

Verax Systems **Operations Support** **Systems**

Whitepaper



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Abstract

This paper presents an overview and trends in the area of Operations Support Systems (OSS). The area of OSS is rapidly and constantly changing and new market trends have to be followed in order to stay up to date. Next generation networks will demand more functionality and, as the result of these trends, implementation and integration of new standards and technology in order to enlarge OSS/BSS architecture.

The primary objective of the presented software is to deliver tools for efficient management, control and monitoring of network device work, and fast detecting of network failures in order to guarantee heightened efficiency and shortened realization and testing time. Verax Systems' OSS Suite described in this document can guarantee a competitive advantage in today's marketplace.

Intended audience

This paper is a publication created by Verax Systems' experts and specialists. Its purpose is to highlight the most important issues related to OSS and present our customers and partners the key information about offered products.

1. Introduction

Telecommunication operators and internet service providers (collectively referred to as operators) face challenges arising from constantly changing business environments as well as diversification of systems. In order to remain competitive, an operator must meet these challenges by making the system environment more flexible in order to level any technical or economic development barriers. Comprehensive understanding of an operator's processes and system interfaces is crucial in building a sustainable basis for business development.

As mentioned above, operators face an increasingly competitive business environment which is the result of market demand changes from traditional circuit switched voice, data and SMS messaging into a diverse set of packet data services. There are a large number of service providers on the market and service life cycles are becoming shorter which puts operators under pressure. They have to invest in new technologies to introduce new services, enlarge service portfolios, enhance service quality, and offer proper customer-adjusted pricing policies. On the other hand, operators should improve their customer relationship and internal management systems to gain information about customer preferences and to retain clients. To become increasingly competitive, operators need to concentrate directly on customers. This strategy is possible by implementing proven OSS and BSS systems that support both operational and business processes within a company.

Transitioning from existing systems to component-based OSS and BSS solutions enables faster introduction of new technical capabilities. Proven OSS/BSS suite might provide the following features:

- Billing and mediation.
- Customer assurance: CRM, retention and call center.
- E-Business.
- Data Warehouse, Business Intelligence and analytics.
- Revenue assurance, profit maximization and data integrity.
- Provisioning.
- Service assurance and network care.
- Network inventory.
- Service activation (including field service automation)
- Fraud and security.

Implementation of OSS/BSS systems brings integration challenges. All mentioned components should allow management of operational and business processes. Furthermore, operators should be able to use the same OSS/BSS infrastructure to manage customers for traditional, mobile and fixed (wireline) telecommunications services. The number of managed network elements in an operator's service core is climbing steadily. In addition, an operator's own systems and any systems belonging to external 3rd party service providers need to be as pluggable and loosely coupled as possible.

2. What are Operations Support Systems?

Operations Support Systems (OSS) are computer systems used by telecommunications service providers. OSSes perform management, maintain network inventory, provision services, configure network components and manage faults for telecommunication service providers and their networks. For traditional telecommunication companies, OSS were mainframe-based systems designed to support automating the daily jobs of telephone company staff members, such as order processing, line assignment, line testing or billing.

The term Business Support Systems (BSS) is newer and typically refers to the business domain of telecommunication activities, such as customer relationship management (taking orders, processing bills, and collecting payments). The two systems together are often abbreviated BSS/OSS or B/OSS. B/OSS plays an important role in supporting and enhancing the operations of a service provider and increasing business services including voice, data, VOIP and multi-media.

The term OSS was historically used to include both network and business systems. Before 1970, OSS activities were performed by manual administrative processes. Implemented OSS systems were not linked to each other and often required manual intervention. This caused performance inefficiency and brought the need to focus all telecommunication company efforts on OSS integration.

The primary architecture of OSS systems was defined as a four element model embracing:

- Processes (the sequence of events),
- Data (information used in processes),
- Applications (systems implemented for supporting data management),
- Technology (technical way of application implementation).

In the 1990's most of the Operations Support Systems were designed based on the Telecommunications Management Network (TMN) model defined by ITU Telecommunication Standardization Sector. This model included 4 layers:

- Business Management Level,
- Service Management Level,
- Network Management Level,
- Element Management Level.

Most recently the TeleManagement Forum (TMF), an international membership organization of communication service providers and suppliers to the communications industry, has presented a communications domain model that provides the basis for clarifying the distinction between OSS and SS systems. In that model OSS focus on traditional resource domains, whereas BSS focus on customer domains.

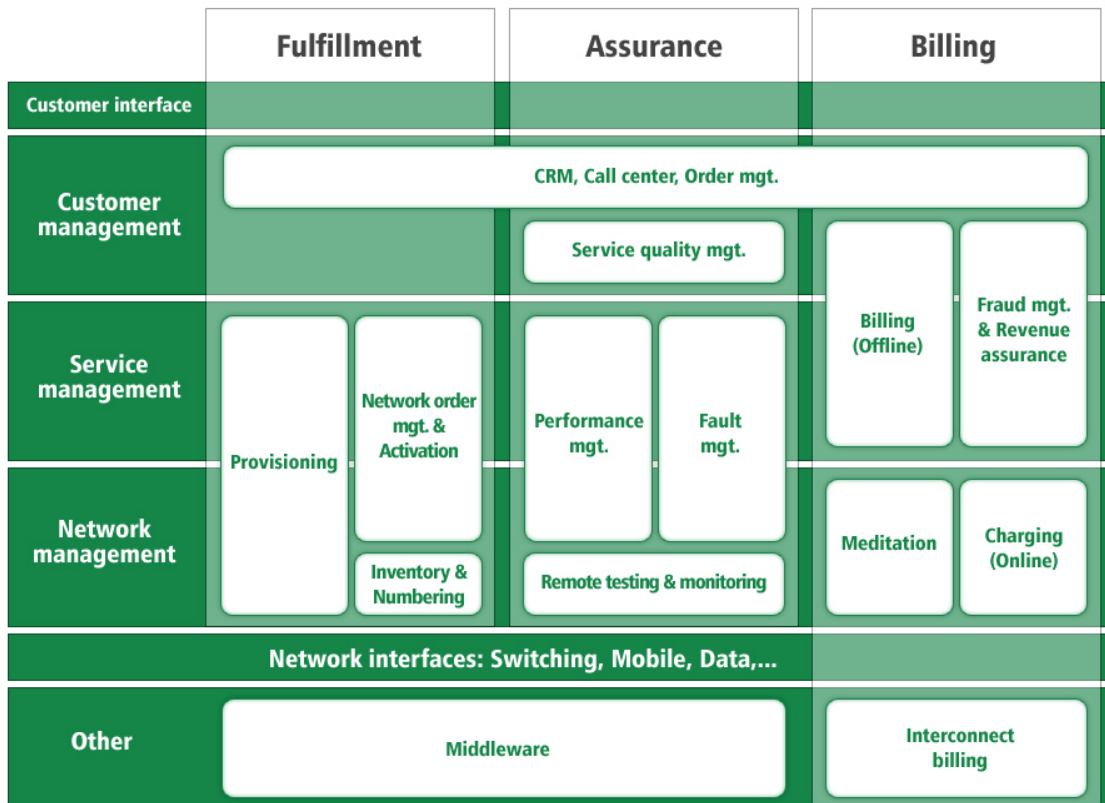


Figure 1: The vertical processes and horizontal layers of telecommunications processes. Typical OSS/BSS systems elements are shown in shaded boxes (source: TMF).

3. Key trends in Operations Support Systems

There are two major initiatives in the OSS industry, which complement each other:

- New Generation OSS (NGOSS) by TeleManagement Forum (TMF),
- OSS through Java™ Initiative (OSS/J).

These two initiatives can be used to solve problems of systems integration. TMF provides a development framework that can be used to steer the future direction of OSS systems. OSS/J gives a practical implementation guideline for new OSS applications and interfaces. NGOSS and OSS/J create the foundation for the OSS middleware components market by defining industry architecture and interfaces.

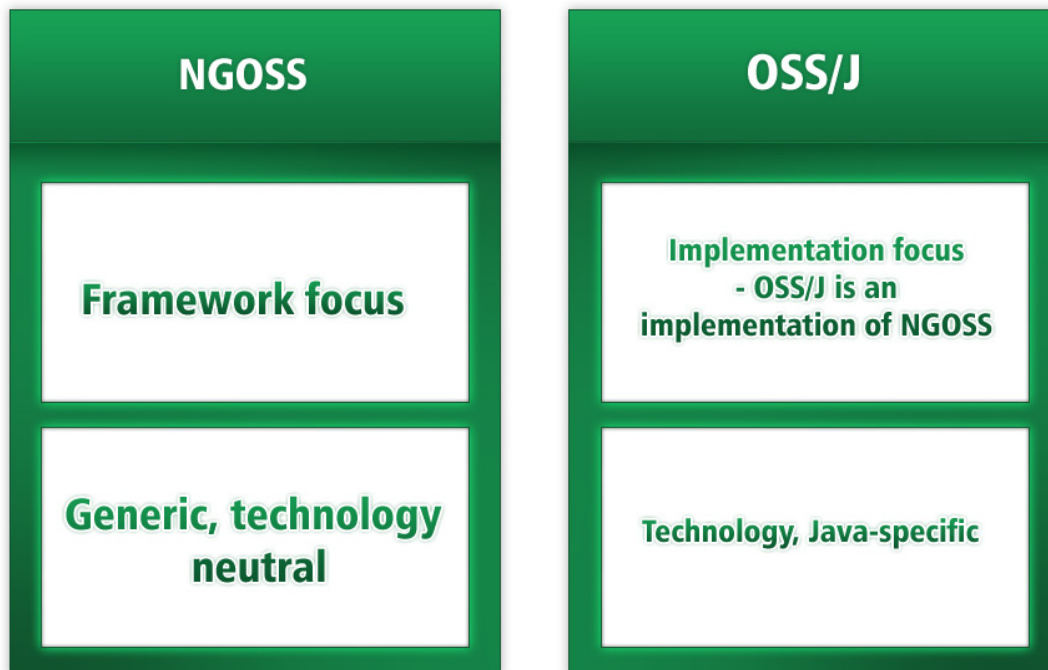


Figure 2: NGOSS and OSS/J (source TMF).

NGOSS is based on five key principles:

- **Separation of Business Process from Component Implementation.** As the traditionally linked OSS systems business processes were distributed across IT infrastructures, NGOSS proposes to manage processes centrally by using a workflow engine to control the flow of business processes between applications.
- **Loosely Coupled Distributed System.** Applications are independent of the overall system. Applications are "plug and play" and they can be changed without affecting the overall system behavior.
- **Shared Information Model.** Data must be shared between applications by using a common model for shared data.
- **Common Communications Infrastructure.** Initially OSS-integrated systems communicated between themselves by using different interfaces which was both ineffective and inefficient. NGOSS proposes a Common Communication Infrastructure which links applications together. Each application requires only one interface to the Common Communication Infrastructure instead of many interfaces to different applications.
- **Contract-defined Interfaces.** Implemented interfaces should be documented and include technology used and functionality of the application. NGOSS contracts can be extensions of Application Programming Interface (API) specifications.

NGOSS includes the following set of technical deliverables:

- **Process Model.** Enhanced Telecom Operations Map (eTOM) is the NGOSS business process framework.
- **Shared Information Model.** NGOSS Shared Information/Data (SID) model provides a common vocabulary and set of information/data definitions and relationships used in the definition of NGOSS architectures. The SID is an object model, which uses UML, a data and process modeling language, to define entities and the relationships between them, as well as attributes and processes.

- **Lifecycle Model.** The NGOSS lifecycle model defines the use and deployment of NGOSS within an organization, and provides a framework for using the SID, eTOM and NGOSS architecture. The NGOSS lifecycle divides system development into four stages: requirements, system design, implementation and operation.
- **Contract Specifications.** NGOSS Contract is fundamental for NGOSS systems because it allows services to be defined and implemented.
- **Telecom Application Map (TAM).** TAM provides the bridge between the NGOSS framework (eTOM and SID) and real, deployable, potentially procurable applications by grouping together process functions and information data into recognized OSS and BSS applications or services.

The Operations Support System through Java (OSS/J) Initiative is a TM Forum technical program whose primary goal is to develop open interface standards (APIs) for OSS/BSS integration. OSS/J freely shares experience, methodologies and ideas supporting the widely adopted OSS/J telecommunications platform. The Initiative makes available Java, XML and Web Services technologies that significantly reduce integration costs and strengthen relationships between vendors and buyers. The OSS/BSS functional APIs delivered by OSS/J support the business and technology goals of the operator:

- End-to-end management of core business processes,
- Flexible, component-based solutions,
- Standardized technologies to ensure vendor independence.

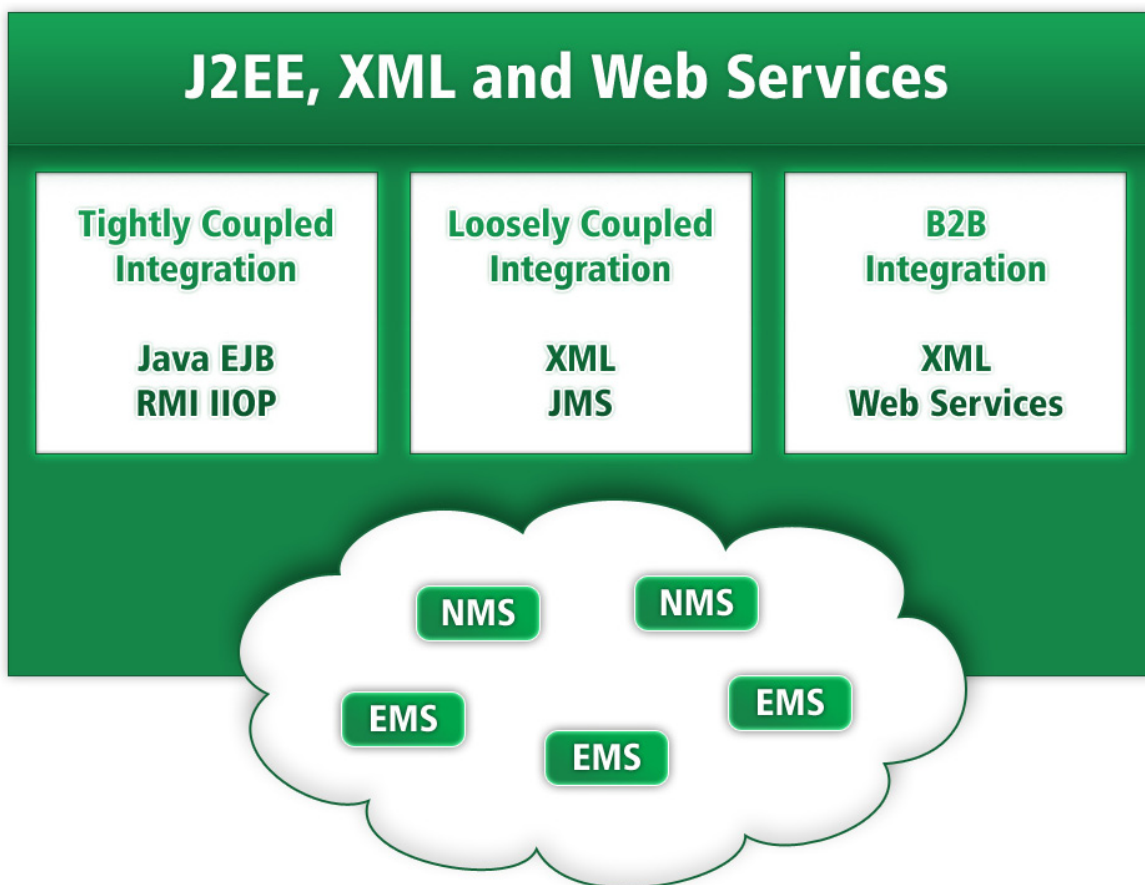


Figure 3: J2EE, XML and Web Services are the technologies used with OSS/J (source: TMF).

4. New OSS Standards and Infrastructure Benefits

The aforementioned traditional approach of operator systems architecture consists of three layers:

- Business Support System layer which focuses on customers and embraces most financial transaction processing and end-users services,
- Operations Support System layer which focuses on products, services and resource inventories in order to perform successful network management,
- Networks layer which is responsible for managing multiple networks and elements.

In order to secure successful interconnection between OSS and BSS systems integration enablers must be implemented.

It is important to apply a service-oriented approach to infrastructure implementation by modeling functions at each level as services in order to allow each level to use higher or lower level services. To obtain a service-oriented architecture model it is important to model the interfaces and data managed in the services in a consistent way.

New architecture should be implemented to manage customers both in mobile and fixed domains. To meet this challenge the infrastructure should evolve from vertical silos to a defined modular and component-based one.

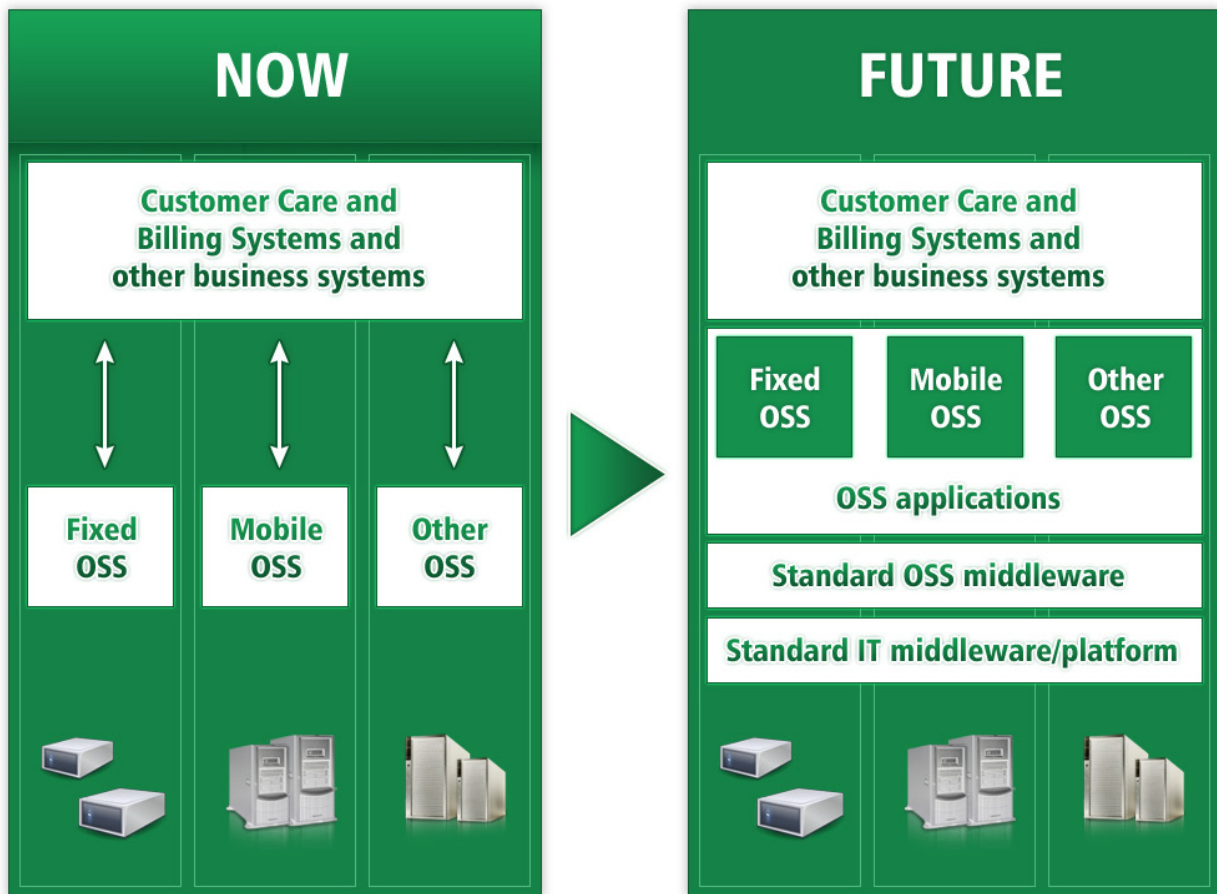


Figure 4: From vertical silos to platform architecture (source: TMF).

Traditionally, vertical BSS architecture is integrated separately for fixed OSS, mobile OSS or other OSS. The idea to implement and maintain platform architecture includes four elements: BSS, OSS, standard OSS middleware and the standard IT platform. OSS middleware facilitates the management of different OSS systems which results in cost reduction of BSS/OSS integration. Standard OSS middleware adds specific functionality to the IT platform such as adaptation to new types of network elements which allow faster implementation of new technical features and reduction of manual work. A major benefit of component-based BSS/OSS implementation is better management of planning and operation processes in a multi-service and multi-technology environment.

Implementation of a new age OSS/BSS system brings benefits in:

- Integration cost reduction,
- Automation of operations to enable customer provisioning and self-care,
- Reduction of time-to-market delivery,
- Reduction of dependencies on suppliers,
- Spread of the risk and the investment across other industries,
- Elimination of silos,
- Reuse of process, architecture and solution patterns and components,
- Enterprise-wide architectures and supply chain-wide interactions,
- Higher customer loyalty,
- Higher productivity and efficiency of services.

In order to fulfill next generation services it is important to consider BSS and Customer Care system (CRM) integration. A BSS/CRM Suite must have a flexible, scalable and open architecture that supports the entire billing chain and allows integration with most third party systems. The suite should include revenue sharing and settlements, the deployment of next generation services, and convergent billing.

Benefits of BSS and CRM integration include:

- Implementation of any kind of business model with comprehensive functionality,
- Better business process management with integrated workflow designer,
- Revenue management with a variety of charging scenarios (subscription fee, per transaction, per byte, by time units, by QoS),
- Possibility to offer attractive tariffs and increase customer retention with flexible rating engine,
- Leverage 3G offerings and new revenue streams with better time-to-market.

Telecommunications operators who want to implement new standards and architecture should start from a deep analysis of their existing processes and data models. They should then model their processes as subsets of the NGOSS-enhanced Telecom Operation Map (eTOM) and their data models as instantiations of NGOSS Shared Information Data (SID). New architectures can be defined with the use of OSS/J technology choices, mapping OSS/J APIs to support their processes and populating the OSS/J APIs with their data models.

5. Verax Systems OSS – an overview

The fragmented nature of most operations support systems has posed some problems and challenges for service providers. Adding network elements, deploying new services, and managing already complex networks are difficult with an OSS comprised of disparate applications from different vendors.

In order to solve this problem Verax delivers consistent OSS which embrace:

- Network Management System,
- Provisioning Service,
- AAA (Authentication, Authorization, and Accounting) services.

Network Management and Inventory

Verax Systems' OSS Suite delivers a highly scalable platform for building network management systems for IP networks featuring full FCAPS (fault, capacity, accounting, performance, security) functionality and network visualization using map services from Yahoo! and Google. Built on the Enterprise Java platform (core, back-end system) and Adobe Flex and AIR (user interface) technologies, the Verax NMS is a highly scalable network management system (NMS) for IP and other networks (3GPP, CORBA, TL1, Q3/CMIP) featuring full FCAPS (fault, capacity, accounting, performance and security) functionality and network visualization using map services from Yahoo! and Google.

As part of the Verax OSS/BSS Suite, the NMS allows work management and monitoring of various kinds of network elements, e.g. switches, routers, servers, firewalls, WiFi/WiMax access points and base stations, HFC networks, disk arrays and others. Due to the plugin-based architecture used, the system can be easily extended with support modules for particular network elements without modifications to the core system..

Network management and inventory features include:

- Multiple network element discovery mechanisms (IP network scan, SNMP scan) with the ability to provide custom, user defined discovery methods.
- Off the shelf support for SNMP devices; other protocols are supported through a mediation layer,
- Inventory database.
- Performance management: collection of performance data from the network, analysis, alarm generation and reporting.
- User friendly, rich GUI based on the Adobe Flex technology.
- Fault Management: trap processing, alarm creation, filtering, blocking, thresholds and correlation.
- Alarm management: creation of alarms based on network data, alarm categorization.
- Easily extendable with new modules during runtime.
- User security levels.
- GPS coordinates for all managed devices with map visualization.
- Configuration management allowing operation to retrieve and publish configuration from and to managed network elements.
- Notification manager for informing network operators about abnormal network conditions via e-mail or SMS.

Benefits of Verax Provisioning Service include:

- Business value – reduction of network operational costs.
- High productivity – Verax NMS offers a rich and intuitive GUI interface, allowing operators to detect problems and gather information about managed networks in a rapid and efficient manner.
- Continuous status monitoring of various network devices including routers, switches, servers, workstations, storage devices, firewalls and other network elements allowing detection of abnormal conditions, before they cause network downtime or service degradation.
- Efficient tracking of network inventory and management of assets.

- Reduction of downtime costs by early detection of abnormal network conditions through root-cause analysis.
- Graphical performance reports allowing capacity and availability monitoring.
- Unified management – providing a common interface and network management infrastructure to perform network management, and system and element integration across multiple, heterogeneous devices and networks.
- Protection of investment through a scalable architecture – scaling on a cluster of low-cost machines virtually eradicates the need for hardware replacements.
- Protection of investment through a modular architecture – adding new network element modules without changing or upgrading the core system.
- Protection of investment through flexible business logic – rules in the system (such as those for alarm correlation) can be changed by users without modifying the core system.
- Low cost of introduction – Verax NMS supports virtually any modern operating system and database type and does not require heavy investments in hardware. It can also be migrated from open source to commercial environments as managed networks grow.

Provisioning Service

Verax Systems' Provisioning Service is a layer between BSS and the OSS systems and is an integral part of the Verax Systems OSS/BSS Suite. It is a business process management engine (BPM) based on parallel, transactional script execution responsible for orchestration, arrangement, coordination, and management of elements involved into delivering the service. The primary role of the provisioning server is to translate BSS service definition into a series of commands to the network elements in order to implement the service.

Benefits of Verax Provisioning Service include:

- Abstracting of low-level configuration protocols and issues.
- Support of most popular NEs different vendors, such as VoIP gateways, DSL modems and others.
- Script driven engine allowing quick implementation of business rules without system downtime.
- Ease of integration via industry-standard web services interface.

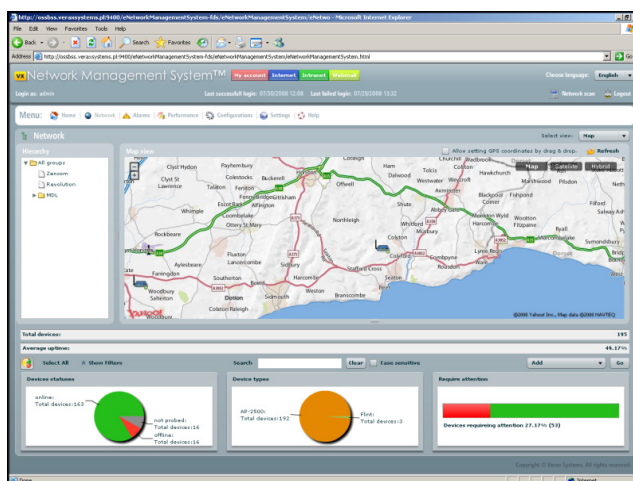


Figure 5: Verax Systems NMS (map view).

Provisioning Service uses NMS network element modules in order to communicate with the network and execute actions required to activate the required service.

AAA Management

Verax Systems OSS Suite contains a AAA manager component providing uniform access to both commercial and open source implementations of AAA servers such as Radius or Diameter. The interface layer is used by the provisioning server in the business rules implementation. In addition Verax AAA Management provides a NMS-like application to manage operator servers and provide individual and aggregate usage reports such as:

- Detailed connection history of each user's activity.
- NAS Reports showing summary and detailed usage statistics per NAS/RAS device.
- Concurrency report showing the maximum concurrency reached on each NAS/RAS device and its duration.
- Active Users report showing those users still connected at the end of the report period on each NAS/RAS device.
- Log Statistics report showing the number the number of START/STOP/INTERIM records processed and duplicate records found.

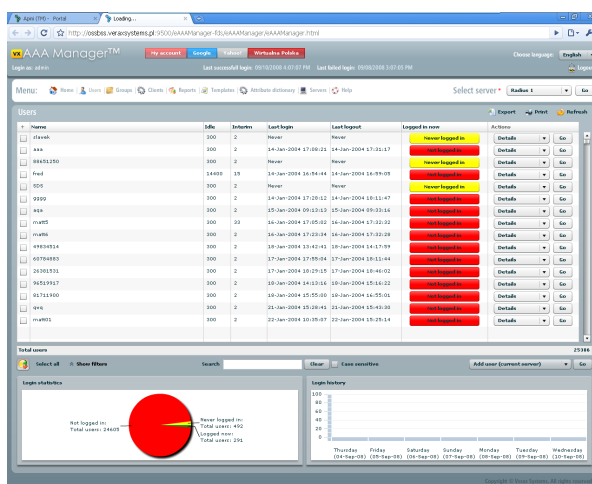


Figure 6: Verax Systems AAA Manager.

As part of the Verax OSS/BSS Suite, the AAA Manager is also a collection of back-end services (that can be combined with the Verax Provisioning Service) that can be used directly (RMI/SOAP) or through EAI in order to provision users and services in the AAA servers on the network.

SLA Management

SLA management is a very important cross-domain end-to-end challenge. End-to-end SLA include:

- Mobile access network SLA,
- Transport network SLA,
- IT network SLA.

SLA management challenges result from:

- Multiple, potentially individually managed domains,
- Mix of traditional Telco and IT equipment and services.

Processes focus on service assurance and SLA monitoring by:

- Continuous status monitoring of different routers, switches, servers, workstations, storage, firewalls and other network devices,
- Network security tracking.
- Early detection of abnormal network conditions with root-cause analysis.

- Graphical performance reports.

Benefits of Verax OSS include:

- Easy to extend the ability to add new devices managed by the system,
- Carrier grade – System fulfils a large number of operator class application requirements,
- Scalability and efficiency – High system efficiency is achieved by use of reliable technology and distribution.
- Flexibility - System is offered as a framework hence it can be adjusted to the specific needs of each client.
- Architecture based on industry standards - Ensures trouble-free and efficient interoperability with a wide range of 3rd party products.
- Various operating systems supported - Runs on Sun Solaris 10, Linux, Windows XP, Vista platforms.

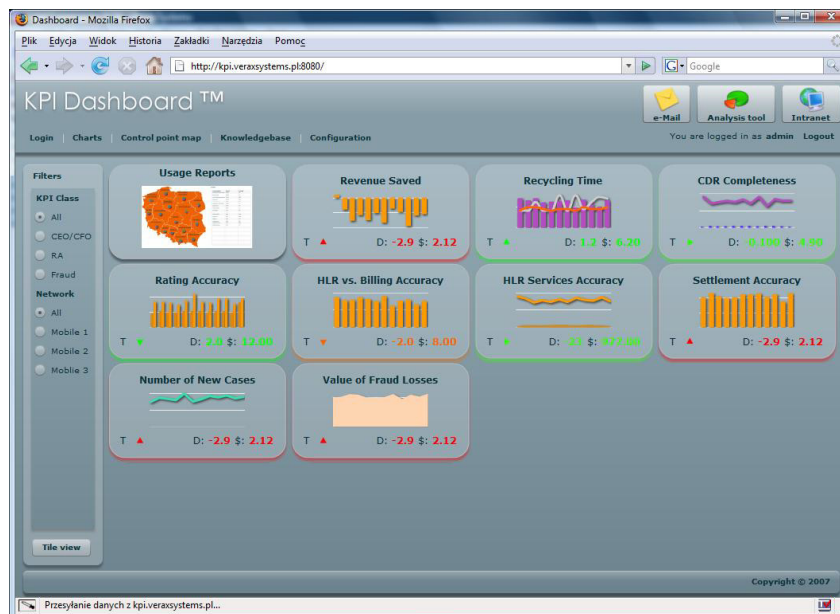


Figure 7: Verax Systems KPI Dashboard.

EAI Ready

Each functional element of the Verax OSS Suite is open via Java RMI or web-service interfaces and relies on interfaces exposed by other services, which can be implemented by different back-ends. Such a design allows EAI-style (Enterprise Application Integration) integration of suite components with third party applications. The integration may take place directly or via an Enterprise Service Bus (ESB) solution such as Tibco or WebMethods.

6. Summary

Understanding new trends in the telecommunication market, Verax Systems offers the comprehensive Verax OSS. The major goal of our efforts is to deliver an open, standards-based, next-generation OSS platform which provides consistent network modeling and a set of interoperable applications, and implements a virtual mediation layer. This approach gives service providers the tools to implement network elements quickly and deliver new services, and helps to reduce overall costs of service provisioning as well as network maintenance.

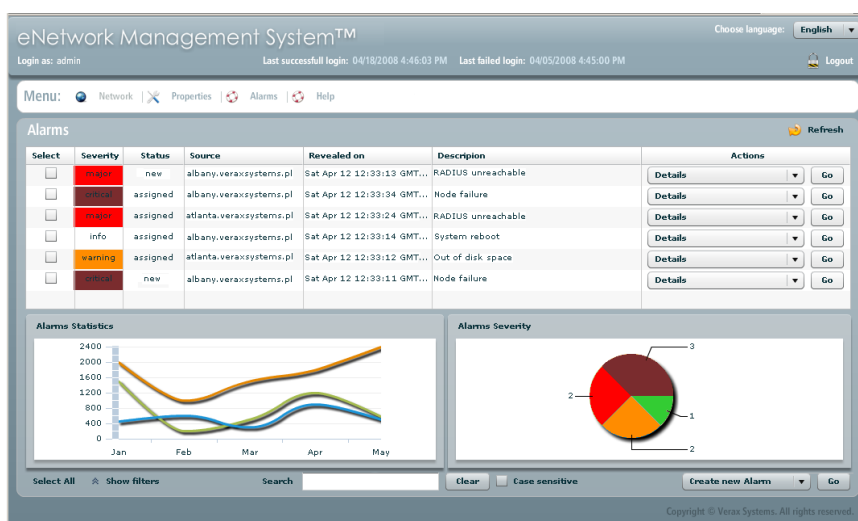


Figure 8: Verax Systems NMS (alarm statistics).

Verax Systems OSS is a proven comprehensive solution for Telecom operators and ISPs. It is a reliable and secure OSS, scalable and efficient. It guarantees successful network support and tangible benefits in key areas of competitiveness, such as:

- Network management and inventory,
- Integration of disparate network elements and systems,
- Service provisioning,
- SLA management.

To learn more about our services and products, please contact one of our offices or visit us on the Internet at www.veraxsystems.com.