such ideas into the standards process is a matter for the IETF and is out of the scope of this group.

Considerations related to hosts connecting to an aerospace network and path selection strategies among available connectivity are initially out of scope.

Structure

- Chairs
  - To be defined for the final RG
  - Responsible for the pre-RG meetings: Juan A. Fraire, Jörg Ott, Nishanth Sastry
- Community
  - Researchers, industry experts, standards people, and space agencies
  - LEOconn event series, LEO-NET workshop series, seminars on space communications
  - Notable record at top-tier networking venues (Mobicom, IMC, Hotnets, Infocom, …)
- Meetings
  - Regular meetings at IETFs: invited talks and discussion to help research and engineering mix
  - Possibly interim meeting alongside relevant conferences

Discussion: how to proceed?

- Next steps
  - Finalize the charter and seek IRTF/IRSG pre-approval
  - Gather community support and refine research focus areas
  - Plan initial research activities and collaborations
  - Encourage participation from academia, industry, and agencies

- Concrete targets
  - “Act like an IRTF research group” [RFC 7418]
  - Establish active communication channels (mailing list, etc.)
  - Have Proposed SPACE RG meetings in Madrid and Montreal