

REAL

VNC 4

Enterprise Server

User Guide



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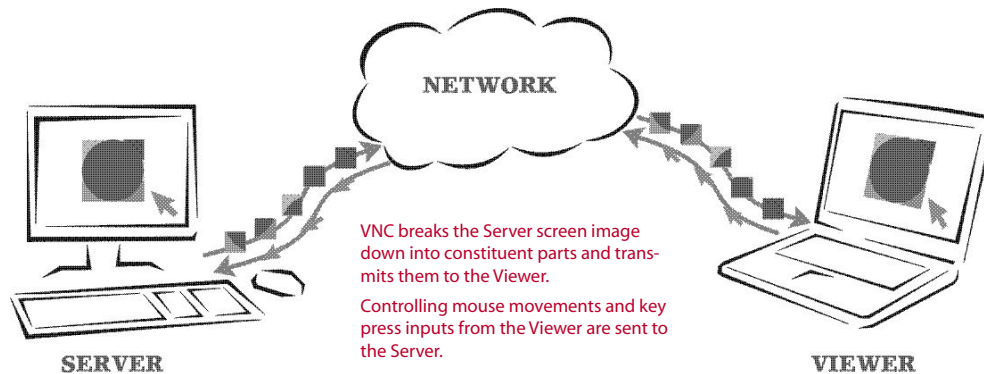
Introduction

What are VNC Server and Viewer?

VNC offers a deceptively simple service - it allows you to view and control a remote system as though seated next to it, wherever you are.

The compact VNC Server 4 application runs on the system to be controlled. Meanwhile, connecting systems can either run the VNC Viewer application or, use a standard web browser to download and use a Java viewer from the server system.

VNC adapts itself automatically and dynamically to varying conditions, including differing screen contents and network bandwidths. VNC is also platform-independent and will happily allow a Windows system to control a Linux server, or vice versa.



VNC Server 4 provides main two modes of operation to suit the manner in which the server system will be used and accessed. Please see [Two modes of operation](#) for details.

Thanks to a comprehensive update VNC now also offers:

- Full user and server authentication,
- Secure link encryption,
- Server screen scaling to fit any window size.
- Integrated connection management.
- File transfer.

Getting started

This guide provides information on various aspects of installing, configuring and using VNC Server 4

- [Installation](#)
Making a standard installation • Service mode registration
- [Configuration](#)
Tips on customising VNC Server 4 for different situations
- [Using VNC Server 4](#)
Connecting to (and from) the server
How to start and stop VNC Server 4
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What is an IP address?
What is a subnet mask?
What is a port?
Windows version support
Troubleshooting
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Installation

Making a standard installation

VNC was designed from the outset to be efficient and compact in operation and such qualities also apply to its installation. VNC Server 4 is available as a self-extracting installer downloaded from the RealVNC website.

To install VNC Server 4

- 1 Run the downloaded self-extracting installer and follow the on-screen prompts.

For the majority of installations it should be possible to choose all of the default options at almost every stage. At certain points you may be asked to enter a password and a valid license key.

Please refer to the [Options when installing](#) section for details about any part of the installation procedure.

If you choose all of the default options, then your VNC Server 4 installation will be as follows:

- Operation mode: [Service-Mode](#)
- Configuration: [VNC Authentication](#)
Encryption: [Always On](#)
- Connection port: [5900](#)



Dormant VNC Server 4 icon within the system tray - this indicates that the server is running but not currently actively connected

- Status: Running and ready to receive connections:
- File location: C:\Program Files\RealVNC\VNC4

Service mode registration

During installation, if you chose not to *Register and configure VNC Server for Service-Mode* then VNC Server can subsequently be registered for use in [Service-Mode](#) via the Start Menu option. Once registered, VNC Server will automatically run every time the computer is switched on, even before any users have logged on.

When it is no longer needed as a system service, you can unregister VNC Server at any time.

To register service mode

- 1 Click the Windows *Start* button. Choose *All Programs* (or *Programs* in non-XP versions). Select the *RealVNC* entry, then *VNC Server 4 (Service-Mode)* and finally select *Register VNC Service*.

VNC Server 4 service mode will be registered within Windows and a confirmation message should be displayed. When you next boot up the system, VNC Server 4 will automatically start as a system service. Alternatively, VNC Server can be started immediately by selecting the 'Start VNC Service' menu item.

To unregister service mode

- 1 Click the Windows *Start* button. Choose *All Programs* (or *Programs* in non-XP versions). Select the *RealVNC* entry, then *VNC Server 4 (Service-Mode)* and finally select *Unregister VNC Service*.

VNC Server 4 service mode registration will be removed and a confirmation message should be displayed. Although VNC Server 4 will continue to operate for the moment, when you next boot up the system, it will not automatically start. VNC Server can be stopped immediately by selecting the 'Stop VNC Service' menu item (see below).

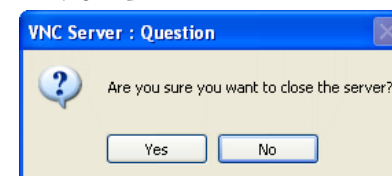
To stop the VNC Server 4 immediately, either:

- Select the *Stop VNC Service* option within the same *Start* menu folder as mentioned above, or
- Right click on the VNC Server icon in the system tray to display a popup menu. Select the *Close VNC Server* option.

Note that on Windows NT-based systems, to stop the VNC Server you must be logged on as a member of the Administrators security group.

In either case, a confirmation dialog will be displayed:

Click the *Yes* button to proceed.



Configuration

Customising VNC Server 4

VNC Server 4 operates perfectly well using its default installation options. However, by making various changes it is possible to optimise VNC Server operation for particular situations. The types of uses covered in this chapter are:

- Where maximum security is required - see below
- [Where speed is the most important factor](#)
- [Where the server is being demonstrated to a group](#)

All changes are made using the VNC Server Properties page. See [Displaying VNC Server Properties](#) for details about how to access it.

Where maximum security is required

There are numerous VNC Server 4 settings on various tabs that affect security and it is worth ensuring that they are all configured correctly when security is of particular issue.

Security tab [see [Security](#) for all options]

In order to create a secure server system, the most crucial settings to consider are *Encryption* and *Authentication*. The configurations of these two settings conspire to determine the robustness of your server system and its connections.

- Wherever possible the *Encryption* setting should be set to **Always On**. The only real drawback here is that users with older legacy viewers will be unable to make a connection (the best remedy is to upgrade such users to VNC Viewer 4 or above).
- With Encryption set to *Always On*, you can choose to use either type of *Authentication*: **VNC Password** or **NT Logon**. The latter is recommended because it uses the native Windows security system and allows you to allocate different access rights to users or groups of users. *Note: NT Logon Authentication cannot be used with servers on Windows 95, 98 or Me.*
- If you must support legacy users, then set *Encryption* to **Prefer On** and select *VNC Password Authentication*. Note that legacy viewers will be authenticated using only the first eight characters of a password. Also, legacy viewers do not support encryption and will not authenticate the server. Consider redressing the balance using *Access Control* (within the *Connections* tab) to restrict access to specific IP addresses.
- If a user will be present at the server system, you may wish to manually approve each connection. If so, tick the *Prompt local user to accept connections*. Exceptions may be made for particular privileged users by granting them the *Connect without querying local user* right in the NT Logon configuration dialog.
- Unless you need it, you can prevent users from enabling the guest login by setting *Guest login access* to *None*.

Sharing tab [see [Sharing](#) for all options]

- If one remote user should not be observable by another, select the *Never treat new connections as shared* option.
- If the existing user should retain precedence over new users, untick the *Non-shared connections replace existing ones* option.

Connections tab [see [Connections](#) for all options]

- *Ports* - Consider combining the main access port (*Accept connections on port*) and the *Serve Java viewer...* port to use the same number. This will mean that only one port needs to be opened through a firewall. Combining the ports will cause each initial connection to take up to two seconds longer to complete. See [Dealing with firewalls](#) for details.
- *Disconnect idle clients* - Reduce the idle time to help ensure that abandoned connections are not abused at the users system.
- *Access control* - Where possible define the IP addresses from which connections will be accepted and deny access to all others. See [Access control](#) for details.
- See also [Listening viewer](#) for details about how to avoid opening any new firewall ports by using the server to initiate connections to each viewer.

Inputs tab [see [Inputs](#) for all options]

- *Clipboard updates* - To prevent sensitive files or data on the local clipboard being accessible remotely or *vice versa*, untick the *Accept clipboard updates from clients*, the *Send clipboard updates to clients*, the *Accept files from clients* and the *Send files to clients* options.
- *Allow ... events* - In situations where users need to view but not interact with the server, you can untick the pointer and keyboard events options. When using NT Logon authentication, you can also untick various rights within the [NT Logon configuration dialog](#).

Desktop tab [see [Desktop](#) for all options]

- *When last client disconnects* - If the system is to be locally unattended and there is a chance of it being accessed by passers by, select the *Lock workstation* option to ensure that the system is not left open following a remote session.

Legacy tab [see [Legacy](#) for all options]

- Ensure that the *Only use protocol version 3.3* option is not ticked. This option forces the server into a compatibility mode that does not support advanced authentication or encryption features.

Where speed is the most important factor

The speed of response is affected by several factors.

Security tab [see [Security](#) for all options]

- **Encryption** - The use of data encryption imposes small performance overheads. Where the threat of data interception is not a strong issue, the *Encryption* option could be set to *Prefer Off*. VNC Viewers select *Let Server Choose* as standard for their encryption setting, so the link will be unencrypted unless a viewer explicitly requests an encrypted session.

Connections tab [see [Connections](#) for all options]

- **Ports** - Combining the main access port (*Accept connections on port*) and the *Serve Java viewer...* port to use the same number lengthens the initial connection time by up to two seconds. Where possible, ensure that these options are set to use different port numbers.

Desktop tab [see [Desktop](#) for all options]

- **While connected** - All three of the options in this section affect response speed. All should be ticked to reduce the information needed to be sent to the viewer.

Where the server is being demonstrated to a group

There are a number of areas where small changes may make VNC Server 4 even more suitable for demonstration purposes.

Connections tab [see [Connections](#) for all options]

- **Disconnect idle clients after** - Ensure that the value set here will not affect viewers who are observing a server demonstration but not necessarily responding to it.

Inputs tab [see [Inputs](#) for all options]

- **Accept events** - Depending on the type of demonstration, it may be advantageous to prevent the viewers from controlling the system. If so, untick both the *Accept pointer events from clients* and the *Accept keyboard events from clients* options in order to retain control.

Sharing tab [see [Sharing](#) for all options]

- If multiple viewers must be simultaneously connected, obviously there must be some element of sharing. Select the *Always treat new connections as shared* option and, as a precaution against certain viewer configurations, untick the *Non-shared connections replace existing ones* option.

Desktop tab [see [Desktop](#) for all options]

- **While connected** - Deselecting all three of the options within this section can help to improve performance. However, will the loss of the background pattern or wallpaper detract from the demonstration?

Listening viewer

In addition to the above settings, a very useful feature when demonstrating is to use the *Listening viewer* feature. This allows the server user to initiate connections to one or more viewers, relieving the users of this task. To achieve this, each VNC viewer application must be told to listen for connection attempts. See [Listening viewer](#) for more details.

Using VNC Server 4

In operation, VNC Server 4 remains almost unnoticed in the background, using minimal system resources. Its only visibility is as an icon within the *system tray* (or *notification area*) in the lower right corner of the Windows screen.



Dormant VNC Server 4 icon within the system tray - this indicates that the server is running but not currently actively connected



Move the mouse cursor over the VNC Server 4 icon to discover the server's IP address as well as its current operation mode: *Service* or *User*

The VNC Server 4 will remain dormant until an incoming connection request is received, whereupon it will deal with the request. In doing this, it will apply all relevant connection, security and operation options, as determined by the settings within the VNC Server Properties dialog.



Active VNC Server 4 icon within the system tray - this indicates that the server is running and has at least one active connection

Connecting to (and from) VNC Server 4

Once running (in Service- or User- Modes) VNC Server 4 can be accessed either by VNC Viewers or any Java-enabled web browser - see the *VNC Viewer 4 user guide* for full details. Additionally, the server system can be made to initiate connections to VNC Viewers that have been set to *listen* for such approaches - see [Listening viewer \(server-initiated connection\)](#) for details.

Starting and stopping VNC Server 4

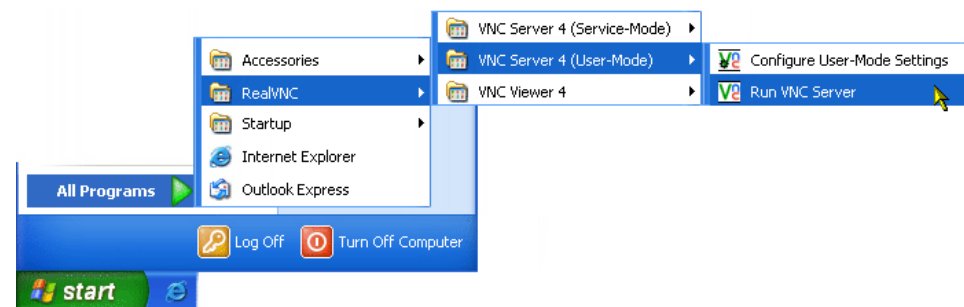
If VNC Server 4 has not been configured to start automatically, then you can start it, in either its *User* or *Service* modes, using the Start menu.

Note: See [Two modes of operation](#) for more details about *User* and *Service* modes.

Starting and stopping in user-mode

To start VNC Server 4 (user-mode)

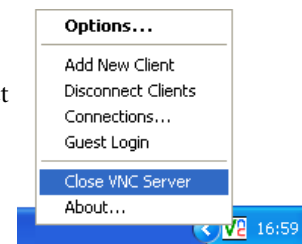
- 1 Click the Windows *Start* button and choose *All Programs* (or *Programs* in non-XP versions).



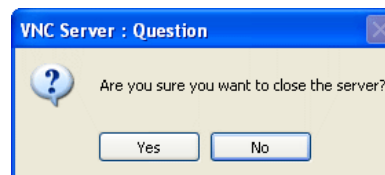
- 2 Select the *RealVNC* entry, then *VNC Server 4 (User-Mode)* and finally select *Run VNC Server*.

To stop VNC Server 4

- 1 Right click on the VNC Server icon in the system tray to display a popup menu. Select the *Close VNC Server* option.



A confirmation dialog will be displayed:

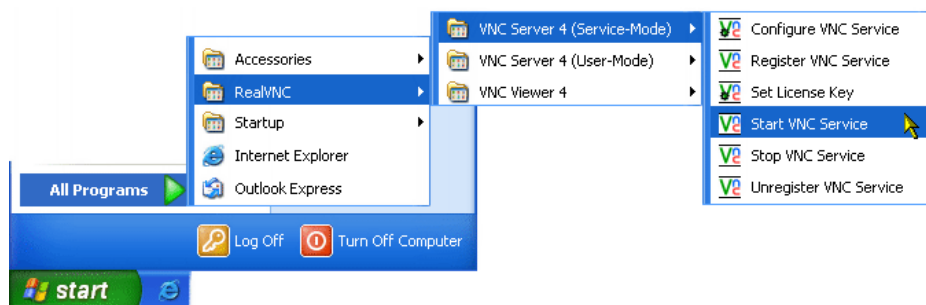


- 2 Click the *Yes* button to proceed.

Starting and stopping in service-mode

To start VNC Server 4 (service-mode)

- 1 Click the Windows *Start* button and choose *All Programs* (or *Programs* in non-XP versions).



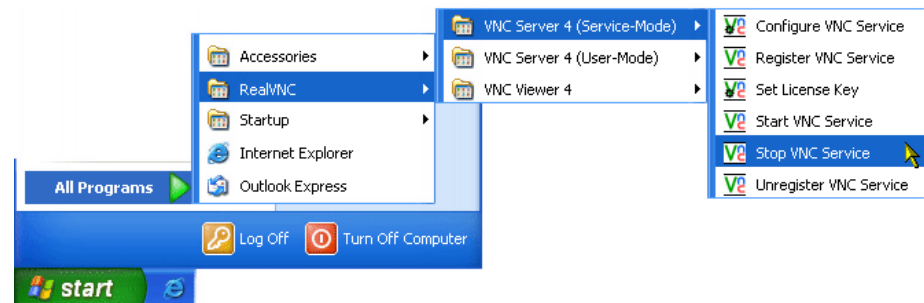
- 2 Select the *RealVNC* entry, then *VNC Server 4 (Service-Mode)* and finally select *Start VNC Service*.

To stop VNC Server 4 (service-mode)

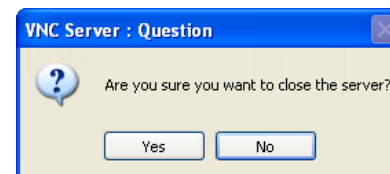
There are two ways to stop the VNC Server 4 when running in service-mode, either:

- Use the VNC Server system tray icon ([as per the user-mode instructions](#)), or
- Use the Start menu:

- 1 Click the Windows *Start* button and choose *All Programs* (or *Programs* in non-XP versions).



- 2 Select the *RealVNC* entry, then *VNC Server 4 (Service-Mode)* and finally select *Stop VNC Service*. A confirmation dialog will be displayed:



- 3 Click the *Yes* button to proceed

Further information

This section provides detailed information on a range of subjects related to VNC Server 4:

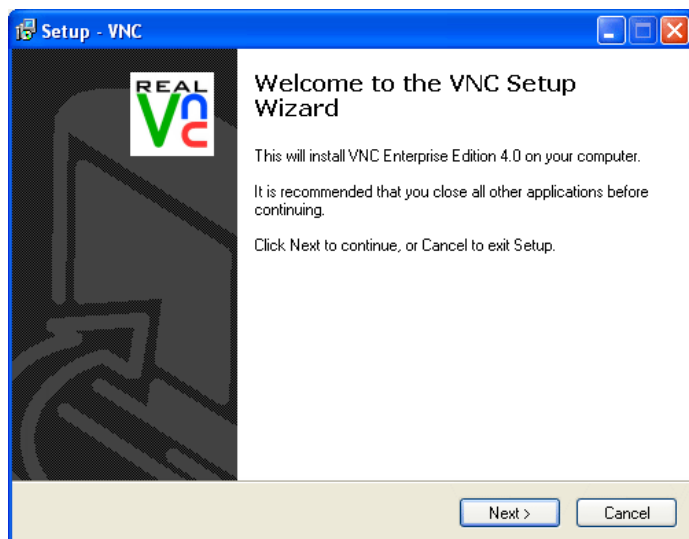
- [Options when installing](#)
An overview of the installation and explanation of the available options.
- [Using the tray icon](#)
A description of features available via the VNC tray icon.
- [VNC Server Properties](#)
Displaying VNC Server Properties
Security • Connections • Inputs • Sharing • Desktop • Hooks • Legacy
- [NT Logon authentication](#)
- [Two modes of operation](#)
User mode • Service mode
- [Listening viewer \(server-initiated connection\)](#)
- [Access control: Allow, deny or query addresses](#)
Calculating a range mask for access control
Ordering the access control list entries
- [Dealing with firewalls](#)
Changing VNC ports
- [What is an IP address?](#)
- [What is a subnet mask?](#)
How a subnet mask actually works
- [What is a port?](#)
- [Windows versions and limitations](#)
- [Troubleshooting](#)
- [Support](#)

Options when installing

For the majority of VNC Server 4 installations, simply clicking through with the setup screens using the *Next* button will be sufficient. For situations where alternative settings may be required, this section provides an overview of the setup procedure.

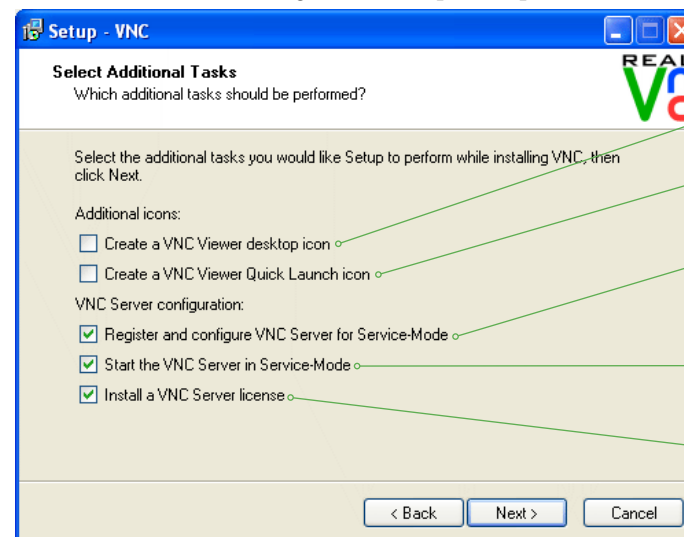
To install VNC Server 4

- 1 Run the downloaded self-extracting installer.
- 2 When the setup program begins, click the *Next* button to acknowledge the welcome screen:



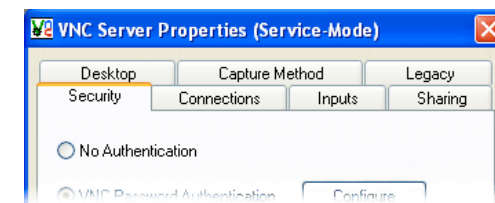
- 3 **License Agreement page:** Read the License Agreement page, select the *I accept the agreement* option and click the *Next* button.
- 4 **Select Destination Location page:** Click the *Next* button to accept the default VNC folder location, or use the *Browse* button to select an alternative location.
- 5 **Select components page:** Both the *VNC Server* and *VNC Viewer* will be installed by default. Untick options, as necessary, to prevent their installation. Click the *Next* button to continue.
- 6 **Select Start Menu Folder:** Click the *Next* button to agree *RealVNC* as the start menu folder name, or use the *Browse* button to locate an alternative. Optionally, tick *Don't create a Start Menu folder* to avoid adding any VNC entries to the Windows start menu.

- 7 **Select Additional Tasks page:** Set the required options and click the *Next* button:

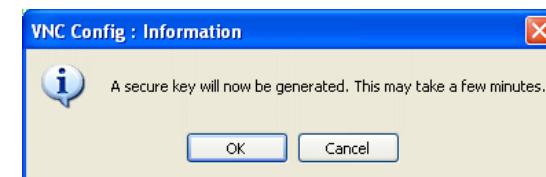


- Tick to create a VNC Viewer icon on your Windows desktop.
- Tick to create a VNC Viewer icon within the Quick Launch section adjacent to the Start button.
- Tick to perform the necessary system registration to allow VNC Server 4 to run as a Windows service.
- Tick to automatically run VNC Server 4 as a Windows service at every boot-up.
- Tick to configure the necessary license key. This step needs to be completed either now or at a later time before operation can take place.

- 8 **Ready to install page:** This page provides a summary of all installation options. Click the *Install* button to begin creating components within the selected folder.
- 9 **VNC Server Properties page:** If *Register and configure VNC Server for Service-Mode* was ticked, the *VNC Server Properties* page will be displayed. You can either make any required configuration changes now or at a later time. See the [Configuration](#) section for details. Click *OK*.

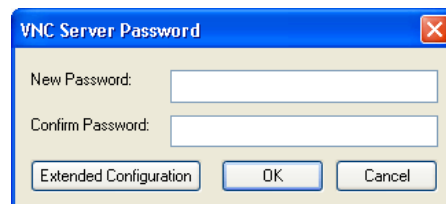


- 10 If *Register and configure VNC Server for Service-Mode* was ticked and an existing secure key was not found then you will be given the option of having one automatically generated. Click *OK*. A confirmation message will be given when the key has been generated.

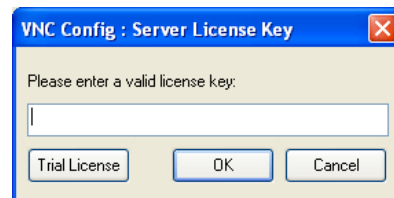


continued

- 11** If *VNC Authentication* (the default) was selected, and no VNC password is currently stored, then you will be prompted to supply one, to be used to authenticate incoming viewer connections. Enter a new password, enter it again to confirm and click *OK*.

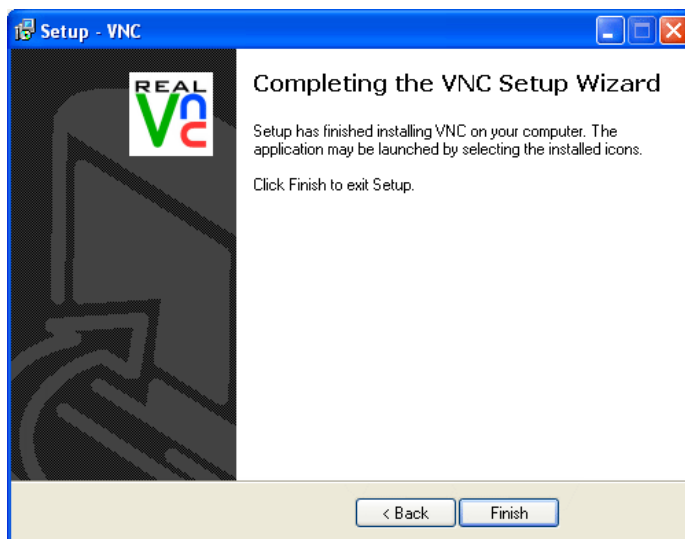


- 12** If *Install a VNC Server licence key* was ticked, and a valid licence key is not currently installed, then you will be prompted to supply a licence key. The license key will have been emailed to you when you purchased your VNC Enterprise Edition license. Either copy and paste the supplied license key and click *OK* or, if you are evaluating VNC Server 4, click the *Trial License* button.



- 13** **Information page:** After installation has taken place, a list of acknowledgements and a reminder of the end user license agreement will be displayed. Please read through and then click the *Next* button.

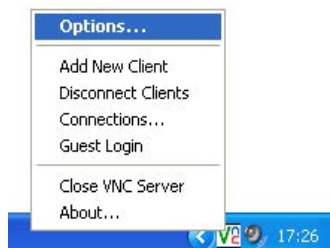
- 14** In the final page, click the *Finish* button to conclude the installation procedure.



Using the tray icon

VNC server installs an icon in the system tray, located on the right-hand side of the task bar. This has several functions:

- If you hover the mouse pointer over the tray icon, it will display the IP address of your computer.
- The background colour of the tray icon indicates whether or not there is anyone connected to your computer. A black background indicates at least one connection, whereas a white background indicates no connections.
- Right-clicking on the tray icon will bring up a menu for configuring and interacting with the program:
 - *Options...* opens the options dialog. See [VNC Server Properties](#) for details. If the VNC server is running in Service-Mode, then this option will be unavailable unless you have administrative privileges on the computer.
 - *Add New Client* allows you to make a reverse connection to a listening viewer. See [Listening viewer \(server-initiated connection\)](#) for details.
 - *Disconnect Clients* disconnects anyone currently connected to the VNC server.
 - *Connections...* opens the connection management dialog. ➡
 - *Guest Login* enables or disables the guest login. ➡
 - *Close VNC Server* closes the VNC server. If the VNC server is running in Service-Mode, then this option will be unavailable unless you have administrative privileges on the computer.
 - *About...* shows program and version information.
- Double-clicking on the tray icon is equivalent to the *Options...* menu item if it is available, or the *About...* menu item otherwise.



Connection management

You can use this dialog to check who is connected to your computer and from where. The current connections are listed, allowing you to see at a glance the IP address and port number of each. Click on a connection to see details of the username that was entered when the connection was made and the current level of access. Click *Change...* to view or change access permissions. Click *Disconnect* to disconnect that user; other connected users are unaffected.

Enabling guest login

At times it may be desirable for a user to temporarily allow access to their desktop on a controlled basis. If VNC Server 4 has been [configured to allow it](#), the user can enable a *guest* login to temporarily allow restricted access to the local desktop. Anyone logging in as *guest* must be approved by the local user, even if the server is not otherwise configured to query connection attempts.

The *guest* login can be enabled or disabled by any user even if the VNC Server is running in Service-Mode. This differs from other VNC Server Properties, which can only be modified by users with administrative privileges on the local computer when VNC Server is running in Service-Mode. If the *guest* login is enabled when VNC Server is closed, it will not be enabled next time it starts up.

VNC Server Properties

The VNC Server Properties dialog is where the key aspects of operation are configured via seven tabbed pages which are labelled as follows:

- [Security](#)
- [Connections](#)
- [Inputs](#)
- [Sharing](#)
- [Desktop](#)
- [Capture method \(Hooks\)](#)
- [Legacy](#)

During installation the settings contained within this dialog are configured to meet the general requirements of most common installations. However, for assistance on customising operation for particular tasks, please see the [Configuration](#) section.

Displaying VNC Server Properties

The VNC Server Properties dialog can be accessed either from the VNC Server 4 system tray icon, or from the Windows Start button.

To display VNC Server Properties (via the system tray icon)

- 1 In the lower right hand corner of the Windows task bar, move the mouse pointer over the VNC icon.
 - If no icon is visible then VNC Server 4 may not be running, see [Starting VNC Server 4](#) for details.

- 2 Click the right mouse button to reveal a popup menu.

- 3 Use the left mouse button to select *Options...*

The VNC Server Properties window will be displayed with the [Security](#) tab selected.



To display VNC Server Properties (via the Start menu)

- 1 Click the Windows *Start* button. Choose *All Programs* (or *Programs* in non-XP versions) and then select the *RealVNC* entry.
- 2 Choose the Start menu sub-options that are appropriate to the VNC Server mode that will be used, either:
 - Select *VNC Server 4 (Service-Mode)* and then choose *Configure VNC Service*, or
 - Select *VNC Server 4 (User-Mode)* and then choose *Configure User-Mode Settings*.

In either case the appropriate VNC Server Properties window will be displayed with the [Security](#) tab selected.

Security

The security tab is concerned with two important operational areas: *User authentication* and *Encryption*.

Note: The authentication and encryption settings are very closely related and the overall effect on security is a product of both settings.

No Authentication

When selected, this option will allow viewer applications to connect with the VNC Server without the need for username or password. This option can be useful when the server system is operating within a completely secure environment such as a Local Area Network or Virtual Private Network, to remove the requirement for authentication.

[Command line equivalent: UserPasswdVerifier=None]

IMPORTANT: Use this option with extreme caution. Do NOT use it unless the host network is known to be completely secure.

Note: Encryption can be used even if 'No authentication' is configured.

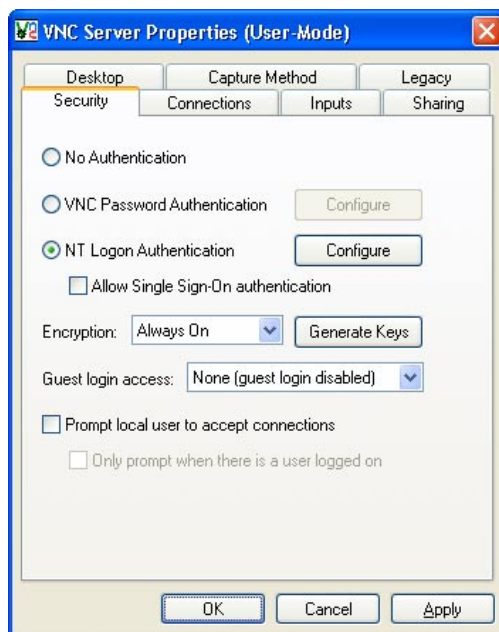
VNC Password Authentication

When selected, this option will require any viewer application to supply a valid password before granting access to the server system. Use the adjacent *Configure* button to create up to four passwords, each of up to 255 characters. Note: If the Encryption option is not set to *Always On* then legacy viewers will be required to provide only the first eight characters of any password.

[Command line equivalent: UserPasswdVerifier=VncAuth]

Configure

Click this button to create a password of up to 255 characters that you will use to access the VNC Server. There are no imposed minimum requirements for the password, however, you are strongly recommended to use at least six characters and to use a mixture of letters and numerals. When VNC Server is accessed by older VNC viewers, only the first 8 characters will of the password will be checked. It is therefore advisable to set the *Encryption level* to *Always On*, to prevent legacy viewers connecting, for maximum security.



VNC Extended Authentication

Starting with version 4.1.4, the standard VNC Password authentication has been superseded by VNC Extended Authentication. This allows up to four passwords each of up to 255 characters for a standard user, an admin user, a view-only user and an input-only user. To configure the admin, view-only and input-only passwords, click the *Extended Configuration* button to access the [VNC Extended Authentication](#) dialog.

NT Logon Authentication

This option (not available on Windows 95, 98 or Me installations) links into the internal security system within Windows NT, 2003 Server and XP. The advantage of this method is that, using the [Windows user configurations](#), you can grant different permissions for different types of users, e.g. administrators, guests, users, etc.

[Command line equivalent: UserPasswdVerifier=NtLogon]

Configure

Click this button to gain access to the [Windows permissions for VNC Server](#) dialog. From here you can select existing user groups for the server system and edit their permissions.

Allow Single Sign-On authentication

If single sign-on is enabled in both the VNC server and the VNC viewer, then the viewer will initially attempt to authenticate the user using his or her login credentials. Only if this fails is the user prompted for a username and password. The advantage of single sign-on is that the user does not have to re-enter his or her password. However, in an environment where workstations are regularly left unattended and unlocked, it can introduce a security risk.

IMPORTANT: Under Windows NT 4, if single sign-on is enabled on the server, then only viewers running under Windows NT 4 will be able to connect using single sign-on. To connect from other viewers you must explicitly disable single sign-on in either the server or the viewer—the viewer will not automatically prompt the user for a username and password in this situation. This is due to a limitation of Windows NT 4.



Encryption

[Command line equivalents: SecurityTypes=see {entries} below]

This option allows you to determine how encryption will be applied to user connections. There are three choices:

Prefer Off: Creates un-encrypted links unless an incoming VNC Viewer has its settings as 'Prefer On' or 'Always On', in which case the link would be encrypted. {RA2ne,None,RA2}

Prefer On: Creates encrypted links unless an incoming VNC Viewer has its settings as 'Prefer Off', in which case the link would be un-encrypted. {RA2,RA2ne,None}

Always On: Forces all viewer connections to be encrypted. Legacy viewers cannot connect when this setting is used. {RA2}

In addition to the SecurityTypes parameter values given above, if single sign-on is enabled, then RA2 and RA2ne are replaced with SSPI,RA2 and SSPIne,RA2ne, respectively.

Generate Keys

Click this button to create new RSA keys that are used as the basis for link encryption. This operation normally needs to be carried out once only during installation.

Guest login access

[Command line equivalent: GuestAccess=see below]

When set to *None* (*guest login disabled*), {GuestAccess=0} the local user cannot enable the guest login (see [Enabling guest login](#)). Otherwise, the user can temporarily allow access to the desktop with either 'View-only' {GuestAccess=v} or 'Interactive' {GuestAccess=d} permissions. The guest login differs from standard user logins in that all connections must be explicitly approved by the local user, even if the query connect feature is not enabled. This can be overridden by editing the GuestAccess value in the registry. For example, setting {GuestAccess=f} will give guest users all access rights, including bypassing the query connect dialog (not recommended).

Prompt local user to accept connections

[Command line equivalent: QueryConnect=true/false]

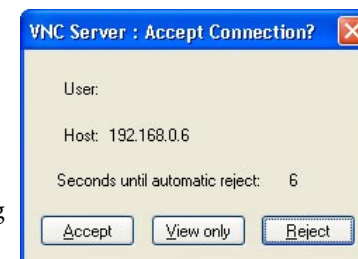
When ticked, when a VNC viewer connects, a confirmation dialog is displayed on the server system indicating the user name supplied by the viewer and the IP address from which the connection originates. If no response is given (by the server user) within ten seconds, the connection is rejected. If a second viewer attempts to make access during this time, then it will be immediately rejected.

When querying of connections is enabled, the server user has the option of allowing the viewer user to connect with the permissions they would normally have, refusing the connection completely, or allowing the connection to go ahead with viewer-only access to the desktop.

Only prompt when there is a user logged on

[Command line equivalent: QueryOnlyIfLoggedOn=true/false]

When ticked, if a local user is logged on to the server system, they will be prompted to accept or reject incoming connections. With no local user logged on, connections are permitted as normal, subject to the other connection criteria.



Connections

This tab determines key connection details relating to the IP ports used, the IP addresses from which viewer connections will be accepted and also the idle disconnection time.

Accept connections on port

This option indicates the port through which viewer clients will be served. The standard setting of 5900 is expected by VNC viewer applications; however, if this port clashes with another local network service, then it can be changed to use any other vacant port number. Please note, however, if you alter this number, then the viewer user(s) will need to specify the non-standard port number as part of the network address when logging-in.

Please see [VNC Viewer documentation - Making a connection](#) for more details.

[Command line equivalent: PortNumber=(port number)]

Disconnect idle clients after (seconds)

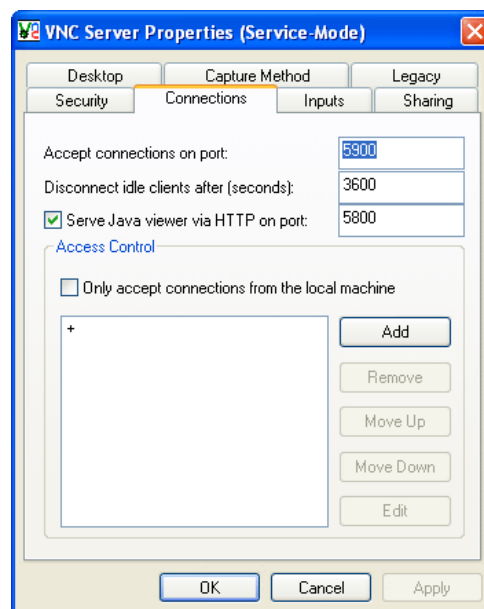
This option is similar to a screen-saver timeout, with the difference that when the specified number of seconds has elapsed without any input from a particular viewer, the viewer's connection will be closed. After the set period of time has elapsed since the last user interaction, VNC Server 4 will terminate the connection in order to conserve resources. As standard this option is set to 3600 seconds, or 1 hour. To prevent any connection timeouts, set this option to 0 (zero).

[Command line equivalent: IdleTimeout=(seconds)]

Serve Java viewer via HTTP on port

This option determines the port through which VNC Server 4 will provide the Java viewer applet to Java-enabled browsers, when requested. As standard, the port number presented here is 100 lower than the current main port address and will change accordingly whenever the main port is changed. If necessary, you can manually alter the Java viewer port number. You may wish, for example, to have the Java viewer served on the same port through which the server accepts VNC connections in order to simplify firewall configuration (connections can take up to 2 seconds longer when this is done). The Java Viewer can be disabled by unticking the check box, if it is not required or if the Java Viewer is to be provided by a separate server.

[Command line equivalent: HTTPPortNumber=(port number)]



Serving Java separately

This is useful in situations where the number of open ports needs to be minimised for security. You can configure a central VNC Server to serve the Java applet to browsers, which (once loaded) can then contact alternative VNC Servers. Thus, only one central port at 5800 is required, rather than one per server. The browsers used must have a Java Virtual Machine (JVM) that supports signed applets. Currently the Opera and Firefox browsers are known to be capable, as is Internet Explorer with Sun's JVM installed..

Access control

This area allows you to restrict access from incoming viewers according to their originating/source IP addresses. Addresses can be specifically accepted or rejected on any scale from a single address right up to small or large scale 'subnets' of addresses.

Only accept connections from the local machine

When ticked, this option will cause the access control settings (if any) to be ignored and make the VNC Server 4 system inaccessible via all network interfaces except the local loop-back interface.

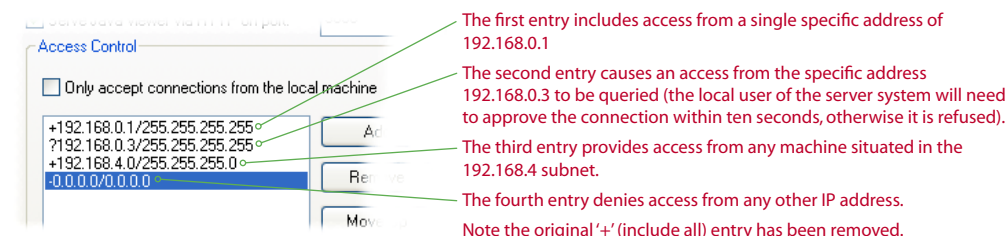
[Command line equivalent: LocalHost=true/false]

Access address area

The access address area is where specific addresses or ranges of addresses are declared and set to be *Allowed* (denoted by a + prefix), *Denied* (denoted by a - prefix) or *Queried* (denoted by a ? prefix).

Each entry in the list comprises an action (+, -, ?), followed by an address pattern. Address patterns consist of an IP address or address prefix, followed by a subnet-style mask. The mask is used to determine how much of the IP address prefix must match the originating address of an incoming connection for the rule to apply to that connection. As standard, the list is empty except for a single "Allow All" entry (" +0.0.0.0/0.0.0.0"), which matches all possible IP addresses of connections and Allows them. If none of the specified rules apply to an incoming connection then the connection will be automatically rejected, for security.

Consider the following example entries:



The first entry includes access from a single specific address of 192.168.0.1

The second entry causes an access from the specific address 192.168.0.3 to be queried (the local user of the server system will need to approve the connection within ten seconds, otherwise it is refused).

The third entry provides access from any machine situated in the 192.168.4 subnet.

The fourth entry denies access from any other IP address.

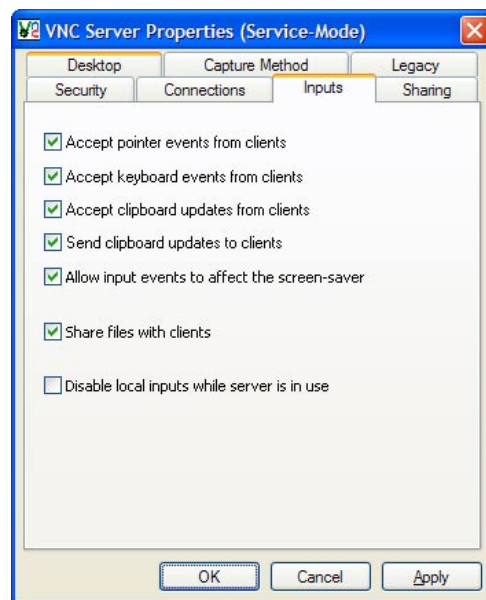
Note the original '+' (include all) entry has been removed.

Please see [Ordering entries in the access control list](#) for details about editing *Access Control* entries. To exclude a particular address or range of addresses, create a Deny rule and place it **before** any Allow rules.

[Command line equivalent: Hosts=[<pattern>[,<pattern> [...]]]

Inputs

This tab determines the level of control that incoming viewer applications (clients) can gain over the server system.



Accept pointer events from clients

When ticked, the viewer user is permitted to control the server using their mouse. In combination with the 'Accept keyboard events from clients' and 'Accept clipboard updates from clients' options, disabling this control is useful for making the server a 'view only' system.
[Command line equivalent: `AcceptPointerEvents=true/false`]

Accept keyboard events from clients

When ticked, the viewer user is permitted to control the server using their keyboard. In combination with the 'Accept pointer events from clients' and 'Accept clipboard updates from clients' options, disabling this control is useful for making the server a 'view only' system.
[Command line equivalent: `AcceptKeyEvents=true/false`]

Accept clipboard updates from clients

When ticked, the viewer user can copy text from their system to the clipboard of the server. In combination with the 'Accept pointer events from clients' and 'Accept keyboard events from clients' options, disabling this control is useful for making the server a 'view only' system.
[Command line equivalent: `AcceptCutText=true/false`]

Send clipboard updates to clients

When ticked, any text added to the clipboard of the server system will be made available to the clipboard of any viewer user who is logged-in at the time. Disabling this option can be useful in preventing private server information from being leaked via the clipboard by untrusted viewer users.

[Command line equivalent: `SendCutText=true/false`]

Allow input events to affect the screen-saver

When ticked, this option allows the mouse and/or keyboard activity from the incoming viewer system to interrupt the screen-saver (if present) on the server system. This is a system option, implemented within later Windows versions and is not available under earlier releases (such as Windows NT).

[There is no equivalent command line option.]

Share files with clients

When ticked, the viewer user can put files from their system onto the clipboard of the server, and *vice versa*. These files can then be pasted into a directory on the server. Note that the VNC Viewer must support file transfer and have it enabled for this to work.

[Command line equivalent: `ShareFiles=true/false`]

Disable local inputs while server is in use

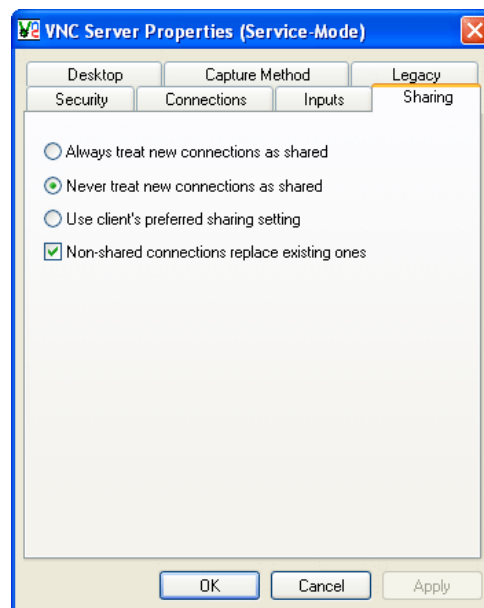
When ticked, this option ignores any input from the server's own locally connected keyboard and/or mouse while remote VNC sessions are active. Note that the desktop remains visible.

[Command line equivalent: `DisableLocalInputs=true/false`]

Sharing

The options within this tab determine exactly how VNC Server 4 should behave when two or more viewers are connected to the server system.

When viewers connect, they request either shared or non-shared connections to the server. Such requests come into effect when another user is also viewing the same server. The settings within this tab determine exactly how the server should respond to such requests.



Always treat new connections as shared

When selected, all incoming connections are treated as shared and so no existing users will be disconnected nor will new users be turned away.

[Command line equivalent: AlwaysShared=true, NeverShared=false]

Never treat new connections as shared

When selected, all incoming connections will be treated as non-shared. When a second incoming connection attempt is made, it will either be rejected or the existing user will be disconnected, depending upon the setting of the 'Non-shared connections replace existing ones' option.

[Command line equivalent: NeverShared=true, AlwaysShared=false]

Use client's preferred sharing setting

When selected, VNC Server 4 will defer to the 'Shared connection' setting of the second incoming viewer. If the second viewer is set to share, then it will be permitted to make the connection, if not it will either be rejected or will replace the existing viewer, depending upon the setting of the 'Non-shared connections replace existing ones' option..

[Command line equivalent: AlwaysShared=false, NeverShared=false]

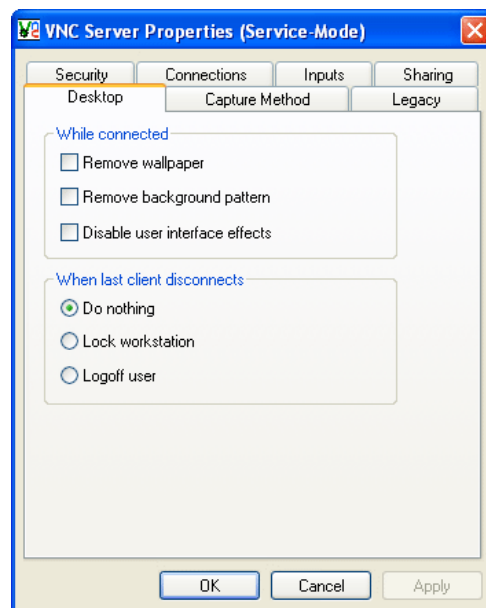
Non-shared connections replace existing ones

This option will determine the outcome when a connection is non-shared, either by viewer choice or when the 'Never treat new connections as shared' option is selected. In such cases, if this option is ticked, then the existing user is disconnected. If this option is unticked, then the new user is rejected.

[Command line equivalent: DisconnectClients=true/false]

Desktop

This tab provides opportunities to fine tune performance by reducing unnecessary desktop effects and also allows you to determine how the server system should be left after it has been accessed.



While connected

Remove wallpaper

When ticked, the wallpaper image (if used) on the server system will be removed and replaced with a plain background whenever a VNC viewer is connected. This option will also attempt to disable Windows Active Desktop, if it is use. This can help to reduce transmitted data and hence improve overall performance.

[Command line equivalent: RemoveWallpaper=true/false]

Remove background pattern

When ticked, the background pattern (if used) on the server system will be removed and replaced with a plain background whenever a VNC viewer is connected. This can help to reduce transmitted data and hence improve overall performance.

[Command line equivalent: RemovePattern=true/false]

Disable user interface effects

When ticked, any visual user interface effects, such as animated drop-down boxes, will be disabled whenever a VNC viewer is connected. This can help to reduce transmitted data and hence improve overall performance.

[Command line equivalent: DisableEffects=true/false]

When last client disconnects

Do nothing

When selected, there will be no change to the operation of the server once there are no more VNC viewers connected to it.

[Command line equivalent: DisconnectAction=None]

Lock workstation

When selected, after the last VNC viewer has disconnected, the server system will be temporarily locked and returned to its log-in screen. This option can help to avoid un-authorised access where the system is left unattended and other people are in its vicinity.

[Command line equivalent: DisconnectAction=Lock]

Logoff user

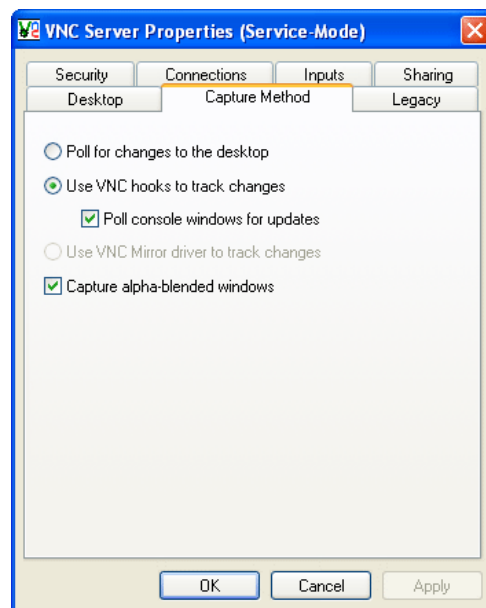
When selected, after the last VNC viewer has disconnected, the current user session of the server system will be ended and the system returned to its initial log-in screen. This option is useful to ensure that the server system never remains logged-on after a VNC session. This option can help to avoid un-authorised access where the system is left unattended and other people are in its vicinity.

[Command line equivalent: DisconnectAction=Logoff]

Capture Method (Hooks)

This tab concerns the various methods that VNC Server 4 can employ to keep track of changes to the desktop so that they may be transmitted to the current VNC viewer(s).

Note: This tab is titled Hooks within VNC versions prior to v4.1.



Poll for changes to the desktop

When selected, this option polls the Windows display system for changes to the entire desktop. This method is slower than the 'Use VNC Hooks...' and 'Use VNC Mirror...' options. However, it can be useful in cases where the other two methods encounter timing/compatibility problems or cannot track an application that interfaces directly with the graphics card, such as with some DirectX applications.

[Command line equivalent: CaptureMethod=poll]

[Command line equivalent (prior to v4.1): UseHooks=false]

Use VNC hooks to track graphical updates

When selected, this option employs the standard VNC hooks technique to monitor changes to the local desktop. VNC hooks allow VNC Server 4 to monitor the messages sent to on-screen windows in order to ascertain when their content may have changed. This method is very successful; however, it can miss certain types of update or conversely can also mistakenly report areas as having changed when in fact they have not. For these reasons, you are recommended to use this method in conjunction with 'Poll console windows for updates' option.

[Command line equivalent: CaptureMethod==hooks]

[Command line equivalent (prior to v4.1): UseHooks=true]

Poll console windows for updates

When ticked, this option will track the visible parts of console windows and poll those areas for changes. This option is best used in close combination with the 'Use VNC hooks to track graphical changes' option because the rate of polling can be reduced, which helps to increase performance.

[Command line equivalent: PollConsoleWindows=true/false]

Use VNC Mirror driver to track changes

When selected, this option takes advantage of a Windows facility that mirrors all primary display graphical updates to a secondary driver, such as VNC. This produces a fast and accurate update method, however, it operates at a low system level and could encounter problems on some systems. This option is disabled unless you have the VNC Mirror Driver installed.

[Command line equivalent: CaptureMethod=mirror]

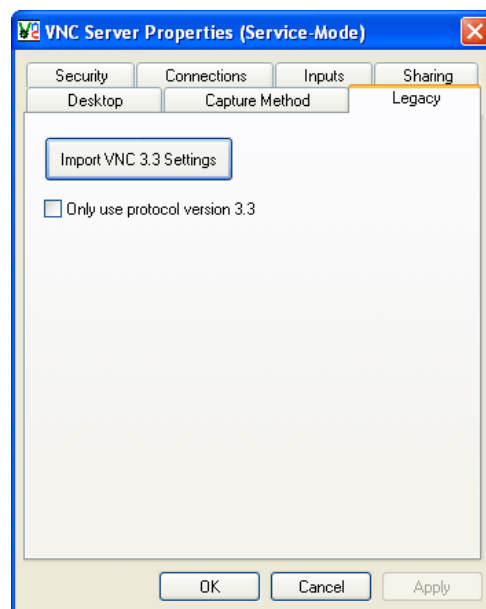
Capture alpha-blended windows

When ticked, this option tracks newer semi-transparent windows, as well as standard windows, including certain menus and tool tips. This method places higher requirements on the server and can induce cursor flicker.

[Command line equivalent: UseCaptureBlt=true/false]

Legacy

This tab contains options that are useful when migrating from an older version of VNC Server and where existing users are still using older viewers.



Import VNC 3.3 Settings

When selected, this option will attempt to overwrite the current VNC Server 4 settings with those of a previous WinVNC 3.3 installation that was installed on the same system. The exact settings that will be imported depend upon the current VNC Server 4 operation mode that you are using:

- User-Mode VNC Server 4: Will attempt to approximate your personal VNC 3.3 settings.
- Service-Mode VNC Server 4: Will attempt to match the default settings from the local system.

VNC Server 4 will warn you when it cannot match existing settings or if they are no longer relevant.

It is not possible to run both WinVNC 3.3 and VNC Server 4 simultaneously on the same port. Therefore, once the settings have been imported, you must either:

- Separately uninstall the WinVNC 3.3 service, or
- Configure one of the VNC Servers to operate on a different port number – Please refer to [Changing VNC Ports](#) for further details.

Only use protocol version 3.3

When ticked, the VNC Server 4 will restrict its operation to use only the version 3.3 protocol. This option is only provided to allow compatibility with some poorly-behaved third-party viewer software, which reports incorrect protocol version numbers or assumes the presence of non-standard features.

Warning: Use this option with caution as the advanced VNC Server security features such as encryption and NT Logon authentication must be disabled completely in order to support older viewers.

[Command line equivalent: Protocol3.3=true/false]

VNC Extended authentication

Older versions of VNC support VNC Password authentication, which has a single password to control access to the desktop. Current versions still support this method of authentication, but it has been extended to provide four different virtual users, each with a distinct password. Access to the desktop can be granted in a more controlled way using the following user names:

- **user** has default access, meaning that anyone connecting as *user* can view and interact with the desktop using the keyboard and the mouse and can access the remote clipboard. However, if the QueryConnect feature is enabled, the local user can refuse the connection. If no username is specified when a connection is made, *user* is substituted as the default.
- **admin** has full access, meaning that anyone connecting as *admin* has all access rights described above, but the local user is not queried to approve the connection, even if the QueryConnect feature is enabled.
- **viewonly** has permission to view the desktop, but cannot interact with it. Mouse and keyboard input is disabled, and access to the remote clipboard is denied. As with *user*, the local user can refuse the connection if QueryConnect is enabled.
- **inputonly** has permission to interact with the desktop, but cannot view it. Mouse and keyboard input and access to the remote clipboard is enabled, but the VNC Viewer window will remain blank. As with *user* and *viewonly*, the local user can refuse the connection if QueryConnect is enabled. The *inputonly* user is included mostly for completeness; in most situations it is not useful.

Each password can be up to 255 characters in length. There are no imposed minimum requirements for the passwords, however, you are strongly recommended to use at least six characters and to use a mixture of letters and numerals.

Legacy viewers

VNC Enterprise Edition provides support for legacy VNC viewers if VNC Extended authentication is enabled. Legacy viewers do not allow a username to be entered, so they can only authenticate as *user*. It is important to note that legacy viewers do not support passwords longer than 8 characters. If the user password is longer than this, only the first 8 characters will be checked. For maximum security, you can prevent legacy viewers from connecting by setting the encryption level to *Always On*.

Enabling VNC Extended authentication

To enable VNC Extended authentication, set the authentication mechanism to VNC Password Authentication and then click the *Configure* button. This allows you to set the *user* password. To set the *admin*, *viewonly* or *inputonly* passwords, click the *Extended Configuration* button. Select the users you want to enable and click the corresponding *Set Password* button to set the password.



NT Logon authentication

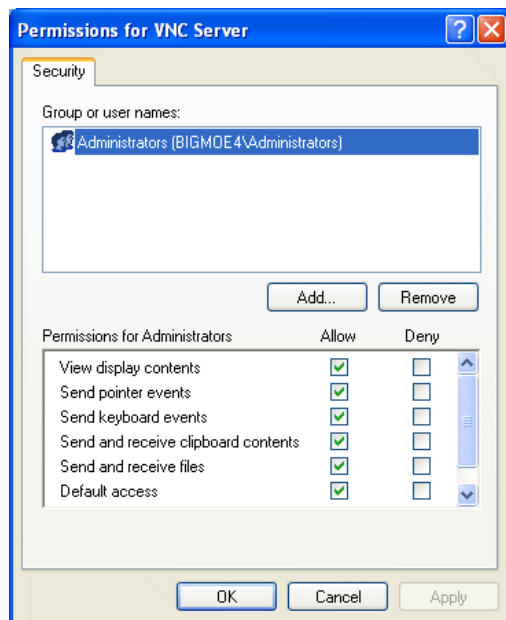
VNC Server 4 offers the ability to authenticate users via the native security system of Windows (not 95, 98 or Me) and allows you to grant different access rights to particular users or groups.

Two main steps need to be completed via the [Security tab](#):

- Select the *NT Logon Authentication* option, and
- Click the *Access Control* button to configure suitable user/group rights.

To configure NT Logon user/group permissions

- 1 Display the Security tab within the [VNC Server properties dialog](#).
- 2 Click the *Access Control* button to display the permissions dialog:



Existing user or group names are displayed within the dialog. New users or groups can be added to the list using the *Add...* button. The procedure for adding new users/groups is a standard Windows function and is beyond the scope of this user guide.

The available access rights for users or groups via incoming VNC Viewer connections are as follows:

- **View display contents**
Allow the remote user to see the contents of the VNC Server desktop.
- **Send pointer events / Send keyboard events**
Allow the remote user to interact with applications running in the VNC Server desktop.
- **Send and receive clipboard contents**
Allow the clipboard contents to be synchronised between the viewer and server.
- **Send and receive files**
Allow file transfer (via clipboard copy and paste) between the viewer and server.
- **Default access**
Allow the default level of access (View display contents, Send pointer & keyboard events, Send and receive clipboard contents, Send and receive files). When new access rights which are enabled by default become available, users and groups previously configured with Default access will automatically have access to them.
- **Connect without accept/reject prompt**
Allow the remote user to connect without a local user having manually accepted the connection. This allows the QueryConnect feature to be bypassed by particular users or groups, for emergency access to servers.
- **Full access**
Grant all available access rights. When new access rights become available, users with Full access will automatically have access to them, regardless of whether they are granted by default.

The default access rights granted to users and groups are as follows:

- **Full access** Members of the local Administrators group.
Members of the local or domain VNC Admins group, if available.
- **Default access** Members of the local or domain VNC Users group, if available.
- **View display contents** Members of the local or domain VNC View-only group, if available.

NT Logon Session Logging

In addition to the default logging of connection attempts by VNC Server, the NtLogon authentication method independently logs successfully authenticated sessions. Sessions' log events are stored in the Application Event Log of the machine that authenticated the session.

- If a VNC connection is made using local user account credentials then the session will be logged in the host computer's event log.
- If a VNC connection is made using domain-based credentials then the session will be logged with one of the domain's controllers.

Two modes of operation

VNC Server 4 offers two levels of operation so that you can match it to suit your needs. The two levels are: *User mode* and *Service mode*. When you install VNC Server 4, both modes will be available and you can choose which one to use. The differences between the two modes are as follows:

User mode

- Runs as a normal application, according to the current users' rights on the system.
- Is not available when the user logs out or when the system is locked.
- VNC Server can be configured independently by each system user who wishes to run it.
- The NT logon authentication method is not supported in User mode under operating systems older than Windows XP.
- **Best used when:**
 - You are a single user who requires occasional help from a remote third party, need to infrequently share work or need to control your system from elsewhere.

Service mode

- Is available as soon as the system has finished starting up, and continues to be available even when you have logged out or the system is locked.
- Configured with a single set of system-wide options that apply regardless of which user (if any) is logged in at the time.
- **Best used when:**
 - Multiple local users of a system need to regularly offer remote access to their machine.
 - The system needs to be accessed by a central administrator.
 - System sharing/control is required out of hours when local users are normally logged off.

Listening viewer (server-initiated connection)

In certain circumstances it can be preferable for the VNC server to initiate connections to one or more viewers, rather than the other way round. For instance:

- Firewalls can often cause problems for incoming connections to server systems. When the server initiates the connection to a viewer, this problem is overcome. The firewall must, however, allow outgoing connections through port 5500. Also, if the viewer system is behind its own firewall, then that must allow incoming connections, also at port 5500.
- Where VNC is used in a classroom or presentation environment, the tutor/presenter can make his server initiate connections to each of the viewer systems. In this way greater overall control is retained and this method obviates the need to provide server connection information to each user.

To create a listening viewer connection

Two main stages need to occur:

1 Set the VNC Viewer on each user's system to listen.

On each VNC Viewer system:

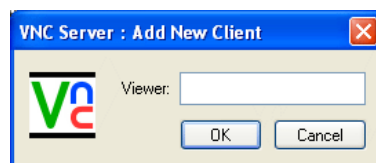
- i Click the Windows *Start* button.
- ii Choose *All Programs* (or *Programs* in non-XP versions). Select the *RealVNC* entry, then *VNC Viewer 4* and finally select *Run Listening VNC Viewer*.
(Alternatively, if starting VNC Viewer from a command line, add the switch '*-listen*')

2 Prompt the VNC Server 4 to add a new client and enter the viewer's IP address.

On the VNC Server 4 system:

- i Right click on the VNC icon in the system tray.
- ii From the popup menu, click the *Add New Client* option.
- iii In the resulting popup dialog, enter the IP address of the viewer system and click *OK*.
No username or password are required.

Providing the correct address is entered and there are no firewall issues with the viewer system, the VNC Viewer will display the server's screen exactly as if it had initiated the connection in the usual manner.



To end a listening viewer connection

Listening viewer connections can be terminated by either party, either:

- **From the viewer:** Close the viewer window.
- **From the server:** Right click on the VNC Server 4 icon in the system tray and select the *Disconnect Clients* option.

Access control: Allow, deny or query addresses

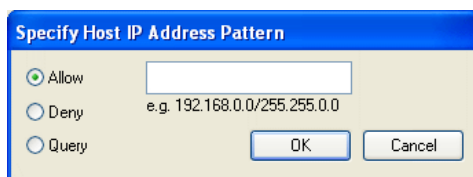
VNC Server 4 provides the opportunity to specifically control connection requests from particular IP addresses, or ranges of addresses. For each specified IP address or range, you can:

- *Allow* – connection attempts from such addresses will be accepted (with the correct password, if set),
- *Deny* – connection attempts from such an address will be rejected immediately.
- *Query* – connection attempts will be announced to the local server user, who will need to confirm acceptance (within ten seconds), otherwise the connection will be rejected.

Each entry requires an *action* (Allow, Deny, Query) and a *pattern*. Patterns consist of an [IP address](#) or prefix, and a [range mask](#) (similar in form and function to a [Subnet Mask](#)) describing which parts of the supplied IP address must match and these are entered via the [Connections](#) tab within the VNC Server Properties dialog.

To add or edit IP address ranges

- 1 Display the VNC Server Properties dialog (see [To display VNC Server Properties](#)).
- 2 Select the Connections tab
- 3 Either add or edit an entry:
 - **Add a new entry:** Click the *Add* button.
 - **Edit an existing entry:** Highlight the entry in the *Access Control list* and click the *Edit* button.



The Host IP address pattern dialog will be displayed.

- 4 In the edit area, enter or edit the required IP address followed by a '/' and then the range mask – see [Calculating a range mask for access control](#) for details.

Note: If you do not enter a range mask after the IP address, VNC Server 4 will assume that you intend to define a single address and automatically insert the necessary 255.255.255.255 for you.

- 5 Select the *Allow*, *Deny* or *Query* options, as necessary.

Note: The order of entries within the access control list is critical to the correct operation of VNC Server 4. See [Ordering the access control list entries](#) for details.

- 6 Click the OK button to add the selected address to the list within the [Connections](#) tab.

- 7 Click the *Apply* button in the lower right corner of the VNC Server Properties window.

Note: The '+' entry in the Access Control list means 'accept all addresses'. If you wish to allow only those addresses that you specify, then you must remove the '+' from the list. You should also add the entry -0.0.0.0/0.0.0.0 (usually at the end of the list) to ensure that no other addresses can gain access.

You can now:

- Add another address
- [Use the Move Up and Move Down buttons to adjust the order](#)
- [Delete an unwanted entry](#)

Calculating a range mask for access control

A range mask is used to define the number of IP addresses that will be given special treatment (either to be: *allowed*, *denied* or *queried*) when attempting to connect with the VNC Server 4. The range mask operates in a similar manner to a standard [subnet mask](#) because it informs the system (in this case the VNC Server 4) which sections of an IP address are significant, and which are not.

To understand the range mask, you need to view it in binary form. Thus, a typical range mask of 255.255.255.224 looks like this when converted to binary:

11111111.11111111.11111111.11100000

The ones indicate the parts of a corresponding IP address that will be examined, whereas the zeroes mark the parts of the IP address that form the range and will be ignored. Hence, the more zeroes there are (and accordingly, the fewer ones), the larger the address range that will be encompassed.

Note: A range mask of 255.255.255.255 examines the whole of the IP address and so defines a single location.

Consider the IP address 192.168.8.22 combined with a range mask of 255.255.255.252. Once applied, the result is as follows:

11000000.10101000.00001000.00010110 **IP address** (decimal equivalent: 192.168.8.22)
11111111.11111111.11111111.11111100 **Range mask** (decimal equivalent: 255.255.255.252)
11000000.10101000.00001000.000101xx **Result** (xx values will be ignored)

11000000.10101000.00001000.00010100 lowest address in the range: 192.168.8.20
11000000.10101000.00001000.00010111 highest address in the range: 192.168.8.23

Thus, due to the two zeroes on the right hand side of the range mask, the values of the equivalent bits in the IP address are ignored. This means that addresses running from 192.168.8.20 (where these two bits are both zero) through to 192.168.8.23 (where these two bits are both one) will all be treated in the same manner. This is the range that VNC Server 4 would allow, deny or query, as instructed.

If the range mask (for the same IP address) was changed to 255.255.248.0, then the third octet would also be affected, as follows:

11000000.10101000.00001000.00010110 **IP address** (decimal equivalent: 192.168.8.22)
11111111.11111111.11111000.00000000 **Range mask** (decimal equivalent: 255.255.248.0)
11000000.10101000.00001xxx.xxxxxxxx **Result** (xx values will be ignored)

11000000.10101000.00001000.00000000 lowest address in the range: 192.168.8.0
11000000.10101000.00001111.11111111 highest address in the range: 192.168.15.255

The following is a list of all valid octet numbers that can be used within a range mask. These values can be used at any of the four positions in the mask. However, if there is a zero at any position (in binary) of any octet, then everything to the right of that zero, must also be a zero.

Mask value	Binary	Addresses encompassed
255	11111111	1 address
254	11111110	2 addresses
252	11111100	4 addresses
248	11111000	8 addresses
240	11110000	16 addresses
224	11100000	32 addresses
192	11000000	64 addresses
128	10000000	128 addresses
0	00000000	256 addresses

In reality, the range that needs to be defined may not align itself neatly with even binary boundaries. In such cases it may be necessary to use two or more entries, each with smaller ranges to accomplish the task accurately. For example, to allow the range 192.168.8.19 to 192.168.8.37, you would need the following entries:

IP address/Range mask	
+192.168.8.19/255.255.255.255	defines 1 address
+192.168.8.20/255.255.255.252	defines 4 addresses
+192.168.8.24/255.255.255.248	defines 8 addresses
+192.168.8.32/255.255.255.252	defines 4 addresses
+192.168.8.36/255.255.255.254	defines 2 addresses

General tips

- There should be no zeroes to the left of a one – while it is technically possible to mix ones and zeroes in a mask, it produces erratic results and should be avoided.
- The stated IP address for each range can be from anywhere within the range, *i.e.* the stated IP address does not have to be the first one; it could be the last or be from the middle of the range.

Ordering entries in the access control list

When there are multiple entries within the Access Control list, the order of those entries becomes important due to the manner in which VNC Server 4 checks the list:

- As a new access request is received from a viewer, VNC Server 4 will compare the incoming IP address with the Access Control list. Starting at the top of the list, it proceeds downwards until the IP address of the incoming system matches an entry.
- When a match is found, the action for that entry (+ Allow, – Deny or ? Query) is carried out.
- Checks for this IP address will then cease, regardless of other matches further down the list.

Therefore, it is vital to order the list correctly, particularly where an address might be covered twice, for instance:

-192.168.1.0/255.255.255.0	<i>Deny subnet 192.168.1.*</i>
+192.168.1.24/255.255.255.255	<i>Allow host 192.168.1.24</i>

In this instance, a request to connect from a VNC viewer at 192.168.1.24 would be denied, even though it is specifically allowed in the second line in the list. This is because it matches the criteria of the first line where the whole of the 192.168.1.* subnet is denied. Swapping the order of the two lines would solve this particular problem.

To adjust the order of access control list entries

- 1 Display the VNC Server Properties window (see [Displaying VNC Server Properties](#))
- 2 Select the *Connections* tab.
- 3 Click the required entry in the *Access Control* list to highlight it.
- 4 As appropriate, click either the *Move Up* or *Move Down* buttons to adjust its position within the list.
- 5 Click the *Apply* button in the lower right corner of the VNC Server Properties window.

To delete an access control list entry

- 1 Display the VNC Server Properties window (see [Displaying VNC Server Properties](#))
- 2 Select the *Connections* tab.
- 3 Click the required entry in the *Access Control* list to highlight it.
- 4 Click the *Remove* button.
- 5 Click the *Apply* button in the lower right corner of the VNC Server Properties window.

Dealing with firewalls

A common cause of VNC operational failures are related to firewalls. One of the key functions of a network firewall is to block the use of most [port](#) numbers by incoming network traffic in order to prevent access by unauthorised or malicious users. Therefore, unless an exception is made for the specific ports used by VNC, any attempt to connect to a VNC Server situated behind a firewall will be denied. There are a number of options available to you in these situations:

- **Adjust the firewall rules to allow incoming traffic via the ports required by VNC, i.e. Port 5900 and port 5800.**

IMPORTANT: Firewall rule changes should be carried out only by an experienced operator. Incorrect configuration could leave a network open to attack. The exact details for changing rules alter between differing firewall types and are beyond the scope of this guide.

- **Place the VNC Server system outside the firewall and use its security to allow only authorised users.**

IMPORTANT: When placing the VNC Server externally to a firewall, i.e. with open access to an outer network, such as the Internet, it is vital that full security features are employed, both within VNC Server 4 and also for the operating system upon which the server is running. See the [Configuration](#) section more details.

- **Set VNC viewers to 'listen' and initiate connections from the VNC Server 4.**

This removes the need to make the server accessible from outside the firewall. See [Listening viewer](#) for details.

- **Use Windows Firewall (Windows XP Service-Pack 2 and newer)**

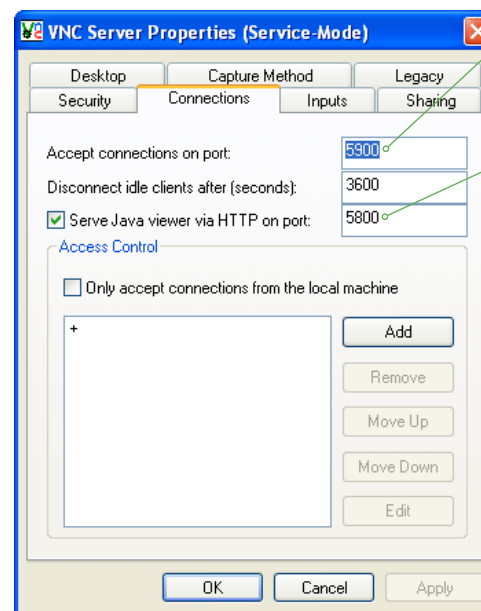
Recent versions of Windows XP include a built-in firewall. From Service Pack 2 onwards, the firewall can be easily configured to allow particular applications to open whichever ports they require. By adding an 'Application Exception' to the Windows Firewall for the VNC Server, both User- and Service- mode servers can be made accessible remotely without the need for port numbers to be specified explicitly. The VNC server is able to detect Windows Firewall and configure it automatically when the VNC Server Properties dialog is dismissed.

Changing VNC ports

- **The VNC port – Default setting: 5900** – This is the main port through which the VNC connection is channelled. This port is set as standard to 5900, which is where the VNC Viewer applications will expect to find it.
- **The Java Viewer port – Default setting: 5800** – This port is used to serve the Java viewer applet to requesting Web browsers. This port number is automatically set to be 100 less than the main VNC port. However, you can adjust it to use any vacant port number, or even to use the same port as is used for VNC connections.

To change port numbers

- 1 Display the VNC Server Properties window (see [To display VNC Server Properties](#)).
- 2 Select the *Connections* tab.
- 3 Edit the required port number:



Edit this value to determine the main port used for viewer connections. Remember, if this is set to any value other than 5900, incoming viewers will need to specify the new number. See [VNC Viewer documentation - Making a connection](#) for details.

Edit this value to select the port used to send the Java viewer to browsers. Ensure that the check-box is also ticked.

When you change the 'Accept connections on port:' entry, the 'Serve Java viewer via HTTP on port:' option will adjust itself to retain the same spacing, as currently exists, between it and the main port number. For instance, if the main port is changed from 5900 to 5950, then the Java port will accordingly change from 5800 to 5850.

Note: To reduce the number of ports that are open within a firewall, it is possible to set the 'Accept connections on port:' and 'Serve Java viewer via HTTP on port:' to use the same port number. The disadvantage of doing this is that it will add a slight delay when connecting to the VNC Server 4. The performance of VNC Server 4 will not otherwise be affected.

- 4 Click the Apply button in the lower right corner of the VNC Server Properties window.

What is an IP address?

An *IP address* is a unique identity given to every device connected to a network of any size: from a two system link up at home, to every system on the Internet.

IP addresses are written as four decimal numbers separated by full stops, such as *192.168.0.4*. This is called *dotted decimal notation* and is used as a means of concealing the equivalent real address that is actually used by computers and networking equipment. The bare truth is that every IP address is really a pattern of 32 ones and zeroes.

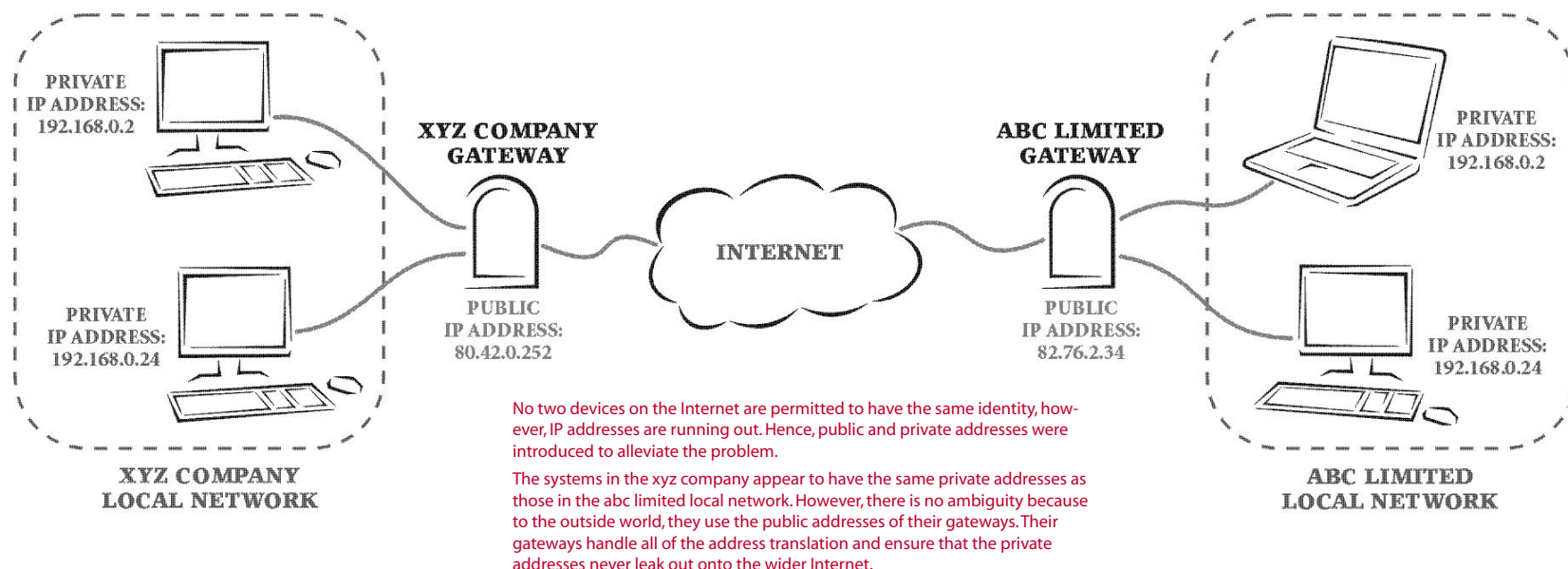
At the inception of the Internet in the 1960s and 1970s, even by wildest estimates, no one ever expected they would need more than the seemingly inexhaustible 4.2 billion unique address patterns that are afforded by 32 ones and zeroes. However, two factors conspired to prove this to be wrong: Firstly, the amazing proliferation and expansion of the Internet; and secondly, the rather inefficient way in which those addresses were originally handed out to organisations and companies. The result was that by the early 1990s, it was already apparent that at the projected growth rates, the reserve of 4.2 billion addresses would soon all be gone.

In order to prolong the current stocks of numbers, the allocation of addresses was greatly tightened and the idea of *public* and *private* addresses was introduced. In the opening sentence here, it was stated that an IP address is a unique identity - this no longer strictly true.

Of the 4.2 billion possible addresses, almost all of them are still used as unique *public* addresses. However, in the revised plan, three groups of addresses were held aside for use as *private* addresses:

- 10.0.0.0 to 10.255.255.255
- 172.16.0.0 to 172.31.255.255
- 192.168.0.0 to 192.168.255.255

To avoid confusion, these ranges are never used as public addresses.



Now, when xyz company needs to connect their many internal computers to the Internet, they might only be given a single public address, say *80.42.0.252*. They would then connect a *Gateway* system to the Internet and give it that unique public address. Situated on the other side of that gateway would be the company's local network and every system in that local network would receive a private IP address. For small local networks, the most common private address range is that which starts at *192.168.0.0*.

Every computer in the local network (or *subnet*) will use their number that is unique to them within the local network. However, the public identity for all of those local systems, as they pass information out across the Internet, will always be that of the gateway: *80.42.0.252*. It is the job of the gateway to translate addresses between the local and wider networks. The gateway must ensure that messages and data are sent through to the correct locations without the private addresses ever leaking out. Assisting with this task are the [subnet mask](#) and [port numbers](#). In this way, there are now many systems using similar private IP addresses, however, because those numbers only ever exist in local domains, there is never any confusion.

Of course, most people never see an IP address. To make network addresses even more memorable than the dotted decimal notations (which in turn are used to hide the true binary values), they are usually converted into named addresses. Such conversions are handled by the Domain Name System and your browser uses it every time you visit a web site.

What is a Subnet mask?

The very short answer is: A subnet mask helps to determine whether another device is within the same part of the network or elsewhere.

For the longer answer you need to consider, in basic terms, a typical local network consisting of several, or several hundred, systems connected together. Messages and data flow around every part of the local network and are then picked up by the systems to which they are addressed. Because all this information needs to go around the whole local network, there are great performance (and security) advantages to splitting local networks into smaller collections of systems, which are called *subnets*. A key part of making different subnets cooperate efficiently is the *subnet mask* that is given to every device along with their unique IP address. A subnet mask is expressed in the same way as an [IP address](#) in that it has four decimal numbers separated by dots. A common subnet mask is 255.255.255.0

When System A (IP address 192.168.2.122 and subnet mask 255.255.255.0) wants to send information to System B (IP address 192.168.2.235), it must first check whether they are both in the same part of the network (in the same subnet). To do this System A first performs a comparison between its own IP address and its own subnet mask:

192.168.128.102	System A address	The parts corresponding to 255's in the subnet mask indicate the Network ID (which defines the identity of the subnet).
255.255.255.000	Subnet mask	The part corresponding to 0 in the mask shows the Host ID (which defines a system's position within the subnet). Only the Network ID parts are required when determining whether the two addresses belong to the same subnet. Therefore, the Host ID portion is reduced to zero because it is not needed for this calculation.
192.168.128.000	Result	

The sending system then repeats the subnet mask comparison, but this time with the destination address:

192.168.128.219	System B address
255.255.255.000	Subnet mask
192.168.128.000	Result

The results of the two subnet mask calculations can then themselves be compared:

$$192.168.128.0 = 192.168.128.0 ? \checkmark$$

- If the two results are equal, then the two addresses lie within the same subnet.
- If the two results are not equal, then the destination device is within a different subnet, in which case, the sender will mark the information to go via the gateway system onto a different network or subnet.

How a subnet mask actually works

In the subnet mask explanation opposite, the example given is 255.255.255.0. This is a commonly used subnet mask and is useful as an example because it helps to simplify matters. However, in reality a subnet mask might look like this:

255.255.255.224

This only starts to make sense when you look at the subnet mask in its binary form:

11111111.11111111.11111111.11100000

The portions covered from left to right by ones mark the Network ID (the location of the whole subnet), while the zeroes on the right show that just the last four bits of the device's IP address are used as the Host ID (the device's position within the subnet).

The calculation that the devices carry out is known as a *bitwise AND*. Basically, when you stack up the IP Address and the subnet mask (both in binary), wherever the equivalent positions in both rows have a one, the end result is one. Where **either** of them have a zero, the result is zero. If you take the previous Device A example, but now use the new subnet mask mentioned above, the results are as follows:

11000000.10101000.10000000.01100110	IP address (decimal equivalent: 192.168.128.102)
11111111.11111111.11111111.11100000	Subnet mask (decimal equivalent: 255.255.255.224)
11000000.10101000.10000000.01100000	Result (decimal equivalent: 192.168.128.96)

Using this method you can see that only the last four bits are affected and this means that any of the other IP addresses from the same subnet: 192.168.128.96 through to 192.168.2.127 would produce the same result.

Using the new subnet mask on the Device B address from the previous example would produce the following result:

11000000.10101000.10000000.11011011	IP address (decimal equivalent: 192.168.128.219)
11111111.11111111.11111111.11100000	Subnet mask (decimal equivalent: 255.255.255.224)
11000000.10101000.10000000.11000000	Result (decimal equivalent: 192.168.128.192)

$$192.168.128.96 = 192.168.128.192 ? \times$$

Hence, the two devices now lie in different subnets and the information would need to travel via a gateway/router.

What is a port?

Not to be confused with a physical port (such as a USB port or a printer port) to which you connect devices, a *Port* in this context could be more accurately described as a ‘*service contact point*’. It provides an indication of where to locate an appropriate known service that can deal with the kind of data being transmitted.

Imagine the problem that exists for networking equipment. A disparate mixture of messages and information are continually flowing from system to system, via gateways and routers, and each needs to find the correct destination. In this process, the [IP address](#) plays a critical role in making sure that the right items arrive at the right places, however, the unsung hero is definitely the port number. While the IP address directs the postman to the correct building, it’s the port number that gets the package through the door of the correct apartment. Without the port number, there would be piles of unclaimed packages filling the foyer.

Every application that sends or receives information across a network uses a port number. In many cases they are fixed numbers that are always used by particular applications, and because they are not often changed, they are not normally mentioned. For instance, if you send an email (via the most common method), then your message will be marked with port number 25. Whenever you browse the Web, the information will always be denoted with port number 80 and VNC applications almost always send and receive using port number 5900. The systems at the receiving end then know to route messages marked as port 25 to the email server, port 80 to the web server, port 5900 to the VNC server and so on.

You should not normally need to change the VNC port number within VNC Server 4, however, if you do then all viewers must declare the new port number when addressing the server system. For instance, if the port number was changed to 5950, then to reach a server at IP address 192.168.0.2, the VNC Viewer user would need to enter:

192.168.0.2::5950

(note the double colons)

Port numbers can range from 0 to 65,535 and are generally divided into three ranges:

- 0 to 1023 are well known ports
- 1024 to 49151 are registered ports
- 49152 to 65535 are dynamic and/or private ports

A list of valid port numbers and their uses is maintained by the Internet Assigned Numbers Authority and can be viewed at <http://www.iana.org/assignments/port-numbers>.

VNC authentication and encryption

VNC user and server authentication

Open network connections pose a number of security challenges and the VNC system has now been updated to provide robust solutions. In addition to the possibility of attackers attempting to gain server access, there is also the chance that false servers can be spoofed to mimic real ones and lure users into disclosing important information. To defend against server attackers, VNC provides secure password protection. To defeat server spoofers, VNC Servers are now required to prove their authenticity by providing a unique identity code before any viewer details are declared. These features are combined with the new high strength link encryption to present a sizeable barrier to attackers.

VNC link encryption

Network links in general, and the Internet in particular, pose an ever present threat of system spoofing and eavesdropping on connections between systems. The VNC user and server authentication system defeats the former threat, while strong data encryption of the type used by VNC presents a significant barrier to eavesdroppers.

When either the VNC viewer or VNC server enable encryption, both parties exchange codes called *public keys*. From that moment, all information is encrypted prior to transmission, using the other party's public key. As encrypted information is received, the receiving party then uses its matching *private key* to restore the sent information to its original form.

Any eavesdropper who manages to intercept the information flowing between the VNC viewer and server (called a *man-the-middle attack*) will be presented with an unintelligible mess. Even if they were able to capture the public keys, they would still be unable to decode and make sense of the encrypted information.

Due to the calculations that must be performed to codify transmitted information, the use of encryption does impose a slight overhead on performance, estimated to be around 10%.

Windows version support

Most releases of Windows are supported by VNC Server 4. Some versions, however, lack certain functionality or cause known problems.

Older Windows versions

VNC Server 4 is *not* designed to operate with older versions of Windows including 3.1, 3.11, NT 3.1 or NT 3.51.

Windows 95

VNC Server 4 will operate with Windows 95 systems that have the Windows Socket 2 Update (Winsock 2.0) or higher installed – Available from Microsoft at:

http://www.microsoft.com/windows95/downloads/contents/wuadmintools/s_wunetworkingtools/w95sockets2/

Due to limitations within Windows 95, it is not possible for the VNC Server settings to be secured in the system registry.

Windows 98 / Windows Me

Under Windows 98 and Windows ME it is not possible for the VNC settings (including the server's password) to be properly secured in the registry - this is an intrinsic limitation of these platforms. NT Logon authentication is not supported on these platforms. Public-key based Server authentication and 128-bit session encryption are supported on these platforms, with the caveat that server private keys cannot be secured in the registry, since they do not support registry security.

Windows NT 4.0

VNC Server 4 will not run in Service Mode unless Windows NT Service Pack 3 or later has been installed. VNC Server 4 can be operated in User Mode. Note that Windows NT 4.0 does not support the NT Logon authentication configuration dialog at this time.

Windows XP

VNC Server 4 is fully compatible with Windows XP. However, please see the [Troubleshooting](#) section for information regarding problems you may encounter using VNC in conjunction with Fast User Switching or Remote Desktop.

Troubleshooting

VNC disconnects during Fast User Switching

When switching users, viewers will be disconnected and must reconnect in order to access the newly logged on user session. The viewer will normally be presented with the Welcome screen again, when reconnecting to a switched session, whereupon logging on again to the required user account will provide access to their session.

VNC causes my Windows NT/2000/XP machine to blue screen

Windows NT Version 4 has bugs in certain operating system interfaces which are used by VNC. You must have service pack 3 or higher installed to avoid problems.

On Windows 2000/XP there are reports that blue screens occur as a result of having Microsoft Hotfixes installed, with or without VNC installed.

VNC does not install any system level hooks or driver software. Consequently it cannot cause machines to crash except by exposing bugs in the underlying operating system and device drivers. If it appears that VNC causes your machine to crash, check that you have the latest service packs, graphics drivers and network drivers installed for your system.

My computer uses roaming profiles, and with VNC installed the profiles are sometimes not saved back to the server. It can take a very long time to log out.

Versions of VNC prior to 3.3.6 have a bug that can cause this behaviour. Additionally we have had reports Windows 2000 machines with Hotfix Q329170 installed exhibit the same behaviour, with or without VNC installed.

Support

If you are unable to solve your problem after checking through the Troubleshooting section in this guide, please take a look at our on-line [FAQ page](#) and also the [Known Bugs & Features](#) section of the RealVNC website.

If you still cannot find a solution, then please contact us for further assistance:

Via the web

The www.realvnc.com website offers a number ways to gain assistance regarding VNC products:

Search indexes

Provides an opportunity to search through the various VNC databases for solutions

www.realvnc.com/swish-e/search

Mailing lists

Real VNC provide discussion forums for important announcements and many other VNC-related subjects. You can browse or search previous discussion entries, or alternatively subscribe to one or more forums.

www.realvnc.com/lists.html

Product support request

This section lets you to send queries directly to a VNC support representative.

www.realvnc.com/support.html

Please include as much information as possible regarding the problem, including the exact text of any error messages you see (including the error number) and what you're doing when you see them. Please also include the version of VNC server and VNC viewer that you are using, and what operating system you are running at both ends of the connection.

Acknowledgements

VNC Enterprise Edition contains software from more than one source. For full details of this software and the terms under which it is distributed, see the RealVNC website.

www.realvnc.com/products/enterprise/4.2/acknowledgements.html

Documentation by:



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