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Why Business Client Devices Are Needed for Self-Service BI

By upgrading a self-service BI user from an Intel® Core™ i5 vPro™ processor to an Intel® Core™ i7 vPro™ processor, we can reduce two hours of query time to almost one.

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Executive Overview

We are in the midst of the democratization of big data. Broadening business users' access to analytics makes it difficult for traditional business intelligence (BI)¹ to meet user demand. At Intel, some users perform self-service BI by running queries, creating visualizations, exploring data, and performing analytics. Twenty-five percent of our sales and marketing group already performs self-service BI.

Analytics—along with other “workplace transformation” initiatives such as social media, mobile technologies, and cloud solutions—are critical to optimizing productivity for all of Intel's business groups. To advance these workplace transformation initiatives, Intel IT provides client devices to users that are powerful enough to enable users to meet the demanding needs of business.

To evaluate the business value of high-performance business client devices for users conducting self-service BI, we tested how processor core speed, processor cache, and RAM influenced simple, medium, and complex query response times of datasets on nine hardware configurations (tablets and laptops).

Our test results led to the following findings:

- Processor core speed proved to be the critical factor in accelerated response time for all dataset queries.
- Higher processor cache and additional RAM also contribute to improved query performance.
- Self-service BI query run times were up to 50 percent faster on Intel® Core™ i7 vPro™ processor clients compared to Intel® Core™ i5 vPro™ processor clients.

In terms of enabling a productive workforce, by upgrading a self-service BI user from an Intel Core i5 vPro processor to an Intel Core i7 vPro processor,

¹ Adherence to Intel security and privacy policies is required to perform business intelligence data analysis. This paper shares only test results and performance analysis and does not reveal any sensitive information regarding data or its sources.

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Acronyms

- BI** business intelligence
- TSX-NI** transactional synchronization extensions-new instructions

query response times can be reduced from two hours to almost one. That efficiency can translate into faster decision making and more time for innovation and productivity.

Business Challenge

Intel IT recognizes increasing business velocity as a competitive differentiator. To help increase velocity, we are enabling a large-scale “workplace transformation” initiative across Intel with solutions for social media, mobile platforms, analytics, and cloud technologies. As part of this effort, we want to provide business users with the client devices they need to optimize their productivity. Users tasked with business intelligence (BI) responsibilities—such as running queries, creating visualizations, exploring data, and performing analytics—want high-performance devices that have business-class attributes—ruggedness, security, and manageability.

With many Intel users being asked to conduct data analysis, and do it quickly, we need to provide them with suitable hardware for self-service BI tasks. Data queries for BI can be massive. Client devices with insufficient processor core speeds, processor caches, and RAM may be too slow or even fail to process the query.

The BI Bottleneck

BI transforms data into meaningful insight to help users make smarter decisions. At Intel, BI already delivers substantial value:

- A factory analytics BI solution transforms unit-level data on one of Intel's product lines into actionable insight that helps optimize test cycles, reducing some test operations by 80 percent.
- A business development BI solution mines internal and external sales data and transforms it into insight that helps Intel's sales force focus on large-volume resellers to increase revenue.
- A failure prediction BI model analyzes previously unmonitored network client logs and uses the data to help proactively reduce failure incidents by 30 percent and reduce the number of service calls.

We have discovered that this level of business value can trigger a bottleneck in BI analysis requests. To receive the actionable information derived from BI—analyzed, interpreted, and visualized in graph form—users first submit a query request to Intel IT. The request then rests in a queue until it can be analyzed so the results can be returned to the requestor. When that queue backlog extends up to six months, users can lose the ability to make smart decisions fast, which can limit the business unit's agility and competitive position.

Business client devices can open this bottleneck and contribute to workplace transformation by providing BI capabilities to business users who can be trained to perform some self-service BI tasks.

The Shift to Self-Service BI

Self-service BI empowers users to gain insight and quickly make smarter decisions by analyzing and visualizing big data with less IT intervention than traditional BI. As data gathering expands exponentially, businesses want more employees to be able to analyze and mine data for BI. Whether for identifying buying patterns or developing marketing content, companies want to empower a broad base of employees to analyze data.

While data analysts may possess the background to transition to self-service BI solutions with minimal training, other users require additional support to frame business opportunities as data mining problems. Intel is already training sales agents, business managers, and other users that depend on data analytics to execute self-service BI capabilities.²

Within our sales group, we are seeing year-over-year increases of 40 percent in utilization of our self-service BI solutions and reports.³ Twenty-five percent of our sales and marketing group already performs self-service BI. As more users learn how to perform analytics, the need for additional high-performance business client devices continues to grow.

Intel IT accomplishes several goals by shifting some BI capabilities to business units:

- Empowers users to be more innovative with data
- Accelerates user decision making and improve customer engagement
- Reduces the IT backlog of BI requests

Integral to our self-service BI solutions are software applications that utilize local and enterprise data, helping users to explore data visually, create mashups of multiple datasets, and import information from other platforms. These intuitive applications have reduced the skillset required to perform analytics and make self-service BI more palatable to a wider user base.

Solution

The success of self-service BI hinges on the user's skillset as well as on a business client device's ability to query, analyze, and visualize large datasets. Our tests show that high-performing business clients can perform self-service BI functions faster than less powerful clients, providing significant productivity gains. These tests highlight the potential advances in personal productivity for business users and the importance of high-performance business clients for analytics.

Our tests compared nine device configurations performing real-world use cases and queries. We established the key metric as the amount of time it took to execute three types of BI queries of large datasets.

² See the Intel IT white paper "Broadening Access to Data Analytics in the Enterprise."

³ See the Intel IT white paper "Delivering Self-Service BI, Data Visualization, and Big Data Analytics."

Our tests show that high-performing business clients can perform self-service BI functions faster than less powerful clients.

Methodology

When examining the amount of time it took for queries to execute on each client device, we isolated processor core speed and RAM size variables for each configuration.⁴ As processor core speed increased, so did the processor cache.

For each of the nine hardware configurations, we conducted tests using the following parameters:

- Each client had the same OS and software configuration.
- Two common in-memory BI software solutions were tested to prove that results are consistent and software-agnostic.
- Queries were executed on the same datasets.
- The same queries were repeated for each client.

Hardware

We tested nine hardware configurations, ranging from a tablet running the Intel® Atom™ processor Z3795 (1.59 GHz) with 4 GB RAM to a laptop running the Intel® Core™ i7-4900MQ vPro™ processor (2.8 GHz) with 16 GB of RAM. See Table 1 for a complete list of the tested configurations.

We set the client running the Intel® Core™ i5-4300U vPro™ processor (1.9 GHz) with 4 GB of RAM as the baseline of the study. At Intel, many IT-supported laptops come with 4 GB of memory. Since self-service BI users prefer the portability of tablets and laptops, desktop workstations were excluded from testing.

Software

Each client device ran the same OS and software configuration. We tested a market-leading self-service BI software tool and the most prevalent self-service BI software tool at Intel. Both of these 64-bit applications use in-memory analytics, which compress and store data in RAM to optimize query performance. In-memory analytics capabilities rely on the amount of RAM available, particularly with large datasets, which explains why RAM was a key variable for us to test against.

⁴ While we did not isolate CPU cache size for this study, our white paper "[Configuring an In-Memory BI Platform for Extreme Performance](#)" illustrates that CPU cache size does play a role in executing queries faster on virtual servers.

Table 1. Intel IT ran the same queries on the same datasets to test the performance gain of each of these hardware configurations. Note: GPU and graphics base frequency were tracked in the study but did not provide any statistical impact on the results.

Processor	Cores	Intel® Turbo Boost Technology	Cache on CPU	RAM	Device Type
Intel® Atom™ Processor Z3795 (1.59 GHz)	4	No	2 MB	4 GB	Tablet
Intel® Core™ i3-4010U Processor (1.7 GHz)	2	No	2 MB	4 GB	Laptop
Intel® Core™ i5-4300U vPro™ Processor (1.9 GHz) Baseline	2	Yes	3 MB	4 GB	Laptop
				8 GB	Tablet
Intel® Core™ i7-4700MQ vPro™ Processor (2.4 GHz)	4	Yes	6 MB	4 GB	Laptop
				8 GB	Laptop
				16 GB	Laptop
Intel® Core™ i7-4900MQ vPro™ Processor (2.4 GHz)	4	Yes	8 MB	4 GB	Laptop
				16 GB	Laptop

Real-World Use Case Scenarios and Queries

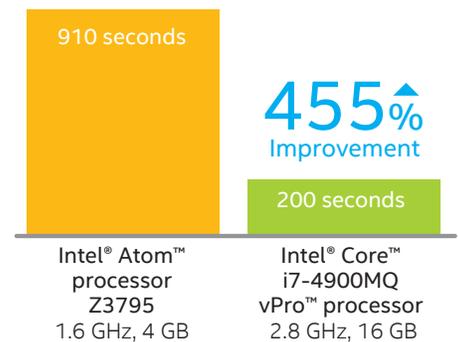
Our tests were based on queries from two actual use cases and data from the sales and marketing group.

- The first use case featured a user mining product consumption information and merging multiple datasets to gain insight into how company products were consumed worldwide.
- The second use case featured a user analyzing consumer insight data and producing advanced data visualizations to help better understand and serve customers. Both use cases queried large datasets that included millions of rows of data.

For each use case, we executed three types of queries:

- **Simple queries**, such as determining annual product market share or quarterly product consumption, executed in a minute or less.
- **Medium queries**, such as examining annual product market share in detail by geographic region, executed in 1-3 minutes.
- **Complex queries** that resulted in data models based on analyzing data at its most granular level executed in 3-10+ minutes. This type of query involved yearly market share analysis from a medium or simple query and then created a model to predict future performance.

Optimal Complex Query Test Results



Test Results

Optimal results came from using the processor configuration that included Intel® vPro™ technology combined with the fastest processor core, the largest processor cache, and the most RAM: the Intel Core i7-4900MQ vPro processor (2.8 GHz) with 16 GB of RAM (see sidebar “Intel® vPro™ Technology”). As illustrated in Figure 1, performance gains accelerated incrementally from the lowest performing configuration to the highest performing configuration,

Performance Gains Compared to Intel® Core™ i5-4300U vPro™ Processor (4 GB)

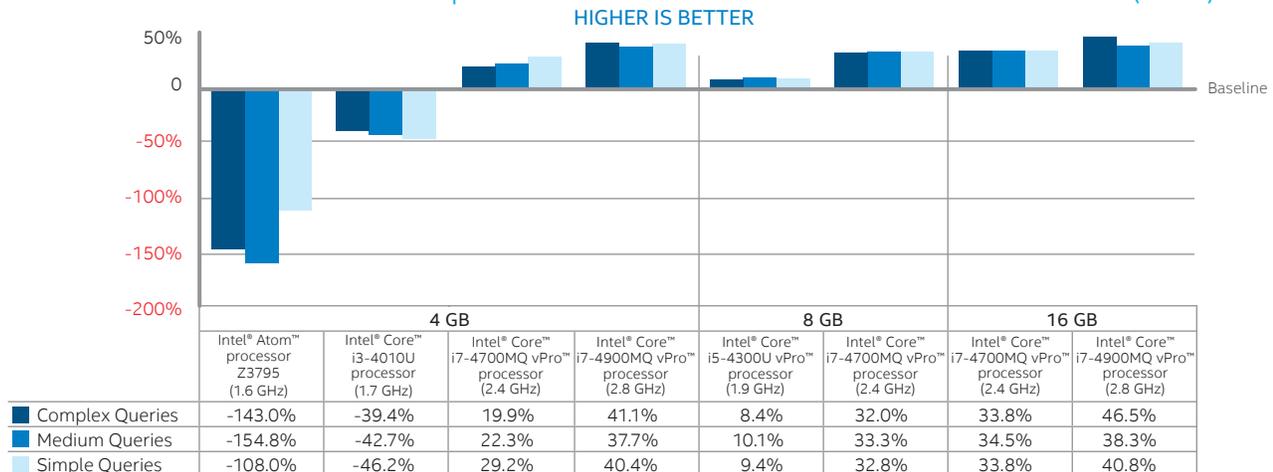


Figure 1. Performance gains increased incrementally from the lowest performing configuration to the highest performing configuration.

indicating that self-service BI performance improves with increased processor core speed, processor cache, and RAM on client devices. Among the configuration variables, increasing processor core speed provided the greatest increase in query response performance.

Advantage of Faster Processor Cores

In Figure 2, we isolated our primary test objective to show that higher performing processor cores accelerate performance gains in self-service BI use cases in the 4 GB test configurations. Intel Core i7-4900MQ vPro processor (2.8 GHz) can provide up to 41.1 percent faster performance compared to the baseline Intel Core i5-4300U vPro processor (1.9 GHz) and up to 192.5 percent faster performance compared to the Intel Atom Z3795 processor (1.59 GHz).

These results reveal that a user who performs two hours of queries on the Intel Core i5-4300U vPro processor (1.9 GHz) can gain almost a full hour of productivity by upgrading to a business client device running an Intel Core i7-4900MQ vPro processor (2.8 GHz)—a reduction in query run times of up to 50 percent.

By examining how long a user spends performing self-service BI queries, we can create a cost-benefit analysis to determine the amount of time a user could save by upgrading to a more powerful business client device.⁵

Advantage of More RAM

One of our test objectives was to see if RAM capacity had an impact on in-memory BI processing. Figure 3 demonstrates the changes to performance gains when we compared the results of using a faster core versus increasing the RAM. Increasing RAM to the Intel Core i5-4300U vPro processor from 4 GB to 8 GB provided a 12 percent reduction in query time. When using the Intel Core i7-4900MQ vPro processor with 4 GB, query time improved by 43 percent.

⁵ Based on self-service BI usage at Intel, upgrade investments can be recuperated in as few as two weeks of normal query activity.

4 GB Performance Gain Comparison

Complex Queries



Medium Queries

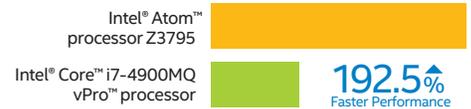


Figure 2. Higher performing processor cores accelerate performance gains in the 4 GB test configurations.

Comparison of Performance Gains Isolated for Processor Core Speed and RAM

LOWER IS BETTER



Figure 3. The faster processor core upgrade provided greater performance gains during the execution of 15 complex queries (30-plus minutes of query time gained) compared to a RAM upgrade (eight minutes of query time gained).

Next Steps

Now that we have confirmed that self-service BI performance improves on client devices with faster processor cores, we will be referencing these results for future fleet management decisions and will also share them with Intel product development groups.

BI is a critical business capability, and we want to support it with client devices powerful enough to efficiently perform queries. As our workplace transforms and self-service BI continues to propagate across the company, we will need to account for a user's BI needs when providing them with a client device.

For Intel product development groups, these results provide incentive to continue improving Intel® architecture to help deliver BI to a broader user base. For example, TSX-NI (transactional synchronization extensions—new instructions) in Intel vPro technology-based clients can accelerate multithreaded workloads such as BI queries.

Conclusion

Based on our test results, we found that faster processor cores in business client devices contributed the greatest performance improvement to executing self-service BI queries compared to improvements attributed to higher processor caches and more RAM. This demonstrates the importance of providing BI users business client devices powerful enough to complete self-service BI analysis with velocity.

Test results include the following:

- Upgrading from Intel® Core™ i3 processor-based client to an Intel Core i5 vPro processor-based client resulted in a 39 to 46 percent reduction in query response time for us.
- Upgrading from Intel Core i5 vPro processor-based client to an Intel Core i7 vPro processor-based client resulted in a 20 to 46 percent reduction in query response time as shown during our testing.
- We found that upgrading RAM for the Intel Core i5-4300U vPro processor from 4 GB to 8 GB resulted in an 8 to 10 percent reduction in query response time.

Intel® vPro™ Technology Combining High Performance with Security and Manageability

Intel® vPro™ technology—part of the latest generation of Intel® Core™ vPro™ processors—is a combination of processor technologies, hardware enhancements, management features, and security technologies that help enable remote access to the client device—including monitoring, maintenance, and management—independent of the client's OS or power state.

Some technologies sacrifice performance in favor of security and manageability. Intel vPro technology allows for high performance while addressing IT challenges with protection from malware and rootkits, strong passwords, and location-based services. In our tests, the laptop with the hardware configuration that responded fastest to self-service BI queries included Intel vPro technology. Additionally, our test's baseline laptop and most common configuration at Intel is the Intel® Core™ i5-4300U vPro™ processor (1.9 GHz) with 4 GB of RAM.

In-memory self-service BI software applications that run on Intel Core i7 vPro processors help users achieve new levels of business insight. Intel Core vPro processors optimize the calculation functions of these self-service BI applications, speeding time to actionable insight. Users can perform faster, more in-depth data analysis right on their tablet or laptop. Include the cost-efficient maintenance features and remote management and Intel Core i7 vPro processors offer self-service BI users a client platform that works harder and smarter, is more secure, and helps them to be more productive.

BI and other big data analytics—in addition to social media, mobile platforms, and cloud technologies—are major contributors to workplace transformation at Intel. Business client devices reduce users' frustration and give them the opportunity to be more mobile, social, and productive while also maintaining security and privacy standards. In addition to recommending higher performing clients to assist with workplace transformation, we are also exploring further training in data mining, analysis, and interpretation so users can optimize the client devices' capabilities.

By using business client devices running faster cores such as Intel Core i7 vPro processors, users performing self-service BI can save a considerable amount of time creating, executing, analyzing, and visualizing queries of large datasets. We believe that by improving self-service BI performance, we are helping to enable users to further explore the benefits of big data innovation. Including Intel vPro technology in the hardware configuration for self-service BI users provides additional features to manage the system and secure data.

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Configurations: Some system configurations and performance tests conducted are included within the body of this paper. For more information go to www.intel.com/performance.

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