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1 Introduction

The NE-ONE Network Emulator is a sophisticated but easy to use product featuring a highly intuitive pictorial web GUI with a unique self-configuration capability.

All NE-ONE models, except the NE-ONE Flex Model 1, support multiple links and Dual-Hop/Last Mile capability.

The NE-ONE Desktop Appliance has an LCD panel on the front of the unit which provides all the day-to-day configuration and management of the Appliance. Please review the ‘LCD Panel User Guide.pdf’ for information on managing the LCD panel.

All NE-ONE Emulator Appliances have two pairs of Ports (Ports 0 & 1 and Ports 2 & 3), though the use of Ports 2&3 is model dependent and access is controlled via the License Key.

All NE-ONE Emulator Virtual Appliances are supplied and licensed to a single pair of Ports (Ports 0 & 1), even though the user can configure more NIC’s within VMware.

Some models support the ability for two users to simultaneously run independent network emulations across different port pairs; highly cost effective when compared to separate dedicated appliances.

Note: The exact Emulation capabilities are determined by the Emulator’s License key.
1.1 End User License Agreement

The Emulator requires the Admin user to agree and adhere to the End User License Agreement.

An End User License Agreements acknowledgement is presented on initial administration login. Logging in is only possible when the administrator clicks Accept.
2  The Desktop Appliance

The Desktop Appliance is a 2U desktop standalone with integrated PSU unit.

Note: Please refer to the NE-ONE Appliance Technical Specifications sheet for more information.

2.1 Connectors and Interfaces

2.1.1 Desktop

Front Panel

- Power On/Off button
- Integrated LCD - Configuration & Management
- Up to 4 x Emulation Ports
  - Model 1: 2 x 50 Mbps Ports (Virtual Appliance Only)
  - Model 5: 2 x 100 Mbps Ports
  - Model 10: 2 x 200 Mbps Ports
  - Model 20: 4 x 1Gbps Ports

Rear Panel

- Power Input Connect
- 1 x 1Gbps Management Port (MGMT)
- 2 x Display Port (NOT USED)
- 4 x USB 2.0 (NOT USED)
- 2 x Audio Jacks (NOT USED)
2.1.2 X-Series Half-Rack

Front Panel

- Power On/Off Button
- Reset Button
- Power Status LED
- 2 x Network Activity LED
- 1 x HDD Activity LED
- 1 x Fan Fail / System Overheat LED / Power Fail

Rear Panel

- 2 x Power Input
  - Power Input
  - Quick Release & PSU Handle
  - LED Indicator
- 1 x IPMI LAN Port
- 1 x 1Gbps Ethernet Management Port (MGMT)
- 2 x 1Gbps Copper RJ45 Ethernet Emulation Ports
- 2 x 10Gbps SFP+ Emulation Ports
- 1 x UID Button
- 1 x 1Gbps Ethernet Port (Not Used)
- 1 x COM1 Port (Not Used)
- 2 x USB 2.0 (Not Used)
- 2 x USB 3.0 (Not Used)
- 1 x VGA Port (Not Used)

2.1.3 Virtual Appliance

Please refer to the NE-ONE Virtual Appliance Installation and Configuration Guide.
Emulation Network Ports

2.1.4 Desktop

The Desktop Emulator has five network interfaces:

1. Two pairs of Emulation Ports (Ports 0&1 and Ports 2&3) on the front of the Appliance.
   These are connected into the equipment/network in order to create network impairments. The interfaces don’t require an IP address unless specifically required in the test network emulation.

2. A single Management (MGMT) interface on the back of the Emulator Appliance which is connected to a network that provides User and/or Administrator access to the Appliance.

Note: The Appliance physical network interfaces (Ports 0, 1, 2, 3 and MGMT) are all 1Gbps auto negotiating.

Port pairs 2&3 are not licensed on some Emulator models.

2.1.5 X-Series

The half-rack emulator has six network interfaces:

1. Two pairs of Emulation ports – the lower pair are Ports 0 and 1, and are 10Gbps fiber ports, and the upper pair are Ports 2 and 3, and are the 1Gbps copper ports.
   These are connected into the equipment/network in order to create network impairments. The interfaces don’t require an IP address unless specifically required in the test network emulation.

2. A single Management (MGMT) interface on the back of the Emulator Appliance which is connected to a network that provides User and/or Administrator access to the Appliance, and an unused interface port next to it.

2.1.6 Virtual Appliance

Please refer to the NE-ONE Virtual Appliance Installation and Configuration Guide on how to configure and add ports to the Appliance.
2.2 Supported Emulation Types

The Emulator supports three types of emulation:

- Point to Point: Single or multiple link configurations.
- Dual-Hop: Dual or multiple link configurations.
- Profiled Emulation: Emulations created with the iTrinegy Profiler
  
  Note: iTrinegy Profiler is an End-of-Life product.

A link is a network connection between two devices or locations that carries network traffic. By default, one link is enabled that will carry all network traffic. Additional links (except on NE-ONE Model 1) can be enabled and configured to carry specific network traffic. For example, Link1 is emulating a 3G network, configured to only forward http traffic, whilst Link2 could be emulating a LAN for all other traffic.

2.3 Scenario Builder

The Scenario Builder allows you to create a network experience over time by graphically combining two or more emulations and/or scenarios together. To provide a more realistic test scenario the emulation and scenario elements can be optionally joined together using transitions. Transitions define what happens when changing between elements, for example 2G to 3G network.

The Emulator must have the Scenario Builder feature enabled in the license key. If the Playback options are disabled, then please contact your Support Representative to obtain an updated license key.

2.4 Emulation Users

There are two types of Emulator Users:

- Admin – A user that can load, configure and run Emulations and can also access all of the Settings menu items.
- Normal User – A user that can load, configure and run Emulations but has restricted access to a subset of the Settings menu items.
3 Loading Emulations and Scenarios

A number of predefined admin user emulation and scenarios are provided on the Emulator when it is shipped. A user can modify these or create new emulations or scenarios, as required. There are also the options to delete, rename and download emulations/scenarios, as well as load (import) an emulation/scenario from a PC.

When the user logs in, the Home page is displayed and lists folders containing Point-to-Point emulations, Dual Hop emulations, Profiled emulations (recorded by using the iTrinegy Profiler), and Scenarios.

Some pre-defined emulations and scenarios are supplied with the emulator and as new ones are created they will appear in the appropriate folders.

There are three Emulation types:

- Point to Point Emulations
- Dual-Hop Emulations
- Profiled Emulations
The Point-to-Point and Dual-Hop Emulations are explained in detail in this guide. The Profiled Emulations can only be created by the iTrinegy Profiler product.

Note: Some models only support Point to Point (single link) emulations. Therefore, no entries will be present in the Dual-Hop and Profiled Emulations lists.

Scenarios contain a combination of emulations and/or scenarios and/or transitions and can be played back over time using the Scenario Builder. Alongside each emulation/scenario file listed, there are four Actions icons which allow you to:

- Load an Emulation/Scenario into the emulator
- Change the Emulation/Scenario Name and Description
- Download the Emulation/Scenario file to your computer
- Delete the Emulation/Scenario File

An emulation/scenario file can also be loaded into the Emulator by clicking on the filename instead of using the icon.

Saved Emulations/Scenarios are owned by the user who creates them, however:

- All users can view/load all emulations/scenarios from the web GUI regardless of who created it;
- Non-admin users can only edit their own emulations/scenarios;
- Admin users can edit any emulation/scenario file.

By implication:

- All users can run all emulation/scenario files on the appliance;
- Admin users can delete all emulation/scenario files;
- Non-admin users can only delete their own emulation/scenario files.

Any saved emulations can be run from the LCD panel or CLI (see the LCD Panel User Guide and Command Line Interface (CLI) Scripting & API Guide for more information).

Note: Currently, Scenarios cannot be loaded and run from the LCD panel but this functionality will be available in a later release of the emulation software.

When you select an Emulation (by clicking the load icon, or its name), the LOAD EMULATION dialog box is displayed, for example:
If your Emulator is licensed to support two Port Pairs then you can choose which Port Pairs you wish to load the emulation onto. Then

- Click on OK to load the configuration.

- Click on Cancel to return to the main Emulation page.

When you select a Scenario (by clicking the load icon, or its name), the LOAD SCENARIO dialog box is displayed, for example:

If your Emulator is licensed to support two Port Pairs then you can choose which Port Pairs you wish to load the scenario on to. Then

- Click on OK to load the configuration.
• Click on Cancel to return to the main Emulation page.

To share emulations/scenarios with other appliances, save them locally on the emulator then use the download button to copy them onto your PC’s local file system. You can then distribute them, as required, to other users via email or file shares etc. and they can load them into their emulator using the “Load File from PC” button.

At the top of the Home Page are two buttons. The first (mentioned earlier) is “Load File from PC”, this is to upload files stored on your PC to the Emulator. The second button is “New Emulation” and will clear any emulation settings and start a fresh scenario, jumping directly to the Emulation Setup & Control page, where it can be set up and then run.
4 Setting up a Point to Point Emulation

Point to Point is the emulation of one or more network links between two locations or devices. In this example we will emulate a network link between New York City and Philadelphia.

To configure a Point to Point emulation, click on the ‘Point to Point (Single or Multi Link)’ button.

**Note:** Most but not all Emulator models support multiple links, for single link models ignore the reference to multiple links. A single link model cannot support Dual-Hop emulations.

In this example we will be using the Emulator’s Port Pair 0&1.

The Point to Point configuration screen is displayed.
Note: In most of this guide we will only display the upper half or relevant part of the Emulation GUI.

4.1 Configuring the End Points

Next, we need to configure the End Points (shown as Ethernet port icons with labels “Not Configured Port 0” and “Not Configured Port 1” by default).

This is achieved by clicking either Ethernet port icon.

The END POINT PROPERTIES panel is displayed.

You have two options for how you configure End Points:

If you select (tick) the “Enable End Point Location Entry” then as you start typing a list of countries and locations within the country will appear that match your criteria. Select the country and the location from the drop-down lists. The latency between the two end point cities is automatically determined.

If you deselect (untick) the “Enable End Point Location Entry” then the latency value associated with the distance between the two End Points must be entered manually.

If you use the endpoint feature, then the base latencies are based on a landline connection between those locations. If you then tell it that the network will be 3G (for example) then the landline values are modified to suit this network.

We can also change the icons using the “Change Icon” buttons to better represent the purpose of the End Point e.g. a corporate HQ building.
A user may wish to use his own icons and these can be added to the icon database. Click on the Browse button at the top of the end point icon dialog, browse to the image file and click Upload. This will be added to the list in the above diagram and will remain unless selected and deleted by the user.

Configure both End Points. You will now see that the End Points have been successfully configured with the locations specified. The End Points are looked up and a corresponding latency is determined. When you click OK, a message pops up explaining extra latency of x ms has been added to the emulation as a result of configuring real locations.

Note: Any changes in link quality “combo field” will provide additional delay (latency) which will be added to the location-based delay value and reflect in the total value in the field as long as location entry is enabled. All these ONLY apply to basic mode.

### 4.2 Configuring the Link(s)

We now need to configure the Link or Links between the End Points. This is achieved by clicking on the relevant Link. It is normal and advisable, although not compulsory, to configure the Links in number order.

When you configure a link, it is enabled (green in color) by default. If you don’t wish to configure the link either cancel editing it or untick the Enable Link box. You can configure the link but not enable it if you want to enable it later, for example.
**Note:** Enabled is not the same as configured. A Link can be enabled, configured but not enabled or enabled and configured. The ability to disable a Link is provided for operational flexibility during emulation testing.

The LINK PROPERTIES (for the relevant Link) panel is displayed in “Basic mode” (click on Advanced for Advanced Configuration Mode):

Decide if you wish to enable the Link at this stage.

You can also change the Link Name to something more appropriate, if required.

Then **select** the **Link Type**, **Subsystem** and **Link Quality** that you require.

The Bandwidth, Latency (if you enabled End Point locations in the End Point configuration) and Loss (%) settings will be automatically completed for you.

You can overwrite any of the impairment values individually, or, alternatively, you can select “Custom” from the Link Type, and all the impairment fields will be blank or zero to facilitate manual entry.

**Note:** For certain network links it is common to have different Bandwidth values in the uplink and downlink directions. The Emulator defaults to symmetric values, which may need to be changed manually.
The link is now configured and ready for use.

Repeat the Link configuration process, but NOT the End point configuration, for each Link that needs to be configured.

Additional links can provide different network experiences for different IP’s, VLANs or TCP ports (see next section).

To add a link, either click on the + sign for the dotted link at the top or click on the cog on the first link and select Duplicate Link (this will copy all the same values set for this link to a second link).

**Note:** You can only add links up to the maximum number permitted by the emulator license.

To edit a link, either click on the number of the link you wish to change, or click on the cog and select Edit Link.

It is also possible to delete a link by clicking on the cog and selecting delete from the menu.

### 4.3 Link Qualification Criteria

When you configure multiple Links (multiple paths between the End Points) it is necessary to define criteria specifying what traffic travels over which Links (paths). If you don’t do this everything will go down the first configured and enabled link.

The Link Qualification Criteria can also be used as a traffic filter i.e. if you select a range of IP addresses for a particular link then only traffic associated with these source and destination IP addresses will traverse this link.

Where no links exist to handle certain traffic, this traffic will be dropped by the Emulator.

Specifying what traffic travels over which Link is handled in the Link Qualification Criteria Section in the Link Properties panel.
The Link Qualification Criteria allows you to select the IP addresses, TCP/UDP Ports and the VLAN tags that will be allowed to run over this Link.

Refer to “Appendix A – Entering Data Values” for a detailed description of the input options.

There is also an Advanced Expressions box for entering criteria with more complex expressions e.g. ipv4.dst=192.168.100.1 OR ipv4.src=192.168.100.1.

In this box the user should enter an expression which describes (in Wireshark like syntax) data that qualifies for this link. For example:

- `eth.dst = 00:1B:21:91:D8:F6` or `eth.src = 00:1B:21:91:D8:F6` - would select that single mac address
- `ipv4.proto = 17` - would select only UDP packets
- `tcp.Destination_Port = 80` or `tcp.source_Port = 80` - would select only port 80 for TCP, not UDP
- `ipv4.tos = x0A` - selects DSCP class AF11

Notes: Link qualifications are in general symmetric so that both directions use the same link, hence source and destination used in the examples above. These expressions are ANDed with any selections in the IP address, port or VLAN boxes.

Refer to “Appendix C – Expressions” for more detail on Expressions.

### 4.4 Mini-Graphs

When an emulation is running in Standard Emulation mode, mini-graphs can be displayed at either or both end points of the link, and pictorially indicate whether packet traffic is flowing through that end point. To select one or both mini-graphs, click on the cog-wheel on the Link between the two end points and select the appropriate graph to be displayed as shown in the next diagram:
The diagram below shows mini-graphs displaying for both end points and shows the traffic activity through each end point:

To dismiss a mini-graph click on the green ‘x’ in the top right-hand corner of the required mini-graph as shown in the next diagram:
4.5 Advanced Mode

4.5.1 Overview

The Edit Link Properties dialog in Basic Mode allows the user to set up a configuration with Point to Point and Dual Hop configurations. Whilst Basic Mode is extremely intuitive and quick to use there is also an Advanced Mode for the more experienced user that wants to setup more sophisticated Emulation impairment configurations.

It is sometimes expedient to start a configuration in Basic Mode and then switch to Advanced Mode. In this situation the following items would be carried across:

<table>
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<td><strong>Left -&gt; Right Bandwidth</strong></td>
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<td><strong>Right -&gt; Left Bandwidth</strong></td>
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<tr>
<td><strong>Min and Max Latency</strong></td>
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<tr>
<td><strong>Loss (%)</strong></td>
</tr>
</tbody>
</table>

In Advanced Mode the Edit Link Properties page appears as follows:
There are two lines of tabs – the top line allows the user to configure the properties for the link direction for Port 0 to Port 1, Port 1 to Port 0 and the Link Qualification Criteria. The second line of tabs allows the user to configure various categories of impairments:

- Bandwidth (including Congestion)
  - Latency
  - Loss
  - Duplicate
  - Out of Order
  - Fragment
  - Bit Error

If a tab has a tick by it then that category of impairment is enabled. The unticked tabs mean those impairments have not been enabled. With each category of impairment, the user may be offered one or more methods of impairment for that category, e.g. For Latency, there are seven methods as follows:
In this case the Random Delay method is selected (which is the same as the Basic Mode latency method of impairment). Once the impairments required have been set, press the Ok button at the top to set and return to the Setup & Control page.

**Note:** Each impairment method has its own specific set of parameters displayed to the right of the list of methods.

### 4.5.2 Link Routing (Link Qualification Criteria)

As with Basic Mode when you configure multiple Links (multiple paths between the End Points) it is necessary to define criteria specifying what traffic travels over which Links (paths). If you do not define this everything will go down the first configured and enabled link.

### 4.5.3 Replacing Emulation with Similar Emulation

When configuring an emulation, or having loaded a particular emulation file, the user can replace it with a “similar” emulation file. By clicking on the “Load Similar” button the user is presented with a list of emulation files that contain a structurally similar configuration i.e. if the current emulation only has one link then the list of “similar” emulations will also only have one configured link (even if it is disabled). Equally, if the current emulation has two links, the list of “similar” emulations will also only have two links even if one or both links are disabled etc.
4.6 Starting the Emulation

To start the emulation, click on the “Start” button above the Emulation Configuration display on the Setup & Control page.

In the example above if we connected a PC to Port 0 (New York City) and pinged a Server connected to Port 1 (Philadelphia) we would observe the latency of approximately 12 ms. This is the round-trip latency – the end point location added 3 ms to the link quality. For a WAN type OC3 network of excellent quality, the latency would be 3 ms, giving a combined total of 6 ms between cities. Therefore, pinging one end point to the other produces a round trip latency of 12 ms.

When the “Start” button is clicked, the emulation starts execution, the “Start” button is greyed out, and the “Stop” and “Update” buttons become active. The “Load Similar” button also changes to “Load & Update”.
Whilst an emulation is running it is possible to load a structurally “similar” emulation and for it to automatically adjust the parameters to the new emulation, continuing running from where the previous emulation was running, without stopping and starting the emulation itself. The structure of the two emulations MUST be the same in order to do this i.e., both emulations must have a matching number of end points and links, even if one or more of the links in the current or new emulation are disabled. A single or two-link emulation can only be replaced by a single or two-link emulation, respectively. If a two-link emulation is running and the second emulation also has two links but one of them disabled, it is still possible to replace the first emulation with the second emulation. A single link emulation cannot be replaced with another that has two or more links, even if they are all bar one disabled. And vice-versa, a multiple link emulation (through link qualification criteria) cannot be replaced by a single link emulation file.

Click on the “Load & Update” button, and a dialog pops up with a list of “similar” emulation files. Select a new emulation file and click “Update” or “Update & Close”. If “Update” is selected the dialog remains on display and the list of emulation files is refreshed, removing the current running emulation and adding the previous emulation file. If “Update & Close” is selected the dialog closes having updated the running emulation.

4.7 Saving the Configuration

If you wish to save the configuration, click on the “Save As” button at the top of the Setup & Control page.
Enter an Emulation Name and a description of this emulation, if required.

Click “Save As” to store on the Appliance.

Saved emulations can be run from the LCD panel (see the LCD Panel User Guide for more information).
5 Setting up a Dual-Hop Emulation

A Dual-Hop emulation is still a Point to Point emulation but it supports a middle hop (which could be another location) or a Last Mile emulation at one of the End Point locations. In this regard we can think of Dual Hop Emulations as Multi-Link emulations. In this example we will emulate a network link between New York City and Philadelphia.

To configure a Dual-Hop emulation, click on the “Dual-Hop (Single or Dual Link)”.

Note: Most but not all Emulator models support Multiple links. A single link model cannot support Dual-Hop emulations.

In this example we will be using the Emulator’s Port Pair 0&1.

The Dual-Hop (Single or Dual Links) configuration screen is displayed.
5.1 Configuring the End Points

First, we need to configure the End Points (shown with the labels “Not Configured Port 0” and “Not Configured Port 1” by default).

However, with Dual-Hop emulations there is also a Middle (End) Point (shown as a Router icon default).

5.1.1 Configure the End and Middle Points

Configuring the End Point properties is achieved by clicking either Ethernet port icon.

The END POINT PROPERTIES panel is displayed.

You have two options for how you configure End Points:

If you select (tick) the “Enable End Point Location Entry” then as you start typing a list of countries and locations within the country will appear that match your criteria. Select the country and the location from the drop-down lists. When you click OK, the latencies between the end point locations will be automatically determined and added to the link. In this case it will add a link quality base latency of 3ms and 2ms.

If you deselect (untick) the “Enable End Point Location Entry” then the latency value associated with the distance between the two End Points must be entered manually.
We can also change the icons using the “Change Icon” buttons, to reflect the nature of the End Point.

A user may wish to use his own icons and these can be added to the icon database. Click on the Browse button at the top of the end point icon dialog, browse to the image file and click Upload. This will be added to the list in the above diagram and will remain unless selected and deleted by the user.

Configure both End Points. You will now see that the End Points have been successfully configured with the locations specified. The End Points are looked up and the delay (latency) between the two end point locations is determined. When you click OK, a message pops up explaining extra latency of x (ms) has been added to the emulation as a result of configuring real locations.

**Note:** Any changes in link quality “combo field”, determine a delay (latency) value which will be added to the location-based delay value and reflect in the field as long as location entry is enabled. All these ONLY apply to basic mode.

You will now see that the End Points have been successfully configured with the locations.
5.2 Configuring the Link(s)

We now need to configure the Link(s) between the End Points. Clearly in a Dual-Hop emulation there must be at least two Links.

This is achieved by clicking on the relevant Link. It is normal and advisable, although not compulsory, to configure the Links in number order.

If you didn’t wish to configure Link1 and Link 2 then these must be disabled; they are enabled (green in color) by default.

**Note:** Enabled is not the same as configured. A Link can be enabled, configured but not enabled or enabled and configured. The ability to disable a Link is for operational flexibility during emulation testing.

The LINK PROPERTIES (for the relevant Link) panel is displayed:

![Link Properties Panel](image)

Decide if you wish to enable the Link at this stage.

You can also change the Link Name to something more appropriate, if required.

Then **select** the **Link Type**, **Subtype** and **Link Quality** that you require.

The Bandwidth, Latency (if you enabled End Point locations in the End Point configuration) and Loss (%) settings will be automatically completed for you.

You can overwrite any of the impairment values individually or you can select "Custom" from the Link Type and all the impairment fields will be blank or zero to facilitate manual entry.
Note: For certain network links it is common to have different Bandwidth values in the uplink and downlink directions. The Emulator defaults to symmetric values, which may need to be changed manually.

The Link-1 link is now configured and ready for use but for a Dual-Hop emulation we must also configure a Link associated with the other End point. Therefore, we need to repeat the process for a second Link (usually called Link-2).

In the example below, we have changed to icons to something more appropriate.

Repeat the Link configuration process, but NOT the End point configuration, for each Link that needs to be configured.

5.2.1 Cumulative Impairments

The impedance metrics for each link will be added together. This means in our example there is a latency of 13ms (which includes 3ms for the end point configuration between New York and Philadelphia), and between 4 and 7ms latency on link-2, which includes 2ms latency between Philadelphia locations. This gives a cumulative total latency of between 17ms and 20ms, and an overall round-trip time of between 34ms and 40ms.

5.3 Link Qualification Criteria

When you configure Multiple Links (multiple paths between the End Points) it is necessary to define criteria specifying what traffic travels over which Links (paths). If you don’t do this everything will go down the first configured and enabled link.

The Link Qualification Criteria can also be used as a traffic filter i.e. if you select a range of IP addresses for a particular link then only traffic associated with these source and destination IP addresses will traverse this link.
Where no links exist, which support the traversing of certain traffic, this traffic will be dropped by the Emulator.

Specifying what traffic travels over which Link is handled in the Link Qualification Criteria section in the Link Properties panel. If you have the Link Properties panel in Advanced Mode then click on the Link Qualification Criteria tab to display the Link Qualification Criteria fields.

The Link Qualification Criteria allows you to select the IP addresses, TCP/UDP Ports and the VLAN tags that will be allowed to run over this Link.

Refer to “Appendix A – Entering Data Values” for a detailed description of the input options.

There is also an Advanced Expressions box for entering criteria with more complex expressions e.g. `ipv4.dst=192.168.100.1 OR ipv4.src=192.168.100.1`.

In this box the user should enter an expression which describes (in Wireshark like syntax) data that qualifies for this link. For example:

- `eth.dst = 00:1B:21:91:D8:F6` or `eth.src = 00:1B:21:91:D8:F6` - would select that single mac address
- `ipv4.proto = 17` - would select only UDP packets
- `tcp.Destination_Port = 80 or tcp.source_Port = 80` - would select only port 80 for TCP, not UDP
- `ipv4.tos = x0A` - selects DSCP class AF11

Notes: link qualifications are in general symmetric so that both directions use the same link, hence source and destination used in the examples above. These expressions are ANDed with any selections in the IP address, port or VLAN boxes.

Refer to “Appendix C – Expressions” for more detail on Expressions.

### 5.4 Mini-Graphs

Mini-graphs are not currently available in Dual Hop Mode (but are planned for a future release).
5.5 Advanced Mode

5.5.1 Overview

The Edit Link Properties dialog in Basic Mode allows the user to set up a configuration with Point to Point and Dual Hop configurations. Whilst Basic Mode is extremely intuitive and quick to use there is also an Advanced Mode for the more experienced user that wants to setup more sophisticated Emulation impairment configurations.

It is sometimes expedient to start a configuration in Basic Mode and then switch to Advanced Mode. In this situation the following items would be carried across:

<table>
<thead>
<tr>
<th>Advanced Mode</th>
<th>Item</th>
<th>Function</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Auto-Configuration Mode</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Left -&gt; Right Bandwidth</strong></td>
<td>Queue</td>
<td>Link speed and FIFO Queue Bytes</td>
<td>-</td>
</tr>
<tr>
<td><strong>Right -&gt; Left Bandwidth</strong></td>
<td>Queue</td>
<td>Link speed and FIFO Queue Bytes</td>
<td>-</td>
</tr>
<tr>
<td><strong>Min and Max Latency</strong></td>
<td>Latency</td>
<td>Random Delay</td>
<td>Values are copied symmetrically to Left -&gt; Right and Right -&gt; Left.</td>
</tr>
<tr>
<td><strong>Loss (%)</strong></td>
<td>Loss</td>
<td>Random Drop</td>
<td>Value is copied symmetrically to Left -&gt; Right and Right -&gt; Left.</td>
</tr>
</tbody>
</table>

In Advanced Mode the Edit Link Properties page appears as follows:
There are two lines of tabs – the top line allows the user to configure the properties for the link direction for Port 0 to Port 1, Port 1 to Port 0 and the Link Qualification Criteria. The second line of tabs allows the user to configure various categories of impairments:

- Bandwidth (including Congestion)
  - Latency
  - Loss
  - Duplicate
  - Out of Order
  - Fragment
  - Bit Error

If a tab has a tick by it then that category of impairment is enabled. The unticked tabs mean those impairments have not been enabled. With each category of impairment, the user may be offered one or more methods of impairment for that category, e.g. For Latency, there are seven methods as follows:
In this case the Random Delay method is selected (which is the same as the Basic Mode latency method of impairment). Once the impairments required have been set, press the Ok button at the top to set and return to the Setup & Control page.

**Note:** Each impairment method has its own specific set of parameters displayed to the right of the list of methods

### 5.5.2 Link Routing (Link Qualification Criteria)

As with Basic Mode when you configure multiple Links (multiple paths between the End Points) it is necessary to define criteria specifying what traffic travels over which Links (paths). If you do not define this everything will go down the first configured and enabled link.

### 5.5.3 Replacing Emulation with Similar Emulation

When configuring an emulation, or having loaded a particular emulation file, the user can replace it with a “similar” emulation file. By clicking on the “Load Similar” button the user is presented with a list of emulation files that contain a structurally similar configuration i.e. if the current emulation only has one link then the list of “similar” emulations will also only have one configured link (even if it is disabled). Equally, if the current emulation has two links, the list of “similar” emulations will also only have two links even if one or both links are disabled etc.
5.6 Starting the Emulation

To start the emulation, click on the “Start” button above the Emulation Configuration display on the Setup & Control page.

In the example above if we connected a PC to Port 0 (New York City) and pinged a Server connected to Port 1 (Philadelphia) we would observe the latency of approximately 12 ms. This is the round-trip latency – the end point location added 3ms to the link quality. For a WAN type OC3 network of excellent quality, the latency would be 3ms, giving a combined total of 6ms between cities. Therefore, pinging one end point to the other produces a round trip latency of 12ms.

When the “Start” button is clicked, the emulation starts execution, the “Start” button is greyed out, and the “Stop” and “Update” buttons become active. The “Load Similar” button also changes to “Load & Update”.

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Whilst an emulation is running it is possible to load a structurally “similar” emulation and for it to automatically adjust the parameters to the new emulation, continuing running from where the previous emulation was running, without stopping and starting the emulation itself. The structure of the two emulations MUST be the same in order to do this i.e., both emulations must have a matching number of end points and links, even if one or more of the links in the current or new emulation are disabled. A single or two-link emulation can only be replaced by a single or two-link emulation, respectively. If a two-link emulation is running and the second emulation also has two links but one of them disabled, it is still possible to replace the first emulation with the second emulation. A single link emulation cannot be replaced with another that has two or more links, even if they are all bar one disabled. And vice-versa, a multiple link emulation (through link qualification criteria) cannot be replaced by a single link emulation file.

Click on the “Load & Update” button, and a dialog pops up with a list of “similar” emulation files. Select a new emulation file and click “Update” or “Update & Close”. If “Update” is selected the dialog remains on display and the list of emulation files is refreshed, removing the current running emulation and adding the previous emulation file. If “Update & Close” is selected the dialog closes having updated the running emulation.

5.7 Saving the Configuration

If you wish to save the configuration, click on the “Save As” button at the top of the Setup & Control page.
Enter an Emulation Name and a description of this emulation, if required.
Click “Save As” to store on the Appliance.
Saved emulations can be run from the LCD panel (see the LCD Panel User Guide for more information).
6 Scenario Builder

The Scenario Builder allows you to create a chronological network experience by combining two or more emulations and/or scenarios (elements) together to run over time. Furthermore, a more realistic network experience can be provided by joining together each element using a transition. Transitions define what happens when changing between elements, for example 2G to 3G network.

The Scenario Builder page is divided into two horizontal sections:

- Workspace, at the top of the page, where you can add emulations, scenarios and transitions for use in your scenario. You then drag the elements from the workspace to the timeline to build the scenario.

- Timeline, at the bottom of the page, graphically displays the scenario with each element and the ability to make changes. When played, the timeline vertical bar moves from left-to-right to indicate the current position of the scenario.

6.1 General Usage

The following provides a general overview of the main items on the Scenario Builder page:
Buttons:
- **Clear All:** Removes everything that you've added from the workspace.
- **Clear Timeline:** Removes everything from the workspace and timeline.

**WARNING:** Be very cautious of using any of the Clear buttons unless you really want to restart the design of the Scenario.

File Menu:
- **New:** You will be prompted to enter a name and description of the Scenario. From here on any actions taken on this page are automatically saved, continually in the background.

  Leaving **Clear Workspace** ticked will remove everything from the workspace.
- **Load:** Load an existing Scenario from the Home page or by selecting File->Load from the Scenario Builder.
- **Rename:** Provide a new name for an existing scenario.
- **Save As:** Save the current scenario configuration under a new name.

View Menu:
- **Background:** Change the background canvas.
- **Arrange Workspace:** Automatically group the elements neatly together on the Workspace.
- **Quick Guide:** Display the Scenario Builder Quick Guide.

**Auto-save**
The Scenario Builder includes an auto-save option which means that all changes are automatically saved in the background.

### 6.1.1 Workspace
The Workspace is an area which allows you to add emulations, scenarios and transitions (elements) for use in your scenario. When adding an emulation or scenario to the Workspace a copy is taken and no linkage is maintained to the original. Transitions are built-in and their behavior cannot be customized.

To add an emulation or scenario click on the Standard or Scenario buttons respectively. Choose the emulations and scenarios that you would like to add to the Workspace and click on the Import button.
Note: Only scenario files containing emulations and transitions (these will be explained later in this section) can be imported into the Workspace. Scenarios containing other scenarios cannot be imported and are excluded from the list.

The properties of each emulation and scenario can be modified. Click on the cog wheel as shown:

The following options are available:
Change allows you to change the element instance to a different emulation or scenario – you will be presented with a list of “similar” emulations to choose from.

Edit to change impairment field values for this instance. Once clicked you will be directed to the Emulation page where you can then make changes to the emulation impairment fields, endpoints and add more links if you require as documented in the section on Emulations earlier.

![Image of NE-ONE Network Emulator interface](image)

When you have finished making changes to the emulation make sure you click on the Save button otherwise the changes will not be saved to the emulation instance on the Scenarios page, and will be discarded.

Important: To return to the Scenarios page click on the “Back to Scenario” button at the top of the page. Do not use the browser’s back arrow.

Duplicate to create a copy of the element which can also be added to the timeline.

Colors can be changed to affect the element’s visual appearance.

Rename to provide a different name for the element.

Remove to delete the element from the workspace.

Change the length of time for an Element

Each element (emulation/scenario/transition) can be altered for the length of time it is to run over. Click on the element and thick line will appear on the right-hand side of it.
Hover-over, click on the line and drag left to shorten or right to extend the duration that the emulation is to run on the timeline. Each small grid square on the timeline represents 5 seconds so the emulation is extended or reduced in 5 second intervals.

### 6.1.2 Transitions

Click on a transition to add it onto the Workspace. Each transition has a cog menu to change, edit, duplicate or remove the transition.

(Edit is reserved for future use)

The following transition types are available:

**Graduating:** This transition changes all emulation parameters Gradually between the values of the Element before and the Element after it. Changes are made every 0.1 seconds.

Example:

If loss in the element before is 80% and loss in the next element is 20%, then during the transition the loss would be gradually reduced from 80% to 20% every 0.1 seconds.

If a gradual change cannot be calculated e.g. due to a change of algorithm or a link being enabled, or disabled then the change to that parameter is made at the end of the transition time, not gradually.

**Variable:** This transition changes all emulation parameters Variably (in a random manner) between the values of the Element before and the Element after it. Changes are made every 0.1 seconds.

Example:

If loss in the element before is 80% and loss in the next element is 20%, then during the transition the loss would take a different random value between 80% to 20% every 0.1 seconds.

If a variable change cannot be calculated e.g. due to a change of algorithm or a link being enabled, or disabled then the change to that parameter is made at the end of the transition time, not variably.

**Outage:** This transition creates an outage as follows: In the first ¼ of the transition the loss is gradually increased to 100% from the value in the Element before. In the middle ½ there is 100% loss. In the last ¼ the loss is changed gradually from 100% to the value in the next Element. Changes are made every 0.1 seconds.

Example:
If loss in the element before is 80% and loss in the next element is 20% and the transition was 20 seconds long, then during the transition the loss would begin by going from 80% to 100% changing every 0.1 second for the first 5 seconds. Loss would then remain at 100% for 10 seconds. Then loss would change from 100% to 20% in the final 5 seconds in 0.1 second increments.

If a variable change cannot be calculated in the first ¼ or last ¼ of the transition e.g. due to a change of algorithm or a link being enabled, or disabled then the change to that parameter is made at the end of the transition time, not variably.

### 6.1.3 Timeline

After you have added all the required elements on to the Workspace, drag them on to the Timeline in the order you would like to play them. Don’t worry if you drag them in the wrong order as you can reorder them and also change other settings within the timeline.

If you need to change the duration of any element you can do so using the same method described above. The following is an example of a scenario.

Having created or loaded a Scenario, you can now play it back over time. Select the Play button, in the Playback controls, to start playing the Scenario. The playback vertical bar will progress along the timeline.
showing the current position in the Scenario. Once started the following Playback controls are available:

- **Stop** will cause the Scenario playback to halt and the playback vertical bar returns to the beginning of the Scenario.

- **Pause** will continue to play the impairments for the current position in the scenario and network traffic will continue to flow through the emulator. Press play to restart the Scenario playing from the current position.

- **Skip** to the start of the current element.

- **Skip** to the end of the current element.

### 6.1.4 Stopping, Continue or Repeat the Scenario

Three options are provided on the stop button to determine what happens when playback is complete:

- **Stops Emulation:** When the Scenario finishes the playback vertical bar returns to the start of the Scenario.

- **Stays On:** Playback remains at the end of the timeline and the network traffic continues passing through the emulator using the scenario’s current impairment settings.

- **Repeat:** Return to the start and repeat playback continuously until manually stopped.

### 6.1.5 Playback Speed

The Speed menu allows you to either slow down or accelerate the playback of a Scenario.
¼ and ½: Slow down playback. For example, if the scenario’s runtime was 60 seconds and 50% was selected then the total runtime would increase to 120 seconds.

2x and 4x: Speed up playback. For example, if the scenario’s runtime was 100 seconds and 2x was selected then the total runtime would change to 50 seconds.
7 Port Settings

For each port pair it is possible to set port addressing for those ports, and/or set a default transmission. Enabling Port Addressing allows the emulator to bridge two sub-networks, and enabling a Default Transmission, means that when no emulation is running, packet traffic can still pass through via a pre-configured background emulation.

7.1 Port Addressing

By default, Port Addressing is disabled, which means that the physical Emulation Ports operate like a network switch (or bridge). Therefore, a device connected to Port 0 can be configured on the same subnet as Port 1.

The Emulator can also be configured to operate like a network router with each physical port having its own IP Address. In the following example the client computer is now on a different subnet of 10.0.0.x with 10.0.0.1 configured on Port 0. The client computer must set its default gateway to 10.0.0.1 so that packets intended for other networks can be forwarded via Port 0. Conversely the server must be configured to use 192.168.200.197 as its gateway so that it can send a response to the client.

7.1.1 Configuring Port Addressing

To configure Port Addressing click on the Port Settings menu item for the ports you are using. Click on the “Enable Port Addressing” check-box and enter the network settings for each port.
When complete click on the Update button. The IP Settings are immediately applied and the ports will now respond to a ping request.

To disable the Port Addressing uncheck “Enable Port Addressing” and click Update.

The Port Properties configuration is persistent and will return following a reboot.

Notes:

1. The fields that must to be populated in the Port Addressing page are the **IP Address** and the **Netmask**.

2. The purpose of the (optional) **Gateway** field is to specify the IP address of another (i.e. not the Emulator) router in that network in the event that the network is more complex and requires further routing.

3. The (optional) **DHCP Server** field is provided so that devices/clients requiring an IP address to be assigned by DHCP can have their “DHCP requests” relayed across the Emulator to the specified DHCP Server even when no emulation is running. This is explained in more detail in the next section.

4. If the Update button is inactive (greyed out) then there is an emulation already running and Port Addressing cannot be enabled or changed whilst this is the case (the Port pair that the emulation is running on will also be highlighted in green in the menu sidebar). In this case stop the emulation first to make changes to Port Addressing.
Once Port Addressing is enabled the Port IP addresses will be displayed on the “Setup & Control” page below the end points, as per the example below:

7.1.2 DHCP Server / DHCP Relay

As discussed briefly in the section above, the purpose of the DHCP Server field is to specify a DHCP Server in “that” network (subnet) which will provide IP addresses for the “opposite” network (subnet).

Let’s use this example:

Suppose on Port 0 we have several devices (PCs, Macs, Games Consoles, Mobiles etc.) which require an IP address to come from a DHCP Server attached to Port 1 and that the addressing of the Ports is per the example above i.e. 192.168.1.254 on Port 0 and 192.168.2.254 on Port 1 and the DHCP server’s address is 192.168.2.50.

Then the Port Settings should be as follows:
As usual, click update to change these settings. They will then be stored and return if the Emulator is rebooted.

Notes:

1. The IP address settings are the same as before but we have added the address of the DHCP Server to the port to which it is connected.

2. The Gateway is optional as usual, but if the DHCP server was not in the network 192.168.2.0 then it would be required in order to route DHCP requests to it. In our example this is not the case.

3. You are not permitted to set up DHCP servers on both Ports in a Port pair. Relaying DHCP requests goes in one direction – from Port 0 to Port 1 to the DHCP server in this example.

How it works:

DHCP requests are broadcast messages and as soon as the DHCP server is defined for Port 1 (and update clicked), then Port 0 (the opposite port in the pair listens for these requests and relays them to Port 1 having first inserted its address (192.168.1.254 in this case) into the DHCP requests Gateway field. This is done so the DHCP server knows which network is requesting addresses and it can allocate an appropriate one for that subnet.

Port 1 now transmits the request as a DHCP relay directly (no broadcasting) to the DHCP server you specified, either directly (as in our example) or via the Gateway, if required.
The DHCP server responds with a suitable offer of address and sends this back to Port 1’s IP address. Port 1 forwards the packets back to Port 0 which sends them to the requesting host.

This meets the DHCP relay standard.

Notes:

1. This process works even if no emulation is running – packets are sent directly between the Emulator’s ports. This means addresses can be obtained as soon as the DHCP setup is completed

2. DHCP requests are not subject to Link characteristics like Latency, Loss etc. as they do not pass through the Links

3. Because the reply from the DHCP server will be directly sent to the address on port 0 (192.168.1.254) in our example, the DHCP server must have a route defined to the subnet 192.168.1.0 which will go via 192.168.2.254

4. Suitable DHCP ranges must be defined in the DHCP server for network 192.168.1.0, as by default they only usually allocate addresses for the networks they are in (192.168.2.0 in our example)

### 7.2 Default Transmission

The emulator can run in a manner such that traffic will only pass through it when an emulation is configured and started, or it can be enabled so that a default transmission is running. This means that when an emulation is not running, traffic can still pass unimpaired through the emulator.

To enable Default Transmission, click on the Port Settings menu option, and in the Defaults section, click the checkbox and then click the “Set” button. To disable the Default Transmission, untick the checkbox and click the “Set” button.
8 Configuration Examples

8.1 Point to Point: Multi-link Configuration Example

Note: An NE-ONE Model 1 has only a single link and therefore cannot support Multi-link configurations.

As discussed in the Setting up a Point to Point Emulation using more than one link allows you to set different network conditions for a single or group of IP Addresses, Applications or VLANs. For example, you may need one client computer to experience a 2G network whilst another experiences 4G.

In the following example we have configured four links with different network types:

Computer 10.0.0.2 will use 2G Link.
Computer 10.0.0.3 will use the 3G Link.
Computer 10.0.0.4 will use the 4G Link.

Packets that don’t qualify for 2G, 3G or 4G will traverse the ‘No impedance’ (Link 4).

To setup the above configuration we need to specify the Link Qualification Criteria for each associated Link:

<table>
<thead>
<tr>
<th>Link 1 – 2G</th>
<th>Link 2 – 3G</th>
<th>Link 3 – 4G</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0.0.2</td>
<td>10.0.0.3</td>
<td>10.0.0.4</td>
</tr>
</tbody>
</table>

Links 1 to 3 apply different network conditions for the three computers. Link 4 will forward all other traffic across a link which isn’t impeded. If link 4 isn’t defined then all other traffic would be dropped.

Link Qualification Criteria can be specified as a single item, range or combination of both and the criteria can be specified separately (i.e. IP Addressing only) or together (i.e. A combination of IP Addressing, Ports and VLANs).

Important: Link Qualification criteria is applied in both directions. For example, when specifying an IP Address, it would use the link if it’s in the packet’s source or destination IP Address fields. The same applies to the TCP/UDP Port.
8.2 Dual-Hop: Multi-link Configuration Example

**Note:** An NE-ONE Model 1 has only a single link and therefore cannot support Multi-link configurations.

As discussed in the Setting up a Dual-Hop Emulation using more than two Links allows you to set different network conditions for a single or group of IP Addresses, Applications or VLANs. Using our previous examples, we now have two locations with four links (2G, 3G, 4G and No impedance) combining into one WAN link.

![Diagram of Dual-Hop Configuration](image)

This emulation is similar to the previous and would be configured as shown in the below diagram.

![Diagram showing Dual-Hop Configuration](image)

Links 1, 3, 4 and 5 are 2G, 3G, 4G and No impedance respectively. Link 2 is configured as the WAN link.
9 Graphing

Once an emulation is running, the user can display a number of graphs – by selecting Graphs from the menu on the left-hand side bar, the user has a choice of a number of types of graphs to display. These will display data in each direction of flow against time. Both directions of data flow are displayed by default but each direction can be filtered for selection.

From the Emulation Graphs page, click on the Add Graph button to bring up the following selection dialog:

![Select Graphs dialog]

Tick the graphs required for display and then click Ok. This will bring up the required graphs on the page.

![Graphs display]

Tick the graphs required for display and then click Ok. This will bring up the required graphs on the page.
For each graph, to filter one direction of data, click on the required Data Flow diagram – the points for the direction selected will disappear from the graph. Click again to bring that direction of data flow back on display.

For each series graphs are fixed to 20 data points.

If an emulation has multiple links, then a set of graphs can be selected for each link and added to the display. In this case, select the link name from the drop-down box and then tick the graphs required for that link. Click on Add Graph again to select another link and the graphs required for this link.

**Note:** The graph height can be extended by clicking on the 3 small dots at the bottom of the graph and dragging the line downwards.

The user can also load and run a similar emulation to that running without stopping and starting and without having to recreate the graphs. By clicking the Load & Update button the user will be presented with a list of “similar” emulation files. Select one and load and the graphs will repaint to reflect the change in emulation.
10 Emulation Logging

10.1 Control Settings

Emulation logging allows you to turn on graph logging and to configure which graphs log statistics to file. Click on the Enable Logging tick box to turn off or on logging, and then click on the tick boxes for the required logs. Logging is started immediately for any running emulations.

The logs can then be found under the Emulation Logs link on the menu on the left-hand side.

10.2 Emulation Logs

The Emulation Logs allows you to download the log files to your computer and perform analysis in Microsoft Excel or similar tools.
Note: Multiple files can be downloaded or deleted by clicking on the tick boxes for required logs and then clicking on the icon at the end of the row of one of them. If the Download icon is clicked for multiple log files, then these are bundled in an archive and the archive (or zip file) is downloaded.

There are two columns showing the duration of the logging and the size of the log file. By clicking on the “Refresh” button at the top of the page, these columns are updated.

Click the Download icon to download the file. The below screenshot shows the statistics for the Average Latency Per Second graph. The first row contains the emulation name, graph name and user name. The next row contains the field headers, date time and metrics for each link. Two metrics are reported, one for the uplink and the other for the downlink. Data is separated by the semi-colon character.
In the above example you can see that the latency for link 1 (uplink and downlink) was increased to 10ms. This is shown from row 10 onwards.

Logs can be deleted by clicking on the Bin Icon at the end of the log file row.

Clicking on the column headings allow you to change the sort order, and select which columns you want to display on the logs summary as shown:
11 Packet Capture

The NE-ONE Emulator has the facility to create Wireshark Packet Capture files. Packet capture is disabled by default, and can be enabled by the user before starting emulations. Packet capture can only be enabled and disabled when there are no emulations running.

Packet Capture can be set for endpoints and captures all the data at the end point. For emulation links Packet Capture files can be created for each direction and for “before impairment” and for “after impairment”, offering the user an array of Packet Capture choices.

Users are reminded to clean up Packet Capture files on a regular basis otherwise the emulator may run out of disk space and not function at its highest efficiency.

11.1 Packet Capture Settings

Click on the Packet Capture link under the relevant Port Pair Setup & Control section. This will bring up the Packet Capture settings page, shown below. The example shown is displayed when Packet Capture has not been enabled or configured. Packet Capture can be enabled and settings altered.
Load an emulation, e.g. ADSL_Medium_GoodQuality, and then click on the Packet Capture option. Note that the title bar has changed and now states the emulation file name, that has been loaded and is currently in cache.

At the top of the page tick the checkbox to enable Packet Capture and untick to stop Packet Capture. **The enabling and disabling of Packet Capture can only take place when there are no emulations or scenario’s running.**
The first section lists the end points – tick the checkboxes to enable Packet Capture of all data at the endpoint. If the checkbox is not ticked no Packet Capture files will be generated for that endpoint.

The second section lists all the links in the emulation. For each link the tick the relevant checkbox to enable Packet Capture for either direction and before or after impairment has been applied to the packet data. There is an “All” convenience checkbox to enable all types of Packet Capture for that link. For each type of Packet Capture a file will be generated containing Wireshark format packet data.

Once you have selected which Packet Capture file(s) are to be generated, you should then click the “Update” button. This will store the settings for that emulation in the relevant emulation file. If you haven’t saved the settings and attempt to change page, you will be prompted to save or discard the changes.

**NOTE:** When changing the Packet Capture settings, please take special care to note the emulation this applies to by checking the Packet Capture title bar. Only the emulation or scenario that is listed in the title bar is loaded in cache, and therefore any changes to the Packet Capture settings only apply to that emulation or scenario.

For example, if an emulation is selected from the HOME page and loaded into Port Pair 0/1, the user then clicks on the Packet Capture page and enables Packet Capture.

Then the user goes to the HOME page, Scenarios section, and loads a scenario that has Packet Capture enabled – to do this, move the cursor over each scenario and look at the pop-up dialog for the Packet Capture status in this file. Load the scenario file into Port Pair 0/1 and the Scenario page will display. Click on the Packet Capture link to display the Packet Capture settings and note the emulation/scenario listed in the title bar – it will be the emulation.

To bring the Scenario into cache go back to the Scenario page, click on the cog wheel of the first element on the timeline and select edit. You will be taken to the Emulation page. Click back to the Scenario page and then click Packet Capture. Note the title bar and the Scenario is now active in cache and the Packet Capture settings can be changed applicable to the Scenario.

When the Emulation Start is clicked or the Scenario playback is clicked the relevant Packet Capture Files will be created according to the Packet Capture settings.

**11.2 Packet Capture Logs**

Click on the Packet Capture Files link on the left-hand side menu to display the Packet Capture logs, as shown below:
You can download the files to your PC for replay via Wireshark. The files can be deleted from this page, either singularly or in multiple groups by ticking the checkboxes of the files to be deleted and then clicking on the bin icon at the end of the line of one of the files.
12 Administration Options – The Settings Menu

The complete Settings menu is only available to the Administrator (Admin) user.

The following sections describe these menu options.

Note: A non-Administrator user only has the Log File Control and Change Password options.

12.1 Licensing

This option allows the installation or update of the Emulator License Key.

The License key enables the use of the Emulator, defines the use criteria (i.e. Perpetual License or Time Expired License) and defines the Emulator Model.

The Emulator will not run without a valid License Key. Furthermore, the emulator cannot be upgraded (with patches) unless a valid maintenance/support contract is in place. Each time the maintenance contract is renewed, a new license will be issued to be installed, allowing the emulator to be kept up to date with software releases. If the maintenance contract is allowed to expire, the emulator will remain operational, but will not be upgradeable.
The License File (Key) is loaded through the GUI from the local file system. Ensure you have a valid License File before proceeding with the “Upload License File” options.

**WARNING:** After a reboot the Appliance GUI will default to the Licensing Page. Whilst the License is being checked the top of the display will show (NO LICENSE), this is completely normal. Please allow enough time for the Emulator to validate the newly entered License and change the display to reflect the new license.

### 12.2 Users

Every Emulator model supports multiple simultaneous users and each user can have their own login to the emulator.

If you have purchased a model that supports two licensed Port Pairs (4 Ports) then it's also possible for one user to use Ports 0 and 1 whilst another user uses Ports 2 and 3 with two different emulations running concurrently.

**Note:** Only admin users can add new users. Non-admin users do not have the Users option.
To add a new user, click on the Add User button.

To Add User simply select “Add User” and fill in the New User dialogue box parameters.

**WARNING:** If the Administrator (Admin) type users forget their password this can only be reset using the Management Console Facility under supervision of iTrinegy Technical Support.

To delete a user simply select the relevant user (the row will highlight in yellow) and then click on the “Remove User” button. Confirm deletion of the user in the confirmation dialog when it appears.

It is also possible to edit the user to change his status from an Admin user to a non-Admin user or vice-versa. Click on the user required to highlight the selected user. Click on the “Edit User” button and in the dialog, click on the Administrator tick box to enable or disable the user status and then click “Update”.

### 12.3 Software Update

Subject to a valid Support Agreement, software updates containing new features, enhancements and bug fixes will be made available for you to download and install. Please contact your support representative for information of where to obtain updates from.

**WARNING:** All Software Updates require the system to be rebooted.

Download the update to your local machine and then click on the *Upload Patch File* button.
The Patch File is loaded through the GUI from the local file system. Ensure you have a valid Patch File before proceeding with the “Upload Patch File” option.

There is a Patch progress bar during the update sequence and most updates will install within a few minutes, although major upgrades may take significantly longer. Please review the supporting patch documentation for further information.

Click on Ok to acknowledge the reboot message and the Appliance will reboot.

**WARNING**: After a reboot the Appliance GUI will default to the License Pane. Whilst the License is checked the top of the display will show (NO LICENSE) this is completely normal. Please allow enough time for the Emulator to validate the License.

### 12.4 Appliance Menu

The Appliance Menu has many sub menu functions.

#### 12.4.1 Control

The Appliance Control option allows the User to Reboot or Shutdown the Appliance.
Reboot
This option will reboot the Appliance in Emulator mode.

**WARNING:** Rebooting an active Appliance will terminate all running emulations and all unsaved emulations/scenarios will be lost.

Shutdown
This option will shut down the Emulator application and power down the Appliance.

**WARNING:** Shutting down an active Appliance will terminate all running emulations and all unsaved emulations/scenarios will be lost.

Reboot and Shutdown can also be initiated from the LCD panel.

12.4.2 Backup
The Backup Utility allows the user to take a backup of all of their NE-ONE system files with the exception of the PCAP and emulation files, the License file and any configuration settings for the management port.
12.4.3 Restore

The Restore Utility allows the user to restore their NE-ONE system to an earlier backup file in the event of a problem.
12.4.4 Config

The Appliance Config page (below)

is divided into two sections. The upper section offers the option for the user to specify a Name/Identifier for this emulator. This can be, for example an IP address, or any text restricted to a maximum of 16 characters. The lower section allows the user to select the IP configuration for the emulator’s network management address. This can be either by DHCP or the user can set a Static address.

12.4.5 Emulator Identity

This identifier will appear at the top of the sidebar in the form <user>@<identifier>. The identifier text also appears on the browser tab so that if a user is using multiple emulators he can easily see which tab has which emulator GUI.

If the sidebar is hidden, by clicking on the arrow at the top of the menu column, the collapsed sidebar also has the user and machine identity displayed vertically.

The user can remove the machine name by deleting the text on the Config page and clicking Update. The product default will appear on the tab again.

12.4.6 Network Management Configuration

The user can opt for the network management address to be specified via DHCP (as shown in above diagram) or Static and specify the address settings themselves. If DHCP is selected the IP fields are greyed out. If Static is selected (as shown in the diagram below)…
...the IP fields are activated and the user is able to specify the Network Management IP address, the Netmask, the Gateway address and the DNS address settings. Having selected the type of address to be specified or when static settings have been specified the user should click ‘Update’ to submit the changes.

12.4.7 Platform Update

The Platform Update page will allow the user to perform package updates to the operating system to ensure it’s up-to-date

12.4.8 Status

The Status link displays a page, which is split into two parts. The upper half shows, pictorially, the disk usage and breakdown of files stored on hard disk, and the lower half shows the Port Statistics for the emulator, detailing information about the traffic passing through the ports. The MAC address of each port is displayed, the number of packets sent and received at that port, the number of bytes send and received and the number of bytes dropped. The picture below shows the Status page and typical data for the Port Statistics.
12.4.9 Disk Cleanup

Disk Cleanup has two sections. The top section is for Log File Control and determines whether files are deleted automatically or manually. The bottom section provides settings for the Packet Capture files.

12.4.10 Log File Control

The Log File Control option allows you to select either Manual or Automatic configuration. Selecting manual means that you will need to delete the graph log files using the Delete option on the Emulation Logs page. The Automatic option will delete log files older than the number of days specified.
Packet Capture Files

This section allows the user to specify the maximum size per Packet Capture file, whether to automatically delete Packet Capture files or manually delete them, and, if automatically, the upper and lower thresholds of disk space before deletion should be activated and halted respectively.

Click on the “View Packet Capture Cleanup Logs” button and the Start and End time of Packet Capture is displayed along with the list of the files for that period of Packet Capture.

Click on the Delete Logs button to delete the files listed.

Change Password

A user can change his password by clicking on the Settings Change Password option. A dialog is immediately displayed.
Enter the new password and retype it, then click Update.

**WARNING**: If the Administrator (Admin) type users forget their password this can only be reset using the Management Console Facility under supervision of iTrinegy Technical Support.
APPENDICES

Appendix A – Entering Data Values

The Link Qualification Criteria data input strings obviously have a particular format. This appendix is a quick reference of the data format options.

Address and Ports use comma delimiter syntax with dashes:

Examples

To display data only related to IP addresses from **192.168.1.1 to 192.168.1.254**

| IP Address: | 192.168.1.1-192.168.1.254 |

To display data only related to IP addresses from **192.168.1.1 to 192.168.1.16** and **192.168.0.1 to 192.168.0.100** and IP address **192.168.1.154**

| IP Address: | 192.168.1.1-192.168.1.16,192.168.0.1 to 192.168.0.100,192.168.1.154 |

Alternatively, the Emulator will also accept CIDR notation (Classless Inter-Domain Routing) i.e. **192.168.0.0 to 192.168.0.255** can be entered:

| IP Address: | 192.168.0.0/24 |

To display data only related to Ports **80** and **3289 to 3299**

| TCP/UDP Ports: | 80,3289-3299 |

**Note:** What may assist you is that the port is set to 0 (for matching purposes) for all packets that do not have a port i.e. are (IPv4 and not UDP/TCP) or not IPv4. You can use this fact in packet matching, for example the port range 1-65535 would eliminate ICMP (IPv4 but not TCP/UDP) and ARP (not IPv4 at all) which have no port. Specifying 0 (zero) in the TCP/UDP Ports will match packets that do not have a port number such as ARP and ICMP (ping).

**Tag** - This would typically be the VLAN/MPLS tag number. This is the VLAN Tag (ID) applied to Tagged VLAN packets by switches that are tagged VLAN packet aware. The VLAN tag needs to be set according to the 802.1Q standard.
Appendix B – List of Standard Impairments

The complete list of impairment functions and their definitions can be found in a technical data sheet on the iTrinegy website:

Appendix C – Expressions

Expressions use a powerful new packet classification (packet selection) engine introduced in V3.5.

With Expressions packet classification (packet selection) is performed by creating a “Wireshark like” expression.

For example, to select all those packets in vlan 601 which have a destination IPv4 address of 192.168.4.1 to be selected in link classification can now be performed by the expression:

\[ \text{Vlan.id} = 601 \text{ and } \text{ipv4.dst} = 192.168.4.1 \]

- Very sophisticated selections can be put together using: **Boolean (logical) operators:** and, or
- **Comparison operators:** =, <>, >, <, >=, <= (note: <> for not equal)
- **Bit operators** & (bit and), | (bit or), << (left shift), >> (right shift)
- **Arithmetic operators:** +, -, *, /, % (mod)
- **Brackets** ( )

A more sophisticated expression, demonstrating some of these operators might be: \((192.168.10.10 = \text{ipv4.src}) \text{ OR } (192.168.10.10 = \text{ipv4.dst}) \text{ OR } (192.168.10.10 = \text{arp.Sender_Protocol_Address}) \text{ OR } (192.168.10.10 = \text{arp.Target_Protocol_Address}) \text{ AND } \text{ipv4.dst}=192.168.10.20\)

Firstly, that is all one expression which broadly says that the packet matches if:
(its source IP address is 192.168.10.10 or its destination IP address is 192.168.10.10 or its ARP sender address is 192.168.10.10 or its ARP target address is 192.168.10.10)

A lot going on there. You might use this statement in a bridged network to send both IPv4 and ARP down the same link provided it has the address 192.168.10.10 somewhere in the addressing (source, dest, arp).

You can see the use of **bracketing and logical operators**, **and** and **or**, also the comparison operator **=**.

**Combining expressions with other Link qualification fields**
As an example, let’s assume you fill out the fields as follows, in your Link Qualification Criteria:
Then it needs to make sure your ip addresses are in the correct range and the expression is true to qualify.

To do this behind the scenes it creates the following expression (it’s actually a little more sophisticated even than this) for you:

\[
((\text{ipv4.dst} \geq 192.168.2.1 \text{ and } \text{ipv4.dst} \leq 192.168.2.254) \\
or (\text{ipv4.src} \geq 192.168.2.1 \text{ and } \text{ipv4.src} \leq 192.168.2.254)) \text{ and} \\
(\text{ipv4.proto} = 6)
\]

You don’t see this process, as it happens in the background.

From the resulting expression (part generated and part input by you) it evaluated whether the packet matches your link (i.e. when the expression is True)

**Symmetry vs Asymmetry**

This leads to a caveat. Suppose instead of \(\text{ipv4.proto} = 6\) you entered the expression \(\text{eth.dst} = 00:11:22:33:44:01\) (for example). Then the resulting combined expression would be:

\[
((\text{ipv4.dst} \geq 192.168.2.1 \text{ and } \text{ipv4.dst} \leq 192.168.2.254) \\
or (\text{ipv4.src} \geq 192.168.2.1 \text{ and } \text{ipv4.src} \leq 192.168.2.254)) \text{ and} \\
(\text{eth.dst} = 00:11:22:33:44:01)
\]
which is of course **No Longer symmetric** because eth.dst = 00:11:22:33:44:01 is itself not symmetric in the MAC address. If you want to keep it symmetric (you don’t have to, but the other fields always generate symmetric link qualification i.e. traffic comes back down the same link it went out on) you need to make sure that your expressions are symmetric e.g. set your expression to be:

```
eth.dst = 00:11:22:33:44:01 or eth.src = 00:11:22:33:44:01
```

Now the resulting auto generated expression is:

```
((ipv4.dst >= 192.168.2.1 and ipv4.dst <= 192.168.2.254) 
or (ipv4.src >= 192.168.2.1 and ipv4.src <= 192.168.2.254)) and 
(eth.dst = 00:11:22:33:44:01 or eth.src = 00:11:22:33:44:01)
```

This is quite an expression, but the hard work is automatically done for you and it is also compiled to machine code by the just in time (JIT) compiler and so evaluated quickly.

**Fields available for use in Expressions**

So, what fields are available for use in expressions?

The following fields are available for use in expressions. They are listed below by Protocol.
The full field names are constructed by prefixing the field name with the protocol name or its alias, separated by a dot (period) character – see the examples below.

Note: Protocol and Field names are NOT case sensitive.

This is not the full list, in the interests of keeping this user guide to reasonable proportions. If you need other fields please contact your support representative.

Before starting with “proper protocols” we look at an important pseudo protocol containing Packet metadata

**@Packet – pseudo protocol**

We may need to refer to parts of the packet which are not actually in the packet contents but instead are extra fields or descriptive fields. These are available as a pseudo protocol called @packet. Following the same format as used for real protocols below:

**Protocol Name: @Packet**
Network Layer: N/A
Alias: -
Fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td>The size of the packet minus the CRC</td>
</tr>
</tbody>
</table>

Examples:
1. So, to test the packet is >=200 bytes: @packet.length >= 200

Ethernet (802.3x)
Protocol Name: 802_3x
Network Layer: 2
Alias: eth
Fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>dst</td>
<td>Destination Address – Mac address</td>
</tr>
<tr>
<td>src</td>
<td>Source Address – Mac Address</td>
</tr>
<tr>
<td>proto</td>
<td>Protocol – Protocol Number</td>
</tr>
</tbody>
</table>

Examples:
1. To test the packet is an ARP packet specify: eth.proto = 0x806
2. eth.dst = 00:11:22:33:44:01
3. 802_3x.proto = x800 or 802_3x.proto = x86DD - (IPv4 or IPv6)

VLAN (802.1q)
Protocol Name: 802_1q
Network Layer: 2
Alias: vlan
Fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>pcp</td>
<td>Priority Code Point</td>
</tr>
</tbody>
</table>
### IPv4

**Protocol Name**: IPv4  
**Network Layer**: 3  
**Alias**: -  

### Fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>version</td>
<td>Version (should be 4)</td>
</tr>
<tr>
<td>hdr_len</td>
<td>Header Length – we provide Actual Value = (hdr_len &lt;&lt; 2)</td>
</tr>
<tr>
<td>tos</td>
<td>TOS - Type of Service</td>
</tr>
<tr>
<td>Length</td>
<td>Length</td>
</tr>
<tr>
<td>Id</td>
<td>Packet Id</td>
</tr>
<tr>
<td>reserv</td>
<td>Reserved</td>
</tr>
<tr>
<td>df</td>
<td>Don't Fragment</td>
</tr>
<tr>
<td>mf</td>
<td>More Fragments</td>
</tr>
<tr>
<td>frag_off</td>
<td>Fragment Offset – we provide Actual Value = (frag_off &lt;&lt; 3)</td>
</tr>
<tr>
<td>ttl</td>
<td>TTL – Time to Live (max hops)</td>
</tr>
</tbody>
</table>

### Examples:

1. `vlan.id >= 601` and `vlan.id <= 700` – *(vlan between 601 and 700)*  
2. `802_1q.id <> 5` – *(vlan id is not 5)*
### IPv4

**Fields:**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>proto</td>
<td>Protocol</td>
</tr>
<tr>
<td>csum</td>
<td>Checksum</td>
</tr>
<tr>
<td>src</td>
<td>Source Address</td>
</tr>
<tr>
<td>dst</td>
<td>Destination Address</td>
</tr>
</tbody>
</table>

**Examples:**

1. \( \text{ipv4.proto} = 6 \) – *(TCP packet)*
2. \( 192.168.1.1 \leq \text{ipv4.dst} \) and \( \text{ipv4.dst} \leq 192.168.1.254 \) – *(The ipv4 destination address lies in the interval 192.168.1.1-192.168.1.254)*

### IPv6

**Protocol Name:** IPv6  
**Network Layer:** 3  
**Alias:** -  
**Fields:**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Version</td>
<td>Version (should be 6)</td>
</tr>
<tr>
<td>Traffic_Class</td>
<td>Traffic Class</td>
</tr>
<tr>
<td>Flow_Label</td>
<td>Flow Label</td>
</tr>
<tr>
<td>Payload_Length</td>
<td>Payload Length</td>
</tr>
<tr>
<td>Next_Header</td>
<td>Next Header</td>
</tr>
<tr>
<td>Hop_Limit</td>
<td>Hop Limit</td>
</tr>
<tr>
<td>Source_Address</td>
<td>Source Address</td>
</tr>
<tr>
<td>Destination_Address</td>
<td>Destination Address</td>
</tr>
</tbody>
</table>

**Examples:**

1. \( \text{ipv6.Next_Header} = 6 \) – *(TCP packet in IPv6)*
2. IPv6.Destination_Address = fe80::612d:7669:d879:1302 and
   ipv6.Source_Address = fe80::6ced:ec22:1e80:bf1
   (standard ipv6 notation - :: means repeating 0 bytes – true if source and
destination ipv6 addresses match the ones specified)

ARP
Protocol Name: ARP
Network Layer: 3
Alias: -
Fields:

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware_Type</td>
<td>Hardware Type</td>
</tr>
<tr>
<td>Protocol_Type</td>
<td>Protocol Type</td>
</tr>
<tr>
<td>Hardware_Address_Length</td>
<td>Hardware Address Length</td>
</tr>
<tr>
<td>Protocol_Address_Length</td>
<td>Protocol Address Length</td>
</tr>
<tr>
<td>Operation</td>
<td>Operation</td>
</tr>
<tr>
<td>Sender_Hardware_Address</td>
<td>Sender Hardware Address</td>
</tr>
<tr>
<td>Sender_Protocol_Address</td>
<td>Sender Protocol Address</td>
</tr>
<tr>
<td>Target_Hardware_Address</td>
<td>Target Hardware Address</td>
</tr>
<tr>
<td>Target_Protocol_Address</td>
<td>Target Protocol Address</td>
</tr>
</tbody>
</table>

Examples:
1. arp.Target_Protocol_Address = 192.168.5.100 - (testing a “who is”
   192.168.5.100 arp request)
2. arp.Target_Hardware_Address = 00:11:22:33:44:01 – (did
   00:11:22:33:44:01 send out the ARP request?)

TCP
Protocol Name: TCP
Network Layer: 4
Alias: -
Fields:
<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source_Port</td>
<td>Source Port</td>
</tr>
<tr>
<td>Destination_Port</td>
<td>Destination Port</td>
</tr>
<tr>
<td>Sequence_Number</td>
<td>Sequence Number</td>
</tr>
<tr>
<td>Acknowledgment_Number</td>
<td>Acknowledgment Number</td>
</tr>
<tr>
<td>Data_Offset</td>
<td>Data Offset</td>
</tr>
<tr>
<td>Reserved</td>
<td>Reserved</td>
</tr>
<tr>
<td>NS</td>
<td>ECN-nonce concealment protection</td>
</tr>
<tr>
<td>CWR</td>
<td>Congestion Window Reduced</td>
</tr>
<tr>
<td>ECE</td>
<td>ECN Echo</td>
</tr>
<tr>
<td>URG</td>
<td>Urgent</td>
</tr>
<tr>
<td>ACK</td>
<td>Acknowledgment</td>
</tr>
<tr>
<td>PSH</td>
<td>Push</td>
</tr>
<tr>
<td>RST</td>
<td>Reset</td>
</tr>
<tr>
<td>SYN</td>
<td>Synchronize Sequence Numbers</td>
</tr>
<tr>
<td>FIN</td>
<td>Finish</td>
</tr>
<tr>
<td>Window_Size</td>
<td>Window Size</td>
</tr>
<tr>
<td>Checksum</td>
<td>Checksum</td>
</tr>
<tr>
<td>Urgent_Pointer</td>
<td>Urgent Pointer</td>
</tr>
</tbody>
</table>
Examples:
1. `tcp.Destination_Port = 80` or `tcp.Destination_Port = 443` - *(is it port 80 – http or port 443 – https)*
2. `tcp.Sequence_Number % 10 = 0` – *(this could be used to drop every 10th packet of a TCP stream)*

**UDP**

**Protocol Name:** UDP  
**Network Layer:** 4  
**Alias:** -  
**Fields:**

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source_Port</td>
<td>Source Port</td>
</tr>
<tr>
<td>Destination_Port</td>
<td>Destination Port</td>
</tr>
<tr>
<td>Length</td>
<td>Length</td>
</tr>
<tr>
<td>Checksum</td>
<td>Checksum</td>
</tr>
</tbody>
</table>

Examples:
1. `udp.Destination_Port = 53` *(is it port 53 and udp i.e. normally dns)*
Appendix D – The Management Console

The Management Console is a text-based console allowing configuration and diagnosis of the NE-ONE when the requirements exceed the capability of the LCD Panel.

**WARNING:** The Management Console facility is only to be used under the supervision of iTrinegy Technical Support. Other than diagnostic and recovery facilities all the other management console functions are available from the LCD or the web GUIs.

There are two methods of accessing the console:

### Accessing via the Network

The NE-ONE Appliance has a Management (MGMT) port on the back of the unit and this is labelled MGMT. All the Emulation and Profiling Ethernet ports are on the front of the Appliance, so there is little room for confusion.

On the NE-ONE Appliance you can find the systems IP Address displayed in the LCD panel option: Network Settings -> Show IP Address.

Using the Management Port (MGMT) IP Address you can connect to the Appliance using your favorite SSH capable terminal software e.g. PuTTY on Windows or the `ssh` command on Mac/Linux.

Start a ssh terminal session using an appropriate terminal session and connect it to the NE-ONE Appliance (192.168.202.178 using PuTTY in this example):

Click **Open** and you'll see the login prompt.

Log in to the system using the username and password provided with the delivery instructions.

### Using a Keyboard and Monitor

You can also connect directly to the NE-ONE Appliance using a **USB Keyboard** and **HDMI Monitor/TV**.

Connect the appropriate monitor and USB keyboard to the Appliance, and after the Emulator is fully booted press the “**Enter**” key and you'll see the login prompt.

**Logging into the Console**

Log in to the system using the username and password provided by iTrinegy Technical Support. Whether you're directly connected via keyboard and
monitor or via ssh/PuTTY you will get one of these console menus.

You are now connected to one of the consoles which displays a menu, which, as you can see has a number of options.

**WARNING:** The Management Console facility is only to be used under the supervision of iTrinegy Technical Support. Other than diagnostic and recovery facilities all the other Management Console functions are available on from the LCD or the web GUIs.
Appendix E – SSL Certificate Warning

When you try to access the Emulator over the SSL (Secure Socket Layer) protocol, it has to identify itself with an SSL certificate to the web-browser.

In order for web-browsers to trust the certificate that the server has presented, the SSL certificate must be issued by a valid Certificate Authority (CA).

The default NE-ONE SSL certificate is a self-signed one, essentially meaning that it has not been issued by a CA, but instead NE-ONE has signed the certificate as being valid.

This works perfectly fine for encrypting data, but it will present you with an error or warning in your web-browser when trying to access the secure content. Below are examples of this from popular web-browsers:

**Google Chrome**

![Google Chrome SSL Warning](image)

Click on Advanced, then *Proceed to 192.168.202.194 (unsafe)* to bypass SSL warning in Chrome.
Mozilla Firefox

Click on *I Understand the Risks*, then click on *Add Exception*....

Next click on *Get Certificate*, and finally *Confirm Security Exception* to bypass SSL warning in Firefox.

Microsoft Edge

Click on *Continue to this webpage (not recommended)* to bypass SSL warning in Edge.
The above warnings are simply letting you know that the SSL certificate was self-signed. In the case of accessing NE-ONE this isn't a problem at all, and you can simply tell your web-browser to accept the self-signed SSL certificate and continue.

Where you would typically take caution on these types of errors would be if you were accessing your bank or an ecommerce website as it could be an indication that your secure data isn't going to the right server.
Appendix F – Browser Compatibility

The following information is related to the Emulator Web GUI for browser compatibility:

The Web GUI uses ExtJs 6 (which has the same browser support as ExtJs 5)

The following browsers support the current Web Gui:

MS IE11 (standards mode only)
Firefox 12+ (PC and MAC)
Safari 6+
Chrome 18+
Opera 12+ (PC and MAC)
MS Edge