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OneWeb presentation

ITU Symposium and Workshop – May 2017

The Dream of Affordable Internet Access for Everyone is Getting Closer

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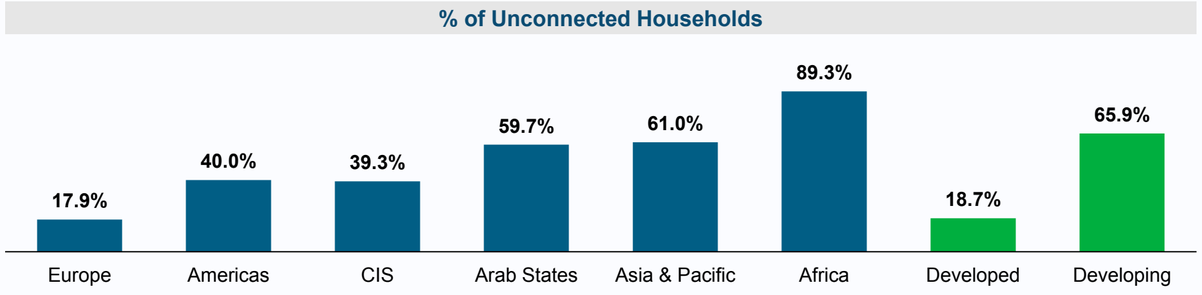
Majority of the World Does Not Have Access to the Internet

- The ITU[1] estimates **over 4 billion people** without internet access globally
- 55 million people lack access to advanced broadband in the U.S. alone
- OneWeb's market entry objectives align with public initiatives and international governments' goals to increase access globally



Source: ITU - ICT Facts & Figures, 2015; FCC 2015 Broadband Progress Report.
(1) International Telecommunication Union, an agency for information and communication technologies within the United Nations (UN).

OneWeb Overview

- Global Communications Company
- Ku-band and Ka-band spectrum
- 900 satellite production
- 1200 km altitude
- Pilot launch – Early 2018
- Ramping introduction of services by 2019
- Fully compatible with existing connectivity solutions (Wi-Fi, 3G, 4G, etc.)

OneWeb Benefits

- Global coverage including Poles
- Seamless mobility
- Low latency
- Small, high-performance user terminals
- Cellular extension, even without towers
- Improved performance in obstructed terrain
- Multiple local distribution options, working with local partners:
  - Direct-to-home, institution, mobile and community models

OneWeb's Solutions Serve Multiple Markets

		Market Growth Drivers	OneWeb Advantages
Satellite Broadband	Residential Broadband	■ Increasing data consumption	■ Lower latency, higher speed, lower cost UTs
	Corporate /SME Broadband		
	Remote Small Cells	■ Low cost integrated terminals will open up demand	■ Cheaper than VSATs; simple distribution model
Cellular Backhaul	Macro-cell Satellite Tracking	■ Displace terrestrial connectivity in low traffic sites	■ Low latency Ku-band reliability
Enterprise Markets	Enterprise Networking	■ Driven by VPN and VoIP	■ Communications at all levels and locations of business
	Maritime	■ Demands continuous broadband connectivity	■ Global, cost effective, higher speed, lower latency
	Aeronautical	■ Demand for constant internet connectivity	■ High latitude coverage, higher speed, lower latency, seamless beam to beam handoff
Government	Government & Military	■ Remote installations, emergency response, and military communications	■ Global, lower latency and better user terminal performance in obstructed terrain

Multi-User, Low-Cost User Terminals

- Development and manufacturing strategy leverages existing industry expertise and common engineering technology
- Compact user terminals enable mass market connectivity with multiple users per terminal
- Highest throughput: up to 50Mbps
- Includes WiFi / LTE / 3G / LMR optional integration for local access
- Multiple manufacturing options with low cost of production
- Flat-phased array antennas that do not require aiming and can be easily installed
- Leverage Qualcomm wireless connectivity expertise and patents

Prototype User Terminals Under Development

Mobile Applications

Enterprise Applications

Small Cell Applications

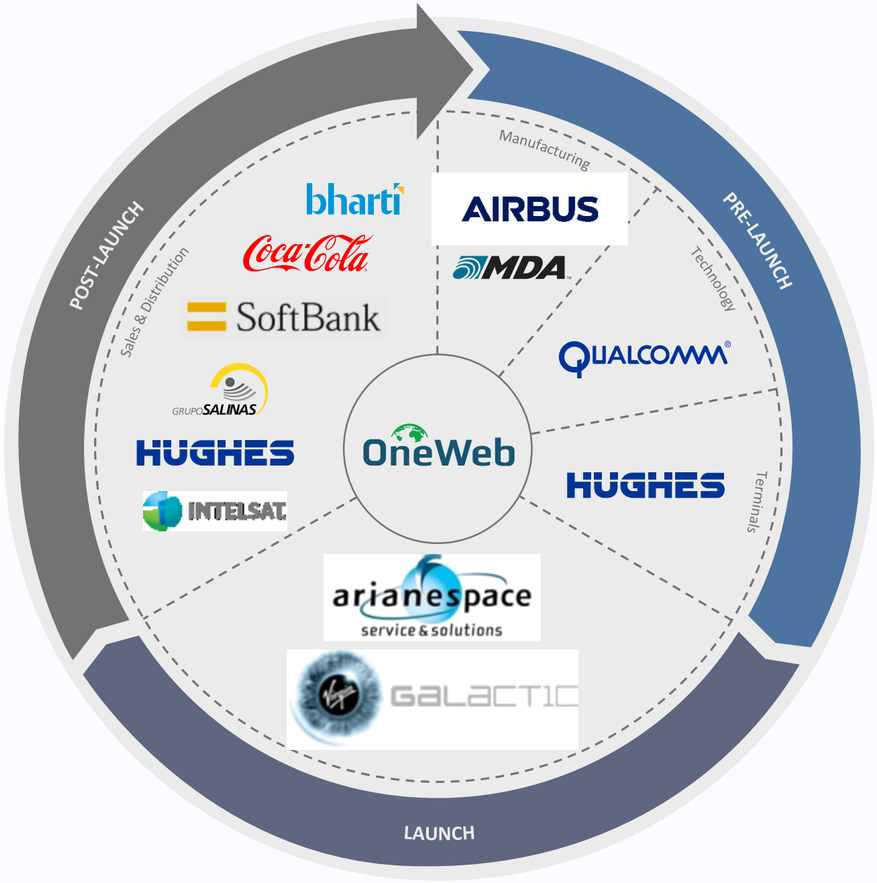
Early residential + Cellular Backhaul Applications

Benefits for the World – Expanded Connectivity

- Tool for economic development, environmental protection and inclusiveness
- Will bring affordable Internet to satellite-dependent communities, where terrestrial means is cost prohibitive to reach – empowering communities with limited or no access
  - Community centers, schools, institutions
  - Rural and remote citizens
- Constant and Assured communications
  - Oil & Gas and Mining industries
  - Global coverage of shipping and airline routes
  - First responder applications for rescues, wildfires and during natural disasters

Well Established Partnership Ecosystem

- OneWeb's partners provide key strategic and commercial relationships across OneWeb's business operations
- Strong technology partnerships support rapid development of the satellite, user terminal and ground systems
- Key distribution partnerships support initial go-to-market strategy
- OneWeb will continue to partner with new industry leaders to support deployment and market access of OneWeb's service
- OneWeb discussing with several potential worldwide beyond those already announced



Spectrum for OneWeb

- Ku-band and Ka-band FSS Allocations

	User Link	Gateway Links
Space-to-Earth	10.7 - 12.75 GHz	17.8 - 20.2 GHz
Earth-to-space	12.75 - 13.25 & 14 - 14.5 GHz	27.5 - 30 GHz

- NGSO FSS allocations: ITU RR No. 5.411, 5.484A and 5.487A

- OneWeb meets Article 22 EPFD limits in Ku- and Ka-bands

Extending Cellular and Broadband Coverage

Satellite Backhaul

- Latency < 50 ms (two-way) air interface only
- Battery & Solar power as an option

Broadband

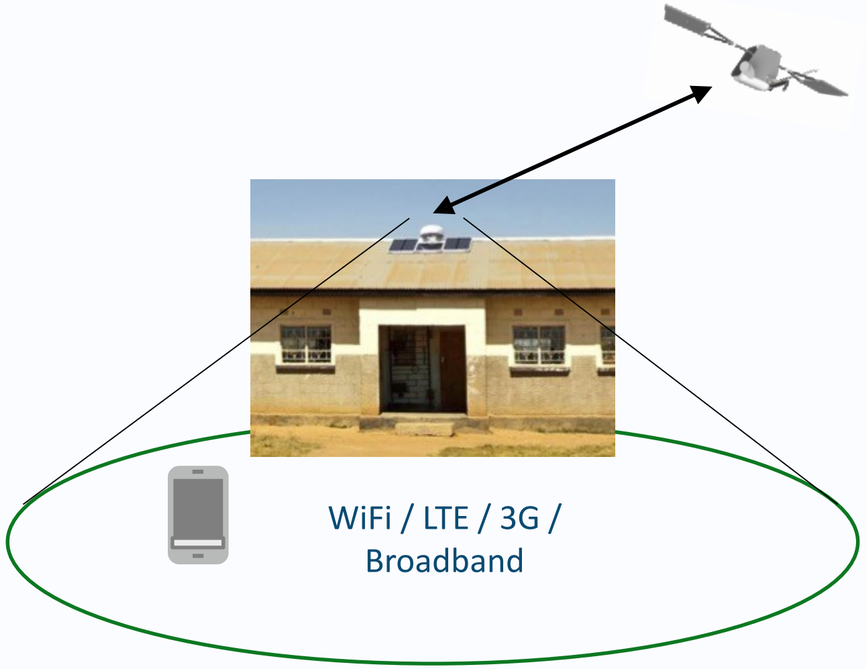
- Ethernet - 2, 10, 24, 48 Mbps

200m Pico Cell

- LTE/3G/WiFi
- Any Cellular Carrier (roaming)
- Licence-exempt WiFi or LTE-U

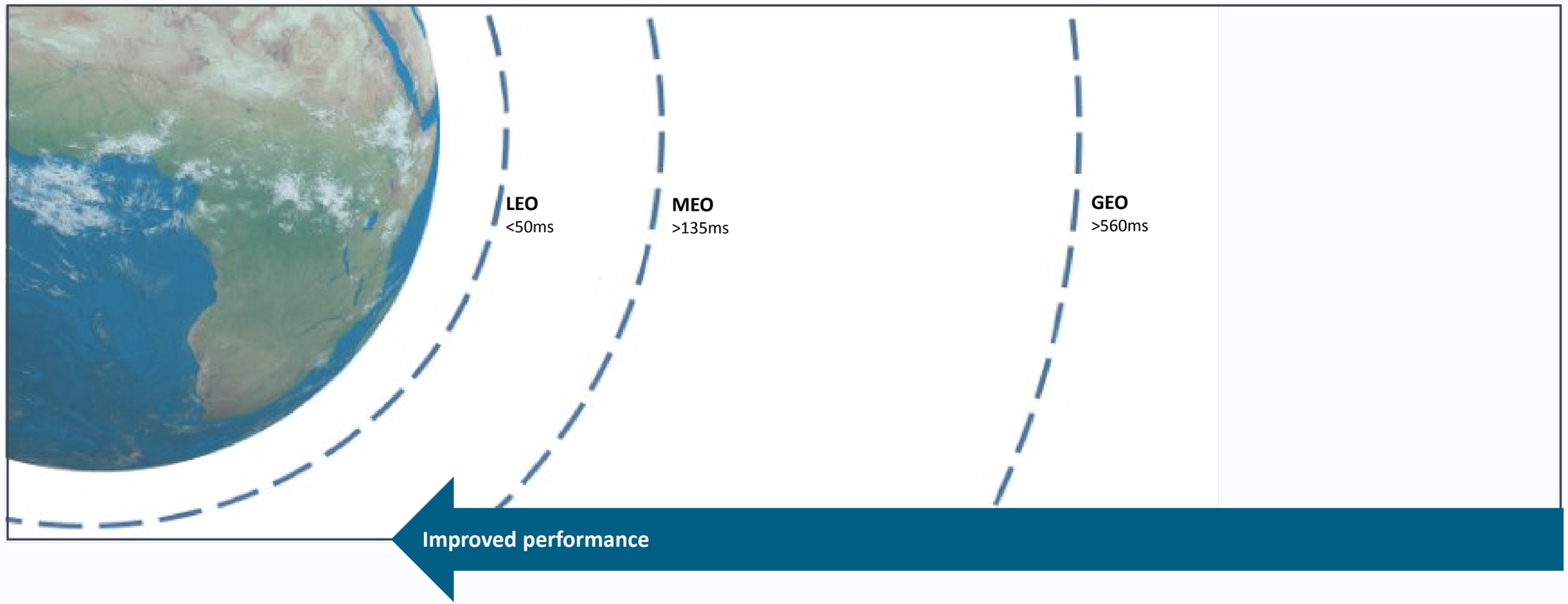
Improved performance in obstructed terrain

- Elevation (Look) angles > 50 degrees



Low Latency System (End-to-end 1/12th of GSO)

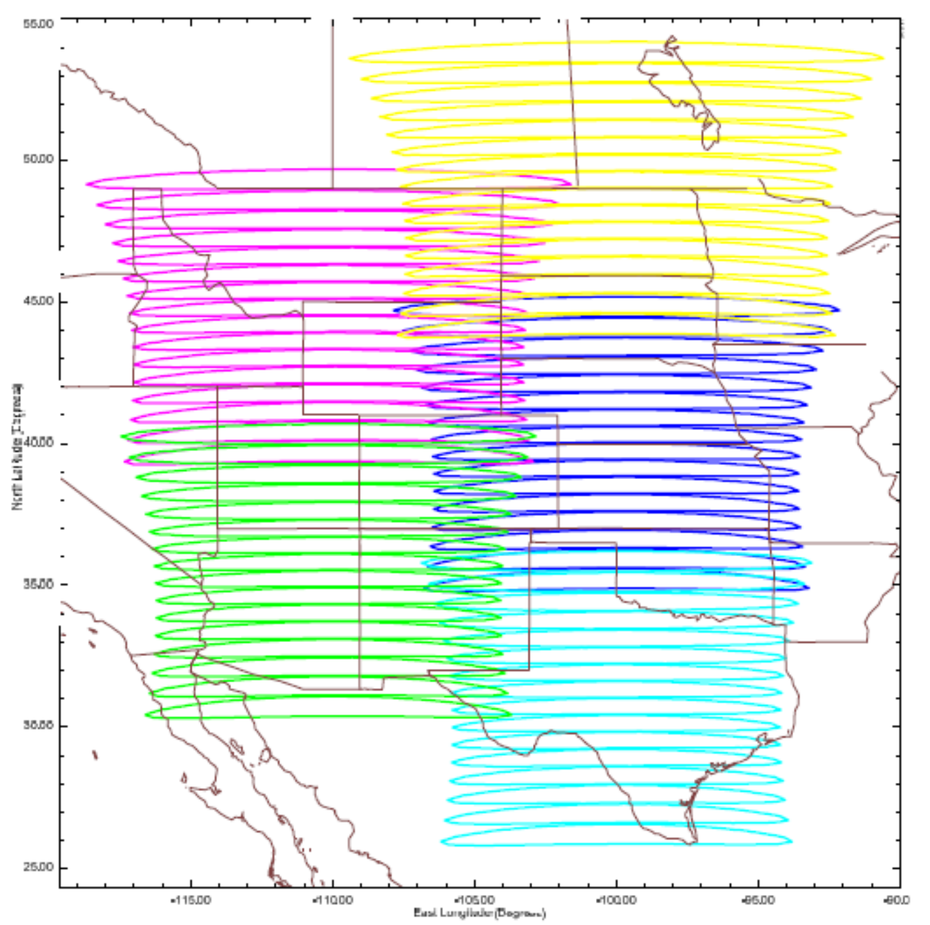
Low latency is the key to quality and cellular extension



[1] Federal Communications Commission; 2015 Measuring Broadband America, Fixed Broadband Report

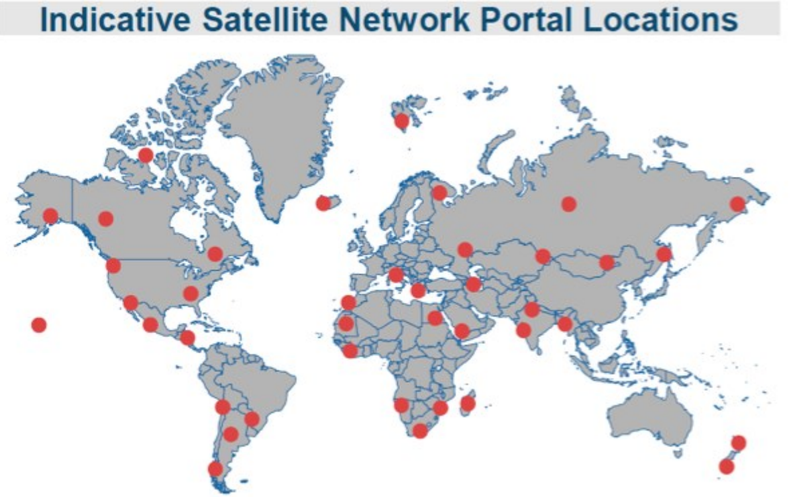
OneWeb Ku-Band Coverage

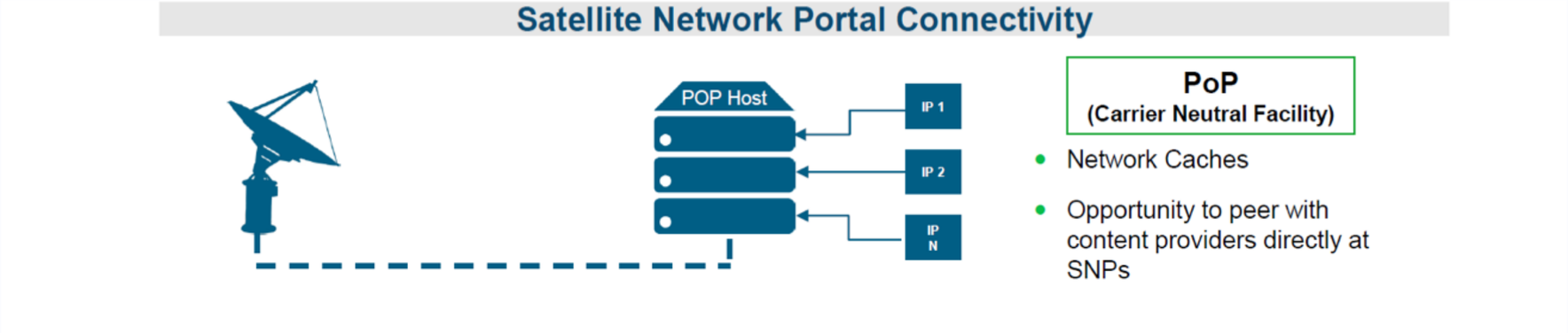
- User terminals operate in Ku-band: 14 GHz transmit and 11-12 GHz receive
- For Ku-band links, blanket global coverage (the exception is the area around equator due to GSO protection requirements until full capacity)
- Image shows overlapping coverage between satellites in same orbit plane (N-S) and satellites from adjacent orbits (E-W)
- The overlapping beams between adjacent satellites in the same plane are necessary to enable the progressive pitch



Gateway Overview – Satellite Network Portals

- The deployment plan has 50 to 60 Satellite Network Portals (SNPs), which provides coverage for OneWeb's operational area
- Site locations to be synchronized with regulatory considerations
- Leverage Hughes ground system design expertise





OneWeb as a Wholesale Provider

OneWeb will not compete with national ISPs and MNOs

- OneWeb will work with global and local ISPs and MNOs
- OneWeb provides a backhaul connectivity at the same quality that terrestrial networks
- OneWeb User Terminal provides ability to extend connectivity to rural and remote areas
- MNOs and ISPs:
  - will manage customer relations, including billing the customer (end user)
  - will provide installation of terminals, where required
  - will apply for the required national service licenses

Empowering Communities Without Access

Enterprise & Commercial Applications

- Satellite equipment (as an extension to WiFi/3G/LTE access)
- First responders
- Enterprise solutions
- Specialized and Mobile equipment

Cellular Backhaul

- Mobile network operators need to upgrade from 2G voice to 3G (higher speed data) to LTE (broadband)
- Eventually will need 5G – even more bandwidth
- What if the site does not have fiber or high-capacity microwave backhaul?
- Macro-site backhaul and integrated pico cells

First Responder Communications and Disaster Relief

Conclusions

- The dream of affordable Internet access for everyone is getting closer
- Universal connectivity is essential for economic development, environmental protection and inclusiveness
- Will serve unserved and underserved: remote communities anywhere on the planet
- Will also provide infrastructure for government services, forestry, mining industries, shipping and first responders which will all benefit from a secure, reliable connectivity option

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