Using the Daintree Networks Sensor Network Analyzer Flexible Decode Engine

Application Note AN031a
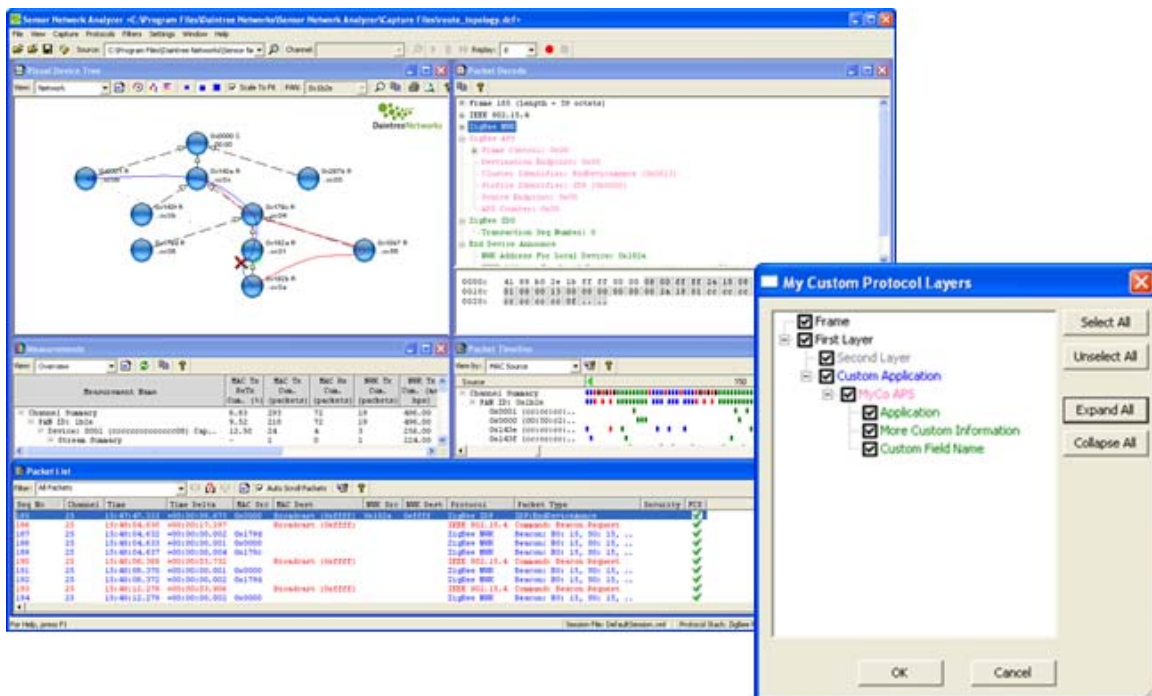
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- 802.15.4™ is a trademark of the Institute of Electrical and Electronics Engineers (IEEE).

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Sensor Network Analyzer Release 3.0 (2009-08-19)

About this application note

This application note describes the ways in which Daintree's Sensor Network Analyzer (SNA) can be used to decode and analyze protocols other than ZigBee and IEEE 802.15.4 (including ZigBee RF4CE and 6LoWPAN).

About Daintree's Sensor Network Analyzer (SNA)

The SNA provides a comprehensive solution for developing, decoding, debugging and deploying wireless embedded networks. Well known as an expert tool for IEEE 802.15.4 and ZigBee, with release 3.0 the SNA extended its support to include additional standards-based and proprietary network protocols (as described in this application note).

The SNA's features include

- a powerful protocol decoder that allows you to drill down to packet, field and byte level

- unique visualization capabilities that allow you to view all network devices and interactions simultaneously

- customization options including filtering, labeling and color-coding to make it easy to locate packets of interest

- performance measurements for 802.15.4 and ZigBee

- intuitive tools that make it easy to perform complex functions such as multi-node and multi-channel capture and ZigBee commissioning

Visit www.daintree.net to find out more about Daintree products.

About protocol decodes

Release 3.0 of the SNA added a flexible decode engine, which provides the ability to decode protocols in addition to ZigBee and IEEE 802.15.4: both standards-based and proprietary.

Some decode definitions are available from Daintree (and their partners) including ZigBee RF4CE, 6LoWPAN, JenNet (from Jennic), SimpliciTI (from Texas Instruments) and Synkro (from Freescale). You can also create your own protocol decode definitions.

The protocol definitions and decode details are stored as XML files in the SNA's Profiles directory. When the SNA first starts, it checks the Profiles directory to see what network protocols are available. You can select any one of the available protocols, and then customize the way in which decode details are shown.

Note that the flexible decode feature is supported only for approved SNA capture devices. These include Daintree's 2400E Sensor Network Adapter plus many third-party boards available from our partners (see www.daintree.net/partners for details).

How the SNA shows decode details

Decode details are shown in the following SNA windows:
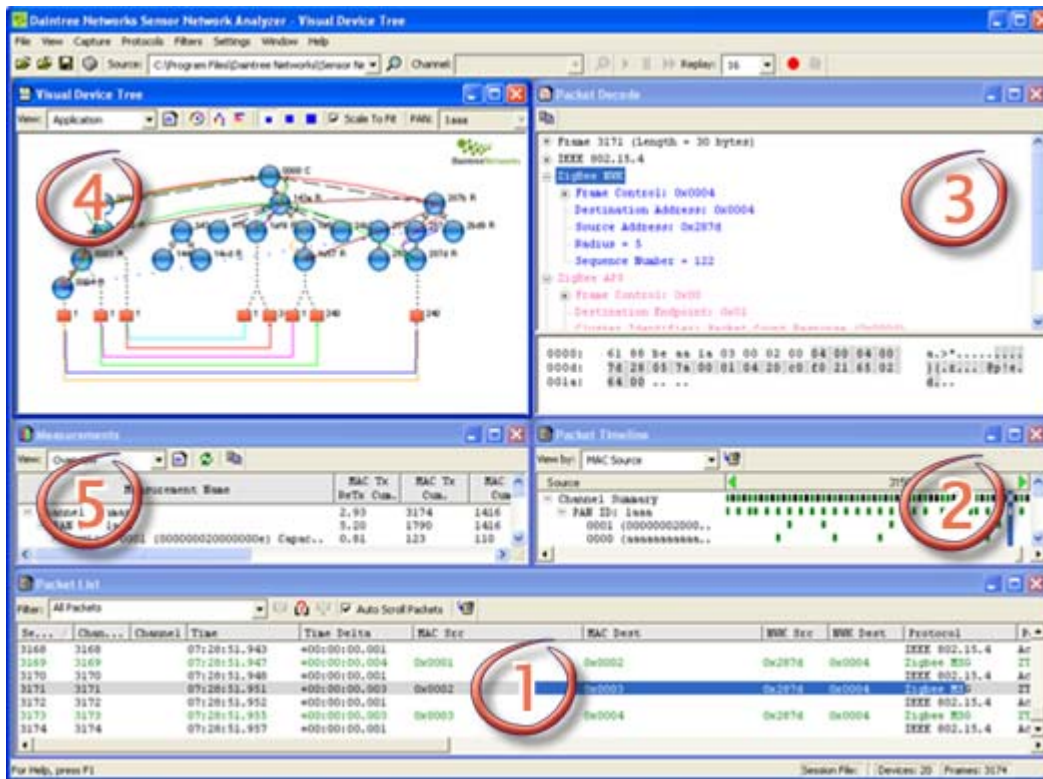
1. The **Packet List** displays received packets sequentially with summary information. You can select which packet details to display and use filters to show the information that is most relevant to you. You can also sort the packet list by clicking column headings. (Supports ALL network protocols.)

2. The **Packet Timeline** displays packet events over time on a per-device basis. (Supports protocols that use IEEE 802.15.4.)

3. The **Packet Decode** displays the decoded structure of an individual packet selected through either the Packet List or Packet Timeline window. (Supports ALL network protocols.)

4. The **Visual Device Tree** shows a graphical representation of network activity only. (Supports protocols that use IEEE 802.15.4 MAC Associations.)

5. The **Measurements** window shows ZigBee and IEEE 802.15.4 performance measurements.

Adding additional protocols to decode

Standards-based protocols such as ZigBee PRO, ZigBee RF4CE and 6LoWPAN are installed with the SNA software by default.

If you want to us a proprietary network protocol (such as JenNet, SimpliciTI or Synkro), you first need to install the XML-based decode definition files for that protocol in the SNA's Profiles directory.

1. Using Windows Explorer (or other file management tool), navigate to the Sensor Network Analyzer's **Proprietary** directory (for example, **C:\Program Files\Daintree Networks\Sensor Network Analyzer\Proprietary**). This is where Daintree provides decode files for proprietary network protocols.

    If you obtained the files from one of Daintree's partners or a different source, go to step 3.

2. Navigate to the sub-directory in which the decode files are stored for the required protocol, and then select to copy all files from that sub-directory. For example,

    o **Freescale** (for the Synkro decodes)

    o **Jennic** (for the JenNet decodes)

    o **TI** (for the SimpliciTI decodes)

3. Copy all network protocol definition files to the SNA's **Profiles** directory (for example, **C:\Program Files\Daintree Networks\Sensor Network Analyzer\Profiles**).

4. **Start** (or restart) the SNA software.

    When the SNA starts, it will load the newly added profile definitions and make them available for selection.
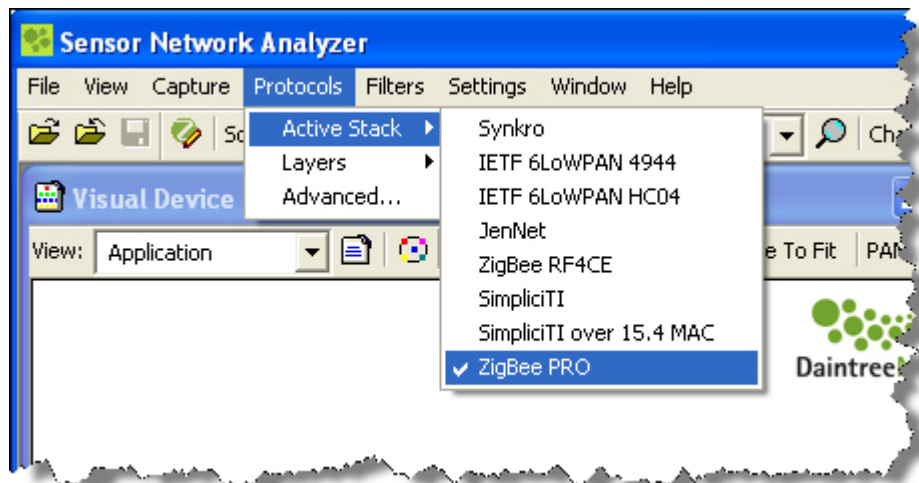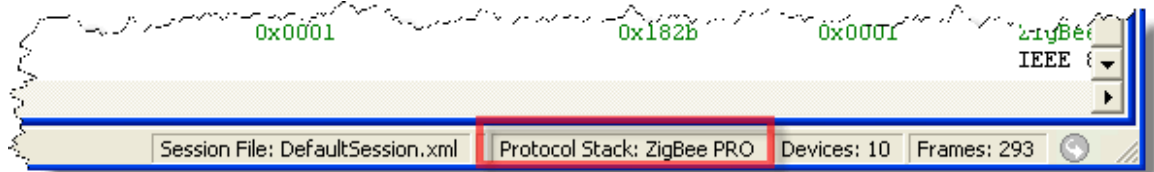
Selecting the protocol stack and layers to decode

Note that the selections you make are hierarchical, in that each selection determines what future options are available. For example, if you select the ZigBee PRO stack, only options that are applicable to ZigBee PRO are available.

1. From the **Protocols** menu, select **Active Stack**, and then select the network protocol to use. The SNA lists all protocol stacks for which XML definition files exist in its Profiles directory.
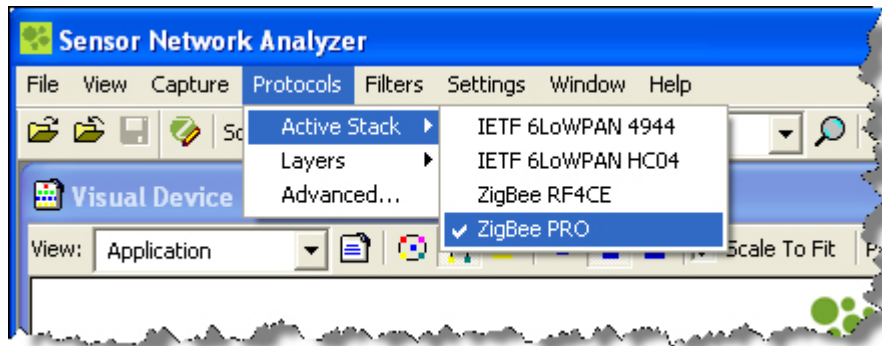
The currently selected protocol stack is shown in the Status Bar at the bottom of the main SNA window.


2. From the **Protocols** menu, select **Layers**, and then select which layers of the selected protocol stack you want to decode. (Each protocol stack is made up of one or more layers.)
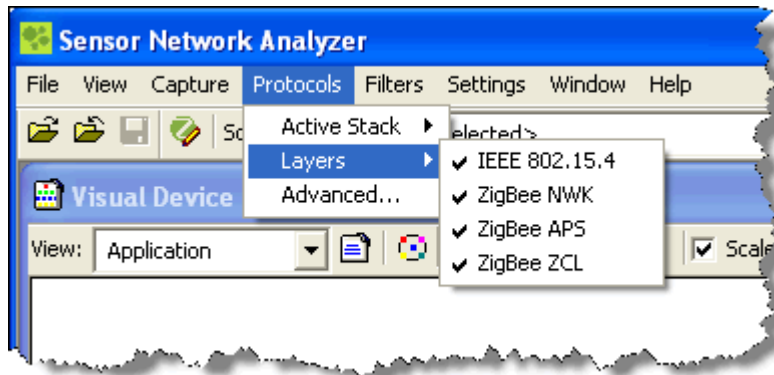
These selections are also hierarchical, in that if you de-select a layer, everything that falls below that layer is also de-selected, and if you select a layer, everything that comes above it is also selected.

Note that because of the size and complexity of some protocol stacks, the **Layers** option lists only top-level layers (that is, those with children). You can use the **Advanced** option to select and de-select the child layers.

3. From the **Protocols** menu, select **Advanced** to open the Protocol Layers dialog box. Click the ⊞ markers or the **Expand All** button to view details for child layers (hidden by default).
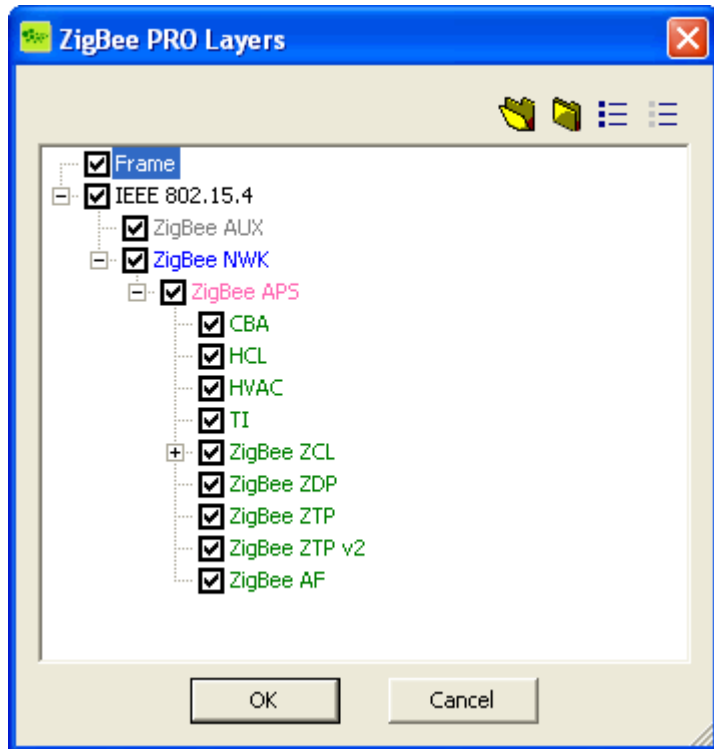
4. Select and de-select the layers you want to make available through the SNA's protocol decoder. You can also use the **Select All** and **Unselect All** buttons to quickly make or clear selections.

    The rules of hierarchy mean that selecting a child layer will automatically select its parent layers (if they were previously de-selected), and de-selecting a parent layer will automatically de-select all of its children.

    Note that selecting a parent layer will NOT automatically select all of its children—the child layers must be selected separately.

5. Click **OK** to save your selections.

    The SNA will immediately begin to use the stack and layers you have selected for the protocol decodes shown in its Packet List, Packet Timeline and Packet Decode windows, and for defining Filters.

Customizing the protocol decoder displays

The XML definition files for protocol decodes contain information including the default layers (columns) to display in the Packet List window, and default names and colors to use for each layer.

Options are provided through the SNA's GUI to change these details so that you can show the information that is most relevant to you in a way that makes it easy to read and understand. Note that these changes are stored in the SNA's session file only—they do NOT over-write the XML definition files.

Selecting columns to display in the Packet List window

1. Open the Packet List Options dialog box in either of the following ways:

   o From the Packets List window, click the Options icon.

   o From the **Settings** menu, select **Options**, and then click the **Packet List** tab.

2. Select the fields to include as columns in the Packet List window:

   o To **Add** columns, select the check box next to the required field(s) from **Available Protocol Fields**, and then click to add the field(s) to **Columns**.

   o To **Remove** columns, select the required field(s) from **Columns**, and then click . (Use the Shift or Ctrl keys to select multiple fields.)
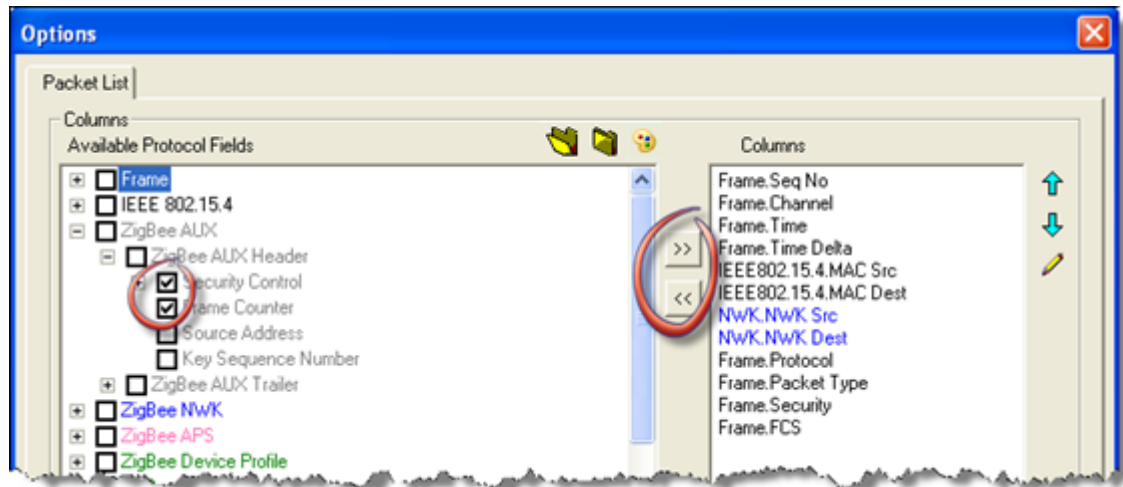
3. If required, change the names and order in which columns are displayed:

   o To **change the name** of any column, click the column to select it, and then click . You can then type the name you want to appear as the column heading in the Packet List window.

   o To **change the order** in which columns are displayed in the Packet List window, click a column to select it, and then click to move it up the order or to move it down.

4. Click the **Default** button if you want to restore the columns, names and order to the values specified in the network protocol definition file.

5. Click **OK** or **Apply** to save your settings.

Changing field colors

Using different colors in the SNA's packet windows can make it quick and easy to identify different layers and different types of packets. Default colors are specified in the protocol definition XML files. Any layer for which a color has not been specified will default to the color of its parent.

You can set or change colors for entire layers and for individual fields/packet types.

1. Open the Packet List Options dialog box (as described previously).

2. To change the color for a layer

    o   Select the **Layer** for which you want to set the color. and then select the color you want to use from the drop-down list.

    o   You can also click **Default** to restore ALL layers to their default color (specified in the XML protocol definition file).
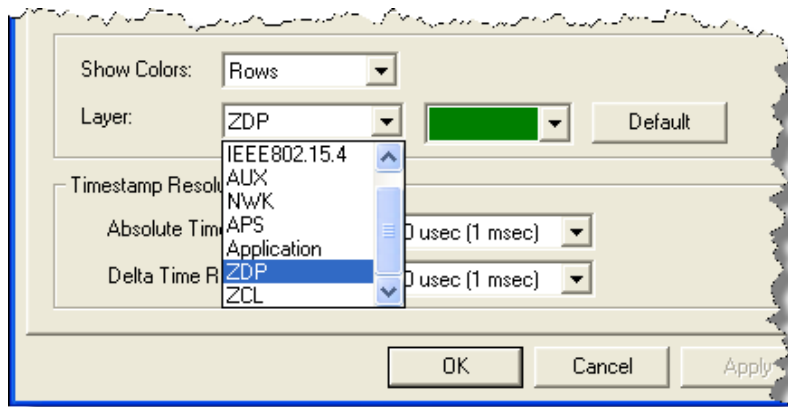
3. To change the color for an individual field

    a   Select the field to change, and then click .

    b   In the Select Field Color dialog box, select the **Color** you want to use from the drop-down list, or else select **Use default color** to restore the default color (specified in the XML protocol definition file).

    c   Click **OK** to set the selected color.
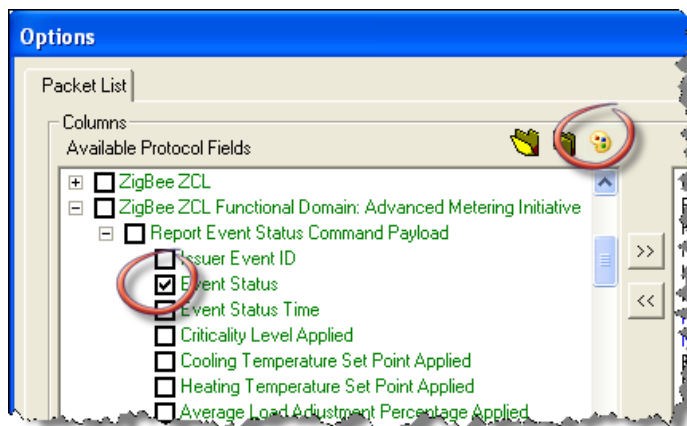
4. Click **OK** or **Apply** to save your color settings.

The colors you set are also applied to the Packet Decode and Packet Timeline windows.

The rules of hierarchy apply here, so the color you select here will be applied to all children of the selected field (with the exception of those children for which a color has also been specified).

Note that the changes you make apply to the current session only—they do not over-write the XML files. That means you must save your session file if you want to retain and re-use these settings.

Changing fonts

You can change the font (face and size) used in the Packet List window to make it easier to read.

1. Click the A icon from the Packet List toolbar, and select to **Change Font**.

2. Select the font face and size to use in the Packet List window. An example is shown below your selection.

3. Click **OK** to save your font settings.
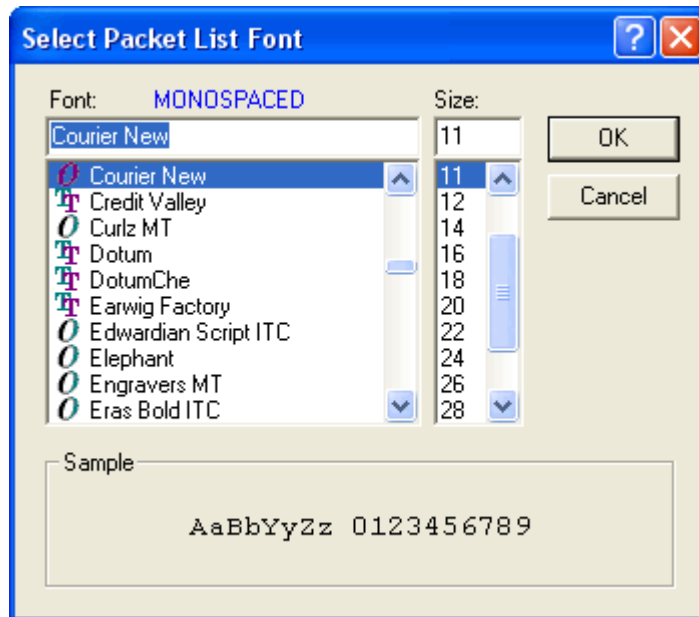
Note that you can also reset fonts to their default typeface and size:

*   Click the A icon from the Packet List toolbar, and select to **Reset Font to Default**.

Short-cuts for adding and removing columns

You can remove columns directly from the Packet List window by right-clicking the column heading, and then selecting **Remove Column**.

You can select a field from the **Packet Decode** window and add it to the Packet List window by right-clicking the field, and then selecting **Add to Packet List**.

Sorting and filtering the Packet List

In addition to customizing the Packet List window to use specific column names and layer/field colors, you can use the following options to further refine your Packet List view:

- Click a column heading to **sort** the Packet List by that field. An arrow ◢ is shown next to the column heading to indicate the column by which the Packet List is sorted. (An upwards arrow indicates sorting in ascending order, and a downwards arrow indicates descending order.)

- Double-click the | bar separating column headings to resize columns to fit their widest entry. (The columns are set to their heading widths by default.)

- Click the 🔣 Filters icon, or select a **Filter** from the drop-down list, to help narrow your search and display only packets of interest. Note that the filter options available will vary depending on the protocol stack and layers currently selected. See the SNA's online help for full details about how to use pre-defined filters and create custom ones.
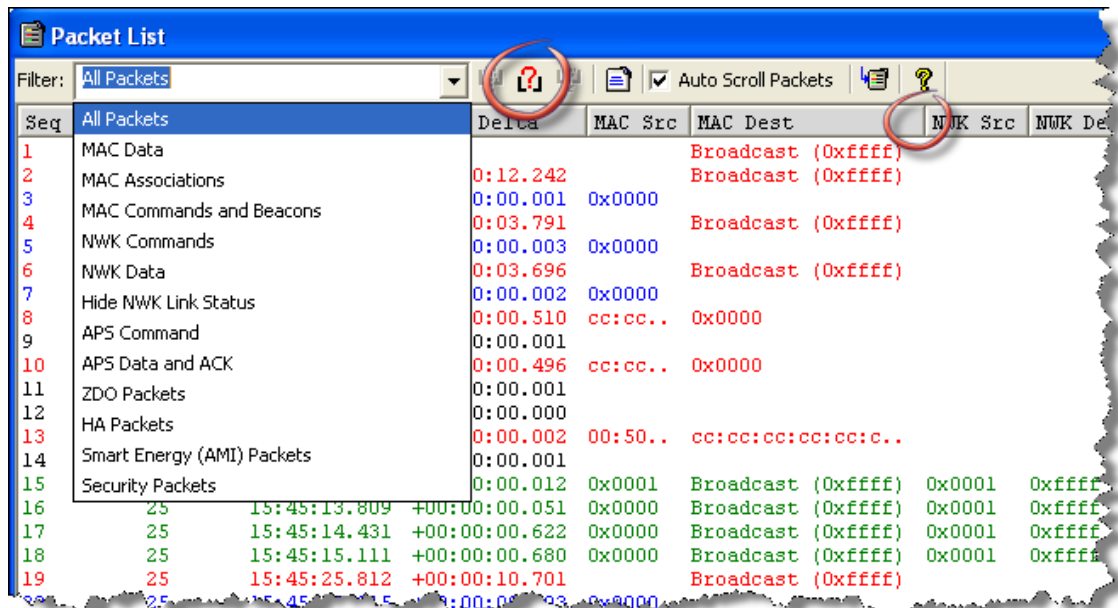
Creating your own decode definitions

Creating your own protocol decode definition takes time and effort, and requires knowledge of XML. You can use the files provided in the Profiles directory for existing definitions as a guide.

Please contact Daintree for assistance if you do want to create your own decode definitions.