Nihon Kohden Patient Monitoring Deployment in the Cisco Unified Wireless Network

Deployment Guide

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This document provides design considerations and deployment guidelines for the Nihon Kohden Patient Monitoring solution used within the Cisco® Unified Wireless Network infrastructure.

Note: Support for Nihon Kohden products should be obtained directly through Nihon Kohden support channels. The Cisco Technical Assistance Center (TAC) is not trained to resolve problems related to Nihon Kohden products.

This guide addresses the configuration parameters that are particular to Nihon Kohden patient monitoring devices in a managed wireless architecture. Basic network design or protocol design concepts are beyond the scope of this guide. A fundamental understanding of network architecture and protocol design concepts is a prerequisite for using this document.

To get the most out of this guide, read and become familiar with the terms and concepts presented in the following Cisco documents:

- Wireless Considerations in Healthcare Environments:
  http://www.cisco.com/web/strategy/docs/healthcare/wireless_hc_environ061208.pdf.
- Wireless and Network Security Integration Solution Design Guide
  http://www.cisco.com/en/US/partner/docs/solutions/Enterprise/Mobility/secwlandg20/sw2dg.html.
- Cisco Wireless LAN Controller Configuration Guide, Release 5.2
  http://www.cisco.com/en/US/docs/wireless/controller/5.2/configuration/guide/Controller52CG.html.
- Cisco IP Telephony Solution Reference Network Design Guide:
  http://www.cisco.com/en/US/docs/voice_ip_comm/cucme/srnd/design/guide/models.html.

These documents are available at http://www.cisco.com with the proper login permissions.

Executive Summary

Although this document builds on the main concepts of Cisco IP telephony, patient monitoring data and its priority should not be compared with that of voice data. Voice transmission quality is well defined, and its value is measured by the Mean Opinion Score (MOS). This numerical scale from 5 (Imperceptible) to 1 (Very Annoying) cannot be applied to patient data, where a lost or delayed packet may have much greater consequences than is the case with voice data. For example, a lost packet in a patient monitoring application may result in communications delays that generate alerts to nursing staff about alarm conditions. With this understanding, a strong radio policy is critical in an 802.11 patient-monitoring environment, where packet loss *must* be kept to a minimum.

Note: The Nihon Kohden Patient Monitoring solution requires Cisco Wireless LAN Controller Software Release 4.2.209.0 or later OR Cisco Wireless Control System Software Release 6.0.199.4 or later.

The Nihon Kohden Solution Overview

Nihon Kohden patient monitoring systems are normally installed by Nihon Kohden America utilizing components that have been certified by Nihon Kohden Corporation to provide a dedicated and isolated network. If your facility must use their own network for a Nihon Kohden patient monitoring system, be sure to adhere to the following guidelines. Your facility assumes all responsibility and liability for network and alarm communication.

It is critically important to understand that medical devices operating on a facility's IT infrastructure represent a new challenge for the IT professional. Medical devices are regulated by FDA and special consideration is needed to mitigate risk and help ensure patient safety. Packet loss, latency, and any network downtime can affect nursing

workflow and patient safety. It's critical to have a strong wireless policy and close communication with patient care professionals, as well as to understand that these devices, which send critical alarm information over the network, cannot tolerate a compromised network infrastructure.

Nihon Kohden TR-6000 Patient Monitoring Solution

Every patient deserves the highest standard of care. Developed in response to the needs of clinicians, the TR-6000 Series Monitors (Figure 1) offer an affordable approach to providing nurses, physicians, and other clinicians with the most comprehensive monitoring information available in a bedside monitor today.

Figure 1.   Nihon Kohden TR-6000 Series Monitors

The TR-6000 Series gets its name from the concept of Total Recall - it's the only line of fully featured bedside monitors that retain the patient's monitored data consistently throughout the product line and under most conditions, during transport. The system consists of a data acquisition unit that uses Nihon Kohden Smart Modular Cables and sensors, and three display options.

Typically, bedside monitors contain feature sets that are associated with display size - larger monitors cost more and have more features. Software options can be purchased to add valuable features but increase the overall cost. Often, these costly options are eliminated before the purchase to meet budgetary constraints. When this happens, who suffers? The clinician, but most importantly the patient.

In contrast, the TR-6000 Series includes these valuable software features at no additional charge: full disclosure, comprehensive arrhythmia analysis and recall, diagnostic 12-lead ECG, 12-lead ST segment analysis and recall, drug calculations, hemodynamic calculations, and pulmonary calculations, just to mention a few.

Nihon Kohden Clinical Monitoring Information Station

Today's fast-paced critical care environment places a high level of demand on the nursing staff to properly assess and document their patient's condition. This requirement places the responsibility on the manufacturer to design a user interface that provides quick access to vital patient monitoring information. This information must be in a format that is easy to use and enhances nursing efficiency and clinical productivity. Figure 2 shows the Nihon Kohden Clinical Monitoring Information Station (CMIS).

Figure 2. Nihon Kohden CMIS

Nihon Kohden's direct-access clinical monitoring information system, empowers the clinician to review and document all patient monitoring information with a few simple keystrokes.

The CMIS's unique and flexible design allows the staff to create five direct-access keys that are best tailored to their environment, allowing one-step retrieval of critical patient information. The user interface is so intuitive that in-service training can be kept to a minimum. Productivity increases almost immediately.

Ideal for the critical care environment, telemetry, the emergency room, and other monitoring areas that require a comprehensive yet simple-to-use central monitoring station, the CMIS sets new standards in the time required to properly assess and document the conditions of patients in critical care.

Architecture Overview

The following section provides an architecture overview, including examples of typical components and network setup.

Components

- Cisco Aironet ®Access Points
- Cisco Catalyst® Switches
- Cisco Wireless LAN Controller (WLC)
- Nihon Kohden TR-6000 Series Bedside Monitors (BSM)

Requirements

- Port-isolated VLAN Interface to connect to the Nihon Kohden monitors
- Single dedicated WLAN Service Set Identifier (SSID): "NKUSA"
- Wireless encryption and authentication: Wi-Fi Protected Access 2 (WPA2) with Advanced Encryption Standard/Pre-Shared Key (AES/PSK)
- Platinum-level quality of service (QoS)
- Cisco WLC running Cisco Wireless Control System Software Release 4.2.209.0 (or later) or Cisco Wireless Control System Software Release 6.0.199.4 (or later)
- Configurable Off-Channel Scanning feature in place on the WLC

Network Setup

Figure 3 shows a typical network configuration. Your particular configuration may vary depending on other wireless and wired dependencies. In our example, the access point is registered to the WLC. The WLC is connected to the Layer 2 switch. The switch that connects the WLC and access point is also connected to the Nihon Kohden network. Our example shows two WLANs configured: one for the Nihon Kohden Bedside Monitors and the other for the internal LAN users.

Figure 3. Network Configuration Example
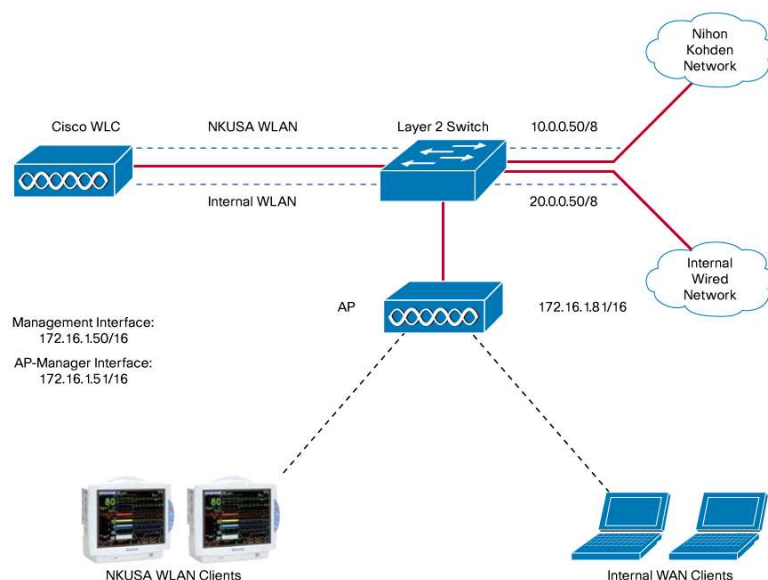
IP Addressing Assignment

There are two ways that IP addresses can be assigned to Nihon Kohden devices:

- Auto mode (default): A unique IP address is assigned automatically in the 10.0.0.0/8 subnet. This is the "out of box" address configuration mode.
- Manual mode: The IP address and subnet mask are assigned manually as a static address.

Network Switch Setup

In setting up the network, be sure that all "NKUSA" interface communications are isolated via a separate network connected to a Nihon Kohden Patient Monitoring Network switch. The Nihon Kohden network is a separate network consisting of Nihon Kohden wired and wireless patient monitors. Connectivity to the wireless monitors is provided by the common switched infrastructure.

Wireless LAN Controller

Be sure that the Cisco WLC is running Cisco Wireless Control System Software Release 4.2.209.0 (or later) or Cisco Wireless Control System Software Release 6.0.199.4 (or later)

Create a new dedicated interface on the WLC:

- Name the interface "NKUSA".
- 802.11a/g rates: Only 11 Mbps or higher rates are recommended. Disable lower rates for optimal performance.
- Assign the appropriate VLAN ID and physical interface settings.
- Configure any necessary gateway setting.

- Do not configure Dynamic Host Configuration Protocol (DHCP) servers because they are not used or required.
- Enable Broadcast Forwarding (Global setting).

Create a new dedicated WLAN (SSID, WPA2-AES, PSK):

- Name WLAN "NKUSA".
- Link the NKUSA WLAN to the NKUSA interface - for example, VLAN (20).
- Select the 802.11a/g radio policy.
- Name the WLAN SSID "NKUSA".
- Secure the WLAN broadcast traffic using WPA2 (disable WPA).
- Encrypt the WLAN broadcast traffic using AES (disable Temporal Key Integrity Protocol [TKIP]).
- Control access to the WLAN with an ACSII-PSK of "nkusa90icon".
- Ensure the WLAN has the platinum QoS setting enabled.
- In a multiple-controller environment, you must ensure the same VLAN is used for the same SSID to allow for roaming.
- Session Timeout (WLAN Advanced setting) will cause several seconds of data packet loss. It is recommended to set this value to a clinically acceptable value or to disable it. The default value is 30 minutes.

Configurable Off-Channel Scanning Feature

To improve WLAN communication, you must execute two configuration commands to allow off-channel scanning to be temporarily deferred during bedside monitor communications. Normally, all access points in the network periodically go off-channel to perform scans to other channels, to perform noise/load measurements, and to look for rogues. During this period, communication to and from existing clients on that access point are interrupted for up to 60 ms. This can cause brief breaks in communication from devices including patient monitors. This deferral mechanism already works for voice/video calls. This feature extends the mechanism to allow full configuration of access class parameters (which class of traffic to defer and the interval between scans. It should be noted that continuous deferrals effectively disable all features of radio resource management for that duration.

The two config commands to enable off-channel scanning are:

```
config wlan channel-scan defer-priority <priority> <enable/disable> <wlan id>
where priority = the user priority value to mask for (each value can be enabled or disabled)
config wlan channel-scan defer-time <time> <wlan id>
where time is up to 60000 ms (60 seconds)
```

The default settings for all new WLANs are a mask of 5 and 6, and a defer-time of 100 ms. Enable a user priority value of 0 (UP=0) and a defer-time of 1 second (1000 ms) on the controller. The defer-time can be tuned if necessary between 100ms to 60000 ms (60 seconds).

Assuming WLAN #1:

```
config wlan disable 1
config wlan channel-scan defer-priority 0 enable 1
config wlan channel-scan defer-priority 5 disable 1
config wlan channel-scan defer-priority 6 disable 1
config wlan channel-scan defer-time 1000
config wlan enable 1
```

A "show wlan 1" command should indicate the correct settings from the command. Off-channel scanning can also be configured from the Cisco Wireless LAN Controller GUI, as shown in Figure 4.

Figure 4. WLAN Settings for Configurable Off-Channel Scanning Feature
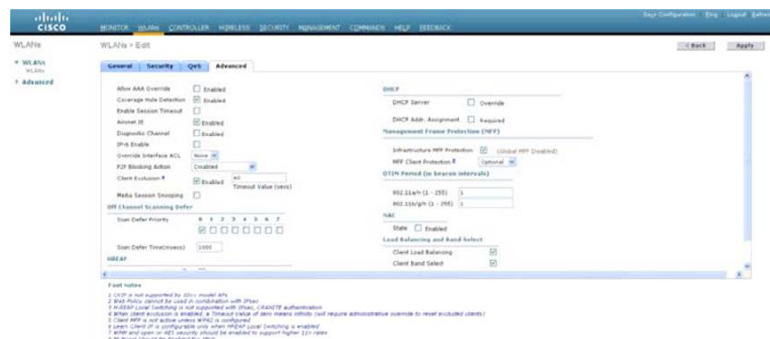
Conclusion

Use the instructions in this guide to help ensure proper configuration and communication of the patient monitoring network, so that alarm communications on the patient monitoring system operate properly. Failure to follow these guidelines could result in loss of network and alarm communication.

Americas Headquarters
Cisco Systems, Inc.
San Jose, CA

Asia Pacific Headquarters
Cisco Systems (USA) Pte. Ltd.
Singapore

Europe Headquarters
Cisco Systems International BV
Amsterdam, The Netherlands

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