



## Capturing and Decoding Packets

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You can set up multiple sessions to capture, filter, and decode packet data using the Capture feature. You can then manage the data in local or remote storage and display the contents of the packets to collect troubleshooting information.



**Note**

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This software feature may be limited depending on your hardware platform. For details, see the [NAM Compatibility Matrix](#) or the [Cisco Prime Network Analysis Module Release Notes](#).

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This chapter contains the following sections:

- [How Do I Solve My Problem?](#), page 3-1
- [Manually Starting a Capture](#), page 3-2
- [Using Alarm-Triggered Captures](#), page 3-3
- [Scheduling Captures](#), page 3-3
- [Troubleshooting Application Slowness Using Alarms](#), page 3-4
- [Application Performance Monitoring Using Capture and Decode](#), page 3-5
- [Creating and Managing Capture Sessions](#), page 3-6
- [Working with Capture Files](#), page 3-21
- [Utilizing Capture Data Storage](#), page 3-24
- [Inspecting Packet Decode Information for Suspicious Traffic](#), page 3-30

## How Do I Solve My Problem?

This section provides an overview of how to collect and analyze packet data to ensure your network is running well or pinpoint network issues.

There are many ways to collect data and analyze it using Prime NAM. In order to collect data, the prerequisite is to have set up SPAN or ERSPAN through your NAM dataports. For details on data source configuration, see [Understanding Prime NAM Traffic Sources](#), page A-1. Many users want a quick capture to analyze their packet data. See [Manually Starting a Capture](#), page 3-2 for details on how to get a quick capture.

[Table 3-1](#) provides an at-a-glance summary of capture tasks you can perform to ensure your network is optimized and trouble-free.

**Table 3-1** Data Collection and Analysis At-a-Glance

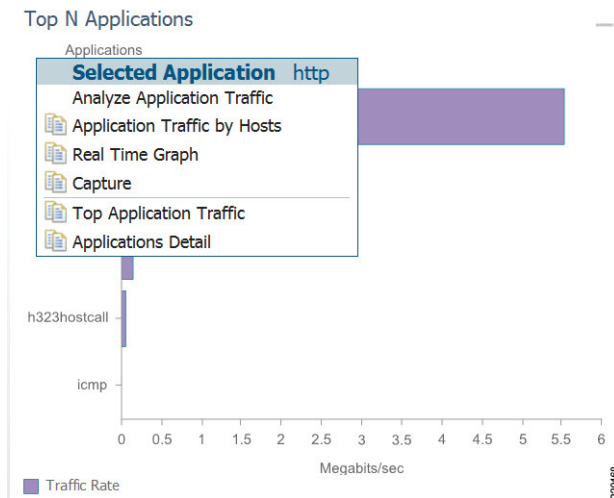
Basics	Operation	Description
Capture the traffic quickly from any NAM dashboard when anomalies are present	Quick Capture	Targets data collection based on the dashboard graph you select and provides a capture session and decode window to analyze the traffic immediately. See <a href="#">Manually Starting a Capture, page 3-2</a> .  Do not use quick capture if your context includes an NBAR application ID. Use <b>Capture &gt; Packet Capture/Decode &gt; Sessions</b> to configure and start your capture.
Proactively capture packet data to learn the cause of a network issue	Continuous capture or schedule capture	Allows you to set up data collection to: <ul style="list-style-type: none"> <li>• Collect data prior to a network problem</li> <li>• Set up data collection based on an anomaly that reoccurs</li> </ul> See <a href="#">Using Alarm-Triggered Captures, page 3-3</a> or <a href="#">Scheduling Captures, page 3-3</a> .
Create hardware and software filters to focus on specific long-term packet data	<b>Capture &gt; Packet Capture/Decode &gt; Sessions</b>	On supported NAM hardware, helps to limit the amount of packet data processing. See <a href="#">Configuring Hardware Filters, page 3-9</a> and <a href="#">Configuring Software Filters, page 3-7</a> .
Storing packet data for problem identification	Continuous capture	Allows you to save data to external storage targets, potentially for larger disk capacity and higher capture throughput or to offload capture files. Continuous capture overwrites itself in memory when the buffer is full.  See <a href="#">About Capturing to Data Storage, page 3-25</a> .
Create targeted monitoring for problem isolation	Stop Capture and Save to File	Allows you to decide when to use trigger capture sessions. This must be setup in <b>Setup &gt; Alarms &gt; Actions</b> .  See <a href="#">Configuring Alarm Actions, page 6-31</a> and <a href="#">Using Alarm-Triggered Captures, page 3-3</a> .
Set up storage for data collection	<b>Capture &gt; Packet Capture/Decode &gt; Data Storage</b>	Allows you to save data for extended periods either to memory or storage. See <a href="#">About Capturing to Data Storage, page 3-25</a> .
Analyze data for potential issues	Decode	See <a href="#">Inspecting Packet Decode Information for Suspicious Traffic</a> .

## Manually Starting a Capture

You do not have to perform any configuration and can quickly collect packet data by selecting the context menu option, **Capture**. [Figure 3-1](#) shows an example of a context menu for Top N Applications dashboard.

For details on how to use the decode window to analyze your data, see [Inspecting Packet Decode Information for Suspicious Traffic, page 3-30](#).

Figure 3-1 Quick Capture



## Using Alarm-Triggered Captures

You can configure multiple alarm-triggered captures that start and stop automatically by alarm events you define.

To set up an alarm-triggered capture:

- 
- Step 1** Choose **Capture > Packet Capture/Decode > Sessions** and create a capture session. For detailed instructions, see [Configuring Capture Sessions, page 3-6](#).
  - Step 2** Create an alarm event from **Setup > Alarms > Actions** and click **Create** to make a new trigger capture action which uses the session from [Step 1](#).  
Configure an alarm event for the type of event for which you want to capture data. For detailed instructions, see [Configuring Alarm Actions, page 6-31](#).
  - Step 3** Create a threshold which uses the alarm event action from [Step 2](#). Choose **Setup > Alarms > Thresholds** window.  
To configure the threshold of parameters of interest in the associated Alarm Event, see [Defining Thresholds, page 6-33](#).
- 

## Scheduling Captures

You can configure multiple time-based triggered captures that start and stop automatically based on a certain time or period of time that you define. This is also referred to as continuous capture. Continuous capture overwrites itself in memory when the buffer is full. The following is an example of setting a 60 minute window to schedule capture packet data.

To set up a schedule capture:

- 
- Step 1** Create a new capture from the **Capture > Packet Capture/Decode > Sessions** window.
  - Step 2** Check the Auto Capture **Enable** check box.
  - Step 3** Set the Start Date and Time and Duration (in minutes) to *60*.
  - Step 4** Select an appropriate storage type to store your capture data. For example, select capture to *memory HDD*.
  - Step 5** Select appropriate software filters.
  - Step 6** Click **Submit**.
  - Step 7** To start the capture session, return to the **Capture > Packet Capture/Decode > Sessions** menu and select the capture session you previously created and click **Start**.
- 

## Troubleshooting Application Slowness Using Alarms

This section describes how to use Prime NAM to use triggered alarms and capture files to help you determine the source of some network problems.

### Before You Begin

You must already create an alarm that notifies you when there is a surge in application traffic. If you need to create an alarm, thresholds, and set up email notification, see [Setting Up Alarms and Alarm Thresholds, page 6-31](#).

To use existing alarms to help you to create and analyze captured packet files:

- 
- Step 1** After receiving an email that was triggered by an alarm notification, view the alarm summary and analyze the details. For example, if your alarm triggers when your application has reached a certain threshold, choose **Monitor > Alarm Summary** to view the Top N Applications by Alarm Count dashboard.  
  
If you use [sites](#), you could view the top sites by alarm count dashboard in order to see the alarm details and determine what threshold variable is causing the alarm to trigger.
  - Step 2** To view more details (or drill down) from this dashboard, left-click the row you are interested in and select **Application Response Time** in order to analyze the response time during the time interval of the alarm trigger. If your application is not listed in the graph, you can select the table icon to choose your application from the list of all the applications and drill down from there to analyze the response time.
  - Step 3** Adjust the Interactive filter to view specific time ranges and severity levels in order to view where the spike in response time occur. This helps to determine if the occurrence is limited to a one-time event, if it occurs more than once in a short period of time, or is an event related to a specific time of the day. For example, by changing the time range filter from 1 hour to 4 hours to 1 day, you can see the latest data trends that help you to determine what to do next. See [Filtering Traffic for Viewing on the Dashboards, page B-4](#).
  - Step 4** In the graph that displays, focus in on the time frame when the event occurs by using the slider to pinpoint the event. Look for peak or valleys; these may be critical changes that require investigation. Using the legend you can determine whether the event was caused by the network or server. See [Changing the Time Interval Using Zoom/Pan Charts, page B-6](#).

- Step 5** Select any of the metrics provided below the application average response time graph.
- a. To view if there are specific clients that have significant transaction time differences, see the Top Clients By Average Transaction Time graph in order to identify data such as Client-Server Application Transactions using an application-specific filter.
  - To view a table of response time metrics and add new metrics for additional data (such as average server response time) and use the drop down menu to select which other metric data you want to appear in the graph.
- 

## Application Performance Monitoring Using Capture and Decode

This task explains how to proactively monitor your application performance, then use it to help isolate and troubleshoot application latency issues experienced by your end user.

### Before You Begin

NAM assumes that your system time is synchronized. If you do not have the time synchronized between the NAM and the standard time source outside the NAM, then you may see either incorrect data or no data. If you suspect inaccurate timestamps, you need to set up the System Time so that NAM data presentation is accurate. For instructions on how to set system time by choosing **Administration > System > System Time**, see [Synchronizing Your System Time, page 4-5](#).

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- Step 1** Identify and monitor your business critical applications. To see Layer 7 application details, ensure you enable deep packet inspection. Choose **Setup > Classification > Applications Settings** and select the Deep Packet Inspection checkbox.
- For detailed instructions, see [Adding More Detail into Dashboard and Application Reports, page 6-53](#).
- Step 2** Proactively detect performance degradation using threshold violation alerts. First, define your alarm by choosing **Setup > Alarms > Actions**. Then define the thresholds for your alarm by choosing **Setup > Alarms > Thresholds**.
- For detailed instructions, see [Setting Up Alarms and Alarm Thresholds, page 6-31](#).
- Step 3** Validate a reported trouble ticket or network issue. Choose **Monitor > Overview > Response Time Summary** and use the Top N Applications by Transaction Time dashboard to identify which application may be impacted.
- You can select the table view to see more than the top default applications. You can also use the other dashboards to view server or client transaction times. See [Using Response Time Summary, page 2-5](#).
- Step 4** Analyze the application performance behavior over time using the Interactive Report filter. Determine if the behavior is transient, persistent, recurring, and so on. For details on using the Interactive Report filters, see [Filtering Traffic for Viewing on the Dashboards, page B-4](#).
- Step 5** Zoom in to view specific spikes in the performance, and drill down to isolate whether the cause of the degradation stems from your network, server or application. See [Changing the Time Interval Using Zoom/Pan Charts, page B-6](#).
- Step 6** Analyze the server response time and network performance metric in order to eliminate one of them as the cause. See [Server Response Time, page 2-22](#) and [Network Response Time, page 2-21](#).
- Step 7** Analyze server activity based on the traffic the server is placing on the network and assess the cause of increase in the server response time. See [Analyzing Host Traffic, page 2-11](#).

- Step 8** Perform packet captures in order to identify the root-cause. For details on quick captures or trigger captures, see [Capturing and Decoding Packets, page 3-1](#).
- Step 9** Perform additional actions to isolate and troubleshoot the problem including: QoS analysis and interface analysis.
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## Creating and Managing Capture Sessions

You can use capture sessions to capture, filter, and decode packet data, manage the data in a local or remote storage, and display the contents of the packets. The captured packets can be decoded and analyzed using Prime NAM for more efficient problem isolation.

This section contains the following topics:

- [Configuring Capture Sessions, page 3-6](#)
- [Configuring Software Filters, page 3-7](#)
- [Configuring Hardware Filters, page 3-9](#)
- [Understanding Hardware and Software Capture Sessions Filters, page 3-19](#)
- [Viewing Capture Sessions, page 3-20](#)
- [Understanding Global Capture Settings, page 3-20](#)

## Configuring Capture Sessions

Because it may be important for you to collect data over time and have various locations for which you want to analyze data, we support multiple sessions per capture location/target. You can collect data using multiple sessions per target, but only one session can be running per target. Prime NAM now supports up to 25 capture sessions. If you have external storage you can save to local disk and some number of LUNs. As part of configuring a capture session, you can also create software filters, if desired (see [Creating a Software Capture Filter for a Capture Session, page 3-7](#)).

To configure a new capture session:

- 
- Step 1** Choose **Capture > Packet/Capture Decode > Sessions**.
- Step 2** Click **Create** to set up a new capture. The NAM displays the Configure Capture Session window.
- Step 3** Enter information in the Capture Settings Fields ([Table D-59](#)) as appropriate.
- When capturing to multiple files, a suffix is added to the file name. For example, the first file for a capture named *CaptureA* would be labeled as *CaptureA\_1* the second *CaptureA\_2*, and so on.
- Step 4** Click **Submit** to finish configuration for this session, or configure Software Filters for this session (see [Understanding Global Capture Settings, page 3-20](#)).
-

## Configuring Software Filters

You can create and save specialized filters that will disregard all capture data except the information in which you are interested (see [Figure 3-6](#)). You can configure multiple software filters for each session (up to six). This allows you to narrow in on the traffic that you are interested in, and it also saves resources (either memory or disk space).

Use the following topics for help on filtering network traffic using software filters:

- [Creating a Software Capture Filter for a Capture Session, page 3-7](#)
- [Editing a Software Capture Filter, page 3-7](#)
- [Understanding Software Capture Filter Options, page 3-8](#)

### Creating a Software Capture Filter for a Capture Session

You can create software capture filter for many variables. This workflow examines how to create a capture session with a software filter.

To create a software capture filter:

- 
- Step 1** Choose **Capture > Packet Capture/Decode > Sessions**.
- Step 2** Click **Create** to create a new capture session.
- If you already have a capture session to which you want to add a software filter, see [Editing a Software Capture Filter, page 3-7](#) for detailed instructions.
- Step 3** Enter information in each of the fields as appropriate. See [Table D-65](#) for descriptions of the fields.
- Step 4** Click **Submit** to create the filter, or click **Cancel** to close the dialog box without creating a software filter.
- 

### Editing a Software Capture Filter

To edit software capture filters:

- 
- Step 1** Choose **Capture > Packet Capture/Decode > Sessions**.
- Step 2** Choose the session to edit, then click **Edit**.
- The Software Filter dialog box displays. See [Table D-65](#).
- Step 3** Enter information in each of the fields as appropriate.
- Step 4** Do one of the following:
- To apply the changes, click **Submit**.
  - To cancel the changes, click **Cancel**.
-

## Important Notes about Software Capture Filters

This section contains important software capture filters details that may be helpful to know.

- For NAM-3 and NAM-NX1 service modules, multiple software filters use the “OR” logic; in other words, if a packet passes any software filter, it is captured.
- If you create a session and then start it, you cannot edit the session or analyze it without stopping it. If you edit a session containing already captured data, you get a warning stating that the session will be cleared and the data removed. If clearing the session and removing the data is acceptable, ignore the warning dialog message, then add a filter to the session and click **Submit** to enable the new filter settings.
- The application filter can be used to filter on the highest layer of the protocol parsing; that is usually a layer 4 protocol (based on port). If you want to filter on the transport protocol (for example, UDP or TCP), you will need to use the IP Protocol selector. Selecting, for example, TCP in the “IP Protocol” selector will filter on all packets using TCP.



**Tip**

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Be careful when setting capture software filtering for encapsulation. If you set a software capture filter with encapsulation for the top three network traffic layers only, data displays only if the top three layers match the specified encapsulation type.

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## Understanding Software Capture Filter Options

You can define a software filter to filter based on any of the following options:

- Source host address
- Destination host address
- Network encapsulation
- VLAN or VLAN range
- TCP Flag bits
- Application
- Source port or port range
- Destination port or port range
- IP Protocol



**Note**

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Software capture filtering is not supported on URL-based applications.

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[Table D-65](#) contains descriptions of the Software Filter dialog box fields.



**Note**

The parameters described in the table above are independently evaluated by the NAM. Therefore, the NAM will allow you to enter parameters that are contradictory, but you will not be able to get meaningful results if they do not match.

For example, the parameters Network Encapsulation and Source/Destination Address are independently evaluated. If a filter is specified with contradicting parameters such as “Network Encapsulation=IP4” and “Source Address=an IPv6 address”, it will never match any traffic, and the result will be 0 packets captured.

## Configuring Hardware Filters

You can use hardware filtering to help limit the amount of traffic allowed into the NAM for processing. In service modules, there is a hardware datapath throughput limitation and hardware filtering helps to reduce the traffic into the NAM. The NAM hardware platforms that support hardware filtering include:

- Service Modules—NAM-3 and NAM-NX1
- Specific NAM 2000 Series Appliances—2320, 2420, and 2440

Depending on your NAM, the hardware filter support varies. The following section describes:

- [Creating NAM Service Modules Hardware Filters, page 3-9](#)
- [Creating NAM Appliance Hardware Filters, page 3-14](#)

## Creating NAM Service Modules Hardware Filters

This section is applicable only for NAM-3 and NAM-NX1 service modules.

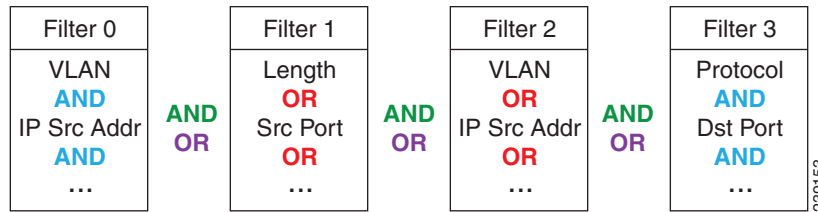
NAM-3 and NAM-NX1 service modules have specific hardware filter logic. These hardware filters allow you to improve capture performance by eliminating extraneous traffic, since packets excluded from capture processing.

Hardware filters and global packet slicing affect all capture sessions, except for ERSPAN capture sessions. See [Figure 3-6, “NAM Capture Sessions Example”](#) for an architectural overview.

NAM-3 and NAM-NX1 support up to four hardware filters. You can disable hardware filters without deleting them.

Within each filter, you can set up conditions with the AND/OR logic. Only the same logic type can be used within the same filter; you cannot mix the AND/OR logic within the same filter. Also, you can combine the filters together with the AND/OR logic. See [Figure 3-2](#) for examples of filter logic you can use.

Figure 3-2 Hardware Filter Logic (AND/OR)



The selections are described in the following sections. For information about how you can achieve specific results, see [Configuring Hardware Filter Examples, page 3-11](#).

**Tip**

Software filters add flexibility to your filtering, but hardware filters are most efficient. The less traffic that requires software filtering, the more efficient the filtering.

See these topics for information about setting up and managing hardware filters:

- [Creating or Editing a NAM Services Modules Hardware Filter, page 3-10](#)
- [Configuring Hardware Filter Settings, page 3-11](#)
- [Configuring Hardware Filter Examples, page 3-11](#)

Choose **Capture > Packet Capture/Decode > Sessions** to view the status and settings of hardware filters that are configured on the Cisco NAM. The Hardware Filters box appears at the bottom of the Sessions page.

### Creating or Editing a NAM Services Modules Hardware Filter

The Hardware Filters window displays the status and settings of the hardware filters if they have been defined. To configure a capture with hardware filters:

- Step 1** Choose **Capture > Packet Capture/Decode > Sessions**. The top half of the window shows Capture Sessions, and the bottom half of the window shows Hardware Filters.
- Step 2** In the Hardware Filters section on the bottom of the window, click **Create**. The Hardware Filter Dialog appears.
- Step 3** Enter a name for the hardware filter in the Name field. The name should be less than 40 characters and contain only supported characters.
- Step 4** Check the **Enable** check box to enable the filter. If the filter is created with the Enable check box unchecked, the filter will be saved but inactive. It can be enabled at a later time by editing the filter and checking the **Enable** check box.
- Step 5** Choose either the **AND** or the **OR** radio button. This selection will apply to all of the selections you make in the next step (the selections are described in [Table 3-3](#)).
- Step 6** Check the boxes for the attributes you want to filter on, and then in the corresponding drop-down menu, select the desired option. The **Check All** check box selects all check boxes. See [Table D-63](#).
- Step 7** Click **Apply** to complete the configuration of the hardware filter.

## Configuring Hardware Filter Settings

The Hardware Filter Settings allows you to set global settings for all capture hardware filters.

To add settings that apply to all hardware filters:

- 
- Step 1** Choose **Capture > Packet Capture/Decode > Sessions**.
- Step 2** In the Hardware Filters section at the bottom, click **Hardware Filter Settings**.
- Step 3** Choose the **AND** or **OR** Combination Logic, which will be applied to all configured hardware filters. This logic is used to combine the filters; see the green text in [Figure 3-2](#).
- Step 4** Choose the **Include in capture** or **Exclude from capture** Packet Match Logic. This selection will apply to all configured hardware filters.
- Exclude from capture** will drop packets that match all of the hardware filters you have configured. Meanwhile, all packets that do not match will be captured.
- Step 5** Click **Apply**.
- 

## Configuring Hardware Filter Examples

Use these topics to configure the following network traffic:

- [IP Subnet + L4 Port \(L5 Application\)](#), page 3-11
- [VLAN + L4 Protocol](#), page 3-12
- [Multiple Hosts](#), page 3-12
- [VLAN Range](#), page 3-12
- [Data Port + Frame Length](#), page 3-13
- [MPLS](#), page 3-13

### IP Subnet + L4 Port (L5 Application)

To capture all HTTP traffic emanating from the 10.1.1.0/24 subnet:

- 
- Step 1** On the Hardware Filters window, click **Create**.
- Step 2** Enter a name in the Name field.
- Step 3** Choose the Logic **AND** radio button (this will combine the selections you make below).
- Step 4** Check the **Source IP Address** check box and enter the subnet “10.1.1.0/24”.
- Step 5** Check the **L4 Source Port** check box and enter the port “80” for HTTP.
- Step 6** Click **Apply**.
- 

To see the opposite direction of the HTTP conversations:

- 
- Step 1** On the Hardware Filters window, click **Create**.
- Step 2** Enter a name in the Name field.
- Step 3** Choose the Logic **AND** radio button.

- Step 4** Select **Destination IP Address** and enter the same subnet as before, 10.1.1.0/24
  - Step 5** Select **L4 Destination Port** and enter the same port, 80.
  - Step 6** Click **Apply**.
  - Step 7** To see the incoming and the outgoing, click **Hardware Filter Settings** and select the **OR** logic. This will combine the two hardware filters with the OR logic.
- 

#### VLAN + L4 Protocol

To see all TCP traffic from VLAN 100:

- Step 1** On the Hardware Filters window, click **Create**.
  - Step 2** Enter a name in the Name field.
  - Step 3** Choose the Logic **AND** radio button.
  - Step 4** Select **VLAN** and enter the VLAN, 100.
  - Step 5** Select **L4 Protocol** and choose TCP.
  - Step 6** Click **Apply**.
- 

#### Multiple Hosts

To see traffic sent to and from multiple hosts: 1.1.1.1, 2.2.2.2, ...:

- Step 1** On the Hardware Filters window, click **Create**.
  - Step 2** Enter a name in the Name field.
  - Step 3** Choose the Logic **OR** radio button.
  - Step 4** Check the **Source IP Address** check box and enter the first host: 1.1.1.1.
  - Step 5** Check the **Destination IP Address** and enter the same host: 1.1.1.1.
  - Step 6** Click **Apply**.
  - Step 7** Click **Create** to make a second hardware filter.
  - Step 8** Enter a name for the hardware filter in the Name field.
  - Step 9** Choose the Logic **OR** radio button.
  - Step 10** Check the **Source IP Address** check box and enter the second host, "2.2.2.2".
  - Step 11** Check the **Destination IP Address** check box and enter the second host, "2.2.2.2".
  - Step 12** Click **Apply**.
  - Step 13** Repeat [Step 7](#) through [Step 12](#) for a third and fourth host, if desired.
  - Step 14** Click **Hardware Filter Settings** and select the logic **OR** radio button.
- 

#### VLAN Range

To see all traffic from VLANS 10 through 20:

- 
- Step 1** On the Hardware Filters window, click **Create**.
- Step 2** Enter a name in the Name field.
- Step 3** Check the check box for **VLAN IDs** and choose **Greater Than** from the drop-down menu.
- Step 4** In the empty field, enter the bottom VLAN range boundary, “9.”
- Step 5** Click **Apply**.
- Step 6** Click **Create** to make a second filter.
- Step 7** Enter a name in the Name field.
- Step 8** Check the check box for **VLAN IDs** and choose **Less Than** from the drop-down menu.
- Step 9** In the empty field, enter the bottom VLAN range boundary, “21.”
- Step 10** Click **Apply**.
- Step 11** Click **Hardware Filter Settings** and select the **AND** radio button, which will combine the logic of all hardware filters.
- 

#### **Data Port + Frame Length**

To see all traffic spanned to DATA PORT 1 that is less than 200 bytes:

- 
- Step 1** On the Hardware Filters window, click **Create**.
- Step 2** Enter a name in the Name field.
- Step 3** Choose the Logic **AND** radio button.
- Step 4** In the **Data Port** drop-down list, choose **DATA PORT 1**.
- Step 5** Check the check box for **Frame Length** and choose **Less Than** from the drop-down menu.
- Step 6** In the empty field, enter the frame length ceiling, “200.”
- Step 7** Click **Apply**.
- 

#### **MPLS**

To see traffic in which the first MPLS label is 300:

- 
- Step 1** On the Hardware Filters window, click **Create**.
- Step 2** Enter a name in the Name field.
- Step 3** Check the check box for **MPLS Label**.
- Step 4** In the empty field, enter the label, “300.”
- Step 5** Click **Apply**.
- 

#### **Bi-Direction Conversation**

To see both directions of a conversation between hosts 1.1.1.1 and 2.2.2.2:

- 
- Step 1** On the Hardware Filters window, click **Create**.
-

- Step 2** Enter a name in the Name field.
- Step 3** Choose the Logic **AND** radio button.
- Step 4** Click the **Source IP Address/Mask** check box, select **Equal To** from the drop-down menu, and enter the first host: “1.1.1.1”.
- Step 5** Select the **Destination Address/Mask** check box, select **Equal To** from the drop-down menu, and enter the second host: “2.2.2.2.”
- Step 6** Click **Apply**.
- Step 7** Click **Create** to make a second hardware filter.
- Step 8** Enter a name for the hardware filter in the Name field.
- Step 9** Choose the Logic **AND** radio button.
- Step 10** Click the **Source IP Address/Mask** check box, select **Equal To** from the drop-down menu, and enter the second host: 2.2.2.2.
- Step 11** Select the **Destination Address/Mask** check box, select **Equal To** from the drop-down menu, and enter the first host: 1.1.1.1.
- Step 12** Click **Apply**.
- Step 13** Click **Hardware Filter Settings** and click **OR**.
- Step 14** Click **Apply**.

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### Negative Filter Logic

In the previous example, you set up filters that match the packets. For negative filter logic, these now need to be blocked.

To see everything except the conversation from the previous example:

- 
- Step 1** On the Hardware Filters window, click **Hardware Filter Settings**.
  - Step 2** For Packet Match Logic, select the **Exclude from capture** radio button.
  - Step 3** Click **Apply**.
- 

Go to the next section, [Understanding Global Capture Settings, page 3-20](#), for information about configuring software filters for capture sessions.

## Creating NAM Appliance Hardware Filters

This section describes how to create NAM appliance hardware filters.

The Hardware filters allow you to improve capture performance by eliminating extraneous traffic, since packets filtered out are excluded from capture processing.




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**Note** The hardware filter applies to the NAM 2320, 2420, and 2440 appliances. The NAM 2304 does not support hardware filters.

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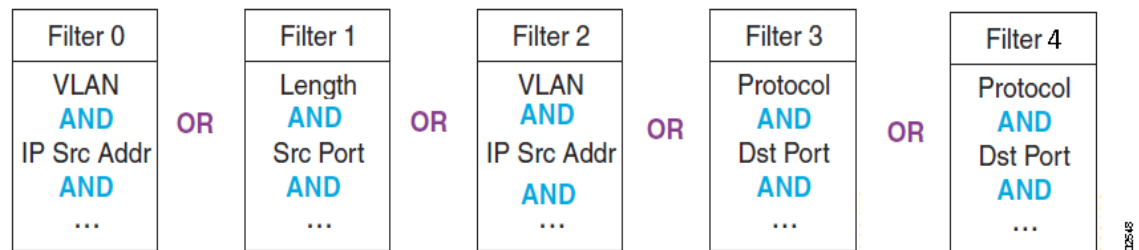
Software filters add flexibility to your filtering, but a capture session is most efficient when you use hardware filters only. The less traffic requiring software filtering, the more efficient the filtering.

For the NAM appliances that support hardware filtering, you can set up to five hardware filters per appliance. When multiple hardware filters are created on the appliance, the logic among them are OR logic.

Hardware filters and global packet slicing affect all capture sessions, except for ERSPAN capture sessions.

All fields within a single filter are combined with AND logic. The filters are then combined with OR logic. See [Figure 3-3](#) for examples of filter logic you can use.

**Figure 3-3 Hardware Filter Logic (AND/OR)**



See [Configuring Supported NAM Appliance Hardware Filters, page 3-15](#) for detailed steps.

### Configuring Supported NAM Appliance Hardware Filters

The Hardware Filters window appears at the bottom of the **Capture > Packet Capture/Decode > Sessions** window. To configure a hardware filter:

- 
- Step 1** Choose **Capture > Packet Capture/Decode > Sessions**.
  - Step 2** At the bottom of the window, select a data port hardware filter and click **Create**.
  - Step 3** Enter a name in the Name field.
  - Step 4** Choose any or all of the following types of filters:
    - Frame Length
    - VLAN IDs
    - MPLS Label
    - Source Address/Mask
    - Destination Address/Mask
    - L4 Protocol
    - L4 Source Port
    - L4 Destination Port
    - [IP and Payload Data](#)
    - [Payload Data](#)

**Note**

When you use the IP address fields in the hardware filters, tunneled packets will be filtered based on the outer IP address. The NAM will further inspect matching packets to analyze the contents within the tunnel. The NAM Packet Analyzer will always display the inner IP address in the packet list. See [Understanding the NAM Packet Analyzer, page 3-33](#) for details.

- Step 5** Data fields will then appear that correspond with the type of hardware filter you select. Fill in the desired fields.
- Step 6** Click **Submit** to complete the configuration of the capture session.

**IP and Payload Data**

To configure an IP and Payload Data hardware filter:

- Step 1** Enter a Filter Name and select your options.
- Step 2** Enter a Source Address / Mask (optional).
- Step 3** Enter a Destination Address / Mask (optional).
- Step 4** Choose a Layer 4 Protocol, either TCP or UDP.
- Step 5** Enter the values for Pattern Match:
- Enter a Value of up to four bytes (eight hex characters).
  - Enter a Mask of up to four bytes (eight hex characters).
  - Enter an Offset from 1-1023. The offset is relative to the beginning of the payload (Layer 5).

**Note**

Only one payload segment (one row) is required and provided. This is to guard against overlapping payload segments. If overlapping segments have different values the filter will never match anything due to the inherent AND logic.

- Step 6** Click **Submit**.

**Payload Data**

To configure a Payload Data hardware filter:

- Step 1** Enter a Filter Name.
- Step 2** Choose a Layer 4 Protocol, either TCP or UDP.
- Step 3** Enter the values for Payload Data:
- Enter a Value of up to four bytes (eight hex characters).
  - Enter a Mask of up to four bytes (eight hex characters).
  - Enter an Offset from 1-1023. The offset is relative to the beginning of the payload (Layer 5).





**Note**

Only one payload segment (one row) is required and provided. This is to guard against overlapping payload segments. If overlapping segments have different values the filter will never match anything due to the inherent AND logic.

**Step 4** Click **Submit**.

**Configuration Example**

Figure 3-4 and Figure 3-5 shows configuration examples on how to calculate the offsite value and how to set mask to use the payload feature.

**Figure 3-4 Configuration Example**

No.	Time	Source	Destination	Protocol	Length	No.	Time	Source	Destination	Protocol	Length
1	0.000000	66::1e00:1010	66::1e00:1600	FTP	107	1	0.000000	66::1e00:1010	66::1e00:1600	FTP	107
6	0.000908	66::1e00:1010	66::1e00:1600	FTP	100	6	0.000908	66::1e00:1010	66::1e00:1600	FTP	100
11	0.001486	66::1e00:1010	66::1e00:1601	FTP	105	11	0.001486	66::1e00:1010	66::1e00:1601	FTP	105
12	0.001644	66::1e00:1010	66::1e00:1601	FTP	120	12	0.001644	66::1e00:1010	66::1e00:1601	FTP	120
13	0.001813	66::1e00:1010	66::1e00:1601	FTP	102	13	0.001813	66::1e00:1010	66::1e00:1601	FTP	102

* Frame 1: 107 bytes on wire (856 bits), 107 bytes captured (856 bits)						* Frame 6: 100 bytes on wire (800 bits), 100 bytes captured (800 bits)					
* Ethernet II, Src: 00:00:e9:ed:c1:e8 (00:00:e9:ed:c1:e8), Dst: 00:00:8f:8e:c8:40 (00:00:8f:8e:c8:40)						* Ethernet II, Src: 00:00:e9:ed:c1:e8 (00:00:e9:ed:c1:e8), Dst: 00:00:8f:8e:c8:40 (00:00:8f:8e:c8:40)					
* 802.1Q Virtual LAN, PRI: 1, CFI: 0, ID: 306						* 802.1Q Virtual LAN, PRI: 1, CFI: 0, ID: 306					
* Internet Protocol Version 6, Src: 66::1e00:1010 (66::1e00:1010), Dst: 66::1e00:1600 (66::1e00:1600)						* Internet Protocol Version 6, Src: 66::1e00:1010 (66::1e00:1010), Dst: 66::1e00:1600 (66::1e00:1600)					
* Transmission Control Protocol, Src Port: 38112 (38112), Dst Port: ftp (21), Seq: 1, Ack: 1, Len: 13						* Transmission Control Protocol, Src Port: 38112 (38112), Dst Port: ftp (21), Seq: 1, Ack: 1, Len: 6					
* File Transfer Protocol (FTP)						* File Transfer Protocol (FTP)					
▶ RETR /#4096\r\n						▶ QUIT\r\n					

0000	00 00 8F 8E C8 40 00 00 E9 ED C1 E8 81 00 21 32	.....@.....12
0010	86 DD 60 00 00 00 00 2D 06 40 00 66 00 00 00 00	.. \ . . . . @ . f . . . .
0020	00 00 00 00 00 00 1E 00 10 10 00 66 00 00 00 00	.....f.....
0030	00 00 00 00 00 00 1E 00 16 00 94 80 00 15 FE BB	.....f.....
0040	7C 21 FE F6 78 A0 80 18 0A E1 AB 42 00 00 01 01	. . x . . . . . B . . . .
0050	08 0A 6E 18 55 84 6E 18 4A 48 52 45 54 52 20 2F	. . n . U . n . J H R E T R /
0060	23 34 30 39 36 0D 0A BA D7 49 1A	#4096 . . . . I .

**Hardware Filter Dialog**

\* Name: ipv6 tcpPortPayload

Description:

Type: IP and Payload Data

Source Address / Mask: 66::1e00:1010/128

Destination Address / Mask:

Protocol: TCP

Payload Data: Offset 6 Value 0x 23343039 Mask 0x ffffffff

Offset Value 0x Mask 0x

Offset Value 0x Mask 0x

Offset Value 0x Mask 0x

Apply Cancel Reset

**Hardware Filter Dialog**

\* Name: ipv6 tcpPortPayload

Description:

Type: Payload Data

Protocol: TCP

Payload Data: Offset 0 Value 0x 51550000 Mask 0x ffffffff

Offset Value 0x Mask 0x

Offset Value 0x Mask 0x

Offset Value 0x Mask 0x

Apply Cancel Reset

**Figure 3-5 Configuration Example (Continued)**

403275

No.	Time	Source	Destination	Protocol	Length
1	0.000000	66::1e00:1010	66::1e00:1600	FTP	107
6	0.000908	66::1e00:1010	66::1e00:1600	FTP	100
11	0.001486	66::1e00:1010	66::1e00:1601	FTP	105
12	0.001644	66::1e00:1010	66::1e00:1601	FTP	120
13	0.001813	66::1e00:1010	66::1e00:1601	FTP	102

....

▶ Frame 12: 120 bytes on wire (960 bits), 120 bytes captured (960 bits)

▶ Ethernet II, Src: 00:00:e9:ed:c1:e8 (00:00:e9:ed:c1:e8), Dst: 00:00:8f:8e:c8:41 (00:00:8f:8e:c8:41)

▶ 802.1Q Virtual LAN, PRI: 1, CFI: 0, ID: 306

▶ Internet Protocol Version 6, Src: 66::1e00:1010 (66::1e00:1010), Dst: 66::1e00:1601 (66::1e00:1601)

▶ Transmission Control Protocol, Src Port: 38116 (38116), Dst Port: ftp (21), Seq: 1, Ack: 1, Len: 26

▶ File Transfer Protocol (FTP)

▶ PASS noreply@ixiacom.com\r\n

```

0000  00 00 8F 8E C8 41 00 00 B9 ED C1 E8 81 00 21 32  ....A.....!2
0010  86 DD 60 00 00 00 00 3A 06 40 00 66 00 00 00 00  ..\.....@.f...
0020  00 00 00 00 00 00 1E 00 10 10 00 66 00 00 00 00  .....f....
0030  00 00 00 00 00 00 1E 00 16 01 94 E4 00 15 FE 96  .....
0040  81 1F FF 6D 75 DA 80 18 0B 29 C8 C0 00 00 01 01  ...mu....).....
0050  08 0A 6E 18 55 85 6E 18 4A 49 50 41 53 53 20 6E  ..n.U.n.JIPASS n
0060  6E 72 65 70 6C 79 40 69 78 69 61 63 6F 6D 2E 63  oreply@ixiacom.c
0070  6F 6D 0D 0A 47 E1 8E D9                          om..G...

```

Hardware Filter Dialog

\* Name  ⓘ

Description

Type

Source Address / Mask

Destination Address / Mask

Protocol

Payload Data

Offset  Value Ox  Mask Ox

Offset  Value Ox  Mask Ox

Offset  Value Ox  Mask Ox

Offset  Value Ox  Mask Ox

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## Understanding Hardware and Software Capture Sessions Filters

You can filter specific traffic data and manage that information in local or remote storage. This increases your visibility into network issues and allows you to filter out unnecessary information. You can use either hardware or software filters to target specific packet data to receive.

As shown in [Figure 3-6](#), if network packets coming into the NAM pass through the hardware filters you have configured, the packets go on to the next step. If no hardware filters are configured, all packets pass through.



### Note

Hardware filters are supported on specific Prime NAM platforms. See [Configuring Hardware Filters, page 3-9](#) for details.

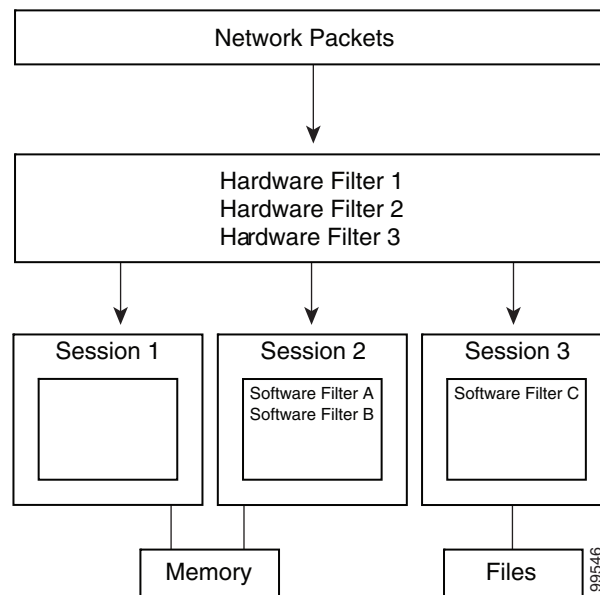
Packets must then pass at least one software filter in that particular session to be saved by that session. If no software filters are configured for a session, then all packets are captured. For more information about software filters, see [Configuring Software Filters, page 3-7](#).

For better performance for the supported NAM platforms, hardware filters are recommended over software filters, and fewer sessions are recommended over more sessions.

You do not have to configure the items in [Figure 3-6](#) in any particular order. For example, you can set Global Capture Settings first, and then configure Capture Sessions, and then create filters; or, you can create Hardware and Software filters first, and then configure Capture Sessions, and finally apply Global Capture Settings. We recommend that you “Start” the session last; otherwise, you will start capturing before you have configured any filters and before doing any packet slicing.

Global Capture Settings and Hardware Filters can be changed at any time, even when the session is running; they will affect running capture sessions immediately. We recommend that you first stop your capture session to edit it since you may capture some unexpected packets during the filter change. See [Understanding Global Capture Settings, page 3-20](#) for details.

**Figure 3-6** NAM Capture Sessions Example



## Viewing Capture Sessions

To access the basic operations for capturing, viewing and decoding packet data on the NAM, choose **Capture > Packet Capture/Decode > Sessions**.

The Capture Sessions window shows the list of capture sessions. If none have been configured, the list will be blank. [Table D-58](#) describes the Capture Sessions fields and operations that you can perform from the Capture Sessions window.

## Understanding Global Capture Settings

You can limit the size of the captured packets by using the Global Capture Settings to apply a custom packet slice and error settings for all capture sessions. This setting applies to NAM-3 and NAM-NX1 only. You can change these settings even when a filter is running since they affect the running sessions immediately.

To enable the Global Capture Settings, click Global Capture Settings in the **Capture > Packet Capture/Decode > Sessions** then click **Enable** and complete your selections.

To understand these settings see:

- [Global Packet Slicing](#)
- [Error Packets](#)

### Global Packet Slicing

Global packet slicing affects all capture sessions, as opposed to the per-session Packet Slice Size parameter, and is performed in hardware. Use this feature to capture packets more efficiently when only the first N bytes are of interest to you. The capture buffer/file is smaller and the NAM is able to capture more packets per second.

The default setting for Global Packet Slicing is Disabled.

This setting overrides individual capture session software slicing settings if it is shorter. For example, if you have a capture session with the slicing field set to 100, but you also have Global Packet Slicing set to 56, then all packets will be sliced down to 56 bytes.

Hardware filters and global packet slicing affect all capture sessions, except for ERSPAN capture sessions.

In addition to global packet slicing you can set choose to allow error packets in the packet. For details on error packet settings, see [Error Packets, page 3-20](#).

### Error Packets

Error packets are packets that would normally be dropped by the network interface card, such as under size and over size packets, as well as packets with CRC errors. Error packets can be very helpful for troubleshooting the network.

If you want to customize how Prime NAM treats error packets use the following options:

- **Include in capture** (Default)—Includes packets with and without errors.
- **Exclude from capture**—Omits error packets. The packet capture only includes packets without errors.

- **Only error packets in capture**—Omits packets without errors. The packet capture includes only packets with errors. This option will save disk space but may not be as helpful since you may be unable to see the big picture view of all packet details.

This setting applies to all capture sessions on NAM-3 and NAM-NX1 only.

This setting is applied to all capture sessions. In addition to setting error packets, you can also enable global packet slicing. For details on global packet slicing settings, see [Global Packet Slicing, page 3-20](#).

## Working with Capture Files

To decode, download, rename, convert/merge, delete, analyze, or error-scan saved packet capture files use the Files option.

This section covers the following topics:

- [Analyzing Capture Files, page 3-21](#)
- [Downloading Capture Files, page 3-22](#)
- [Deleting a Capture File, page 3-22](#)
- [Deleting Multiple Capture Files, page 3-22](#)
- [Understanding Capture Sessions, page 3-23](#)

## Analyzing Capture Files

The Capture Files window (available at **Capture > Packet Capture/Decode > Files**) enables you to obtain various statistics including traffic rate (bytes/second) over a capture period and lists of hosts and protocols associated with network traffic.

This window also enables you to drill down for a more detailed look at a particular set of network traffic. The pane above the **Traffic over Time** graph displays the time shown in the graph in the **From:** and **To:** fields. It also provides fields for Protocol and Host/subnet, and a **Drill-Down** button.



### Note

After clicking the **Drill-Down** button, the Host Statistics results table will display both source and destination hosts, if either the source or destination host of the traffic belongs to the Host/Subnet that you had specified.

Each slice in the **Traffic over Time** graph displays the amount of traffic for the amount of time set in the Granularity of the capture file.

You can view more detail about a specific time frame by entering the time in the **From:** and **To:** fields and choosing **Drill-Down**. You can also drill down on a specific **Protocol** or **Host/subnet** address.

[Table D-57](#) describes the different areas of the Capture Analysis window.

## Drilling Down into Packet Error Details

You can further investigate, or drill down, into packet error details by viewing the decode packet data available on Prime NAM.

The Capture Errors and Warnings Information window shows warnings and errors, and packet irregularities. From here, you can launch the Packet Decode Window, where you can drill down to packet details.

To get to the Capture Errors and Warnings Information window, choose **Capture > Packet Capture/Decode > Files**. Highlight a file and click the **Errors Scan** button. The Error Scan window displays. The fields are described in [Table D-60](#). Then select the packet details by selecting a row and clicking the **Decode Packets** button.

## Downloading Capture Files

You can only download one capture file at a time. To download a capture file to your computer:

---

**Step 1** Choose **Capture > Packet Capture/Decode > Files**.

**Step 2** Choose a capture file from the list of captures.

**Step 3** Click **Download**.

A **File Download** dialog box displays and asks “**Do you want to save this file?**”

**Step 4** Click **Save**.

A **Save As** dialog box opens and provides a way for you to rename and save the file at a location of your choice.

---

## Deleting a Capture File

To delete a capture file:

---

**Step 1** Choose **Capture > Packet Capture/Decode > Files**.

**Step 2** Check the check box to select a capture file from the list of captures, or select more than one if desired.

**Step 3** Click **Delete**. A dialog box displays and asks “**Delete the following file(s)?**” and displays the file name.

**Step 4** Click **OK** to delete the file(s) or **Cancel** to allow the file(s) to remain.

---

## Deleting Multiple Capture Files

To delete all capture files at once:

---

**Step 1** Choose **Capture > Packet Capture/Decode > Files**.

**Step 2** Check at least one check box to select a capture.

**Step 3** Click **Delete All** to delete all captures.

A dialog box displays and asks “**Are you sure you want to delete all files?**”

**Step 4** Click **OK** to delete all the files or **Cancel** to allow them to remain.

---

## Understanding Capture Sessions

To understand how Prime NAM creates capture files with saved packet data, it is important to learn about how NAM handles capture session triggers.

This section contains the following topics:

- [Types of Capture Triggers, page 3-23](#)
- [Resolving Session Conflicts, page 3-23](#)
- [Manipulating Capture Files, page 3-24](#)

### Types of Capture Triggers

Packet capture sessions can be triggered on the Prime NAM in several ways:

- Manually, by starting a capture using the Capture menu option or clicking the Start capture button.
- Scheduled, by specifying a start date/time and maximum duration when you create or edit a capture session.
- Alarmed, by creating an alarm with an associated trigger capture action that starts a particular capture session.

### Resolving Session Conflicts

Prime NAM supports multiple capture sessions associated with the same capture storage location, but only one of these sessions can be running at any given time. Since there are several ways for such capture session to be started, it is possible for conflicts to arise among such capture sessions.

For example, suppose one capture session is started manually, but another capture session is scheduled to begin capturing while the first is still running. If these two sessions capture to the same storage location, there is a conflict. In this case, Prime NAM resolves the conflict by automatically stopping the manual session and allowing the scheduled session to begin.

In general, NAM resolves capture session conflicts by prioritizing them in the following (descending) order:

1. High-severity alarm triggered capture
2. Low-severity alarm triggered capture
3. Scheduled capture
4. Manual capture

For example, if a manually started capture session is saving data to the local disk and a scheduled capture is set to begin capturing to the same local disk, Prime NAM stops the manual session before the scheduled session begins.

If there are existing capture sessions already running on the same storage target, this means there is a conflicting alarm trigger. An alarm trigger is created when you configure an alarm threshold to start collecting packet data. Each alarm has a severity option.

Once a capture session is completed, you can manipulate the file. See

### Manipulating Capture Files

This section provides an overview of the tasks you can complete with capture files. See [Table 3-2](#).


For information about how to save capture sessions to files, see [Creating and Managing Capture Sessions, page 3-6](#).



#### Caution

If you have capture files with a state of *Full* and the NAM is rebooted, the capture is triggered again and these files may be overwritten by the new capture. If you want to retain the file, save the file before you reboot.

**Table 3-2** Actions You Can Complete with Capture Files

Action	Description
<b>Decode</b>	Display the packets in a file.
<b>Download</b>	Download a file to your computer in <b>.pcap</b> file format.   <b>Note</b> Do not add a file suffix when you provide the filename. The suffix <b>.pcap</b> is added automatically.
<b>Rename</b>	Give the file a new name. A dialog box displays and asks you to enter the new name for the selected capture file.
<b>Merge</b>	Merges capture files that were captured simultaneously in chronological order. <b>Note</b> Merged files cannot exceed 2,000 MB.
<b>Delete</b>	Delete selected capture files.
<b>Analyze</b>	View statistical analysis of the selected capture. See <a href="#">Analyzing Capture Files, page 3-21</a> .
<b>Errors Scan</b>	View more information about the file (Packed ID, Protocol, Severity, Group, and Description). From here you can also decode the packet. For more information see <a href="#">Drilling Down into Packet Error Details, page 3-21</a> .

## Utilizing Capture Data Storage

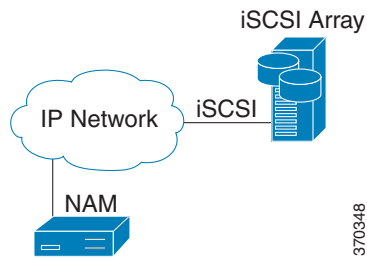
Cisco Prime Network Analysis Module platforms offer external storage connectivity for extended capture durations and higher capture bandwidths. All platforms support iSCSI data storage. Some platforms may support other forms of data storage, but this document covers only iSCSI data storage.

This section covers the following topics:

- [About Capturing to Data Storage, page 3-25](#)
- [Installing and Configuring Local and External Storage, page 3-25](#)
- [Recovering Data Storage, page 3-29](#)



**Figure 3-7 External Storage Setup**



For instructions on installing and configuring external storage not covered here, see your platform-specific guides on Cisco.com or related documentation in the [Cisco NAM Documentation Overview](#).

## About Capturing to Data Storage

To avoid filling up the local server disk on the NAM, you can capture files to external storage. One of the benefits of using external storage is that it can provide larger capacities, higher read/write speeds, and can be moved from one Cisco NAM to another. The capture files are decoded in the same manner as the **Capture > Packet Capture/Decode > Files** page.

Using Prime NAM, you can perform internal and external storage management using **Capture > Packet Capture/Decode > Data Storage**. This window lists detected storage devices, including the internal hard drive, if one is available. For details on how to install and configure local and external storage, see *Installing and Configuring Local and External Storage*, page 3-25.

This release supports 32 external data storage targets, or Logical Unit Numbers (LUNs).

You can create multiple capture sessions per target. Only one capture per storage target (file location) is allowed at a time. Additionally you can have multiple sessions to memory.

## Installing and Configuring Local and External Storage

You can use local or external storage as a repository for long term data for performance comparisons.

This topic covers:

- [Configuring the iSCSI Array, page 3-26](#)
- [Preparing LUNs for File Storage, page 3-28](#)
- [Connecting the Storage Array, page 3-26](#)
- [Using LUNs to Store Packets from a Capture Session, page 3-28](#)
- [Logging In and Out of External Storage LUNs, page 3-28](#)
- [Connecting and Disconnecting External Storage, page 3-29](#)

## Configuring the iSCSI Array

You may decide that in addition to or instead of local storage that you want to set up an external storage drive using iSCSI. This section contains the required settings for Prime NAM.

Use your vendor's user documentation to ensure you have properly configured the iSCSI array. The Prime NAM is independent of most array settings, but some are important for accessibility and performance.

- 
- Step 1** To configure the disk volumes on the array there is often a *Segment Size* setting. Larger segment sizes can improve write speeds. Configure the *Segment Size* setting to use the largest possible segment size (up to 512 KB).
- Multiple volumes can be configured on a single array.
- Step 2** Assign a Logical Unit Number (LUN) to the disk volume. This number is used for volume identification by the host.
- Step 3** Map the LUNs to iSCSI Qualified Names (IQNs) on the array. Each IQN represents a different list of LUNs which hosts (such as the Prime NAM) can access.
- Prime NAM supports up to 32 LUNs between all protocols and multiple LUNs mapped to one IQN.
- Step 4** Prime NAM also has an IQN, which represents the host side of an iSCSI session. You must give the Prime NAM's IQN access to the iSCSI array's LUNs. The array calls this *Host Access*. Be sure to give the Prime NAM's IQN read-write access. Most arrays require this for security reasons to ensure that only certain hosts can access the LUNs.
- Each Prime NAM has a unique IQN, so perform this required step for each Prime NAM that requires access and for each target LUN that you want to access. For more details about which CLI command to use, see [Locating the Prime NAM IQN, page 3-26](#).

**Caution**

Only one Prime NAM should connect to a LUN because only one host can have write access at a time. If multiple Prime NAMs connect to the same LUN simultaneously, there will be access conflicts and capture operations may not work properly.

- 
- Step 5** Ensure the Prime NAM management port has IP connectivity to the iSCSI array. For details on how to complete this required task, see [Connecting the Storage Array, page 3-26](#).
- 

## Locating the Prime NAM IQN

To find the Prime NAM IQN, use the **remote-storage iscsi local-iqn** CLI command:

```
root@nam.domain# remote-storage iscsi local-iqn
Local iSCSI Qualified Name: iqn.1987-05.com.cisco:WS-SVC-NAM3-6G-K9.00:19:55:07:15:9A
```

For details on how to complete the storage array configuration, see [Connecting the Storage Array, page 3-26](#).

## Connecting the Storage Array

After you configure the iSCSI storage arrays, ensure that the array has an IP path to the Prime NAM management port. The array can be connected while the Prime NAM is running.

Some arrays come with multiple storage controller modules. As a security feature, module ownership must often be mapped to each LUN or IQN.

The Prime NAM logs into the storage to start an iSCSI session using the IP address and IQN(s) of the storage array.

To connect the storage array using the user interface:

- 
- Step 1** Log into the Prime NAM web interface. To access the Data Storage page, choose **Capture > Packet Capture/Decode > Data Storage**.
- Step 2** Click **iSCSI Login** and enter the iSCSI array IP address. Then click **Search IQN Targets**.  
A list of IQNs available to the Prime NAMs host IQN appear.
- Step 3** Depending on the outcome, perform one of the following steps:
- If the IQNs do not appear, check **remote-storage iscsi list** to verify the iSCSI session was properly started.

The follow example shows how to verify the iSCSI session.

```
root@nam.domain# remote-storage iscsi list
Storage ID: 16
Label:
Status: Ready
Protocol: iSCSI
Target IP: 172.20.122.81
Target IQN: iqn.2011-09:celeros.target11
Type: LUN
Model: IET VIRTUAL-DISK
LUN: 4
Capacity: 24.98GB
Available: 24.98GB
Active iSCSI Sessions:
tcp: [8] 172.20.122.81:3260,1 iqn.2011-09:celeros.target11
```

The LUN number (in the above example, *LUN 4*) helps you identify one LUN from others mapped to the same IQN. This number is unique to each IQN, meaning two LUNs from different IQNs can have the same number.

- If the iSCSI session was properly started, check the storage array configuration to verify that:
    - The LUNs are mapped to the target IQN, and
    - The Prime NAM IQN has been given Read/Write access to the LUNs.
  - If you make any configuration changes, logout of the iSCSI session and login again. To logout, use the CLI **remote-storage iscsi logout** or use the GUI and click **iSCSI Logout**. All LUNs mapped to that target IQN will be disconnected from the Prime NAM.
-

## Preparing LUNs for File Storage

Some arrays come with multiple storage controller modules, and the module ownership must often be mapped to each LUN (Logical Unit Numbers). This is a common security feature.

To see if the NAM can access the storage array LUNs and prepare them to store files:

- 
- Step 1** Choose **Capture > Packet Capture/Decode > Data Storage**.
- New LUNs which have not been used by the NAM show a status of *Unformatted*.
- Skip to [Step 3](#) if your LUNs are formatted.
  - If no LUNs appear, see [Installing and Configuring Local and External Storage, page 3-25](#) and [Configuring the iSCSI Array, page 3-26](#) for detailed instructions on how to set up your storage array.
- Step 2** To prepare these LUNs for capture use, select the LUN and click **Format**. After a few minutes, the status should change to *Ready*.
- Step 3** To apply optional user labels to the LUNs to help differentiate between them, select the LUN and click **Label**.
- The Label dialog appears with information about the current label and the last time the LUN was formatted.
- 

You are now ready to use the external storage for capture files.

## Using LUNs to Store Packets from a Capture Session

To use a LUN to store packets from a capture session:

- 
- Step 1** Go to **Capture > Packet Capture/Decode > Sessions**.
- Step 2** Under the Capture Sessions table, click **Create**.
- Step 3** Fill in the appropriate fields for creating a session, and for Storage Type choose the **Files** option.
- Step 4** Use the File Location table to select the LUN you wish to use. Each list entry includes the protocol and either the model or the user label if it is set. Note that the list will only include targets which are in the *Ready* state.
- Step 5** Click **Submit** to create the session.
- 

When a session is *STARTED*, the associated LUN state changes to *In Use*. At that point, no other session can use that LUN until the session is deleted. This prevents contention, corrupted data, and write bandwidth degradation.

## Logging In and Out of External Storage LUNs

You can use iSCSI to facilitate data transfers over intranets and to manage your remote capture data storage.

Prime NAM provides a more streamlined workflow to log in and out of your data storage targets. You must log into iSCSI in order to save capture sessions to remote storage. If you do not log in, capture sessions are saved to either local disk or memory locations.

To log in or out of your available remote data storage LUNs:

- 
- Step 1** Ensure you have configured your target iSCSI system with read/write permission to your NAM for at least one LUN in the storage array. For details, see [About Capturing to Data Storage, page 3-25](#).
  - Step 2** Choose **Capture > Packet Capture/Decode > Data Storage** and click **iSCSI Login**.
  - Step 3** To enable auto discovery of any iSCSI Qualified Name (IQN) target, enter the target IP address of the storage location and click **Search IQN Targets**.  
All available IQNs for that location display in the table.
  - Step 4** To log out, click **iSCSI Logout**. The list of IQNs to which you are currently logged into displays in a table.
  - Step 5** To view the LUNs which the system will log you out, select one of the IQNs and a popup displays the associated LUNs to select.
- 

## Connecting and Disconnecting External Storage

Before physically disconnecting an external storage device, it is highly recommended to use the **Unmount** button on the **Capture > Packet Capture/Decode > Storage** window. This notifies the Cisco NAM that the device will be disconnected, so that the Prime NAM can perform important cleanup procedures. After this is done, the storage target displays as *Unmounted* in the status column, and it is safe to remove the external storage device. External storage is automatically unmounted in this manner when the Cisco NAM is powered down.



### Caution

If this step is skipped, it is possible to corrupt the storage data upon physical disconnect.

If a device has been logically disconnected using the **Unmount** button, but the storage is still physically connected, it can be reactivated using the **Mount** button. It will restore the storage target's previous state. This makes it unnecessary to physically disconnect and reconnect the storage, which can be particularly useful if the storage is located far away from you.

## Recovering Data Storage

In the event that a previously working target displays as *Unformatted*, you can use the CLI to determine what happened by running a filesystem check on it. Use the command **remote-storage <protocol> fsck <storage ID>**, when you know the protocol. You can find the storage ID using **remote-storage <protocol> list**. The filesystem check can potentially resolve filesystem corruption or state issues. If the command succeeds, it automatically mounts the storage and displays as *Ready*.

The following shows a iSCSI recovery example:

```
root@nam.cisco.com# remote-storage iscsi list
Storage ID: 16
  Label:
    Status: Unformatted
    Protocol: ISCSI
    Target IP: 172.20.10.81
    Target IQN: iqn.2011-09:celeros.target11
    Model: IET VIRTUAL-DISK
      LUN: 4
    Capacity: 24.98GB
```

```

Available: 24.98GB

Storage ID: 15
  Label: target 16
  Status: In Use
  Protocol: ISCSI
  Target IP: 172.20.10.81
Target IQN: iqn.2011-09:celeros.target16
Model: IET VIRTUAL-DISK
  LUN: 5
  Capacity: 24.98GB
  Available: 16.47GB

Active iSCSI Sessions:
tcp: [8] 172.20.10.81:3260,1 iqn.2011-09:celeros.target11
tcp: [7] 172.20.10.81:3260,1 iqn.2011-09:celeros.target16

root@nam.cisco.com# remote-storage iscsi fsck 16
FS check completed successfully.
root@nam.cisco.com# remote-storage iscsi list
Storage ID: 16
  Label:
  Status: Ready
  Protocol: ISCSI
  Target IP: 172.20.10.81
Target IQN: iqn.2011-09:celeros.target11
Model: IET VIRTUAL-DISK
  LUN: 4
  Capacity: 24.98GB
  Available: 9.87GB

Storage ID: 15
  Label: target 16
  Status: In Use
  Protocol: ISCSI
  Target IP: 172.20.10.81
Target IQN: iqn.2011-09:celeros.target16
Model: IET VIRTUAL-DISK
  LUN: 5
  Capacity: 24.98GB
  Available: 16.47GB

Active iSCSI Sessions:
tcp: [8] 172.20.10.81:3260,1 iqn.2011-09:celeros.target11
tcp: [7] 172.20.10.81:3260,1 iqn.2011-09:celeros.target16

```

## Inspecting Packet Decode Information for Suspicious Traffic

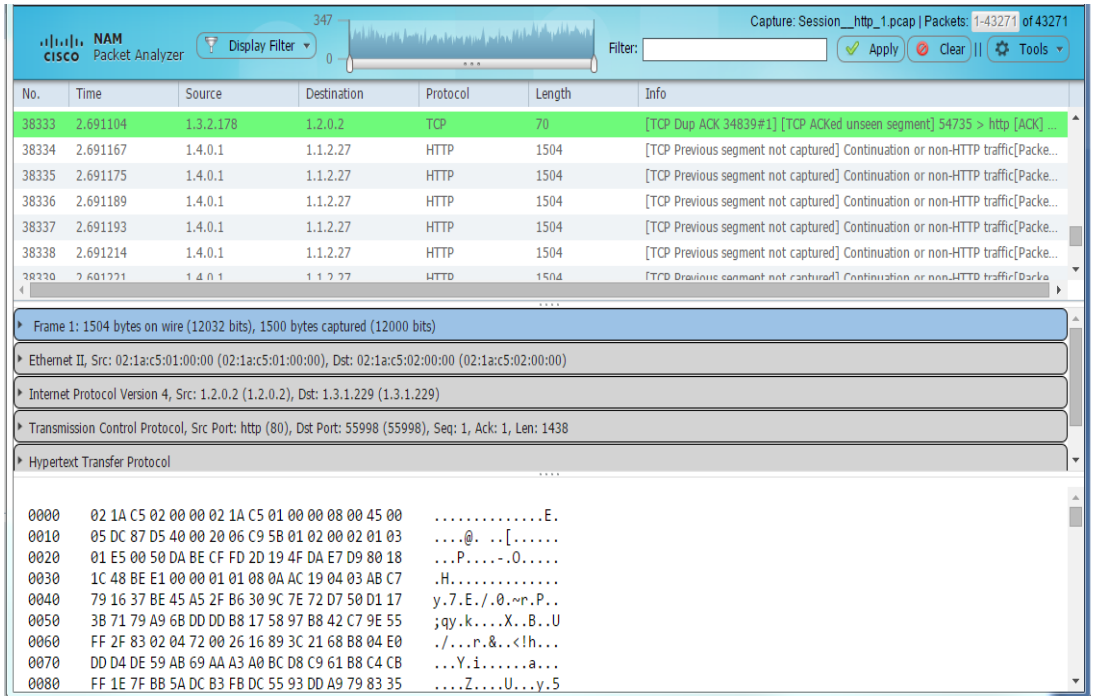
After you have captured some traffic data packets, you can use the NAM Packet Analyzer to view the packet contents and inspect for suspicious traffic.

This section includes the following sections:

- [Analyzing Packets in the NAM Packet Analyzer, page 3-31](#)
- [Filtering Packets Displayed in the NAM Packet Analyzer, page 3-32](#)
- [Viewing Detailed Protocol Decode Information, page 3-33](#)
- [Understanding the NAM Packet Analyzer, page 3-33](#)

# Analyzing Packets in the NAM Packet Analyzer

Figure 3-8 NAM Packet Analyzer Window



## Note

To use these decode features, you must be capturing to memory with the no rotate option selected. Otherwise, captures must be paused or stopped. For detailed descriptions about the features in this window, see [Understanding the NAM Packet Analyzer](#).

To inspect packet decode information for suspicious traffic:

- Step 1** Choose **Capture > Packet Capture/Decode > Sessions** and create a capture session. If you already have a capture session choose **Capture > Packet Capture/Decode > Files**.
- Step 2** Choose a capture session or file, and then click **Decode**. The NAM Packet Analyzer window displays. See [Figure 3-8](#). For table descriptions see [Table D-63](#).
- Step 3** To quickly filter on a key word or phrase, for example rtp to focus on voice quality, enter the word in the Filter text box (see callout 1 in [Figure 3-8](#)). The window refreshes displaying only data that includes the filtered information.
- Step 4** To filter packet data based on multiple filters, click **Display Filter** and enter your options in the window, then click **Apply**. This action displays only the distribution of the packets that match your filter. For detailed steps, see [Filtering Packets Displayed in the NAM Packet Analyzer, page 3-32](#).
- Step 5** To save filters for future use, click **Saved Filters** on the Display Filter window. You can also edit or remove existing filters as needed.
- Step 6** To view the packet capture flow and focus in on a specific time interval or area of interest click on the slider in the Packet Histogram and move the left or right cursors to zoom in (see callout 2 in [Figure 3-8](#)). To pan this filtered data, click and hold the slider while moving it inside the histogram. This provides a visual of packet capture flow and enables you to navigate through the packet list.

- Step 7** To toggle
- between a one and two-column layout view, choose **Tools > Toggle Layout**.
  - between the Packet Histogram and the packet paging controls, choose **Tools > Show ...**
- Step 8** To disable the default colors in the packet window, choose **Tools > Disable Protocol Coloring**.
- Step 9** To review capture file information, choose **Tools > Capture Info**.
- Step 10** To save the current filtered packet info displayed on this page, choose **Tools > Save Filtered Packets**. Only visible when filters are in use. Saves to memory or to the capture file based on the options in your Capture Sessions window. See [Configuring Capture Sessions, page 3-6](#).
- Step 11** To make the font size larger or smaller for the hex data pane, hover over the top-right corner of the pane to see the enlarge option. To increase the font, select the **A+** or to decrease it select the **A-**.
- Step 12** Use the Tools menu to perform validation tasks—options have limited support. Options include:
- TCP Checksum Validation check box—filter on TCP in the decode window and use the TCP pane to verify that the checksum has been validated.
  - UDP Checksum Validations check box—filter on UDP in the decode window and use the UDP pane to verify that the checksum has been validated.
  - IP Host Name Resolution—perform global host name resolution for NAM. Synchronizes with the Administration preferences.
- Step 13** To view packet details including packet range displayed, data port, and number of filtered packets, see the heading in the upper right corner of the NAM Packet Analyzer window.
- 

## Filtering Packets Displayed in the NAM Packet Analyzer

To filter packets based on multiple options for display in the NAM Packet Analyzer:

- Step 1** From the NAM Packet Analyzer, click **Display Filter**. The NAM Packet Analyzer - Display Filter Window displays.
- Step 2** Do the following:
- Choose a **Filter Mode**:
    - **Inclusive** displays packets that match the condition(s.)
    - **Exclusive** displays packets that do not match the condition(s).
  - Choose an **Address Filter**:
    - **IP/Host** address filters on IP address.
    - **MAC** address filters on MAC address.
    - **Source** allows you to specify the source address, or leave it blank if not applicable.
    - **Destination** allows you to specify the destination address, or leave it blank if not applicable.
    - **Both Directions** allows you to match of packets traveling in both directions.
  - Define a **Protocol Filter**:
    - Click **Match any (or)** to display packets that match any of the protocols or fields.
- or



- Click **Match all (and)** to display packets that match all of the protocols or fields.
- Choose a protocol from the **Protocols** list.



**Note** You can enter the first few letters of the protocol name to go directly to the protocol. If you make a typo, press **ESC** or **SPACE** to reset.

- Choose a protocol field from the Fields list, then specify the field value if applicable.

**Step 3** To add more protocol filters, click the + sign.

**Step 4** To delete a defined Protocol Filter, click the - sign.

**Step 5** Click **OK** to apply the filter and close the window or **Apply** to apply the filter and keep the window open.

## Viewing Detailed Protocol Decode Information

To view detailed protocol information:

**Step 1** Highlight the packet number about which you want more information.

Detailed information about that packet is displayed in the Protocol Decode and hexadecimal dump panes at the bottom of the window.



**Note** If you highlight the details in the Protocol Decode pane, the corresponding bytes are highlighted in the hexadecimal dump pane below it.

**Step 2** To review the information, use the scrolling bar in the lower panes.



**Note** When you decode SCCP traffic, Prime NAM lists the protocol as *skinny*, not SCCP.



**Tip**

- Protocols are color coded both in the Packet Browser and the Protocol Decode pane.
- Choose the protocol name in the Protocol Decode pane to collapse and expand protocol information.
- To adjust the size of any of the panes, click and drag the pane frame up or down.

## Understanding the NAM Packet Analyzer

The NAM Packet Analyzer, also known as the packet decoder, uses two levels of packet analysis: basic and full. Because preparing a large capture file for full analysis can take a long time, NAM automatically chooses which level to use based on your filtering complexity. This allows you to browse your captured packet data more quickly without having to wait for analysis.

When you select a capture file to analyze for the first time, NAM limits some of the more complex display filters you can use. For example, you can filter using protocol identifiers such as TCP, UDP, SDP, and SIP which allow the packet decode to display more quickly than an advanced filtering selection.

If you enter more advanced filters (such as those with and/or logic operators on the protocol field), NAM automatically begins the full analysis of the capture file and then applies your complex filter to display the results. For example, if you filter using `'ip.src==192.168.1.1 && tcp.dstport==80'`, the NAM Packet Analyzer starts the full analysis and displays it only after the results have been filtered.

### Understanding the NAM Packet Analyzer Window and Browser Pane

The NAM Packet Analyzer window shows three views of a packet:

- a summary line briefly describes the packet type
- the protocol field of interest can be shown and analyzed in the portion of the window directly below the summary line
- a hexadecimal dump shows exactly what the packet looks like when it goes across the wire.

There are many unique features in the NAM Packet Analyzer decode window; for example, it can assemble all the packets in a TCP conversation and highlight the ASCII data in that conversation. You can use the expanded display filter functionality to allow you to view more focused data.

[Figure 3-8](#) is an example of the NAM Packet Analyzer window. [Table D-64](#) describes the packet decoder operations on the NAM Packet Analyzer decoder window.

You can perform the following tasks in the NAM Packet Analyzer window:

- Show Packet histogram display the number of packets over a specific time range. This provides a feel of the packet flow for the capture. You can use the histogram selector control to navigate through the packet list as well. You can apply a display filter to make the histogram show the distribution of the packets that match the applied filter. Can set time range and move across histogram. Firefox is faster than IE performance with this feature.
- Toggle to Show Packet Paging Controls displays the buffer divided into pages.
- Toggle layout changes how the three content panes in the decoder are arranged.
- Display Hex data font size by hovering over two buttons in the top right corner of the hex data content pane of the decoder. You can increase or decrease the font size of the contents.
- Display the current range of packets in the packet list by selecting the Packet range button. You can also enter the range of packets to view.
- Use the Display Filter button to display Saved Display Filters and Manage Display Filters windows.
- Alter Protocol coloring. You can map custom colors to specific protocols in this release. Default colors
- Use the Tools menu—options have limited support. Options include:
  - TCP Checksum Validation check box—filter on TCP in the decode window and use the TCP pane to verify that the checksum has been validated.
  - UDP Checksum Validations check box—filter on UDP in the decode window and use the UDP pane to verify that the checksum has been validated.
  - IP Host Name Resolution—perform global host name resolution for NAM. Synchronizes with the Administration preferences.
- Display Filter input field to manually enter display filters.

## Customizing Display Filters

Use custom display filters to create and save customized filters to use in the NAM Packet Analyzer decode window to limit which packets are displayed.

NAM supports most software display filters with the following exceptions:

- Filters using Perl Regular Expressions. For example:  
`http.request.uri matches "gl=se$"`
- Filters on a protocol payload (a protocol section in a packet). For example:  
`udp[8:3]==81:60:03`

See these topics for help setting up and managing custom display filters:

- [Creating Custom Display Filters, page 3-35](#)
- [Editing or Deleting Custom Display Filters, page 3-38](#)

## Creating Custom Display Filters

To create custom display filters:

- 
- Step 1** Choose **Capture > Packet Capture/Decode > Sessions**.  
The Hardware Filters box is displayed at the bottom of the page.
  - Step 2** Click **Create**. The Hardware Filters Dialog box displays. See [Table D-62](#).
  - Step 3** Enter information in each of the fields as appropriate.
  - Step 4** Do one of the following:
    - To create the filter, click **Submit**.
    - To cancel filter creation, click **Cancel**.
- 

## Tips for Creating Custom Decode Filter Expressions

You can construct custom decode filter expressions using the following logical and comparison operators listed in [Table 3-3](#).

**Table 3-3 Logical and Comparison Operators**

Operator	Meaning
and	Logical AND
or	Logical OR
xor	Logical XOR
not	Logical NOT
==	Equal
!=	Not equal
>	Greater than

To group subexpressions within parentheses, use the fields in [Table D-61](#) to help you add filter expressions.

#### Examples of Custom Decode Filter Expressions

[Table 3-4](#) provides some examples of basic NAM display filters you can use to filter on application types.

**Table 3-4 Basic NAM Display Filters (Limited to Application Types)**

Filter	Meaning
tcp	Find all TCP-based applications
udp	Find all UDP-based applications
! eth	Find all packets other than Ethernet
tcp and not vlan	Find all TCP traffic NOT running over vlan
http	Find all src/dst HTTP application packets (may be not standard port 80 if different application 'decode as' port specified; e.g. 'tcp.port==8080,http')
ftp    http	Find either ftp or http packets
not tcp	Exclude all TCP packets
! tcp	Exclude all TCP packets
! (ftp    http)	Exclude all FTP and HTTP packets

[Table 3-5](#) provides some examples of complex NAM display filters.

**Table 3-5 Compound NAM Display Filters**

Filter	Meaning
tcp.port eq 80	Find all src/dst HTTP packets on standard HTTP port 80
ip.addr == 192.168.1.0/24	Find all packets in Class C network (subnet)
tcp.flags.reset == 1	Find all TCP resets

**Table 3-5 Compound NAM Display Filters (continued)**

Filter	Meaning
tcp.window_size == 0 && tcp.flags.reset != 1	Src is instructing dst to stop sending data (TCP buffer full)
Ipv6.addr == ::1	Correct statement with IPv6 label and IPv6 address.

Table 3-6 provides some examples of protocol field hexbyte filters.

**Table 3-6 Protocol Field Hexbyte Filters**

Filter	Meaning
eth.src==00:3c:06:0a:02:68	Find source MAC
eth.dst==00:3c:06:0a:02:68	Find destination MAC
eth.addr==00:3c:06:0a:02:68	Find source or dest MAC
!(eth.addr==00:3c:06:0a:02:68)	Find all MAC except specific address
eth.addr contains 00:3c	Find bytes in any protocol field subrange

Table 3-7 provides some examples of protocol field hexbyte subrange filters.

**Table 3-7 Protocol Field Hexbyte Subrange Filters**

Filter	Meaning
eth.addr[0:2]==00:3c	Find specific subrange in MAC
eth.addr[1:3]==3c:06:0a	Find specific subrange in MAC

Table 3-8 provides some examples of hexbyte data representations syntax.

**Table 3-8 Hexbyte Data Representations (Syntax)**

Filter	Meaning
eth.dst == ff:ff:ff:ff:ff:ff	Hexbyte separators can be colons
eth.dst == ff-ff-ff-ff-ff-ff	Hexbyte separators can be dashes
eth.dst == ffff.ffff.ffff	Hexbyte separators can be dots (one or two bytes)

**Note**

You can use a filter expression with other fields in the Custom Decode Filter dialog box. In this case, the filter expression is ANDed with other conditions. Invalid or conflicting filter expressions result in no packet match.

## Editing or Deleting Custom Display Filters

To edit custom display filters:

- 
- Step 1** From the NAM Packet Analyzer, choose **Display Filters**.
  - Step 2** To edit a filter, choose the filter to edit then click **Edit**.
  - Step 3** Change the information in each of the fields as appropriate.
  - Step 4** To delete a filter, choose the filter to delete from the Hardware Filters Data Port 1 or Data Port 2 pane, then click **Delete**.
-