

# 5G PRIVATE NETWORK FOR CRUISE LINES



## Overview

Cruise ships rely on intricate onboard networks. Many use a mix of LAN, Wi-Fi, and cellular networks for communications, to enable critical services such as passenger information, entertainment, and navigation systems. With a growing number of on-board digital services, cruise ships have ever more need for reliable high-speed internet.

Wi-Fi quality is hindered by the ship's metal structure, and presents security risks, obstructing the adoption of novel IIoT applications. Mobile networks are patchy at sea, so there is growing adoption of LEO satellite solutions for enhanced bandwidth and lower latency.

A 5G Private Network could address these issues and enhance guest experiences. It would allow real-time data collection from numerous sensors, enabling immediate analytics and optimizations, delivering cost-savings and operational improvements. Meanwhile, 5G private network's software-defined architecture could create opportunities for cruise operators to monetize new services.



## Challenges

The cruise industry faces numerous challenges with current underperforming networks.

Real-time video surveillance plays a crucial role in the safety and security of passengers and crew. It requires high-quality video feeds from multiple cameras and real-time image analysis, which can put significant strain on network bandwidth and compute capacity, particularly with current Wi-Fi networks. Providing high definition 2K video feeds from numerous surveillance cameras can be challenging on ships.

Cruise ships can have up to 8,000 people on board. Streaming video and entertainment content to guests can pose a challenge due to limited Wi-Fi coverage and bandwidth constraints. The quality of Wi-Fi can be affected by the steel structure of the ship or other electronic equipment on board.

To reduce operational costs, autonomous vehicles, and service Robots/Cobots can be used to move assets without manual intervention. However, achieving safe and reliable autonomous navigation on cruise ships requires fast, reliable, and low latency connectivity, as well as real-time processing of data from sensors and other sources. Current Wi-Fi networks are limiting the efficiency of such automation.

Ships can optimize fuel and energy use through systems of sensors and operational systems that make lots of minor changes in real-time, from

adjusting heating and cooling, to adopting more fuel-efficient routes. But current Wi-Fi networks cannot support lots of sensors simultaneously, and many will be needed to take advantage of all the possibilities for energy saving.

Finally, cruise ships are complex vessels that require specialized expertise for maintenance and repairs, which may not be readily available while at sea. Immersive Augmented Reality (AR) support can improve time to diagnose and repair equipment issues. Such AR solutions require high bandwidth network that cannot be supported using current Wi-Fi infrastructure.



## Our Solution

A cruise ship network may include existing wired infrastructure that supports multiple network protocols, augmented by WiFi and private cellular networks such as 4G/LTE/5G.

To address backhaul connectivity needs, the cruise ship may rely on a combination of satellite connectivity options such as GEO, MEO, and more recent high-bandwidth and low-latency

LEO satellite connections, depending on availability and the ship's location. When the ship is at port or close to coastal areas, it can utilize public cellular (4G/LTE/5G) and port WiFi networks to provide the best possible internet connection. Continually optimizing backhaul connectivity is crucial for consistent, high-quality, cost-effective internet for onboard applications.

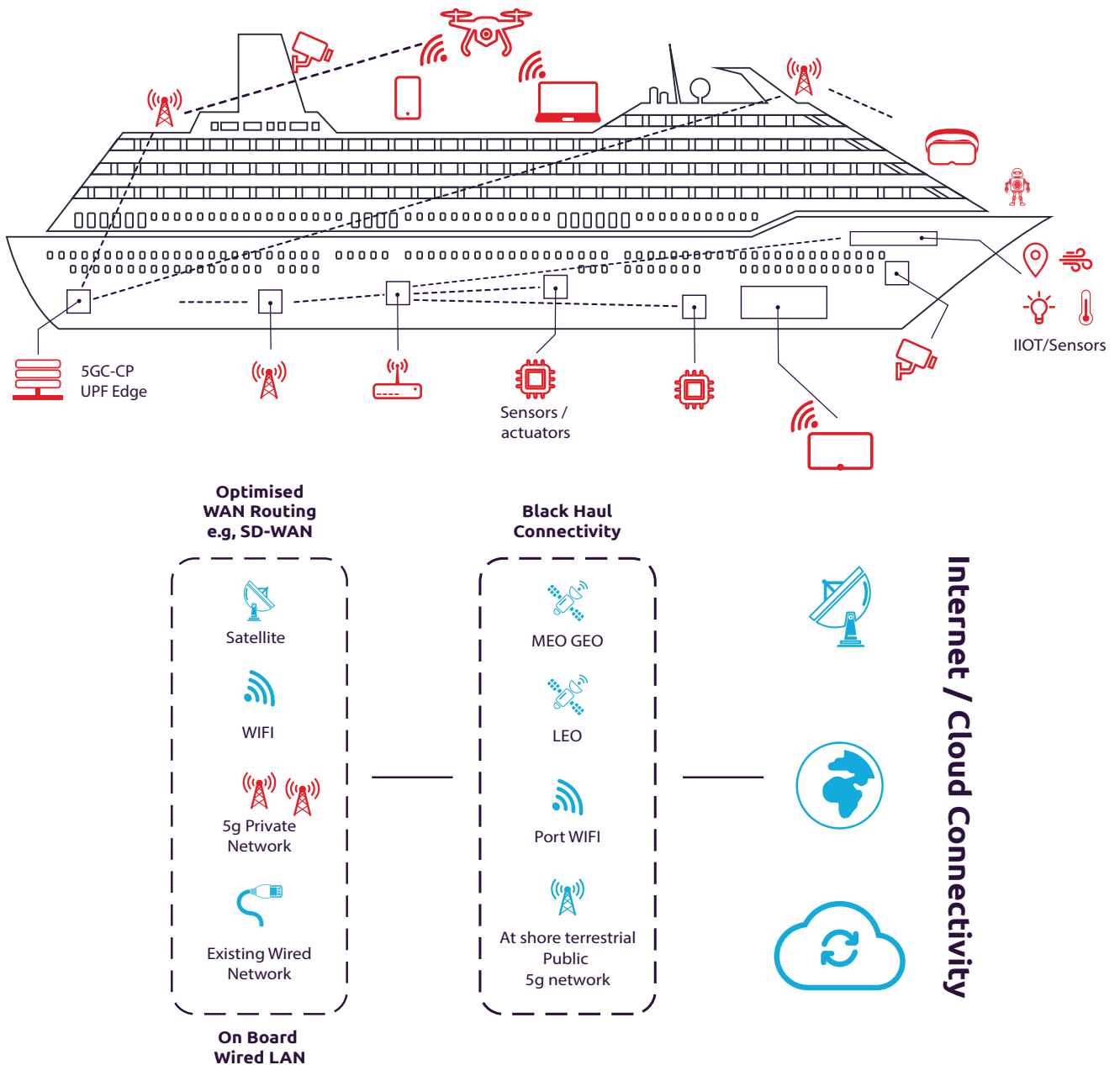


Figure 1 Cruise Ship Communication Networks

Augmenting the onboard Wi-Fi with a 5G private network can solve Wi-Fi challenges by providing a highly secure, fast, low-latency broadband network, which can handle a massive number of connections without degrading network performance.

The ability to link up many sensors and IIoT devices can support autonomous guided vehicles, and enable efficient onboard system monitoring and maintenance, reducing costs and increasing operational efficiency.

Private 5G networks enhances internet access experience and video streaming with higher frequencies and better coverage than WiFi.

Network slicing can enable different applications to run on different 'slices' of the network, allowing specific use cases and applications to be prioritised as needed, improving guest and crew experience.

New applications, which capitalize on this improved onboard and backhaul connectivity, can reduce operational costs, enhance guest experiences, and generate revenue through application monetization.

Below are some potential application opportunities:

#### **Improve Security, Safety, and Operational Efficiencies:**

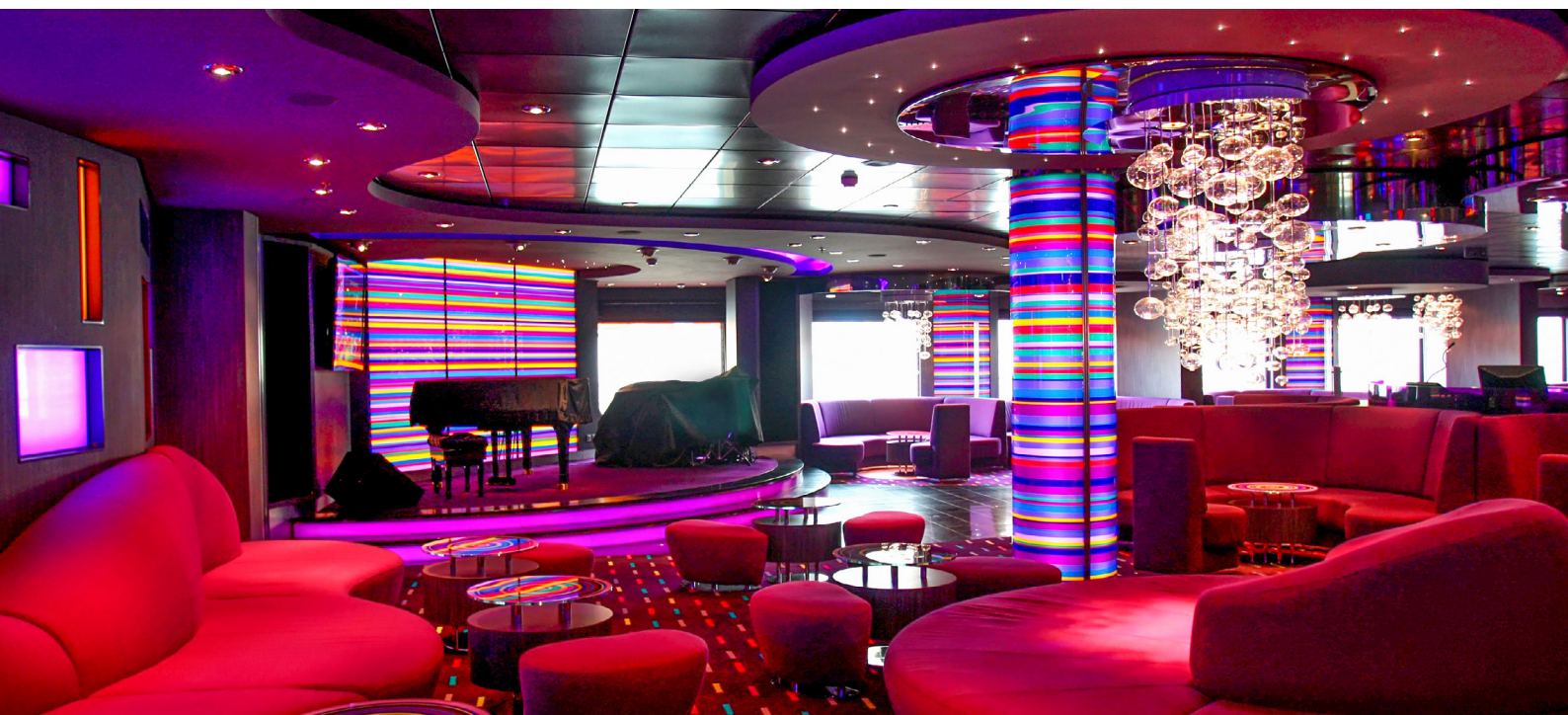
- Use IoT/Sensors for monitoring and optimizing Fuel/Energy consumption, create Digital Shadow/Twin of key operational domains for cruise ship and improved real time Inventory Management.
- Stream real-time high-resolution videos with live Vision AI/Analytics for enhanced security, faster onboard check-in, improved cruise ship operations, and crowd management, among other benefits.

- Use automated vehicles and robots onboard for operational efficiencies and for loading crates and baggage for reduced ship turnaround times.
- Provide onboard immersive crew training and support.
- Conduct drone-based inspections, maintenance, and revamping.

#### **Improve Guest and Crew Experiences:**

- Offer live performance simulcast.
- Provide immersive AR/VR/XR onboard navigational guest experiences.
- Stream onboard edge-enabled entertainment and games.
- Leverage the Smart Energy Management Digital HUB to create Smart Cabin applications for guests.
- Use AI/ML-enabled vision-based embarkation/disembarkation/identity verification processes at sea and at port.
- Enable improved onboard guest-to-guest, guest-to-crew, crew-to-crew communication including push to talk services through the onboard mobile app
- Enable seamless connectivity to mobile network operator services for guests and crews to communicate with their families on land.

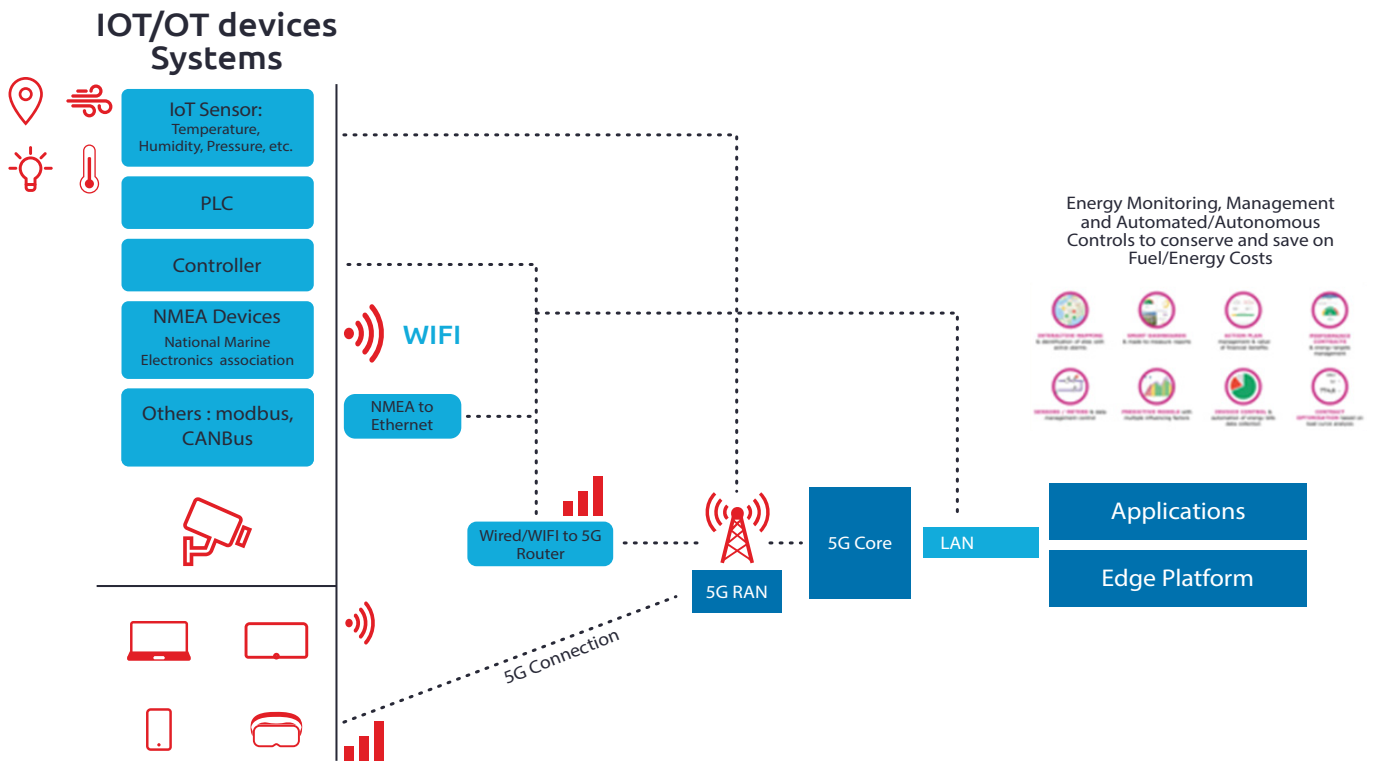
We will explore four use cases in more detail and see why a 5G private network can enable them and why Cruise line operators would benefit from them:



**Use Case 1:  
Monitor and Optimize Fuel/Energy Consumption**

A 5G-enabled energy management system can monitor and autonomously control onboard lighting and HVAC, potentially saving up to 24% of energy, leading to significant cost reductions. Such a system, leveraging the massive

sensorization capacity of 5G, provides real-time optimization, predictive maintenance, and promotes sustainability. Using 5G network slicing for prioritization, this solution improves operational efficiency, lowers energy consumption, and enhances onboard guest experiences.



**Figure 2 Fuel/Energy Monitoring and Optimization Solution**





### Use Case 2: Entertainment and HD Video Streaming

A 5G network provides bandwidth for live streaming of onboard entertainment to thousands of guests. Equally, high-profile events on board the ship could also be simulcast outside the ship to other ships or terrestrial subscribers via network slicing and optimized SD-WAN routing. It also

supports real-time surveillance and vision-based AI analytics for security, crew compliance, crowd management, and quicker check-ins. Improved communication with push-to-talk video services enhances guest and crew experience. This solution promotes revenue growth, operational efficiency, and guest satisfaction for cruise operators.

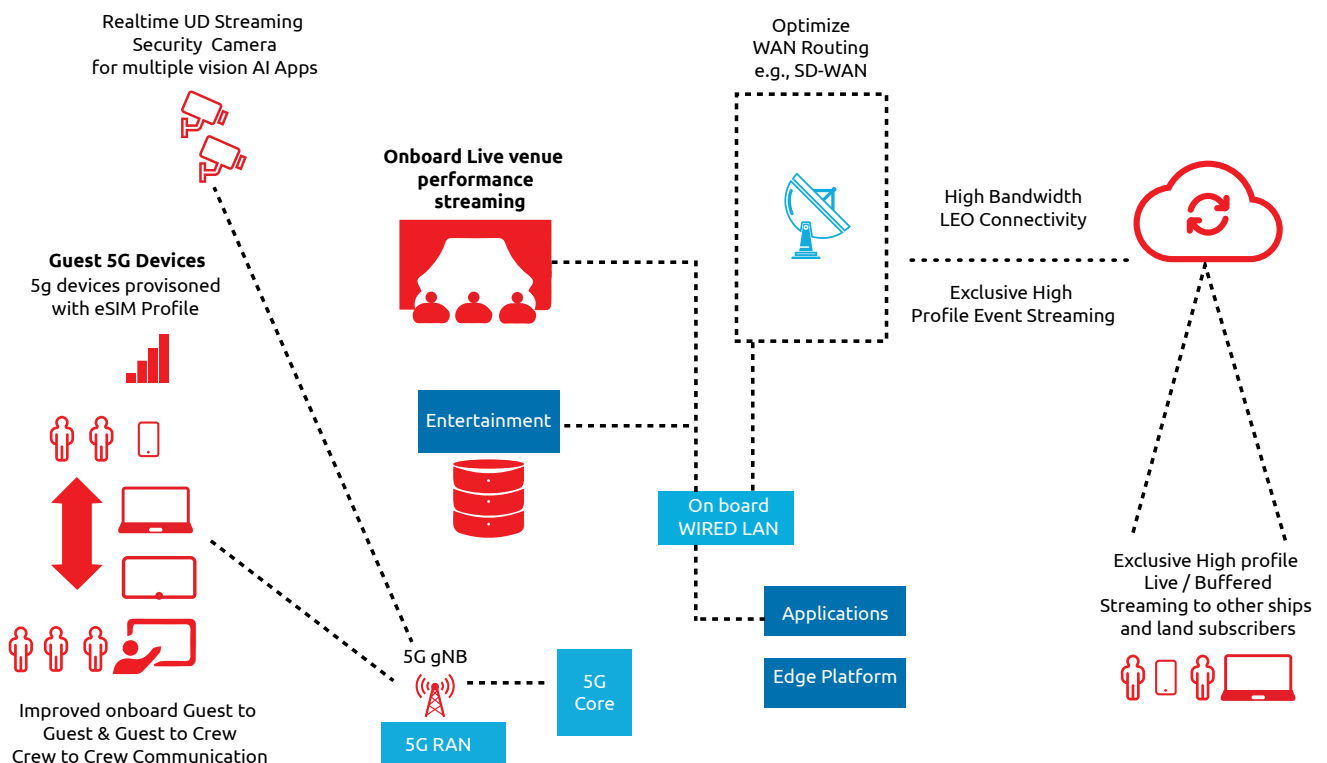


Figure 3 Live Stream Video applications using 5G Private Network

### Use Case 3: Seamless Mobile Network Passenger Connectivity for Voice, SMS, and Data

Using a 5G Private Network on board, cruise operators can collaborate with MVNOs (Mobile Virtual Network Operator) or NHNs (Neutral Host Network) providers and MOCN (Mobile Operator Core Network) services to offer cost-effective, seamless cellular service to guests and crew. The private network can also support edge applications with

application prioritization using network slicing capability of 5G. This improves onboard operations, guest experience, and reduces costs, while ensuring secure connectivity. With the advent of LEO satellite connectivity, this becomes more attractive from a cost perspective, presenting a revenue opportunity for cruise lines by offering a cheaper and more reliable alternative to high cellular costs and poor connectivity.

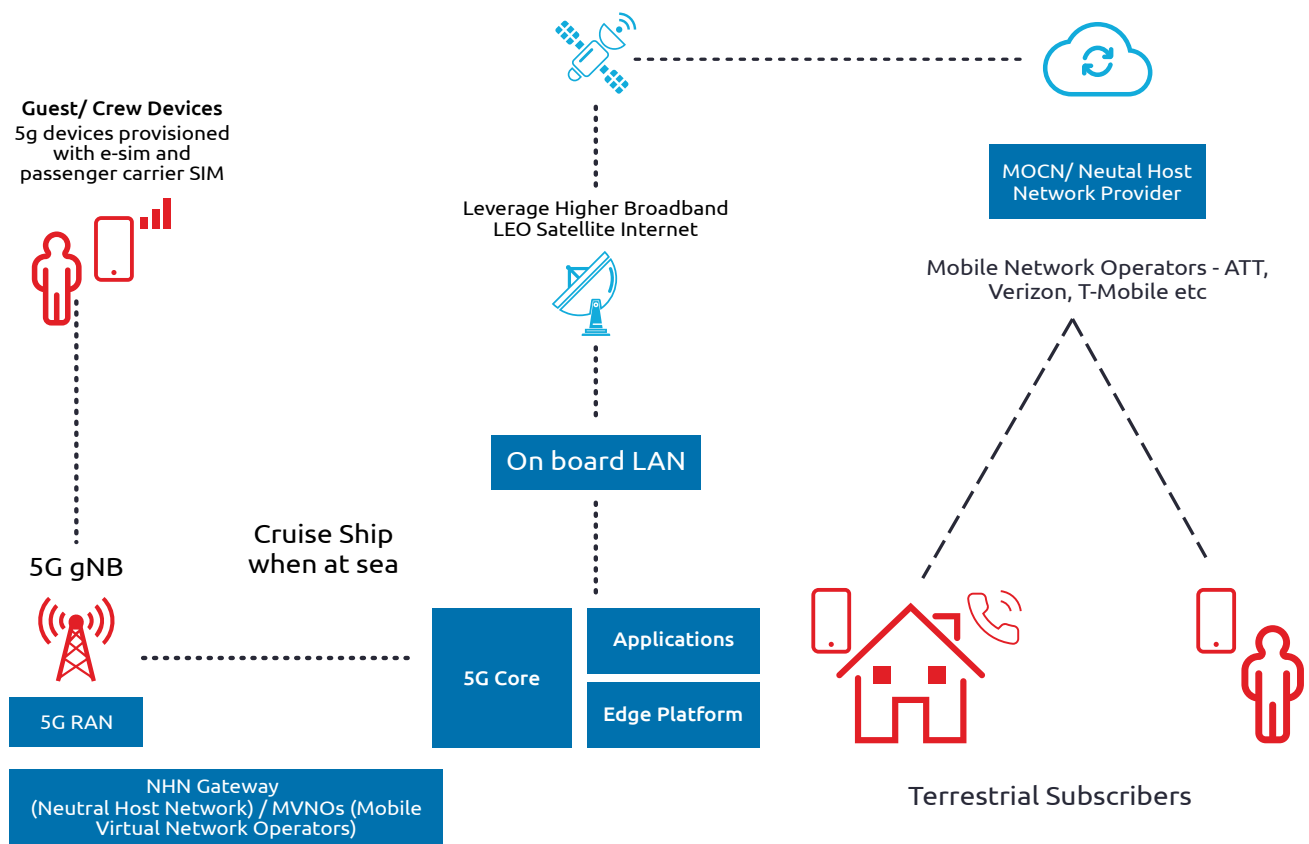
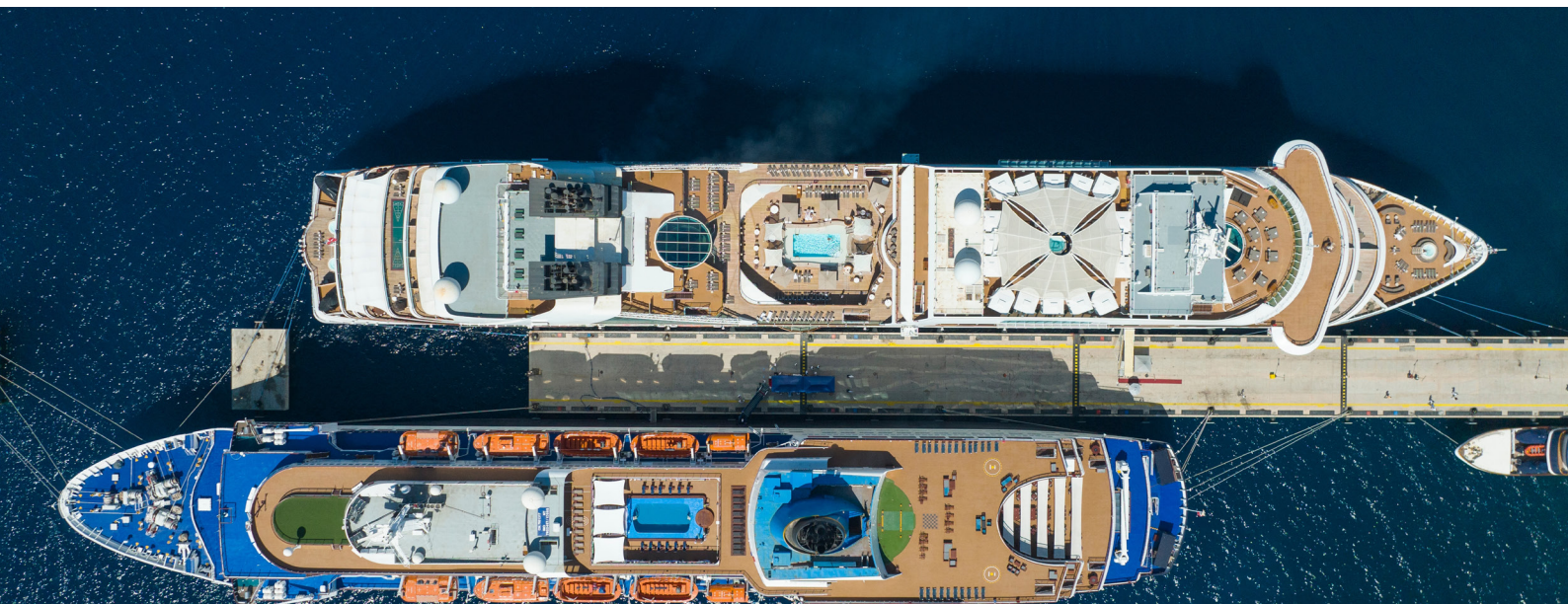


Figure 4 5G Private Network and High bandwidth LEO Internet solution for seamless carrier connectivity







**Use Case 4: Automation using Autonomous Intelligent Guided Vehicles**

Autonomous Intelligent and Guided Vehicles (AIVs/AGVs) offer precision task automation and real-time inventory tracking. Used for loading and unloading while docked

and automating onboard tasks at sea, they require a low-latency network provided by 5G. This automation reduces turnaround times, enhances efficiency, and saves costs. Onboard restaurants can also employ service Robots and Cobots to assist waitstaff, decreasing guest wait times.

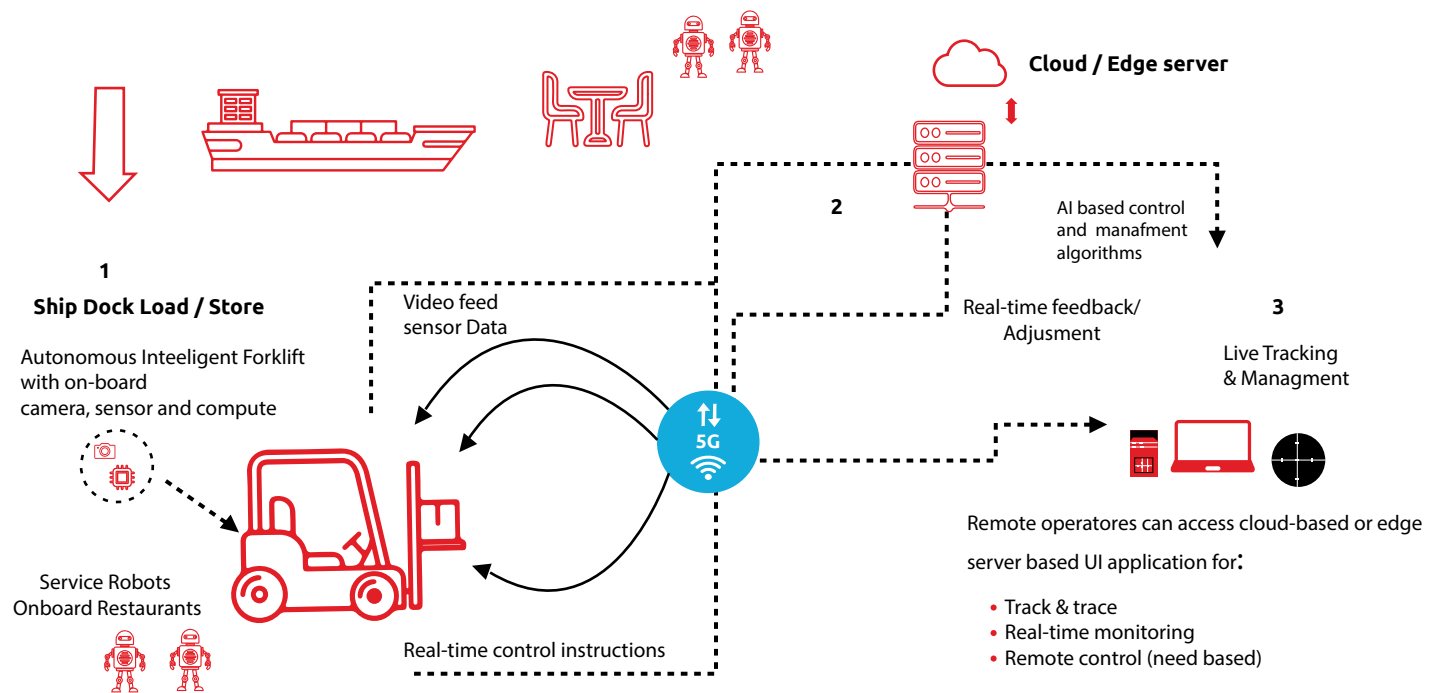


Figure 5 Reliable and low latency network for AIVs and AGVs for automation

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