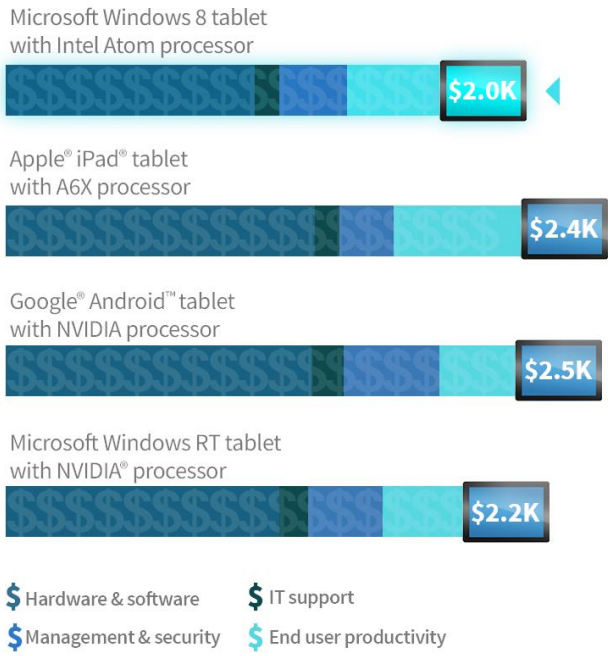
COMPARING THE TCO OF INTEL ATOM PROCESSOR-BASED TABLETS VS. ALTERNATIVES IN THE ENTERPRISE

Microsoft® Windows 8 tablet with an Intel Atom™ processor shows a lower two-year TCO compared to competitor tablets.



Organizations purchasing thin and light touch tablets for their users have four primary categories from which to choose: Windows 8, iPad, Android and Windows RT. Of these, only Windows 8 tablets with Intel Atom processors provide both a long battery life and a true PC experience, allowing users to run familiar desktop applications and maintain productivity without having to find new ways to do things.

They can read, edit, and print their emails and Office documents—tasks that can be a challenge on other tablets. IT departments also benefit with Windows 8 tablets, which administrators can secure and manage with the same tools and policies as other Windows PCs.

We estimated costs for a hypothetical organization and found that Windows 8 tablets with Intel Atom processors can provide total cost of ownership (TCO) savings of up to 24 percent compared to other tablets, primarily due to reduced software costs, low management costs, and improved end-user productivity.

MARCH 2013
A PRINCIPLED TECHNOLOGIES WHITE PAPER
Commissioned by Intel Corp.

LOWER 2-YEAR TCO WITH WINDOWS 8 TABLETS

Our TCO analysis is for a hypothetical organization considering tablets from four categories running a typical office productivity suite on their current laptops or desktops: Microsoft Windows 8 tablets powered by Intel Atom processors, Windows RT tablets, Android tablets, and Apple iPads. Each of these meets the organization's need for a tablet with a battery that can last throughout the typical 8-hour workday. For each category, we selected a representative model with 64 GB of storage and a screen 9 inches or larger (see Figure 1). We selected a Windows 8 tablet with an Intel Atom processor, rather than a Windows 8 tablet with Intel Core™ processor, because the Intel Atom processor offers a longer battery life.

	Windows 8 tablet	Apple iPad	Google Android tablet	Windows RT tablet
Model	Lenovo® ThinkPad® Tablet 2	Apple iPad with Retina display	ASUS® Transformer Pad Infinity TF700T	Microsoft Surface RT
Processor	Intel Atom processor Z2760	Dual-core A6X with quad core graphics	NVIDIA Tegra® 3 Quad-core CPU	NVIDIA Tegra 3 Quad-core CPU

Figure 1: The four tablets in our analysis.

We started with the base price of the tablets, which ranged from $599.99 to $699.00; added costs for hardware support, keyboards, and software; and estimated management costs and productivity savings. As Figure 2 shows, the Windows 8 tablet with Intel Atom processor had the lowest two-year TCO.

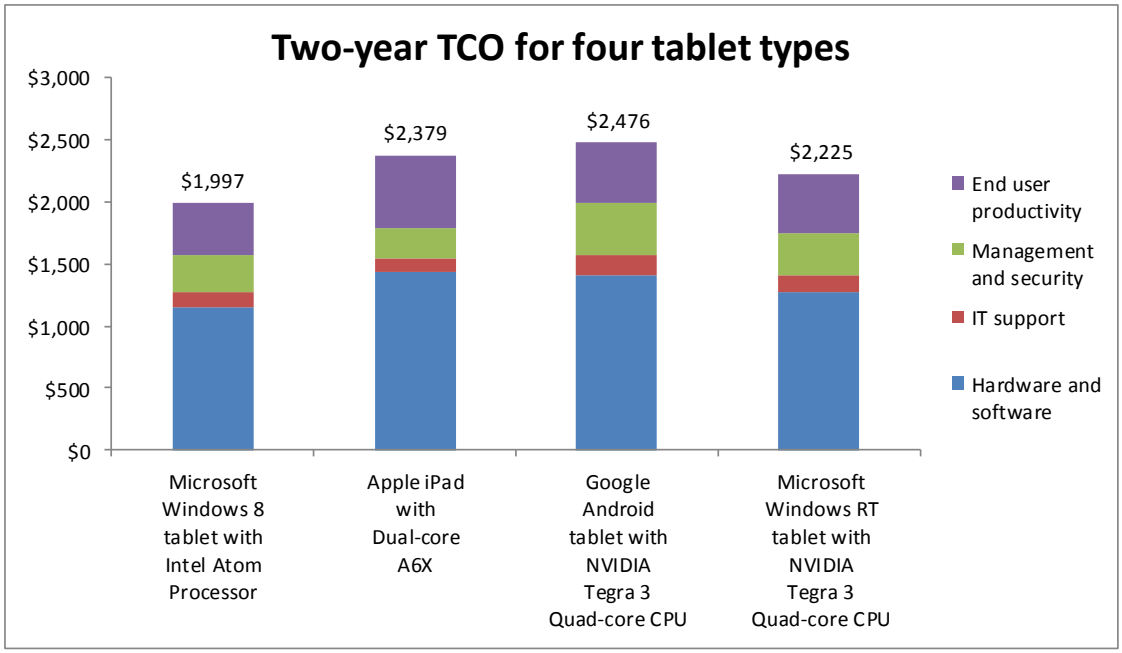


Figure 2: Total cost of ownership over two years for the four tablets we analyzed.

In Appendix A, we provide the details of our analysis and the assumptions we have made.

Windows 8 tablets with Intel Atom processors compared to iPad and Android devices

In our analysis, the key TCO disadvantage for iPad and Android tablets is their inability to readily run Microsoft Office software, including Microsoft Outlook®—applications that business users want to run on their tablets. Figure 3 shows the key advantages of Windows 8 tablets with Intel Atom processors over iPad and Android devices.

Windows 8 tablets with Intel Atom processors	Apple iPads and Google Android tablets
Run the same Windows applications that computers run, including Microsoft Office and Microsoft Outlook	Run apps from vendor's app stores. Some apps are customized for the tablet, while others are the same versions as run on the vendor's smart phones.
Run full version of Microsoft Office locally. In some cases, a user can share a single license between his or her notebook and tablet.	Can run Microsoft Office applications remotely from a cloud service or through a VDI desktop, but not locally. Some apps support reading and editing Office documents and spreadsheets, but are not fully compatible with Microsoft Office, and many files experience document decay.
Can be managed and secured along with other Windows computers using the latest version of popular PC management suite SCCM 2012 SP1 Can join network domains and use Remote Desktop Connection	Can be managed with Mobile Device Management (MDM) software

Figure 3: Advantages of Windows 8 tablets over Apple iPads and Google Android tablets. (Note: Windows 8 tablets with Atom processors can be also be managed by a variety of third-party tools (e.g., Fiberlink MaaS360, which includes mobile device management plus laptop management, including support for Windows 8.)

Windows 8 compared to Windows RT

In late 2012, Microsoft introduced both Windows 8 and the Windows RT operating system, which is available only with the purchase of a less-powerful ARM processor-based Windows RT tablet.

When we considered costs related to hardware and software, IT support, management and security, and end-user productivity, the representative Microsoft Windows 8 tablet with Intel Atom processor provided the lowest cost of ownership over two years. It beat out the Windows RT tablet for three primary reasons:

- the additional cost of licensing Microsoft Office under Windows RT
- the complexities of management using Microsoft Intune™
- the loss of productivity on the part of users who cannot run full versions of Microsoft Office or any local version of Microsoft Outlook on the Windows RT tablets.

Figure 4 summarizes the advantages we see in Windows 8 vs. Windows RT.

Windows 8, Windows 8 Pro, Windows 8 Enterprise	Windows RT
Available with either Intel Core processors or Intel Atom processors	Available only with the purchase of a less-powerful ARM processor-based Windows RT tablet
Runs professional versions of Microsoft Office applications, including Outlook	Includes Office Home & Student 2013 RT Preview editions of Word, Excel, PowerPoint, and OneNote licensed for non-commercial use. Enterprise use requires an additional license. Does not include Outlook or support its installation.
Runs current Windows desktop applications, third-party desktop applications, and touch-friendly Windows 8 apps (either built-in or available in the Windows Store)	Runs touch-friendly Modern UI apps created specifically for Windows RT (either built-in or available in the Windows Store)
Can be managed with Microsoft System Center Configuration Manager like a PC	Can be managed by Microsoft Intune and Microsoft Exchange ActiveSync like a smart phone
Cellular access is available as an add-on for some Windows 8 tablets, including the Lenovo ThinkPad Tablet 2	Windows Surface RT tablets have no cellular data option

Figure 4: Advantages of Windows 8 over Windows RT.

Other savings

The Windows 8 tablet with Intel Atom processor offers not only the numerous advantages we quantified in our TCO analysis, but also many other potential areas of savings we did not quantify. These include the following:

- **An organization can offset much of the cost of providing and supporting tablets if they replace existing notebooks or desktops, especially on an already scheduled refresh cycle.** IT could allow users to replace their aging notebooks or desktop systems by selecting from a range of mobile touch devices with Intel architecture and Windows 8, including tablets, detachables, convertibles, and Ultrabook™ devices with touch.
- **When a tablet serves as a companion device to an existing notebook or desktop, it is possible to save on Microsoft Office licenses.** IT can choose a version that allows a single license to cover both a user's notebook and tablet, such as the Office 365 Professional Plus that we include for the Windows RT tablet, reducing the software cost of the tablet. However, Office 365 Professional Plus lacks the complete functionality you get with a local version of Office Professional.
- **Windows 8 tablets can save the organization the cost of security breaches and penalties thanks to the robust security available through firmware, hardware, and management tools.** The cost of such tools and processes is small compared to the potential costs of data breaches or lost devices.
- **Software-application development efforts can be shared among Windows 8 and other Windows devices, including notebooks and desktops, whereas other tablets require OS-specific development for applications you want to run locally on them.** An IDC survey found that close to 80 percent of respondents reported their organizations were developing applications for iOS platforms and almost 70 percent were developing them for Android platforms for an average of two applications and two platforms.[1] Application development and support can be a cash sink for an organization, with

[1] https://www.eiseverywhere.com/file_uploads/6cb52ed13036bf97166daa5c9ff590f4_ITR_Denver_2012_Rick_Nicholson_IDC_Energy_Insights.pdf

costs ranging from tens to hundreds of thousands of dollars per application and platform depending on and the size and complexity of the app. If that development is porting in-house Windows applications to other tablet platforms, IT could save those costs by using Windows 8 tablets.

THE ENTERPRISE AND BEYOND

Our hypothetical organization for the TCO analysis is an enterprise, but the benefits of Windows 8 tablets with Intel Atom processors are not limited to large enterprises. Many of the features that benefit business IT and business users would also appeal to those in healthcare and education settings.

Windows 8 tablets with Intel Atom processors provide the security health care professionals need

In addition to the productivity and manageability benefits and TCO advantages we have discussed already, many healthcare organizations in particular could reap enormous value from the security features of Windows 8 tablets.

Health care organizations have detailed privacy and security rules and hefty fines for failure to comply. Cleaning up the mess caused by the loss of a single device that stores or has insecure access to sensitive personal data on customers or clients can cost a company millions. One study reported the average cost per record of a healthcare data breach in 2011 was $240.[2] A fine of 1.5 million dollars was recently levied for a violation of the Health Insurance Portability and Accountability Act related to the loss of as unencrypted notebook with patient information stored on it.[3] Tablets face the same rules and penalties. While some tablets store minimal amounts of data locally, they could have unprotected access to sensitive data on corporate SharePoint® or email servers or the Web. The loss or theft of these tablets jeopardizes the security of that data.

Windows 8 Pro tablets with Intel Atom processors have features that can help with compliance and help the organization avoid potentially costly security

[2] http://www.symantec.com/content/en/us/about/media/pdfs/b-ponemon-2011-cost-of-data-breach-us.en-us.pdf
[3] http://www.crn.com/news/security/240145780/hipaa-healthcare-data-breach-fines-climb-with-enforcement-boost.htm;jsessionid=79cYHbN0Youdk8GifhRh9A**.ecappj02?pgno=2

breaches. The ability of some of these tablets to provide multi-factor authentication, with options such as fingerprint readers, could provide significant benefits. In addition, Windows 8 Pro and BitLocker whole-drive encryption technologies allow you to securely protect the data on a hard disk.

Windows 8 tablets with Intel Atom processors are a win for schools and students

While Windows 8 tablets with Intel Atom processors, Windows RT tablets, Apple iPads, and Android tablets may all be used in a school environment, Windows 8 tablets with Intel Atom processors offer some important advantages. Figure 5 lists the features we expect to be of greatest concern in school and district acquisitions.

	Windows 8 tablet with Intel Atom processor	Apple iPad	Android tablet	Windows RT tablet
Hardware capabilities				
Battery life	Up to 10 hours	Up to 10 hours	9.5 hours 14 hours w/ dock	Up to 10 hours
Can recharge at a charging cart	Yes	Yes	Yes	Yes
Quick to boot and wake from sleep	Yes	Yes	Yes	Yes
Front camera	2 MP	1.2 MP	2 MP	720p HD LifeCam
Rear camera	8 MP	5 MP	8 MP	720p HD LifeCam
Manageability and security				
IT can secure and manage wirelessly	Yes, with SCCM 2012. (Others like Fiberlink MaaS360 include laptop and Windows 8 support.)	Yes, with high-end mobile device management (MDM) package	Yes, with high-end MDM package	Yes, with Microsoft Intune or third-party MDM that supports Windows RT
Custom app store that lets IT restrict app downloads	Yes, with custom Windows Store portal or SCCM 2012 Software Catalog	Yes, with Custom App Store in MDM	Yes, with Custom App Store in MDM	Yes, with custom Windows Store portal or setup store in MDM
Antivirus protection	Yes. Windows 8 includes Windows Defender antivirus and runs with third-party antivirus software.	Yes. Some MDMs provide antivirus protection.	Yes. Some MDMs provide antivirus protection.	Yes. Windows RT includes Windows Defender antivirus.
Connectivity				
Multiple options for running programs – locally, on cloud, HTML5 Web applications, via VPN, VDI, on network	Yes	Yes	Yes	Yes

	Windows 8 tablet with Intel Atom processor	Apple iPad	Android tablet	Windows RT tablet
Connectors	Lenovo ThinkPad Tablet 2 has full-size and micro USB 2.0, Mini-HDMI, Micro-SD card reader, SIM card	Lightning connector	Tablet: Micro HDMI Micro SD Card Reader Mobile Dock: USB 2.0 port SD Card Reader	USB 2.0, microSDXC card slot
WiFi	802.11 a/b/g/n	802.11a/b/g/n	802.11 b/g/n	802.11a/b/g/n
Bluetooth® wireless technology version	4.0	4.0	3.0	4.0
Cellular access	Optional pay-as-you-go mobile broadband (depends on tablet)	Optional pay-as-you-go mobile broadband	Not available	Not available
Connect to keyboard	Yes. Keyboards connect via Bluetooth or USB (included in some models, available as accessory for others).	Yes. Optional keyboards connect via Bluetooth.	Yes. Keyboard included in some models, available as accessory for others.	Yes. Keyboard included in some models, available as accessory for others.
Connect to mouse	Yes	No	Yes	Yes. Keyboard has a trackpad, Wedge Touch Mouse available as accessory.
Accessibility				
Assistive technologies adapt tablet for specific needs	Yes. Wide array of existing Windows hardware and software solutions; additional accessibility capabilities built into OS; many require Windows 8 Pro OS.[4]	Yes. Wide array of assistive software and devices to use with iPad; some developed specifically for iPad, some capabilities built in.[5]	Yes. Fewer apps and less device support; newer versions have more built in capabilities such as text-to-speech.	No. Requires Window 8 app to run; vendors may wait to develop these.
Geolocation (e.g., Find my device)	Yes, through management tools	Yes, through management tools	Yes, through management tools	Yes, through management tools

Figure 5: Tablet features of interest to those in educational settings.

[4] http://www.microsoft.com/enable/products/windows8/default.aspx
[5] http://www.apple.com/education/special-education/

While all the tablets meet most of the minimal requirements we set for a tablet in schools, the Windows 8 tablet with Intel Atom processor has the following advantages over the other tablets:

- Students can work with the same Microsoft Office and Windows apps they are likely to find in the workplace in the future or at home now.
- When paired with a keyboard or keyboard and mouse, these tablets are easier to use for creating content, including long documents.
- IT staff can manage and secure the Windows 8 tablets with the same PC management software used to manage Windows computers elsewhere in school. The best MDM solutions provide similar capabilities for managing iPad, Android, or Windows RT devices, but can add another layer of management.
- These tablets are likely to be compatible with the assistive technologies the school already uses with Windows PCs.
- Android tablets and Windows RT tablets have fewer options for assistive technology.

Appendix C provides detail about Windows capabilities for education.

SUMMARY

In our analysis, Windows 8 tablets with Intel Atom processors offer significant advantages over the other tablets as day-to-day tools for most users and offer the lowest total cost of ownership to the organization.

Windows 8 tablets let users run their current desktop applications—and the growing number of apps available in the Windows Store—while enjoying the mobility and user experience of the tablet form-factor.

The Windows 8 tablet is a win for IT, too, as they integrate with the existing infrastructure they already use to manage the organization's Windows devices. The Windows 8 tablets can simply be managed the same way as Windows notebooks.

For users whose tasks comprise mostly Microsoft Office applications and Web browsing, Windows 8 tablets could replace a notebook or desktop system, at a much lower cost. Finally, selecting Windows 8 tablets can save on application development costs now and on the costs of supporting the new applications in the future.

APPENDIX A – DETAILS OF OUR TCO ANALYSIS

In this appendix, we provide the details of our analysis and the numerous assumptions we have made. Figure 6 provides the specifications of the models we analyzed. None of the models allowed us to select different memory amounts.

	Microsoft Windows 8 tablet	Apple iPad	Google Android tablet	Microsoft Windows RT tablet
Model	Lenovo ThinkPad Tablet 2	Apple iPad with Retina display	ASUS Transformer Pad Infinity TF700T	Microsoft Surface RT
Processor	Intel Atom processor Z2760	Dual-core A6X with quad core graphics	NVIDIA Tegra 3 Quad-core CPU	NVIDIA Tegra 3 Quad-core CPU
Memory	2 GB	1 GB	1 GB	2 GB
OS	Windows 8 32-bit edition	iOS 6	Android 4.1. Jelly Bean	Windows RT
Display	10.1"	9.7"	10.1"	10.6"

Figure 6: The tablet models we analyzed.

Figure 7 summarizes the assumptions on which we base our analysis.

- Tablets must be 9 inches or larger with 64 GB of storage and Wi-Fi support.
- Tablets must have a keyboard and a keyboard cover, stand, or dock.
- Tablets must have two-year support with accidental damage protection.
- Tablets must allow users to read and edit Microsoft Word documents and Excel® spreadsheets, and to access documents on SharePoint and email on Microsoft Exchange.
- Each user in the organization has a Microsoft Enterprise CAL Suite license.
- TCO includes the cost of the device itself and keyboard accessories, hardware support, software and software support, deployment, user training, and help desk support.
- IT would use Microsoft System Center Configuration Manager (SCCM) 2012 Service Pack 1 to manage Windows 8 tablets, would use SCCM plus Microsoft Intune to manage Windows RT tablets, and would use a cloud-based mobile device management (MDM) tool to manage iOS and Android devices.
- We calculate costs for two-years.

Figure 7: Primary assumptions of our TCO analysis.

Hardware costs

Figure 8 shows the costs of the tablets we analyzed.

	Microsoft Windows 8 tablet	Apple iPad	Google Android tablet	Microsoft Windows RT tablet
Tablet cost (undiscounted)	$679.00	$699.00	$599.99	$699.00
Support plan	Third-party two-year Tablet Protection w/Accidental Damage from Handling Coverage $124.99	AppleCare+ with two incidents of accidental damage $99.00	Third-party two-Year Tablet Protection w/Accidental Damage from Handling Coverage $124.99	Two-year Microsoft Complete with Surface support $99.00
Keyboard	ThinkPad Tablet 2 keyboard and stand $119.99	Logitech Ultrathin Keyboard Cover $99.95	Keyboard dock $149.99	Touch cover with keyboard included N/A
Hardware subtotal	**$923.98**	**$897.95**	**$874.97**	**$798.00**

Figure 8: Hardware cost information for the four tablets we analyzed.

We include undiscounted hardware cost, two-year support cost including coverage for accidental damage, and the cost of a keyboard if the base device configuration does not include one. For the Lenovo ThinkPad Tablet 2, we cite the tablet cost from the Lenovo Web site and include two-year tablet protection from SquareTrade. We include the cost of the ThinkPad Tablet 2 keyboard and stand. For the Apple iPad, we include the cost of the tablet listed on the Apple Web site and include the cost of AppleCare+® with support for two incidents, and added the cost of a Logitech® Ultrathin Keyboard Cover for the iPad that Apple includes in the list of suitable accessories. For the ASUS Transformer Pad Infinity TF700T Android tablet, we include the advertised device list price and a two-year tablet protection plan with accidental damage from SquareTrade. We added the price for a keyboard dock from the list of accessories available for the tablet. For the Microsoft Windows RT tablet, we included Microsoft's advertised price for the tablet and two-year Microsoft Complete with Surface support plan. The hardware and hardware support prices for the four devices were within a $125.98 range, with the Windows RT tablet lowest at $798.00 and the Windows 8 tablet highest at $923.98.

Software costs

Figure 9 details the software costs for each tablet.

	Microsoft Windows 8 tablet	Apple iPad	Google Android tablet	Microsoft Windows RT tablet
Microsoft Office	Microsoft Office Home and Business 2013 $229.00	OnLive Desktop Plus $4.99/mo. for 24 mos. $119.76	OnLive Desktop Plus $119.76	Office 365 Professional Plus at $20.00/mo. $480.00
Microsoft SharePoint access	Included in CAL suite N/A	SharePlus SharePoint app $19.99	SharePlus SharePoint app $19.99	Included with Office 365 N/A
Cloud storage	Not needed N/A	Dropbox Pro 200 at $199.00/yr for 2 yrs $398.00	Dropbox Pro 200 at $199.00/yr for 2 yrs $398.00	Not needed N/A
Software subtotal	**$229.00**	**$537.75**	**$537.75**	**$480.00**

Figure 9: Software cost information for the four tablets we analyzed.

We chose software that would allow access to Microsoft Office, Microsoft Exchange, and SharePoint for each platform, either locally or cloud-based. We assume each user has a Microsoft Enterprise CAL Suite license. For the Windows 8 tablet, we chose Microsoft Office Home and Business 2013, using the price in the Lenovo configurator for the ThinkPad Tablet 2. For the Apple iPad, we chose OnLive Desktop, which is available for both the iPad and Android platforms. A free version accesses a cloud desktop with Microsoft Word, Excel, and PowerPoint®. A $4.99 per-month service plan adds Dropbox support, priority access, and other features. Competitor CloudOn is currently free. The CloudOn app accesses cloud-hosted copies of Microsoft Word, Excel, and PowerPoint. We include the OnLive Desktop Plus $4.99 per month service plan in the cost analysis because we expect that over the two years of this model, apps that are currently free will introduce tiered pricing, as CloudOn has said it might, and leave only basic features in the free version. Alternatively, organizations might migrate to apps that integrate with Office 365 and will need to add its monthly cost to their budget.

For cloud storage to use with OnLive Desktop, we selected Dropbox Pro 200 because of its security.[6] We assumed the user would use the built-in iPad email app to access Exchange email. The Google Android tablet came pre-loaded

[6] We used the price per additional user of $199 per year. https://www.dropbox.com/teams/pricing

with Polaris Office, but because that software is not completely compatible with Microsoft Office, we added OnLive Desktop Plus and Dropbox Pro 200 to that solution as well. The Microsoft Windows RT-based tablet includes Office 2013 Home and Student 2013 RT Preview, but not with a commercial license, and does not include Outlook. For both, we added the cost of Office 365 Enterprise E3 plan, which provides cloud-based versions of Microsoft Office applications, plus SharePoint. Office 365 Enterprise E3 includes the right to run Office on up to five devices for a user. We assume it can be used to license Microsoft Office on the Surface RT tablet for commercial use. In cases where the tablet is a companion device, there could be some savings by sharing the license with a notebook or desktop.[7]

In this analysis, the software cost includes only Microsoft Office, Microsoft SharePoint, and cloud storage. Different software choices could yield very different TCO results. The software cost does not include additional costs associated with porting and migrating in-house applications to run on non-Intel architecture/non-Windows devices. This would add more cost to non-Intel architecture/non-Windows devices.

IT support costs

Figure 10 includes our estimate of IT support costs for the four devices. We include help desk calls, on-site repair, and time to handle devices that suffer accidental damage.

	Microsoft Windows 8 tablet	Apple iPad	Google Android tablet	Microsoft Windows RT tablet
Help desk calls	$80.00	$68.00	$112.00	$88.00
On-site repair	$12.00	$10.20	$16.80	$13.20
Accidental damage	$24.05	$33.85	$24.05	$24.05
IT support subtotal	**$116.05**	**$112.05**	**$152.85**	**$125.25**

Figure 10: IT support cost information for the four tablets we analyzed.

IT can support the Windows 8 tablets with the same help desk and repair staff and procedures in place to support Windows desktops and notebooks; no additional training is needed. Support staff use SCCM features and tools to help with diagnosis and repair.

[7] http://www.symantec.com/content/en/us/about/media/pdfs/b-ponemon-2011-cost-of-data-breach-us.en-us.pdf

Help Desk calls

For Windows 8 tablets, we assume a help-desk call-volume of one call per year at $40 per call for a total of $80 over two years.

We estimate these costs at 15 percent lower for the iPad tablets. Apps, such as those on the iPad, are less complex than desktop applications on the Windows tablets so typically require less support. However, in our model, the iPad is running cloud versions of desktop software on the Windows 8 tablets. The added costs of help desk support for the cloud applications and any connectivity problems related to them means the difference in help desk costs for iPad and Windows 8 models is not as large as it would otherwise be.

We estimate much higher costs to manage the Android tablet than iPad and Windows 8 tablet, 40 percent higher than the Windows 8 tablets. The tightly controlled iPad environment, where Apple controls the hardware and OS and vets all Apple Store apps, makes iPads easier to manage and support compared to Android tablets, which are a part of the highly customizable, less controlled, open source environment of the Google Android. Android users need more support to understand Android apps, which have more options and have UIs that may not be cohesive. Apps can also cause problems for which users need support. Because apps are not sandboxed as they are on the iPad, the possibility of apps interfering with one another is greater. Because apps are not vetted, the likelihood of malware is higher. All of this adds to help desk volume even if IT supports only one tablet model. An IT department managing more than one Android tablet model incurs the added costs of keeping track of features and capabilities of the different devices and OS versions.

We estimate the Windows RT tablet will require 10 percent more help desk support than the Windows 8 tablet. Many of the support requests will come from users confused about differences between the Microsoft Office RT and RT email apps and the Office and Outlook versions they run on other PCs.

On-site repair

We assume most hardware repair work is handled by the hardware support plan vendors. On-site repair will be escalations of help desk calls. For Windows 8 tablets, we estimate $200 per repair incident for on-site repair and assume that 3 percent of tablets require one repair a year, at an average cost across all deployed tablets of $12 over two years. We expect iPad costs to be

lower and Android and Windows RT tablets to be higher in the percentages and for the same reasons as they are for help desk calls.

Accidental damage

We assume that 10 percent of all tablet models suffer some form of accidental damage per year and that a system administrator averages 3 hours per incident to diagnose the problem, back up and wipe the device, send it for repair, configure a loaner, and redeploy the tablet after repair. We estimate the average cost per incident at $120.25[8] and an average cost, across all the deployed Windows 8 tablets, of $24.05 over two years per device. For the iPad, we add one-tenth of the $49 Apple charges for accidental breakage per incident year.

Management and security costs

Figure 11 shows our estimates of management and security costs for the four devices.

	Microsoft Windows 8 tablet	Apple iPad	Google Android tablet	Microsoft Windows RT tablet
Management and security	$307.80	$246.24	$430.92	$341.66

Figure 11: Management and security cost information for the four tablets we analyzed.

We assume IT staff uses a capable cloud-based MDM to manage and secure the iOS or Android devices, uses SCCM SP1 for the Windows 8 tablets, and uses the latest Windows Intune update for the Windows RT tablets.

We estimate the cost for the Windows 8 tablet based on our experience with Windows notebook management costs. IT can move smoothly into managing Windows 8 tablets and keep costs low because IT administers Windows 8 tablets with the same tools and best practices it uses to administer notebooks and desktops. We assume one administrator per 500 clients for Windows 8 tablets.

We do not find even the most capable MDMs to be as easy to use or as feature rich as SCCM and other leading PC management tools. Even so, we estimate the Apple iPad will have a 20 percent lower administration cost than

[8] We calculated cost for this task based on the average salary plus benefits for a System Administrator I of $76,950.00 as reported by Salary.com and 1,920 working hours per year, averaging about $40.08 an hour.

the Windows 8 tablet because it will be running critical applications in the cloud rather than locally. This makes it easier to manage, but limits user access to the locations covered by Wi-Fi. For the Google Android tablet, we assume 40 percent higher administration costs than the Windows 8 tablets because administration is complicated by the problems we discussed earlier with OS updates and differences in OS versions and because we find the security features of Windows 8 and the Intel Atom processor to be superior to those on the Android. For the Windows RT tablet, we assume an 11 percent higher cost than for the Windows 8 tablet because Windows RT tablets run a consumer version of Microsoft Office, do not run Microsoft Outlook directly, and lack some of the capabilities users expect from Windows devices, adding to user confusion and management complexity. These devices also have to be managed with an MDM such as Microsoft Intune, rather than the SCCM software used for other Windows 8 devices, which adds a layer of complexity and additional cost.

End-user productivity costs

We include end-user time costs in the end-user productivity estimate. Figure 12 shows our estimates of user downtime and training time for the various devices and the costs of that time.

	Microsoft Windows 8 tablet	Apple iPad	Google Android tablet	Microsoft Windows RT tablet
Lost productivity due to downtime	$300.00	$375.00	$270.00	$270.00
Cost of lost productivity on all but high-performance Windows 8 platform	N/A	$90.00	$90.00	$90.00
Training time	$120.00	$120.00	$120.00	$120.00
End-user productivity subtotal	**$420.00**	**$585.00**	**$480.00**	**$480.00**

Figure 12: User downtime cost estimates for the four tablets we analyzed.

Lost productivity due to downtime

We estimate the average hourly salary plus benefits of users at $60 per hour. We include an estimate of lost productivity due to hardware or software problems, connectivity problems, missing features (such as mouse support and multi-tasking on the iPad), and the time end users spend fixing their tablets and installing their software. We assume a base of 5 hours lost productivity for the Windows 8 system (compared to doing the same tasks on their laptop or desktop PC). Much of that lost time is due to two factors:

- They will lose time in the first weeks of using their tablets as they get used to Windows 8.
- They will spend some time on self-support for hardware and software issues.

We expect 6.25 hours lost productivity for iPad users. While they will likely spend less time on self-support, we see three substantial causes of lost productivity for the iPad:

- Because it does not support both a mouse/trackpad and a physical keyboard, most users lose efficiency compared to doing these tasks with a Windows PC or tablet.
- Because it does not support true multitasking, users cannot open two documents side by side for reference or easily cut and paste between documents.
- Users cannot use the cloud versions of Microsoft Office applications to do their work when they are out of range of Wi-Fi. With Windows 8 tablet, the user can run local applications, such as Word and Excel, away from their Wi-Fi connection.

We expect 4.5 hours of lost productivity for users of the Android tablet, which can support both a keyboard and mouse and can open two applications side by side. We see two key causes of lost productivity:

- As with the iPad, users can use the cloud applications only when Wi-Fi is available.
- Users will spend some amount of time on self-support.

We estimate the Windows RT tablet at 4.5 hours lost productivity. On the positive side, the Windows RT tablet can support both a keyboard and a mouse,

can open two applications side by side, and has the Office RT apps installed locally so the user can work with those away from a Wi-Fi network. On the negative side, users can lose time debugging and self-supporting software and hardware problems. We see two key causes of lost productivity:

- Users will spend some time on self-support issues, as they would with the Windows 8 tablet.
- Users will need some time to get used to Windows RT.

Cost of lost productivity on all but high-performance Windows 8 platform

This category of lost productivity is related to device and software performance. We estimate that users suffer at a minimum one and a half hours in lost productivity compared to the higher-performance Windows 8 platform with the iPad, Android, and Windows RT devices. The cloud versions of Microsoft Office applications are much more sluggish that the local versions on the Windows 8 tablet.

Training

We also add two hours per user for training on each device at the same $60 per hour average salary.

APPENDIX B: ENTERPRISE TABLET COMPUTING: AN OVERVIEW

In this appendix, we summarize the tablet options available to organizations and look at some of the issues they must consider. While our focus is on enterprises, most of the same features that benefit business IT and business users would have the same value for those in healthcare and educational settings.

The changing landscape

Over the past couple of years, tablets have moved quickly from consumer devices to essential tools for workers. Experts expect the tablet market share to continue to grow in the next few years. Headlines suggest that 2013 may be the year of the tablet—tablets may outsell notebooks this year.[9] Global sales forecasts for tablets range from IDC's recent estimate of 282.7 million sales in 2016[10] to Forrester's estimate that sales will top 375 million that year.[11]

Whether the tablets are purchased by employers or by workers themselves—known as BYOD or bring your own device—they are typically used as both personal and professional devices and are companion devices, supplementing workers' notebooks and desktop systems. Tablets appeal to workers because of their portability, ease of use, long battery life, and the applications they run. Enterprises are starting to embrace them, but they can be an enormous corporate expense.

A 2011 IDC survey found that 49 percent of enterprises provided tablets for employees—primarily executives, sales, and IT staff.[12] That percentage continues to grow. Gartner anticipates that by 2016, tablet purchases by businesses will triple.[13]

Even when employees provide their own devices, the costs to enterprises can be significant. Enterprises must pay to manage and secure tablets and the corporate data they can access. They incur additional costs delivering content

[9] http://www.hindustantimes.com/technology/IndustryTrends/2013-will-be-the-year-of-the-tablet/SP-Article1-962677.aspx

[10] http://www.idc.com/getdoc.jsp?containerId=prUS23833612

[11] http://blogs.forrester.com/node/8252

[12] https://www.eiseverywhere.com/file_uploads/6cb52ed13036bf97166daa5c9ff590f4_ITR_Denver_2012_Rick_Nicholson_IDC_Energy_Insights.pdf

[13] http://techcrunch.com/2012/11/06/gartner-1-2-billion-smartphones-tablets-to-be-bought-worldwide-in-2013-821-million-this-year-70-of-total-device-sales/

and applications to tablets and providing help desk support for them. For example, a business might adopt thin client solutions such as cloud hosting, virtualized desktops so that workers can run desktop applications on their tablets, or invest in file-sharing solutions designed for mobile platforms so that workers can access their work files on their mobile devices. Creating tablet-specific applications can greatly increase the enterprise's development costs. These software, management, and development costs add up. The total cost of ownership of a tablet to the enterprise may equal or exceed the cost of a notebook or desktop. This expense is usually on top of the expense for a worker's notebook or desktop system and smart phone.

In December 2012, Forrester reported on a survey that showed that among business users, 33 percent used Apple tablets, 22 percent used Android tablets, and 10 percent used Microsoft Windows tablets.[14] This Apple and Android dominance in the business tablet market may be short-lived with the release, roughly coincident with this survey, of two new Windows operating systems for tablets.

In late 2012, Microsoft released Windows 8, which runs on both PCs and tablets. Several vendors have released Windows 8 tablets with Intel architecture. In addition to the tablet form factor, a variety of other mobile touch devices with Intel architecture and Windows 8 are available, including convertibles, detachables, and Ultrabook devices that give enterprises the ability to choose the type of device and OEM that best suits their needs.

The tablet market

Windows 8 tablets have advantages over the two leading tablet vendors' Apple iPad and Google Android tablets, as well as the new Windows RT. Below, we describe and compare the tablets. We group the Apple iPads and Google Android devices because they are both mobile devices that have emerged from the consumer market into the organization. Windows 8 tablets trace their lineage from enterprise-ready notebooks and desktops. Windows RT straddles the line—its background is Windows, but seems to target consumers rather than the enterprise.

[14] http://go.bloomberg.com/tech-blog/2012-12-18-more-people-would-rather-have-no-tablet-than-an-android-tablet/

Window 8 tablets

Windows 8 runs on a variety of devices including PCs, Ultrabook devices, convertibles, tablets, and more. Windows 8 runs both existing Windows 7 desktop software and new touch-enhanced, full-screen apps that you download from the Windows Store. Windows 8 Pro adds enhanced networking and data encryption features.

Windows 8 tablets released with Intel Atom processors provide a satisfying experience for most knowledge workers running a typical mix of browser, Microsoft Outlook, and Microsoft Office applications. For power users of those and other Windows applications, some Windows 8-based tablets can offer performance similar to an Ultrabook with 3rd generation Intel Core processors. Because it can do the work of a PC, the Windows 8-based tablet, with the addition of a keyboard and other accessories, can replace a PC for some workers and can serve as an excellent supplemental device for others. Convertibles are another strong option for PC replacement, providing the notebook and tablet experiences in one device. Convertibles that meet the requirements for Ultrabook devices are sometimes referred to as Ultrabook convertibles.

Windows 8 runs both current Windows 7 desktop applications and new full-screen, touch-friendly Windows 8-style apps. Users can supplement the built-in apps and programs with apps they download from the Microsoft Windows Store, many of which are free. Users can also install and run third-party desktop applications, including those integral to business productivity and operations.

Microsoft recently released its own Windows 8 Pro tablet, the Surface Pro, which costs $899 for a unit with 64 GB of internal storage with a touch or type cover available for an additional $120 to $130. A model with 128 GB of storage costs $100 more. A number of Intel architecture and Windows 8 mobile touch devices are available from a variety of OEMs, including thin and light tablets with the Intel Atom processor, performance tablets with the Intel Core processor, Ultrabook devices, and convertibles.

Intel showed new chips for Windows 8-based tablets at the 2013 Consumer Electronics Show. Intel announced the quad-core Intel Atom processor for tablets that they say includes improved security features, provides daylong battery life, and offers more than twice the performance of the current

generation Atom processor. Intel also announced that its 3rd and 4th Generation Intel Core processor Y Series would have an SDP (scenario design power) of 7 watts, enabling thinner and lighter designs with Intel Core processors.

Microsoft Windows RT tablets

The Windows RT operating system is available only with the purchase of a less-powerful ARM processor-based Windows RT tablet. Microsoft released Windows RT on its own Surface RT tablet and other vendors have released tablets with Windows RT. Windows RT systems run only built-in apps or apps downloaded from the Windows Store, and do not include the full features of the Windows 8 release.

Windows RT tablets compete more with the iPad in capabilities and price, while Windows 8 tablets compare more with notebooks or Ultrabook devices. Windows RT includes built-in touch-friendly apps like Mail, Calendar, Photos, Messaging, and SkyDrive. Windows RT also includes Office Home and Student 2013 RT Preview for non-commercial use and Microsoft Internet Explorer® 10. Interestingly, Windows RT does not run Microsoft Outlook—probably the most-used Microsoft Office application—locally. Microsoft released its own ARM processor-based Windows RT tablet in October, the Microsoft Surface RT. It is lightweight and has a long battery life. The base 32GB model is priced at $499. The 64GB model, which comes with a keyboard cover, is $699. Microsoft Surface RT has advantages over iPad and Android devices. It connects easily to certain printers, supports Flash, has a keyboard and touchpad for content creation, comes with a version of Microsoft Office preloaded, supports multiple user accounts, and allows true multi-tasking. It also includes a micro SD card slot for additional storage and USB 2.0 for more storage via flash drives. Several other vendors also offer or are planning to offer Windows RT tablets.

Apple iPad and Google Android tablets

Apple iPad and Android tablets are in many ways tablet versions of iPhones and Android smartphones minus the phone capabilities. The tablets and their corresponding smartphones run the same operating systems, share many of the same apps from their vendor's app store, and require the same management tools. The tablets typically have long battery lives.

Apple iPads are in their fourth generation, with the latest version being the 9.7-inch iPad with Retina display. The base configuration iPad with Retina

display costs $499, includes 16 GB of storage, and connects to the Internet over Wi-Fi networks. The most expensive configuration currently available on the Apple site, which costs $829, includes 64 GB of storage and connects to the Internet over Wi-Fi or cellular networks. Apple recently released a model with 128 of GB storage for $799. Apple recently introduced a smaller-screened iPad mini at a lower price. As with the standard iPad, the mini is available in three storage sizes—16 GB, 32 GB, and 64 GB—and two networking options, Wi-Fi only or Wi-Fi plus cellular networking.

The iPad has built-in apps such as a browser, mail, camera, eBook reader, FaceTime®, and maps. It also includes access to Apple's App Store℠ with over 700,000 apps; more apps appear every day and at least 275,000 of them have been customized for the iPad. Despite the proliferation of apps, one study found that only 111,540 of them have gained any traction.[15] App Store apps are free or nominally priced. Some apps connect to cloud-based services that charge monthly fees.

A number of vendors offer open-source Google Android OS tablets of varying sizes and capabilities. Some convertible Android tablets include detachable keyboards for ease of data entry.

At least half of the Android tablet market share comes from consumer purchases of advanced e-readers such as the popular Amazon® Kindle Fire® and Barnes and Noble Nook® tablets. These devices have limited functionality compared to other tablets and are still primarily consumer, not enterprise, devices.

Management and security for tablets

Cloud-based tasks, such as email, that users carry out on their personally owned tablets can create security issues. An IDC study found that most corporations support Web browsing or Internet access, email, and intranet access to tablets.[16] Tablets running those applications gain access to valuable corporate intellectual property, putting that data at risk. Intranet access with file browser, SharePoint, and VPN apps give them access to corporate file stores. File-hosting services and apps let workers move files from secure corporate

[15] http://www.pcmag.com/article2/0,2817,2413376,00.asp

[16] https://www.eiseverywhere.com/file_uploads/6cb52ed13036bf97166daa5c9ff590f4_ITR_Denver_2012_Rick_Nicholson_IDC_Energy_Insights.pdf

storage to third-party clouds. Organizations that do not address management and security for these tablets properly risk violating legal and regulatory requirements that protect data on servers and mobile devices.

Because workers rely on tablets for productivity, IT must take responsibility to keep them and their applications running just as they do the PCs in their environments. This is true of both employer-provided and BYOD devices. Tablet management requires management software and procedures.

PC management tools

For robust security and manageability, organizations have deployed and relied on PC management tools for years. IT staff can manage Windows 8 tablets in the same way, with the same tools that are likely already in place in the organization.

Mobile device management

Some organizations use Exchange ActiveSync (EAS) to control iOS and Android mobile devices. EAS is a protocol to communicate between mobile device email clients and Microsoft Exchange servers. EAS supports some useful device management features and policies, but is not a full mobile device management solution. iOS devices and the various Android devices support different capabilities. EAS can disable apps (such as the camera and browser on iOS devices), set password control, and wipe data remotely. EAS is of limited use managing Windows 8 devices. EAS does not recognize the Windows 8 device as a mobile device, so these devices can only utilize a few of the email policies via the Mail app in the start screen. In general, PC management tools manage Windows 8 devices better than mobile device management tools.

IT more efficiently manages iPad, Android, and Windows RT devices with mobile device management tools that organizations are less likely to have currently in place and that do not yet have the full set of capabilities of Windows management tools. If the organization has PC management tools in place but does not have robust MDM tools in place, managing iPads, Android tablets, and Windows RT tablets will require greater effort and carry a higher cost than managing Windows 8 tablets. For our analysis, we assumed IT managed Windows 8 tablets with SCCM 2012 and the other tablets with appropriate MDM tools.

MDM solutions manage mobile device policies, permissions, configurations, security, and other aspects of mobile device use to ensure usage complies with corporate policies and regulatory requirements. These solutions usually include both device management features and application management features, including whitelisting and blacklisting of applications, data encryption, remote control over configurations, wiping a lost or stolen device remotely, and policy enforcement.

These tools can be on-premises, appliance-based, or cloud-based, and are available from managed service providers (MSP). Many of the MDM and mobile application management (MAM) solutions do not offer the same level of management and security for the devices they manage that are available for Windows 8 devices with SCCM and other enterprise-grade manageability solutions. MDM platforms differ on features, scalability, and performance.

Not all vendors provide comprehensive mobile management and security, so organizations may have to put together a solution from multiple vendors.

Osterman Research Inc. counted more than 80 MDM vendors in mid-2012.[17] One leading vendor, AirWatch®, offers a combined mobile device management, mobile application management, and mobile email management cloud-based package. The cost is $3.25 per device per month or a one-time $50.00 fee per device with a 20 percent annual fee.[18]

Android devices add a wrinkle to management. As Bloomberg quotes a Forrester analyst, many companies do not support Android devices beyond e-mail access because Android devices support many different versions of the OS, adding complexity and cost to device management.[19] He also notes that CIOs are avoiding Android devices because they think those devices are more susceptible to malware because Google is more reactive to security problems, while Microsoft and Apple are more proactive.[20]

[17] http://www.slideshare.net/mosterman/mobile-devices-in-the-enterprise-mdm-usage-and-adoption-trends
[18] http://www.air-watch.com/downloads/pricing/mdm-pricing-na.pdf
[19] http://go.bloomberg.com/tech-blog/2012-12-18-more-people-would-rather-have-no-tablet-than-an-android-tablet/
[20] http://go.bloomberg.com/tech-blog/2012-12-18-more-people-would-rather-have-no-tablet-than-an-android-tablet/

APPENDIX C: WINDOWS 8 TABLETS IN EDUCATION

Assistive technologies

- Built-in assistive technologies such as Narrator, Magnifier, and Speech recognition in Windows 8 work with both Windows 8 applications and with desktop software.
- Assistive technology hardware and software products, such as screen readers and alternative input devices, that are compatible with Windows are likely compatible with Windows 8 or Windows 8 Professional—though likely not with Windows RT.[21]

Integration with school and district IT infrastructure

- Windows 8 tablets work well with the audio video technologies you use with other PCs, though may require special cables.
- Windows 8 tablets can print to existing network printers.
- Windows 8 is unified platform for laptops, desktops, and tablets.

Bountiful apps

- Windows 8 tablets run all of the following:
    - Windows productivity software, including Microsoft Office
    - The rich collection of existing Windows educational software, including popular free programs
    - New Windows 8 apps

Ability to control student access

- Windows 8 tablets allow individualized login for multiple users.
- IT can limit students to approved Web sites and approved apps with custom Windows Store portals.
- Remote management tools let IT control many device settings, including camera functions; monitor and restrict application and Web access; and disable camera usage or printing if desired.
- Classroom management tools give teachers control, allowing them to view student screens and monitor application and Web usage down to the keystroke while students do deskwork during class.
- Teachers can interact one-to-one with students via audio during foreign language classes or share screens during classroom discussions.

[21] Many assistive technologies will run on Windows 8 tablets, which provide USB, WiFi, or Bluetooth connectivity. Windows RT tablets, which can install only Windows Store apps, must wait for the Windows 8 apps and ARM-specific drivers for these devices. That will take time and will require vendors to be motivated by demand. Many of these assistive devices run on Windows 8 tablets, iPads, and some Android devices, while others are limited to a single platform. If you need a specific assistive device for your students, check with the vendor to see learn on which tablets and operating systems it runs.

Excellent for content creation and content consumption

- With optional keyboards, Windows 8 tablets can handle the serious work of content-creation applications.
- Some Windows 8 tablets offer pen support—excellent for active reading, digital note taking, and creating art.
- With productivity tools like Microsoft Office and the optional keyboard, students can comfortably produce long papers.
- Can operate as a digital textbook or document reader supporting multiple document formats including Kindle with additional, often free software.
- Can run apps that support the tasks students need to do on the tablets – writing, making presentations, doing research, creating multi-media, email and other communication, collaboration.

Robust administration

- IT can use the same tools and procedures they use for PCs to remotely manage devices, provide security, asset tagging, system updates, deployment, and other tasks.
- Built-in GPS lets IT find missing tablets.
- Management tools or third-party software can remotely wipe lost or corrupted tablets.

ABOUT PRINCIPLED TECHNOLOGIES

Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
www.principledtechnologies.com

We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.