Nuance Dragon Medical 360 | Network Edition with VMware Horizon 6 Best Practices and Performance Guidelines

TECHNICAL WHITE PAPER
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Overview of Medical Speech Dictation in a Virtual Desktop Environment

Dictation and transcription are important tasks in the healthcare industry. When these tasks are streamlined, clinicians can spend more time with patients. Medical dictation software increases the speed of dictation and transcription. Nuance is a leader in healthcare speech recognition and dictation software. Nuance provides Dragon® Medical for clinicians. Dragon Medical is integrated with the majority of the clinical applications that clinicians use today.

Virtual desktops provide a fast, secure, mobile desktop experience for clinicians. A virtual desktop solution allows clinicians to spend more time with patients and less time logging into desktops and applications. VMware, a leader in virtual desktop software, provides View in VMware Horizon® 6, the most comprehensive desktop virtualization platform in the healthcare industry.
Nuance Dragon Medical 360 | Network Edition

Dragon Medical 360 | Network Edition is a leading front-end speech recognition solution for provider organizations that creates a dramatically improved physician experience, saving physicians 20 minutes or more of documentation time per day. Dragon Medical 360 | Network Edition enables easy, centralized user management and enhanced dictation performance while running an EHR in any virtualized environment.

The fastest and most accurate Dragon Medical ever, Dragon Medical 360 | Network Edition is used by clinicians to dictate Progress Notes, HPI, and Assessment and Plan directly into EHR software. It is up to 99 percent accurate and includes medical vocabularies covering more than 90 specialties and subspecialties.

Because the solution gives clinicians the power to dictate while reviewing the full medical record, clinicians readily embrace their EHR system, significantly accelerating EHR adoption throughout the enterprise.

Dragon Medical is designed for large practices, hospitals, and health systems that have made an organization-wide commitment to front-end speech recognition for their clinicians.

Nuance works in close engineering collaboration with EHR vendors such as Epic®, Cerner®, AllscriptsTM, NextGen®, GE, eClinicalWorks®, and others to ensure that users can dictate, edit, and voice-navigate within the text box (e.g., ‘select ankle,’ ‘choose 2’), directly within the EHR.
VMware Horizon 6

VMware Horizon 6 (formerly VMware View®) is a desktop virtualization solution that delivers virtual desktop services. It is available as a standalone offering—Horizon 6 Standard Edition—or as part of the VMware Horizon 6 family in the Horizon Advanced Edition and Horizon Enterprise Edition. Where security and availability are both high priorities, you can use View in Horizon 6 to simplify and automate the management of desktops and securely deliver desktops as a service to users from a central location. A single administration console provides granular levels of control, allowing you to customize the end-user experience, access, and personalization to support corporate policy. End users get a familiar, personalized environment that they can access from any number of devices anywhere throughout the enterprise or from remote locations. And as an administrator, you have centralized control, efficiency, and security by having desktop data in the data center.

Horizon 6 allows IT to centrally manage images to streamline management, reduce costs, and maintain compliance. With Horizon 6, virtualized or hosted desktops and applications can be delivered through a single platform to end users. These desktop and application services—including RDS-hosted apps, packaged apps with ThinApp, SaaS apps, and even virtualized apps from Citrix—can all be accessed from one unified workspace to provide end users with all of the resources they want, at the speed they expect, with the efficiency business demands.

VMware closed-loop management provides cloud orchestration and self-service management, movement across data centers, and end-to-end visibility into the health and performance of the Horizon 6 environment.

Use of virtualization to provide cloud-based clinical workspaces untethers clinicians from specific devices. A user’s desktop or workspaces are now tied to that user’s identity, so clinicians can use the latest devices, such as iPad tablets, to access their clinical desktops and applications. Healthcare IT can also set policies or restrict access for specific users or groups of users. For example, IT can allow physicians to access patient care applications and data from outside the hospital so they can finish charting patients at home or quickly view a clinical image. Physicians now can make fast, informed, initial decisions about patient treatment, even remotely. This granular level of control satisfies the needs of both clinicians and healthcare IT.
Overview of Environment

Peripherals
Remote peripherals are available in two form factors: composite devices or audio devices.

Composite Human Interface Devices (HID) are USB devices that are recognized as a composite resource with multiple features. Typically, these devices contain combinations of microphone, speaker, pointing device, buttons, mouse, or scanner. These are the common PowerMic microphone devices used in most hospitals. Other third-party solutions can also be recognized as a HID composite device via USB. It is important to recognize that these types of devices work only over USB and will not be using the default Windows audio or speaker channels.

Special Purpose Virtual Device Channels
Technologies such as Real-Time Audio and Video (RTAV) redirection allow the client endpoint to process audio and video using its own CPU rather than centrally processing the data and then recompressing and shipping the output. RTAV can reduce bandwidth by capturing and compressing and decompressing data at the endpoint and sending the minimal data stream over the wire. This solution is ideal for Windows OS, Mac OS, and Linux endpoints where CPU compute resources are available.

USB Redirection
For endpoints where there is no compute resource available, all audio and video received over the USB channel is shipped to the centralized desktop for processing. This utilizes more bandwidth but reduces latency and response time when using external devices.

Types of Microphones
When working with Dragon Medical, we often see two primary types of microphones in use. These microphones can be either wired or wireless and come in the following configurations:

• Composite devices deliver multiple functionalities to a single user device. These devices often include microphones, mouse, track pad, buttons, keypads, or scanners. These composite devices serve multiple functions and typically are supported via USB redirection.

• Audio-only devices can capture audio and send it back to the central virtual desktop. These devices are typically audio input microphone, USB microphones, Bluetooth microphones, or other desktop array microphone solutions.

Types of Endpoints and Horizon Clients
The VMware Horizon Client runs at the physical endpoint where the user microphone is attached. This endpoint must typically be configured to work in the context of VMware Horizon 6 to match features within the centralized guest operating system with the remote Horizon Client. Dragon Medical does not include any specific drivers or plugins that implement microphone functionality in a virtual desktop environment accessed using View.

VMware Horizon Client for Windows, Mac OSX, and Linux
The Horizon Client for Windows, Mac OSX, and Linux allows traditional desktop and laptop computers to be repurposed as remote terminals allowing remote access to centralized desktops. These client OSs offload the risk of data loss from the endpoint and move compute resources and backups to the data center where they can be centrally managed and secured. Resources no longer reside at the endpoint and only the interface devices are available to the users.

These solutions offer differing values to the end user in that the remote computer can still be used for local services such as Web browsing and other basic compute tasks when not connected to a central desktop. The addition of a CPU, memory, and storage at these devices allows them to process media more efficiently and permits support for technologies such as multimedia redirection and caching of data. These solutions are
future proofed with potential for support of new audio and video technologies with a simple client change. This solution has full support for RTAV. Third parties can optimize their applications to take full advantage of the optimized audio and video stack.

These extra compute and processing resources can result in a reduction of bandwidth when processing audio and video across a WAN. The latest VMware Horizon Clients have been optimized for bidirectional audio and video and updates to support USB 3.0, composite devices (such as Nuance PowerMic II), and audio-only devices.

**VMware Horizon Client for Embedded and Thin OS Devices**
This configuration offers the benefits of an embedded OS and limited device functionality in a low-power endpoint while still allowing for some Client-side applications and services to be made available to the endpoint. These devices still require patching, but typically less frequently. These devices are also less enticing for thieves and easy to replace in the event of a device failure. At this time, thin clients and embedded OS devices are the preferred device technology by VMware to ensure future proofing your devices and to allow for more resource-intensive services to be offloaded to the endpoint through its local compute resources. Technologies such as RTAV are available to thin OS and embedded OS devices that are not available to zero clients.

**PCoIP Zero-Client Hardware for VMware Horizon 6**
Zero clients are hardware-based terminals without an operating system. These devices are the easiest to manage, and offer the most secure, highest-performance user experience available, but lack local compute to take advantage of bandwidth-saving technologies. Zero clients lack a growth path as an end-user device. These devices only support USB redirection and do not support RTAV.

**VMware Horizon Client for Mobile Devices**
Horizon 6 for mobile devices offers remote access to centralized desktops via phone- and tablet-based OSs. With the exception of the Microsoft Surface Pro, many of these devices do not offer USB ports for microphones and are not ideal candidates for dictation endpoints at the current time. Those devices without USB support are better suited for remote viewing of content and consumption of data, but are not ideal for content creation or complex input.

**VMware Horizon 6 Browser-Based Sessions**
The most recent addition to the VMware Horizon 6 presentation model is support for a clientless and plugin-free display solution. Just using standard HTML5 and JavaScript, the browser can display a full desktop session and allow for bidirectional interaction. At this time, the solution does not allow for the use of bidirectional audio, since audio input via HTML5 is limited without the use of third-party plugins. This solution is not a viable Dragon Medical interaction solution.

**VMware View Agent**
A critical piece to Horizon 6 desktop management and device support is the View Agent. This guest OS agent is installed in the virtualized desktop and allows for the redirection and management of remote devices to the guest OS.
Early Architecture and Capacity Considerations

Session Roaming

VMware Horizon 6 allows users to roam from endpoint device to endpoint device while maintain a single OS instance in the data center. This roaming ability allows mobile workers to discontinue and resume workflow with minimal interruption from location to location. Doctors and mobile users can work from multiple endpoints with different functionality while still maintaining a single work session. Endpoints can vary in location, bandwidth, screen resolutions, and attached devices. This dynamic ability to move while working offers some challenges that need to be addressed when adding dictation solutions to the desktop session experience. Even when two desktop endpoints have similar configurations and features, the same process for connection and disconnection will be required by the Nuance Dragon Medical 360 | Network Edition user to ensure data integrity and application stability. Session roaming will always consist of the following events:

• Disconnection of the VMware Horizon 6 desktop from the client endpoint
• A period of time in which the desktop is no longer connected to an endpoint
• The establishment of a new connection between the VMware Horizon 6 desktop and a new client endpoint

Disconnecting and reconnecting the same endpoint is also session roaming since all of the same actions will occur.

Input Source Selection

When a Dragon Medical user opens a user profile, the user can choose a vocabulary and input source. When only one vocabulary and input source combination is available, Dragon Medical may not present the user with a choice. Dragon Medical can be configured to allow or not allow a user to choose a vocabulary and input source.

The chosen vocabulary and input source impact both the physical microphone type that the Dragon Medical user speaks into, and the type of Windows multimedia recording device that Dragon Medical uses to obtain an audio stream containing the user’s speech.

• If USB redirection is used to access the microphone from a View desktop, and the physical microphone is a Nuance PowerMic II, then, within the guest operating system, Dragon Medical detects the PowerMic II USB device, and the Dragon Medical user can select the input source. Dragon Medical has direct access to input from the Nuance PowerMic II, including the audio input, button presses, and more.

• If virtual audio only microphone access is set up in the View desktop, and the physical microphone is still a Nuance PowerMic II, then within the guest operating system, Dragon Medical detects the non-USB, virtual microphone device, and the Dragon Medical user cannot select the “PowerMic II” input source. Instead, the Dragon Medical user must select a “Microphone (Mic-in)” input source.

• When a virtual audio-only microphone mode is selected, Dragon Medical can access the View audio-only virtual microphone device.

• When a virtual audio-only microphone mode is selected, Dragon Medical does not have access to the special purpose buttons on the Nuance PowerMic II. However, a Dragon Medical user can access the PowerMic II buttons on the endpoint device where the microphone is physically attached. It is also possible to make use of an endpoint-side utility to map button presses to hotkeys. This allows the Dragon Medical user to press buttons and perform actions in their View desktop, such as turning Dragon’s logical microphone state on and off, and navigating among fields in a template.

• If you are going to use a Nuance PowerMic II, be sure to update the microphone to the latest firmware and download the latest USB PowerMic drivers and update utilities from the Nuance Web site.
The initial input source that a Dragon Medical user selects depends on:

- The physical microphone type attached to the endpoint
- The type of endpoint device
- The type of multimedia recording device in the guest operating system associated with the physical microphone

If a Dragon Medical user moves between different endpoints (a roaming session), the currently open input source may no longer apply to the currently connected microphone and endpoint combination. The input source may only be valid for one microphone and endpoint combination.

Dragon Medical may display an error message and the Dragon user may be unable to perform dictation. The Dragon Medical user may need to perform additional steps to align the input source type with the endpoint from which they are accessing the View desktop. There is no input source type auto-switching capability in Dragon Medical 360 | Network Edition. The only recourse in this circumstance is for the user to know how to use the DragonBar to open a different input source if required. Ideally, the following steps would occur when a Dragon user roams between endpoints:

- Closing of the user profile in Dragon
- Session roaming
- Reopening of the Dragon user profile, including correct input source selection

Since this process cannot be automated, some user training or experience is necessary.

**CPU Resource Utilization and Capacity**

Planning for CPU capacity is one of the most critical aspects when deploying Nuance Dragon in a virtual desktop model. Desktop CPU utilization will spike to 100 percent while the recognizer is processing the audio stream. This spike can cause significant issues for desktop pool capacity if it is not included in the pool capacity planning exercise.

When planning CPU resource requirements for your desktop pool, start by identifying what percentage of your users will be active dictation users at any given point in time. Based on industry analysis, Nuance has calculated that 15 percent is a typical average of active users using dictation at any point in time in a given environment.

Since active dictation users will require 100 percent of a physical CPU core (pCore) while recognizing dictation, the desktop pool should be scaled accordingly. Here is an example:

A production medical desktop pool currently hosts 1,000 users on 250 physical CPU cores. These are heavy CPU usage medical users with a desktop-to-physical core ratio of 4:1. Assuming that 15 percent of the 1,000 active users are using dictation at any given instant, we need to scale the desktop pool CPU resources accordingly. For the 150 active desktop users, we need an additional 150 CPU cores available to the desktop cluster. The resulting server farm would have a total of 400 CPU cores available to the desktops across all of the physical nodes in the cluster after considering performance adjustments for Nuance Dragon Medical 360 | Network Edition.

In addition, Dragon Medical is multi-process aware and capable of preforming recognition across multiple cores in a single OS instance. Recognition accuracy is based on total CPU cycles the recognizer executes in the permitted window of time. This means more cores and faster GHz CPUs result in a more accurate speech recognition results. Creating desktops with multi-core CPU configurations in the desktop pool can increase recognition and reduce recognition times. This is a trade-off that should be calculated in the early planning when determining the CPU needs of the core applications and the total resources available across the desktop compute cluster.

CPU consumption by Dragon Medical must be added to the CPU requirements of the base OS and core applications available to the desktop image.
Desktop Performance Latency Issues

For information on latency issues, refer to the VMware Knowledge Base (KB) article Poor virtual machine application performance may be caused by processor power management settings (1018206). This poor performance can be caused by server power-management features not allowing the guest OS to take full advantage of the CPU or hardware by operating in a power-saving mode. Ensure you have disabled all power and CPU performance-management settings in the server BIOS.
Application Considerations That Impact Resource Utilization

For your virtual desktop environments, it is recommended to change the default profile type to BestMatch IV (BM-IV) to achieve the best performance for speech recognition. This should be set in the Group settings for dictation users within the Nuance Management Console (NMC) to ensure that when users create their profiles, they are set up for optimal use within the virtual desktop environment.

Accuracy is a factor of duration and CPU GHz available. The longer recognition is allowed to run, and the more GHz available to the desktop OS, the more accuracy you will experience. In a virtual desktop model, GHz may be restricted by overcommitment of multiple desktop OSs to a single core. In other words, better consolidation ratios result in fewer resources available per desktop.

Dragon Medical is a “bursty” CPU load that needs as much CPU as possible available to the guest OS to maximize the recognition accuracy. When a CPU is overcommitted to multiple desktop OSs, Horizon may need to move workloads to make capacity available to the active desktop. This movement will result in CPU Ready waits for the heavily used desktop while resources are re-allocated. However, it is possible that dictation and analysis may complete before all resources become available for this desktop, potentially resulting in lost audio and inaccurate recognition.

For more information, refer to the KB Determining if multiple virtual CPUs are causing performance issues (1005362).

You may want to establish alerts in VMware vCenter™ to notify you of excessive CPU Ready events. CPU Ready events that affect performance for View desktops running Dragon may be very short, and averages over 5 minutes could be very low, but these events may have a significant effect on the recognition, so it might be beneficial to monitor actual, real-time numbers from ESXTOP.
Hardware for Endpoints

Microphones

Different microphone types and manufacturers will have different configuration considerations. In most cases, the microphones will be recognized by the guest OS across the network. By default the VMware Horizon Client does not redirect HID devices as they typically contain mouse functionality and are kept local to the endpoint. The composite devices often contain microphone, mouse, speaker, scanner, and other HID features such as play, pause, stop, record, and media movement buttons. Since the mouse is kept local to the endpoint and not passed to the virtual desktop, some HID devices need special filter settings to enable proper redirection of the desired functionality.

According to Nuance, the Nuance PowerMic II (with or without scanner) does not require installing any device drivers inside of the View desktop. The Dragon Medical application has the drivers built-in to the application. If you still encounter problems identifying these devices, review the USB Device Redirection, Configuration, and Usage in View Virtual Desktops View 5.1 and Later, Including View in VMware Horizon 6 version 6.1 white paper.

Do not configure the Nuance PowerMic II (with or without scanner) for HID redirection. This device is automatically shown in the drop-down menus for USB Redirection in the Horizon Client.

When using the Philips SpeechMike, you will need to download the speech control application and drivers from Philips and install and configure them inside your Horizon 6 guest OS desktop. Without this additional software, the buttons on the Philips SpeechMike will not be operational.

It should also be noted that by default, the Horizon Client excludes certain HID from the drop-down menus for redirection. This will directly affect the mouse and trackpad controller on the Philips SpeechMike. To allow this redirection, follow the instructions in the VMware KB article Configuring USB device filters and redirecting Human Interface Devices (HIDs) in View Client (1011600).

To ensure all devices are recognized at the endpoint, added steps must be taken for each and every endpoint to guarantee the microphone is a recognized device. This is accomplished by a series of validations performed by connecting each microphone type to the client while connected to a desktop. To ensure your microphone is recognized at each endpoint type, register every microphone to the desktop image. Follow these steps:

1. Create a master desktop image and install Direct Connect Drivers for Horizon.
2. Direct connect a zero, thin, or Windows or Mac client to the desktop OS.
3. Connect the USB microphone to the first USB port to ensure the device is recognized.
4. Connect the microphone to the other USB ports to ensure recognition.
5. Repeat these steps for each of the USB ports.
6. Repeat these steps for each of the microphone types.
7. Repeat these steps for each of the client types (Windows client, zero clients, thin clients).

This process will ensure that you have validated every speech device with each USB port on each of your known endpoint devices. Even if you have a minor version difference between endpoints, validate the connection. Different hardware revisions may report back USB devices differently.
By default, Horizon Client for Windows excludes certain devices from the drop-down menu for configuring redirection:

- Human Interface Devices (HIDs), such as USB keyboards, mice, and authentication tokens
- Any Bluetooth device that is paired with an HID
- Smart card readers and USB authentication tokens that present themselves as smart card readers

These devices are redirected separately so that they are available for authentication on the remote desktop.

To set a default HID microphone for the Windows session, you will need to make a minor change to the Windows Registry. To accomplish this, follow the instructions in the VMware KB article Configuring USB device filters and redirecting Human Interface Devices (HIDs) in View Client (1011600). This KB details the steps to identify the class GUID and Vendor Product ID within Windows for the plugged-in microphone. You can use these values to configure redirection filters for the computer on which you want to run the Horizon Client.

**USB Redirection Configuration and Best Practices for View 5.1 and Horizon 6.x**

With the release of VMware Horizon 6 version 6.1, VMware published a white paper dedicated to USB Device Redirection, Configuration, and Usage in View Virtual Desktops. This paper addresses multiple test and validation strategies to ensure your USB microphones and devices are being passed properly from the client to the guest OS for View 5.1 and later.

**Mobile Devices**

There is currently limited support for bidirectional audio on mobile devices. Some RDP clients provide functionality for bidirectional audio, but as of the release of the Horizon Client for iOS v2.3 and Android v2.3, there was no support for bidirectional audio. Some third-party applications may provide bidirectional audio when using RDP, but there currently is no support for bidirectional audio for these devices using PCoIP.
Desktop OS Considerations

When starting your Horizon 6 deployment, start with the *VMware Horizon 6 with View Performance Best Practices* to create your desktop server cluster. These best practices will serve as the foundation for the desktop pool.

When building the desktop image, it is essential that you follow the guest OS optimization best practices. These settings will ensure that the appropriate Windows services are disabled, appropriate power management settings are set, and device optimization is complete. You can apply these settings by running scripts provided in *VMware Horizon with View Optimization Guide for Windows 7 and Windows 8*.

**Disable USB Selective Suspend Settings in Windows Registry**

It has been observed that VMs running on overprovisioned servers and consuming less than 1 GHz of CPU, or guest desktop OSs that have been idle for long periods of time, may experience an issue in Windows where the OS will selectively disable the virtual USB HUB to save power during idle or low-power (over subscribed CPU) instances. This can often lead to USB devices being disabled, disconnected, or not reconnecting after long periods of inactivity or on an oversubscribed host. To correct this issue with Windows 7, 8, 8.1, and 10, as well as Windows Server 2008 and 2012, you will need to disable selective suspend for all USB devices.

To disable selective suspend on all USB devices:
1. Open the Registry on the affected machine and navigate to the key `HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\USB`
2. Edit or create a DWORD value named `DisableSelectiveSuspend` and set it to a decimal value of 1.
3. Reboot the computer.

**Windows Customer Experience Improvement Program**

Nuance has indicated that the Customer Experience Improvement Program (CEIP) in Windows 7 and Windows 8 can have negative impact on desktop performance and potentially add delays to the recognition process. Disabling Windows CEIP and the related Task Scheduler tasks that control this program can improve Windows 7 and Windows 8 system performance in large View desktop pools. To disable Windows CEIP:

1. In the Windows 7 or Windows 8 guest operating system, start the control panel and click *Action Center > Change Action Center settings*.
2. Click *Customer Experience Improvement Program settings*.
3. Select *No, I don’t want to participate in the program*, and click *Save changes*.
4. Start the control panel and click *Administrative Tools > Task Scheduler*.
5. In the Task Scheduler (Local) pane of the Task Scheduler dialog box, expand the *Task Scheduler Library > Microsoft > Windows* nodes and open the *Application Experience* folder.
6. Disable the *aITAgent* and *ProgramDataUpdater* tasks.
7. In the *Task Scheduler Library > Microsoft > Windows* node, open the *Customer Experience Improvement Program* folder.
8. Disable the *Consolidator, KernelCEIPTask*, and *Use CEIP* tasks.
Energy Options

Modern computer systems, and especially mobile devices, are engineered for the purpose of saving as much energy as possible. However, this savings is often at the cost of the computer’s overall performance, making it more likely to experience audio dropouts. Try the following procedure to eradicate energy-saving-related performance problems.

1. Go to **Start > Control Panel > System and Security > Power Options**.

2. Set the Power Scheme to **High Performance** (if this setting is not available, click **Show additional plans** first), then click **Change plan settings**. On the next page, set both **Turn off the display** and **Put the computer to sleep** to **Never**.

3. Click **Change advanced power settings**. In the window that opens make sure you have the following settings:
   
a. Hard disc > Turn off hard disk after > Setting (Minutes) = Never
   
b. Sleep > Sleep after > Setting (Minutes) = Never
   
c. USB settings > USB selective suspend setting > Setting = Disabled
   
d. Display > Turn off display after > Setting (Minutes) = Never
   
e. Processor power management > Minimum processor state > Setting = 100%
   
f. Processor power management > Maximum processor state > Setting = 100%

Power-management features built into modern servers may introduce significant CPU wait issues if power management is enabled. Most modern servers allow the administrator to configure BIOS settings for power management to reduce power consumption and these settings may be enabled by default. These features are counterproductive to virtualization and should be disabled in VMware vSphere® servers.

Additional optimization can be achieved with the publicly available [VMware OS Optimization Tool](#), a VMware Fling.

Virtual Desktop Resources and Settings

CPU Cores

Single-core OS instances are sufficient for Dragon Medical, but as mentioned in the resource planning section, additional CPU cores increase recognition accuracy and reduce recognition time. Desktop OS instances will consume 100 percent of a CPU core while processing audio and can consume multiple CPU cores if made available to the desktop images. Dragon Medical is multi-processor aware and multi-threaded to take full advantage of all resources made available to the application. If your desktop users are indicating that speech accuracy is not sufficient, you may need to either add more cores to your desktop pool to accommodate concurrent users and/or add additional cores to your desktop virtual machine to accommodate the processing of the audio.

CPU Reservations

While CPU reservations are not generally advised for View, for limited-size desktop pools with heavy speech recognition, CPU reservations may reduce the balancing of workloads when a recognition process starts. For CPU cores where multiple desktops are currently residing, a recognition start will force the other VMs off of the shared CPU resulting in a momentary latency for the workload to reach full compute capability. CPU reservations will reduce your consolidation ratio considerably.

**Note:** If you have a large number of Nuance Dragon desktops, do not enable CPU reservations as this may dramatically reduce availability of resources for desktop pools across a cluster. If you have a dedicated cluster for Nuance Dragon Medical users, do not enable CPU reservations. Use reservations with extreme caution.

Memory Resources

Dragon Medical can benefit from a limited increase in memory reservations. While the recognizer starts, the process of restoring memory to the OS instance can add additional latency to the recognizer. In addition,
services like DRS and VMware vSphere vMotion® can deflate the memory resources available to the recognizer resulting in a very brief delay in the recognizer startup. Traditional best practices for virtual desktops indicate 25 percent memory reservation or less, but an increase to 50 percent or more may significantly reduce startup latency for Dragon Medical. Consider the requirements of your other applications and resources available across the desktop cluster when making reservation considerations. Use reservations with extreme caution.

Network Resources
Network bandwidth for PCoIP, Real-Time Audio Video (RTAV), and USB redirection has traditionally had minimal impact on modern servers. USB redirection is typically around 1.1 Mbps for active Dragon Medical users while the microphone is turned on. These resources may be more constrained by Wi-Fi or mobile devices and laptops on slow networks or by users working from home across slow WAN links. When clients are not on the same network as the servers, network bandwidth and resources should be assessed to ensure sufficient bandwidth is available. Because traffic is generated whether the microphone is turned on or off, users should be trained to turn the microphones off when they are not dictating, rather than putting microphones to sleep.

Configuration Considerations
Here is a short list of considerations when working with Dragon Medical 360 | Network Edition in VMware Horizon 6.

1. **Accuracy** is the result of GHz available to the recognition engine. The more GHz, the more cycles it can spend on analyzing the data stream in a set period of time. CPU contention by multiple VMs on the same core will have considerable impact on desktop speech recognition accuracy, start-up delays, and resource availability.

2. VMs that have been idle experience significant delay on reconnect if they have been idle for long periods of time. Nuance has identified that memory reservations can reduce this delay due to reducing memory that is swapped out to the system or disk. A small percentage memory reservation reduces this initial delay. Nuance has seen significantly better initial performance for desktops with 25 percent or greater memory reservations. This will also vary based on other applications and resources installed in the desktop.

   **Note:** Memory reservations will have significant impact on desktop pool density for Dragon dedicated pools. With larger View environments with mixed usage pools, memory reservations may reduce memory swap latency when users start a dictation and thereby reduce user wait times from the time a microphone button is pressed to the actual recording start time.

3. CPU contention or sharing desktops on a single core reduces total GHz available to the desktop resulting in a less accurate analysis of the audio stream. Low speech recognition accuracy may be a symptom of too little CPU available to the desktop.

4. If resources are not available, Dragon buffers may not respond and result in application lockups or application crashes. Do not rely on Windows to accurately report available resources to Windows OS. Always validate resources available from vCenter or VMware vRealize® Operations for Horizon.

5. CPU reservations may not improve performance but will usually result in fewer VMs fighting for the same resources. A 25 percent CPU reservation will reduce oversubscribed cores from high ratios such as 10:1 or 20:1 down to 4:1. This lower density ensures a more rapid response within the VM and reduces the resources that need to be re-allocated to other cores when a dictation process begins. With larger View environments with mixed usage pools, CPU reservations may reduce memory swap latency when users start a dictation by ensuring CPU resources are immediately available when Dragon starts recording.

6. Ensure vSphere vMotion and DRS are enabled on the desktop cluster.

7. Due to the “bursty” nature of Dragon CPU and memory performance, traditional aggregate resource-monitoring tools may not report contention when resources are being consumed and other resources are waiting for resources to free up for usage. ESXTOP is required to monitor actual real-time resources contention and CPU Ready issues.
Configuration Guidance for Endpoints

Windows, Mac, and Linux Desktop Client
Starting with version 3.3.x, the Horizon Client includes support for USB 3.0 and has several improvements to increase performance and connectivity of microphones on Windows desktops. Mac and Linux clients have not been tested or validated with Nuance Dragon Medical 360 Direct and the Horizon Client.

Teradici Zero Clients
Ensure zero clients have the latest Teradici firmware before testing. Substantial enhancements have been added to USB support in recent Teradici firmware releases. As of Spring 2015, ensure you minimum firmware Version is 4.80 or above.

Windows Embedded and Thin Clients
Windows Embedded, Wyse Thin-OS, HP ThinPro, HP Smart Zero, and others all have release notes for the most recent Horizon support. Ensure your thin client OS has support for Horizon 6.0 and later to take full advantage of USB 3.0 and the new USB redirection stack.

Windows Embedded 8 Standard and Windows Embedded Standard 7 both have Horizon Client support. Ensure you are leveraging the most recent VMware client release with these OSs before validating microphones.
VMware vSphere Virtual Environment Impacts

VMware vSphere vMotion and DRS

It has been observed that VMs that are actively processing audio while being moved across systems by VMware vSphere vMotion or DRS often see latency issues. These VMs suffer from swapping memory and resources out during the move and back in when the recognition processes begin. To reduce the memory swapped out and reduce recovery time, memory reservations can be assigned to the guest OS to ensure the resources are available. VMware recommended best practice is traditionally 25 percent memory reservations, but this may be increased until an acceptable latency response time is achieved.

Note: Increasing this reservation will reduce your host desktop consolidation ratios.

Resource Overcommit and Consolidation Ratios

When calculating the resource requirements of the desktop pool, close consideration should be paid to consolidation ratios and how much you are willing to overcommit resources in each server. Desktop density that is too high will result in increased latency in recognition as idle desktops are moved off of the active compute core as recognition begins by an active Dragon user. Active users could consume 100 percent of the compute and a larger-than-normal amount of memory resources during the recognition process. Typical desktop consolidation ratios of 8:1 to 12:1 for traditional desktops may be greatly reduced to 4:1 and as low as 2:1 for heavy Dragon Medical dictation users or users using complex EMR and healthcare solutions.

When planning the overcommitment of resources, it is better to err on the side of a lower ratio early and increase as the system grows in density. Tools like VMware vRealize Operations for Horizon can manage the utilization of resources and notify you as your desktop pools start to see resource constraints.

VMware vRealize Operations for Horizon can keep close tabs on individuals and key applications to notify you if users are experiencing constraints due to Dragon Medical or other desktop applications. This solution also allows you to identify offending applications or user practices that are negatively impacting performance.

Storage: Arrays, Virtual SAN, and App Volumes

While these technologies are not required by Dragon Medical, they do offer additional performance considerations when using Dragon on Horizon 6.

VMware Virtual SAN™ can increase disk response time for application startups by leveraging local cache storage and increased IOPS of the distributed array architecture. Virtual SAN has been shown to reduce the operational cost of Horizon 6 while increasing the overall desktop performance.

VMware App Volumes™ can further reduce the complexity of base desktop gold images by removing Dragon Medical from the base image and making the application available to desktops that require dictation and keeping it off of desktops that do not. It also allows for quick updates to the application by managing only the application disk image and not every user’s disk image.
Attributes and Environmental Impacts on Performance

Bandwidth and Latency to the Desktop

Remote home users may experience poor dictation recognition as a result of latency in the network or other network bandwidth limitations. To ensure best performance for remote users and home users, establish a minimum bidirectional bandwidth and round-trip latency for desktop users. Establish maximums for latency, jitter, and packet loss for these users. If users are connecting through a VPN or other gateway, ensure these numbers are validated while connected to VPN. VPN may introduce additional delays or slow bandwidth during peak usage.

End-User Devices with Real-Time Audio and Video Support (RTAV)

Home users may want to use their native microphone and audio devices. These devices can often take advantage of RTAV with the Horizon Client. These microphones will redirect audio to the client from the VM and back outside of the PCoIP stream to reduce overhead. These types of audio connections can reduce bandwidth consumption from as high as 2 Mbps to as low as 100 Kbps. These are significant reductions. Please note that RTAV is not available with Composite USB Audio devices such as the PowerMic.
Additional Best Practices

Other environmental anomalies may have significant impact on Nuance Dragon Medical 360.

Architecture Considerations

Here is a short list of architecture considerations that have significant impact on availability and performance.

- Memory leaks will consume available memory in the Windows desktop and ultimately take away buffering space for Dragon. If there is insufficient available memory within the desktop OS for Dragon Speech Recognition Audio Buffers, the application will begin to respond extremely slowly and ultimately become unresponsive or crash the application. In 2015, several VMware partners identified a memory leak in Microsoft Internet Explorer 10.
- If you are getting an unrecognized device when a microphone is connected, reconnect to the master and ensure the devices are recognized correctly. Then, refresh the desktop pool images with the revised master image.
- Windows clients will experience a small delay from when the microphone button is pressed to when the application starts recording. Educate your doctors about this delay.
- Ensure you are using the most recent release of the Dragon client and mini-Dragon.
- Ensure vSync is installed and enabled for the user profile if you are leveraging applications delivered via Citrix XenApp to the virtual desktop to eliminate the double-hop issues introduced by XenApp.
- Ensure you have the VMware Virtual USB Hub installed and active in your virtual desktops. This is installed and enabled by default. Use the VMware KB article Troubleshooting USB redirection problems in VMware View Manager (1026991) to validate the configuration.
- Upon connect and disconnect, call a simple batch file to shut down and restart the Dragon client to ensure the profile is loaded and saved correctly. Users who do not frequently save their Dragon profiles may lose their trained vocabulary.
- Microsoft creates an application called Windows Device Console (Devcon.exe) that allows you to script connecting and disconnecting USB devices. You can leverage this both at the Windows desktop endpoints and within the virtual desktop to ensure the devices are connected correctly. You can script the removal and reconnection of microphones from the command line.

Pool Considerations

The following best practices apply to pool resources:

- Ensure that there is sufficient CPU and memory for all active Nuance Dragon users in the desktop pool.
- Dedicate a cluster to these desktops to prevent contention with other desktop pools. If you dedicate a cluster for Dragon users, you may not want to establish CPU reservations to ensure resource availability. Dedicated Dragon desktop clusters will require more resources available per desktop.
- Enable vSphere vMotion and DRS on this cluster so desktops can move to accommodate bursts in resource utilization.
- With large, mixed desktop environments, reservations for CPU and memory for a limited number of desktops will reduce desktop bunching on a single core and reduce reconnect and recognition issues. This is not advised for dedicated Dragon desktop clusters.
- Resources reported within a desktop OS will not accurately reflect resources available to the desktop OS if other desktops are sharing the same CPU cores. Leverage tools like vRealize Operations Manager for Horizon to accurately see resource contention, bottlenecks, and hardware faults. To see contention in real-time, take advantage of ESXTOP form the command-line vSphere tools.
Resources

Nuance Resources

Nuance Support
Nuance Dragon Medical 360 | Network Edition – Using Dragon Medical with VMware

VMware Resources

VMware Support
VMware Horizon 6 with View Performance and Best Practices
VMware Horizon 6 Reference Architecture
USB Device Redirection, Configuration, and Usage in View Virtual Desktops View 5.1 and Later, Including View in VMware Horizon 6 version 6.1
Configuring USB device filters and redirecting Human Interface Devices (HIDs) in View Client (1011600)
VMware Horizon with View Optimization Guide for Windows 7 and Windows 8
Disable Windows Customer Experience Improvement Program