

Sjunet – The National IT Infrastructure for Healthcare in Sweden

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Abstract

Sjunet is the Swedish Health Care Network comprising an infrastructure for communication between hospitals, primary care centres and home care. It is also hosting a wide range of services from national authorities and health care service providers and selected vendors. Sjunet allows secure transmission of health care data and applications on an IP-network separate from the Internet. The network is used for telemedical videoconferences, teleradiology, remote access to applications, database access, secure e-mail, EDI-messages and IP telephony. It is also useful for e-learning in medical education and further training for health personnel. Carelink is responsible for Sjunet in close co-operation with the county councils and other actors within Sjunet. Hence, Sjunet is as much a co-operative network as it is a technical communicative platform for Swedish health care.

1. Background

Seven county councils initiated Sjunet as a project in 1998 within the R&D programme “ITHS” funded by The Swedish Knowledge Foundation and the Federation of County Councils. The initial investment of 1,400,000 Euros was shared equally by ITHS and the seven county councils. Since 2001 Carelink, a collaborative organisation for ICT in Swedish health care, is responsible for Sjunet in close co-operation with all the county councils and representatives for the private care providers and local authorities. Hence, Sjunet is thus as much a co-operative network as it is a technical communicative platform for Swedish health care.

2. Description of Sjunet

Practically all Swedish hospitals and primary care centres as well as some national authorities and vendors are connected to Sjunet and use it both for telemedicine and administrative communication. The network infrastructure allows secure communication and distribution of patient data, pictures, medical applications and services for which the Internet is not acceptable. The idea from the beginning was to form a layered infrastructure consisting of a secure network (1), a set of common services (2) and telematics applications (3). Sjunet is continuously under development especially what regards establishment of new services and connecting other branches of the health care and more service providers.

2.1 The Network

Sjunet is an IP-based broadband network, connecting all Swedish hospitals, primary care centres and many other health services. Sjunet is built up of nodes connecting the firewalls in the 21 county councils and regions separate from the Internet. Users connected to a county council network can reach either the Internet or Sjunet depending on what kind of service they need to access. In its first version Sjunet was set up as a virtual private network (VPN) with “tunnels” on the Swedish part of the Internet, and was delivered by the Swedish telecom company Telia. The VPN technology guaranteed that information was not accessible from or communicated through the public Internet and the network provider

guaranteed that the available bandwidth was sufficient for applications and services. From 2003 the network is based on VLAN technology from Song Networks with built in redundancy, technically separated from the Internet, as shown in Figure 1. The separation from the Internet means better availability what regards bandwidth. The bandwidth is determined by how much each county council purchase for access to Sjunet. Normally 10-100 Mbps is sufficient for most applications.

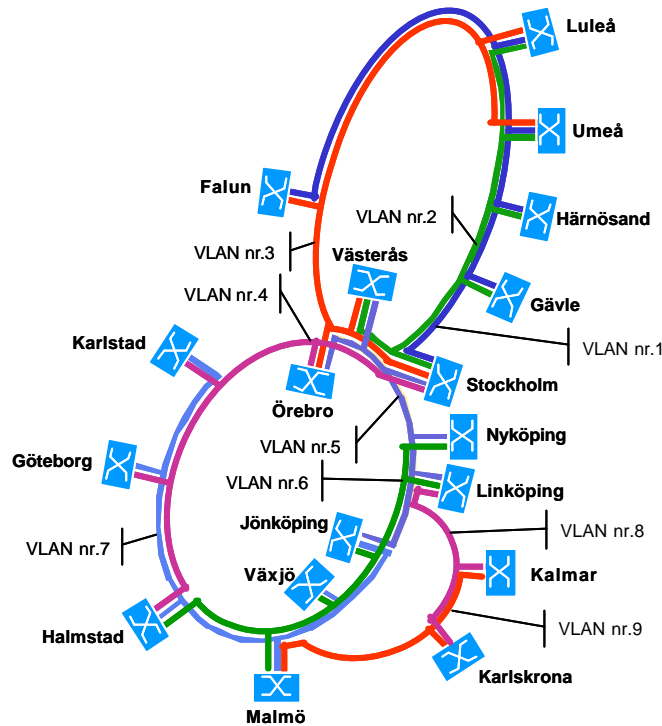


Figure 1: Sjunet as VLAN with redundant connections between county councils

2.2 Usage of Sjunet

From the very beginning of Sjunet the need for certain common services was obvious. Some services relate to the functionality of the network infrastructure. Others are practical services where a need for co-operation has been identified or for which it is more cost efficient to procure the service in collaboration.

Infrastructure services are e.g. DNS, protocols, nodes and directory services. Of special interest is the provision of security certificates following the PKI standard from a CA-server (see Figure 2) that allows decryption and authentication of messages sent on Sjunet. All hospitals connected to Sjunet can make use of this service, which is procured by Carelink from the vendor Steria. The PKI infrastructure relies on another joint service, the health personnel directory. This is built up with X500 directories in each member organisation within Sjunet. The directory allows the use of secure messaging as well as providing correct contact details for health care staff in Sweden.

Some examples of successful services and collaborative applications follows.

2.2.1 Electronic Prescriptions

Electronically transmitted prescriptions enable Swedish physicians to communicate effectively and swiftly with all the pharmacies in Sweden. And the time they save can be devoted to the patient. Physicians write the prescription in their electronic journals and it is then transmitted automatically from the physician's computer to the pharmacy. The patient goes to the pharmacy, identifies themselves and quickly get their medicine and the information needed. The electronic transfer also leads to increased reliability in handling prescriptions.

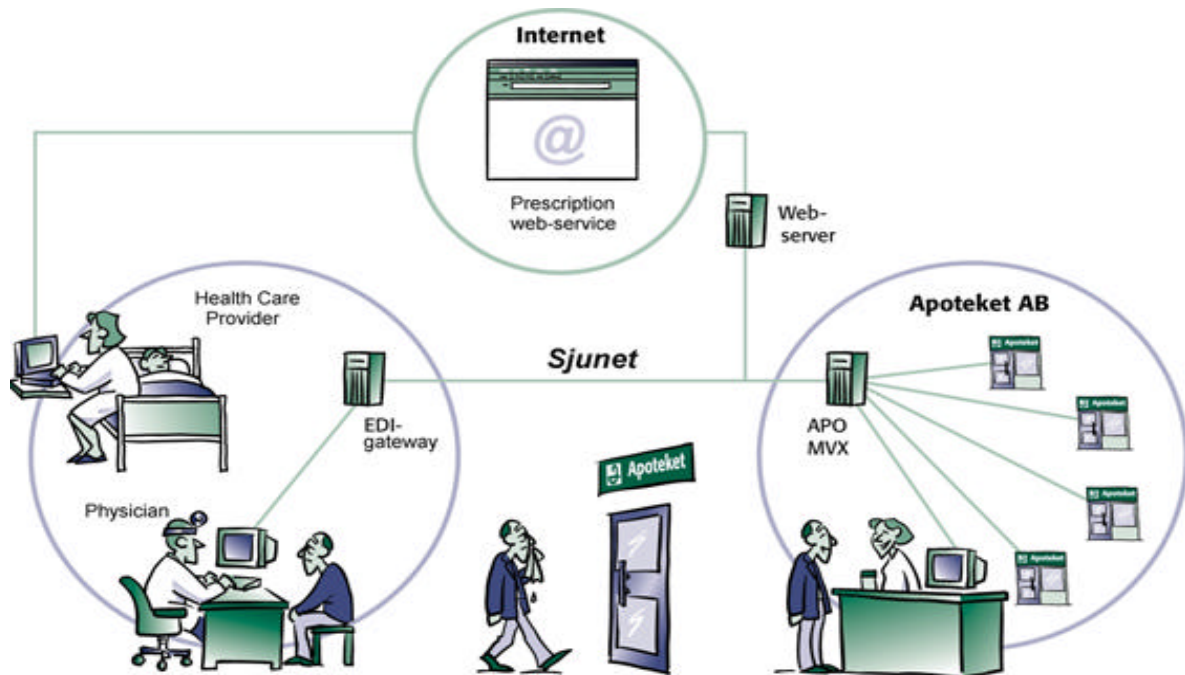


Figure 3: Sjunet used for electronic prescriptions

2.2.2 Telemedicine in Neurophysiology in the Region of Uppsala

The use of ICT and telemedicine in the field of neurophysiology started before Sjunet. The BITNET project established collaboration between Uppsala and the Baltic states. This pioneer work was also a trigger to start Sjunet, first as a network in the region of Uppsala. With use of Sjunet, specialists at the neurophysiology centre in the University Hospital of Uppsala, can analyze results from examinations conducted at local hospitals in the region or elsewhere in Sweden i.e. electro-encephalography (EEG) and nerve conduction studies (CV). A special software developed at the university clinic is used for analyzing the examination data which stays at the local clinic..

2.2.3 Teleradiology Service from Barcelona

When the radiology department at Sollefteå Hospital failed to recruit a specialist for MRI (magnetic resonance imaging) they choose a hitherto unusual solution. Skilled radiology nurses conduct the MRI examinations and the images are sent to the newly established Telemedicine Clinic in Barcelona for analysis. This is done with a certain portion of the examinations in order to lower the pressure for the radiologists in Sollefteå and to make it possible to shorten the waiting list. When the examination is done the images are sent to Barcelona and the answer arrives within 48 hours. Since the start in mars 2003 the waiting time for MRI scan has been cut to the half, also at nearby hospitals in Örnköldsvik and Sundsvall which sends patients to the smaller hospital in Sollefteå for this examination. The pilot project between Sollefteå and Barcelona, successful so far, is planned to continue for six month with an amount of 400 examinations. Within that period the project will be evaluated what regards technical possibilities, judicial restraints and economic effects. After the pilot period, if successful, it is likely that this service will be procured for regular operation. Telemedicine Clinic is also delivering this service to the Hospital of Borås in southern Sweden and to hospitals in the region of Stockholm.



Figure 3: Sjunet as a platform for European collaboration between northern Sweden and Barcelona

2.2.4 Videoconference Platform in Örebro

Up until now the most common technology for videoconferencing has been ISDN. In Swedish healthcare there are hundreds of those systems. They are used for telemedical consultations, clinical rounds, care planning and administrative meetings throughout and between the health care organisations. It is well known that using videoconferencing is a matter of habits. It is also a matter of complexity or simplicity. The easier it is to connect the more you might use this way to meet. Recently there has been expressed wishes to use videoconferencing even more in many county councils and municipalities, due to large deficits in health care budgets. It would be a way to avoid costly travelling. Still it has to be simple to reach each other, regardless of technology or type of network.

Carelink has co-ordinated a joint procurement of videoconference equipment for all county councils so as to assure functionality and compatibility of the technology. There is however a need both for ISDN and IP-based videoconference facilities as well as videoconferencing over the Internet. In order to make interconnection possible, a videoconference platform was procured and the County Council of Örebro manage this for all connected health care organisations. The platform or bridge can connect many parties regardless of technology, PSTN (telephony), ISDN (H323), IP or Internet (H324). It can be used as a point-to-point connector between the different networks or as hub for multi-part videoconferencing.

The videoconference platform in Örebro is an Accord MGC-100 with possibilities to connect IP, ISDN and PSTN systems. In each health care organisation there is a gatekeeper that keep track of all available equipments in that domain. This is also used for assigning aliases to IP-based equipment, making it easier to find the right counterpart.

Sjunet also hosts a videonumber directory and the staff in Örebro support all those who want to use the common platform. The technology in Örebro is financed by Carelink.

3 Benefits from Sjunet

Since Sjunet is a national infrastructure which is gradually developed and has a large variety of usage it is difficult to evaluate the total impact and cost-benefit of the network. Some examples of the utility of Sjunet follows.

3.1 Cost Benefits

Using Sjunet means lower costs for transferring information. A cost-benefit (CB) analysis in Uppsala County Council estimated a yearly net benefit of 0.6 MEUR from using Sjunet compared to other alternatives. Although the estimated economic benefits depend on the volume of services utilised, the CB analysis demonstrates the potential contribution that Sjunet can make toward more efficient use of resources in the Swedish health care system. The greatest economic gains result from improved collaboration, lower staff costs and less physical transportation.

3.2 Access to Care

Remote services make it possible to bridge lack of resources or expertise in some areas or specialities. In Västernorrland, transfer of MRT images from Sollefteå Hospital to Telemedicine Clinic in Barcelona can reduce by half the 58-week waiting time for MR examinations.

In northern Sweden, advanced radiation therapy is offered in Sundsvall with dose planning and field simulation delivered by specialists in Umeå. This allows the patients to be treated closer to home, avoiding tiring travel.

3.3 Quality of Care

By using specialist resources, regardless of physical location, it is possible to increase quality of care. Co-operation among specialists will improve the diagnostic process and treatment. Remote EEG and EMG examinations allow more efficient use of expertise in neurophysiology, shorten diagnostic lead time and improve treatment planning. Using Sjunet for teleradiology, diagnoses are made more rapidly which could even save lives.

4. Discussion

Using health telematics is definitely easier and more cost efficient with a permanent infrastructure, such as Sjunet, than e.g. ISDN. The concept of infrastructure includes standards, rules, security and availability.

Sjunet is managed and further developed within Carelink, with a steering committee and several working groups with representatives from all county councils. This form of maintenance guarantees the regional and local commitment for Sjunet. It also enhances the co-operation between county councils and the spread of best practice between actors.

Even if the use of Sjunet is steadily increasing there is a need for a national strategy for use and further development of the infrastructure. The goal is to use efficient communication between health care providers to bridge lack of resources and increase quality of care. This can be done in Sweden but it is as possible to extend this goal to the European level.