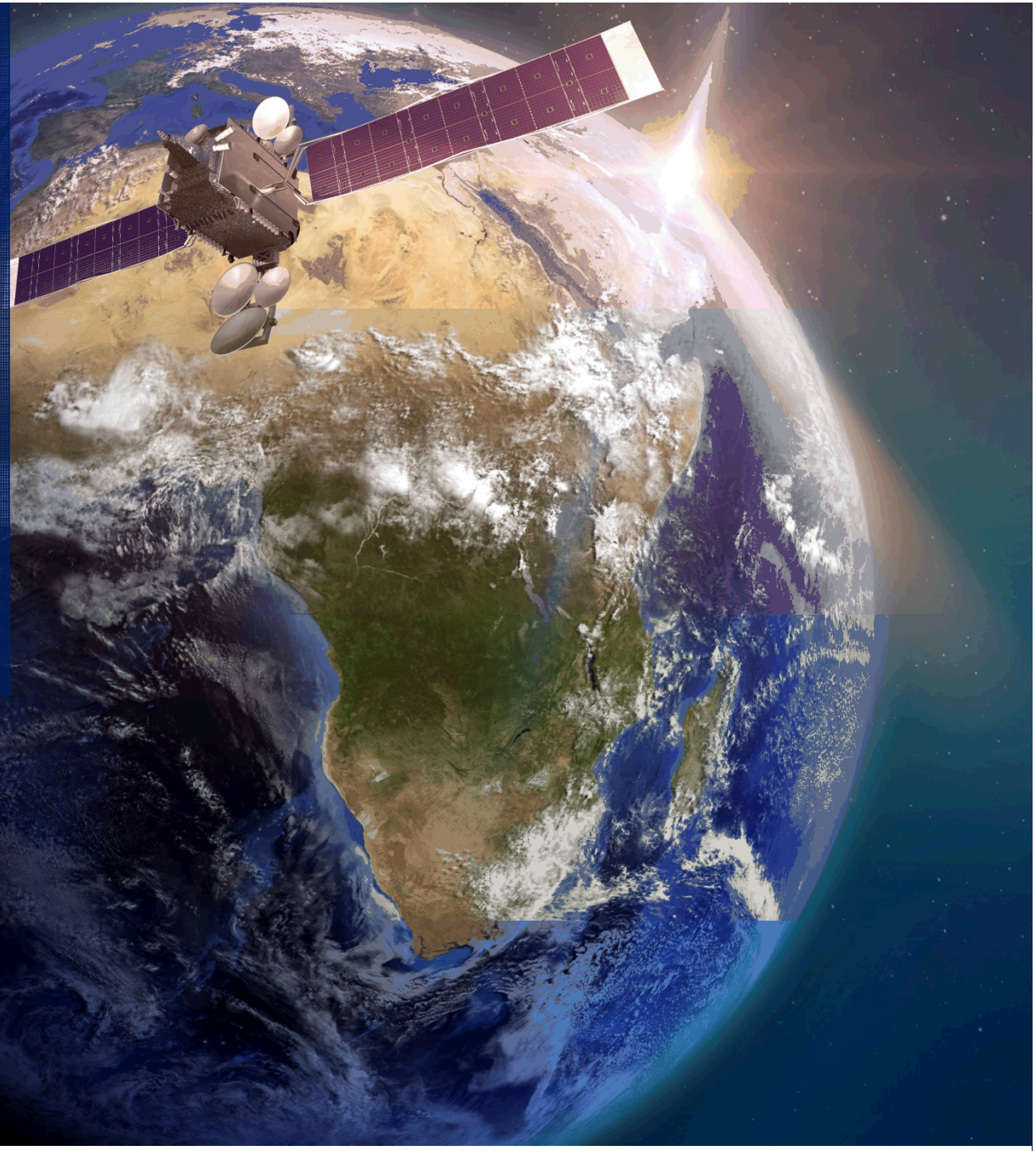
Satellites and 5G

Architectural experience

Avanti
Simon Watts



Avanti connects people wherever they are - in their homes, businesses, in government and on mobiles.

Through the HYLAS satellite fleet and more than 150 partners in 118 countries, the network provides ubiquitous internet service to 27 per cent of the world's population. Avanti delivers the level of quality and flexibility that the most demanding telecoms customers in the world seek.

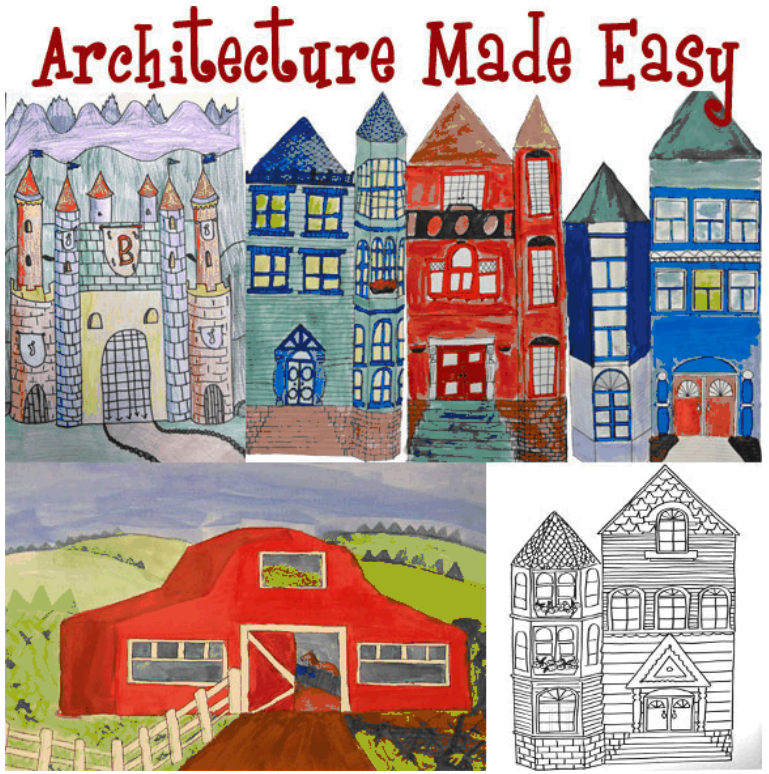
Avanti is the first mover in high throughput satellite data communications in EMEA. It has rights to orbital slots and Ka-band spectrum that cover an end market of over 1.5bn people. The Group has invested $1.2bn in a network that incorporates satellites, ground stations, datacentres and a fibre ring. Avanti has a unique Cloud based flexible customer interface that is protected by patented technology.

The Group has three satellites in orbit and a further two fully funded satellites under construction.
Avanti Communications is listed in London on AIM (AVN)

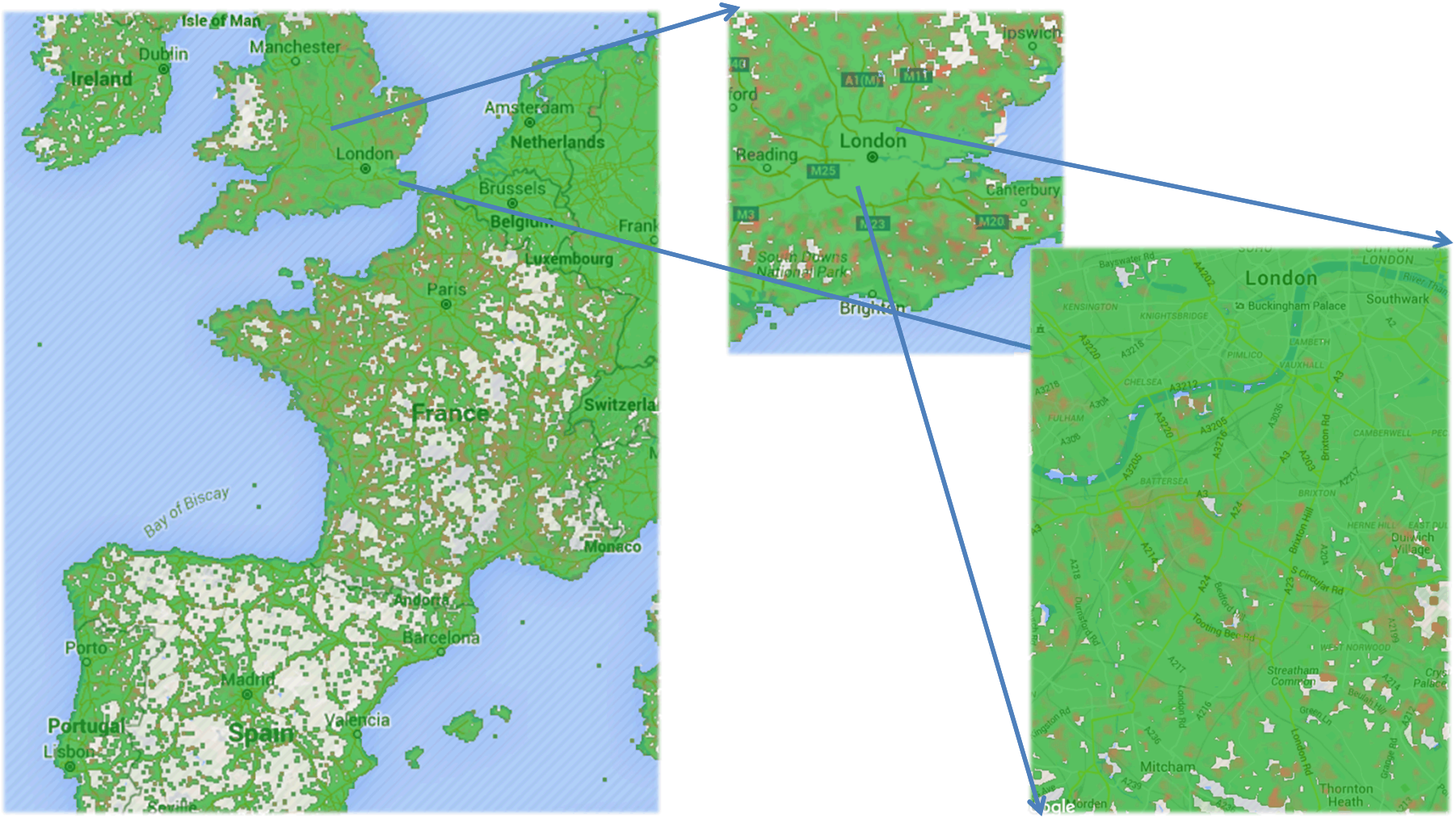
Avanti's Applied Technology team (and its predecessor Avanti Consulting) involved in many R&D plus incubator projects to extend applications and service products

Introduction

- Avanti has a number of projects with useful architectural lessons
- 3G and 4G today
  - Base station backhaul services
  - Product and innovation work
- Further lessons from
  - BATS (EC FP7)
  - SANSA (EC H2020)
  - RIFE (EC H2020)
- Where satellite communications fits the emerging 5G architecture

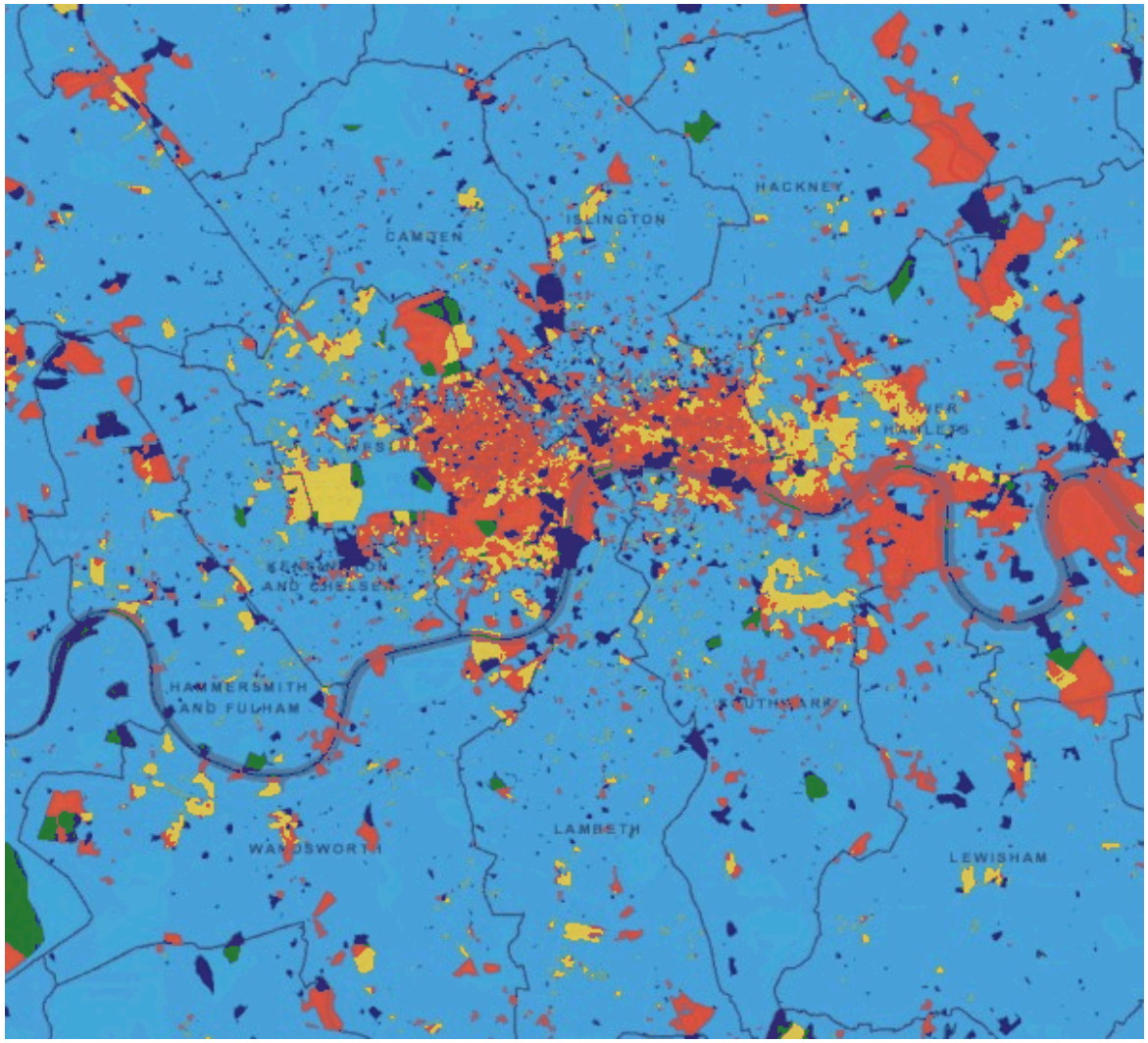


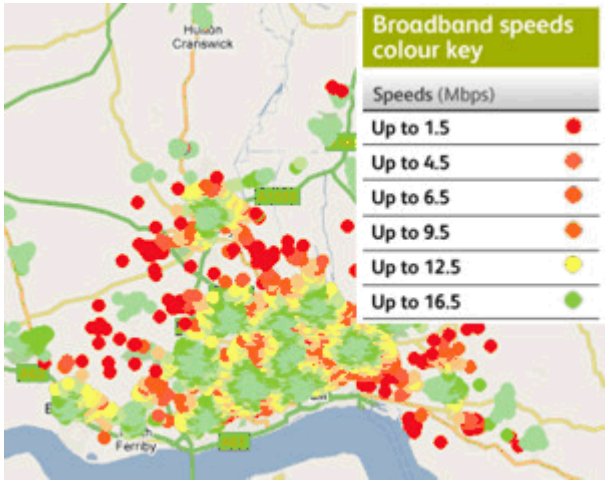
4G coverage today – gaps even within areas of good coverage



www.opensignal.com

These same kind of gaps appear in broadband speeds when you zoom in





http://www.ispreview.co.uk/story/2010/03/01/kc-calls-for-greater-uk-broadband-isp-speed-transparency.html

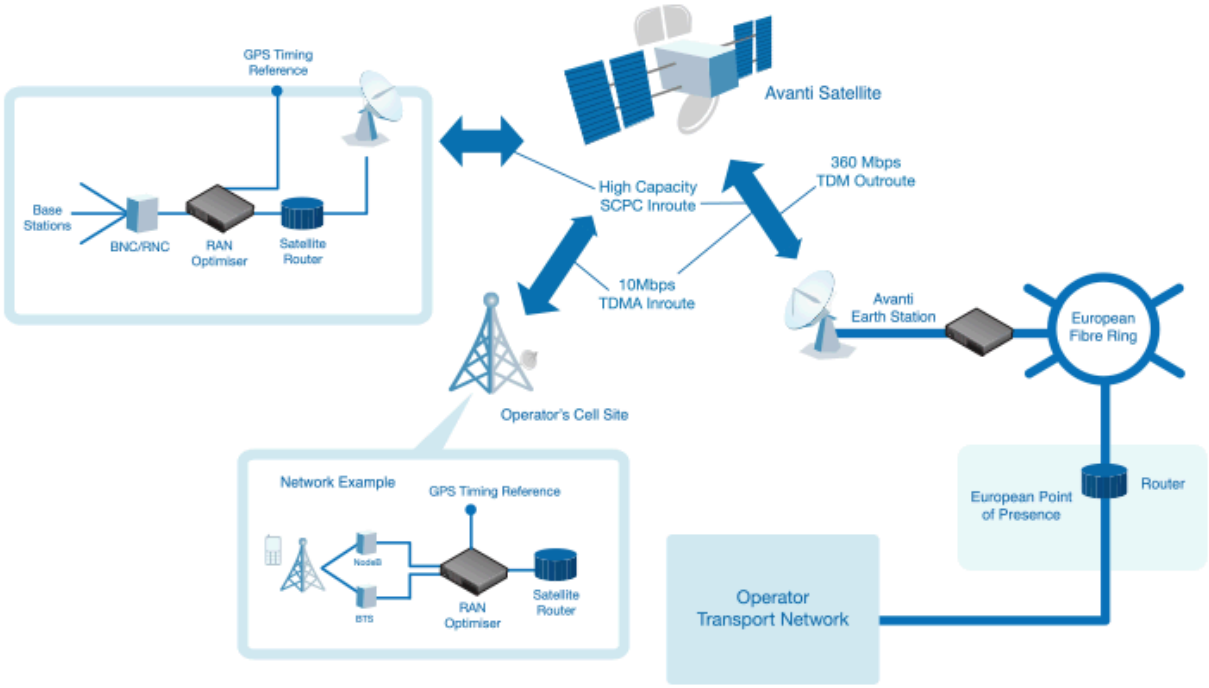
http://glaconservatives.co.uk/news/over-340k-inner-londoners-without-high-speed-internet/

Then again

Avanti's IP Satellite Backhaul

Extending Mobile Data Connectivity

- Service designed to provide primary connectivity as well as overspill for traffic during peak times
  - Designed by Avanti and operator
  - To 3G base stations in Europe
  - Small terrestrial backhaul circuits



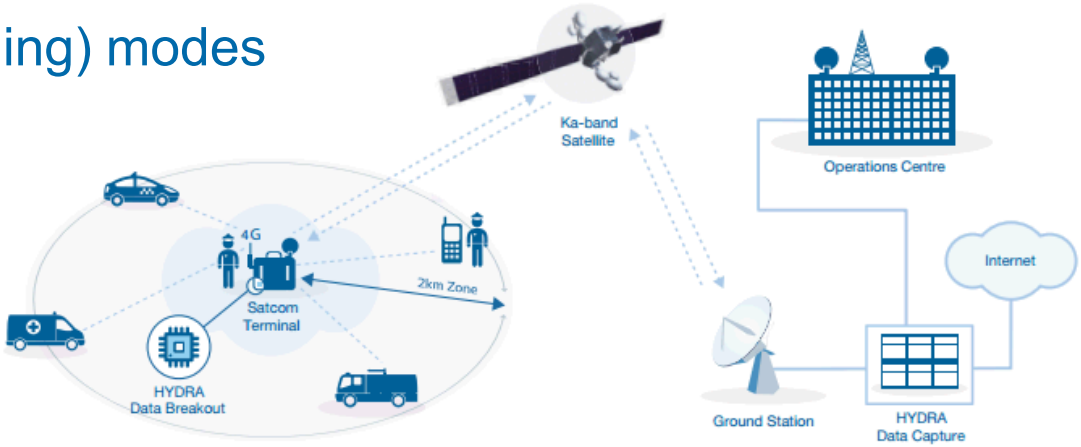
Vendor specific

http://www.avantiplc.com/mno/
http://www.avantiplc.com/mno/images/avanti-mno-case-study.pdf

Hydra

- HYDRA provides a private high speed 4G overlay network anywhere in the UK
  - Backward compatibility with 2G and 3G devices
  - As a completely transportable network, it can be rapidly deployed wherever an incident takes place
- The solution provides a complete small cell network that can operate in
  - Standalone (private) or
  - Interconnected (roaming) modes
- Hylas service delivers end-users up to 60Mbps download and 20Mbps upload

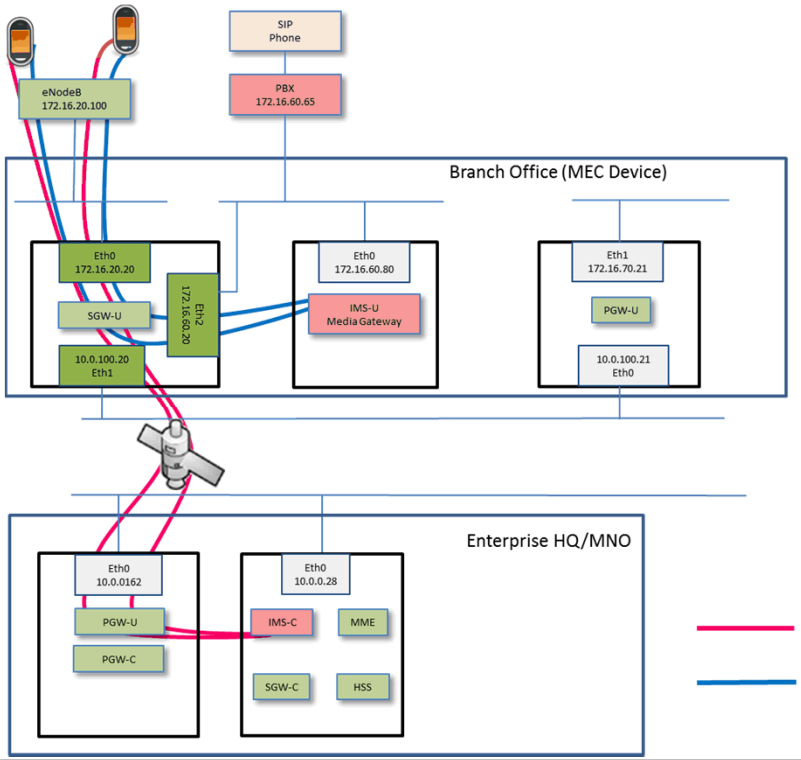
Vendor specific

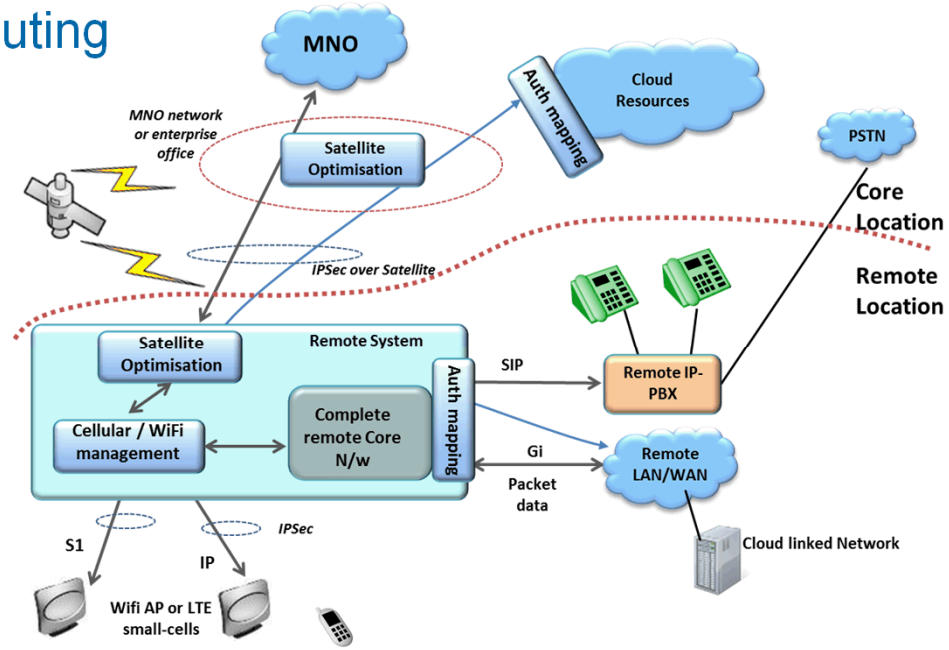


http://www.avantiplc.com/mno/images/hydra-case-study-web.pdf

VOLANS

- Developing solutions for 4G backhaul
- Specific optimisation and routing
  - Local voice breakout
  - Function, user and control plane separation

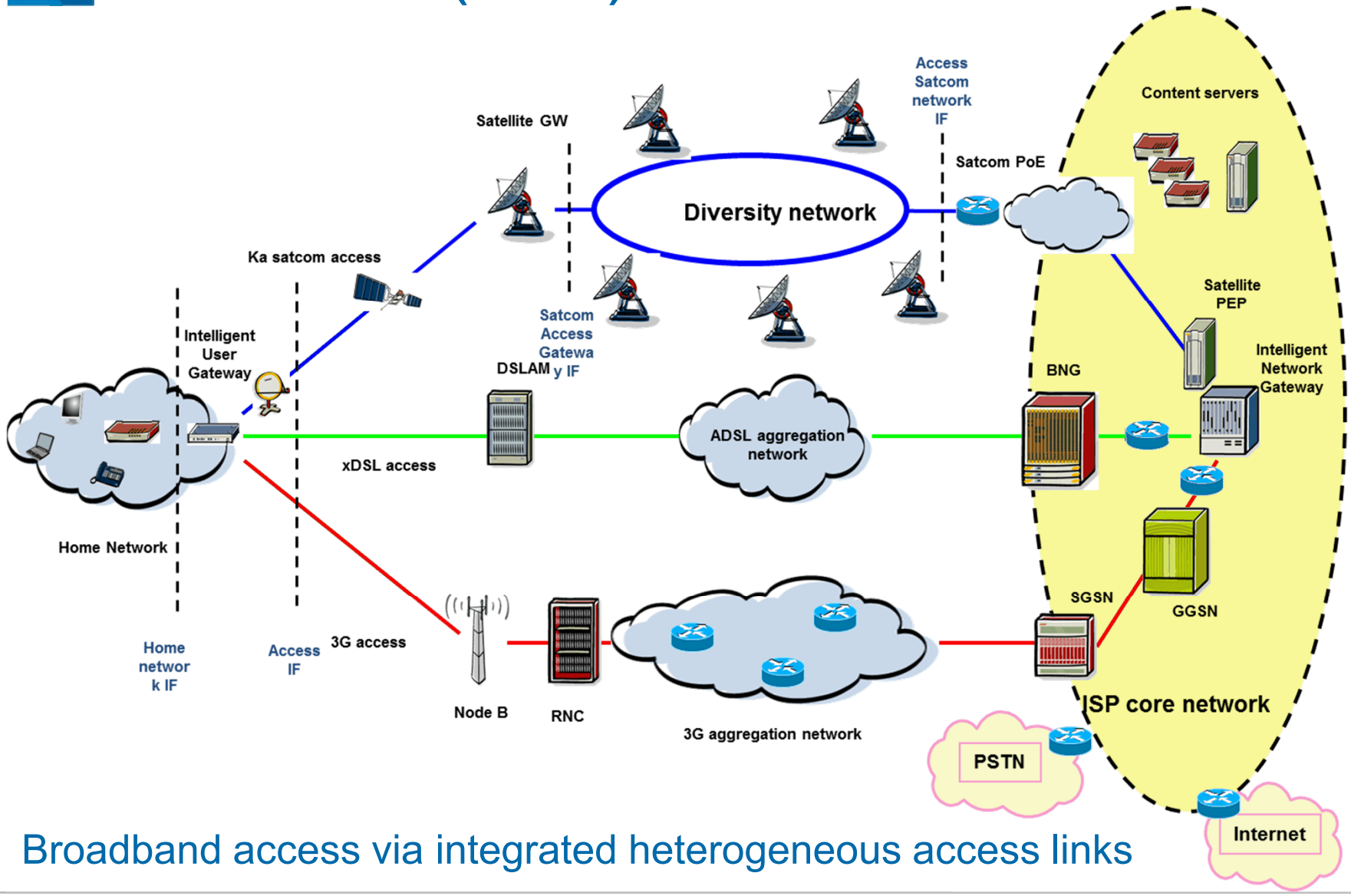




Vendor specific

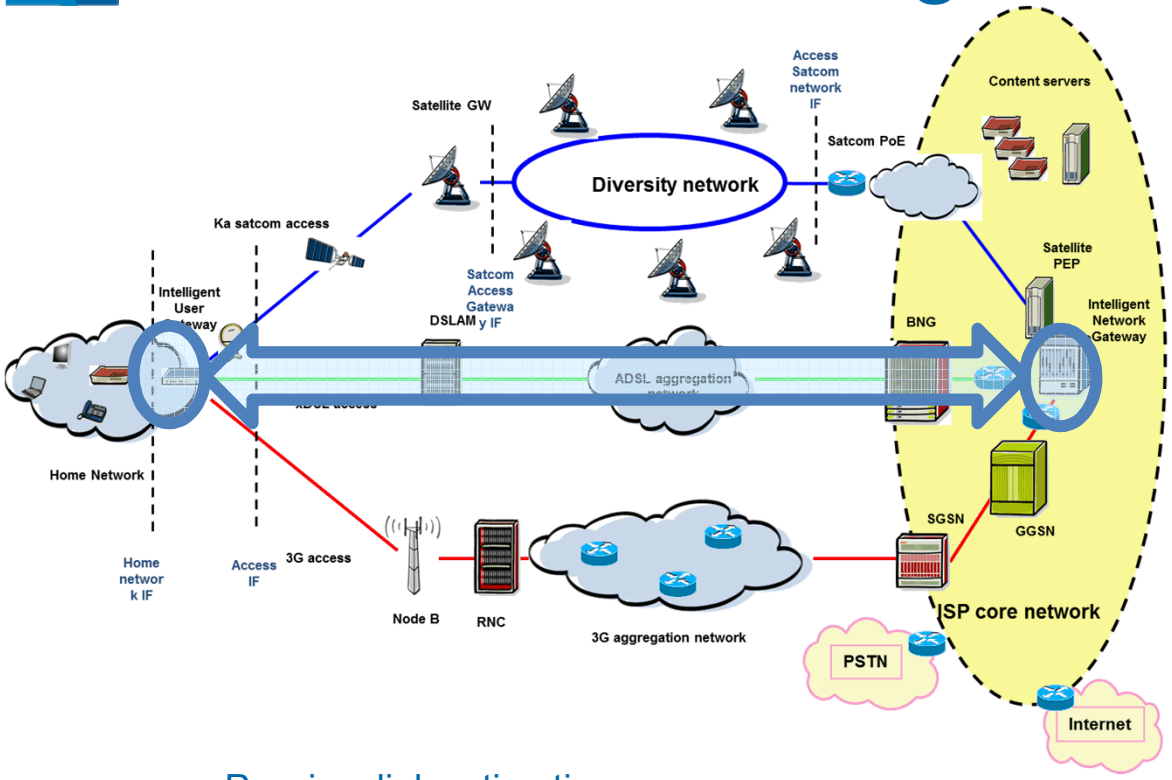
http://gtr.rcuk.ac.uk/projects?ref=102049

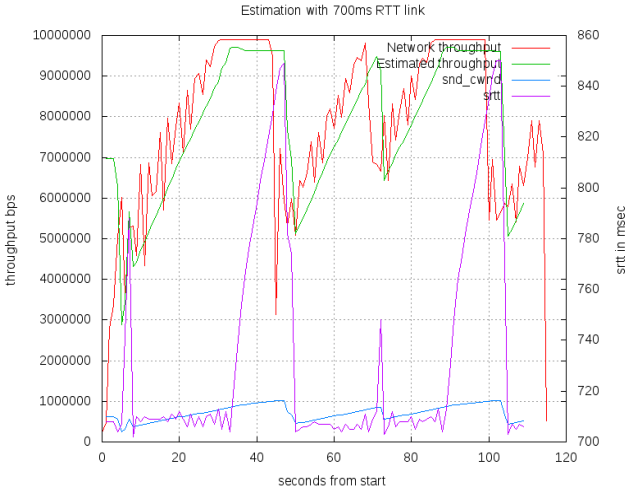
BATS (FP7) architecture

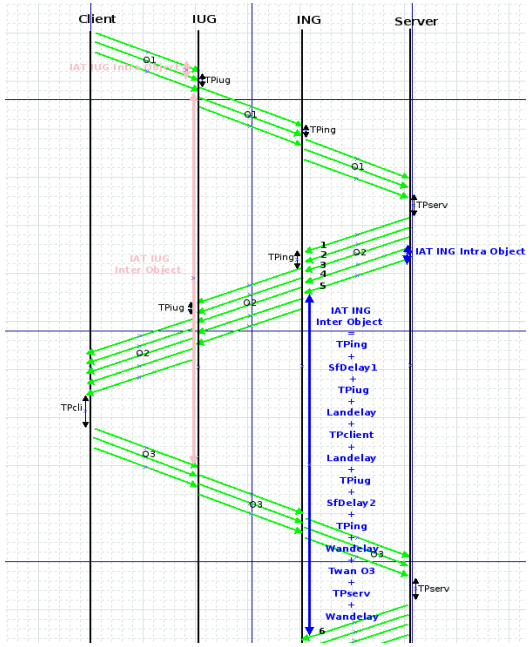


Broadband access via integrated heterogeneous access links

BATS and intelligent routing



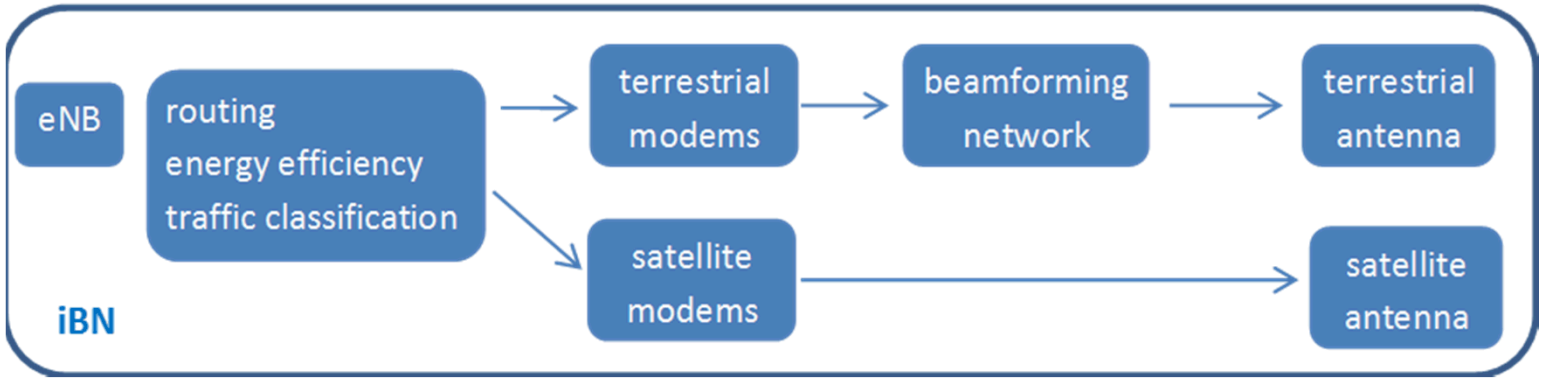




- Passive link estimation
  - Using TCP data to estimate path characteristics
- Intelligent routing based on object length and inter-arrival time (including encrypted objects)
- TCP initial window allows good throughput for small and large objects over high latency links without PEP
- Factsheets on the website www.batsproject.eu
- Significant standards activities

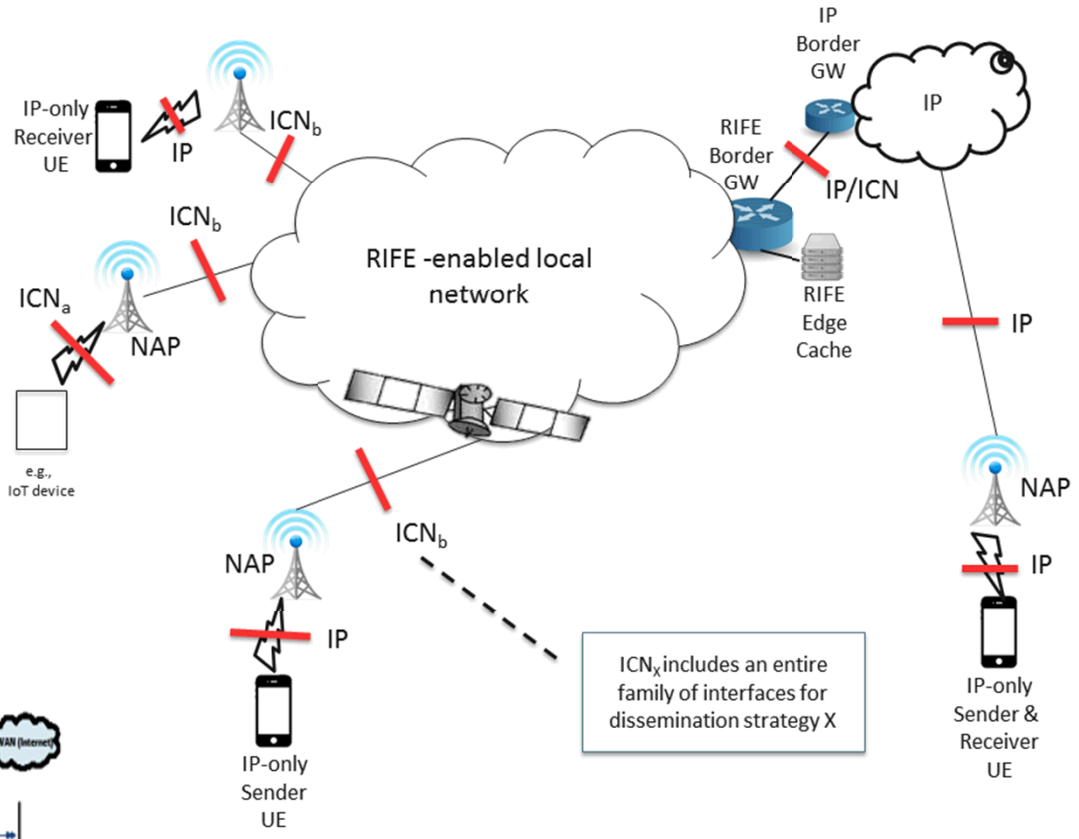
SANSA (H2020)

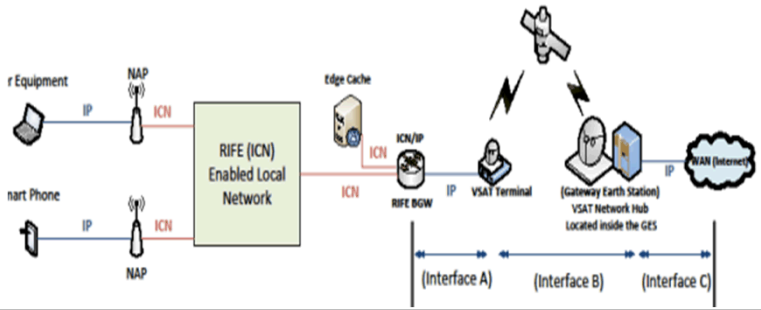
- Presented in more detail earlier today…
- In summary developing heterogeneous backhauling to eNB including satellite links
- Inputs to ETSI have started



RIFE (H2020)

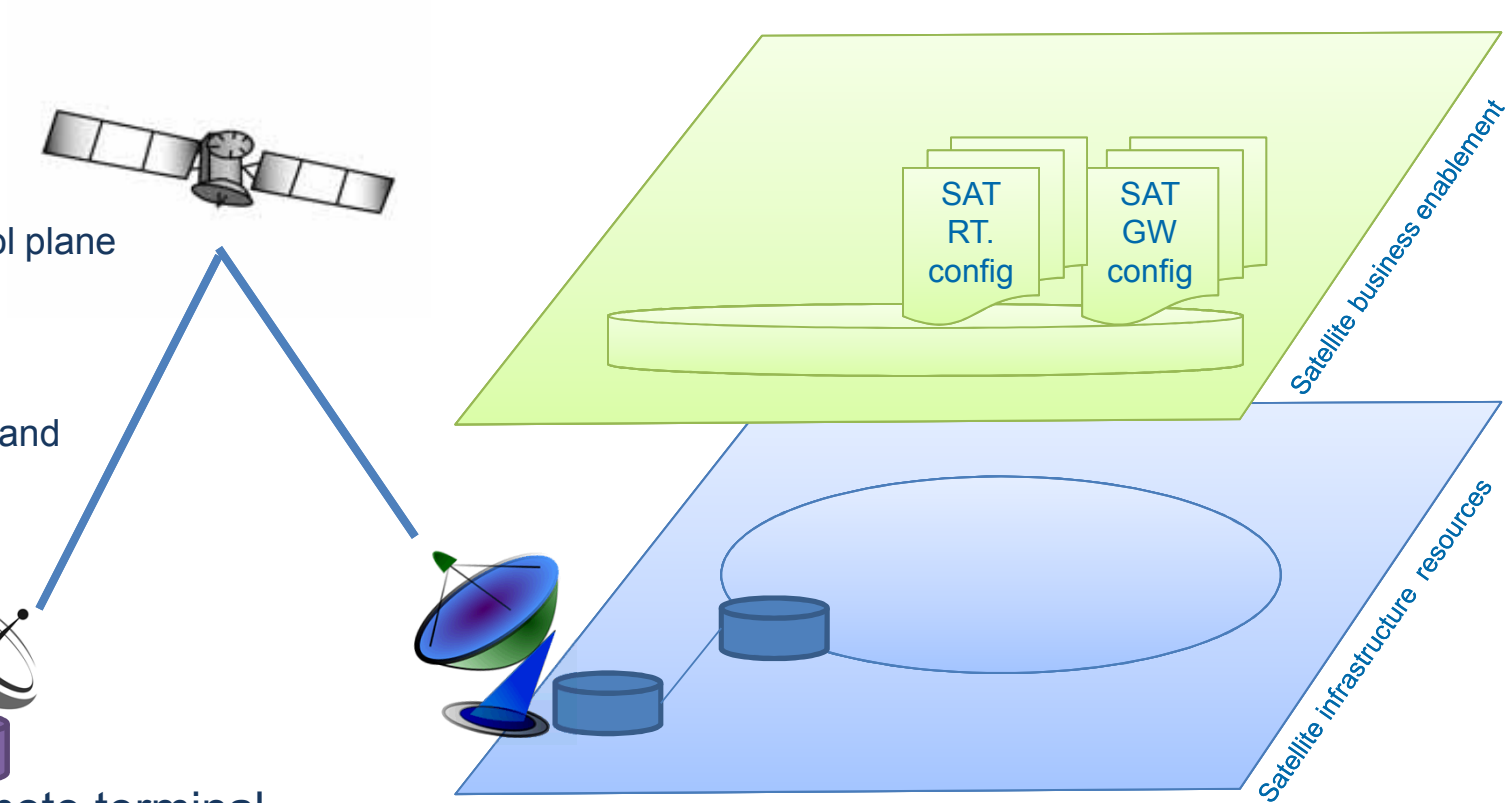
- Addresses the major societal challenge of providing affordable Internet access by
  - Harnessing unused transmission capacity
  - Placing content caches and service functionality closer to the user
  - Information-centric and delay-tolerant networking by developing optimized dissemination strategies
- Will input to the standards bodies





Adding satellite to the 5G architecture

Primarily at the infrastructure resources level



Backhaul role

User and/or control plane to RAT

Fronthaul role

Cache population and multicast streams

Satellite remote terminal at RAT (rural or moving)

(baseband could be virtualised)
(optional cache could be virtualised)

Satellite gateway

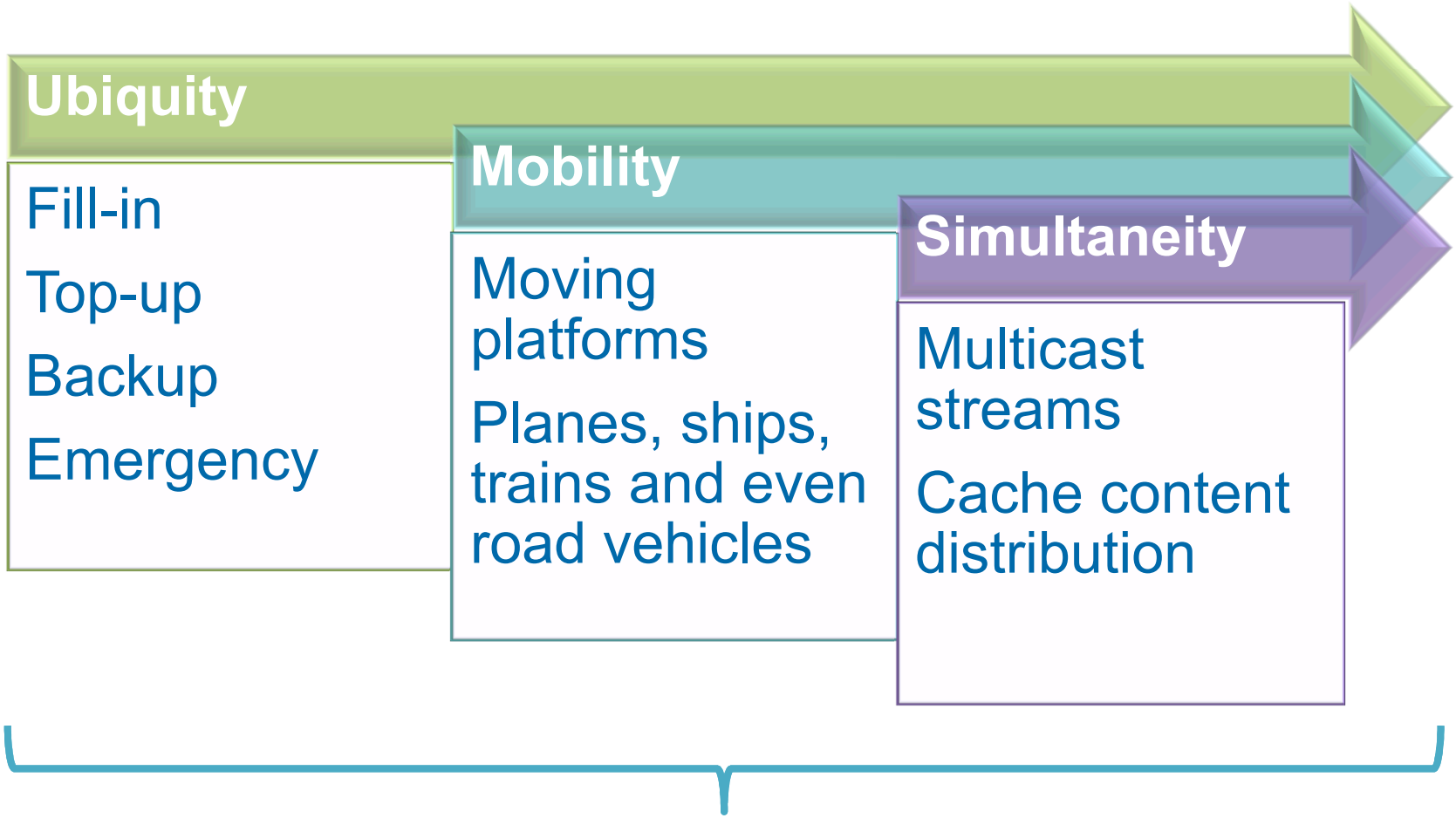
(Baseband and signal processing virtualised)

Satellite trade-offs

- LEO (Low earth orbit)
  - Low latency (~60ms)
  - Many satellites providing global coverage
  - Tracking remote terminal antennas needed
  - Capacity per constellation over Europe ~100Gbps

- GSO (Geostationary orbit)
  - Higher latency (~600ms)
  - One satellite is fine (coverage from few countries to continental)
  - Simple low cost remote terminal antennas
  - Capacity per satellite ~1Tbps by 2020 (can offer tens of Tbps over Europe)

Satellite strengths supporting 5G



Thank you for your time

Global demand for data will rise indefinitely, with 33% growth over the next five years.

Avanti's satellites are critical in supporting the future of 'big data'.

We do the heavy lifting making sure that no telecom has gaps in its network and no home, business, government or base station goes unserved.

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