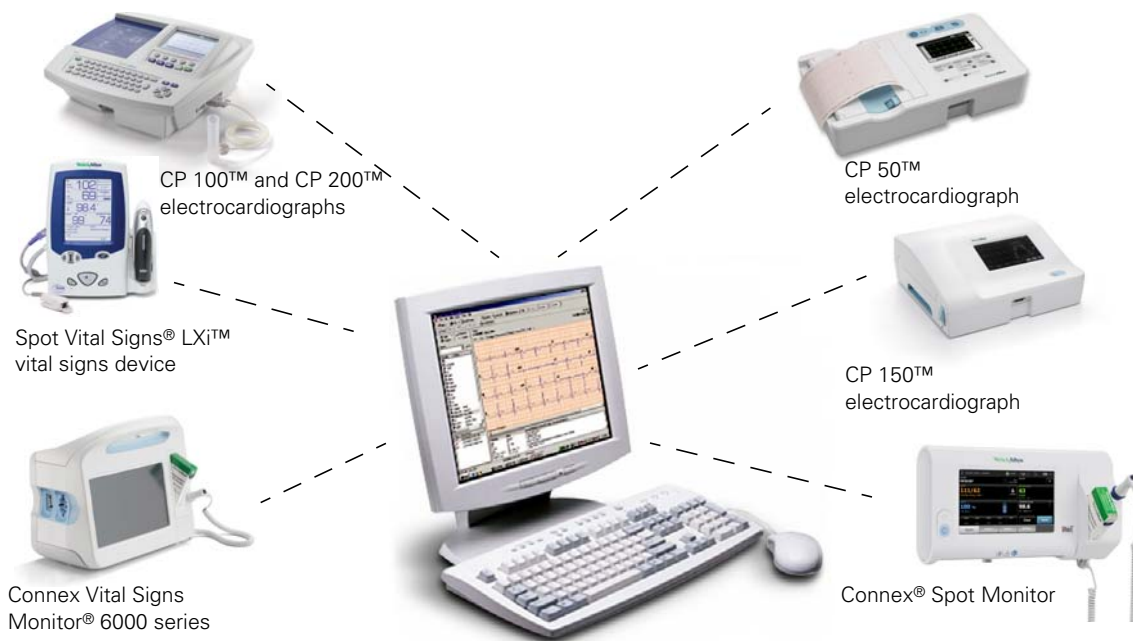


Connex[®] Device Integration Suite (CDIS) Network Connectivity Engine (NCE) software



Best practices guide

WelchAllyn[®]

Advancing Frontline Care[™]

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Overview

Introduction

The intent of this document is to describe the usage and integration of best practices for the CDIS-NCE connectivity software.

The Welch Allyn CDIS-NCE software is intended to provide bi-directional connectivity between Welch Allyn medical devices and various Welch Allyn and non-Welch Allyn data management systems.

The CDIS-NCE software supports the device initiated network workflow where the device is sending data to a server. The device initiated network workflow occurs when the device initiates communication with the server (for example verifying a patient ID, clinician ID, or sending vitals or ECG data).

The CDIS-NCE software does not honor requests for data from the server.

Intended audience

The intended audiences of this document include:

- Customer site IT professionals
- Integrators (integrators or EMR developers)
- Welch Allyn Field Engineers
- Welch Allyn Technical Support personnel

Personnel providing integration of devices into EMR systems will need to know the components included in the software solution (e.g. DCP, NCE, CPSAPI, FileImporter):

- Site IT professionals will need to understand the TCP/IP Ports used in the solution.
- Site IT professionals may need to know basic troubleshooting.
- Welch Allyn service personnel will need to know basic and advanced troubleshooting.

References

- See the appropriate EMR summary for solution context
- 60072721 CDIS-NCE Deployment Instructions
- 60059617 IDS-CFG CDIS-NCE HL7 EMR Interface
- 60067493 IDS-CFG CDIS-NCE HL7 WebServices EMR Interface
- 60063382 IDS-CFG PCC-WA - CDIS-NCE HL7 EMR Interface
- 60072805 IDS-CFG MatrixCare-WA - CDIS-NCE EMR Interface

Definitions

Term	Definition
WACP	Welch Allyn Communication Protocol
CPWS	CardioPerfect Workstation - A comprehensive cardiopulmonary data management system that transforms any computer into an efficient diagnostic solution. Enables you to easily acquire, analyze, store and transmit data from all your cardiopulmonary testing modalities, from resting and stress ECGs, to spirometry and ambulatory blood pressure, all in one comprehensive patient record. A bidirectional interface to major leading EHRs helps you reduce error and expedite report reviewing.
CDIS	Connex Device Integration Suite – A suite of software to enable connecting medical devices to host systems (e.g. EMR software).
HL7	Health Level Seven (HL7) is a standard for exchanging information between medical applications. This standard defines a format for the transmission of health-related information.
NCE	Network Connectivity Engine – Part of CDIS to support device initiated connectivity workflow.
NRS	Network Rendezvous Service – NRS is used to assist devices in finding the server(s) for specific device functions (e.g. sending vitals, remote service, etc.).

Technical specifications

Supported operating systems

Server Windows 2008 R2, Windows 2012 R2

The CDIS-NCE software is not capable of running on a server that is a domain controller.

Computer requirements

CPU Episodic: Any CPU meeting the operating system requirements

Continuous with alarms: Quad Core Intel Xeon or higher performance

RAM Episodic: Minimum 4 GB

Continuous with alarms: Minimum 8 GB

Storage 2 GB for solution software

100 GB available after install

Network connection

NIC 1 GB or higher recommended

Internet connection Minimum: An Internet connection is required for installation and first-time use

Recommended: Internet connection required

Device support

Models Spot LXi, Connex Vital Signs Monitor (CVSM), Connex Integrated Wall System (CIWS), Connex Spot Monitor (CSM)

Capacity Episodic: Up to 400 spot check vitals devices per instance of NCE.

Continuous: Up to 48 continuous devices per instance of NCE.

Note A single instance of NCE software can handle up to 400 episodic devices and 48 continuous devices

Note Only one instance of NCE can be installed to run on a server.

Performance guidelines

This section describes a few topics to consider when setting up the connected solution (e.g. NCE software specifications, type of server hardware, number of virtual machines, number of devices connected per virtual machine, etc.). Please consider the following when configuring the system as it will have some impact on performance based on the type and number of devices used in the environment.

For applications that are made up of only episodic devices (e.g. spot check), one CDIS-NCE server can be used for up to the specified number of devices per the technical specifications.

For applications that combine episodic and continuous devices, the following actions are recommended:

1. The technical specifications are followed for deterministic performance and high data reliability.
2. The NCE software is connected to a host capable of receiving and processing concurrent messages on the same IP/port.
3. Configure the NCE's continuous host index's maximum concurrent connections setting as equal to the number of continuous devices connected to the instance of NCE.
4. Configure the HL7 integration engine to have one connection per continuous device plus one additional connection for every 10 episodic devices.

For example:

- a. If the environment has 250 devices connected to the same IP/Port of the HL7 integration engine and 30 are continuous and 220 episodic, then NCE's continuous host index's max concurrent connections and the HL7 integration engine's max connections should both be set to $52 = (30 + 220 / 10)$.
 - b. If the environment has 42 devices and all 42 devices can work as continuous monitors, then the configuration must be set for the worst case. NCE's continuous host index's max concurrent connections and the HL7 integration engine's max connections should both be set to 42.
5. If the environment has 288 devices and all may be used as a continuous device, based on the technical specifications, six NCE servers are required to support the six sets of 48 continuous devices. Virtual servers can be used, however each virtual server needs to meet the technical specifications, so the server hardware needs to scale to support all six virtual images.

Workflows

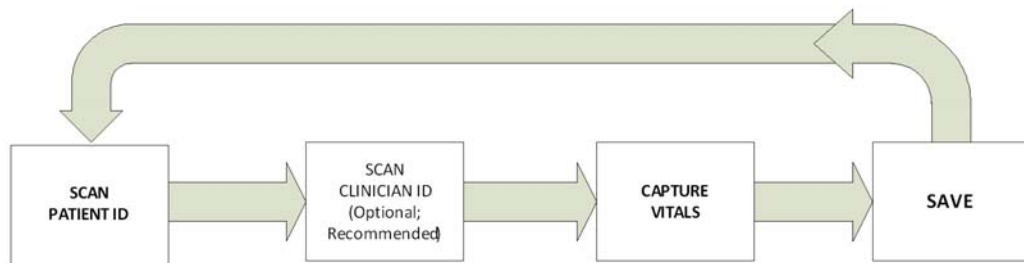
Devices supported and workflow choices

Supported Devices	CPWS	HL7
CP 100	D	N/A
CP 200	D, P, C	N/A
CP 50	D, P, C, O	N/A
CP 150	D, P, C, O	N/A
Spot Vital Signs LXi	N/A	P, C
Connex Vital Signs Monitor (CVSM)	N/A	P, C, O, S
Connex Spot Monitor (CSM)	N/A	P, C, O

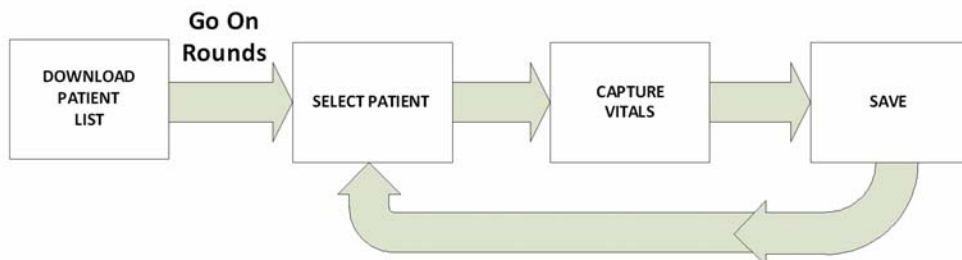
D = Disconnected (Flash Drive Workflow)
 P = Partially Connected (Batch Workflow) *Not a best practice workflow
 C = Connected (Network Workflow)
 O = Orders (or Patient Lists)
 S = Continuous Clinical Surveillance (CVSM 2.00.00 and higher)

Vitals

Device Initiated Network Workflow



Device Initiated Patient List Workflow

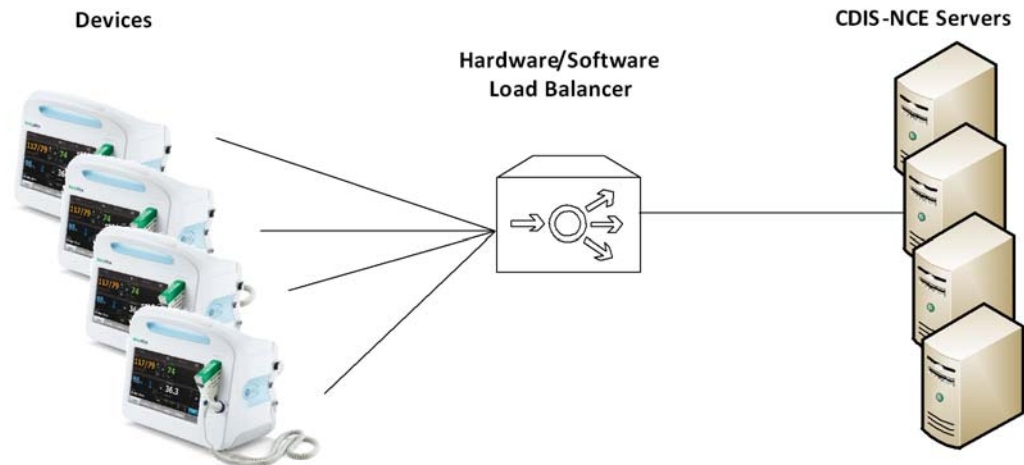


Custom data/modifiers/scores

For information on custom data modifiers and custom scores please contact your Welch Allyn sales representative.

Scalability - Vitals

Depending on network performance, a given installation may be able to handle up to the specified number of devices on a single instance of CDIS-NCE. When the installation requires more devices to be connected (or the solution is not performing as needed due to network bandwidth, network, or server performance) it is a best practice to scale up the solution by using load balance software or hardware between the devices and the CDIS-NCE servers.

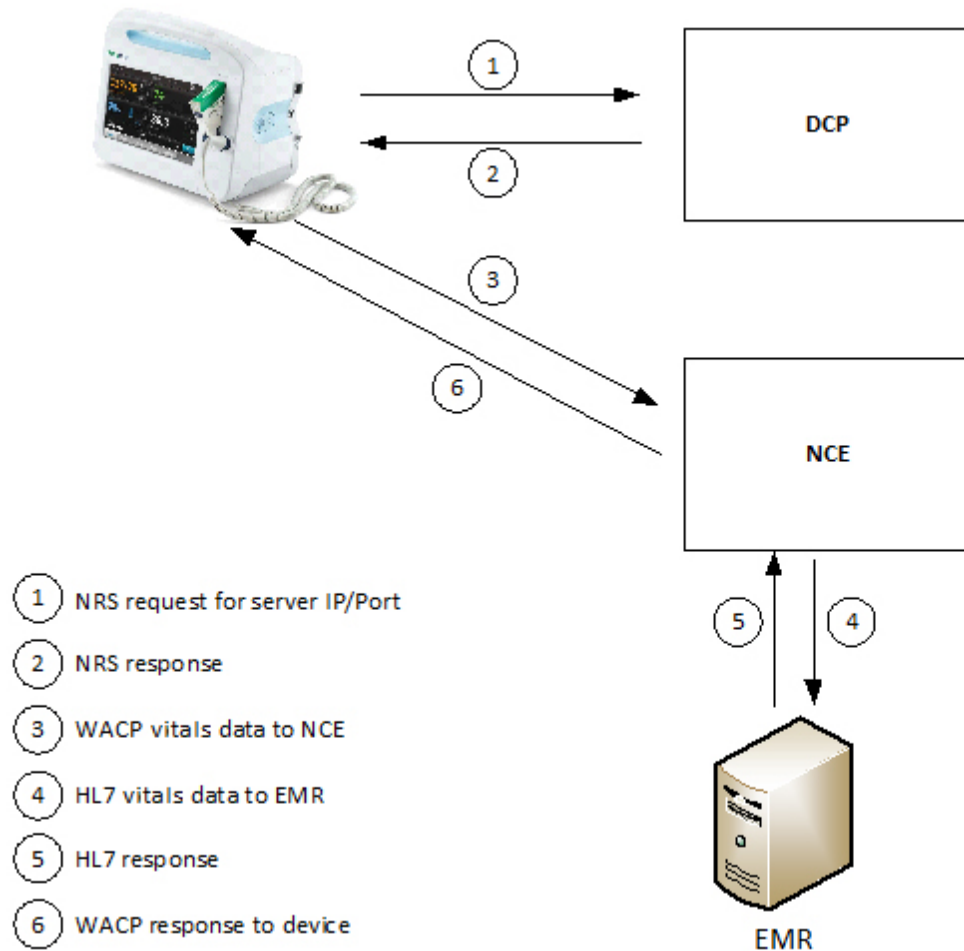


Data flow diagrams

Vitals and continuous data

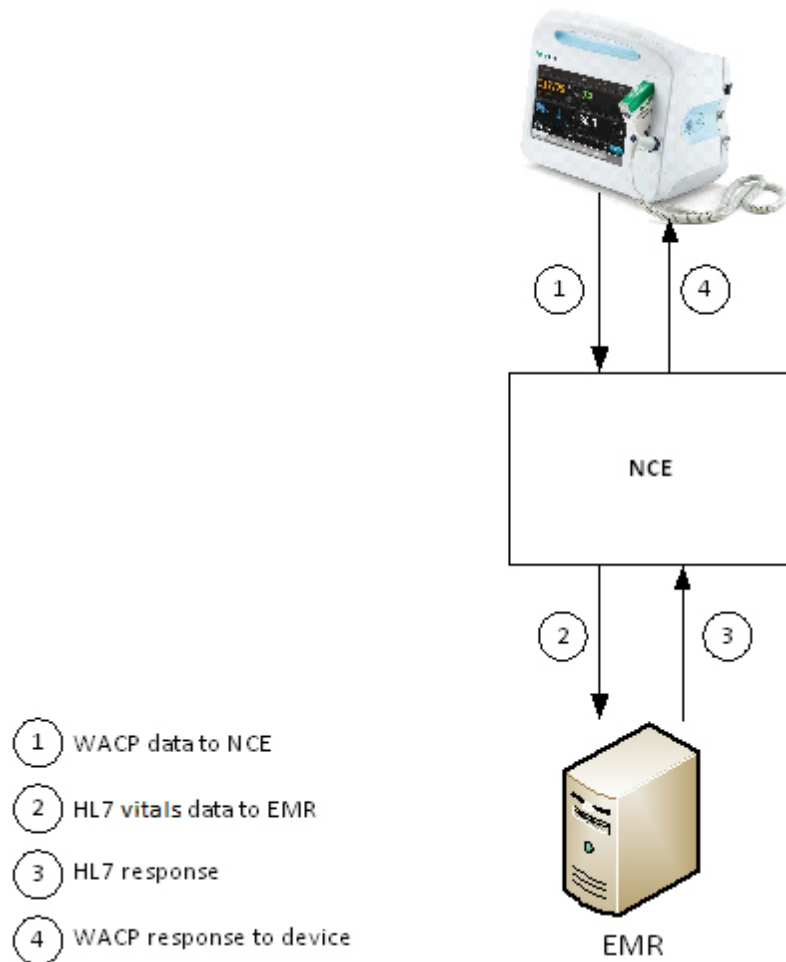
Vitals device with scan patient and send workflow (using NRS IP)

Configuring the device to use NRS IP is the best practice so that the device can take advantage of sending vital data and it also supports the remote service features. The diagram shows the sequence of data transactions.



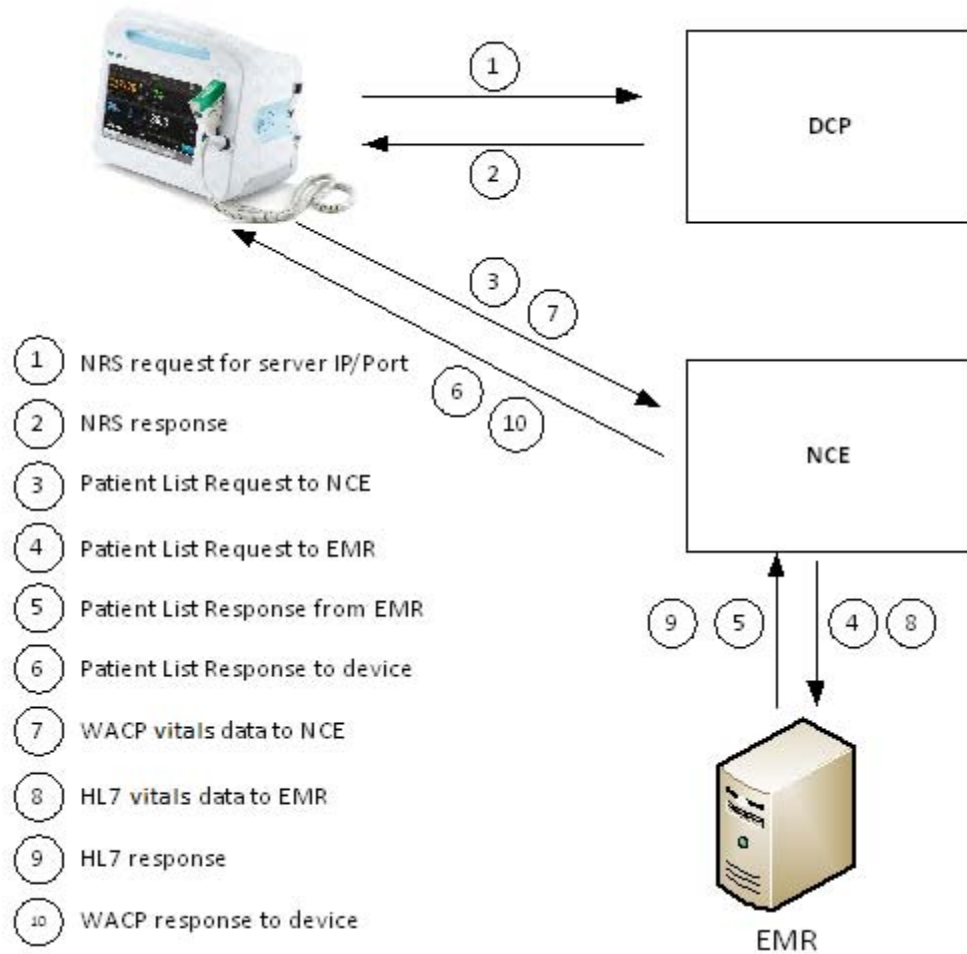
Vitals device with scan patient and send workflow (using VM IP or Host IP)

The devices can also be configured to point directly to the NCE software. Using this option will only allow for sending vitals, this configuration will not allow the system to take advantage of the remote service features. The diagram shows the sequence of data transactions.



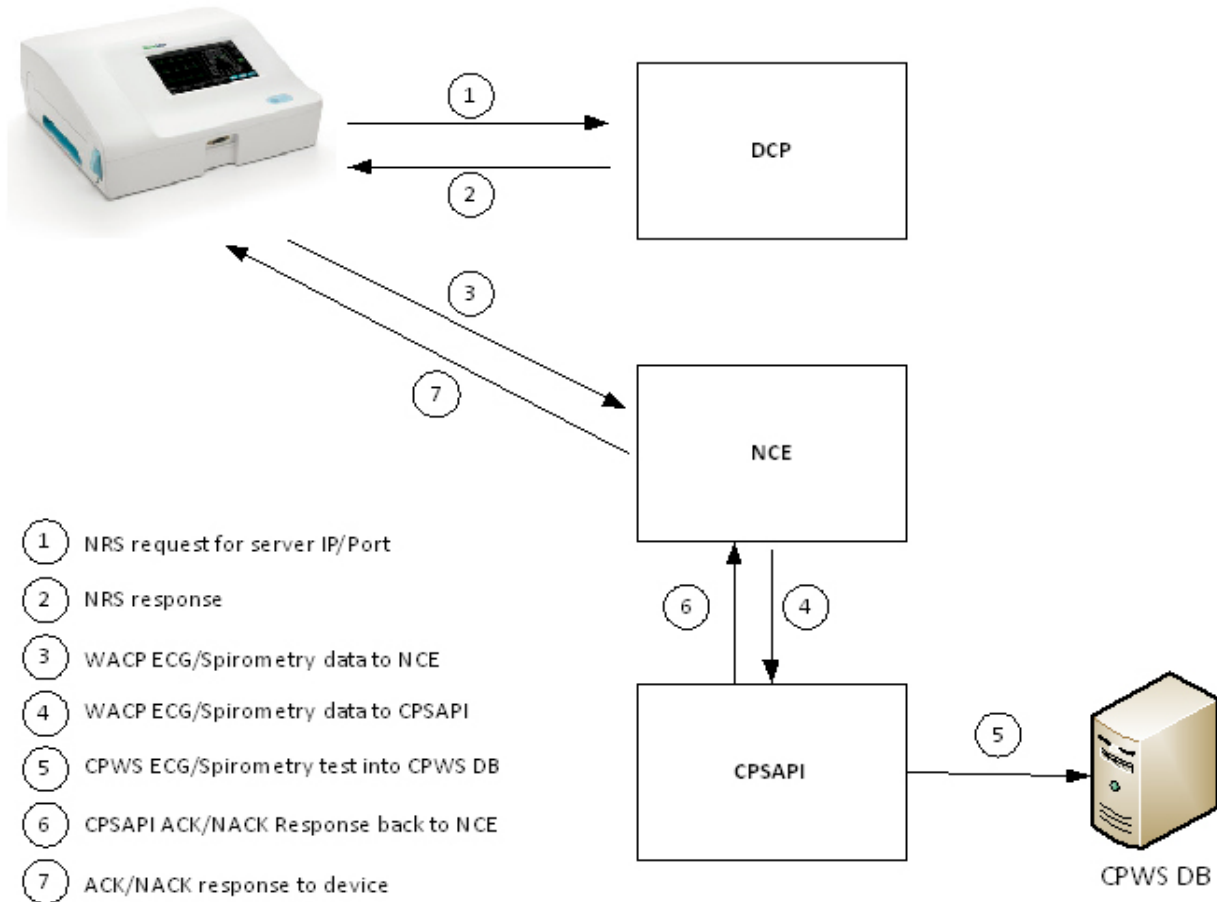
Vitals device with patient list workflow (using NRS IP)

Configuring the device to use NRS IP is the best practice so the device can take advantage of sending vital data and it also supports the remote service features. The diagram shows the sequence of data transactions.



CP 50 and/or CP 150

The diagram shows the sequence of data transactions.



Site Maintenance Activities

The following actions may be needed to maintain the system.

NCE Server address changed

The NCE Server address change can happen for a few reasons:

- Moving from a test environment to a production environment. The facility may have NCE on a test server and the facility does not want to use that same server for production.
- The failure of a server and the resulting need to put in place a new server with a new IP address.
- Server software has been split across multiple servers.

To change the NCE Server address:

- Reconfigure the DCP ordinal settings to point to the correct server(s).
 - The DCP settings are stored in the registry at:
"HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Welch Allyn DCP\Parameters"
The configuration of DCP is set at install time, however if configuration setting changes are needed, they can be done through the computer's Registry.


Note The Welch Allyn DCP Windows service (only the Windows service, not server) requires a restart after any configuration change.

EMR Server address changed

The EMR Server address change can happen for a few reasons:

- Moving from a test environment to a production environment, where the NCE configuration needs to be updated to point to the EMR's production server.
- EMR server failure and the resulting need to put in place a new server with a new IP address.
- EMR server software has been split across multiple servers.

To change the EMR Server address:

1. Open the NCE Configuration Interface. See the  icon in the system tray.
2. Select "Information Network" in the Settings menu on the left column.

For an ORU Outbound Configuration:

- a. Select Host Index representing the ORU outbound data.
 - b. Update the Host Address to the proper IP address.
 - c. Press the "Save Settings" button on the bottom right of the configuration interface.
3. Close the NCE configuration interface.

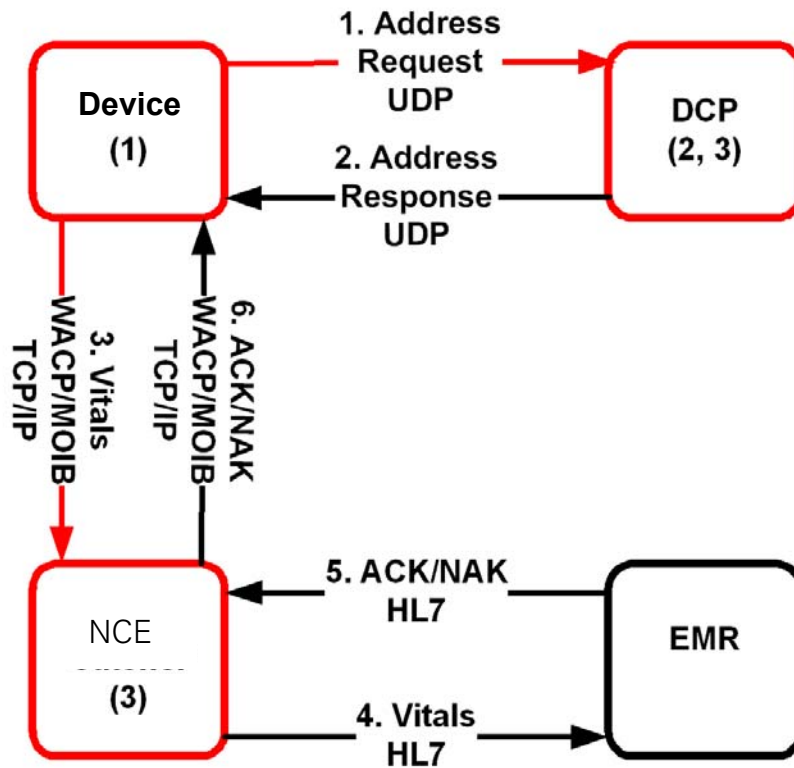
Troubleshooting

This section describes issue that could potentially cause a failure condition and steps to diagnose the issue. Some of the topics have a drawing containing a red indication of the interface or component that may be at fault.

Device cannot access the network

1. Ensure that the device is within range of an access point.
2. Verify the wireless settings match the network settings:
 - a. SSID
 - b. Radio band
 - c. Authentication
 - d. Passphrase (if needed)
 - e. Security protocol
3. If you are still having trouble connecting the device to a wireless network, try connecting the device via Ethernet to determine whether the wireless network is the issue.

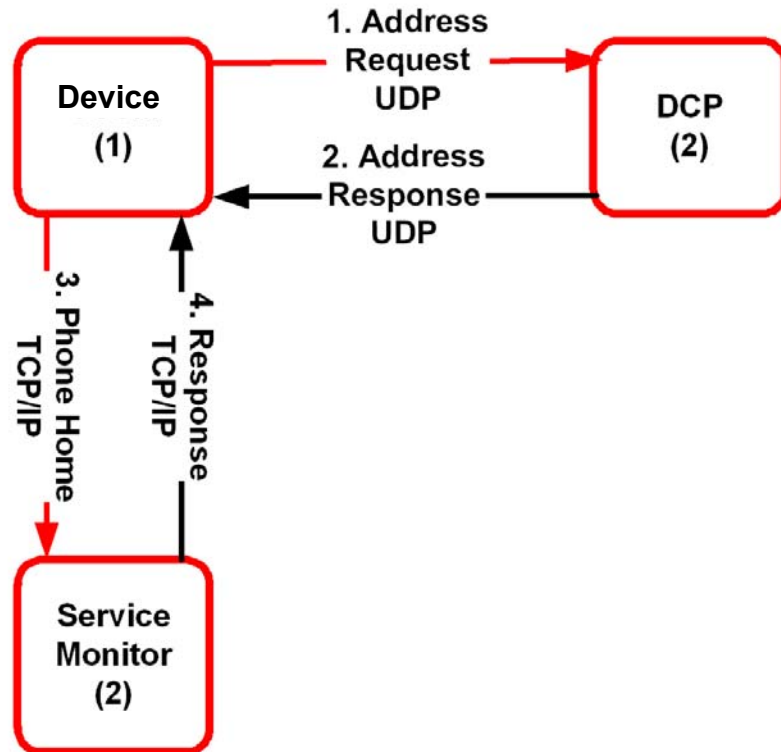
Server test failed



1. Check that the Welch Allyn Vitals Gateway Server IP address matches the IP address setting on the device's "NRS IP" setting.
2. Check the DCP configuration to make sure it is pointing to the correct Welch Allyn Vitals Gateway Server IP address and port at Ordinal 8 (non-encrypted episodic/spot vitals data); Ordinal 5 (Continuous vitals data) and Ordinal 14 (encrypted episodic/spot vitals data). DCP configuration can be found in the registry at:
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Welch Allyn DCP\Parameters
3. Check Windows Services to make sure "Welch Allyn NCE" and "Welch Allyn DCP" are running.

PartnerConnect – “Sync with server” failed

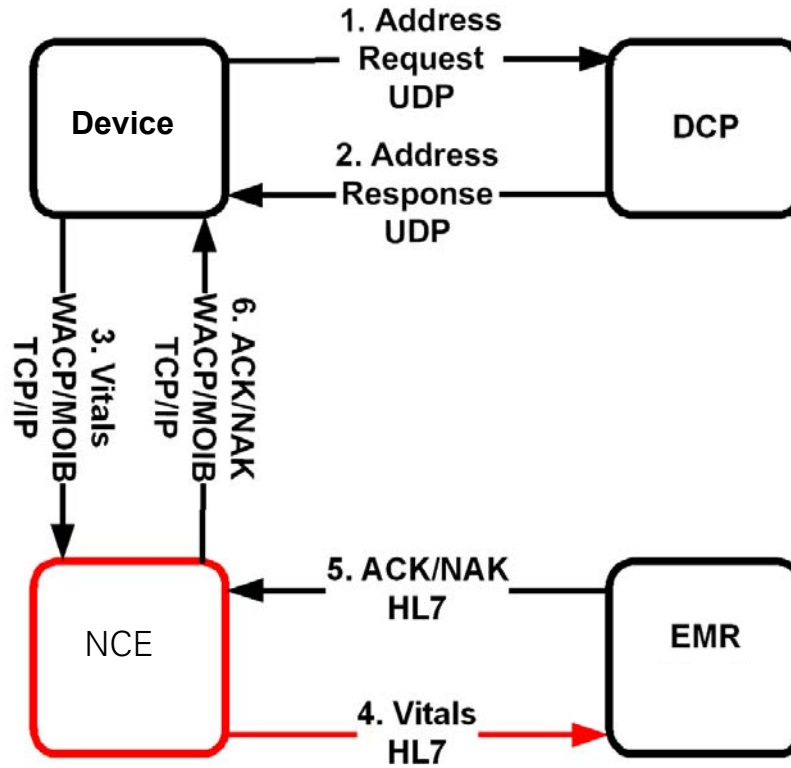
This section assumes that the Server test has passed before arriving to this stage.



1. Check that the Welch Allyn Vitals Gateway Server IP address matches the IP address setting on the device's "NRS IP" setting.
2. Check the DCP configuration to make sure it is pointing to the correct Welch Allyn Vitals Gateway Server IP address Ordinal 10. DCP configuration can be found in the registry at: `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Welch Allyn DCP\Parameters`
3. Check Windows Services to make sure "WelchAllyn.ServiceMonitor" is running.

Retrieve list failed (if applicable)

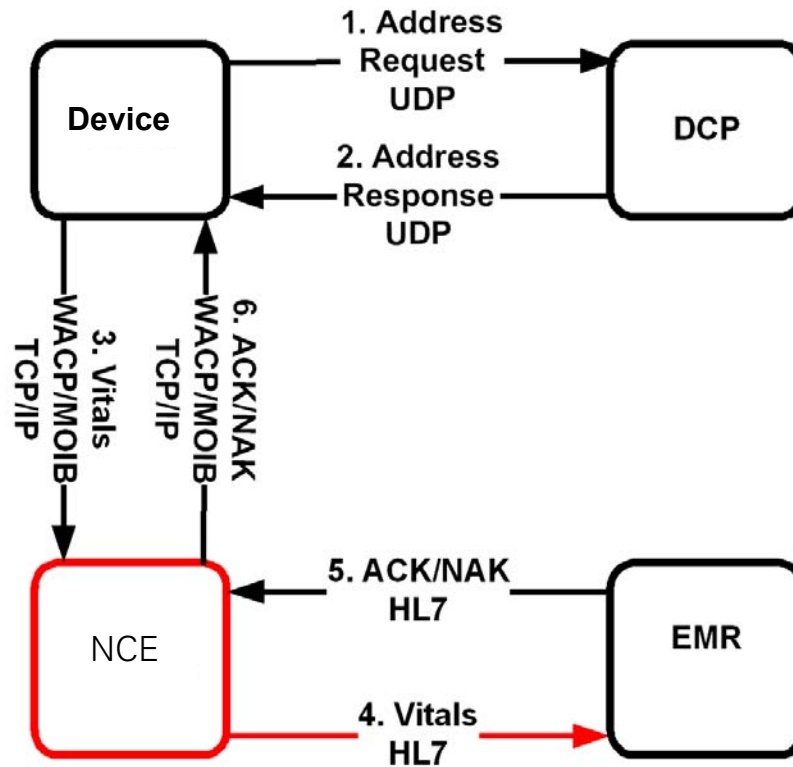
This section assumes that the Server test has passed before arriving to this stage.



1. The NCE configuration may not be pointing to the correct EMR server configured in the NCE web interface – Information Network screen – Host x.
2. Verify that the devices' location ID is set to the proper facility [;unit[;floor]], where unit and floor are optional.

Vitals send failed

This section assumes that the Server test has passed before arriving to this stage.



The NCE configuration may not be pointing to the correct EMR server configured in the NCE web interface – Information Network screen – Host x.

Vitals sent but date-time stamp is wrong

1. Check device's configuration:
 - a. Ensure that the device's "Time zone" is set to the correct time zone.
 - b. Ensure that "Emulate Spot Vital Signs LXi" is disabled.
2. Check Server's configuration:

Ensure that the server's time zone setting is the time zone corresponding to the time zone of the devices connected to this server.

Note The Welch Allyn NCE Windows service must be restarted anytime the server date/time is changed or if the server timezone is changed.

Collecting log files and saved or failed files

Log files can be found in the folder **C:\Program Files (x86)\Welch Allyn\NCE**. There may be many log files named **NCEDebugLog*.txt**. These files are critical to determine the root causes of issues. These files will need to be collected when issues arise.

If enabled, a history of the transactions can be found in the **SavedCopies** folder within the path **C:\Program Files (x86)\Welch Allyn\NCE**. When this feature is enabled in the NCE Configuration, it will save data coming in from the device (**DeviceToNCE**); messages going to the host (**NCEToHost**) containing the exact message that NCE sent to the host; and responses received from the host (**HostToNCE**) containing the exact message the host sent back to the NCE engine. This data is very helpful to diagnose formatting or other application issues.

If enabled, any failed transactions can be found in the **FailedCopies** folder within the path **C:\Program Files (x86)\Welch Allyn\NCE**. When this feature is enabled in the NCE Configuration, it will save data coming in from the device when a failure happens. This is helpful to see what data was sent from the device that may have caused a failure to happen.

Advanced troubleshooting

Please use this section to try to answer a few service related questions.

Note To fully debug:

- Log level must be set to 9 prior to the occurrence of the fault, and
- SavedCopies files is enabled and set to at least 7 days and at least 1000 files.

Problem	Solution
<p>I can't download a patient list to the device</p> <p>I scanned a patient ID but the device is not showing the patient's demographics.</p> <p>I took vitals but it failed to send.</p>	<p>The reason for failed transactions can be identified by using the NCE log files and the saved transaction files.</p> <p>Note: Default log file location: C:\Program Files (x86)\Welch Allyn\NCE</p> <ol style="list-style-type: none"> 1. Select the log file containing data around the time of the failure 2. In Notepad++ enter "Response Type = NACK" into the Find dialog 3. Press "Find All in Current Document". This will display all the failures in this log file 4. Note the MessageContext number next to the line containing "Response Type = NACK" <p>Look in the file and find where the log file shows "Attempting to transform XML data using provided .xsl sheet" and matches the same MessageContext number.</p> <p>If the next line shows "Connecting to information host" and matches the same MessageContext number then this NACK was a failure from a message sent to the host system (e.g. EMR).</p>

	<p>5. Around this area in the log there will be 3 lines that say "XML formatted device data saved locally to file". These lines point to the saved transaction files:</p> <ul style="list-style-type: none">a. DeviceToNCE.xml Data sent from device to NCE in the WACP XML format Patient List: Contains data that the device sent for the query; e.g. org; location Patient ID: Contains data that the device sent for the query; e.g. patient ID Vitals Send: Contains patient data; serial number; location; software version; clinical datab. NCEToHost.txt Data sent from NCE to host in the host format (e.g. HL7) Patient List: Contains data that is sent to the host for the query; e.g. org; location Patient ID: Contains data that is sent to the host for the query; e.g. patient ID Vitals Send: Contains patient data; clinical datac. HostToNCE.txt Response data sent from host to NCE in the host format (e.g. HL7) May tell specifically what is wrong based on the error data
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<p>How can I tell the % of successful messages and the % of failed messages?</p>	<p>Searching data within the NCE log file can help determine the quality and reliability of the communications.</p> <ol style="list-style-type: none"> 1. Select the log file containing data around the time statistics would like to be captured. Typically the latest log file is sufficient. 2. Find the number of messages sent to all hosts (Patient List, ClinicianID query, Vitals, etc.) <ol style="list-style-type: none"> a. In Notepad++ enter "Connecting to information host" into the Find dialog b. Press "Find All in Current Document". The number reported at the bottom of the display is how many messages were sent from NCE to all hosts. 3. Find number of successful responses from all hosts <ol style="list-style-type: none"> a. In Notepad++ put "ACK received from external host" into the Find dialog b. Press "Find All in Current Document". The number reported at the bottom of the display is how many successful responses were returned. 4. Find number of unsuccessful responses from all hosts <ol style="list-style-type: none"> a. In Notepad++ put "Response Type = NACK" into the Find dialog b. Press "Find All in Current Document". The number reported at the bottom of the display is how many unsuccessful responses were returned. <p>Successful % = "ACK received from external host" / "Connecting to information host" * 100</p> <p>Failure % = "Response Type = NACK" / "Connecting to information host" * 100</p> <p>NOTE: It is possible that Successful % + Failure % do not add up to 100% exactly because #5 is a measure of message success at the transmission level, while #6 could be a transmission or an application error. However these measures can give an indication for how successful the interface is during the time represented by the log file.</p>
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<p>How can I tell if the host system is being responsive or if there are timeouts?</p>	<p>A customer may indicate there are failures at the device. That statement does not clarify if the failures are network-related or if the failures are data-related. If timeouts occur between NCE and one or more hosts, the host was not available when the problem occurred at the device.</p> <ol style="list-style-type: none"> 1. Select the log file containing data around the time statistics would like to be captured. Typically the latest log file is sufficient. 2. Determine if there are timeouts reported between NCE and the hosts. <ol style="list-style-type: none"> a. In Notepad++ enter "timeout" into the Find dialog b. Press "Find All in Current Document" c. The number reported at the bottom of the display is how many messages were sent from NCE to all hosts that timed out
<p>The configuration interface does not come up and shows the screen looking for the interface (Potential cause:Service is stopped.)</p>	<p>Restart the service and try interface again. If problem persists, then for some reason the application may be crashing and restarting on its own and when the configuration interface is called up it may be when the application is not running.</p>
<p>The configuration interface comes up but shows no data (Potential cause: Service is running but the application crashed. The windows logs may show this condition.)</p>	<p>Check the setting for "Heartbeat interval" (found in "Device Network Settings"). If this is zero, set it to 10 and then press "Save Settings" button. Wait 20 seconds then set it to 600 and then press "Save Settings" button.</p>
<p>Nothing is going through to NCE. When sending data, no saved copies getting created, no log file entries (Potential cause:The NCE application stopped listening to incoming messages from devices.)</p>	<p>Set telnet ip port to NCE to see if the listener is still running. If yes, garbage is returned, if not timeout. Example: telnet 10.20.30.40 281"</p>

Limitations

1. CDIS-NCE cannot push a file to a remote server.
If file output is desired, the files must be stored locally on the server NCE is running within the NCE folder.
2. CDIS-NCE is supported only on Windows OS platforms.
3. Thin client (Citrix or RDP) is not supported. The CDIS-NCE solution is intended to be a server software solution where the device(s) will connect to CDIS-NCE via a network connection.
4. CDIS-NCE does not support a Bluetooth connection.
5. CDIS-NCE does not support ADT. CDIS-NCE only supports query-response of patient or clinician information.
6. Sending of data (e.g. HL7 ORU) is initiated by the device only. A host system cannot query for data from the CDIS-NCE software or directly from the device.
7. Batch workflow is not a preferred workflow since not all EMR systems can properly handle sending a bulk set of data.
8. When a test send fails, the test data is saved on the device. The device will attempt to resend the test data from a failed send when the device sends another (new) test. If there is something wrong with the test data (as opposed to a wireless connectivity issue) that caused it to fail a send on the first attempt, it will also fail on the second attempt. To avoid an abundance of errors in the EMR, remove records from the device that failed to send.
9. Modifications of the solution configuration (transforms or EMR data mapping) need to be done by Welch Allyn personnel.

