Stefono verginelli – Allied Telesis

Utilising switch centric networks for ICT

In Japan, a lead has been taken in applications of information and communications technology (ICT), and public and private hospitals elsewhere can learn from advances which are described in this article.

The Japanese mentality is dedicated to continually improving everything as part of a constant learning process. In Japan, every cubic millimetre of space is valuable and expensive so nothing can be wasted. There is a constant drive to make everything smaller and to use less energy, which, coincidentally, is in line with the Western World's awakening to green issues.

Changes in healthcare processes and procedures over the past three decades have been significant and progress is now greater than ever before, and accelerating. Increased numbers of patients flowing through a hospital means more patients per bed per year and a greater re-use of beds, wards, and all facilities associated with patients and visitors. This opens up increased opportunities for hospital acquired infections (HAIs), which are a major cause for concern, to occur.

In Britain, a considerable number of volunteers are used to carry, by hand, patient records, X-rays, folders and post throughout hospitals. This adds to the risk of HAIs, especially where there is no enforced hand washing at every point of entry to rooms.

The risk is minimised by using ICT to acquire, store and disseminate information rather than have it in paper or film form.

Another benefit of ICT is the avoidance of human error in the form of keyboard operators trying to decipher doctors' dictated notes made during their rounds and dropped off for input and printing for inclusion in patient record folders.

Over the 1990s, PC proliferation led to vast increases in data as internet and email capabilities grew exponentially. PCs, MRI scanners and micro-electronics also enabled an unprecedented growth in medical science, research and patient treatment options, but drastically increased the need for ever greater capacities for data movement and storage.

Hospital networks also began to evolve from simple Ethernet networks to complex collaborative networks encompassing multiple hospitals and clinics that need to share data, some of which is highly confidential patient data while some is in the public domain.

There is more medical information available online for diagnosis and treatment options than at any time in our history, so even a new junior doctor has access to better diagnostic tools and knowledge that would have been confined to the most senior consultant a few years ago.

Today's hospital networks take advantage of the continual improvements in Ethernet IP equipment conforming to open standards.

Slowly but surely, structured wiring has been incorporated into international standards. Full duplex data became possible as coaxial cable was eliminated in favour of Cat 5 and now Cat 6. This allowed 10 Mbps to be increased to 100 Mbps then to 1 Gbps and even 10 Gbps, (usually over fibre optics) today.

Advanced switching systems at the network core provide Layer 3 switching with power and control redundancy combined with scalability. Being required to work 24 hours a day, every day of the year, redundancy is essential and scalability was mandated due to the planned changes and expansion of any hospital.

Patient benefits

The first aspect of ICT that a patient would notice is the extensive range of bedside services available, including HD TV on demand, high speed internet access and VoIP (low cost telephone Voice over Internet Protocol). Less noticeable is the "back office" monitoring of all the life support systems to which the patient may be connected and which are linked through the network. Even less likely to be noticed is the live video conferencing between consultants, doctors and nurses who can now call on experts almost anywhere in the connected world. Video conferencing also provides training for medical school students who are located "remotely".

Patient confidentiality

By using separate, secured, virtual local area networks (VLANs), no matter how remote they may actually be, confidential data can be restricted purely to those who need to know in order to treat each patient. Separate VLANs are created for office systems such those for patient invoicing and cost tracking, and similarly for each appropriate activity area, including that dedicated to patient entertainment services.

Looking ahead

Every time we put into place a newer network with faster access to data or better visibility of that data in graphical, coloured photographic or video form, we make it easier to see and understand. That not only allows us to give better patient care and ultimately reduce costs, but also opens up the opportunity to envisage even more aspects that would have been sci-fi pipe dreams a few years ago.

The key to future proofing a network is to choose a supplier that has future technologies available or in the pipeline. As a result the next expansion will be with smaller, lower energy consuming switches from the same supplier.

For example, much of Allied Telesis' existing equipment can be re-deployed as we replace 1 Gbps links with 10 Gbps, the line cards being swapped and the old one being moved to another part of the network. Where we need new equipment in the expansion, we

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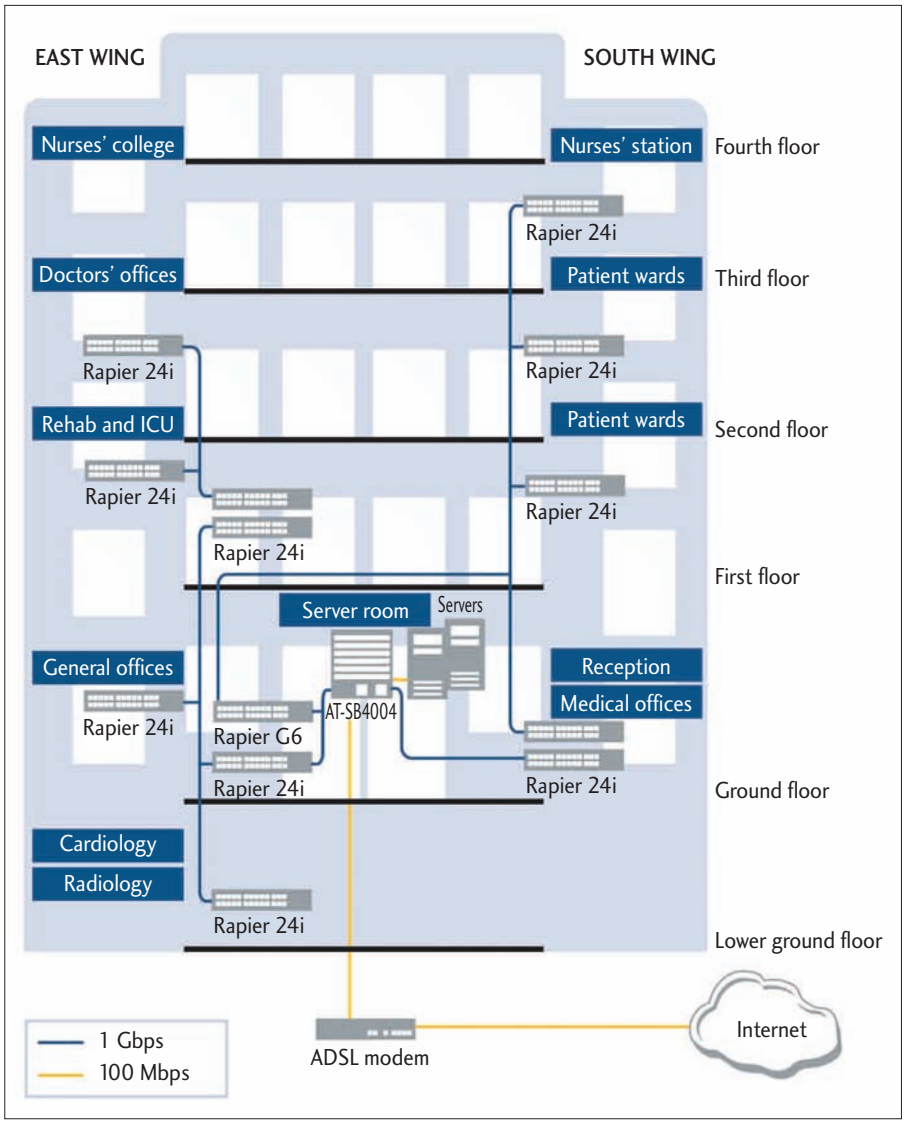

Figure 1: Network.

can choose even newer switches that are compatible but offer better technology from continual research and development progress.

For example, the SwitchBlade x908 is today able to do in just 3 RU everything we needed 9 RU to achieve some five years ago – cutting down two thirds of the size. The space saved can house six file servers or six drawers of surgical instruments.

In addition to redundant power supplies and fans, all of which are hot swappable just like the Ethernet port modules (XEMs), the power supplies actually load share so both are running at half their rated load for most of the time, only switching to full load on one of them, while alerting the network manager, if the other fails. When the failed power supply is replaced, it takes half of the load and the other power supply reduces its load accordingly, all without any disruption to users.

Ethernet Protection Switching Ring (EPSR) technology, driven mainly by metropolitan area television distribution with voice telephony and high speed internet access, is proving most attractive to hospitals and their associated service providers, medical schools and other faculties.

This technology enables multiple switches to be linked in a ring with anything up to 80 kilometres between each switch using fibre optics. Unlike slower Spanning Tree failover technology, (which is also supported), the EPSR detects and overcomes any cable break or switch failure within 50 ms. This means that there is no interruption to any of the time sensitive VoIP and TV network traffic.

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EPSR is ideal for linking up hospitals that are housed in diverse separate buildings, spread across cities and even those with campuses in different towns. The same technology can be used to link distributed switches tucked away in closets, cupboards and odd cubby holes left after the architects have been maximising "rentable" space when designing or refurbishing hospitals.

Even the port concentration has improved at the edges where we can now get 48 ports in a 1 RU high switch. This is particularly important in major hospitals in Tokyo and other cities in the world.

Green issues

There is a great amount of hype about green issues, and in hospitals the needs of the patient come first. We need to investigate how we can best treat and care for patients with the most efficient tools, with less energy consumption and therefore with less cost.

Allied Telesis now has an Eco 28 port edge switch that takes only 30.14 watts of power at full load, while the nearest equivalent uses 72 watts in normal operation. When edge switches are incorporated in a network, the uplinks are often aggregated to give multiple Gigabit paths, commonly via two different aggregation devices to ensure total resilience in the worst-case scenario of someone cutting cables or smashing a switch. Current designs tend to use up to four ports, usually fibre, for this and keep the other 24 for user devices to attach. It is simpler, more secure and provides 4 Gbps for 24 x 100 Mbps to share, so there is never any delay for any user.

The Allied Telesis switch allows savings to be made in terms of capital expenditure, running cost, and rack space.

Figure 2: Eco 28 port edge switch.