The role of satellites in 5G

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Introduction

4G

5G

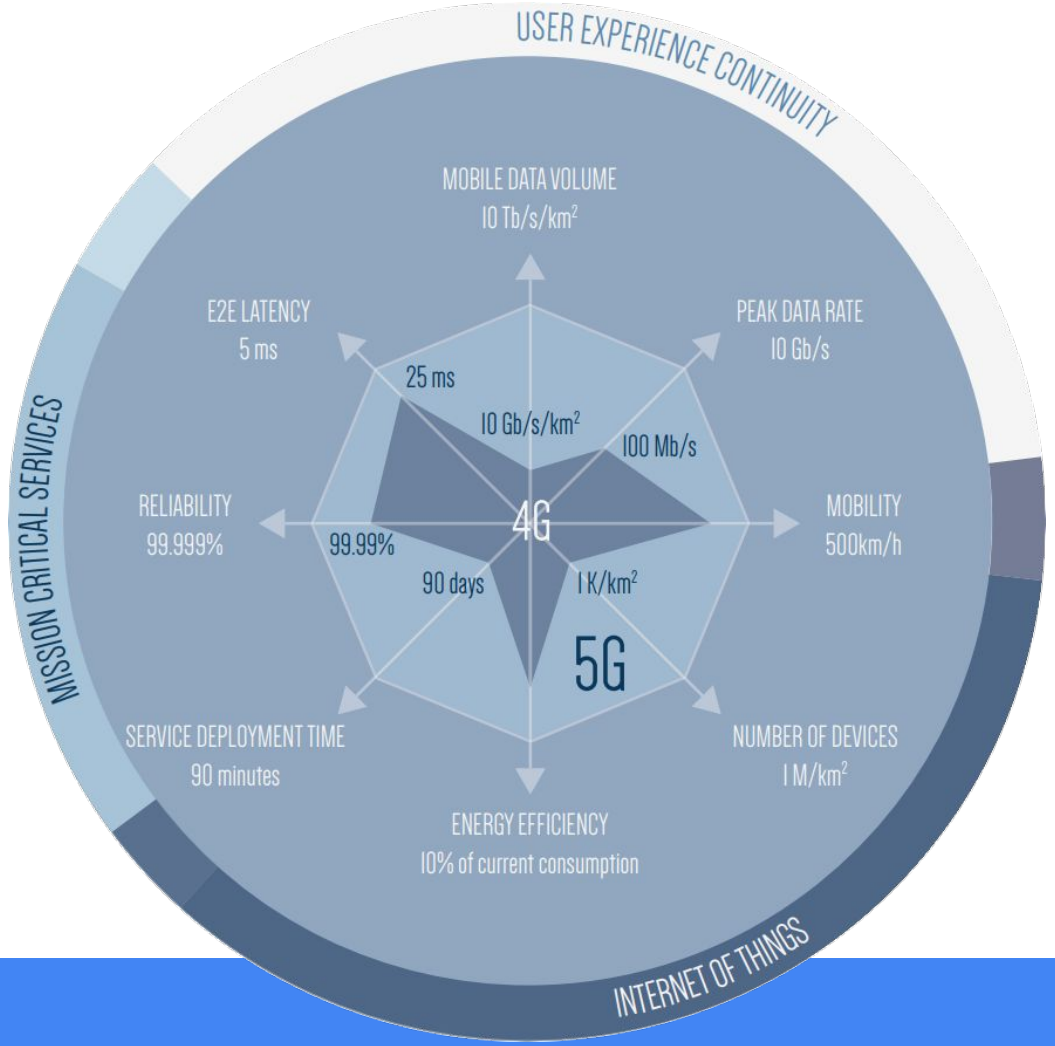


Chart taken from the 5G-PPP brochure
http://bit.ly/1GZuqHW

5G Key Performance Indicators

- Providing 1000 times higher wireless area capacity and more varied service capabilities compared to 2010.

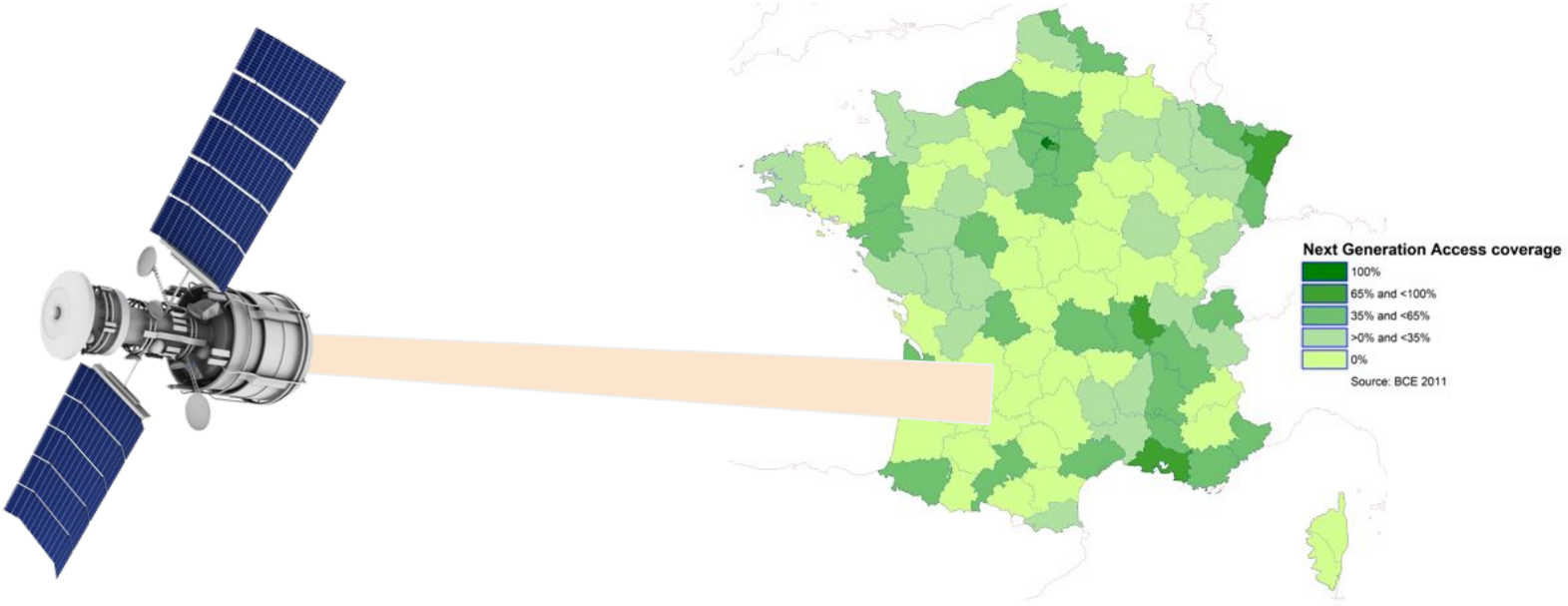
- Secure, reliable and dependable Internet with zero perceived downtime for services provision.

- New economically viable services of high societal value like U-HDTV and M2M applications.

Which role for satellites in 5G ?

I. Extended coverage

Satellites can fill the gaps and extend coverage.

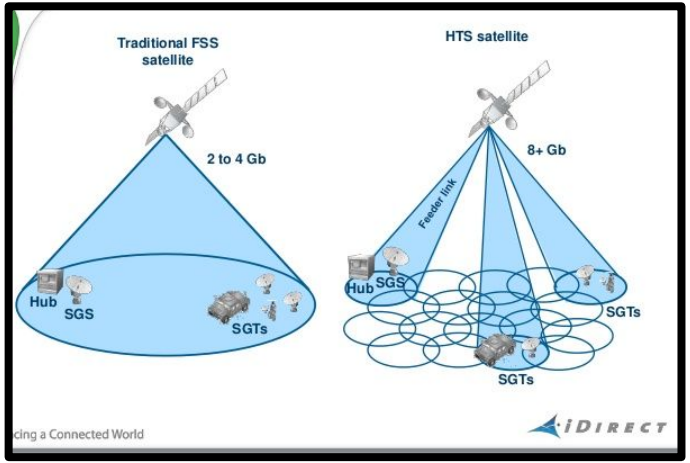


I. Extended coverage

HTS : High Throughput Satellite	up to	140 Gbps	80 beams
FSS : Fixed-satellite Service	up to	1 Gbps	1 beam

Currently : satellite communications are expensive.

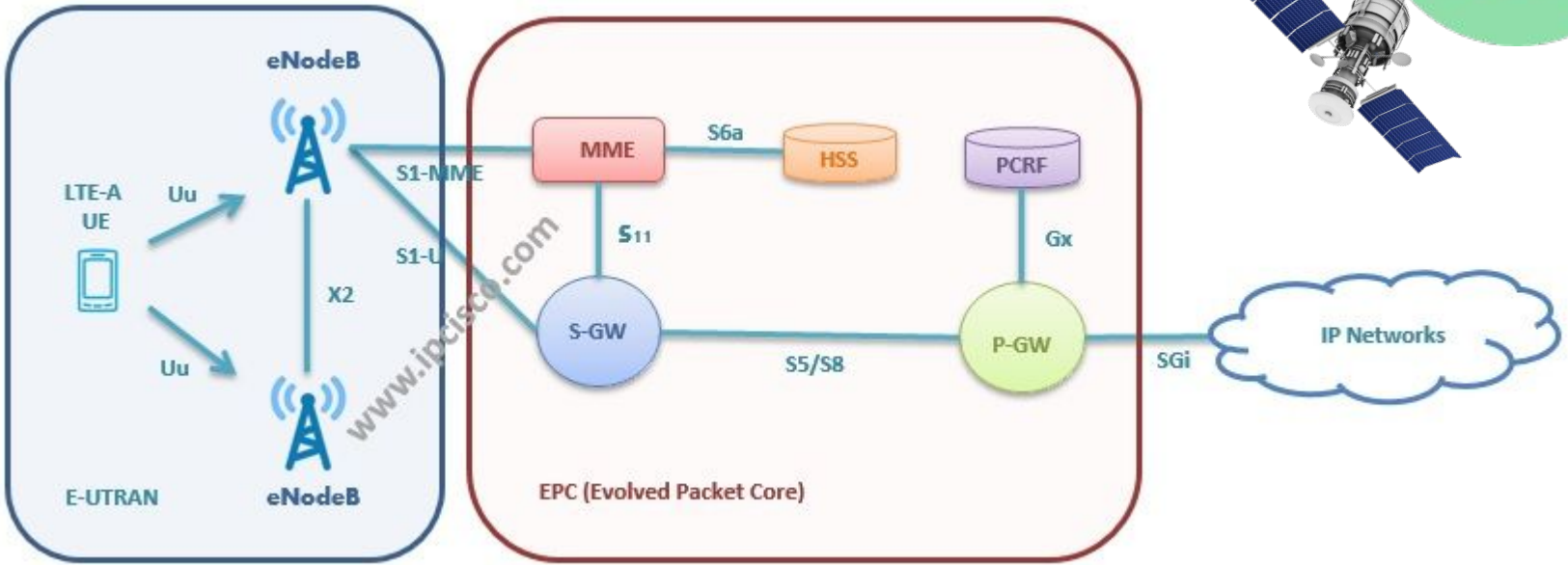
Example of HTS antenna [2]



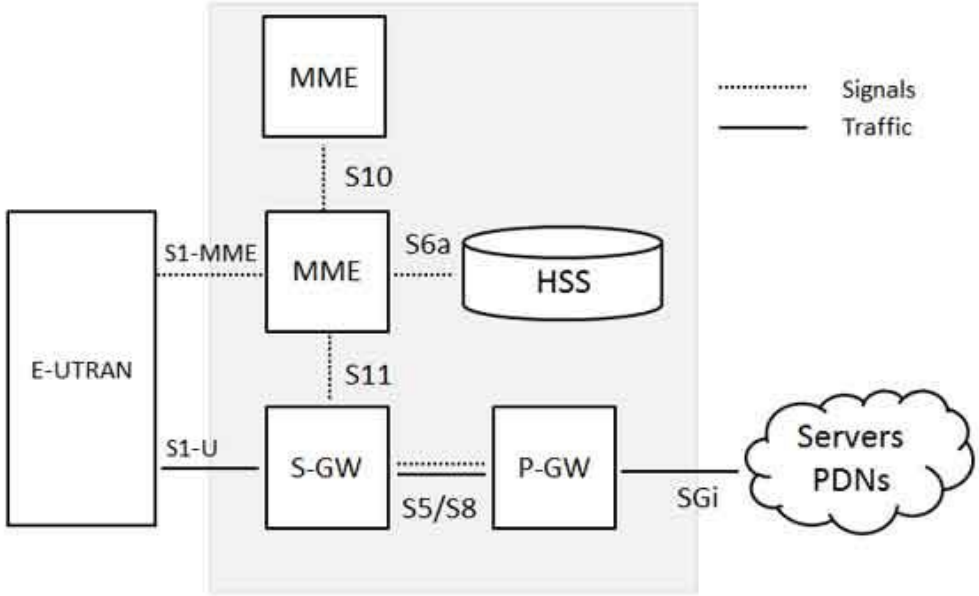
Difference between FSS beams and HTS beams [1]

[1] http://pt.slideshare.net/iDirect/high-throughput-satellite-hts-capability-for-increasing-situational-awareness-and-enabling-real-time-decision-making
[2] https://artes.esa.int/projects/compact-c-band-feed-assembly-single-and-multi-beam-missions

II. Network architecture key



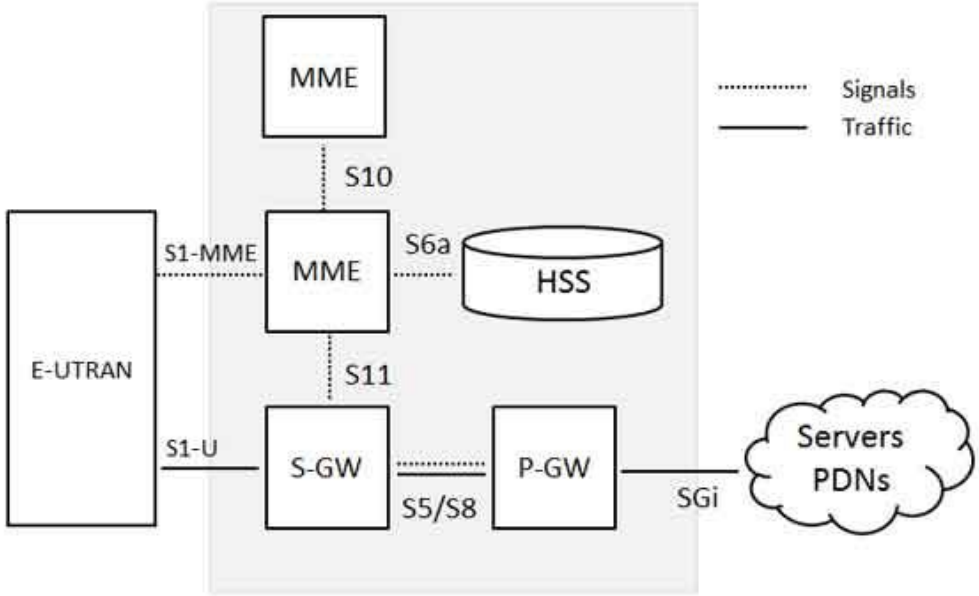
II. 1. Splitting control / user planes



4G Infrastructure

II. 1. Splitting control / user planes

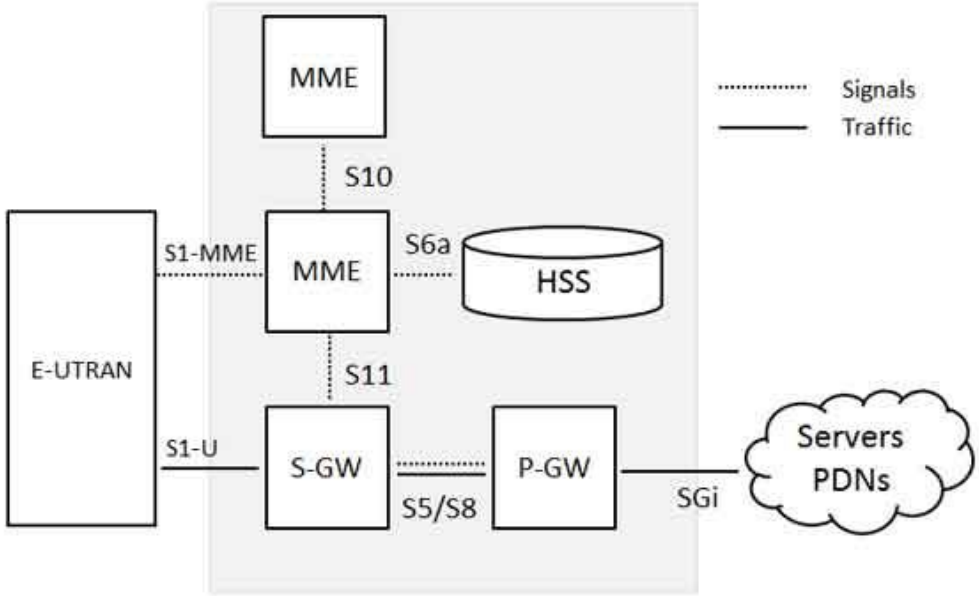
- Provide control plane to help terrestrial infrastructures



4G Infrastructure

II. 1. Splitting control / user planes

- Provide control plane to help terrestrial infrastructures
- Signaling in macro cells over satellites



4G Infrastructure

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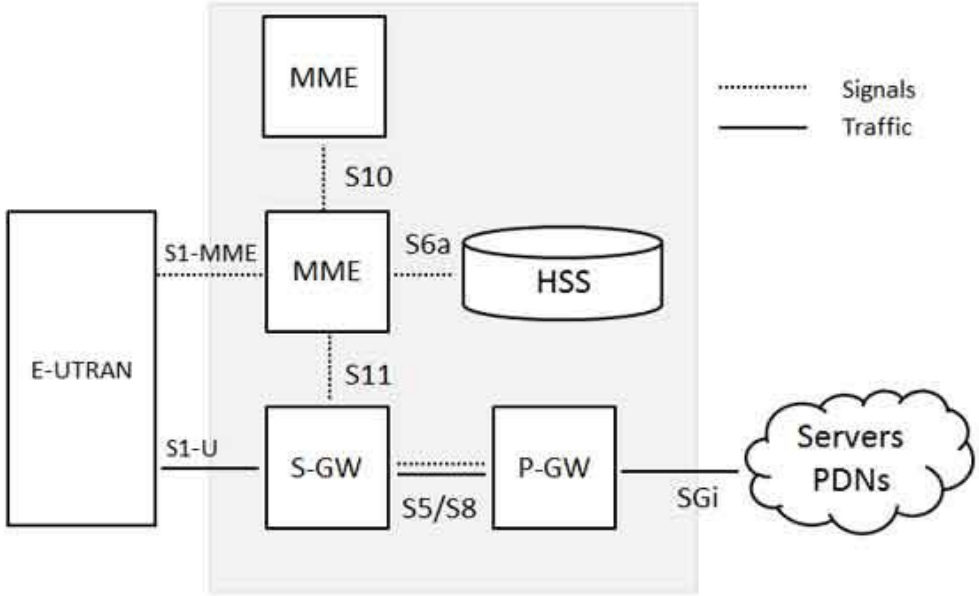
- Signaling in macro cells over satellites

Increase throughput available



4G Infrastructure

II. 2. SDN/NFV approach

Before

Closed / Specialized networking equipments

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Before

Closed / Specialized networking equipments

Now

Virtualized network

OpenFlow

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Before

Closed / Specialized networking equipments

Now

Virtualized network

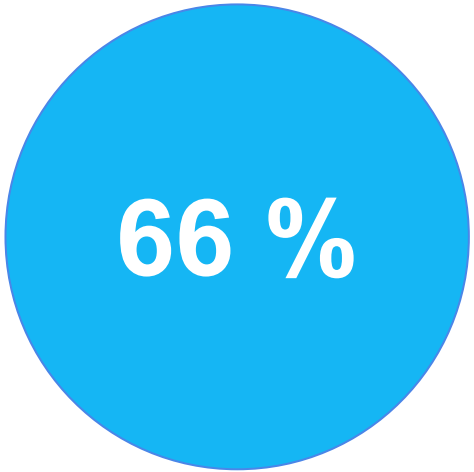
OpenFlow

→ Creating an “On demand network”

Ability for dynamic reconfiguration

III. 1. Closer to the edge Multimedia

Trending **multimedia content** constitutes the majority of the volume of mobile telecommunications. This proportion is expected to grow more and more !



Source : IEEE paper [1]

[1] B. Evans, O. Onireti, T. Spathopoulos and M. A. Imran, "The role of satellites in 5G," 2015 23rd European Signal Processing Conference (EUSIPCO), Nice, 2015, pp. 2756-2760

III. 1. Closer to the edge Multimedia

HTS Satellites in service or production

818Gbps total throughput

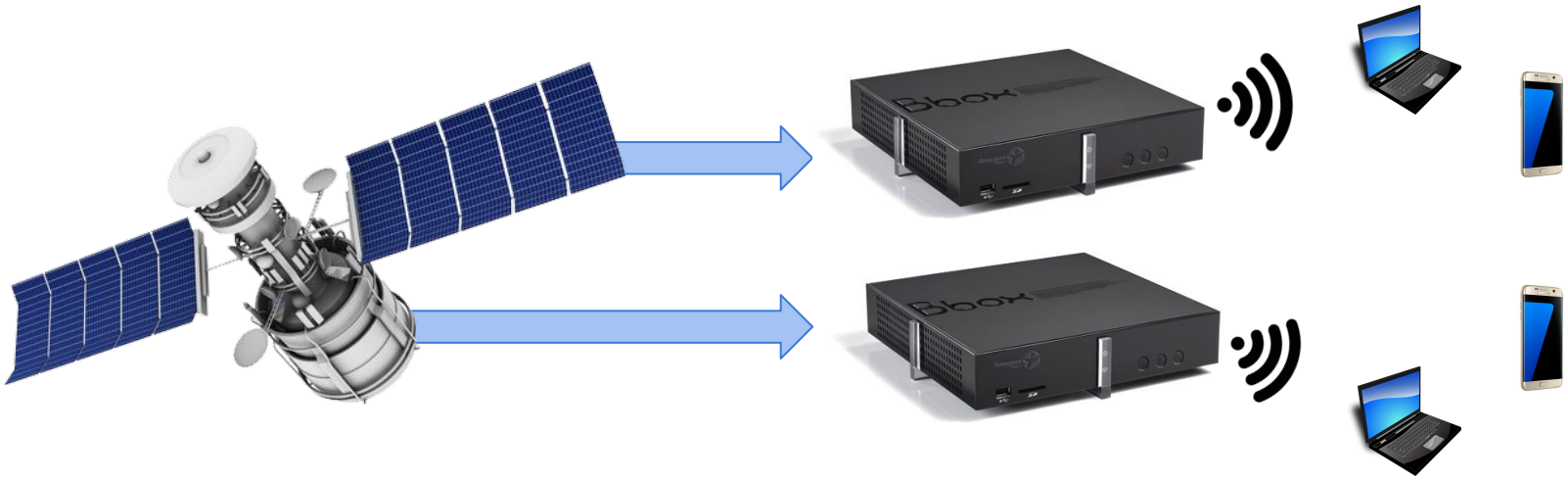
Operator	Satellite	Other name	Launch Date	Xponders	Throughput, Gbps	Capacity, MHz	Spots	Orbit Location
Eutelsat	KA-SAT		26-Dec-10	all Ka	70	20,500	82	13ºE
Yahsat	Yahsat 1A		22-Apr-11	14C/25Ku	1.6	1,404		52.5ºE
Viasat	Viasat-1		20-Oct-11	all Ka	140	18,000	72	115ºW
Yahsat	Yahsat 1B		24-Apr-12	45 Ka	92	15,250	61	52.5ºE
Hughes	Echostar 17	Jupiter	30-Jun-12	all Ka	100	15,000	60	95ºW
Avanti	Hylas 2		1-Jul-12	all Ka	36	8,280	24	
Hispasat	Amazonas 3		15-Dec-12	19C/33Ku/9Ka	16	2,250	9	61ºW
Eutelsat	Eutelsat 25B	Es'hail	15-Jan-13	16 Ku/7Ka	7.6	2390		25.5ºE
Inmarsat	Global Express	Inmarsat 5	15-Oct-13	all Ka	15	4,170		144ºE
Telenor	Thor 7		20-Oct-13	11 Ku/X Ka	5.4	5,000		1ºW
Inmarsat	Global Express	Inmarsat 5	18-Jan-14	all Ka	20	5,560		64ºE
Eutelsat	Eutelsat 3B		15-Mar-14	12C/30Ku/9Ka	11	3762		3ºE
Inmarsat	Global Express	Inmarsat 5	13-Jun-14	all Ka	25	6,950		55ºW
NewSat	Jabiru-1		15-Jun-14	50 Ka	75	7,600	50	88ºE
O3b	O3b		30-Jun-14	all Ka	120	30,000	10	N/A
Intelsat	IS-29		15-Jun-15	C & Ku	25	6,950		60ºW
Intelsat	IS-33		15-Jun-16	C & Ku	60	16,680		63ºE
	Subtotal				818	169,746		

HTS in Service or in Production (2016) [1]

[1] http://www.vizocomsat.com/blog/will-high-throughput-satellites-impact-satellite-industry/

III. 1. Closer to the edge Multimedia

Bring multimedia content closer to the edge.

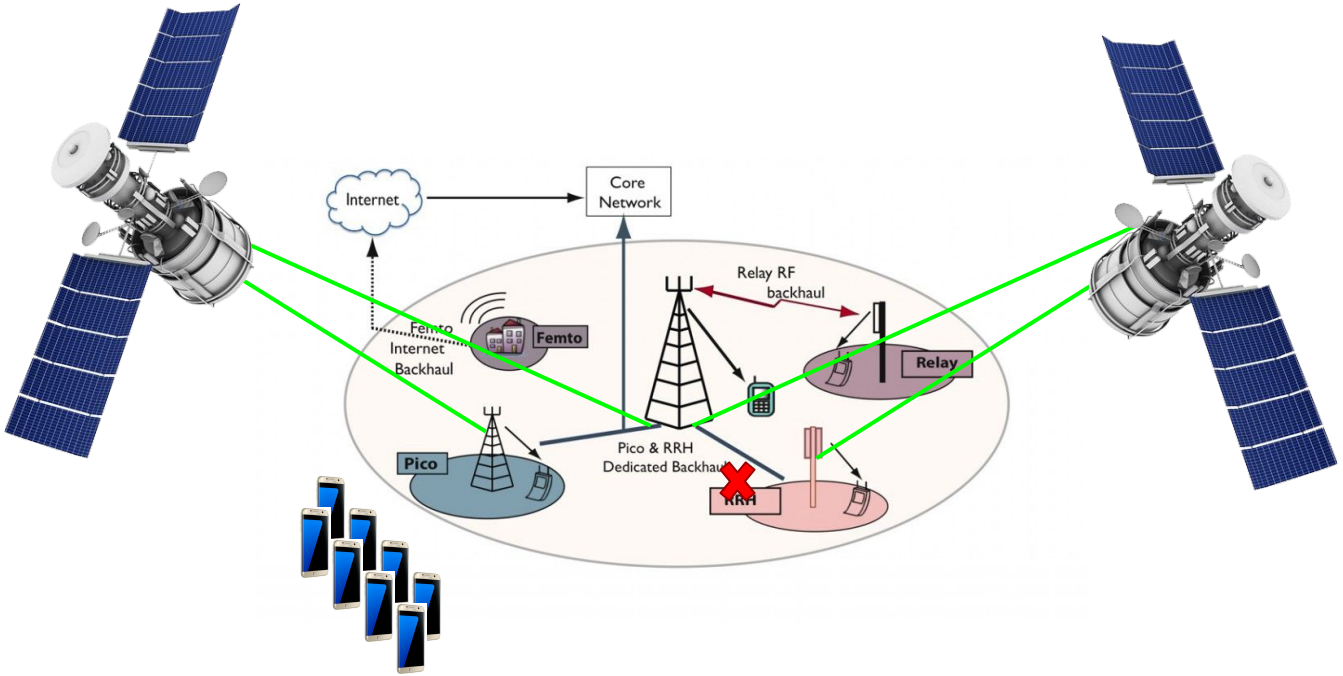


Satellite

Box

Devices

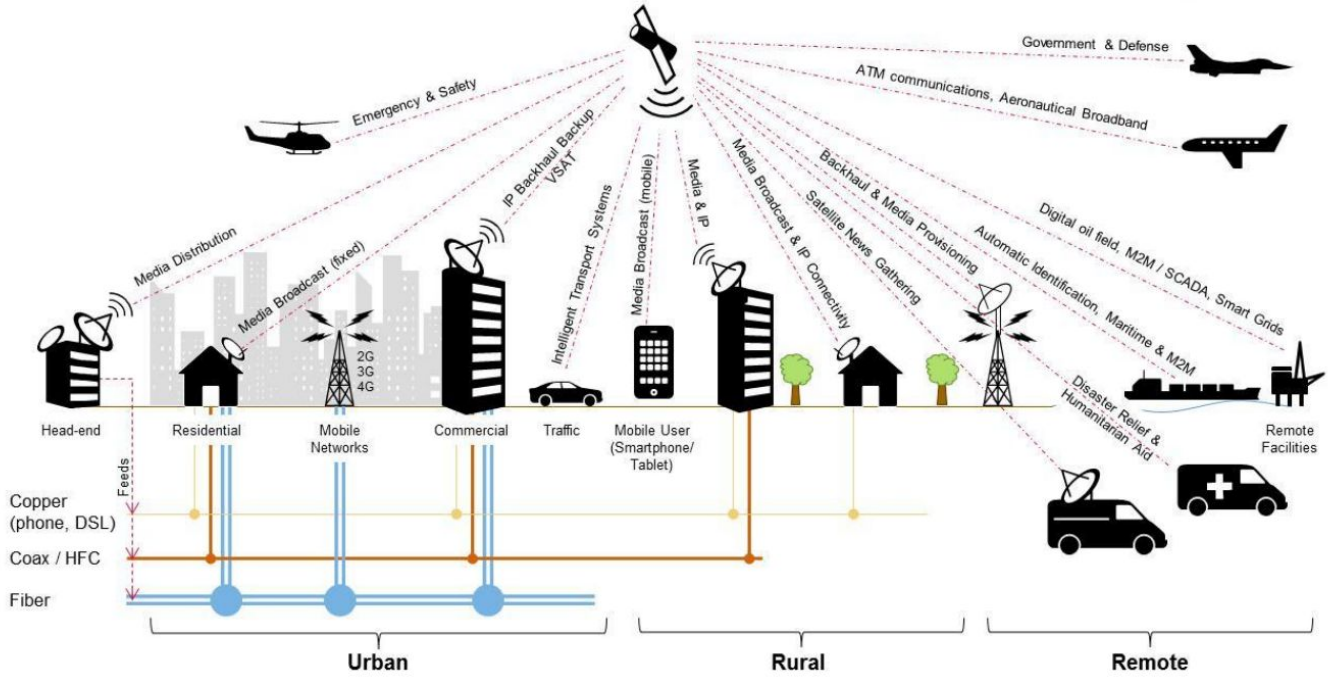
III. 2. Offload terrestrial networks



High throughput => **offload to satellite**

Broken link => **Resilience** and **Availability**

Conclusion


Government & Defense
ATM communications, Aeronautical Broadband
Emergency & Safety
IP Backhaul Backup VSAT
Media Distribution
Media Broadcast (fixed)
Intelligent Transport Systems
Media Broadcast (mobile)
Media & IP
Media Broadcast & IP Connectivity
Satellite News Gathering
Backhaul & Media Prowsioning
Automatic Identification, Maritime & M2M
Digital oil field, M2M / SCADA, Smart Grids
Disaster Relief & Humanitarian Aid
2G
3G
4G
Head-end
Residential
Mobile Networks
Commercial
Traffic
Mobile User (Smartphone/ Tablet)
Remote Facilities
Feeds
Copper (phone, DSL)
Coax / HFC
Fiber
Urban
Rural
Remote

Merci :)