EUTELSAT,
SATCOM AND EMERGENCY SERVICE COMMUNICATION NEEDS

PSCE Conference, Paris, December 2019

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AGENDA

Mark RAWLINS
- → **Who is and what is Eutelsat**
- → **Types of Satellite Services**
- → **Business Sectors**
- → **Satellite flavours**
  - → **High throughput**
  - → **Flexible**
  - → **IoT**

Ali BELMAACHI
- → **New applications, New Communication Needs**
- → **A Complex Ecosystem**
- → **PMR & Tactical Bubbles**
- → **RPAS**
- → **IoT**

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Mark RAWLINS

A KEY PLAYER IN THE SPACE BUSINESS

PIONEER IN SPACE

40 **YEARS**
OF EXPERIENCE

37 **SATELLITES**
FOR GLOBAL COVERAGE

SOLID INVESTMENT PROGRAMME

6 **SATELLITES**
TO LAUNCH

IN THE 70'S

▮ Wide European effort to achieve independence in the space sector

→ Establishment of the European Space Agency (ESA) in 1973

→ Decision to implement the Ariane launcher program the same year

→ Creation of a regional telecommunications satellite system, EUTELSAT, in 1977 (interim status, definitive EUTELSAT established in 1985)

▮ Objectives of the founders

→ Meet Europe's requirements for satcoms

→ Active participation in the growth and development of the European space industry by procurement and launch of satellites in series, using technologies developed in Europe

▮ First EUTELSAT satellite launched in 1983
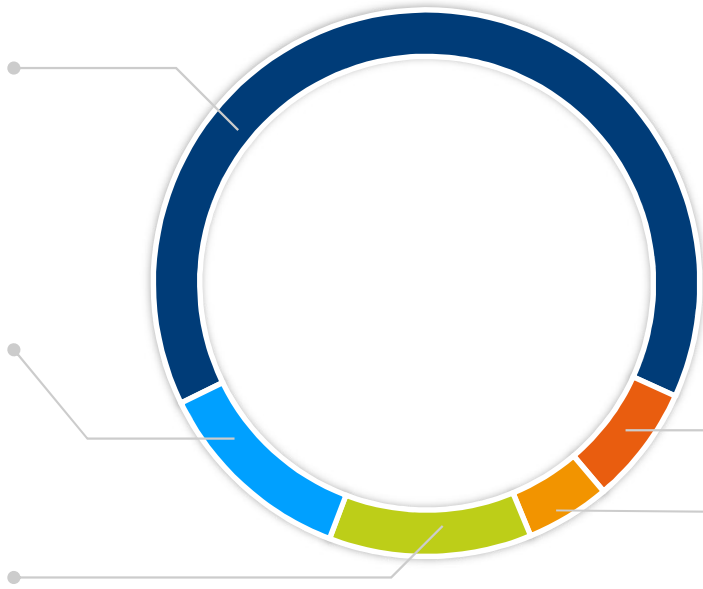
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SERVICES DRIVING DIGITAL GROWTH

CORE BUSINESS

66% VIDEO

10% FIXED DATA

12% GOVERNMENT SERVICES

CONNECTIVITY

6% FIXED BROADBAND

6% MOBILE CONNECTIVITY

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CONNECTIVITY WITH NO LIMITS

IP BACKBONE CONNECTIVITY

OFFSHORE CORPORATE CONNECTIVITY

MARITIME CONNECTIVITY

BROADBAND CONNECTIVITY, LIVE TV

HEADEND (CABLE, IP) DELIVERY

DIGITAL TERRESTRIAL TV

MOBILE BACKHAUL

DISASTER RECOVERY AND HUMANITARIAN NGO INTERVENTIONS

GOVERNMENT, MILITARY AND CIVIL COMMUNICATIONS

NEWS-GATHERING

DIRECT-TO-HOME (TV, BROADBAND)

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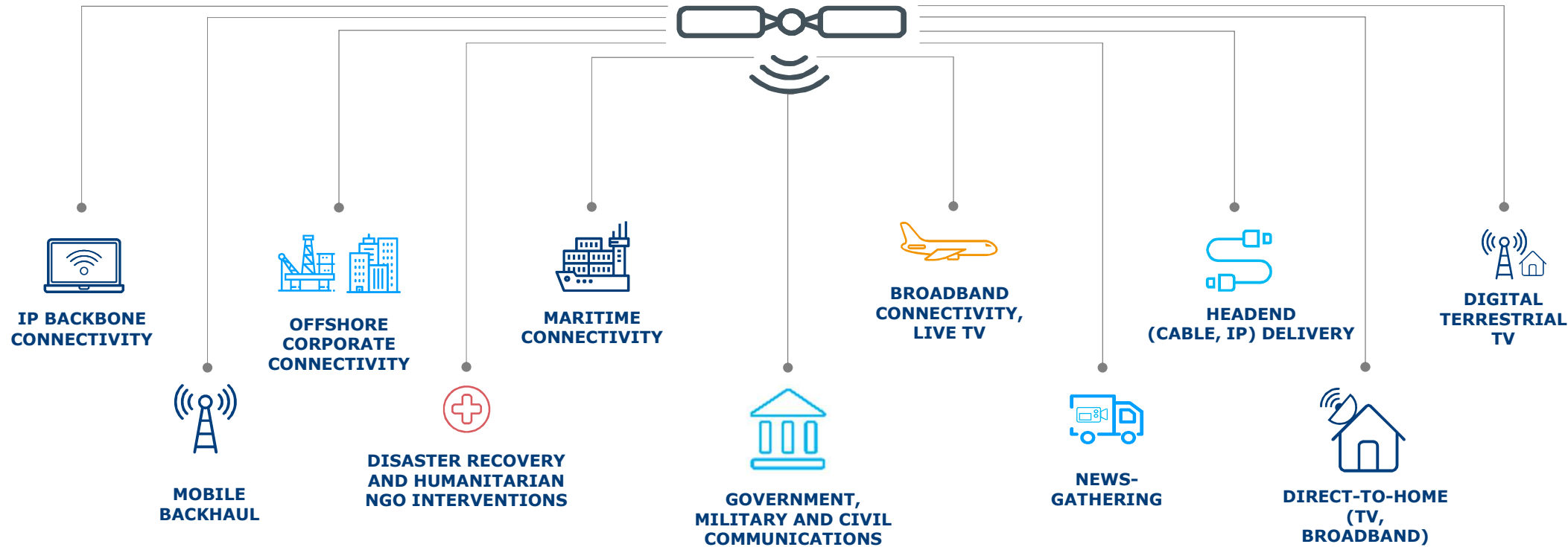
HOW SATELLITE CAN HELP YOU ADDRESS YOUR STAKES?

❶

Satellite can cover **100% of unaddressed areas,** and **100% of population**

❷

Economically much more flexible and efficient
than extending a fiber or 4G network in unserved and underserved areas

❸

Instant coverage and availability
from 2020

❹

Help you **seize all business opportunities** with minimal development and **extend your value proposition**

SATELLITES DELIVER OUTSTANDING PERFORMANCES

Optimised throughput

More efficient initial design allowing higher throughput over regions with higher broadband satellite demand
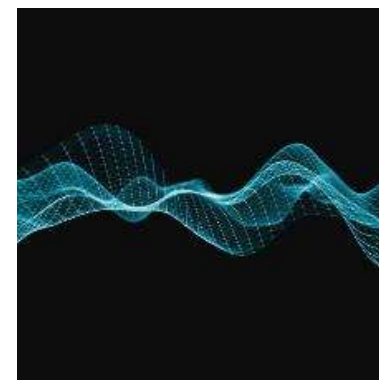
Wider coverage

Including over maritime and low density land, for B2B services to industry verticals, and for maritime and aero broadband

Higher capacity

Higher overall capacity provided by the satellite and higher capacity available over a given country or region, permitting operations at scale

Increased flexibility

Ability to allocate dynamically more capacity to region where and when the demand is higher

Broadband and high data rate connectivity by Satellite

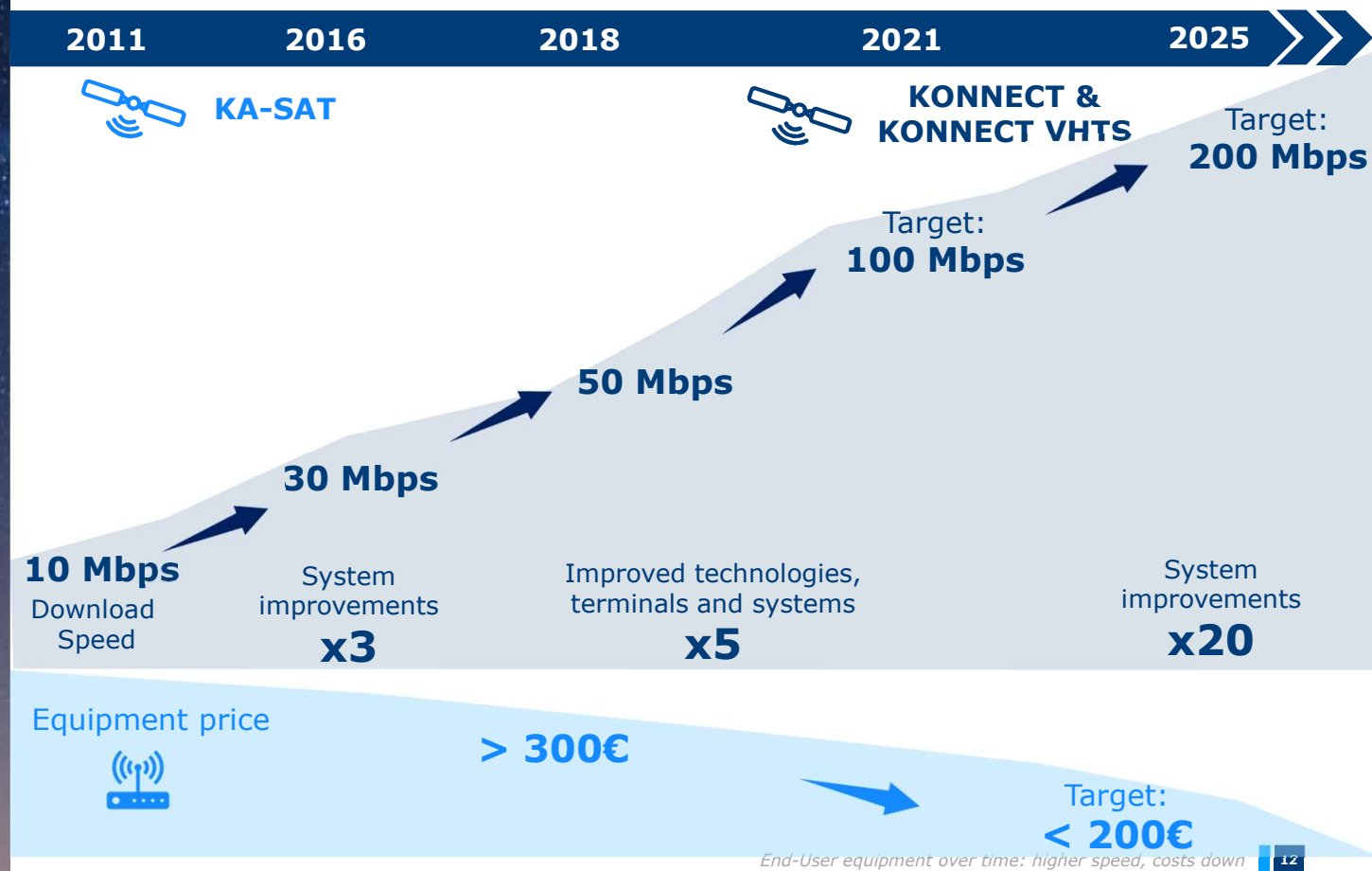# SATELLITES MEETING EMERGENCY RESPONDER COMMUNICATION NEEDS

Civil, Military & Crisis Management CONOPS continuously evolving

→ Different locations calling for fast deployable terminals, vehicles and support

→ Different scenarios, fire, flood, civil unrest, terrorist, major events...

→ New operational requirements with 'just in time operations' (UOR: Urgent Operational Requirements)

→ Mix of requirements in terms of throughput, conditional access, confidentiality per application (VoIP, VTC, SD & HD Video, Data)

Need for a multi-tiered system approach

→ Resilience only through diverse systems to efficiently all environments and conditions

→ Diversity of communication resources will provide increased operational agility and responsiveness

→ International partnerships and industry cooperation shall be consolidated at system level to provide bespoke interoperability

END-USER EXPERIENCE - HIGHER SPEEDS, LOWER COSTS

End-User equipment over time: higher speed, costs down

2011   **2016**   **2018**   **2021**   **2025**

KA-SAT

KONNECT & KONNECT VHTS

Target: **200 Mbps**

Target: **100 Mbps**

50 Mbps

30 Mbps

10 Mbps
Download Speed

System improvements **x3**

Improved technologies, terminals and systems **x5**

System improvements **x20**

Equipment price

> 300€

Target: **< 200€**

EVOLVING SATELLITES TO INCREASE BROADBAND CAPACITY

	KA-SAT	KONNECT	KONNECT VHTS
Launch	2010	2019	2021
Capacity*	90 Gbps	75 Gbps	500 Gbps
Flexibility	Limited flexibility	Enhanced flexibility	Full flexibility
Effective cost per Gbps		Divided by ~2 as compared to KA-SAT	Divided by ~4-5 as compared to KA-SAT
Coverage	Europe & MENA	Western Europe & Africa	Extended Europe & MENA

*Capacity figures : forward + return

An ambitious ka-band fleet delivering increasing Broadband capacity **13**

HIGH BANDWIDTH INTERNET CONNECTIVITY ACROSS EUROPE

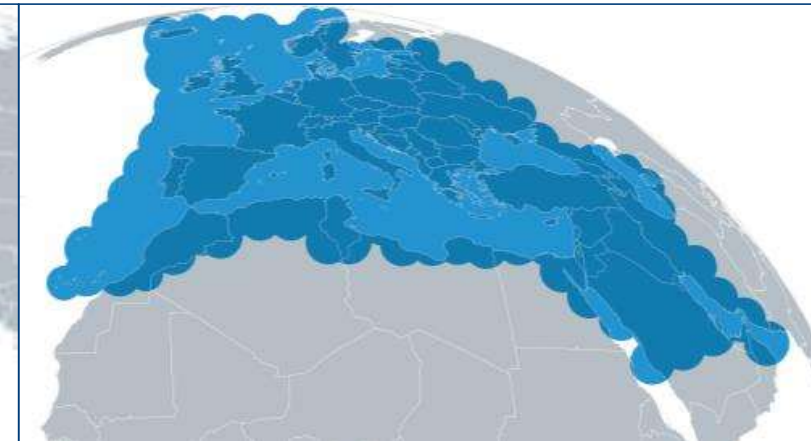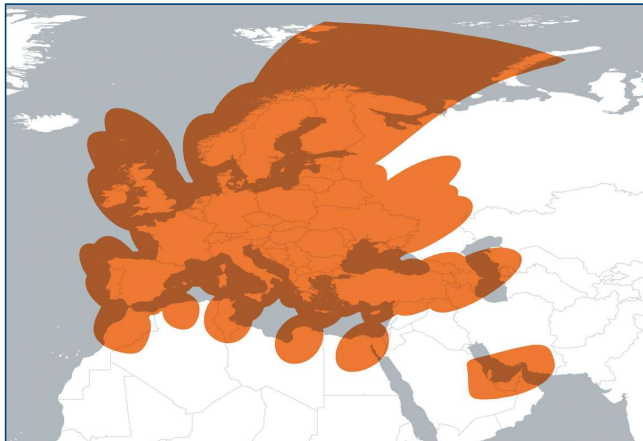| 10Mb/s	KONNECT	100Mb/s
2011	**2020**	**2022**
KaSat	**KONNECT**	**KONNECT VHTS**
30 countries covered over Europe and beyond	**15+ countries covered over Western Europe**	**Up to 60 countries covered over extended Europe & MENA**

The first HTS System in Europe providing cost effective Internet to **homes, businesses, civil users**, and **aviation**.

Complementing and improving the services already delivered on KaSat

Enhanced **coverage of coasts, seas** and **major aero routes**, enabling connectivity and **service continuity** for mobility applications**.**
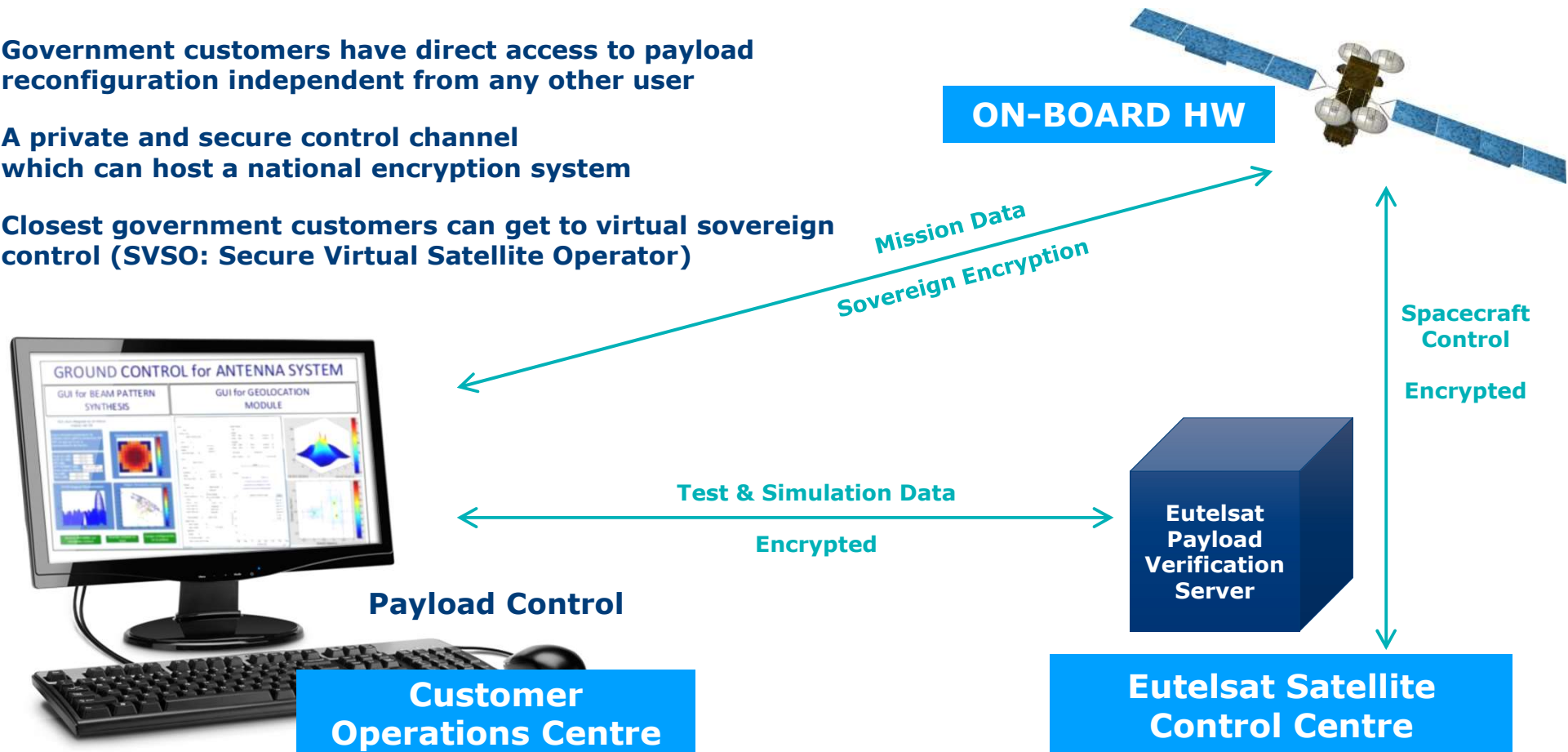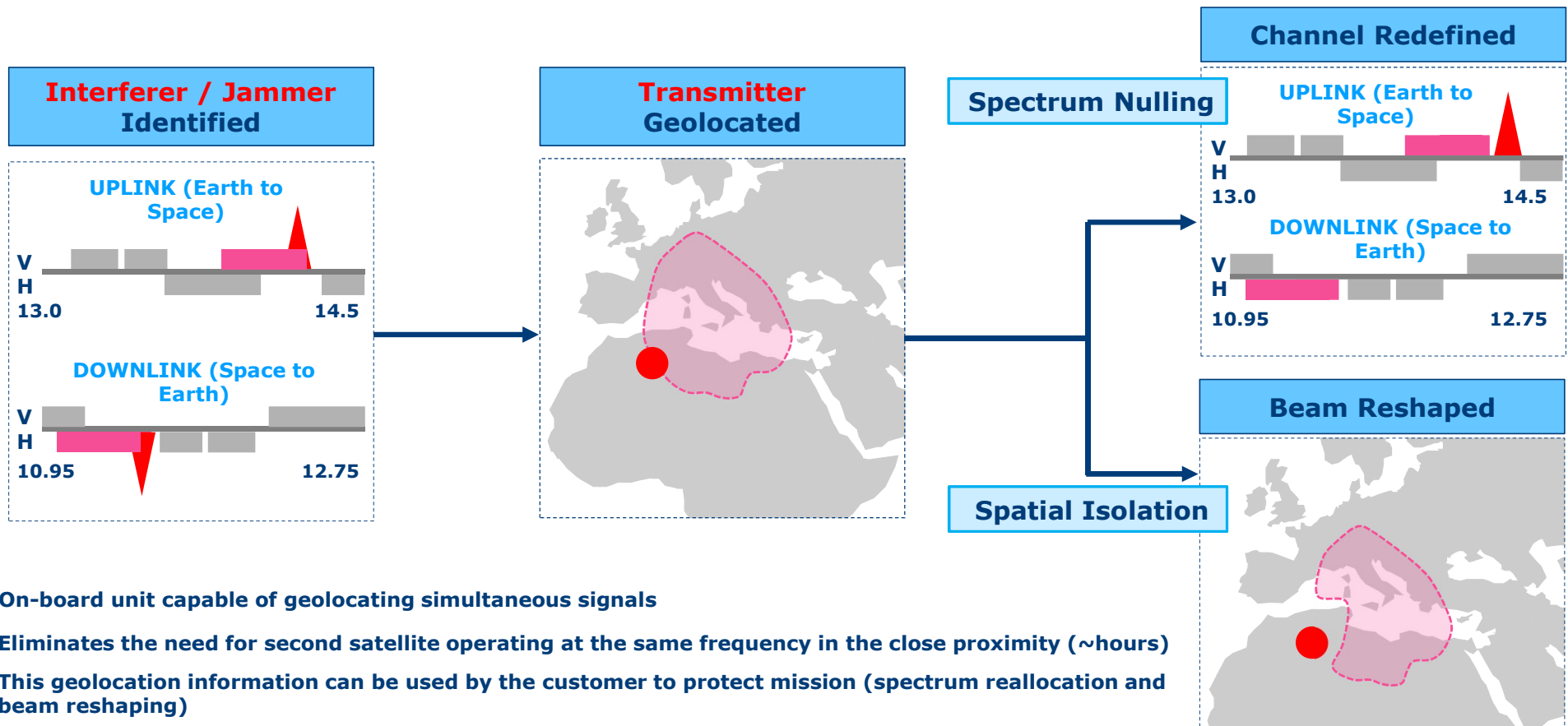
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European 14
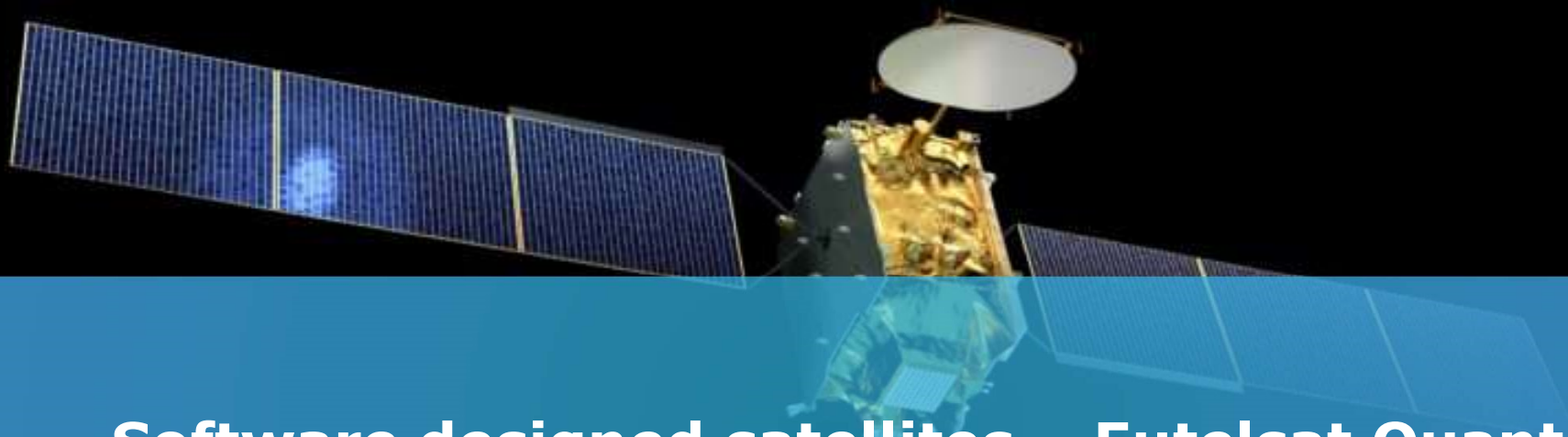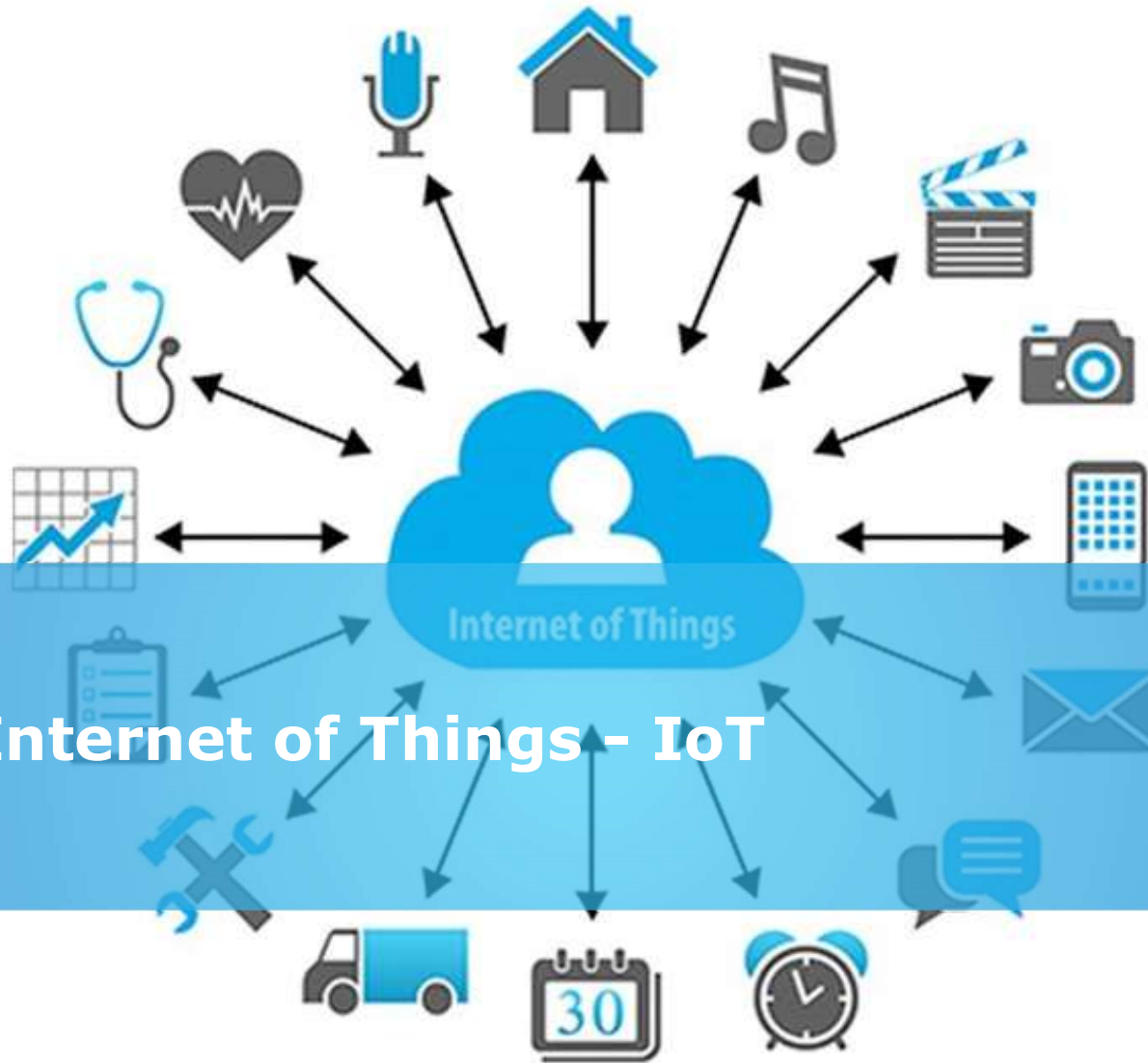
Software designed satellites – Eutelsat Quantum

SECURE VIRTUAL SATELLITE OPERATOR: A NEW PARADIGM

- Government customers have direct access to payload reconfiguration independent from any other user

- A private and secure control channel which can host a national encryption system

- Closest government customers can get to virtual sovereign control (SVSO: Secure Virtual Satellite Operator)

ON-BOARD HW

Mission Data

Sovereign Encryption

Spacecraft Control

Encrypted

GROUND CONTROL for ANTENNA SYSTEM

GUI for BEAM PATTERN SYNTHESIS

GUI for GEOLOCATION MODULE

Test & Simulation Data

Encrypted

Eutelsat Payload Verification Server

Payload Control

Customer Operations Centre

Eutelsat Satellite Control Centre

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EUTELSAT QUANTUM - ANTI-INTERFERENCE CAPABILITY

Interferer / Jammer Identified

UPLINK (Earth to Space)

V
H
13.0   14.5

DOWNLINK (Space to Earth)

V
H
10.95   12.75

Transmitter Geolocated

Spectrum Nulling

Channel Redefined

UPLINK (Earth to Space)

V
H
13.0   14.5

DOWNLINK (Space to Earth)

V
H
10.95   12.75

Beam Reshaped

Spatial Isolation

- On-board unit capable of geolocating simultaneous signals

- Eliminates the need for second satellite operating at the same frequency in the close proximity (~hours)

- This geolocation information can be used by the customer to protect mission (spectrum reallocation and beam reshaping)

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The Internet of Things - IoT

WHY SATELLITE IOT?

IoT has become **key** for increasing operational efficiency

Connecting **remote assets** remains a challenge

Satellite proposes some **unique advantages** to connect assets

However, Satellite has been **barely used for IoT** until now

2019: Eutelsat enters the **satellite IoT market**

- *IOT is emerging as the fourth industrial revolution, allowing companies and organizations to become more efficient and more eco-responsible*

- *However, it still remains a challenging task despite technological & commercial progress*

- *Truly ubiquitous coverage: many assets have poor/no access to terrestrial networks*

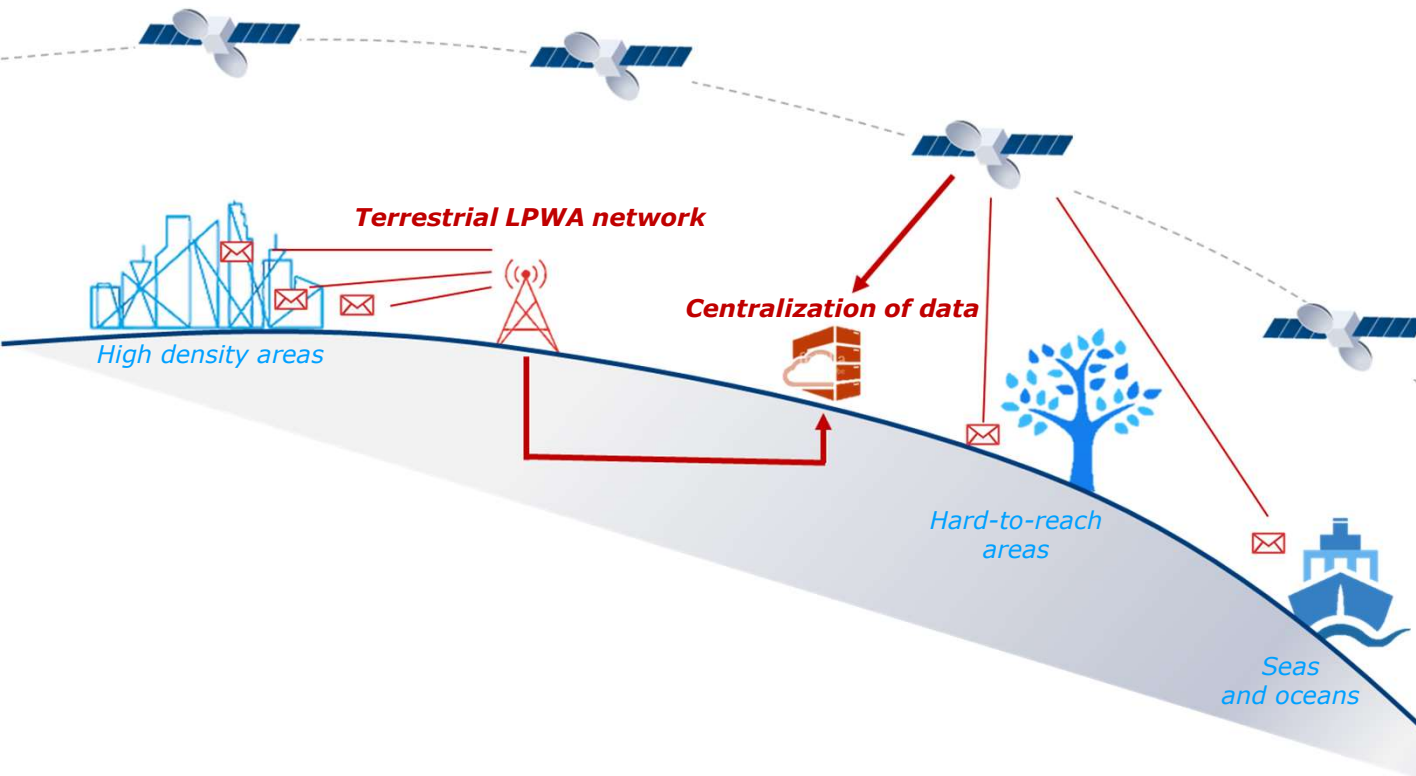- *Highly reliable connectivity: satellite service providers guarantee SLA's*

- *Because existing satellites services have been designed for other applications: broadband, backhaul, voice, maritime, etc.*

- *They typically are too expensive & complex for IoT use cases, and lack IoT-specific features*

- *To tap into this major market opportunity*

- *And propose a portfolio of satellite IoT offerings designed & optimized for IoT*

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ELO: A NEW CONSTELLATION TO COMPLEMENT TERRESTRIAL IOT NETWORKS AND ENABLE GLOBAL COVERAGE

A new scalable constellation of small satellites in low-orbit

Terrestrial LPWA network

Centralization of data

High density areas

Hard-to-reach areas

Seas and oceans

➢ **First with Sigfox, LoRa integration under study, NB-IoT / LTE-M compatibility a longer term objective**

Value proposition

- **Global coverage from day 1 and low latency** (less than 1h to receive emitted message) **as a target as soon as 2022**

- **Complement to terrestrial IoT networks, <u>not a substitute</u>:** objects connect to the satellites only when out of reach of terrestrial network, seamlessly

- **Terrestrial + Satellite integration:** a single chipset connecting to both networks, same format for the messages

- **Price points of chipset & satellite connectivity compatible with terrestrial IoT:** a few dollars per chipset and a single-digit annual price for satellite connectivity (for one message per day)

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HOW DOES ELO WORK EXACTLY? AN INNOVATIVE SYSTEM LEVERAGING A BEACON TO OPTIMIZE EFFICIENCY

1 **Satellite Detection**

- Hybrid objects detect the presence of the satellite thanks the broadcast of a beacon signal (@ 400.1MHz)

- Additional feature: Doppler rate compensation, Radio Configuration implemented diffusion positioning capability for objects without the use of a GPS
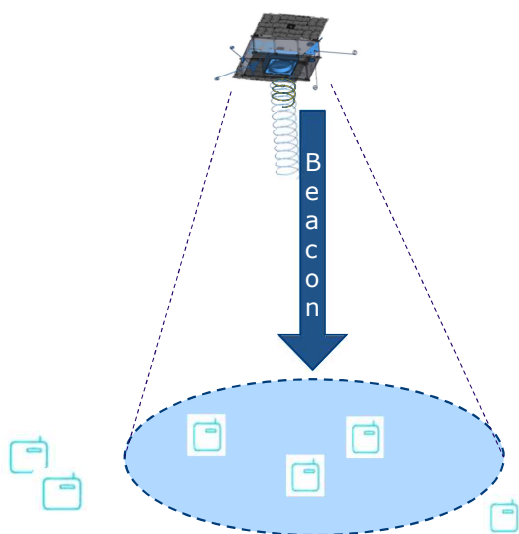
2 **Messages collection**

- The objects emits their message (12 bytes of data) during the satellite pass (average pass duration of 4 minutes)

- The messages are extracted and stored on-board (Store and Forward mode)

- The satellites is based on generic flexible **S**oftware **D**efined **R**adio IoT module
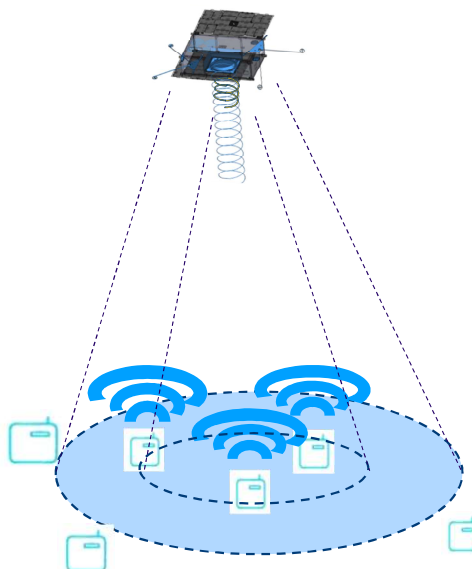
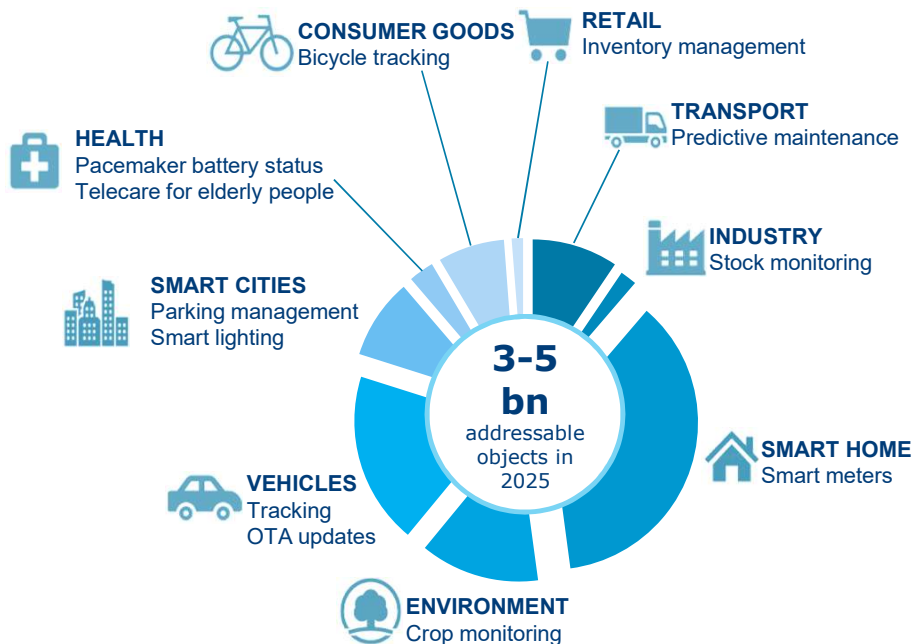**3** **Data downlink and client interface**

- The collected messages are downlinked along with the satellite TM when passing over a Ground Station

- Eutelsat Mission Control System will gather the messages, reconfigure the mission via TC

- The messages are pushed to the Client Cloud

Beacon

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TM & Messages Downlink

TC & Configuration update

KSAT

Eutelsat Mission Control Centre

sigfox
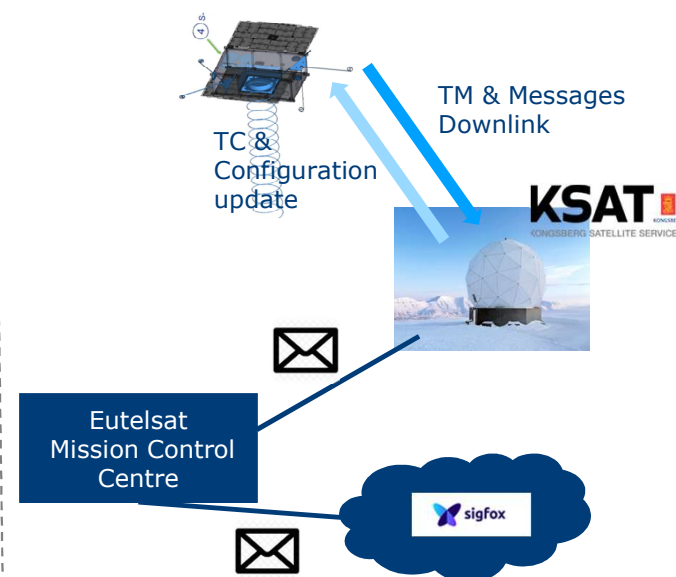
THERE IS PREDICTED TO BE 3-5 BILLION CONNECTED OBJECTS BY 2025.

Satellite can **cost-efficiently expand the reach of IoT terrestrial networks in sparsely populated areas.**

In 2025, there will be **8 bn connected objects worldwide*.**
Most of them will have a short range and be connected via WiFi/Bluetooth or wired.
For the remaining 3-5 bn (o/w 20-25% in rural areas)**, different technologies compete.**

CONSUMER GOODS
Bicycle tracking

RETAIL
Inventory management

TRANSPORT
Predictive maintenance

HEALTH
Pacemaker battery status
Telecare for elderly people

INDUSTRY
Stock monitoring

SMART CITIES
Parking management
Smart lighting

3-5 bn
addressable objects in 2025

VEHICLES
Tracking
OTA updates

SMART HOME
Smart meters

ENVIRONMENT
Crop monitoring

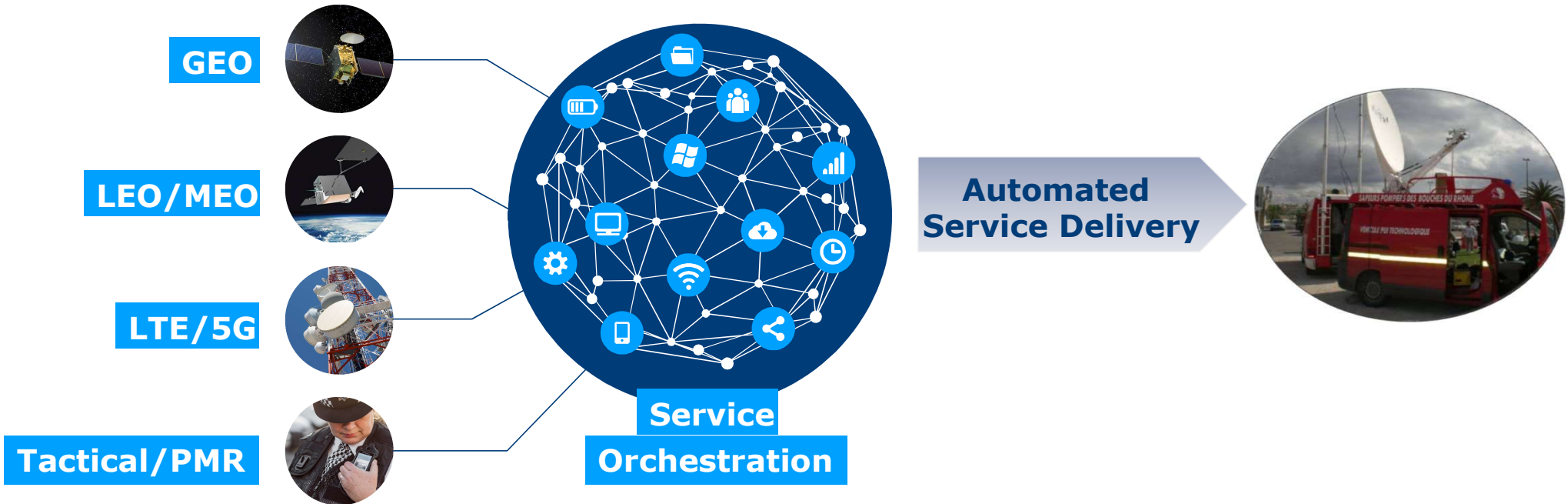|	
Cellular **LTE**	• Coverage unavailable in remote areas • **Unsuited to low power** objects
Licensed LPWA** **NB-IoT LTE-M**	Deployments started in 2017 • Backed by major **M**obile **N**etwork **O**perators • Can be deployed via **software upgrade** over existing 4G networks • **Evolutive throughput** up to 1 Mbps • No uncontrolled interferences • Will integrate in the **5G standard**
Unlicensed LPWA** **Sigfox LoRa Ingenu**	First deployments in 2012 • Sigfox **pioneered** in developing a network dedicated to IoT • **Low cost, low energy**, throughput limited to 50 kbps • Exposed to **interferences** because of the use of unlicensed spectrum • Need to deploy a new **physical network**
Satellite **Direct To Object**	• Currently, mostly expensive MSS services • In the future, **Low Earth Orbit constellations** could be a critical enabler.

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* Excluding communication devices such as smartphones, tablets, laptops, …
** Low Power Wide Area

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Automating Access to Satellite Services

AUTOMATING ACCESS TO SATCOM SERVICES

GEO

LEO/MEO

LTE/5G

Tactical/PMR

Service Orchestration

Automated Service Delivery

- / SATCOM connectivity is achieved through bespoke Service Orchestration triggered by Missions control planning and IP services profiles

- / Automated Service Provisioning can be achieved via secure Web Portals providing API (Application Programming Interface) are effectively defined according to military guidance for IP services and Security stringent schemes implementation

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Ali BELMAACHI – USE CASES and Applications in the domain of Emergency responders

SITUATION AWARENESS – OPERATIONAL AGILITY – NEW APPLICATIONS

SITUATION AWARENESS

▮ How to keep HQ fully informed on fields operations (video/voice/geolocation) in real time and in HD?

OPERATIONAL AGILITY

▮ How to easily and quickly deploy an LTE network independent from any terrestrial infrastructure for?

- → Special Forces
- → Regular Military Operations
- → Public Safety
- → Disaster Recovery

APPLICATIONS 2.0

▮ How to

- → Share live video (PushToVideo) from the field to HQ or to other remotes?
- → Enable HQ Group Call/Push To Talk?
- → Share files in real time?
- → Use one single ruggedized device per user?

By using
LTE TACTICAL BUBBLES
&
SATELLITE CONNECTIVITY

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APPLICATIONS & CONNECTIVITY INFRASTRUCTURE

Connectivity Infrastructure

Satellite Capacity

HUB Anchor Station

HUB Platform

Remote VSAT Stations
- Fixed Stations
- Deployable Stations
- Mobile Stations

Ground IP Network

Traffic Management

Routing

IP Security

Networks Interconnection

PMR Radio Spectrum

PMR Core Network

PMR Terrestrial Links

PMR BTS

PRM LTE eNode B

PMR WiFi HotSpot

...

LTe P25 TETRAPOL
TETRA DMR

Applications Servers

PMR Dispatchers

MCPTT, PTV Application Server

Sensors Application Server

Video Surveillance Application Server

Radar Data Processing

...

Remote Applications & Devices

MCPTT Client App

Mobile Devices

Intrusion Detectors

Video Cameras

Video Processing

RPAS Gimbal Payload

Multispectral Sensors

Facial Recognition

Number Plate Recognition

...

Associated Services

Installation/Deployment	Operations
Maintenance	Field Services

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- **Heterogeneous networks**
- **Multiple applications**
- **Large range of expertise to provide a service to the End-User**

LTE TACTICAL BUBBLE COMBINED WITH SATELLITE CONNECTIVITY

Governmental organizations need for their critical communications
- → Secured exchanges
- → Operational Agility
- → Resilient & Robust network
- → Modular Solution
- → Latest technologies enhancing standard PMR functionalities (MCPTT, Group Call via Tetra, etc.)
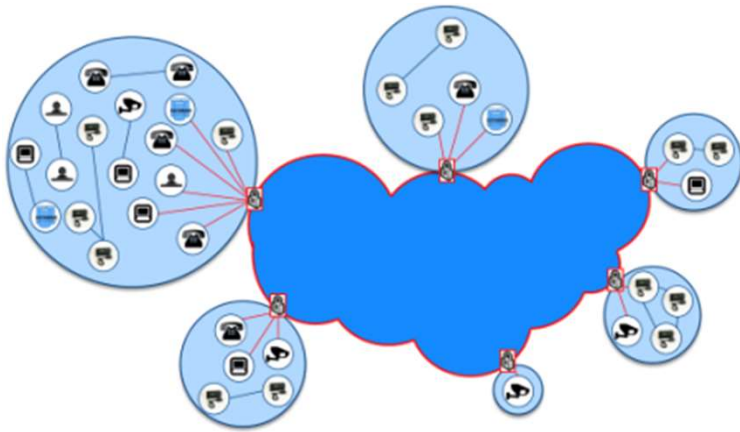
Ultra Secure Smartphone
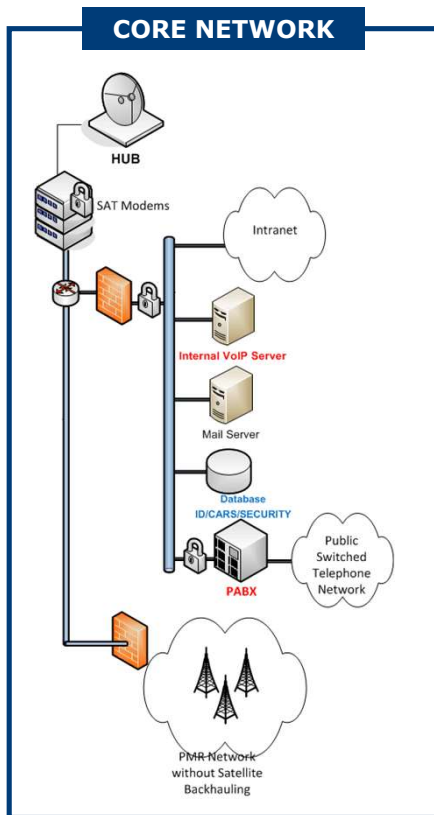
Scalable LTE Range

**Compact Deployable Base Stations + Core Combined**

Manpack VSAT for Quick Deployments

lte

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LTE TACTICAL BUBBLE IS MORE THAN AN LTE EXTENSION

LTE EXTENSION & BACKHAULING

CORE NETWORK

- For PMR over LTE, the Core is connected to the eNodeB via Satellite
- The local LTE network is dependant on Core Network status

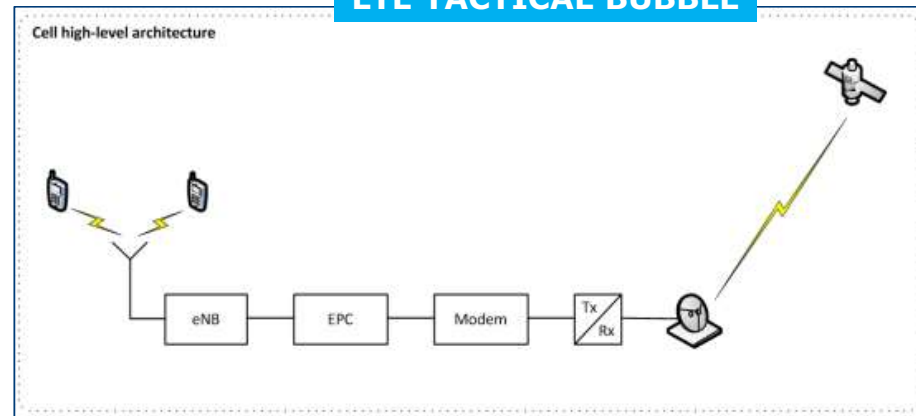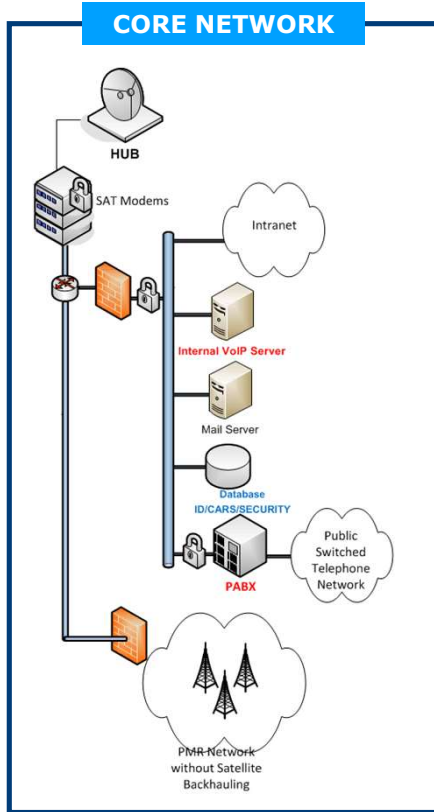- Remote site is equipped with a PMR Base Station connected via satellite to the PMR Core Network

REMOTE PMR BASE STATION
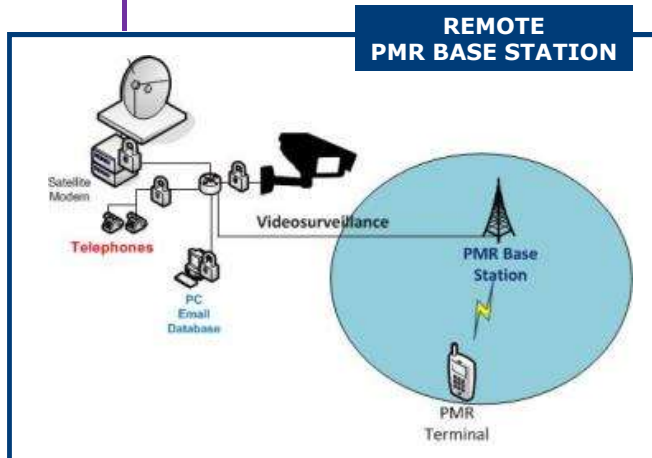
LTE TACTICAL BUBBLE

- Core (EPC) and eNodeB are colocated
- Mission Critical SW included in the Bubble
- Private/Robust/Resilient Standalone LTE Network
- Satellite gives access to HQ, command Center, etc.
- Secured, Encrypted Data Communications
- Radio Band Flexibility for Gov usage
- Transportable and various Radio ranges 1 to 10s of km
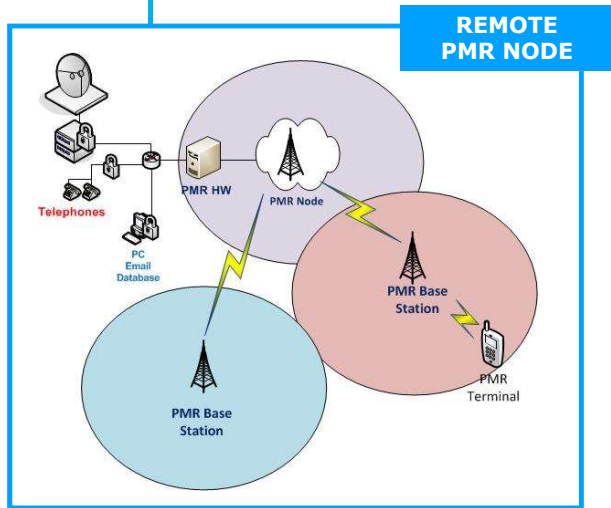- Can be connected to PMR Networks and Public Networks
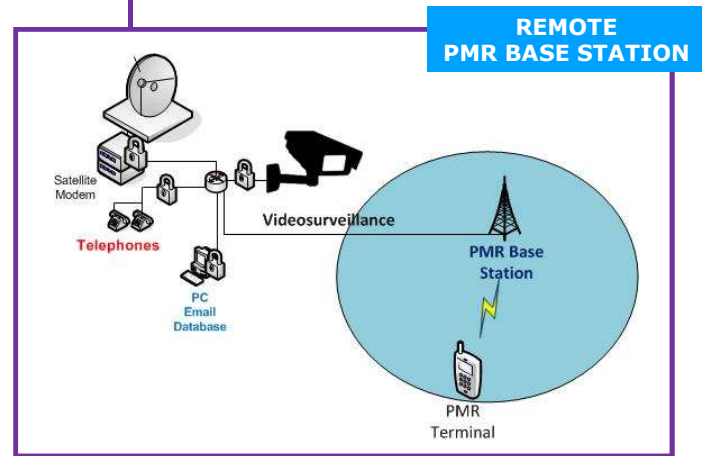
LTE TACTICAL BUBBLE

Cell high-level architecture

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NATIONAL PMR NETWORK COVERAGE EXTENSION

**CORE NETWORK**

REMOTE PMR NODE

▟ Remote sites, equipped with a PMR Node, communicate with one or multiple PMR Base Stations via radio links. Communications with PMR Core Network transit via the satellite link

▟ Remote site is equipped with a PMR Base Station connected via satellite to the PMR Core Network

REMOTE PMR BASE STATION
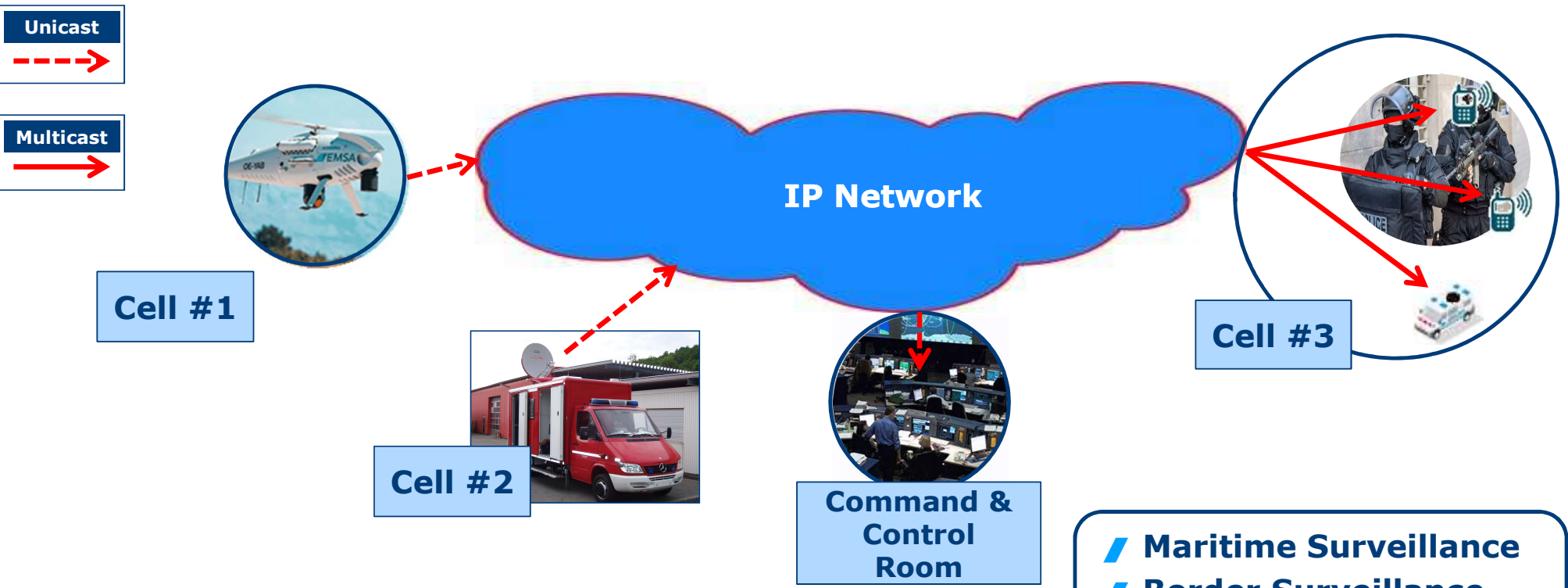

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TACTICAL BUBBLES – PUSH TO VIDEO
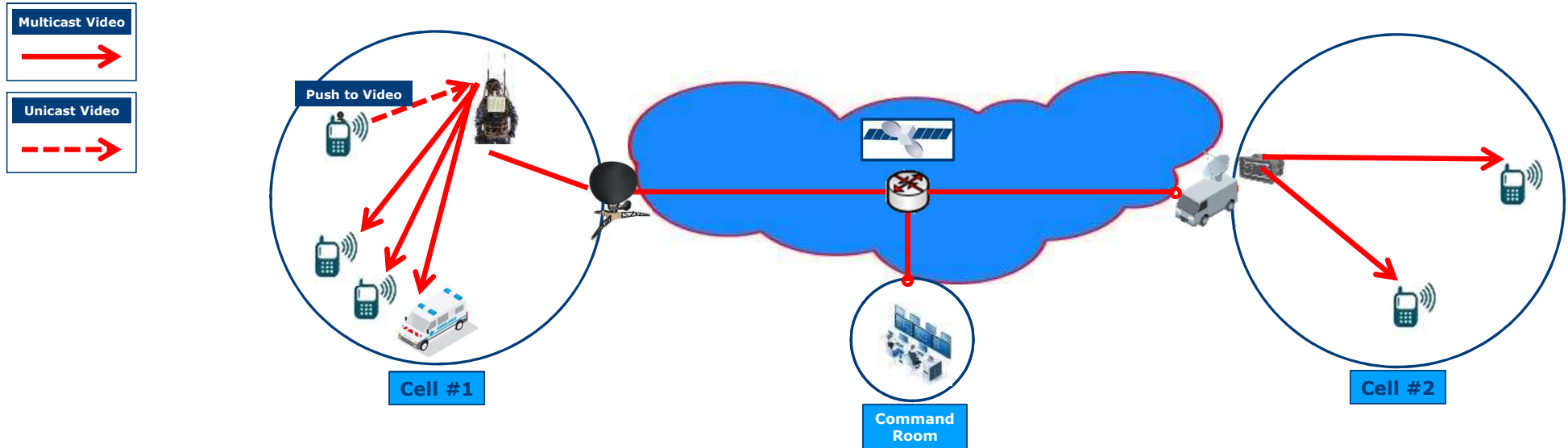
In each Tactical Bubble Push To Video uses
- for Intra-Cell reach: LTE for PMR in Multicast mode (ie. eMBMS)
- for Inter-Cells reach: Satellite IP Network in Multicast Mode

Thanks to IP Network (Satellite and Terrestrial) routing and Multicast, Video Stream is received by different Cells&Users

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APPLICATION EXAMPLES: INTER-CELLS VIDEO DELIVERY

Unicast

Multicast

IP Network

Cell #1

Cell #2

Cell #3

Command & Control Room

/ **Maritime Surveillance**
/ **Border Surveillance**
/ **Situational Awareness**

/ **Live Video Feeds from different sources**
- → Gathered via Satellite IP Network
- → Delivered in Multicast using Satellite & Terrestrial IP Networks

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CRISIS MANAGEMENT SUPPORTED BY SMALL TACTICAL RPAS
AN EMERGING ISR MARKET FOR SATCOM

User landscape

GEOPOLITICAL TENSION
→ Counter-terrorism
→ Illegal migration
→ Drug trafficking
→ Border surveillance
→ Maritime domain surveillance
→ Anti-piracy

OPERATIONAL AGILITY REQUIREMENTS
→ Reduced staff
→ 24H operations
→ Smaller airfield
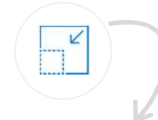→ Civilian govt. usage

BUDGET CONSTRAINTS
→ Manned ISR mission costs
→ Defence budget cuts
→ Smaller airfield

Emerging solutions

CHEAPER SMALL TACTICAL RPAS
→ Lower CAPEX costs vs. MALE
→ Reduced staff - OPEX
→ Increased # deployed units

SMALLER SATCOM TERMINALS
→ SWaP terminals
→ More performant satellites

→ New **ISR** solutions for countries without access to large MALE **RPAS**

→ New entrants including RPAS suppliers need agile SATCOM

→ All-Inclusive RPAS as a Service Model is developing

RPAS: Remotely Piloted Aircraft System
ISR: Intelligence, Surveillance, Reconnaissance

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EUTELSAT'S IOT PORTFOLIO FOR CIVIL AND DEFENCE USAGE

Preventative maintenance

IOT FIRST
Collecting sensor data to optimize process flows & increase equipment availability

IOT MOBILE
Extract data in real-time from the connected vehicles

Medical Monitoring

IOT FIRST
Provides patient status data for more effective end-to-end support between each Level

ELO
Monitoring of the state of health during of emergency responder teams

Fleet Management

IOT MOBILE
Vehicle tracking to increase logistics efficiency on the air, sea or land routes

ELO
Asset tracking to optimize logistics flows and reduce the loss & theft

Facility management

IOT FIRST
Collect sensor data to optimize the energy balance of buildings

ELO
Remotely monitor small buildings in remote locations

Site monitoring and security

IOT FIRST
A reliable solution for remote site alarms

IOT Mobile
Connected Drones for Zone Monitoring

ELO
Single-use tags to ensure the safety of operations

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AND MORE...

IoT
- → Flood detection
- → Intrusion detection
- → Earthquake monitoring
- → Sensitive sites monitoring

COTP (Communication On the Pause)/Fixed VSAT
- → Terrestrial Infrastructure back up (French Mairies)
- → Disaster recovery
- → Firefighters

COTM (Communication On the Move)
- → Ambulance service in remote area
- → Manned Aircrafts

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COMMITTED TO SUPPORTING DISASTER RELIEF EFFORTS

Founding signatory with the UN of the Crisis Connectivity Charter

4 satellites available with pre-allocated bandwidth

11 years of partnership

14 years of field support