



NEXUSTELECOM

WHITE PAPER

Mobile Wireless Providers

Performance Management Challenges

Issued Date	22 October 2007
Author	Franz Neeser / Mary-Lou Murphy
Issued by	Nexus Telecom, Switzerland
Document	T-12-00247



NEXUSTELECOM
NETWORK AND SERVICE INVESTIGATION

Table of Contents

1	Introduction	3
2	Mobile Wireless Infrastructure Evolution	3
3	Performance Management – 3G Wireless Challenges.....	4
4	Wireless 3G Performance Data Sources.....	6
5	How Nexus Meets the 3G Challenges	6
	5.1 NexusMETER.....	6
	5.2 NexusNETVIEW	7
6	Service Assurance in the Wireless Market	8
7	Delivering Proactive Service Assurance.....	9
8	Conclusion	12
9	About Nexus Telecom	14

1 Introduction

In the competitive mobile communications world, many service providers are in a transition phase from GPRS to GPRS/UMTS technologies and are building new systems, applications and network infrastructure in order to deliver new mobile data services. As part of this evolution, mobile wireless service providers are bringing together their voice and data infrastructures, and leveraging both their existing and new platforms, such as media gateways, services gateways and soft switches. These new platforms become the key components for delivery of mobile data services.

As with any other network service, guaranteed service levels and performance management reporting are critical factors in optimizing the performance of the infrastructure. Subscribers expect reliable access to their new services. Robust fault and performance management, which can identify potential issues before they impact subscriber services, is a must for all wireless service providers, and is an important part of the business & operational support systems (BSS/OSS) of the Service Provider's business.

However, due to the rapidly advancing technologies, comprehensive performance reporting facilities are not as common as might be wished. Innovative leaders in mobile telephony are searching for an integrated performance reporting solution to report on the GPRS and UMTS services within their Core Network, covering the GGSN / SGSN core, the GSM voice backbone, together with the ATM and Frame Relay backbone.

Nexus Telecom has deployed its performance reporting business throughout the world, by providing end-to-end fault and performance management systems, supporting the needs of both traditional and wireless Service Providers, and providing a modular, scalable approach to helping wireless service providers around the world deploy new mobile data services with confidence.

This White Paper discusses the transition challenges of Performance Management within Mobile Services Providers and Nexus Telecom's approach.

2 Mobile Wireless Infrastructure Evolution

Wireless Service Providers are building new systems, applications and network infrastructures in order to deliver new mobile data services, including application servers to support capabilities such as MMS, SMS and WAP services, along with the new network infrastructures that are being deployed to deliver these new data services.

With the introduction of instant messaging, visual-calls, "see-what-I-see" instant visual push, presence, chat, voice- and video-conferencing, gaming, Push-to-Talk, Push-to-View services, a new platform will also be introduced into the network topology: IP Multimedia Sub-system (IMS).

IMS is a control platform for multimedia services internationally standardized by 3GPP, which is also responsible for the UMTS standard. With IMS, the mobile network operator can give his subscribers access to an easier and more natural world of communication.

Until now, subscribers were barely able to phone each other and tap into common data services at the same time. IMS has the power to combine real-time services, such as voice and video telephony, with non-real-time services. Operator and national boundaries no longer represent an obstacle, nor does the radio technology employed for access.

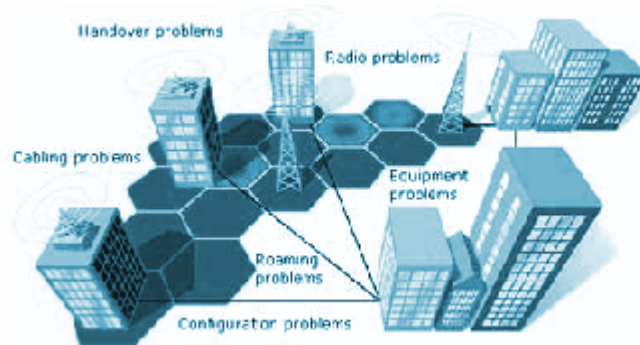
The success or failure of the service can only be determined by analyzing both the network's ability to deliver the service and the semantics of the data as it passes through the network. As new services will demand rapid introduction to the mass market, requirements for introduction of monitoring and service surveillance platforms demand flexible and scalable solutions.

Voice services were designated as 1G, or first generation. Data/Digital services started with 2G, or second-generation wireless. Speed and capacity requirements to support new, higher-performance data services quickly drove the need to move to 2.5G, where most carriers are today. New 3G standards and implementations are now being rolled out. 3G networks provide even greater throughput, to improve the performance of existing applications, and support the next round of new applications, such as video telephony. Different standards have evolved for voice services over the years with the progression of data generations.

In the competitive mobile communications world, many service providers are in a transition, moving from GPRS to GPRS/UMTS technologies, and are building new systems, applications and network infrastructure in order to deliver new mobile data services. As part of this evolution, mobile wireless service providers are bringing together their voice and data infrastructures, and are leveraging both their existing and new platforms, such as media gateways, services gateways and soft switches. These new platforms are key components regarding delivery of mobile data services.

3 Performance Management – 3G Wireless Challenges

Carriers offering UMTS services to their existing GPRS services have high expectations of any reporting systems. Due to the technological challenges involved in their requirements, the choice of possible solutions in today's market is small. The reporting system must not only be a source of data for network operations, but should also produce trend statistics and calculate KPIs for the network planning department and executive management.



Service Availability — Connectivity and Session Level

- ▶ Service Access and Session Management
- ▶ Authentication and Ciphering
- ▶ Multiple Sessions, Timeouts, Dropped Connections
- ▶ Mobility Management

Service Performance and QoS (per Service Class)

- ▶ Circuit-switched Call Control (Voice)
- ▶ Payload Packet Data Traffic Control
- ▶ Packet Loss, Retransmissions,
- ▶ Throughput, Delivery Delays
- ▶ Heartbeat Service Testing

Service Performance Reporting

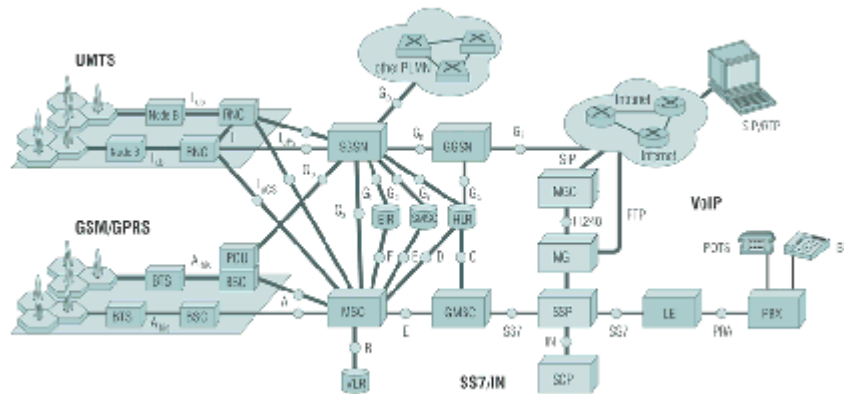
- ▶ Statistics for detailed Service Performance Analysis

Flexibility is paramount to a chosen application: It needs to enable on-going development in order to meet an operator's requirement to be at the forefront of technology to meet the customer's performance reporting needs. Reporting flexibility is of particular importance, as the yet-to-come services offered over the mobile broadband technologies, such as EDGE enhanced GPRS networks or 3G access networks, demand highly customizable reporting engines to support reporting on newly introduced services to the customer. Nexus Telecom's performance monitoring product, NexusMETER, is the ideal solution, meeting the operators' need to stay abreast of network management and service reporting tools in a fast- evolving and dynamic network topology.

Nexus Telecom has deployed its performance reporting software throughout the world, providing end-to-end fault and performance management systems that support the needs of both traditional and wireless Service Providers, providing a modular, scalable approach to helping wireless service providers around the world deploy new mobile data services with confidence.

4 Wireless 3G Performance Data Sources

Performance data on the 3G wireless transmission network can be gathered from many sources, but the diagram below identifies the most common ones required by Wireless Service Providers and delivered by Nexus Telecom:



Data Analysis Basics

Once data has been collected, it must be processed, analyzed and archived. Processing the data can be challenging for a number of reasons:

- ▶ Operators typically have equipment from a number of different vendors, sometimes with a unique interface format, as well as open standards.
- ▶ Operators often use measurement programs from different technology networks (e.g. GSM and WCDMA) and/or different infrastructure vendors, often with their own proprietary interface formats.
- ▶ Data sets collected at different interface points may need to be synchronized so that they can be merged for troubleshooting across network elements.
- ▶ Data sets may be extremely large (many gigabytes). Key information must be filtered and reduced before it can be used to make decisions.
- ▶ Formats are constantly being updated. The technology is constantly changing (e.g. 3G rolling out on the back of 2.5G technology).
- ▶ Many engineers have limited training and experience with newer technologies.

5 How Nexus Meets the 3G Challenges

5.1 NexusMETER

Nexus Telecom's performance reporting software, NexusMETER, provides a set of modular application tools with a common database that provides carrier-grade performance management functionality for wireless service providers.

NexusMETER is currently comprised of two main applications:

▶ **Raw Data Reporting Client**

The Raw Data Reporting Client is a workstation-based network analysis reporting tool that provides detailed operational reports on all performance aspects of a wireless data network. Its common database structure shared with the Value-Added Reporting Client saves time and resources for network data population for scheduled and on-demand reporting.

▶ **Value-Added Reporting Client**

This client-server performance management application tool is used to measure and depict network availability, response times and utilization rates, producing a wide variety of detailed or summary reports on the traffic in your wireless GPRS/UMTS network to prove that you meet or surpass your service level agreements. The Value-Added Reporting Client's Wireless module is responsible for populating and processing performance statistics data collected by various data collectors within the wireless network, as shown in the diagram above.

NexusMETER's Wireless Reports provide sophisticated, easy-to-read graphical performance reports for two key areas of Service/Network Management: 1) Performance Management; and, 2) Service Quality.

5.2 NexusNETVIEW

NexusNETVIEW meets all the criteria required to provide a comprehensive service-based wireless network monitoring application. It monitors GSM, GPRS, UMTS and MMS network topologies by using state of the art hardware and software technologies with a flexible, scalable architecture.

NexusNETVIEW provides a holistic network perspective of data-services. It analyzes data from all the underlying transport and service networks that are used in completing the service. It can extract the required data from the GPRS/UMTS network access technology interfaces, the GSM HLR provisioning queries, the ATM backbone transport network, DNS public internet queries and SMS messages, and correlates them all with the according service transactions to provide a complete view of the service-provider to service-consumer session. Performance monitoring and troubleshooting are easily performed using the visual GUI or reports that enable the network operator to quickly and accurately identify root problems regardless of source, be it one of the transport networks, the service network, the service provider or the service user.

Wireless GPRS/UMTS Module

Data storage and processing requirements increase with the number of managed devices, the amount of data collected and the collection intervals. NexusMETER has been designed to meet this challenge with its multi-processor support, client-server architecture and concurrent data processing capabilities, allowing large volumes of data to be analyzed and processed quickly.

With Nexus Telecom's Wireless GPRS/UMTS module, a wide range of standard report templates is available. Additionally, with the report pack licenses, NexusMETER provides a Database Query (DBQ)

license feature giving service providers the flexibility to define their own reports or to tailor existing report templates to meet their evolving needs. The architecture of NexusMETER provides the scalability needed to meet the changing needs of large complex networks as they continue to grow.

NexusMETER is a modular Client/Server application, available for a variety of networking data transmission technologies, helping enterprise and service provider managers evaluate their networks, and providing historical Performance Reporting capabilities for network performance against service level agreements, to monitor network device/link usage trends and to analyze problem areas.

The total solution provides for a common shared repository of information that integrates the key elements under common architectures and platforms, thus the performance information can be used to assess your network and services, and to then bill customers according to network usage and the quality of service delivered. Alternately, any part of NexusMETER may be used on its own or in association with other OSS/BSS provider systems. Select the component modules that you currently need and grow the system as your network and services evolve.

The Wireless GPRS/UMTS solution processes and populates statistical and service data collected by various data collectors (e.g., the SNMP Data Collector from IP devices that support the SNMP protocol) and various vendors' multi-service switches via their OMC's in combination with the data management processes, and then summarizes and creates a value-added information data store to provide meaningful network and service management reports at user-specified levels of detail, providing sophisticated, easy-to-read, graphical performance reports for Performance Management and Service Quality — two key areas of Service/Network Management.

6 Service Assurance in the Wireless Market

Nexus Telecom provides both hardware and software OSS and BSS support systems for a wide variety of network segments and equipment vendors. Our software is based on years of experience and expertise in the areas of Services and Network Performance Reporting, Telecom Services Billing, Network Troubleshooting and Network Security.

Business customers want to enable mobile virtual-private-network (VPN) access for corporate intranets to access e-mail, e-learning and workforce optimization applications to name just a few. Consumers are looking for services such as Web-based shopping, Internet gaming and camera phones. These mobile data services are key to driving the critical business metrics — subscriber growth, increased Average Revenue Per User (ARPU) and reduced churn. For example, with subscribers who access e-mail, send photos, or utilize a Push-to-Talk over Cellular (PoC) service, or with the introduction of instant messaging, visual-calls, "see-what-I-see" instant visual push, presence, chat, voice- and video-conferencing, and gaming services, average monthly spending can increase considerably, in addition to today's expenditure on traditional telephony service — a substantial increase in ARPU to the service provider. For major service providers with tens of millions of subscribers, this increased ARPU equates to hundreds of millions per month in revenue.

- ▶ Wireless Service Providers are working diligently to roll out the data services that users demand.
- ▶ Businesses want to enable mobile virtual-private-network (VPN) access to corporate intranets to access e-mail, e-learning and workforce optimization applications, etc.
- ▶ Consumers are looking for services such as Web-based shopping, Internet gaming and camera phones.

For wireless service providers it is clear that the critical business success metrics — subscriber growth and churn — are at stake. Mobile data services are the key new service offerings, which will drive these metrics in the right direction. The additional \$5 - \$10 per month that these services can demand represents substantial revenue increases.

Media Message (Camera Phone) Example

Media Messaging is a way to record and send media messages with pictures, sounds and text. A Media Message phone (often referred to as a camera phone) is required to send or receive media messages. Most wireless service providers now offer a media messaging service. Typical pricing for the service is 30 to 50 cents per message sent. According to the Zelos Group study, embedded digital cameras are the number one preferred feature of cell-phone users.

Assuming a subscriber sends 10 to 30 messages per month, the increase in ARPU can be anywhere from \$3 per month to as much as \$15 per month. Again, for major service providers with tens of millions of subscribers, a \$3 to \$15 per month increase in ARPU equates to hundreds of millions of dollars per month in additional revenue.

7 Delivering Proactive Service Assurance

The success of new data services offerings is largely determined by the availability and performance of the Mobile wireless service. Whether the user is connecting to the office to access e-mail, sending a photo using a camera phone, or just surfing the web, available, reliable, connectivity and acceptable response times means satisfied and happy customers.

The stakes for service reliability are higher today than they were only a few years ago. With the increased penetration of wireless data services comes the increased expectation for high availability and reliability. Customers expect true proactive service assurance — the ability of their service provider to find and fix problems before customer service is impacted. Without this capability, wireless service providers risk loss of market share.

The key to true proactive service assurance is to identify problems before faults occur. The ability to identify trends in service degradation, before customers are affected, depends on identifying negative abnormal performance. To do so requires an understanding of the normal expected performance. NexusMETER can gather and analyze critical performance parameters from the entire range of

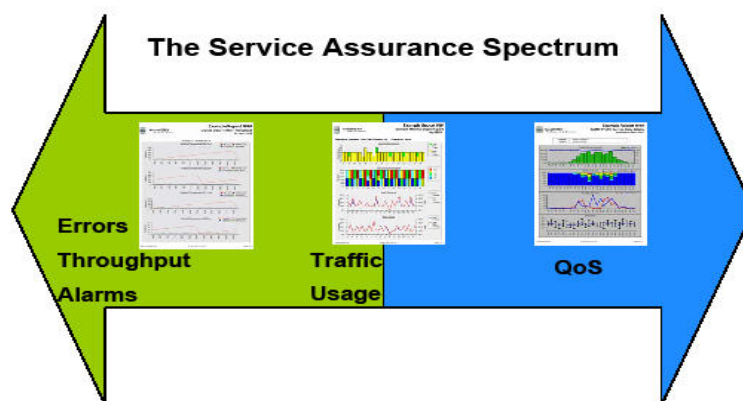
devices comprising today's wireless data networks, allowing service providers an unmatched ability to identify and correct service degradation indicated by abnormal performance parameters.

Nexus Telecom has deployed its performance reporting business successfully throughout the world, by providing end-to-end fault and performance management systems to support the needs of both traditional and wireless Service Providers, thus providing a modular, scalable approach in helping wireless service providers deploy new mobile data services around the world with confidence.

Nexus Telecom fulfils the information service providers need to resolve performance issues and make capacity adjustments to ensure customers are pleased with their mobile wireless data service.

► **NexusMETER allows wireless service providers to:**

- Manage performance of Mobile Wireless platforms, such as GGSN, SGSN, PDSN/FA, HA, PCF, Content Gateways, Services Gateways, Media Gateways and Soft Switches, as well as managing the traditional core network infrastructure, including Frame Relay, ATM, Routers, Switches, Remote Access equipment and IP technologies.
- Leverage end-to-end historical data and intelligent reporting to make informed capacity planning decisions
- Identify and analyze potential issues quickly to resolve problems before they impact customers. NexusMETER integrates fault and performance management into a single service view, provides association with performance history, and stores data in a single database.
- Wireless service providers are able to reduce Mean Time to Repair (MTTR) because they can identify critical problems quickly, investigate them and fix them within a short period of time.



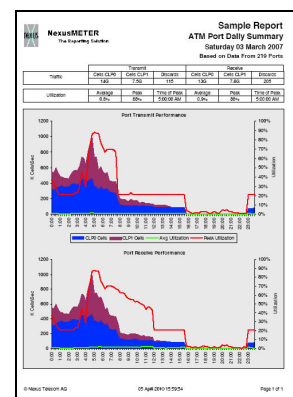
NexusMETER is a flexible, modular multi-domain, multi-vendor OSS performance reporting solution, offering support for FR/ATM networks, next generation IP services and Wireless GPRS/UMTS/GSM. It assists enterprise and service provider managers analyze problem areas at various levels of detail, while monitoring and evaluating network usage trends and traffic volumes. Many of the service-based reports are used for Service Level Verification of customer Service Level Agreements. NexusMETER provides support for multi-domain networks within Carriers, Service Providers and large Enterprises,

thus enabling detailed and flexible network analysis to meet ever-changing business needs cost effectively. Both clients cater to GPRS, UMTS and GSM technology.

With NexusMETER capacity planning reporting capability, wireless service providers are able to identify usage patterns, overtaxed Mobile platforms and core network utilization issues before they impact service performance and customer satisfaction. Using end-to-end historical data from the NexusMETER database, out-of-the-box reports provide information on how efficiently the network, systems and applications are running. Network planners can analyze trends, determine whether critical resources are available and make informed capacity planning decisions.

Executive Summary Reports

Single Page Period Reports — Daily, Monthly, etc., highlighting Hourly, Daily, Monthly traffic and utilization trends. All reports are filterable to specified services, elements or ports — be it individual or grouped as required. ▶

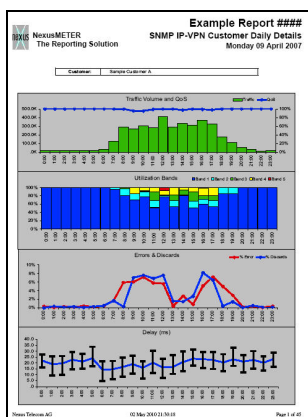


Analysis and Trending Reports

Multi-Page Reports providing detailed analysis on specific Key Performance Indicators. Ideal for spotting trends before they become customer service affecting.

Detailed Reports

Multi-Page Reports providing sorted line-by-line breakdown on the appropriate performance metrics being reported on.



◀ Example Analysis and Trending Report

Example Detailed Report ▶

Due to the technological challenges involved in UMTS operator requirements, the choice of possible service reporting solutions is small. The reporting system shall not only be a source of data for network operations, but should also produce trend statistics and calculate KPIs for the network planning department and executive management.

NexusMETER software package is ideal to plan further expansion of an operator's UMTS core network, thus ensuring complete and consistent fulfillment of demands for high quality by the end-consumers.

8 Conclusion

Due to the modular format, service providers and enterprises can choose which reporting components of NexusMETER suit their requirements together with the devices in their network. The base platform and database query tool, combined with the off-the-shelf GPRS and UMTS reporting packs, provide sophisticated, easy-to-read, graphical performance reports for two key areas of Service/Network Management: Performance Management and Service Quality.

As expected from a carrier-grade solution, NexusMETER is flexible and powerful, yet simple and scalable. It combines efficient and flexible data collection mechanisms with an intuitive, yet powerful, value-added report production and distribution facility, designed for automated reporting delivery.

Many Service Providers around the globe currently use NexusMETER. It delivers detailed value-added information allowing network and service managers to justify network growth, plan service improvements and confirm specified service levels, thus positioning our customers for future growth and profitability.

Partnering for Excellence

Nexus Telecom is committed to providing excellence in end-to-end service and infrastructure performance management by understanding and accommodating leading vendors' network devices and applications.

For example, Nexus Telecom is an OSS ISV partner for Nortel Networks, Alcatel, Nokia and Siemens, and Nexus works closely with many service providers in expanding the product capabilities and features by supporting new platforms offered by leading vendors.

Wireless service providers have a tremendous opportunity to increase the base of their subscribers and ARPU by delivering desirable data services with good performance and reliability. But the added network complexity resulting from network growth and service expansion places added expense pressure on support staffs already stretched to the limit. Capital expenses must be timed in order to meet rapidly growing markets and to support the launch of new services.

NexusMETER provides the tools that service providers need to make intelligent, informed decisions before, during and after the wireless data services deployment. Our powerful performance reporting solutions provide end-to-end visibility across networks, systems and applications to offer service providers a deeper understanding of their infrastructure, allowing them to fine-tune their network for the highest possible performance by optimizing the capabilities of the individual components.

Leveraging NexusMETER's end-to-end network infrastructure visibility allows service providers to move the competitive focus from reducing prices to offering value. Armed with the ability to monitor performance across networks, systems and applications together, service providers can deliver proactive service assurance to their customers. This capability leads to decreased churn, builds customer loyalty and strengthens the service provider's brand and reputation for reliable and consistent delivery of enhanced services.

Easy to install and use, NexusMETER allows wireless service providers to dramatically lower operational expenses by reducing the number of service assurance tools required to support services. NexusMETER normalizes performance data across networks, systems and applications to present operations staff with an easy-to-understand and consistent workflow.

Released from time-consuming tasks of acquiring in-depth knowledge of the large number of technologies found in typical networks, operations staff is free to support the launch of new, revenue-generating services.

NexusMETER's capacity planning capabilities allow service providers to make informed decisions when network expansion is forecast. Using NexusMETER's vast store of historical network performance information, service providers can use a variety of NexusMETER reports to accurately project when and where additional capacity must be ordered and installed to meet customer demand—proactively rather than reactively.

Nexus Telecom builds intelligence into its software to help customers make and save money. With NexusMETER software in place to complement revenue-generating business strategies, wireless service providers can position themselves to take advantage of opportunities to gain market share, increase revenues and drive down costs to reach, maintain and increase profitability.

For detailed technical overviews of currently available NexusMETER modules, please visit our website (www.nexustelecom.com) or contact your nearest Nexus Telecom Office.

9 About Nexus Telecom

Founded in 1994, Nexus Telecom is a privately-held company with headquarters in Zurich, Switzerland and regional offices in Canada, Chile, South Africa and Pakistan. With over 200 employees, Nexus Telecom is a major OSS/BSS vendor delivering sophisticated state-of-the-art telecom management solutions to 2G, 3G, NGN and VoIP service providers and network operators worldwide.

Nexus Telecom - Network and Service Investigation

Nexus Telecom provides investigation tools and techniques with which telecommunication service and network malfunctions and degradations can quickly be determined and successfully solved. Based on scientific analysis methods, these investigation, troubleshooting and monitoring tools help to unravel the hidden secrets behind often complex and mysterious service malfunctions.

Product Portfolio - Full range of investigation tools

Nexus Telecom offers a wide range of such investigation tools used to effectively study problem cases, to collect and process transaction 'evidence' data, to correlate and combine events, to translate and decrypt transaction details and ultimately, to solve the case and fully restore the respective service quality. Clearly, such tools are indispensable to network operators and service providers who are committed to improving service quality to all their business and residential customers.



**Nexus Telecom
Zurich**

Nexus Telecom - Partners and Customers

With solutions deployed in over 100 countries, Nexus Telecom's installed customer base spans the globe, assuring service quality and revenue streams for many of the world's best-known telecom operators. For small and large service providers alike, including the world's largest GSM/UMTS network operated by T-Mobile, the highly scalable and modular end-to-end solutions from Nexus Telecom maximize the service provider's competitive edge through excellent ROI, quick and smooth launch of new services, and greatly increased end-customer satisfaction.

Nexus Telecom's fast time-to-market strategy is to gain early in-depth know-how about upcoming network technologies through strong development partnerships with leading network equipment manufacturers such as Nokia Siemens Networks, Nortel and Alcatel Lucent.

©Nexus Telecom, Zurich, Switzerland

This document and all the information contained herein is subject to change without notice and should not be construed as a commitment by Nexus Telecom. Although we believe the contents of this document to be accurate, Nexus Telecom assumes no responsibility for any errors that may occur in this document.

Nexus Telecom, and all Nexus Telecom Logos are trademarks of Nexus Telecom.

All other trademarks are acknowledged and are the property of their respective owners.

Head Office

Europe
Zurich, Switzerland
Tel: +41 44 355 6611

Sales Offices

North America
Ottawa, Canada
Tel: +1 613 224 2637

Central and Latin America
Santiago, Chile
Tel: +562 946 3102

Africa
Centurion, South Africa
Tel: +27 8 2773 5730

Middle East
Islamabad, Pakistan
Tel: +92 5 1285 4890

South East Asia
Kuala Lumpur, Malaysia
Tel: +603 7725 2099