O3b & mPOWER

Solution overview for Jamaica

Reimagine your success story

SES

SatMaster

LET US INTRODUCE OURSELVES

Who is O3b mPower and SES

Global infrastructure

54	**33**
GEO widebeam satellites	Orbital locations
3	**20**
GEO HTS satellites	MEO HTS satellites

Differentiated portfolio

Network coverage

In Orbit

In Orbit GEO HTS Satellite (High-throughput satellites)

Future Launch

Future GEO HTS Satellite (High-throughput satellites)

MEO HTS Satellite (Low latency, high throughput satellites)

Inclined

Expected orbital position

To be relocated

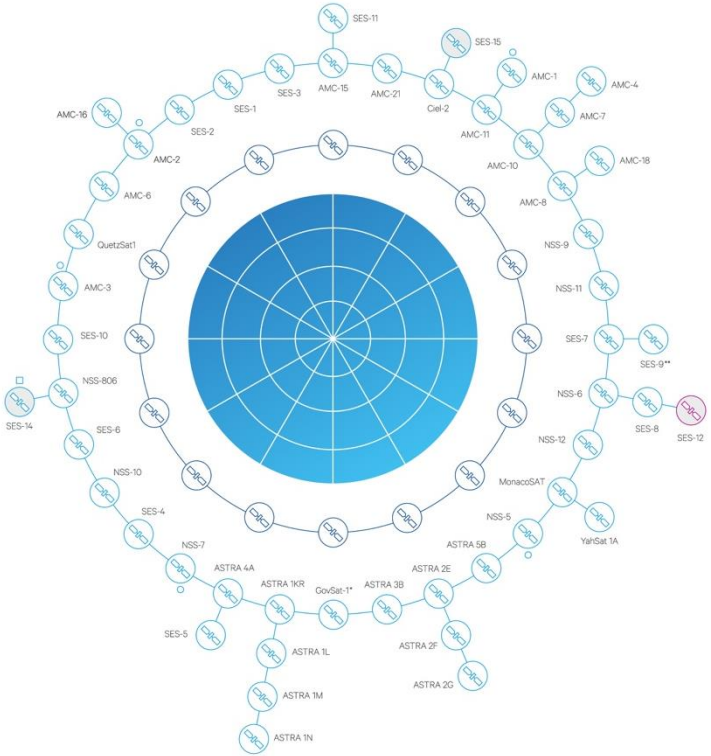
Geostationary Orbit (36,000km from Earth)

Medium Earth Orbit (8,000km from Earth)

Additionally, we have nine satellites flying secondary missions:
ASTRA 1D, ASTRA 1F, ASTRA 1G, ASTRA 1H, ASTRA 2A, ASTRA 2B, ASTRA 2C, ASTRA 2D, ASTRA 3A.

Fleet configuration is based on current planning and is subject to change.
SES holds a 70% interest in Ciel Satellite Limited Partnership and a 100% ownership interest in QuetzSat. Yahsat 1A's Ku-band payload is owned by YahLive, where SES holds a 35% ownership interest. MonacoSAT is a partner satellite with transponders onboard TurkmenAlem at 52°E.
SES-17 will be launched in 2020.

* Procured by LuxGovSat
** SES-9 at 108.2E vicinity



54
GEO satellites

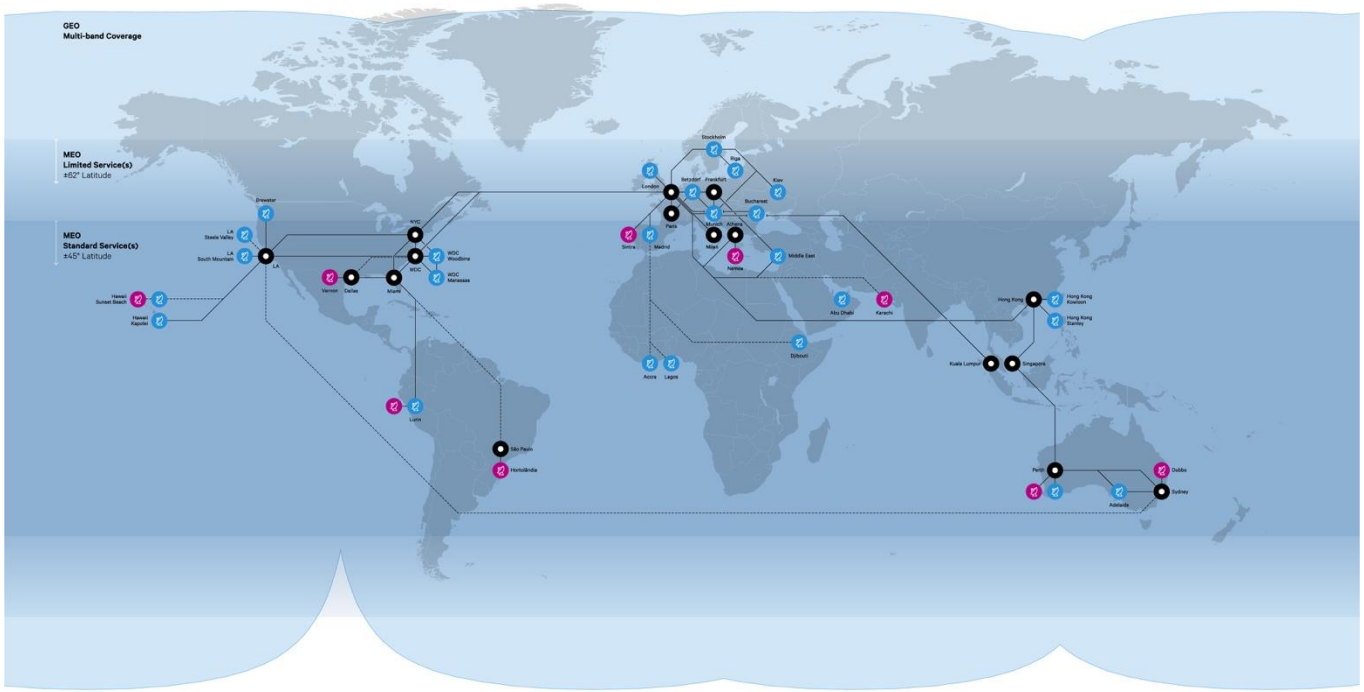
3
GEO HTS satellites

20
MEO satellites

99%
Global coverage

Differentiated portfolio

Network coverage



Industry-leading network performance:

- Throughput
- Latency
- Flexibility
- Availability

MEO gateway

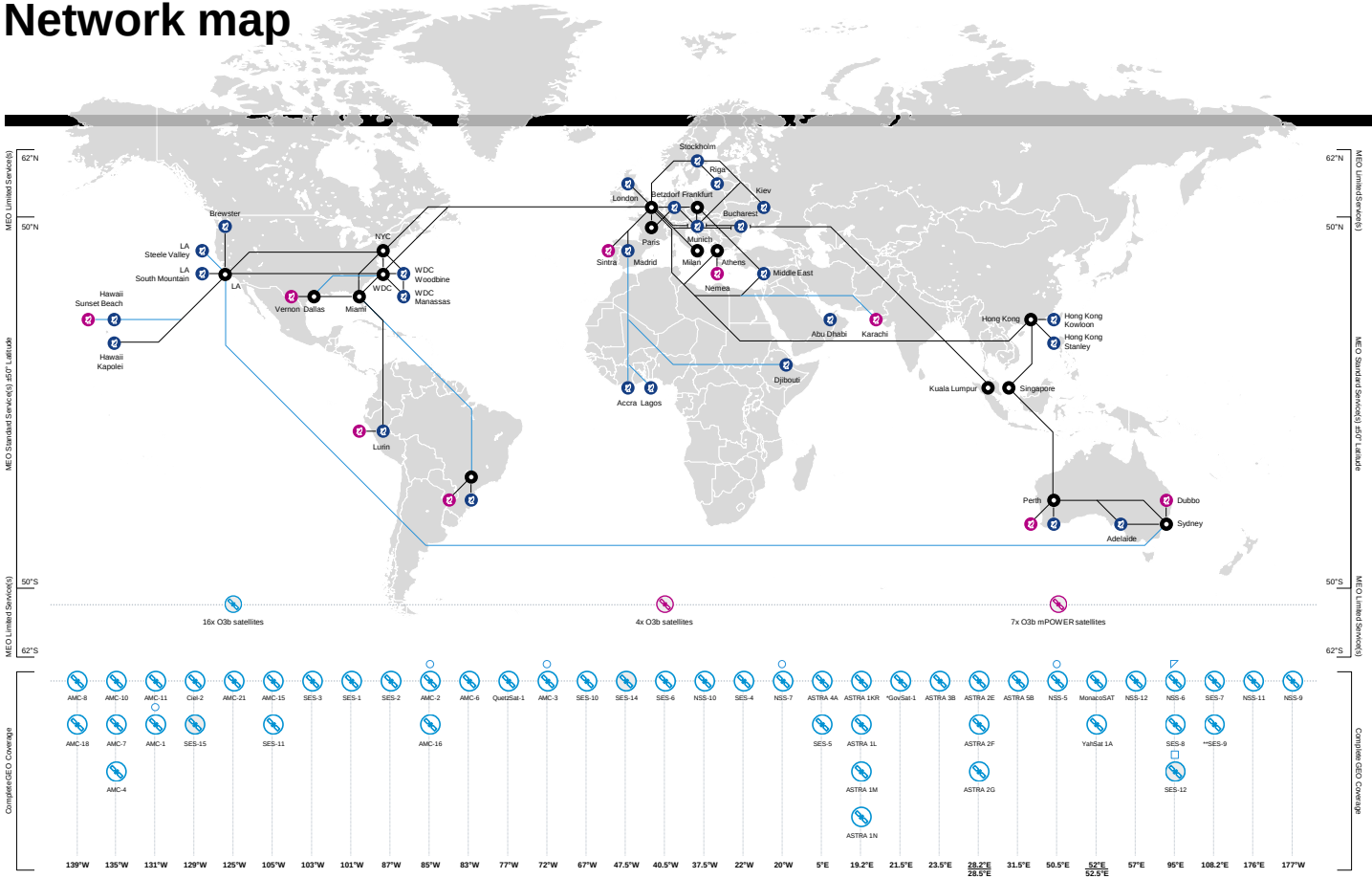
GEO gateway

Point of presence (POP)

Existing link

Future link

Network map



SES SATELLITE FLEET

- In orbit
- In orbit HTS satellite (High-throughput satellite)
- Future launch
- Future HTS satellite (High-throughput satellite)

SES NETWORK

- GEO Gateway
- MEO Gateway
- Point of presence (POP)
- Inclined
- Expected orbital position
- To be relocated
- Existing link
- Future link

What do we offer?

Global connectivity solutions to these industries

Telco/ISP

MNO

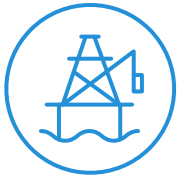
Cloud

Cruise/Maritime

Aero

Defence and Security

Civil Applications



Energy

With a unique MEO-GEO constellation

54
GEO widebeam

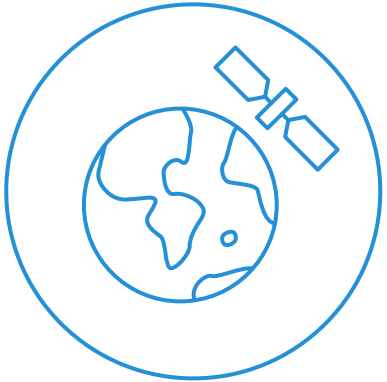
3
GEO HTS

20
MEO HTS

+

11
O3b mPOWER

One network offering differentiated capabilities delivering value to our customers' businesses & missions

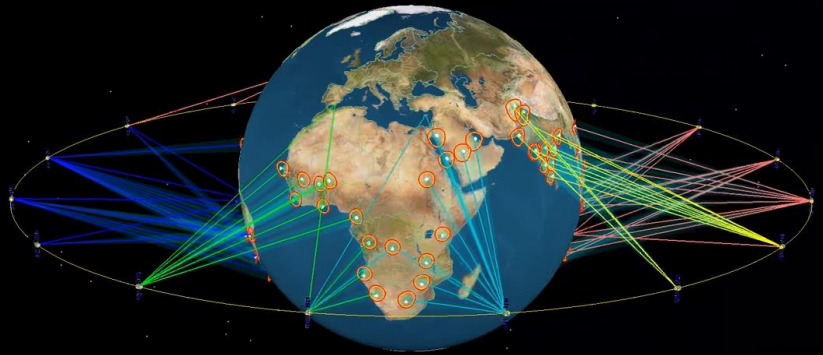


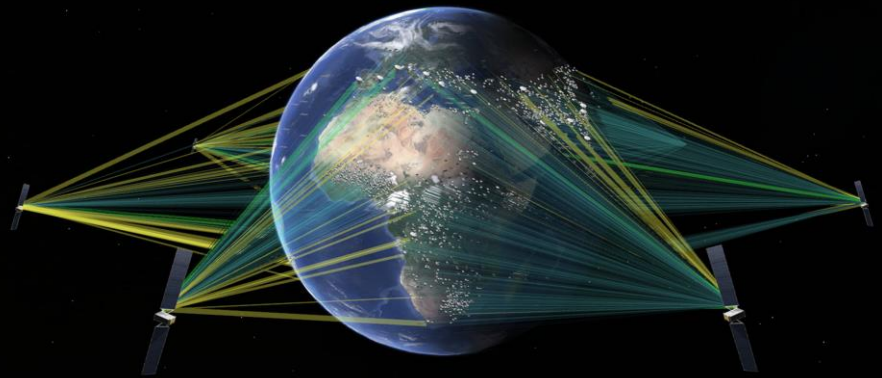
99%
global coverage

“Doubling down” on our MEO success

Path to O3b mPOWER

2014	2016	2018	2020	2022
O3b MEO start of service at 12 satellites	Mobility, Telco, Energy Government success	Scale O3b MEO to 20 total satellites	O3b mPOWER development	O3b mPOWER start of service



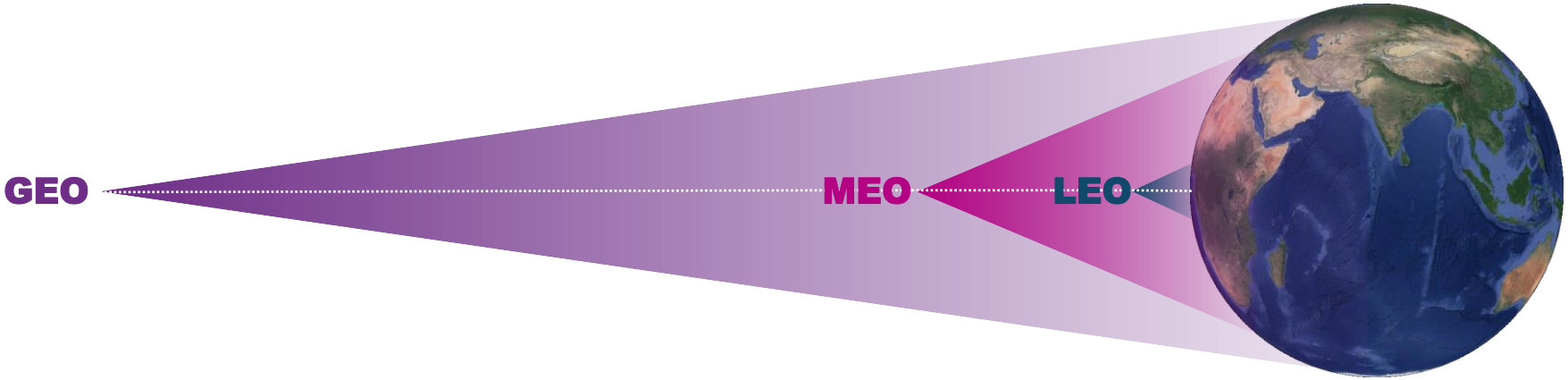


O3b mPOWER evolution
massive scale, performance, & flexibility

WHAT'S SO GREAT ABOUT MEO?

Fibre like Service above the Clouds

Comparing orbits



GEO – 36,000km	NGSO MEO ~ 8,000km	NGSO LEO ~ 1,000km
High latency (~700 msec)	Low latency (~150 msec)	Very low latency (~50 msec)*
Very large Earth view	Large Earth view	Small Earth view
Continental gateways (HTS for data)	Regional gateways (high throughput)	Many local gateways (low throughput)
Stationary antennas (3 satellites for global coverage)	1-hour tracking (6 satellites for coverage)	10-minute tracking (100's-1,000's needed for coverage)
100s Mbps per terminal	Multiple Gbps per terminal	100s Mbps per terminal

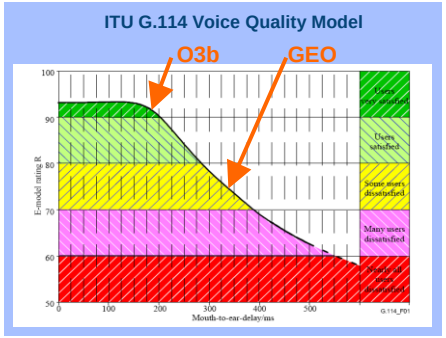
** Gateway distance, ISL & ground network dependent*

What SES Brings Today

On our MEO Constellation

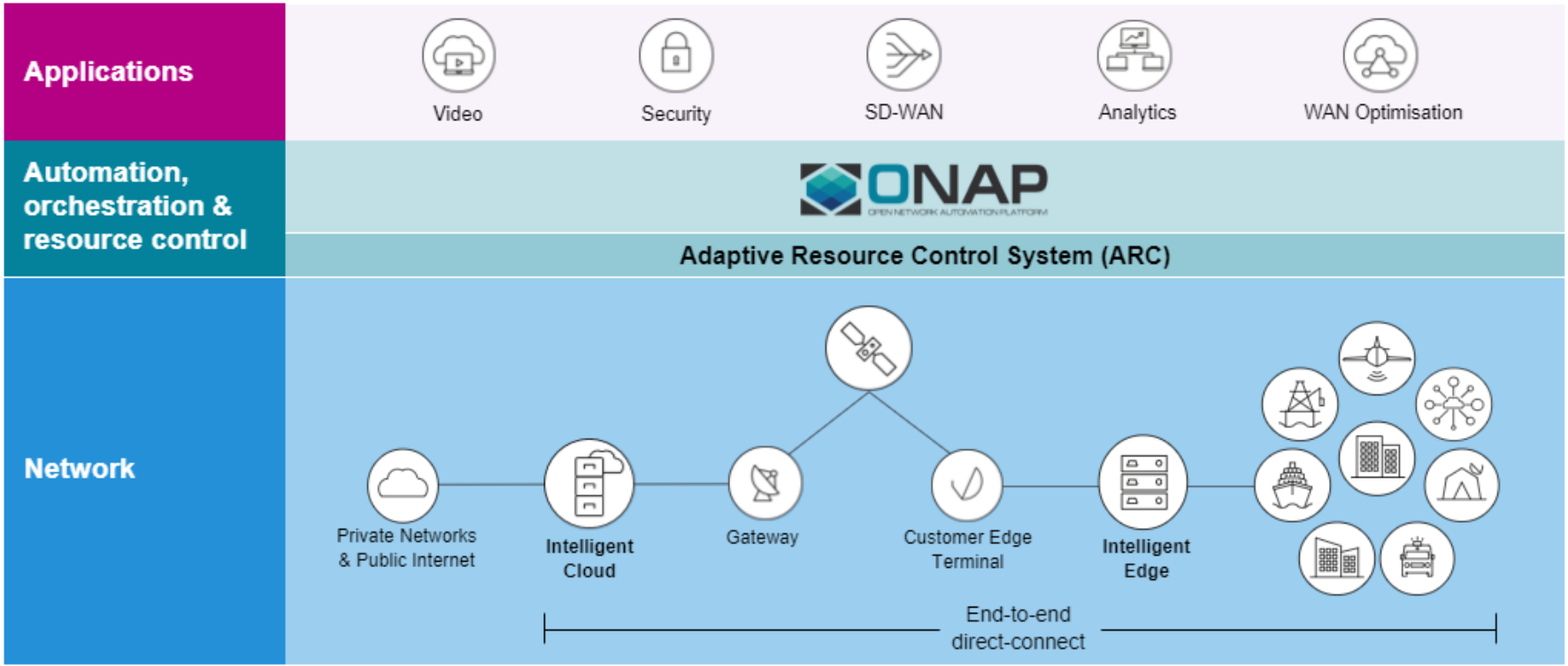
- Secure & Reliable –
  - Low Probability of Jamming, as assessed by the Office of Secretary of Defense, Joint Vulnerability Assessment Branch
  - Encryption Assessment by SOCOM, US Navy, CODA Lab & USMC SATCOM Lab
- Low latency, guarantee 150ms or less Roundtrip
- High throughput, up to 2 Gbps to a single terminal
  - 1.2 Gbps to a 2.4m terminal
- Carrier grade quality which enables and optimize video, voice, data and applications
  - Meets Metro Ethernet Compliant (MEF) International carrier standard
  - Meets International Telecommunications Union at the highest level, under ITU G. 114 Voice Quality Model
- Beam Mobility by user, Secure beam mobility without O3b interaction

CE 2.0 MEF CERTIFIED



These attributes enhance government's ability to operate and response with disparate forces to work together to communicate and synchronize their efforts

ARC works with ONAP to optimise network resources for Virtualised Network Functions and Applications



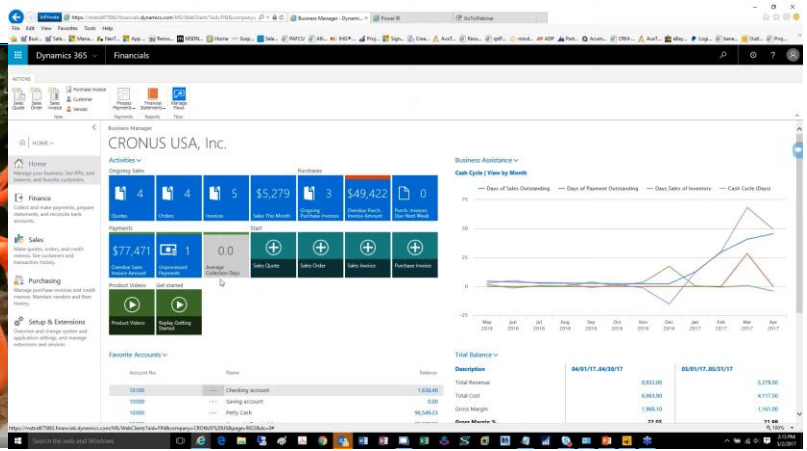
Latency impacts on applications

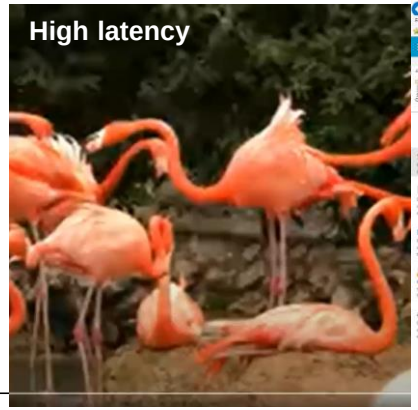
Latency is the measure of delay or responsiveness

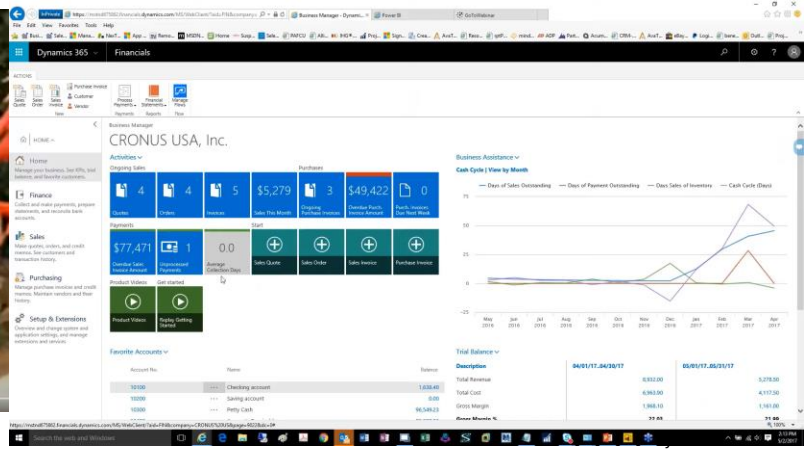
- Latency impacts throughput
- Audio/video quality

- Stick to screen
- Intolerable to humans
- Timeouts and restarts

- TCP/IP is an ACK protocol
- IoT, M2M is synchronous
- Cloud QoE <= 300msec



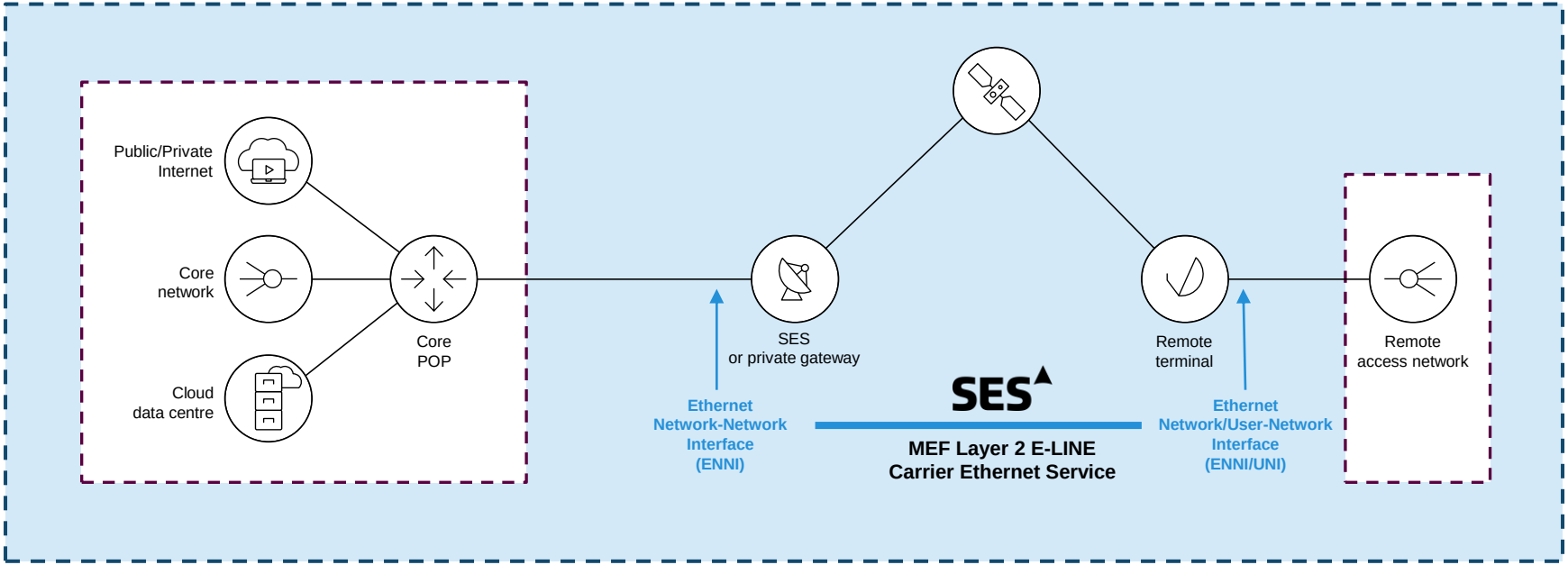




WHAT'S SO GREAT ABOUT O3b mPOWER?

A managed service solution

Simple E-LINE managed data service with Service Level Agreement (CIR, latency, availability)



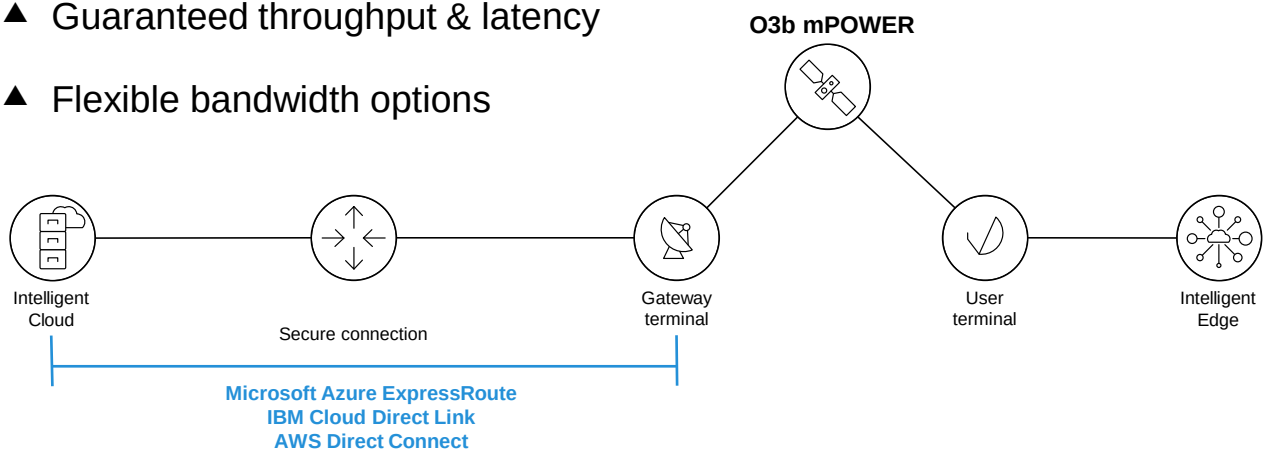
CLOUD ANYWHERE

EXTEND CLOUD SERVICES WITH FIBRE-LIKE PERFORMANCE

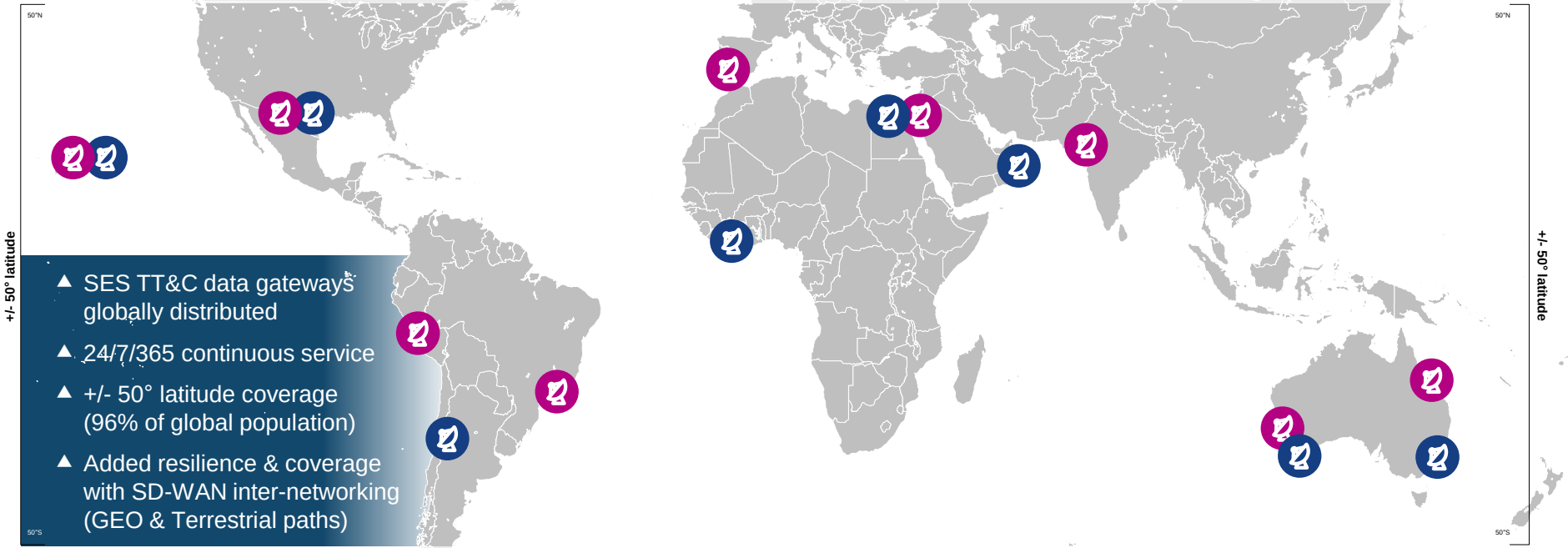
HYBRID AND PRIVATE CLOUD

FULLY MANAGED SOLUTION

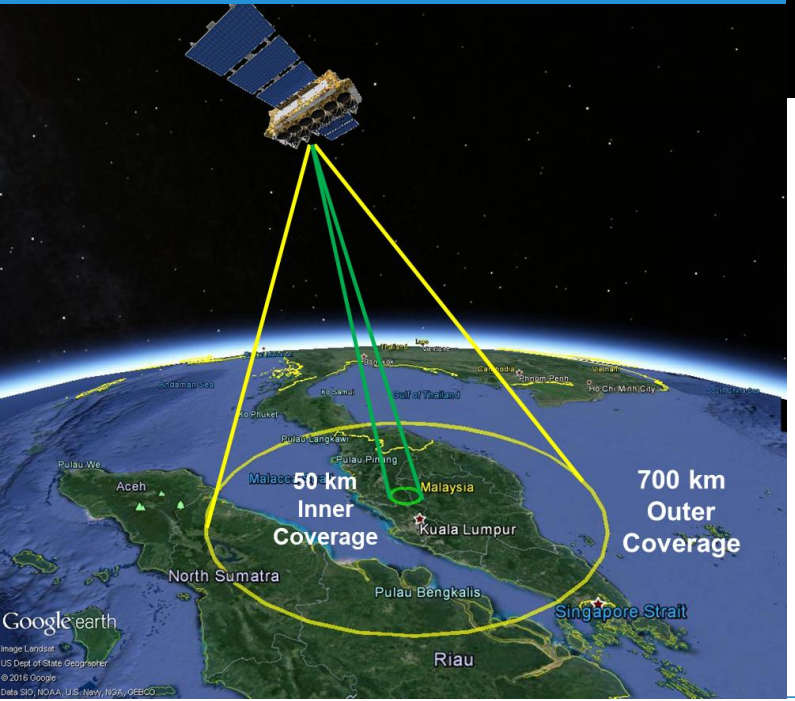
- Direct connection to cloud infrastructure
- Guaranteed throughput & latency
- Flexible bandwidth options

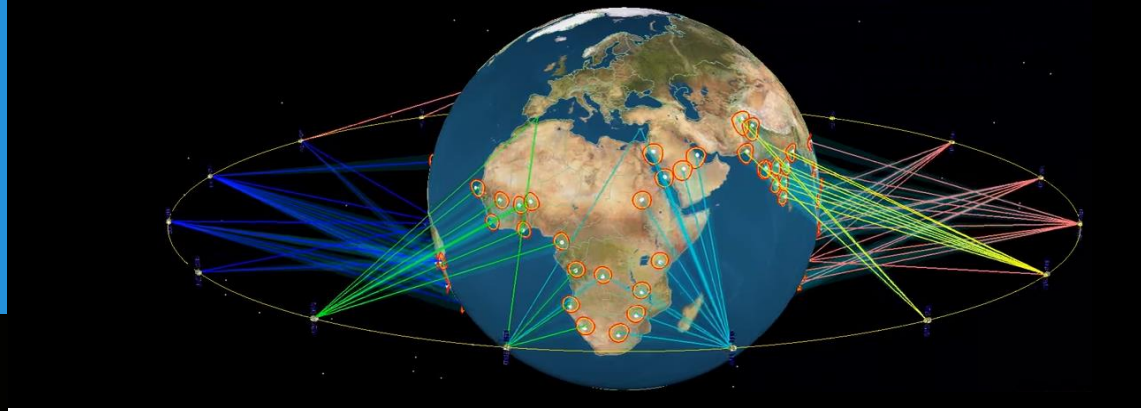


O3b & O3b mPOWER coverage map



O3b MEO TODAY

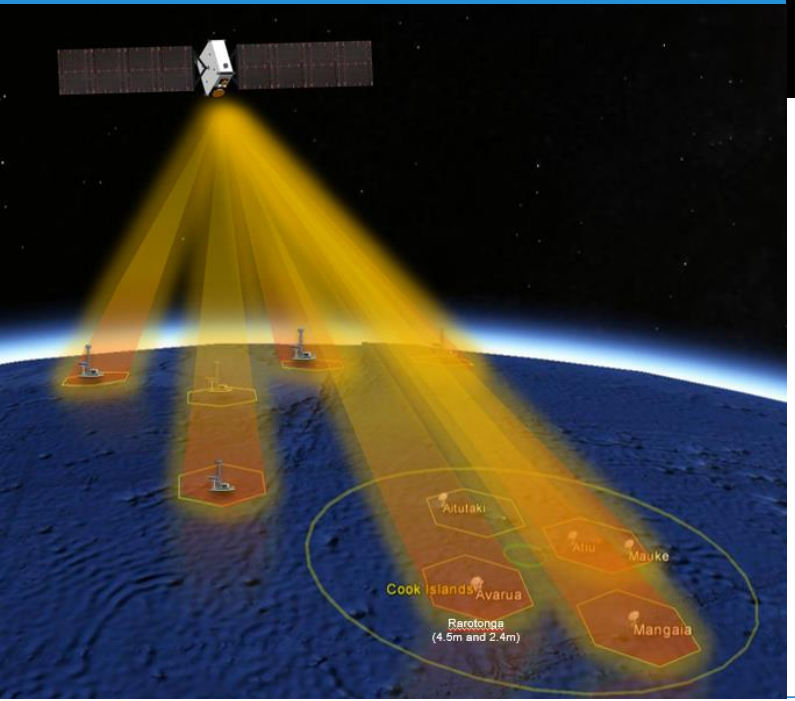


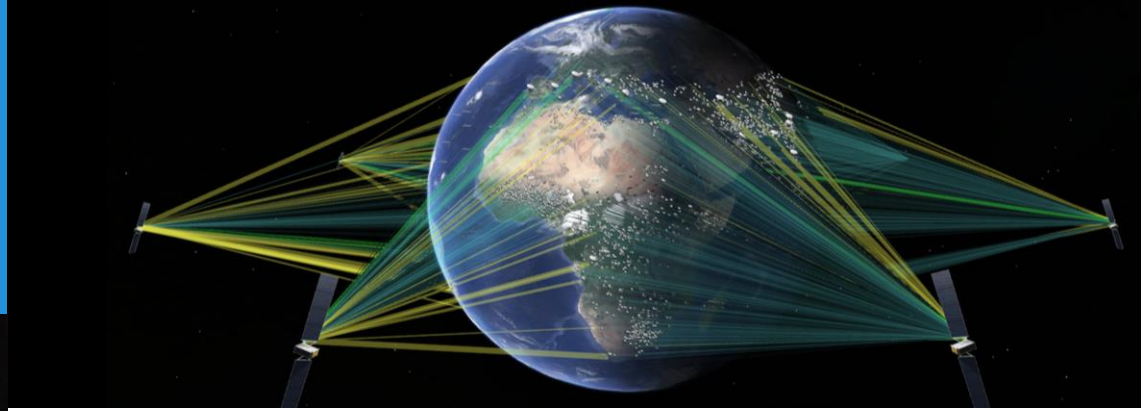


CAPABILITIES

- MEO low latency (~150msec)
- 20-satellite constellation
- 10 x 700km beams per satellite
- Up to 1.6Gbps per beam throughput
- SES TT&C/data gateways interlinked globally
- Sell now, plan for O3b mPOWER if qualified

O3b mPOWER





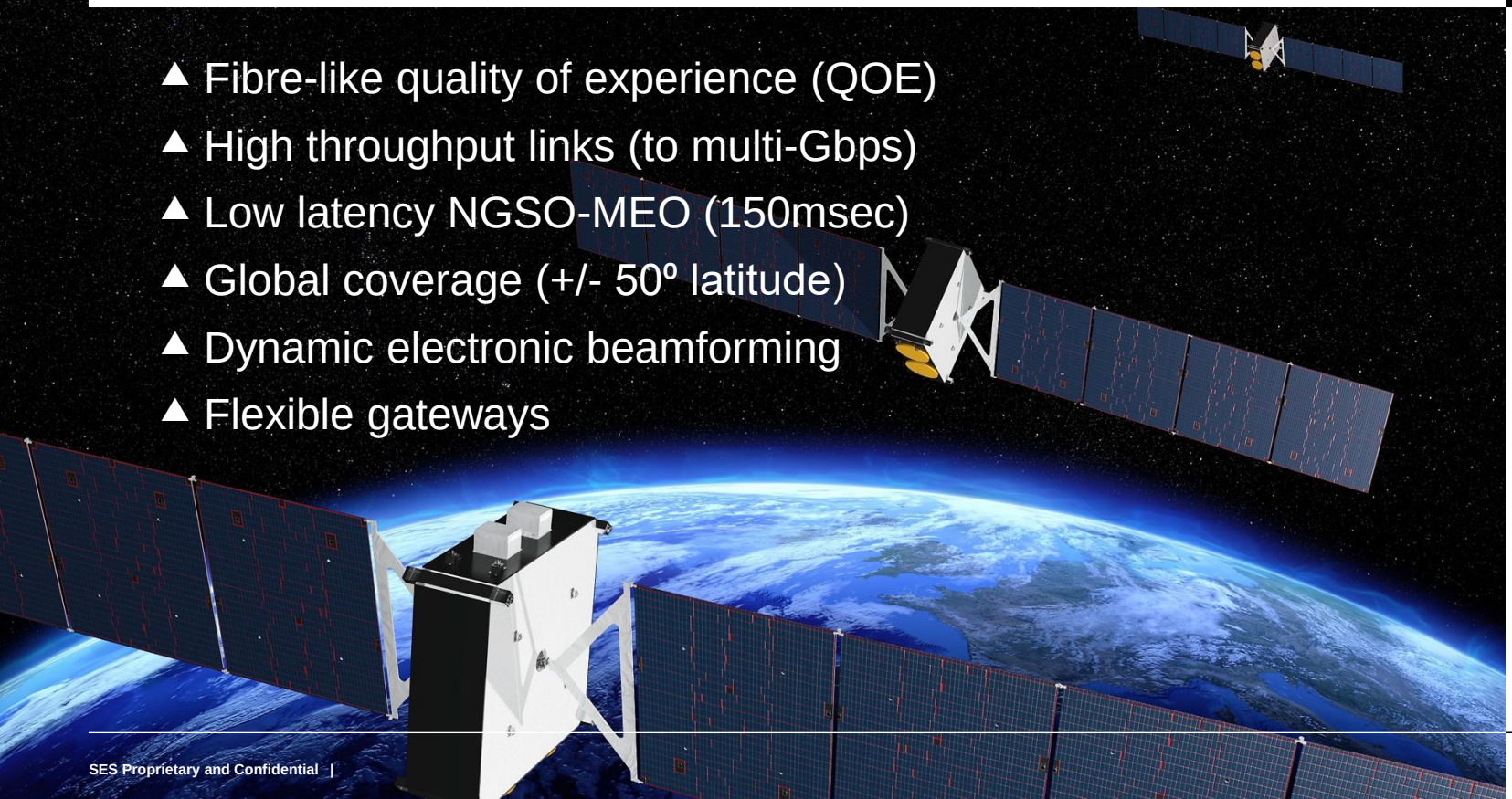
CAPABILITIES

- Same MEO low latency & reach
- 11-satellite constellation
- Up to thousands of 250Km beams per satellite
- From 50Mbps to 10Gbps per beam/site
- Flexible data gateways
- Position & commit now for 2022 start of service

O3b mPOWER

Satellite innovations

- Fibre-like quality of experience (QOE)
- High throughput links (to multi-Gbps)
- Low latency NGSO-MEO (150msec)
- Global coverage (+/- 50º latitude)
- Dynamic electronic beamforming
- Flexible gateways



O3b mPOWER

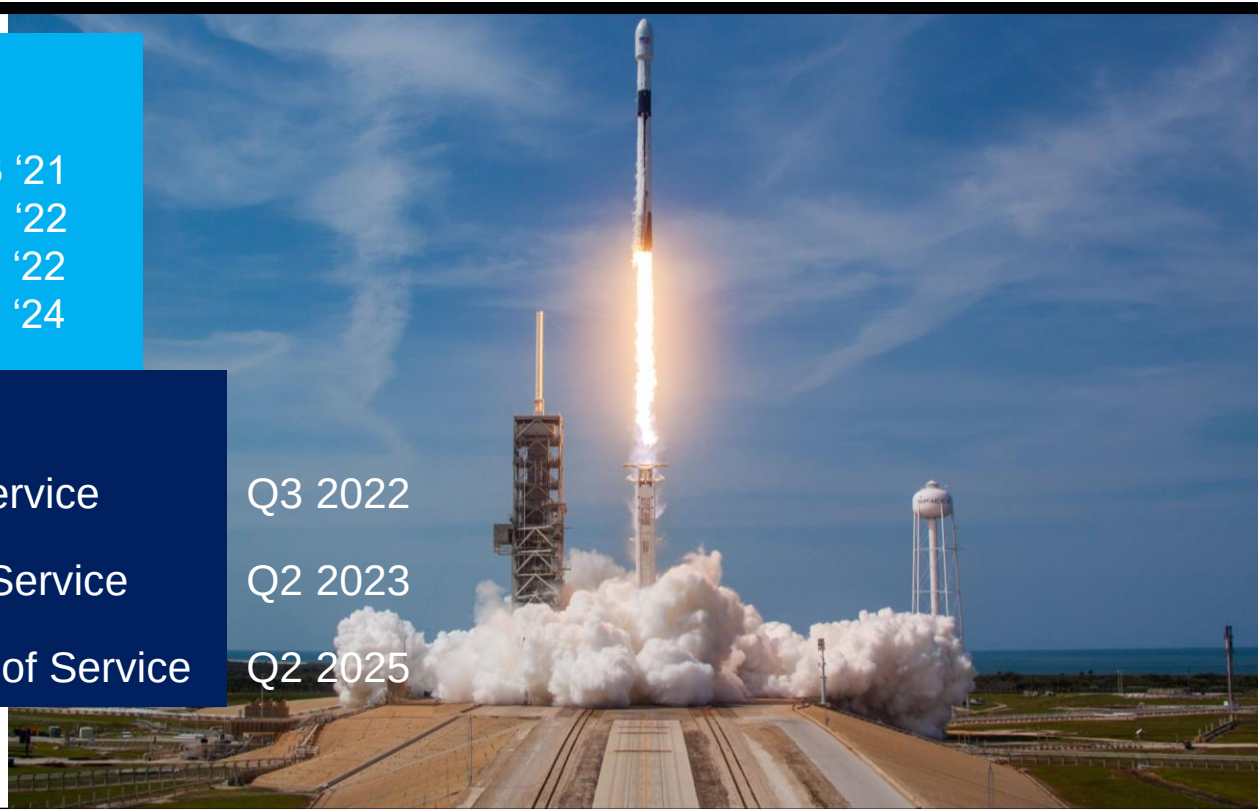
Deployment schedule

LAUNCH
SpaceX Falcon 9

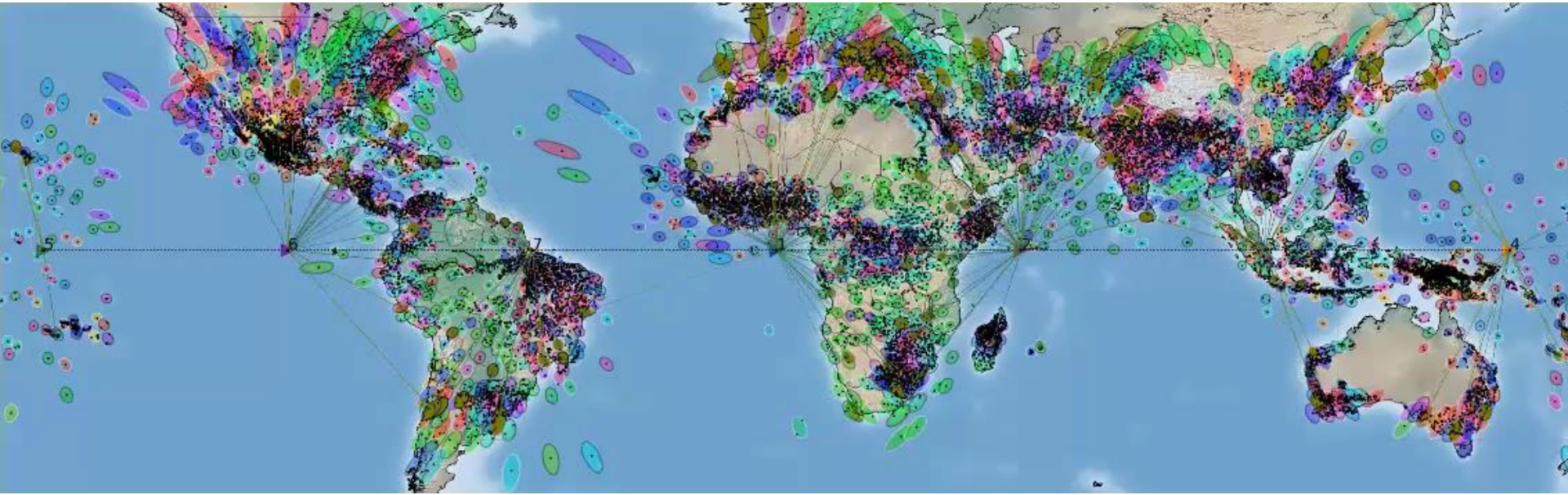
O3b mPOWER	1-3	Q3 ‘21
O3b mPOWER	4-6	Q1 ‘22
O3b mPOWER	7-9	H2 ‘22
O3b mPOWER	10-11	H2 ‘24

START of SERVICE

Six (6) Satellites - Start of Service	Q3 2022
Nine (9) Satellites - Start of Service	Q2 2023
Eleven (11) Satellites - Start of Service	Q2 2025



Satellites in action



- Continuous coverage (make before break)
- Electronically formed beams
- Frequency reuse (for non-overlapping beams)
- Automated power utilization
- Intelligent software control

Gateways and terminals

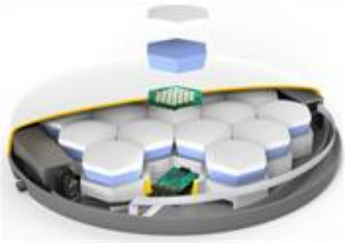
Ground infrastructure is key

OPEN INTELLIGENT GATEWAYS, MODEMS & ANTENNAS

INDUSTRY STANDARDS

MOBILE FLEXIBILITY

NEW ESA TECHNOLOGIES



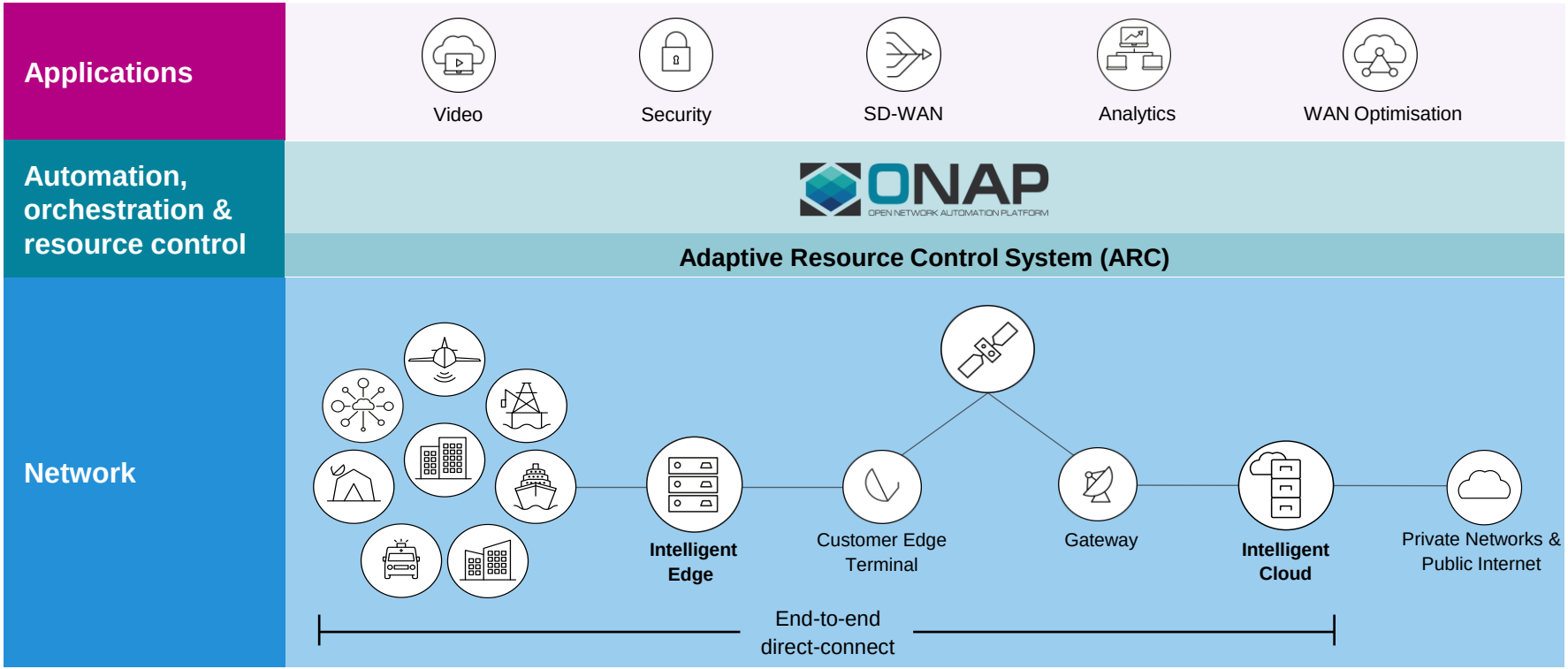
O3b mPOWER
Ground systems and user terminals

SES

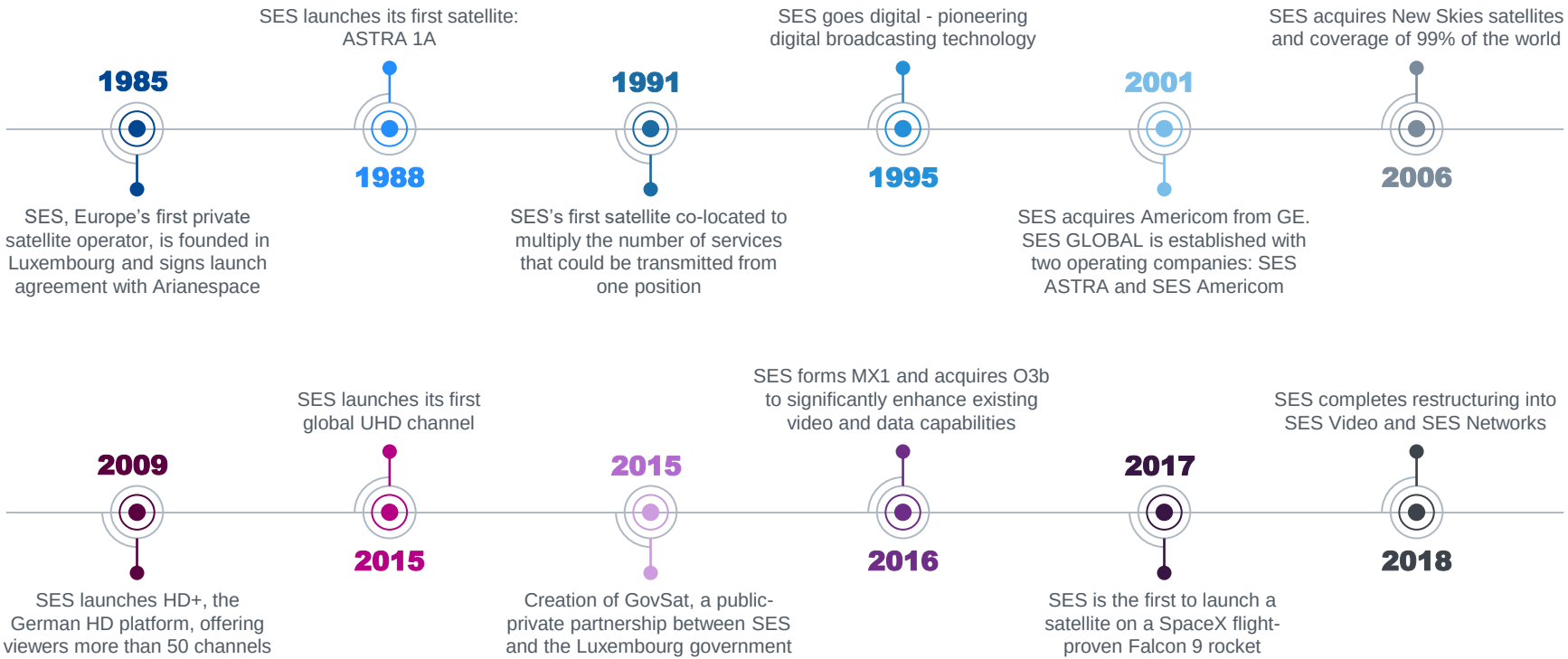
- SES managed and/or private data gateways
- Open intelligent gateways, modems & antennas
- Advancing technologies (small, flat panel)
- High power, spectrum, bandwidth

Software control and integration

Cloud-optimized, seamless, resilient, & secure



History

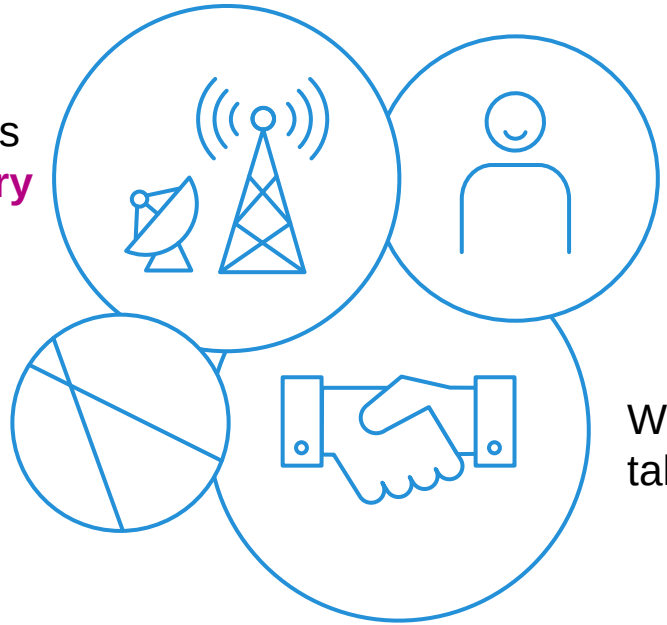

1985
SES, Europe's first private satellite operator, is founded in Luxembourg and signs launch agreement with Arianespace
1988
SES launches its first satellite: ASTRA 1A
1991
SES's first satellite co-located to multiply the number of services that could be transmitted from one position
1995
SES goes digital - pioneering digital broadcasting technology
2001
SES acquires Americom from GE. SES GLOBAL is established with two operating companies: SES ASTRA and SES Americom
2006
SES acquires New Skies satellites and coverage of 99% of the world
2009
SES launches HD+, the German HD platform, offering viewers more than 50 channels
2015
SES launches its first global UHD channel
2015
Creation of GovSat, a public-private partnership between SES and the Luxembourg government
2016
SES forms MX1 and acquires O3b to significantly enhance existing video and data capabilities
2017
SES is the first to launch a satellite on a SpaceX flight-proven Falcon 9 rocket
2018
SES completes restructuring into SES Video and SES Networks

Our purpose

We do the extraordinary in space to deliver amazing experiences everywhere on Earth

What we do is **extraordinary**

We are obsessed with **customer success**



We are here to **make a difference**

We use our team and talent to **give back**

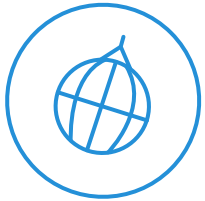
What we do

Global content connectivity solutions

We broadcast over 8,200 TV channels that reach **over 1 billion people**

We connect over 300 customers in **130 countries** and planes, ships, oil rigs

We deliver HD & Ultra HD content to **any platform**, on **any device**



We help **restore connectivity** after natural disasters

We champion SpaceX **reusable rocket technology**

We support telcos with their 4G roll-outs and **connecting remote areas**

The company we keep

Solutions to meet the needs of a wide range of customers

A unique combination

The only MEO-GEO constellation

54
GEO widebeam

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Technology roadmap

An Intergraed Approach