# Real-Time Analytics for Real Business Advantage

**The Transformative Power of In-Memory Computing**

Today's rising flood of diverse, fast-moving data represents one of the greatest business opportunities of our time. Companies that can combine, analyze, and distribute data better and faster than their competitors can act more quickly and intelligently to increase revenue and to grow and protect their business.

In-memory computing delivers a massive leap in computing capability that is helping thousands of companies unlock the full potential of their growing data sets. When complex queries can be completed in seconds or minutes rather than hours or days, the results can be integrated into time-sensitive business processes to support everything from proximity-based mobile advertising to real-time logistics and pricing optimization.

Four-socket, eight-socket, and larger servers based on the Intel® Xeon® processor E7 family are ideal for the intense demands of in-memory computing. They provide the massive processing power, large memory capacity, and advanced reliability needed to support real-time, mission-critical business processes. They also provide an industry-standard computing platform that can help IT organizations keep their costs down and their options open as the demands on their in-memory computing platform continue to grow.

## In-Memory Computing Redefines the Possible

In-memory computing solves an issue that has plagued the computing industry—and data-driven businesses—for decades. Bulk data storage systems are simply too slow to keep pace with high-performing processors, and today's multi-core Intel Xeon processors widen the gap even more.

By keeping all data in system memory, in-memory computing delivers data to processors at or near clock speed to eliminate data access latencies and improve transactional and analytical performance by tens, hundreds, even thousands of times.[1] The performance potential is truly game-changing, opening the door to transformative new business models that have not been possible before.

Many software vendors offer in-memory database appliances and solutions today, including industry leaders such as SAP, SAS, Oracle, IBM, Microsoft, and Teradata. Each vendor has a different strategy, so capabilities vary widely. Most current solutions are designed to support real-time analytics acting on large data sets. Others accelerate performance for transactional applications. A few support both types of workloads running on the same database, so analytics can be applied to fresh operational data without the costs, complexities, and delays associated with transferring data to a separate data warehouse or data mart.

## A Platform that Can Grow with Your Business

Some big data analytic solutions are optimized to run on large numbers of two-socket servers based on the Intel® Xeon® processor E5 v3 family. This approach can be valuable for many use cases, such as warm data storage, data preparation, and targeted analytics. However, the best combination of speed, scale, and reliability for real-time business is achieved using large memory footprint server platforms based on the Intel® Xeon® processor E7 v3 family. Running in-memory solutions on a single, enterprise-class server eliminates network latencies to accelerate time to results. It also eliminates the need to partition data across multiple servers.

The Intel Xeon processor E7 v3 family was designed specifically with in-memory computing in mind. These processors provide the performance, scalability, reliability, and flexibility needed to support a smooth transition toward next-generation, real-time business models.

### Extreme Performance across Massive Data Sets
The Intel Xeon processor E7 v3 family provides up to 18 cores, 36 threads, and 45 MB of last-level cache per socket to make fast work of high-volume transactions and complex queries. These processors also support up to 1.5 TB of DDR4 or DDR3 memory per socket—up to 6 TB on a four-socket system and up to 12 TB on an eight-socket system—enough to support extremely large operational data sets. Even larger configurations are available from select server vendors.

Intel has integrated key technologies to provide additional and dramatic performance benefits for transactions and queries in both in-memory and traditional disk-based computing environments. Intel® Transactional Synchronization Extensions[2] (Intel® TSX), for example, provides a flexible and easy to use mechanism that accelerates multi-threaded workloads, such as databases, by dynamically exposing otherwise hidden parallelism[3,4].

### Mission-Critical Reliability and Uptime
In-memory computing is typically used to support critical, time-sensitive processes, so high availability is essential. According to ITIC, servers based on the Intel Xeon processor E7 family have been delivering uptime levels on par with best-in-class RISC-based platforms for several years.[5] Intel® Run Sure Technology[2] provides an array of Resilient System and Resilient Memory technologies, and the Intel Xeon processor E7 v3 family adds valuable new features. Automatic error recovery, for example, has been extended to the core execution engine. Address Range Memory Mirroring has also been added, so you can provide extreme data reliability for targeted needs, while leaving more memory available for other requirements.

### Flexibility for All Data Center Workloads
The transition to in-memory computing will be gradual for most businesses. The Intel Xeon processor E7 v3 family can help to ease the transition by providing exceptional support for both in-memory and traditional disk-based workloads.[6] Traditional databases, enterprise resource planning (ERP), data warehousing, and online transaction processing (OLTP) applications can all be deployed with high confidence on this platform. Demanding workloads can also be virtualized without sacrificing performance, so mission-critical infrastructure can be integrated into private cloud infrastructures to increase agility, efficiency, and resilience.

## Chart a Path for High Value

Eventually, real-time business intelligence based on in-memory computing will become the de facto standard for all business applications. Today, successful implementations typically focus on one or more high-value use cases, such as driving better results in customer engagements or optimizing an organization's most critical internal processes.

With the right business model, the returns on in-memory computing investments can be extraordinary. The expertise gained in deploying and using these technologies may be even more valuable. According to Gartner, the majority of organizations can be expected to have a combination of in-memory and traditional, disk-based databases within the next five years.[7] Beginning now can help you gain the experience and knowledge you need to effectively negotiate one of the most critical technology transitions of our time—a transition that will have an enormous impact on the speed

and intelligence of your core business operations.

*In-Memory Analytics in Action*
## Fraud Management in the Banking Industry

Combating fraud is a high-stakes battle in the financial services industry. Banks face an ever-changing threat matrix across multiple channels, business units, and service areas. Securing transactions can be extraordinarily complex, yet is essential to protect the business and its customers.

Computacenter Germany and Concepts and Solutions (CAS) collaborate to deliver powerful, real-time fraud detection solutions based on in-memory analytics applications running on Intel® Xeon® processor E7 family-based platforms. The large memory capacity, high core counts, and advanced RAS features of these processors are helping financial institutions detect and respond to fraud faster and more reliably than ever before.

Read the full success story at
www.intel.com/content/www/us/en/big-data/
big-data-xeon-e7-computacenter-germany-study.

html?wapkw=banking+on+sap+hana*

*In-Memory Analytics in Action*
## Turning Big Data into Competitive Advantage

The Bonafarm Group manages roughly 27,000 hectares of land in Hungary, Germany, Serbia, and Romania, and processes more than half a million animals and 15 million eggs per year. Looking for ways to improve decision making across this complex business, the group recently upgraded their data warehousing and business intelligence environment to support in-memory analytics.

The performance and scalability of the platform, which is powered by Intel® Xeon® processor E7 v2 family, has allowed the group to reduce query run times by 80 percent and data loading times by 50 percent. Decision makers can now access data and insights far more quickly, and delve deeper into their data to make better and faster decisions.

Read the full white paper at
www.intel.com/content/www/us/en/big-data/
bonafarm-xeon-e7-brief.html

*In-Memory Analytics in Action*

## Higher Performance with Each New Processor Generation

NTT DATA Global Solutions Corporation ran a series of tests to verify in-memory performance for the Intel Xeon processor E7 family. Performance results showed excellent performance under heavy loads. They also demonstrated up to 2.5X faster performance in going from the Intel Xeon processor E7 family to the Intel Xeon processor E7 v2 family.

With up to 20 percent more cores and threads and faster memory options, the Intel Xeon processor E7 v3 family provides the resources needed to take in-memory performance to even higher levels. With these and many other improvements, companies can scale their real-time analytics platforms with confidence to support next-generation needs.

Read the full white paper at
www.intel.com/content/www/us/en/big-data/
big-data-ntt-data-twitter-case-study.html?wapkw=ntt+data

To learn more about the Intel Xeon processor E7-8800/4800 v3 product families, visit **www.intel.com/xeonE7**

1   For transactional applications, Gartner recently stated that operational in-memory databases can speed up transactions by 100 to 1,000 times for application systems requiring high-speed transactions. Source: Market Guide for In-Memory DBMS, by Roxane Edjlali, Ehtisham Zaidi, and Donald Feinberg, December 9, 2014, Gartner, Inc. Document ID: G00261658. Performance benefits for analytics can be even higher. For example, SAP has reported performance gains as high as 864,000x for customers using SAP HANA to generate reports. http://sapvod.edgesuite.net/SapphireNow/sapphirenow_orlando2012/pdfs/23407.pdf

2   Intel technologies may require enabled hardware, specific software, or services activation. Check with your system manufacturer or retailer.

3   Software and workloads used in performance tests may have been optimized for performance only on Intel® microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.

    a) Up to 25% performance gain claim based on OLTP brokerage workload using Windows* Server 2012. Configurations: 1) Baseline 1.0: 4S Intel Xeon processor E7-4890 v2, Microsoft SQL Server* 2014, 1 TB DDR3-1333 memory, 4x RS25N008 HBAs, 56x 800GB Intel S3700 SSDs. 2) 4S Intel Xeon processor E7-4890 v3, Microsoft SQL Server* 2012, 1 TB DDR4-1600 memory, 6x RS25N008 HBAs, 70x 800GB Intel S3700 SSDs.

    b) Up to 37% performance gain claim based on OLTP warehouse workload results measuring transactions per minute (tpm) using Oracle* 11g R2 on Red Hat Enterprise Linux 6.5. Configurations: 1) Baseline 1.0: 4S E7-4890 v2 using 1 TB DDR3-1333 memory, 60x 800GB Intel DC S3700 SSDs. Score: 4789K. 2) 4S E7-8890 v3 using 2 TB DDR4-1600 memory, 84x 800GB Intel DC S3700 SSDs. Score: 6602K.

    c) Up to 1.58 times increase claim based on SAS Mixed Analytics workload measuring sessions per hour using SAS Business Analytics* 9.4 M2 on Red Hat* Enterprise LINUX 7. Configurations: 1) Baseline 1.0: 4S Intel Xeon processor E7-4890 v2, 512 GB DDR3-1066 memory, 4x 2.0 TB Intel DC P3700 SSDs + 8x 800 GB Intel DC S3700 SSDs. 2)Up to 1.58x more sessions per hour: 4S Intel Xeon processor E7-8890 v3, 512 GB DDR4-1600 memory, 4x 2.0 TB Intel DC P3700 SSDs + 8x 800 GB Intel DC S3700 SSDs.

    d) Up to 5.9 times performance improvement claim based on SAP* OLTP internal workload measuring transactions per minute (tpm) on SuSE* LINUX Enterprise Server 11 SP3. Configurations: 1) Baseline 1.0: 4S Intel Xeon processor E7-4890 v2, 512 GB memory, SAP HANA* 1 SPS08. 2) Up to 5.9x more tpm: 4S Intel Xeon processor E7-8890 v3, 512 GB memory, SAP HANA* 1 SPS09.

4   Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance.

5   ITIC 2014-2015 Global Server Hardware, Server OS Reliability Report; Information Technology Intelligence Consulting (ITIC) Corp

6   For the latest Intel performance benchmarks, visit http://www.intel.com/content/www/us/en/benchmarks/intel-data-center-performance.html.

7   Source: Market Guide for In-Memory DBMS, by Roxane Edjlali, Ehtisham Zaidi, and Donald Feinberg, December 9, 2014, Gartner, Inc. Document ID: G00261658