How mesh networks can be used to provide broadband wireless access between oil rigs in the NSR

Case Study Final Report

Investing in the future by working together for a sustainable and competitive region

How mesh networks can be used to provide broadband wireless access between oil rigs in the NSR

1 Executive summary

1.1 Introduction

ScandiCall AS was established in 2009 in Innovationpark Stavanger as a result of Ipark´s involvement in the E-CLIC project. The idea was conceived during a conference at Karlstad University in 2008 on wireless networks and service development. The business idea is to deliver high speed Mesh-networks built with our own developed technology. Key markets will be for industrial usage, with a specific focus on Maritime and the Oil & Gas Industry. The solutions are also suitable for consumer/commercial markets and initially the company will use the consumer and traditional business market to generate revenue and build a customer base with reoccurring revenue.

Since the establishment of the company, the development work for the key parts of the technology have been completed and now the company is focused on commercialising part of that technology to create a healthy business. The work has been going on for approximately 10 years and the Transport authority of London is using the solutions for its river passengers. The mesh network are in operation in several location across the UK through its former UK-subsidiary Mesh-Hopper which owns the IPR-rights.

The timing for introducing a new service / product into the Nordic offshore market seems appropriate.

1.2 Background

An overview of the scope of the project for the period Sep 2010 – Dec 2011 is provided below.

Phase 1 – build onshore infrastructure/test facilities
Phase 1 (Sep 2010 – Des 2010)
Complete build of Mesh network at Ipark.
The plan is to use the pilot in the Ipark Incubator which is installed to restore and build confidence in wireless networks as users have been complaining in the past about poor network connection. After initial pilot testing the plan is to roll-out the complete solution for the entire Innovation Park.
The network will initially provide up to 100 mb/per second when the new backbone is rolled-out.

Phase 2 (Jan 2011 – Mar 2011)
Build Mesh Network in Stavanger Town Center.
The plan is to expand the initial Ipark network to also include the city town center. A precondition is that the backbone provided is in place to be able to provide speeds up to 300 mb/per second.

Phase 3 (Apr 2011 – Dec 2011)
Mesh network build: Kvadrat, Madla/AMFI, Vågen 33, Kilden, Sandnes Town Center, Sola and Forus. The plan is to further expand the network to include the most central areas of Stavanger. The city wide network should at this point be able to deliver speeds up to 500 mb/per second.

Phase 2 – upgrade test facilities offshore
Carry out offshore tests (Risavika port area of Stavanger). The plan is to connect the mesh network at Ipark with the to provide complete test facilities for the industry. This will require “proof of concept”. (At a later stage the testing facilities can be integrated into the upgraded Ullrigg test centre at IRIS to offer a complete EX-certified test-laboratorium for drilling and well services and performance testing).

2 Technology / roadmap status

2.1 Current status (Release version 3.1)

Version 3.1 is the network software which has been fully developed and tested for the deployment on 2.4 and 5.0 GHz Wifi frequencies. Therefore, ScandiCall are currently able to provide mesh networks using this software for industry and consumers, where the nodes are typically in a fixed location.

ScandiCall have a team of software developers in the UK that are constantly upgrading the software and have 2 planned updates scheduled for release until the end of 2011.

Software Version	Speed	Planned Release Date
Version 3.1	2.4 & 5.0 ghz	Released October 10
Version 3.2	300 Mbit per second	Q4 2010 (December)
Version 3.4	Up to 550 Mbit per second in the 5Ghz band.	Q1 2011 (March)

In Innovation Park Stavanger (Ipark), version 3.1 is implemented and fully operational being used on a daily basis by companies in the Incubator and employees in Ipark AS and Prekubator AS.

A new backbone line into the incubator building in Ipark offered by Lyse has been established to provide better access for incubator companies and employees to the wireless network.
The new fiber-optic backbone connection and layout of the building will make it possible to carry out wireless experiments/testing on new services/equipment for the Oil&Gas industry.

Due to high testing costs offshore this will enable the industry to test out new services in a controlled environment onshore before deployment offshore as offshore tests requires huge financial investments.

2.2 Release 4.0 – Due for Release Q1/2012

The next major step to improve the technology is to make the software work on low frequency mobile networks in ranges between 400 and 900 MHz. ScandiCall have already obtained test licenses from the Norwegian “Post and Teletilsynet”.

The key technological advancement in this step will be in providing more coverage, due to lower frequencies. The challenge in providing this service is enabling the same speed of the network.

The impact on the end customers in having this kind of speed over their wireless networks is great.

The final evolution of the technology will be to deploy the software on mobile cells that are moving.
For example, imagine a high speed, mesh network on an oil rig or vessel that can seamlessly move location, without disturbing network capabilities delivering a multitude of services such as audio, video, application streaming, data exchange and measurements. This is a totally new business opportunity, where a vast range of services can be delivered over a robust mesh network.

These kinds of testing services will require access to a robust test-environment that is capable of offering speeds up to 1 GB throughput p/s. The network in the incubator is currently being upgraded from version 3.1 to version 4.0. The speed offered by the backbone is upgraded from 10/10 MB to 100/100 MB with an optional upgrade to 1GB. This will offer excellent testing facilities for the industry.

3 Project (Future & current industry needs)

3.1 Basic idea / concept

The basic idea behind the project is better mobility – flexibility – availability. Fiber-optic solutions today on existing brownfield installations have limited range, coverage and flexibility. As the shallow water oilfields in the North Sea are getting harder to extract, more detailed data is required about wells drilled, drilling data, subsea operations and, topside operations and offshore/maritime operations. Currently, fiber-optic communication is the only viable alternative, but higher demands from the oil companies/-service companies places higher demands for more bandwidth and capacity on Tampnet who serves 40-50 installations on the Norwegian and British side of the North Sea and is 100% owned by Statoil. Not even all of the fields are hooked up through the cable, some are only using radio links as the primary communication tool, thus creating a vacuum for more flexible solutions.

3.2 Innovation / technological readiness level

As production now is starting to decrease on NCS and increase in remote areas / deep water areas the industry and the R&d competence institutions will require new innovations & services to be developed in order to take out the full possibility of the 300 MNOK value potential that OLF estimates can be achieved from integrated operations. This is especially applicable to the Arctic areas of the Barent Sea. The coastal areas outside the cost of the Mexico Gulf, Brazil, Australia and South East Asia will require the same flexible solutions because of the water depth and currents in the area. The technology can also be a supplement to fiberoptic comm. and provide greater coverage between the oilfields currently in operation in the North Sea. The industry trends and technology advancements supports this view.

The degree of radical/disruptive or incremental / sustaining innovation is characterized below:

Technology:
Radical developments are occurring in 1) wireless comm.. 2) satellite comm. 3) IP/radio-comm.:
Satellite communication – the new Immarsat satellite launched in 2010 will be capable of handling 1.4 GB per/second vs. 3.6 MB per/second with 7 millisecond roundtrip delay.
Wireless communication – WiMax/CDMA/LTE nodes combined with mesh technology in the network will have boosted radius ranges from 20-30 km to 40-50 km coverage.
IP/Radio communication – Radio links mounted on ships capable of transferring 35 mbps will be capable of transferring 75-150 mbps in a mesh network with IP-radio com.

The main benefits / advantages / unique attributes of the technology:
Load/traffic balancing - use alternative routing paths/split packets to reduce load
Data transfer/bandwidth capacity - condition monitoring requires greater processing.
Robustness/scalability/flexibility –ships require secure, robust and flexible comm.
Availability/continuity – ships require more continuity of services to reduce idle time.
Investment/deployment - cheaper alternative to fiber/cable and lower roll-out costs.

Market:
The technology supplement fiber optic comm. in brownfield areas on the NCS/North Sea
The technology can replace fiber optic comm. in deep water/remote areas worldwide
The technology concept can also be applied to a range of overlapping sectors offshore such as offshore windmills, ports and logistical operations and maritime emergency services.

4 Technology alternatives

Wireless offshore communication solutions today have limitations in terms of limited range, hazardous operating environments and static point-to-point network links. New wireless technologies such as WiMax/CDMA/LTE in combination with advancements in mesh protocols and improvements in satellite communication will enable better bandwidth coverage, increased capacity, higher speeds and boosted ranges and in turn create a market-driven demand for new applications and services in the Offshore/Maritime sector.

There have so far been a limited number of studies done in this field and the findings have not been publicly published. One of the main issues in the past has been that the technologies used have not been mature enough for industrial usage in terms of robustness and security. It has therefore been a widespread view in the Maritime & Offshore Oil & Gas industry that wireless networks have limited use due to heavy infrastructure upgrade costs and limited bandwidth coverage. This project aims to show that there are, contrary to previous findings, huge unexplored opportunities in the area of 1) satellite communication 2) wireless communication and 3) IP/Radio-based communication for offshore use.

4.1 Satellite Communication – exponential increase in bandwidth and capacity for mobile satellite services

A. Mobile Satellite Services - significant opportunities for maritime sector

Mobile Satellite Services (MSS) represents a new area of huge interest associated with the "Future Internet" call within the Communication Technology" priority and "Mobile Internet" stream in the Norwegian Research Council. The European commission has awarded contracts to Inmarsat and Solaris to operate the "next generation mobile satellite communication in all 27 member states in the EU. Terminals will also be designed for being mounted on ships and used for maritime communication. The new mobile satellite services (MSS) will be capable of transferring 1.4 GB per/second vs. 3.6 MB per/second with 7 millisecond roundtrip delay from location to location making it a radical advance in data transfer capacity and data throughput rate. For the project, this will be a huge advancement in data transmission capability that can enable development of new services and applications such as, for example, seismic data collection and condition monitoring of subsurface and topside equipment.

B. International Mobile Satellite Organization (IMSO) – new developments between IMO/ IMSO

The International Mobile Satellite Organization (IMSO) is the intergovernmental organization that oversees certain public satellite safety and security communication services provided via the Inmarsat satellites. IMSO is supported by the International Maritime Organization (IMO) These public services include: 1) services for maritime safety within the Global Maritime Distress and Safety System (GMDSS) established by the International Maritime Organization (IMO) 2) distress alerting 3) search and rescue co-ordinating communications 4) maritime safety information (MSI) broadcasts 5) general communications. IMSO also acts as the International LRIT Coordinator, appointed by IMO to coordinate the establishment and operation of the international system for the Long Range Identification and Tracking of Ships (LRIT) worldwide. For the project, these value-added services will provide added value to vessels owners and field operators enabled with new capabilities in MSS services.

C. IP-based satellite services – new terminals to be fitted on ships in the near future to enable MSS

Inmarsat is the sole global provider of GMDSS (Global Maritime Distress and Safety Services) and is supported by the IMO (International Maritime Organization) responsible for all maritime standards. Services are grouped into 1) existing services operated by Inmarsat and 2) IP-based services distributed through partners and owned and operated by Inmarsat: B) Fleet Broadband (FB): A maritime service, Fleet Broadband is based on BGAN technology, offering similar services and using the same infrastructure as BGAN. A range of Fleet Broadband user terminals are available, designed for fitting on ships. For the project, new terminals developed can be placed or fitted on the vessels to enable the above services (A) and (B) for vessel owners and subcontractors.

4.2 Wireless Communication – future internet applied to remote areas offshore

A. WiMax – providing last mile access and boosted ranges through new developments

WiMAX, meaning Worldwide Interoperability for Microwave Access, is a telecommunications technology that provides wireless transmission of data using a variety of transmission modes, from point-to-multipoint links to portable and fully mobile internet access. The technology provides up to 10 Mbit/s [1] broadband speed without the need for cables. The technology is based on the IEEE 802.16 standard (also called Broadband Wireless Access). The 802.16m system can support both 120 Mbit/s downlink and 60 Mbit/s uplink per site simultaneously. It is expected that the WiMAX Release 2 will be available commercially in the 2011-2012 timeframe [26]. The goal for the long-term evolution of WiMAX is to achieve 100 Mbit/s mobile and 1 Gbit/s fixed-nomadic bandwidth as set by ITU for 4G NGMN (Next Generation Mobile Network).

B. CDMA – providing multiple access to users on a single communication channel

Code division multiple access (CDMA) is a channel access method utilized by various radio communication technologies. One of the basic concepts in data communication is the idea of allowing several transmitters to send information simultaneously over a single communication channel. This allows several users to share a bandwidth of different frequencies. This concept is called multiplexing. CDMA employs spread-spectrum technology and a special coding scheme (where each transmitter is assigned a code) to allow multiple users to be multiplexed over the same physical channel. For the project, CDMA will enable access to multiple users using different frequencies on the same radio communication channel enabling services such as Push-to-Talk (PTT) and Location-Based Services (LBS) on oilfields and rigs.

C. LTE – Next generation Mobile Internet of the Future (4G)

LTE (Long Term Evolution) is the last step toward the 4th generation (4G) of radio technologies designed to increase the capacity and speed of mobile telephone networks. On August 18, 2009, the European Commission announced it would invest a total of €18 million into researching the deployment of LTE and LTE Advanced. The LTE specification provides downlink peak rates of at least 100 Mbps, an uplink of at least 50 Mbps and RAN round-trip times of less than 10 ms. LTE supports scalable carrier bandwidths, from 20 MHz down to 1.4 MHz and supports both Frequency Division Duplexing and Time Division Duplexing. The main advantages with LTE are high throughput, low latency, plug and play, FDD and TDD in the same platform, improved end-user experience and simple architecture resulting in low operating costs. For the project, LTE offers the latest advances in Mobile Internet Technology and a giant leap from 3rd generation (3G) technologies such as UMTS and HSDPA from downlink 42 mpbs and upload speed 11.5 mpbs to 360 mpbs and 80 mbps. This will enable almost up to 10 times equivalent more data to be transferred, enabling large batches of data processing and real time information to be displayed and live streaming of applications between vessels and rigs.

4.3 IP/Radio-based Communications

A. Sensor technology: increased flexibility and robustness

Mesh networks are a self-organizing wireless network of mobile nodes communicating using multi-hop routing. The nodes act as both hosts and routers. The mesh capability of the nodes makes it possible to use even old radio equipment to broadcast signals through IP-based networks without having to change the equipment or invest in expensive infrastructure equipment. This can be done by either placing a small sensor connected to the radio equipment or program the radio using developed software to convert the signals that the radio transmits from radio-signals to IP-based. Another added benefit is that intelligent sensors also has the capability to sense interfering airwaves and automatically switch between available channels that are available to provide the best continuity and provide less downtime for end-users.

B. Wireless technology – future internet applied to remote areas offshore

WiMax/CDMA/LTE are all promising technologies to enable access in areas were fibre optic cables are unsuitable and out of reach or insufficient to provide the best Quality of Service. As production is decreasing in traditional brownfield areas, the industry will need to adapt to more flexible and robust communication solutions to operate in areas with deeper water and harsher weather conditions. One of the reasons for this is that communication between ships and rigs or FPSOs are becoming more critical to operate. Wireless technologies offer a more flexible and robust way to operate that enables greater mobility of vessels and floating rigs/FPSOs and ensures faster data exchange of information between ships and rigs and between vessels.

5 R&D challenges & problem scenarios

5.1 Timing and launch of new innovation to market

We believe that there is an urgent need for a more flexible, mobile communication infrastructure and value added services network accessible offshore on both brownfield (shallow water) and deep water oil fields capable of transferring greater amounts of data from any ship or vessel offshore onto a fixed platform/rig and/or floating rig/mobile production vessel (FPSO) or transfer data from one ship or vessel to another ship or vessel or directly back onshore to the experts via either fibre optic networks or satellite communication.

5.2 Possible market scenarios

By placing a wireless device or sensors on the ship it will be possible to track the ships movement, access cameras in the front and the back of the ship, access floors, doors and emergency exits and the main deck. It will also be possible to collaborate through video, audio or application streaming with experts/crew onboard the ship to operate subsea/topside equipment and buoy/loading operations.

1) Scenario 1: seismic surveys and exploration of seabed & geological data

Seismic exploration ships carry out seismic surveys on the geology and topology of the seabed floor. Vast amounts of data are stored in the ship's mainframe computer and processed. To unload the data at present the ship has to dock with the nearest platform or rig to unload the massive data volume which is transferred onto the rig/platform and then transferred back onshore to the control centre / geology experts or even have to go back to the port to unload the equipment and data volume. With new technology ships would be able to freely operate without downtime, saving the vessel operator and subcontractor both delays and downtime.

2) Scenario 2: Mobilization of topside/subsea equipment on supply vessels

Supply vessels receives orders to carry subsea/topside equipment and experts from the port onto the oil field installations. An average supply vessel can easily have 35-50 mobilization missions per year. Each time the ship returns to the port and unloads its payload onshore a new crew comes onboard together with 4-5 experts to plan the next mission and where to place the new equipment on the deck. With an average of 35-50 mobilization missions per year the average cost per hour of not being in operational modus is approximately 100.000 NOK per hour which is equivalent to about 1MNOK per non-idle day and 9-10 MNOK per year/per ship in profit loss for the operator/owner.

3) Scenario 3: Condition monitoring / parameter trending of topside/subsea equipment

Parameter trending and diagnostics of subsea equipment is another major issue. At present areas that have deep water outside their coastline to place fixed rigs/platforms do not have the same fibre optic capacity as the north sea. This limits implementation of condition monitoring applications to monitor specific trending parameters causing equipment to break down faster and have to be replaced more often causing disruption in the production flow. With robust wireless solutions these areas would be able to operate more cost-efficient and transfer more data back onshore because of the bottleneck problems in remote areas with limited fibre optic capacity.

4) Scenario 4: Tracking of sailing paths and ship coordinates & logistics
Tracking sailing paths and monitoring ship coordinates is also a costly job. Currently Vispo3D is being used by ConocoPhillips to monitor ship sailing paths, weather patterns, wave height, etc., and Statoil will soon adapt the same system. For the project, the system can also be equipped to keep track of wireless zones and connectivity as well as keeping track of RFID tags and keep track of ship logistics and ship heading and sailing paths. In addition, the system can also be equipped to handle port and ship communication and coordination between ships and rigs/platforms/FPSOs to prevent accidents and hazardous operations offshore.

5.3 Market opportunity - offshore

1) Brownfield installations – current industry needs
As production is going down on traditional oilfields which are typically located in brownfield / shallow waters were the platform/rigs are either fixed or floating constructions, whereas in the new exploration areas; The Arctic, Gulf of Mexico, Brazil, India/Vietnam and Australia are all surrounded by deeper waters which require floating and subsea structures to be built because of higher water depth, weather conditions and topology of the seabed floor. Fibre optic communications are insufficient in these areas.

Main R&D-Challenges:

- **Bandwidth capacity and bottlenecks** – Operators/-service companies are requesting more bandwidth and capacity simultaneously as the need for production data to be processed has increased exponentially. Tampnet is currently evaluating wireless alternatives in addition to fibre optic communication and radio links.
- **Mobilization of vessels and idle time –** How can new wireless and satellite technology be used more efficient to reduce downtime on vessels and reduce downtime for both the field operators and vessel owners?
- **Transfer of geological and seismic data –** How can new wireless technology make the process of processing and transferring geological/seismic data from exploration vessels to rigs/onshore more efficient?
- **Tracking of vessels and oilfields –** Today, radio communication is widely distributed on vessels that have limited data transfer capability. How can wireless and satellite communication improve coordination of vessels entering into an oilfield or an area with many supply vessels or dangerous objects more efficient?
- **Loading/Buoy operations –** Today, there are a lot of accidents and minor incidents occurring while supply vessels are unloading and loading equipment on and off a platform/rig causing damage/injury to the equipment, vessel and/or structural integrity of the platform/rig. What can be done to prevent this using wireless / satellite technology (e.g. camera monitoring, video, voice etc.)?
- **Industrial Automation & meter readings –** how can wireless / satellite communication enable meter readings of instruments (valves, sensors, etc.) readers in a mesh network on a platform or onboard a vessel?

2) Deep water installations – future industry needs
Supply vessels and FPSOs will play an important role in deep-water areas. As data traffic and volumes increase, supply vessels will require more flexible, mobile communication solutions and will have to be capable of relay signals/traffic between ships / floating installations and be capable of transferring vast amounts of data through satellite uplink and be able to share applications and data with the experts onshore and onboard the FPSOs / floating platforms/rigs. Wireless communications are critical in these areas.

R&D-Challenges:

- **Condition monitoring –** the lack of fibre optic options in remote areas makes it harder to do trend analysis and diagnostics because of the limited bandwidth capacity, causing equipment to break down faster which ends up costing the operator valuable time and money. How can wireless/satellite technology in remote areas be utilized to transfer diagnostics parameters and do trending analysis on equipment?
- **Robustness/ remote operations –** because of the changing weather conditions and rugged geology in some remote areas some of the operations will have to be performed from a distance. Will the wireless solutions be robust enough to withstand the hazardous operating conditions and robust enough to be remotely operated?
- **Scalability/Handover issues -** will the proposed wireless solutions be flexible and scalable to handle large transaction volumes per millisecond? How will handover between mesh networks and different wireless networks offshore behave?
- **Investment/deployment –** What will be the actual investment and deployment cost of a wireless sensor and satellite-based network? What type of add-on services will typically be needed in order to operate remotely? What is the advantage / disadvantage in comparison to fibre optic cable networks?
- **Power consumption needs –** What will be the actual power consumption needs of a wireless sensor and satellite-based network? What will be the typical consumption by nodes and sensors (taking into account data traffic transmission rates, volume, number of users, volume of transactions, number of nodes, etc.,.)?

Summary: All of the above identified scenarios and research & development challenges amount to huge cost savings for both the field operator and rig/platform owners and vessel owners/lenders and subcontractors / offshore equipment suppliers and will provide challenging and value-added research assignments for partners.

Table 1: List of possible R&D collaboration programs in Norway and in the European Union:

Prosjekttype	**Prosjekt**
EU-Project (Interreg IVB NSR)	European Collaborative Innovation Centres (E-CLIC)
EU-Project (Interreg IVB NSR)	Offshore Wind Power Cluster (Power Cluster)
EU-Project (Interreg IVB NSR)	Implementation of the Motorways of the Sea (StratMoS)
EU-Project (Interreg IVB NSR)	Simulation and e-tools for Maritime Safety and Security (SMIASS)
EU-Project (Interreg IVB NSR)	Incident Maritime Response (IMPRES)
FP7/CORDIS (IST Project)	WiMax extension to isolated research data networks (WEIRD)
Norwegian Centre of Expertise (NCE)	Norwegian Centre of Expertise Maritime (NCE Maritime)
MAROFF program (MAROFF)	Maritime Communcations Project (MARCOM)
ARENA program (ARENA)	Arena Integrated Operations (Arena IO)
ARENA program (ARENA)	Arena Maritime Operations (Arena Offshorefartøy)
ARENA program (ARENA)	Arena Trådløs Framtid (Trådløs Framtid)
NORWEGIAN RESEARCH COUNCIL	SYNCROPORT / OFFSHORE WINDMILLS (Grieg Logistics)
OLF Telecom User Forum Group	Pilot Valhall WiMax (OLF)
TAIL	Statoil, ABB, SKF, IBM, AkerSolutions

6 Conclusion / Implementation plan

6.1 Conclusion / summary

A demonstration of the proposed wireless solution outlined above in the report was provided by ScandiCall and tried out during the 2010 ONS conference “Open day” at Statoil. The need arose when Statoil and the organizers realized before running the event that the current closed wireless network provided by Telenor in the conference centre was unable to support the video and streaming services.

The conference organized by Ipark had speakers from NASA, Seabed Rig and Statoil that required greater flexibility and speeds offered by the current network installed in the IB-centre at Statoil.

In effect, the mesh network provided by ScandiCall was installed in a matter of only a couple of days before the conference and configured remotely in a matter of a few hours. The network worked seamlessly and the demonstrators could remotely operate robots on the sea bed and in space.

The event demonstrated to the industry representatives that the technology was capable of handling such loads placed on the network, and moreover, handle remote operations in space and offshore.

6.2 Implementation plan

6.1.1 Phase 1 (onshore)

ScandiCall has completed roll-out of the mesh network in the incubator building in Ipark. The plan is currently to upgrade the nodes to firmware 4.0 to support lower frequencies granted by the Norwegian Post og Teletilsynet and enable faster speeds up to 1 GB p/second.

The next step is then to roll-out the network in the Stavanger downtown area. The city is currently facing problems with its city wide wireless network established in 2007 which has cost the city around 1.5 MNOK to implement and 300.000 NOK per year in annual service fees. The number of users have been steadily declining since the introduction in 2007 and the city is now looking at other alternative solutions. Since suppliers to the O&G industry are dispersed across the city the key is to connect the areas with high speed broadband access to the backbone in Ipark and provide wireless test equipment.

Phase 1 will be completed when the whole of the Stavanger-area is connected to the wireless network.

Phase 1 (Sep 2010 – Des 2010)	**Phase 2 (Jan 2011 – Mar 2011)**	**Phase 3 (Apr 2011 – Dec 2011)**
Complete build of Mesh network at Ipark	Build Mesh Network in Stavanger Town Center	Mesh network build: Kvadrat, Madla/AMFI, Vågen 33, Kilden, Sandnes Town Center, Sola and Forus.
First 2 customers signed (Ipark AS and Ipark Eiendom AS)	Signing of 20 additional customers at Ipark	Sign 20+ companies in Rogaland as customers
Hire Support Person for Network located in Ipark	Hire additional local Sales & Services personnel	Start building R&D capability in Stavanger
Create reference customers for Mobile VOIP.	Have 500+ Mobile VOIP customers	Have more than 5000 Mobile VOIP customers
Perform successful launch of ScandiCall to media	Complete agreement with Avinor on rollout to Norway’s largest 20 airports.	Create distributorship agreements with partners for technology distribution
Deliver 100mbit/s speed	Deliver 300mbit/s speed	Deliver 550mbit/s speed

6.1.2 Phase 2 (offshore)

When Phase 1 is completed Ipark will have a new test-bed for testing out new equipment / services to the industry on as well as an experimental test-laboratory for academic research partners/institutions.

a) Onshore -testing

The next step after phase 1 is completed will be to connect the port area in Stavanger, located in Risavika, where most of the large oil & service companies are positioned, to the backbone in Ipark.

Ipark has allready had discussions with several potential pilot customers to test out the new services / equipment on their premises. This will require access to the customers ISP network and backbone.

A speficic service (VoIP, video etc) to test should be chosen based upon the pilot customers preferences.

b) Offshore -testing

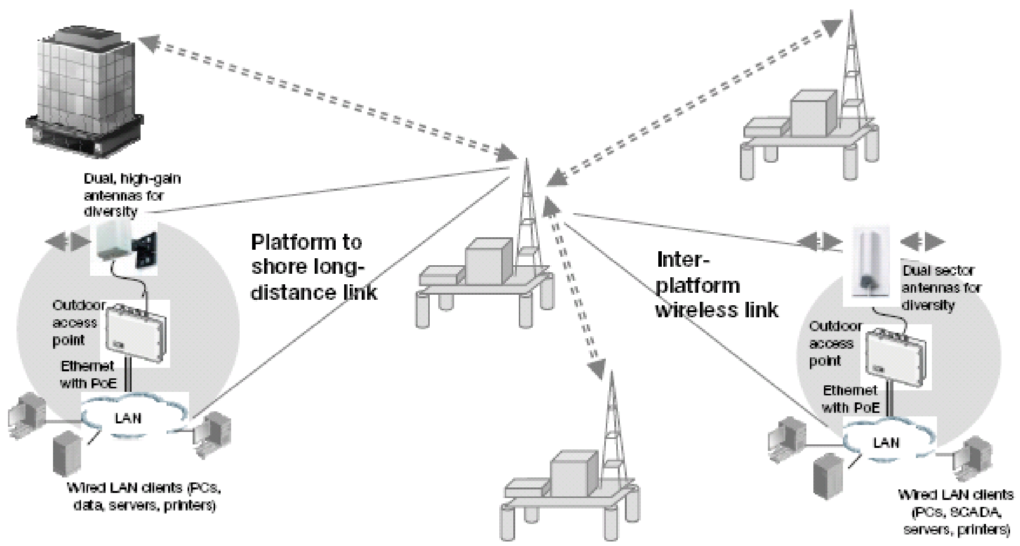
Normally it can takes years to get access to test-facilities offshore and get approval from the rigg owner / plattform operator and contractors (usually service companies) as testing costs offshore are very high.

It is usually necessary to have a written agreement / contract with the contractual partner that is responsible for servicing the plattform for the rigg owner / plattform operator as well as clearance from the plattform owner issuing that the technology has been EX-certified for use in offshore operations.

This requires the technology to be trial-tested in a controlled onshore environment / test centre. IRIS is providing such facilities with EX-certification at Ullrigg, located next to the incubator building at Ipark. However, such equipment is also subject to testing at the pilot customers location before offshore trials. Therefore, the link to the Risavika port area is important.

Once the equipment has been installed and the service chosen has been tested thouroughly with successful results an application for offshore testing will be submitted to the authorities/operator.

The final "proof of concept" will be the offshore test with the chosen operator.



Inter-platform wireless communications for an offshore oilfield

7. Other Application areas

The participating industry and R&D partners will benefit from participating in the project. Other industry sectors and segments that we plan to initiate contact with will also greatly benefit from the projects results. Other R&D expert institutions will also benefit from the project to increased awareness around the commercialisation possibilities and the outlined areas for future R&D research. Below are the most important areas outlined:

A. Application areas in offshore Oil&Gas industry

1. Transmission of voice, video and data through IP networks between rigs and standby/supply vessels.
2. Video monitoring of unmanned offshore installation (Platform, Loading Buoy)
3. Video monitoring of supply vessel loading/unloading
4. Internet / E-mail access for Standby-vessels/Supply vessels
5. HMS / security / training of offshore personnel on supply vessels and rigs
6. LBS/RFID services for monitoring/tracking personnel/utilities/assets on ships and rigs/platforms
7. Industrial automation & meter readings/condition monitoring (valves, sensors, equipment pumps)
8. Seismic activity / measurements and data transfer from ships to rigs/platforms/onshore

B. Other industry/sector usage and synergies:

1. High demanding WSN applications with need of Performance and Robustness
2. High Value Assets (Oil rigs, Pipelines, Nuclear plants, Airports)
3. Military tactical network and sensor network communication
4. Homeland Security and Public Safety / emergency services
5. Industrial Communication and Automation
6. Logistics and Telemetry
7. Port communication and ship tracking/coordination of logistics
8. Offshore windmills and sensor communication