

# How Should We React to the Tremendously Increased Volume of Data Being Processed Through Hospital Lans?



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## Abstract

The amount of data flowing through modern hospital LANs has increased tremendously. Historically they were dedicated to data communication only, but we can expect them to widely integrate voice communication in the near future, which in terms of data volume could result in data overloads. Here, I show how to safely manage data and voice communication.

## Introduction

### Volume of patient information in hospitals

The amount of patient information held and processed by hospitals is increasing, as is the amount of information per person. The modality of information has grown in variety from text only in the past to currently include images and videos. The amount of information in images has increased from 20MB per still image, as in the case of a full chest slice, to as much as 256 KB in CT and MRI imaging, and hundreds of images may be handled as a series. With the increased frequency of imaging, this has led to a significant increase in data volume. Videos are used for recording surgeries and other medical purposes, and their image quality has increased with moves from SD to HD, 4K, and other formats with dramatically increased information per frame. Recently, medical devices have begun to have integrated communication functions. The amount of information flowing through hospital LANs can be expected to further increase with the use of ECGs, images, alarms issued by a device in the event of a patient having a medical problem, and the monitoring of the operating conditions of medical equipment.

In the past, hospital LANs for distributing this information were cable-based, but the need for bedside information reference and input has led to the widespread use of wireless LANs: 90% of the hospitals in major Japanese areas now have wireless LANs [1].

In addition to the above, there is a move towards voice communication through IP networks. In Japan, voice communication has been provided by a telephone or PHS

network (self-owned mobile phone networks based on Japanese standards using the 1.9 GHz band [2]) used as an in-hospital voice communication system. However, the obsolescence of PHS technology and the termination of public services have led to the search for alternatives, one of which is the use of IP networks [3]. Replacing PHS with an IP network is part of a move to "IP integration".

### Potential problems with "IP integration" based on LAN capacity

How much capacity (transfer rate) would be required if all communications were integrated into an IP network, especially in a modern hospital with patients who require acute care?

To estimate this, the structure of the hospital LANs must be considered. Most hospital LANs are still using cables, but often only the area around the terminals is wireless. At present, the maximum transfer rate (theoretical value) of the latest wireless LAN standard (IEEE802.11ax) is 9.6 Gbps, while the maximum transmission speed (theoretical value) of the new standard (IEEE802.11be), which will appear in 2024, is 30 Gbps. On the other hand, the maximum transfer rate of LAN cables is 10 Gbps for Category 6A, currently the most widely used cable.

There are also problems with hospital wireless LANs. Once purchased, medical devices are used for from several years to a decade. Changing the wireless LAN standard used in a medical device means a modification of the device and, in Japan, medical devices used in hospitals require government approval under the

law, which means that hospitals or device manufacturers cannot modify medical device without obtaining re-approval. Therefore, the wireless LAN standards used in medical devices are often not the latest, and the transfer rate of the installed hospital wireless LAN cannot be expected to be fully exploited.

As a result, it seems risky to do "IP integration" in hospitals, particularly if it includes the voice communications used in nurse calls. Nurse call systems are used by patients to request nursing care, but calls can also currently be automatically activated by sensor detection. As a result, almost 3,000 calls are made per day in large Japanese hospitals. A nurse call system dispatches messages to all terminals in a ward when a patient presses a button, and voice packets for conversation flow, which creates a heavy burden on the LAN when IP integration is done. In addition, "roaming" (switching between communication partners) is necessary in the wireless LAN networks of a large hospital, and it has already been reported that voice quality deteriorates during the process of roaming.

### To achieve stable communication in a hospital LAN

What can be done to prevent problems?

The first thing that needs to be done is to separate voice communication from data communications. However, there is no need to eliminate a small amount of data communication through the voice communication system.

It is also necessary to estimate the local and instantaneous maximum information distribution volume in data communications. To do this, it is necessary to diagram the workflow, including the

movement of nurses with information terminals, the timing of rounds performed by doctors, and the operating times of medical devices (especially devices transmitting images) and sensors, etc. Only after these things have been done out can an appropriate LAN be designed.

Also, as mentioned above, the maximum transfer rate of wireless LANs may soon exceed that of LAN cables. Therefore, hospitals should check the cable category and performance of routers, switches, etc. and to update them if necessary.

### Conclusion

Here I showed problems that are likely to occur in hospital LANs in the near future. The amount of patient information held by hospitals will surely increase, but there is little chance will decrease. It is hoped that hospital LANs will be properly constructed so that information needed by the hospital staff be able to be referred to quickly and accurately as possible and that information they enter can be shared accurately and quickly.

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