PBS Endo *Enterprise*
Hardware Requirements and Prerequisites

PBS Endo Enterprise is a server-client based software. The Client application is a thin client because it uses a centralized server and doesn't communicate with SQL Server directly.

Server minimums

- Xeon E3 v5 - 3.7 GHz or better
- 32 GB RAM
- 400 GB available disk space
- 1 Gbps Ethernet card
- Standard monitor and video card capable of displaying 32-bit color, and a resolution of at least 1366 x 1024

Server:

The Server is the computer on which the PBS Endo data is held, and acts to serve data to all workstations on the network. The Server can be used as a workstation. However, with a working server, network response will be slower. Therefore, a computer dedicated as the server is recommended.

Operating Systems:

Windows Server 2016/2019/2022, Windows 10 Pro, 64Bit
Latest Service Packs Installed

Supportive structure requirements for the Server:

.NET 4.8 or later, Latest service packs and Windows Updates
Remote access through either RDP or TeamViewer.
If the C:\ drive is only for the OS, it must have a minimum of 80 GB remaining.

Virtual Servers:

PBS Endo will not tolerate a Virtual Server with minimal resources. Please see the last page of this document for more details.

As a Working Server:

The PBS Endo server is the computer that holds the PBS Endo database.
The server can be used as a workstation, called a Working Server. A Working Server requires more memory, processing speed, and network responsiveness than other systems. As such, throughput requirements should be evaluated and optimized to ensure that the overall response and performance for all computers is acceptable if a Working Server is used.

SQL Server:

The practice may need Microsoft SQL Server Standard instead of Express.
Minimum version supported SQL Server 2014.

See page 5, "PBS Endo *Enterprise* Server Preinstall checklist"

Workstations (Client)

- Intel i5
- 8 GB RAM *minimum*
- 10 GB available disk space
- 1 GB Ethernet card *minimum*
- Standard monitor and video card capable of displaying 32-bit color and a resolution of at least 1366 x 1024

Workstation:

The Workstation is the computer that office staff will use to run the PBS Endo client in a client/server architecture and will communicate with the server over the office network. Typically, workstation computers are located at the front desk, operatories, and the doctors' office. The configuration can be a desktop or laptop pc that meets the hardware requirements above.

Operating Systems
Windows 10 Pro 64bit
Latest Service Packs Installed

Supportive structure requirements for the Workstation:
Adobe Reader
MS Word 2010 or greater.   Operatories can use Libre if letters are not created.
All outstanding Windows updates to be installed.
.NET 4.8 or higher Framework to be installed on all workstations.

Additional Hardware & Software Configuration Requirements

Tablet, iPad, portable device:
To use PBS Endo on a Tablet requires the same operating system as a desktop; Windows RT is not supported. To use the Patient Registry *only*, any Tablet with a Browser is acceptable. Please note that some of the patient information captured requires a keyboard. Therefore, the most versatile tablet would be the Asus tablet or the Surface Pro 3 purchased with a keyboard.

Networks:
Industry standard Ethernet network cards should be used that support the TCP/IP protocol. Wireless networks are to be used at your own risk due to the inherent nature of interference in dental offices from X-ray machines and other devices. Wireless networks require professional installation to ensure appropriate security and to provide a reliable signal in order for the PBS Endo to operate correctly. Wireless networks must still meet the minimum Ethernet network speed to be in compliance with system requirements. If a router is being used on the network, it is recommended that all computers be on a single subnet to ensure that all computer workstations receive the server broadcast. Disable the Power Management options on each of those computer's Network Interface Card (NIC).
IPv6 protocol is not supported for remote access such as from home, off site locations, and Patient Registry. Disable all power saving features on all network cards.

Router and Cabling:

Offsite access outside the VPN of PBS Endo requires a router allowing 4 ports to be open: 9090 - 9095. Cat5 cable is needed as a minimum Ethernet connection; Cat5E is preferred for faster network response. PBS Endo supports Wi-Fi 802.11g or higher.

Network functionality and User Accounts:

All users should have a Windows user account with administrator rights to allow for full read and write privileges on the server.

Graphics Card:

The demands for PBS Endo, Images, Video, X-Rays, and Monitors require at least 128 MB of RAM on the graphics card and the ability to support a minimum 1366 x 1024 high-color resolution settings.

Printers:

A laser printer is best used for all insurance forms, cards, envelopes, statements, and internal reports.
A color printer is best used for Letters and Final Reports to referrals.
A label printer is best used to print one mailing or chart label.
We cannot guarantee that all printers will be completely compatible with PBS Endo. However, we have found that PCL5 printer drivers are stable. For label printers, the Dymo 450 is the most common.

Scanners:

Your practice will receive paper which you may want to scan. The scanner should be TWAIN compatible and have a multipage feeder as well as a bed for one page or one x-ray.

Webcams:

A webcam is used to add photographic media to the patients' Documents tab. We cannot guarantee that all webcams will be compatible with PBS Endo but we have found that the Microsoft Lifecam Studio operates well with PBS Endo. Installation is plug and play, and no additional software is required for operation. Compatible with Enterprise clients on Windows 10Pro.

Antivirus Software:

Computer and Network performance can be adversely affected by a virus scanner regardless of anti-virus software. Set up the virus scanner to
> Not scan the PBSEndo folder.
> Not scan the pbsendo.server.exe
> Not scan ports 9090-9096.
> Not scan the LAN IP of the server that is used by clients to connect to PBS Endo.
> Not scan LibreOffice

Third Party Products:

PDF Support - PBS Endo requires Adobe products to read PDF files. Latest version of Adobe Reader installed on the Server and all workstations. MS Reader in Windows v8.1 cannot be used.
Word Processing - MS Office must be installed on the hard drive, the cloud based only version is not acceptable.

Backup:

When: Backup should be performed each day. The PBS Endo automatic backup must run before the overall backup of the entire system. Allow time for the PBS Endo backup to run before the entire system backup starts.

Media: Many offices use external hard drives, rotating a drive for each day. Maintain external drives offsite to protect against theft, fire, and flood. A RAID drive is *not* a backup solution.

Conflict: *Do NOT run a backup throughout the day including an image backup against the PBSENDO folder or services.*

Ports:

PBS Endo uses ports 9090-9096. Depending on other software running on the server, you may need to reserve these ports for programs only so that Windows cannot use them for background tasks.

Example: OpenFire uses 9090 and 9091

General Setup:
- Disable hibernation on all computers.
- Disable Offline Files in the operating system.
- Exclude the PBSENDO folder from Defender on both Server and Workstations.
- Ensure that the latest drivers are installed for printers, scanners, and graphics cards.
- Minimize background tasks that frequently access the internet and reduce the computer's responsiveness.
- If a virus scanner is enabled, ensure that the computer's responsiveness is maximized.
- Ensure that an Image backup is not running throughout the day while PBS Endo is in use.

Configurations and Settings *Not* Supported:
- DEP – Data Execution Prevention. Only use the default of DEP on Windows programs and services only.
- Compressed hard drives
- Backup against the PBSENDO folder throughout the day while in use
- Software RAID
- Terminal Server
- Roaming Profiles
- Power saving features on drives and network cards
- Hibernation on servers
- Novell, LANtastic or other non-Windows networks
- Energy Star compliant system power saver setup may disconnect a workstation from the network
- Antivirus programs running against the PBSEndo folder or programs. Programs that have been reported to be intrusive across systems are McAfee, Panda, Avast and Spy Doctor.
- IPv6 IP Address is not supported for Multi-location, remote access, and Patient Registry remote access.
- Bootcamp

Speed and Legacy Hardware:

If the office has computers, a careful evaluation of the server and overall network needs to be performed. The responsiveness of the network is dependent on Routers, Network Cards, and Server Hard drives. Network Routers quickly become obsolete as users expect more throughput from LAN and WAN based servers. Users access more data and larger files on the LAN and internet. A Router and Network Cards for each computer on the network need to be tested for 100MB - 1GB preferred.

The evaluation of a Server hard drive is not just the amount of hard drive space left of the drive. Older technology hard drives with slow IOPS and/or slow controller cards is also not acceptable. Motherboards with an older bios can also pull down performance even with hard drives that should run faster. Match components to get ensure that each capitalizes on the synced environment.

For configurations with 30 or more users, the following server configuration is recommended:
- Xeon with 4 cores and at least 3Ghz
- Minimum 32GB of RAM

- ### **PBS Endo *Enterprise* Server Preinstall checklist**

1. OS, Updates, and Background Tasks:
   - Microsoft Server 2016/2019 with the latest service packs installed and current with Microsoft updates.
   - Windows updates to be configured for auto download but not auto installation. This setting prevents interruption of PBS Endo software functionality. It is recommended that server updates be performed off hours to accommodate server reboots.
   - If a virus scanner is installed, ensure that it is minimally invasive to ensure that the computer's responsiveness is maximized.
   - Ensure that an Image backup is not running throughout the day while PBS Endo is in use. This issue concerns the basic requirement of data slices and responsiveness. Image backup, and other backup programs like CrashPlan and StoreageCraft use Volume Shadow Copy to freeze the IO to the MDF/LDF to make the backup. The user is shut out for the 20-30 seconds for constant backups.

2. Access by PBS Endo Support staff to the Server:
   - TeamViewer, or Microsoft Remote Desktop configured for remote access.
        If TeamViewer, please provide the TV partner ID and password.
   - Administrator credentials for full read/write access.
        Please ensure that IF there is a Domain, any Domain credentials are also set.

3. .NET Framework: .NET 4.8 or higher installed.

General SQL Configuration requirements *per Microsoft:*
   - Do not install SQL Server on a read-only, compressed, network-mapped, or external volume.
   - Do not install SQL Server on a Domain Controller.   This is an interesting issue. A common configuration is Server 2014 with Domain Controller and Active Directory for the server. The real concern in all the literature is server load. To have DC-AD   and SQL on the same machine may result in delayed performance. Technically, SQL can be installed on the same DC-AD server.
   - Ensure that C:\ drive has at least 150GB of available disk space on the system drive. SQL Server creates temporary files on the system C:\ drive.

Note: While PBS Endo Enterprise can use SQL Express on many offices, SQL Standard may be required by some offices to accommodate additional data as their practice grows.

Multi-Location Configuration for PBS Endo

If you choose to not set up a VPN from one location to the other, a WAN configuration can be set up.
Access to PBS Endo from *outside* the local area network requires:

1. Static IP or Rerouted URL
   The remote computer connects to the server via a Static IP address. A static IP is assigned by your ISP.

2. Path
   Within PBS Endo > Tools > Application Configuration
   The Server Address is the Static IP.   Example Static IP: 72.120.56.255

3. Router
   Enable access to ports 9090, 9091, 9092, 9093, 9094, and 9095 redirected to the Server.

4. HIPAA Compliance and Encryption
   PBS Endo uses Compression *and* Encryption for the network traffic. The use of a VPN for additional
   protection can be set up using either a SonicWall FireWall device, or the VPN software set up.

5. Speed
   To maximize the responsiveness of PBS Endo while ensuring stability and data integrity, PBS Endo uses the
   best combination of development tools. The architecture within PBS Endo maximizes the use of MS SQL,
   and server and client resources. In addition, PBS Endo uses compression.

Bandwidth	The responsiveness of PBS Endo with patient, ledger, schedule, and chart data is fast. However, bandwidth is a consideration with images and scans where DICOM, JPG,PDF, and DOC files are being saved from a remote location to the main server.
Connection	Do not use DSL.

Virtual Servers:

Valid reasons for a Virtual Server are to
- maximize server resources
- separate server functionality
- isolate application compatibility issues with two or more operating systems on the same server.

Caution must be exercised with a virtual server. If incorrectly configured, several issues arise with virtualization including slowness and random data loss due to starved resources. Virtual environments are expected to be monitored and adjusted. With all due respect, experience has shown that most techs configure a network and do not return to monitor performance in use over the course of a typical week.

If a virtual server is set up, the following points are suggested:

- Memory
  Monitor memory usage over several days of use to ensure that free RAM is never below 30%. Minimum of 32GB RAM, dedicated for the Virtual Machine.

  Matching RAM for Host and Virtual: If the Virtual has 32GB, the Host should have 32GB as well.

- Virus scanner
  Exclude the virtual process and/or file extensions from a virus scanner.

- Hard drive
  Choose a drive 10,000-RPM or faster. *SSD is preferred*.

- Network
  Monitor network throughput over several days to ensure that the network traffic is not squeezed.

Server 2016/2019 Operating System

Essentials
  Ideal for small business with no virtualized server.
  CALS not required (limited to 25 users / 50 devices).
  64 GB RAM

Standard
  Allows for 2 Hyper-V Containers.
  CALS required.
  24 TB RAM