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Applying Thought

Expand and Enhance Health IT Capabilities While Reducing Healthcare Operating Costs with Medical Devices Using Intel® Active Management Technology

As increasing financial pressures are placed on the healthcare industry from rising technology costs and an aging population, US healthcare providers need solutions that can meet the ever-present demand for improved patient care without breaking the bank. Healthcare providers are turning to the implementation of health IT to streamline their organizations on both the cost and patient care fronts. With this increasing role in healthcare, health IT departments are in position to be major drivers of added value and differentiation for their organizations.
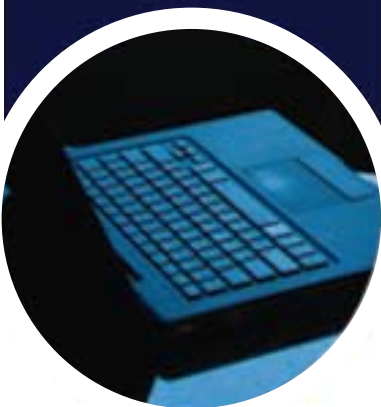
One solution for health IT is the use of electronic medical devices that utilize the enhanced management capabilities offered by Intel® Active Management Technology (Intel AMT). Intel AMT is a set of hardware-based capabilities that expand and enhance the ability of health IT to remotely monitor, maintain, and repair medical devices. While there are currently no medical devices that utilize this technology, this study will detail both the hard and soft benefits that medical devices using this technology would provide to healthcare organizations.

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EXECUTIVE SUMMARY

Wipro Consulting Group's Product Strategy and Architecture Practice conducted interviews with 17 North American healthcare providers and medical equipment vendors to assess the costs associated with supporting electronic medical devices and to understand the current technological trends involving IT in healthcare.

The insights from this research into the cost structures of medical device support were combined with Wipro's knowledge of the benefits of Intel Active Management Technology for PCs and other similar electronic devices to create a return on investment calculator specifically for the healthcare industry.

In order to demonstrate the financial benefits of Intel Active Management Technology-enabled medical devices for healthcare organizations, Wipro estimated savings for a representative health IT organization overseeing 2,835 electronic medical devices of which 61% were connected to the organization-wide medical IT network. The average life of these devices was four years and there were 22 different vendors from which they were procured. The impact of rolling out medical devices using Intel AMT according to the existing 4-year life cycle was a net benefit of $659,008 over four years, which translates to a net present value (NPV) of $551,225 for the investment or 152% internal rate of return (IRR).[i,ii] This ROI breaks down as follows:

- o 19% of the return on investment is due to the reduction in on site break fixes for less specialized medical devices such as infusion pumps and central patient monitors.
- o 12% of the financial benefit is from the reduction in costs associated with medical device management and tracking activities, such as the manual resolution of inventory failures and patch deployments.
- o The remaining 69% of savings is a result of the reduction in cost of managing a complex electronic medical device infrastructure through standardization on an Intel hardware platform that is AMT-compatible.

Furthermore, the enhanced remote diagnostic capabilities of AMT can also reduce the downtime of specialized medical equipment such as MRI machines, which can create a potential savings of as much as $40,000 per day of downtime eliminated.

Intel AMT also provides soft benefits for healthcare providers. By purchasing medical devices that employ AMT technology, healthcare providers can better adapt to industry trends in the following ways:

- AMT provides solutions to technical compatibility and security barriers that healthcare organizations face in the integration of medical devices onto the medical IT network.
    - o The use of AMT-compatible Intel hardware allows devices to be more readily integrated into the medical IT network and enables management with AMT-compatible remote management tools that are already commonly used by healthcare organizations.

  o AMT provides unique security enhancements through the use of out of band communication to isolate, remediate, and re-connect compromised devices through remote network reconfiguration.

- AMT can provide manageability and reliability enhancements for portable medical devices such as portable or cart based ultrasound systems or ePCR (Electronic Patient Care Reporting) systems, which are being used in innovative ways to raise the quality of patient care.

  o Health IT can proactively push updates and security patches to portable medical devices, even if they are powered off, to maintain optimal performance and reduce vulnerability to software-based malfunctions and attacks.

  o Device failures can be dealt with swiftly through AMT's enhanced diagnostic and repair capabilities to minimize life threatening repercussions of device malfunctions.

INTRODUCTION

Healthcare in the US is under extreme pressure as healthcare delivery costs rise along with the quality of healthcare demanded by consumers. The IT department has the potential to create value for its healthcare organization by leveraging today's tools to cut costs and improve patient care.

In 2007 at the Joint Workshop on High Confidence Medical Devices, Software, Systems and Medical Device Plug-and-Play Interoperability, Robert Kolodner from the Office of the National Coordinator for Health IT stated in his keynote address that healthcare is one of the last industries that has not fully integrated IT into its operations to improve the quality of its service delivery.[iii] An essential part of this healthcare delivery system, and the focus for this report, is medical devices. The demand for IT in the context of medical devices is echoed in a recent trend – the integration of medical devices onto the greater organization-wide medical IT network.

Traditionally, medical devices were deployed onto their own private local area networks. This created "islands of information" within a healthcare delivery organization and the passing of information between these medical devices and the organization-wide information system was difficult. This model is breaking down and these devices are being deployed onto the organization-wide network because there is a demand for information exchange between devices and the use of these medical devices in an interdepartmental context.

With the increased intimacy between electronic medical devices and the health IT network, the healthcare IT department has come to be significantly involved in the upkeep of these devices. Wipro research has found that IT is at least partly responsible for the monitoring, managing, and maintenance of common electronic medical devices in a large majority of healthcare organizations (see Figure 1). This shift in the connectivity of medical devices also raises many issues that require IT competencies to solve. The integration of many different types of medical devices onto one common network creates many technical problems while the increased exposure of these devices leads to ethical challenges such as the proper access and protection of patient information.

Health IT Involvement in the Monitoring, Management and Repair of Medical Devices

Percentage of Healthcare Organizations Surveyed by Wipro (n=17)

- ■ IT supports, manages, and repairs these devices
- ■ IT monitors these devices and then hands-off to biomedical engineering for management/repair
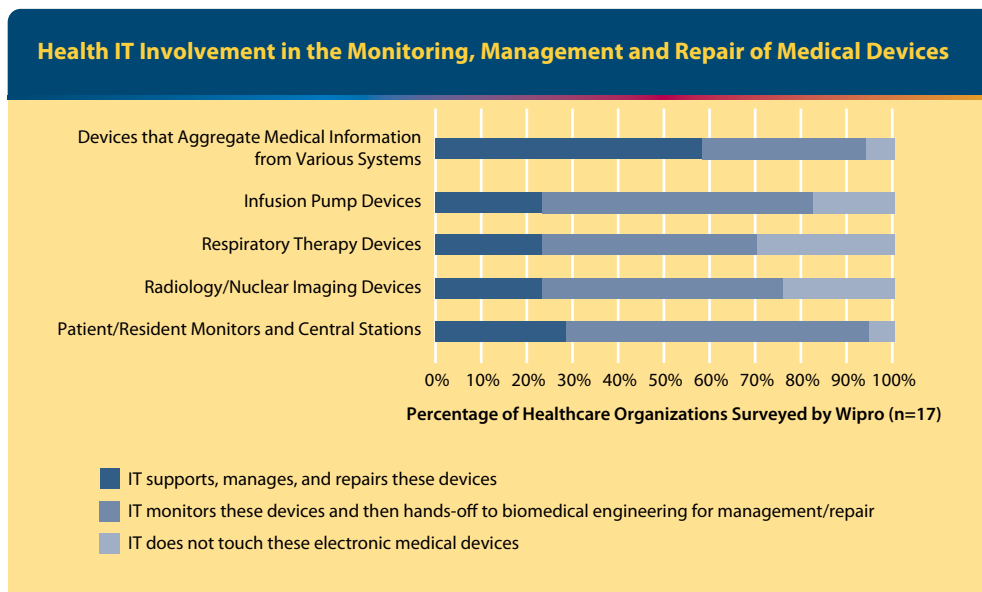- ■ IT does not touch these electronic medical devices

FIGURE 1. IT is Involved in Electronic Medical Device Support in a Majority of Healthcare Organizations

Through the task of integrating medical devices onto the greater medical IT network, the IT department can be a driving force for improving patient care. A critical, actionable step toward enabling this integration is the implementation of medical devices with Intel Active Management Technology.

Wipro Consulting Group's Product Strategy and Architecture Practice studied the medical device infrastructures, management practices, and cost structures of healthcare IT organizations in order to identify the potential value of Intel AMT implementation in electronic medical devices. Quantifiable financial benefits as well as soft benefits like the improvement of patient care were explored; the conclusions drawn from the study are summarized in this white paper. Accompanying this document is a Return-on-Investment calculator which allows hospitals and other healthcare delivery organizations to estimate projected financial savings from the use of AMT-enabled devices.

WHAT IS INTEL® ACTIVE MANAGEMENT TECHNOLOGY?

Intel® Active Management Technology (Intel® AMT) is a hardware and firmware-based solution, providing system managers with "any platform state" access. Using Intel AMT to remotely discover, heal, and protect computing assets 24x7, system managers can respond more efficiently, while reducing operating costs.

This technology resides in the following core hardware elements:

- Intel Core 2 Duo processor with AMT capability
- Intel AMT capable chipset
- Intel AMT capable wired or wireless Ethernet controller

Intel AMT expands the health IT organization's ability to reach and manage its assets by using built-in platform capabilities and popular third-party management and security applications. (visit the Intel Manageability Technology for Embedded and Communications Applications site for more details at http://developer.intel.com/technology/advanced_comm/active-management.htm?iid=ce_prodtech+activemanagement). Although there are currently no medical devices that utilize the complete set of AMT elements, Wipro used knowledge gained from assessing the impact of the technology on other settings, such as corporate PCs and retail point of sale systems, to estimate the benefits of medical devices with AMT. This document describes several ways in which electronic medical devices can make a positive difference in healthcare settings.

INTEL® ACTIVE MANAGEMENT TECHNOLOGY FOR MEDICAL DEVICES

With the recent paradigm shift in the US healthcare industry toward network integrated medical devices, health IT has come to play a larger role in the support and maintenance of the medical devices found throughout a healthcare organization. Wipro research has found that on average, 61% of electronic medical devices in a healthcare delivery organization are connected to the medical IT network.

The use of Intel AMT-enabled medical devices can significantly increase the ability to track, manage, and repair these electronic medical devices. This technology allows health IT organizations to do the following unique actions:

- Discover, identify, and proactively update software on assets that are wired into the network and plugged into the wall, even if they are powered off
- Remotely diagnose and take remedial action on devices even when there are problems with the operating system or some hardware components have failed

These actions are enabled by the use of an out-of-band communication channel that allows IT staff to reach assets even when ordinary communications channels have ceased functioning.

Deploying Intel AMT platforms can also allow IT organizations to reduce the complexity of their medical device environment. While the increasing integration of medical devices onto medical IT networks is improving the quality of patient care, the corresponding increase in the complexity of the IT infrastructure that must be supported is costly. Previous Wipro studies of other industries have shown that there are increases in asset management costs associated with increases in infrastructure complexity.[iv] Standardization on Intel AMT-enabled platforms can simplify this infrastructure and generate significant cost benefits.

By leveraging these enhanced management capabilities provided by Intel AMT, healthcare organizations can reduce the costs associated with supporting their electronic medical devices and contribute to the improvement of patient care delivery.

FINANCIAL BENEFITS OF INVESTING IN INTEL® AMT FOR MEDICAL DEVICES

The assessment of the financial impact of Intel AMT on healthcare delivery organizations combines the knowledge gained from previous Wipro studies of the impact of Intel AMT on the management of enterprise PCs with industry-specific insights gathered from interviewing 17 North American healthcare delivery organizations.

Wipro has identified the following four types of financial benefits that healthcare organizations can realize by leveraging the power of Intel AMT technology:

- Reduction in the cost of medical device support by using enhanced management features and the out of band communications channel to significantly increase the number of hardware and software malfunctions that can be fixed remotely
- Reduction in the cost of maintenance and tracking of devices by applying improved manageability and identification functionality to minimize manual activities such as resolving inventory failures or patch deployments
- Reduction in the overall cost of IT management by reducing the complexity of the medical device infrastructure through standardization on an Intel AMT-compatible hardware platform
- Reduction in the loss of potential revenue from medical device downtime by leveraging AMT-enabled operational efficiencies

In order to demonstrate these financial benefits, this paper will explore and quantify savings for a representative healthcare delivery organization constructed by taking the average interview responses of the healthcare organizations that Wipro surveyed. These are mainly hospitals (community hospitals, university medical centers, and health management organizations) with a handful of ambulatory care and assisted living organizations. Table 1 describes the electronic medical device characteristics of this example organization.

Average Healthcare Provider	
# of Electronic Medical Devices and Applications	2835 Devices
# of Medical Device Vendors Supplying Devices	22 Suppliers
% of Medical Devices Connected to the Medical IT Network	61%
Average Life Cycle of Electronic Medical Devices	4 Years

Table 1. Characteristics of the Average Healthcare Provider

By implementing AMT-enabled medical devices, this representative healthcare provider saves an estimated net of $659,008 ($762,840 in savings and $103,831 in implementation costs) over 4 years, assuming that the roll-out of AMT-enabled devices is distributed evenly across each year of the life cycle of these products.[i] The net present value (NPV) of this investment amounts to $551,225 and yields a high internal rate of return (IRR) of 152%.[ii]
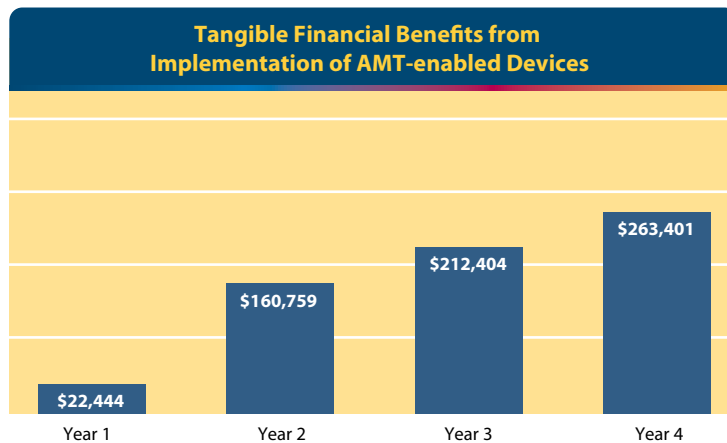
Tangible Financial Benefits from Implementation of AMT-enabled Devices

Year 1	Year 2	Year 3	Year 4
$22,444	$160,759	$212,404	$263,401

FIGURE 2. **Intel AMT-enabled Medical Devices Provide Significant Cost Savings for the Healthcare Provider with 2835 Devices**

In addition to these benefits, the use of Intel AMT-enabled medical devices can prevent the loss of revenue from the downtime these machines experience. For example, reducing one day of MRI machine downtime by leveraging AMT remote diagnostic functionality can save as much as $40,000 in lost revenue.

The following sections will explore these financial benefits in more detail.

Reducing On-Site Visits to Fix Hardware and Software Malfunctions

A significant component of expenditures by healthcare organizations is the support and maintenance of electronic medical devices. Wipro surveys uncovered that the cost to support a single electronic medical device can range from $30 per year for low-end patient monitoring devices to $50,000 per year for high-end MRI scanners. A large part of this cost comes from time-intensive on-site break fixes that are executed to resolve hardware and software malfunctions. By increasing the reach of health IT to fix these malfunctions down the wire, healthcare organizations can rely less on the costly on-site work to keep their organizations working and reduce their device support costs as a result.

However, the highly specialized nature of high-end equipment such as the MRI machine makes the remote servicing of these devices difficult. Wipro found anecdotal evidence that only 15% of service calls for high-end medical equipment can be resolved remotely. Still, high-end equipment accounts for only a small part of the electronic medical devices at healthcare provider facilities, and AMT-enabled remote remediation benefits can be assessed for the majority of electronic medical devices such as infusion pumps and central patient monitors.

AMT's unique out-of-band communication channel allows health IT to securely communicate with, diagnose, and repair the lower end devices even if there are software errors that are keeping the device operating systems from booting or responding. Devices with malfunctioning hardware components such as non-volatile storage drives can also be remotely assessed as long as they have functioning motherboards and processors.

The average healthcare delivery organization described in Table 1 saves an estimated $145,504 from reductions in manual fixes over the course of four years.[i] Of the total $762,840 in savings from AMT before factoring in the costs of implementation, the savings due to reducing the cost of hardware and software malfunctions is approximately 19% as seen in Figure 3.[i] In unit terms, this savings equates to an average of $12 per electronic medical device per year.
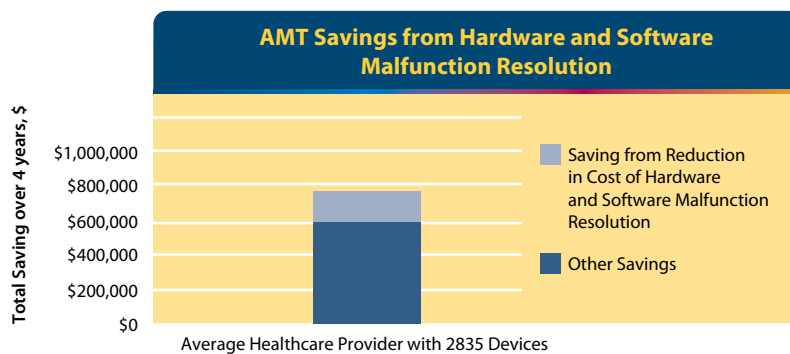

FIGURE 3. **The 2,835 Device Healthcare Provider Will Realize $145,504 in Savings from Streamlining its Device Break Fix Processes Over 4 Years**

Minimizing the Need for Manual Medical Device Management

Along with cost-laden on-site break fixes, another substantial source of medical device support cost is the manual labor associated with non-automated remote management activities for devices that can't be reached through the network. Traditionally, devices that are powered off or have issues with their operating systems can't be accessed using remote consoles in order to perform the following activities:

- Device Deployment Failure Resolution
- Application Deployment Failure Resolution
- Patch Deployment Failure Resolution
- Audit Failure Resolution
- Inventory Failure Resolution
- Security Incident Resolution

The use of Intel platforms with AMT technology can greatly increase the efficiency with which health IT handles these activities. Along with the management of the malfunctioning devices discussed in the previous section, the AMT out-of-band communications channel allows health IT to remotely power on devices that have been turned off.   Although previously

devices that were powered off could not be covered by remote automated management activities, AMT devices can remotely turn these systems on to allow health IT to leverage the operational efficiency and cost benefits from automation with greater effectiveness.

These benefits amount to $92,211 over four years for the average healthcare provider use case (see Figure 4), or 12% of total savings from AMT.[i]
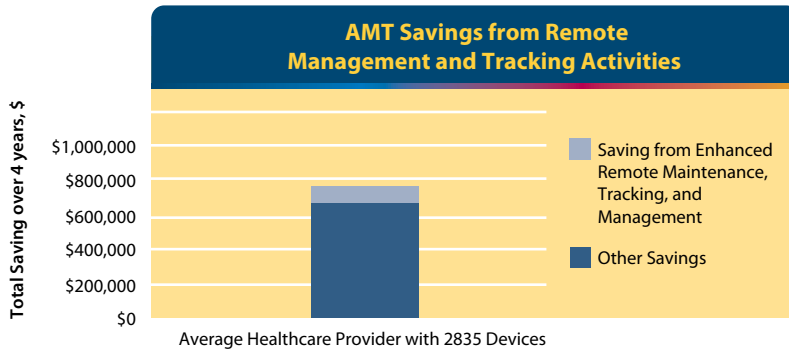
AMT Savings from Remote Management and Tracking Activities

FIGURE 4. **The Representative Healthcare Provider with 2835 Devices will Save $92,211 Over 4 Years by Minimizing the Need for Manual Management and Tracking Activities of Electronic Medical Devices**

Lowering the Cost of Supporting a Complex Medical Device Infrastructure

The largest component of AMT-enabled savings is from standardization on an AMT-compatible Intel platform. Prior studies conducted by Wipro and Intel have shown that money can be saved by reducing the number of hardware and software configurations that need to be supported by IT.[iv]

Healthcare delivery organizations, especially hospitals, have very diverse device infrastructures. There are a multitude of device types, vendors, and management consoles that are used in this complex network of devices. Wipro found that hospitals purchase devices from up to 50 vendors and use a combination of off-the-shelf software, vendor specific tools, and internally developed solutions to manage their electronic medical devices.

Deploying medical devices based on standard Intel AMT platforms means that standardized hardware components can be found throughout the hospital device infrastructure, providing less hardware and software configurations that need to be accounted for and maintained by health IT staff.

In the example of the average healthcare provider, this reduction in complexity saves the organization $525,125 over the average life cycle of the electronic medical devices.[i] This is equivalent to 69% of the total support cost savings.
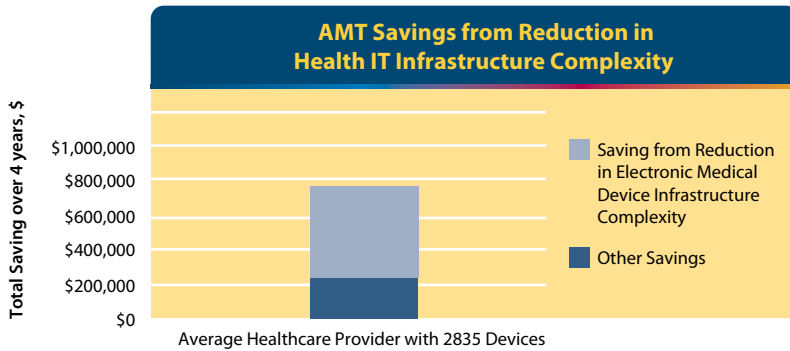
AMT Savings from Reduction in Health IT Infrastructure Complexity

FIGURE 5. **The Average Healthcare Provider Can Reduce their Health IT Infrastructure Management Costs by $525,125 Over 4 Years**

Reducing the Loss of Potential Revenue with Intel® AMT-Enabled Operational Efficiency

The few high-end medical systems that do not benefit from AMT-enabled cost reductions discussed previously due to their highly specialized nature often represent significant revenue sources for the healthcare organization. When one of these devices stops functioning properly, the services that they provide cannot be executed, resulting in a negative effect on the income of the organization. By using Intel AMT to streamline the remediation process for these machines, healthcare providers can reduce this loss of potential revenue.

Taking the MRI machine as an example, the traditional response to malfunction was to have a vendor technician travel to the site of the break, diagnose the trouble on arrival, and then order necessary replacements parts. The delivery of the parts usually takes about a day since they must be shipped from a warehouse in a distant location. Through the use of AMT-enabled out of band communication with the MRI system, the technician can diagnose problems remotely, enabling him or her to arrive on site with the necessary replacement parts. This eliminates one day of downtime which could mean retaining as much as $40,000 in revenue (see Table 2).[v]

MRI Usage Model	Heavy Use	Typical Use
Days MRI Facility is Open per Year	365	285
Facility Open Hours per Day	24	10
Standard Number of MRI Exams per Year	7400	3625
Number of Exams per Day	20.3	12.7
Revenue per MRI Exam	$2,000	$2,000
Potential Revenue per Day of MRI Operation	$40,548	$25,439

Table 2. **Potential Revenue from a Day of MRI Machine Operation**[v]

While the reduction of downtime through the use of Intel Active Management Technology can significantly improve the balance sheet of a healthcare facility, it can also improve the delivery of patient care. Reducing downtime of critical equipment can enable more timely diagnosis or treatment as a result of increased equipment availability. For one day of downtime in a heavily used MRI machine, there are approximately 20 MRI exams that are postponed (see Table 2). Each of these exams represents not only a source of revenue for the healthcare provider, but a fundamental step toward improving the workflow of diagnosing and treating patients. By reducing downtime and minimizing disruptions to the provision of healthcare, medical devices using Intel Active Management Technology can do more than provide cost savings. This report will next explore how the technology can be applied to create value in non-financial ways.

USING INTEL® ACTIVE MANAGEMENT TECHNOLOGY TO IMPROVE DELIVERY OF PATIENT CARE

While the previous section discussed how Intel AMT-enabled medical devices can allow healthcare organizations to alleviate some of the increasingly intense cost pressures that face the industry, the following section will explain how this technology can be used to provide some less tangible, but just as significant, benefits to improve the delivery of patient care.

It is the mission of healthcare delivery organizations to provide the best possible healthcare to patients. These organizations constantly evolve in order to meet rising healthcare expectations and standards. From a technological standpoint, the healthcare industry has seen some shifts on the use of technology that have raised the bar for patient care in recent years. These are:

- The integration of electronic medical devices into medical IT networks
- Use of truly portable medical devices to improve patient care from outside the walls of the healthcare organization

The use of Intel AMT-enabled medical devices can empower hospitals, assisted living organizations, and ambulatory care facilities to efficiently and effectively adapt to these changes that enable better delivery of patient care.

Leveraging Intel® AMT to Streamline the Integration of Medical Devices into the Medical IT Network

US healthcare organizations are increasingly integrating their electronic medical devices into medical IT networks. This is enabling the creation of richer electronic medical records and personal health records, driven by the need to create a more effective system of preserving and using medical information. In 2010, the IEC 80001 standard, a set of guidelines on the management of risks involved with the integration of medical devices onto enterprise health IT networks, is expected to be released. The existence of this standard highlights the significance of the challenges involved with the increase in medical device connectivity for healthcare organizations.

Overcoming the Challenges of Medical IT Network Integration with Electronic Medical Devices using Intel® AMT

Traditionally, medical devices have run on their own private servers, making the process of integrating these devices onto the greater medical IT network difficult. While some devices cause unanticipated integration issues, others prove too difficult to be integrated into the enterprise network altogether. Wipro research depicted in Figure 6 shows that healthcare organizations can't integrate an average of 28 % of their electronic medical devices into the medical IT network.

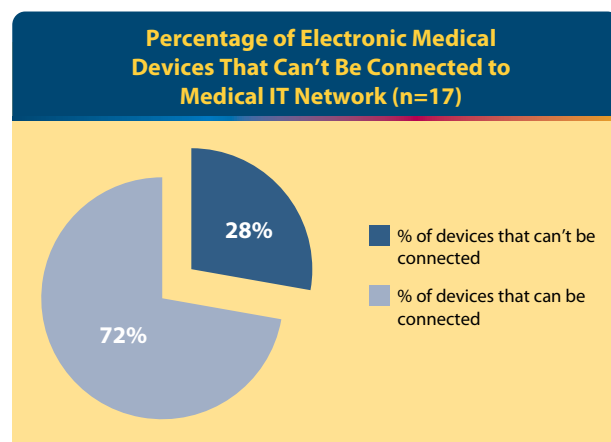**Percentage of Electronic Medical Devices That Can't Be Connected to Medical IT Network (n=17)**

28%

72%

- % of devices that can't be connected
- % of devices that can be connected

FIGURE 6. **A Quarter of Medical Devices Cannot be Integrated Into the Medical IT Network**

Reasons Why Some Medical Devices Cannot Be Integrated into Medical IT Network

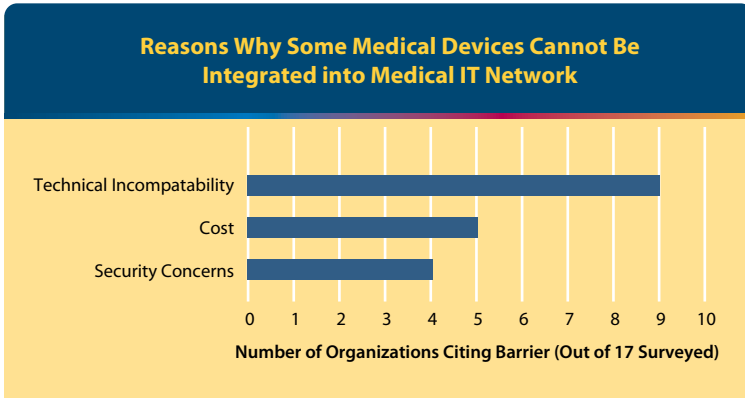Number of Organizations Citing Barrier (Out of 17 Surveyed)

FIGURE 7. Reasons Cited for Why Healthcare Providers Don't Integrate Some Electronic Medical Devices with Medical IT Network

These organizations cited technical incompatibility of devices, cost, and security concerns as barriers to integration (see Figure 7). The financial impact of Intel AMT has already been discussed but this technology can also be used to overcome these other barriers.

Combating the Technical Incompatibility of Medical Devices with the IT Network

Since Intel AMT resides in hardware components that utilize standard network protocols and hardware interfaces, healthcare providers can use electronic medical devices with Intel AMT to enable technical compatibility with their medical IT networks.

Furthermore, Intel has worked extensively with third party vendors on remote management tools such as Altiris, SMS, and LanDesk to ensure that these solutions can unleash the potential benefits of AMT's management capabilities. Figure 8 shows that healthcare organizations already use these tools alongside internally developed applications to manage their medical IT networks. The deployment of AMT-enabled medical devices can create an electronic medical device infrastructure that leverages third party tools and eliminates the need for the development of custom management applications. Intel AMT elements ensure compatibility with the medical IT-network from a software perspective as well as a hardware perspective.

Remote Management Tools for Electronic Medical Devices Used by Healthcare Organizations

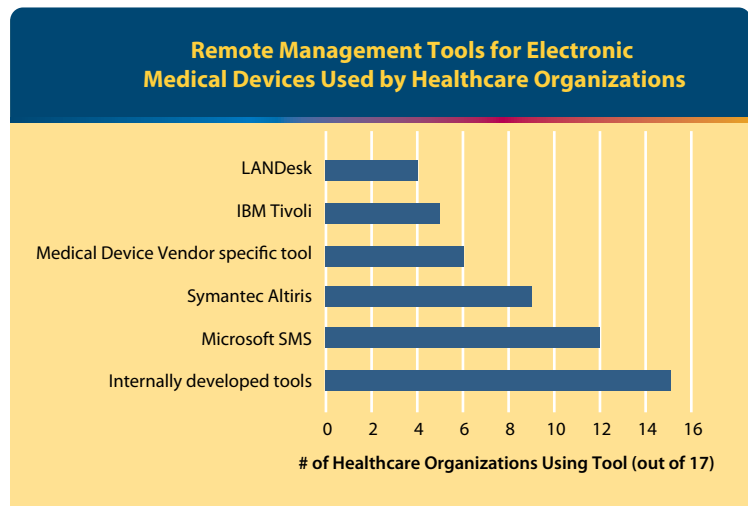# of Healthcare Organizations Using Tool (out of 17)

FIGURE 8. Wipro Research Shows that Healthcare Providers Already Commonly Use Tools that are Compatible with Intel AMT

Increasing Electronic Medical Device Security with Intel® AMT to Enable Network Integration

There is a lot of pressure on healthcare organizations to maintain the integrity and reliability of medical devices, especially as they handle Protected Health Information (PHI).   Integrating medical devices into the medical IT network will result in greater exposure to security threats.

Intel AMT allows health IT to mitigate this security risk. Through AMT, healthcare organizations can take preventative action to keep their devices current with up-to-date security software, even if the devices are turned off. In the actual event of a security incident such as a worm or virus attack, IT staff can remotely reconfigure the network settings of the affected medical devices, resolve the security threat while they are in isolation, and then release them back into the medical IT network.   This AMT-enabled method eliminates the manual labor involved in this process and, most importantly, it allows for health IT staff to be more nimble in reacting to security threats.

Enhancing the Management and Productivity of Portable Electronic Medical Devices with Intel® AMT

Recent advancements in medical technology have given rise to the use of portable electronic medical devices to add value to patient care in ways that were previously not possible. Data captured by Wipro has uncovered that an average of 6% of electronic medical devices are portable and travel beyond the walls of the healthcare organization today.

While there are benefits to patient care from the mobility of medical devices, there are difficulties and risks involved with respect to the management of these devices. Intel AMT has the capabilities to overcome some of these challenges and enable portable systems to improve the delivery of patient care.

Take the example of electronic patient care reporting (ePCR) devices from companies such as the Corner Group. These are ruggedized portable systems which can be used to transmit diagnostic information of emergency care patients within ambulances that are en-route to hospitals. These portable devices communicate with hospitals to improve efficiency in the delivery of the care provided to these patients by:

- Allowing the hospitals and ambulance to make better informed decisions as to where the patient should go to in order to get the most appropriate care
- Arming hospitals with information on the condition and symptoms of the patient so that they can be better prepared to receive and treat him or her

There are two challenges related to the management of these assets. First, these machines handle very sensitive information about individual patients which need to be protected from inappropriate access. Also, given the life-critical function that the ePCR device plays in the pre-hospital treatment of the patient, any downtime in these devices could have detrimental effects on patient care. The implementation of Intel Active Management Technology provides hospital IT with the following enhancements to combat these challenges to ePCR device management:

- AMT out of band communication channel extends the availability of ePCR devices that are deployed in the field so that they can be updated with all necessary software updates and security patches even if they are powered down. This minimizes the vulnerability of the ePCR fleet from attack and protects confidential patient information.
- AMT allows for the proactive monitoring of devices via a remote console and provides advanced remote diagnostic and repair functionality through BIOS level access to ePCR devices. This ensures that any problems with the devices are detected quickly and dealt with quickly.

Through the use of Intel AMT, ePCR devices can be more secure and reliable from a technical perspective, and this reliability can translate into improved delivery of care to patients. The Niagara Falls Memorial Medical Center found that the real-time upload of ECG information from ambulances using an ePCR device can reduce the time it takes for a patient to receive thrombolytic therapy treatment by up to 27 minutes, potentially improving the outcome of patients with myocardial infarctions.[vi]

CONCLUSION

Healthcare costs are increasing as is the demand for higher quality healthcare in the US. By deploying electronic medical devices that incorporate Intel Active Management Technology, healthcare organizations can lower the cost to manage and maintain their devices while contributing to more efficient delivery of patient care. Wipro's assessment of the impact of AMT on healthcare organizations demonstrates that the deployment of this technology provides tremendous return on investment on many levels, and organizations should keep Intel AMT in mind when making strategic technology investments in the future.

APPENDIX

Methodology

This study builds on previous work conducted by Wipro PSA consultants to assess the financial and business impacts of Intel® AMT (a key component of Intel vPro Technology).

In 2006 and 2007, Wipro PSA consultants and technical architects interviewed CIOs, IT directors, and senior IT managers at 160 companies in North America, Europe and Asia. Wipro PSA selected companies to represent a full spectrum of industries, management practices and user distributions, and a good mix of desktop and notebook systems. Based on the aggregate findings, Wipro PSA created the algorithms for an ROI model
(available at http://www.intel.com/business/business-pc/roi/demo.htm).

In 2008 and 2009, Wipro PSA consultants gathered data from IT decision makers and practitioners in 17 medical IT organizations to understand how costs and activities of managing electronic medical device environments differ from that of enterprise IT departments, and then adapted the impact of deploying Intel vPro technology accordingly. The environment that medical devices operate in, their security requirements, the applications they run, and the use they are put to differs significantly from enterprise IT environments. This whitepaper and the ROI model for healthcare organizations is therefore targeted specifically to calculate the ROI of investing in Intel® AMT enabled electronic medical devices, and the costs and benefits are specific to the healthcare industry.

In order to get a complete picture of the electronic medical device management eco-system, Wipro targeted the following segments in their assessment of the impact of AMT on the healthcare sector:

- Healthcare Management Organization
- Community Hospital
- University Medical Hospital/Center
- Long Term Care Facility/ Nursing Home
- Medical Device/Services Company

ROI Calculator Assumptions and Algorithms

Savings Generated by Intel® AMT

In this study, Wipro analysts compared the standard set of support capabilities and related IT activities against the capabilities and activities associated with hypothetical electronic medical devices with Intel AMT. Hypothetical electronic medical devices with Intel AMT were assumed to have similar manageability as enterprise PCs due to their similar architecture. Based on this comparison, researchers concluded that Intel AMT can mitigate the cost and labor requirements required to investigate and resolve:

- Electronic Medical Device deployment failures
- Application deployment failures
- Patch management failures
- Audit failures
- Inventory failures
- Major hardware malfunctions
- Major software malfunctions
- Security incidents

Effort and costs are reduced by:
- Reducing indirect IT support costs due to the lowering of overall medical device infrastructure complexity, realized by migrating to Intel SIPP-compliant, Intel® AMT-enabled medical devices. We have found that there are two complexity factors which are taken into account by the ROI calculator
  - o REFRESH FACTOR - In the ROI model, we account for the refresh cycle impact on failure rates. Longer refresh cycles mean markedly higher failure rates for both major and minor application deployments.
  - o HARDWARE CONFIGURATION FACTOR –Previous Wipro/Intel research has shown that there is a correlation between IT costs, and the number of hardware configurations being managed. Simply put, there is a price to be paid in support costs for having multiple medical devices from multiple vendors, and an efficiency saving to be gained from reducing the number of hardware configurations.
- Increasing the capabilities provided by automated medical device management and security software.

The projected net benefits of deploying electronic medical devices with Intel Active Management Technology was obtained by balancing the one-time and per-device implementation costs against yearly savings. We model medical device upgrades on a standard refresh cycle rather than a forklift upgrade at one time, hence the yearly savings increase as the refresh cycle proceeds.

Implementation Costs

Both one-time and per-device implementation costs have been included in our analysis:

One time implementation costs are incurred during the first year of an organization moving to Intel AMT enabled medical devices and include:

- the cost of training IT staff to take advantage of Intel AMT including staff and trainer costs
- the cost of staff and consultants associated with re-engineering IT installation and support processes with Intel AMT specific activities
- engineering costs to integrate Intel AMT technology features and capabilities with existing electronic medical device management tools

Per-device implementation costs are incurred as the medical devices are deployed and include:

OEM Intel AMT technology charge – additional premium charged by OEMs for Intel AMT technology-based medical device systems

Configuration cost – additional cost of configuring medical devices with Intel AMT

It is assumed that there is no additional license charge by Independent Software Vendors for electronic medical device management / security software to support medical devices with Intel AMT, as this support will be included in their normal release updates, although if such costs are incurred the ROI calculator can capture those costs and include them in the analysis.

GLOSSARY OF TERMS

Term	Definition
Electronic Medical Device	Electronic medical device refers to a diagnostic monitoring device or therapeutic device which is connected to the medical IT network of the hospital and the diagnostic instruments which are attached to it. This does **not** include general PCs found in the hospital for doing administrative work. Examples of electronic clinical devices are portable sonogram devices, the display devices attached to PACS for radiology, and electronic infusion pumps.
Medical IT Networks/ Health IT Networks	Wired and wireless networks - both local and wide area networks - that connect medical devices to their own servers and client applications, in addition to connecting them to other systems of medical devices and/or health care information systems.
Devices which Aggregate Medical Information from Various Systems	Electronic medical devices which interface and collect information from other medical devices and information systems to display information and/or provide alarms based on the information. These can be homegrown systems or devices from vendors such as LiveData.
Infusion Pump Devices	Electronic medical devices which administer fluids or medication into patients' circulatory systems in controlled intervals and doses.
Respiratory Therapy Devices	Electronic medical devices used to administer respiratory care to patients by providing ventilation and ventilation monitoring capabilities.
Radiology/Medical Imaging/Nuclear Imaging Devices	High end electronic medical devices such as MRI machines and CT scanners which are used in radiology and nuclear imaging applications to assess organ structure and function.
Patient/Resident Monitors and Central Stations	Electronic medical devices which monitor and provide alerts based on patients' vital signs and the central stations which graphically display this information.
New Application Deployment	The installation of new software onto devices or machines.
Patch Deployment	A program that is released to fix bugs in programs, address security problems or enhance functionality.
Audit	The task of evaluating the overall or component- specific performance (there are all types of audits from the device level to everything in the technical environment) of tools and/or systems.
Inventory Management	The task of accounting for hardware, software, and firmware throughout the system lifecycle.

Major Hardware Malfunction	For the purposes of this survey, hardware would include medical device systems. A major malfunction is one where any part of the medical device system's hardware components are not working at all.
Major Software Malfunction	For the purposes of this survey, software would include all software/applications that are deployed and in use on the medical device systems. A major malfunction is one where the application /software is completely broken and cannot start up or work properly.
Security Incidents	Technology related security incidents are virus/worm attacks, actual or suspected loss or disclosure of company and/or confidential information, etc.
Push(ed) Down the Wire	Ability of IT staff to remotely access and alter PCs or medical devices. Often used to describe the ability of IT to deliver updates to images and other software to remote machines.

i Assumes an annual rate of inflation of 3%

ii All NPV calculations in this document use a discount rate of 6%

iii See Video of Dr Kolodner's keynote address at the June 2007 Joint Workshop on High Confidence Medical Devices, Software, & Systems (HCMDSS) and Medical Device Plug-and-Play (MD PnP) Interoperability at http://cimit.org/mdpnpjune07/start.htm

iv See Wipro whitepapers *Measuring the Value of Intel® Core™ 2 Processor with vPro™ Technology in the Enterprise* and *The Benefits of Intel® Centrino Pro Processor Technology in the Enterprise,* available for download from Intel.com/vPro

v Potential revenue for one day of MRI downtime is calculated using the following formula: [# of MRI procedures per year] * [Revenue per MRI procedure] / [# of days of MRI operation per year] where the # of MRI procedures and the # of days of MRI operation are based on proposed MRI capacity standards from *The Finger Lakes Health Systems Agency 2005 MRI Survey Results Summary*, available at http://www.flhsa.org, and Revenue per MRI procedure is based on information from the Certificate of Need for an MRI Acquisition by the Golden Triangle Diagnostic Center submitted to the Mississippi Division of Health Planning and Resource Development, available at http://www.msdh.state.ms.us

vi See quote from Dennis O'Dowd from Medtronics on the Niagara Falls Memorial Medical Center website at http://www.nfmmc.org/Home/News/MedtronicLIFENET