Enabling Integrated Operations

THE LARGEST OFFSHORE HIGH CAPACITY COMMUNICATION NETWORK IN THE WORLD
This is Tampnet

- Tampnet is the market leading provider of ‘state of the art’ secure communication to oil & gas operators and maritime industry in the North Sea (Norwegian & UK Continental shelves) and Gulf of Mexico

- **Providing high-capacity and low-latency infrastructure based on:**
  - Subsea fibre optic cable system (2.500 km)
  - Line-of-Sight solutions (85 LoS connections)
  - Wireless communication based on 4G LTE

- Tampnet’s prime vision is to design, invest and manage subsea fibre infrastructure for the offshore O&G industry

- Tampnet has 15 years experience from building and operating an offshore fibre network

- With no truly competitive technologies in today’s market and an increasing emphasis on control, HSE, quality and efficiency of operations, all clients confirm the strength of Tampnet’s offering and market position

- Tampnet’s network allows customers to realize cash savings and increase safety throughout the drilling and production phases of a field development
Tampnet’s Vision & Mission

VISION
Tampnet’s vision is to become a global leader in providing high capacity, low latency and reliable connectivity to offshore installations, mobile rigs and vessels.

MISSION
Tampnet’s mission is to add value to our customers through connecting offshore assets to robust and reliable terrestrial network with high capacity and low latency. Our services shall enable our customers to improve on quality, health, safety, efficiency and welfare in their offshore operations.
<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tbody>
<tr>
<td>2001</td>
<td>Statoil acquires the subsea fibre network out of Enitel bankruptcy and later establishes Tampnet</td>
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<tr>
<td>2003</td>
<td>Installs subsea fibre from Oseberg to Grane, completing the ring structure</td>
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<tr>
<td>2008</td>
<td>Acquires fibre network in the East of Shetland area from Shell</td>
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<td>2009</td>
<td>New business strategy for Tampnet implemented</td>
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<td>2010</td>
<td>HitecVision acquires Tampnet from Statoil</td>
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<tr>
<td>2011</td>
<td>Tampnet acquires North Sea Communications from TeliaSonera</td>
</tr>
<tr>
<td>2012</td>
<td>EQT acquires Tampnet from HitecVision</td>
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<tr>
<td>2013</td>
<td>Tampnet awarded new fibre-laying contracts; - 300 km with new subsea fibre to three new fields (Total, Statoil &amp; Lundin)</td>
</tr>
<tr>
<td>2014</td>
<td>Acquire US based Airtap, leading offshore broadband provider</td>
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<tr>
<td>2014</td>
<td>Acquire CNSFTC from BP</td>
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<tr>
<td>2015</td>
<td>Tampnet acquires Broadpoint in US, and has entered into a strategic long-term roaming agreement with AT&amp;T for the GoM region</td>
</tr>
<tr>
<td>2015</td>
<td>Tampnet starts to deploy 4G LTE in the GoM</td>
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</table>
The Tampnet Infrastructure in the North Sea

LEGEND:
- FIBRE OPTIC CABLES
- RADIO LINKS
- NEW FIBRE CABLES
The Tampnet infrastructure – Gulf of Mexico
Tampnet Flexi Mattress

Tampnet develops technology and equipment to improve cable installations

Best Practice

Tampnet Flexi Mattress with the cable channel
Pipeline Crossings – Tampnets Best Practice

Tampnet develops technology and equipment to improve cable installations

Utilizing Tampnet Flexi Mattress

1. Pipeline to cross
2. Install Tampnet Flexis Mattress
3. Install the fibre cable
FOC System Pull-in

- Tampnet has designed and/or performed a wide variety of pull-ins:
  - TLP platforms
  - Concrete Gravity Base platforms
  - Subsea wet-mate tie-ins
  - Jacket platforms
  - FPSO Turret tie-in designs
- Some examples;
Even more challenging conditions for broadband infrastructure!
The North Sea

0-100 Gbps in less than 10ms
ROADM Add-Drop Options

**Multi-degree ROADM**
- Flexible wavelength routing between WAN ports
- Fixed channel filters for connecting client ports to specific WAN ports
- Cost effective and contentionless

**Directionless ROADM**
- Flexible connection of add/drop channels to any WAN ports through addition of add-drop WSS.
- Dual DIA reduce contention
- Contentionless for 2 degree
- Pre-planned restoration

**Colourless ROADM**
- Reconfigurable to add/drop any wavelengths on any port through addition of colourless mux to directionless configuration
- Contentionless for 2 degree
- Arbitrary restoration

6500 ROADM designed to support of combinations of above configurations via in-service upgrade to enable application evolution
What is Contention?

Ports on CCMD12 are colorless; any $\lambda$ can be connected to any port.

However if one specific lambda is connected (say $\lambda_n$), then a Tx tuned at the same wavelength cannot be connected to any of the other port of this bank of SMD/CCMD12's.

This limitation is referred to as lambda contention.

Colorless, DIA ROADM
Both the direction and the “color/wavelength” of the Tx/Rx can be remotely reconfigured.
One way around the contention limitation, is to add a second Bank (DIA / colorless OTS).

In this case, a second Tx tuned at the same $\lambda_n$ can now be connected to this 2nd Bank.

A trade off exists between # of DIA’s and # of branching connections, whereas the sum of the two is equal to the WSS total port #. E.g. for a 1x9 WSS ROADM, one could have 5 DIA’s serving up to 5 directions.

Can support 100% colorless add/drop per direction.
Contentionless Solution

Ports on the CCMD8X16 are also colorless; any $\lambda$ can be connected to any port.

Moreover, multiple Tx tuned to a given lambda (say $\lambda_n$), can be connected to any of the ports of the CCMD8X16’s.

This configuration is referred to as lambda contentionless.

With 8 degrees that support $\lambda_n$, then you can have 8 unique signals at $\lambda_n$ add/drop on a single CCMD8X16.

Enabling technologies
- Twin 1x20 WSS
- 8x16 multi cast switch with EDFA array
- Fiber shuffle and MPO connectors
- Connection and fiber validation architecture
- Coherent Rx

Contentionless, Colorless, DIA ROADM
Both the direction and the “color/wavelength” of the Tx/Rx can be remotely reconfigured. No wavelength blocking restrictions.
Tampnet Offshore Wireless Access with 4G LTE

• Requirement for connection of rigs and vessels in motion
• Currently using radio links and VSAT
  - Time constraints
  - Costly installations
  - Limited access to nearby platforms
• Use of new technology in order to offer reliable broadband services.
• Retain focus on providing bandwidth services to the industry
• Low latency
• High bandwidth
LTE Coverage plan
Examples of Recently Connected Units to 4G/LTE

The customers using Tampnet’s 4G/LTE are very satisfied with the services and especially appreciate the high capacity and low latency that was not possible earlier using satellite.

<table>
<thead>
<tr>
<th>Name: Gryphon</th>
<th>Name: Transocean Winner</th>
<th>Name: Bibby Sapphire</th>
<th>Name: Island Pride</th>
<th>Name: West Linus</th>
<th>Name: North Sea Producer</th>
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<tbody>
<tr>
<td>Type: FPSO</td>
<td>Type: Drilling Rig</td>
<td>Type: Offshore Vessel</td>
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<td>Type: Drilling Rig</td>
<td>Type: FPSO</td>
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<tr>
<td>Online: Aug 2013</td>
<td>Online: May 2014</td>
<td>Online: June 2013</td>
<td>Online: June 2014</td>
<td>Online: July 2014</td>
<td>Online: July 2014</td>
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<th>Name: Sedco 704</th>
<th>Name: Maersk Resolve</th>
<th>Name: Global Producer 3</th>
<th>Name: Well Enhancer</th>
<th>Name: Floatel Superior</th>
<th>Name: Maersk Giant&amp;Gallant</th>
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<tr>
<td>Type: Drilling Rig</td>
<td>Type: Drilling Rig</td>
<td>Type: FPSO</td>
<td>Type: Offshore Vessel</td>
<td>Type: Accommodation unit</td>
<td>Type: Drilling Rig</td>
</tr>
<tr>
<td>Online: June 2014</td>
<td>Online: June 2014</td>
<td>Online: October 2013</td>
<td>Online: Sept 2013</td>
<td>Online: June 2014</td>
<td>Online: Aug 2014</td>
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