



Satellite For Rural Broadband

**Brainstorming Broadband
Developing a Roadmap for India**

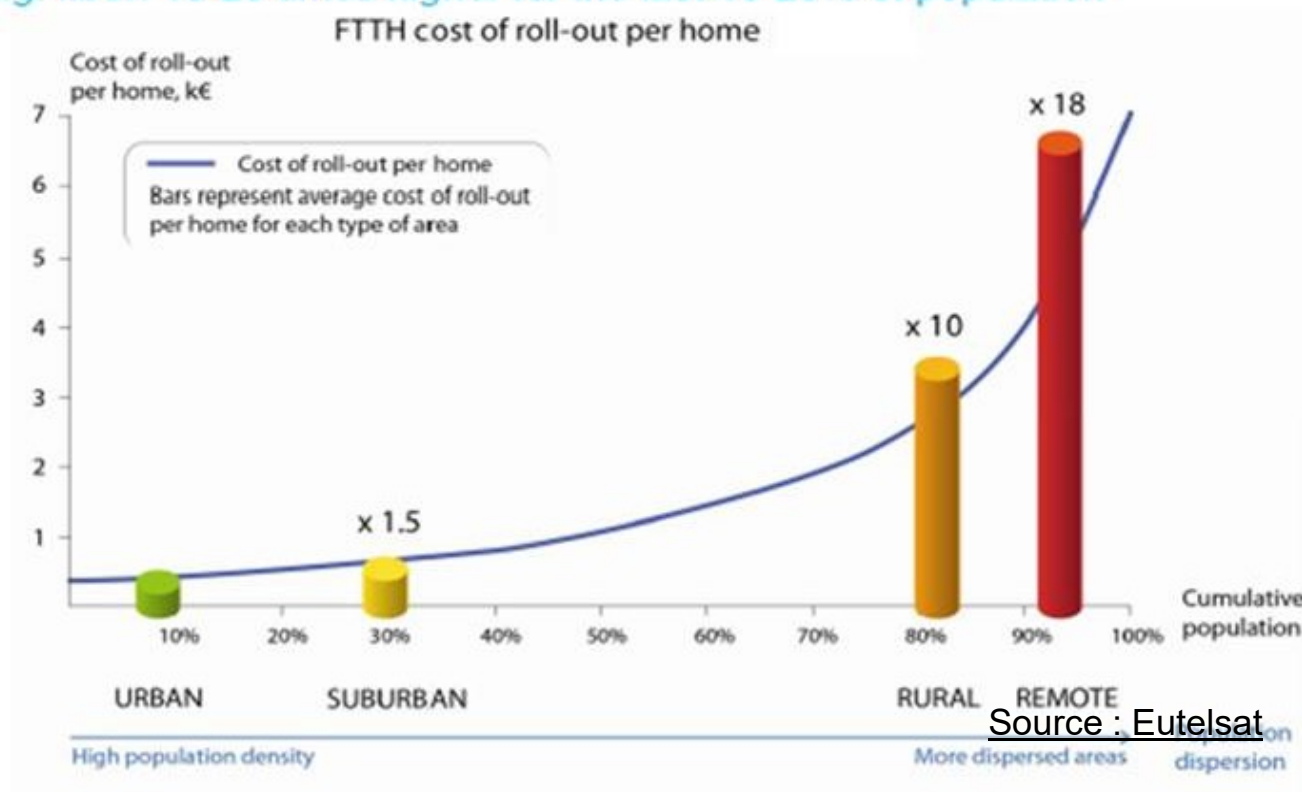
K Krishna
HUGHES[®]
An EchoStar Company



Why Satellite is still relevant for broadband?

Cost of roll-out of terrestrial technologies in dispersed areas increases with remoteness

- E.g. fiber: 10-20 times higher for the last 10-20% of population

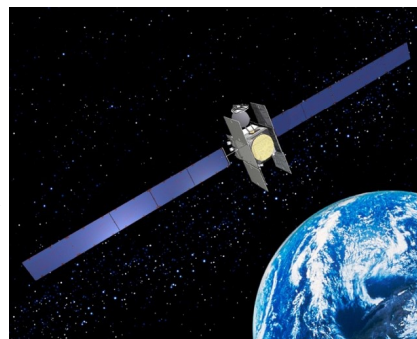


The simplicity of A satellite Network



← Hub or Master Station

Satellite →

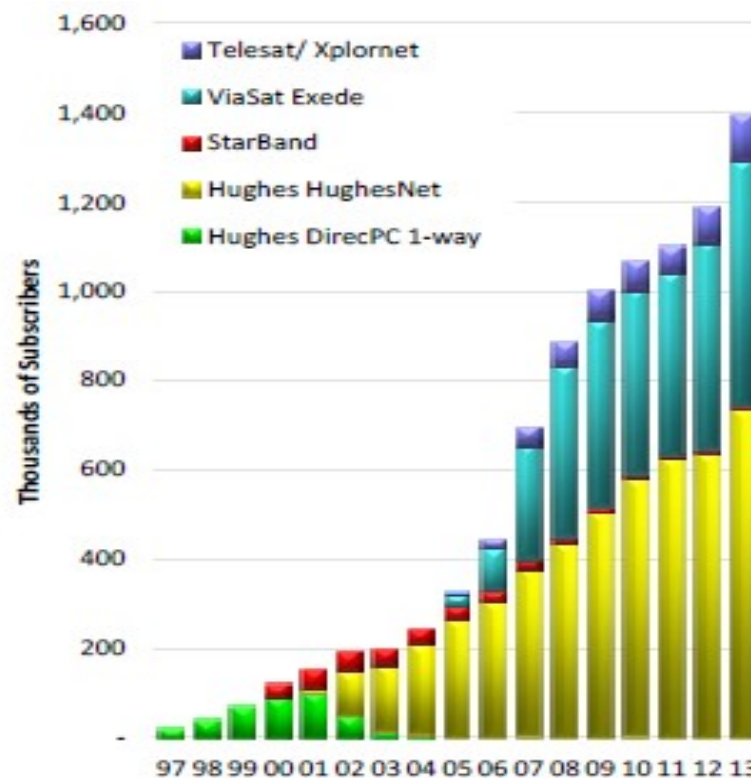


Satellite Router →



Satellite growth in the most wired nations

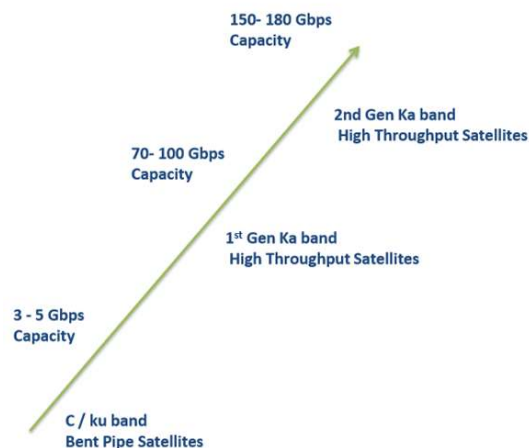
Over 1.4 million consumers in North America access the Internet via satellite



Source: COMSYS VSAT Report 13th Edition

HTS & Ka Band: The Game Changer

High Throughput



- FSS Satellite: 1~2Gbps (Currently Available in India)
- Highest bandwidth available from a HTS: 100Gbps (Already in use [USA])
- Double the capacity is expected in the next two years

Smaller Antenna

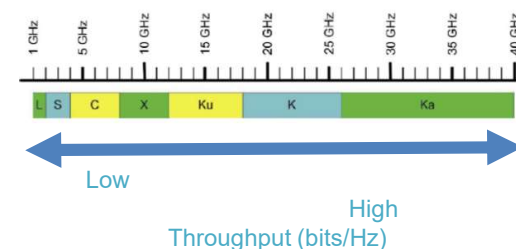


0.75m / 0.67m antenna

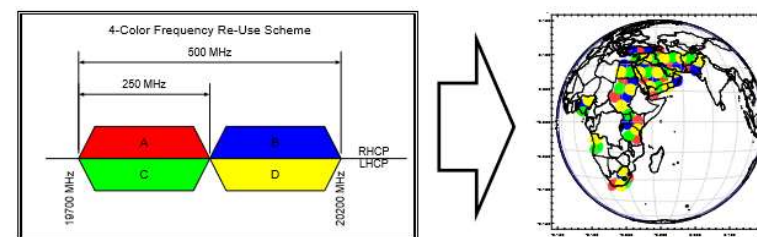
Ultra-Wide Transponders

15 times bigger
500MHz transponders vs
36MHz prevalent now

Superior band

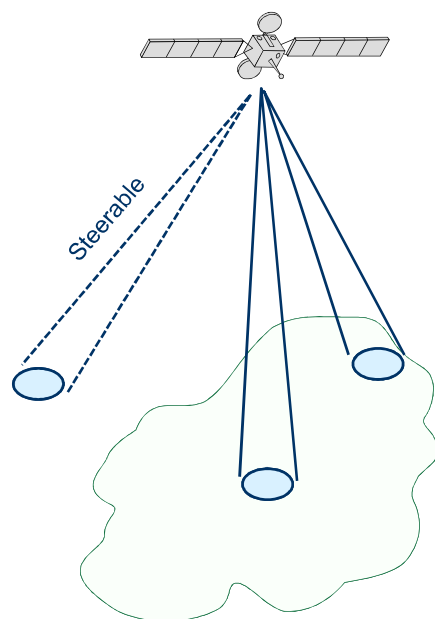


Frequency Reusage

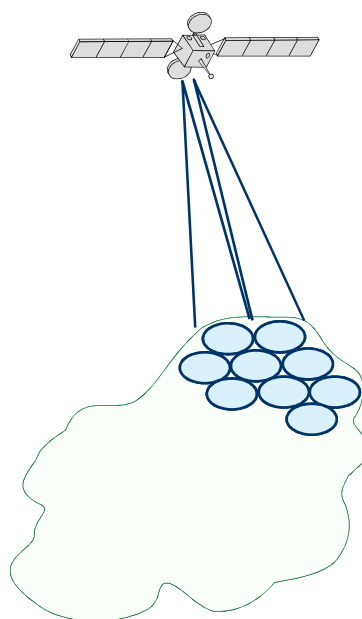


HTS Satellite Technology

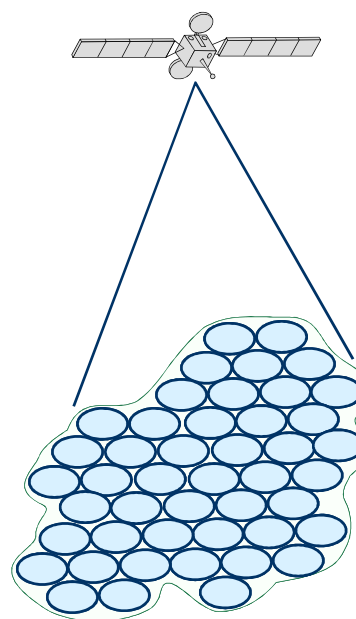
Hosted Payload



Small/Medium Satellite



Large Satellite



Non-Geo Constellation



1 Gbps

>100 Gbps+

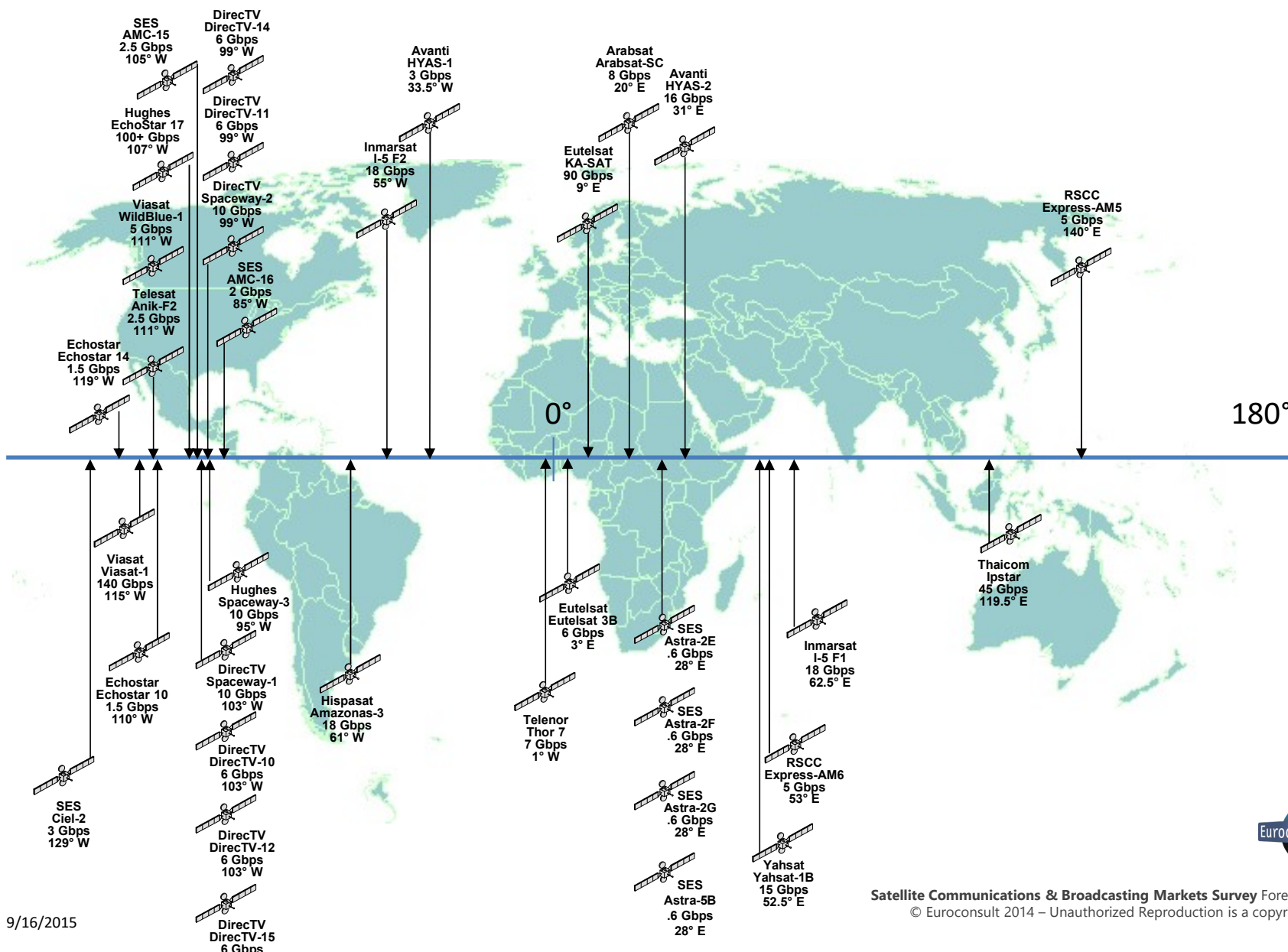
1 Tbps+

Sample Bandwidth plans on HTS – Hughes U.S.A

The following chart is the service pricing for HughesNet (an Echostar company)

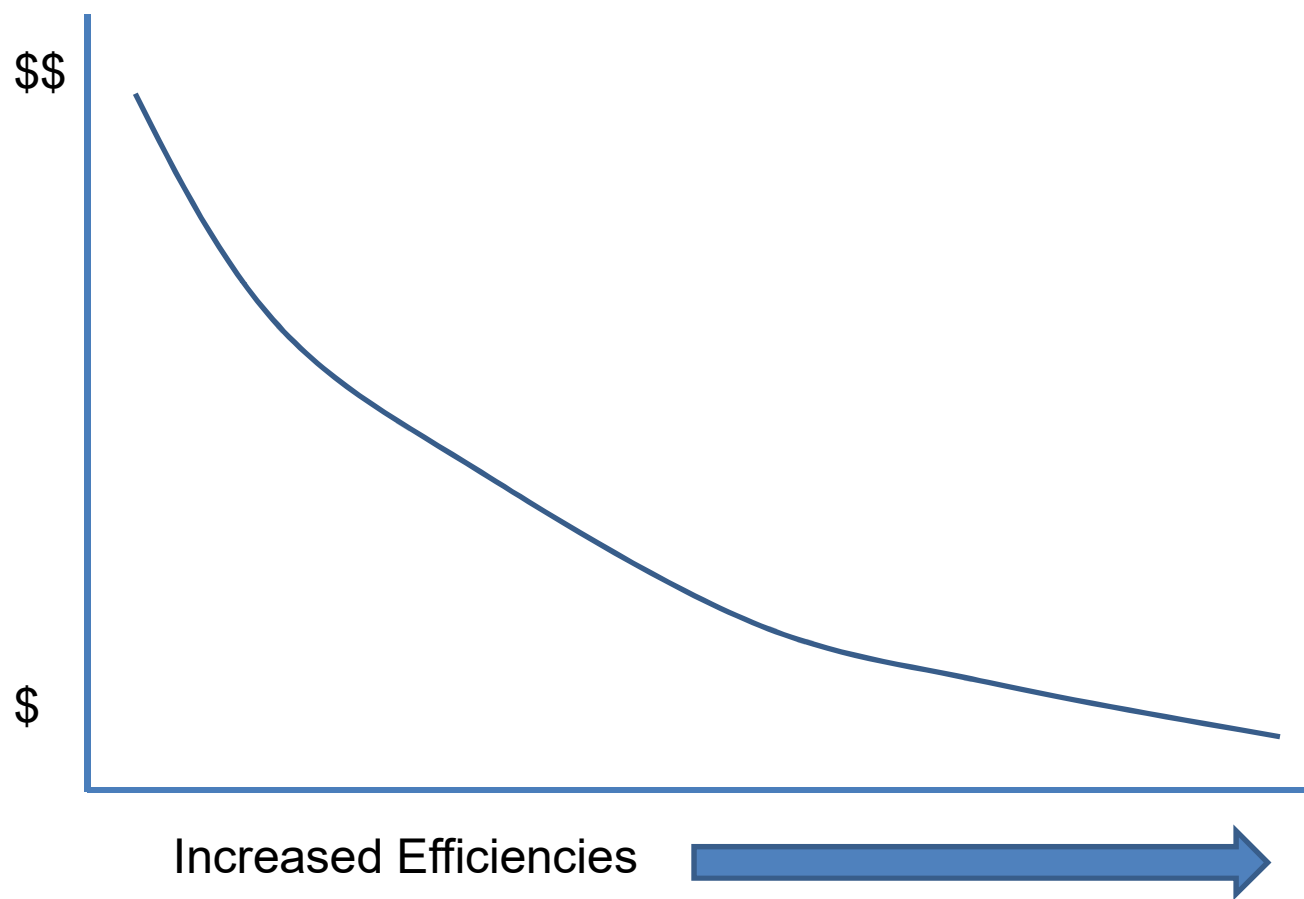
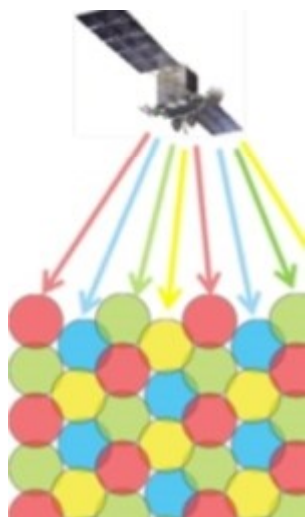
Choice	Prime Plus	Pro Plus	Ultra
For home use and one computer.	Great for multiple users, browsing, emailing, and social networking! Includes SmartBrowsing!™	Ideal for multiple users, more frequent browsing, emailing, social networking, watching video clips and more! Includes SmartBrowsing!™	The fastest satellite Internet speeds you can get and an incredible 100 GB/month Data Allowance. Includes SmartBrowsing!™
<p>⌚ Downloads Up to 5 Mbps*</p> <p>⌚ Uploads Up to 1 Mbps*</p>	<p>⌚ Downloads Up to 10 Mbps*</p> <p>⌚ Uploads Up to 1 Mbps*</p>	<p>⌚ Downloads Up to 10 Mbps*</p> <p>⌚ Uploads Up to 2 Mbps*</p>	<p>⌚ Downloads Up to 15 Mbps*</p> <p>⌚ Uploads Up to 2 Mbps*</p>
<p>⌚ Data Allowance*</p> <p>Anytime 5 GB Bonus Bytes 50 GB Monthly Total* 55 GB</p>	<p>⌚ Data Allowance*</p> <p>Anytime 10 GB + SmartBrowsing™ Bonus Bytes 50 GB Monthly Total* 60 GB</p>	<p>⌚ Data Allowance*</p> <p>Anytime 15 GB + SmartBrowsing™ Bonus Bytes 50 GB Monthly Total* 65 GB</p>	<p>⌚ Data Allowance*</p> <p>Anytime 50 GB + SmartBrowsing™ Bonus Bytes 50 GB Monthly Total* 100 GB</p>
<p>\$49.99</p> <p>\$39.99</p> <p>per month for 3 months†</p>	<p>\$59.99</p> <p>\$49.99</p> <p>per month for 24 months††</p>	<p>\$79.99</p> <p>\$69.99</p> <p>per month for 24 months††</p>	<p>\$89.99</p> <p>\$79.99</p> <p>per month for 24 months††</p>
Order Now!	Order Now!	Order Now!	Order Now!

HTS Satellites Launched to Date



HTS: Maximizing HTS Cost Efficiencies

Always Drive to the Lowest Cost per Bit



HTS: Expanding the Application Set

Cost Efficiencies are Driving an Expanding Set of Applications



Expanding the Application Set

HTS is Well Suited for Cellular Backhaul

- ❖ Good economics—even for data
- ❖ Latency/jitter performance is essential
- ❖ 3G/LTE acceleration improves user experience

Small Cell Technology



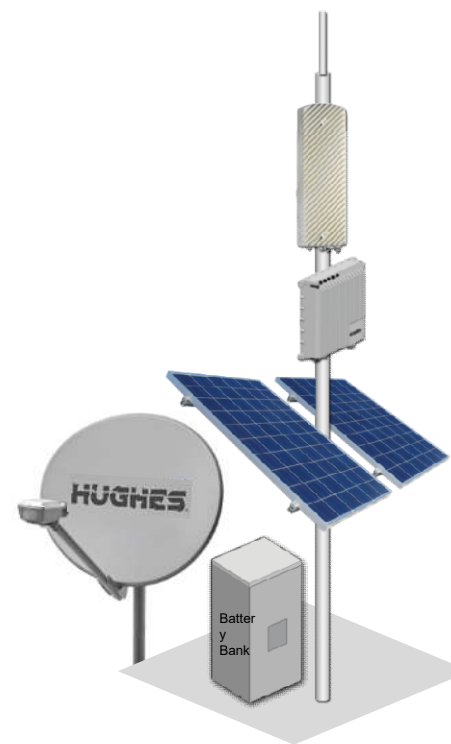
- Low Cost
- Low Power Consumption
- Easy to Install



VSAT Technology



- Low Cost
- Low Power Consumption
- Easy to Install



Expanding the Application Set

Mobility Is a Natural Application

“On The Move” ...



Maritime



Aeronautical

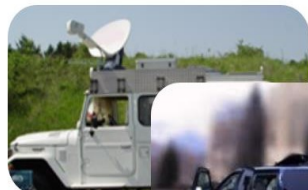


Rail

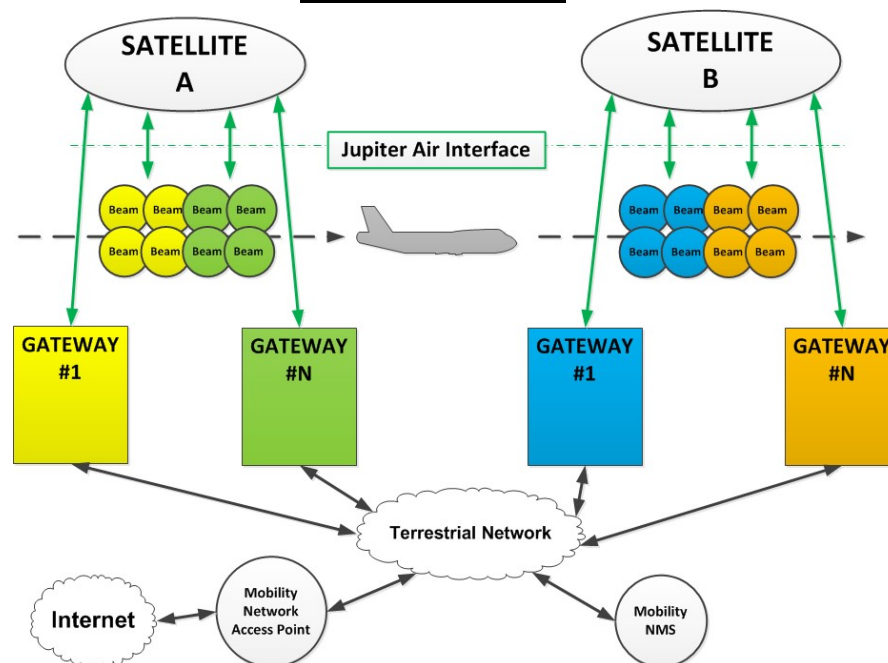


Land Mobile

“On The Pause” ...



Aeronautical



Technical Challenges

- Physical layer adaptation to handle terminal movement, Doppler, and timing
- Multiple transport gateways, each supporting multiple beams
- Common mobility network access point to the Internet
- Single NMS manages entire system

HTS and Hughes

Most Flexible HTS System

SPACEWAY® 3

FDMA/TDMA Uplink
112 fixed coverage spot beams
(30 GHz)

Low uplink power,
moderate uplink
data rates are
optimum for small
terminals

Data
Packets

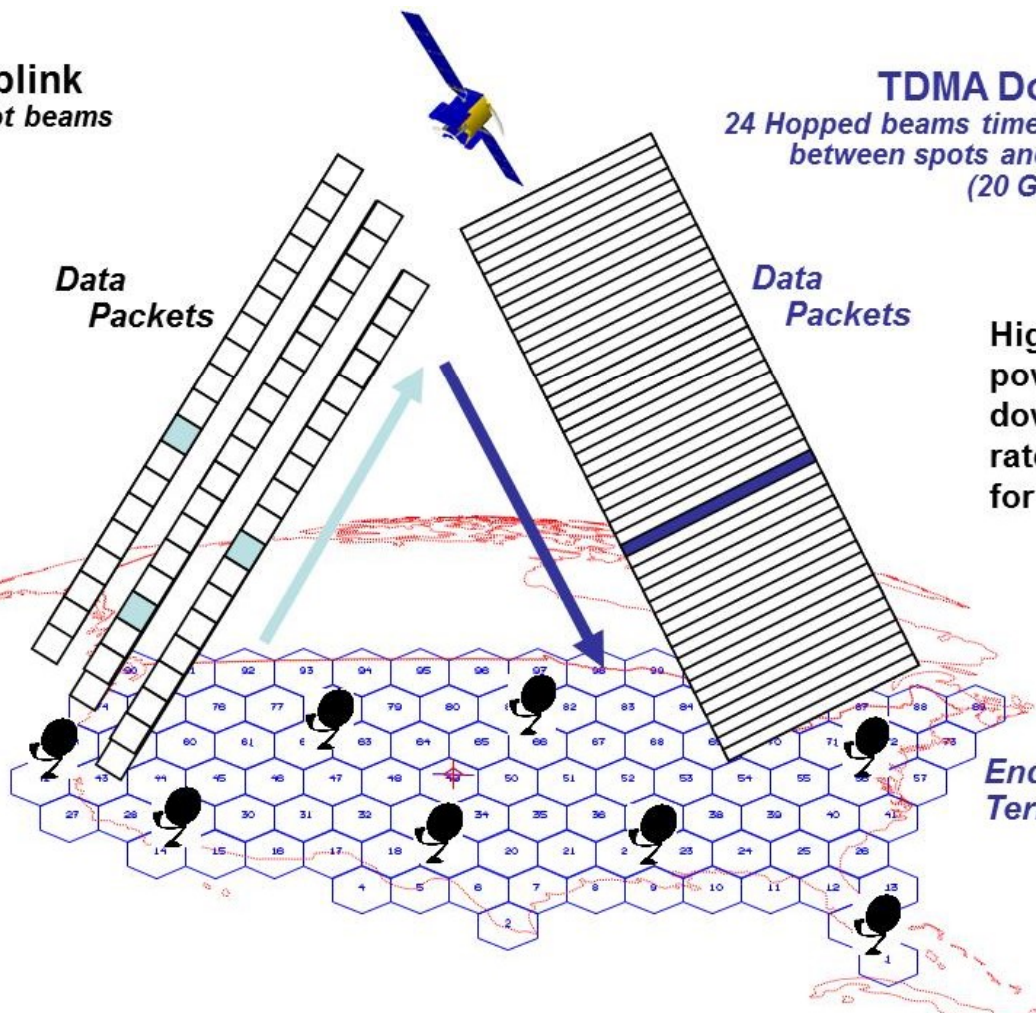
TDMA Downlink
24 Hopped beams time division multiplexed
between spots and CONUS coverage
(20 GHz)

High downlink
power, high
downlink data
rates are optimum
for small terminals

Data
Packets

End-User Satellite
Terminal (ST)

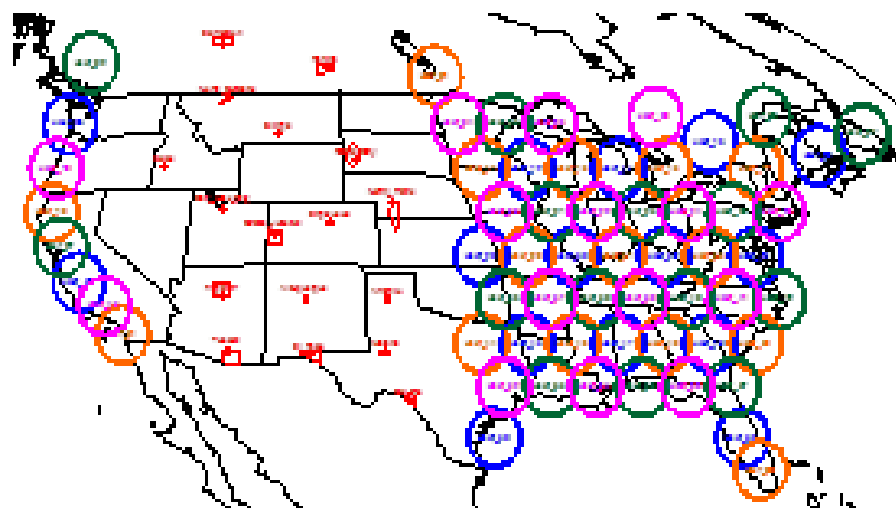
End-User Satellite
Terminal (ST)



JUPITER 1 (EchoStar® XVII) System

Service Launch: October 2012

- ❖ North America consumer service
- ❖ Fifteen gateways serving the US and Canada
- ❖ Sixty total spot beams
- ❖ ~ 100 Gbps capacity



HughesNet
Gen4

JUPITER 2 (EchoStar® XIX) System

- ❖ HughesNet Consumer Internet Service
- ❖ Capacity >200 Gbps
- ❖ 120+ user beams
 - US
 - Canada
 - Central America



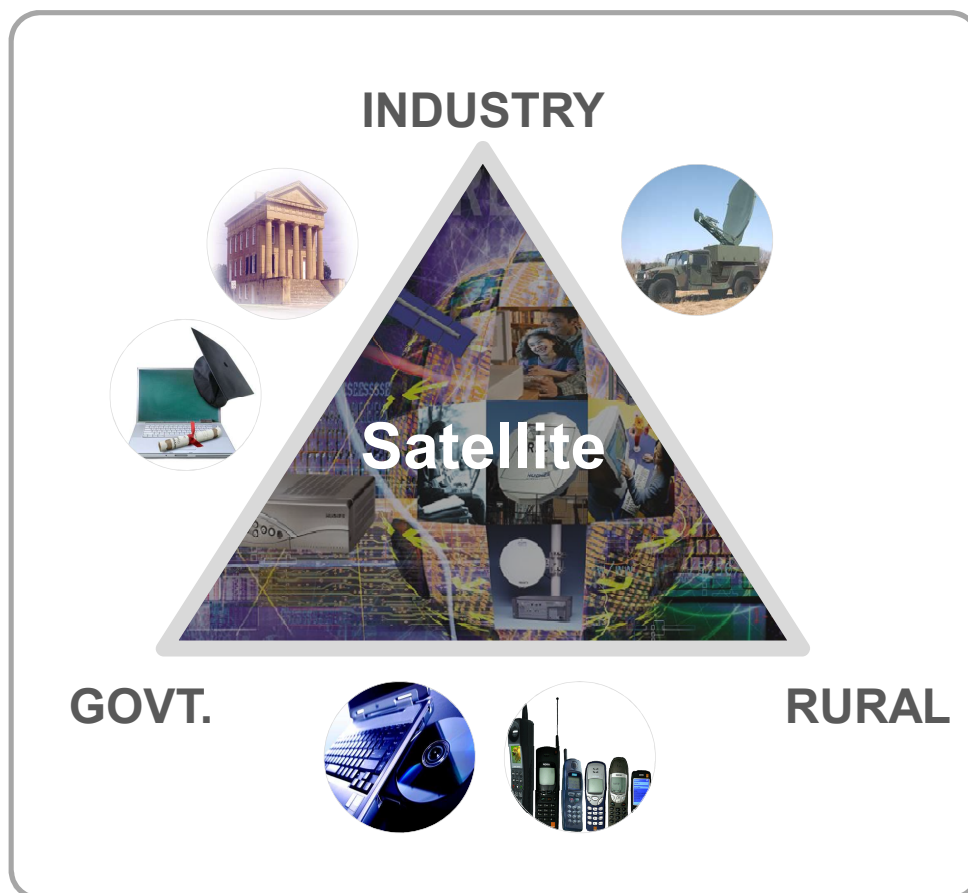
Hughes Brazil HTS System

High-Throughput Capacity on the EUTELSAT 65 West A Satellite for Broadband in Brazil

- ❖ Consumer broadband services in Brazil
- ❖ Service launch 2016
- ❖ Leveraging US experience and local expertise
- ❖ Preparation in full swing
 - Distribution agreements
 - OSS/BSS development
 - Gateway deployment



Indian Economy - Powered by Satellite



**100,000 terminals in Bank ATMs;
4 Billion ATM transactions annually**

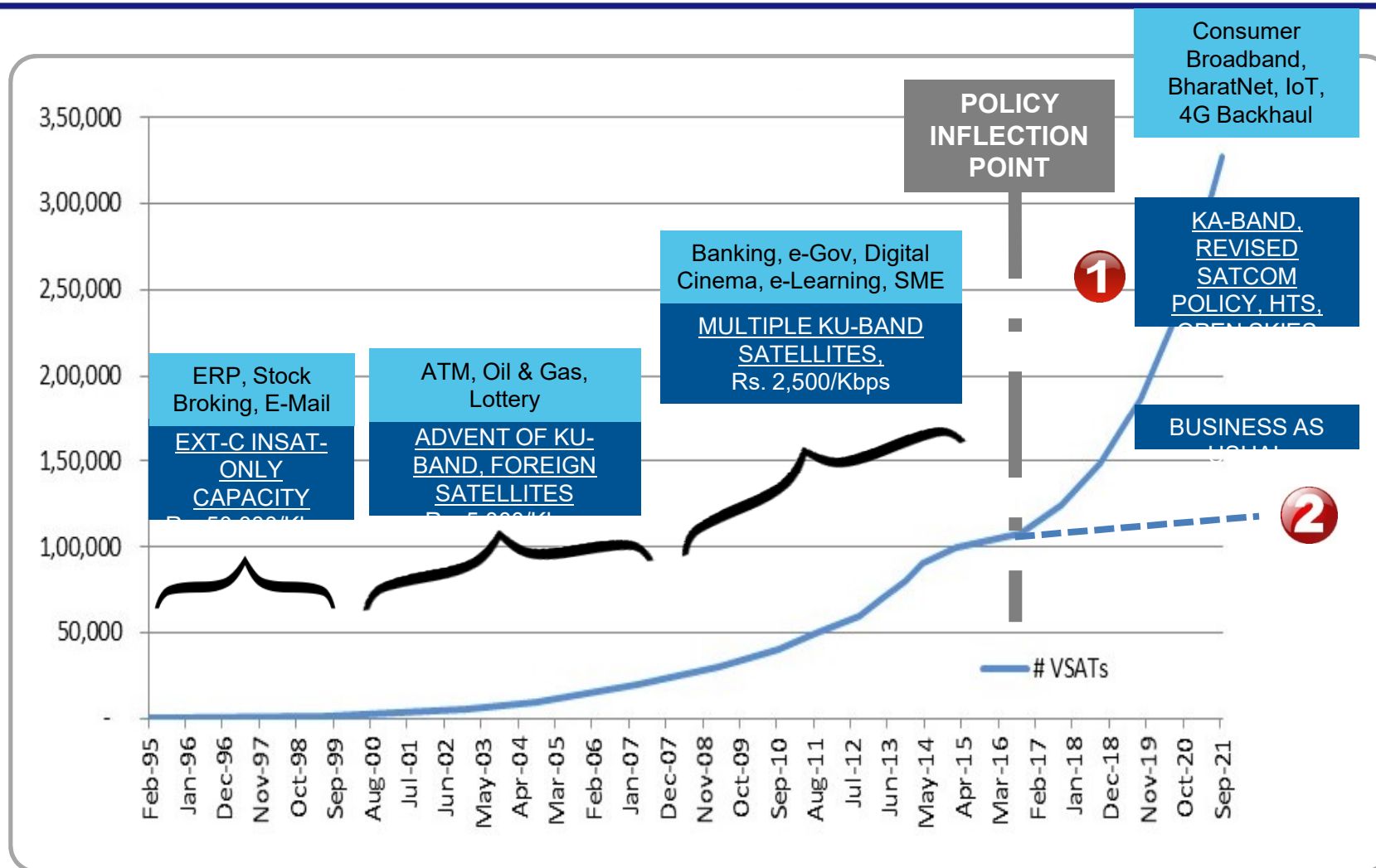
**Networking the
\$1.5 Trillion Equity Market**

**Passing out 10% of all Ivy League
MBA students**

**> 1000 Movies distributed annually;
piracy reduction**

**30,000 Villages empowered by
e-Governance**

India - Growth Scenario



Who needs Communications Satellites in India

ENTERPRISE SERVICES

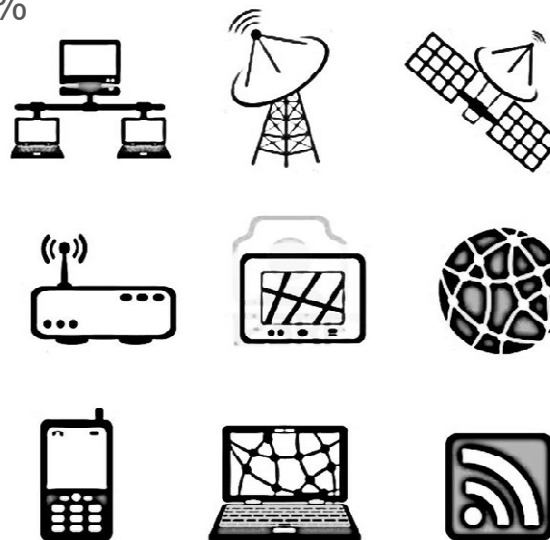
(250,000 units, growing by 5% annually on average)*

CELLULAR BACKHAUL

(Emerging 4G rollouts to benefit hugely)

MOBILITY

(~900mn mobile users with 150mn internet subscriptions)*



HIGH SPEED RURAL BROADBAND

(~ 60% still unconnected)

WI-FI SERVICES

(~200mn wireless devices currently. India's population in the age group 10-25yrs is 350 mn)

ULTRA HDTV

(Bring in 4K broadcasting platform)

Exclusive Satellite Addressable Sites – Digital India

Region	States	Total GPs	% feasible by Fibre	Estimated VSAT Sites
North-East	7 Sister States & Sikkim	11960	25%	8970
Maoist Affected	26 Districts in 8 States	7433	0	7433
Hilly States	J&K, Jharkhand, Uttarakhand	14572	25%	10929
Islands	A&N, Lakshadweep	79	0	79
Other States	Remote areas in mainland	211336	95%	10567
Total VSAT Sites				37,978

Satellite Can also play significant role beyond these sites in quick rollout before Dec 2016 deadline where Fiber laying will take time

India satellite bandwidth rates are **284 times** of the prevalent rates in USA/elsewhere

Serial		VSAT provider USA	VSAT provider INDIA
(I)	Download Mbps	15 Mbps	1 Mbps
(II)	Upload Mbps	2 Mbps	0.3 Mbps
(III)	GB capacity per month	40 GB	32 GB
(IV)	Monthly cost USD	129 USD	670 USD
(V)	Total Bandwidth Mbps (D+U) [ROW(I) +ROW(II)]	17 Mbps	1.3 Mbps
(VI)	USA Bandwidth/India Bandwidth factor [(ROW V) USA / (ROW V) INDIA]	13.1	
(VII)	Monthly INDIA price/USA price [ROW(IV) INDIA / ROW{IV) USA]	5.2	
(VIII)	GB capacity plan factor USA/INDIA [ROW(III) USA/ROW(III) INDIA]	1.25	
(IX)	PPP factor USA/INDIA	3.33	
	ADJUSTED INDIA price/USA price factor [ROW(VI) x ROW(VII) x ROW(VIII)* ROW(IX)]	284	

Hughes Proposal for India

- ❖ Hughes has proposed to the Indian Government to put up a High Throughput Satellite for India at an investment of \$500 Million
- ❖ We have been waiting for Governmental approvals for last seven years
- ❖ In the short term ease out the space segment procurement norms so that we can exploit the quick deployment advantage of the satellite

