

White Paper
Enterprise Server
Predictive Enterprise

Sense, Predict, Act: The Predictive Enterprise

The Predictive Enterprise

Predictive Enterprise is the new model for enterprise computing—using technology to make your business proactive instead of reactive by reducing the gap between knowledge and execution. As a Predictive Enterprise, your business will become more agile, letting you maximize your return on investment (ROI) and build a competitive edge to expand growth. The key to becoming a Predictive Enterprise is learning how to develop business processes and infrastructure that are connected and adaptive. This white paper is a high-level primer that introduces you to the Predictive Enterprise and the business and IT issues companies face on the way to becoming one.

Converging Technologies

Over the last five years, the convergence of information technologies has driven—and extended—the capabilities needed for new business services. The importance of technology convergence to business services was explained in a 2006 Intel article¹:

- **Internet-based communications** will significantly blur the boundaries between enterprises to create global ecosystems.
- **Emerging technologies** (e.g., infrastructure virtualization, pervasive networks, service-oriented architecture) are becoming highly converged. Open standards will enable IT and business services extend across corporate boundaries.
- **Services between enterprises** will be orchestrated to deliver capability to global customers and consumers.

This convergence provides the technological foundation that enables businesses to design and implement the capabilities to search out, capture, and interpret clues about emerging customer

wants and needs, and to respond to unanticipated requests.² Businesses in multiple industries are integrating IT capabilities and online business data to help improve business operations and enable business growth. A recent Accenture article defined a vision for predictive business:

*A company's ability to predict business needs and incorporate advanced technologies to meet them will be increasingly important to enabling...future business success. Key technologies allow business to capture, manage, access and analyze data at a level and speed never before possible, thus enabling agile and proactive response.*³

Soon, having a complete and easily accessible picture of both the present past—still a goal for many organizations—will be a basic business requirement. But real differentiation will be provided by predictive insight. Top business performers will look over the horizon, anticipate future eventualities, and take the right actions today to optimize outcomes and prevent problems.

This Accenture research supports the case for using existing and emerging IT capabilities to enable more accurate business decisions and actions.

This white paper explores the concept of predictive business insight, examining the role IT and Intel® architecture-based technologies play to help enable predictive business capabilities. Intel calls this concept the Predictive Enterprise.

Based on prior experience, both internally and with customers, Intel has developed a conceptual model to illustrate the core functional capabilities needed to enable and support the Predictive Enterprise:

- **Capture** appropriate, filtered data from a variety of sources including readers and sensors.
- **Manage** the explosion of distributed data and events and be scalable, reliable, and secure
- **Access** the data any time, anywhere enabling appropriate people, applications, and business processes to use it.
- **Analyze** the data and events in real time for business intelligence and proactive process improvement.
- **Respond** to events and information automatically and allow for people to manage by exception.

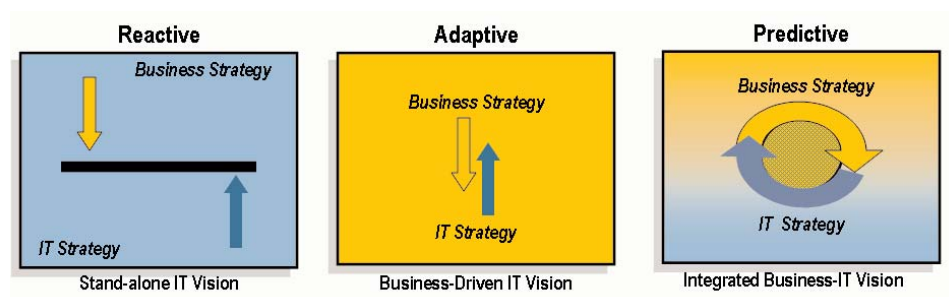
Businesses will need to address strategic management issues as they move to develop and utilize their business and IT capabilities as a Predictive Enterprise.

These management issues relate to the challenges of business analytics (knowledge) as well as the operational capabilities needed to apply this analysis in a customer interaction (execution). For most companies, the problem is not converting data into knowledge; it is converting this knowledge into actions and using the IT infrastructure to make these actions operational. This is where companies often struggle.

Strategic IT infrastructure architectures such as Forrester Research's Digital Business Architecture and Gartner Group's Real Time Infrastructure define the type of adaptive and responsive capabilities Intel sees as the architectural models needed to enable predictive business. The principles and capabilities defined in these strategic IT models are being developed and realized in enterprise architecture roadmaps from vendors including IBM (On-Demand*), HP (Adaptive Enterprise*), EDS (Agile Enterprise*), and others.

Intel sees its role as enabling the Predictive Enterprise, acting as a catalyst to help the IT ecosystem accelerate the business and IT innovations and capabilities enterprises will need to realize the Predictive Enterprise and enjoy its business benefits. Intel plays a fundamental role in this process, supplying the architecture-based technologies needed to implement and support computing capabilities for the Predictive Enterprise. Intel also works with its enterprise customers and their strategic IT partners to apply and unlock the value of Intel architecture-based technologies to enable the IT foundation needed for the Predictive Enterprise.

Figure 1: IT's Evolving Role in Enabling Business Capabilities



From reactive to adaptive to predictive. After years of painful cost optimization, the combination of business trends and technology innovation is leading toward a new wave in business optimization.

Changing CIO Priorities

To see how much priorities have changed over the last few years, consider a 2002 *Harvard Business Review* article called “IT Doesn’t Matter.” The key message for the reader was:

*The ability of any one company to use IT in a distinctive way to gain competitive advantage will diminish until...it will make more sense to manage IT as a commodity; something that is absolutely necessary but (that) isn't going to set you apart from competitors.*⁴

The article’s premise was that IT is a commodity-type resource for supporting business operations—not a means to enable business innovation and growth. The perspective of this article reflected the thinking of many senior business managers in the post-dot-com era.

A Gartner Group study of the Top 10 CIO Management Priorities for 2002 supported this perspective. It lists “Reducing total IT costs” as the top priority. The other nine items on the list reflected a similar focus of improving on existing IT resources⁵.

Today, an enterprise CIO’s priorities have evolved in a different direction. The Gartner Group study of the Top 10 CIO Management Priorities for 2006 lists “Delivering projects that enable business growth” and “Linking business and IT strategies and plans” as the first and second priorities. In today’s enterprise, business looks to IT strategies and capabilities to help enable business innovation and growth. The role of IT in the enterprise is evolving from cost center to enabler of new business capabilities (Figure 1)⁶.

For CIOs, it’s all about maximizing return on investment. And to make it happen, a CIO’s world usually revolves around cost containment.

Investing for competitive advantage can also be a priority, but the last time this happened was before the dot-com bust, when companies were investing heavily in e-Business. This included Intel, which became the first company to earn a billion dollars worth of e-Business revenue.

Now experts seem to agree that after years of painful cost optimization, the combination of business trends and technology innovation is finally leading toward a new wave in business optimization.

The Changing Role of IT

In the past, information technology tended to react to business requirements. IT focused on quickly capturing business information about what had happened in the past, working to reduce the lag to facilitate better decisions.

Today, business is evolving to be more adaptive—to capture information in real time and be more responsive, enabling the business to act on the information IT provides.

Tomorrow’s businesses will be predictive, capturing information in real time to not only facilitate the best possible decisions, but to actively make business systems easily adaptable to changing business strategies. This capability will help businesses bring new products to market faster than their competition, more quickly identify higher-yielding market segments, and respond faster to customer demands. IT will give business the foundation capabilities to enable a competitive advantage.

Understanding likely future outcomes gives an organization the ability to move from being reactive to proactive in its business behavior—and the opportunity to base business decision-making on what-if scenarios.

In the Predictive Enterprise, IT matters. The power of flexible information technology is a fundamental ingredient that enables new business capabilities for innovation and growth.

The Predictive Enterprise

Conceptual Model

The idea of using predictive capabilities to improve business decision-making is not new. Weather forecasting is a good example of how predictive capabilities are already widely used. Improved collection and analysis of data has enabled weather forecasters to develop a better understanding of what is likely to happen. Being able to accurately predict future weather patterns is valuable to both government agencies and citizens, enabling these stakeholders to take appropriate, proactive actions.

The predictive capabilities that have proven so valuable for weather forecasting can also apply to business management (Figure 2). The Predictive Enterprise concept is about using advanced and emerging information technologies and online data to anticipate future business issues and enable better decisions.

For business management, the Predictive Enterprise concept is about the potential impact improved actions and decision-making can have on overall business operations. Using predictive capabilities can enable business management to evolve from:

- **Explaining** (reporting what happened) to
- **Reacting** (focusing on key business drivers) to
- **Predicting** (anticipating the future so that you can take appropriate actions)

This evolution of business analytic capabilities is the foundation of the Predictive Enterprise concept.

The first steps to building a Predictive Enterprise are to:

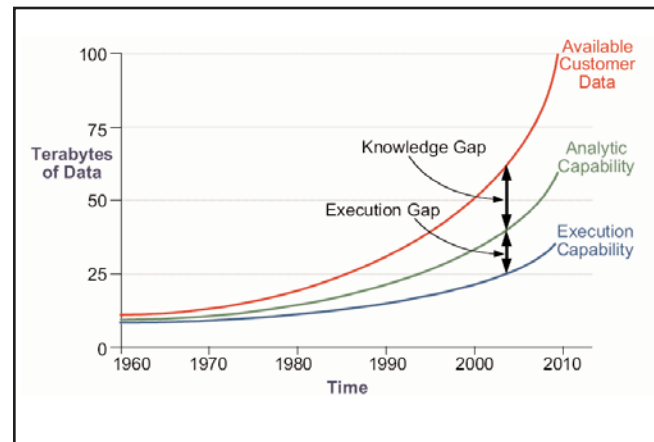
- **Understand** core business operational points
- **Gather** the appropriate information in the right timeframe
- **Use** information to support decision-making

Figure 2: Predictive Capabilities and Decision-Making

	<i>Explain</i>	<i>React</i>	<i>Predict</i>
Weather Forecasting	<i>"A hurricane just hit..." ... circa 1900</i>	<i>"We predict a hurricane will hit the North Carolina coast in 48 to 72 hours." ... circa 1965</i>	<i>"We predict that 10 hurricanes will hit the Atlantic coast next year. Here are the approx. dates and strengths for each." ... circa 2005</i>
Business Management	<i>"We missed our forecast due to a \$10MM loss of sales due to unexpected competition."</i>	<i>"Looking at our business pipeline, we do not have sufficient volume to meet our FY06/07 profit goals."</i>	<i>We forecast demand shift between our top three product lines that, w/o action, will result in backorders, overstock, and net \$10MM sales loss</i>

For business management, the Predictive Enterprise concept is about the potential impact improved actions and decision-making can have on overall business operations.

Figure 3: The Knowledge and Execution Gap



Most businesses start with all available data and then analyze it (knowledge). However, this top-down approach does not enable the business to effectively transform the results of this analysis into a customer interaction (execution).

This ability to sense information is not something a business can buy and plug in. It requires a clear understanding of what is important to the business, the interfaces to the business, and the environment that governs the way business is conducted.

Making Decisions in a Sea of Data

IT is making it possible to gather, store, and access massive quantities of data from a number of sources—going well beyond practices in traditional enterprise systems. Computing power and processing speed have advanced to the point where data can be manipulated and transmitted in real time.

Organizations that understand the value of using appropriate information taken at the right place and at the right time can stream new data from either existing systems or new sources. This offers the opportunity to connect the physical world to the logical world—which strains current capabilities including data warehousing, remote analytics, dashboards, and IT-generated reports.

Over the last decade, the volume of online business data available to the enterprise has exploded. For example, five exabytes of new data were created in 2005.⁷ (One exabyte represents one million terabytes or one billion gigabytes.) Some IT Industry analysts have likened the situation to being lost in a sea of data.

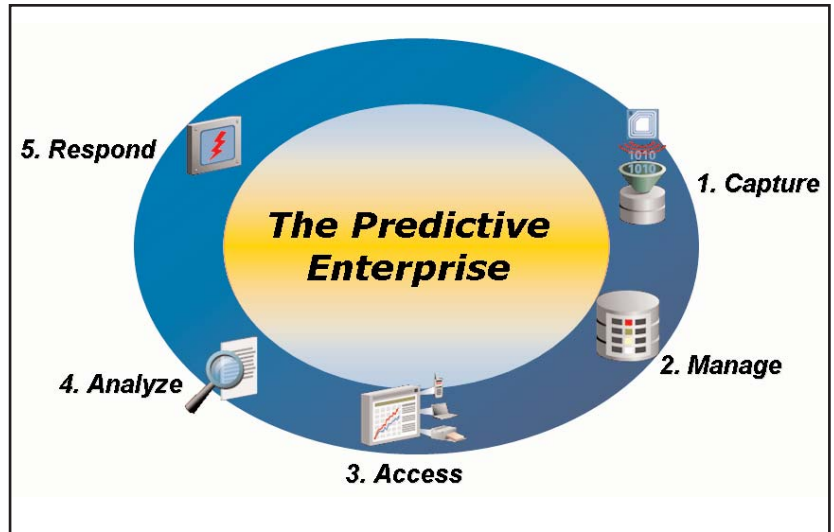
The ability to have sophisticated computational and storage capabilities and applications to manage this sea of data is far outreaching the intrinsic worth of the data. At the same time, increasingly sophisticated computational and storage capabilities often create a negative impact. The ability to collect any and all data can far outpace a company's ability to use that data for strategic advantage, or to make it both timely and easy to use and available for real decision-makers.

Figure 4: Improving Execution Capability

	<i>Explain</i>	<i>React</i>	<i>Predict</i> <i>(Analytics)</i>	<i>Respond</i> <i>(Execution)</i>
Weather Forecasting	"A hurricane just hit." ... circa 1900	"We predict a hurricane will hit the North Carolina coast in 48 to 72 hours." ... circa 1965	"We predict that 10 hurricanes will hit the Atlantic coast next year. Here are the approx. dates and strengths for each." ... circa 2005	Set dates for 'just in time' emergency supply deployments, including analysis of what can be re-used/relocated
Business Management	"We missed our forecast due to a \$10MM loss of sales due to unexpected competition."	"Looking at our business pipeline, we do not have sufficient volume to meet our FY06/07 profit goals."	We forecast demand shift between our top three product lines that, w/o action, will result in backorders, overstock, and net \$10MM sales loss	Set dates to reassign manufacturing capacity from product lines 1 & 2 to product line 3 in order to avoid overstock and backorders, increasing net sales volume \$5MM

Improving execution capability is the business opportunity from the Predictive Enterprise.

Figure 5: Functional Capabilities



Functional capabilities needed for the Predictive Enterprise include capture, manage, access, analyze, and respond.

The Knowledge and Execution Gap

A Gartner Group paper on the challenges of using the growing volume of online business data provides an important perspective on the data analysis challenge: "Only 20% of enterprise will use more than 50% of the total data they collect to gain competitive advantage."⁸

The fundamental challenge for these companies is how to best utilize the business data (e.g., operations, customers, and marketplace) to understand current conditions and make better business decisions going forward.

According to this Gartner model (Figure 3), most businesses start with all available data and then analyze it (knowledge). However, this top-down approach does not enable the business to effectively transform the results of this analysis into a customer interaction (execution).

This Gartner model shows the functional challenges businesses face when they try to fully realize the capabilities and benefits of the Predictive Enterprise. For most companies, converting data into knowledge is not the problem. Converting this knowledge into actions and making these actions operational using the IT infrastructure is where many companies struggle.

Extending the predictive capabilities model (Figure 2) to include the challenge of execution yields a more complete model to illustrate the Predictive Enterprise concept (Figure 4). Timely response (execution) based on better understanding (analytics) of future situations is the key business opportunity the Predictive Enterprise offers.

Enabling the Predictive Enterprise

Functional Model

Figure 5 shows the essential functional capabilities an organization needs to enable and support the Predictive Enterprise.

- **Capture** appropriate, filtered data from a variety of sources including readers and sensors.
- **Manage** the explosion of distributed data and events and be scalable, reliable, and secure.

- **Access** the data any time, anywhere enabling appropriate people, applications, and business processes to use it.
- **Analyze** the data and events in real time for business intelligence and proactive process improvement.
- **Respond** to events and information automatically and allow for people to manage by exception.

Logical Architecture

Using the model in Figure 6, Intel defined a logical architecture model for the Predictive Enterprise.

Developed from an enterprise architecture perspective, the model includes both business- and technology-driven elements.

The structure of this logical architecture model (Figure 7) is composed of:

- **System interface:** The human or machine interface that enables interaction with a computer system to collect input, manipulate data, and/or display output
- **Business architecture:** The functions and processes required for company's business to be successful
- **Data architecture:** What must be known to effectively execute and support the business processes
- **Application architecture:** The applications required to support business functionality and delivery methods for information
- **Technical architecture:** Defines and manages the infrastructure, enabling access to information by providing the environment and platforms to run applications
- **Service-oriented architecture:** A design approach to standardize functions or services so that numerous dissimilar applications and technologies can share them—both inside and outside the company
- **Service-oriented infrastructure:** The hardware and storage infrastructure that can appear and be used as virtualized resources

The computing elements defined in this logical architecture are a combination of existing and evolving computer hardware and software. They do not represent an exhaustive list of computing elements; they do represent the computing elements that enable the functional capabilities the Predictive Enterprise needs. Many of these computing elements are either in use or being introduced into business organizations.

Intel and the Predictive Enterprise

A fundamental aspect of the journey to the Predictive Enterprise lies in the infrastructure on which the computing stack will be assembled. There are many choices to be made, and today no single product can deliver the entire vision. Intel understands this challenge and has focused product and technology delivery on supporting the foundational elements of the Predictive Enterprise.

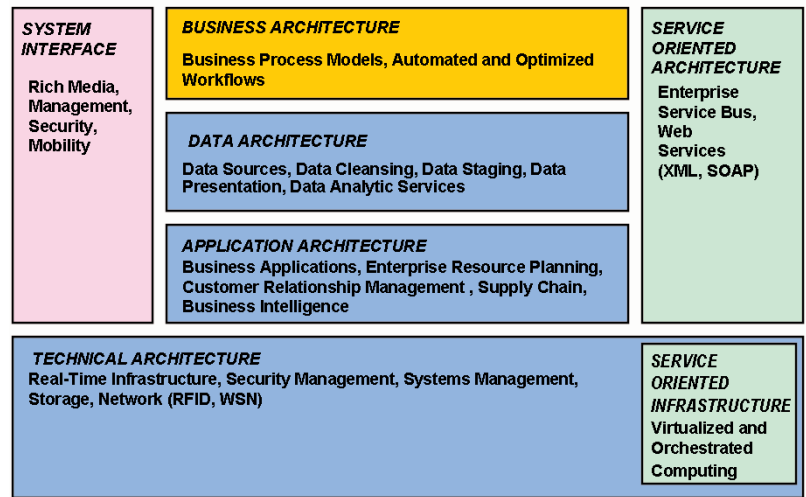
With each generation of technology, Intel introduces new products, technology, and standards to enable the organization to continuously improve, as well as to create a more autonomous, green, and self-managing infrastructure.

Intel Architecture Technology Pillars

Intel contributes to the Predictive Enterprise in three key ways:

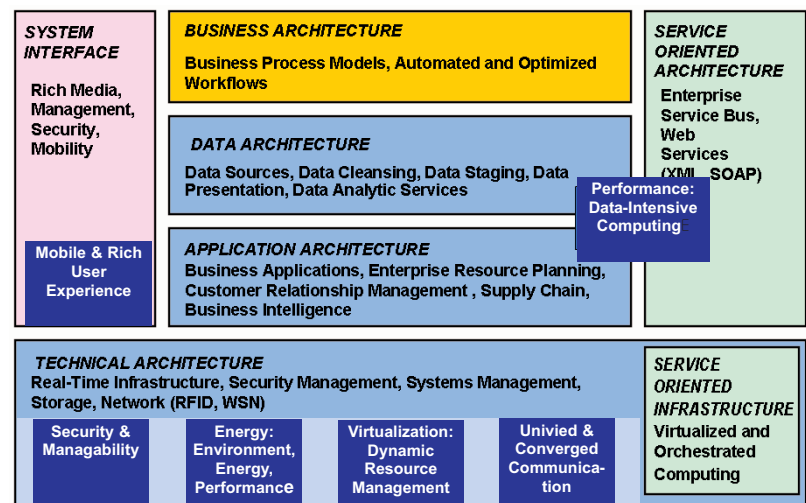
1. **Leadership** in products, technology, and standards.
2. **Influence** on the information ecosystem, both indirectly through standards and directly through engagement. Intel works diligently to ensure that software and solutions are available to help organizations make the most of product and technology innovations.
3. **Vision.** Intel has used its understanding of strategies from end users, system integrators, and fellow travelers to define a future vision that allows business and IT success.

Figure 6: Logical Architecture for the Predictive Enterprise



Intel defined a logical architecture model for the Predictive Enterprise using both business- and technology-driven elements.

Figure 7: Logical Architecture with Intel Technology Pillars



To show how Intel technologies enable the Predictive Enterprise, Figure 7 extends the logical architecture model to include the six Intel architecture technology pillars.

To make Intel's technical contributions to the Predictive Enterprise easy to understand, we have divided them into six key pillars:

1. Security and manageability
2. Energy: Environment, energy, and performance
3. Virtualization: Dynamic resource management
4. Performance: Data-intensive computing
5. Unified and converged communication
6. Mobile and rich user experience

These pillars are built on Intel's foundation of leading performance and efficiency. Each pillar provides a context for the technologies and features enabling the enterprise journey to the Predictive Enterprise.

To show how Intel technologies enable the Predictive Enterprise, Figure 7 extends the logical architecture model to include the six Intel architecture technology pillars.

Security and Manageability

Security attacks are becoming more frequent, software viruses are becoming more sophisticated, the methods used for attacks are continually evolving, and enterprises must protect confidential information about customers, products, and employees. A Predictive Enterprise manages its resources proactively to address existing and emerging threats.

Today, the security focus is on building a consistent and reliable boundary of to ensure that clients and servers are up to date, the appropriate agents are running and protected, and network traffic is monitored and filtered.

Intel continues to enhance security solutions, including new hardware support to address emerging threats such as rootkits. Equally important is the work Intel does in this area with the leading independent software vendors (ISVs). Through our Intel® vPro™ and Intel® Centrino® Pro processor technologies, Intel® Active Management Technology (Intel® AMT) in clients delivers these capabilities:

- **Discover:** The ability to find and connect to systems for hardware and software inventory and resolve issues regardless of power state or system

- **Heal:** The ability to remotely connect to and troubleshoot systems even if the host OS is unable to launch.
- **Protect:** This includes a wake and update function for critical patches and network filters for isolating systems to prevent virus propagation and to limit connectivity before remediation of systems that don't meet minimum security requirements. It also includes new sets of filters that can proactively detect anomalous network behavior and take action.

Energy: Environment, Energy, and Performance

Intel is leading the way to reduce power in silicon and across the platform, the rack, and the data center, and adding capabilities to help proactively manage power and thermal consumption. Intel AMT client management technology and systems based on Intel vPro processor technology allow client devices to be powered down for power savings without sacrificing off-hours IT patch distribution.

In the data center, Intel has changed the nature of performance delivery. Through the last three generations, Intel server platforms have delivered a four-fold increase in performance, while staying inside a flat power envelope. This achievement makes for excellent efficiency and allows data center designers to plan for a set rack power/cooling that will work today and with future generations.

Besides constantly improving silicon efficiency, Intel continues to add new technologies like dynamic-based switching and node power management for monitoring and managing energy use across the platform, the rack, and eventually the entire data center. This combination of efficiency and management enables true data center optimization.

Virtualization: Dynamic Resource Management

Industry visions for the data center are consistent in their promise of providing increased flexibility, agility, and utilization. Enabling this vision is driving the addition of technology and features across Intel's diverse product families.

The primary vehicle for achieving these goals is increased and improved virtualization, much like what has already been achieved in the storage space in SAN and NAS arrays (i.e., abstracting the physical disc and delivering the virtual volume). Extending this model to compute and network resources is a logical next step that holds the promise for Predictive Enterprise optimization of server size and capability to exactly fit the workload assigned.

Intel's leading virtualization performance makes Intel-based servers the ideal platform for partitioning into virtual servers. Intel has led the marketplace with the introduction of silicon enhancements to improve server virtualization. Intel® Virtualization Technology, the first hardware virtualization in standard servers, was introduced in 2005. Intel continues to introduce new, enhanced virtualization technologies for servers and desktop and mobile systems, including enhanced I/O virtualization and VMware Vmotion* across processor generations.

Collaborating with other leading companies, Intel is enabling standards and technology for enhancements to Ethernet for the data center, combining the affordability and ubiquity of Ethernet with the guaranteed latency and throughput of other data center fabric technology.

Virtualization is the path of the future data center, and Intel is leading the way through close working relationships with key ISVs and solution developers.

Performance: Data-Intensive Computing

Analysts are raising the alarm because a massive wall of data is about to hit the data center. IT managers need to ensure their architectural choices will not only survive, but also take advantage of this data wealth. Intel anticipated this trend and—through products, technology, and standards—is delivering the best in data processing architecture.

Data is doubling every year, yet customers want to do more to improve business decisions. Companies like Wal-Mart* and Amazon* have expressed a strong interest in mining the data for information on a continuous, real-time basis. The 24-hour batch cycle is no longer adequate. CIOs are being asked to do more work on more data in less time. The data center with the best ability to process data will deliver the greatest business value.

Besides providing raw performance leadership, Intel's research and development engine is delivering new platform technologies to further increase I/O performance. Extensible Markup Language (XML) is the fastest-growing type of data on the Internet. Intel's acquisition of XML acceleration companies has combined silicon and software expertise to improve XML processing. Within the processor, Intel is adding new instructions to speed processing of large XML data types including searching and encryption (QuickAssist*).

Data accelerators are getting a lot of attention and Intel has opened our front-side bus to drop in accelerators. The industry momentum for this solution is in the expansion of the PCI/Express standard that Intel is driving (Geneseo technology). Geneseo provides a standard drop-in interface for data- and work-specific acceleration by expanding on an industry standard.

Intel® QuickPath, QuickAssist, and QuickData technologies accelerate data from network, storage, memory, and processors.

Unified and Converged Communications

Virtual offices, remote workers, global distributed teams, and mobile road warriors challenge today's information infrastructure. Unified communications can deliver features like presence detection, giving users more information about how and when to connect with colleagues. Instant messaging, voice, and video collaboration from a single user interface can increase productivity. Utilizing wireless networks and mobile clients connects employees on the go. Being able to deliver these features on a single flexible and scalable IP network helps reduce total cost of ownership versus multiple traditional separate networks that require their own staffing, training, and support models.

A workforce that is global and mobile requires a communications and collaboration environment that can deliver voice, data, video, and messaging from a consistent, presence-aware interface. By combining multiple separate networks with a single unified communications network, IT departments can deliver new productivity capabilities while driving down total cost of ownership (TCO). According to a recent report by the Aberdeen Group, enterprises with best-in-class implementations of unified communications systems averaged annual savings of \$154 per user and 49% ROI⁹.

Intel understands the network. In fact, Intel architecture powers nearly 50% of the high-end IP-PBX systems from leading vendors. Intel is the leading processor in enterprise servers and clients. Bringing servers and communications together on the same architecture allows for a scalable and flexible enterprise solution that helps reduce TCO.

Intel delivers business value through converged applications platforms that consolidate multiple functions on to a single voice, application, and security device. As

Figure 8: The Journey to Predictive Enterprise

Focus Area	Data Center	Enterprise Computing	Business Ecosystem
Time Frame	Current (past 3 years)	Emerging (next 3 years)	Future (beyond 3 years)
Implications for Business Capabilities	"Do more, with less" Management	"Adaptive Business"	"Predictive Enterprise"
Implications for IT Capabilities	Gain control over IT	Provide IT as a service	IT services are an integral part of Business Strategy and Capabilities
Maturity State	Being implemented and managed by IT	Being planned and developed by IT with ISVs and SIs	In discovery by OEMs, ISVs and SIs

Beyond the next three years, Intel expects enterprises to invest in business ecosystem capabilities that will build on the capabilities developed during the data center and enterprise computing stages of development.

voice over IP (VoIP) is migrated to more comprehensive deployments, new security threats emerge.

In 2009 Intel will deliver Intel® QuickAssist Technology, which integrates acceleration for functions like encryption and compression, allowing for more application processing capabilities. This will provide higher-quality and more secure and cost-effective platforms. In the future, voice commands and speech recognition and fixed and mobile video conferencing will raise productivity to new levels.

Figure 9: Predictive Enterprise Vision Framework

Time Frame	Current (past 3+ years)	Emerging (next 3 years)	Future (beyond 3 years)
Scope	Data Center Efficiency	Enterprise Computing Acceleration	Business Ecosystem Optimization
Business Priorities	<ul style="list-style-type: none"> Improve return on IT investments Achieve greater scalability and availability from IT offerings Increase efficiency 	<ul style="list-style-type: none"> Bring new services to market faster Respond rapidly to business opportunities Develop and deliver innovative products and services 	<ul style="list-style-type: none"> Enable business growth through innovation and transformation Better understanding of customer needs and characteristics Reduce the risk in building new markets Quickly fine tune business strategies
Technology Catalysts	<ul style="list-style-type: none"> Storage and Datacenter virtualization Software management agents Provisioning and Asset Management software Standardization on XML 	<ul style="list-style-type: none"> Basic Utility Computing services based on virtualized infrastructure Real-time analytics and data-intensive compute models Edge Servers, Data Fabrics SOA, Web Services, SaaS HW-enhanced management and security Ultra Mobil Device-based clients 	<ul style="list-style-type: none"> Ecosystem services and orchestration Increased business automation and Policy-based compute models Context-aware clients in many form factors Ubiquitous wireless wideband: always connected computing
Implications for IT Capabilities	Gain control over IT: <ul style="list-style-type: none"> Reduce capital and maintenance costs Reduce complexity Scale quickly and dynamically 	Provide IT as a service: <ul style="list-style-type: none"> Enable optimization through reusability of services Reduce development costs Accelerate deployments Reduce application and data "silos" 	IT services are an integral part of business capabilities: <ul style="list-style-type: none"> Continued expansion of technology enabled, dynamic business relationships Explosion of business analytics and business automation
Implications for Business Capabilities	"Do more, with less" Management <ul style="list-style-type: none"> Reduce costs via Power/Thermals, virtualization, manageability, and security 	Adaptive Business: <ul style="list-style-type: none"> Is flexible and dynamically changeable, in both business processes and technology. Is able to integrate new resources or reallocate existing ones as needed to solve business problems and address arising needs. 	Predictive Enterprise: <ul style="list-style-type: none"> Extends the "Adaptive Business" model beyond just reacting faster & faster: Adds the capabilities to: <ul style="list-style-type: none"> Sense: Collect Real-time data Predict: Develop accurate conclusions Act: Make effective actions

Beyond the next three years, Intel expects enterprises to invest in business ecosystem capabilities that will build on the capabilities developed during the data center and enterprise computing stages of development.

Mobile and Rich User Experience

Intel has led in the areas of mobility and performance, two vectors that continue to be critical to the business enterprise moving forward. Graphics and visualization and advanced analytics are also areas of increasing importance. Intel's leadership in silicon engineering and manufacturing is extending to new integrated technologies combining graphics and compute. Graphics and visualization are becoming more important with the transition to Microsoft Windows* Vista and the trend toward a distributed workforce. New collaboration solutions that integrate voice video and data sharing will drive the need for power and connection in client as the endpoint.

On the analytics side, multiple vectors are driving needs. The agile enterprise enables better and faster decisions using enterprise data, with a requirement for secure, interactive access both online and offline. Algorithms and analyses performed with desktop and enterprise search tools are evolving beyond text to include audio, video, and semantic-based search. This growth will demand optimum client performance for maximum productivity in a knowledge-centric workforce.

The Journey to Predictive Enterprise

Developing the business and IT capabilities needed to fully realize the Predictive Enterprise will take years—and a foundation built on emerging enterprise and data center capabilities. This transformation will happen in stages (Figure 8).

The first stage, the data center computing stage, has already been taking place. Over the last three years, many enterprises have invested in new data center capabilities to help them:

- **Do more with less:** Business management solutions have helped to reduce costs through power/thermal optimization, virtualization, manageability, and security.
- **Gain control over IT:** Information technologies have helped to reduce capital and maintenance costs and complexity and make data centers quickly and dynamically scalable.

In the next stage, which will happen over the next three years, these businesses will invest in new enterprise computing capabilities. The enterprise computing stage of development will build the capabilities developed during the data center computing stage of development. The enterprise computing stage includes:

- **Adding business management capabilities:** Becoming adaptive, flexible, and dynamically changeable in both business processes and technology. This includes being able to integrate new resources or reallocate existing ones as needed to solve business problems and address needs as they arise.
- **Providing IT as a service:** Enabling optimization through reusable services—reducing development cost, accelerating deployments, reducing application and data silos, and optimizing computing resources.

Beyond the next three years, Intel expects enterprises to invest in business ecosystem capabilities that will build on the capabilities developed during the data center and enterprise computing stages of development (Figure 9).

The business ecosystem stage will include:

- **Building the Predictive Enterprise:** Extending the adaptive business model beyond just quicker reaction by adding the ability to:
 - **Sense:** Collect real-time data
 - **Predict:** Develop accurate conclusions
 - **Act:** Make more effective actions
- **Making IT services an integral part of business capabilities:** Continued expansion of technology-enabled, dynamic business relationships and an explosion in business analytics and business automation.

Building the Predictive Enterprise

Intel is committed to providing the computational capacity to meet today's and tomorrow's business demands with the next-generation Intel® Core™2 and Intel® Xeon® processor families based on our industry-leading 45-nanometer (nm) Hi-k + metal gate process technology and latest microarchitecture enhancements. This next evolution in Intel Core microarchitecture builds on the tremendous success of our revolutionary microarchitecture (currently used in both the Intel Xeon and Intel Core 2 processor families) and marks the next step in Intel's rapid cadence of delivering a new process technology with an enhanced microarchitecture or an entirely new microarchitecture every year.

Over many years, Intel has built a unique capability and combination of products, technologies, tools, and services. We have also established the deepest relationships with hardware, software, and integrator companies around the world. Intel continues to invest in new products, infrastructure, and standards for the future.

Intel will continue to work with customers, hardware and software vendors, and system integrators to help provide and enable the underlying computer stack for the Predictive Enterprise. Intel's role is to develop and align the Predictive Enterprise framework and work with the IT industry ecosystem as a catalyst for business innovation.

Since nothing is more important than the business success of our customers and colleagues around the globe, Intel will continue leading the industry through innovation, enabling, standardization, and integration inside your platforms, across your business, throughout the industry, and across the world.

To learn more or begin taking steps to make your own company a Predictive Enterprise, contact the consulting professionals at Intel® Solution Services or visit www.intel.com/go/intelsolutionservices.

Appendix: Industry Examples

Logistics/Transportation: Metro

Metro is the transportation authority for the area around St. Louis, MO. Its fleet of 433 MetroBuses carries more than 100,000 passengers daily. Metro recently completed a pilot program based on predictive business. The goal was to see if Metro could forecast and address vehicle equipment problems in a way that would reduce maintenance costs while also minimizing customer inconvenience. The pilot program enabled Metro to:

- **Sense:** Twenty buses were outfitted with sensor devices and data collection boxes that sent engine and transmission information to central data collection computer.
- **Predict:** For each bus, the computer first developed a model that reflected normal operating conditions and performance. Then data from each bus was captured three times a day and compared with the model for that specific vehicle.
- **Act:** When a particular bus operated outside its performance parameters, it showed up on a watch list. Once alerted, mechanics could call up more detailed data, then identify and execute an ideal response.

The next phase of the project will combine maintenance predictions with other data such as the cost and availability of parts and labor and the value of lost revenue. This will enable public transportation officials to fine-tune their overall maintenance operation and significantly reduce costs. For example, improved lifetime maintenance along with continuous, real-time monitoring could keep buses in service between 8 and 10% longer, saving as much as \$25,000 per bus over the life of the vehicle.

HealthCare: St Vincent's Hospital

St. Vincent's is a 300-bed, acute care hospital with advanced services for treating patients. From a 2004 analysis, St. Vincent's estimated there were 3,161 hours of medical staff time diverted per year from delivering healthcare.

By implementing new technology in key areas of the hospital, St. Vincent's was able to sense, analyze, predict, and then act upon information to address this issue and deliver:

- **An 85% improvement** in admissions time
- **A 100% improvement** in discharge time
- **Increased** patient satisfaction
- **Better** staff morale and productivity

This Predictive Enterprise solution was initially deployed along with business process modifications in a 35-bed surgical unit. The seven-month project generated impressive benefits and return on investment (ROI). The hospital is now rolling the solution out to 12 additional nursing units. The increased visibility of patient flow data helped produce significant improvements in patient throughput.

The same information gathered during the pilot program can also be used to analyze patient care, help optimize clinician and nurse resources, and make better usage of assets—all from using the initial solution investment in technologies to:

- **Sense** what is happening in the environment
- **Predict** the consequences of the information gathered
- **Act** through providing recommendations

Retail: Hannaford Brothers

Hannaford Brothers operates 158 supermarkets and supermarket/pharmacies in New England and New York. For supermarkets and other traditional retailers, technological advancements in the last decade have transformed both customer service and business operations. With help from Intel, Hannaford Brothers was able to put together an infrastructure that can:

- **Sense:** When a customer checks out, the bar code is scanned at the register. Managers use handheld wireless devices that run applications processed on the central mainframe to look up inventory, order more products, adjust prices, and produce coupon stickers that are scanned at the register. All of this data is transmitted to a central data warehouse for storage and analysis.
- **Predict:** By analyzing daily store sales data, the Hannaford category manager for meat can see if a store is cutting too much or too little of a specific meat item on a given day and then develop a revised plan to improve in-store meat offerings for the next day.
- **Act:** The store's butcher can access daily store sales data analysis through an application that runs on an in-store PC that pulls the information from the corporate mainframe. Knowing that there is a surplus of a particular item, and based on the recommendations of the Hannaford category manager, the butcher can cut a reduced amount of that item for the following day.

Timely and accurate in-store sales data collection and analysis make it possible for Hannaford and other grocers to successfully operate in an industry well known for its small profit margins, which hover between 1 and 2%.

Technology Infrastructure: Asklepios

One of Europe's leading healthcare providers, Asklepios has an annual turnover of EUR 2.3 billion (US\$2.9 billion). It runs 95 rehabilitation centers, clinics, and hospitals in Germany and across Europe and the USA.

Asklepios needed a solution that could:

- **Reduce PC downtime**, potentially increasing staff productivity and delivering more efficient and timely patient care.
- **Provide reliable, 24/7 visibility** to the IT infrastructure, operating system, and software to cut average system downtime from seven hours to a few minutes.

Initially deployed at one site, this Predictive Enterprise solution is now being rolled out across the rest of the Asklepios Group. Having seen the solution's value, Asklepios is continuing to test and assess additional features such as platform-level alerting.

The same information that has been gathered (sensed) has helped with the proactive maintenance in the support and helpdesk operations. These features can also be integrated to assess asset usage and registering and validation of all software installed across the IT infrastructure. It can also be integrated with the change management processes to assure that all security, patches, definition files, and versions of software are applied everywhere with the same level of security. The capabilities that allow the sensing also allow technicians to act on the instructions sent, run programs, shut down the system, or start up the system.

Intel's Predictive enterprise within IT Infrastructure:

- **Senses** what is happening in the environment
- **Predicts** the consequences of the information gathered
- **Acts** by providing recommendations

These capabilities augment an organization's own systems for asset management, software licensing, helpdesk, capacity planning, disaster recovery, availability management, and security.

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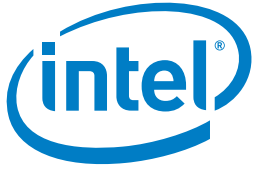
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