

Some satellite related aspects and topics

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Background

- Eurescom was the prime contractor of ESA ARTES 1 study Service delivery over Integrated Terrestrial and Satellite Networks
 - Integration of satellite networks with terrestrial networks for future services delivery
 - Admittedly, for historical reasons satellite is not really integrated with terrestrial networks
 - 5G was identified as a unique opportunity for such an integration as 5G by definition should encompass all transmission technologies
- Eurescom currently leads the ESA ARTES 1 study INSTINCT – Scenarios for integration of satellite components in future networks (essentially addressing the cloud networking paradigm including satellite components)

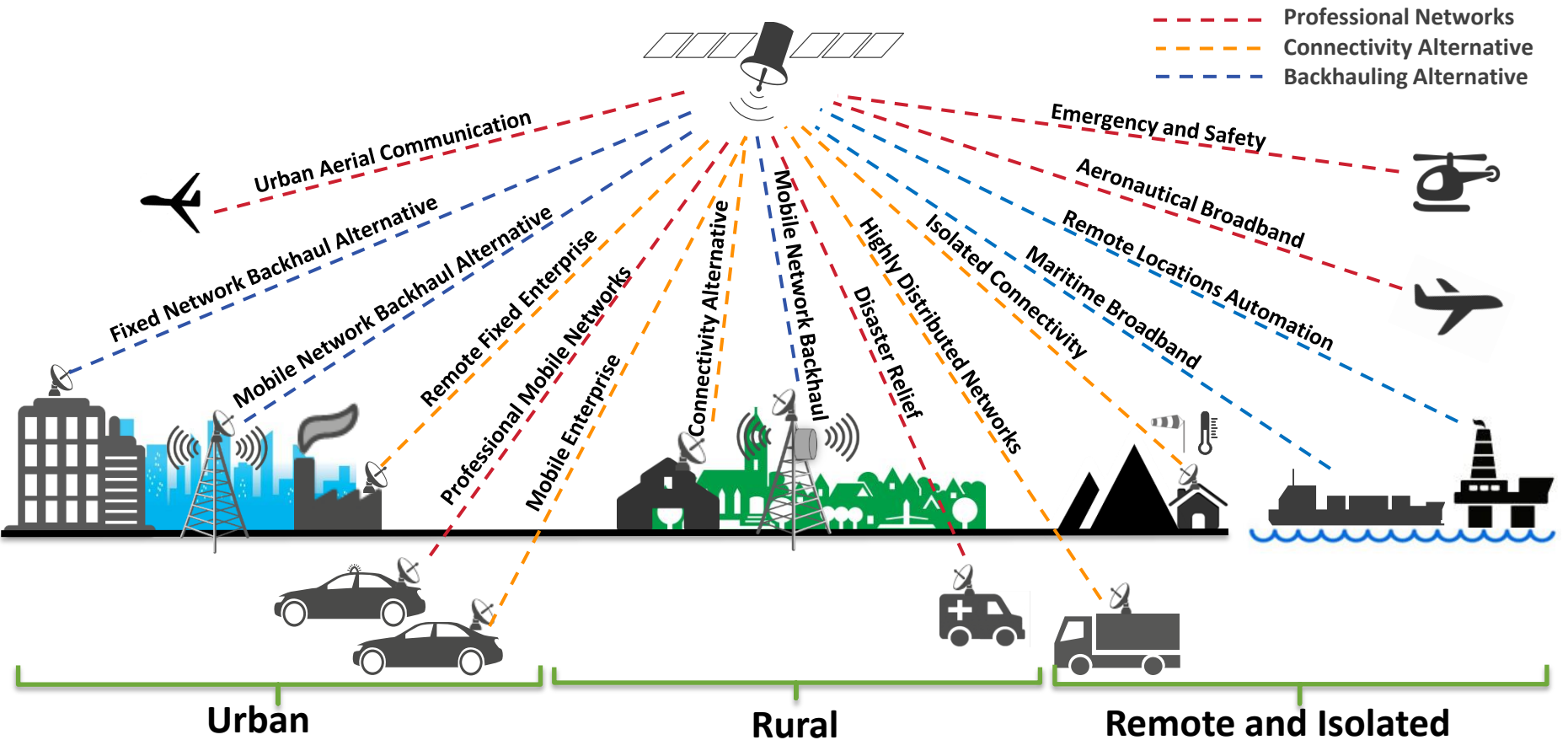
Eurescom's ambition

- Considering the still persisting gap between the two communities, satellite and terrestrial, Eurescom sees a role for itself to support a dialogue between the two communities eventually leading to the proper integration of satellite networks with terrestrial ones

The 5G, IoT and satellite triangle

- 5G and satellite
 - 5G was identified as a unique opportunity for integration of satellite with terrestrial as 5G by definition should encompass all transmission technologies
- 5G and IoT
 - IoT is identified as a major application area in 5G, representing a completely different set of requirements than the other major application area, content delivery
- Satellite in 5G and IoT
 - Satellite can bring unique benefits to 5G and nicely complement terrestrial solutions (broadcast, large coverage area, very high sharing of the backhaul environment)
 - Satellite can also contribute to the support of IoT applications in 5G (e.g. maintenance of edge nodes)

Role of satellite



Potential topics of interest

- There is a definite need for trialling and demonstrating key 5G technologies incorporating satellite components and using IoT as one of the main application area – the other being content delivery
- Satellite can bring/offer mature technology and solutions, (e.g. regarding modems, etc.) that may fit in terrestrial concepts and nicely complement them – connectivity for very high speed mobile nodes (high speed trains, etc.)
- The satellite ground segment is currently being re-thought and undergoing the same transformations dictated by software defined networking just as any terrestrial network components
- Early attempts are on their way to make space segment technologies and payloads ready to accept virtual machines, offering entirely new opportunities, including separation, redundancy, testing in lab on the ground and shipping to space new functions
- IP enabled video distribution via satellite is another interesting segment and likely candidate for convergence with terrestrial in the process of CDN evolution

Examples of advanced modem prototypes

- M2M/IoT satellite connectivity
 - Flexible M2M baseband modem prototype for M2M terminal exploiting full capabilities of random access technique – Enhanced Spread Spectrum Aloha (E-SSA) (available via loan-agreement).
<https://artes.esa.int/projects/frequency-flexible-m2m-terminal-modem-development> (prime Space Engineering (IT))
 - Full pre-commercial gateway station available from MBI (IT)
- Video High Data Rate Modem (DVB-S2x)
 - Up to 400 Mbaud Symbol Rate; IP/GSE & MPEG-TS support; High dynamic range (-10dB to 20dB Es/No) (available via loan-agreement)
<https://artes.esa.int/projects/wide-band-direct-home-widiho-itt6613> (prime Fraunhofer-IIS)

Examples of on going R&D

- M2M/IoT: Evolution of MAC protocols i.e. Asynchronous Contention Resolution Diversity Slotted Aloha (ACRDSA), Multi-slots Coded Slotted Aloha –MuSCA, Hybrid schemes –perform comparison with METIS proposal
- High Data Rate Modems for point-to-point and point-to-multipoint (Aeronautical, Maritime & Inter-satellite links (RF up to optical))
- M2M/IoT networks and Optical Communications:
 - Data-centric ground segment supporting intelligent cache-management and multicast based on natively delay tolerant networking concepts
- Next Generation Constellations (combination of GEO, MEO and/or LEO satellites) and optimization of onboard routing in space mesh networks

Funding opportunity

- **Partners from labelled** Celtic projects can apply for funding in the frame of the ESA ARTES 3-4 and 5 programme **regarding satellite related subjects and extensions / added elements** using a **support letter** from their ESA national delegate.
- Further information on ARTES 345 programme:
 - Ms Maria Guta, ESA, Maria.Guta@esa.int