CASE STUDY

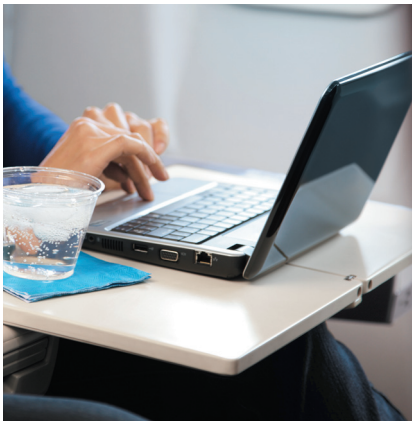
**Intel® Xeon® processor E7 family**
**Enterprise Server**
**Performance for Data-intensive Computing**
Mission-Critical Computing

# Starting a New Journey

## ETH Zurich leads the way for database innovation with the Intel® Xeon® processor E7 family

ETH Zurich has come to symbolize excellence in education, groundbreaking basic research, and applied results that are beneficial for society as a whole.

Founded in 1855, the university has more than 16,000 students from approximately 80 countries, 3,500 of whom are doctoral candidates. More than 400 professors teach and conduct research in the areas of engineering, architecture, mathematics, natural sciences, system-oriented sciences, and management and social sciences.



"We saw a significant performance increase with the Intel® Xeon® processor E7 family. The Intel platform was ideal for this workload."

Timothy Roscoe, Professor,
Department of Computer Science,
ETH Zurich

### CHALLENGES

- **Keep innovating:** ETH Zurich is recognized as one of the world's top research centers. Technological innovation is key to meeting its high standards.
- **Drive performance:** Increase the scalability and throughput of mission-critical databases while providing guaranteed response times.

### SOLUTIONS

- **Test the options:** Evaluated a new distributed database platform for performance in different environments.
- **Best performance:** System built on Intel® Xeon® processor E7-4860 showed 33 percent more data processed for the same throughput as other platforms.
- **Make it scalable:** Distributed, multi-core platform enables optimum flexibility and scalability to support growth.

### IMPACT

- **Higher throughput and capacity:** New platform delivers better performance while remaining within the target response time of 2 seconds per query.
- **New standard:** Project has demonstrated a new way of building databases for the future.

### Pioneering Research

Within ETH Zurich, a team of professors in the Systems Group of the Department of Computer Science set up the Enterprise Computing Center (ECC). The center's aim is to promote education and research in areas of computer science that are relevant to the large IT infrastructures used in many companies and industries today.

The ECC is by nature a multi-disciplinary effort encompassing topics such as networks, operating systems, distributed systems, software engineering, databases, data streams, performance engineering, and enterprise architecture.

### The World's Largest Travel Database

One of the ECC's research projects is motivated by a use case from Amadeus SA, the leading provider of IT solutions to the tourism and travel industry. Amadeus operates a booking system which processed more than 850 million billable travel transactions in 2010.

Part of Amadeus' service involves answering an increasing number of real-time, decision-support queries about travel bookings such as, "Give the number of first-class passengers in wheelchairs who depart from Tokyo to any destination in the U.S. tomorrow." Traditional relational database engines are not well-suited to answering these kinds of complex queries within a very short timeframe, particularly when the data is updated very frequently (in this case, several hundred times a second).

# Intel® Xeon® processor E7-4860 drives significant performance improvements to deliver fast database query response time

Timothy Roscoe, a professor in the Systems Group at ETH Zurich, puts it into context: "The workload on this part of the database is truly challenging. Every time someone does anything to a booking - confirms a flight, selects a seat, checks in, and so on - the database is updated. While all this is happening, it has to answer all these complex, ad-hoc queries, preferably in under 2 seconds."

## A Database with a Difference

To tackle this class of problem, researchers in the ETH Enterprise Computing Center, in collaboration with Amadeus, designed and built a new kind of database which uses a cluster of servers. The design was first published in the Very Large Data Base conference in 2009, and publically demonstrated at the SIGCMOD conference the following year.

The new system is designed to scale out in capacity (number of queries per second) while still maintaining the guarantee of less than 2 seconds for each query. It is built to take full advantage of the fastest multi-core processors available.

The researchers recently evaluated the performance of the database by running a workload based on data from Amadeus. They compared the performance of servers powered by the Intel Xeon processer E7-4860 against previous generations, including the Intel® Xeon® processor 7500 series and other brands.

"We saw a significant performance increase with the Intel Xeon processor E7-4860," says Roscoe. In fact, the platform was able to process 33 percent more table data per core than the others tested, at the same query throughput and latency as before.

He continues: "The Intel platform was an ideal match for this workload, as it has enough memory bandwidth to allow us to scale up in cores for more performance. This means it's really scalable, which for such a heavy - and continually growing - workload like our Amadeus use case is imperative. Moreover, by moving towards a distributed architecture, we're enabling scalability both between cores and across machines.

"We're pleased that we could perform so well on this workload," comments Roscoe. "However, for us as a research institution, what's really exciting is the future potential of this innovative approach to hosting databases. We see this distributed, scalable model based on multi-core processors as being where database research is heading, so this is the first step down a long road."

Although other research organizations are now beginning to work on this approach, the original idea came from ETH Zurich, driven forward by the Amadeus project. Roscoe concludes: "Our ongoing collaboration with Intel has played, and will continue to play, an important role in keeping us at the forefront of computing innovation with projects like this."

Find a solution that is right for your organization. Contact your Intel representative or visit the Reference Room at **www.intel.com/references.**

### Spotlight on ETH Zurich

ETH Zurich regularly appears at the top of international rankings as one of the best universities in the world. Twenty-one Nobel laureates have studied, taught, or conducted research at ETH Zurich, underlining the excellent reputation of the institute.

Transferring its knowledge to the private sector and society at large is one of ETH Zurich's primary concerns. It has succeeded in this, as shown by the 80 new patent applications each year and the 215 spin-off companies that were created out of the institute between 1996 and 2010. ETH Zurich orients its research strategy around global challenges such as climate change, world food supply, and human health issues.



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