

## Solution Brief

Intel® Multi-Core  
Processors

Mobile Arts\* Short  
Message Service Center

Wireless Networks



# Lowering SMS Infrastructure Costs

Worldwide demand for short message service (SMS) messages is growing at an impressive rate. According to Mobile Europe magazine<sup>1</sup>, SMS revenues are projected to almost double by 2013 from 2009 levels, despite the recent economic downturn. SMS is extremely popular globally, and it's the mechanism for many new services such as Twitter\*, text conferencing and machine to machine communication, which should fuel further growth.

Along with success comes intense competition and pressure on operator margins, which are forcing manufacturers to find ways to lower both CAPEX and OPEX of SMS infrastructure equipment. This includes the Short Message Service Center (SMSC), which enables mobile GSM/UMTS network operators to provide SMS services to their subscribers. As such, Mobile Arts\*, a leading supplier of carrier-grade mobile messaging, advertisement and location solutions, has significantly reduced mobile operator expenses relative to hardware cost, footprint and energy consumption by migrating to a higher throughput platform. They ported their SMSC application to the Sun\* Fire\* x4170, an Intel® architecture-based server running the Sun\* Solaris\* operating system.

The code migration comprised two steps. First, Mobile Arts ported its SMSC application from a Sun\* Fire\* V245 server with two 1.5 GHz UltraSPARC\* III processors to a Sun\* Fire\* X4150 server equipped with two Intel® Xeon® processor 5400 series<sup>A</sup>. The effort required less than a man-week, and it produced a 2.1 times performance improvement. A year later, Mobile Arts migrated to the Sun Fire X4170 server with Intel® Xeon® processor 5500 series. This effort did not require application code changes and performance nearly doubled, for a net performance gain of 1.9 times. This solution brief discusses these software migration efforts and how Mobile Arts achieved significant CAPEX and OPEX cost reductions.

### *Two Straightforward Migrations*

- *Ported the SMSC application to the new server platform in less than a man week*
- *Source code did not have to be modified*
- *Significantly improved price-performance and performance per Watt*
- *Lower CAPEX and OPEX for mobile operators*

## SMSC in the Network

The success of SMS is partly due to the seamless transmission of messages within and between wireless networks, which ensures fast and reliable delivery of messages. This is accomplished by the message service center (SMSC), which serves subscribers connected to different wireless networks, as illustrated in Figure 1. The following lists factors contributing to the success of SMS.

- **Simplicity and connectivity:** Any mobile user can message virtually any other mobile user in the world by simply entering a text and a phone number
- **Speed:** An SMS message is delivered in just a few seconds
- **Availability:** Since users tend to always carry their mobile phones with them, they can send and receive SMS messages at any time
- **Message storage and delivery confirmation:** When the destination mobile phone is offline at message sending, the SMSC stores the message and delivers it when the destination mobile phone attaches to the network
- **Simple internet access:** The SMSC enables the mobile user to communicate with content and applications on the Internet using a fast and easy-to-use interface
- **Critical mass of usage:** Since nearly everyone is using SMS, users can expect their messages will be received and read by others, which is crucial to the success of SMS services

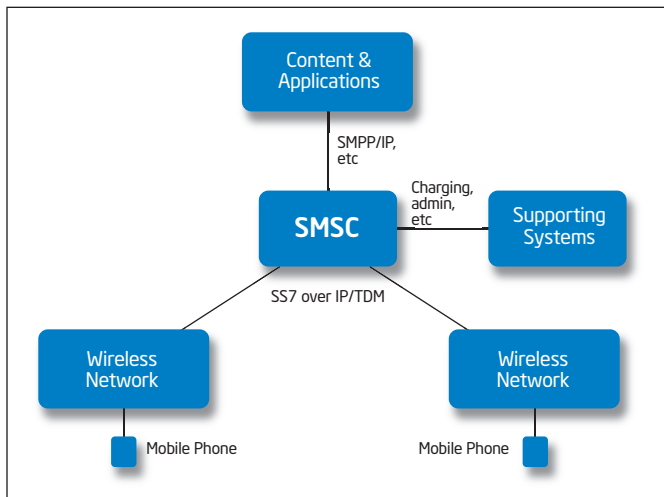


Figure 1. Basic SMSC Network Diagram

## SMSC Functions

The Mobile Arts Short Message Service Centre (SMSC) is a high throughput, full-featured SMSC, supporting both classic originating SMSC functionality as well as unique terminating SMSC capabilities, as shown in Figure 2. In addition, Mobile Arts provides a suite of embedded SMSC applications.

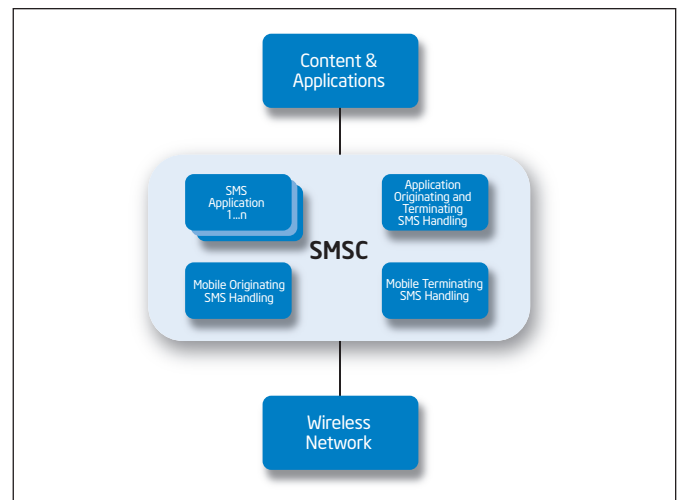


Figure 2. SMSC\* Functions

### The SMSC features include:

- **Mobile Originating (MO) message handling:**  
Supports receipt, processing and onward routing of MO short messages according to 3GPP standards. When messages cannot be delivered immediately, they are stored for later delivery based on flexible retry schemes and interworking with the GSM/UMTS network.
- **Mobile Terminating (MT) message handling:**  
Supports intercept/redirect, receipt, processing and onward routing of MT short messages. Terminating SMS applications can be invoked regardless of the SMS originating network and the visited network of the message receiver.
- **Application Originating and Terminating message handling:**  
Facilitates both-way communication using open APIs that support bulk and scheduled message sending. Clients (e.g., Content and Applications Providers) can be easily created and tailored with respect to principles for addressing, routing, charging, accounting and client load control.
- **SMS Applications:**  
The Mobile Arts SMSC includes an extensive set of powerful SMS applications such as: SMS forwarding/copy to another mobile, SMS copy to e-mail, SMS Child control, SMS SPAM control.

## Virtualization Simplifies the Migration

Mobile Arts' SMSC application code was written to run in an Erlang\* virtual machine (VM), which greatly simplified the migration effort. Erlang is an open-source, general-purpose programming language and runtime environment with built-in support for concurrency, distribution, fault tolerance and incremental code loading. Since the Erlang VM already ran on Intel® platforms, the majority of the migration effort was verifying the application worked properly after the porting effort. The Erlang VM is different from most virtualization

solutions since its threads and processes all run as a single process on the host. This construction does not use a virtual machine monitor (VMM), so it is more similar to JAVA\* VM than to other virtualization solutions.

## Two Straightforward Migrations

Mobile Arts migrated their SMSC application on two occasions, transitioning between the following server platforms:

1. Sun Fire V245 server to the Sun Fire X4150 server equipped with two Intel Xeon processor 5400 series
2. Sun Fire X4150 server to the Sun Fire X4170 server with two Intel Xeon processors 5500 series

For both migrations, Mobile Arts software design engineers ported the SMSC application to the new server platform in less than a man-week. The migrations were straightforward and problem-free. A factor that simplified the porting effort was the APIs for the application code interfacing to the Erlang VM, which meant the source code did not have to be modified.

The overall porting comprised five steps, as illustrated in Figure 3. The engineering team began by upgrading to a new development environment and Erlang virtual machine that supported the new Intel® processor and operating system version. Next, they recompiled the SMSC application, and no code changes were needed. Then, third party software components were added, and the SMSC application was installed. Finally, the application was started, and the migration was completed. Over the course of the migration efforts, more than 99 percent of the entire software package remained unchanged.

“The new Intel® Xeon® processor 5500 series platform enables us to significantly reduce both the CAPEX and OPEX of the SMSC. We have measured a 1.9 times performance boost over the prior generation Intel Xeon processor.”

**Lars Kari**  
Chief Technology Officer, Mobile Arts

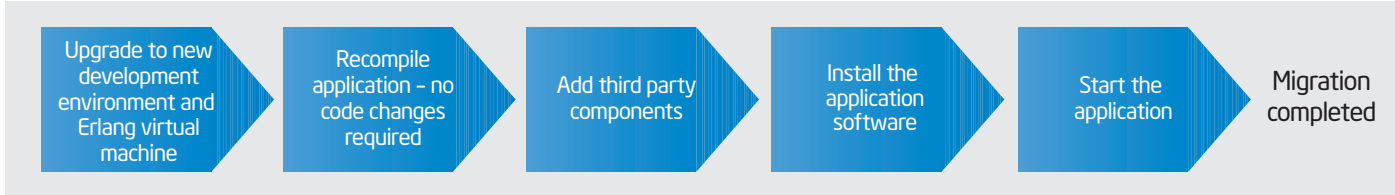


Figure 3. Generic Software Migration Flow

## Measures of Success

By migrating their SMSC application to Intel platforms, Mobile Arts significantly improved price-performance and performance-per-watt, which ultimately translates into lower CAPEX and OPEX for mobile operators. The CAPEX improvement is illustrated in Figure 4, which shows the Sun Fire X4170 server outperforming the Sun Fire V245 server by 400 percent<sup>1</sup>, as measured by SMS Message capacity. The OPEX improvement, which is represented relative to system power consumption, is over 200 percent<sup>1</sup>, as measured by SMS messages per second per server watt (Figure 5). Another OPEX factor is equipment footprint, and the 2U Sun Fire X4170 server delivers greater performance than the Sun Fire V245 server without increasing form factor.

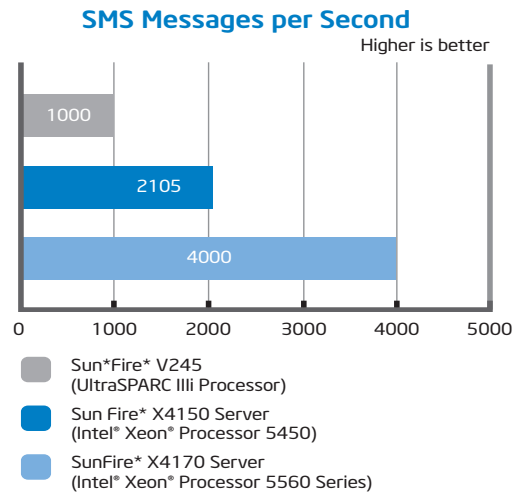


Figure 4. Performance Comparison

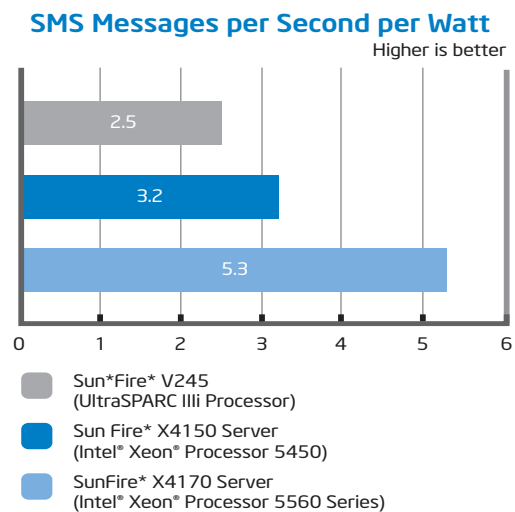


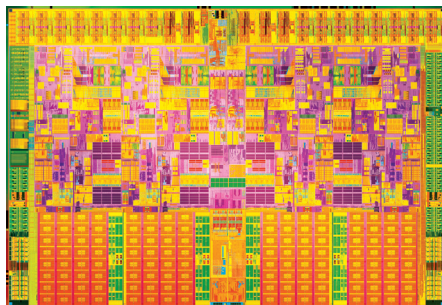
Figure 5. Performance per Watt Comparison

“A single 2U SMSC server equipped with a pair of Intel® Xeon® processor series 5560 with quad-core technology can process more than 4000 peer-to-peer SMS messages per second, or more than 14 million messages per hour. This means that the Mobile Arts\* SMSC will be able to process all SMS traffic for all users in all mobile networks in a country such as Sweden on only 2 servers (4U) – including the extreme traffic peaks during major holidays like New Years.”

**Lars Kari**  
Chief Technology Officer, Mobile Arts

## Benefits for Wireless Infrastructure

While developing the Intel Xeon processor 5500 series, Intel made changes to the microarchitecture that increased overall performance and power efficiency without adding more cores. This latest processor has four processor cores, like its predecessor the Intel Xeon processor 5400 series, but with dramatically improved performance. The performance increase is a result of various architectural enhancements: adding a thread per processing core, integrating L3 cache memory on-chip and migrating to faster memory technology. Figure 6 illustrates the key architectural enhancements as a progression from the Intel® Xeon® processor L5400 series to the Intel Xeon processor 5500 series. These enhancements translate into CAPEX and OPEX benefits for wireless infrastructure, as described in Table 1.



- **Four processor cores** – Eight processing threads total
- **Integrated L2 and L3 caches** – Up to 8 MB for each cache
- **Integrated memory controller** – 3 DDR# channels at 1066 MHz

Figure 6. The Intel® Xeon® Processor 5500 Series

Features of Intel® Xeon® Processor 5500 Series Architecture	Benefits for Wireless Infrastructure
Intel® Hyper-Threading Technology	Delivers two processing threads per physical core for a total of eight threads, which dramatically increases the number of SMS messages that can be processed simultaneously.
On-chip L3 (last-level) cache	Allows the multithreaded application code to efficiently share data between cores. Cache is dynamically allocated to the processing cores in accordance to their workload.
Intel® Turbo Boost Technology	Increases the processor’s frequency automatically when the application requires more computing power and the system is operating below specified limits.
Integrated DDR3 memory controller	Offers memory performance up to 25.6 gigabytes per second, needed for fast database lookups.
Dynamic power management	Transitions idle processor cores to various sleep states during non-peak periods, which significantly reduces system power consumption.

Table 1. Mapping Intel® Microarchitecture to Wireless Applications

## Lower SMS CAPEX and OPEX Costs

Mobile operators are looking closely at CAPEX and OPEX costs when selecting equipment. Responding to these industry requirements, Mobile Arts migrated from Sun® SPARC servers to lower cost Intel Xeon processors, which reduces purchasing and operating costs while improving performance by 400 percent. The Intel Xeon processor 5500 series, featuring advanced microarchitecture enhancements, is delivering a strong performance boost without impacting footprint or power consumption. Mobile Arts recharged an existing SMSC network element by performing straightforward and timely application migrations.

For more information on mobile solutions from Mobile Arts\*, please visit <http://www.mobilearts.com>

For more information on embedded Intel® processors, please visit <http://www.intel.com/embedded/index.htm>.

<sup>4</sup> Intel® processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See [www.intel.com/products/processor\\_number](http://www.intel.com/products/processor_number) for details.

<sup>5</sup> Performance tests and ratings are measured using specific computer systems and/or components and reflect approximate performance of Intel® products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit [http://www.intel.com/performance/resources/benchmark\\_limitations.htm](http://www.intel.com/performance/resources/benchmark_limitations.htm)

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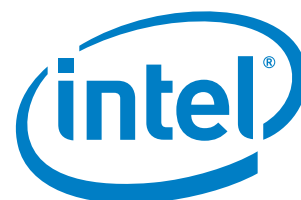
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<sup>1</sup> [http://www.mobileeurope.co.uk/features/114494/Mobile\\_messaging\\_in\\_2009\\_-\\_SMS\\_still\\_the\\_driver.html](http://www.mobileeurope.co.uk/features/114494/Mobile_messaging_in_2009_-_SMS_still_the_driver.html)