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An Infrastructure for the Future

What are the overriding requirements for a hospital ICT system? High capacity and reliability, for sure. Flexibility and future-proofed, maybe. Yet most hospitals spend management time and money on individual systems like a new PAC S system or EMR customisation, ahead of sufficient investment into an efficient basis to satisfy the overriding requirements for all hospital systems. St. Olavs Hospital in Trondheim is an example of the opposite.

About the Project

The new St. Olav's Hospital is a publicly funded redevelopment of the existing regional hospital in Trondheim, Norway. Phase 1, comprising 100,000 m2, began in 2006. In 2010, the hospital moved into another 100,000 m2 and started the demolition of the last remains of the old hospital. In 2013, a total of 804 beds in single rooms will be completed, the first hospital in Norway with all single rooms. Capacity is planned with a 200 percent increase in day surgery and outpatient treatments, and a 10 percent reduction in beds and staff. The new hospital is arranged in an urban block or campus style layout, with six clinical centres and several other buildings interconnected with bridges and tunnels and an extensive ICT network which connects the whole 25 Ha area with wired and wireless networks. The university's medical school is closely integrated within the hospital buildings, adding 700 employees and 1,250 students (and 50,000 m2) to the hospital.

A Converged IP Architecture

The old network at St. Olav's was, as in most hospitals, a collection of systems, each with its own wiring and structure. Even if these systems were IT based, there would be one PC controlling elevators, another controlling pocket paging, and small clusters of machines supporting MRs or other advanced equipment in silo structures.

During the initial design, a fundamental decision was made: that no one would be allowed to buy or specify any ICT equipment unless it also contributed to the total system, and that no IT equipment would be allowed unless subjected to common requirements for security, availability and mobility.

Hence, a new ICT infrastructure was built utilising a single converged IP network for the entire hospital. The goal was a hospital where both staff and technical systems were connected, mobile and fl exible for optimal effi ciency and adaptability.

In concrete terms, the solution encompasses about 5,000 PCs, 5500 IP phones (3,500 wireless), 150 servers and 1,100 wireless access points. The network uses more than 200 completely separate VLANs, each with its separate service level and separate rules for authorisation and access. Over 170 integrations between technical systems and the message server middleware have been made.

The mantra of "IP overall, all over IP" leads to the integration of several disparate networks (data, television, telephony, video and security as well as clinical systems like PACS and nurse calls) in one IP multiprotocol label switching (MPLS) converged network designed to a reliability of 99.999 percent.

Building Automation and ICT Working Together

The integrated infrastructure is built as an integral part of the buildings themselves. This gives immediate advantages in controlling the environment. Since all building automation is accessible via the infrastructure, it is easy to establish control room functions anywhere it is required. A supervisor can access a system from home and give advice and support when needed. ITV is fully accessible in the security offi ce, but is also accessible for technical staff in case of situations like fl ooding or broken equipment.

There is only one source of identity in the network – the hospital's personnel system. From this initial identifi cation that you are YOU, the systems determine what computer access, door access, software access, telephone number and even what work clothes YOU may be entitled to.

What is a phone?

Most people would say that a telephone is exactly that – an instrument to talk to people who are not nearby. Yet at St. Olav's, it is far more. It is the tool for receiving Nurse Call alerts. Every nurse logs on to his hand held phone when he comes to work, and then assigns himself e.g. the role of "nurse for room 414". From that moment, every nurse call from room 414 goes to this phone, and can be responded to (or transferred to another nurse). No displays or buzzers in the corridor - which makes for much calmer environment – which again makes for a more pleasant and shorter stay for the patient, but also less stress and a better work situation for the nurses.

It is the tool for receiving work orders. You can of course call an orderly or a cleaner directly, but you can also call, email or SMS to the dispatch centre. The centre sends out about 1,000 work orders for orderlies every day. The system can automatically detect the nearest orderly and also keeps track of workloads. The work orders pop up on the telephone just like an SMS, and go to a work-list when accepted – and out of the work list when they are marked as 'completed'.

The phones are also used to send technical alerts, report that an automatic guided vehicle has deposited goods, or to activate and receive medical assembly alarms. It is even possible to unlock doors and commandeer elevators as a part of a Code Blue call.

You do not have to remember names and phone numbers. The system only calls a doctor who is present, and display directories only of present staff. An anaesthesiologist can sign in and then assume the role "anaesthesiologist on duty", meaning that any call to this role will go to THIS

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phone – until somebody else assumes the role at the end of a shift.

Costs and Benefits

The hospital has over the last few years reduced the number of beds (by 170), reduced staff (by 450) and reduced length of stay (from 5.7 days to 4.6 days) while increasing production (in DRG) by three to four percent per year. The cost is of course substantial, more than fi ve percent of the total construction costs. Yet it should be noted that the region spent more on software development alone during the same period.

The system has completely changed the basis for working at the hospital, more than changing the work itself. The digital EMR system is now augmented with speech recognition, which is used by doctors for their notes. A hospital-wide drug dispensing system with two automated pill pick machines is under implementation, where doctors prescribe at their PCs and drugs arrive in single dose packaging at the bedside. All this would not be possible unless there was a solid infrastructure to build on.

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