



## IMS Adoption Fueled by the Open IMS Core Project and MySQL



### Open Source Telecommunications Project

Database: MySQL

OS: Linux & Solaris

Hardware: x86

“Based on our previous experience and its extensive user base within the telecommunications industry, selecting MySQL to power the Open IMS Core project’s HSS was the obvious choice”

#### Peter Weik

Senior Researcher,  
Fraunhofer Institute FOKUS

### Open IMS Core Project Overview

The project was launched in 2006 to promote IMS (IP Multimedia Subsystem) technology adoption in next-generation telecommunications networks, and empower a developer community to create new IMS-based services. Since then the Open IMS Core project has served as a reference implementation and test-bed for IMS technology testing and prototyping. The project is designed for Research and Development (R&D) functions within Telecommunications equipment providers, network operators and to many university research projects.

The Open IMS Core is an open source implementation of IMS Call Session Control Functions (CSCFs) and a Home Subscriber Server (HSS), which together form the core elements of Next Generation Network (NGN) architectures. The components of the implementation are all based upon open source software including the SIP Express Router (SER) and the MySQL database. The software is distributed under the GNU General Public License (GPL Version 2).

By deploying the IMS core routing functions on standard off the shelf hardware rather than simulators, application developers are able to quickly develop and test new IMS-based concepts and services without having to concern themselves too much with the underlying routing infrastructure or paying for access to test environments.

Open test-beds are an important means for providing the enabling infrastructure to accelerate innovation through research and development activities. The basic goals of the project are to fuel interoperability testing and benchmarking, as well as prototyping of technology extensions and innovative multimedia applications for emerging telecommunications networks.

As a result, the Open IMS Core project has been adopted by some of the world’s leading telecommunications operators and vendors as they trial practical applications of IMS and how these services can interact with the underlying network transport layer.

The Open IMS Core has been developed by the Fraunhofer Institute for Open Communication Systems (FOKUS) based in Berlin, Germany. The Fraunhofer Gesellschaft is the leading organization for applied research in Europe with more than 80 research units, including 57 Fraunhofer Institutes, at 40 different locations in Germany and close to 15,000 employees. Its Institute for Open Communication Systems (FOKUS) has been involved in the research and development of demand-orientated solutions for partners in industry, research and public administration in the fields of telecommunication, automotive engineering, eGovernment and software development for over 20 years.

For IMS networks, Fraunhofer FOKUS offers additional services such as prototyping, proof-of-concept implementations, benchmarking and consulting as well as the implementation of IMS test-bed environments located within partner and community facilities.

## Technology Behind IMS

IMS is the foundation of Next Generation Networks (NGNs), a key architectural transformation in telecommunications networks designed to deliver communications services, such as voice, data and multi-media, over converged, all-IP (Internet Protocol) networks. It is expected that IMS will become the prominent technology enabler for converging fixed, mobile and cable networks, providing seamless triple and quadruple play services.

NGNs enable optimized Quality of Service rules for different traffic types, i.e. prioritizing time-sensitive voice packets over video downloads to deliver higher quality voice services. NGNs also allow service-related functions to be defined, provisioned and operated independently from the underlying network transport technologies. As a result, Service Providers can deploy new communications services with less complexity, greater agility and with a faster to market.

The Call Session Control Function (CSCF) processes and routes IP packets within IMS signaling. The Home Subscriber Server (HSS) is the master user database storing and managing a range of data including subscriber profiles, routing tables and charging information.

## Open IMS CSCFs

IMS is specified within the 3GPP (3rd Generation Partnership Project) and is built upon IETF (Internet Engineering Task Force) specifications such as the SIP (Session Initiation Protocol) and the Diameter standards. It has also been adopted as the de-facto standard of many NGN architectures standardized by bodies like 3GPP2, TISPAN and CableLabs.

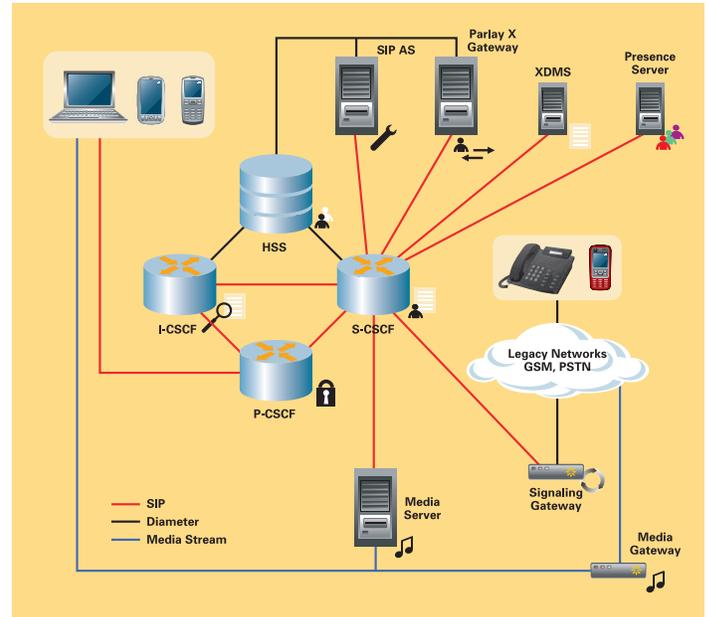


Figure 1: The Open IMS Core as part of an IMS Test Bed Implementation

The Open IMS CSCFs comprise Proxy (P-CSCF), Interrogating (I-CSCF) and Serving (I-CSCF) call session control functions. The CSCFs that were developed at FOKUS are extensions to the SIP Express Router (SER) and tested for interoperability with commercial IMS products.

The Open IMS CSCFs are built upon the SIP Express Router (SER) that can act as SIP registrar, proxy or redirect server and is capable of handling many thousands of calls per second. SER has a highly modular architecture and scripting facilities making it ideal for test bed environments where new functionality can be easily added and prototyped. This project was also initially developed at FOKUS and is now one of the most widely deployed SIP proxies in the world, with leading performance and flexibility and presenting itself in a range of variants including SER, SIP Router, OpenSER/Kamailio and OpenSIPS.

Each CSCF entity of the Open IMS Core is implemented as a SER dynamically loadable module that adds compliance with most of the 3GPP technical specifications. The modules are capable of parallel processing and can maintain supplementary state information. As SER has been widely adopted within commercial SIP deployments, it is recognized as setting the industry standard for SIP routing performance.

## MySQL within the Open IMS Core Project

The maintainers of the project already had a good experience of working with MySQL, and from their involvement with the telecommunications industry and academia, recognized MySQL as having the broadest adoption of any open source database. With extensive deployments in some of the most demanding telecommunications and web applications, and the proven ability to scale to support millions of users, MySQL was the obvious choice in providing the foundation for the FOKUS Home Subscriber Server (FHoSS).

The application logic of the FHoSS is written entirely in Java, using the open source Tomcat servlet container. The main component of the HSS is the MySQL-based master user database, supporting network entities which handle communications over IMS. Specifically, the HSS provides the following functions:

- Stores and manages subscription-related information (i.e. subscriber profiles)
- Generates data for authentication and authorization of the users
- Maintains routing tables in the form of subscriber location directories
- Provide information about the subscriber's servicing points
- Manages the service triggering and orchestration base information
- Stores charging information that is later extracted by billing systems for revenue assurance applications.

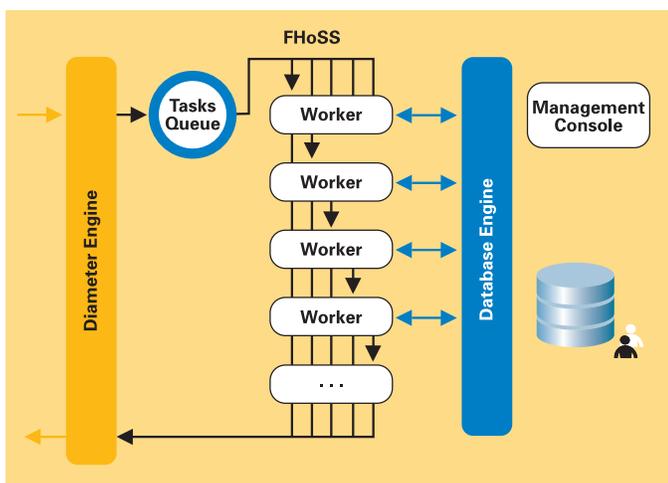


Figure 2: FOKUS Home Subscriber Server

### Open IMS Core and MySQL Project Overview

- Open IMS Core project formed to promote innovation and adoption of IMS technologies
- Components of the project used to implement core routing functions of IMS
- Enables application developers to quickly and simply test new IMS-based concepts and services
- Call Service Control Functions based on open source SIP Express Router (SER)
- Home Subscriber Server based on open source MySQL database
- MySQL selected due to broadest industry adoption of any open source database
- Entire Open IMS Core setup with MySQL Server can run on a single workstation, serving a subscriber base of 1 million users
- MySQL Server handles multiple hundreds of subscriber registrations per second with sub 30ms latency
- Low hardware resource allows extensive and realistic simulations to be run at much lower cost than traditional telecoms test environments
- MySQL offers proven deployments within the telecommunications industry

As part of a series of benchmark tests, the MySQL database was configured to support multi-million subscriber populations while also providing very low operational latencies. As a matter of simple reference, a regular workstation system running the entire Open IMS Core setup and the MySQL back-end was deemed sufficient to service a subscriber base of one million users well within operational parameters. One of the main success factors here is the capacity of the database to serve multiple hundreds of subscriber registrations per second, which is regarded as one of the most demanding functions, with latencies under 30ms per registration. This level of performance allows the Open IMS Core project to not only provide a functional component for a test-bed, but adds the additional capability to run extensive and realistic simulations within affordable hardware conditions; historically, such performance testing was considerably more expensive for the telecommunication domain.

While the HSS implementation within the Open IMS Core project is based more on standards conformity rather than performance, it is recognized that MySQL has been widely adopted within the telecommunications industry. The background experience gained by using it as part of the IMS technology evaluations, demonstrates the suitability of the MySQL database back-end for carrier-grade ready equipment and solutions.

With the rapid shift from closed, expensive and proprietary technology, MySQL has grown to become the world's most popular open source database. MySQL Cluster Carrier Grade Edition has become the high-availability relational database of choice in the telecommunications network domain, powering real-time, carrier-grade database solutions for the likes of Ericsson, Nokia, Alcatel Lucent, Juniper, and UTStarcom. MySQL Server is the database of choice for the web with deployments in some of the most prolific names on the internet including Yahoo!, Google, Flickr, YouTube and Wikipedia. As a result, MySQL can provide the products, insight and experience to marry the network and IT worlds that are central to powering the transformation to Next Generation Networks based on IMS.

### The Future of the Open IMS Core Project

The goal of the project was to create a developer community for the core elements of Next Generation Networks. Growing subscriber numbers to the project's mailings lists indicate this goal is being achieved. The Open IMS Core community can quickly develop IMS services and trial IMS concepts using highly configurable and extensible open source software.

The IMS Core Project and Fraunhofer FOKUS are already being used in a variety of commercial and community driven projects including:

- The integration of IP Version 6 (IPv6) between the Open IMS Core and the community SailFin SIP/Java application server originally developed by Ericsson and Sun Microsystems. This integration has allowed the prototyping of converged "click and dial" communication services over IMS
- The foundation for IMS integration, interoperability and performance testing by telecommunications operators and vendors
- Prototyping of next generation services
- Standards compliance testing



"MySQL's characteristics made it a "Sine qua non" condition for our Open IMS Core project. Even though various users have later added support for other database systems, MySQL remains the premier solution capable of serving alongside critical SIP signaling, with guaranteed benefits beyond our project's NGN test-bed targets, into future real-life telecommunication core network exploitations."

**Dragos Vingarzan**

Senior Researcher, Fraunhofer Institute FOKUS

To accelerate the adoption of IMS, the project is working to further build the community of both users and contributors involved with Open IMS Core, which collectively will make the vision of Next Generation Networks a reality.

To learn more about the Open IMS Core project, and join the community, please visit their home page:

<http://www.openimscore.org>

For more information on the performance of the project backed by the use of MySQL database please visit

[http://www.sipnuke.org/one\\_million](http://www.sipnuke.org/one_million)

## MySQL Cluster Carrier Grade Edition

*The Leading Open Source, High Availability Database for Telecommunications Services*

MySQL Cluster Carrier Grade Edition is a high availability implementation of the MySQL Server designed specifically for the telecommunications market. MySQL Cluster is the industry's only true real-time database that combines the flexibility of a high availability relational database with the low TCO of open source.

### Carrier Grade Availability

MySQL Cluster features a "shared-nothing" distributed architecture with no single point of failure to assure 99.999% availability, allowing you to meet your most demanding mission-critical application requirements.

### High Throughput and Low Latency

MySQL Cluster's real time design delivers consistent, millisecond response times with the ability to service tens of thousands of transactions per second.

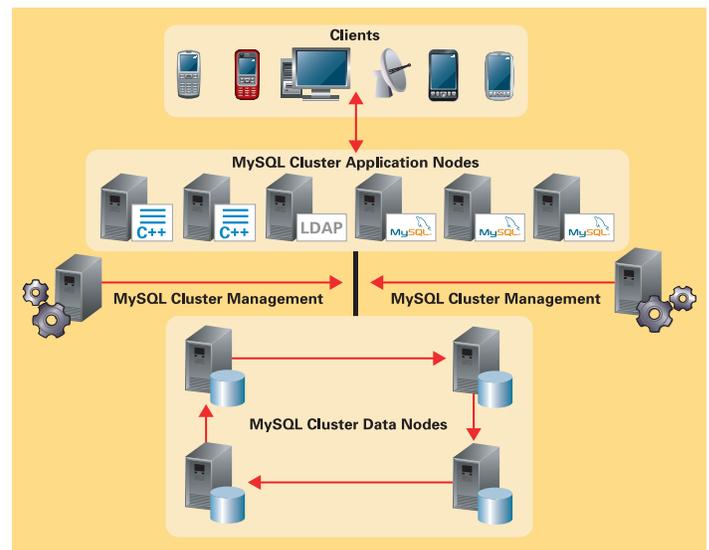
### Linear Scalability

Support for disk based data, automatic data partitioning with load balancing and the ability to add nodes to a running cluster with zero downtime allows almost unlimited database scalability to handle the most unpredictable web-based workloads.

*The MySQL Cluster architecture has been designed for 99.999% availability and delivers massive read/write scalability*

### MySQL Cluster Target Applications:

- AAA / RADIUS / Diameter Data Stores
- Application Servers
- Data Store for LDAP Directories
- DNS/DHCP for Broadband
- eCommerce
- Mobile Content Delivery
- On-Line application stores and portals
- Payment Gateways
- Service Delivery Platforms
- Subscriber Databases (HLR/HSS)
- VoIP, IPTV & Video on Demand
- Web Session Stores



## About MySQL

MySQL is the most popular open source database software in the world. Many of the world's largest and fastest-growing organizations use MySQL to save time and money powering their high-volume Web sites, critical business systems, communications networks, and commercial software. At [www.mysql.com](http://www.mysql.com), Sun provides corporate users with premium subscriptions and services, and actively supports the large MySQL open source developer community.

To learn more about MySQL in the telecommunications industry, go to [www.mysql.com/communications](http://www.mysql.com/communications)

To contact MySQL online or via telephone, please go to [www.mysql.com/contact](http://www.mysql.com/contact)



The World's Most Popular Open Source Database