WHITE PAPER

Business Computing
Endpoint Stability and Manageability

The Economic Case for the Intel® vPro™ Platform

Computing endpoints based on the Intel vPro platform can lower the total cost of ownership (TCO) over the life of the installed base

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Executive Summary

The personal computer has been central to business productivity for decades. Also central to Information Technology (IT) have been challenges in PC deployment, maintenance and support. Various analysts have reported that the TCO for a single PC can be five times its original purchase price[1]. This is largely due to maintenance costs such as reactive incident response and productivity loss due to downtime over the life of a given system.

In the modern era, computing downtime does not only impact PC users but also Internet of Things (IoT) appliances such as point-of-sale terminals, conference room PCs, or embedded manufacturing controls. These types of devices are often in the critical path to business results. The need to reduce both *incident count* and *incident resolution time* becomes paramount.

Businesses can employ various strategies to reduce the TCO for their installed base of computing endpoints. For over a decade, the Intel vPro platform has formed the building blocks for premium business computing. Platform features such as the Intel® Stable Image Platform Program (Intel® SIPP) and Intel® Active Management Technology (Intel® AMT) can help a business avoid problems and solve issues faster.

This white paper explores how the Intel vPro platform can reduce operational expenses and maximize computing uptime by improving the incident profile of deployed endpoints. This white paper also presents scenarios where investing in premium hardware and in labor for activating Intel AMT results in meaningful return on investment (ROI).

Managed IT Solutions

In a *managed* IT environment, a business can enforce corporate policies across its computing infrastructure. This may include hardware standards, common software images, security practices and other forms of asset control designed to optimize productivity and control costs. Businesses that deploy *unmanaged* computing endpoints, which is common in smaller companies, often purchase consumer devices and potentially introduce risk and higher maintenance costs as devices get older. For this reason, Intel recommends businesses of all sizes deploy *managed computing endpoints*, whether the management of these endpoints is executed internally or outsourced to a service provider.

In-band Management

When executing a managed IT environment, a business must decide what level of endpoint control is required to meet the corporation's TCO objectives. A common option is to employ in-band management. In this model, the operating system must be operational at the endpoint, and typically, the PC user must be present to interact with automated system maintenance or to collaborate with a support technician to resolve an issue. While companies can resolve a majority of incidents via in-band management tools, this approach still limits the types of problems or failures that can be fixed remotely. This creates a need for out-of-band management (Figure 1).

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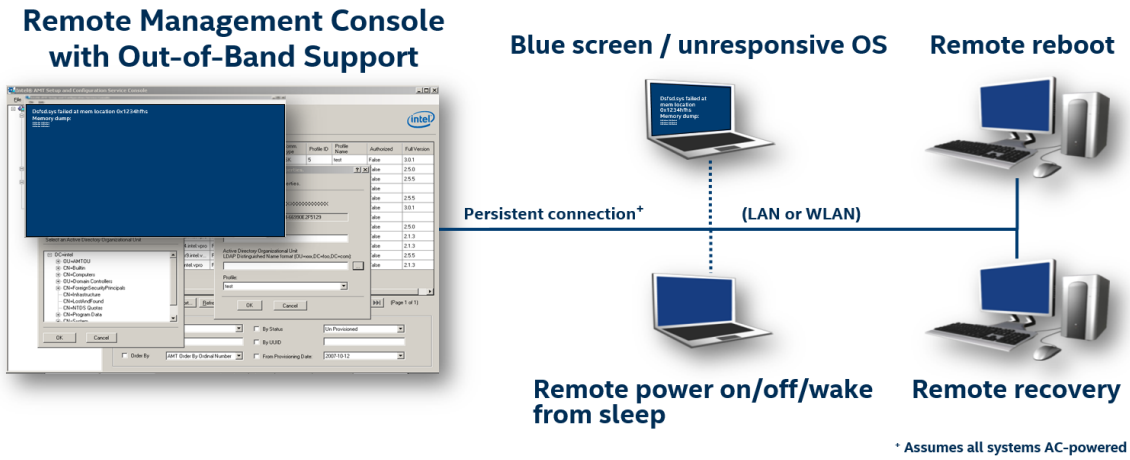

Figure 1: Out-of-Band Remote Management

Out-of-Band Management

As shown in Figure 1, an out-of-band remote management console provides the IT technician with a persistent connection to each endpoint that enables:

- Full remote control of the endpoint as if the technician were sitting right in front of the machine
- Endpoint control independent of its operating system, which could be unresponsive or even missing
- Maintaining a remote session even while endpoint reboots
- Remote power on/off or wake from sleep state
- Remote recovery from a security incident

As a result, the technician can solve a wider range of issues from updating drivers/firmware to reinstalling the operating system. A technician with full remote control can debug a system faster as a result of a support call. It is also possible to patch a system off-business hours so software updates and reboot cycles do not impact employee productivity.

Remote out-of-band (OOB) management reduces desk-side visits, on-site technical support and service center repairs, leaving those IT support mechanisms to solve only the most complex hardware issues. Today's workforce is highly distributed and most companies do not have dedicated IT support at every location. OOB management can help a company do more with tight resources.

Solving problems quickly is important to a business. For example, a small business can lose 21 hours of productivity per PC per year due to downtime on newer PCs and the number doubles for PCs older than 4 years[2].

The benefits of OOB management are even greater for IoT devices that do not have a dedicated user and may not even have a physical keyboard and mouse connected. Remote OOB is the best way to avoid "truck rolls" or on-site repairs to remote locations, where travel time may add hours or days to address an issue. The cost of endpoint downtime in an IoT environment varies greatly from a digital sign (unmet ad commitments and negative publicity) to a point-of-sale terminal (lost revenue) to a manufacturing terminal (lines down situation). Fast growth of embedded PCs into these types of appliances makes OOB management a necessity.

In conclusion, a flexible endpoint management solution should perform both in-band and out-of-band functions to bring maximum economic benefit to an organization.

The Intel® vPro™ Platform

The Intel vPro platform was created because businesses need better trusted, well-maintained productivity tools. The platform's value proposition (Figure 2) spans four pillars, including stability and manageability.

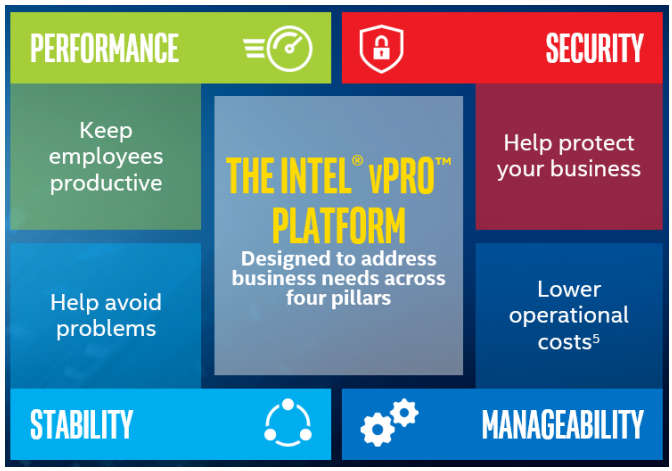

Figure 2: Intel® vPro™ Platform Value Proposition

Performance has long been the focus of PC refresh conversations due to workers losing up to ten percent of their workday due to slow computers[3]. A platform's security capabilities also have a huge impact on economic value but that topic requires its own white paper[4]. However, it is possible to couple stability and manageability to make an economic case for the Intel vPro platform because both directly impact the incident profile for a deployed computing fleet.

What is the Intel® vPro™ Platform?

- **A set of hardware, technologies and solutions utilized to build premium business computers**
- **A multi-generational platform**
- **A superset of Intel's product offering**
- **Formal requirements for mobile, desktop, workstations and IoT/embedded appliances**

Learn more at www.intel.com/vpro

Intel® Active Management Technology

With Intel Active Management Technology (Intel AMT), the Intel vPro platform provides a flexible and powerful remote management solution. Intel AMT supports both in-band and out-of-band management as described in the previous section. Its key capabilities for proactive and reactive system maintenance are listed in Figure 3.

Intel AMT can solve a wider range of issues versus in-band tools resulting in faster issue resolution for complex incidents[5]. In addition, Intel AMT has the type of system controls that allow for efficient proactive maintenance that reduces incident count and does not interfere with employee productivity[6].

Intel® AMT Proactive Maintenance Features†	
Boot Control	Ability to remotely turn a system on/off including graceful shutdown, boot to BIOS
Alarm Clock	Program devices to wake up or power on at predetermined dates and times
Power On / Remote Wake	Conduct remote maintenance and software updates even when endpoints are powered off
Hardware and Software Inventory	Poll for hardware IDs and software versions regardless of power state; faster and more accurate than manual audits
Agent Presence	Watchdog timers to ensure an agent is running, such as anti-virus software
Access Monitor	Configurable list of auditable items, audit logs and alerts; remote actions on system are recorded
Event Manager	Create and manage event filters and alerts
Environment Detection	Discovers whether endpoint is on an enterprise or public network and sets operational policies and protocols accordingly
Intel® AMT Issue Remediation Features†	
KVM Remote Control	Full keyboard/video/mouse remote control of endpoint as if sitting right in front of it, over either a wired or wireless connection
Serial over LAN (SOL)	Limited remote control of endpoint over low-bandwidth connection; enables simple background IT tasks while user continues to work
Storage Redirection	USB-R or IDE-R over Transmission Control Protocol; enables installation and booting of a PC from a standard image on the corporate network
Fast Call for Help	User-initiated remote connection
System Defense	Monitor and take action on network traffic packets, including limiting network access for a suspect system

† Not a complete list

Figure 3: Intel® AMT Feature Set

Intel® Stable Image Platform Program

Platform stability, if executed well, can be a great recipe for problem avoidance. Many IT departments go through a robust validation process before standardizing on a handful of specific products for their volume system purchases. However, it is possible for system firmware, drivers or components to change between the time of initial system validation and the deployment of future purchases of the identical SKU. When that happens, software or network compatibility issues may arise that nullify the original validation effort.

The Intel Stable Image Platform Program (Intel SIPP) was designed to address this very challenge. With Intel SIPP, each supporting system goes through a rigorous validation process aiming to provide zero changes to key platform components over a 15 month window or until the next generational release. Intel platform components included in the program include specific versions of:

- Intel® Core™ vPro™ Processors
- Intel® Xeon® Processors
- Intel® HD Graphics
- Intel® Iris™ Plus Graphics
- Intel® Chipsets (Peripheral Control Hub)
- Intel® SSD Pro Series
- Intel® Thunderbolt™ 3 Controllers
- Intel® Ethernet Connection
- Intel® Dual Band Wireless-AC

Corporations that standardize on the latest Intel SIPP offering at first availability can maximize the benefit of the program, especially if coupled with deferred deployment of Windows* 10 releases[7]. With Windows 10 version 1607 and newer, Microsoft offers servicing tools allowing corporations to delay feature updates, thus extending the validation period and improving stability within the deployed computing fleet. By deferring or pushing out adoption of the next Windows 10 release, a company can standardize on a given Intel SIPP plus Windows 10 configuration for about a year, only executing priority security updates on these platforms. This results in a consistent and predictable computing infrastructure, and therefore, reduced support incidents across the installed base.

Economic Model

A framework is needed to estimate TCO and ROI for Intel vPro platform deployments. Since the goal is to draw a comparison versus deploying non-Intel vPro-branded systems, only the cost factors that affect the comparison are included. That means TCO components such as software or administration costs are not part of this framework. This economic model focuses on hardware costs, deployment costs, and maintenance costs as shown in Figure 4. Maintenance costs are derived from incident and OS refresh costs that may occur, such as a company's initial transition to Windows 10 or corporate-wide delivery of custom system images.

TCO Component	Definition	Intel® vPro™ Platform Impact+
Total Hardware Cost (THC)	Estimated from total number of systems to be deployed and average selling prices for systems purchased	**Higher** hardware costs due to premium platform purchase
Total Deployment Cost (TDC)	Estimated from IT labor and logistics costs, where IT labor includes planning, installation and configuration time	**Higher** deployment costs due to activation of Intel AMT
Total Maintenance Cost (TMC)	Calculated by adding Total Incident Cost and OS Refresh Cost	**Lower** maintenance costs due to platform stability and manageability features
Total Incident Cost (TIC)	Estimated from IT labor costs and productivity loss due to endpoint downtime	**Lower** incident cost due to improved lifetime incident profile
OS Refresh Cost (ORC)	Estimated from IT labor, logistics costs, and productivity loss due to endpoint downtime	**Lower** cost due to remote OS installation and easier remediation of failed upgrades

+ Estimated

Figure 4: TCO Components of Economic Model

Using the variables in Figure 4, the proposed TCO formula for endpoint deployments is:

TCO = THC + TDC + TMC

where **TMC = TIC + ORC**

The proposed formula estimates full life cycle costs for a given endpoint deployment from inception up until the time the endpoints must be replaced. This enables a fair comparison of all costs involved, since Intel vPro platforms have higher up-front costs due to premium hardware and more complex deployment. TCO savings are expected to be realized through lower maintenance costs across the useful life of the installed base.

The effort to activate Intel AMT is the reason deployment costs are higher for Intel vPro platforms, especially if the business lacks experience with Intel AMT. It is not Intel AMT that is overly complex, but adapting it to complex networks is a task that can consume many hours of IT labor. The good news for a business that invests in activating Intel vPro platforms is that once the intricacies of Intel AMT are understood, subsequent deployments become much simpler and should generate even greater ROI.

Lifetime Incident Profiles

The key to the economic case for Intel vPro platforms is lifetime incident profiles. Reactive support issues throughout the usable life of computing endpoints are common. While proactive maintenance efforts help avoid trouble tickets, systems can still suffer from network or software incompatibilities, operator error, operating system malfunction, virus remediation, manufacturer errata, lost passwords and more.

From research conducted during Q3 2017, businesses reported on average 5 incidents on just the first year of a device's life, with the number of incidents increasing every year the device remained in use[8].

Figure 5 demonstrates how incidents compound over the life of a computing endpoint. When this per-device incident rate is applied to a large population of computing endpoints, the numbers can be staggering. For example, a company that has deployed 1,000 desktop PCs may see around 36,000 incidents over a 5 year period before they refresh the same desktop computers.

Typical Compounding Incident Rate Over a 5 Year Life Cycle		
Time in Service	**Incidents per Year**	**Cumulative Count**
Year 1	5 incidents	5 incidents
Year 2	6 incidents	11 incidents
Year 3	7 incidents	18 incidents
Year 4	8 incidents	26 incidents
Year 5	10 incidents	36 incidents

Figure 5: Incident Rate as Endpoint Gets Older [8]

Intel estimates that businesses solve on average 80 percent of all incidents through in-band manageability tools. That implies simple remote fixes where the issue was reported by the PC user who contacted IT to fix it and collaborated with the technician throughout the remediation process.

However the remaining 20% of support incidents tend to be complex, requiring an on-site repair or a visit to the service center if one is available. These types of problems can take hours to solve and wait time is based on the service level agreement at a given corporation. Average times for incident resolution are shown in Figure 6.

Description	Value
Avg. Time to Repair Simple Incident (T_{SI})	.55 hours
Avg. Time to Repair Complex Incident (T_{CI})	2.7 hours
Avg. Complex Incident Resolution Wait Time (T_W)	6.82 hours

Figure 6: Average Incident Resolution Times [8]

Impact of Intel vPro Platform Technologies

Intel estimates that Intel AMT and Intel SIPP combine to reduce total lifetime incident count by 10 percent due to improved proactive maintenance capabilities and improved stability that helps avoid network and software compatibility issues. In addition, Intel estimates that the OOB capabilities of Intel AMT can help the average business convert half the complex incidents into simple remote fixes, with the remaining incidents truly requiring IT hands-on service and Intel AMT often playing a role in making that determination. The impact of the Intel vPro platform on a typical incident profile is shown in Figure 7.

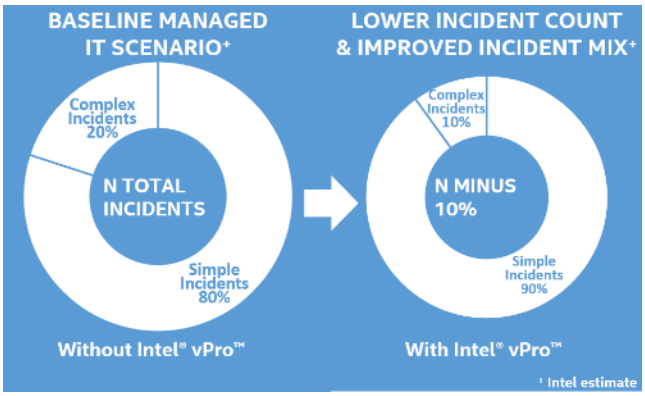

Figure 7: Incident Profile Comparison

These estimates are based on dozens of customer interviews and platform deployments over the last 10 years. In truth, incident profiles vary quite a bit. For instance, the simple incident range can be anywhere between 60 to 90 percent of all issues depending on endpoint complexity, what tools are being used, how fragmented the installed base is, or technical ability of the user making the support call. While this white paper assumes a sophisticated managed IT environment where 80% of issues are solved quickly, that may not always be the case. Businesses that have a complex incident rate higher than 20% could enjoy an even greater improvement in their IT operations with the deployment of Intel AMT.

This is because every complex incident that becomes a simple repair is likely to save a company hours in both IT labor cost and employee productivity (as shown in Figure 6). Even though on average IT can solve a complex issue in 2.7 hours, the average wait time before the incident is resolved approaches 7 hours. While most knowledge workers are not 100% dependent on their computer to be productive, this can still result in a few hours of lost productivity. For an IoT endpoint, the business loses the full value of that endpoint the entire time it remains out of service.

The overall economic impact of endpoint downtime should be in proportion to the total incident volume, whether that volume is due to a high per-device incident frequency or due to simply having a large installed base. This might explain why historically the Intel vPro platform has been a great fit for large enterprise versus small business. However, there may be scenarios where the economics demonstrate ROI even for smaller deployments.

For instance, there has been increased demand for Intel AMT in IoT uses cases. When devices do not have a dedicated user, OOB becomes the best way to service digital signs, point of sale terminals, manufacturing equipment and more. Onsite servicing of these devices is often costly or impractical, especially when computing endpoints are dispersed over a large geographic area. The combination of high repair cost and possibly even higher downtime costs can make Intel AMT a practical investment regardless how many endpoints are being deployed.

TCO Estimator Tool

Intel has created an online TCO estimator tool based on the economic model described in the previous section. The Intel vPro Platform TCO Estimator resides at the URL below:

http://estimator.intel.com/vpro

The tool estimates TCO for two endpoint deployment scenarios, one based on Intel vPro platforms and one based on similarly-configured endpoints that do not support the Intel vPro brand specification. Its outputs match the TCO components described in Figure 4. In addition, the tool computes TCO savings and resulting ROI.

TCO estimates are based on a set of inputs provided by the user of the tool. Figure 8 lists each input and how it is used.

Input Variable	TCO Impact
Number of Notebooks (N_{NB})	Used to calculate Total Number of Endpoints and estimate all other TCO values
Number of Desktops (N_{DT})	Used to calculate Total Number of Endpoints and estimate all other TCO values
Number of IoT Endpoints (N_{IOT})	Used to calculate Total Number of Endpoints and estimate all other TCO values
Endpoint Life Cycle in Years	Used to estimate Total Incidents over Life Cycle and to set limit on OS Refreshes
OS Refreshes over Life (OSR)	Used to estimate OS Refresh Cost
Incidents per Endpoint (Year 1)	Used to estimate Total Incidents over Life Cycle using an algorithm that increases incidents as endpoint gets older
Custom Image	Y or N. Used to estimate Total Deployment Cost; impacts IT planning time plus installation and configuration time per endpoint
Company Size	Used to estimate effort in activating Intel AMT
Industry	Used to estimate IT (L_{IT}) and Full Time Employee (L_{FTE}) labor costs; the user also has the option to manually enter own labor costs
IoT Endpoint Downtime Cost	Used to estimate revenue or productivity loss for IoT scenarios

Figure 8: Estimator Tool User Inputs

The sections that follow share additional details how these inputs impact the estimation of Total Hardware Cost, Total Deployment Cost and Total Maintenance Cost.

Estimator Tool Assumptions

The tool only considers the stability and manageability capabilities of the Intel vPro platform, so the user should be aware that it does not measure the performance benefits of premium hardware nor the value of security features in the platform, both of which could further make the case for standardizing on the Intel vPro platform.

The tool assumes a refresh decision has been made and new endpoints will be deployed by the business. In addition, the tool does not assume any previous experience with activating Intel vPro platform features.

Finally, the TCO estimate intentionally leaves out shared costs such as:

- Software licenses
- Management software
- Proactive maintenance
- Service center operational expenses
- IT staff

The immediate impact is that the estimated TCO for both scenarios is likely to be lower than the results of an alternative economic analysis that incorporates these cost factors. It should also be noted that deploying a sophisticated remote management practice based on the Intel vPro platform may actually result in additional economic benefits in some of these areas but that is not estimated by this tool.

Total Hardware Cost

The current version of the TCO tool uses volume by device type (N_{type}) and static worldwide average selling prices (ASPs) for each hardware type (C_{type}) to calculate Total Hardware Cost (THC) using the formula:

$$THC = N_{NB}C_{NB} + N_{DT}C_{DT} + N_{IOT}C_{IOT}$$

While there is large variance in system price points across the computing industry, static values provide a reasonable cost basis for the TCO estimator. Specifically, Intel vPro platform ASP was derived from PC sales in large business where Intel's premium platform has a high market segment share. Alternatively, non-Intel vPro platform ASP was derived from small business consumption data where the opposite is true.

Since Intel® Core™ vPro™ processors are available in i5 and i7 versions, the average of all i5 and i7 system sales was utilized to create the pricing table in Figure 9.

System Type	Q3 '17 Worldwide ASP
Desktop: Intel® Core™ i5/i7 vPro™ (C_{DT})	$814
Desktop: Intel® Core™ i5/i7 (C_{DT})	$751
Notebook: Intel® Core™ i5/i7 vPro™ (C_{NB})	$1,129
Notebook: Intel® Core™ i5/i7 (C_{NB})	$977
IoT: Intel® Core™ i5/i7 vPro™ (C_{IOT})	$972
IoT: Intel® Core™ i5/i7 (C_{IOT})	$864

Figure 9: System Price Points Used by TCO Estimator [9]

While notebook and desktop prices stem directly from third party research, the IoT endpoint ASPs on Figure 9 are estimated to be the midpoint between notebook and desktop prices.

Total Deployment Cost

The tool estimates Total Deployment Cost (TDC) from IT labor (L_{IT}) and logistics (L) expenses incurred during the initial customization and integration of computing endpoints into the workplace. IT labor spans three time-consuming tasks – deployment planning (T_P), endpoint software installation (T_I) and endpoint configuration (T_C). The resulting equation is:

$$TDC = L_{IT}(T_P + T_I + T_C) + L$$

While the equation itself is relatively simple, its implementation within the estimator includes additional adjustments:

- All cost factors must scale with the number of endpoints being deployed
- Planning time scales with the order of magnitude of the deployment (1x for tens, 2x for hundreds, 3x for thousands, 4x for tens of thousands, 5x for 100Ku+) because the tool assumes larger deployments involve more device types, configuration options, geographically-dispersed endpoints, quotations and other factors that impact the planning time
- Configuration and logistics costs scale with every unit being deployed
- Software installation time assumes up to 10 endpoints are completed in parallel
- Custom images increase the time values on Figure 10 according to these multipliers: planning time (3x), installation time (3x) and configuration time (2x)
- For the Intel vPro platform scenario, IT labor hours for activating Intel AMT are added to the planning time, with hours increasing based on company size

The static values that form the basis of the TDC estimate are shown in Figure 10. IT hourly labor variables are populated from Intel research or users of the tool can enter their own labor cost assumptions.

Variable	Static Value
Avg. Deployment Planning Time (T_P)	2.04 hours
Avg. Installation Time per PC (T_I)	1.45 hours
Avg. Configuration Time per PC (T_C)	.79 hours
Avg. Deployment Logistics Cost per PC (L)	$91

Figure 10: Static Values for Estimating Deployment Cost [8]

Total Maintenance Cost

As described in Figure 4, Total Maintenance Cost is estimated by adding Total Incident Cost and OS Refresh Cost. In both cases, IT labor and productivity loss at the endpoint must be included in the estimate. In addition, the endpoint life cycle (in years) becomes a critical factor, as it helps determine total incident count and how often system software might be upgraded across the installed base.

The Total Incident Cost (TIC) equation is based on the lifetime incident profiles described earlier. It first estimates total incident count based on volume, life cycle and first year incidents per endpoint as entered by the user. Then it categorizes simple (I_S) versus complex (I_C) incidents using the 80/20 assumption (Figure 7). Finally, it multiplies the incident resolution values from Figure 6 (T_{SI}, T_{CI} and T_W) times the cost of IT (L_{IT}) or Full Time Employee (L_{FTE}) labor.

The resulting formula is:

$$TIC = L_{IT}\,(I_S T_{SI} + I_C T_{CI}) + L_{FTE}\,(I_S T_{SI} + I_C T_{PL})$$

where $T_{PL} = \frac{1}{2}\, T_W$ for notebooks/desktops

and $T_{PL} = T_W$ for IoT endpoints

The variable T_{PL} indicates endpoint productivity loss for complex incidents, and this is different for user devices versus IoT endpoints. For user devices, productivity loss is estimated at 50% of the wait time, given most workers are only partially dependent on their PCs to be productive. For IoT endpoints, the entire issue resolution wait time is considered downtime that results in revenue or productivity loss. In addition, the estimator replaces the L_{FTE} variable with a user-entered hourly IoT endpoint downtime cost, which can vary greatly by industry or use case.

The Intel vPro platform scenario utilizes the same TIC formula except it applies the incident count and incident mix assumptions from the comparison in Figure 7.

OS Refresh Cost (ORC) is estimated similarly to Total Deployment Cost except it adds productivity loss at the endpoint. Planning time is part of the IT labor portion of the formula but it is omitted from the endpoint side. The user of the tool directs how many OS refreshes to simulate (OSR input) which can be zero for devices that are locked down after deployment. The ORC estimator formula is:

$$ORC = OSR\,[L_{IT}\,(T_P + T_I + T_C) + L + L_{FTE}\,T_{PL}]$$

where $T_{PL} = \frac{1}{2}\,(T_I + T_C)$ for notebooks/desktops

and $T_{PL} = T_I + T_C$ for IoT endpoints

Like with the TDC formula, all cost factors scale with the number of deployed endpoints in the manner described on the previous page. As with the TIC estimation, the L_{FTE} value is populated by either employee hourly labor or hourly IoT endpoint downtime cost. The same 50% productivity hit assumption is made for users of notebooks and desktops.

The Intel vPro platform scenario removes logistics cost from the equation because the system image is updated remotely versus the hardware having to go to back to IT for updating. As mentioned on Figure 3, Intel AMT has a feature called IDE Redirection that allows a remote upload of a system image residing anywhere on the corporate network, such as from an IT server, onto an Intel AMT-enabled computing endpoint.

Test Cases

Intel utilized the online TCO estimator to simulate typical deployments across businesses of different sizes. The online tool can be used to evaluate a wide variety of scenarios with a supported total number of endpoints ranging from 10 to 150,000. It also allows a refresh rate between 3 and 10 years, with the longer endpoint life cycles intended for IoT scenarios. The full list of user controls is described in Figure 8 of this document.

Large Business Scenario

The following test case considers a large business that is refreshing 675 endpoints consisting of 500 notebooks, 150 desktops and 25 IoT devices, all with a custom software image. IoT devices would span factory controls, digital signs and conference room PCs.

The scenario uses an industry average 5-year life cycle and assumes the operating system will be updated to a newer version twice during the life of the installed base. An average of 4 incidents per computing endpoint is assumed for the first year of deployment, which scales to over 19,000 total incidents over the 5 years the devices remain in use. Industry average salary data was selected and productivity loss from IoT endpoint downtime was estimated at $100 per hour.

The results of this scenario are shown in Figure 11. Estimated TCO savings were over $500,000 (17%) and the ROI on Intel vPro platform expenses was over 5 times the initial investment in higher hardware and deployment costs ($91,237 into $500,241).

Variable	Without Intel® vPro™	With Intel® vPro™
Total Cost of Ownership	**$3,012,392**	**$2,512,151**
Total Hardware Cost	$622,750	$710,888
Total Deployment Cost	$125,096	$128,195
Total Maintenance Cost	$2,264,546	$1,673,068
Total Incident Cost	$1,825,437	$1,304,023
OS Refresh Cost	$439,109	$369,045

Figure 11: TCO Results for Large Business Scenario

As theorized in the economic model, the value for the Intel vPro platform is captured via lower maintenance costs over the life of the installed base. It is also important to note that deployment cost is ultimately a small fraction of the total cost of ownership and that the extra hours invested in activating Intel AMT are easily amortizable over this type of deployment, which is also the default scenario presented by the Intel vPro Platform TCO Estimator on first use.

Small Business Scenario

The next scenario ponders whether the Intel vPro platform offers value to a small financial services firm deploying 20 notebooks and 10 desktops with no custom image over a shorter 4 year life cycle. This use case suggests a set of demanding users, therefore, the scenario assumes six incidents per device on the first year (users need support every other month) and only one OS refresh over the 4-year life of the installed base. The results are intriguing.

As shown in Figure 12, the Intel vPro platform resulted in estimated TCO savings of 20% and an ROI of nearly 7 times the initial investment. These returns are even better than the previous large business scenario. The reasons for this are:

1. The higher cost of Intel vPro-branded hardware has a lower impact over a small 30 unit volume
2. The "Without Intel vPro" scenario already assumes a managed IT environment; the costs to make the jump from unmanaged IT to managed IT are not captured
3. This scenario has an increased incident count per device
4. The cost of endpoint downtime was higher due to salary assumptions for the financial services industry

Variable	Without Intel® vPro™	With Intel® vPro™
Total Cost of Ownership	**$145,889**	**$117,081**
Total Hardware Cost	$27,050	$30,720
Total Deployment Cost	$4,414	$4,998
Total Maintenance Cost	$114,425	$81,363
Total Incident Cost	$107,911	$77,487
OS Refresh Cost	$6,514	$3,876

Figure 12: TCO Results for Small Business Scenario

While not all small business scenarios will see the same economic benefit, Intel recommends that decision makers model their own deployment plans to determine fit. The data may also help with a decision to outsource IT.

Very Large Business Scenario

The third scenario depicts a very large tech/telco business deploying 10,000 notebooks and desktops (5ku each) with a custom image and simulating the lifetime incident profile from Figure 5 (an incident rate starting at 5 per device with a 5 year life cycle, which was a common scenario based on primary research). This scenario also assumes two OS refreshes per computer on average over the life of the installed base.

Variable	Without Intel® vPro™	With Intel® vPro™
Total Cost of Ownership	**$53,496,923**	**$43,547,852**
Total Hardware Cost	$8,640,000	$9,715,000
Total Deployment Cost	$1,921,362	$1,929,373
Total Maintenance Cost	$42,935,561	$31,903,478
Total Incident Cost	$36,242,879	$26,098,324
OS Refresh Cost	$6,692,682	$5,805,154

Figure 13: TCO Results for Very Large Business Scenario

Figure 13 demonstrates that with higher costs also come meaningful TCO savings. Large deployments can cost tens of millions of dollars due to significant maintenance costs. In these situations the Intel vPro platform delivers optimal ROI potential, with estimated TCO savings approaching $10 million dollars and a return of over 9 times the initial investment for this particular deployment.

Further Comments on TCO Results

The estimator tool can simulate a wide range of deployments but not all possible scenarios support a decision in favor of the Intel vPro platform. For instance, a low ROI result can be expected for endpoint deployments with abnormally low incident rates or when endpoints are refreshed faster than industry average. Since companies have different metrics for what constitutes great ROI or what TCO savings are meaningful, Intel encourages a thorough investigation.

As stated earlier, the estimator does not measure all benefits of the Intel vPro platform. A low ROI result from this tool is not the end of the evaluation when performance or security features are a factor in the buying decision.

Outsourced IT

The Intel vPro platform offers benefits in an outsourced IT scenario. First, the service provider responsible for system maintenance should see a reduced incident count and faster issue resolution times, and therefore, could generate better margins from a services contract. This can become a catalyst to developing a device as a service (DaaS) practice.

Secondly, the business that outsources IT also benefits when a remote repair solves an issue faster without the need of an on-site visit. A business considering outsourcing IT could use the estimator to approximate endpoint downtime costs. This can be done by choosing the "Custom" option under Employee Costs to reduce the IT hourly salary to a minimum ($1) so the resulting Total Maintenance Cost becomes an indicator of productivity loss due to endpoint downtime.

Installed Base of Intel® vPro™ Platforms

Businesses that have already invested in Intel vPro-branded systems could use the estimator to help inform an Intel AMT activation decision.

For instance, they could estimate Total Maintenance Cost for their installed base and ignore the Total Hardware Cost in the TCO comparison. Hardware costs far exceed deployment costs in the TCO breakdown. Which means that if hardware is considered a "sunk cost" and the expected maintenance savings are only pitted against the deployment costs, the resulting ROI should be very appealing and convince the business to take a deeper look into activating Intel AMT.

For example, using the scenario in Figure 13, the difference in deployment cost was approximately 160 hours of IT labor (just over $8,000) for activating Intel AMT across 10,000 endpoints in a complex network. A company could save millions of dollars in maintenance costs as a result of a relatively small investment in IT labor, even when activating Intel AMT years into the life cycle of the installed base.

Activation Considerations

Deployment costs are ultimately a small portion of the lifetime TCO for a given deployment, and part of that cost could include activating the manageability features of the Intel vPro platform. The time invested on Intel AMT activations can vary greatly from one company to the next. This is because adopting the Intel AMT end-to-end architecture (Figure 14) can be a challenge on complex networks.

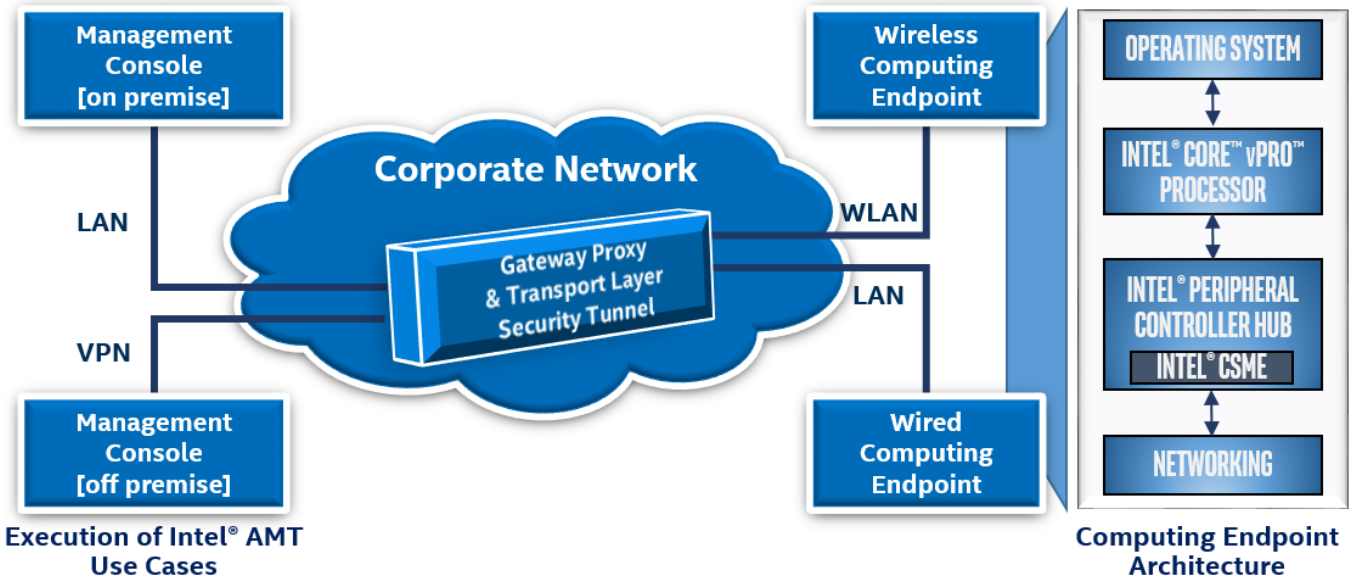

Figure 14: Typical Intel® AMT End-to-End Architecture

As Figure 14 indicates, the typical end-to-end architecture for Intel AMT uses an encrypted connection, established by the Transport Layer Security (TLS) protocol, from the management console to the target computing endpoint. The management console can be on-premise or off-premise (such as in the case of outsourced IT), which then would connect via a Virtual Private Network (VPN).

The computing endpoints can be on a wired or wireless local area network (LAN), with the network connection controlled by the Intel® Converged Security and Management Engine. The Intel® CSME resides within the Intel® Peripheral Controller Hub. It is an energy-efficient computing subsystem that enables hardware-based capabilities such as the out-of-band feature of Intel AMT, offering system access via a persistent network connection that functions independently of the operating system.

In order to successfully implement this end-to-end architecture, an IT program manager must coordinate between various administrators for:

- Network infrastructure: Domain Name Servers (DNS), Internet Protocol port settings, firewall settings
- Public Key Infrastructure (PKI): organization-specific security certificates, enabling of TLS
- Microsoft SQL database: services such as tracking client configuration profiles
- Microsoft Active Directory*: Intel AMT systems require their own unique entry

These activities impact the Total Deployment Cost for Intel vPro platforms by adding hours of IT labor, with the exact hours dependent on network complexity, number of endpoints, and experience level of the IT staff performing the described functions.

Conclusion

The acquisition of Intel vPro platforms and the subsequent activation of their remote management capabilities can deliver lower TCO and meaningful return on investment for a wide range of deployment scenarios across businesses of all sizes. Together, Intel SIPP and Intel AMT can reduce both incident count and resolution time, resulting in a more cost-effective lifetime incident profile for a given installed base of computing endpoints. By helping avoid problems and solving issues faster, Intel vPro platforms can help a business run more smoothly.

Intel Recommendations

- **Deploy managed computing endpoints with a flexible solution that incorporates both in-band and out-of-band capabilities**
- **Standardize on the Intel vPro platform for computing endpoints that deliver better performance, stability, manageability and security features**
- **Activate manageability features in Intel vPro platforms to help reduce TCO**
- **Access the Intel vPro Platform TCO Estimator to simulate endpoint deployments**

Learn more at estimator.intel.com/vpro

Where to Get More Information

For more information about the Intel vPro platform visit: http://www.intel.com/vpro

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