IBM

Personal Systems Group

IBM NetVista Thin Client for Windows-based Terminal Standard 1.5 - Printing Overview

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Chapter 1. IBM NetVista Thin Client for Windows-based Terminal Standard 1.5 - Printing Overview

1.1 Summary

The objective of this document is to provide an overview of the printing facilities available on the IBM NetVista Thin Client for Windows-based Terminal Standard 1.5, hereafter abbreviated as WBT (for Windows-based Terminal).

For now, this is meant to provide only a high level overview of the capabilities provided in the first release of this product.

Because there are many combinations and possibilities of how to use the print facilities, it is easier to break those down according to where the printed output is to be sent and where it comes from.

1.1.1 What are the possible scenarios?

There are two possible destinations for a print job:

1. A remote printer, that is a printer attached to a print server somewhere in the network.

2. A local printer, that is a printer which is attached to the WBT.

For every case of printing, there are (at the time of this writing) three possible sources from where the print job might originate:

- Applications executed on a Windows server via a Microsoft Remote Desktop Protocol (RDP) session.

- Applications executed on a Windows server via a Citrix ICA session.

- Applications executed locally on the WBT. At this time, the only applications available are emulator applications. For these local applications, we have two possible cases:

  1. Printing from the host application to a system printer or to any printer available from the host where the application is executing.

     This is the *business as usual* case where the print job is sent to a printer that is either attached to the remote host where the application is executing or to a printer attached to another host but defined in the host where the application is executing.

     One of these printers could be a WBT-attached printer. In the case of a 3270 application for example, this is the equivalent of printing to a 3287 printer. This is typically called LU1 or LU3 printing, in SNA terminology.

  2. Printing the local presentation space (or a portion of it) to a local (WBT-attached) printer. This is typically called a local Print Screen function and consists of copying all, or a portion, of what currently appears on the screen to a local printer.

1.2 Printing to Remote Printers

When printing to remote printers, there are two primary cases; printing from applications executed on a Microsoft Windows server via an RDP or ICA session, and printing from applications executed locally on the WBT.

1.2.1 Applications Executed via RDP or ICA

In the case of applications (a spreadsheet application for example) executed on a Windows server via either an RDP or an ICA session from the WBT, this is really *business as usual* in the sense that these applications are not different from any other applications executing on a Windows machine and they have access to all the printers that are defined on that server.

These printers can be local to that server, they can be remote shared printers or printers reachable through TCP/IP printing facilities such as LPR/LPD. If the printer can be defined on that Windows server, then it is reachable by the applications.
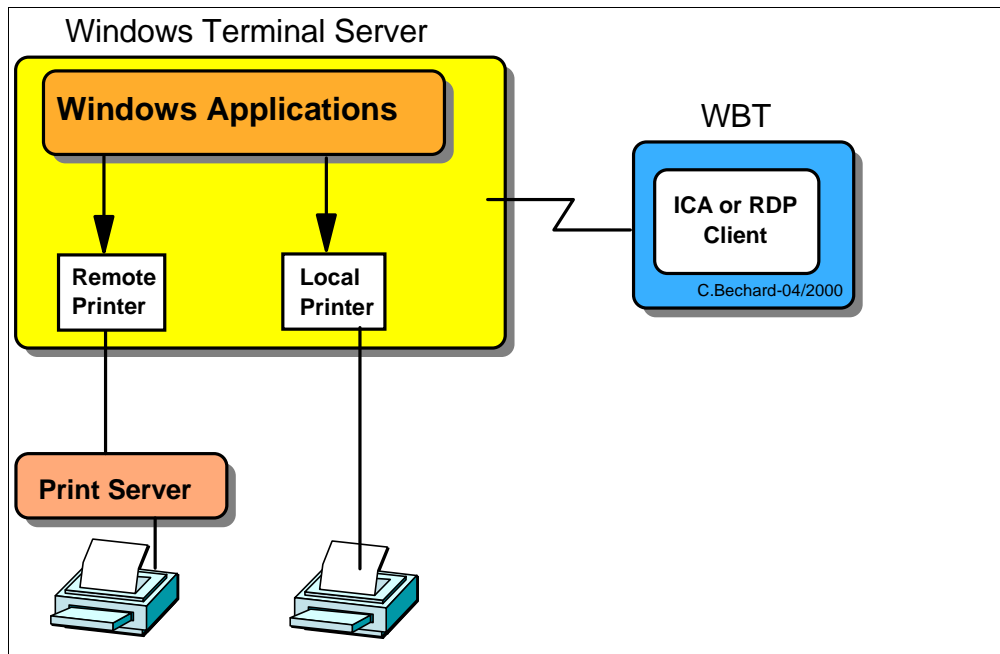
Figure 1. Printing via ICA or RDP Client on Remote Printers

Printers supported are all those that are supported by the Windows environment.

1.2.2 Applications Executed locally on the WBT

Applications executed locally on the WBT (at the time of this writing, these are emulator applications) can print to a remote printer by using the NetPrint capabilities.

Note: The NetPrint server is a product available separately, from FutureSoft Inc., for a fee. See www.futuresoft.com for details.

1.2.2.1 How Does Remote Printing Work?

Already included in the WBT base operating system (Windows CE) is a NetPrint client module and all applications that wish to print can send their output to the NetPrint Client. The function of the NetPrint client is to receive the print job from the local application and to route it to a NetPrint server which in turn hands the print job over to any printer available from that server.

Essentially, the NetPrint client module communicates with the NetPrint server, to get a list of printers that are available (to that client), then the user chooses a printer to which the print job is to be sent. When the application prints, the job is transferred to the NetPrint Server by the NetPrint client, and the Netprint server spools the job to the appropriate printer.

Any local or remote printer available from the Windows server on which the NetPrint server module is executing is, in theory, available to the WBT. However, the specific printers that are actually made available to the NetPrint client running on a WBT are dependent on the configuration of the NetPrint server that specifies the printers that are to be made available on a client by client basis.
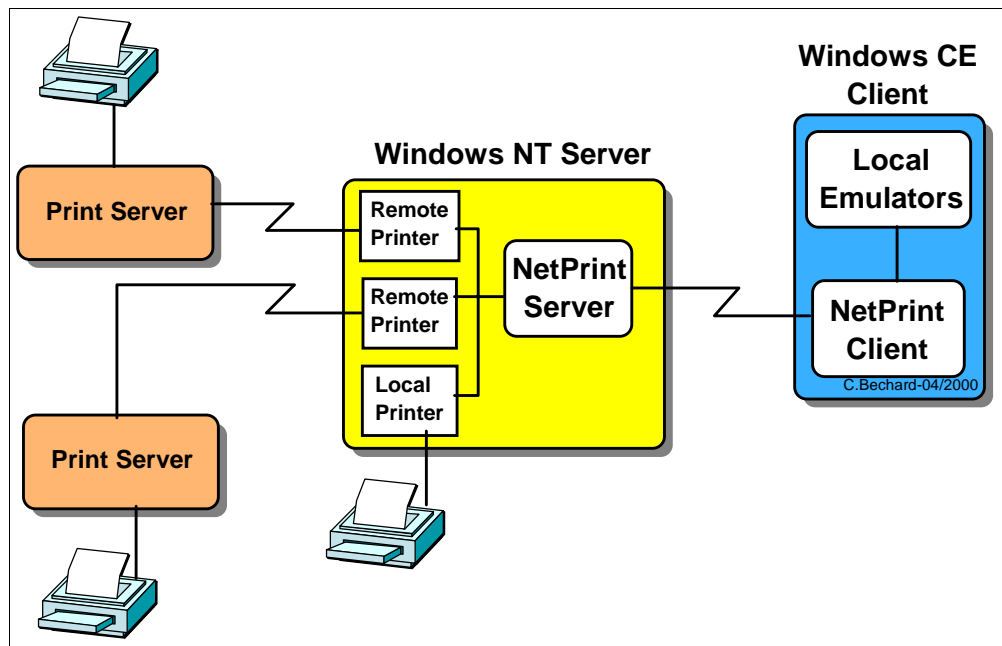
Figure 2. Simplified NetPrint Overview

Printers supported are any printers that can be defined on a Windows server.

1.2.2.2 How Is the Remote Print Server Configured?

Once the NetPrint server product is installed on a Windows NT server somewhere on the network, and all the printers that we want to make available to the WBT clients are defined on that server, whether they are defined as printers locally attached to the server machine or shared printers on the network, all these printers appear in the NetPrint server configuration window, as illustrated in the next figure.

Note: If printers are added after this NetPrint interface has been started, the list does not get updated automatically. The interface needs to be restarted for the

list to get updated. However, the added printers will show up when selecting a user and configuring his printers (see below).
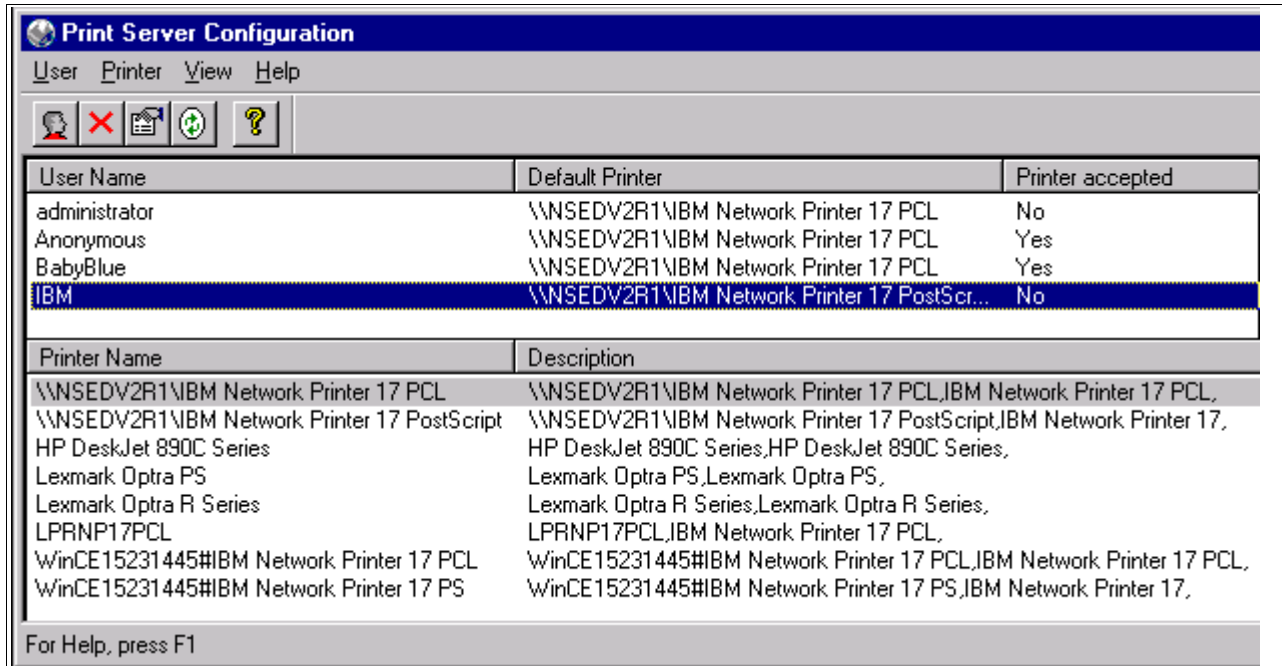

Figure 3. A Sample NetPrint Configuration Panel

In this particular example, the top part of the panel lists the different user names and the default printer currently assigned to that user. The *Yes* or *No* under the column labeled *Printer Accepted* indicates whether this particular user has already (some time in the past) connected to this server and selected a printer.

The bottom part of the panel lists all the printers that are currently available to be selected for assignment to a user. In this specific example, the list shows:

- The first two entries are shared printers that are located on a server called NSEDV2R1
- The next three entries are printers defined locally on this server, that is the server where the NetPrint server application is installed
- The LPRNP17PCL is actually an LPR printer port pointing to a printer on a remote LPD server (this could be a full NSM Network Station attached printer for example)
- The last two entries are actually client printers that are WBT-attached (they appear here because the NetPrint server in this example happens to be installed on the MetaFrame server, which is not typical but was done in a test environment with limited machines).

To configure a printer specifically for a user, select a user and double click the entry, which brings up the panel illustrated in the next figure.
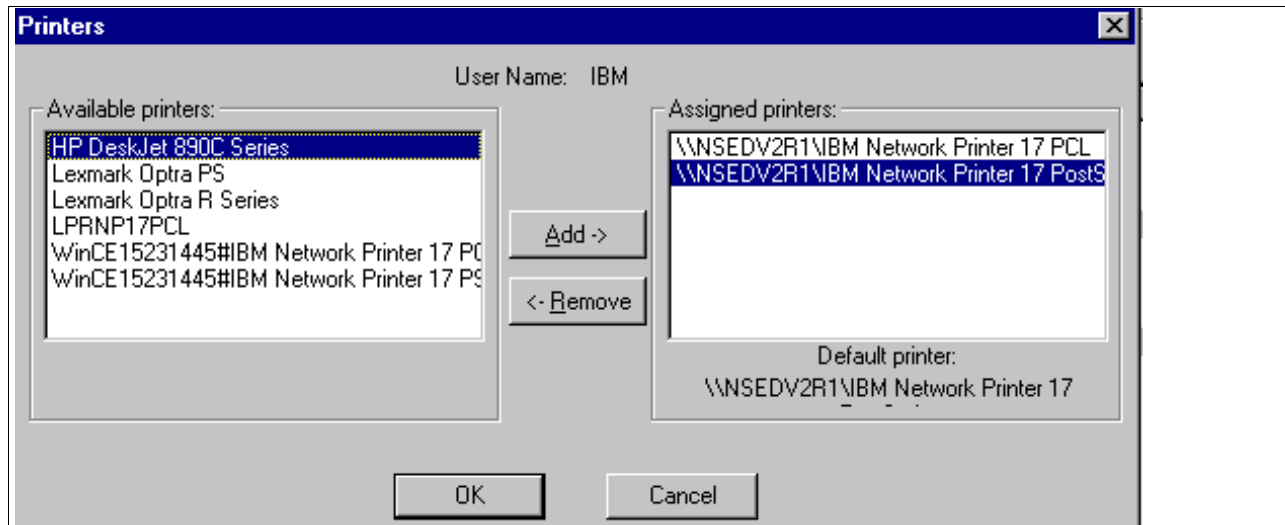
Figure 4. Sample Printer Configuration for User IBM

In the panel above, printers from the list on the left can be made available to this user by moving them to the list on the right using the Add button. The currently selected printer is the one that becomes the default printer.

Note: The list on the left (as opposed to the list on the main panel shown in the previous figure) does get automatically updated if printers are added after the NetPrint Server interface is started.

1.2.2.3 How is Remote Printing Configured on the WBT Station?

On the WBT, there are two steps required to select a remote printer.

1. Select a NetPrint server.

   Because there might be more than one NetPrint Server available on the network, a specific NetPrint Server must first be identified.

   This is done by using **Connect** on the emulator menu and then **Print Setup...**, as illustrated in the figure below.
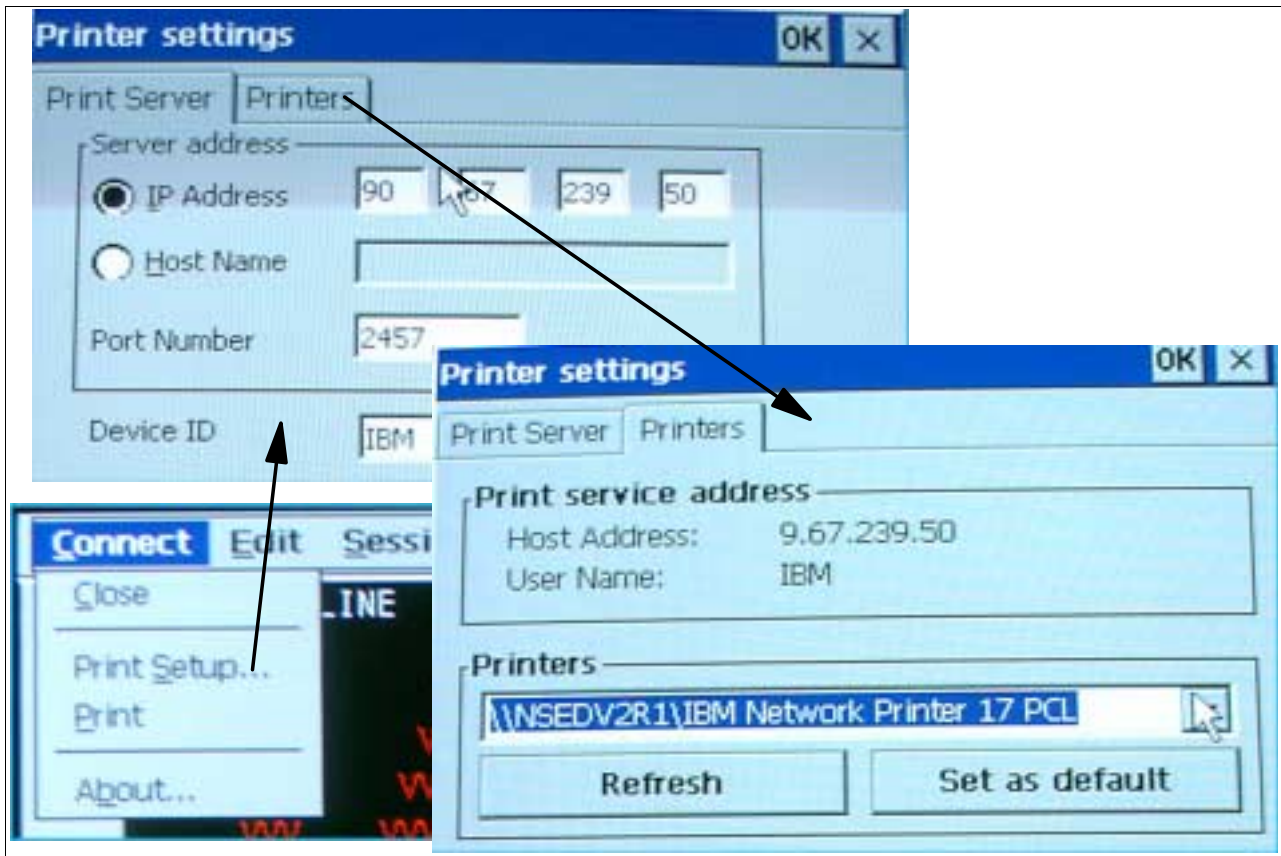
Figure 5. Selecting a Remote NetPrint Server and Printer

A specific NetPrint server is selected by entering either its IP address or its host name.

Notice the Device ID field! The name appearing in this field (the default name is IBM) is what the NetPrint server calls the user name, as was described above when discussing the NetPrint server configuration.

In other words, when this WBT NetPrint client contacts the Netprint server, it identifies itself as user IBM (in this example).

2. Select a specific printer on the NetPrint Server, if more than one are available.

A click on the *Printers* tab causes the NetPrint client on the WBT to contact the NetPrint server and to request a list of the printers available to the user called IBM (or whatever is the entry in the Device ID field). Notice that the selected NetPrint server and the user name appear in the top portion of the panel. The entry appearing in the Printers dropdown list is normally the default printer assigned to that user.

A click on the dropdown list displays the other printers that are configured as available to that user.

The **Refresh** button is used to refresh the list if changes have been made on the server since the last time the list was accessed.

The **Set as default** button is used to change the default printer assigned. This actually causes the default printer configuration on the server to be changed.

1.2.2.4 Printing the Presentation Space (Print Screen)

The whole presentation space (what appears on the screen), or a portion of it, can be selected and printed to a remote printer. To do so, use **Connect** pull-down on the emulator and select **Print,** as illustrated in the next figure.

If a portion of the presentation space is selected prior to entering the Print dialog, only the selected portion is sent to the printer.

A click on the **Setup...** button shows that the current printer selected is the Vprinter and the port is CE Print Services, which points to the NetPrint server. If we wanted to send the output to a locally attached printer instead, this is where we would change the printer and port.
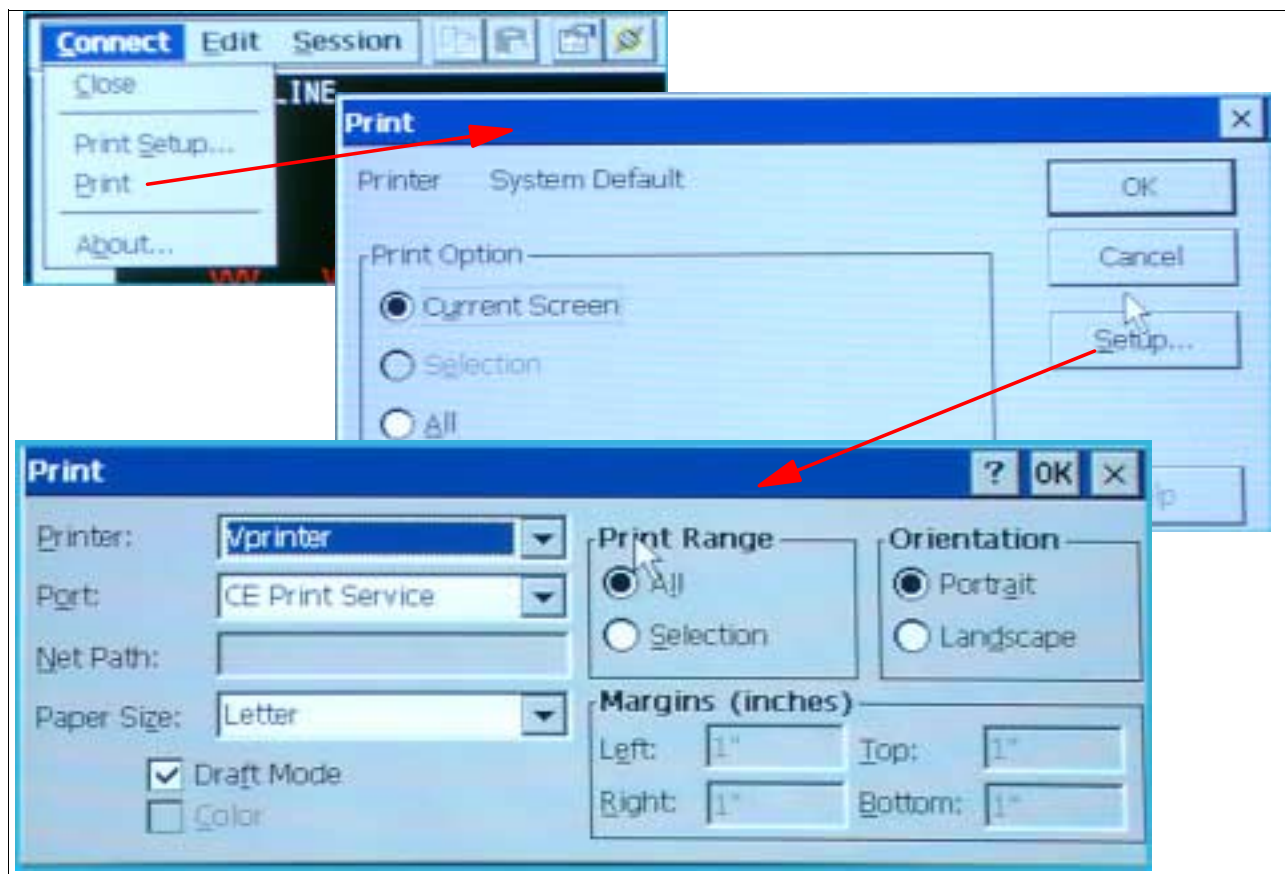

Figure 6. Printing the Presentation Space

1.2.2.5 Printing From a Host Application

Similar to an RDP or ICA session, the host application can print to any printer (local to the application host or remote from the application host) that is defined on the host where the application resides.

1.3 Printing to a Local (WBT-attached) Printer

Let's now consider the case of local printing, meaning printing to a WBT-attached printer.

1.3.1 USB Attached Printer

Printing to a local printer is done through one of the two USB ports available on the N2200w because the N2200w does not have a parallel port, or a serial port.

A printer can be attached either directly to the USB port if that printer is a USB printer or it can be attached via a USB to parallel converter adapter if the printer only supports a parallel adapter.

In our tests, we used an IBM 4317 Network Printer attached to the WBT (N2200w) using a Belkin USB Parallel Printer Adapter cable. This is a cable with a USB plug on side and a 36-pin Centronics Male adapter on the other.

Note: Most parallel printers have a 36-pin Centronics female port in the back and most PC have a DB-25 female port in the back and therefore, the typical printer cable used has a DB-25 male end and a 36-pin Centronics male end. Some printers though may offer both a USB port and a 36-pin Centronics parallel port and some printers may even have a proprietary port, typically supplied with a cable with a DB-25 male end that plugs into a PC's parallel port. In that case, some special converter cables are available at computer shops to provide the gender changing required.

1.3.2 Applications Executed via an RDP Session

For applications executed on a Windows server via an RDP session from the WBT, there are two cases:

1. **Windows NT 4.0 Terminal Server Edition**

   If the RDP session connects to a Windows NT 4.0 Terminal Server Edition machine, printing to a WBT-attached printer (which is called the client printer) is not supported.

2. **Windows 2000 Server**

   If the RDP session connects to a Windows 2000 server, the WBT-attached printer can be defined as a client printer and applications executed on the server can sent output to the WBT-attached printer.

1.3.2.1 How Does it Work?

In a simplified fashion, the printer attached to the WBT is defined as if it was attached to the server where the RDP session originates, and therefore the appropriate printer device driver can be selected and associated with the printer device.

When the application generates the print data stream, it behaves as if the printer device was local and generates the appropriate data stream. The data stream is then *passed-through* to the device inside the RDP session and handed over to the client printer device without any modifications, as illustrated in the following figure.
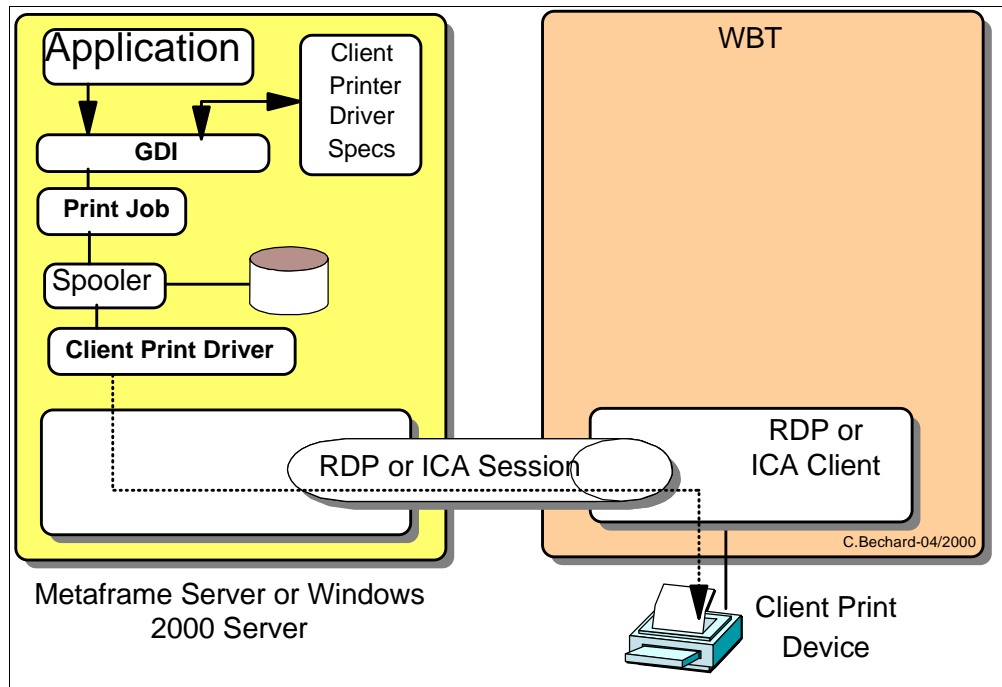
Figure 7. Local Printing via RDP or ICA Session

1.3.2.2 How Is the Printer Defined on a Windows 2000 Server?

In this environment, when the RDP 5.0 client on the WBT connects to a Windows 2000 server, a client printer is automatically defined (by default)and automatically appears in the Printers folder for that user.

The name of the printer is in the format "PrinterName/ClientName/Sessionx" where:

- PrinterName is whatever Printer name was used to define this printer originally (the default driver for that printer is a HP Deskjet 895C printer).

- ClientName is the name of the client as defined on the WBT. This is the Terminal Name parameter on the Terminal Properties/Network panel on the WBT.

- Sessionx is automatically generated by the Terminal Server and x is incremented in some fashion, dependent on the number of active sessions.

The following figure illustrates what a Printers folder contains for a user after he logged on using an RDP session. The printer is called Local WBT Printer/IBMWBT/Session2.
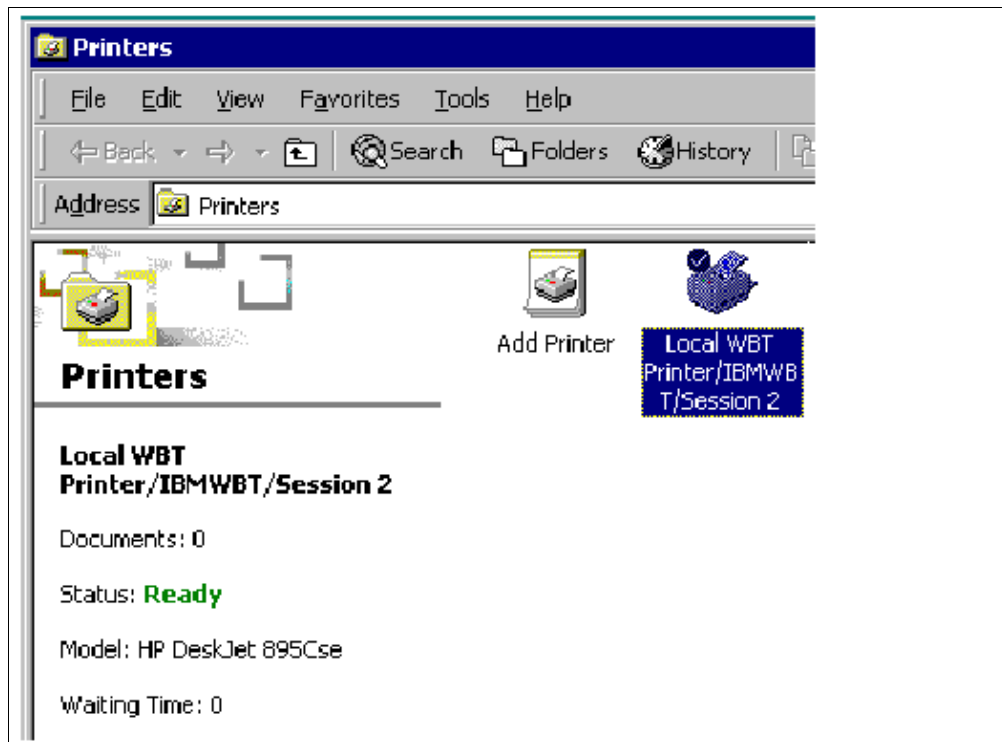
Figure 8. A Client's Printers Folder

If we take a look at the Properties of this printer and use the General tab of the Properties panel (illustrated partially in the next figure), it shows that the printer driver used for that entry is the HP Deskjet 895Cse.
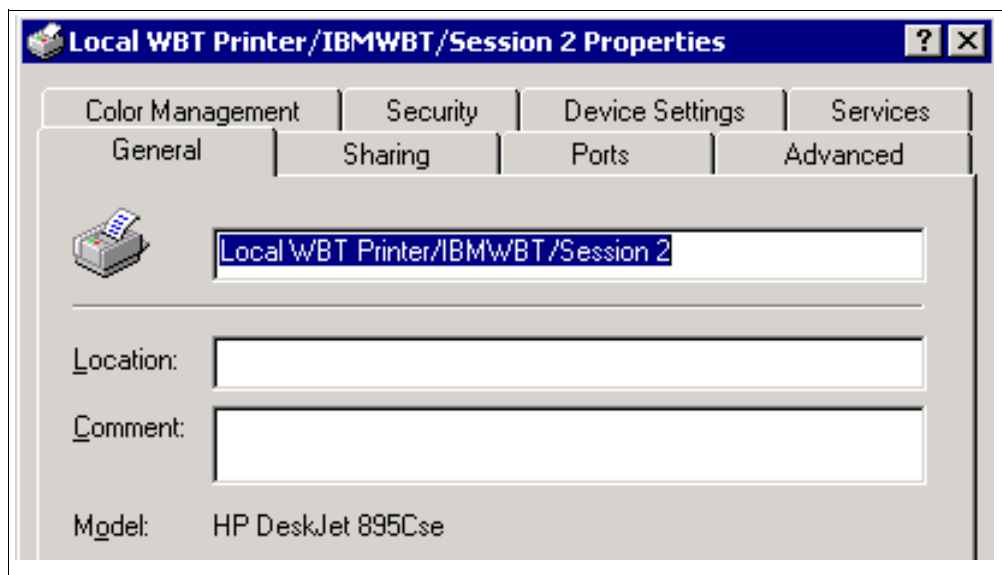

Figure 9. Client Printer Properties in Windows 2000

Assuming that the printer attached to the WBT is not an HP Deskjet 895C, the device driver can be changed, by the administrator, in the following fashion:

- The RDP session for that client must be active

- In the administrator session, the administrator opens his Printers folder, selects the printer for that particular client, opens the Properties for that printer, clicks on the Advanced tab, and selects the proper printer driver from the drop down list that appears besides the driver name, as illustrated in the next figure.

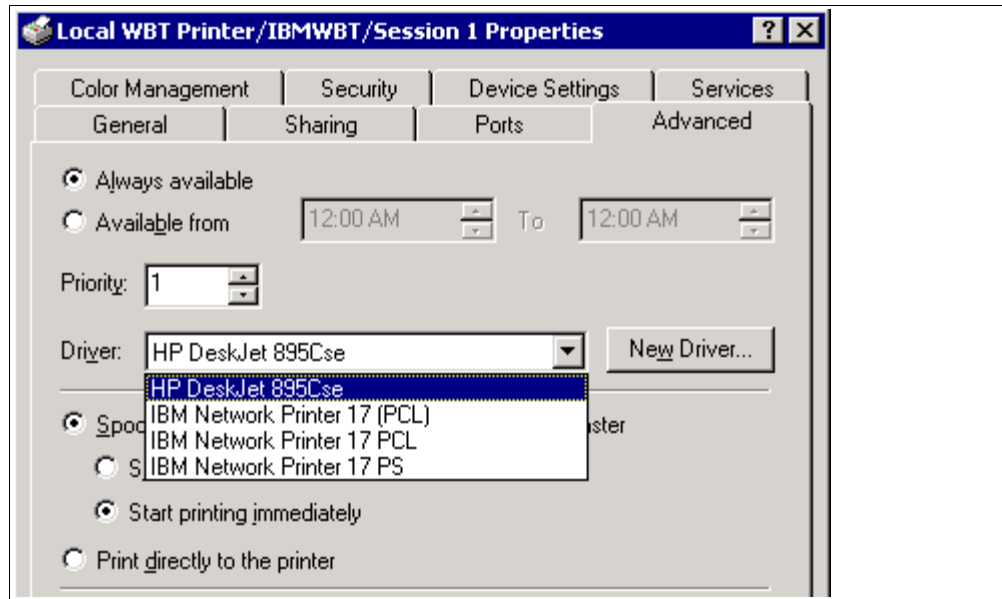- If the driver is not in the list, a new driver can be installed by clicking on **New Driver...**.

Figure 10. Selecting a New Printer Driver for a Client Printer

Once this operation has been performed once by the Administrator, the Windows 2000 system remembers these Properties and automatically recreates this printer with the proper device driver when this client reconnects later on.

Note that the printer definition disappears when the RDP session is ended by the client, but re-appears automatically when the client reconnects.

1.3.3 Applications Executed via ICA

For applications executed on a MetaFrame server via an ICA session from the WBT, (and this is valid for both a MetaFrame server on a Windows NT 4.0 server or Windows 2000 server) the WBT-attached printer can be also be defined (mapped) as a client printer, similar to what we described above for an RDP session to a Windows 2000 server, but with a few differences.

When a WBT initially connects to a MetaFrame server, a client printer is **not** automatically defined by default (as in an RDP session to a Windows 2000 server) but it must be defined initially by the owner of the ICA session by using the ICA Client Printer Configuration application. Once it has been defined however, the printer is automatically deleted when the ICA session is ended, and automatically recreated (albeit with a different name every time) when the ICA session is re-established.

In the case of a MetaFrame server, the name of the printer is in the format "ClientName#PrinterName" where:

- ClientName is a name which is dynamically generated by MetaFrame each time that the WBT connects into the server. For example, WinCE089361.

- PrinterName is the name that was used when this printer was originally defined on the server.

For example, the figure below illustrates the Printers folder after an ICA client has connected into the MetaFrame server.
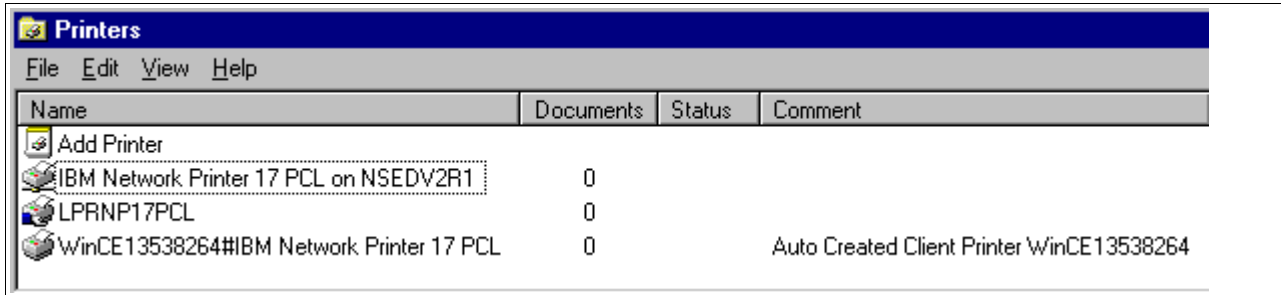

Figure 11. Printers Folder in an ICA Session

Notice the last entry that represents the client printer that was automatically re-created, and the comment that indicates that this is an Auto Created entry.

The first part of the name is the dynamically generated client name, as it would appear on the MetaFrame Server Administration panel, as illustrated in the next figure, where we see the ICA-tcp#10 connection for user Claude and client name WinCE13538264.
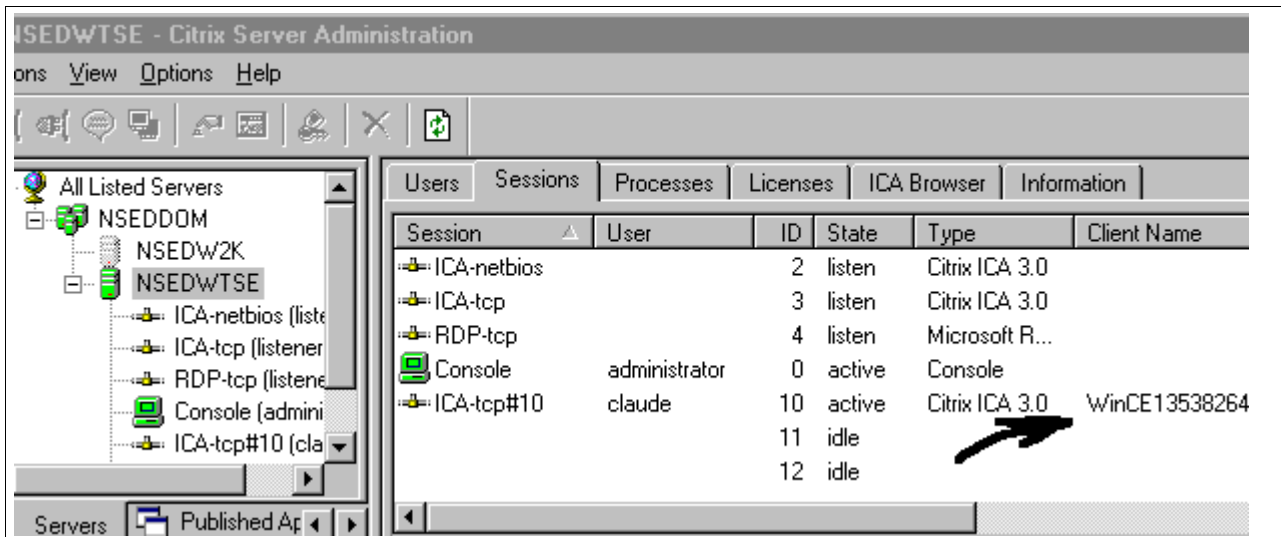
Figure 12. MetaFrame Server Administration Panel

1.3.3.1 Adding a Client Printer in MetaFrame

For this printer to appear automatically, the user had to initially use the ICA Client Printer Configuration Application to create the printer once. This application is initiated by using **Start** => **Programs** => **MetaFrame Tools** => **ICA Client Printer Configuration**, which brings up the panel illustrated in the next figure.

Initially, there are no entries in this panel and the user must select **Printer** =>
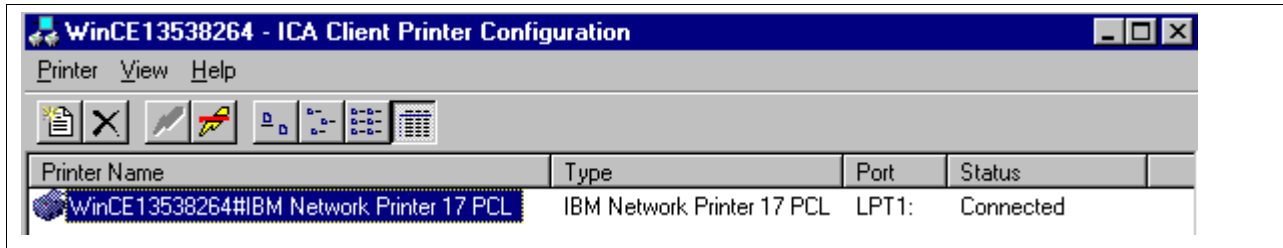**New** in order to define the initial printer.

Figure 13. ICA Client Printer Configuration Panel

The user selects the appropriate driver printer from a list and the only choice for
the port is LPT1. The printer driver for the selected printer must already have
been installed by the administrator in order to be available.

1.3.3.2 Adding a Client Printer in Citrix Device Services (CDS)
In CDS, there is no ICA Client Printer Configuration application, so a client printer
is added via the normal Add a Printer Wizard and using the Add a Client Printer
port. Here are the steps to follow:

- Get the ICA client name as described above using **Start -> Programs
  ->Administrative Tools ->Terminal Server Administration** and using the
  Sessions Tab.

- Then create a new printer by selecting **My Computer -> Printers -> Add
  Printer** to open the Add Printer Wizard, and then select **My Computer**, then Add
  a Port, select Client Printer Port, and enter the string "Client\LPT1" as illustrated
  in the figure below (**Note**: In this string, do not replace Client with the Client
  Name, but enter the string exactly as shown).
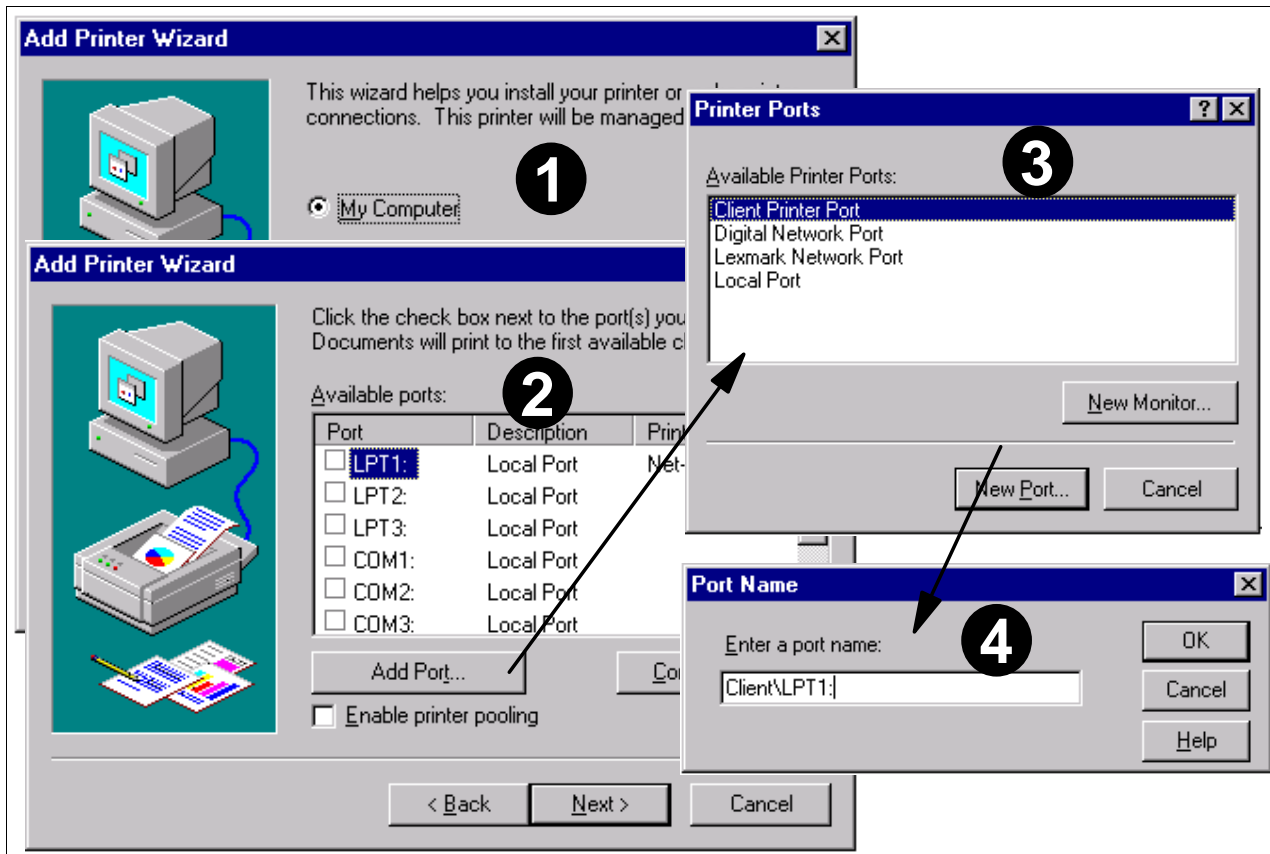
Figure 14. Adding a Client PRinter in CDS

- After entering the Port Name, click OK, and then select the specific printer being added.

- Finally, on the last panel, enter the printer name as Client Name#Printer Name, where client name is the name of the client as it appears in the MetaFrame Administration panel, and printer name is any name that you want to use to describe the printer.
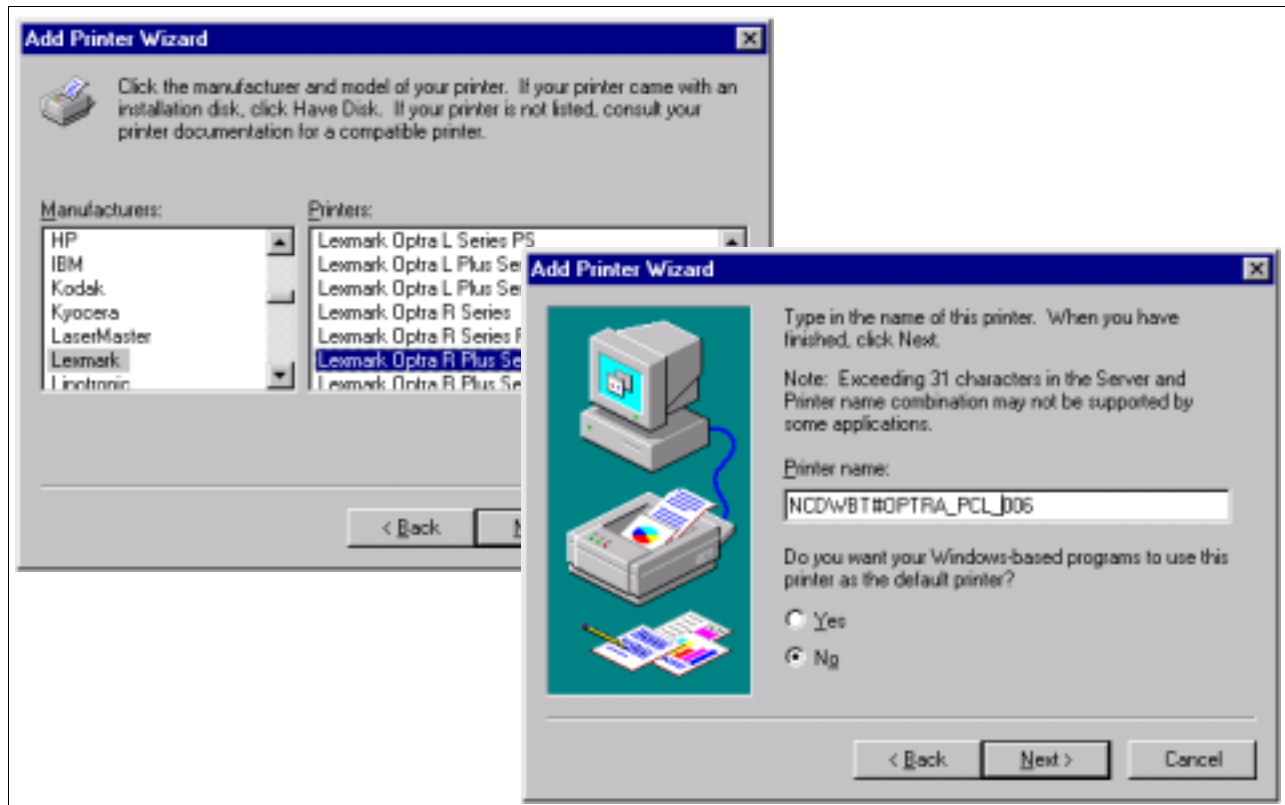
Figure 15. Adding a Client Printer on CDS

1.3.3.3 Making a Printer Definition Permanent

If having a printer name that is dynamically generated on every connection presents a problem, there is a way to prevent the removal and re-addition of the client printer at every connection by modifying the description of the printer once.

This is done by accessing the Printer Properties with a right-click on the printer icon for example, which brings up the panel illustrated below.

Figure 16. ICA Client Printer Properties

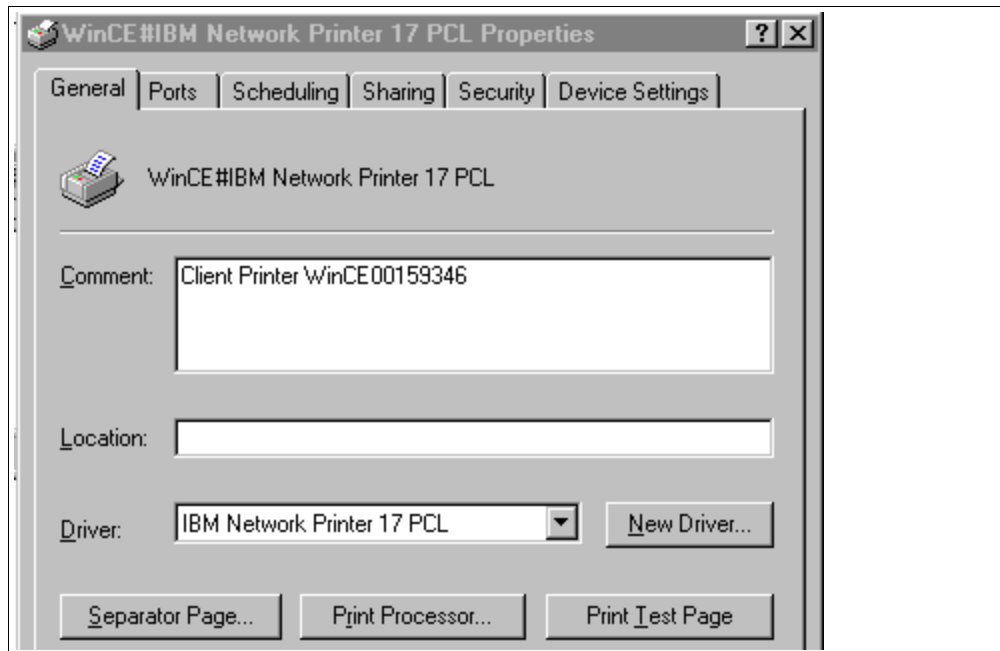In this example, the Comment field normally contains the string Auto Created Client Printer WinCE00159346. We removed the words Auto Created, as indicated in the figure above. The result of this action is that this printer definition remains permanently from this point on and is therefore not removed when the ICA session ends.

This could likely be used so that the printer queue can be put in hold mode for example, and print jobs could be sent to this printer while the client is actually not connected, but spooled out to the client's printer after the session reconnects and the printer resumes printing.

1.3.4 Applications Executed Locally on the WBT

For applications executing locally on the WBT, there are two cases; printing the presentation space locally and printing from a host application to the local printer.

1.3.4.1 Printing the Presentation Space Locally (Local Print Screen)

In this case, instead of using the **Connect** -> **Print Setup** function on the Emulator Menu bar to connect to a NetPrint server and to select a remote printer, the user goes to **Connect** -> **Print**.

On the Print panel, the user selects the entire screen or, if a selection was made prior to entering this function, the selection button is already pre-selected, indicating that the user only wants to print the selected portion of the presentation space.

The user then uses the **Setup..**. button, which brings up the standard Windows CE 2.1 Common Dialog for Printing illustrated in the next figure.

This panel contains an entry called *Printer* where the pre-selected entry is Vprinter and the *Port* entry contains the value CE Print Service, which are the

normal settings for printing to a remote printer through the NetPrint server. The printer entry can be changed by selecting either PCL InkJet or PCL Laser in the printer selection drop down and the port entry can be changed to LPT1.

A click on OK and then OK again on the main Print panel causes the content of the screen to be sent to the local LPT1 port.
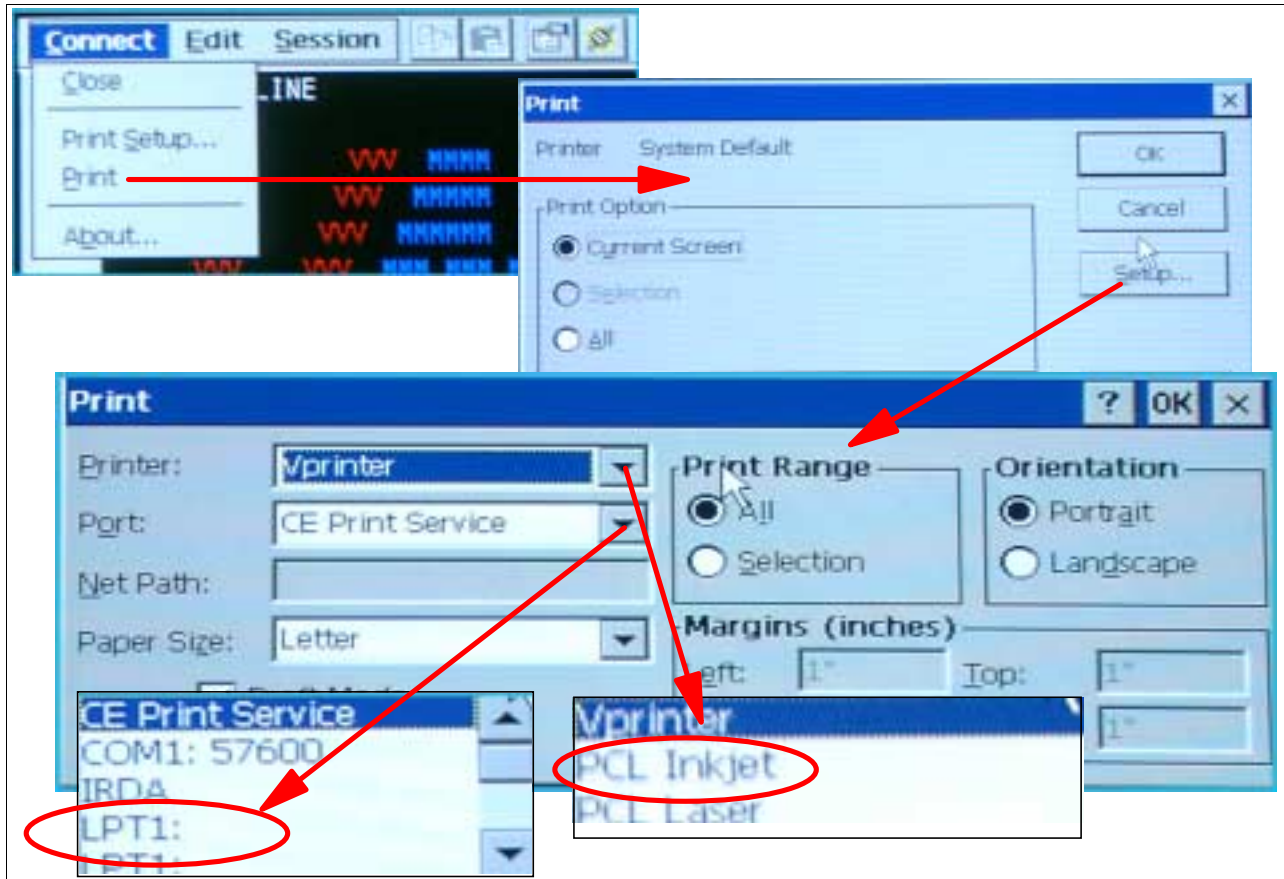

Figure 17. Printing to a Locally Attached Printer

1.3.4.2 Printing From a Host Application to the Local Printer

When executing a host application through an emulator, the host application can print to the local WBT-attached printer via an Emulator Print session.

Because these are TN3270E and TN5250E sessions, both the 3270 and 5250 emulators can have an emulator print session active with the host that allows a host application to send a print data stream via the print session to the local device.

The chart in the next figure might appear complicated at first, but it attempts to summarize the important aspects of an emulator print session by using a 5250 example.

These are the steps that one would follow to use a 5250 emulator print session:

- On the WBT, we define a normal 5250 emulator display session and connect the session to an AS/400

- On the WBT, we also define a 5250 Emulator Print Session, and as indicated by the number 1. Notice that we indicate the device name as CLAUDED. When we start this session and it connects to the AS/400, it causes the auto-creation of a print device called CLAUDED, as indicated in number 2.

- Next, on the 5250 Print Emulator session on the WBT, we configure where we want the printed output to go. That is, the print data stream will be sent from the host using the print session, but once received via the print emulator session, we still have a choice of sending the output to a remote printer or to a local WBT-attached printer. If we really wanted to send the output to a remote printer, it is likely that we could simply have defined that remote printer on the AS/400 host and routed the output directly from the AS/400 to the remote printer. So in this case, we will assume that we want to print locally on the WBT-attached printer.

- As indicated in number 3, the print destination is configured by selecting **Print** on the **Connect** pull-down in the emulator session, then **Setup** on the next panel, which brings us the choice indicated here. If we select CE Print Service as the port, the output is sent to the NetPrint Client which then sends it to a remote printer on the NetPrint server. If we select LPT1 as the port, the output is routed to the local Print driver handling the printer locally attached via the USB port on the WBT.

- In number 4, the user starts an application on the AS/400 via his emulator display session and requests the output to be routed to the CLAUDED printer device, which sends it along to the 5250 Print session.

- Assuming we had chosen LPT1 as the destination port, the output is then sent to the local printer, as indicated in number 5.

There are other considerations in terms of how the printer is defined on the AS/400, and how the queues are managed, as well as the drivers used to print, which are outside the scope of this discussion.

The 3270 Emulator has similar capabilities except that instead of defining a Device Name in the Print Properties panel (as was shown in number 1), it is an SNA LU name that is used to connect the print session with a particular printer definition statement on the S/390 host.
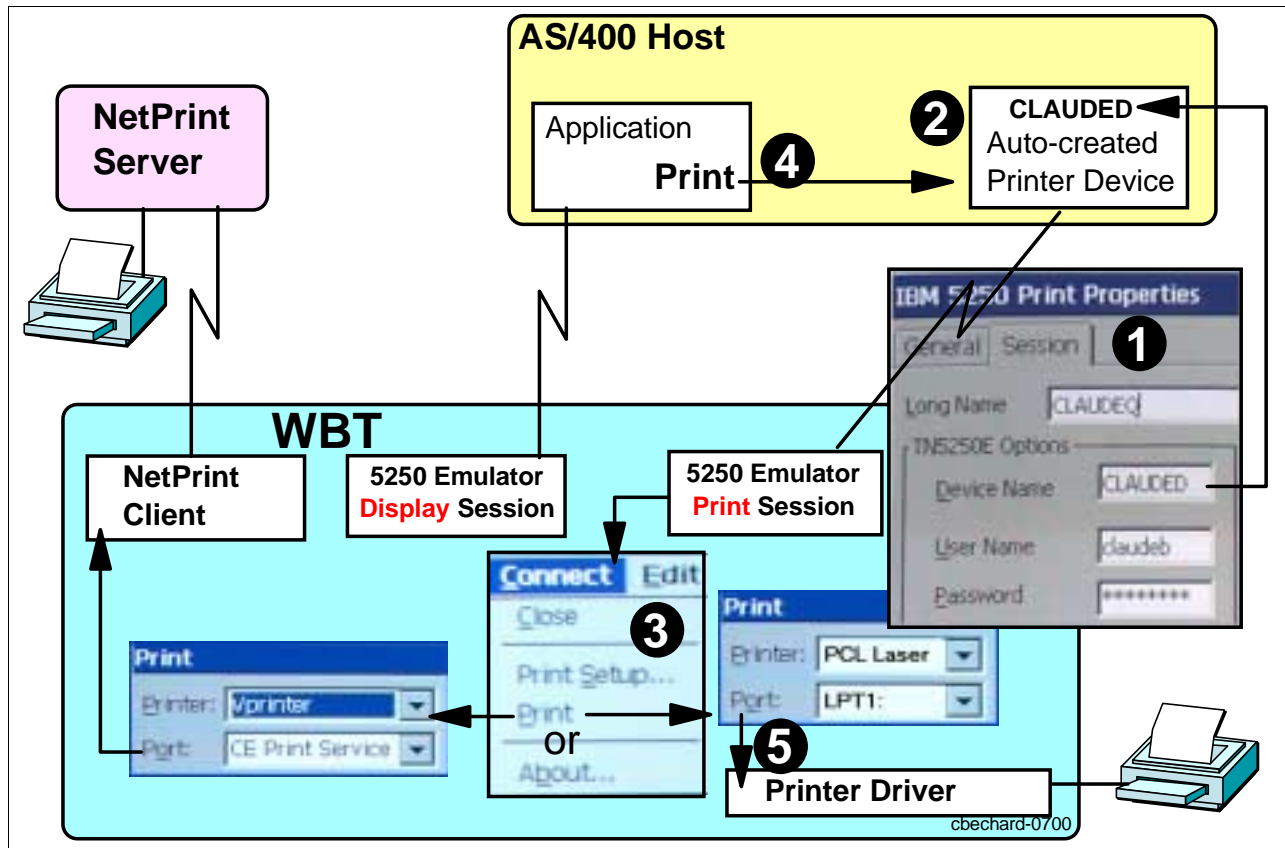
Figure 18. Printing via an Emulator Print Session

1.3.4.3 How Does Local Printing Work?

At the moment, when the user selects to print locally on a WBT-attached printer, the local application (in this case, the emulators) starts by presenting the Print Dialog on which the user can choose the following:

• Printer: Vprinter(default), PCL Inkjet, PCL Laser

• Port: CE Print Service (default), LPT1, COM1:57600, IRDA and Network

• Paper Size: Letter (default), Legal, A4 B5

• Network Path:

• Print Range: Choices are All (Default) or Selection

• Orientation: Choices are Portrait (Default) or Landscape

• Margins: Left, Right, Top and Bottom

Once the a selection has been made on this panel, for example PCL Inkjet on LPT1, the application uses a generic HP PCL2 Printer driver to generate a PCL2 data stream (this is the only available choice at this time).

This data stream is then handed over to a Printer Class Driver, whose role it is to determine whether the attached printer is a printer connected directly to a USB port or whether it is a parallel printer attached via a USB to parallel converter, as illustrated in the figure below.
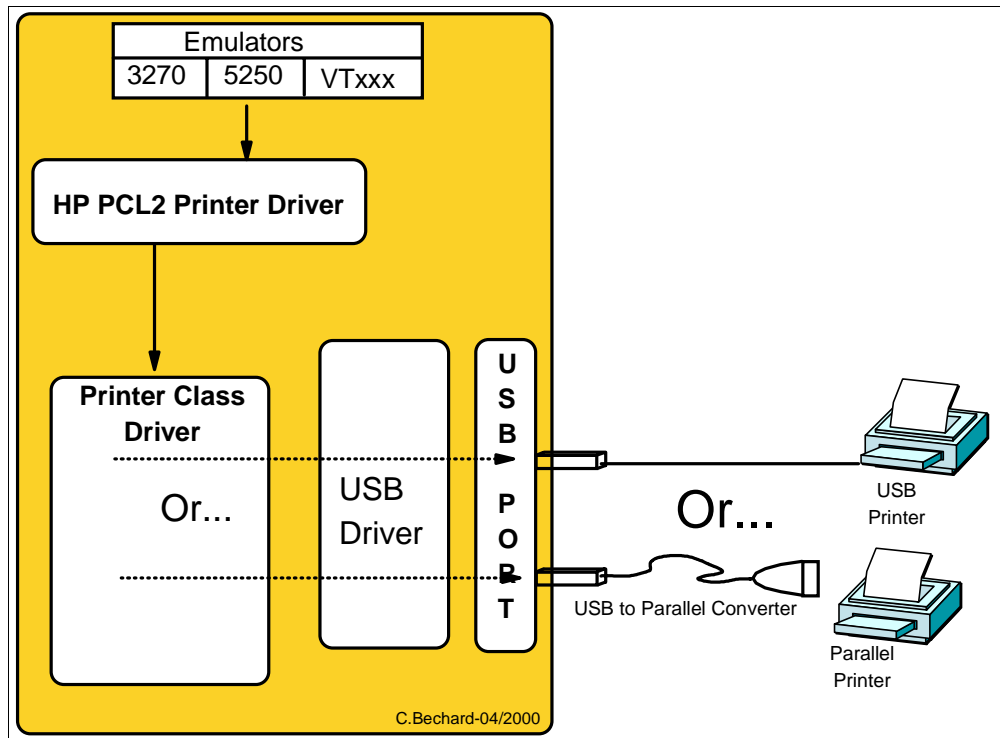
Figure 19. Locally Attached Printer

The USB driver can determine whether the attached printer is a USB printer or not and inform the Printer class driver.

Therefore, as long as the attached printer supports the PCL2 level of printer control language, local applications should be able to print correctly.

1.4 Defining a Local ICA Client Printer as a Remote Printer in NetPrint

Since the WBT-attached printer can be defined as a client printer in an ICA session, this printer appears on the MetaFrame server as an available printer and can therefore be selected by local applications (from other users connected via an ICA session for example) as the print destination.

This printer can also be shared on the network and therefore be selected by remote users on the network, allowing them to send print output to the WBT-attached printer.

Since a shared printer is available to the NetPrint server, we have also been able to assign the WBT-attached printer as any other remote printer and to specify it as the destination printer in an emulator session, effectively configuring the local WBT-attached printer as if it was a remote printer. Indeed, we have been able to make this work somewhat, but with some problems related to the speed of the output, the cause of which we are still trying to identify.

In a situation where there are many WBTs, one of which with an attached printer, this method would allow the other WBT's to direct their printing to a peer WBT, as long as this peer WBT has an active ICA session.
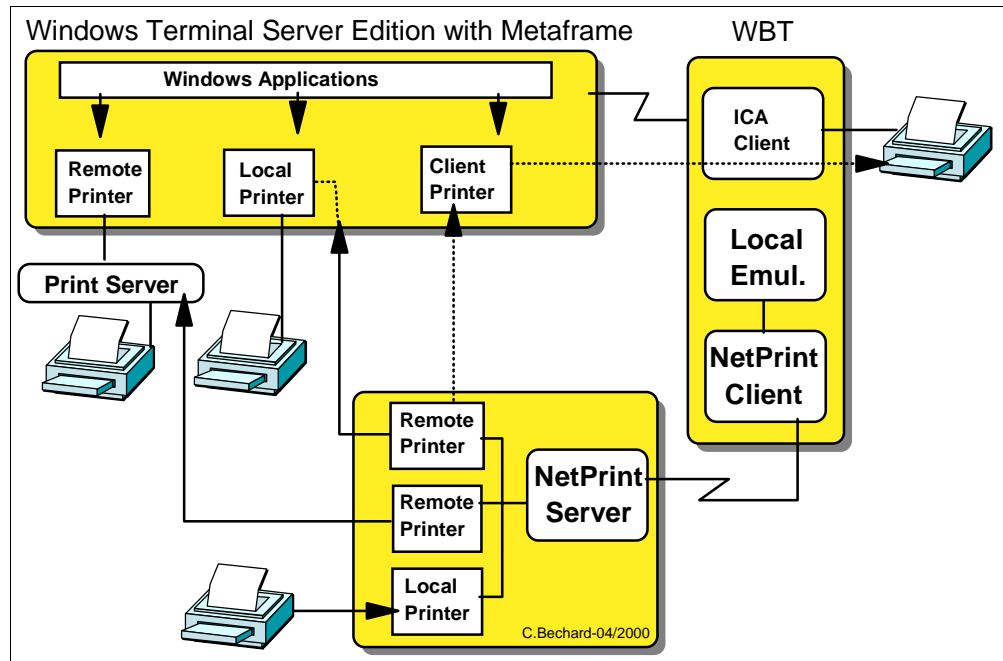
Windows Terminal Server Edition with Metaframe   WBT

Windows Applications

Remote Printer   Local Printer   Client Printer   ICA Client

Print Server

Local Emul.

NetPrint Client

Remote Printer

Remote Printer   NetPrint Server

Local Printer

C.Bechard-04/2000

Figure 20. Using an ICA Client Printer as a Remote Printer

1.5 Same Physical Client Printer - Multiple Servers

As illustrated in the next figure, it is possible to have multiple ICA and RDP sessions to multiple MetaFrame and Windows 2000 servers.

In that case, each client can have the local WBT-attached printer defined as a client printer in more than one server.

This is possible to do, and to define, without entering into any conflicts, as long as two sessions do not try to print at the same time.

If the user prints from the ICA session, and then, when printing is completed, prints from the RDP session for example, both printouts should print correctly.

If one session tries to print while another is still spooling data to the printer, the user gets an error message indicating that the device is busy, and is given the option to retry or cancel. If the user waits until the first server has finished spooling out, and then clicks on **Retry**, the job prints correctly.
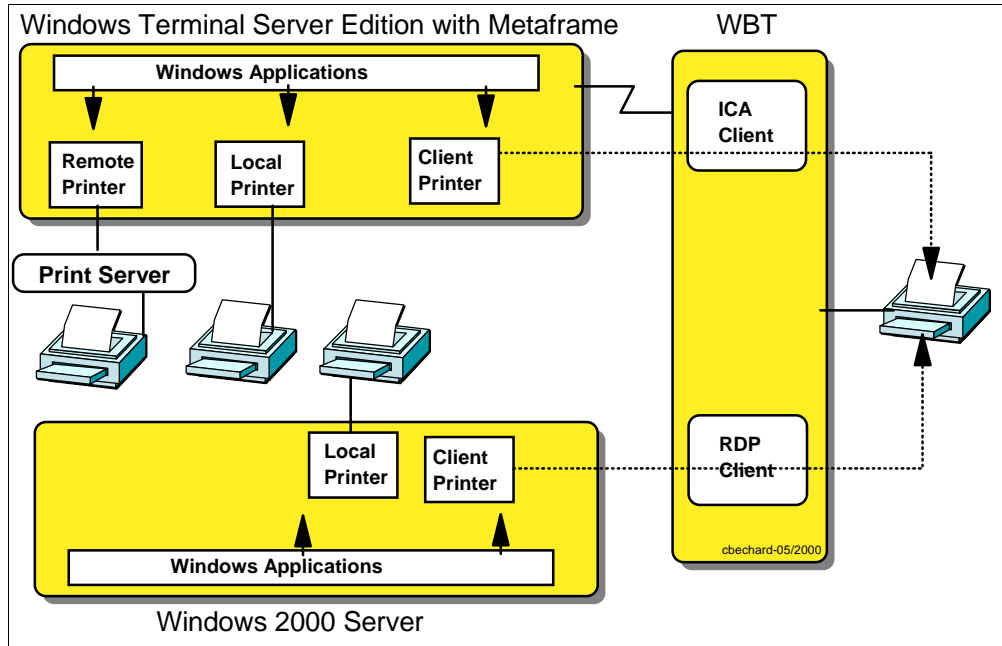
Figure 21. Same Physical Client Printer - Multiple Servers - Manually Managed

In effect, this is sort of a manual setup where the user is acting as the scheduler and must wait for one job to end before sending the other.

A better way to set this up so that the system manages the print queue automatically is to define a client printer in one MetaFrame system, and then define it also as a shared resource that can be selected on other servers as a remote printers. This way, all output goes to the same queue and is managed automatically by the system, as illustrated in the next figure.
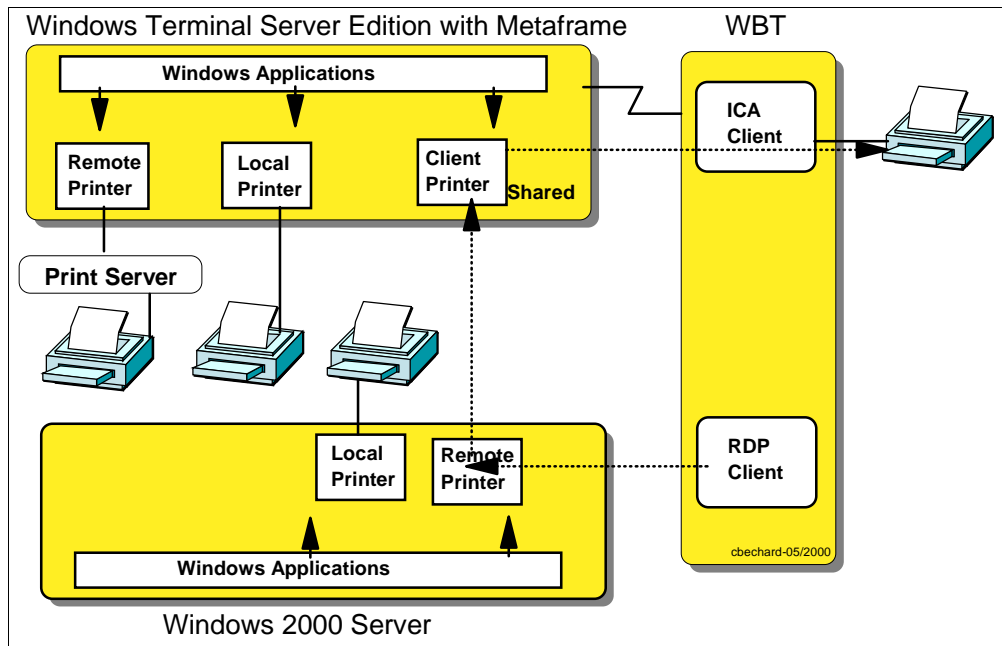

Figure 22. Same Physical Client Printer - Multiple Servers - Automatically Managed

In this case however, it is probably preferable to define the client printer as a permanent definition (as opposed to auto-created and auto-removed) so that it can be shared on the network and made available to other servers.