

maritimes cluster
norddeutschland

DRYNET Coffee Break #01

Stade, 21st of March 2024



Agenda

14:30 Get Together

15:00 Welcome & Introduction

15:10 Update: Satellite Communications

15:35 Break

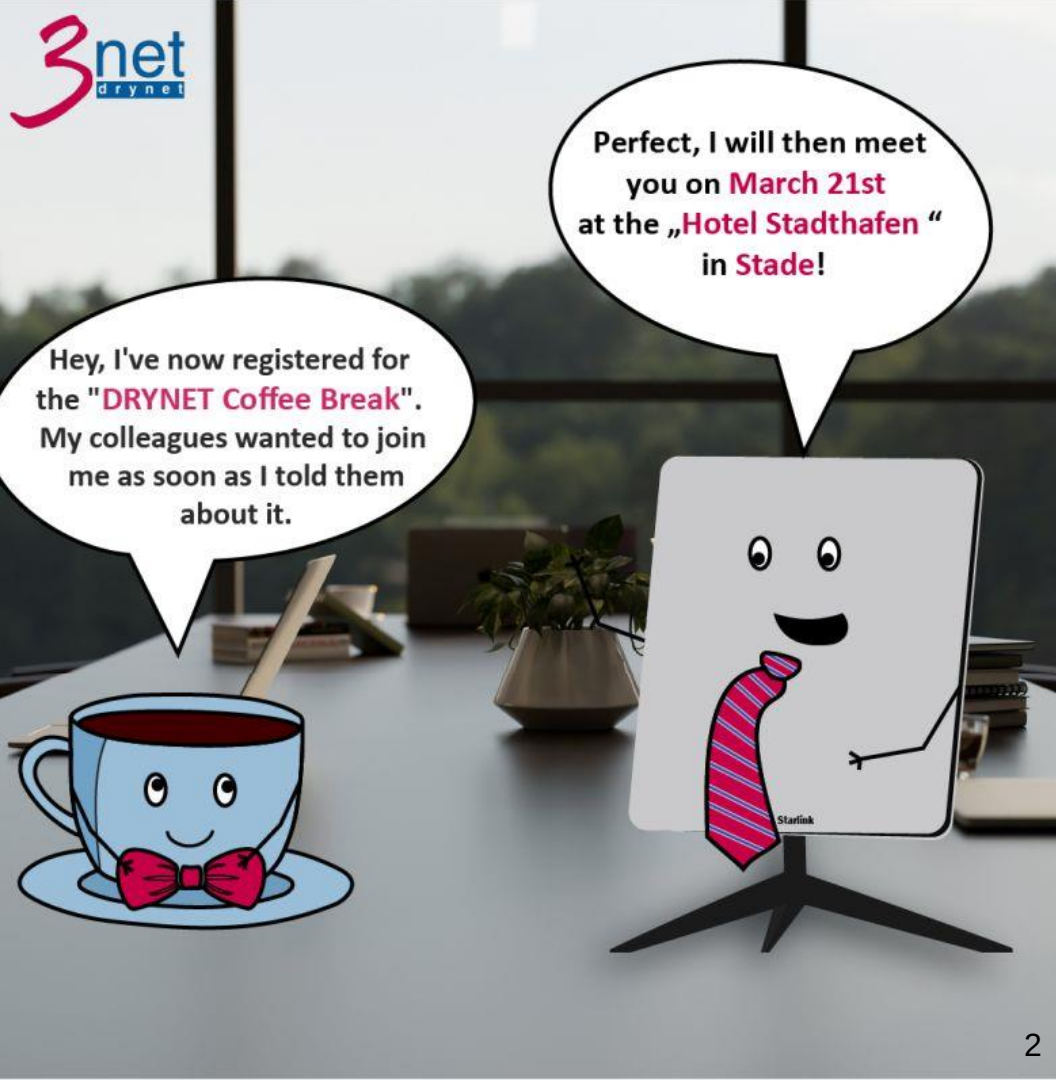
15:45 Maritime Cellular Services (5G / 4G LTE)

16:15 Break

16:25 Hybrid Networks on Board

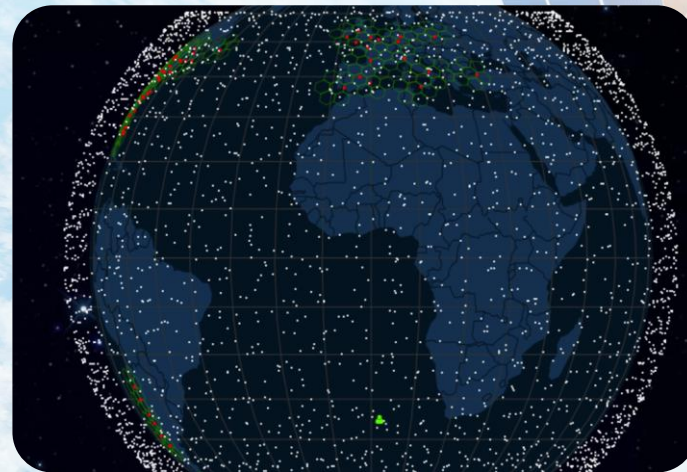
16:45 Q & A – sweepstakes

17:00 Closing



Update SatCom

- a. Time of Disruption in Space and on Earth
- b. Architecture, Orbits, Frequencies & Bands
- c. Convergence
- d. „New Space“
- e. Trends & Characteristics
- f. Innovation (Examples)
- g. Use Cases
- h. Customer Requirements
- i. 2024 Trends



Time of Disruptive Change (in Space)



Cost of 1 GB data volume on mobile satellite

- 1996 Inmarsat 3rd Gen: 1 GB, häh???
- 2005 Inmarsat 4th Gen: \$ 4.000
- 2013 Inmarsat Alphasat: \$ 1.000
- 2016 Eutelsat KA-Sat: EUR 30,00
- 2024 Starlink: \$ 1.000 (1 TB)

Time of Disruptive Change (in Space)



Time of Disruptive Change (and on Earth)



Orbit Constellations



GEO

GEOSTATIONARY EARTH ORBIT

Altitude 36,000km

Latency 600 ms

GEO satellites match the rotation of the Earth as they travel, and so remain above the same point on the ground.

Hundreds of GEO satellites are in orbit today, traditionally delivering services such as weather data, broadcast TV, and some low-speed data communication. Over the past few years, GEO has been significantly enhanced by High Throughput Satellites (HTS), which are purpose-built for data.

MEO

MEDIUM EARTH ORBIT

Altitude 5,000 to 20,000km

Latency 150 ms

MEO has historically been used for GPS and other navigation applications.

More recently, HTS MEO constellations have been deployed to deliver low-latency, high-bandwidth data connectivity to service providers, government agencies, and commercial enterprises.

LEO

LOW EARTH ORBIT

Altitude 500 to 1,200km

Latency 50 ms

LEO is densely populated with thousands of satellites in operation today, primarily addressing science, imaging, and low-bandwidth telecommunications needs.

The next generation of LEO satellites intends to serve communication markets such as mass-consumer and enterprise broadband internet, as well as IoT, Internet in Space and Cellular interoperability.

SpaceX & Starlink at a Glance



- SpaceX founded 2002 by Elon Musk (PayPal, Tesla) @Redmond, WA
- Complete value chain from launch vehicle, satellites to end user service
- With SpaceX the launch price of 1 lbm payload dropped below \$1000
- Space X manufactures and operates Starlink
- Small satellites between 230 and 300 KG, V2.0 up to 800 KG
- Operates in Low Earth Orbit, currently at 530 to 570 KM height
- Disruptive pricing, technology and service
- Starlink test launch in 2018 – global coverage 2023
- 5.800 Starlink satellites in orbit; 24.000 launches are licensed, another 22.500 are planned
- Currently more than 2 mio subscribers



SpaceX & Starlink Technology



- Small LEO satellites
- Downlinks currently use Ku- and Ka-Band
- Estimated 15 Gbit/s per satellite usable bandwidth
- Groundstations at teleports plus small containerized hubs
- Since V1.5 laser-satellite-interlinks are deployed
- Local Internet Break-Outs
- Prioritized Bandwidth instead of SLA CIR/MIR

Devices:

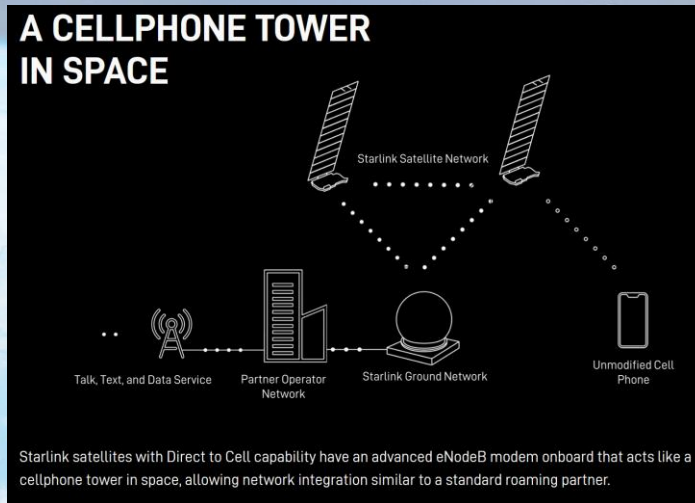
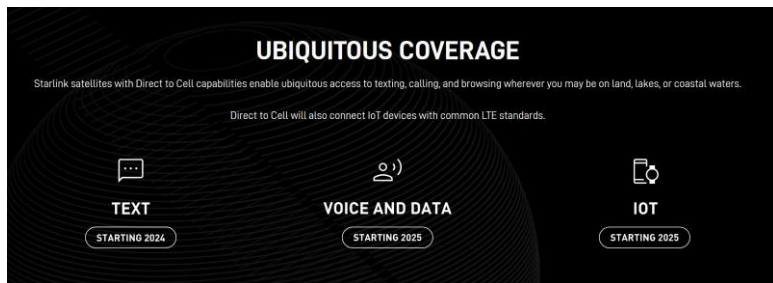
- 1st gen fixed site phase-array dish antenna (53cm)
- Flat panel and electronically steered phase-array antennas for fixed site and mobile use
- Mobile phones: Direct to Cellular service announced



Starlink Devices



Direct-to-Cell Announcement



- Future Starlink satellites will have a large 2 GHz antenna to communicate with LTE phones.
- The current satellites are unable to provide LTE service.

Starlink Competition

➤ Traditional Incumbents



➤ New Space:



2024 Trends

- a. Mainstream LEO
- b. Satellite-to-Cell
- c. Multi-Orbit Constellations
- d. New launch start ups
- e. AI and Space
- f. Space Debris Removal
- g. Sustainable Space Operations
- h. In-Space Manufacturing
- i. Industrialization of Satellite Production
- j. GPS-Denied Navigation Technologies
- k. Governments planning their own LEO systems
- l. Climate Change as a Catalyst for Earth Observation Technologies





Maritime Cellular Services

Navigating the waves of connectivity

- Intro
- M2Sea
- Tampnet
- Sputnik 24
- Peplink
- Future
- Integration



Maritime Cellular Services

Vodafone's "Near Shore Connectivity Survey"



- Conducted in 2019 with operators of more than 6.000 vessels
- Ships spend 60% of their time in port or coastal waters and potentially within 4G/LTE coverage.
- On average, 57GB of data per month per vessel between ship and shore (online and offline); this grew by 249% in 2024, to an average of 150 GB per month per vessel.
- 60% of the vessel average monthly data volume can be moved from satellite to 4G/LTE



5G Scenarios

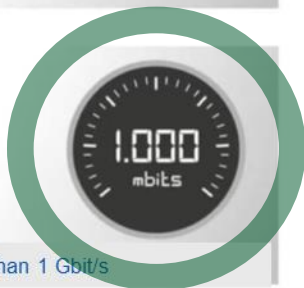
5G Highband 3,5 GIGAHERTZ

Works particularly
well on smaller areas



1

Allows
speeds of



More than 1 Gbit/s

(small cell)

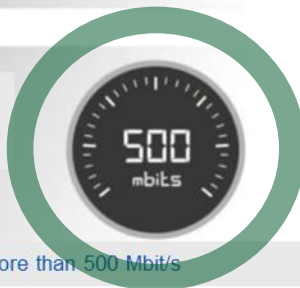
5G Midband 1,8 GIGAHERTZ

Fast network for
larger areas



2-3 km

Allows
speeds of



More than 500 Mbit/s

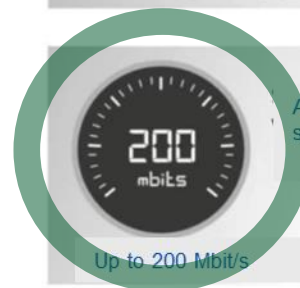
5G Lowband 700 MEGAHERTZ

„Long Range“
5G



5 - 8 km

Allows
speeds of



Up to 200 Mbit/s

(macro cell)

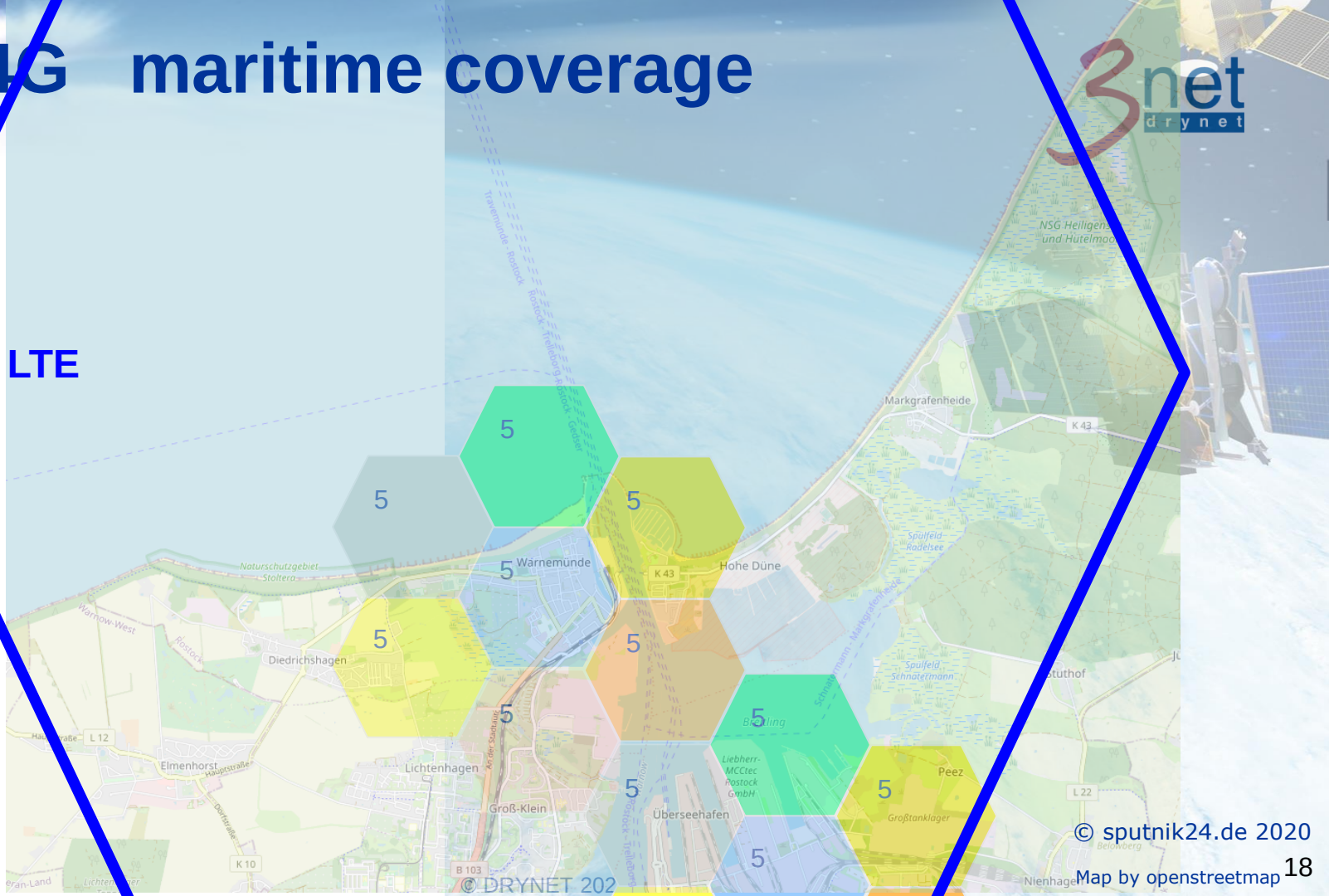


5G & 4G maritime coverage



4G - LTE

1 km



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© DRYNET 202

Map by openstreetmap

Maritime Cellular Services

M2Sea® Global Coverage



- **Quality matters: DRYNET APN in the global TIER-1 Vodafone network**
- **Roaming Packages with Flat Rates:**
 - 3 packages: P1 (30), Z1 (50+) and Z2(100+)
 - Bundles from 1GB to nTerabytes
 - 5G Roaming for over 50 countries
- **Subscription**
 - Always full bandwidth / no throttling
 - From 1 month term
 - Optional fleet allowance plan / data sharing pool
 - Pre-Activated SIM with 1 GB „test data“

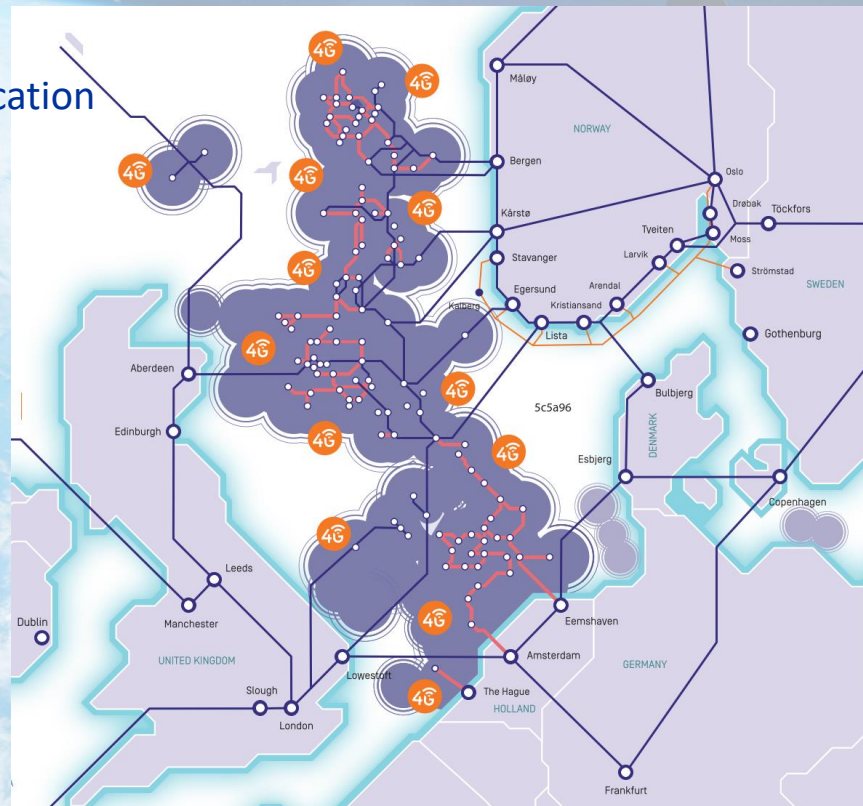


Maritime Cellular Services

Tampnet



- The largest offshore high capacity communication network in the world
- The North Sea
- Gulf of Mexico
- Canada
- East Coast USA
- Trinidad & Tobago



Maritime Cellular Services

Sputnik 24



- Rugged Maritime Dome Design
- Reaches up to 70 KM
- Download Speed up to 150 Mbit/s*
- Upload Speed up to 50 Mbit/s*
- Easy Installation, Easy Operation
- Manufactured in Germany
- Patented antenna
- ISO 9001 Quality Standard



* With dual system up to 300/100

Maritime Cellular Services

Peplink/ ProTac



- Supports 3G / 4G / 5G
- Regional variants (EMEA, Americas, Asia)
- Scalable product family
- High Throughput up to CAT20
- Powerful management interface
- Can be combined with (up to 4) ProTac antennas
- SIM injector support (2 SIMs without)



Maritime Cellular Services

Peplink HD1 Dome Pro



- Supports 3G / 4G / 5G (Worldwide)
- High range and throughput
- Highly configurable
- Outdoor, IP67, Metal (-40°C to 65°C)
- Ethernet data and power
- Wi-Fi 6 (23dBm), Wi-Fi as WAN
- Sim Injector Support (4-SIMs without)



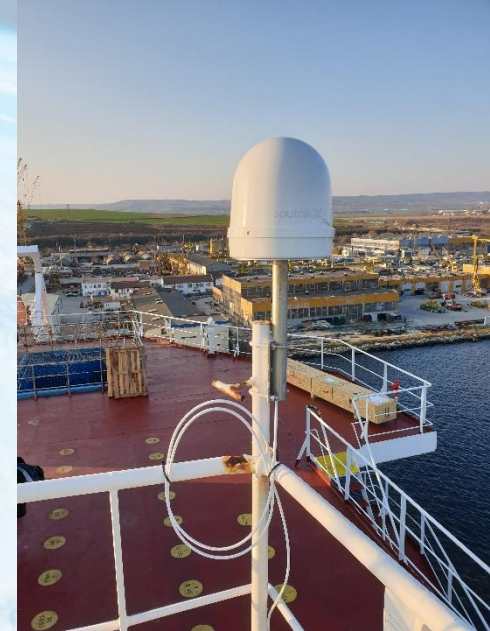
Maritime Cellular Services



Sylt Ferry

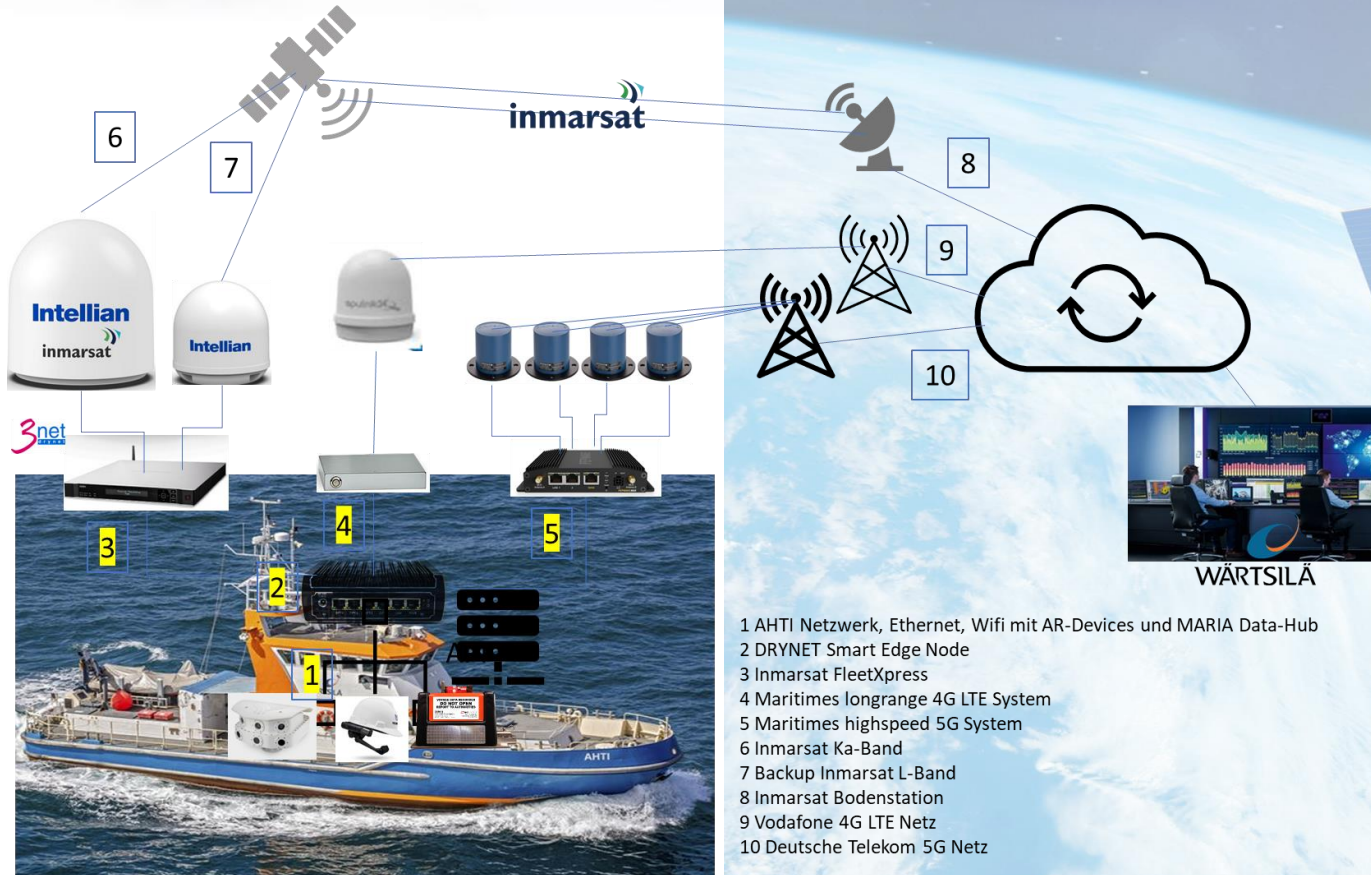


Halunder Jet



Sloman Themis

Maritime Cellular Services



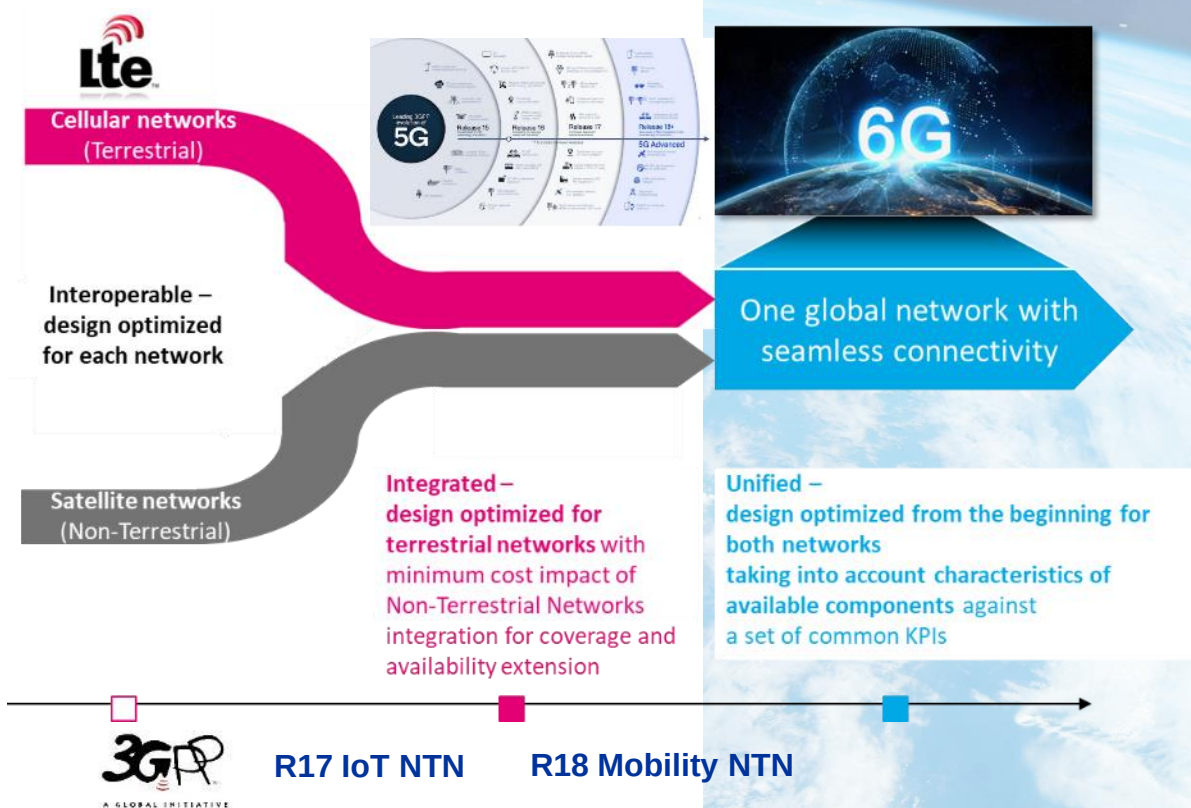
Maritime Cellular Services

What to expect

- Expanded Coverage
- Enhanced Bandwidth
- Integration with Emerging Technologies
- Newer Concepts: Direct Access to Satellites
- Industry standards Development
- Coverage in areas without satellite



NTN / Cellular Convergence



BRYTE

3net
drynet

TM



DRYNET GmbH

BRYTE® - Network Orchestrator & SD WAN Gateway

Holger Ritter



Maritime Communication Challenges



How can I ...

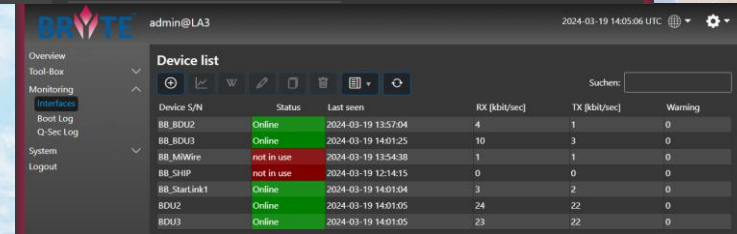
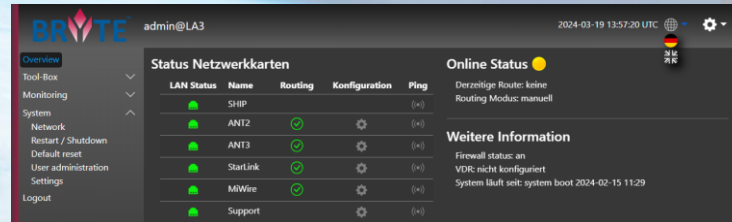
- ... control the communication cost?
- ... assign resources to critical business network?
- ... enable IoT data on my vessels?
- ... manage Internet Access for my passengers?
- ... manage crew welfare Internet Access?
- ... automate switching between different communication channels?
- ... centrally monitor my fleet communications?
- ... reduce complexity overall and increase productivity?

BRYTE® Network Orchestrator

Intuitive Interface



- Easy to install
- comes pre-configured
- individually customizable
- Intuitive, role based user interface
- delivered as a rugged maritime appliance
- from Raspberry Pi to full 19" Rack High Availability Server
- runs also in a virtual machine



BRYTE® Network Orchestrator

Scaleable Design

- Easy to install
- comes pre-configured
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BRYTE® Network Orchestrator

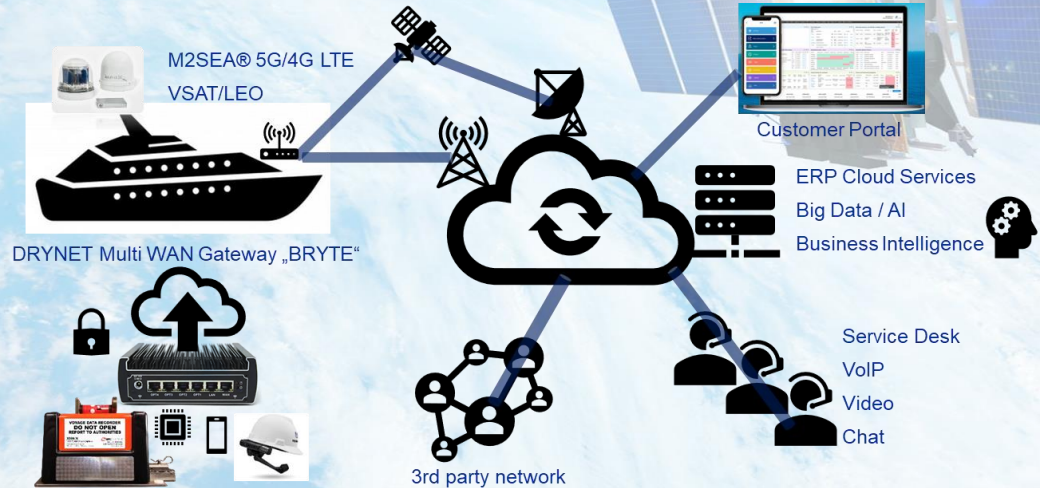


- BRYTE®SD-WAN: orchestrates intelligent SatCom/5G/4G/LTE/Wifi ship-to-shore communications
- Augmentend reality, digital twin and AI for remote vessel maintenance and after sales
- Secure communication infrastructure for autonomous shipping projects and ocean technologies
- Cooperation with Fraunhofer IGD and CML during MARIA project, sponsored by



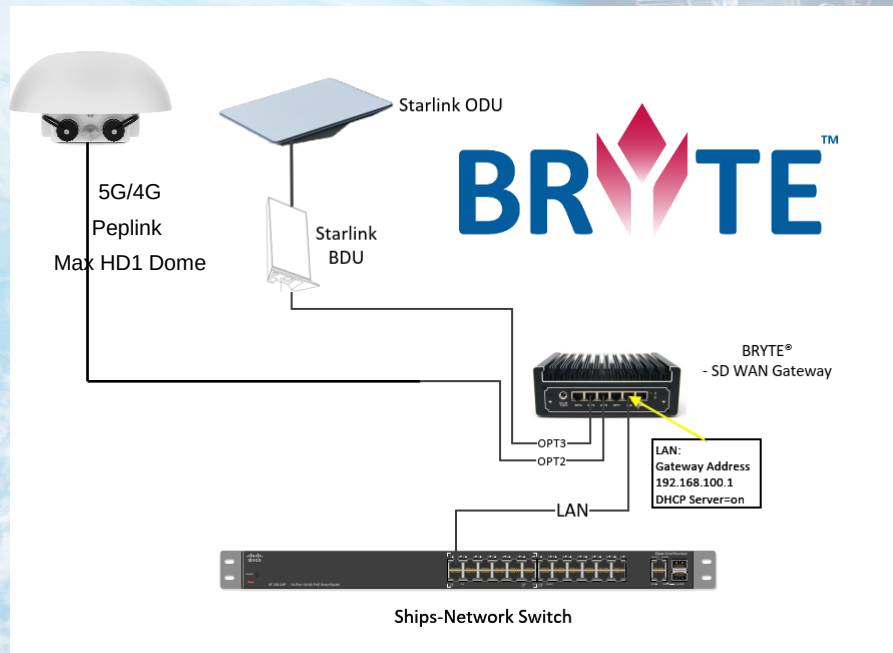
Bundesministerium
für Bildung
und Forschung

BRYTE™



BRYTE® for Starlink Network Design

- Easy integration with ship network
- Multiple WAN options
- Load Balancing Option
- Optimized routing with one or many Starlink systems
- increased control of Starlink system (e.g. Traffic Shaping)



Selected BRYTE® Projects (Cruise)



- Dual – High Availability Servers
- Load Balancing of up to 6 x Starlink, 2 x 5G systems and VSAT
- Passenger und Crew Internet Access



Selected BRYTE® Projects



- Starlink, 4G Integration
- Dual 4G Load balancing
- WAN Mangement
- Remote Monitoring
- Secure Remote Access / VPN
- Passenger und Crew Internet Access





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