

DIAGNOSING WHICH DEVICES PROVIDE MORE FOR HEALTHCARE

Executive Summary

The right device can make you a healthcare IT hero by allowing clinicians and staff to work smarter, not harder. For instance, when you equip users with rich-client devices instead of zero-client devices, you empower them to transcribe exam notes up to 51 percent faster! This was one of the results we saw when we assessed the performance of rich-client devices, including a tablet and an all-in-one device—a popular option in healthcare today—against a zero client for performing common healthcare tasks. The devices we examined were:

- A Lenovo® ThinkCentre® M900z all-in-one device powered by an Intel® Core™ i5-6500 processor with Intel® vPro™ technology
- A Lenovo® ThinkPad® X1 Tablet powered by an Intel Core m7-6Y75 processor with Intel vPro technology
- A zero client with a virtualized desktop hosted on a server running Windows® MultiPoint® Server 2012

Our Primary Diagnoses

- An all-in-one rich-client device, such as the Lenovo ThinkCentre M900z all-in-one we tested, can help office staff add and check in new patients faster and more efficiently than a zero client.
- Rich-client devices let doctors and technicians view images in medical-image processing software faster, and more efficiently consult with others about those images, than zero clients.
- Zero clients fall short for using some technologies and typically take longer than rich-client devices to complete tasks.



More time saved
when using rich-client devices



Faster image rendering
on rich-client devices



Broader options
with rich-client devices

Clinicians Are More Efficient with the Right Digital Options

Medicine today is solidly entrenched in the digital age. IT decisions have a big impact on enabling clinicians and patients to spend less time waiting—time that can then be used to deliver or receive care. Choices for IT are broad: local software, software as a service (SaaS), rich clients, thin clients, zero clients, traditional infrastructure, virtual desktop infrastructure (VDI), and the cloud.

To help you with one of those choices—how to best equip the clinicians and staff with the right devices—we compared the performance of rich-client and zero-client devices when performing healthcare tasks using leading medical software solutions.

Our tests show that while zero clients running in a virtualized environment might seem like a sound choice for clinical settings, zero clients do not stand up to rich-client devices for efficiency or flexibility. Zero clients might be well suited for some needs, but today's healthcare professionals need more performance and flexibility than zero clients provide. We found that those performance and flexibility needs are best satisfied by rich-client devices.

Start Off Right with a Good Patient Check-in Experience

In our test scenario, a large health facility wants to automate the patient check-in process with a single solution that could be used by administrative staff as well as by patients to check themselves in. The facility chose Savance Health solutions, which are used by hospitals and clinics throughout the U.S. to streamline operations, improve the patient experience, save time, and reduce costs.

Because the patient experience starts when a patient first arrives, we started our testing with the Savance Health Patient Self Check-In solution. We examined how the process works for both patients and admins using our two rich-client devices and the zero-client device.

In our test scenario, a new patient, Betty Marshall, arrives at a clinic.¹ Betty has two options to check in.

1. She can use a device located in the waiting room.
2. She can go to the front desk and check in with the admin.

Because Betty is a new patient, she checks in at the front desk. The admin, Mike, welcomes Betty, learns that she's a new patient, and uses the Savance Health solution to create a record for Betty in the clinic's system.¹

Speed Up the Time It Takes to Add New Patients

In our test, Mike adds Betty as a patient on the zero-client and rich-client devices. Mike is able to add Betty faster and more efficiently using the Lenovo ThinkCentre M900z all-in-one device, powered by an Intel Core i5-6500 processor with Intel vPro technology, than he can using

the zero client. While the time savings are fairly small for one patient, if Mike checks in eight patients a day for five doctors, over the course of the average 261 working days for 2016, he will save almost an entire day (7.74 hours) by using the all-in-one device instead of the zero client.



Admins can **save almost a full day (7.74 hours) each year** using a rich-client device to add new patients.

Make It Convenient for Everyone, Let Patients Check Themselves In

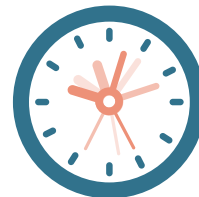
Shortly after Betty checks in, a current patient, Don Anderson, arrives for his appointment.¹ Don can use either a zero client at a workstation or one of the rich-client tablets located on end tables throughout the waiting room to check himself in. In our test, using the tablet and its touch capabilities, Don takes just 22.65 seconds to check in—less than half a minute. The zero-client device that we tested doesn't support touch capabilities, so Don has to go to a zero client located at a workstation and wait in line.

MAKE IT CONVENIENT FOR THE PATIENT

Mike's clinic considered a zero-client setup for patient check-in. In the end, the clinic opted to give staff and patients the convenience of using either a touch or keyboard interface. It chose the Lenovo ThinkPad X1 Tablets for Savance Patient Self Check-In in the waiting room due to the device's lighter weight and portability.

MAKE IT CONVENIENT FOR CLINIC STAFF

Because Don is an existing patient, letting him check himself in saves Mike, the admin, the time needed to check Don in. If Mike were to check Don in using his all-in-one device, it would take Mike just 19.89 seconds with the all-in-one's keyboard.



Save office staff **up to 7.21 work days annually** by equipping patients with the ability to check themselves in.

This means that by enabling Don to check himself in, Mike saves roughly 20 seconds every time a patient uses Savance Health Patient Self Check-In on one of the tablets in the waiting room. If 40 patients check themselves in every day, that saves Mike 13.26 minutes every day; over the course of a year, that equals 57.68 hours or 7.21 work days saved.

When Mike does have to check patients in—for instance, when all the tablets are in use, or when a patient prefers to talk with Mike—he still saves time by using his all-in-one device compared to the time it would take to use a zero-client device.

MAKE IT CONVENIENT FOR THE IT TEAM

Choosing rich-client devices over a zero-client environment not only saves time and adds convenience for the clinic's staff and patients, it also lets the clinic's IT team avoid the hassle of buying, installing, and maintaining added peripherals—such as a monitor, keyboard, mouse,

and camera—as well as buying, installing, and managing the equipment needed to support a virtualized environment. Peripherals are not included with zero clients and would have to be purchased, installed, and maintained separately.

Zero Client a No-Go for Patient Check In

Based on our results, our conclusion is that rich-client devices offer more for patient check-in: more convenience and more efficiency. The ability to complete check-in faster, in addition to the ability to use touch capabilities and built-in peripherals, made these devices the best choice in our estimation.

SAVANCE HEALTH SOLUTIONS

Savance Health (www.savancehealth.com) provides a line of Health Insurance Portability and Accountability Act (HIPAA)–compliant software solutions to help hospitals and other medical facilities save time and money while improving the work environment and the patient experience. From the moment that a patient arrives at a facility until the time that patient leaves, Savance Health solutions aim to simplify processes, collect crucial data, improve efficiency, decrease patient wait times, and increase overall patient satisfaction (and Hospital Consumer Assessment of Healthcare Providers and Systems [HCAHPS] scores).

Enable Faster Patient Tracking and Flow

Once our new patient, Betty, is registered as a patient, Mike sets her status in the Savance backend to “Sign In.” This status carries over to Savance Health Patient Tracking & Flow, a comprehensive, easy-to-use patient-tracking software that is designed to help hospitals and other healthcare facilities improve the effectiveness and efficiency of workflow processes and clinical procedures.

In our tests, Mike can set Betty’s status using his Lenovo ThinkCentre M900z all-in-one in just 7.46 seconds—4.29 seconds, or 37 percent, faster than if Mike were using a zero client. Mike uses a second monitor with his all-in-one. This way, he has the Savance Health solution open on one screen and his email open on another. He does not have to spend time switching between applications.

To gain the same benefits with a zero-client device, IT would first have to buy not one but two monitors for Mike to use. Mike’s zero-client has fewer ports than the all-in-one, so he might use up all of his ports, because he needs at least a printer and scanner in addition to his extra monitor.

After Mike has Betty checked in, a medical assistant, Susan, takes Betty to an exam room.¹ Susan has access to Savance Health Patient Tracking & Flow on the Lenovo ThinkCentre M900z all-in-ones located in each exam room. She also has access to the Savance Health solutions on a Lenovo ThinkPad X1 Tablet, powered by an Intel Core m7-6Y75 processor with Intel vPro technology, which she uses as she moves among exam rooms and patients.

After Susan has Betty settled, she changes Betty’s status in Savance Health Patient Tracking & Flow to “Waiting.” Susan does this on her Lenovo ThinkPad X1 Tablet in just 5.78 seconds—1.68 seconds faster than if she used the all-in-one in the exam room, but 5.97 seconds, or 51 percent, faster than if she were using a zero-client device.

With the Lenovo ThinkPad X1 Tablet, Susan gains the convenience of mobility in addition to being able to complete her tasks fast. And if Susan assists two doctors who each see eight patients each day, that savings gives Susan an extra 6.93 hours annually to do other things. Susan is just one of the clinic's three medical assistants who assist a total of five doctors with 40 patients a day, so the clinic overall saves 17.31 hours annually.



Enable medical assistants to update patients' statuses **up to 51 percent faster** with an Intel® processor-powered rich client.

Rich-Client Devices Let Staff and Patients Spend Less Time Waiting

The numbers prove it: the rich-client devices powered by Intel® Core™ vPro™ processors that we tested let clinicians and support staff—and therefore their patients—spend less time waiting. What's more, these rich-client devices come with monitors and keyboards along with ports for connecting additional monitors, printers, and other peripherals. When mobility is important, or even just a nice convenience, an Intel® processor-powered tablet empowers the clinic's team members to do their computer-based tasks on the go. Conversely, the zero client we tested is slower, stationary, does not support touch capabilities, and would require added cost and configuration time to equip it with a monitor, keyboard, and other peripherals.

DRAGON® MEDICAL

Dragon Medical speech recognition solutions empower clinicians to deliver more accurate documentation without disrupting their workflows, so they can spend more time with their patients. Dragon Medical solutions are in use at more than 10,000 healthcare facilities, and they are used by more than 500,000 physicians worldwide.

Dragon Medical Practice Edition (<http://www.nuance.com/products/dragon-medical-practice-edition/index.htm>) is designed and priced exclusively for independent practices of 24 physicians or less.

Nuance offers a wide range of speech-recognition solutions for healthcare, including cloud-based, on-premises, hybrid, and mobile solutions.

Empower Clinicians to Spend Less Time Transcribing Exam Notes

Clinicians must capture accurate information about their patients—not only to deliver the best care, but also to ensure regulatory compliance. To capture patient information, many doctors choose to record notes verbally and later transcribe them for inclusion in the patient's electronic health record (EHR).

To see how our test devices compare for recording and transcribing patient notes, we chose Dragon® Medical Practice Edition from Nuance. Dragon Medical Practice Edition is a leading clinical speech-recognition solution that interoperates with all major EHR platforms.

In our scenario, Dr. Zone records notes from Betty's exam in the exam room.¹ He asks Susan to transcribe the recording after the exam and to ensure the transcribed notes get added to Betty's EHR.

In our tests, we discovered that while we were able to get Dragon Medical Practice Edition to run on our zero-client device, Nuance does not provide support for Dragon Medical Practice Edition on zero clients. Clinics choosing a virtualized environment with zero clients would have to choose to run Dragon Medical Practice Edition without support.

We also found the Intel processor–powered Lenovo rich clients outperformed the zero client for this task. Susan is able to use the automated “Transcribe Recording” feature to transcribe Dr. Zone’s 93-second recording of the notes on the all-in-one in her office. Completing this task takes Susan just 37.16 seconds—48 percent faster than if she uses the zero client. If she were away from her office with her Lenovo ThinkPad X1 Tablet in hand, she would still complete the transcription faster than she could with the zero client—29 percent faster at 50.84 seconds compared to 72.05 seconds on the zero client.



Dragon® Medical Practice Edition is **not supported** on the zero-client device we tested.



Save 40.47 hours annually by empowering one medical assistant to transcribe exam notes in Dragon® Medical Practice Edition on an all-in-one rich client.

The time saved for Susan is dramatic when extended out a year. If she uses the all-in-one device to transcribe two doctor’s notes for eight patients each day, Susan will save an entire week—40.47 hours—a year. That is a week she can spend caring for patients instead of working on

administrative tasks. And remember, our clinic treats 40 patients each day, so the clinic could save 101.18 hours, or 12.65 work days each year!

Table 1. Time saved when transcribing recorded exam notes in Dragon® Medical Practice Edition using Lenovo® devices powered by Intel® processors compared to a zero client

	Percent Faster Than the Zero Client	Time Saved Daily If Transcribing Notes for 16 Exams	Time Saved Annually for One Medical Assistant	Time Saved Annually for Three Medical Assistants Treating 40 Patients per Day
Lenovo® ThinkCentre® M900z all-in-one device, powered by an Intel® Core™ i5-6500 processor	48% (37.16 seconds vs. 72.05 seconds)	9.30 minutes	40.47 hours	101.18 hours
Lenovo® ThinkPad® X1 Tablet, powered by an Intel Core m7-6Y75 processor	29% (50.84 seconds vs. 72.05 seconds)	5.65 minutes	24.60 hours	61.51 hours

Rich-Client Devices Reduce Time for Patient Care and Ensure Software Is Supported

Our results show that transcribing exam notes with the rich-client devices powered by Intel processors let clinicians and support staff spend more time on patient care and less time on administrative overhead, compared to the zero-client device. And even though we were able to get Dragon Medical Practice Edition to run on our zero-client device, Nuance does not support running Dragon Medical Practice Edition on the zero-client device we tested.

OBJECTIVEVIEW™ DIGITAL PATHOLOGY IMAGE VIEWER

ObjectiveView image viewer (<http://www.objectivepathology.com/#objectiveview/c3zr>) is a vendor-neutral software solution from Objective Pathology that lets clinicians view digital-pathology images locally.

Objective Pathology offers network, image storage/management, hosting, and mobile web-based applications that allow pathologists, researchers, and educators to connect and make digital pathology immediately accessible for anyone who can benefit from the technology.

Deliver Better Quality and Faster Access to Medical Images

Medical images—photos, X-rays, magnetic-resonance images (MRIs), ultrasounds, and more—are an integral part of medicine. To test viewing medical images, we used ObjectiveView™ digital-pathology image viewer. In our scenario, Don has been suffering from upper back pain, and Dr. Zone wants an X-ray image of his spine. Jim, the X-ray technician, takes an X-ray.¹ He wants to consult with Dr. Zone before he concludes Don's X-ray and sends Don back to Dr. Zone's office.

In our tests, Jim notices significant image degradation on the zero client, even when he tries it with different monitors. The image is pixelated on all monitors, and it renders with an incorrect aspect ratio on some. Pixelation can be especially problematic in black-and-white medical images because it impedes Jim's and Dr. Zone's ability to distinguish noise from signal. They might not be able to tell if a dark image in the bone is pixelation or if it is localized bone decay or a small fracture. Because the rich-client devices render images more clearly, they make it easier to make accurate diagnoses and, therefore, provide better patient care.

In our tests, Jim opens and annotates the X-ray in ObjectiveView image viewer in just 36.17 seconds using the Lenovo ThinkCentre M900z all-in-one device. The same flow on the Lenovo ThinkPad X1 Tablet takes roughly five more seconds at 41.38 seconds, and it takes almost six seconds longer on our zero client at 42 seconds. If Jim uses his all-in-one instead of a zero client, those six seconds, extrapolated out over 16 patients per day, will net Jim an extra 6.76 hours annually. Those are hours he can spend helping patients, validating images, and more.

And if we add the time saved on retaking images to verify whether pixelation is noise or an actual issue, Jim saves even more time each year, as do Dr. Zone and the clinic's patients.



Viewing medical images on an Intel® processor-powered all-in-one rich-client device, **one technician can save 6.76 hours annually**

Rich-Client Devices Enable Time Savings and Added Quality and Flexibility

In our test scenario, if Jim's clinic equips him with the Lenovo ThinkCentre M900z all-in-one device that we tested, the device's built-in 23.8-inch monitor lets Jim see the granular detail he needs to assess if a doctor consult or additional images are needed. The magnifier tool works smoothly on the rich-client device as he moves his mouse to zoom in on specific areas of the image. Jim can view images and make annotations faster with the rich client than he can with the zero client. And, he will not waste valuable time because of the image degradation that we saw with the zero client.

If a facility needs nothing more than an image viewer that integrates with its picture-archiving-and-communication-system (PACS) or electronic medical record (EMR) platforms, a zero client might be sufficient (although the facility will want to take care that images are not distorted by the chosen monitor), but zero clients can be limiting for users who depend on image quality and need to complete tasks faster. To provide users with the greatest efficiency, we recommend decision makers consider outfitting their environments with Intel processor-powered rich-client devices. These devices can be managed using standard Microsoft® environment-management tools, which can help ensure the facility's compliance officer that patient data is secure and protected by the same policies that manage other devices in the environment.

INTEL® UNITE™ SOFTWARE FOR CONFERENCE ROOMS

After a one-time software install on a Windows® or macOS™ device, Intel Unite software (www.intel.com/unite) for conference rooms enables colleagues near or far to connect screens and audio. Users simply share the six-digit PIN shown on the display with those with whom they want to connect, and then they press a button to start sharing a screen. The 256-bit Secure Sockets Layer (SSL) data encryption helps protect the shared data, and all data traffic remains safely within the network.

Ensure Collaboration Is Easy and Efficient

With vast amounts of medical knowledge available today, doctors depend on each other for specialized expertise. Medical assistants might notice things doctors miss. And technicians are on the front lines, delivering the critical diagnostic aids doctors need. With so many players involved in healthcare, collaboration is key for accurate communication and diagnoses. The devices used are a significant factor in determining whether that collaboration is effective or ineffective.

For our clinical collaboration testing for rich-client against zero-client devices, we chose Intel® Unite™ software.

In our test, Jim wants to review the X-ray he's just taken of Don's spine with Dr. Zone. Dr. Zone is in a distant wing of the facility, so a face-to-face consult is not realistic. Jim uses the all-in-one in the radiology lab to initiate a peer-to-peer connection with Dr. Zone using Intel Unite software. He uses chat in the facility's Savance Health solution to send the PIN for the conference to Dr. Zone. Within seconds, he and Dr. Zone are connected.

Jim shares the X-ray with Dr. Zone and discusses the annotation that he made previously. Dr. Zone determines that Jim's concerns are well founded, and an additional X-ray is the best next step. Within Intel Unite software, Dr. Zone circles a specific part of the X-ray as he talks, to show Jim an area to focus on in the next X-ray.

Because Don—the patient—is still in radiology, Jim takes the second X-ray right away. Don is saved from making the trip back to Dr. Zone's clinic only to be told he needs to go back for another X-ray. Don avoids wasted time, extra hassle, and unneeded worry.

The second X-ray rules out any significant concerns, and Dr. Zone starts Don off with physical therapy and muscle relaxants.

In our test, if Jim had been tethered to the zero client we tested, he would not have been able to initiate a peer-to-peer connection with Dr. Zone. He would first have had to contact Dr. Zone or one of Dr. Zone's admins and ask that one of them initiate the connection using an Intel processor-powered device. Those added steps would have meant more waiting and time wasted for Don, Jim, Dr. Zone, and the admin.

The rich-client devices also outperform the zero-client device in our test. Jim and Dr. Zone are able to complete their collaboration in just 14.43 seconds with both participants using the Lenovo ThinkCentre M900z all-in-one device powered by an Intel Core i5-6500 processor with Intel vPro technology. The same consult takes 20.36 seconds—5.93 seconds longer—if one of the two participants uses the zero client. That makes the Lenovo ThinkCentre M900z all-in-one 29 percent faster for this task. If both users are on a Lenovo ThinkPad X1 Tablet, powered by an Intel Core m7-6Y75

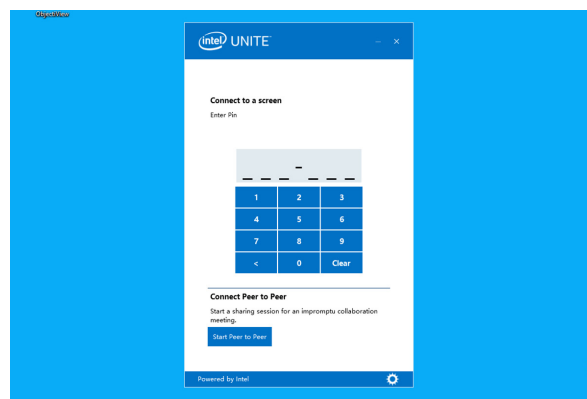
processor with Intel vPro technology, the task takes just 17.21 seconds—making the tablet 3.15 seconds, or 15 percent, faster than the zero client.



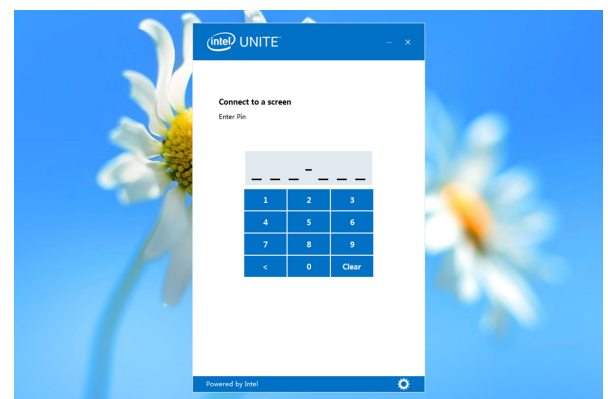
Enable online collaboration that is **15 to 29 percent faster** with an Intel® processor-powered rich client.

Rich-Client Devices Enable Collaboration without Delays or Limited Capabilities

Using an Intel processor-powered rich-client device not only lets Jim complete his radiology tasks more efficiently, it also gives him the capability to quickly and efficiently collaborate with doctors and others. Our recommendation for collaboration in healthcare settings is rich-client devices powered by Intel processors.



Peer-to-peer connection screen on the Lenovo® ThinkCentre® M900z all-in-one device



Peer-to-peer connection screen on the zero client

Figure 1. The zero client that we tested was unable to initiate a peer-to-peer connection using Intel® Unite™ software; it could be used to participate when another device initiated the connection, but it could not be used to initiate the connection itself

The Virtual-Desktop-Infrastructure (VDI) Reality

Healthcare organizations are often drawn to a virtual-desktop-infrastructure (VDI) model where zero or thin clients are used with a desktop operating system hosted inside a virtual machine running on a centralized server. The perception that these devices are cheaper makes this model seem more affordable. However, the initial cost of acquiring zero or thin clients does not include peripherals, the time needed to install drivers for peripherals, or management and maintenance time, and is therefore not necessarily the most important contributing factor to total cost of ownership (TCO) of a VDI implementation.

A VDI environment capable of meeting the complex needs of a healthcare setting might actually cost more up front and can require added investments going forward. One limiting factor is the dependency on network bandwidth. If the network goes down, or if too many users are consuming bandwidth—with video conference calls for example—clinicians will not be able to fully use their devices. Performance could be slow or non-existent, crucial features might not work, and so on. That could require IT to add costly infrastructure in order to increase bandwidth.

A VDI environment also requires added costs to equip zero clients with the necessary peripherals, including monitors, keyboards, mice, cameras, and other items. None of these items come with a zero client. Additionally, connecting zero clients to peripherals, printers, and legacy devices can be more complicated in a VDI configuration. Zero or thin clients can lack the required drivers, making zero clients more time-consuming to deploy at the outset and harder to upgrade in the future. Add in the extra costs of meeting different licensing requirements or the burden of preparing staff for significant changes in their computing resources, and the total deployment expenses can quickly spiral upward.

Simulating a VDI

To simulate a VDI environment without the complex overhead typically required, we ran our zero client in a virtual machine running Windows MultiPoint Server 2012. The zero client streamed a desktop in the style of the Windows® 8 operating system, in addition to streaming the software used in our testing.

Intel® Processor–Powered Rich-Client Devices Deliver More Efficiency and More Options for Clinicians

In our testing, we found the zero client underperformed when compared to the Intel processor–powered rich-client devices. Additionally, rich-client devices support broader options for users along with mobility when needed. They also provide the best assurance that new applications and changes in the technology landscape are supported by users' devices in the long term.

When evaluating device choices, it is important to choose the best device for the individual task and overall workflow. Based on our research and the devices we tested, Prowess Consulting recommends healthcare IT decision makers choose rich-client devices powered by Intel processors for healthcare clinicians and staff.

“The gap between zero clients and tablets or all-in-ones is shortening every day. And there are real problems with maintaining a zero-client environment; not to mention that they are totally inflexible if you change your mind.”

— Julian Lancaster, IT Manager, Prowess Consulting

Appendix A: Hardware and Test Environment

Devices			
Form Factor	All-in-one	Tablet	Zero client
Model	Lenovo® ThinkCentre® M900z	Lenovo® ThinkPad® X1 Tablet	1003-E03 SKU#662724309007
Processor	Intel® Core™ i5-6500 processor, 3.2 GHz, four cores, up to 3.6 GHz with Intel® Turbo Boost Technology and with Intel® vPro™ technology	Intel Core m7-6Y75 processor, 1.2 GHz, two cores, up to 3.1 GHz with Intel Turbo Boost Technology and with Intel vPro technology	No CPU
Cache	6 MB Intel® Smart Cache	4 MB Intel Smart Cache	Not applicable (N/A)
RAM	4 GB	16 GB	N/A
OS	Windows® 10 Pro (64-bit edition)	Windows 10 Pro (64-bit edition)	Windows® MultiPoint® Server 2012 with 6 GB RAM, four cores, and 100 GB storage
Graphics	Intel® HD Graphics 515	Intel HD Graphics 515	N/A
Ports	<ul style="list-style-type: none"> 6 USB 3.0 ports (one always-on fast-charge USB) 9-in-1 card reader (optional) Headphone and microphone combo port DisplayPort™ in and out combo AC-in RJ45 LAN connector Serial port (optional) 	<ul style="list-style-type: none"> 1 USB 3.0 1 USB Type-C™ power delivery Mini DisplayPort (mDP) microSD™ Audio Nano SIM 	<ul style="list-style-type: none"> 1 Video Graphics Array (VGA) 4 USB 2.0 1 microphone 1 audio line-out 1 LAN (Gigabit Ethernet [GbE])
Camera	Up to 1,080p	2 megapixels (MP) or 8 MP with flash, 1,080p	N/A
Display Size and Resolution	23.8" (604.5 mm) full high definition (FHD) 1,080p (1,920 x 1,080) thin-film-transistor (TFT) color, WVA panel, wide viewing angle (+/- 89 degrees), light-emitting diode (LED) backlight, 250 nits, 16:9 aspect ratio, 1,000:1 contrast ratio, anti-glare for both touch models and non-touch models, works as a standalone monitor via DisplayPort (in/out combo)	12.0" (304.8 mm) FHD+ (2,160 x 1,440), glare, LED backlight, in-plane switching (IPS), anti-fingerprint display with Corning® Gorilla® Glass, wide view (170 degree viewing), 360 nits, 3:2 aspect ratio, 800:1 contrast ratio	N/A
Weight	17.20 lbs	1.69 lbs	N/A
Dimensions (W x D x H)	11.8 x 8.4 x 0.3 in	15.09 x 10.1 x 0.76 in	3.4 x 0.7 x 5.2 in
Wireless	Intel® Dual Band Wireless-AC 8260 802.11 a/b/g/n/ac (2 x 2) wireless and Bluetooth® 4.2 combo	Intel Dual Band Wireless-AC 8260 802.11 a/b/g/n/ac (2 x 2) wireless and Bluetooth 4.2 combo	N/A
Software			
Savance Health Patient Self Check-In	9.0.76	9.0.76	9.0.76
Savance Health Patient Tracking & Flow with Savance Health EIOBoard for the backend	9.0.113	9.0.113	9.0.113
Dragon® Medical Practice Edition	2	2	2
Intel® Unite™ software	2.0.27.10	2.0.27.10	2.0.27.10
ObjectiveView™ image viewer	1.46	1.46	1.46
Notepad	1511	1511	1511

File Sizes Used in Prowess Use Cases	
X-ray image	523 KB
Medical recording (m4a)	2.15 MB
Medical recording (mp3)	942 KB

Appendix B: Functional Use Case Steps and Findings

Patient Check-in with Savance Health Patient Self Check-In

Using Keyboard

1. From the desktop, double-click the **Savance Health - Patient Self Check-In** icon.
2. Click **Sign in**.
3. In the **First Name** field, type **Don**.
4. In the **Last Name** field, type **Anderson**.
5. In the **Birthdate Month** field, type **05**.
6. In the **Birthdate Day** field, type **28**.
7. In the **Birthdate Year** field, type **1945**.
8. Click **Next**.
9. In response to all five questions, click **No**.
10. Click **Confirm**.

Using Touch

1. From the desktop, double-tap the **Savance Health – Patient Self Check-In** icon.
2. Tap **Sign in**.
3. In the **First Name** field, type **Don**.
4. In the **Last Name** field, type **Anderson**.
5. In the **Birthdate Month** field, type **05**.
6. In the **Birthdate Day** field, type **28**.
7. In the **Birthdate Year** field, type **1945**.
8. Tap **Next**.
9. In response to all five questions, tap **No**.
10. Tap **Confirm**.

Add a New Patient in Savance Health EIOBoard

1. From the desktop, double-click the **EIOBoard** icon.
2. From the top menu bar, click the **Administrator** icon.
3. From the bottom of the screen, click the **User Type** drop-down menu, and then select **Patient**.
4. Click **New**.
5. In the **First Name** field, type **Betty**.
6. In the **Last Name** field, type **Marshall**.
7. In the **Email Address** field, type **b.marshall@gmail.com**.
8. In the **Phone Number** field, type **801-555-0199**.
9. In the **Cell Phone** field, type **801-555-0188**.
10. In the **DOB** field, type **01/15/1967**.
11. In the **Home Phone** field, type **801-555-0199**.
12. In the **Home Email Address** field, type **b.marshall@gmail.com**.
13. In the **Home Address** field, type **1025 Big Blvd Way**.
14. In the **Home City** field, type **Somewhere**.
15. In the **Home State** field, type **UT**.
16. In the **Home Zip** field, type **11111**.
17. In the **Receptionist Comment** field, type **Insurance verified**.
18. Click **Add**.

Change Patient Status to “Waiting” in Savance Health Patient Tracking & Flow

1. With Savance health EIOBoard open, double-click **Don Anderson**.
2. Click **Waiting**.
3. Click **Okay**.

Chat with a Colleague in Savance Health Patient Tracking & Flow

1. With Savance Health Patient Tracking & Flow open, from the top menu bar, click the **More** drop-down menu.
2. Click **Chat**.
3. Select the user with whom you wish to chat.
4. Click **OK**.
5. Type **Can you call Dr. Todd's office and get Don Anderson's records?**¹
6. Press **Enter**.

Change a Patient's Status to "Discharged" in Savance Health Patient Tracking & Flow

1. With Savance Health EIOBoard open, double-click **Don Anderson**.
2. Click **Discharged**.
3. Click **Okay**.

Record Exam Notes in Dragon® Medical Practice Edition

1. From the desktop, double-click the **Dragon Medical Practice Edition** icon.
2. On the Windows task bar, double-click the **Notepad** icon to open Notepad.
3. Click the red square to turn the microphone on.
4. Read the note out loud, making sure to mention all line breaks and punctuation.
5. Click **File > Save As**.
6. Double-click **OneDrive**.
7. Double-click the **Marshall_Betty** folder.
8. In the Filename field, type **Marshall, Betty_Notes**.
9. Click **Save**.

Transcribe Recorded Exam Notes in Dragon Medical Practice Edition

1. From the desktop, double-click the **Dragon Medical Practice Edition** icon.
2. Click **Tools > Transcribe Recording > Next > Browse to locate file > Documents**.
3. Double-click **Marshall-Betty_Notes.mp3**.
4. Click **Transcribe**.

View/Annotate an X-ray Image in ObjectiveView™ Digital-Pathology Viewer

1. From the desktop, double-click the **ObjectiView** icon.
2. Click **File > Open File > OneDrive**.
3. Double-click the **Anderson, Don** folder.
4. Double-click **CSPine3of4.jpg**.
5. Click **Annotation Tool**.
6. Click the ruler icon.
7. Click and hold at the bottom of skull, and then draw a line to the top of the fifth vertebrae.
8. In the comment box, type **DB: What are your thoughts on this?**
9. Click **Annotation Tool**.
10. Click the pointer icon.
11. Click at the top of the seventh vertebrae and drag up and to the left to make a pointer.
12. In the comment box, type **DB: Does this look okay to you?**
13. Click **X** in the top right corner of the application to close the application.
14. Click **Yes** to save the annotations.

Collaborate to Discuss an X-ray Using Intel Unite Software

1. From the desktop, double-click the **Unite** icon.
2. Click **Start Peer to Peer**.
3. When the request to join pops up, click **Accept**.
4. Click **Present Desktop**.
5. Click **Annotation Tool**.
6. Click the circle icon.
7. Click to the left of the bottom of the second vertebrae and drag to the top right of the third vertebrae.
8. In the comment box, type **RS: Check with Bob on this**.
9. Click **X** in the top right corner of the application to close the application.
10. Click **Yes** to save the annotation.

Functionality Test Results

	Lenovo® ThinkCentre® M900z, powered by an Intel® Core™ i5-6500 processor	Lenovo® ThinkPad® X1 Tablet, powered by an Intel Core m7-6Y75 processor	Zero client with a virtualized desktop hosted on a server running Windows® MultiPoint® Server 2012	Comparison: Difference using Lenovo ThinkCentre M900z compared to the zero client	Comparison: Difference using the Lenovo ThinkPad X1 Tablet compared to the zero client
Patient check-in with Savance Health Patient Self Check-In (using the keyboard)	19.89 seconds	27.76 seconds	20.34 seconds	0.45 seconds faster	7.42 seconds slower
Patient check-in with Savance Health Patient Self Check-In (using touch)	20.76 seconds	22.65 seconds	N/A	N/A	N/A
Add a new patient in Savance Health EIOBoard	57.19 seconds	68.66 seconds	59.86 seconds	2.67 seconds faster	8.80 seconds slower
Change a patient's status to "Waiting" in Savance Health Patient Tracking & Flow	7.46 seconds	5.78 seconds	11.75 seconds	4.29 seconds faster	5.97 seconds faster
Chat with a colleague in Savance Health Patient Tracking & Flow	20.69 seconds	22.19 seconds	24.59 seconds	3.90 seconds faster	2.40 seconds faster
Change a patient's status to "Discharged" in Savance Health Patient Tracking & Flow	4.16 seconds	5.41 seconds	4.67 seconds	0.51 seconds faster	0.74 seconds slower
Record exam notes in Dragon® Medical Practice Edition	116.89 seconds	122.76 seconds	141.71 seconds	24.82 seconds faster	18.95 seconds faster
Transcribe recorded exam notes in Dragon Medical Practice Edition	37.16 seconds	50.84 seconds	72.05 seconds	34.89 seconds faster	21.21 seconds faster
View/annotate an X-ray image in ObjectiveView™ digital-pathology viewer	36.17 seconds	41.38 seconds	42.00 seconds	5.83 seconds faster	0.62 seconds faster
Collaborate to discuss an X-ray using Intel® Unite™ software	14.62 seconds	17.21 seconds	20.36 seconds	5.74 seconds faster	3.15 seconds faster

All times shown are the median of three test runs. Margins of error run from +/- 0.03 percent to +/- 10.13 percent.

¹ Betty Marshall, Mike, Don Anderson, Susan, Dr. Zone, Dr. Todd, and Jim are fictional composites. All patient data is fictitious.



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