stryker

Vocera Carescape Adapter Configuration Guide

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Notice

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Contents

Understanding a Vocera Carescape Adapter Configuration

Configure a Vocera Carescape Adapter to allow communication between the external GE Carescape system and the Vocera Platform.

Adapters send information to and receive information from the Vocera Platform, as well as monitor and collect data. Each adapter is configured to allow the Vocera Platform to communicate with a specific type of resource and any devices that resource may control.

The Vocera Carescape Adapter integrates alarm details from GE Carescape patient monitors with additional information provided by the facility to deliver a more complete context to caregiver devices responding to patient alerts. For example, the Vocera Carescape Adapter implements the GE Carescape broadcast message protocol to allow the Vocera Platform to receive monitor alarm information directly. Vocera Platform then can integrate available data to deliver meaningful information to caregivers via wireless devices and web browsers.

In the figure below, installers can see how information and data is communicated between systems.
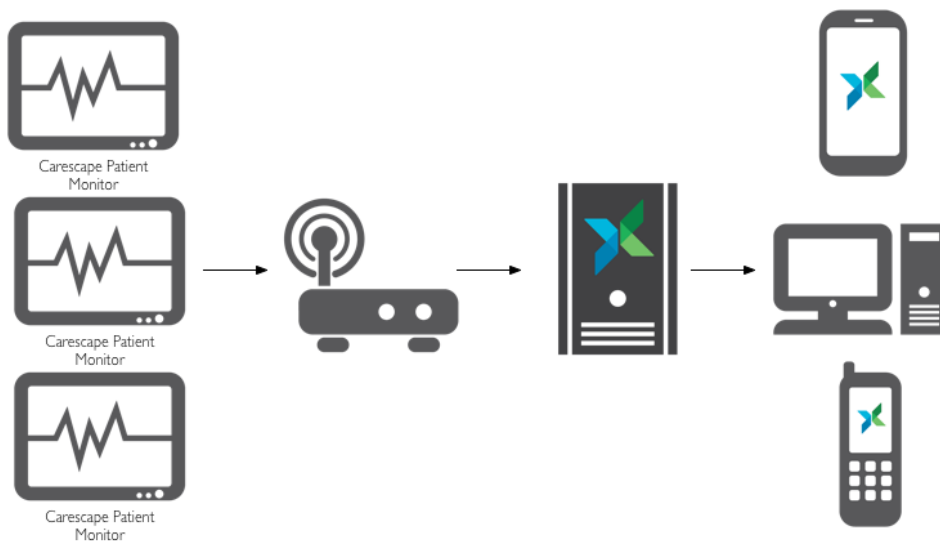
Viewing the Vocera Carescape Adapter Requirements

The minimum requirements for a Vocera Carescape Adapter installation are described here.

Network

An alarm router device is required to forward UDP traffic to the new Vocera Platform appliance. The alarm router should re-write packets from the Carescape subnet to the Vocera Platform appliance subnet. If the appliance is configured to expect packets on a different broadcast address than the one that the router is forwarding from, the appliance will discard the forwarded Carescape broadcast messages.

See the Understanding GE Carescape Networks on page 16 documentation to ensure that the network is configured correctly.

Ports

The Vocera Carescape Adapter requires three designated ports to receive communication from the Carescape network; **port 2000** for time synchronization, **port 7000** for device discovery, and **port 7001** for alarm messages, by default.

See Using Ports in Adapter Guide Requirements on page 6 for a list of ports that should not be used.

Datasets

An adapter defines a default Dataset structure in order to function. Attributes are organized by Datasets and store the information required by the adapter. Adapters use this data during the process of receiving and sending messages.

Not all adapters require Datasets to function. When an adapter does require Datasets, the system will determine if they already exist. If they do not exist, the system will create the needed Datasets.

When creating or editing an adapter, use the following information to select the appropriate datasets in the Required Datasets section.

- The CLINICALS Dataset stores all clinical alert information.

CLINICALS Dataset

Element	Name	Reverse Name	Key	Reverse Key	Required	Type	Description
Attribute	clinical_id	N/A	True	N/A	N/A	String	Attribute that stores the unique identifier for the clinical alert.
Attribute	alert_type	N/A	False	N/A	True	String	Attribute that stores the type of the alert.
Attribute	activity_state	N/A	False	N/A	False	String	Attribute that stores whether this alert is active or inactive.

Element	Name	Reverse Name	Key	Reverse Key	Required	Type	Description
Attribute	alarm_time	N/A	False	N/A	False	Date/Time	Attribute that stores the time that the alert was generated by the sending system. This is not the same as the created_at time.
Attribute	priority	N/A	False	N/A	False	String	Attribute that stores the priority description for the alert.

Using Ports in Adapter Guide Requirements

Some ports are not recommended for use when configuring an adapter.

Warning: Do NOT use the following ports for an adapter configuration: 22, 8888, 8443, 1099, 52517, 3700, 3820, 3920, 4848, 7676, 8080, 8181, 8686, 13579, 36123, 41776, 52071, 5432, 80, 443, 25

Understanding the GE Carescape System Components

The GE Carescape system may use telemetry packs, bedside monitors, and message logs when integrated with Vocera Platform.

GE Carescape Telemetry Packs

Alarm text received from the telemetry pack may differ from the same condition on the bedside monitors. For instance, the telemetry pack may send through text of "HR HI 259" and "HR LO 36", including actual values, as opposed to more simple condition text always seen from the bedside monitors.

The telemetry pack may have multiple codes for a "leads fail" event: LEADS FAIL and LF: NO TELEM.

The telemetry pack has a call button on it that the patient can push which results in an alarm with the text message "NURSE CALL". Unlike the other alarms, this message is only ever sent a single time. The text of any alarm that is not received continuously throughout the duration of the event should be configured in the Alarm Reset Exceptions field in the Vocera Carescape Adapter.

GE Carescape Message Logs

The Vocera Carescape Adapter will retain a log of all alarm messages received for a period of 50 hours. A separate log file is created each hour, and the oldest log file is deleted when a new file is created. Log files can be found on the appliance under `/opt/EXTENSION/log/Carescape/<ReferenceName>`. The most recent log file is named `AlarmPackets.log` and older logs will be compressed and named with a timestamp suffix. These logs contain the raw hexadecimal format of each message received.

Configuring a Vocera Carescape Adapter

Description of the settings that enable direct communication between the Vocera Carescape Adapter and the Vocera Platform.

Select an empty field and begin typing, or select an existing value and type over it. To keep an existing value, do not edit that field.

1. Access the Vocera Platform Web Console and navigate to the adapters.

   See Navigating the Vocera Platform Adapters on page 33 for instructions.

2. Select **New Adapter** in the Action menu, or select an adapter you wish to configure and then select **Edit**, to display the configuration fields. The configuration fields are the same for new and existing adapters.

3. Navigate to the New Adapter option, or navigate to an existing adapter to edit. See Creating a New Adapter on page 36 and Editing an Adapter on page 35 for instruction as needed.

   The configuration fields are the same for new and existing adapters.

4. Complete the configuration fields as described in the table, for new or existing adapters. This table describes a portion of the fields provided in the configuration dialog. See the Configuring Carescape Main Settings on page 9, Configuring Carescape Alarm Settings on page 10, Configuring Carescape Location Types on page 11, and Configuring Carescape Message Types on page 12 descriptions in this adapter guide.

Configuration Field	Description
Component Name	Click the Component Name field to display a list of the systems and devices that the Vocera Platform currently supports. Select the name of the adapter to create.
Reference Name	Enter a short descriptive name in the Reference Name field to uniquely identify an adapter instance. It may demonstrate the adapter function or other information; for example, Production adapter may differentiate a live adapter from a development or "sandbox" adapter.
Enabled	Select the Enabled checkbox to allow the Vocera Platform to use the new adapter. The Vocera Platform ignores the adapter if this option is disabled.

Configuration Field	Description
Required Datasets	If more than one dataset exists that meets the adapter's requirements, select the appropriate datasets for the new adapter to function correctly. The system searches for the datasets that meet the adapters requirements. If the datasets already exist, the system will use them. If the datasets do not exist, the system will create them automatically. Select Create in the drop-down menu to create a new dataset to meet the organization's requirements, if needed.

5. Select one of the available options to exit the adapter configuration page. See Saving an Adapter on page 37 for details.

Configuring Carescape Main Settings

Configure the fields in the Main Settings section of the Vocera Carescape Adapter.

Select an empty field and begin typing, or select an existing value and type over it. To keep an existing value, do not edit that field.

1. Access the Vocera Carescape Adapter configuration page, and locate the **Main Settings** section.

2. Complete the configuration fields as described in the table, for new or existing adapters.

Configuration Field	Description
Accepted IP Addresses	Enter the IP address of the source from which the adapter will receive clinical events from the Carescape network. Use a standard IP address format (xxx.xxx.xxx.xxx, where each xxx is a number from 0-255), and enter one server address per line. Vocera recommends that at least one IP address is entered in this field, as an empty field will allow all UDP traffic to be processed by the Vocera Carescape Adapter. **Warning:** Unexpected UDP traffic may be processed by the Vocera Carescape Adapter when the Accepted IP Addresses field is left empty. Enter at least one IP address.
Alarm Packet Port	Enter the port number on which the adapter will receive Carescape clinical event or alarm packets. This field is required. The default port number is **7001**.

Configuration Field	Description
Discovery Packet Port	Enter the port number on which Discovery packets are monitored to determine if a particular Carescape device starts or stops communicating. This field is required. The default port number is **7000**.
Time Packet Port	Enter the port number to monitor to determine if the time used on the GE Carescape network is within a tolerance of the server time. This field is required. The default port number is **2000**.
Report Non-Matching Messages as Audit Events	Select the checkbox to record received messages that do not match a message definition as an audit event. Non-matching messages will be found in the audit log as they are received, if enabled.

3. Select one of the available options to exit the adapter configuration page. See Saving an Adapter on page 37 for details.

Configuring Carescape Alarm Settings

Configure the fields in the Alarm Settings section of the Vocera Carescape Adapter.

This section of the Main Adapter Settings provides the fields used to configure repeatable Carescape alarms. The facility must specify repeat intervals for High, Medium, Low, and Message priority alarms, as well as a reset interval, for determining how long to wait for a repeated alarm before setting it to inactive.

1. Access the Vocera Carescape Adapter configuration page, and locate the **Alarm Settings** section.

2. Complete the configuration fields as described in the table, for new or existing adapters.

Configuration Field	Description
High Priority Alarm Repeat Interval	Enter a time in seconds before an active High (level 7) priority alarm is registered as a new alert. The default setting is 240 seconds; enter a number between 0 and 3600 (1 hour). Use 0 to never resend an alarm.
Medium Priority Alarm Repeat Interval	Enter a time in seconds before an active Medium (level 6) priority alarm is registered as a new alert. The default setting is 240 seconds; enter a number between 0 and 3600 (1 hour). Use 0 to never resend an alarm.
Low Priority Alarm Repeat Interval	Enter a time in seconds before an active Low (level 5) priority alarm is registered as a new alert. The default setting is 240 seconds; enter a number between 0 and 3600 (1 hour). Use 0 to never resend an alarm.

Configuration Field	Description
Message Priority Alarm Repeat Interval	Enter a time in seconds before an active Message (level 3) priority alarm is registered as a new alert. The default setting is 240 seconds; enter a number between 0 and 3600 (1 hour). Use 0 to never resend an alarm.
Reset Interval	The Alarm Reset Interval is the period of time to wait for a repeated alarm before setting it to inactive. Enter a time in seconds after the last message from an alarm was received before setting the alarm to Inactive. The default setting is 5 seconds; enter a number between 0 and 3600 (1 hour). Use 0 to never automatically reset an alarm to Inactive.
Reset Exceptions	Specify the alarms for which no repeated alarm is expected, and therefore should not be reset. Enter one alarm per line in this field. For example, some monitored medical devices allow the patient to press a call button. This type of alert (nurse call) does not repeat, and therefore, this alert should not be made inactive when additional alarm messages are not received.

3. Select one of the available options to exit the adapter configuration page. See Saving an Adapter on page 37 for details.

Configuring Carescape Location Types

Configure the fields in the Location Types section of the Vocera Carescape Adapter.

Location Type uses regular expressions to utilize the bed information within the alarm messages received from the GE Carescape network. When multiple facilities are supported by a single Carescape network, location types are also important in identifying the correct facility for each message received. To differentiate the facilities in an implementation, enter the appropriate attribute paths relating to each facility as part of the mapping of capture groups for each Location Type.

1. Access the Vocera Carescape Adapter configuration page, and locate the **Location Types** section.
2. Expand **New Location Type** to define the regular expressions needed to capture bed data. Select **Add** to create additional locations as needed.

3. Complete the configuration fields as described in the table, for new or existing adapters.

Configuration Field	Description
Reference Name	Enter a descriptive name to identify the location type. This field is required.

Configuration Field	Description
Active	Select this checkbox to indicate whether or not the location type is active.
Discard	Select this checkbox to not process the alarm message received if it matches this specific location type. Location types may be created for alarm messages which are expected to be received but are of no interest; by marking these for discard, the messages may be filtered from the audit log.
Regex	Enter the regular expression to capture values from the bed information within the clinical event received from the Carescape monitor. This field is required.
Regex Mapping	Enter one or more attributes or attribute paths, one per line, to be filled with data from the above regex. This field is required. Specify the regex mapping from the capture groups of the Regex field above to attribute paths starting from the Clinicals dataset. The paths from bed, room, unit and facility are required to link the alarm event to a patient bed.
Clone Location Type	Select **Clone Location Type** to create a duplicate configuration of the selected location type. The duplicate's reference name will be unique and will not be active, by default.
Remove Location Type	If more than one location type is created, the ability to remove a location type becomes active. Select **Remove** under the location type to remove it from the configuration.

4. Select one of the available options to exit the adapter configuration page. See Saving an Adapter on page 37 for details.

Configuring Carescape Message Types

Configure the fields in the Message Types section of the Vocera Carescape Adapter.

The Vocera Carescape Adapter message types include a regex mapping for the event data from the Carescape clinical event. The regex mapping stores the event data as a clinical alert. The type of alert is mapped to the attribute alert_type in the Clinicals dataset and the additional details are mapped to the attributes clinical_details.detail_type and clinical_details.value in the ClinicalDetails dataset.

Although only one message type is required to create the adapter, implementation specialists may add, remove, or modify message types as needed. See the Understanding Regular Expressions (Regex) on page 21 documentation for more information on regular expressions.

1. Access the Vocera Carescape Adapter configuration page, and locate the **Message Types** section.
2. Expand **New Message Type** to define the regular expressions needed to capture unit and bed data. Select **Add** to create additional locations as needed.

3. Complete the configuration fields as described in the table, for new or existing adapters.

Configuration Field	Description
Reference Name	Enter a descriptive name to identify the message type. This field is required.
Active	Select this checkbox to indicate whether or not the location type is active.
Discard	Select the Discard checkbox to not process the alarm message received if it matches this specific message type. Message types may be created for alarm messages which are expected to be received but are of no interest; by marking these for discard, the messages may be filtered from the audit log.
Regex	Enter the regular expression to capture values from the event data of a clinical event received from the Carescape server. This field is required.
Regex Mapping	Enter one or more attributes or attribute paths, one per line, to be filled with data from the above regex. This field is required. Specify the regex mapping from the capture groups of the Regex field above to attribute paths starting from the Clinicals dataset. Two attribute mapping patterns are supported; plain attribute list, and statement of equality. Plain attribute list: Each item in the mapping is a simple attribute path. The first capture group of the matched regular expression is used as the value of the first attribute path in the list, and so on. The number of capture groups in the regex must match the number of attribute paths in the list. The syntax is dataset_link_attribute_name.attribute_name, or dataset_attribute_name. Statement of equality: The left-hand side of the statement is the attribute path, while the right-hand side is the value that the attribute path should be set to. On the right, use numbered captured groups (such as $1) to reference elements matched, or literal strings. The syntax is dataset_link_attribute_name.attribute_name=LITERAL, or dataset_attribute_name=$1, or example_with_two_capture_groups=$2:$1.
Clone Message Type	Select **Clone Message Type** to create a duplicate configuration of the selected message type. The duplicate's reference name will be unique and will not be active, by default.
Remove Message Type	If more than one location type is created, the ability to remove a location type becomes active. Select **Remove** under the message type to remove it from the configuration.

4. Select one of the available options to exit the adapter configuration page. See Saving an Adapter on page 37 for details.

Understanding the Vocera Carescape Adapter Rules

This adapter does not require dataset rule configuration.

Understanding GE Carescape Networks

GE Carescape networking and configuration details are provided for the three types of network messages that the Carescape system sends to the Vocera Platform.

GE Carescape Network Traffic

There are three types of network messages which are expected to be received by the Vocera Carescape Adapter:

- Time Synchronization
- Discovery
- Alarms

Time Synchronization (UDP port 2000)

Time messages (UDP port 2000) are sent minimally once per day, and when a time change is initiated on the network.

Occasionally, the master node of the network sends out a time synchronization message.
- The message is transmitted at least once per day, as well as any time that the system time is changed.

Changing the time on any node within the Carescape network results in the time of all nodes being updated.
- When a slave node is the point at where the time is changed, it will send a private message to the master node.
- The master node in turn will broadcast the time synchronization message across the network.

The length of the data within the packets received is consistent across device types.
- 106 byte packet / 64 bytes data.

Bytes	Content
7-10	Consistent for all messages from a single device, but different between devices. This is a hex representation of the IP address of the monitor. The device IP address is used to uniquely identify each device.
25-37	Location identifier. Formatted as <unit>|<room>. The Unit is limited to 7 characters. The Room is limited to 6 characters. If either element is not present at its full length, then the trailing characters of this block are null (00). The location identifier received in the message will be for the master node (the central station).
61-64	Represents the time in seconds since Jan. 1, 1900.

Discovery (UDP port 7000)

Discovery messages (UDP port 7000) are used as a heartbeat to the Vocera appliance to indicate that it is in fact connected to the CARESCAPE Network.

On a regular basis, every node of the Carescape network sends out a discovery message.

- One message every ten seconds is the expected frequency.
- Discovery messages are received from every node in the system including:
  - Bedside monitor
  - Telemetry packs
  - Telemetry base station
  - Central station

The length of the data within the packets received varies by source.

Bytes	Content
5-8	Consistent for all messages from a single device, but different between devices. This is a hex representation of the IP address of the monitor. The device IP address is used to uniquely identify each device.
13-25	Location identifier. Formatted as <unit>|<room>. The Unit is limited to 7 characters. The Room is limited to 6 characters. If either element is not present at its full length, then the trailing characters of this block are null (00).
29-41	Patient name, if admitted. Formatted as <last name>,<first name>. If the last name is 13 characters, then the comma is omitted. If the last name is 12 characters, then the last name is 12 characters and the comma is present, but first name is not. If the combination of elements is not present at its full length, then the trailing characters of this block are null (00). Data is only ever present in a message received for patient monitors and when a patient is admitted to the monitor. Patient name is never stored by the adapter.

Alarms (UDP port 7001)

Alarm messages (UDP port 7001) are sent to provide alarm data from monitors/telemetry to be processed by the Vocera appliance and delivered to Cisco wireless handsets.

For the duration of a patient alarm, the patient monitors within the Carescape network will send out an alarm message.

- One message every two seconds is the expected frequency.
- Silencing the alarm at the monitor does not stop the messages from being broadcast.
- Pausing the alarm at the monitor does stop the messages from being broadcast for the duration of the pause.

The length of the data within the packets received from all patient monitors is consistent.

Bytes	Content
7-10	Consistent for all messages from a single device, but different between devices. This is a hex representation of the IP address of the monitor (e.g., C0A80104 == 192.168.1.4). The device IP address is used to uniquely identify each device.
25-37	Location identifier. Formatted as <unit>|<room>. The Unit is limited to 7 characters. The Room is limited to 6 characters. If either element is not present at its full length, then the trailing characters of this block are null (00).
62	Actual alarm priority. Values include: - 07 – High - 06 – Medium - 05 – Low - 03 – Message
67-79	Text of the alarm.

Bytes	Content
80-84	Duration of the alarm in seconds. Each subsequent message received is incremented. When a paused alarm is resumed, the counter reflects the entire length of the alarm incidence (large increase in the counter since the last message received) as opposed to being reset to zero.

GE Carescape Network Configuration

An alarm router device is required to forward UDP traffic to the new Vocera Communications appliance. The alarm router serves as a one-way connection between the UNITY/Carescape Mission Critical (MC) network and the Vocera Communications appliance that allows broadcast messages on the MC network to be forwarded to an Vocera Communications appliance using broadcast forwarding. No traffic will be sent back to the UNITY/Carescape MC network from the alarm router. The alarm router must be an enterprise-grade router, able to forward UDP traffic and prevent traffic back to the MC network via an ACL.

The alarm router should re-write packets from the Carescape subnet to the Vocera appliance subnet. If the appliance is configured to expect packets on a different broadcast address than the one that the router is forwarding from uses, the appliance will discard the broadcast messages. Configure the NIC on the appliance to match the broadcast address of the Carescape packets sent from the router. The exact method of doing this is determined in the final configuration, depending on if a second NIC is used, and if a router is in between the network and the appliance.

The router and appliance are likely to be on different physical networks, in which case a VLAN can be used to transport the packets across the network from the router to the appliance. If, for any reason, the router cannot re-write the packets to match the main subnet of the appliance, then a second network address that is on the subnet that the router is sending from can be added.

There are three types of GE broadcast messages that the router will forward as unicast to the Vocera appliance:

- **Alarm messages** (UDP port 7001) are sent to provide alarm data from monitors/telemetry to be processed by the Vocera appliance and delivered to Cisco wireless handsets
- **Discovery messages** (UDP port 7000) are used as a heartbeat to the Vocera appliance to indicate that it is in fact connected to the CARESCAPE Network.
- **Time messages** (UDP port 2000) are sent minimally once per day, and when a time change is initiated on the network.

Network Configuration Example

The following example of network configuration for GE Carescape uses the Cisco 871 router. Traffic between two networks is denied by default; you can explicitly allow traffic to flow between the two networks, if desired.

```
Router Configuration for test network:
version 12.4
no service pad
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname ext-ge
!
boot-start-marker
boot-end-marker
!
no aaa new-model
!
```

```
dot11 syslog
ip cef
!
ip domain name ext-inc.com
!
multilink bundle-name authenticated
!
username extension privilege 15 secret 5 $1$.wlA$Mlh02Xn/v8vtm5DX2DY8I1
!
archive
log config
hidekeys
!
ip ssh rsa keypair-name ext-ge.ext-inc.com
ip ssh version 2
!
!
interface FastEthernet0
!
interface FastEthernet1
!
interface FastEthernet2
!
interface FastEthernet3
!
interface FastEthernet4
ip address 10.42.22.10 255.255.255.0
ip helper-address 192.168.1.5
duplex auto
speed auto
!
interface Dot11Radio0
no ip address
shutdown
speed basic-1.0 basic-2.0 basic-5.5 6.0 9.0 basic-11.0 12.0 18.0 24.0 36.0 48.0 54.0
station-role root
!
interface Vlan1
ip address 192.168.1.1 255.255.255.0
!
no ip forward-protocol nd
ip forward-protocol udp 7000
ip forward-protocol udp 7001
ip forward-protocol udp 2000
!
!
no ip http server
no ip http secure-server
!
control-plane
!
line con 0
logging synchronous
no modem enable
line aux 0
line vty 0 4
login local
!
scheduler max-task-time 5000
```

end

Understanding Regular Expressions (Regex)

Adapters uses regular expressions (Regex) when parsing incoming messages for storage in a designated dataset in the Data Manager. This page contains an explanation of Regex, describes methods to specify Regex mappings, and provides a quick reference table of operators.

Incoming message data is processed in order to store information from a nurse call system and may later be used by the Workflow Engine to display a message on the end user's device. For example, the Vocera NaviCare Adapter uses Regex mappings configured in the Message Type settings to capture alert data sent by the NaviCare nurse call system.

This document will discuss Literal Expressions, Statements of Equality, and Global Variables.

General Guideline for Regular Expressions

When building a Regex for a facility, be sure to keep the expression as simple as possible while still meeting the needs of the facility. Performance issues, including delays in Alerts, can occur when overly complex Regex strings are written.

The system enforces a maximum processing time limit of five seconds to ensure that CPU loads are not significantly increased by overcomplicated Regex strings. A string that exceeds the threshold will generate an audit event and will not match any results.

⚠️ **Warning:** Avoid building extremely complex Regex functions, as performance issues may result.

For example, preprocessing rules might contain inefficient Regex with nested ungreedy matchers such as (.*?) that result in excess load on the system.

Below is an example of inefficient Regex for a preprocessor rule:

```
(OBR(\|.*?){7}.?)(\d){4}(\d){2}(\d){2}(\d){2}(\d){2}
```

This example could be expressed more efficiently as the following:

```
"OBR(\|.*){7}.*?(\d){4}(\d){2}(\d){2}(\d){2}(\d){2}(\d){2}"
```

Literal Expressions

Regex describes a search pattern, similar to the way *.txt is used to find text files in a file management system. An adapter that uses Message Types to parse incoming message data will define Regex fields to describe the data pattern to match, and a corresponding mapping which describes the attribute expressions to store the data. Each segment in the Regex field corresponds to one line in the Regex Mapping field.

The adapter expects to find data in the defined pattern for processing; if no match is made, the message is not processed. A number of Message Types, with Regex mappings, have to be created to address each and every format or combination of data that the implementation will need to handle.

In this example, the Regex (\d+\+(\d+)\+(1|2))\s+(.+) maps to the following attribute expressions:

- bed.pillow_number
- bed.room.room_number
- bed.bed_number
- alert_type

Regex:	(\d+\+(\d+)\+(1|2))\s+(.+)
Regex Mapping:	bed.pillow_number bed.room.room_number bed.bed_number alert_type

This Regex mapping results in stored data, which may be used to display on the user device. The Regex (\d+\+(\d+)\+(1|2))\s+(.+) may result in a user's device displaying "100:103:1 Code Blue" due to the stored data captured by the following segments.

- "100" is stored by the first segment and mapping, and is the pillow number.
- "103" is stored by the second segment and mapping, and is the room number.
- "1" is stored by the third segment and mapping, and is the bed number. Bed numbers depend on how many beds are in the room.
- "Code Blue" is stored by the fourth segment and mapping, and is the alert type triggered. Alerts are preconfigured to cover conditions ranging from "Code Blue" to "Patient needs water" in a clinical setting.

Literal Expressions Explanation

Regex provides a method of pattern matching where the system expects to find the designated characters in a particular position in the incoming message data. Regex is written in a formal language that can be interpreted by a regular expression processor, which is a program that either serves as a parser generator or examines text and identifies parts that match the provided specification.

Regular expressions have a syntax in which a few characters are special constructs, called metacharacters, and the rest are ordinary. An ordinary character matches that same character and nothing else. The metacharacters are reserved for special search terms and to use one of them as a literal in a Regex, it must be escaped with a backslash (\) character.

There are 11 special or metacharacters: the opening square bracket [, the backslash \, the caret ^, the dollar sign $, the period or dot ., the vertical bar or pipe symbol |, the question mark ?, the asterisk or star *, the plus sign +, the opening round bracket (and the closing round bracket). Any two regular expressions can be concatenated.

The Regex example (\d+\+(\d+)\+(1|2))\s+(.+) is described by its concatenated segments:

- The (\d+\ segment matches the bed.pillow_number mapping, which stores digits in the message data that pertain to the pillow number of the patient.
- The (\d+)\+ segment matches the bed.room.room_number mapping, which stores digits in the message data that pertain to the room number of the patient.
- The (1|2)) segment matches the bed.bed_number mapping, which stores digits 1 or 2 in the message data to associate the alert to bed one or two in that room.
- The \s+ tells Vocera Platform to expect any number of spaces after the group, but there must be at least one space.
- The (.+) segment matches the alert_type mapping. This segment catches any other information that is not recognized by the rest of the string.

Statements of Equality

Statements of equality are an alternative way to specify Regex mappings. In a statement of equality mapping, the left-hand side of the equality statement is the attribute path, while the right-hand side is the value of the attribute path. The right-hand side should use numbered captured groups (e.g., $1) to reference elements matched, but may also include literal strings. When any item contains an equals sign, then every item is expected to be a statement of equality. If the item is not formatted as a statement of equality (i.e., no equals sign or more than one attribute path or value), then an error message will be written to the audit log indicating that the processing failed for this message type.

In this example, the Regex ((\w+):(\w+))\s+(.+) maps to the following attribute expressions:

- bed.room.facility.name
- bed.pillow_number
- bed.room.room_number
- bed.bed_number
- alert_type

Regex:	((\w+):(\w+))\s+(.+)
Regex Mapping:	bed.room.facility.name=General bed.pillow_number=$1 bed.room.room_number=$2 bed.bed_number=$3 alert_type=$4

This Regex mapping represents how the information is sent to Vocera Platform by NaviCare. Using the mapping of ((\w+):(\w+))\s+(.+) the information comes to Vocera Platform as General301:1 Code Blue.

A diagram of the expression is: ((\w+):(\w+))\s+(.+)

Pillow Number is equal to bed.pillow_number=$1

Room Number is equal to bed.room.room_number=$2

Bed Number is equal to bed.bed_number=$3

Alert Type is equal to alert_type=$4

- "General" is the name of the facility. In the example above General has been hardcoded into the mapping. The string from NaviCare must include General or the message will not be parsed correctly by Vocera Platform.
- The first section of the mapping is the group ((\w+):(\w+)) and represents the Pillow Number. The Pillow Number is derived by taking the Room Number and the Bed Number and seperating them with a colon ":". Using the example above, the Pillow number is 301:1
- Contained within the group of ((\w+):(\w+)), the first segment is (\w+) which is the Room Number. The example above tells Vocera Platform that the room number is 301.
- The colon ":" is used to separate the Room Number from the Bed Number.
- The second part of the group is located after the colon ":" and is (\w+) which is the Bed Number. The example above tells Vocera Platform that the bed number is 1. Bed numbers depend on how many beds are in the room.
- The \s+ tells Vocera Platform to expect any number of spaces after the group, but there must be at least one space.
- The final segment of the mapping is (.+). This tells Vocera Platform to expect any number of charcters, but there must be at least one character. This is the alert type that is triggered. In our example, the alert type is Code Blue. Alerts are preconfigured to cover the clinical conditions needed by the facility.

Statements of Equality Explanation

Regex provides a method of pattern matching where the system expects to find the designated characters in a particular position in the incoming message data. Regex is written in a formal language that can be interpreted by a regular expression processor, which is a program that either serves as a parser generator or examines text and identifies parts that match the provided specification.

Regular expressions have a syntax in which a few characters are special constructs, called metacharacters, and the rest are ordinary. An ordinary character matches that same character and nothing else. The metacharacters are reserved for special search terms and to use one of them as a literal in a Regex, it must be escaped with a backslash (\) character.

There are 11 special or metacharacters: the opening square bracket [, the backslash \, the caret ^, the dollar sign $, the period or dot ., the vertical bar or pipe symbol |, the question mark ?, the asterisk or star *, the plus sign +, the opening round bracket (and the closing round bracket). Any two regular expressions can be concatenated.

The Regex example ((\w+):(\w+))\s+(.+) is described by its concatenated segments:

- The ((\w+):(\w+)) segment matches the bed.pillow_number=$1 mapping, which stores the Room Number:Bed Number.
- The (\w+) segment matches the bed.room.room_number=$2 mapping, which stores digits in the message data that pertain to the room number of the patient.
- The (\w+) segment matches the bed.bed_number=$3 mapping, which stores digits in the message data to associate the alert to bed number one or two in that room.
- The (.+) segment matches the alert_type=$4 mapping. This segment stores the alert type information. In our example, the alert type is Code Blue. Alerts are preconfigured to cover the clinical conditions needed by the facility.

Global Variables

A Global Variable represents a capture group that has a fixed set of modifiers. These variables define ways to transform and format data that is stored in the Vocera Platform appliance.

Vocera Platform has created two global variables; now which evaluates to the current time of the systems time zone, and today which evaluates to the current date. To utilize these variables, select a modifier from the list below.

To format these variables, the modifer must be to the right side of the global variable. For example, selecting the global variable of now will add the current time of the system time zone. To format that time as HH:mm, use the modifier of as_mil_time. The full global variable is: #{now.as_mil_time}.

The modifiers below are also defined and may be used to format or augment the base value of the date/time group, now by adding ".modifier", for example #{now.as_mil_time}.

Modifier	Definition
as_date	The date portion of a date/time returned in the format MM/DD/YYYY.
as_iso	A time formatted using ISO8601. The format is YYYY-MM-DD'T'hh:mm:ss.sssTZD
as_iso_date	The date portion of a date/time using ISO8601. The format is YYYY-MM-DD.
as_mil_time	The time portion of a date/time in the form 'HH:mm' (where HH is 0-23).
as_mil_time_sec	The time portion of a date/time in the form 'HH:mm:ss' (where HH is 0-23).

Modifier	Definition
as_time	The time portion of a date/time in the form 'hh:mm AM/PM'
as_time_sec	The time portion of a date/time in the form 'hh:mm:ss AM/PM'.
as_weekday	Returns the name of the week part of a date.
with_increment	Returns the succeeding day of the value being modified; may be used multiple times.
with_decrement	Returns the preceding day of the value being modified; may be used multiple times.

Only a subset of the above modifers may be used to format or augment the base value of the date group, {today} by adding ".modifier", for example #{today.as_date}.

Modifier	Definition
as_date	The date portion of a date/time returned in the format MM/DD/YYYY.
as_iso_date	The date portion of a date/time using ISO8601. The format is YYYY-MM-DD.
as_weekday	Returns the name of the week part of a date.
with_increment	Returns the succeeding day of the value being modified; may be used multiple times.
with_decrement	Returns the preceding day of the value being modified; may be used multiple times.

Global Variables Example

The global variables and modifiers that are defined above are used to store a date, time, or date and time stamp on any alert. The following example shows how to use the literal expression, the statement of equality, and the global variables.

The Regex example ((\w+):(\w+))\s+(.+) maps to the following attributes:

- bed.room.facility.name
- bed.pillow_number
- bed.room.room_number
- bed.bed_number
- alert_type
- clinical.alarm_time
- clinical_id


```
Regex:            ((\w+):(\w+))\s+(.+)

Regex Mapping:    bed.room.facility.name=General
                  bed.pillo›w_number=$1
                  bed.room.room_number=$2
                  bed.bed_number=$3
                  alert_type=$4$
                  clinical.alarm_time=#{now}
                  clinical_id=MR:General$1$2$3$4#{now.as_iso}
```

This Regex mapping represents how the information is sent to Vocera Platform by the vendor. Using the mapping of ((\w+):(\w+))\s+(.+), the information comes to Vocera Platform as General301:1 Code Blue.

- "General" is the name of the facility. In the example above General has been hardcoded into the mapping. The string from the vendor must include General or the message will not be parsed correctly by Vocera Platform.

- The first section of the mapping is the group ((\w+):(\w+)) and represents the Pillow Number. The Pillow Number is derived by taking the Room Number and the Bed Number and seperating them with a colon. Using the example above, the Pillow number is 301:1.
- Contained within the group of ((\w+):(\w+)), the first section is (\w+) which is the Room Number. The example above tells Vocera Platform that the room number is 301.
- The ":" is used to separate the Room Number from the Bed Number.
- The second part of the group is located after the ":" and is (\w+) which is the Bed Number. The example above tells Vocera Platform that the bed number is 1. Bed numbers depend on how many beds are in the room.
- The \s+ tells Vocera Platform to expect any number of spaces after the group, but there must be at least one space.
- The next piece to the mapping is (.+). This tells Vocera Platform to expect any number of charcters, but there must be at least one character. This is the alert type that is triggered. In our example the alert type is Code Blue. Alerts are preconfigured to cover conditions ranging from "Code Blue" to "Patient needs water" in a clinical setting.
- The \s+ tells Vocera Platform to expect any number of spaces after the alert, but there must be at least one space.
- The clincial.alarm_time will store the time the alert was received by Vocera Platform, according to the time zone set in the appliance.
- The clinical.id will store the type of device from which the alert was received, (MR), the name of the facility, (General), all of the alert information, ($1$2$3$4), and transform the time to a date/time formatted using ISO8601, (#{now.as_iso}).

Regular Expression Quick Reference

Use the following list of Regular Expression operators to help create useful mappings in a Vocera Platform implementation.

Regular Expressions Anchors

^	Start of string, or start of line in multi-line pattern
\A	Start of string
$	End of string, or end of line in multi-line pattern
\Z	End of string
\b	Word boundary
\B	Not word boundary
\<	Start of word
\>	End of word

Regular Expressions Character Classes

\c	Control character
\s	White space
\S	Not white space
\d	Digit
\D	Not digit

\w	Word
\W	Not word
\x	Hexadecimal digit
\O	Octal digit

Regular Expressions POSIX

[:upper:]	Upper case letters
[:lower:]	Lower case letters
[:alpha:]	All letters
[:alnum:]	Digits and letters
[:digit:]	Digits
[:xdigit:]	Hexadecimal digits
[:punct:]	Punctuation
[:blank:]	Space and tab
[:space:]	Blank characters
[:cntrl:]	Control characters
[:graph:]	Printed characters
[:print:]	Printed characters and spaces
[:word:]	Digits, letters and underscore

Regular Expressions Assertions

?=	Lookahead assertion
?!	Negative lookahead
?<=	Lookbehind assertion
?!= or ?<!	Negative lookbehind
?>	Once-only Subexpression
?()	Condition [if then]
?()|	Condition [if then else]
?#	Comment

Regular Expressions Quantifiers

Add a ? to a quantifier to make it ungreedy.

*	0 or more

+	1 or more
?	0 or 1
{3}	Exactly 3
{3,}	3 or more
{3,5}	3, 4 or 5

Regular Expressions Escape Sequences

"Escaping" is a way of treating characters which have a special meaning in regular expressions literally, rather than as special characters.

\	Escape following character
\Q	Begin literal sequence
\E	End literal sequence

Regular Expression Common Metacharacters

The escape character is usually the backslash - \.

^	[	.
$	{	*
(	\	+
)	|	?
<	>	

Regular Expressions Special Characters

\n	New line
\r	Carriage return
\t	Tab
\v	Vertical tab
\f	Form feed
\xxx	Octal character xxx
\xhh	Hex character hh

Regular Expressions Groups and Ranges

Ranges are inclusive.

.	Any character except new line (\n)
(a|b)	a or b

(...)	Group
(?:...)	Passive (non-capturing) group
[abc]	Range (a or b or c)
[^abc]	Not a or b or c
[a-q]	Letter from a to q
[A-Q]	Upper case letter from A to Q
[0-7]	Digit from 0 to 7
\n	nth group/subpattern

Regular Expressions Pattern Modifiers

g	Global match
i	Case-insensitive
m	Multiple lines
s	Treat string as single line
x	Allow comments and white space in pattern
e	Evaluate replacement
U	Ungreedy pattern

Regular Expressions String Replacement

Some Regex implementations use \ instead of $.

$n	nth non-passive group
$2	"xyz-" in /^(abc(xyz))$/
$1	"xyz-" in /^(?:abc)(xyz)$/
$`	Before matched string
$'	After matched string
$+	Last matched string
$&	Entire matched string

Ruby Editor Reference

Use the Ruby Regular Expression Editor for troubleshooting: http://rubular.com/

Conclusion

This concludes the discussion of Regular Expressions that may be used in a Vocera Platform implementation.

Understanding Adapter Installation

Adapters are installed on the Vocera Platform in a solution package, or individually as needed by the customer.

The Vocera Platform uses adapters to integrate with external systems and devices. Each adapter is configured by the user to include information that will allow the Vocera Platform to communicate and interact with a specific type of resource and, depending on the adapter, devices that resource may control. Adapters can allow the Vocera Platform to monitor and collect data, as well as send data out, when triggered manually or automatically.

When implementing Vocera Platform at a customer site, use this document to install an adapter that is not supplied in the Gold Image. Otherwise, you will install a needed adapter when instructed in the solution package installation process described in the Vocera Platform Installation Guide.

Recreating a Repository

In the event that the repository reference file has been compromised, you can re-create the platform repository.

This information should be specified on the related adapter's Release Information page in the wiki. See **Releases** and navigate to the needed adapter.

1. Verify that the adapter resides in a repository which is in '**/etc/yum.repos.d/**'.
2. If the **repolist** or **yum** commands fail, verify that the file exists and try again. For example, use the following code to verify the repository exists on the Vocera Platform appliance:

   ```
   [tpx-admin@engage log]$ cat /etc/yum.repos.d/vocera.repo
   ```
3. Verify the output appears as shown.

   ```
   #-------------------------------------------------------------------------------
   # NOTICE: Only use the General Availability (platform-6.X-ga) repository for customer
    deployments.
   # Use of Controlled Release (platform-6.X-cr) or Software Quality Assurance
    (platform-6.X-sqa) in
   # accordance to process QOP-75-01 Production Work Order and History Record, contact
    your
   # manager for questions.
   #-------------------------------------------------------------------------------
   [Platform-6.0]
   name=Platform-6.0
   baseurl=https://box.voceracommunications.com/Platform-6.0-GA
   enabled=1
   gpgcheck=0
   ```

Installing an Adapter

Install or uninstall a Vocera Platform adapter at a customer site on a Vocera system for a customer.

Execute the following steps using the system's command prompt.

1. Verify that the adapter resides in a repository which is in '**/etc/yum.repos.d/**'.
2. Run the following commands:

```
sudo yum clean all
sudo yum check-updates
```

3. Verify that the rpm package to be installed is available using the following command:

```
sudo yum list available | grep extension
```

4. Install the adapter by specifying its rpm package name in place of <package-name> in the code below. (This information should be specified on the related Release Information page in the wiki; see **Release Notes**.)

```
sudo yum install <package-name>
```

5. Uninstall an adapter by specifying its rpm package name in place of <package-name> in the code below. (This information should be specified on the related Release Notes page; see **Release Notes**.)

```
sudo yum remove <package name>
```

Practicing an Adapter Installation

Replicate these steps using the needed adapter package, in order to install adapters other than the example given here.

1. Verify the repo file contains the repos up to and including the release of interest.

```
[tpx-admin@engage log]$ cat /etc/yum.repos.d/vocera.repo
#------------------------------------------------------------------------------
# NOTICE: Only use the General Availability (platform-6.X-ga) repository for customer
 deployments.
# Use of Controlled Release (platform-6.X-cr) or Software Quality Assurance
 (platform-6.X-sqa) in
# accordance to process QOP-75-01 Production Work Order and History Record, contact
 your
# manager for questions.
#------------------------------------------------------------------------------
[Platform-6.0]
name=Platform-6.0
baseurl=https://box.voceracommunications.com/Platform-6.0-GA
enabled=1
gpgcheck=0
```

2. Execute the following commands:

```
[tpx-admin@engage log] $ sudo yum check-updates
Loaded plugins: langpacks, product-id, subscription-manager
This system is not registered to Red Hat Subscription Management. You can use
 subscription-manager to register.
Quartz
                                                | 3.6 kB  00:00:00
(1/2): Quartz/group_gz
                                                |  483 B  00:00:00
(2/2): Quartz/primary_db
                                                |  29 kB  00:00:00
```

3. Verify the package is available, using the following command:

```
[tpx-admin@engage log] $ sudo yum list available | grep extension
  extension-navicare-interface.x86_64                    1.3.6-0           Platform 5.0
```

4. Install the needed adapter; in this example, install the Navicare adapter:

```
[tpx-admin@engage log] $ sudo yum install extension-navicare-interface
Loaded plugins: langpacks, product-id, subscription-manager
This system is not registered to Red Hat Subscription Management. You can use
 subscription-manager to register.
Resolving Dependencies
--> Running transaction check
---> Package extension-navicare-interface.x86_64 0:1.3.6-0 will be installed
--> Finished Dependency Resolution

Dependencies Resolved

================================================================================
 Package                              Arch
 Version                   Repository                    Size
================================================================================
Installing:
 extension-navicare-interface                  x86_64
 1.3.3-0                   Quartz                        59 k

Transaction Summary
================================================================================
Install  1 Package

Total download size: 59 k
Installed size: 62 k
Is this ok [y/d/N]: y
Downloading packages:
extension-navicare-interface-1.3.6-0.x86_64.rpm
                                           |  59 kB   00:00:00
Running transaction check
Running transaction test
Transaction test succeeded
Running transaction
  Installing : extension-navicare-interface-1.3.6-0.x86_64
                                                             1/1
  Verifying  : extension-navicare-interface-1.3.6-0.x86_64
                                                             1/1


Installed:
  extension-navicare-interface.x86_64 0:1.3.6-0


  Complete!
```

5. This completes the steps to install an adapter.

Navigating the Vocera Platform Adapters

Access the Adapters tab and use the filter or search tools to display a specific adapter.
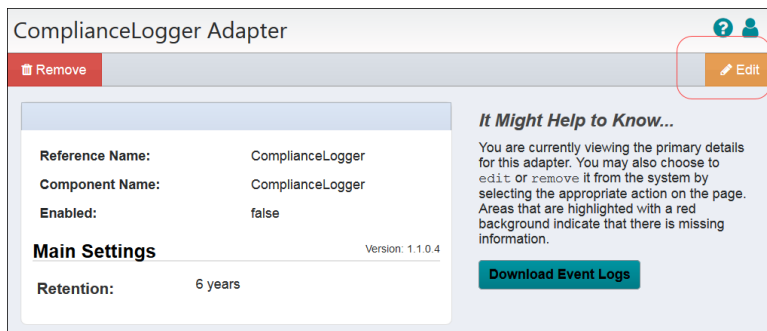
This page is used by all the adapter guides, and therefore, the adapter used as an example here may not be the adapter that you are working with currently.

1. Access the Vocera Platform Web Console and sign in with your system credentials.
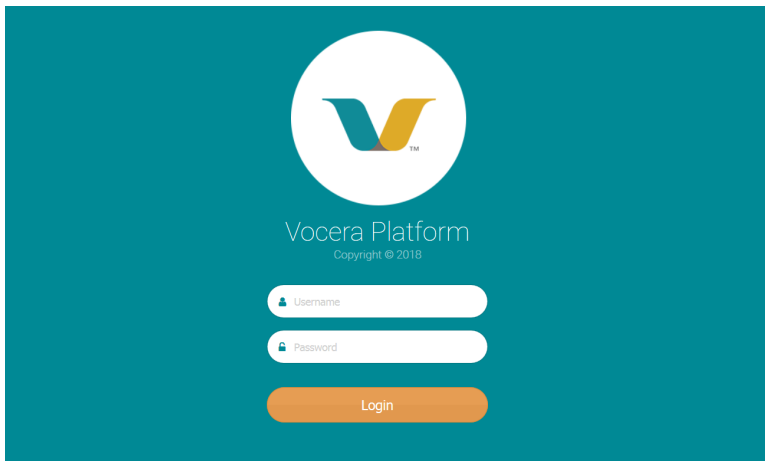
2. Select **Settings > Adapters** in the navigation menu.
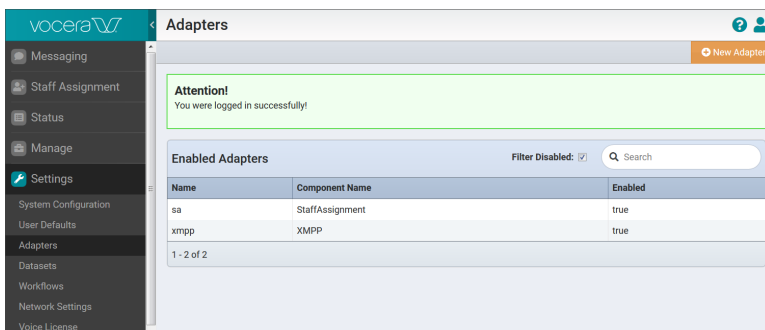
   The **Adapters** page displays.

3. Select an adapter to work with from the list displayed in the grid, or select the New Adapter Action option to create a new adapter.

   On the **Adapters** page you can identify adapters by their name or component name. The Enabled column (displaying a true or false status) indicates whether the adapter is active on the system, or disabled.

   The bottom row of the grid reports the number of adapters displayed, of the available adapters.

   The Filter Disabled box is checked by default, and displays only the enabled adapters that are configured on the Vocera Platform.
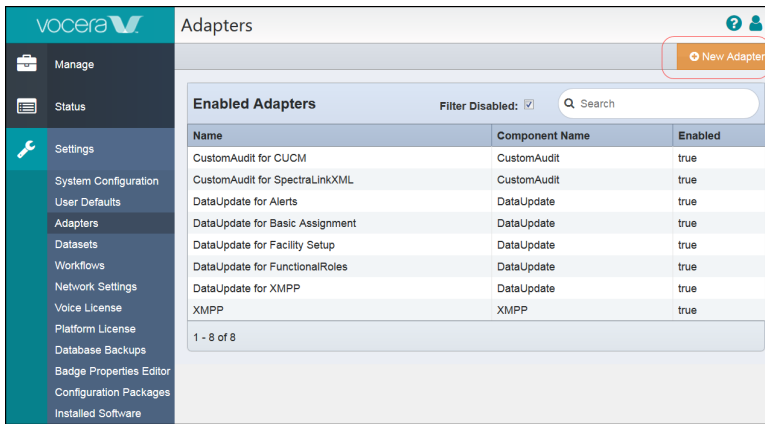
4. Uncheck the **Filter Disabled** box to display all the adapters that have been installed, including those that are not currently enabled. The column title now displays **All Adapters**.

The Filter Disabled box is checked by default.
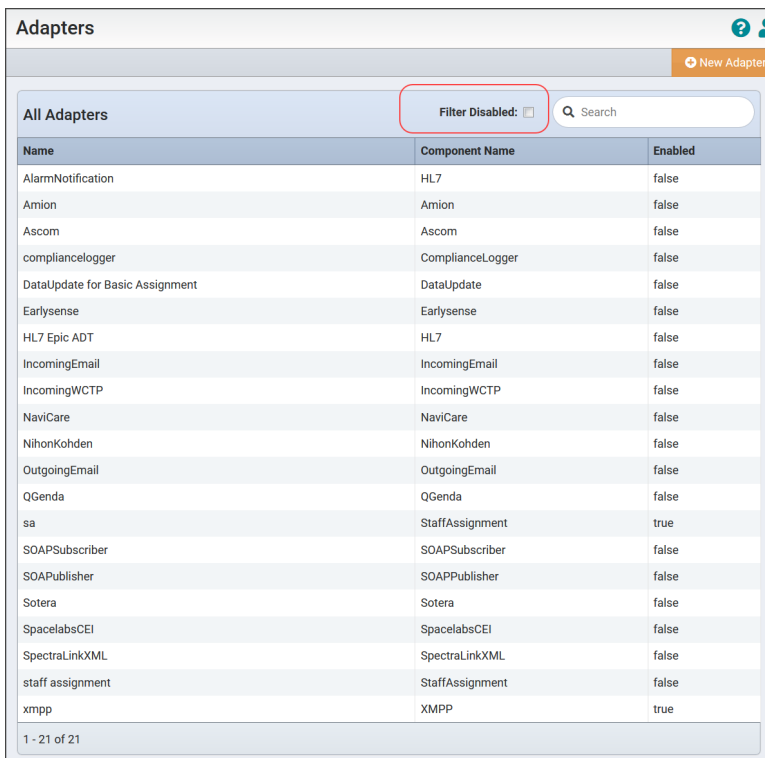
5. Enter a term in the **Search** field to locate a needed adapter on the system.

The search field is identified by a text field with a magnifying glass icon. The search is performed on the Name and Component Name columns.

When results are returned, the column header displays **Adapters Search Results** and an **x** icon allows you to clear the search field.
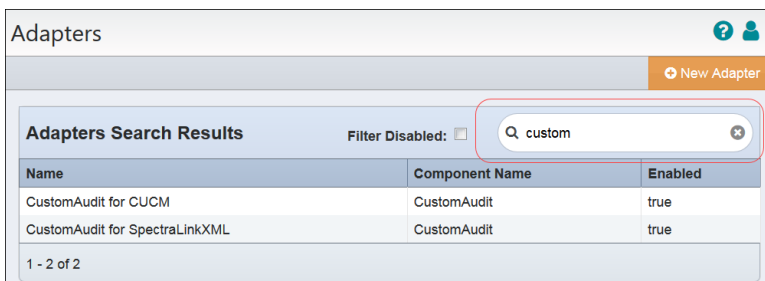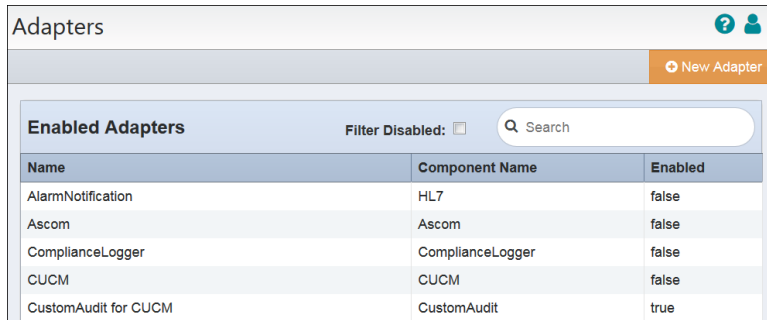
Editing an Adapter

Edit an adapter that has been installed on the Vocera Platform.

This page is used by all the adapter guides, and therefore, the adapter used as an example here may not be the adapter that you are working with currently.

1. Access the Vocera Platform Web Console and navigate to the adapters.

   See Navigating the Vocera Platform Adapters on page 33 for instructions.

2. Select the adapter to edit in the **Adapters** list.

3. Select **Edit** in the adapter's menu.
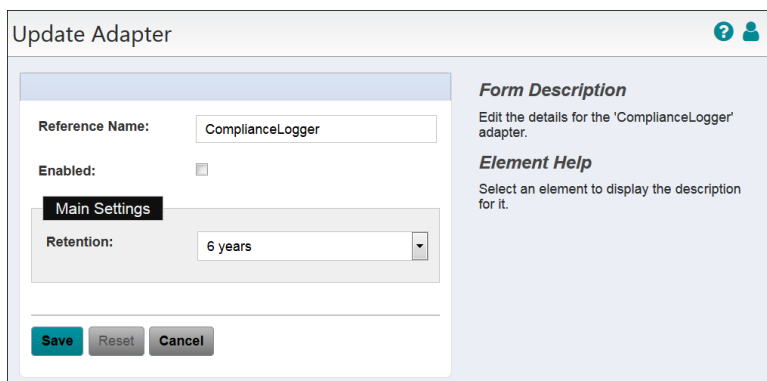
   The **Update Adapter** page for the adapter displays.

4. Edit the adapter's settings to revise the configuration as needed. See the adapter-specific configuration page for details on working with settings for this adapter.

   Select an empty field and begin typing, or select an existing value and type over it. To keep an existing value, do not edit that field.

5. Select one of the options to exit the **Update Adapter** page. See Saving an Adapter on page 37 for details.

Creating a New Adapter

Access the Vocera Platform Web Console to work with adapters, or create a new adapter when prompted in the package import process.

This page is used by all the adapter guides, and therefore, the adapter used as an example here may not be the adapter that you are working with currently.

1. Access the Vocera Platform Web Console and navigate to the adapters.

   See Navigating the Vocera Platform Adapters on page 33 for instructions.
2. Select **New Adapter** in the Action menu on the Adapters page.
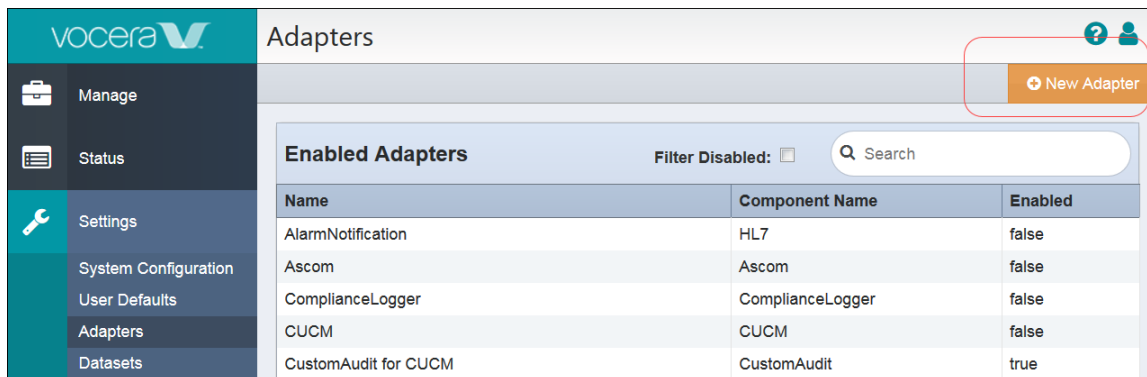
The **Create a New Adapter** dialog displays.
3. Complete the configuration fields.

Name	Description
Component Name *	Select the Component Name field dropdown arrow to display a list of the systems and devices that Vocera currently supports. Select the name of the adapter to create.
Reference Name	Enter a short descriptive name in the Reference Name field to uniquely identify an adapter instance. It may demonstrate the adapter function or other information; for example, Production adapter may differentiate a live adapter from a development or "sandbox" adapter.
Enabled	Select the Enabled check box to allow Vocera Platform to use the new adapter. Vocera ignores the adapter if this option is disabled.

4. Select **Upload Bundle** in the Action menu to install a package on a Vocera Platform.

   Use the Upload Bundle feature to install when the adapter is not available in the Component Name dropdown list, and you have downloaded the needed adapter bundle to a storage location.
5. Click on **Browse** to navigate to the bundle to install.

6. Select one of the Action options to exit from the Upload a Bundle dialog.
   - **Upload**: Upload the selected bundle to the appliance.
   - **Cancel**: Close the Upload a Bundle dialog without making a change to the system.

Saving an Adapter

Close an adapter configuration dialog using the Save, Reset, or Cancel options.

This page is used by all the adapter guides, and therefore, the adapter used as an example here may not be the adapter that you are working with currently.

When creating a new adapter, the options at the bottom of the adapter configuration page are Save, and Cancel.

When editing an existing adapter, the options are Save, Reset, and Cancel.

Choose an option to close the dialog:

Option	Description
Save	Select Save to store the adapter configuration in the system, when the fields are set to desired specifications.
Cancel	Select Cancel to close the configuration window without saving your changes to the system.
Reset	Select Reset to clear all fields without closing the window, in order to select other specifications for the adapter's settings.

Deactivating an Adapter

Temporarily deactivate an adapter to avoid unintentional use of it in an implementation.

This page is used by all the adapter guides, and therefore, the adapter used as an example here may not be the adapter that you are working with currently.

1. Access the Vocera Platform Web Console and navigate to the adapter to deactivate.

   See Navigating the Vocera Platform Adapters on page 33 for instructions.

2. Select **Edit** in the Actions menu to access the Update page for the adapter.

3. Un-check the **Enabled** box to temporarily deactivate the adapter.

   When deactivated, the Vocera system will ignore the adapter. You can easily enable or disable the adapter at any time.

4. Select one of the options to exit the **Update Adapter** page. See Saving an Adapter on page 37 for details.

Removing an Adapter

Permanently remove an adapter from the Vocera system.

This page is used by all the adapter guides, and therefore, the adapter used as an example here may not be the adapter that you are working with currently.

Use the remove function to permanently delete the adapter from the system. Alternatively, you can disable an adapter and the Vocera system will ignore it.

⚠️ **Warning:** Remove cannot be undone. If any system features use this adapter, removing the adapter prevents the features from functioning.

1. Access the Vocera Platform Web Console and navigate to the adapter to remove.

   See Navigating the Vocera Platform Adapters on page 33 for instructions.

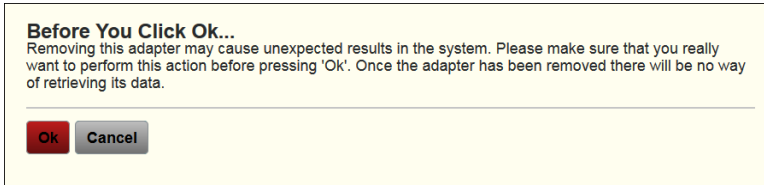2. Select **Remove** in the Actions menu to permanently delete the adapter.

3. Click **Ok** in the confirmation window.

Before You Click Ok...
Removing this adapter may cause unexpected results in the system. Please make sure that you really want to perform this action before pressing 'Ok'. Once the adapter has been removed there will be no way of retrieving its data.

Ok   Cancel

- **Ok**: Confirm the choice to remove the adapter from the system.
- **Cancel**: Return to the adapter page without making a change.

4. Confirm that the adapter no longer displays in the Adapters list view, when a success message displays.

Adapters

➕ New Adapter

Attention!
The adapter was removed from the system successfully.