IBM Network Station Family of Thin Clients

Access for today, flexibility for tomorrow

Windows Application Access (ICA)

November 5, 1999

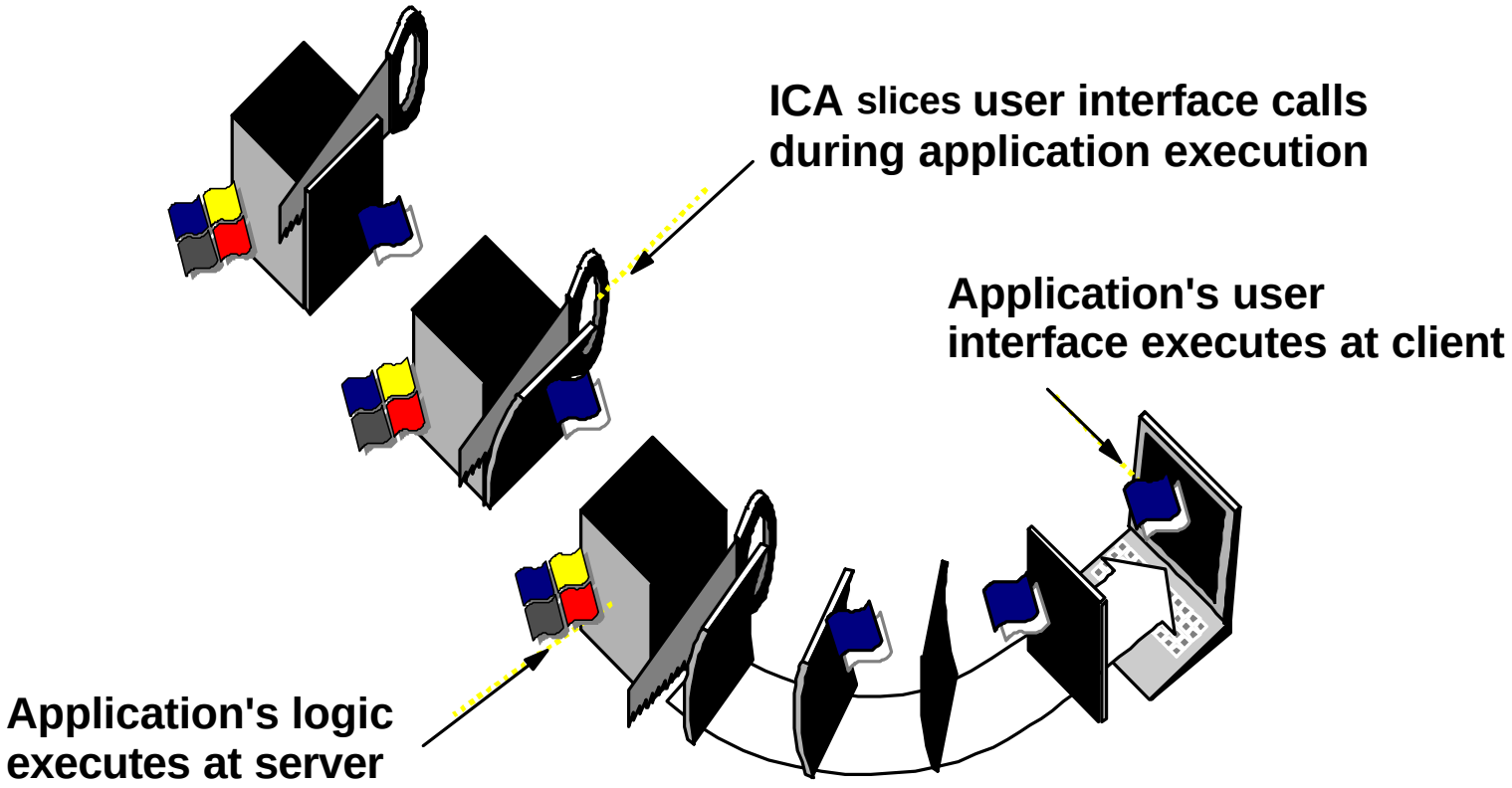
e-business

IBM

Windows Application Access

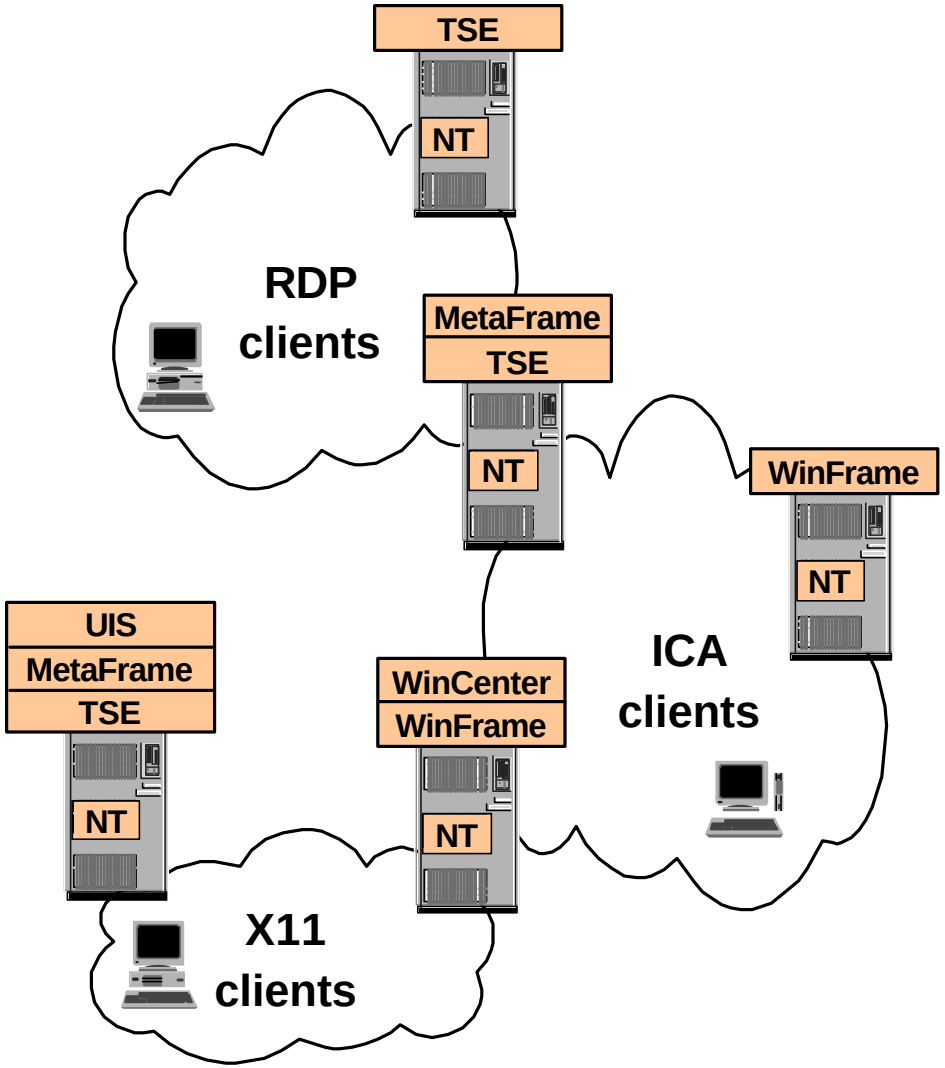
ICA - Independent Computing Architecture

- Allows any standard DOS or Microsoft Windows application to be run remotely
- Similar in concept to X11 Windows



Windows Application Access

- **Lots of terms . . .**
  - ICA
  - WinFrame
  - MetaFrame
  - CDS
  - UIS
  - RDP
  - TSE
  - X11
  - WinCenter



Windows Application Access

Definitions

- **What is ICA ?**
  - ICA is the Independent Computing Architecture developed by Citrix. It is a general purpose presentation services protocol. (IBM licensed the ICA protocol on 1/14/98).
  - Conceptually similar to the Unix X11 Windows protocol, ICA allows a Windows NT application's user interface to execute on a client machine, such as the IBM Network Station.
  - The application's logic executes on WinFrame and MetaFrame application servers.
- **What is WinFrame ?**
  - WinFrame is a Citrix multi-user Windows application server based on Microsoft NT Server Version 3.51 under license from Microsoft to Citrix.
  - Microsoft NT Server Version 3.51 is bundled with WinFrame.
  - It provides for Windows application serving to ICA clients.

Windows Application Access

Definitions

- **What is MetaFrame ?**
  - The successor to WinFrame.
  - Software from Citrix that extends Windows NT Terminal Server Edition function to non-RDP clients by enabling the Citrix ICA protocol.
  - Ability to load balance multiple Terminal Servers into a server farm.
  - Ability to publish and manage applications from a single server in a server farm.
  - Ability to connect any ICA client (DOS, 16 bit and 32 bit Windows, Java-based devices, Macintosh, Unix-based devices, Windows Based Terminals) to a Windows NT Terminal Server.

- **What is CDS ?**
  - CDS (Citrix Device Services) is a subset of MetaFrame that runs on Windows NT Terminal Server Edition.
  - IBM distributes CDS for free.

Windows Application Access

Definitions

- **What is RDP ?**
  - RDP (Remote Display Protocol) is yet another client/server presentation protocol.
  - Developed by Microsoft for exclusive use by Microsoft products.
  - (Currently) considered to be less functional than the ICA protocol, and poorer performer.
  - http://www.thinplanet.com/opinion/protocols.asp.
- **What is TSE ?**
  - TSE (Terminal Server Edition) is a multi-user Windows application server from Microsoft. It is based on Windows NT Server Version 4.0.
  - Uses a proprietary protocol called RDP to communicate exclusively with Microsoft clients.
  - MetaFrame and TSE are not bundled. Each must be separately purchased.

Windows Application Access

Definitions

- **What is X11 ?**
  - X11 is a presentation client/server protocol developed at M.I.T. by an industry consortium. (IBM was a founding member).
  - Used for windowing systems on Unix based machines, including IBM Network Stations and AIX.
- **What is WinCenter ?**
  - WinCenter is an NCDi product that extends WinFrame's multi-user capabilities to support Unix clients via the X11 protocol or the ICA protocol.
  - When using the ICA protocol, WinCenter is simply a front door to WinFrame.
- **What is UIS ?**
  - UIS (Unix Integration Services) is a Citrix product that provides Windows application access to Unix-based desktops and terminals via the X11 protocol.
  - There is no relationship between UIS and ICA.

Windows Application Access

What's new ?

- Based on the Citrix ICA Client for Linux, version 3.0
- ICA Remote Application Manager. This is the ICA user interface that Citrix distributes with their Unix ICA Clients. This has also been called the "ICA Chooser" and the "ICA Connection Manager"
- RSA 40, 56 or 128 bit encryption
- Cut and paste of graphic data between ICA windows
- Audio mapping, including configurable quality levels
- Drive mapping from Network Station directory paths to NT server drive letters
- Persistent caching for saving icons and bitmaps
- Key stroke remapping (HotKeys) for key stroke sequences that conflict with the Network Station Window Manager
- Kiosk mode. The ICA Remote Application Manager or the ICA Client cam be configured to run as the Network Station desktop, i.e., full screen with no window manager borders. (It looks just like a PC running Windows)

Windows Application Access

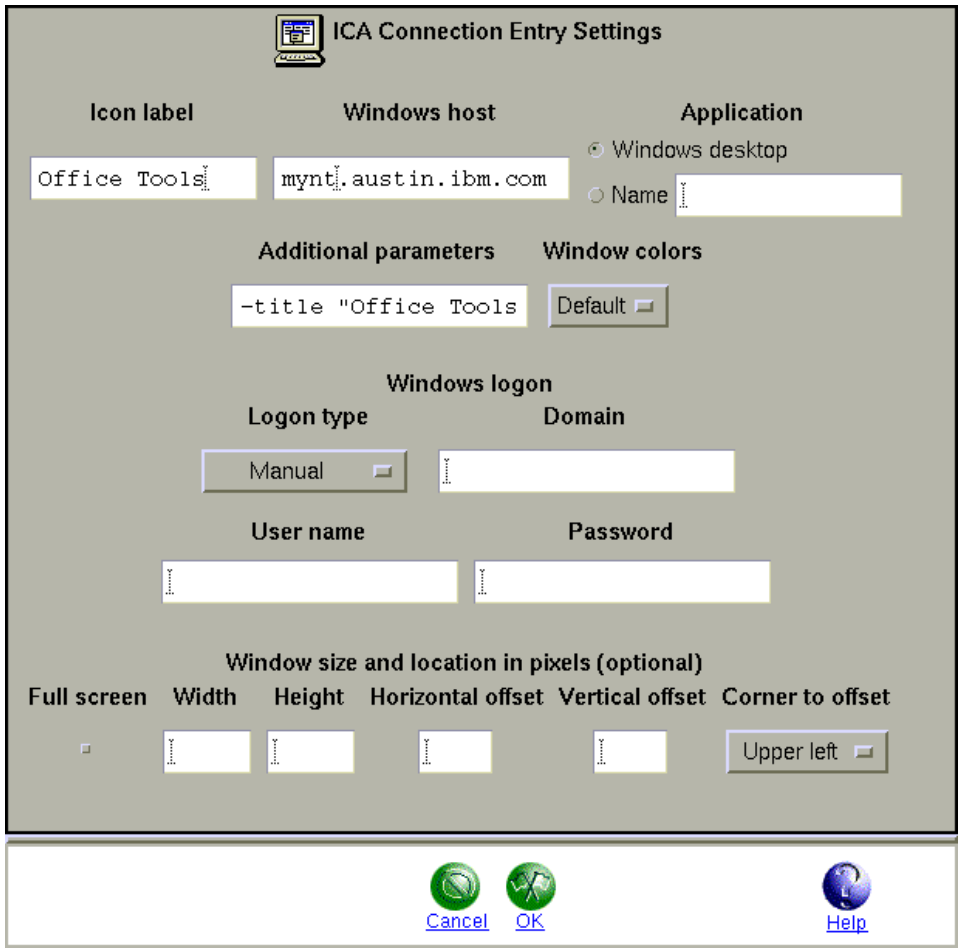
What's new ?

- Protocol compression
- Shared color map support eliminates color flashing (potentially at the cost of color fidelity)
- True color support. (16 or 256 color Windows applications are mapped to true color on the IBM Network Station)
- HTML help text that can be invoked from the ICA Remote Application Manager
- Multiple ICA browser support in the ICA Remote Application Manager and the ICA Client command line
- Enhanced flash support. Unused boot monitor fields can be used to pass the ICA Client additional command line parameters
- The ICA Client can be configured to
  - prompt the user for a Windows NT server to connect to
  - use the current NSM user id and/or user password to connect to a Windows NT server
- Network Station Manager configuration of ICA connection entries

Windows Application Access

Network Station Manager

- Use the Network Station Manager to create and/or edit ICA connection entries



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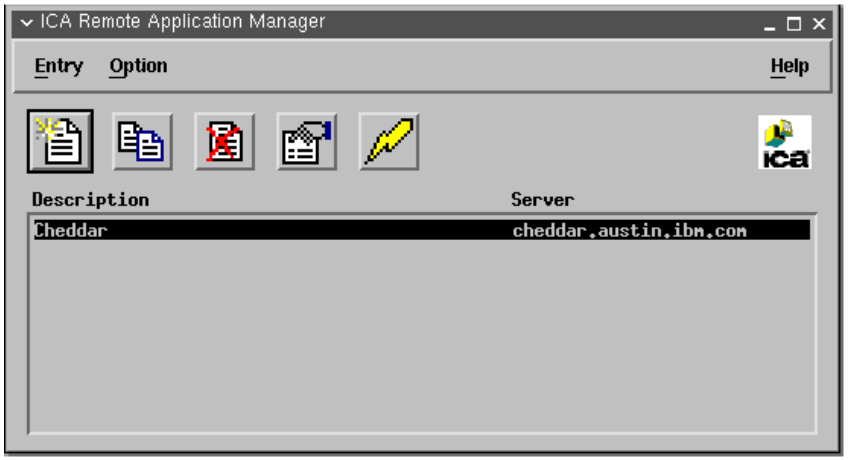
ICA Remote Application Manager

- Display ICA connection entries. The user can choose an ICA connection and connect to an ICA application server
- Connection entries created by Network Station Manager can not be edited or deleted
- Connection entries created by the ICA Remote Application Manager can be edited and /or deleted. (This method of creating connection entries can be disabled)




Create new connection entry


Copy connection entry


Delete connection entry


Edit connection entry


Connect to server

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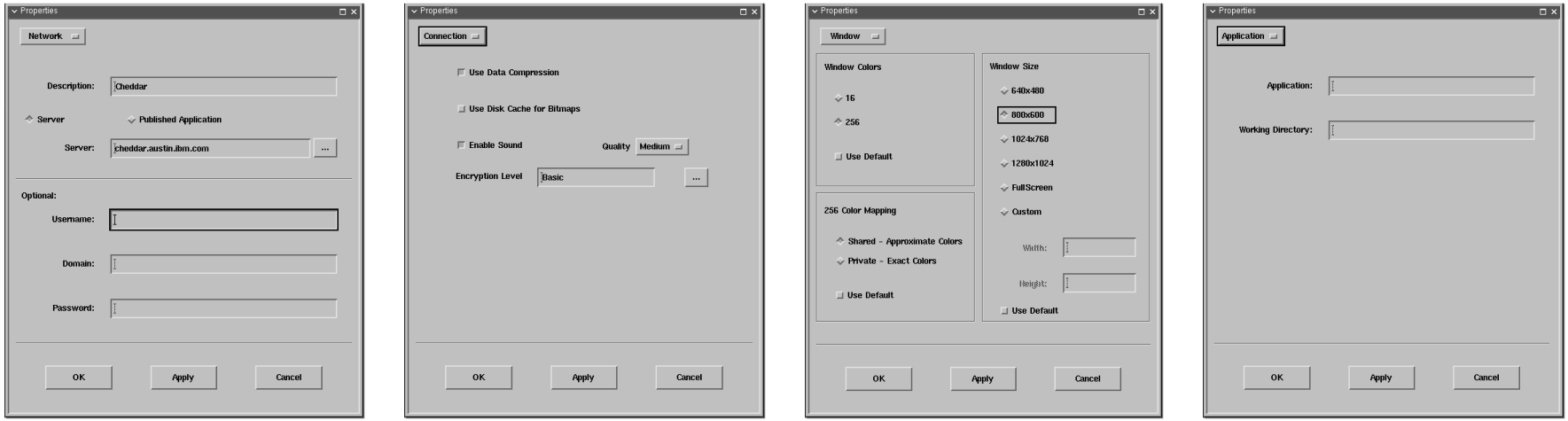
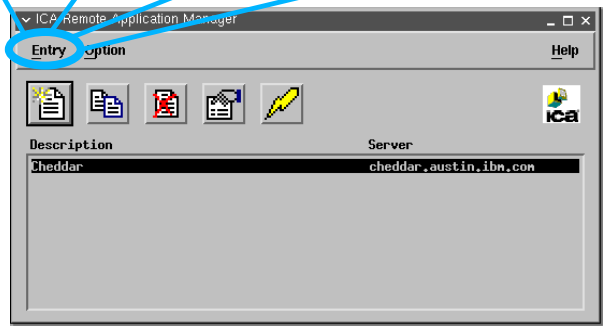
ICA Connection Properties

- **Network**
- **Connection**
- **Window**
- **Application**





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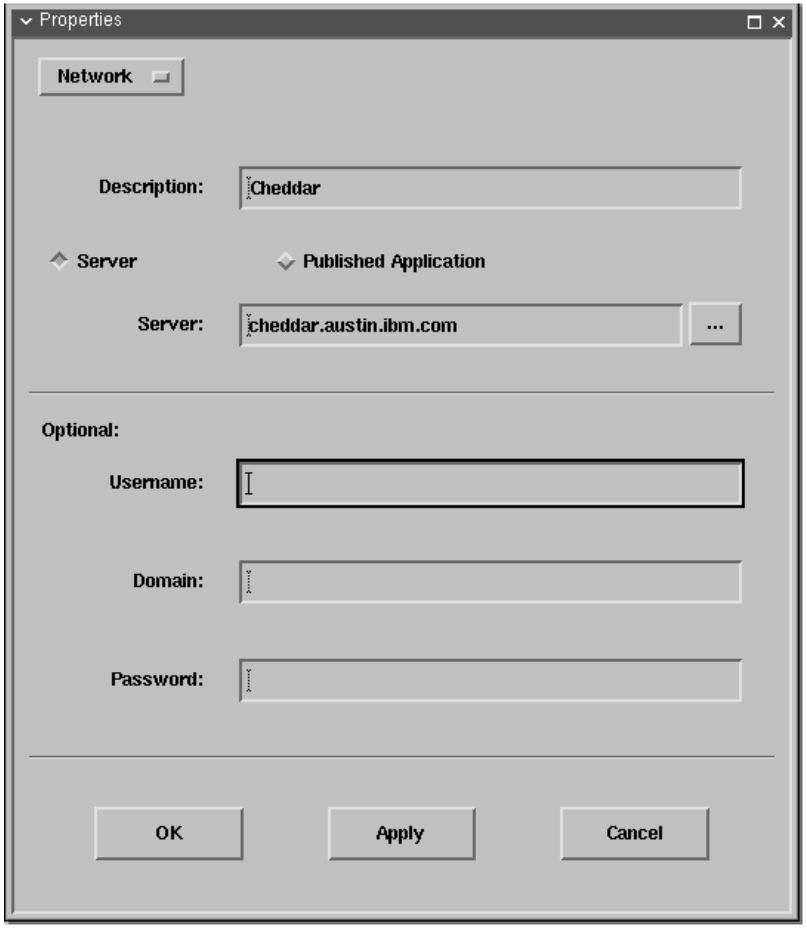
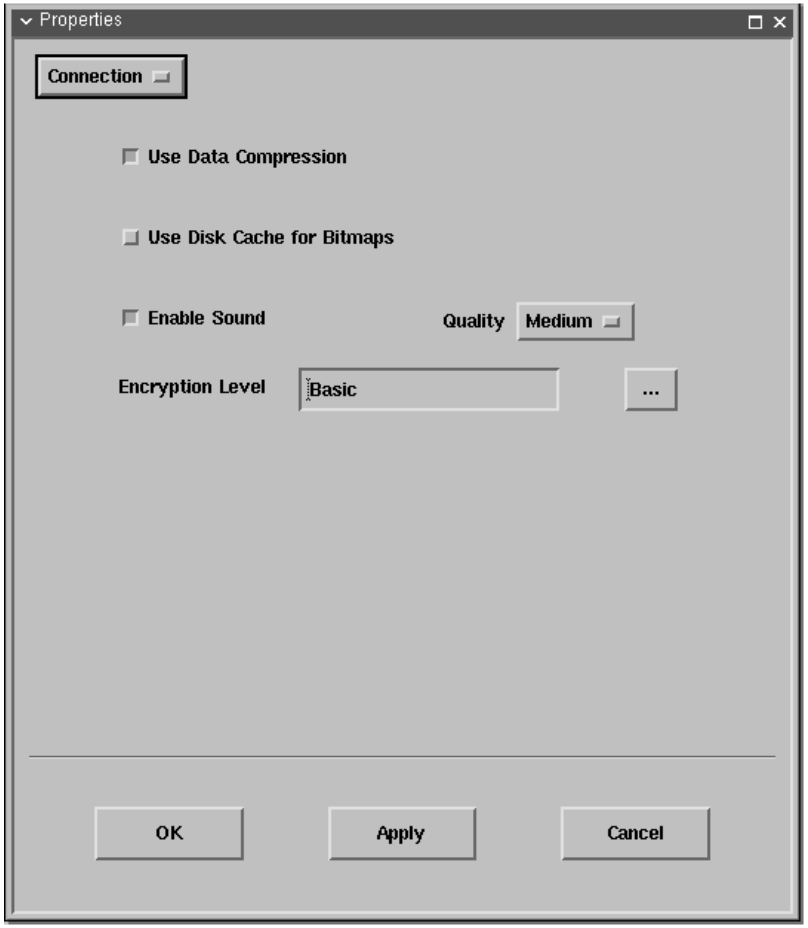
ICA Connection Properties

- Network



- Connection



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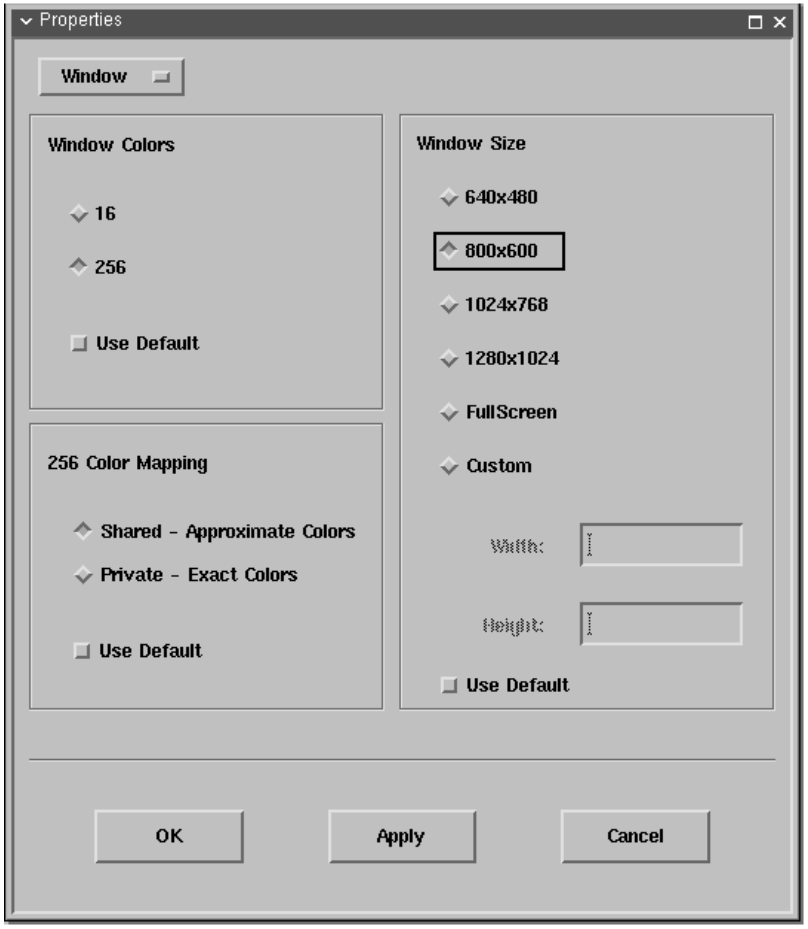
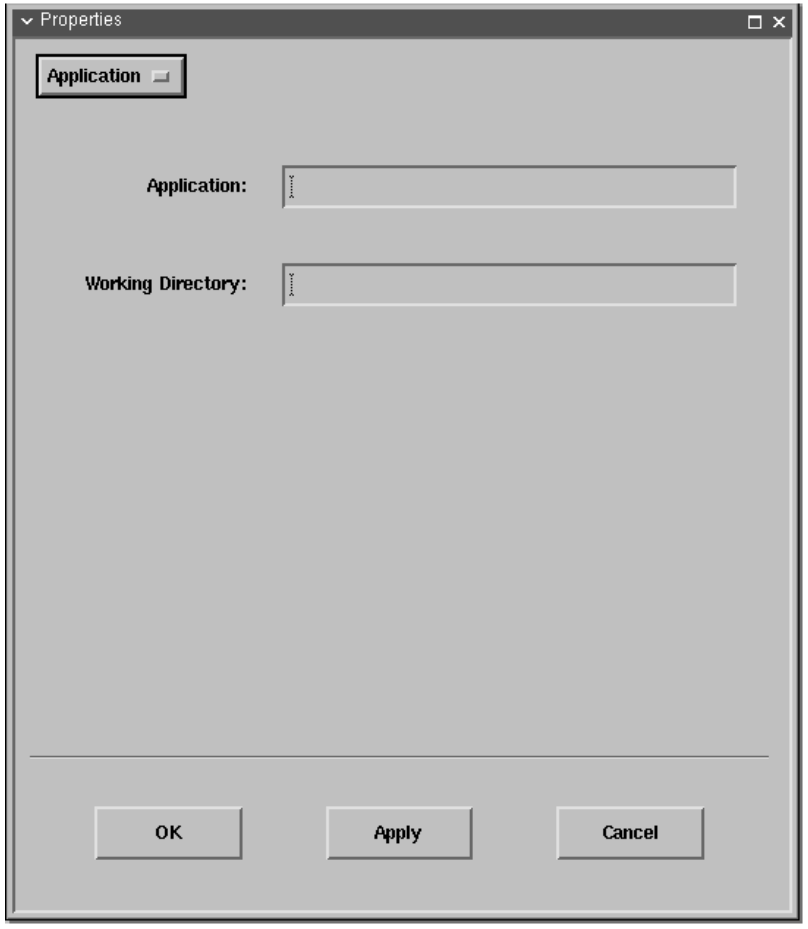
ICA Connection Properties

- Window



- Application



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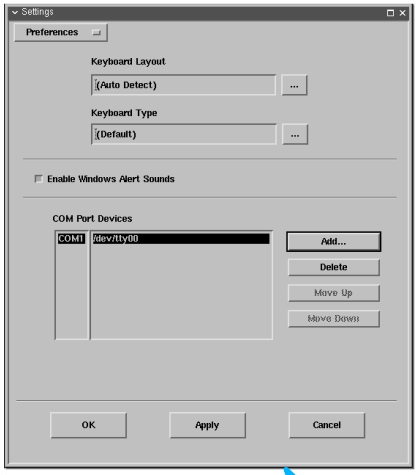
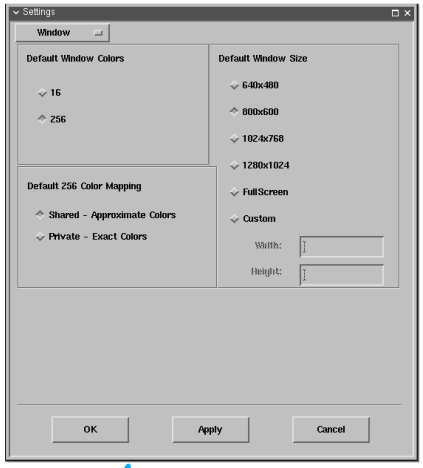
ICA Client Options

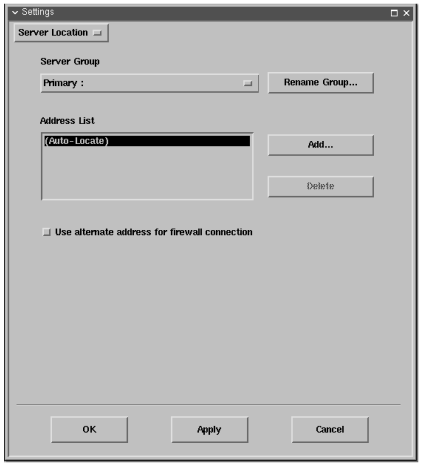
- **Preferences**



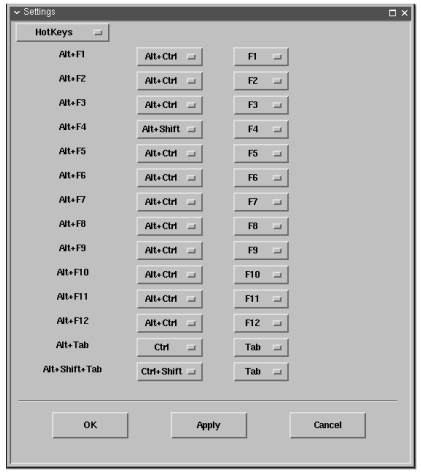
- **Window**

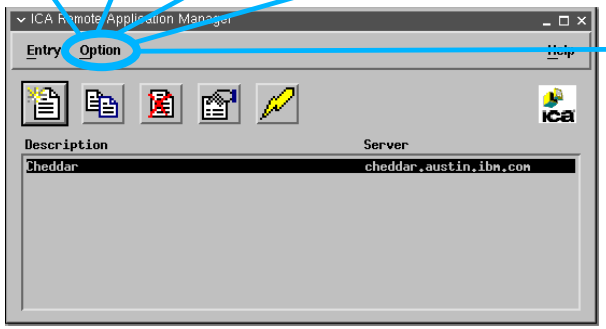


- **Servers**

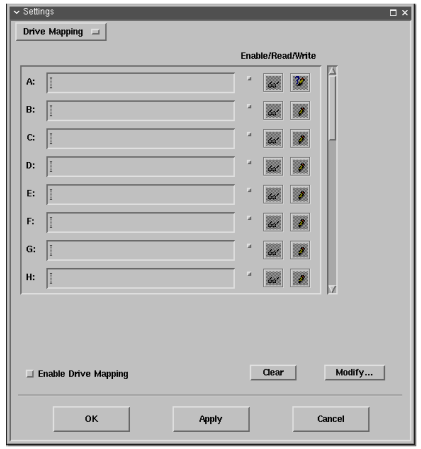


- **Hot Keys**





- **Drive Mapping**



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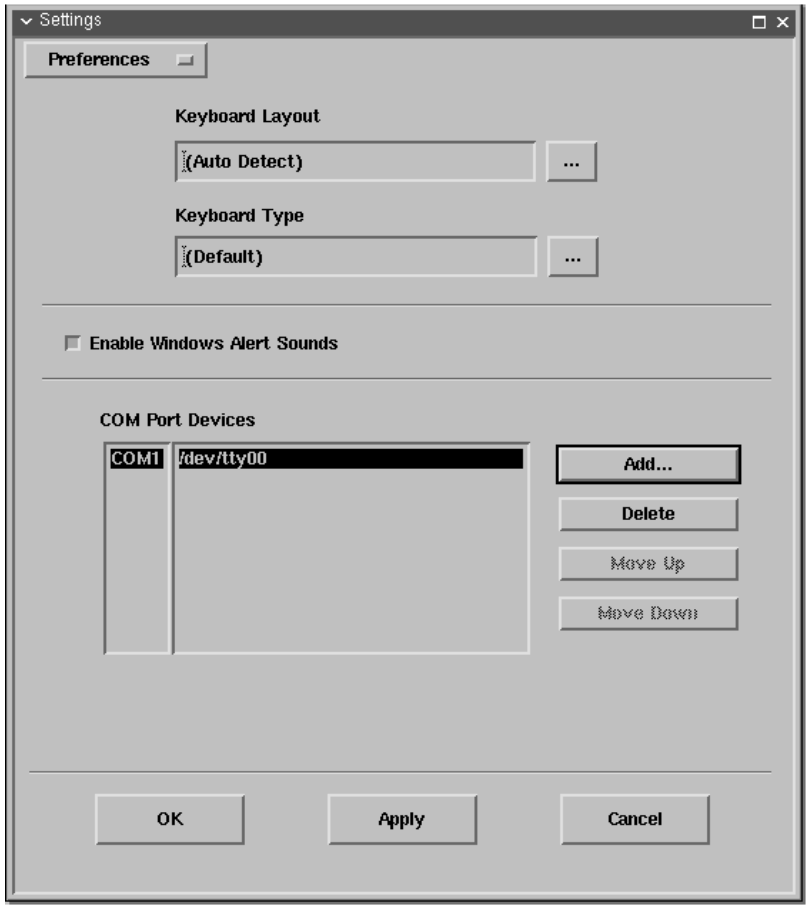
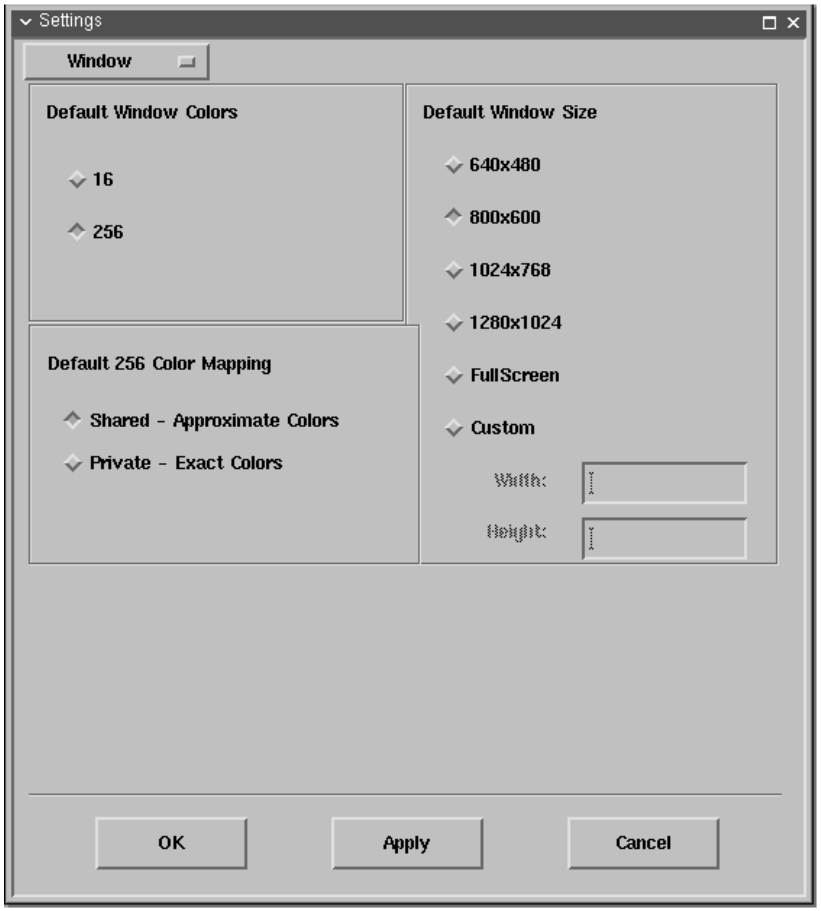
ICA Client Options

- Preferences



- Window Defaults



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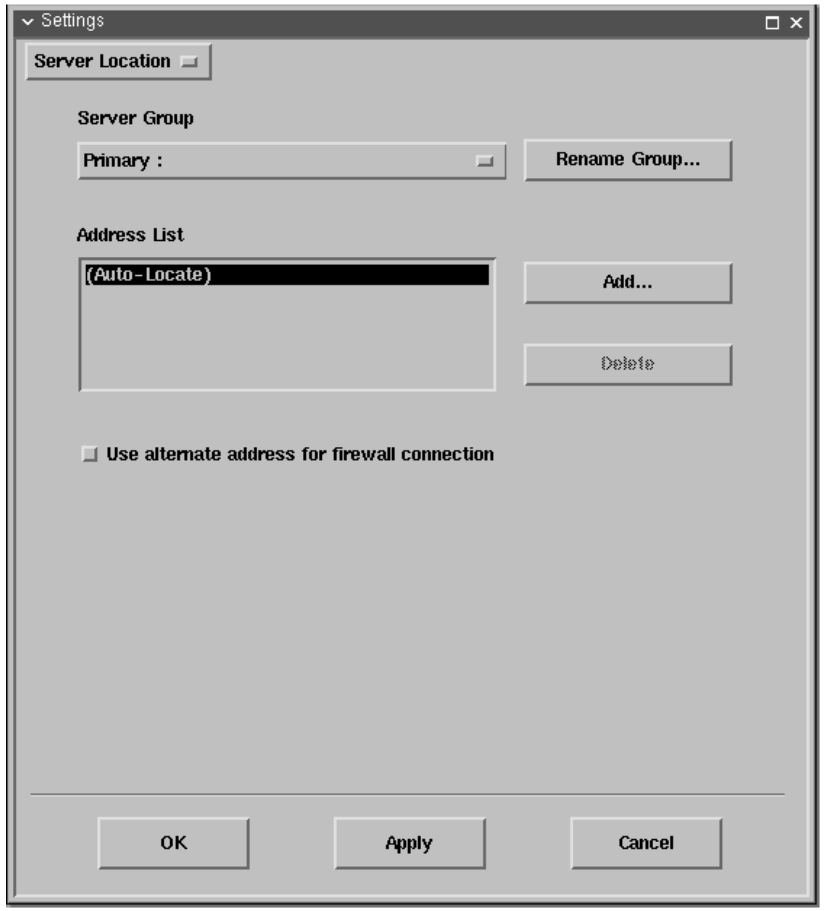
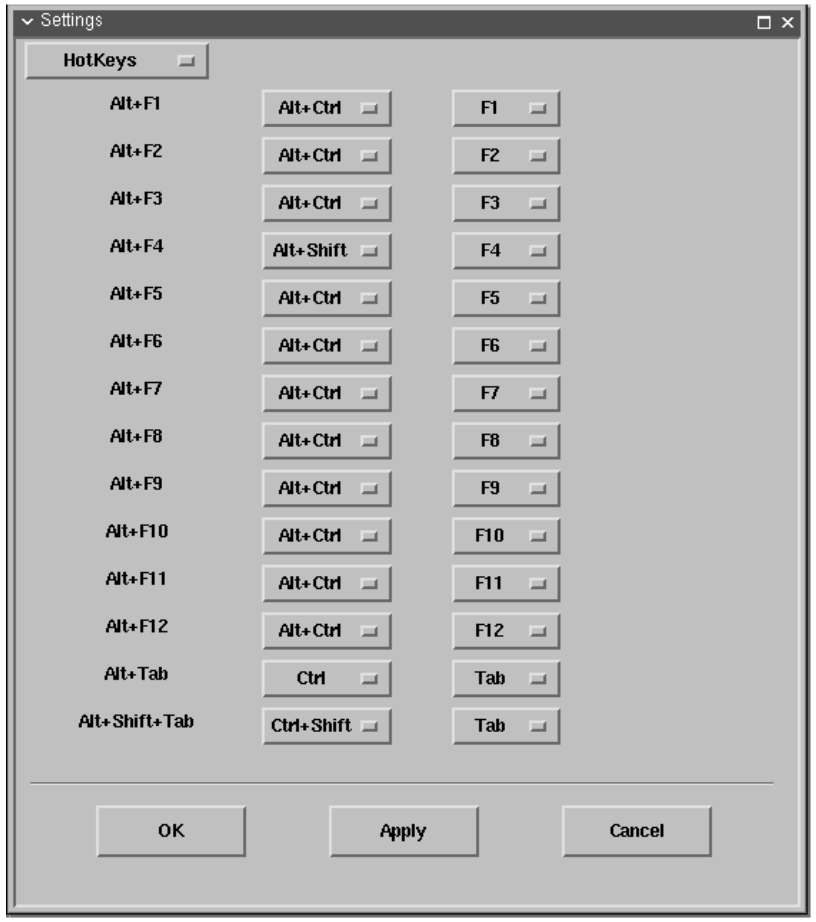
ICA Client Options

- Server Locations



- Hot Keys



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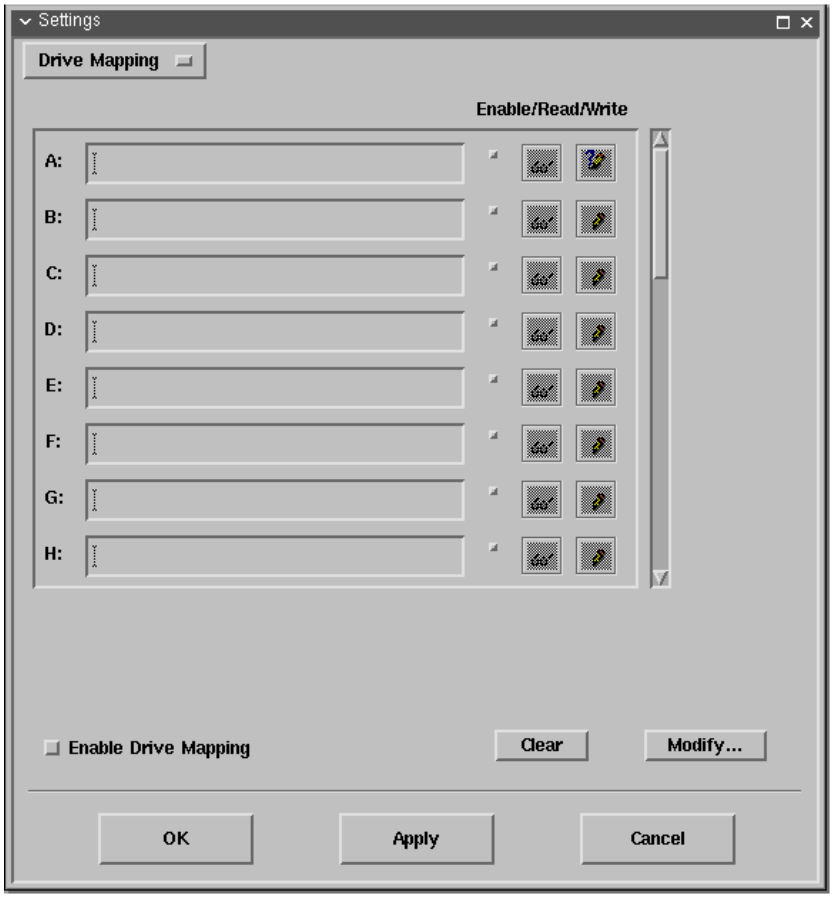
ICA Client Options

- Drive Mapping



Windows Application Access

Audio Support

- Configurable quality levels
  - Low
  - Medium
  - High
- Windows NT Server Audio
  - Wave sounds only. (Server may convert other formats to wave format)
  - Midi music is not supported
  - CD audio is not supported
  - no sound card is required on the Windows NT server
- Supported audio characteristics
  - linear PCM
  - 8 and 16 bit
  - 8, 11, 22 and 44 Khz
  - mono and stereo
- Device controls (e.g. volume, balance) are not supported

Windows Application Access

ICA National Language Support

- The following keyboards and languages are currently supported by both the ICA Remote Application Manager and the ICA Client:

Danish	French	Italian
Dutch	French (Belgian)	Norwegian
Dutch (Belgian)	French (Canadian 1988)	Portuguese
English (UK)	French (Canadian 1992)	Portuguese (Brazilian)
English (US)	French (Swiss)	Spanish
English (US ISO)	German	Spanish (Latin America)
Finnish	German (Swiss)	Swedish

- At connect time, ICA Client passes the Windows NT server a Microsoft Windows defined code that specifies the keyboard, locale and input method. Once connected, the ICA client becomes "NLS stupid". It simply sends keyboard hardware make/break scan codes and receives bitmaps.

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Device Support

- Virtual Com
  - Applications running on the Windows NT can access serial devices attached to the COM port of an IBM Network Station
  - The application must provide the serial driver
  - Virtual Com is bi-directional
- Virtual Print
  - Redirect print jobs from applications running on the Windows NT server to a printer connected to the IBM Network Station
  - Any spooled printer supported by the NC operating system can be used as long as the relevant printer driver is installed on the Windows NT server.
  - Virtual print is uni-direction only

Windows Application Access

wfcmgr - ICA Remote Application Manager Command

There is a small set of command line parameters for the ICA Remote Application Manager. The **-noupdate** parameter is the only parameter that is anticipated to be used by the IBM Network Station product. The other parameters came with the Citrix ICA Remote Application Manager.

-help	the usage text for the wfcmgr command is sent to the console.
-noupdate	when this option is specified, updates to the connection file and/or the configuration file are not allowed.
-description <*text*>	the full *text* from the Description field of the connection definition dialog. If this argument is not specified, then the first description in the [ApplicationServers] section of the appsrv.ini file will be used.
-file <*name*>	the fully qualified file *name* of the file that contains the connection description to be used. If the HOME environment variable is defined then the default file name is $HOME/.ICAClient/appsrv.ini. Otherwise, the default file name is /usr/lib/ICAClient/config/appsrv.ini.
-icaroot <*directory*>	the fully qualified *directory* where the ICA client package was installed. If not specified then the ICAROOT environment variable is accessed to get the directory. If neither the **-icaroot** argument nor the ICAROOT environment variable are used to define the install directory, then by default, it is /usr/lib/ICAClient.

Windows Application Access

wfica - ICA Client Command (1 of 3)

-help the usage text for the wfica command is sent to the console.

-version the following message is sent to the console:

> IBM Network Station ICA Client
> Version 2.0 (Build dd/mm/yyyy - hh:mm:ss)
> Copyright International Business Machines Corp. 1999
> All rights reserved

-quiet connection dialogs will not be presented to the user. By default, the ICA client will present a "connecting to" dialog followed by a "connected to" dialog. Both of these dialogs are informational and require no response by the user.

-description <*text*> the full text from the Description field of the connection definition dialog. Either **-description** or **-server** or **-- <application>** must be specified.

-file <*name*> the fully qualified file name of the file that contains the connection description to be used. If the HOME environment variable is defined then the default file name is $HOME/.ICAClient/appsrv.ini. Otherwise, the default file name is /usr/lib/ICAClient/config/appsrv.ini.

-icaroot <*directory*> the fully qualified directory where the ICA client package was installed. If not specified then the ICAROOT environment variable is accessed to get the directory. If neither the **-icaroot** argument nor the ICAROOT environment variable are used to define the install directory, then by default, it is /usr/lib/ICAClient.

Windows Application Access

wfica - ICA Client Command (2 of 3)

(The following parameters can not be combined with the **-description** parameter)

-server <*name*> specifies the ICA application server to connect to. The *name* can be a fully qualified network host name, an abbreviated network host name or a dotted decimal network address.

Either **-description** or **-server** or **- - <application>** must be specified. **-server** and **-browser** are mutually exclusive.

-browser <*namelist*> specifies the *name* of an ICA master browser. The master browser is an ICA server that tells the ICA client which ICA application server to connect to and which application to run on that server.

A colon ":" separated list of master browsers can be specified. Each name can be a fully qualified network host name, an abbreviated network host name or a dotted decimal network address.

-username <*name*> Windows NT server login user *name.*

-password <*password*> Windows NT server login *password.*

-domain <*name*> Windows NT server domain *name.*

Windows NT may prompt for login information if username, password and/or domain are incorrect or not specified

-name <*clientname*> specifies the *client name* to be used by the ICA application server.

-color <*number*> specifies the *number* of colors that the ICA application server should use to generate application graphics. Allowable values are 16 and 256.

-title <*text*> puts the specified *text* into the X11 window title bar.

Windows Application Access

wfica - ICA Client Command (3 of 3)

(The following parameters can not be combined with the **-description** parameter)

-encryption <*level*> specifies the *level* of encryption to be used between the ICA client and the ICA application server. Supported encryption levels are:

basic	simple encryption (this is the default)
login	128-bit RSA encryption for login only
40	40-bit RSA encryption
56	56-bit RSA encryption (North America only)
128	128-bit RSA encryption (North America only)

If any level of encryption is specified other than basic, then the Windows NT login dialog will appear.

-geometry <*WxH±X±Y*> the X11 window Width, Height, X offset and Y offset. All values are in pixels. Positive X offsets are from the top of the screen, negative from the bottom. Positive Y offsets are from the left side of the screen, negative from the right. Variations of this specification include <WxH> and <±X±Y>.

-geometry fullscreen same as < maximun_screen_width x maximum_screen_height + 0 + 0 >

-cache <*size*> size in kilobytes of the internal ICA Client transient cache.

- - <application> specifies the program that the ICA application server should run if the **-server** argument is also specified. Otherwise it specifies a published application and a master browser will be contacted to get both the program to run and the ICA application server to run it on. This parameter must be last.

Windows Application Access

ICA Flash Support

- **The ICA Client command (wfica) provides the following command line parameters to support flash card operation:**

-server<n>	indirectly specifies the **-server** parameter where the server <*name*> comes from the First Boot Host parameter in NVRAM if **-server1** is specified Second Boot Host parameter in NVRAM if **-server2** is specified Third Boot Host parameter in NVRAM if **-server3** is specified
-browser<n>	indirectly specifies the **-browser** parameter where the browser <namelist> comes from the First Boot Host parameter in NVRAM if **-browser1** is specified Second Boot Host parameter in NVRAM if **-browser2** is specified Third Boot Host parameter in NVRAM if **-browser3** is specified
-nvram <*fieldname*>	specifies the name of a text field in nvram. The text field will be analyzed and, if the first non-blank character is a dash (-), then the text will be used to replace the **-nvram** <*fieldname*> specification. Some nvram field names that may be available include **second-boot-path**, **third-boot-path** and **alternate-config-file**.

Windows Application Access

ICA Configuration Files

- One set of ICA configuration files are the .ini files:
  - **appsrv.ini** connection records (host, userid, password, encryption, window properties, ...). These records can be created, modified and deleted by the ICA Remote Application Manager. This file is in the **$HOME/.ICAClient** directory.
  - **wfclient.ini** default properties (browser host list, geometry, number of colors, keyboard definition, hot key definition, comm port definition, compression options, ...). Can be modified by the ICA Remote Application Manager. This file is in the **$HOME/.ICAClient** directory.
  - **module.ini** virtual drivers, protocols and transports. Cannot be modified by the ICA Remote Application Manager. This file is in the **/usr/lib/ICAClient/config** directory.
  - **keyboard.ini** keyboard types. References keyboard optional keyboard definition files. Cannot be modified by the ICA Remote Application Manager. This file is in the **/usr/lib/ICAClient/keyboard** directory.

Windows Application Access

ICA Configuration Files

- Another set of ICA configuration files are the application default files:
  - **Wfcmgr** application default file for the ICA Remote Application Manager. This file is in the **/nls/*/ICAClient** directory. If not found, an untranslated backup copy in the **/usr/lib/ICAClient/config** directory is used.
  - **Wfica** application default file for the ICA Client. This file is in the **/nls/*/ICAClient** directory. If not found, an untranslated backup copy in the **/usr/lib/ICAClient/config** directory is used.
  - **Xtra** an extra application default file used by both the ICA Remote Application Manager and the ICA Client. Late (untranslated) fixes to the user interface are put into this file. This file is in the **/usr/lib/ICAClient/config** directory.

Windows Application Access

ICA Configuration Files

- The following configuration files must be present for ICA operations:

Wfcmgr	Xtra	appsrv.ini	module.ini
Wfica		wfclient.ini	keyboard.ini

- The first time the ICA Remote Application Manager or the ICA Client accesses a connection record, the appsrv.ini and wfclient.ini "template" files are copied from the read-only /usr/lib/ICAClient/config directory to the read-write $HOME/.ICAClient directory.

DO NOT EDIT THE CONFIGURATION FILES.

IBM does not support modifications to the IBM Network Station ICA configuration files other than through the IBM Network Station ICA Remote Application Manager.

Windows Application Access

ICA Technical Notes

- When The ICA client starts, it negotiates with the configured server what features will be supported. Only features supported by both client and server will work. This allows the ICA client to connect to both WinFrame/WinCenter which is Windows NT 3.51 based and MetaFrame which is Windows NT 4.0 TSE based.
- If connecting to a WinCenter server, users may see the WinCenter logo - even though they are using the ICA client.
- Logging out from the Windows NT session will close the ICA session. Disconnecting from the Windows NT session detaches the ICA session. A disconnected ICA session continues to run on the Windows NT server. When reconnecting, the disconnected ICA session will be reattached using the original options and settings.
- The ICA command line parameters from the previous release are supported.

Windows Application Access

ICA Technical Notes

- Color
  - 8-bit pseudo color provides 256 colors. Each 8-bit color quantity is used to look up an RGB value in a color lookup table. This color mode is supported by the IBM Network Station.
  - 16-bit true color provides 65536 colors. Each 16-bit color quantity is decoded directly into a unique RGB value. This color mode is supported by the IBM Network Station.
  - The ICA protocol supports 8-bit color bitmaps. It does not support true color.
  - The ICA Client takes the 8-bit color bitmaps it receives from a Windows application running on the NT server and maps them into the current IBM Network Station color mode.

Windows Application Access

The Battle of the Window Managers

- Running the Windows NT desktop as an ICA client within an X11 window controlled by the NC Window Manager is fraught with conflicts. For example:
  - When Alt-F4 is pressed, the Windows NT desktop wants to close one of its Window NT windows but the NC Window Manager wants to close the ICA client.
  - When Alt-Tab is pressed, the Windows NT desktop wants to cycle through its Window NT windows but the NC Window Manager wants to cycle through its X11 windows.
- Three workarounds:
  - toggle (Alt-Shift-Ctrl-F11) the NC Window Manager to "process" or "pass through" special keystroke sequences
  - use the ICA Remote Application Manager's HotKey dialog to set non-conflicting, alternate keystroke sequences
  - modify the NC Registry to redefine conflicting NC Window Manager keystroke sequences
- Depending on a customer's environment, attempt to runWindows NT applications in separate ICA sessions rather than running the Windows NT desktop in a single ICA session. This puts each Windows NT application within its own X11 window.

Windows Application Access

Tips and Techniques

- Flash support for multiple ICA browsers

  To specify multiple ICA browsers, the following text could be entered in the Boot Monitor's Alternate Configuration File field:

  -b 9.8.7.201:9.8.7.104:server2 -- MyApplication

  Then the command

  wfica -nvram alternate-config-file

  will actually be interpreted as

  wfica -b 9.8.7.201:9.8.7.104:server2 -- MyApplication

- How to enable persistent caching

  The following instructions can be found in the /.profile file:

  # For enhanced ICA caching, uncomment the following
  # 4 lines and adjust the mount_ifs -s SIZE accordingly
  # **/bin/mkdir /tmp/.ICACache** >/dev/null 2>&1
  # **/bin/chmod 777 /tmp/.ICACache** >/dev/null 2>&1
  # **/sbin/mount_ifs -o rw -s 4096 none /tmp/.ICACache** >/dev/null 2>&1
  # **/bin/chmod 777 /tmp/.ICACache** >/dev/null 2>&1

  Each connection record must explicitly enable persistent caching in the Entry-->Connection dialog

Windows Application Access

Tips and Techniques

- Read the README file in /usr/lib/ICAClient
- Ensure the latest Citrix "hot fixes" for WinFrame, MetaFrame or CDS are installed on the Windows NT server
  - http://www.citrix.com/support
- To clean up a user's ICA configuration, simply remove (or rename) the user's $HOME/.ICAClient directory

Windows Application Access

Useful URLs

- CITRIX
  - **www.citrix.com/support/winfrm17/index.html**
    - WinFrame 1.7 documentation
  - **www.citrix.com/support**
    - hot fixes for WinFrame and MetaFrame servers
    - searchable knowledge data base
- IBM
  - **www.ibm.com/nc**
    - IBM Network Station information

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Restrictions and Limitations

- The ICA Remote Application Manager and the ICA Client both support a list of ICA master browser host names. A list of ICA application server host names is not supported.
- When run as an ICA Client, the Windows 95/98/NT DOS Command Prompt cannot be made full screen by either pressing <Alt><Enter> nor by selecting full screen in the DOS Command Prompt properties.
- ICA Protocol limitations include:
  - no true color support
  - no bi-directional audio support
  - no audio device control
  - no parallel port device support (other than virtual printer support)
  - no bi-directional printer support
  - no USB virtual device support

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Problem Determination

- A good test of the Windows NT configuration is to (1) set the Windows NT locale, (2) specify and attach an applicable keyboard and (3) run both NotePad and WordPad directly from the Windows NT. This usually identifies any problems that must be corrected before an ICA client will work correctly.
- Determine how a Citrix Windows 95/98/NT ICA Client behaves in a problem environment. Frequently, the Citrix Windows ICA Client exhibits the same problem as the IBM Network Station ICA Client. Our goal is to be compatible with the Citrix Windows ICA Client.
- Make sure the following files exist:

$MRIPATH/ICAClient/Wfcmgr	$HOME/.ICAClient/appsrv.ini
$MRIPATH/ICAClient/Wfica	$HOME/.ICAClient/wfclient.ini
/usr/lib/ICAClient/config/Xtra	
/usr/lib/ICAClient/config/module.ini	/usr/lib/ICAClient/keyboard/keyboard.ini

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What we need in a problem report ...

- **Run the wfreport command**
  - this produces an **ica_report.Z** file which contains:

    A list of environment variables
    A list of $ICAROOT files
    A list of /tmp/.ICACache files
    The contents of $ICAROOT/config/module.ini
    The contents of $ICAROOT/config/.server
    The contents of $ICAROOT/config/Xtra
    The contents of $ICAROOT/keyboard/keyboard.ini
    The contents of $MRIPATH/ICAClient/Wfcmgr
    The contents of $MRIPATH/ICAClient/Wfica
    The contents of $HOME/.ICAClient/wfclient.ini
    The contents of $HOME/.ICAClient/appsrv.ini
    The contents of /.profile
    NSM ICA connection entries from the Registry

  - Send the **ica_report.Z** file to IBM

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What we need in a problem report ...

- **Provide a <u>detailed</u> description of the scenario that causes the problem**
  - more than likely, we will need to reproduce the problem in our lab
- **Network information**
  - Ethernet vs token ring
  - network speed
- **Windows NT application server configuration**
  - version numbers (Windows NT, WinFrame or MetaFrame, applications, ...)
  - resources (free space on hard disk, free RAM available, ...)
  - number of concurrent users
- **Network Station configuration**
  - what other activities were going on
- **For ICA Client problems, how was the ICA Client invoked ?**
  - if invoked from the command line, send in the command line string
  - if invoked from the ICA Remote Application Manager, send in the description name