IETF 105

Update on draft-irtf-nwcrg-network-coding-satellites-05

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CENTRE NATIONAL D'ÉTUDES SPATIALES

From *-04 to *-05

- Since last IETF : WGLC process
- Comments from Lloyd Wood and John Border
- Rather than presenting a diff, this presentation presents *-05

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Abstract

- **Follows the taxonomy document [RFC8406]:**
  - coding as a linear combination of packets
  - operates above the network layer
- **Details a multi-gateway satellite system to identify use-cases where coding is relevant**
  - Cope from residual losses
  - Provide reliable multicast services
  - …

➢ **Contribute to a larger deployment of coding techniques in SATCOM**

➢ **Identify open research issues**

  - Interaction between congestion controls and coding techniques
  - …

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Introduction

- **The notations used in this document are based on the taxonomy RFC8406**
  - Channel and link codings are gathered in the PHY layer coding and are out of the scope of this document
  - FEC (also called Application-Level FEC) operate above the network layer
  - This document considers coding (or coding techniques or coding schemes) as a linear combination and not as a content coding (e.g., to compress a video flow)
- **Active research activity on coding techniques and SATCOM**
- **Not much has actually made it to industrial developments**

➢ **This document aims at identifying opportunities for further usage of coding in these systems**

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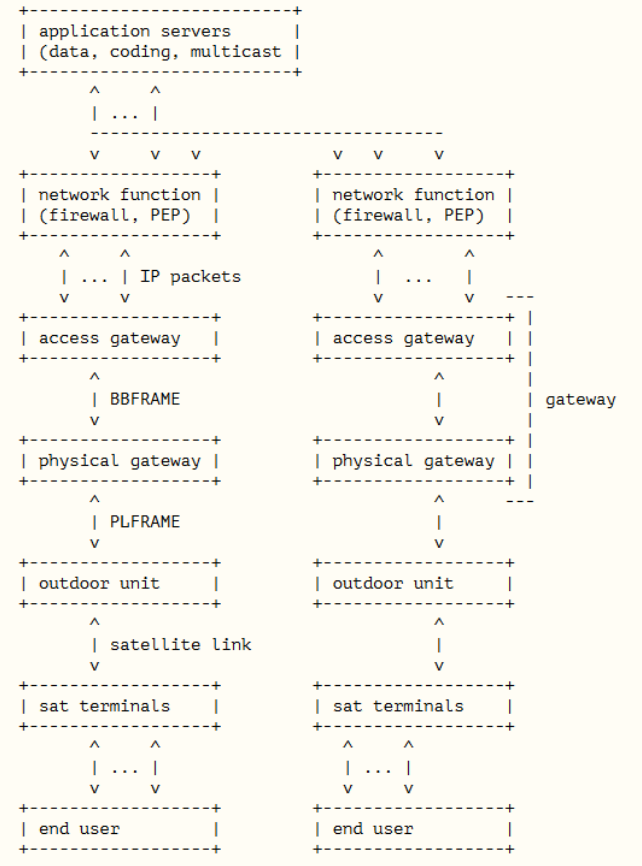
Note on satellite topology



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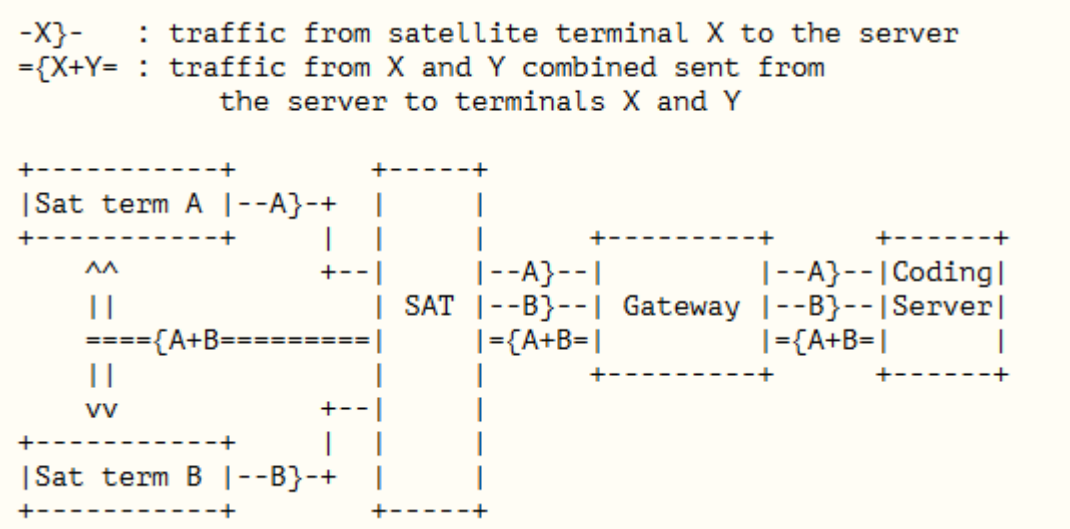
Use-case: Two-way relay channel mode



Demonstrated at ASMS2010

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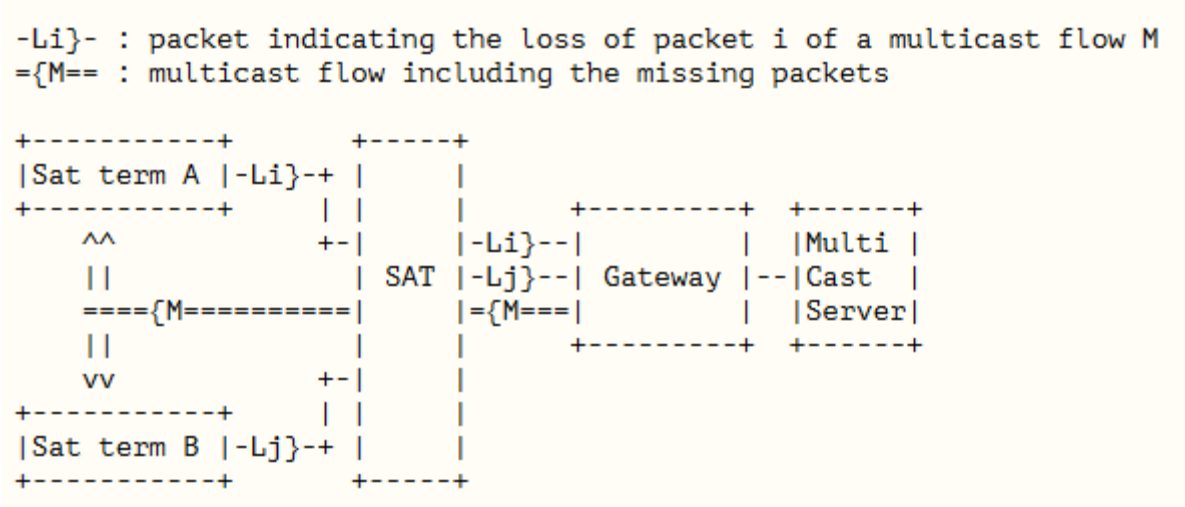
Use-case: Reliable multicast



Could be achieved by using other multicast or broadcast systems, (NORM [RFC5740] in situations where a feedback link is available, or FLUTE [RFC6726] otherwise.

Note that both NORM and FLUTE are limited to block coding, none of them supporting sliding window encoding schemes [RFC8406].

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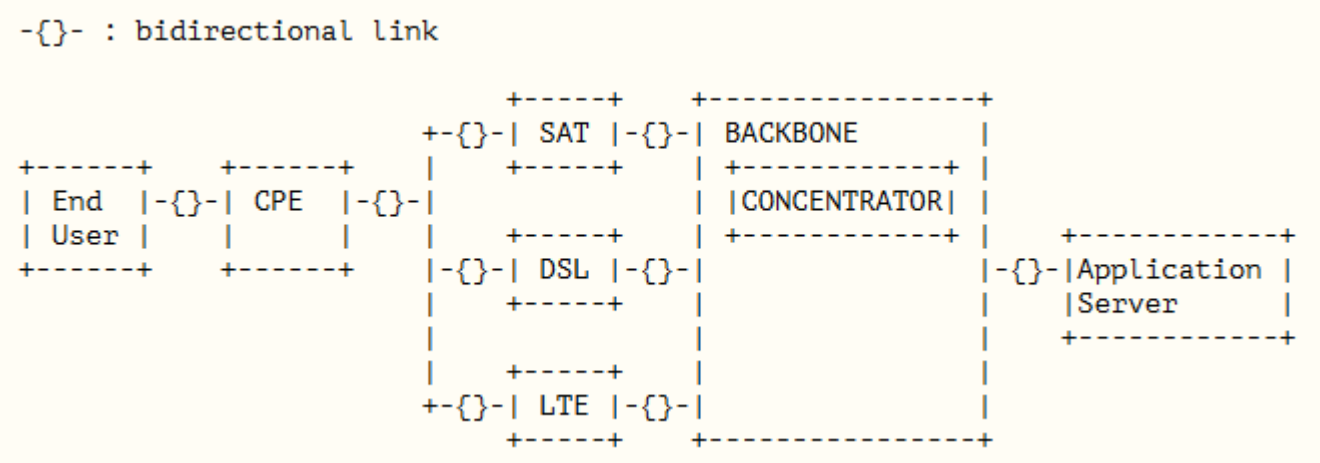
Use-case: Hybrid access



- To cope with packet loss (due to either end-user mobility or physical-layer impairments), coding techniques could be introduced both at the CPE and at the concentrator.
- Better tolerance to out-of-order packets which occur when exploited links exhibit high asymetry in terms of RTT.

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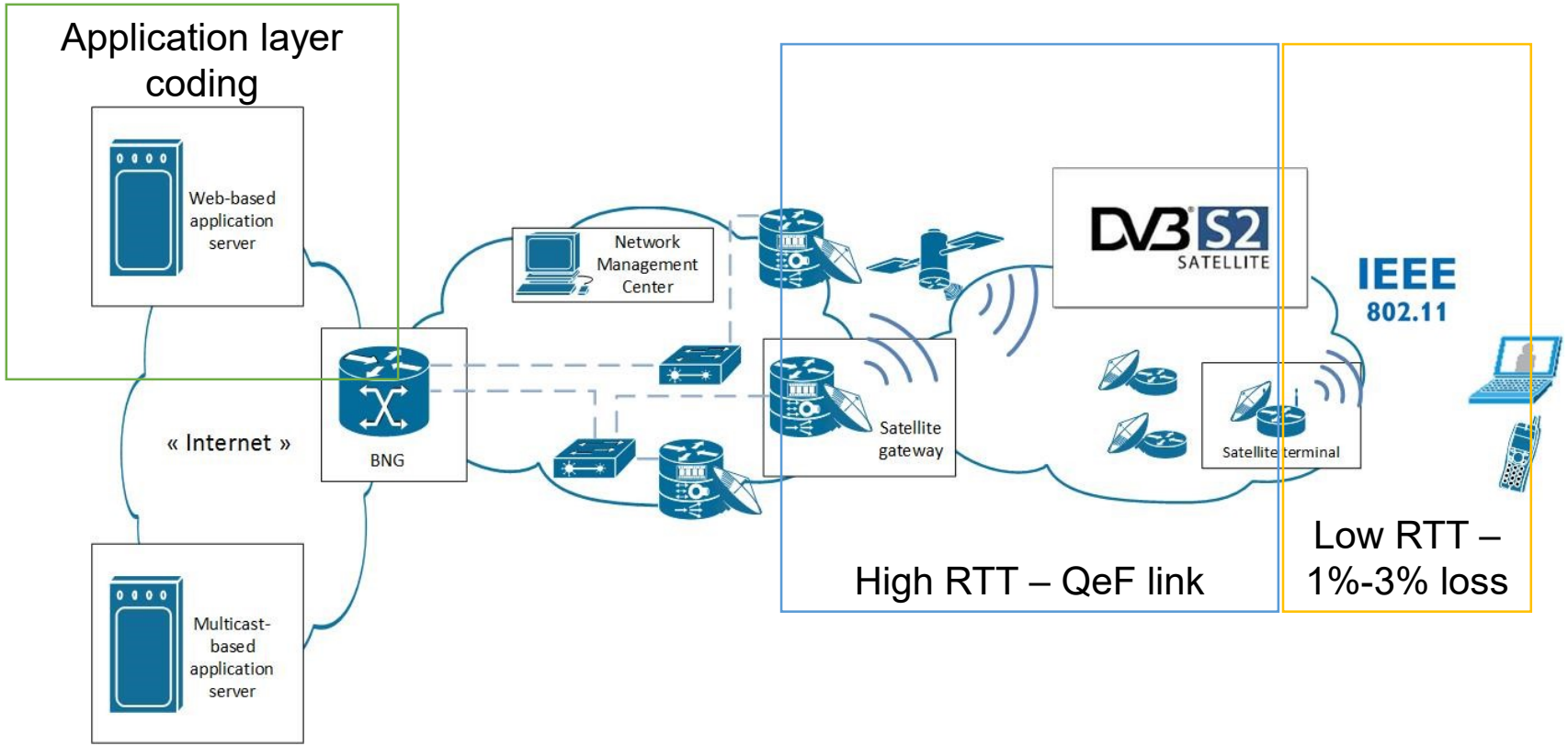
Use-case: Dealing with LAN losses



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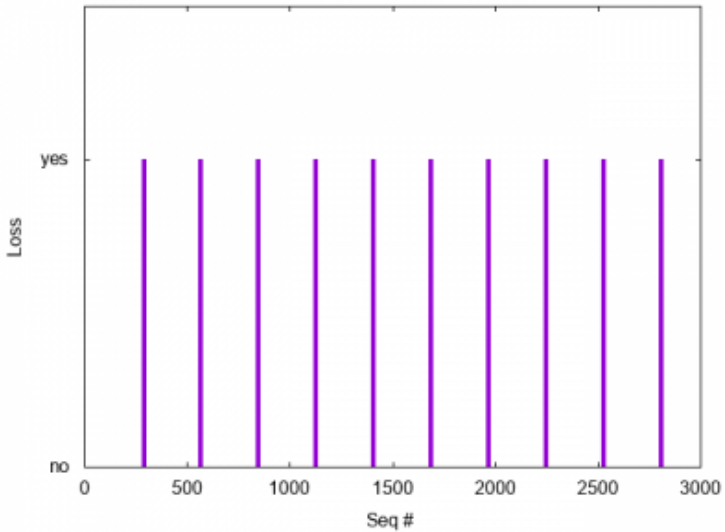
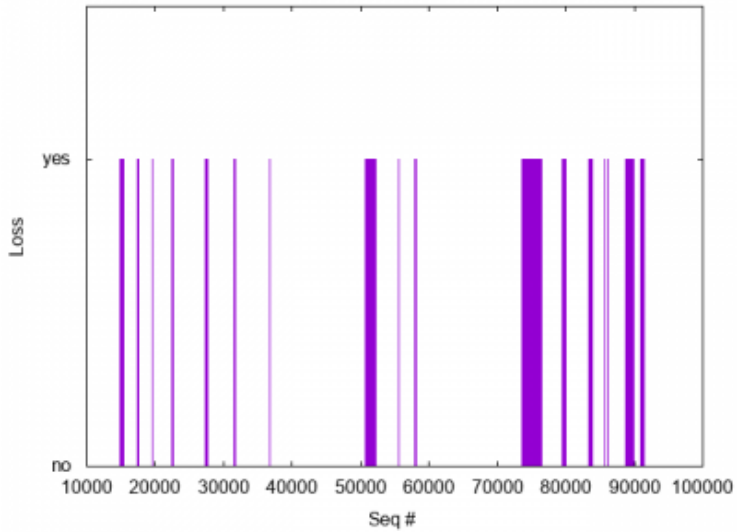
Use-case: Dealing with varying channel conditions

- 3-meters antenna put on a train
- VL-SNR headers (DVB-S2X)
- C/N = 0 dB (QPSK2/9)



- LMS channel
- VL-SNR headers (DVB-S2X)
- C/N = 15 dB (QPSK11/45)



These results have been obtained with CNES SMILE project. The traces format has been adapted by Bastien Tauran (TéSA / ISAE-SUPAERO) with CNES R&T funding

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Use-case: Dealing with varying channel conditions

- Optical links with fading events
- GEO-to-ground downlink scenario

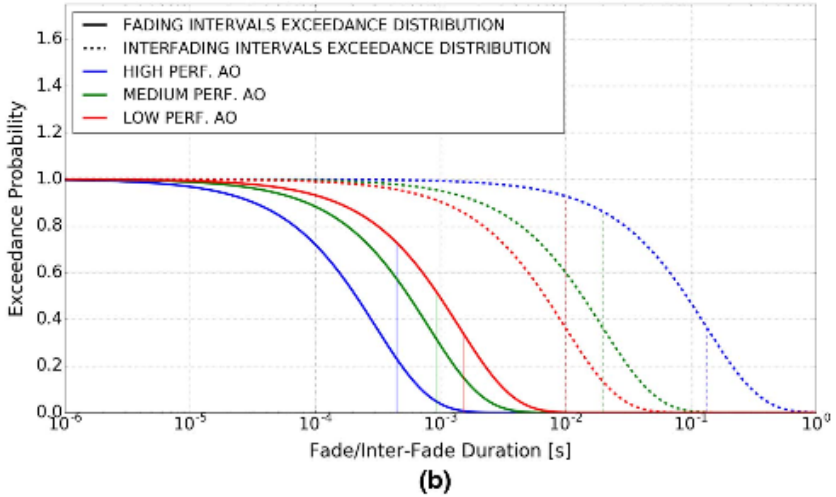

Fig. 12. Fade duration (plain lines) and interfade duration (dashed lines) analytic exceedance distributions for each AO performance level

➢ There are cases where physical layer robustness is limited

Canuet, Lucien and Vedrenne, Nicolas and Conan, Jean-Marc and Petit, Cyril and Artaud, Géraldine and Rissons, Angélique and Lacan, Jérôme Statistical properties of single-mode fiber coupling of satellite-to-ground laser links partially corrected by adaptive optics. (2018) Journal of the Optical Society of America A, 1 (35). 148-162. ISSN1084-7529

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Use-case: Dealing with varying channel conditions

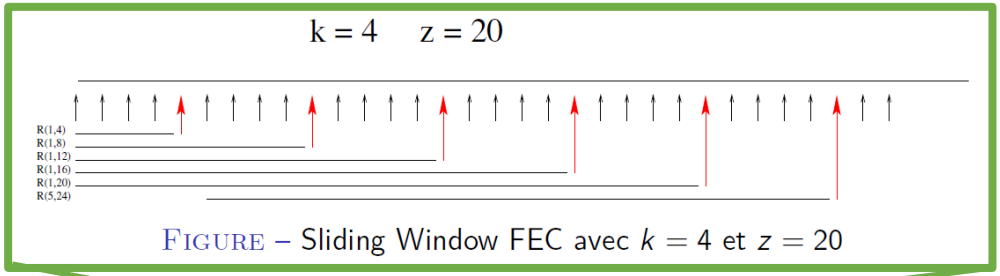
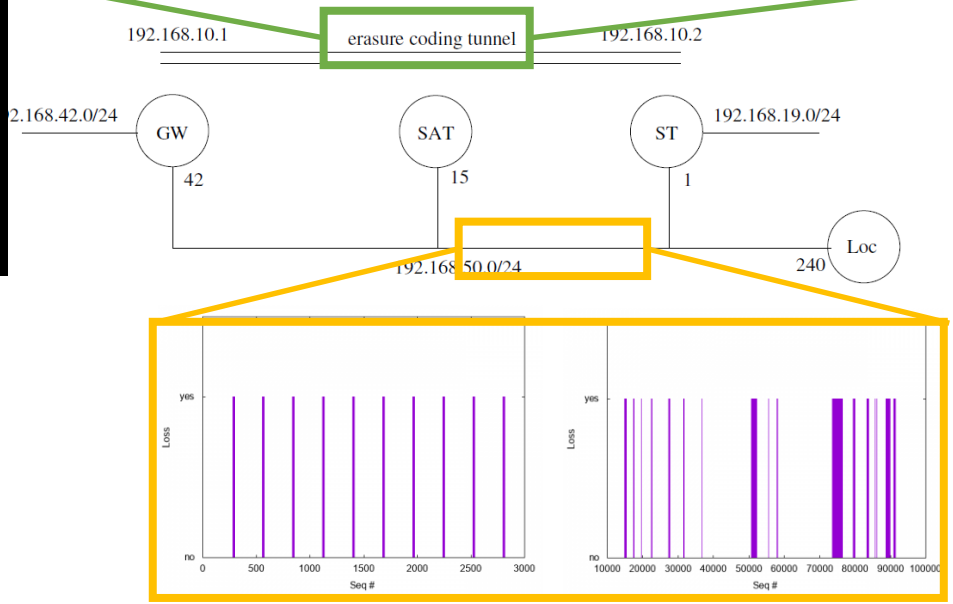


FIGURE – Sliding Window FEC avec $k = 4$ et $z = 20$



Thanks to Bastien TAURAN, Jérôme LACAN, Emmanuel LOCHIN (TéSA / ISAE-SUPAERO) and Benjamin ROS (project funded by CNES)

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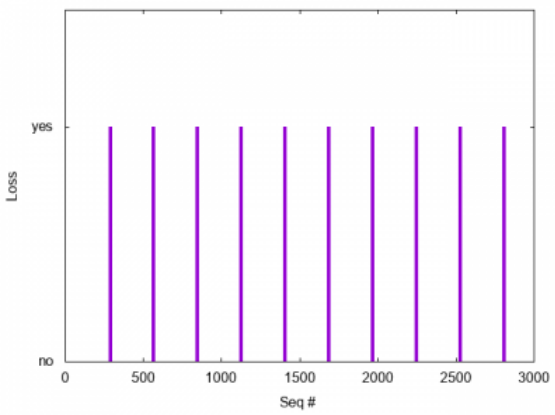
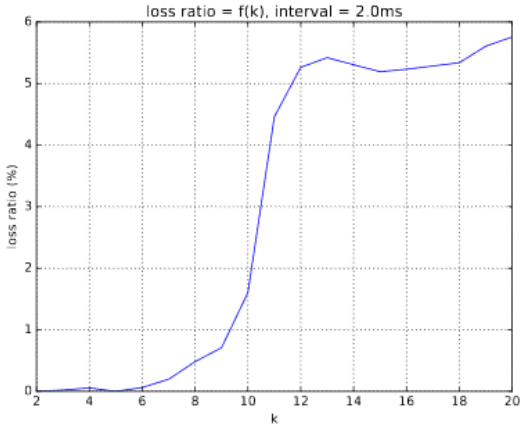
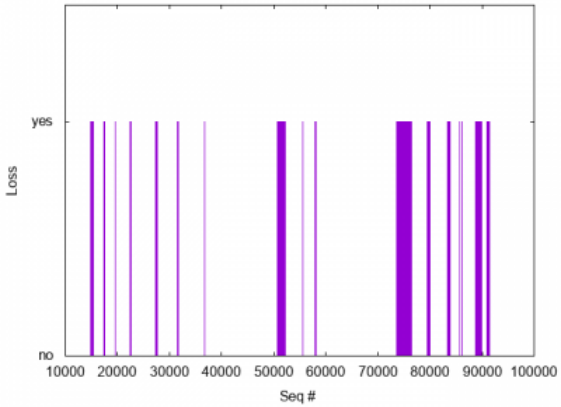
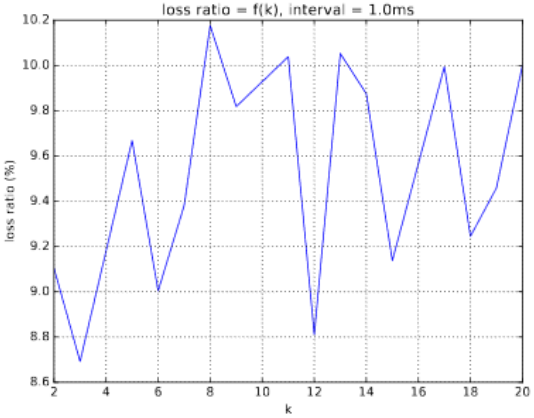
Use-case: Dealing with varying channel conditions









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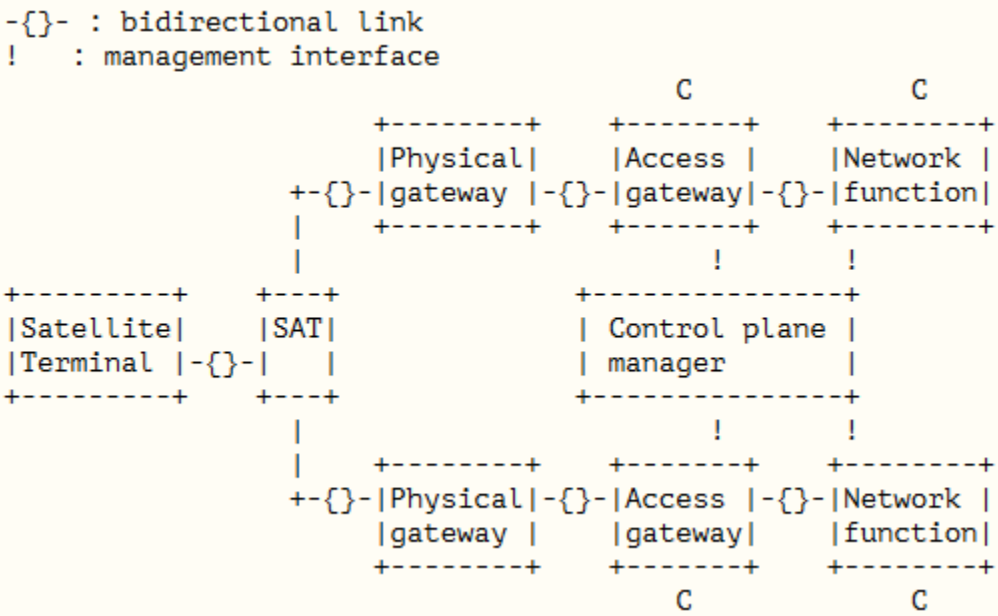
Use-case: Improving the gateway handovers



Research challenge : coding and congestion control

- **Coding and congestion control**
  - PEP : could host coding techniques
  - This leads to research question on the interaction between coding schemes and TCP congestion controls
    - E.g. impact of reordering level on the interest of using RACK
- **Efficient usage of resource**
  - How much overhead from redundant reliability packets can be introduced to guarantee a better end-user QoE while optimizing capacity usage ?
- **Virtualization**
  - optimization of the NFV service function chaining considering a virtualized infrastructure and other SATCOM specific functions
  - guarantee an efficient radio usage and easy-to-deploy SATCOM services
- **DTN**
  - Integration in the IETF DTN stack?

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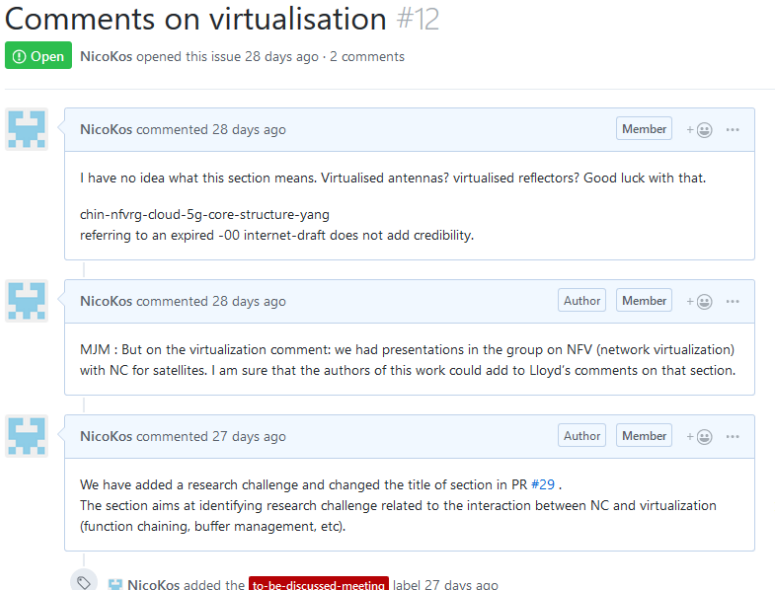
Open issues

- **Comments on virtualisation**
- **Research challenge**
  - optimization of the NFV service function chaining considering a virtualized infrastructure and other SATCOM specific functions
  - guarantee an efficient radio usage and
  - easy-to-deploy SATCOM services.
  - virtualized SATCOM terminals: management of limited buffered equipment ?

➢ **Proposition to close the issue**



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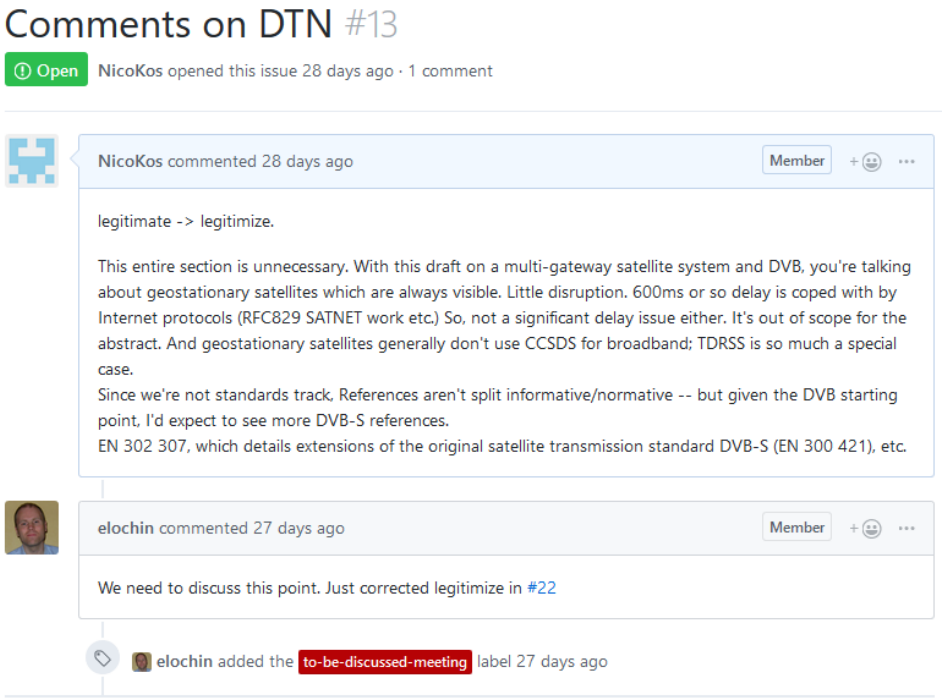
Open issues

- **Comments on DTN**
- **Answer**
  - The document uses DVB as a example on how to present SATCOM systems
  - No specific focus on GEO

➢ **Proposition to close the issue**



Comments on DTN #13

Open NicoKos opened this issue 28 days ago · 1 comment

NicoKos commented 28 days ago — Member

legitimate -> legitimize.

This entire section is unnecessary. With this draft on a multi-gateway satellite system and DVB, you're talking about geostationary satellites which are always visible. Little disruption. 600ms or so delay is coped with by Internet protocols (RFC829 SATNET work etc.) So, not a significant delay issue either. It's out of scope for the abstract. And geostationary satellites generally don't use CCSDS for broadband; TDRSS is so much a special case.
Since we're not standards track, References aren't split informative/normative -- but given the DVB starting point, I'd expect to see more DVB-S references.
EN 302 307, which details extensions of the original satellite transmission standard DVB-S (EN 300 421), etc.

elochin commented 27 days ago — Member

We need to discuss this point. Just corrected legitimize in #22

elochin added the to-be-discussed-meeting label 27 days ago

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From *-05 to *-06

- Next steps: WGLC?

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