NWAM Spec v2.0

23 Feb 2011

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Change History

Revision	Description	Author	Date
2.0	Multiple changes for Highlander project, which introduces support for Fixed network configuration profiles (NCPs), in addition to the existing type of NCPs, which are now known as “Reactive” NCPs. Areas affected: panel icon, panel menu, connection status view, network profile view, locations dialog, network modifiers dialog. This and future versions of the spec will *not* be posted to opensolaris.org, where the change history was previously maintained. The Change History has been moved into the document instead.	Calum Benson	2011 Feb 22
1.17.0	Add 'Advanced Resolver Settings' section to name services dialog, as required by CR 6944603.	Calum Benson	2010 Aug 20
1.16.0	Replace 'VPN Applications' with 'Network Modifiers' throughout, per agreement on nwam-dev list.	Calum Benson	2010 Feb 05
1.15.2	Indicate which functions are disabled if user only has Network Autoconf User rights profile. Add 'Switched profile' notification message, which is already implemented but wasn't in the UI spec.	Calum Benson	2010 Feb 03
1.15.1	Remove ability to restore previous password in Edit Wireless Network dialog by pressing Esc while typing in password field, due to implementation issues; Esc now just activates the Cancel button. Modify Add/Edit Network Profile behaviour for consistency with Add/Edit Location and VPN Application behaviour.	Calum Benson	2010 Jan 15
1.15	Changes for bugs 12886 (multiple NCP support), 12593 (nsswitch file selection), 12941 (saved wireless passwords), 13141 (new NCP rule for locations and ENMs), 12994 (show signal strength as text), 12917 (add to favourites behaviour). See bug reports for full details.	Calum Benson	2009 Dec 15
1.14	Modify panel icon status logic, per bug 12079. Show VPN Application status in panel icon tooltip. Clarify behaviour of IPv6 configuration UI. Fix typo in Name Services tab spec.	Calum Benson	2009 Nov 23
1.13	Add Refresh button to Wireless Chooser dialog.	Calum Benson	2009 Nov 4
1.12	Remove functionality that won't make it into Phase 1: Network Services tab, ability to rename Locations and VPN Applications once committed to system, ability to rename NCUs, wireless security types other than WEP and WPA Personal, option to join an open network if no favorite networks available, and all "Ask Before" options on wireless tab. Minor tweaks: clicking panel icon should open Network Prefs rather than Location Prefs dialog, and Connection Properties view now only shows manually enabled NCUs, plus NCUs in the active priority group.	Calum Benson	2009 Oct 14
1.11	Updates to Connection Properties, Connection Status and Network Profile views to accommodate possibility of simultaneous DHCP and static IPv4 connections, and to reflect the source of IPv6 addresses (static, stateful or stateless).	Calum Benson	2009 Aug 17
1.10	Revert erroneous bits about Automatic NCP now being editable (it's not), and update Locations dialog and panel icon submenu for latest proposal in bug #9561.	Calum Benson	2009 Aug 07
1.9	Updates related to bug numbers 9561 (two extra controls in Locations dialog), 9653 (Automatic profile should be editable), 9705 (User profile should be created on demand), 9495 (wireless-related menu items should be disabled/hidden depending if wireless NIC disabled/not present), 9821 (remove "ask before joining any favorite network" option), and 9646 (remove IPSec Key configuration).	Calum Benson	2009 Jul 30
1.8.4	Incorporate final activation status icons from Bruce.	Calum Benson	2009 Apr 27
1.8.3	Minor terminology change, from "Location Preferences dialog" to "Network Locations dialog", for consistency and to better reflect purpose.	Calum Benson	2009 Apr 06

Revision	Description	Author	Date
1.8.2	Change menu item from Preferences>Location to Admin>Network Locations, since these are system-wide settings, not per-user. Change what happens if user inputs a CIDR (w.x.y.z/n) IP address (no longer try to convert it and display it as separate IP/subnet fields, but just disable the subnet field instead. Rationale: generally better to show the user's data in the format *they* prefer, where possible.). Include the location name in the condition text for location rules dialog. Show wired icon on panel instead of old NWAM icon, if no wireless interfaces present. A couple of other doc cleanups that don't affect functionality.	Calum Benson	2009 Mar 26
1.8.1	Update Name Services tab to include Servers field for LDAP (unintentionally omitted from v1.8), hide the Advanced button from the Connection Status view for Phase 1, and replace inconsistent usage of "Profile" and "Connection Profile" with "Network Profile" on panel menu and in Connection Status view.	Calum Benson	2009 Mar 18
1.8	Update Network Profile view, Name Services tab, VPN Applications dialog and list of available Rules to match latest NWAM spec and improve usability.	Calum Benson	2009 Mar 11
1.7.1	Allow multiple BSSIDs to be associated with an ESSID, and fix a copy/paste error in the first panel status icon table.	Calum Benson	2009 Jan 29
1.7	Multiple changes to reflect latest version of NWAM Phase 1 functional spec. Primarily: support priority groups in network profile view; support conditional locations and ENMs; updated Security (previously IPfilter) and Network Services tab in Location Properties dialog. Task flow improvements: show wireless strength in notification icon; separate location switching and editing into different dialogs; pull condition editing out into a separate dialog rather than using expander widgets.	Calum Benson	2008 Dec 22
1.6	Incomplete update for internal review; not uploaded to website.	Calum Benson	2008 Oct 24
1.5	Changes as per proposal. Also: update icons to match preview of delivery from visual designers; some additional panel context menu re-arrangement (p2); notification balloon simplification (p4); addition of a more general "Repair" button in the status window (p7); layout changes to wireless-related menus and dialogs to accommodate icon delivery. Removed storyboard section at end of document until it can be properly updated to match spec (v1.5.1 reflects this change on the Contents page, which I forgot to update at the time-- there are no other changes in v1.5.1).	Calum Benson	2007 Nov 8
1.4	Applet redesign (now a single icon again), support switching environments and wireless networks manually, add Proxies tab to Environment dialog, remove hostname/domain/router controls until interaction with Duckwater name services management is clarified, simplify IPv6 controls, update available wireless security types, change 'preferred networks' to 'favorite networks'.	Calum Benson	2007 Jun 20
1.3	First version of this design posted to opensolaris.org. Separate out Environment dialog, add support for multiple IP addresses and VPN. Revised JDS applet design.	Calum Benson	2007 May 18
1.2	Numerous updates based on team comments.	Calum Benson	2007 Mar 26
1.1	First version of this design.	Calum Benson	2007 Mar 14

Link Types and Names

In various parts of the NWAM GUI, it is necessary to display a string that uniquely identifies a link configured on the system. The format used for links in both Fixed and Reactive network connection profiles is *LinkType (Name)*, for example:

Wired (net0)

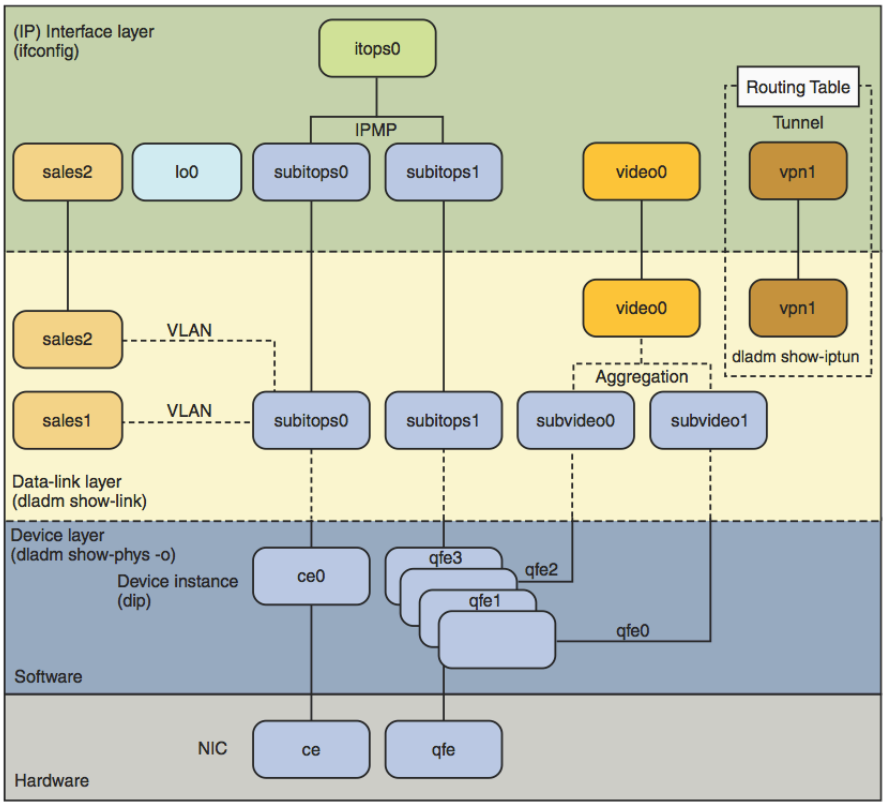
Tunnel (vpn1)

where:

- *LinkType* is one of:
  - **Aggregation**: an aggregated link as listed by `dladm show-aggr`
  - **Bridge**: a bridge as listed by `dladm show-bridge`
  - **IPMP Group**: an IPMP group as listed by `ipmpstat -g`
  - **Tunnel**: an IP tunnel link as listed by `dladm show-iptun`
  - **VLAN**: a virtual Local Area Network as listed by `dladm show-vlan`
  - **VNIC**: a virtual Network Interface Card as listed by `dladm show-vnic`
  - **Wired**: a wired physical link as listed by `dladm show-phys`
  - **Wireless**: a wireless physical link as listed by `dladm show-phys`
- and *Name* is either:
  - the link's vanity name as defined by the user, or the default hardware device name if no vanity name is defined
  - for IPMP groups, the GROUP (*not* the GROUPNAME) as reported by `ipmpstag -g`

When displaying a list of links in the GUI, each IP NCU is merged with the link NCU directly underneath. *(Comment from Renee: I think that's a reasonable approach. Though it does make for some odd dissonance in the state--a physical link could either be 'Not plumbed' or 'Up', depending on whether or not it's underneath another link, for example. But that might be okay.)*

For example, consider these two network topology diagrams for a Fixed network connection profile:

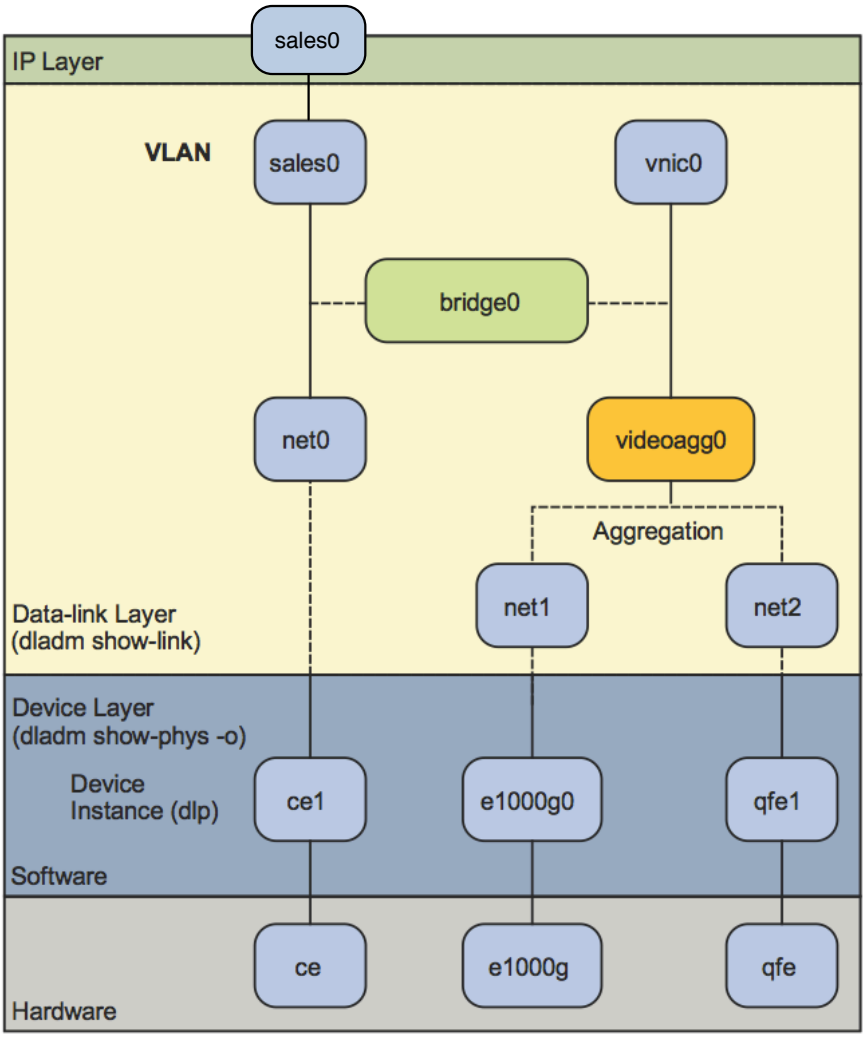


The list of links and link names that would appear in the GUI for this configuration would be:

Aggregation (video0)
IPMP (itops0)
Tunnel (vpn1)
VLAN (sales1) - *note: not plumbed*
VLAN (sales2)
Wired (qfe1)
Wired (subitops0)
Wired (subitops1)
Wired (subvideo0)
Wired (subvideo1)

Note that for links that have been plumbed into the IP layer -- in this case, VLAN (sales2), Aggregation (video0), and Tunnel (vpn1) -- only the underlying link is listed. However, in some cases, when showing the properties of the link, it will be useful to show some properties of the plumbed IP link, too.

The loopback interface is not shown in the GUI as it is not part of any network profile.



The list of links and link names that would appear in the GUI for this configuration would be:

Aggregation (videoagg0)
Bridge (bridge0)
VLAN (sales0)
VNIC (vnic0) - *note: not plumbed*
Wired (net0)
Wired (net1)
Wired (net2)

Note that for data links that have been plumbed into the IP layer -- in this case, VLAN (sales0) -- only the underlying link is listed. However, in some cases, when showing the properties of the link, it will be useful to show some properties of the plumbed IP link, too.

Panel Icon

The *Network Status notification icon* is shown in the panel's status notification area at all times, and is the primary means by which you will interact with NWAM. It is the focus for information messages about changes to your network status, and its menu allows quick access to essential network functionality.

The icon's appearance indicates your current level of network connectivity (via the emblem overlaid on the icon).

When a Reactive Network Profile is active

	**Full**: All manually-enabled connections in the active network profile are online, and the required number of connections in the active profile group (if such a group exists) are online. The "required number" means: one connection for groups of priority type *Exclusive;* one or more connections for groups of priority type *Shared*; and all of the connections in the group for groups of priority type *All*.
	**Partial**: The NWAM service is running normally, but one or more manually-enabled or priority group connections are offline such that the status is not 'Full Connectivity', as defined above. This status emblem is also shown if a wireless connection is pending user input, such as the choice of an available wireless network to connect to, or the input of a WEP/WPA key.
	**Offline**: The physical:default service is disabled or in maintenance mode.

When a Fixed Network Profile is active

	**Full**: The status of all plumbed links is 'up', and the status of all configured IPMP groups is 'ok'.
	**Partial**: The status of or more plumbed links is 'down', and/or the status of one or more IPMP groups is 'degraded or 'failed'.
	**Offline**: The physical:default service is disabled or in maintenance mode.

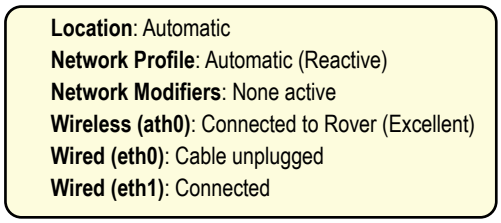
If one or more wireless interfaces are online, the main part of the icon shows the current wireless signal strength instead of the generic network icon. If multiple wireless interfaces are online, the average signal strength is indicated. The emblem is still used to represent your overall network connectivity, that is:

	Full connectivity (Fixed or Reactive NCP)
	Partial connectivity (Fixed or Reactive NCP)
	Offline: the physical:default service is disabled or in maintenance mode (Fixed or Reactive NCP)

Clicking the panel icon opens the Network Preferences dialog (p??).

When you hover the mouse over the icon, the tooltip shows the name of the currently active location, the name and type of the active network connection profile, and the status of any active network modifiers. The rest of the information depends on whether a Fixed or Reactive network profile is active:

- *Reactive*: the tooltip lists the status of any manually-enabled connections, and the status of connections in the active priority group (if there is one), ordered alphabetically by link name. For example:

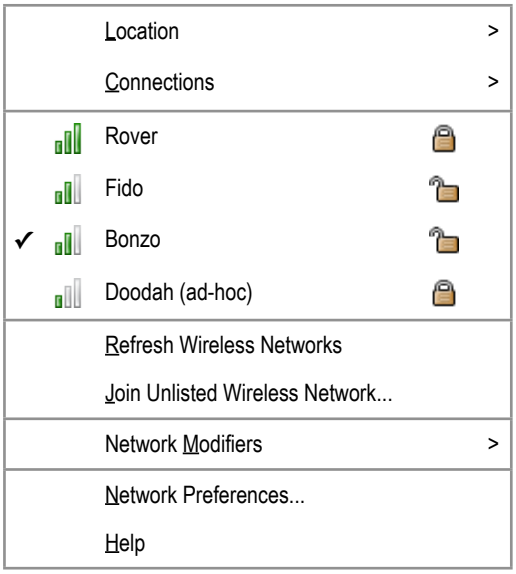


- *Fixed*: the tooltip lists the status of all configured links, as described in Link Types and Names (p??), ordered alphabetically by link name. For example:

The Network Modifiers item lists any currently-running network modifier, e.g. “CiscoVPN active” if a single application is active, “*n* active” if two or more applications are running, or “None active”.

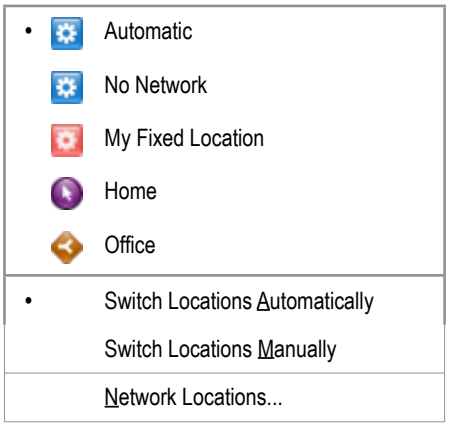
Panel Icon Context Menu

This menu is posted by right-clicking the panel icon:



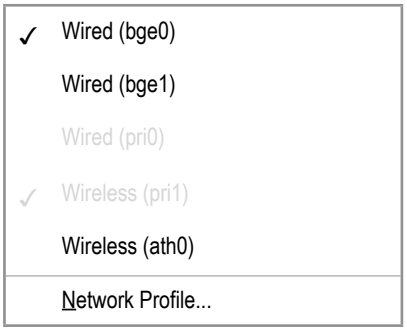
The function of the menu items is as follows:

- *Location* reveals a submenu *(TBD: Need an additional icon for Fixed locations from xDesign)*:



  - First section lists each available location, with an icon representing its activation type: system, fixed, manual or conditional. The current location is represented by a radio button indicator (•). If the *Switch locations manually* menu item is selected, then choosing a location other than the current location attempts to activate that location. Fixed locations are always greyed-out because they cannot be manually activated.
  - *Switch locations automatically (radio button, selected by default)*: When this mode is selected, you have no direct control over location changes, so all the locations in the submenu are grayed-out. The most appropriate System or Conditional location will be activated at any time, in response to network environment changes.
  - *Switch locations manually (radio button)*: In this mode, you have full control over location changes, so each location in the submenu can be activated by selecting it, regardless of its activation type. Any location you activate in this way will remain active until you activate a different location, or select *Switch locations automatically*.
  - *Network Locations* opens the Network Locations dialog (p??). This menu item is only enabled for user accounts that have been assigned the Network Autoconf Admin rights profile by a system administrator.

- *Connections* reveals a submenu:



  - First section lists each connection in the current network profile, in the same order they are listed in the Network Profile view (p??). Enabled connections are shown with a check mark. Selecting an enabled connection attempts to disable it, and vice versa.

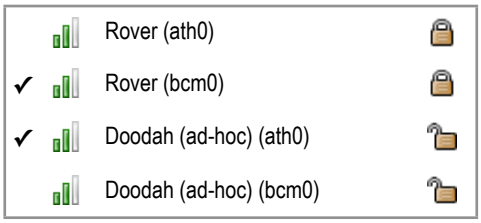
    If a Reactive network profile is active, connections of activation type Prioritized (pri0 and pri1 in example) are greyed-out, since they cannot be manually enabled or disabled.

    If a Fixed network profile is active, *TBD: What do we need to grey-out here if a Fixed network profile is active? Should it be possible to bring any links up/down using this menu? If so, which link types?*

  - *Network Profile* opens the Network Preferences dialog (p??), with the Network Profile view (p??) selected. This menu item is only enabled for user accounts that have been assigned the Network Autoconf Admin rights profile by a system administrator.

- The next section of the menu is a combined list of available favorite wireless networks, and any other currently available networks that are broadcasting their ESSID. The list is ordered by current signal strength, strongest first. Signal strength indicator is shown first, then ESSID followed by "(ad-hoc)" for ad-hoc networks, then secure/open indicator (right-aligned).

  If you have *N>1* active wireless interfaces, each wireless network is shown N times, with the link name appended in parentheses, and each connection marked with a check mark. For example:



  Any network to which you are currently connected is indicated with a check mark indicator (✓) to the left of the signal strength indicator.

  If no networks are available to be listed in this section, a single disabled menu item is shown: "No wireless networks detected".

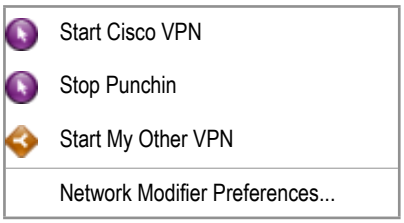
  If no wireless connections are currently enabled, a single disabled menu item is shown, "No wireless connections enabled". If no wireless NICs are installed, this section of the menu is hidden altogether.

  Selecting the ESSID of a network to which you are not currently connected attempts to connect to that network. If connection fails, you are re-connected to your previous wireless network, if any. This manual switching of networks does not affect any stored network configuration, and lasts until the next manual or automatic switch of locations occurs. *TBD: Hopefully this behaviour is also possible when a Fixed network profile is active?*

  Selecting the ESSID of a network to which you are already connected has no effect.

- *Refresh Wireless Networks* causes the list of available wireless networks and their signal strengths to be re-scanned and updated in the menu. This menu item is disabled if no wireless connections are currently enabled, and hidden if no wireless NICs are installed.
- *Join Unlisted Wireless Network...* opens the Join Wireless Network dialog (p??) with no details pre-filled, to allow you to connect to a network that is not broadcasting its ESSID. Once connected to any such network, it appears on this context menu in the list of favorite and available networks. If the network was not added to the list of favorites when connecting, it will disappear from this list again after the next disconnection.

  This menu item is disabled if no wireless connections are currently enabled, and hidden if no wireless NICs are installed.
- *Network Modifiers* submenu has one menu entry for each network modifier defined in the Network Modifiers dialog (p??) if any, in the same order as they are defined there, followed by a *Network Modifier Preferences* menu item. E.g:

  - Each entry in the first section contains an icon indicating the network modifier's activation type: manual or conditional, followed by *Start <name>* for network modifiers that are not running, and *Stop <name>* for those that are currently running. The entries for conditional network modifiers are greyed-out since you cannot manually start/stop a conditional ENM.

    If a Fixed network profile is active, selecting a *Start* menu item opens the alert box described here, and the network modifier is not started.
  - The *Network Modifier Preferences* menu item opens the Network Modifiers dialog (p??). This menu item is only enabled for user accounts that have been assigned the Network Autoconf Admin rights profile by a system administrator.
- *Network Preferences* opens the Network Preferences dialog (p??). This menu item is only enabled for user accounts that have been assigned the Network Autoconf Admin rights profile by a system administrator.
- *Help* opens the help browser at a page appropriate to this context menu.

Notification messages

A notification message appears when a significant change of network status occurs. All messages are shown for the system default length of time before disappearing again.

Connection events

When a Reactive network profile is active, the following link events should trigger a notification message:

Event	Message format	Example
A wired connection is established.	**InterfaceType (LinkName) connected** Address: IPv4 and/or IPv6 address Speed: Connection speed *	**Wired (eth0) connected** Address: 192.168.1.1 Speed: 100Mb/s
A wireless connection is established.	**InterfaceType (LinkName) connected to ESSID** Address: IPv4 and/or IPv6 address Signal strength: [Very Weak|Weak|Good|Very Good|Excellent] Speed: Connection speed *	**Wireless (ath1) connected to Rover** Address: FEBC:A574:382B:23C1:AA49:4592:4EFE:9982 Signal strength: Very Good Speed: 11 Mb/s
A wired connection is dropped.	**InterfaceType (LinkName) disconnected** Reason *	**Wired (eth0) disconnected** Cable unplugged
A wireless connection is dropped.	**InterfaceType (LinkName) disconnected from ESSID** Click this message to view other available networks**	**Wired (ath1) disconnected from Rover** Click this message to view other available networks
A wireless connection attempt failed.	**Unable to connect to ESSID1** Trying ESSID2 instead***	**Unable to connect to MyOffice** Trying MyHome instead
No wireless networks were found.	**No wireless networks found** Click this message to join an unlisted network****	**No wireless networks found** Click this message to join an unlisted network

* Clicking the message opens the Connection Properties view (p??) for the interface in question

* * Clicking the message opens the Wireless Network Chooser dialog (p??)

* * * Only shown if the user has manually attempted to connect to ESSID1, e.g. via the panel icon menu

* * * *Clicking the message opens an empty Join Wireless Network dialog (p??)

TBD: What link status notifications can/should be shown when a Fixed network profile is active, and for which link types? With the possibility of many links going up/down at the same time, showing one notification for each event could be rather annoying, and not necessarily useful. So perhaps it's best not to show any, for now?

Network profile events

The following network profile events should trigger a notification message:

Event	Message format	Example
The network profile has changed to a Reactive profile.	**Switched to profile 'Name'** This is a Reactive network profile.	**Switched to profile 'Automatic'** This is a Reactive network profile.
The network profile has changed to a Fixed profile.	**Switched to profile 'Name'** This is a Fixed network profile.	**Switched to profile 'Acme VPN'** This is a Fixed network profile.

Location events

The following location events should trigger a notification message:

Event	Message format	Example
The location has changed.	**Switched to location 'Name'** This is a System|Fixed|Manual|Conditional location.	**Switched to location 'Home'** This is a Manual location.

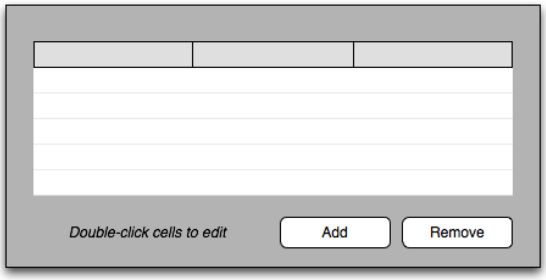
Editable Tables

The remainder of this document describes the *Network Preferences* and *Locations* dialogs, both of which include, in various places, tables whose contents can be edited by the user.

The general specification for editable tables is described here, and will be referenced as required from elsewhere in the document.

Initial State

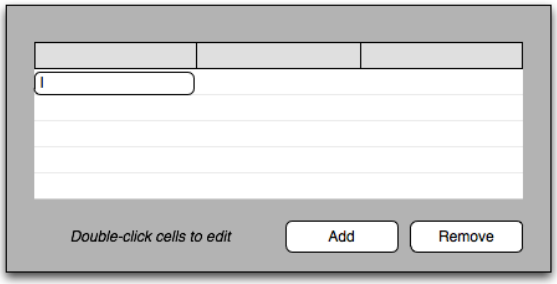
Editable tables have adjacent **Add** and **Remove** buttons, and inline help text that reads "Double click table cells to edit". An empty table will therefore look something like this:

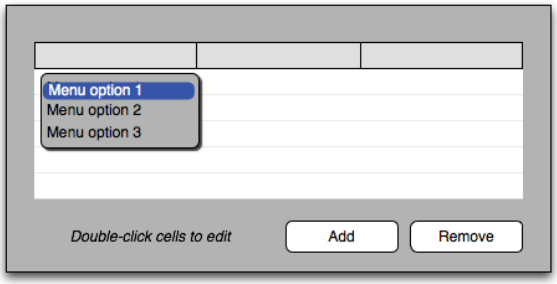


Entering a new row

User initiates entry of a new row by clicking the **Add** button, or by double-clicking any cell on any empty row. The **Add** button is enabled at all times, except while a row is already being added.

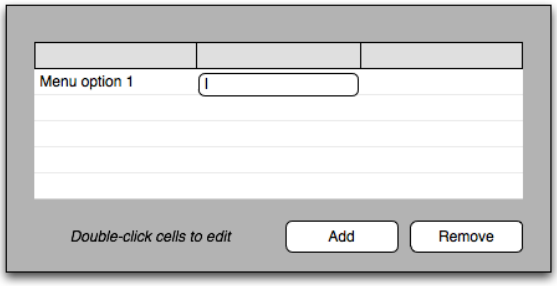
When a row is added, an input control is shown overlaying the first cell in the first empty row, and given keyboard focus. This control will usually be a text field, but it may also be a combo box or a popup menu:





At this point, the user has three choices:

1. **Complete the entry for this cell**: enter text and press *Return* or *Tab* (for a text field), or select a menu item using up/down arrows and press *Return* (for a menu choice), or click the desired menu choice with the mouse. The overlaid control is replaced by the text that was entered/chosen, and focus moves to the next cell in the row:

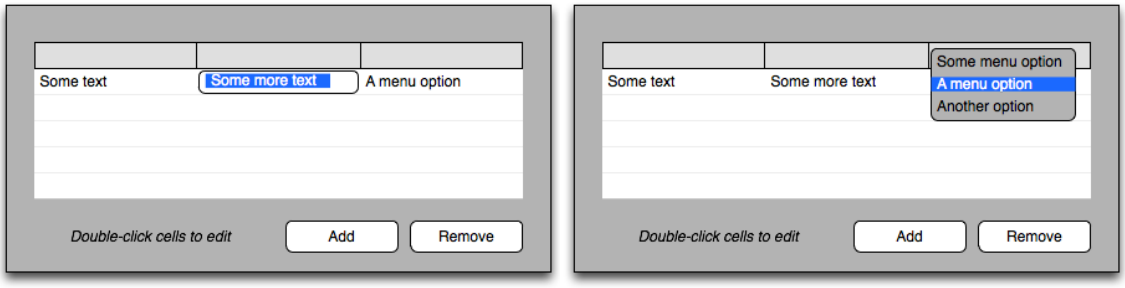
   When the last cell in a row is entered, focus moves to the first cell of the next row, allowing entry of another row, unless otherwise specified for a particular table.

2. **Move to another cell**: press *Tab* to move focus to the next cell in the row, or *Shift+Tab* to move focus to the previous cell in the row. If the user enters any text before pressing *Tab*, the text is retained. Focus wraps between rows, but not between the first cell and the last cell in the table.

3. **Cancel entry for the entire row**: press *Esc*. All cells in the row are cleared, and keyboard focus returns to the **Add** button in the dialog.

Editing a cell

Double-clicking a non-empty cell causes its input field to be displayed and focused, with the current cell contents pre-selected:

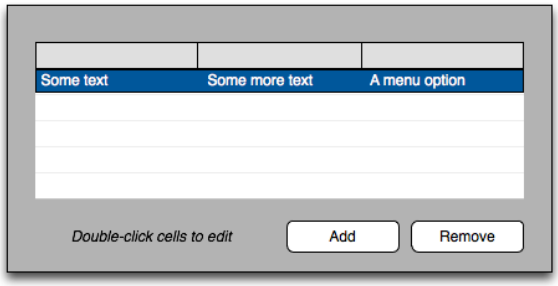


From here, behaviour proceeds as though the user were part way through entering a new row, except that pressing *Esc* does not clear the row. Instead, *Esc* cancels any pending changes to that cell, and returns focus to the *Add* button.

Removing a row

A row can be removed in two ways.

1. Select the row, then click the **Remove** button. A row is selected by clicking any cell in the row, causing the entire row to be highlighted. Multiple row selection is allowed in the usual way (using *Ctrl* and/or *Shift*) unless otherwise specified for a particular table. Empty rows cannot be selected.

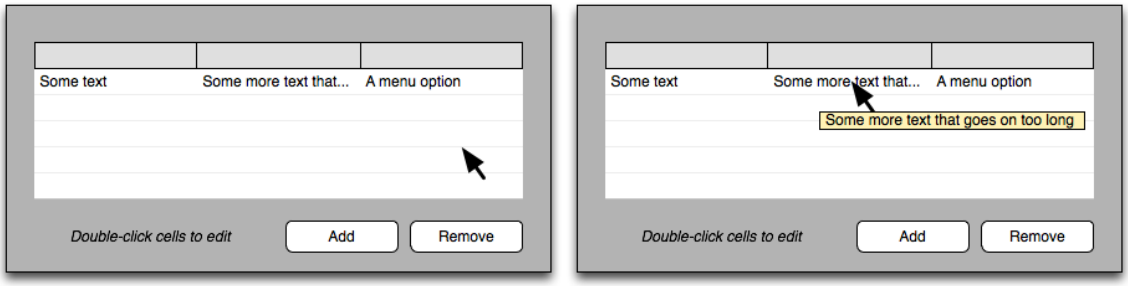


2. Click the **Remove** button while any cell is being edited. That cell's entire row will be removed.

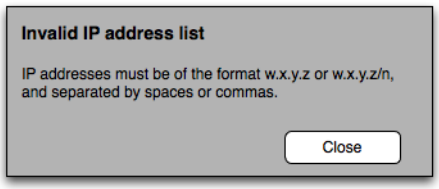
The **Remove** button is disabled at all other times.

Other behaviour

Table cells whose contents are not fully visible are ellipsised, and given a tooltip that shows the entire cell contents.



Input validation is performed whenever focus leaves a cell that is being edited, either explicitly (e.g. by pressing *Enter*) or implicitly (e.g. by clicking the dialog's **OK** button whilst editing a cell). If validation fails, an alert is shown that indicates the problem and the input required. Closing the alert returns focus to the invalid cell in the table.



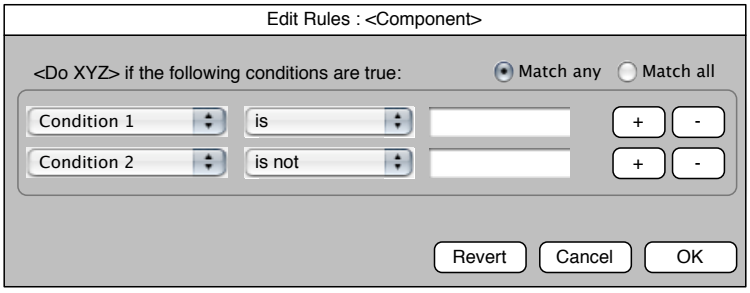
Rules Dialog

The Rules Dialog is accessed from the Network Locations dialog and the Network Modifiers dialog.

The specific rules available differ for each of those purposes, and are listed in the appropriate section. This section describes the general behaviour of the Rules Dialog, regardless of the specific rules provided.

Components

The dialog has three components: the condition text, the rule combination radio buttons, and the condition table.



By default, the condition text is "If the following conditions are true:". This text can be changed for any given instantiation of the dialog, typically to "Do <something> if the following conditions are true:".

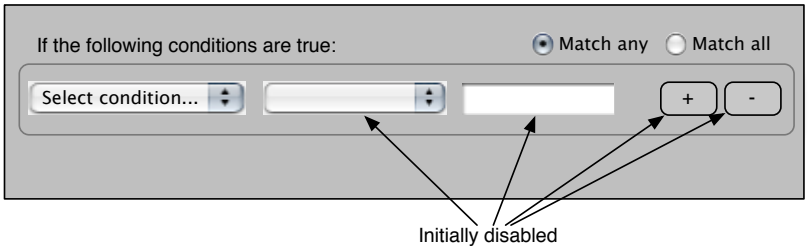
The rule combination radio buttons are a group of two radio buttons labelled **Match any** and **Match all**. The radio buttons may be hidden for any given instantiation of the dialog.

The conditions themselves comprise a dynamic table (explained below).

Initial State

The title of the Rules Dialog is "Edit Rules : <Purpose>". For example, "Edit Rules : Home" for a conditional location, or "Edit Rules : Punchin" for a conditional network modifier.

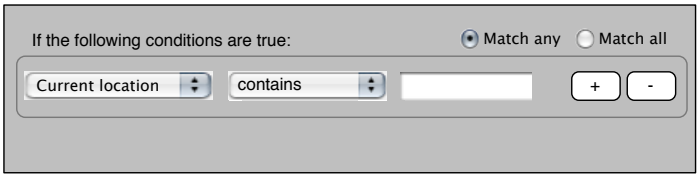
The initial state of the conditions table is as follows:



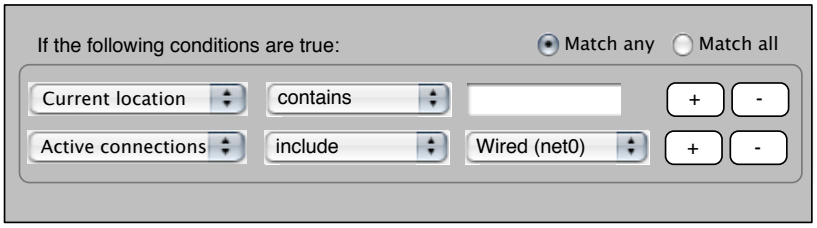
Specifically:

- **Match any** radio button is selected by default, if the radio buttons are present
- One row of controls is initially visible, the first of which is a dropdown menu showing the entry *Select condition....* The remaining controls in the row are disabled.

The user proceeds by selecting a condition from the first dropdown list. When any item other than Select condition is selected, all the remaining controls in the row become active, and the Select condition item is removed from the list so it can no longer be directly selected. Also, one or more of the intermediate controls may change type, e.g. from a dropdown list to a text field, to accommodate the chosen condition:



At this point, the user can either return to the initial *Select Condition* state by clicking the **Remove** ("-") button, or add a new rule row by clicking the **Add** ("+") button:



The user need not complete any blank fields before clicking the **Add** button; rule validation will not be performed until later.

Each new condition added begins with the first unspecified item in the first dropdown list, where possible. For example, if the available conditions are *Current location*, *Any system domain name* and *Any IP address*:

- User adds an initial rule, "Current location is Home", then clicks **Add**
- The first dropdown of the new rule is set to the first item on its list that hasn't been used yet, *Any system domain name*
- User edits new rule to read "Any IP address is 192.168.1.1", then clicks **Add**
- At this point, *Any system domain name* is still the first unused item on the list, so the first dropdown of the new rule is set to *Any system domain name*.

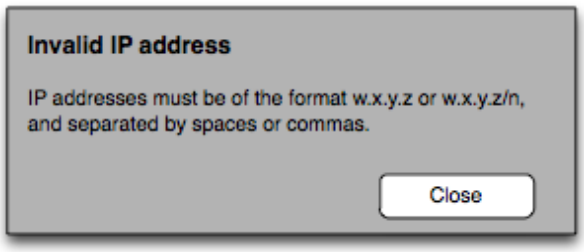
When all rule types have been exhausted, clicking **Add** adds another rule of the same type, if two rules of the same type are permissible for that component. If they are not permissible, a rule of the first permissible type on the list is added.

Removing Rows

The user can remove any row at any time by clicking its **Remove** ("-") button. When the **Remove** button of the last remaining row is clicked, the component is returned to its initial *Select Condition...* state.

Validation

Rule validation is performed whenever the user closes the dialog containing the component. If validation fails, an alert is shown that indicates the problem and the input required:



Closing the alert returns focus to the invalid entry field in the rule construction component.

Revert

The dialog has a **Revert** button in addition to the usual **OK** and **Cancel** buttons. Clicking **Revert** causes any changes made since the dialog was opened to be discarded, but the dialog remains open for further editing.

Available Conditions

The following conditions are available. Not all will be required/available for each instantiation of the dialog.

Active connections	DL: include, do not include	DL: list of all available NCUs
Active network profile	DL: is, is not	DL: list of all available NCPs
Any IP address	DL: is, is not, is in range, is not in range	<string>
Any advertised domain name	DL: is, is not, contains, does not contain	<string>
Any system domain name	DL: is, is not, contains, does not contain	<string>
Current location	DL: is, is not	DL: list of all defined locations
Running network modifiers	DL: include, do not include	DL: list of all available ENMs
Wireless network name	DL: is, is not, contains, does not contain	EC: list of favorite networks
Wireless network BSSID	DL: is, is not	<string>

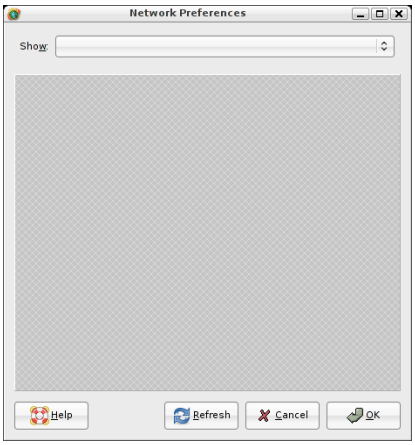
DL=dropdown list

EC=editable combo, into which user can either type or select from dropdown

<string> = text field

Network Preferences Window : Overview

This window is where you can configure individual network connections, and view the current state of each network connection. It offers access to various views, between which you switch using a dropdown list at the top of the window:



You open this dialog by either:

- Selecting *System>Administration>Network*, or
- Clicking the panel status icon, or
- Selecting *Network Preferences*... from the panel status icon context menu.

The Network Preferences dialog is only available to user accounts that have been assigned the Network Autoconf Admin rights profile by a system administrator.

The *Show* dropdown list comprises several groups:

- *Connection Status*, *Network Profile*,
- For each Reactive network profile, a list of all connections defined in that profile
- a list of all Fixed network profiles followed by a menu item, “How to Edit Fixed Profiles...”

For example:

Connection Status
Network Profile
Automatic Profile
Wired (hme0)
Wired 1 (hme1)
Wireless (bcm0)
User Profile
Wired 1 (hme1)
Wireless (bcm0)
Acme VPN
Another Fixed Profile
How to Edit Fixed Profiles...

The header items (“Automatic Profile” ,“User Profile”, “Acme VPN” and “Another Fixed Profile” in this example) are disabled items in bold, italic text.

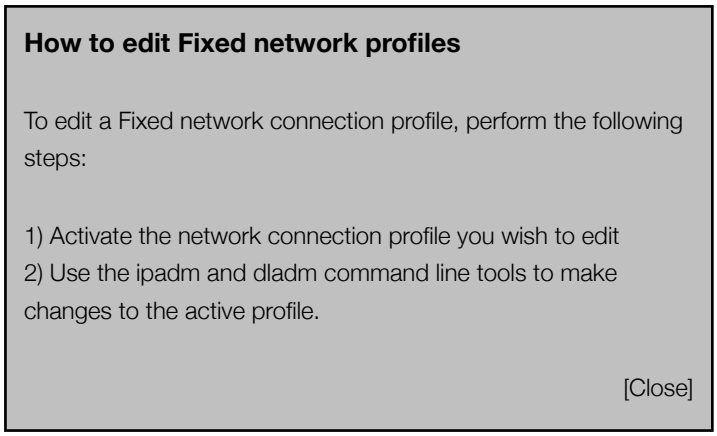
Default view is Connection Status View (p??).

Selecting *Connection Status* from the dropdown list switches to the Connection Status View (p??)

Selecting *Network Profile* switches to the Network Profile View (p??)

Selecting a connection name from the dropdown list, or double-clicking it in connection status view, switches to the Connection Properties View (p??)

Selecting *How to Edit Fixed Profiles...* opens an alert box describing how to edit Fixed network connection profiles:



Refresh causes the NWAM subsystem to be refreshed, wireless networks rescanned, and the dialog updated if required.

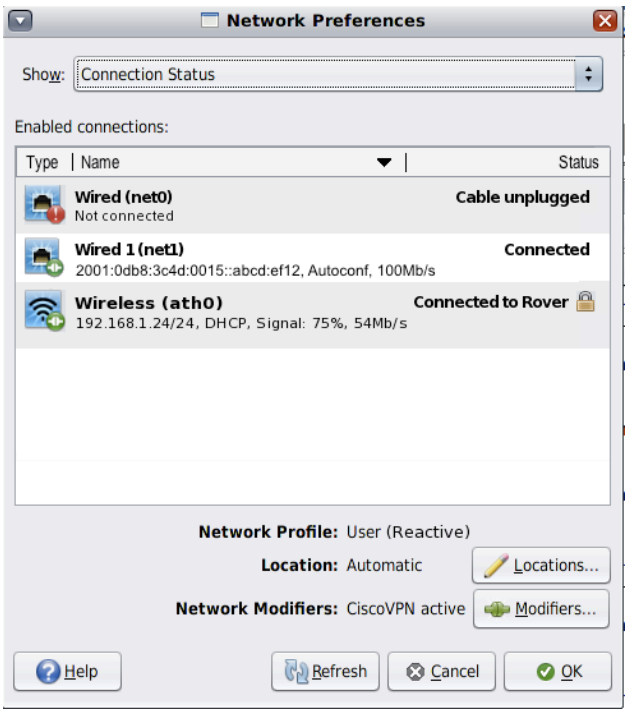
Cancel closes the dialog without applying any pending changes.

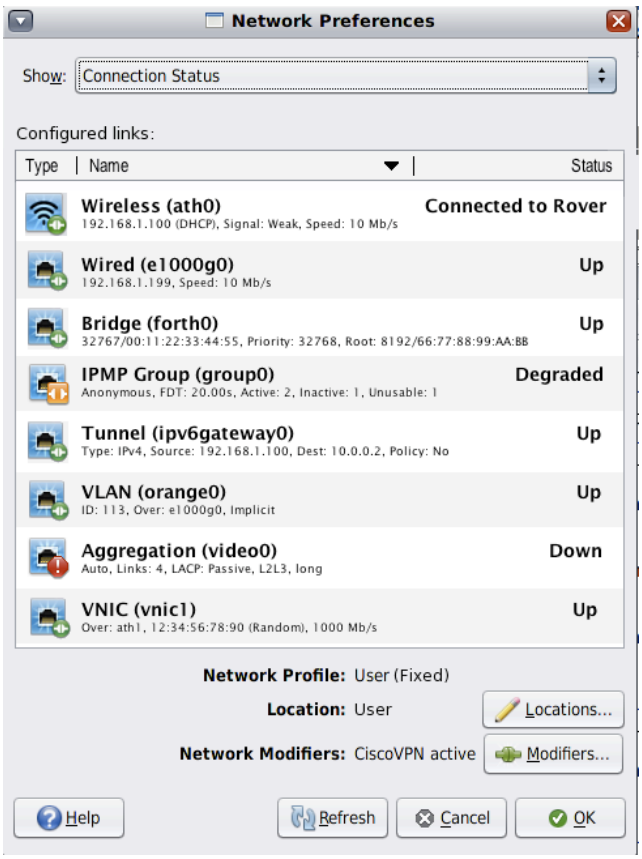
OK closes the dialog and applies any pending changes, causing the NWAM subsystem to be refreshed.

Network Preferences : Connection Status View

Show this view by selecting *Connection Status* in the dropdown list at the top. Shows information about each connection in the current profile (NCP) that is either always enabled, or part of the active priority group, as configured in the Network Profile view (p??). Connections that are always disabled, or that are part of an inactive priority group, are not shown in this view.

TBD: Icons for link types other than Wired and Wireless.





When a Reactive network profile is active, the *Enabled Connections* list shows enabled connections in the same order as in the Network Profile View (p??); that is, the order in which connections are attempted. The order cannot be changed here, however, but only in the Network Profile View.

When a Fixed network profile is active, the *Enabled Connections* label text is changed to *Configured Links*.

To order the list by link type, click the first column header. To order the list by link name (this is the default), click the middle column header. To order the list by connection status (connected, then connecting/degraded, then disconnected), click the third column header. To reverse the current sort order, click the header of the column by which the list is already sorted.

Icon indicates type of connection (wired or wireless; in later project phases, tunnel, aggregation etc.) and current status (connected/disconnected for wired or wireless, plus signal strength and security type for wireless).

Bold text for each connection shows *LinkType (Name)*. Current status is shown on the same line, right-aligned. The icons, link text and status text for each link type is as follows:

Icon	Link Class	Link Text	Status Text
	IP/Physical	**Wired (name)**	**Connected:** A wired interface is connected
	IP/Physical		**Connecting:** A wired interface is attempting to connect, but is not yet connected

Icon	Link Class	Link Text	Status Text
	IP/Physical		**Network unavailable:** Wired interface is up but non-functional, e.g. unable to contact DHCP server or gateway. **Cable unplugged:** Wired interface is enabled but cable is unplugged. **Not connected:** Wired interface is enabled but down.
	IP/Physical	**Wireless (name)**	**Connected to *ESSID*** [icon]: A wireless interface is connected to the network with the given ESSID. Icon indicates whether network is open or secured.
	IP/Physical		**Connecting to *ESSID* [icon]:** A wireless interface is connected to the network with the given ESSID. Icon indicates whether network is open or secured.
	IP/Physical		**Network unvailable**: Wireless interface is up but non-functional. **Not connected**: Wireless interface is enabled but down.
	Aggregation	**Aggregation (name)**	**Up**: Aggregation link is plumbed and up.
	Aggregation		**Down**: Aggregation link is plumbed but down. **Not plumbed**: Aggregation link has not been plumbed into the IP layer. **Unknown**: Aggregation link status cannot be determined.
	Bridge	**Bridge (name)**	**Up**: Bridge link is up.
	Bridge		**Down**: Bridge link is down. **Unknown**: Link status cannot be determined.
	VLAN	**VLAN (name)**	**Up**: VLAN link is plumbed and up.
	VLAN		**Down**: VLAN link is plumbed but down. **Not plumbed**: VLAN link has not been plumbed into the IP layer. **Unknown**: VLAN link status cannot be determined.
	VNIC	**VNIC (name)**	**Up**: VNIC link is plumbed and up.
	VNIC		**Down**: VNIC link is plumbed but down. **Not plumbed**: VNIC link has not been plumbed into the IP layer. **Unknown**: VNIC link status cannot be determined.
	IP Tunnel	**Tunnel (name)**	**Up**: Tunnel link is up.
	IP Tunnel		**Down**: Tunnel link is plumbed but down. **Not plumbed**: Tunnel link has not been plumbed into the IP layer. **Unknown**: Tunnel link status cannot be determined.
	IPMP Group	**IPMP Group (group)** *or* **IPMP Group (Anonymous)**	**OK:** All interfaces in the group are usable.
	IPMP Group		**Degraded:** Some (but not all) interfaces in the group are usable.
	IPMP Group		**Failed:** No interfaces in the group are usable.

TBD: Currently, we use "Connected" and "Disconnected" rather than "Up" and "Down" for Wired and Wireless links. Should we change to "Up" and "Down" in Reactive connection profiles for consistency, even if they're slightly less meaningful terms to the more casual user?

Secondary text for each link type is as follows:

Link Type	Secondary Text
Wired	*IPv4 or IPv6 address* / *CIDR subnet mask or* Multiple IPs *[*(DHCP *or* DHCPv6 *or* Autoconf)], Speed: *n* Mb/s Examples: 192.168.1.100, Speed: 10 Mb/s 192.168.1.100 (DHCP), Speed: 100 Mb/s fe80::200:f8ff:fe21:67cf, Speed: 1000 Mb/s fe80::200:f8ff:fe21:67cf (Autoconf), Speed: 1000 Mb/s Multiple IPs, Speed: 1024 Mb/s
Wireless	*IPv4 or IPv6 address* / *CIDR subnet mask or* Multiple IPs [(DHCP *or* DHCPv6 *or* Autoconf)], Signal: Very Weak|Weak|Good|Very Good|Excellent, Speed: *n* Mb/s Examples: 192.168.1.100, Signal: Good, Speed: 11 Mb/s 192.168.1.100 (DHCP), Signal: Weak, Speed: 14.4 Mb/s fe80::200:f8ff:fe21:67cf, Signal: Excellent, Speed: 30 Mb/s fe80::200:f8ff:fe21:67cf (Autoconf), Signal: Very Weak, Speed: 45 Mb/s Multiple IPs, Signal: Good, Speed: 150 Mb/s
Aggregation	Auto|Fixed, Links: *n*, [Forced,] LACP: Off|Active|Passive, [[L2][L3][L4]], [short|long]] Examples: Auto, Links: 2, LACP: Off Fixed, Links: 3, Forced, LACP: Active, L2, short Auto, Links: 4, LACP: Passive, L2L3, long
Bridge	*BridgeID,* Priority: *priority,* Root: *BridgeID of root node* Example: 32767/00:11:22:33:44:55, Priority: 32768, Root: 8192/66:77:88:99:AA:BB
VNIC	Over: *linkname*, *MAC address* (Random|Factory), *speed* Mb/s Examples: Over: e1000g0, 12:34:56:78:90 (Random), 1000 Mb/s Over: e1000g0, ab:cd:ef:01:23 (Factory), 1000 Mb/s
VLAN	ID: *vid,* Over: *linkname,* [Forced|Implicit] Examples: ID: 111, Over: e1000g0 ID: 112, Over: e1000g0, Forced ID: 113, Over: e1000g0, Implicit
Tunnel	Type: IPv4|IPv6|4to6, Source: *IPv4/IPv6 address,* [Dest: *IPv4/IPv6 address*,] [Implicit,] Policy: Yes|No Examples: Type: IPv4, Source: 192.168.1.100, Dest: 10.0.0.2, Policy: No Type: IPv6, Source: e80::200:f8ff:fe21:67cf, Dest: 2001:05c0:9168::1, Implicit, Policy: Yes Type: 4to6, Source: 192.168.1.100, Policy: No
IPMP Group	*groupname*|Anonymous, FDT: *time*|, Active: *n,* Inactive: *n,* Unusable: *n* Examples: itops0, FDT: 10.00s, Active: 2, Inactive: 0, Unusable: 0 acctg1, FDT: --, Active: 0, Inactive: 0, Unsable: 2 Anonymous, FDT: 20.00s, Active: 2, Inactive: 1, Unusable: 1

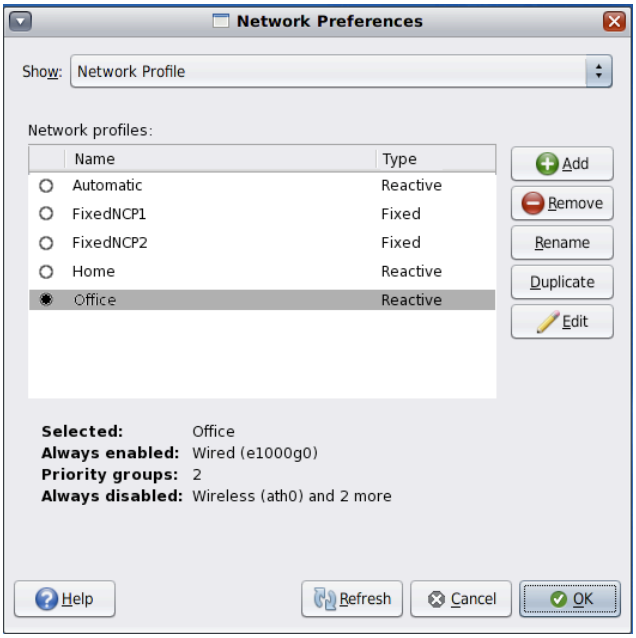
Double-clicking a connection in the list when a Reactive network profile is active switches the status view to that connection's properties view (p??). Double-clicking a connection in the list when a Fixed network profile is active has no effect.

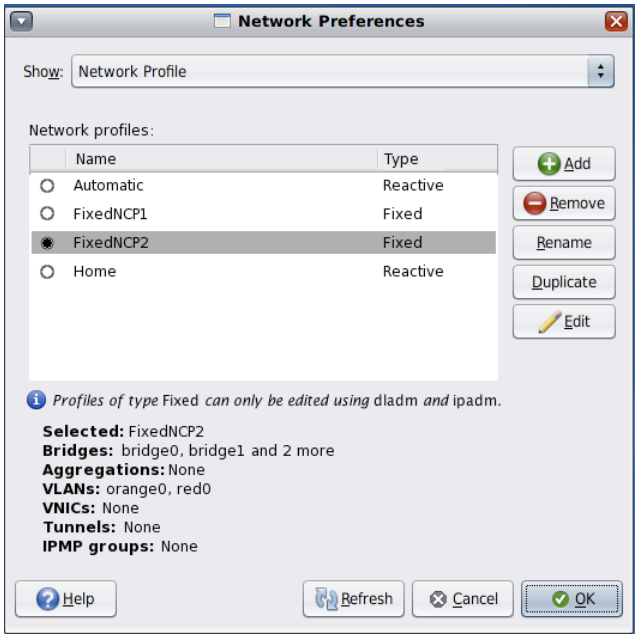
Network Profile shows the current network configuration profile followed by its type (Fixed or Reactive) in parentheses.*Current Location* shows the currently active location. **Edit Locations...** button opens the Network Locations dialog (p??)

Network Modifiers lists any currently-running network modifier, e.g. “CiscoVPN active” if a single application is active, “*n* active” if two or more applications are running, or “None active”. Click the **Modifiers**... button to open the Network Modifiers dialog (p??) where applications can be configured, started and stopped.

Network Preferences : Network Profile View

This view allows inspection, switching and editing of of network configuration profiles. Show this view by selecting Network Profile in the dropdown list at the top of the window.





The *Network profiles* list shows each available network profile and its type (Fixed or Reactive), with the currently active profile shown by a radio button indicator. By default, there is one profile, *Automatic*, which you can activate but not edit or delete. You can add as many additional Reactive profiles as you wish, which you can activate, edit or delete as required. You cannot create, edit or rename Fixed profiles with the GUI at this time.

To sort the list by profile name, click the Name column header. To sort the list by profile type, click the Type header. To reverse the current sort order, click the header of the column by which the list is already sorted.

Selecting the radio button of a profile other than the active profile will activate that profile when the **OK** button is clicked. Activating a Fixed profile always activates its corresponding Fixed location.

Below the list are several read-only text fields that summarise the behaviour of the profile that is selected in the list. When a Reactive profile is selected, these fields are:

- *Selected*: shows the name of the selected profile.
- *Always enabled*: shows which network interfaces are always enabled in this profile, or *None* if no interfaces are always enabled.
- *Priority groups*: the number of priority groups defined in the selected profile, or *None* if there are no priority groups.
- *Always disabled*: shows which network interfaces are always disabled in this profile, or *None* if no interfaces are always disabled.
- For the *Always enabled* and *Always disabled* fields, if more than one interface is always enabled or disabled, the name of one of the interfaces is shown, followed by "and *n* more". For example, if four interfaces are always enabled, the text might read "Wired (e1000g0) and 3 more".

When a Fixed profile is selected, these fields are:

- *Selected*: shows the name of the selected profile.
- *Aggregations:* The name of the first aggregation configured in the selected profile, followed by "and *n* more" if there is more than one. If there are no aggregations in the profile, *None* is shown.
- *Bridges:* The name of the first bridge configured in the selected profile, followed by "and *n* more" if there is more than one. If there are no bridges in the profile, *None* is shown.

- *IPMP Groups:* The name of the first IPMP group configured in the selected profile, followed by "and *n* more" if there is more than one. If there are no IPMP groups in the profile, *None* is shown.
- *VLANs:* The name of the first virtual LAN configured in the selected profile, followed by "and *n* more" if there is more than one. If there are no virtual LANs in the profile, *None* is shown.
- *VNICs:* The name of the first virtual NIC configured in the selected profile, followed by "and *n* more" if there is more than one. If there are no VNICs in the profile, *None* is shown.
- *Tunnels:* The name of the first tunnel configured in the selected profile, followed by "and *n* more" if there is more than one. If there are no tunnels in the profile, *None* is shown.

To create a new Reactive network profile, click the **Add** button. This will add a new profile to the list, focused and ready for in-place editing of the name. The default name of the new profile is "User" if no profile with that name exists, otherwise "User *N*", where N is the lowest available integer that would make the profile name unique.

To remove the selected network profile, click the **Remove** button. An alert will appear asking for confirmation:

Remove network profile: *name*

Are you sure you want to delete this network profile? This operation cannot be undone.

[Cancel] [Remove]

The **Remove** button is disabled if the Automatic profile is selected.

TBD: Should deleting a Fixed network profile also delete its corresponding Fixed location? I suspect 'yes'.

To rename a Reactive profile, double-click its name, or select it and click the **Rename** button. This causes the profile name to be replaced by an in-place text field in the list, whose contents are the current name, fully selected. This allows immediate overtyping of a new name. The user can press *Enter* to accept the new name and exit the editing mode, or *Esc* to revert to the previous name and exit the editing mode.

The **Rename** button is disabled when a Fixed profile is selected.

A profile cannot be renamed if its name has already been committed to NWAM. In this case, an alert is displayed when the **Rename** button is clicked:

Cannot rename '$PROFILE'

Network profiles can only be renamed immediately after they have been created. However, you can duplicate this profile, then immediately rename the duplicate.

[Cancel] [Duplicate]

To duplicate a Reactive profile, select the profile, then click the **Duplicate** button. This opens the Add Network Profile dialog (p??), with a copy of the selected network profile ready for editing. The default name of the new profile is "Copy of *selected profile name*". The **Duplicate** button is disabled when a Fixed profile is selected.

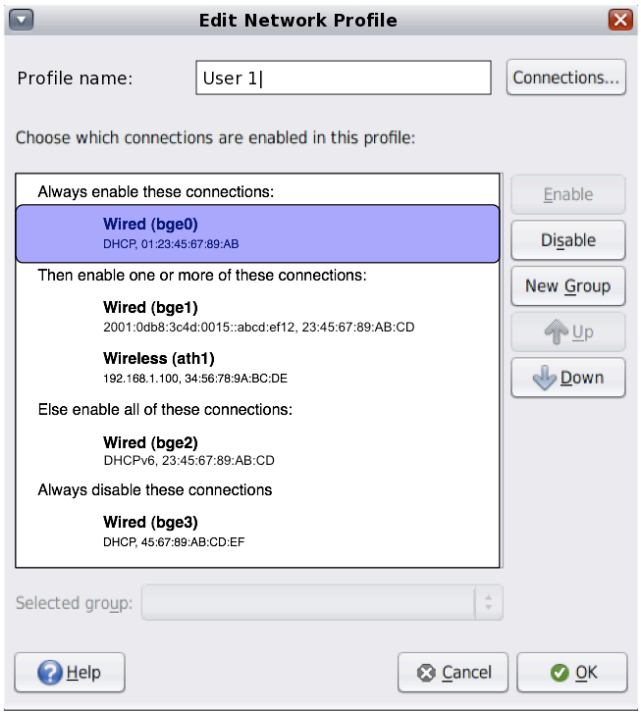
To Edit a Reactive profile, select the profile, then click the **Edit** button. This opens the Edit Network Profile dialog (p??), with the selected network profile ready for editing.

Click **OK** to close the dialog and activate the profile whose radio button is selected. Click **Cancel** to close the dialog without activating a different user profile. Any profiles that have been added or deleted since the dialog was opened will remain added or deleted, even if you click **Cancel**.

The **Edit** button is disabled when a Fixed profile is selected.

Edit Network Profile dialog

This application modal sub-dialog is opened by clicking the **Edit** button when a Reactive profile is selected.



The *Profile name* field is read-only if the name has already been committed to NWAM. If you want to rename such a profile, you must duplicate the profile, then rename the duplicate.

The network connections (NCUs) of the selected profile are shown in a tree view. The expander arrows are not shown in the tree, instead the top level nodes of the tree act as headers for their child nodes.

The tree view will consist of at least two top level nodes:

- "Always enable these connections:" The children of this node are NCUs whose activation mode is Manual, and whose enabled state is True, listed in alphabetical order. If there are no such NCUs, a single child item "(None)" is shown.
- "Always disable these connections:" The children of this node are NCUs whose activation mode is Manual, and whose enabled state is False, listed in alphabetical order. If there are no such NCUs, a single child item "(None)" is shown.

If there are any prioritized groups in the network profile, these will be shown between the "always enable" and "always disable" groups, highest priority first, with one top level node for each group. Their NCUs are listed in alphabetical order. The text of the top level node for a prioritized group is as follows:

The first word of the text is "Then" for the highest priority group, or "Else" for any other priority group.

- For groups of type Exclusive, the rest of the text is "enable any one of these connections:"
- For groups of type Shared, the rest of the text is "enable one or more of these connections:"
- For groups of type All, the rest of the text is "enable all of these connections"

Primary text for all NCUs in the tree view is *InterfaceType (LinkName)*. Secondary text consists of two items, separated by spaces:

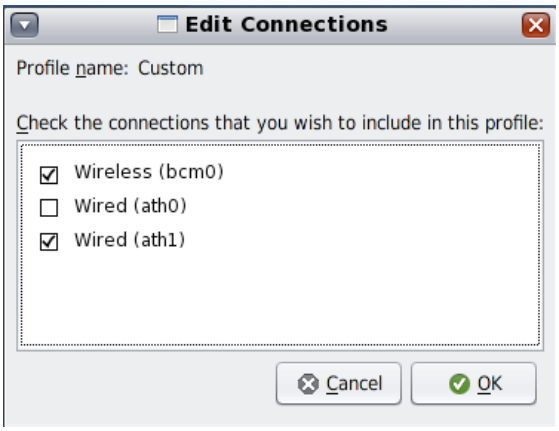
"Address: IPv4/IPv6 address / CIDR subnet mask" or "Multiple IPs" or "DHCP" (IPv4 only) or "DHCPv6" (IPv6 only) or "Autoconf" (IPv6 only)	MAC address

Automatic Profile

The Automatic profile is read-only. When viewing the Automatic profile, all of the profile editing buttons and dropdown lists are disabled.

Adding/Removing Connections from the User Profile

Clicking the **Connections** button (disabled for the Automatic profile) opens the *Edit Connections* dialog:



The list shows all the connections that are currently available in the *Automatic* profile. (Rationale: It is assumed that any connections not available in the *Automatic* profile have not been correctly configured/installed, so that must be rectified before they can be added to user-defined profiles.)

Check a connection to include it in the profile being edited, uncheck it to remove it from the profile being edited. It is not possible to uncheck a connection if it is currently the only checked connection in the profile. (*Or would it be better just to verify that you had at least one connection checked when you clicked OK? Or is it valid/useful to allow a user-defined profile with no NCUs?*)

Enabling and Disabling Connections

The **Enable** button is enabled only when an NCU in the "always disabled" group, or in any prioritized group, is selected. Click **Enable** to move the selected NCU from its current group to the "always enabled" group. Alternatively, you can drag and drop the NCU into the "always enabled" group. In either case, the NCU remains selected afterwards.

The **Disable** button is enabled only when an NCU in the "always enabled" group, or in any prioritized group, is selected. Click **Disable** to move the selected NCU from its current group to the "always disabled" group. Alternatively, you can drag and drop the NCU into the "always disabled" group. In either case, the NCU remains selected afterwards.

You can also move NCUs between the "always enabled" and "always disabled" groups by clicking the **Up** and **Down** buttons. The **Up** button is enabled when any NCU that is not in the "always enabled" group is selected. The **Down** button is enabled when any NCU that is not in the "always disabled" group is selected.

Clicking **Up** moves the selected NCU out of its current group to the group above, which may be a priority group or the "always enabled" group. Clicking **Down** moves the selected NCU out of its current group to the group below, which may be a priority group or the "always disabled" group. The NCU remains selected afterwards.

Working with Priority Groups

The **New Group** button is enabled whenever one or more NCUs are selected, or when the "always enabled" group header is selected, or when the "always disabled" group header is selected. Click **New Group** to create a new priority

group comprising those NCUs. The group is created with type Exclusive by default, with a priority lower than any existing priority groups.

Adding/Removing NCUs

You can move an NCU in or out of a priority group by clicking the **Up** and **Down** buttons. The **Up** button is enabled when any NCU that is not in the "always enabled" group is selected. The **Down** button is enabled when any NCU that is not in the "always disabled" group is selected.

Clicking **Up** moves the selected NCU out of its current group to the group above, which may be a priority group or the "always enabled" group. Clicking **Down** moves the selected NCU out of its current group to the group below, which may be a priority group or the "always disabled" group. The NCU remains selected afterwards.

Alternatively, you can move an NCU out of a priority group by selecting it, then clicking **Enable** or **Disable** to move it to the "always enabled" or "always disabled" group.

You can also move NCUs in or out of priority groups by dragging and dropping them.

When the last NCU is moved out of a priority group, the group no longer exists and is removed from the tree view.

Changing Priority Mode

To change the priority mode of a list, select its top-level node or any of its child NCUs in the tree view. This enables the *Selected group* dropdown below the tree view, with the priority mode of that group selected. Choose a different value from the dropdown to change the selected group's priority mode:

- "Exactly one connection is enabled": (*Exclusive* mode) NWAM will enable one connection in the group, and disable the others. As long as NWAM is able to keep exactly one connection in the group alive (not necessarily the same one all the time), it will not attempt to enable connections in any lower priority groups.
- "One or more connections may be enabled": (*Shared* mode) NWAM will enable all connections in the group that it is able to do so. As long as at least one connection in the group remain alive, NWAM will not attempt to enable connections in any lower priority groups.
- "All connections must be enabled": (*All* mode) NWAM will enable all the connections in the group. As long as all connections remain alive, NWAM will not attempt to enable connections in any lower priority groups.

Increasing/Decreasing Priority

To increase the priority of a group, select its top-level node and click the **Up** button. The group will swap places with the group immediately above it in the list, with both groups' priorities adjusted accordingly. The **Up** button will be disabled if the selected group already has the highest priority of the priority groups in the profile.

To decrease the priority of a group, select its top-level node and click the **Down** button. The group will swap places with the group immediately below it in the list, with both groups' priorities adjusted accordingly. The **Down** button will be disabled if the selected group already has the lowest priority of the priority groups in the profile.

Deleting Priority Groups

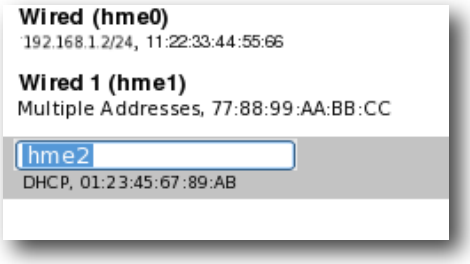
To explicitly delete a priority group, select its top-level node. At this point, the **New Group** button will be enabled, and its label changed to **Remove Group**. Click **Remove Group** to set the activation mode of all the group's NCUs to Manual, and their enabled state to Disabled. The priority group then no longer exists and is removed from the tree view.

A priority group will also be deleted when its last NCU is moved to a different group. The priority group then no longer exists and is removed from the tree view.

Renaming Connections

Not required for this version

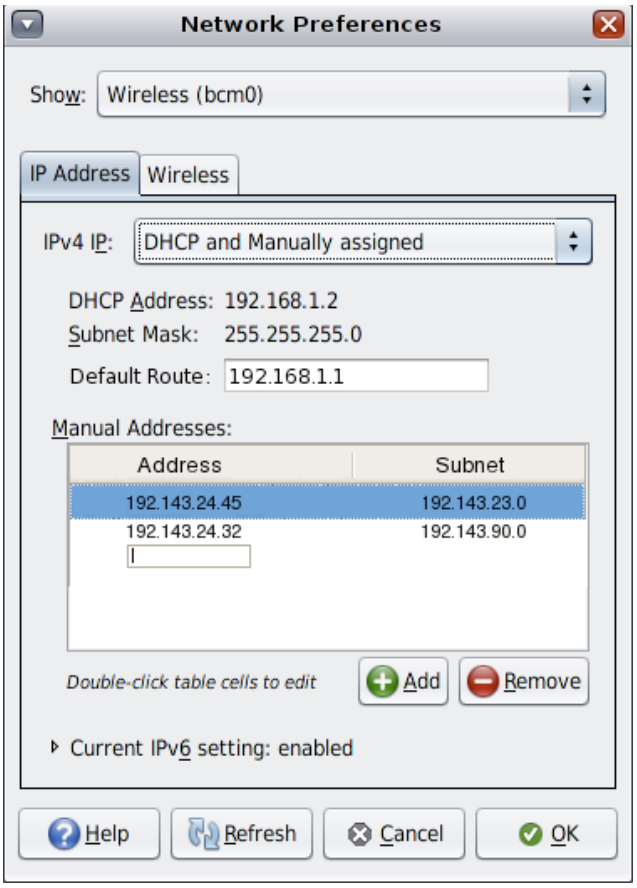
~~To change a link's vanity name, select it and click Rename. This opens an embedded text field in the tree view, the contents of which are the link's current (possibly default) name. Text is selected, ready for overtyping:~~



~~Specify a new vanity name by entering new text and pressing Return. Press Esc to dismiss the text field with no changes to the vanity name.~~

Network Preferences : Connection Properties Overview

This view allows you to choose how the IPv4 and IPv6 addresses for a specific network connection are obtained, and for wireless interfaces, how and when wireless connections are automatically attempted. The network interface is selected from the *Show* dropdown list at the top of the window.

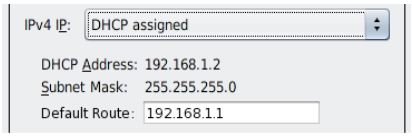


When you select a network interface, a tabbed view appears allowing you to edit its properties. For all connection types, the first tab is the *IP Address* tab, on which you configure its IPv4 and IPv6 addresses. For wireless connections, a *Wireless* tab also appears, on which you choose the way in which the wireless interface connects to available wireless networks.

Connection Properties : IP Address (IPv4)

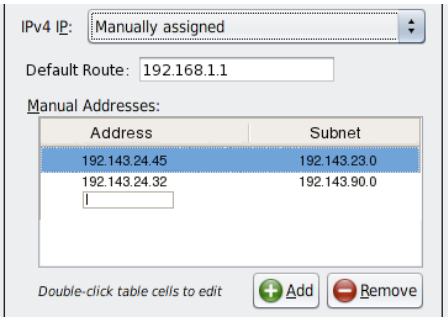
IPv4 addresses can be assigned automatically, manually or disabled for each network interface. The controls shown vary dynamically based on the selection made from the *Current IPv4 setting* dropdown list:

Disabled: No IPv4 address is assigned to this network interface, and all other IPv4 configuration controls are hidden.

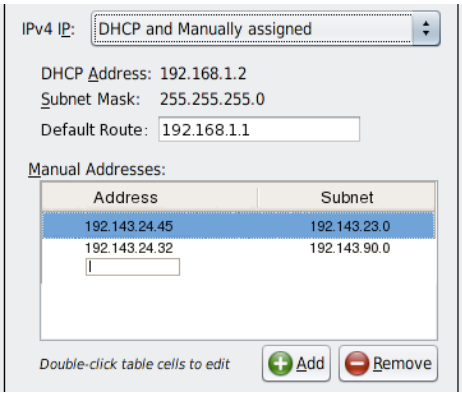


DHCP assigned: when this option is selected, the *DHCP Address* and *Subnet* fields are provided via DHCP and shown as static labels. The *Default Route* field is read-only if the route has been assigned by the DHCP server, and editable (and empty by default) if the route must be assigned manually.

The *Manual Addresses* configuration table is hidden.



Manually Assigned: when this option is selected, the *Default Route* field is editable (and empty by default), and a table is shown in which you can enter one or more *Address* and *Subnet* pairs. This is an editable table as defined on p??. The overlaid control used for both the *Address* and *Subnet* cells in each row is a text box.



DHCP and Manually assigned: when this option is selected, one address and subnet pair are provided via DHCP, and shown as static labels. The *Default Route* field is read-only if the route has been assigned by the DHCP server, and editable (and empty by default) if the route must be assigned manually. Finally, one or more *Address* and *Subnet* pairs can be entered in the *Manual Addresses* table. This is an editable table as defined on p??. The overlaid control used for both the *Address* and *Subnet* cells in each row is a text box.

Persistence

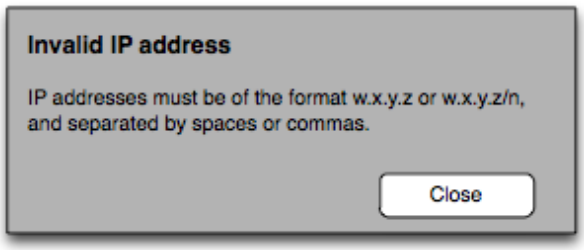
When switching between *DHCP assigned*, *Manually assigned* and *Multiple addresses*, any data that was entered is stored in case you later switch back to that view. This data is also remembered between sessions.

Address format and validation

For the *Manually Assigned* and *Multiple Addresses* input modes, you may enter the IP addresses and subnets separately in their respective text boxes, in the format `w.x.y.z`.

Alternatively, you may enter an address in the CIDR format `w.x.y.z/n`, where n is an integer from 0-32 representing the subnet mask. In this case, the corresponding *Subnet* field is cleared and disabled when keyboard focus is moved out of the *Address* field. Keyboard focus will therefore move to the next control after the subnet field. If the address is subsequently changed to the format `w.x.y.z`, the corresponding *Subnet* field is re-enabled when keyboard focus is moved out of the *Address* field.

Address and subnet syntax is checked when you switch to a different tab, click **OK**, or select a different item from the *Show* dropdown at the top of the dialog. An appropriate alert is shown if any of the fields are invalid, for example:

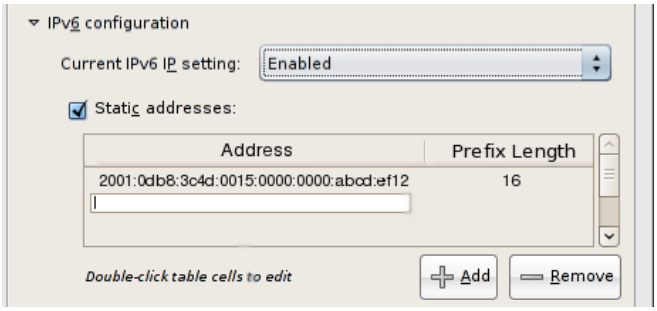


Dismissing the alert focuses the offending field ready for input.

Connection Properties : IP Address (IPv6)

IPv6 addresses can be assigned automatically, manually or disabled for each network interface. The controls shown vary dynamically based on the selection made from the *Current IPv6 setting* dropdown list, which is one of the controls in the *IPv6 Configuration* expander.

The expander is collapsed by default for interfaces for which IPv6 is disabled, and expanded by default for interfaces for which IPv6 is enabled.



Disabled: No IPv6 addresses will be assigned to this network interface.

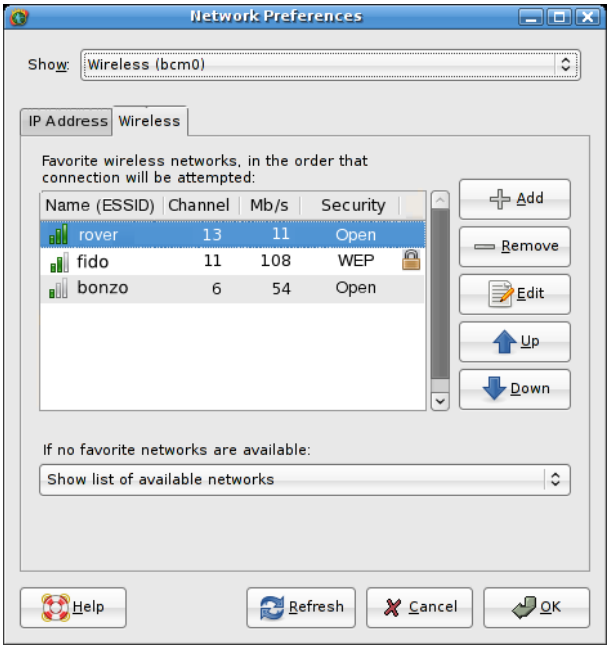
Enabled: when this option is selected, the network interface the network interface attempts to obtain IPv6 address(es) via DHCP and/or Autoconfiguration.

Static Addresses: When checked, the table below the checkbox is enabled to allow assignment of manual IPv6 addresses to the network interface. These addresses will be assigned *in addition to* the address obtained via DHCPv6 or Autoconfiguration. The table is an editable table as defined on p??, with text fields used as the overlaid input controls for both the *Address* and *Prefix Length* fields. Their syntax is checked when you switch to a different tab, click **OK**, or select a different item from the *Show* dropdown at the top of the dialog. An appropriate alert is shown if any of the fields are invalid.

When the *Static Addresses* box is unchecked, the table is disabled but remains visible.

Connection Properties : Wireless

This tab only appears when a wireless network interface is selected from the *Show* dropdown list at the top of the window.



The list shows your current favourite (or “bookmarked”) networks, in the order in which any automatic connection will be attempted.

First column shows signal strength and name (ESSID). Second column shows wireless channel, third column shows speed, fourth column shows security type, with a right-aligned 'secure' icon for secure networks. List is re-orderable using drag and drop, or the **Up** and **Down** buttons.

If no favorite networks are available when a wireless connection is attempted for this interface, a dropdown list offers the choice of what to do:

- *Show list of available networks*: opens the wireless network chooser dialog (p??) to ask which other network to join.
- *(not in Phase 1)* ~~Join an open network: attempt to join any available unsecured wireless network, starting with the one with the strongest signal. If the Ask before joining a new open network preference is checked (see next page), you will be asked to confirm before joining any open networks.~~
- *Do not connect*: do not attempt to join any other wireless network until new networks are detected, or a different Network Profile or Location is selected.

Add opens the Add Wireless Network dialog (p??), but with its *Add to favorite networks* checkbox hidden.

Remove deletes the selected network from the list.

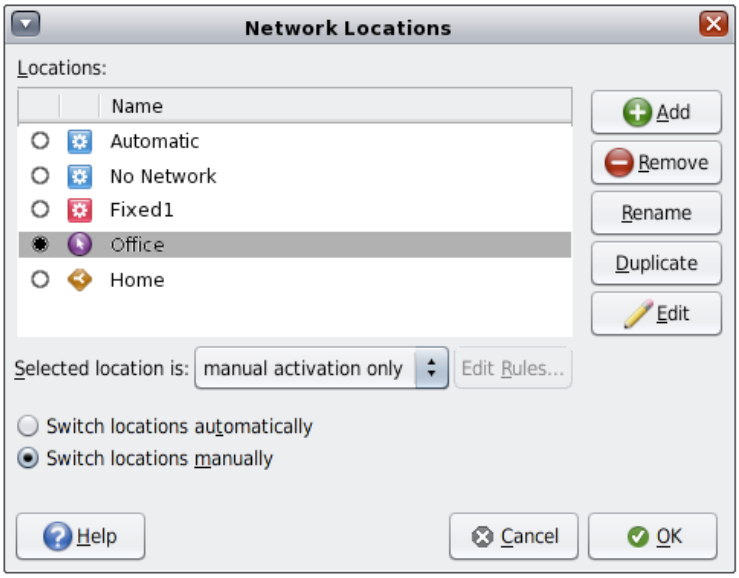
Edit opens the Edit Wireless Network dialog (p??), preloaded with the the selected network's details, and with its *Add to favorite networks* checkbox hidden. The **Edit** button is disabled if no network is selected in the list.

Up/**Down** buttons move the selected network up/down in the list. **Up** is disabled when the selected network is at already at the top, likewise **Down** is disabled when the selected network is already at the bottom.

Network Locations Dialog

This dialog allows you to switch locations, edit their properties, and create new locations. Open this dialog by choosing *Network Locations* from the panel applet's right-click menu (only enabled for user accounts that have been assigned the Network Autoconf Admin rights profile by a system administrator), or by clicking the **Locations** button in the Network Status view of the Network Preferences dialog (p??).

TBD: Need an additional icon from xDesign for Fixed locations.



The *Locations* list is analogous to that on the panel icon context menu; it lists each available location, with an icon representing its activation type: *system*, *fixed*, *manual* or *conditional*. The mode of the selected location is also shown by the *Selected location* dropdown list.

The current location is represented by a radio button indicator. Selecting the radio button of a manual location other than the current location attempts to activate that location when the **OK** button is clicked.

The radio button for locations is visible but always disabled. To enabled a Fixed location, you must enable its corresponding Network Profile. *TBD: Since this might not be an obvious enough visual indication, perhaps show the name as greyed-out text, too?*

Changing location activation modes

To change the activation mode of a Reactive location, select it in the list, and select the new mode from the *Selected location* dropdown below the list. Note that when a system or fixed location is selected, the dropdown list and **Edit Rules** button are disabled. The dropdown list entry *activated by system* or *activated by fixed profile* is shown, respectively.

When a manual or conditional location is selected, the dropdown list options are:

- *manual activation only*: this location is only enabled when it is manually selected. When this option is selected, the **Edit Rules** button is disabled.
- *activated by Rules*: the location will be automatically selected when certain network conditions occur. When this option is selected, the **Edit Rules** button is enabled. Clicking the button opens a Rule Editing dialog (p??), with the following parameters:
  - Condition Text: Activate location '*name*' if the following conditions are true:
  - Match any/all radio buttons: shown
  - Conditions: Active connections, Active network profile, Any IP address, Any advertised domain name, Any system domain name, Current location, Running network modifiers, Wireless network name. (See available conditions, p??)

Changing how locations are activated

The *Switch locations* radio buttons control how locations are activated.

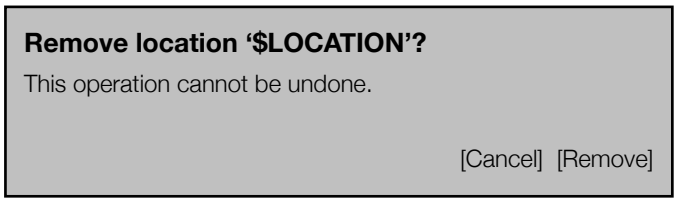
- *Switch locations automatically (default)*: In this mode, you have no direct control over location changes, so all the locations in the list are grayed-out. The most appropriate System or Conditional location will be activated at any time, in response to network environment changes. Note that Manual and Fixed locations are never activated automatically.
- Switch locations manually: In this mode, you have full control over location changes, so any location in the list, apart from Fixed locations, can be activated by clicking its radio button. Any location you activate in this way will remain active until you activate a different location, or select *Switch locations automatically*.

Adding locations

To add a new location with default settings, click the **Add** button. A new location (of activation type Manual) will be created with the name "Unnamed Location *N*". The "N" is not shown for the first unnamed location, and is the lowest numerical value >=1 that would make the location name unique. The new location is selected (but not activated) in the list, and is placed into editing mode as if the user had clicked the **Rename** button (see below).

Removing locations

To delete the selected location, click the **Remove** button. A confirmation alert appears:

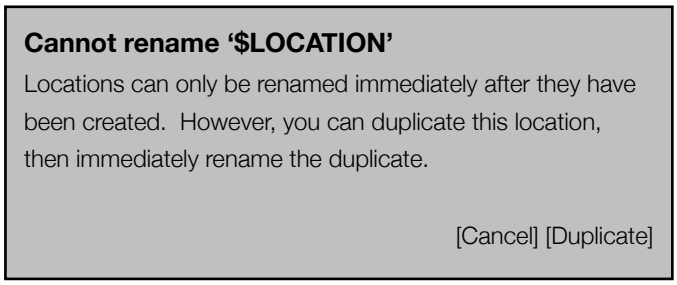


The **Remove** button is disabled when a system location (*Automatic* or *No Network)* or a fixed location is selected, as they cannot be deleted.

Renaming locations

To rename a location other than a Fixed location, double-click its name, or select it and click the **Rename** button. This causes the location name to be replaced by an in-place text field in the list, whose contents are the current name, fully selected. This allows immediate overtyping of a new name. The user can press *Enter* to accept the new name and exit the editing mode, or *Esc* to revert to the previous name and exit the editing mode.

A location can only be renamed if it has been added since the Network Locations dialog was opened. If a location that existed prior to opening the dialog is selected, an alert is displayed when the **Rename** button is clicked:



Fixed locations cannot be renamed, so the **Rename** button is disabled when a fixed location is selected.

Duplicating locations

To duplicate a location other than a Fixed location, select it in the list, then click the **Duplicate** button. A new location will be created with the name "Copy of *LOCATION*" if that name is unique, otherwise "Copy of *$LOCATION N*" where N is the lowest numerical value >=1 that would make the location name unique. The new location is selected (but not activated) in the list, and is placed into editing mode as if the user had clicked the **Rename** button (see above).

Fixed locations cannot be duplicated, so the **Duplicate** button is disabled when a fixed location is selected.

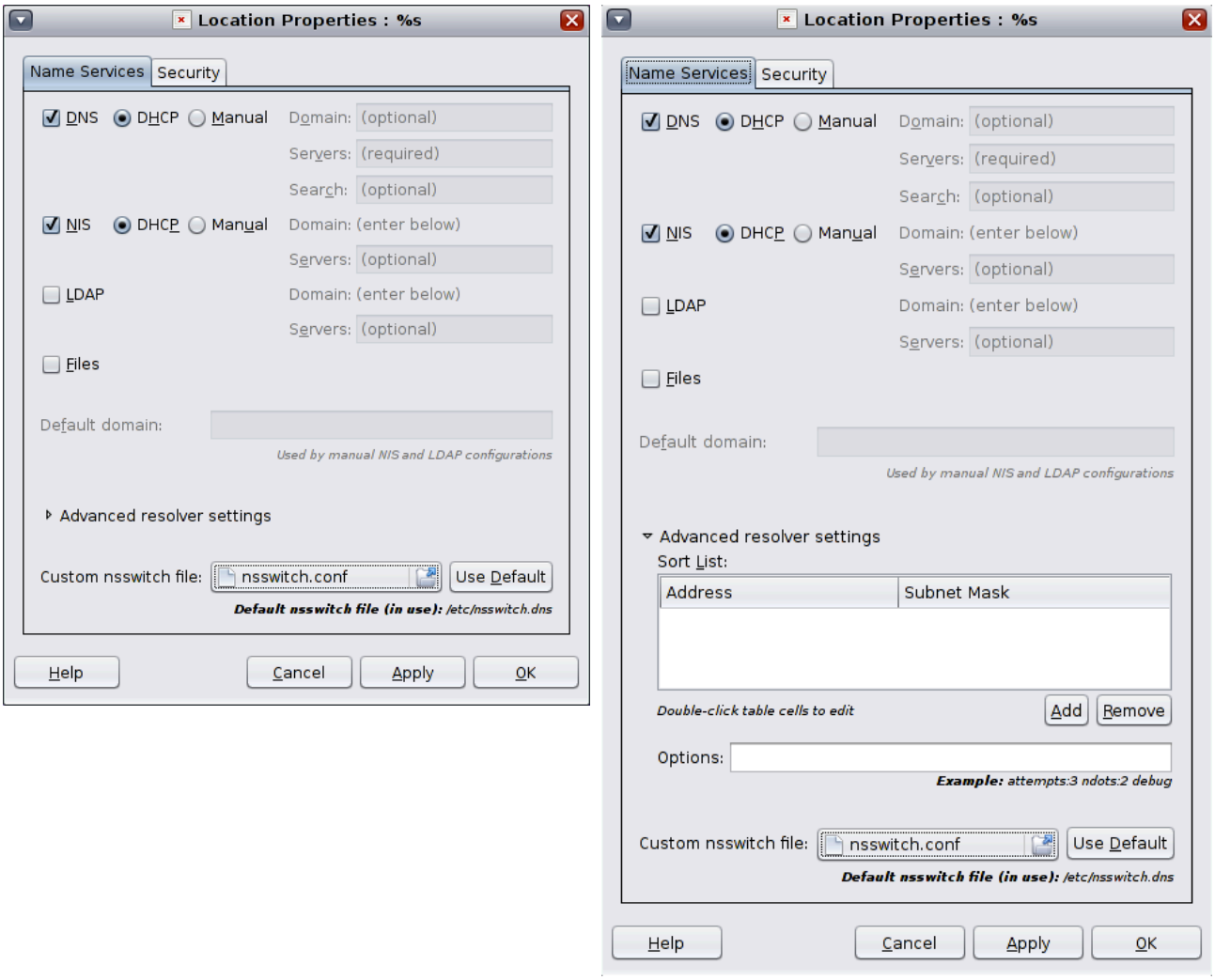
Editing locations

To edit the properties of a location other than a Fixed location, select it in the list and click the **Edit** button. This opens the Edit Location dialog (p??).

Fixed locations cannot be edited using the GUI, so the **Edit** button is disabled when a fixed location is selected.

Edit Location : Name Services

This tab allows you to configure name services that are used when the location is active.



Check one or more of the *DNS*, *NIS*, *LDAP* or *Files* checkboxes to specify which services should be configured for this location.

- DNS: When checked, the *DHCP* and *Manual* radio buttons are enabled. When unchecked, the radio buttons are disabled. When the *DHCP* radio button is selected (default), the *Domain*, *Servers*, and *Search* fields are disabled, and the DNS service is configured via DHCP. When the *Manual* radio button is selected, the *Domain*, *Servers*, and *Search* fields are enabled.

  Domain (optional): type one or more DNS domain names into the text field, separated by spaces or commas.

  Servers (required): type one or more DNS server names into the text field, separated by spaces or commas.

  Search (optional): type one or more DNS search domain names into the text field, separated by spaces or commas.

- NIS: When checked, the *DHCP* and *Manual* radio buttons are enabled. When unchecked, the radio buttons are disabled. When the *DHCP* radio button is selected (default), the *Domain* and *Servers* fields are disabled, and the NIS service is configured via DHCP. When the *Manual* radio button is selected, the *Domain* and *Servers* fields are enabled.

  Domain: a static text label that reflects the contents of the *Default domain* field below. To specify an NIS domain, you must type it into the Default domain field. While the *Default domain* field is empty, the text "(enter below)" is shown as the NIS domain.

  Servers (optional): type one or more server names into the text field, separated by spaces or commas.

- LDAP: When checked, the *Domain* and *Servers* fields are enabled. When unchecked, the *Domain* and *Servers* fields are disabled.

Domain: Domain: a static text label that reflects the contents of the *Default domain* field below. To specify an NIS domain, you must type it into the Default domain field. While the *Default domain* field is empty, the text "(enter below)" is shown as the LDAP domain.

Servers (required): type one or more server names into the text field, separated by spaces or commas.

- Files: no further configuration options available.

Advanced Resolver Settings

This expanded section is hidden by default.

A sort list allows addresses returned by the libresolv-internal `gethostbyname()` to be sorted. The list is specified by IP address and subnet mask pairs. The subnet mask for each IP address is optional, and defaults to the natural value for that address.

The Sort List is an editable table as defined on p??. The overlaid control used for both the *Address* and *Subnet Mask* cells in each row is a text box. Address entry, format and validation is the same as the Connection Properties view, that is, addresses can either be entered in CIDR `w.x.y.z/n` format, or as separate IP and subnet mask values. The netmask for each row is optional, so if you do not enter a netmask or subnet value, the default value is calculated and displayed automatically. Also, no more than 10 rows may be added to the sort list.

The *Options* field is a text field in which you can enter one or more options that allow certain internal resolver variables to be modified. Options should be separated by a space, for example:

```
attempts:5 debug no-check-names
```

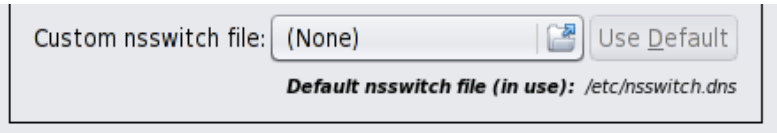
The options are passed directly to the backend as typed, and no validation is currently performed. For details of available options, see the resolv.conf(4) man page.

nsswitch File Selection

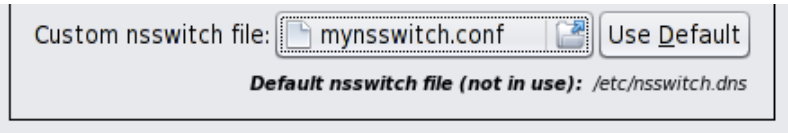
Custom nsswitch file is a file selection button that allows you to specify a name service configuration file to be used for this location.

The default value of the file selection button is *(None),* i.e. no custom nsswitch file has been specified.

While no custom nsswitch file is specified, and a single name service is checked, NWAM will choose the most appropriate nsswitch file for the selected name service (e.g. `/etc/nsswitch.dns` if only the DNS service is checked) when this location is active. The default file in use is shown in small text below the **Use Default** button, with the label "Default nsswitch file (in use)":



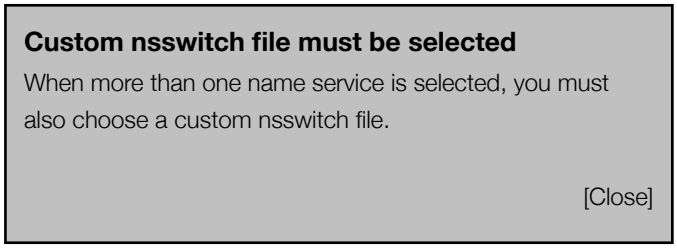
You can choose a custom nsswitch file by clicking the file selection button. The specified file will always be used whenever this location is active. When a custom file has been selected for a single name service, the default file that would be used when you click the **Use Default** button is shown in small text below the button, with the label "Default nsswitch file (not in use)":



The **Use Default** button is enabled only when a single service is checked, and when the current value of the file selection button is not *(None)*. Clicking the **Default** button changes the custom nsswitch file property back to *(None)*, which means that NWAM will choose the most appropriate nsswitch file for the selected name service when this location is active.

When multiple name services are checked, no additional text is shown:

When multiple services are checked, you must also specify a custom nsswitch file before saving any changes, otherwise an alert will be displayed when you click **OK**:

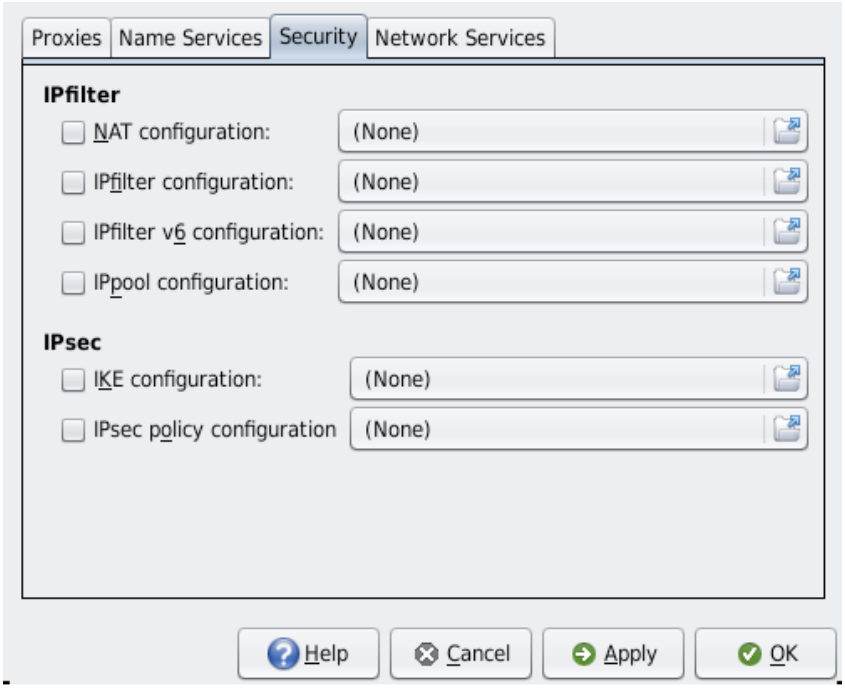


Closing the alert moves keyboard focus to the *Custom nsswitch file* selection button.

Note that making changes on the Name Services tab does not cause any changes to be written to any custom nsswitch file you might select, so you may still need to edit a custom nsswitch file by hand to achieve the exact behaviour you require.

Edit Location : Security

This tab allows you to select configuration files to be used by IPfilter and IPsec features when the location is active.



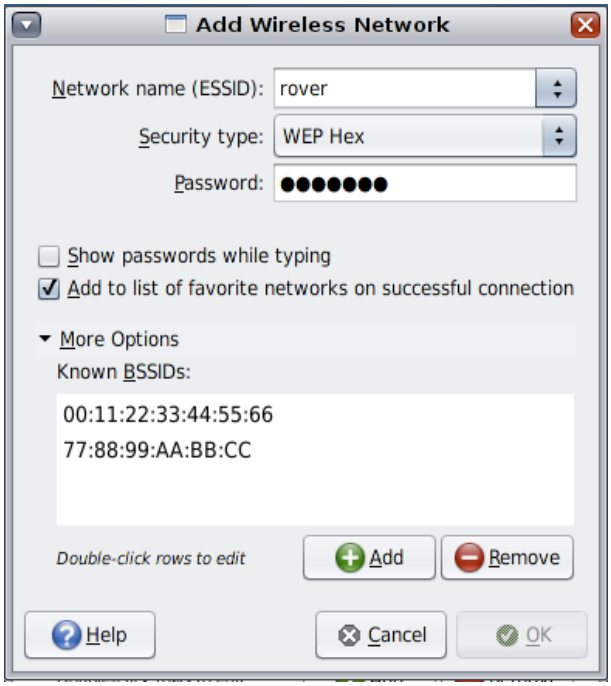
Each checkbox / file chooser button combination behaves the same way:

- When you check a box, the corresponding file chooser button is enabled. If no filename is currently associated (i.e. the file chooser button is showing "(None)"), a file selection dialog is opened immediately, allowing you to choose the configuration file. (If you cancel this dialog, the box is automatically unchecked again.) Otherwise, the filename that was already showing in the button will be used until you click the file chooser button.
- When you uncheck a box, the corresponding file chooser button is disabled, and the filename shown in the button will no longer be associated with that feature when the location is active. However, the last-used filename remains visible in the disabled control, and is remembered between sessions. This allows the filename to be quickly re-associated with the feature simply by checking the corresponding box.

No changes are made to running IPfilter, NAT or IPsec services until you click the Apply or OK button.

Add/Join/Edit Wireless Network

This dialog asks for information about a specific wireless network.



The dialog is opened in several ways:

- Manually, by selecting *Join Unlisted Wireless Network* on the panel icon context menu (p??). The title bar text in this case is “Join Wireless Network”
- Manually, by clicking **Add** or **Edit** in the Connection Properties, Wireless tab (p??). As much information as is already known about the network (its ESSID, and any previously-entered username and passwords that have been stored locally) will be pre-filled when the dialog appears. The title bar text in this case is “Add Wireless Network” or “Edit Wireless Network”, accordingly.
- Manually, by clicking the “No wireless networks found” notification message (p??). The title bar text in this case is “Join Wireless Network”
- (*Not in Phase 1*) ~~Automatically, if any of the “Ask Before” criteria in the Connection Properties, Wireless tab are satisfied (p??). The title bar text in this case is “Join Wireless Network” or “Add Wireless Network” accordingly.~~

Network Name (ESSID): The name of the wireless network you wish to connect to. This is a combo box whose dropdown lists the currently available wireless networks that are broadcasting their ESSID. The combo box is enabled in the *Add Wireless Network* and *Join Wireless Network* dialogs, but disabled in the *Edit Wireless Network* dialog.

Security Type: A dropdown list of supported security protocols. When connecting to an access point that is broadcasting its ESSID, the security type is pre-selected when the dialog opens or when the ESSID is entered in the field above. Password fields vary according to selection, see next page.

Show passwords while typing: If unchecked (default), typing will be masked in password fields. If checked, the password field will be shown in plain text while it has focus, and revert to mask characters when focus is lost.

Add to favorite networks list: This checkbox is:

- (*Not in Phase 1*) ~~Visible, if the dialog is opened from the panel icon context menu, and the Ask before adding any new network to favorites checkbox in the connection's Connection Properties, Wireless tab (p??) is also checked.~~
- (*Not in Phase 1*) ~~Hidden, if the dialog is opened from the panel icon context menu, and the Ask before adding any new network to favorites checkbox in the connection's Connection Properties, Wireless tab (p??) is not checked.~~
- Hidden, if the dialog is opened from the **Add** button on the Connection Properties, Wireless tab, or by clicking **Connect** or **Join Unlisted...** in the Wireless Network Chooser dialog (p??).

If the box is checked, the specified network is added to the Favourites list once a successful connection is made. Toggling this checkbox also affects the state of the *Add to favorite networks* checkbox in the Wireless Network Chooser dialog. That is, there is a single "add to favorite networks" preference value that is used throughout the GUI.

The *More Options* expander is collapsed by default. It expands to show:

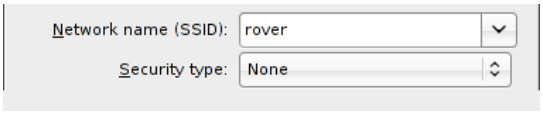
- *Known BSSIDs :* A list of MAC addresses of the access points that are known to be associated with this ESSID, which is used by NWAM to identify known wireless networks. This is an editable table as defined on p??.

The **OK** button is disabled until a network name is entered. When the user clicks **OK**, an alert is displayed if:

- The two passwords entered do not match
- The passwords match but are an invalid format/length
- A BSSID is provided but is an invalid format (should be MAC address format)

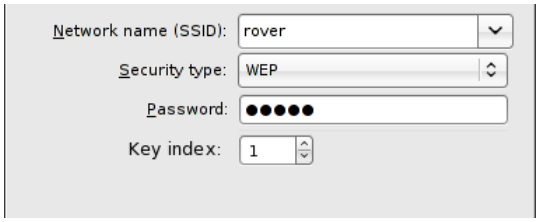
When the alert is dismissed, the offending field is focused ready for input.

Security type *None*:



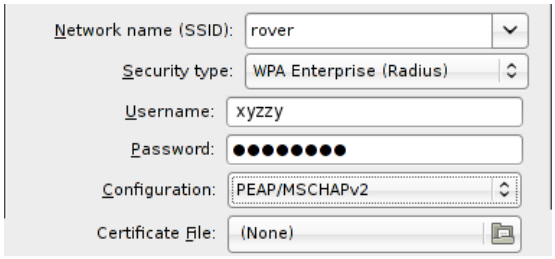
- Open network, no password fields displayed. *Show passwords while typing* field is disabled.

Security types *WEP* and *WPA Personal*:



- *Password:* 5- or 13-character password (WEP), or 10- or 26-digit hex string (WEP), or 8-63 character passphrase (WPA Personal) required to join specified network.
- *Key Index:* Only visible when WEP is selected. Determines which of the four possible WEP keys generated from the specified passphrase should be used. Valid Range: 1-4.

(*Not supported in Phase 1*) ~~Security type: WPA Enterprise:~~

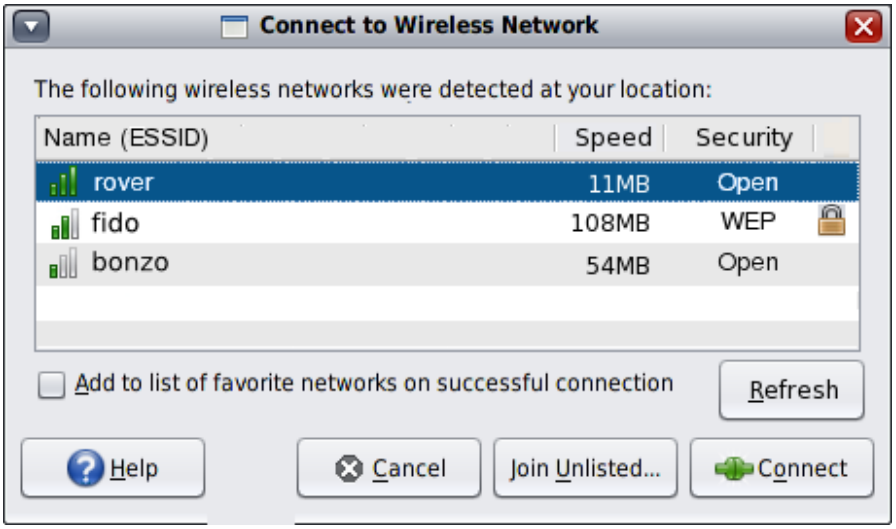


- ~~Username, Password: WPA username and password~~
- ~~Configuration: LEAP or PEAP/MSCHAPv2~~
- ~~Certificate File: Click to open a file chooser from which the certificate file can be selected TBD is there a file extension on which we could/should filter?. Only valid for PEAP/MSCHAPv2 configuration; button is disabled if LEAP configuration is selected.~~

For all security types, if a password has been previously entered and stored for this wireless network, the password field and *Show passwords while typing* checkbox are initially disabled, with the text "Click here to change saved password" shown in the password field. Clicking the password field enables and clears the password field, and enables the checkbox. If you click in the field accidentally, you can press *Esc* to activate the **Cancel** button and close the dialog, reverting any changes you made in the dialog while it was open.

Wireless Network Chooser

This dialog shows the wireless networks that are currently available, and allows you to connect to one of them.



The dialog is shown if any of the following happen:

- The user clicks the “InterfaceType (LinkName) disconnected from ESSID” notification message (p??)
- A wireless connection is attempted when the user's favorite wireless networks list is empty
- No favorite networks have been found, and the *Show available networks* preference has been set on the Connection Properties, Wireless tab (p??).

The dialog title includes the name of the interface attempting to connection: “Connect: *InterfaceType (LinkName)*”. Wireless networks are listed in descending order of signal strength.

~~The Add to favorite networks list checkbox is shown only if the Ask before adding any networks to favorites preference is checked on the Connection Properties, Wireless tab (p??). If it is not checked, the network is not added to your favorites list upon connection.~~ (*This preference not implemented in Phase 1, so the* Ask before adding *checkbox is always shown*.)

If no wireless networks are in range, the list consists of a single entry, “No wireless networks available”.

Clicking **Refresh** causes the list of networks to be updated, showing any changes in availability, security or signal strength.

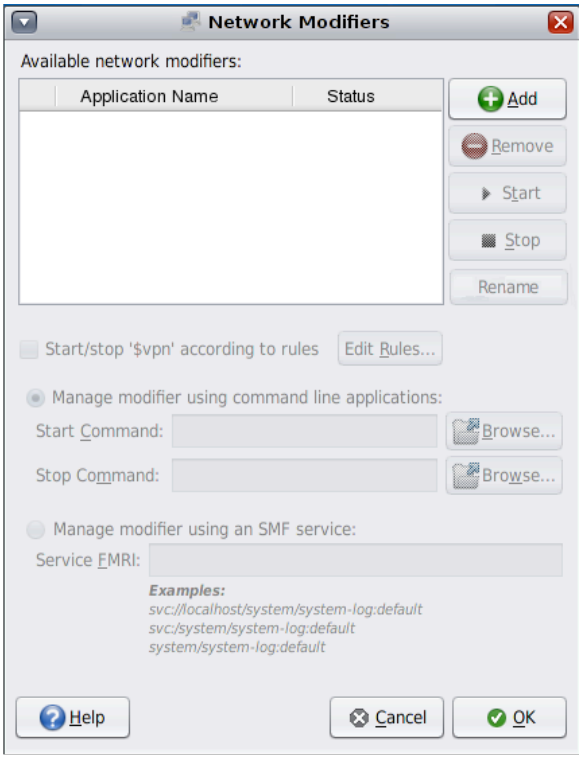
Clicking **Connect** attempts to join the selected network immediately, if no further input is required. Otherwise, the Join Wireless Network dialog (p??) is opened with the network's details pre-filled, to allow input of passwords and other security credentials.

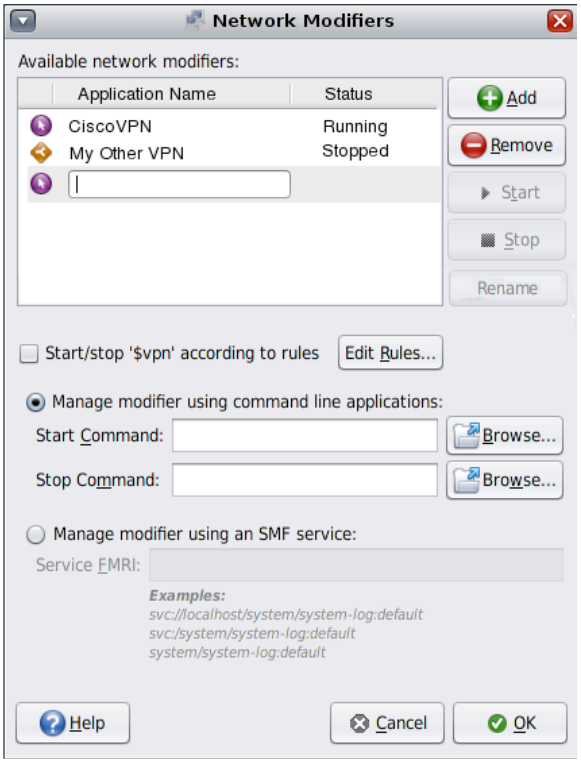
Clicking **Join Unlisted...** is equivalent to selecting *Join Unlisted Wireless Network* from the panel icon context menu (p??). That is, it opens the Join Wireless Network dialog (p??) with no details pre-filled, to allow you to connect to a network that is not broadcasting its ESSID. Once connected to any such network, it appears in the context menu and in the list of favorite and available networks. If the network was not added to the list of favorites when connecting, it will disappear from this list again after the next disconnection.

If the *Add to list of favorite networks* checkbox is checked, the selected network will be added to the list of favorites when a connection is established. Toggling this checkbox also affects the state of the *Add to favorite networks list* checkbox in the Add/Join/Edit Wireless Network dialog that may appear when you click **Join Unlisted** or **Connect**. That is, there is a single “add to favorite networks” preference value that is used throughout the GUI.

Network Modifier Preferences

This dialog allows you to edit and monitor External Network Modifier applications (ENMs) that alter the behaviour of your network connection. A typical example is an application that starts/stops a VPN tunnel.





Open this dialog by clicking the **Modifiers...** button on the Network Preferences, Status View (p??), or the *Network Modifier Preferences...* menu item on the panel icon's context menu (p??). The Network Modifiers dialog is only available to user accounts that have been assigned the Network Autoconf Admin rights profile by a system administrator.

The main part of the dialog is a three column list, which shows, for each application:

- Activation state (manual or conditional)
- User-defined name, e.g. "Cisco VPN"
- Current status, "Running" or "Stopped"

The Start/Stop according to rules checkbox below the list is checked if the selected network modifier has an activation type of Conditional, and unchecked if the type is Manual. You can change the type by toggling the checkbox.

The initial dialog state is shown above left, when no network modifiers have been added. Only the **Add** button is enabled.

Adding a new network modifier

Clicking **Add** switches focus to an embedded text field in the table, where the user can type a name for the new network modifier. At this point:

- Pressing *Enter* or *Tab* adds the new entry (of activation type *Manual* by default), and enables the two *Manage Network Modifier* radio buttons. The first of these radio buttons (*command line applications)* is selected by default.
- Pressing *Esc* cancels the typing and no new application is added.

Adding a command line-controlled network modifier

When the *Manage network modifier using command line applications* radio button is selected, the *Start Command* and *Stop Command* text fields, and the two *Browse* buttons are also enabled. The *Service FMRI* field and example text is disabled.

Type the command that starts the network modifier process into the *Start Command* text field, or look for it using the **Browse** button, which opens a file chooser dialog. The **Start** button remains disabled for this network modifier until a valid command has been typed into this text field.

Type the command that starts the network modifier process into the *Stop Command* text field, or look for it using the **Browse** button, which opens a file chooser dialog. The **Stop** button remains disabled for this network modifier until a valid command has been typed into this text field.

Adding an SMF service as a network modifier

When the *Manage network modifier using an SMF service* radio button is selected, the *Service FMRI* field and example text is enabled. The *Start Command* and *Stop Command* text fields, and the two *Browse* buttons are disabled.

Type the FMRI of the network modifier service into the text field. The **Start** and **Stop** buttons remain disabled for this network modifier until a valid FMRI has been typed into this text field.

Removing a network modifier

You can remove any (stopped) application from the list by selecting it, then clicking **Remove**. If the selected network modifier is running, the **Remove** button is disabled, and the application must be stopped first.

Renaming a network modifier

To rename a network modifier, double-click its name, or select it and click the **Rename** button. This causes the application name to be replaced by an in-place text field in the list, whose contents are the current name, fully selected. This allows immediate overtyping of a new name. The user can press *Enter* to accept the new name and exit the editing mode, or *Esc* to revert to the previous name and exit the editing mode.

A network modifier can only be renamed if it has been added since the Network Modifiers dialog was opened. If an application that existed prior to opening the dialog is selected, an alert is displayed when the **Rename** button is clicked:

> **Cannot rename '$APPLICATION'**
> Network modifiers can only be renamed immediately after they have been created.
> [Close]

Starting and Stopping network modifiers

You can start a network modifier manually by selecting it in the list, then clicking **Start**. The **Start** button is only enabled for Manual network modifiers that are not currently running. *TBD: or should it be possible to select conditional ENMs? Would this attempt to change their type to manual and activate them? See email from mph.*

If you click the **Start** button while a Fixed network profile is active, the following alert is displayed and the ENM is not started:

> **Cannot start '$APPLICATION'**
> The Fixed network profile '<name>' is currently active.
> Network modifiers can only be used with Reactive network profiles.
> [Close]

You can stop a network modifier manually by selecting it in the list, then clicking **Stop**. The **Stop** button is only enabled for Manual network modifiers that are not currently running. *TBD: or should it be possible to select conditional ENMs? Would this attempt to change their type to manual and activate them? See email from mph.*

You can have a network modifier start and stop automatically by setting its activation type to Conditional. You do this by checking the *Start/Stop according to rules* checkbox when the application is selected in the list.

When the box is checked, the **Edit Rules** button is enabled. This button opens a Rule Editing dialog (p??), with the following parameters:

- Condition Text: '*network modifier name*' will run while the following conditions are true:
- Match any/all radio buttons: shown
- Conditions: Active connections, Active network profile, Any IP address, Any advertised domain name, Any system domain name, Current location, Running network modifiers, Wireless network name. (See available conditions, p??)