

SABER deliverable 4.5

Future broadband technologies

June 2014, Workshop #7 - Norway



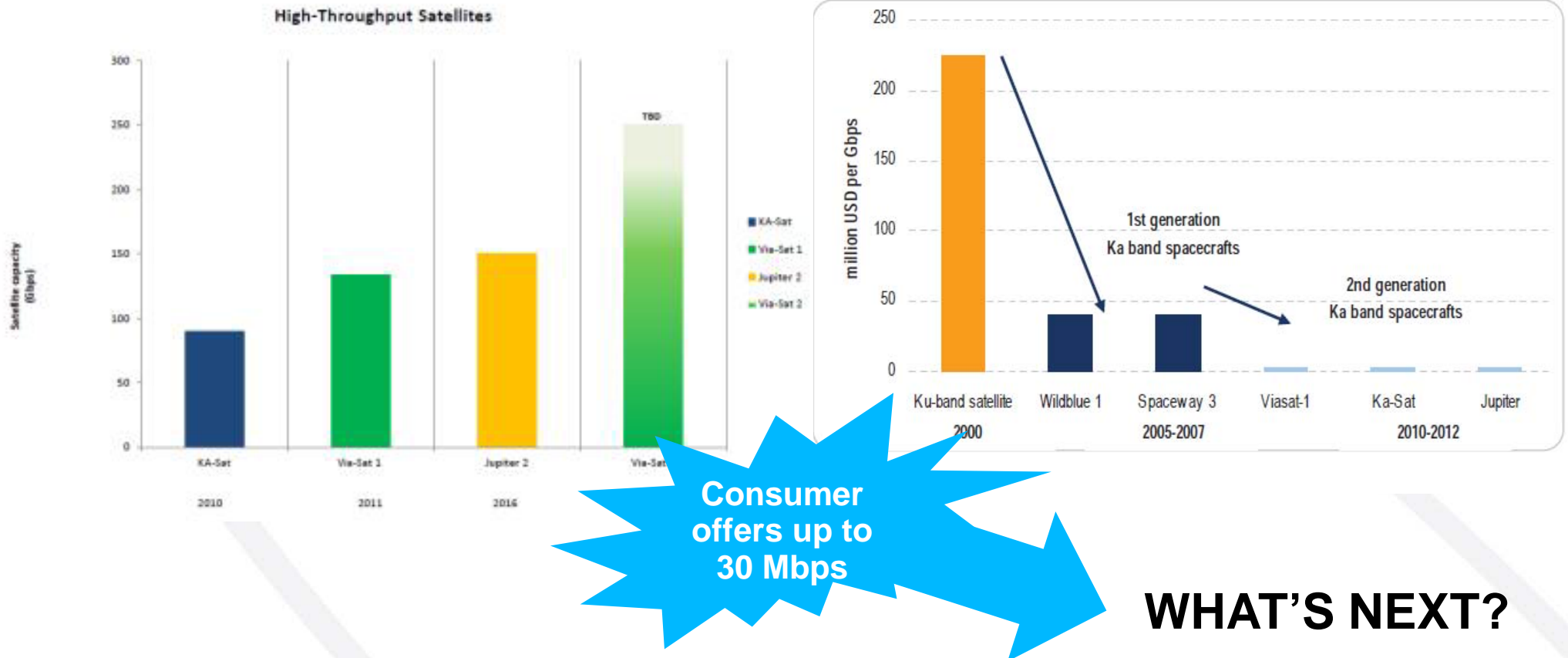
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Content

- 1. Setting the scene**
- 2. Innovative and/or integrated operational approaches**
- 3. Increasing on-board payload performance and throughput**
- 4. Acting at overall mission level**
- 5. Disruptive system architectures**
- 6. Technology and System design roadmap: what H2020 can do to help!**

Setting the scene



- **Quest for bandwidth while reducing Mbps-in-orbit cost:**
 - X 2 to 3 number of spot beams
 - Feeder links in higher frequencies
 - Flexible payloads
 - Ground infrastructure enhancement
- **More cost-efficient overall launched satellite**
- **Disruptive concepts (balloons...)**
- **Hybrid networks and broadcast/broadband convergence**

2- Innovative and/or integrated operational approaches

1. DAE 2020 objectives : 100% of citizens with internet speeds of 30Mbps and 50% above 100 Mbps

2. Evolution in users' behavior and services

- Video will be approximately 86% of the consumer IP traffic by 2016
- New expectations of users: ultra HD, interactivity (eg. VOD)
- => *Terrestrial networks won't have the capacity to fulfil these expectations alone*

3. Solutions: a) Broadband & broadcast convergence

- Mix of broadcast infrastructures and broadband infrastructures = all contents delivered in IP format
- Full interaction between the final users and network operators / broadcasters
- Content in “ATAWADAC” way: Any Time, Any Where, Any Device, Any Content

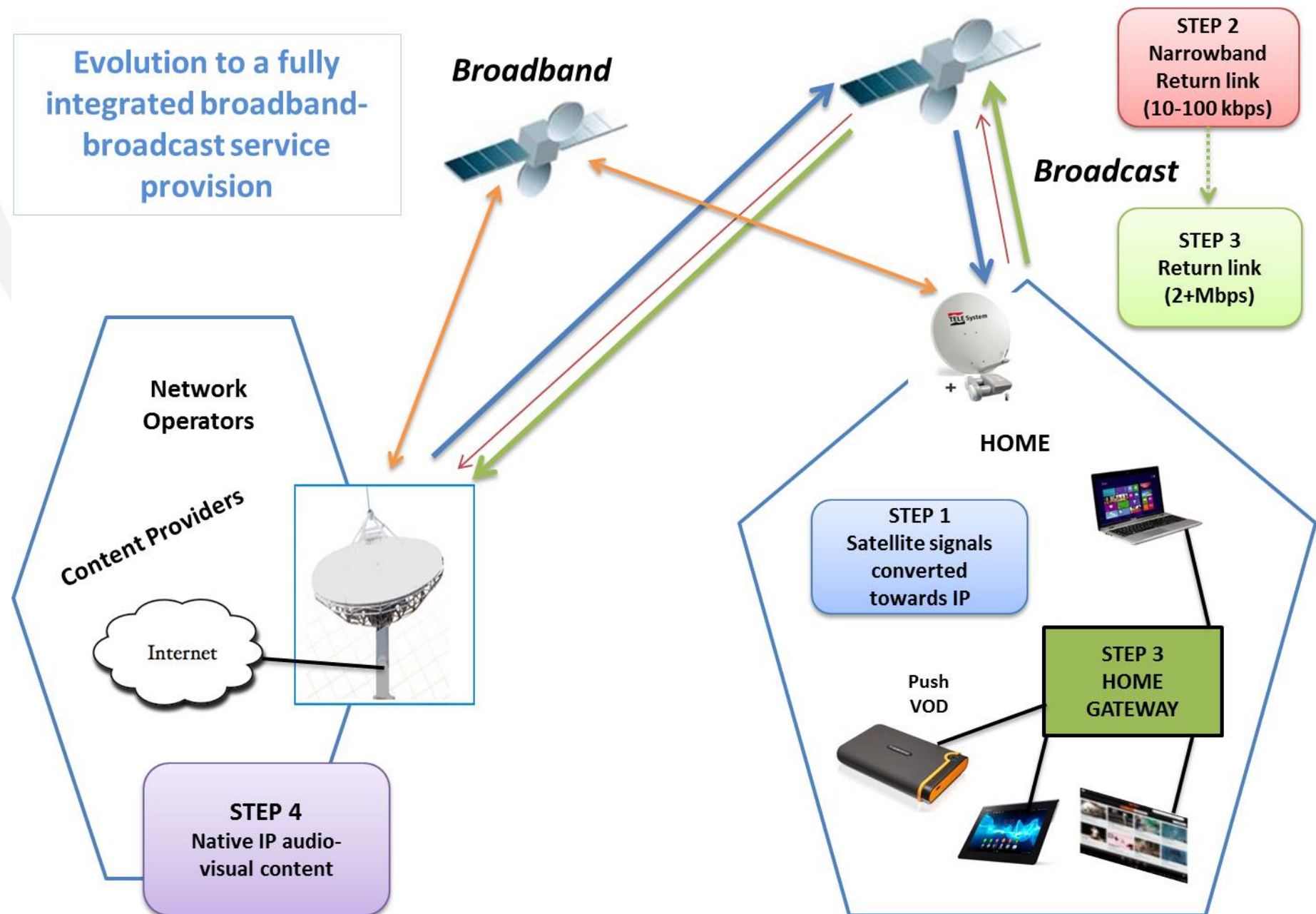
b) Terrestrial and space networks hybridation

- Smart and interactive management of networks: no congestion, possibility to push content
- Secure delivery of content



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2- Innovative and/or integrated operational approaches



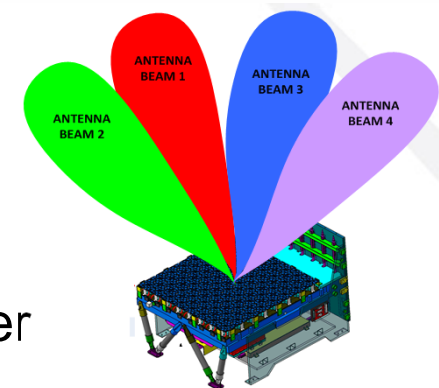
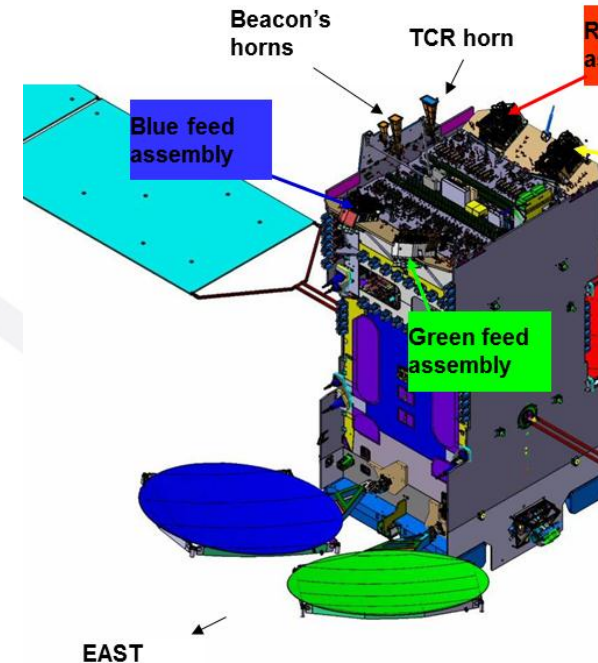
Increasing on-board payload performance and throughput

1. System level enhancements

- Frequency re-use and interference mitigation
- Feeder link in higher frequencies (QV and optical)
- Payload flexibility to adapt to the demand

2. Enabling technologies

- Larger antennas reflectors in KA (>5m) and QV band (~2,5 m)
- Small size and mass antenna feeds
- Enhanced antenna pointing system (0,025° BPE)
- Optical feeder link chain (telecom, opto-mechanical, ground network)
- Equipment to flexibly manage more signal capacity while lighter and more compact, and process wider bandwidth with finer granularity etc.
- Air Interface (modulation techniques)



Acting at overall mission level

1. System level enhancements

- Reduce satellite mass, thus launch cost
- Reduce platform volume to increase payload volume
- Increase power to payload
- Improve thermal control to allow more dissipative telecommunication payload on-board



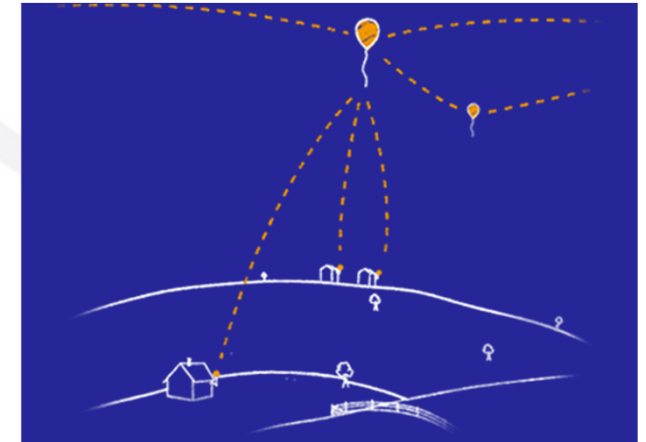
2. Enabling technologies

- Next generation solar arrays (>20 KW with ultra-thin GaAs cells, new lay-out)
- Next Generation batteries (e.g regenerative fuel cells)
- NG thermal control: so-called pumped loops
- Electric propulsion to reduce overall mass/Volume



Disruptive system architectures

- Major Internet players are launching ideas which appear crazy, but who knows?
- **Google Project Loon:**
 - Balloons float in the stratosphere where there are many layers of wind, each varying in direction and speed.
 - Loon balloons go where they're needed by rising or descending into a layer of wind blowing in the desired direction of travel.
 - People connect to the balloon network using a special "Internet antenna". The signal travel through the balloons network and then down to the global Internet on Earth.
 - Issue: trajectory control for positioning over the right area



Technology and System design roadmap: what H2020 can do to help! 1/2

This exercise allowed to identify research areas not, or not enough, addressed by national space agencies and ESA.

AREA	TOPICS	H2020 Space	H2020 ICT
Frequency re-use	Interference mitigation at high frequencies, Ka band reflectors > 5m, antenna pointing systems, repeater optical technologies	X	
Higher frequencies	Antennas >5m deployment systems, QV feed end-to-end demo, Optical feed technologies and end-to-end demo	X	
Flexibility	European foundry capacity, innovative technologies for active antennas (GaN, meta-materials, Rotman lense)	X	
Air Interface	Support DVB work group		X
Overall mission	New solar arrays lay-out, regenerative fuel cells, HPS, deployed radiators,		
Disruptive	Disruptive architectures potential assessment, spectrum management in Low Earth Orbit		X

Technology and System design roadmap: what H2020 can do to help! 2/2

This exercise allowed to identify research areas not, or not enough, addressed by national space agencies and ESA.

AREA	TOPICS	H2020 Space	H2020 ICT
Convergence of broadcast with broadband networks	Parallel access to both broadcast/broadband networks by the final user in a transparent manner / smart management of both broadcast and broadband resources by an operator / Storage of content pushed directly to the user's premises under the control of the service provider.		X