massive investments in platforms and infrastructure are providing the 56,000 Greenlandic inhabitants with state of the art telecom services at affordable prices

INTRODUCTION

The Tele Greenland company vision “Greenland in the centre of the world” is unfolding these years, where massive investments in platforms and infrastructure are providing the 56,000 Greenlandic inhabitants with state of the art telecom services at affordable prices. The company vision states that one can live and work with even conditions whether you are based in Ilulissat, Hamburg or Copenhagen. This vision challenges the tough conditions for operating a telecom business in a huge arctic country hosting 17 cities and 55 settlements scattered across the coast embracing the inland icecap. Greenland has a geographic area of 2,166,086 km² and the ice free land area is 410,449 km². The distance from North to South is 2,670 km. Deployment and commissioning in the field are extremely cumbersome in rural arctic areas where sites only can be reached in the short summer and even then only by helicopter.

PENETRATION

A series of years seeing the launch of new services and continuous growth in traffic in the increment range of 100% per year has opened opportunities for reduced prices across a full scale selection of telecom services. This delivery has been possible, even though the licence to operate telecom services held by Tele Greenland obliges the company to support a full range of services in a countrywide footprint, offering a homogenous price scheme, even covering settlements down to 70 inhabitants. A successful market strategy has lead to a high penetration across all products, and the result of this work positions Greenland within the range of leading OECD countries pertaining to penetration and revenue per user. The market strategy on broadband access to private households has been a package, offering an affordable installation of 500 DKK and a monthly subscription - free of charge and volume based billing. All up- and download traffic is volume based charged at a cost of 0.42 DKK/MByte. The result of this strategy has been a penetration of 51 installations per 100 households. The numbers for mobile and fixed telephony are equally
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high and this massive costumer growth leads to increased traffic. Multi Protocol Label Switching (MPLS) service to business users is also driving increased traffic growth. Data traffic covers 70% of the volume though these services still only bring 15% of the revenue. Fixed switching and mobile voice are still the cash cows as is the case for most full scale incumbent operators.

**NETWORK TOPOLOGY**

The infrastructure architecture is based on a SDH (Synchronous Digital Hierarchy) microwave backbone, in a single line chain structure without physical redundancy, along the West coast from Nanortalik to Uummannaq. Fibre deployment is not commercially feasible in the desolated arctic environment with huge distances between populated areas. Some areas are even outside the reach of the microwave chain and can only be reached by satellite link. To cover cities in the North and East, Tele Greenland operates 16 earth stations using Intelsat C band satellites. Tele Greenland also owns and operates a satellite earth station in Copenhagen, which is the single one transmission route to cover international traffic to the entire country.

The basic infrastructure of the satellite and microwave backbone is becoming a very scarce resource and is almost saturated beyond the limit due to the growth in the market and traffic. To remedy that situation, Tele Greenland is in the process of a comprehensive swap of the West coast microwave chain to increase traffic capacity to 7 times STM-1 (Synchronous Transport Module, 155Mb/s). The undertaking encompasses the swap of all radio equipment, feeding systems and antennas. This project alone has a budget of 130 million DKK, and the Northbound link from Nuuk to Uummannaq will be taken into operation this year. Simultaneously, Tele Greenland is upgrading all supporting site infrastructure, like power, cooling, fire extinguishers and general Operational Sub System (OSS) equipment.

The microwave upgrade will give Tele Greenland the needed scalable expansion dynamics to meet traffic demands until 2014. Satellite links involve high operational expenditures, even though Tele Greenland is in the fortunate position that Intelsat satellites provide a hemi beam focused footprint on both North-West Europe and Greenland. Currently, Tele Greenland consumes 125 Mb/s to cover all international traffic in and out of Greenland – broadband and data are counting for more than 70% of the traffic volume. The transponder capacity is deployed with careful planning of the up/down symmetry and balance between link budget and bandwidth. The available capacity can meet the Greenlandic demand until end 2009, but only with the implementation of all possible traffic optimization enhancements like advanced turbo coding and cashing of frequently targeted internet sites. Even given the scenario that Tele Greenland absorbed all available satellite traffic in the entire world, satellite technology would only be sustainable until 2012 and extremely costly since Tele Greenland would be forced to track at commercial satellites with global beams which would lead to ineffective throughput per rented bandwidth unit compared to presently used hemi beam operation.

<table>
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**Telecom statistics, Tele Greenland, 2003-2007**
Moreover, satellite telecommunication is threatened by the thirst of other services for frequency space to support the launch of land based mobile services like wireless broadband access. A time coincidental example is the awarded licence to operate WIMAX wireless broadband access in Denmark. Tele Greenland has raised concerns with the Danish National Telecom agency that land based services which operate in the satellite C band (3.5 GHz) hardly can co-exist with highly sensitive long haul transmission systems like satellite earth stations. Furthermore, it becomes increasingly clear that applications for residential users and enterprises are still more sensitive to latency of the transmission link. Satellite links give delays of no less than 300 ms, which is far more than many applications can cope with efficiently.

Greenland Connect is a submarine cable project connecting Greenland to Europe and North America.

GREENLAND CONNECT

This picture leads to the decision to launch a new strategy to support the continuous development of the vision, “Greenland in the centre of the world”. Tele Greenland’s management team presented in 2006 the Greenland Connect prospect to the management board. Greenland Connect is a submarine cable project connecting Greenland to Europe and North America. The solution is based on 20 year long backhaul agreements giving Tele Greenland market conditions on backhaul traffic from landing sites in Iceland and Newfoundland to London and Halifax where interconnect and IP peering can be traded at fair market conditions. The submerged cable system will be an amplified dual fibre link with the capacity of 2 x 96 wavelengths of 10 Gb/s each. Landing sites will be established in Landeyersandur near Vestmanna Islands in Iceland, Qaqortog and Nuuk in Greenland and Milton in Newfoundland. Landing sites will host high voltage power supply systems for the submerged optical amplifiers and transmission equipment for the Dense Wavelength Division Multiplexing (DWDM) system. Moreover, the transmission latency will be reduced from 300 ms via satellite to app. 30 ms. Increased transmission capacity and reduced latency will lead to better functioning Internet services and business applications.

The Greenland Connect project status per October 2008 is that the desk survey is completed and the route and landing sites decisions are frozen. A contract on Wet survey was granted to the Oceanographic Institute in Trieste, Italy and the exploration ship Explora completed the survey of the seabed across the route in the summer 2006. A turnkey contract covering delivery and installation of the entire submerged system, amplifiers, transmission and power equipment, was granted to ASN

The new infrastructure opens the technical possibility for a differentiated set of offerings and calls for delicate political decisions on a possible new scheme of differentiated offerings.
Alcatel Lucent Submarine Networks in December 2007 and the installation work is in progress as planned in the autumn of 2008. Tele Greenland’s financial position is strong and allows for company ownership of the entire system with a budget of 734 million DKK and positive net present value in less than a 20 year time span.

PLANS AND CHALLENGES

To bring full benefit of the microwave project and the Greenland Connect project, Tele Greenland is working on a general refurbishment of other platforms like a 40 million DKK upgrade of the IP/MPLS backbone to increase capacity and redundancy on Internet and MPLS services. Furthermore, there is work ongoing on the extension of some PDH (Plesiochronous Digital Hierarchy) trunks feeding the larger settlements outside reach of the microwave chain and a swap of the entire mobile access and core platform to bring traffic blocking numbers down from double digit values to less than 2%.

This undertaking gives Tele Greenland a modern infrastructure to offer the customers fast and reliable Internet, data and voice services with sufficient bandwidth and workable latency rates. All these new technologies open the potentials for new broadband and data services – especially close to the sea cable landing sites and cities where the new microwave chain has its termination points. Up till the present time, Tele Greenland has offered the same services at equal prices anywhere in Greenland, but the new infrastructure opens the technical possibility for a differentiated set of offerings and calls for delicate political decisions on a possible new scheme of differentiated offerings. The controversial price model for the volume based broadband rating, which has been physically unavoidable with a infrastructure saturated beyond its limits, can be open for political debate but calls for an understanding of the need for the implementation of one set of services in e.g. the densely populated city of Nuuk and another set of services in the rural settlement of Kullorsuaq.

The vision “Greenland in the centre of the world” and the technology strategy plan to deliver the vision and bring fast broadband services to Greenlandic users are set in stone and will progress for the years to come in a cycle with winter planning and logistic preparations and fast summer roll out.