

# CELLULAR ACCESS SOLUTIONS FOR CRUISE SHIPS

*(APPLICABLE TO OIL & GAS PLATFORMS AND RURAL AREAS)*

## CELLULAR ACCESS SOLUTIONS

### INTRODUCTION

This technology white paper describes the solution options for deploying a cellular access system to provide voice, video and data services to passengers on-board a cruise ship.

The function of the cellular access system is to provide voice, data and video services on mobile or handheld devices on-board a cruise ship. The customers' traffic will be backhauled onshore via the VSAT system on-board the ship.

The purpose of this white paper is to identify possible solutions to extend cellular coverage on a cruise ship.

### CRITICAL SUCCESS FACTORS

The critical success factors for designing and implementing the 2G/3G/LTE solution are :

- To have more defined requirements
  - Access technologies to be identified (2/3G, LTE or WiFi)
  - Actual coverage areas to be identified
  - Bandwidth requirement to be determined (for VSAT)
  - Requirement for Access Control, User Management and Billing
  
- To have detailed information about the cruise ship
  - Floor plans (including existing LAN points, location of equipment room, decks, wall materials, etc)
  - Location of equipment rooms
  - Possibilities of reusing existing infrastructure
  - User density
  
- Determination of frequency licensing issues
  - License to operate in international waters
  - License to operate during docking when overseas

# CELLULAR ACCESS SOLUTIONS

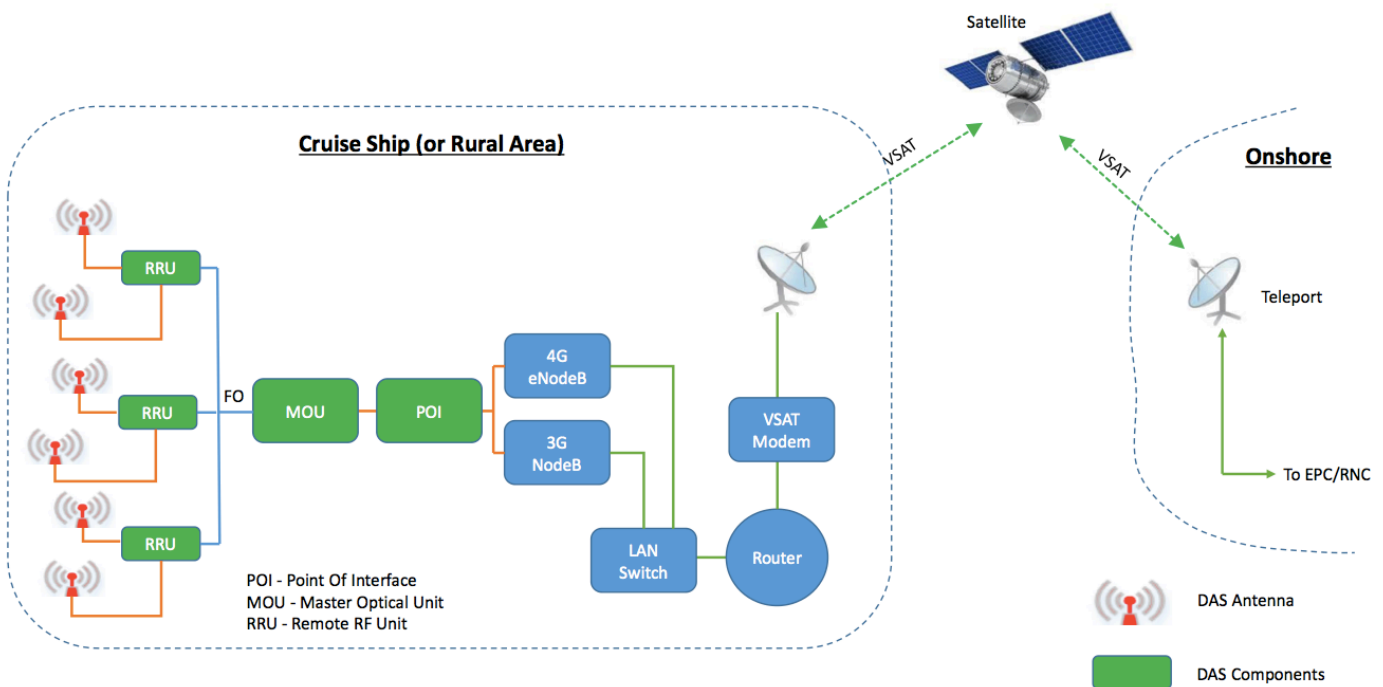
## SOLUTIONS OVERVIEW

There are three (3) proposed solution options :

1. Solution based on ***Distributed Antenna System (DAS)***
2. Solution based on ***Small Cells (Femto and Pico)***
3. Hybrid solution based on ***DAS and Small Cells***

### 1. Solution based on Distributed Antenna System (DAS)

Below is a block diagram showing the typical architecture of a solution based on Distributed Antenna System (DAS). The DAS system is basically a network of antennas deployed on the cruise ship depending on the coverage areas.



**Figure 1 : Distributed Antenna System-based Solution**

## CELLULAR ACCESS SOLUTIONS

The antennas shall be distributed within the cruise ship where coverage is required. The DAS system is mainly recommended for indoor coverage areas. For outdoor coverage using DAS, external omni-directional or directional antennas will be required. The deployment of DAS requires installation of fibre optic and coaxial cables to distribute the coverage within the cruise ship including installation of both indoor and outdoor antennas.

The components that make up the DAS and their functions are :

**POI:** Combines the RF signals from BTSs and MOU

**MOU:** Converts the RF signals into optical signals

**RRU:** Receives optical signals and converts them into RF signals and transmitted into a radiating system

The antennas are connected to the base stations via fibre optic cables via the POI and MOU. The fibre optic cable will be terminated to the RRU which converts the optical signal back into RF signals connecting to the antenna via a coaxial cable.

The Pros and Cons of the DAS solution are :

Pros	Cons
<ul style="list-style-type: none"> <li>▪ Centralized Macro eNode B &amp; Node B</li> <li>▪ Aesthetically more pleasant</li> <li>▪ More subscribers per base station supported</li> </ul>	<ul style="list-style-type: none"> <li>▪ Need to lay new FO/Coaxial cable</li> <li>▪ Installation more difficult</li> <li>▪ Implementation more difficult</li> </ul>

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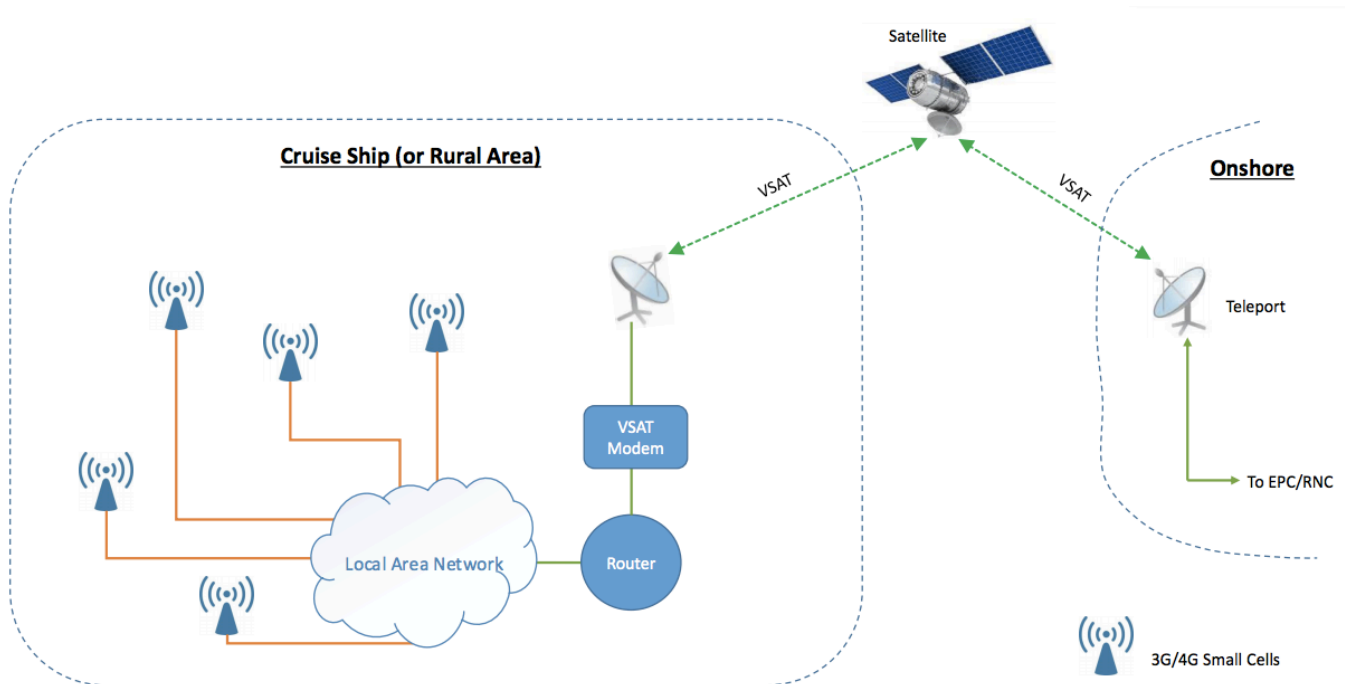
### 2. Solution based on Small Cells (Femto and Pico)

The small cells solution involves the deployment of Femto and Pico cells in and around the area of coverage. The small cells can be deployed using the existing LAN infrastructure of the cruise ship, the 2/3G or 4G base stations can be connected to any existing LAN port in the area of coverage.

The benefits of this solution are :

- Flexible – fast, easy deployment
- Proven – no cell distortion, interference or handover problems
- Lower Cost – Less cabling required as compared to DAS

The diagram below shows the system architecture of the Small Cells Solution.



**Figure 2: Solution based on Small Cells**

The Pros and Cons of the Small Cell solution are :

Pros	Cons
<ul style="list-style-type: none"><li>▪ Can make use of existing LAN infra fibre optic cable may not be required</li><li>▪ Distributed architecture with non-critical single point of failure</li><li>▪ Easier to add/expand more base stations to improve coverage</li><li>▪ Easier and faster to install and implement</li></ul>	<ul style="list-style-type: none"><li>▪ Aesthetic issues</li><li>▪ Lesser subscriber per base station</li><li>▪ Less stable due to more active equipment</li></ul>

### 3. Hybrid Solution (DAS + Small Cells)

The hybrid solution involves the deployment of both the DAS system and the Small Cells in and around the area of coverage.

For indoor coverage, the DAS system can be used to provide coverage in indoor small spaced areas (e.g. accommodation rooms at the various decks). Small cells may be deployed in bigger space areas (e.g. restaurants, casino floors, etc.) where additional capacity is required. Small cells can also be deployed in areas to cover the holes where the DAS system is not able to cover.

For outdoor coverage, omni and/or directional antennas can be used via DAS or base stations depending on the existing LAN infrastructure.

## CELLULAR ACCESS SOLUTIONS

### RADIO ACCESS TECHNOLOGY

Here are the various radio access technologies that can be used to provide wireless access for users on-board the cruise ships :

#### 2G - GSM

2G base stations may be used for the purpose of providing voice communication for the users who subscribed to the service. The advantage of deploying a 2G solution is that it will reduce the backhaul bandwidth requirement on the VSAT system. The 2G system can also be deployed together with the WiFi solution to provide both voice and data access respectively.

#### 3G - WCDMA/HSPA

3G base stations shall be used for the purpose of providing voice communication for the users who subscribed to the service as most LTE base stations (eNode Bs) currently do not support VoLTE which allows for voice communication. Moreover, not all User Equipment (UE), e.g. mobile phones and tablets, is able to support LTE access.

#### 4G - LTE

4G LTE may be used to provide higher data capacity and throughput. However, as the current LTE technology does not support voice, LTE shall only be used for data (including video). LTE may not be suitable for use as it will take up higher bandwidth, which may be a strain on the VSAT system that is not specifically designed with the VSAT system for mobile backhaul. Alternatively, LTE can be replaced by WiFi for data access.

#### WIFI

WiFi access may also be considered on-board the cruise ship to provide data coverage for users on mobile, tablets or laptops. Hence, the proposed 3G/LTE base stations will preferably be able to support multimode access (3G/LTE + WiFi). WiFi is a popular method for data offload in 2/3G networks and are supported in latest smart phones which can switch seamlessly.

Additional value added services can then be offered with WiFi access. For example, passengers can receive real-time travel information via TV screens, traditional Dot Matrix displays, and synchronized web portals accessible over the WiFi and by automated messages on the ship's public address systems. Passengers can now get instant and reliable travel information regarding not only the current journey, but also about connections at the destination and predicted arrival times.

## Radio Access Technology – A Comparison

RAN Technology	Service	Remarks
2G	Voice	Low bandwidth requirement. Good for backhaul. 2G can be deployed with WiFi to provide both voice and data services.
3G	Voice & Data	Can provide both voice and data services in a single platform. A viable solution.
4G	Data	Voice service is not supported. VoLTE is not yet supported in most User Equipment (UEs) and eNode Bs. Using LTE will also increase the bandwidth requirement and may cause bottleneck on the VSAT backhaul.
WiFi	Data	WiFi can be deployed together with 2G to provide both voice and data services.

## CHALLENGES

Some of the challenges that can be foreseen are :

- The need for a telecom service provider to operate the service and provide connections to the terrestrial network
- Installation may be a challenge as it can only take place when the ship is docked
- If the existing infrastructure (fibre and copper cables) cannot be used, then may be required to lay new cables
- Additional bandwidth requirement for VSAT system for backhaul
- Registration, administration, management and billing / charging of users
- Availability of multimode base stations (3G+LTE+WiFi) in the market



### CONCLUSION

We have performed a feasibility study of deploying a 3G/LTE solution on-board cruise ships (extendable to oil & gas platforms and rural areas). We have discussed the critical success factors and challenges. We have also identified the various solutions that can be used including the pros and cons of each solution :

- Solution based on Distributed Antenna System (DAS)
- Solution based on Small Cells (Femto and Pico)

A more concrete requirement will be required from the service provider in order to identify the most appropriate and suitable solution. A combination of the above solutions (hybrid solution) may be required depending on the site conditions on-board the cruise ship.

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OrisTel is a wholly owned subsidiary of **ST Electronics**, one of Asia's largest Information and Communications Technology (ICT) solutions providers specialising in Satellite and Broadband Communications, Intelligent Transportation, e-Government and eco-Enabling Telematics solutions.

OrisTel combines the advanced cutting-edge products from leading telecom equipment manufacturers with the extensive resource and domain expertise of ST Electronics in large-scale mission critical telecom infrastructure, real-time software and complex systems integration to provide turnkey solutions in

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- High Performance 3G, 4G LTE Radio Access Solutions
- Integrated Network Management suite
- Professional Services and Comprehensive 24x7 Technical Support

For more information, please visit [www.oristel.com.sg](http://www.oristel.com.sg)

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