IT@Intel White Paper

Intel IT
IT Best Practices
Business Intelligence and IT Business Transformation
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Roadmap for Transforming Intel's Business with Advanced Analytics

Intel IT is working in close partnership with Intel business groups to help them envision new ways of using business intelligence to improve insight, decision making, and business velocity.

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Executive Overview

Intel IT is laying the technical and business foundation for deploying advanced business intelligence (BI) solutions across the enterprise. In particular, we believe that advanced analytics, such as "what if" scenarios and the ability to mix and match data from a wide variety of sources in real-time, can greatly improve the ability to respond quickly to market changes and transform Intel's business.

Improving analytical capabilities enables Intel to keep up with the accelerating pace of business. A better understanding of customer expectation and sentiment, tighter processes for product design and development, and the ability to dramatically improve our operations will help maintain Intel's market leadership.

Business groups and other information consumers at Intel increasingly ask for solutions that rely on advanced BI. They want:

- The ability to parse data, interpret patterns, and make predictions.
- Visual representations of data.
- Self-service tools to manipulate, interrogate, and analyze information autonomously, at the point of need.
- The ability to combine data from a variety of sources beyond Intel's enterprise databases.

Advances in affordable but powerful processors, such as Intel® Core™ processors, as well as similar technology improvements in data storage capabilities, make such solutions possible.

Intel IT is working in close partnership with Intel business groups to help them envision new ways of using business intelligence to improve insight, decision making, and business velocity. We are conducting several proofs of concept (PoCs) that illustrate the power of BI:

- **Batch computing algorithm that proactively predicts when product design jobs will fail.** This algorithm is currently in production, and we expect it to generate up to USD 7 million in capital avoidance annually for one process alone.
- **Information security dashboard that helps track and respond to malware threats.** We intend to use advanced analytics and add a predictive engine to this data, which will enable proactive protection as well as simulations that can improve our ability to respond to threats.
- **Predictive engine that enables early detection of product quality problems on our manufacturing lines.** With early detection, we can dramatically improve line yields and prevent high-volume, costly mistakes.

Today, each of these advanced BI solutions serve the needs of a single business group; however, we see opportunities to maximize business value through broad reuse across our enterprise.

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BACKGROUND

As the velocity and complexity of Intel's business accelerate, Intel IT has identified explosive opportunities for business intelligence (BI)—especially advanced analytics—to become a significant competitive differentiator for the company. If we improve analytical capabilities for Intel's many business groups, we can help them understand customer expectation and sentiment, tighten product design and development processes, and dramatically improve operations.

To take advantage of these opportunities, we need to provide insights in real time and at the point of opportunity—not reports from a static date in the past. Business groups expect information when and where they want it—such as real-time trend analysis based on large data sets or visual representations of data during a sales call with customers. Two key technology inflection points help make such capabilities a reality: affordable advances in processing power, such as that offered by Intel® Core™ processors, as well as better and less expensive storage capabilities, such as in-memory data storage. (Figure 1).

Intel's manufacturing environment is already using advanced analytics, and Intel IT's vision is to expand this capability across the enterprise by delivering reusable predictive models that will provide real business value for Intel.

IMPLEMENTING ADVANCED ANALYTICS AT INTEL

Important opportunities exist for enhancing the use of BI within Intel's business groups. While many Intel business groups have indicated they want and need better BI capabilities to enhance decision making, they cannot always conceive of what is possible with new tools, new processing power, and new paradigms for information analysis. Intel IT is therefore taking a leadership role with these customers to help them to think in new ways and identify possible BI solutions that go far beyond the basic reporting with which they are familiar.

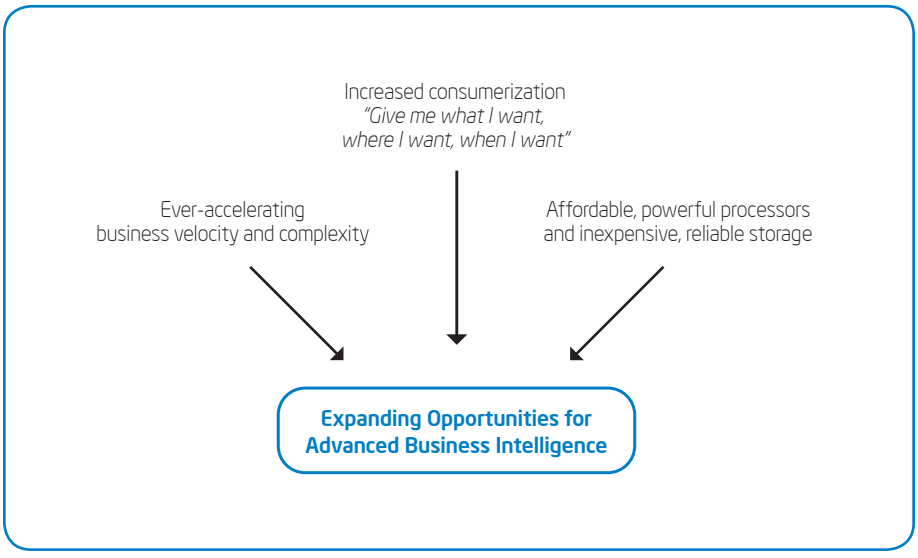

Figure 1. Improvements in processing power and storage, consumerization, and increasing business velocity and complexity all point to new opportunities in advanced business intelligence.

Our implementation of advanced BI is shaped by three themes, shown in Figure 2, that describe shifts in our customers' expectations and business needs:

- **Intel's "expanding brain."** We want Intel employees to be as productive as possible, focused on strategy, execution, and decision making—not on processing data. To facilitate employee productivity, we can expand the way we use our systems to simulate and complement the human brain. For example, combining predictive models and business activity monitoring can enable management by exception, where an employee becomes involved in a process only when that process violates pre-set control limits or rules

  Further, employees can collectively enrich the interpretation of information and subsequent actions through collaborative BI, enabling the whole to be greater than the sum of its parts.
- **Exploding consumption.** Information consumers at Intel are technologically sophisticated, and they want information to be available in more varied ways than ever before.
  - They want to ask questions and get immediate answers at the point of opportunity, when they are trying to gain insight to make a decision. They don't want to wait until the end of the month for a report.
  - They want self-service opportunities to mix and match data so they can extract the information best suited to their immediate needs. They don't want static, pre-defined reports.
- **Insight without bounds.** In the future, data will come from a variety of sources—both internal and external—beyond Intel's enterprise databases.

While "traditional" BI—such as pre-defined reports and ad hoc queries based on data contained in large enterprise databases—is still valuable, our new emphasis will be on advanced analysis. To that end, we will focus on:

- New ways of aggregating and parsing data.
- Performing predictive or "what if" analysis.
- Looking for trends and patterns.
- Providing real-time and visual representations of data to business groups with a business need.
- Combining data from multiple sources, such as personal spreadsheets and social media tools

As with traditional BI, data quality is imperative for accurate analysis. Therefore, we will continue to improve data management technology and processes to boost the integrity of Intel's data, including implementing best practices for data quality and properly cataloging and securing data.

We also need to invest in enhancing our capacity to store and analyze large amounts of data, as well as in developing platforms for personalized and self-served information. The results of these investments will complement Intel's existing BI capabilities.

Business Intelligence Roadmap

Using an enterprise-wide BI roadmap defined by line-of-business needs as a starting point, Intel IT works closely with business group leaders to understand the problems they are trying to solve. We then design BI solutions that meet their needs. We often employ agile development methodologies to iteratively develop solutions.

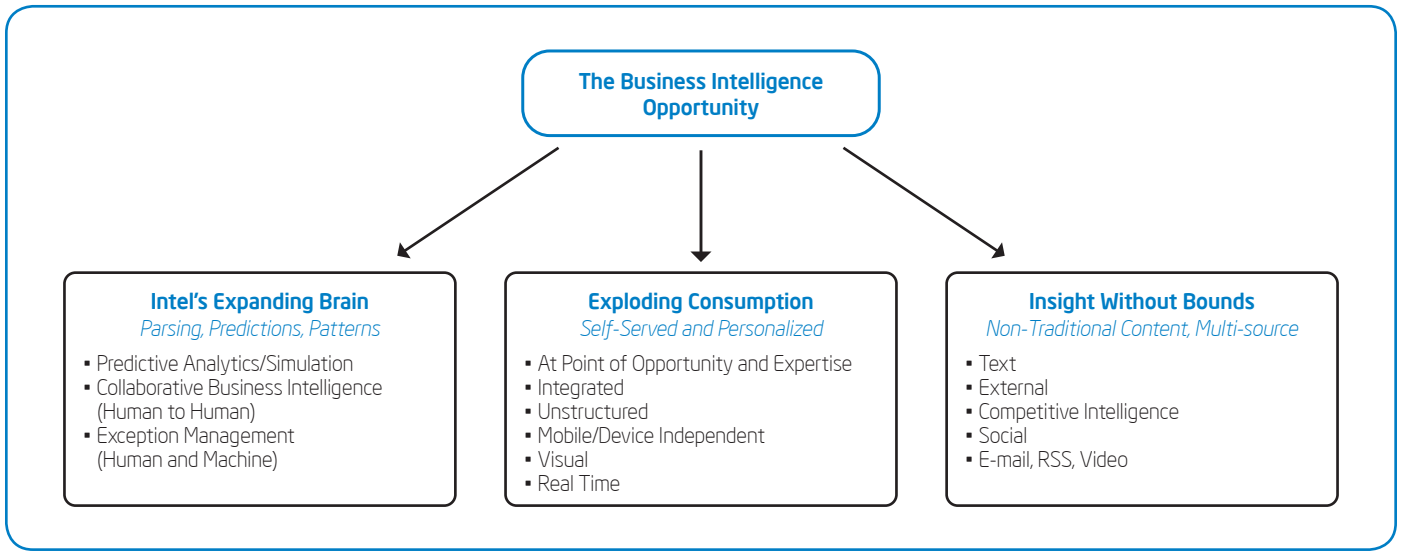

Figure 2. Maturing Intel's business intelligence capabilities requires a fresh look at the role of systems in our decision-making process, a more personalized approach to information consumption, and the expansion of our historical view of data sources.

When we face more demand for BI solutions than available resources can support, we assess the potential value and impact of each solution across the enterprise to determine how to prioritize opportunities. Our goal is to develop analytical models that are reusable across multiple lines of business. We believe that our small BI solution design teams can deliver about USD 5 to 10 million in value for every six-month advanced-analytics project focused on solving high-impact business problems.

If we decide to invest in a solution, we build a plan that incorporates three key components:

- Research and pathfinding activities that help us discover what our users need and how to incorporate new technologies into our environment.
- A core foundation of trusted data.
- Right-sized platform options to balance business need and cost. These technology platforms include front-end tools that provide end-user access to data, data movement technologies, and the back-end tools we use to manage the data.

Proofs of Concept and Results

Business groups are eager to consume more sophisticated BI. Our 2011 investment in Intel's data foundation has yielded multiple "certified" subject areas for cross-enterprise use, as well as a mature technology platform to manage that data. In addition, solutions supporting Intel's product design and development processes, corporate marketing efforts, information security, and employee management have begun to reduce risk and return tangible savings for Intel.

- **Batch computing.** To support Intel's product design community, we developed an engine to predict how long batch jobs are likely to run and when they are likely to fail. This allows early intervention to optimize and rebalance design compute capacity across our server environment before time is wasted and resources are expended.

  By implementing compute capacity optimization in our production environment, we expect capital avoidance of up to USD 7 million annually for one process alone. We can also apply this predictive engine to other processes at Intel where early intervention can save time and money.
- **Security.** To help protect Intel's information assets and minimize risk, we deployed a highly flexible dashboard that integrates malware data from multiple sources to provide granular information about specific clients or servers that have been infected. This enables a more complete picture of our environment and boosts our ability to intervene quickly and accurately.

  To build on this success, we are applying advanced analytics to add a predictive engine to this data. The predictive engine will enable proactive protection and simulations that can improve our ability to respond to threats.
- **Factory Performance.** To support Intel's core competency—high-volume, precision manufacturing—we developed an engine to enable early detection of product quality problems on our manufacturing lines. With early detection, we can dramatically improve line yields and prevent high-volume, costly mistakes.

  The engine uses rules generated from predictive models as well as additional rules that factory engineers and operators define based on preferences and experience. We anticipate that this engine, and others like it based on reusable models, will easily surpass our USD 5 to 10 million in value rule.

Challenges

While the business value of enhanced BI is clear, we must address technical, behavioral, and business challenges to implement our BI roadmap and goals.

INFRASTRUCTURE AND TECHNICAL CHALLENGES

Over the next several years, Intel IT will address technical and infrastructure challenges associated with advanced BI with investments in the following areas:

- **Deploying new data storage and access techniques.** Price-performance advances and in-memory techniques will enable us to increase processing power and storage to support large amounts of data and advanced analytics in a cost-effective manner. This includes storing and accessing unstructured data associated with large-volume data mining and text analytics.
- **Reducing latency to give employees access to real-time data.** To accomplish this, we may upgrade servers to the latest generation of Intel® processor and increase application capabilities with new software.
- **Supporting multiple data sources and allowing users to combine data in new and compelling ways.** For example, content could come from external Web pages, text, and e-mails, and other non-traditional sources. Users may want to mix data from enterprise databases with data they have captured in their own spreadsheets or extract sentiment from social media.
- **Enabling collaborative, mobile, and visual BI.** This will allow employees to interact with information how they want, where they want, and when they want.
- **Implementing context-aware delivery of BI to a variety of devices.** To enable collaborative, mobile, and visual BI, we must

provide access to information from an array of devices—from mobile business PCs to handheld devices. This raises user interface and security protocol issues we must resolve.

BEHAVIORAL CHALLENGES

We need to invest in new skills within IT to develop advanced BI solutions, including constructing analytical models, supporting use of unstructured data, developing mobile applications, and presenting information in a visual format.

In addition, business groups will need to learn how to consume, interpret, and trust more sophisticated analytical information.

BUSINESS PLANNING CHALLENGES

To gain the best return on investment from constrained resources, we need to determine which efforts require priority.

- Many users want mobile BI, visual solutions, and a high degree of personalization. We must balance the investment that these types of solutions require against the bottom-line value to Intel to determine the order and urgency of BI efforts.
- When working on our data foundation, we need to prioritize the subject areas for cleanup and governance, and select those that will provide the greatest positive impact across Intel's business. In addition, we must improve our ability to predict data foundation requirements to stay one step ahead of solution need.
- We must continue to work with business groups to achieve collective agreement on which BI solutions offer the greatest business opportunities to Intel as a whole.

CONCLUSION

Implementing advanced business analytics helps Intel business groups dramatically improve the velocity and quality of decision-making. Intel IT's vision for BI includes personalized, visual solutions that allow employees to manipulate, analyze, and interrogate both structured and unstructured data autonomously.

Advances in affordable processing power, such as that offered by Intel Core processors, as well as improvements in affordable data storage technology, make such advanced capabilities a reality at Intel. We are currently building the necessary technical and business foundation, and engaging in specific line-of-business point solutions that illustrate the immense power of BI to set the pace of business transformation. Moving forward, we will focus on opportunities where BI can connect lines of sight and insight across functional lines within Intel.

ACRONYMS

BI	business intelligence
PoC	proof of concept

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