

Embedded Operating Systems Selection Guide



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Information Technology personnel frequently must determine which thin client embedded operating system best meets their requirements for devices and applications. This paper helps you with that process by providing feature comparisons between the three HP thin client operating systems:

- Microsoft Windows XP Embedded (XPe)
- Microsoft Windows CE
- Embedded Linux

Common features

The following table provides an overview of the features common to HP thin clients based on operating system using the following legend:

- ◆◆◆ Feature is fully functional and operates the same as the desktop environment.
- ◆◆ Feature is partially functional and does not operate the same as the desktop environment.
- ◆ Feature is barely functional and requires a highly skilled administrator to enable it.

Common Features			
Features	XPe	CE	Linux
Accessibility (508)	◆◆	◆◆	◆◆
Automatic logon	◆◆◆	◆◆◆	◆◆◆
Browser	◆◆◆	◆◆	◆◆◆
Citrix	◆◆◆	◆◆◆	◆◆◆
Connection manager		◆◆◆	◆◆◆
Firewall	◆◆◆		
International keyboard	◆◆◆	◆◆◆	◆◆◆
Kiosk	◆	◆◆◆	◆◆◆
Media player	◆◆◆	◆◆	
Networking	◆◆◆	◆◆◆	◆◆◆
Operating system restores	◆◆◆	◆◆◆	◆◆◆
Persistent connections	◆	◆◆◆	◆◆◆
RDP	◆◆◆	◆◆◆	◆◆◆
Remote management	◆◆◆	◆◆◆	◆◆◆
Setup wizard		◆◆◆	
Single button logon	◆	◆◆◆	◆◆◆
SNMP	◆◆◆	◆◆◆	
SNTP Client	◆◆◆	◆◆◆	◆◆◆



Common Features			
Features	XPe	CE	Linux
Terminal emulation	◆◆◆	◆◆◆	◆
Graphical/text printing	◆	◆	◆
Touch screen monitor	◆◆◆	◆◆◆	◆◆◆
Wireless	◆◆◆	◆◆	◆

Advantages of embedded operating systems and thin client hardware

The advantages of the embedded operating systems thin clients use include:

- Lower administration costs - Like managed desktops, client management is performed remotely on a centralized server. However, thin clients offer the additional advantages of a smaller footprint (offering less surface area for attacks and patching) and image lifecycle (because applications are stored on the server or PC blade, the thin client operating system does not require upgrading).
- Security - You can configure local operating systems for resilience against user changes and harden against viruses and worms.
- Lower hardware costs - Customers benefit from lower hardware maintenance costs because the devices are less prone to failure from spinning media, power system fans, and system heat. As a result, the products may have a longer life cycle than personal computers.
- Data theft/data loss - With server-based computing, local operating systems are software platforms for access devices. Data is not normally written to or stored on the thin client.

Windows XP Embedded (XPe) operating system

The Windows XPe operating system is based on binaries used in the Windows XP Professional operating system. The Win32 programming model provides security, performance, multimedia, internet browsing, and extensive hardware device support features in a familiar user interface. The following table lists strengths and weaknesses of the Windows XPe operating system:

Windows XPe Operating System	
Strengths	Weaknesses
Large peripheral device support	Large memory requirement
Win32-based applications support	Operating system license cost
User interface similar to Windows XP	



Windows XPe Operating System

Strengths

Multimedia capable

Remote management

Microsoft Internet Explorer

Image is locked down

Windows Firewall support

.NET Messenger

Support for Symantec Embedded Security (formerly known as Sygate Security Agent)

Weaknesses

Windows CE operating system

Windows CE is a real-time operating system specifically designed by Microsoft for the embedded device marketplace. This operating system features a real-time kernel, networking, multimedia, and Internet browsing using a custom user interface. Since the operating system was designed to be embedded, the kernel will fit in a smaller footprint than the XPe operating system. The following table lists strengths and weaknesses of the Windows CE operating system:

Windows CE Operating System

Strengths

Kiosk mode - locked down

Small memory requirement

Multimedia capable

Remote management

Import/exporting registry settings

Microsoft Internet Explorer

Connection administrator application

Weaknesses

Limited peripheral device support

Limited printer support

Limited Win32-based applications support

Web sites mis-identify Internet Explorer as mobile Internet Explorer

Embedded Linux operating system

The HP Linux thin client image is a real-time operating system created by Hewlett-Packard using open-source Linux components. The operating system contains a Linux kernel, command shells, networking, multimedia, Internet browsing, and a custom user interface. This operating system provides the additional capacity of adding or removing other Linux utilities not part of the standard installation. The following table lists strengths and weaknesses of the Embedded Linux operating system:

Embedded Linux Operating System	
Strengths	Weaknesses
Small memory requirements	Limited peripheral device support
Firefox browser	Limited printer support
Remote management	No Win32-based applications support
Can lock down or customize image	User interface not identical to Microsoft products
Operating system license cost	
Connection administrator application	
Kiosk mode - locked down	
XDM (X-Terminal)	
Customizable with open source software and components on select platforms	
Open source	
Multimedia capable	

Operating system feature set

The following sections list the features that each thin client operating system supports.

Remote management

Remote management applications help you manage your thin client environment. The following remote management tools are available:

- Altiris delivers a deployment solution that allows you to capture, customize, and deploy thin client images within an entire network.
- The FTP upgrade tool provides the ability to upgrade your images from an FTP site.
- The factory image restore tool allows you to restore a thin client system to the factory image from a USB flash drive or a CD ROM.
- The export/import registry settings feature allows you to modify a CE image and then transfer the image settings to a similar system.

Remote Management	Operating Systems		
	XPe	CE	Linux
Altiris	✓	✓	✓
FTP upgrade		✓	✓
Export registry settings	✓	✓	✓
Import registry settings	✓	✓	✓
Reset registry settings		✓	✓
Factory image restore	✓	✓	✓
Auto system upgrade		✓	

Limiting factors:

- Altiris Deployment Server cannot install a custom image with Rdeploy using a USB flash drive without executing a post configuration job in all three operating systems.
- FTP upgrade using the **Auto System Update** option on CE 5.0 supports only three file extensions - ARP, IBR, and CAB.
- FTP upgrade using the **Use values from DHCP** option fails to complete correctly unless the values for the file server and file root path setting remain at the factory default values.
- FTP upgrade will not correctly execute back to back .ARP file transfers.
- You can only successfully import/export registry settings between identical thin client systems.



Terminal service clients

Terminal service clients provide remote display and input capabilities over network connections to and from a terminal server. Citrix ICA client supports TCP/IP, IPX, SPX, and NETBIOS. Remote Desktop Protocol (RDP) is Microsoft's terminal services protocol that governs input/output between a Windows terminal client and Windows Terminal Server. Rdesktop is an open source terminal services client capable of natively speaking Remote Desktop Protocol (RDP).

Terminal Service Clients	Operating Systems		
	XPe	CE	Linux
Citrix ICA Client	✓	✓	✓
RDP	✓	✓	✓

Limiting factors:

- The Linux operating system is unable to establish a dial-up ICA connection and displays the `Invalid serial number` error message.
- Mapping a CD-ROM drive within a Linux ICA connection does not work.

Internet browser applications

Internet browser applications allow you to view documents on the Web.

Internet Browsers	Operating Systems		
	XPe	CE	Linux
Internet Explorer 6.0	✓	✓	
Firefox			✓
PDF Viewer	✓	¹	✓
Sun Java	✓		✓
Uninstall Browser		✓	✓

¹ A fee-based PDF Viewer is available for CE. For more information, contact your account representative.

Limiting factors:

- Windows CE 4.22 Internet Explorer will not display email attachments that are greater than 10 megabytes.
- Some Web sites mis-identify Internet Explorer as a mobile device browser and do not correctly display their contents.

Multimedia applications

Multimedia applications use video, music, and the Internet for education or entertainment.

Multimedia	Operating Systems		
	XPe	CE	Linux
Media player	✓	✓	2
Midi	✓		
Messenger	✓	✓	
Shock Wave Flash	✓		

² HP does not provide a media player with its Linux systems. You can download and install various commercial open source media players.

Limiting factors:

- The Windows CE 4.22 and 5.0 media player does not contain Dolby 5.1 codec support.
- Microsoft Windows XPe Service Pack 2 may drop video frames when using Symantec Embedded Security (formerly known as Sygate Security Agent).

Terminal emulation applications

Terminal emulation applications enable thin clients to simulate a specific type of computer terminal so that you can access a mainframe computer or bulletin board service.

Terminal Emulation	Operating Systems		
	XPe	CE	Linux
TEC	✓	✓	3
VNC		✓	✓
XDM			✓

³ HP does not provide a commercial terminal emulation package with its Linux systems. Commercial and open-source emulation packages are available that work on HP Linux thin clients.

Limiting factors:

- For Windows CE 4.22 and 5.0 to display the Euro currency sign in TEC when using foreign language keyboards, you must select the **ISO Latin-9** character set.
- VNC Linux viewer may not refresh Internet Explorer content when connected to a Windows operating system when you scroll up and down.



- VNC Linux viewer may terminate the connections when you switch to full screen mode.
- VNC on Windows CE 4.22 and 5.0 is unable to display video clips using the host's media player.

Print services applications

Print services provide the ability to publish documents in hard copy format.

Print Services	Operating Systems		
	XPe	CE	Linux
Jetcet		✓	
MS Printer Service	✓		

Limiting factors:

- Windows CE 4.22 and 5.0 Jetcet does not support simultaneous USB printing from two different applications. This is a limitation of usbprint.dll.
- The Windows XPe default printer driver supports only text printing.
- None of the operating systems support printing documents larger than the printer spool size.

Shell applications

Shell applications allow you to customize your user interface's look and feel.

Shells	Operating Systems		
	XPe	CE	Linux
Windows Explorer	✓	✓	
Kiosk		✓	✓
Connection Manager		✓	✓
Citrix Connection Manager			✓
Setup Wizard		✓	
XFce			✓

Limiting factors:

- Windows CE 5.0 Kiosk Mode - To prevent an empty desktop from displaying when you hide the entire user interface, you cannot toggle the connections back to the **No Auto** setting.
- Windows CE 5.0 Connection Manager - Changing the connection name results in the connection dropping from the user's connection list.



- Windows CE 4.22 Connection Manager - The hot key combination **Ctrl+Alt+ Up** or **Down Arrow** will not maximize a minimized RDP connection window.
- Windows CE 5.0 Connection Manager - Selecting the **Hide Connection task bar** option also selects the **Disable local Windows key combinations** option.

Text viewer applications

You can use text or document viewers to display .txt or .pdf-formatted files on your thin clients.

Viewers	Operating Systems		
	XPe	CE	Linux
Notepad	✓		1
Txtpad		✓	
Adobe Acrobat Reader	✓	✓	✓
vi text editor			✓

Security applications

Security features help to protect your data from theft or corruption.

Security	Operating Systems		
	XPe	CE	Linux
EWF	✓		
Locked-down partition	✓		✓
Windows Firewall	✓		
Symantec Embedded Security (formerly known as Sygate Security Agent)	✓		
Auto start connection		✓	✓
Lock screen	✓	✓	✓
Automatic logon	✓	✓	✓
Single button logon		✓	✓
Persistent connections		✓	✓
Ping type		✓	✓

Limiting factor:

- Persistent connections are available only with RDP connections.



Special features

Thin clients may offer the following features.

Special features	Operating Systems		
	XPe	CE	Linux
SNTP Client	✓	✓	✓
SNMP	✓	✓	
DCHP options	✓	✓	✓
Accessibility	✓	✓	✓
Port lock	✓	✓	
Mouse settings	✓	✓	✓
Keyboard languages	✓	✓	✓
Memory allocation changes	✓	✓	

Peripheral devices

The following table provides a list of the more common external peripheral devices supported by some embedded operating systems.

Peripheral devices	Operating Systems		
	XPe	CE	Linux ⁴
Elotouch monitor	✓	✓	✓
SCM smart card reader	✓	✓	✓
Schlumberger smart card	✓	✓	
HP smart card reader	✓	✓	
Zoom serial modem	✓	✓	✓
USB modem	✓	✓	
NVIDIA Quadro Dualhead	✓		
WL 220	✓	✓	
WL 215	✓		
WL 500	✓		
IBM 4/16 token ring	✓		✓



Peripheral devices	Operating Systems		
	XPe	CE	Linux ⁴
1394 support card	✓		
80-GB hard drive	✓	✓	✓
CD-ROM drive	✓	✓	✓
1.44 MB diskette drive	✓	✓	

⁴ There are numerous Linux drivers available in the market for many peripherals. HP has chosen to incorporate only a few.

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