



CASE STUDY

CARDIAC SERVICES & THE CHANGING ENVIRONMENT OF MEDICAL TELEMETRY

In the last 40 years Cardiac Services have witnessed the advances of Medical Telemetry technology as its capabilities move from beyond the CCU into general medical-surgical units. Today, patients with potential cardiac concerns can be monitored through a wireless centralised system by staff who are not directly in the patient's vicinity. Monitoring from a remote location within the hospital has given skilled nursing staff the ability to conduct 24-hour visualisation across multiple units. This relieves local staff of responsibilities for high acuity patient monitoring, freeing up acute beds for critical cardiac patients and overall it has a significant impact on improving the patient care. Today, there are multiple players within the market providing Radio Frequency Medical Telemetry. Some providing solutions using Wi-Fi and others through proprietary systems. However, both present challenges of their own, not least from the influx of mobile devices crowding an already busy radio frequency (RF) environment.

“With the increase in wireless technologies available, the environment in which medical telemetry is performing within has become crowded and polluted.”

-Colm Nolan, Services Manager, Cardiac Services

UNDERSTANDING THE WIRELESS SPECTRUM

Proper management and monitoring of the radiofrequency environment has never been more important. The RF spectrum runs from VHF, UHF into the present WIFI frequencies 2.4/5 GHz. Within these ranges there are restricted bands where broadcast radio, TV, military, Aircraft and mobile phones are licensed to operate. Others such as 2.4/5 GHz, are less regulated, operators have to comply with some technical standards, but are then expected to co-exist with each other. Unfortunately, despite its obvious critical nature

medical technologies have never had their own appropriately reserved space. As more devices are being introduced to the hospital environment, there is an increased responsibility in managing the electromagnetic spectrum needed for these wireless devices to communicate effectively.

CHOOSING A SOLUTION - WIFI VS PROPRIETARY

Most manufacturers now offer solutions in the 2.4/5 GHz frequency range. Essentially there are two options using a proprietary solution or using the 802.11 wireless standard that most company/Hospital WIFI solutions use. It's critical to note that in choosing a WI-FI based system, the Hospital IT Department ultimately takes on the responsibility for delivering an infrastructure that can maintain and deliver a network that provides delivery of "life critical" data. Just having a WIFI network does not mean it is suitable for use for a critical patient monitoring system. For instance, most hospitals are not equipped for people to send emails from the bathrooms, it's simply not a design consideration. But in a hospital/telemetry setting, that is one place that definitely needs a strong signal when mapping out the access points for installation.

Similarly, with the use of a proprietary system, it is critical to have the support

and expert knowledge needed to analyse the installation environment and to map out the correct position for access points to obtain the best performance. For Cardiac Services, the whole process of deploying a telemetry system starts right from the initial enquiry with mapping the hospital floor plans, understanding the structure of the building based on where the walls and obstructions are and how many walls the radio waves must travel through. Only at this point can the telemetry team begin to scope out the installation at hand and ensure the correct and most efficient number of access points for the system are installed.

WATERFORD HOSPITAL

Cardiac Services have a long standing partnership with Waterford University Hospital, providing support and service for Medical Telemetry. In 2009, the hospital started to move into the 2.4 GHz arena as it wished to extend the then UHF telemetry system into the new AMAU. Cardiac Services began to roll out the new Philips ITS system by adding the AMAU area of their hospital while retaining the existing UHF system. Over time the system expanded through the hospital and they slowly replaced the old system with the new.



OPERATING A WIRELESS MONITORING SYSTEM IN A CHALLENGING ENVIRONMENT

Towards the end of 2016, Cardiac Services began to receive reports from the clinical engineers of Waterford Hospital about dropouts in signal in their telemetry system. The problem manifested in the intermittent loss of random telemetry signals whereby those affected patients were not monitored for certain durations. Any situation where a telemetry signal is interrupted is a matter of great concern from a patient safety perspective, and this further emphasised the need to ensure certain progress and the earliest resolution of the problem. This fault was elusive and intermittent which by its nature necessitated a logical approach where various assemblies were methodically and incrementally eliminated as the source of the problem. The intermittent nature of this problem, and the inability to recreate the fault also meant that after every iteration of fault finding, a period of observation/delay was necessary to establish if the problem was improved or resolved. Following standard procedures and checks, the Cardiac team then proceeded to explore possible changes within the Hospitals environment, given that it was in fact 7 years from the initial install of the equipment refresh.

During the Christmas period the Hospital reduced the telemetry service down to a specific area to ensure CCU nursing staff could keep a close eye on patients that needed to be monitored and they would be able to assist quickly in the case of a cardiac event. Cardiac Services continued to work closely with the hospital and engaged with their contractors to run some temporary cables in the hospital in a bid to find a solution to the level of drop outs that were occurring. Although there were some improvements, it just wasn't resolving the matter.

At this point, Cardiac Services engaged the support of their partner Philips in the UK to ensure they could find a resolution as soon as possible. Philips sent over one of their own engineers with a spectrum analyser. At this point, both Cardiac and Philips suspected that there was



something interfering with the signal of the Telemetry System but they were struggling to identify what exactly it was. They persevered and eliminated many things that could potentially be the issue but still to no avail.

Following nearly 8 months of trialling, testing, and reporting, Cardiac Services and Philips introduced an additional expert in RF troubleshooting from the USA. He came over to Ireland for a week in April with highly sophisticated instrumentation and scanners that measured the RF spectrum in a more detailed way. Cardiac Services and Philips were determined to find a solution that resolved the RF interferences and ensure that no other customer would have an issue like this going forward.

DISCOVERY & RESOLUTION

Following the ongoing collaboration between Cardiac Services, Philips and Waterford University Hospital, it was discovered that the problem lay in the background/baseline noise within the hospital. The levels of noise were equivalent to the signal strength of the telemetry transmitters and the Philips ITS System was being overwhelmed when the baseline noise rose slightly.

“that was the point that we stopped looking for the source of interference and started dealing with the environment we were living in”

Cardiac Services began to measure the signal strength for certain access points. By moving these points to a more central point in each area and adding a number of additional points signal/noise ratio was significantly improved. They focused on the two operational wards and they worked with the hospital to get the system performing to a capacity that they were happy with. They could then begin to talk about correcting the rest of the system and after a period of time all the remaining wards were restored to full working capacity.

During the fault finding process, a significant number of assemblies were replaced in an effort to resolve the problem.

“The perseverance, commitment and strength of the local knowledge of Cardiac Services, backed up by the global expertise of Philips Healthcare, proved to be an invaluable combination in the resolution of this problem”

*(Seamus Guiry, Chief Clinical Engineer/
Contracts Officer, University Hospital
Waterford)*



Having identified this critical challenge, Cardiac Services now provide all Telemetry customers with the option of having an annual RF survey. The aim is to continue to monitor and track any changes that may occur within the hospital environments and to mitigate any potential interferences before they become a problem.

Key Take Away:

The RF environment in any hospital is never fixed. On a day to day basis the signals from the various broadcasters flux in strength. Additional devices are brought into the hospital continuously, some for short periods (visitor devices) others for longer (new systems).

No longer can we assume when we install wireless monitoring systems that they will continue to function without reassessing the environment. Historically, it is only when the system starts to under perform or is reported as broken that corrective action would commence. Traditionally, service contracts would cover the repair of broken parts of the system, but who identifies and fixes the environment when it is "faulty"?

Having Built on their extensive experience with wireless monitoring

systems over the last 50 years and coupled with the global experience of their partners, Cardiac Services and Philips Healthcare have developed a range of services that together ensure the correct and continued operation of installed wireless Patient monitoring systems for hospitals all over Ireland.

These services start with pre-sale RF and placement surveys. After installation, a coverage assessment survey verifies the performance of the system in the environment at that time. Annual RF and coverage assessment surveys ensure that the system performance is monitored quantitatively into the future. These latter surveys will identify degradation in the RF environment prior to loss of performance and allow for preventative corrective action to be taken.

On the hospital side consideration should be given to the establishment of a group who would manage the RF environment within the hospital confines. This group should have input from IT, Clinical Engineering and Technical Services as these are the groups most likely to introduce systems that operate within the RF environment. Naturally this group should have inputs from both the clinical and corporate side of the hospital management, who are the internal consumers.



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