

Phil Wade – Static Systems Group

Standards, design and technology

This article focuses on the issues impacting hospital design and management and how technology can be utilised. It goes on to explain the growing use of IP for nurse call systems and their application in a range of different scenarios — from refurbishment projects to new build schemes.

It is first worthy of note that the Health Technical Memorandum (HTM) 08-03: Bedhead Services is the standard reference document used throughout the UK and other worldwide territories for nurse call systems. It is part of a series of documents published by the Department of Health in the UK, which gives guidance on all aspects of the design, build and operation of healthcare buildings.

Recognising that practise and technology are continually changing and developing, it is interesting to note that the current HTM 08-03 is less prescriptive than previous versions. This is evident by the inclusion of words such as; 'typical' and 'best practice' rather than 'must' or 'shall.'

This less prescriptive nature can, however, present difficulties to users and those involved in specifying systems and it is the responsibility of nurse call manufacturers to not simply 'up-sell' technology, but rather to engage with all interested parties to fully understand requirements and then recommend appropriate solutions.

Key factors and drivers that currently impact hospital design and nursing management and how nurse call systems can assist include:

Single bed wards – In common with many other international territories there is a

growing trend and requirement in the UK for single bed accommodation. While there are many benefits with single rooms there are also a number of negative factors which arise.

The need for patient privacy, dignity, and better control of infection are very strong drivers for single bed rooms. However, patients in single bed wards can often feel isolated. By providing nurse call with speech facilities patients and staff are able to talk together. The nurse is able to reassure patients that they have received their call and also quickly assess whether an urgent response is required.

Linking the nurse call facility to a mobile VoIP phone offers real efficiencies. Calls can be routed to a specific nursing team. The call can then be dealt with without the need to return to the staff base.

Nursing in single wards can also be helped by the introduction of a nurse presence system. These are in common use in European hospitals. Nowadays it is likely to be an automatic system. Staff members wear badges that transmit to sensors in the rooms. By linking this to over door lamps outside the rooms and to nurse base indicators, staff can quickly locate their colleagues. The systems will also record events, very useful, in case of complaint or investigation, by being able to evidence staff attendance at the bedside.

Patient experience – Healthcare providers are now very much focussed on the overall patient experience. An important factor here is to give patients the ability to control the ambient conditions of their room. Modern nurse call systems can integrate third-party systems to allow patients, to manage their own environment, control lighting, heating and window blinds, for example. Many hospitals now also have catering provided by



Linking nurse call to a mobile VoIP phone brings real efficiency.

outside sources, so why not include a catering call button on the handset?

As part of the overall patient experience healthcare providers are increasingly required to demonstrate standards of care and a frequent issue is the length of time taken to answer the nurse call. In the UK the issue of call response has become very important and it is a requirement of HTM for

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During this time he has been involved with many projects including a number of high profile overseas and UK based PFI schemes, as well as numerous developments such as the company's Fusion-IP, bedhead services trunking and fire alarm range of products. In addition he has represented Static Systems on various industry related working parties including, recently, the ProCure21+ standardised components initiative. He has also been invited to present on the topic of nurse call and bedhead services at a variety of conferences and seminars.

He is an active member of IHEEM, serving on Council and as a member of the Conference Committee. He also represents exhibitors on the Healthcare Estates Exhibition Advisory Board.



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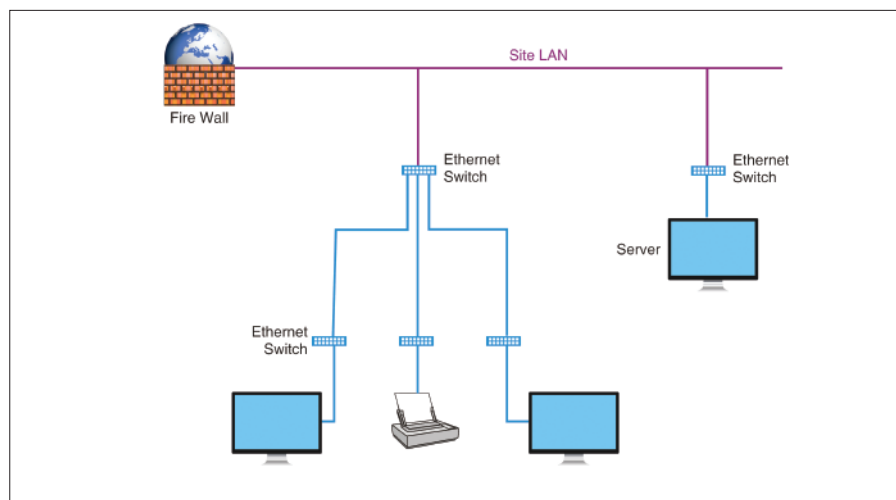


Figure 1: The principles of an Ethernet-based LAN.

nurse call systems to log all activities. Once collected, this data can easily be sorted to analyse response times. It can be presented in the form of pie charts and bar charts which can help identify peaks and troughs in patient demand and help to assess required staffing levels. Static Systems has found most management teams and staff to be very supportive of such data and they are using it, along with other measures, to help demonstrate continual improvement.

Patient safety – The growing use of single bed rooms, linked with an aging population, does give rise to a number of patient safety issues. Slips, trips and falls are a real focus for most nursing management teams. A confused or elderly patient attempting to leave their bed is a potential safety issue. So, why not use the nurse call system by connecting bed sensors or pressure mats to it to alert staff?

Then, because the nurse call system can connect to other systems, why not use it as the interface to automatically turn on low level lighting as the patient leaves the bed to help avoid falls. In addition, such links

could be really usefully — assisting staff with cardiac calls for the lights to be automatically illuminated to a pre-defined level.

Maintenance and system integrity – HTM also calls for routine maintenance to check the functionality of equipment. Increasing reliance on systems means that regular and routine checks should be carried out to ensure correct functionality. Modern nurse call systems have extensive fault diagnostics which indicate system and component faults.

Furthermore, because systems can be connected via a network — usually a site LAN — signals can be indicated in the maintenance department. By using a messaging server, alerts can also be transmitted to a pager, or, more likely nowadays, a smart phone or tablet. This information can be accessed from anywhere — so there is no escape for the hospital maintenance technician, even on holiday! It allows systems suppliers and service specialists to easily access the system and advise on fault diagnosis and rectification.

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IP technology

Against the backdrop of current trends, practice and issues let's now briefly review IP (Internetworking Protocol) technology in a little more detail and then go on to explain how it might be applied in a modern nurse call system.

LANs and the Internet are often illustrated as a fluffy cloud with lots of things connected to it. One might be forgiven for thinking that you could simply plug anything into it and it will work. In reality, it is not that simple. It is important to note that while different systems for example — nurse call, BMS, and CCTV systems — might now all communicate across IP, it does not mean that they automatically understand the messages coming from different systems.

Much as we might need a translator when someone speaks a different language, each system requires interfaces to translate the different messages. This requirement has led to a growing number of providers of 'middleware' maybe better described as 'translation software'.

In addition, as the popularity and use of IP grows, most of the standard and well-accepted protocols such as MODBUS, LONWORKS, and BACNET are being developed on to an IP platform to allow them to fully integrate.

The rather simplistic illustration (Fig. 1) is useful to show the principles of an Ethernet based LAN, which is probably the most widely used type of LAN. This is a generic application that could relate to a computer network, a BMS system, a nurse call system or any other Ethernet based LAN.

Traditionally, however, nurse call systems have been bus-wired. The key difference to bear in mind with regard to nurse call is that a LAN is a point-to-point network with one piece of equipment or switch at the end of each run of the structured cable network. The LAN cable should be Cat 5e as a minimum. Higher specification cables are quite commonly specified for example Cat 6 or Cat 7 and these allow a much higher bandwidth. However, for the purposes of nurse call, Cat 5e is commonly used and with a capacity of 100Mbps (mega bits) is adequate.

So the choice of cable is really about what is required to be transmitted across the network with cable costs increasing as the specification is increased. Whatever cable is

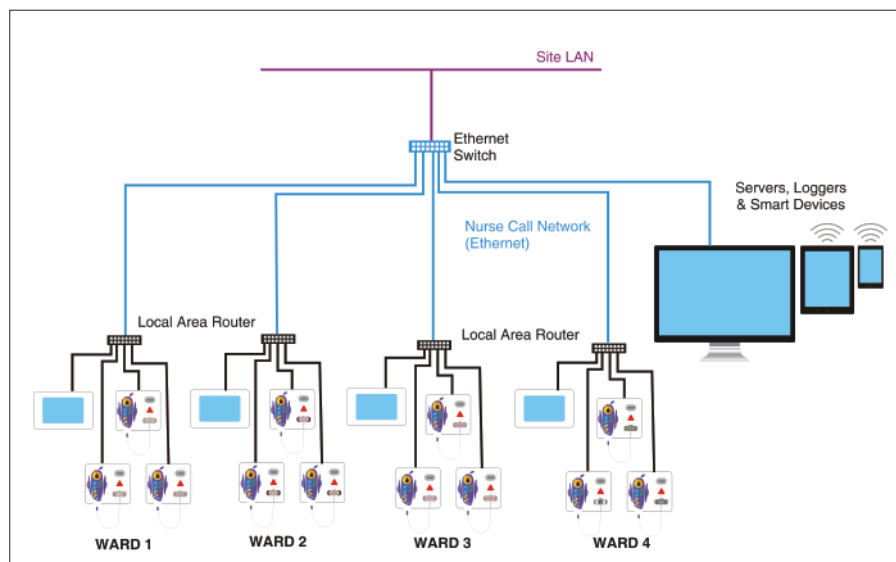


Figure 2: Structured wiring principles for the nurse call system.

used, the key rule for Ethernet cabling is 100 m maximum from point to point.

IP nurse call systems

So how might IP be applied to nurse call systems? There are different options for IP nurse call systems. The actual IP element can extend just to ward level or right down to the bedhead unit – the ‘end point’ – or anywhere in between. The choice will largely depend on the facilities and functionality required and whether the project is a refurbishment with existing cable containment and conduit, or a new site development where structured wiring will be installed throughout. Although there are a number of variations, there are probably just three basic designs and architecture of systems to consider. We will briefly review each one and also look at their application.

IP to a ward: This application is used where the nurse call is required to connect to the LAN (IP) at a single point in the ward to enable facilities such as central data-logging or transfer of calls. It is really just a more modern version of some of the networking of systems that have been in use for some time with nurse call. The LAN could be specific to the nurse call system, but more likely it will be part of a site wide LAN used for other services and facilities.

This illustration is typical of many bus-wired systems widely used throughout the world. The bus and power cables are wired from the network link around the ward to all the bedheads and other nurse call equipment and then back to the network link. Ancillary items such as over doors and pull cords are wired from the equipment connected to the bus.

As cabling within the wards is consistent with the traditionally used bus-wired principles, this solution is ideal for ward refurbishments where existing containment and very often wiring can be re-used. We call our version of this Codem. Although we use LonWorks there are a number of other types of bus protocol used by different systems, the main alternative being RS485.



The use of IP for nurse call systems is growing.

The wards are connected together using IP. Each network link is wired back to a standard Ethernet switch. The advantage of this design is that the wards are wired completely separately to the LAN, so they can be commissioned and operated without the need for, or reliance on, the LAN. If the network connection fails the ward will continue to operate stand alone.

IP to a zone: An alternative solution is to use structured wiring principles for the nurse call system. (see Fig. 2) This allows the IP element to be connected at a ‘zone’ – a sub division of the ward or department.

A single device is connected by a Cat5+ cable to a switch. However, in this type of system the connection from the switches to the nurse call device is using LonWorks or another similar protocol — but not Ethernet — hence the ‘switches’ referred to in the diagram as Local Area Routers are not

standard Ethernet switches but instead are a hybrid device which would be supplied by the nurse call manufacturer.

The nurse call equipment connected at the switches is identical to the bus wired system described earlier, but they now receive data and power down the structured wired cable. It is important to note that while this is power down a Cat5+ cable it is not PoE as there is no Ethernet, and therefore it should not be misconstrued as ‘full IP’ to the bedhead. For compliance with HTM 08-03 the local area routers should be powered from the UPS system if they do not have a battery backup built in.

Ancillary devices, such as over doors and pull cords, are still wired from the nurse call equipment the same as for the previous bus wired system. The connection between the local area switches is IP and each network link is wired back to a proprietary Ethernet switch.

A key advantage of this design is that the installation is fully structured wired and so allows for the system to be easily upgraded at some time in the future. It is an ideal ‘half-way’ house between the previous system and a full IP to the bed system. It would, typically, be used on new builds where containment was installed to suit structured wiring but cost constraints or functionality required did not justify the more expensive system.

As with the previous example the majority of testing and commissioning can also be carried out before the LAN is complete and spare capacity can be built in at the design stage to allow for future expansion.

IP to the bed: The final example is a structured wired nurse call system (see Fig. 3) which provides full IP to the bedhead. It utilises proprietary PoE (Power over Ethernet) switches and is wired identically to any other structured wired system. As it is unlikely that ancillary devices will require the full IP functionality of a bedhead they are still

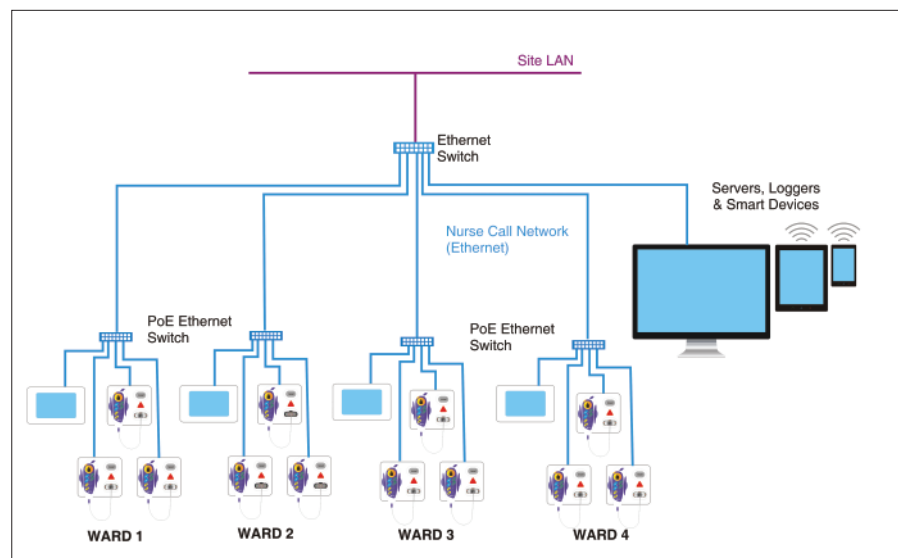


Figure 3: Structured wired nurse call system providing full IP to the bedhead.

normally wired from the nearest bedhead, or IP interface unit.

This type of system is typically used in new build installations, where the full benefits of IP at the bedhead can be realised. This might be, for example, integration with a third-party VoIP (Voice over IP) telephony system to provide multi-channel speech communication between the patient and nursing staff.

It is important to note the number of PoE nurse call devices could be considerable, maybe in excess of 1000 on a large site. Therefore, the special requirements and thermal management of the racks for housing the switches, and the UPS system to supply them needs to be considered. It is often the case that the nurse call supplier and the site-wide IT network installer would work in partnership to develop and co-ordinate the design and installation process.

It is important to consider the resilience of the nurse call system during the design process. For example, the health checking of the nurse call equipment within a ward and call logging is performed by a ward monitor unit. While in theory a single monitor device could do this from anywhere on the LAN, for resilience it makes good sense to use one per ward.

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Because this system is fully IP, it could actually be a part of the site IT LAN, although, of course if the system is to be an integral part of the site LAN then it cannot be commissioned until the LAN is fully installed and tested. Alternatively, and probably more likely, it could be a separate nurse call LAN which is then connected to the site LAN at strategic points. These are important issues which need to be considered at the design stage.

Summary

There is no doubt that IP-based systems are here to stay. Modern nurse call systems that are compliant with current standards, practice and guidance now have access to technology and applications that have never hitherto been available. However there are different types of IP systems with differing levels of integration that allow a choice of features and functionality within a range of budgets.

It is important to consider the technology alongside engagement with end-users, designers, client teams and installers to ensure that the solution offered is appropriate in all respects. Thought should be given to the system and IP network design to ensure a balance between resilience and cost. This should be considered along with any installation constraints and restrictions and with a thought about future expansion and flexibility.

In conclusion, although much has changed in hospitals since Florence Nightingale's days at the turn of the century and through the 1970s, the principles established in those early days still revolve around patient safety and nursing management. The focus from nurse call manufacturers and suppliers needs to be on how technology, applied to their systems, can properly and effectively support these objectives. ■