IPRO 349 – 3.2

Final Report

Team: Piotr Baranowski, Adam Berg, Manuel López,
Wojciech Szymanski
Supervisor: Jakub Zaluski

Instructor: David Pistrui

July 2007, Krakow

Executive Summary

1. Telecommunications providers spend $21.5 billion each year on Operations Support System (OSS) software, and this is growing at 6.8%.
2. Corporations spent $114.8 million on Enterprise Service Buses (ESBs) last year, a gain of 160.7% over the previous year.
3. US corporations are spending $6.1 billion every year on the technology-dependent aspects of complying with the Sarbanes-Oxley Act (SOX) regulations.

These are three opportunities that Comarch SA, an OSS provider, ESB integrator, and emerging play in the US market, must take advantage of.

IPRO 349-3.2 is pioneering the development of Comarch's next-generation Operations Support System (OSS), which telecommunications companies use to manage their networks and services. Though Comarch is a small player globally (0.001%), its product offering is very strong and has great potential – *if* it can expand outside of Europe. We have evaluated three opportunities to improve Comarch's OSS and recommend our strategies to enable expansion into the United States and other lucrative markets. OSS use is becoming more important as telco networks grow. By attracting 0.01% of the total OSS market alone, Comarch's Telecommunications division revenue will exceed $215 million.

Table of Contents

3. eTOM Template Creation

SOX: Overview

Compliance

Is Google about to usher in a revolution in business computing just as it did Internet search and advertising a few years ago? It could happen. In early July 2007, Google announced the acquisition of Postini, a fully-hosted, web-based email service designed for businesses that complies with US regulations and other standards by offering secure data access, storage, and retrival (Dornan, 2007). Add this enterprise-class security to Google's already-existing (but not secure) online email, word processing, and spreadsheet applications, and you have an inexpensive, capable, and convenient alternative to an IT department to ensure compliance.

US corporations are spending $6.1 billion every year on the technology-dependent aspects of complying with the Sarbanes-Oxley Act (SOX). Imagine the opportunity that exists: if Comarch could tap into this market and develop or demonstrate compliance in its already-existing enterprise applications, it could have $61 million in revenue with only 0.01% of the market.

Let us explore the Sarbanes-Oxley Act and how it can affect Comarch.

Origin of the Sarbanes-Oxley Act

In 2001, $60 billion was lost to the people of the United States - $200 for every man, woman, and child – from the bankruptcy of Enron, and the unethical and criminal behavior of the executives at one of world's most innovative and respected companies. And for once, the government stepped in to stop this from ever happening again. But what the federal government put into place was an expensive and confusing disturbance for many, and one of the most controversial regulations in United States business history.

The Sarbanes-Oxley Act (SOX) is a landmark piece of United States legislation that greatly intensified government regulation of large public companies. This law was passed in 2002 and coincided with the infamous string of corporate fraud cases that included the scandals not only at Enron, but WorldCom, Tyco, HealthSouth, and others. It was enacted to restore investor confidence in the public markets following this mess, and it did so primarily in two ways: first, by imposing harsher personal penalties for white-collar crimes; and, second, by establishing a process of internal and external checks in public companies, aimed at eliminating the potential for corporate fraud.

Overview of the regulations in SOX

As mentioned in the previous section, SOX was passed in congress to restore investors' confidence in the public companies' financial statements. The spirit of the legislation is to create a documented system of checks and balances in public companies, to make companies' CEOs and CFOs formally attest to the accuracy of financial statements –and the systems and processes that underlie them–, and to create complete transparency in corporate governance. In short, SOX makes company executives legally responsible for the accuracy of the financial statements (Hewlett Packard, 2006).

The sections (numbered to 1107) in SOX can be classified in five main groups based on their purpose: first, the group of sections that stipulate that public companies in the US are obliged to disclose in periodic reports the methods of collecting information for financial statements and an assessment of the reliability of these methods; second, the group of sections that establish the procedure for certifying accuracy in those reports and create the governmental entity that will oversee this certification; third, the group that regulates companies' and governmental agents' practices and behaviors to avoid corruption in the process of certification; and fifth, the group that establishes what penalties and sanctions result from the violation of any regulation in SOX.

By obliging companies to disclose periodic reports assessing the reliability of the methods used to support financial statements, SOX ensures the existence of transparent communication between a company and its investors. And it is precisely this part (section 404) which has caused the greatest commotion among public companies. They must present periodic reports stating the responsibility of management in having an adequate internal control structure and procedures for financial reporting, besides containing an assessment of the effectiveness of the internal controls. Implicitly, this section obliges companies to set up tighter internal controls and implement quick data retrieval mechanisms that can be proven to be reliable.

SOX also establishes harsh penalties. Presentation of faulty or incomplete financial reports has devastating results. In Title IX in SOX, it is explicitly said that the CEO or CFO who willfully and knowingly fails to deliver financial statements and disclosures that fully comply with provisions of the Securities Exchange Act, or to "fairly present, in all material respects, the operations and financial condition of the issuer" may be subject to a "fine of not more than $500,000 and/or imprisonment of up to 5 years." Any other violation of SOX is treated as a violation of the Securities and Exchange Act of 1934, giving rise to the same penalties imposed for violations of that Act. In addition, non-compliance may not only cost the liberty of executives, but also the reputation of the company, thus affecting stock prices and its ability to survive.

The agency created in SOX to oversee the audit process is called the Public Company Accounting Oversight Board (PCAOB). This Board is self-regulated and understanding in its powers is keep to complying with SOX.

Enforcement of SOX Auditors by the PCAOB

Outside of the new regulations, a key provision of the Sarbanes-Oxley Act is the enforcement of its principles – especially for the auditors that examine and verify companies' internal controls. This was handled in the creation of a new private-sector agency (with government-like functions), the Public Company Accounting Oversight Board, or PCAOB.

The PCAOB has the power to perform many specialized functions in the hopes of transparently guaranteeing auditor competence. This includes (but is not limited to):

- Setting auditing standards
- Inspecting auditing firms
- "[Sue] and be sued, complain and defend, in its corporate name and through its own counsel, with the approval of the SEC, in any Federal, State or other court
(Wikipedia, 2007)

The PCAOB's function to oversee auditors of public companies is important, because it sets up a chain of oversight that goes from public company all the way to the public (see Figure 1). As a result of SOX, there is a clear – albeit long – method of ensuring that corporate fraud is minimized.

Figure 1: Hierarchy of Public Company Oversight

US Citizens → Federal Gov't → SEC → PCAOB → Auditors → Public Companies

But if a public company is to be audited annually, what are the standards by which it should be judged?

SOX Mindset as Best Practice

Although SOX is often viewed as a US-only regulation, it has effects and benefits far outside that country's borders.

Many European companies are required to adopt SOX-compliant practices because of their roles with US corporations as subsidiaries or other close relationships. Furthermore, not only is compliance beneficial when working with US corporations, but the executive accountability and regular financial audits that are a part of SOX make any business a more attractive investment. SOX compliance can be seen outside the US as an international standard of financial reporting quality, similar to other industrial standards such as ISO 9001. (Sawers, 2007)

The Role of IT Department in SOX Compliance

Convincing the PCAOB that a company has reliable internal controls and immutable data that supports financial statements is as easy as demonstrating that there is no needle in a haystack. To comply with SOX, the company's transactions have to be continuously monitored, financial documents and databases have to be strongly guarded, sales information and financial information have to be synchronized, and all these procedures have to be continuously monitored and documented to ensure the reliability for which SOX is looking.

No company can afford in terms of time and money to do all this monitoring and documenting manually. Consequently, most of the practical responsibility of complying with SOX falls on the shoulders of the IT department of the company.

SOX Compliance and IT

SOX Sections Relevant to IT

While it is true that, for the most part, a company's compliance with SOX relies on the IT department, only a few sections directly involve IT. These sections are 302, 404, 409, and 802. Why is this information important for Comarch in the dawn its OSS upgrading? By knowing what SOX requires all IT departments in companies to do, Comarch would be able to determine if its OSS Solution needs to support new functionalities or could contribute to the development of other software that is directly related to SOX compliance.
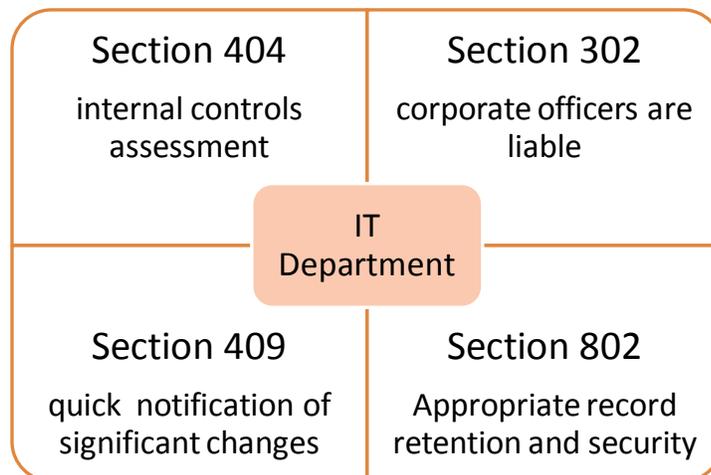
Figure 9.9.9.9 SOX sections that directly involve the IT department

Section 302 requires executive officers to certify (with their reputation and liberty at stake) that the periodic financial reports required by the Securities Exchange Act of 1934 contain accurate information, that there are internal controls ensuring the credibility of those reports, that the internal controls' efficiency has been evaluated, and that all deficiencies that could impact the financial statements have been disclosed. In summary, section 302 makes corporate officers liable for the disclosure of internal controls and procedures, and assurance from fraud. Due to the tight relation between financial data internal controls and a company's IT department, it may be necessary to have the CIO of the company sign a sub-certification (Brown and Nasuti, 2005).

Section 404 in SOX requires an internal control report that includes a statement of "the responsibility of management for establishing and maintaining an adequate internal control structure and procedures for financial reporting" and an "annual assessment of the effectiveness of the internal control structure and procedures."

More concretely, the Auditing Standard #2 (directly related to Section 404) developed by PCAOB tells auditors to "trace a transaction from origination through the company's information systems until it is reflected in the company's financial reports" and assess the internal control's effectiveness. (PCAOB, 2004) In other words, section 404 requires the IT department to ensure data integrity and security, besides demanding the company to have the ability to track its transactions almost in real-time from the transaction's initiation to its impact in the financial statement.

In section 409, it is stipulated that a company must disclose to the public "on a rapid and current basis" any material changes on the company's financial condition or operations. This section relates to the IT department only in cases when problems in the IT infrastructure or functionality affect financial performance (e.g. a computer virus that stops production).

Section 802 establishes penalties for altering financial documents and data. In addition, it stipulates that audit documentation must be preserved for a period of at least 5 years. In this case, it is the IT department's job to securely retain financial data.

After knowing what SOX sections are most relevant to the IT departments, it becomes necessary to discern the IT role in SOX compliance; to analyze how exactly the IT department will assume the responsibility that SOX assigns it.

SOX Compliance in Practice

Good Practices

SOX compliance in general is, by law, a top-down effort that affects the entire organization. The best practices come from leaders that can implement well-defined business processes that are standardized within and often from outside the organization. One example is the use of data standards for financial and business information information. XBRL, or eXtensible Business Reporting Language, is one such standard. (Furness, 2006)

Many US corporations publish case studies of how they transitioned to a process-based strategy of SOX compliance, including Johnson & Johnson, AON Corporation, and Motorola. However, these studies are written from the perspective of corporate-wide administration and give very little detail regarding specific processes or data sets.

TeleManagement Forum (TMF) is currently in the process of developing guidelines for implementing SOX compliance and NGOSS (Next-Generation Operations Systems and Software) at the same time. This project, "SOX Catalyst," is ongoing and will outline ways to approach business processes using SOX, in a similar fashion to the eTOM map. In 2005, TMF recommended the following sequence of actions to perform for each business scenario to incorporate Risk Management techniques and ensure compliance with SOX (TM Forum, 2005):

1. Determine Financial Requirements for SOX
2. Establish Control Objectives (overall; transaction should occur and be recorded   without error)
3. Identify Specific Risks in each business scenario (at every point in the process; file   transfer errors, incorrect formatting/sequence of information)
4. Develop Controls to mitigate risks (at every point in the process; monitor gateway for   errors, flag for corrective action, make correction and monitor)
5. Evaluate/Monitor; report for SOX

Typical Challenges

For many organizations, the internal controls of the IT systems are weak in some areas, so mistakes occur. CFO Research Services has identified the following problems that are typical pitfalls within a corporation (CFO Research Sciences 2005):

- Underutilized automated controls that already exists in corporate IT systems
- Too many SoD (Segregation of Duties) violations due to bad IT access controls
- Too many user roles – increases chances of SoD violations
- Manual user provisioning
- Too much time analyzing the control environment - companies need to just wipe the slate clean and redo their processes if they're that bad

Recommendations to Comarch

Current Comarch OSS standing in SOX terms

Comarch OSS Suite encompasses Service, Network, Service Level, and Network Performance Managements –among others. The OSS functionalities used in complying with SOX regulations include tracking of transactions, internal controls, quick disclosure of significant changes, and data security. Comparing Comarch OSS's capabilities and the SOX-required tasks it can be seen that Comarch OSS suite can fully support the processes that a Telco needs to perform to comply with SOX.

Comarch OSS Network and Service Inventory tracks accurately physical devices (assets) and customers' agreements (source of income of a Telco). The Telco that uses these Comarch services will be able to support its financial statements with the reliable data provided by the OSS Process Manager; therefore giving a firm step in complying with Section 404 of SOX. With Comarch's Service Level Management and Network Performance Management services, Telcos are able to monitor how well they are fulfilling their Service Level Agreements (SLAs).

Development

Although we believe that Comarch's OSS suite is currently SOX compliant, we recommend collaborating further with SOX experts (lawyers and accountants) as well as clients to determine specific needs or improvements that can be made to the OSS regarding SOX.

Marketing

We were surprised to learn during our discussion with a representative from Comarch's Marketing Department that there is no defined target market for Comarch OSS, even among the classic telco groupings of Tier 1, 2, or 3. We believe that, with a SOX-compliant OSS, Comarch should target specific customers who could benefit from a brief training about SOX and Comarch's solution. These targets are:

1. US companies that are on a "project-basis" compliance strategy
2. Non-US companies that understand the advantages of a high standard of financial reporting quality

First, the general recommended strategy for SOX compliance – developing permanent business processes to automate any extra information gathering or security required for – is quite expensive to implement in a short period of time. Therefore, some corporations have not yet adopted these so-call "process-based" strategies for SOX compliance, and are still complying on a more expensive project-basis. This is an ideal market for Comarch to target with a SOX-compliant solution or SOX consultation – especially if they are new purchasers of Comarch OSS.

Second, although SOX compliance is required only in the US, there are good reasons for non-US companies to adopt the processes and accountabilities specified by SOX. Not only is compliance beneficial when working with US corporations, but the executive accountability and regular financial audits that are a part of SOX make any business more attractive to investors. Furthermore, SOX compliance can be seen outside the US as an international standard of financial reporting quality, similar to other industrial standards such as ISO 9001. (Sawers, 2007)

Introduction - some background information, history of integration

Connectivity across the IT environment for enterprise is now increasingly critical for integrating existing and new applications, processes and services in an efficient and cost-effective manner. There is a need for ability to push for the innovation and more-flexible integration. We can differ from two kinds of methods of integration:

➢ **Point-to-point method** – This is not very good method because the connection grow very quickly across an organization. For example the number of n connections to become the fully point-to-point mesh is $n(n-1)/2$, so for 20 applications we need to have 190 connections to be fully connected. And for more applications the number grows very fast and it becomes "spaghetti".

➢ **Hub-and-spoke method** – a better way of integration. The model of this method consists of a central located hub and connection, paths that lead to destination spokes. This method uses many fewer connections than the point-to-point method; for n applications, there are only (n-1) connections.

In the past years we have seen several technology trends like:

➢ **Service Oriented Architecture (SOA)** – there are many definitions of SOA and they are often limited to technology or just web services. We can say that SOA is a design for linking business and computational resources (principally organizations, applications and data) on demand to achieve the desired results for service consumers (which can be end users or other services). (Wikipedia)

➢ **Enterprise Application Integration (EAI)** - defined as the uses of software and computer systems architectural principles to integrate a set of enterprise computer applications.(Wikipedia)

➢ **Business-to-Business (B2B)** - a marketing strategy which involves the transaction of goods or services between businesses (Wikipedia)

➢ **Web services** - a software system designed to support interoperable Machine to Machine interaction over a network .They are frequently just Web APIs that can be accessed over a network, such as the Internet, and executed on a remote system hosting the requested services.(Wikipedia)

These technologies have attempted to address the challenges of improving the results and increasing the value of integrated business processes, and have garnered the widespread attention of IT leaders, vendors, and industry analysts. But still it is not enough and because of that fact companies invented another method of integration called ESB – Enterprise Service Bus. The ESB draws the best traits from described methods and technology trends. The ESB concept is a new approach to integration that can provide the underpinnings for a loosely coupled, highly distributed integration network that can scale beyond the limits of a hub-and-spoke methodology. In the next part of the report we will try to describe what ESB really is and what their characteristics and functions are.

Description of ESB (Enterprise Service Bus)

It is hard to say what exactly ESB is, whether it is a framework, an architecture style, a product and how ESB can be implemented. "An Enterprise Service Bus (ESB) is a new architecture that exploits Web services, messaging middleware, intelligent routing, and transformation. ESBs act as a lightweight, ubiquitous integration backbone through which software services and application components flow." (Source: Roy Schulte, Gartner).

The ESB is also often referred to as an *integration network* or *integration fabric* because any application can plug into an ESB network using a number of connectivity options, and immediately participate in data sharing with other applications that are exposed across the bus as shared services. ESB architecture forms an interconnected grid of messaging hubs and integration services, with the intelligence and functionality of the integration network distributed throughout.

According to the book "Enterprise Service Bus" by Dave Chappell we can distinguish sort of characteristics of an ESB:

➢ *Pervasiveness* - the ESB can form the core of a pervasive grid. Applications plug into the bus and are capable of having visibility and of sharing data with any other applications or services that are plugged into the bus.
➢ *Standards-Based Integration:*
  o J2EE components such as the Java Message Service (JMS) for MOM (Message-oriented middleware) connectivity
  o J2EE Connector Architecture (JCA or J2CA) for connecting to application adapters
  o ESB can also integrate with applications built with .NET, COM, C#, and C/C++
  o Integrate with anything that supports SOAP (Simple Object Access Protocol or Service Oriented Architecture Protocol) and web-services APIs, which includes standard web-services toolkit implementations such as Apache Axis (open source, XML based Web service framework)
  o Can use XML standards such as XSLT, XPath, and XQuery to provide data transformation, intelligent routing, and querying of "inflight" data
  o For dealing with SOA and business process routing, an ESB can use the Web Services Description Language (WSDL) to describe abstract service interfaces, and Business Process Execution Language for Web Services (BPEL4WS), WS-Choreography, or some other XML-based vocabulary such as ebXML BPSS, to describe abstract business processes
➢ *Highly Distributed Integration and Selective Deployment* - ESB provides integration services such as business process orchestration and routing of data, data transformation, and adapters to applications.
➢ *Distributed Data Transformation* - the ability to readily convert data formats between applications

➢ *Event-Driven SOA* - applications and services are treated as abstract service endpoints, which can readily respond to asynchronous events. Services simply receive a message from the ESB as an event, and process that message. The ESB gets the message to anywhere else it needs to go.

➢ *Process Flow Capabilities* - make possible to define business processes that are local to an individual department or business unit, and that can also coexist within a larger integration network.

➢ *Security and Reliability* – the connections between nodes of the ESB are firewall-capable. There is a capability of establishing and maintaining the most stringent authentication, credential-management, and access control between applications and ESB

➢ *XML as the "Native" Datatype of the ESB* – XML is an ideal foundation for representing data as it flows between applications across the ESB.

➢ *Real-Time Throughput of Business Data* – eliminates latency problems by providing real-time throughput into in-flight data as it travels between applications across the ESB. The latency due to nightly batch processing can be very costly to a business, so there is a need of real-time throughput.

➢ *Operational Awareness* – the ability of a business analyst to gain insight into the state and health of business operations. A need of an infrastructure that allows the timely tracking and reporting of data as it flows across an organization in the form of business messages in a business process.
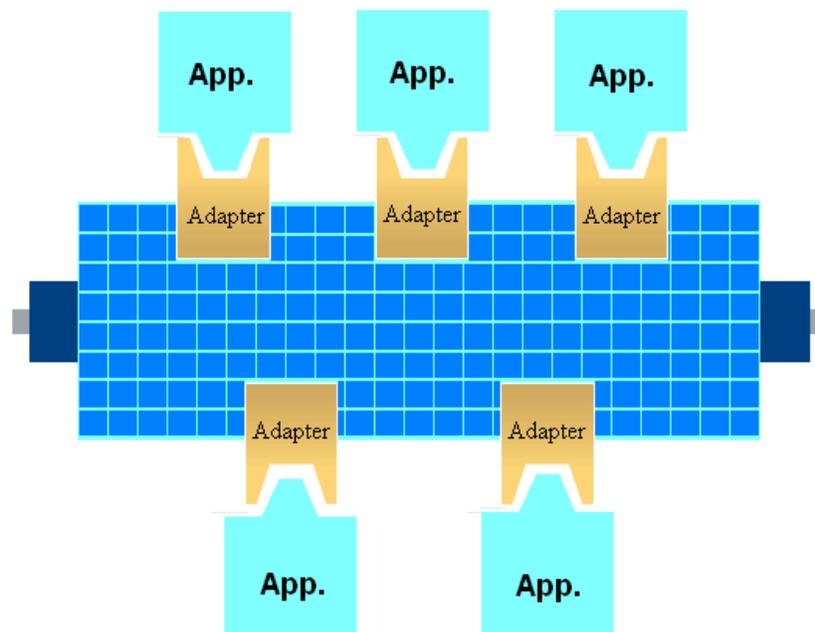
ESB Market

Companies that provide ESB – solutions, standards, pictures with the architecture, strengths

Bea: Aqua Logic Service Bus

➢ It contains with 2 components:
- o ESB which is responsible for:
- o supporting communication between services
- o service switching
- o routing, transformation, security and validation of messages
- o exceptions handling

➢ WSM (Web Service Bus) which functions are:
- o lifecycle management
- o service registration and making accessible
- o service versioning
- o security
- o service and message management
- o integration with other management systems

Aqua Logic Service Bus architecture:
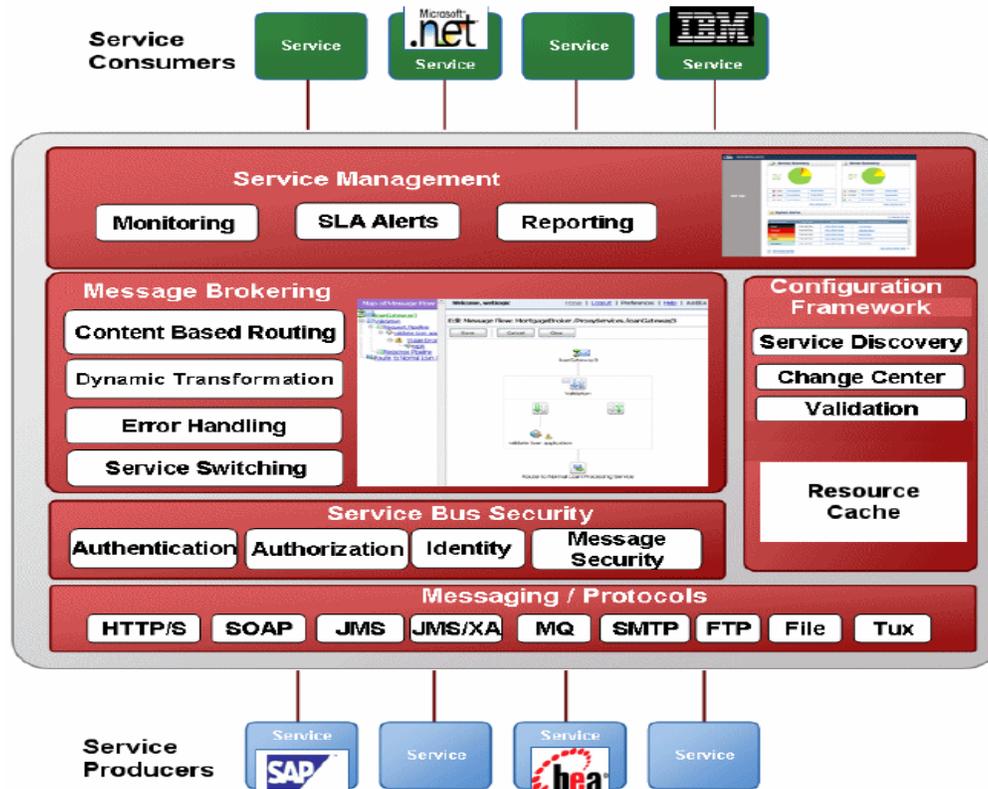
IONA: Artix ESB

Artix ESB enables:

➢ Incremental SOA adoption—Artix ESB creates a network of smart, standards based endpoints using existing infrastructure so enterprises can begin with low-risk, high-value SOA projects and gradually add services as needed.

➢ Dynamic and adaptable deployments—Artix ESB endpoints are independently configurable so services can be extended, modified and hot deployed without disrupting the rest of the enterprise.

➢ Technology-neutral solutions—Artix is a multi-platform and multi-protocol solution that connects diverse and lightweight endpoints without an expensive and cumbersome centralized server, and without promoting vendor lock-in.

IONA Artix infrastructure
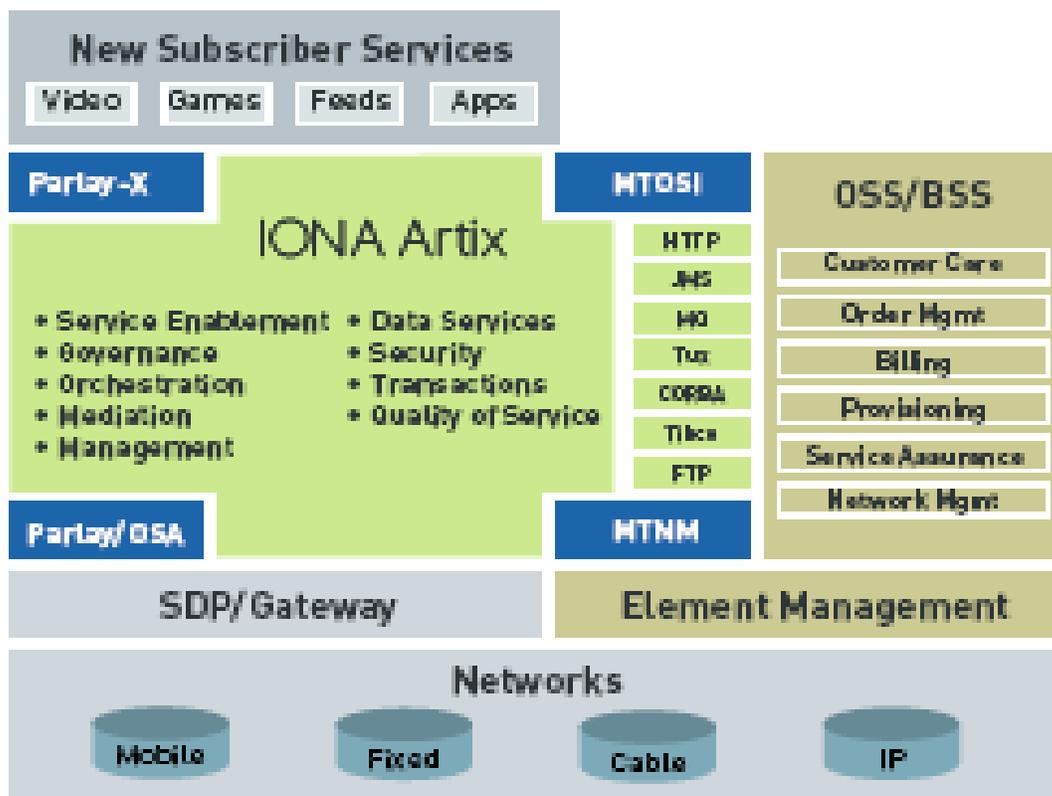
Sonic Software: Sonic ESB 7.5

Key Capabilities
- ➤ Integrates with broad range of applications and technologies
- ➤ Distributed architecture scales to manage large numbers of integration services and service orchestrations
- ➤ Fast, reliable, and fault-tolerant messaging-based communication backbone
- ➤ Integrates across organizational boundaries and to remote sites
- ➤ Transactional failover of service interactions
- ➤ Reliable, asynchronous and secure interoperability using advanced Web services standards
- ➤ Proven, market-leading solution, recommended by customers and analysts

Key benefits
- ➤ Faster <u>integration</u> of new applications into existing IT environment
- ➤ Eliminates rigidity and fragility of hard-wired point-to-point integration of applications and services
- ➤ High levels of reliability and availability assure business continuity
- ➤ Leave-and-layer approach adapts existing systems to new purposes without disrupting running systems
- ➤ Flexibly adapts to new business requirements
- ➤ Incrementally deployed for reduced risk and up-front investment
- ➤ Easy to learn and use standards-based technology

Sonic ESB architecture:

IBM: Websphere Message Broker

IT Benefits:
- Create additional value from existing applications and information
- Quickly add best-of-breed applications
- Reduce the total cost of ownership through a standards based service-oriented architecture (SOA)
- Quickly respond to changing value-chain requirements
- Leverage existing assets in new ways
- Simplify complex programming tasks
- Reduce software development and maintenance cost
- Improve system security, scalability, availability and robustness

Business Benefits:
- Improve customer service and business agility
- Lower operating costs
- Access real time business information accurately and rapidly
- Accelerate mergers and acquisitions
- Lower inventory costs
- Improve return on assets
- Eliminate manual process errors
- Improve and automate value-chain management

Cape Clear ESB

The Cape Clear ESB includes:
- ➢ Cape Clear Server: handles all aspects of hosting services, and mediating end-to-end paths between those services. This includes the handling all aspects of transport, transformation, and policy and error management.
- ➢ Cape Clear Orchestrator: proven to execute 37M BPEL transactions per day, with continuous availability via our unique Server Affinity Clustering Architecture.
- ➢ Cape Clear Studio is a comprehensive, integrated, Eclipse-based tools environment for the development of SOA-based and on-demand applications.
- ➢ Cape Clear BAM delivers real-time visibility into IT system and business health to ensure that service-level agreements, business commitments, and customer expectations can always be met.

Cape Clear ESB Architecture:
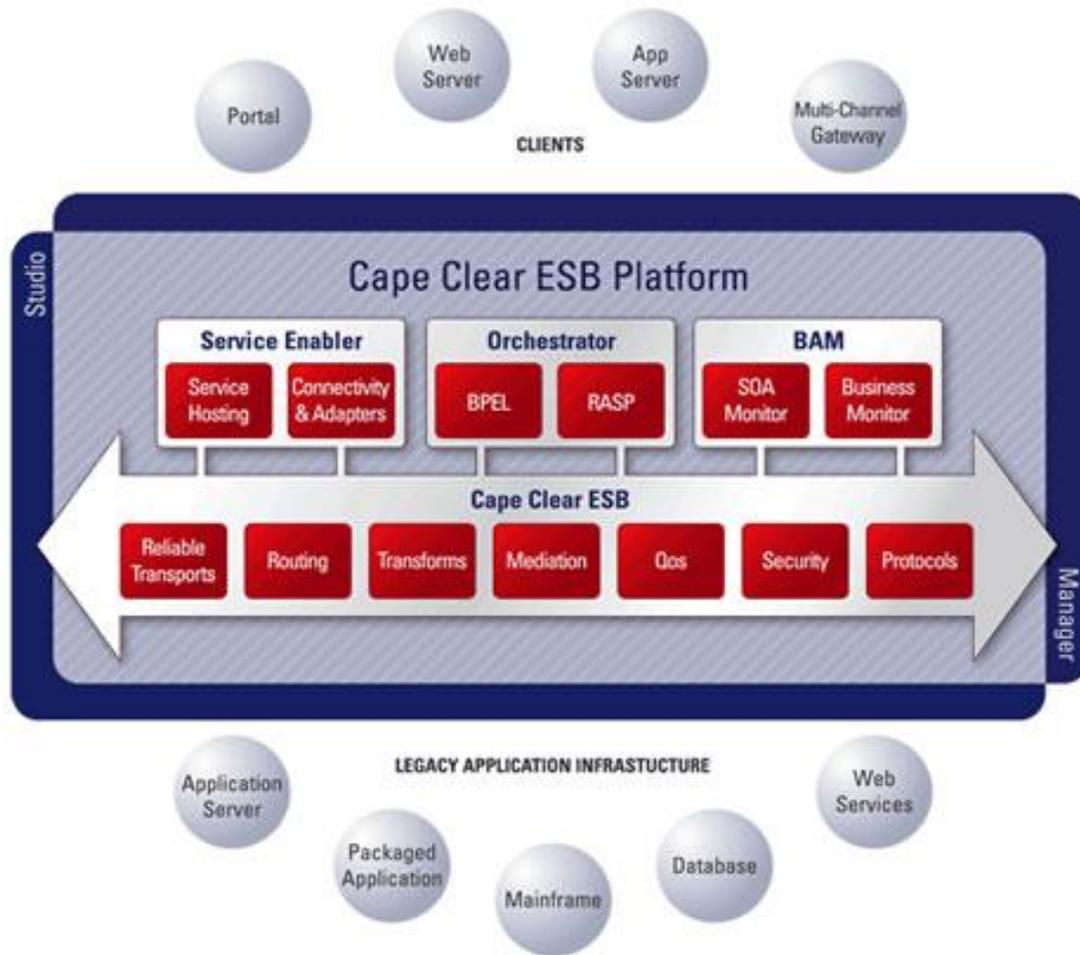
TIBCO: Business Works

Key benefits:

- ➢ Reduces costs and boosts productivity by enabling IT personnel to configure application interfaces, build complex data transformations, and orchestrate process definitions without low-level coding.
- ➢ Accelerates the application development and deployment cycle by exposing discrete business functions as reusable services that can be easily invoked without requiring and understanding of their technical implementation.
- ➢ Reduces the cost of application development by making functions and data available as reusable services that can be orchestrated to form complex business processes and assembled to form composite services and applications.
- ➢ Simplifies the inherent complexity and heterogeneity of enterprise-wide SOA initiatives with its completely application–and platform-neutral approach to integration.

> ➢ Improves the consistency, performance and scalability of mission-critical infrastructure with a standards-based, comprehensive and proven platform capable of integrating virtually any IT resource.

Business Works architecture:
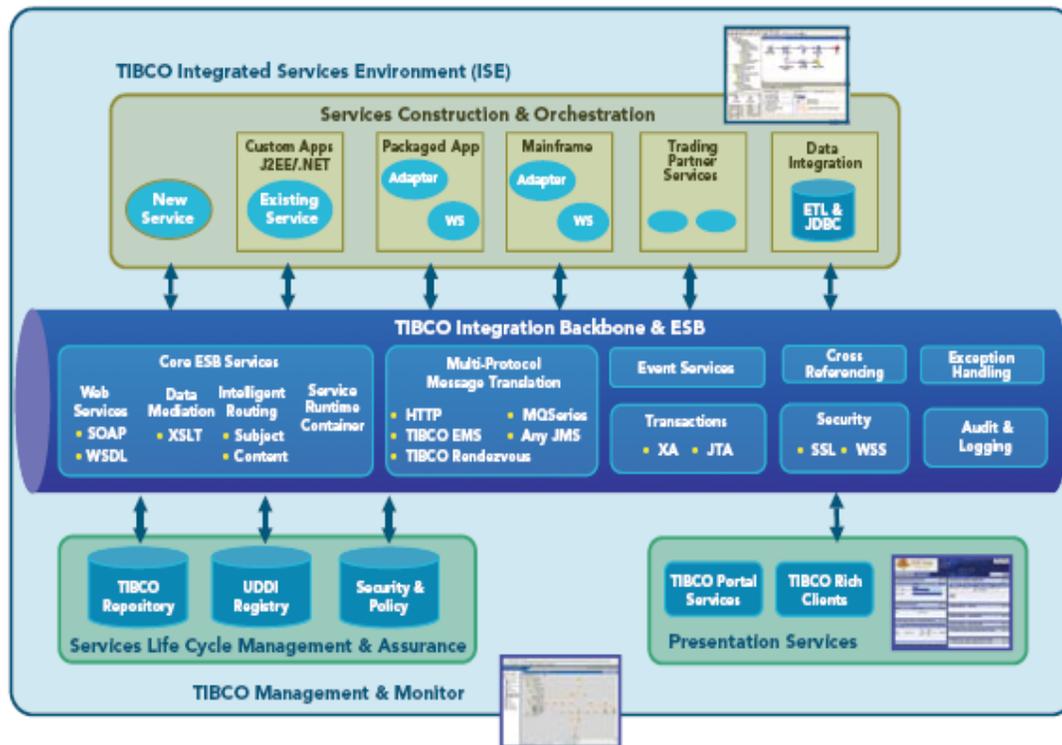
JBossESB

Capabilities:

- ➢ Business Process Monitoring
- ➢ Integrated Development Environment,
- ➢ Human Workflow User Interface
- ➢ Business Process Management
- ➢ Connectors, Transaction Manager
- ➢ Security, Application Container
- ➢ Messaging Service
- ➢ Metadata Repository
- ➢ Naming and Directory Service
- ➢ Distributed Computing Architecture
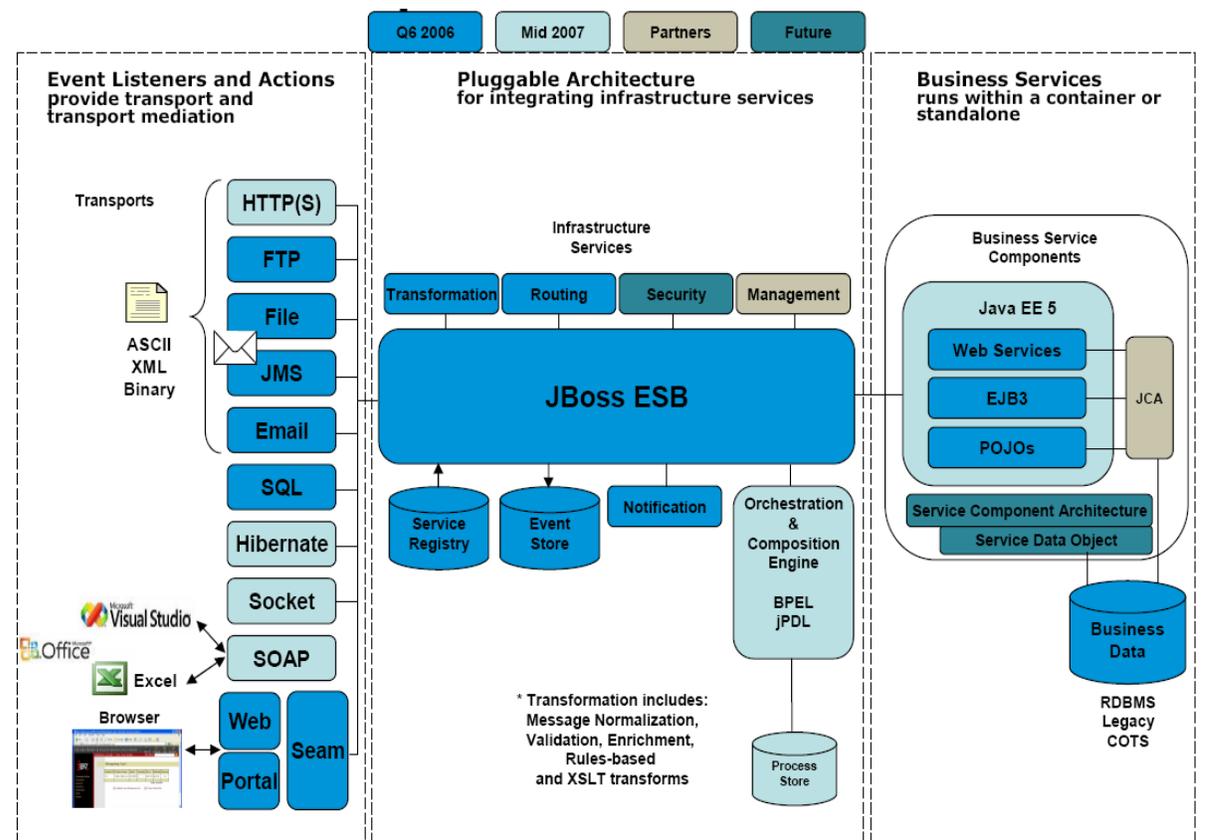
Mule ESB

Key benefits:

- ➢ Scalable Enterprise Service Bus framework that should handle most of the complexities of systems integration.
- ➢ Easy to use, yet powerful server that can operate over complex topologies.
- ➢ Simple Autonomous component development and deployment
- ➢ Code reuse. If all components are self-contained, independent units of work they can be plugged into any other system
- ➢ Rapid time to market. Using Mule will provide time-saving features and functionality and should certainly not result in any development or maintenance overhead
- ➢ Flexible a powerful configuration that should be easy to manage over a distributed environment.

Enterprise Service Bus
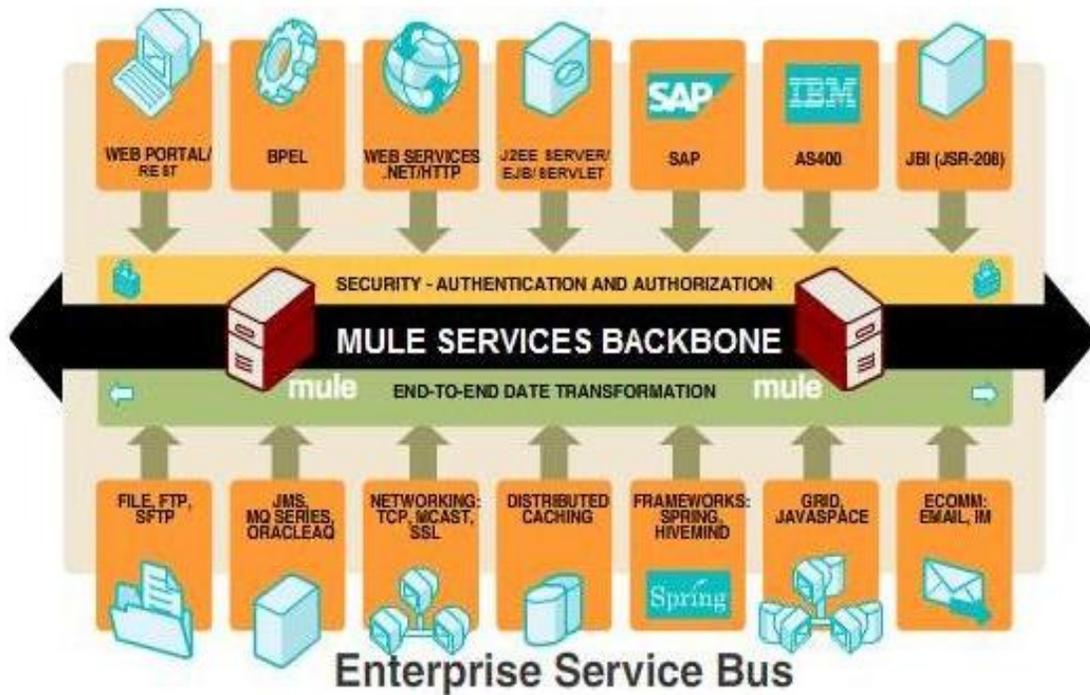
ESBs Suite Features

	Bea: Aqua Logic Service Bus	Cape Clear: 7 ESB	IONA: Artix ESB	TIBCO: Business Works	Progress Software: Sonic ESB	IBM: Websphere Message Broker
Platforms:						
Windows	YES	YES	YES	YES	YES	YES
Linux	YES	YES	YES	YES	YES	YES
Solaris	YES	YES	YES	YES	YES	YES
AIX	NO	YES	YES	YES	NO	YES
Features:						
AXIS Web services	NO	YES	-	YES	NO	NO
XML Native Persistent Store	NO	YES	-	NO	YES	NO
SOAP test clients	YES	YES	-	NO	NO	NO
Bus integration points:						
Generic JMS	YES	YES	YES	YES	YES	YES

SOAP Consumer	YES	YES	YES	YES	YES	YES
SOAP Producer	YES	YES	YES	YES	YES	YES
Generic JDBC/ODBC	NO	NO	-	YES	YES	YES
MQ Series	YES	YES	YES	YES	YES	YES
TIBCO RV	NO	YES	YES	NO	YES	YES
HTTP/S	YES	YES	YES	YES	YES	YES
File	YES	YES	YES	YES	YES	YES
E-mail (SMTP/POP3)	YES	NO		YES	YES	YES
FTP	YES	YES	YES	YES	YES	YES
Oracle	NO	NO	-	YES	YES	YES
DB2	NO	NO	-	YES	YES	YES
Sybase	NO	NO	-	YES	YES	YES
SQL Server	NO	NO	-	YES	YES	YES
Mainframe/CICS	NO	NO	-	YES	YES	YES
SOA registry/repository (UDDI)						
Design time	YES	YES	-	NO	NO	NO
Run Time	YES	YES	-	NO	NO	NO
Included in product/suite	YES	YES	-	NO	NO	NO
Standards						
BPEL	NO	YES	YES	NO	NO	NO
SOAP	YES	YES	YES	YES	YES	YES
WS-I Basic Profile	YES	YES	YES	YES	NO	YES
WS- Security	YES	YES	YES	YES	YES	YES
WSDM	NO	NO	YES	NO	NO	YES
Transport Methods						
Server	J2EE	J2EE	-	OS Native	J2EE1	OS Native
Bus Transport	JMS	HTTP	-	User-defined	Sonic MQ	TIBCO EMS
Metadata	Other	BPEL	-	Other	Other	Other

ESB most popular standards and trends in improving functionality

Web services 74%
HTTP 69%
HTTPS 59%
FTP 48%
JMS 33%
SMTP 33%
IMB MQ Series 31%
Microsoft MQ 22%
TIBCO RV 15%
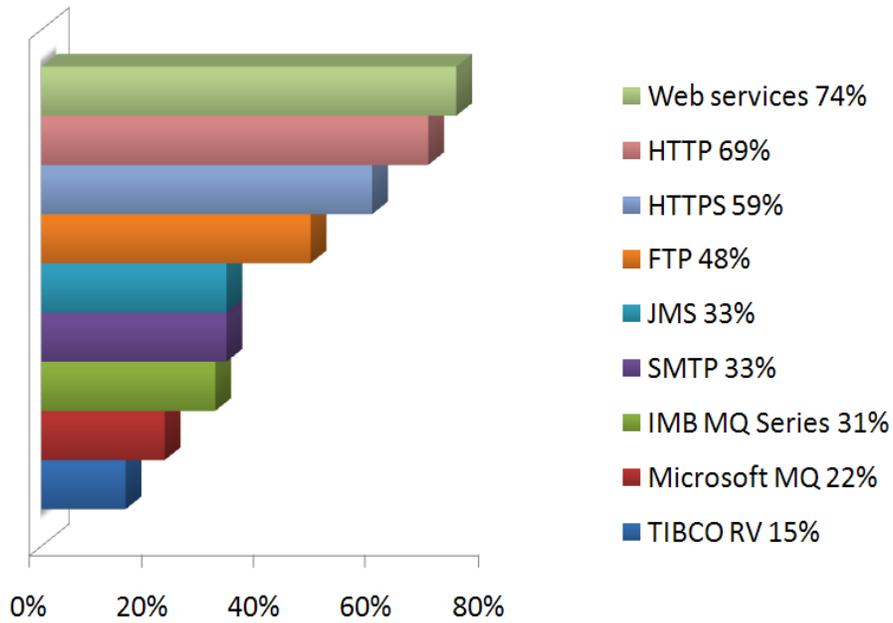
Primary security mechanism in ESB

Custom XML tags
WS-Security
HTTP BasicAuth
No security mechanism implemented

31%
28%
27%
14%
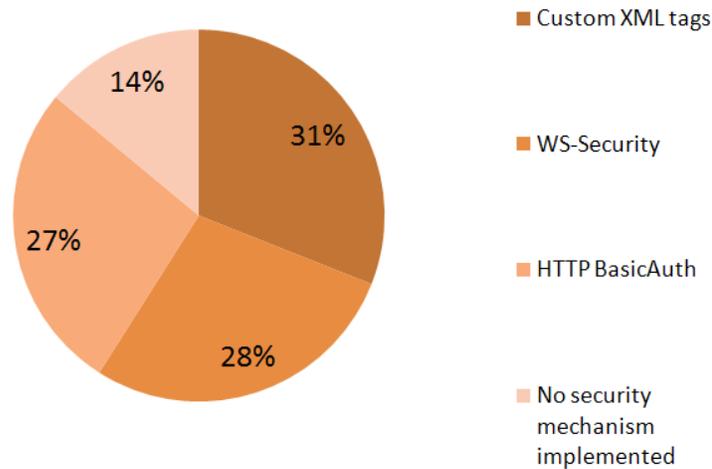
ESB market situation
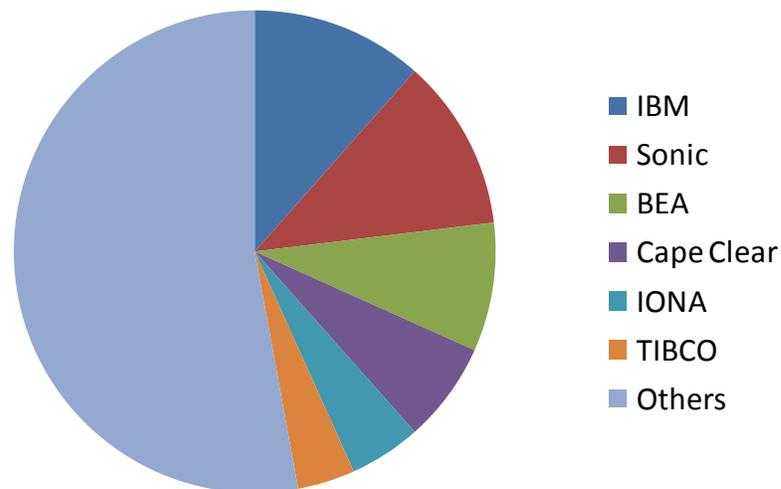
Company name:	ESB rating:	Biggest customers:	Market share (estimated):
BEA	4.3/5 (www.networkcomputing.com) 4.2/5 (The Forrester Wave)	America Online, City of Chicago, Covad Communications	9%
Cape Clear	7.6/10 (www.infoworld.com) 3.6/5 (www.networkcomputing.com) 4.1/5 (The Forrester Wave)	Alliance Trusts, AT&T, Lockheed Martin	7%
IONA	7.6/10 (www.infoworld.com) 3.75 (The Forrester Wave)	Credit Suisse Deutsche Post Poste Italiane	5%
TIBCO	4/5 (www.networkcomputing.com)	City of Seattle, Gillette, SBC, Axfood	4%
Progress software (Sonic)	8.3/10 (www.infoworld.com) 2.8/5 (www.networkcomputing.com) 4.2/5 (The Forrester Wave)	BP, Delta Airlines, Deutsche Bank, Telecom Italia, Proctor & Gamble	11%
IBM	3.2/5(www.networkcomputing.com) 4.2/5 (The Forrester Wave)	The Bekins Co, Merrill Lynch	11%

ESB trends

ESB capabilities timeline
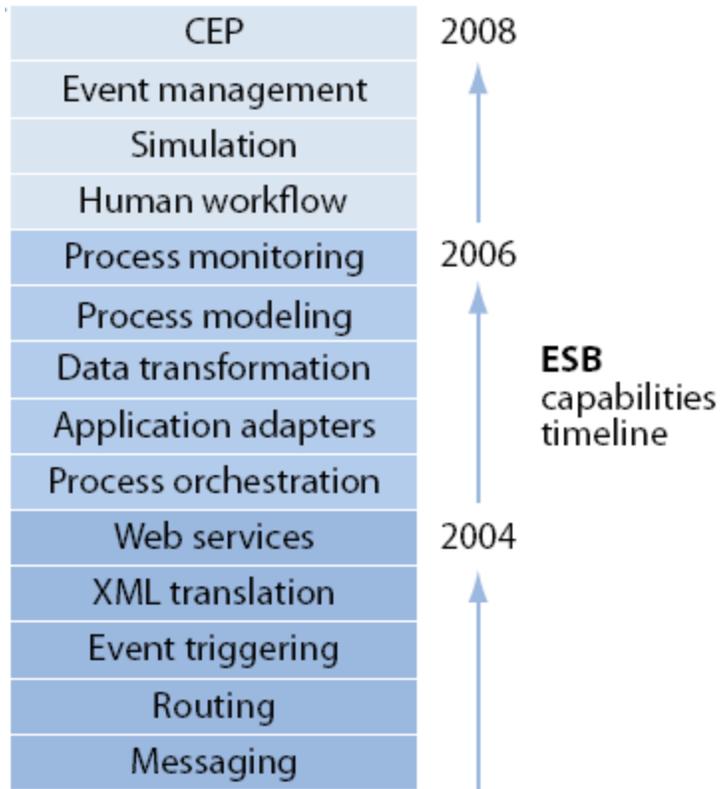
Recommendations for Comarch – what they need to implement ESB and integrate it with their Process Manager

Comarch's Process Manager
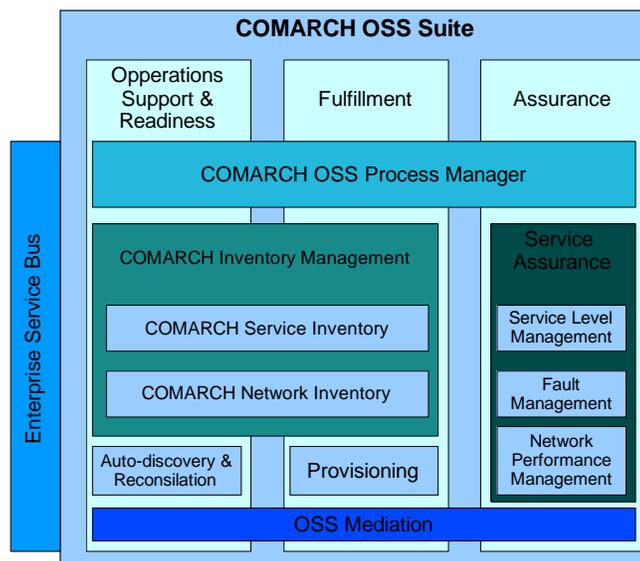
Comarch OSS Process Manager is designed to manage small, interconnected processes, especially Telco processes, and it is customizable. Its architecture can be easily scalable and it has the ability of interoperability. Some operations are very good automated because of using scripts. Comarch OSS Process manger can be configurable at runtime. It has Web based GUI for user access and has also groups of predefined processes and set of ready to use tasks to increase efficiency. Comarch uses many technologies in its Process Manager like: JBoss, JBPM, Groovy (an agile and dynamic language for the Java Virtual Machine), GWT (Google Web Toolkit), Hibernate (an object-relational mapping ORM solution for the Java language), and Spring Framework (an open source application framework for the Java platform). Comarch uses also Sun Java 5, Oracle 10g (database management system), JBoss application server and BEA WebLogic9.

Implemented processes in Comarch OSS Process Manager
> Implemented eTOM processes
    o Operations Support & Readiness
    o Service Fulfillment
    o Service Assurance
> Supported eTOM layers:
    o Services
    o Resources
> Implemented ITIL processes
    o Incident Management
    o Problem Management
    o Change Management
    o Approval (part of Change Management)
    o Configuration Management
    o Service Level Managements

Possible solutions and needs for Comarch to implement ESB

Comarch weakness of offered BSS/OSS products is having difficulties and being lack of standards in integration their own products. The biggest problem is that practically every product uses its own mechanism of integration and it differs in every implementation. So the purpose of the ESB is to make a simple, good working mechanism and a standard of integration which will enable Comarch to integrate all their products and also 3rd party customer products into one functional piece. There can be several solutions for Comarch to help them to have more integrity among their products.

First one could be changing only products or maybe implement some adapters for them in the way that they can be easily integrated with ESBs made by other vendors. This solution is dictated because of the present market trend. Nowadays there is a tendency of buying different products from different companies. For example a customer can buy OSS from Comarch, BSS from other company and wants also an integration product (ESB) from somebody else. So to be competitive Comarch should make products that can be easily integrated with the most popular ESBs in the market or should implement some

kind of adapters for their products to make the products to be able to just plug in to an ESB. According to our market analysis the best ESBs that exist are Bea Aqua Logic Service Bus, Progress Software Sonic ESB and IBM Websphere Message Broker. These three ESBs are most common, use most of the popular standards and come from the biggest and well known companies among ESB providers. The most common standard is Web Services. Web service is mainly a software system designed to support interoperable Machine to Machine interaction over a network. It can also be used to implement architecture according to ESB. (1) …………..

The second solution is implementing Comarch's own ESB which will enable all Comarch's products and also customer's products integration. However there are lots of companies in the market that provide ESB but still this topic is quite new and Comarch have a chance to become one of the best ESB vendors in Europe. (In Poland there is no company that provides ESB and Comarch can be competitive in the price of the ESB). This solution requires also the solution number one – changing Comarch products.

Comarch can gain the knowledge of the ESBs existing in the market, recognize the most useful standards and use some open source technology like JBoss or Mule to implement their own ESB. They can also go even further and implement some new functions in the existing open source standards. We can recommend Comarch to use open source Jboss ESB. Here we can present some strengths of Jboss ESB:
- Jboss is a very common product used in Comarch Telco
- The architecture and the roadmap is precisely defined and published in Jboss web site
- Jboss has very interesting and effective solutions
- LGPL License

However building Comarch own ESB will be a difficult and costly project. Firstly Comarch need to know the possible customers who will want to buy Comarch ESB. We can distinguish three types of Comarch customers: small companies, medium companies and big companies. Small companies probably won't buy ESB because they don't have many products and so they don't need to integrate them with ESB. The only benefit that they could achieve is future compatibility. Medium companies will also be difficult to convince to buy the ESB. The biggest profit will gain big companies. They have lots of products to integrate and ESB will make the integration very effective and efficient, with the reduction of costs. Despite this, Comarch having their own ESB will become more attractive company and will have better offers for their customers. The ESB could reduce costs, will become a simple, fast and effective product for integration of Comarch and customer products. Comarch products and Comarch ESB could become a full software which they sell in "a box".

Secondly there is a license problem. Because it is open source all the changes that Comarch can introduce to Jboss ESB must become open source for every one. So however Comarch will have their own ESB (Jboss ESB with improvements) which will bring profits and could be cheap and competitive, it will become an open source for everyone.

Thirdly there are also other risks of implementing Comarch ESB. Comarch have no experience in building an ESB. The project can become very time consuming and will need lot of money to spend. Comarch should also be more innovative in building their ESB because customers have to know that Comarch ESB is a really new generation product.

Bibliography

- http://wikipedia.org/
- http://www.fiorano.com
- http://www.sonicsoftware.com
- http://bea.com
- http://iona.com
- http://www-306.ibm.com
- Book: Enterprise Service Bus by Dave Chappell, O'Reilly, June 2004
-

Acronyms

ABE - Aggregate Business Entities

BPEL - Business Process Execution Language

BPEL4WS - Business Process Execution Language for Web Services

BPMN – Business Process Modeling Notation

CAPEX/OPEX - Capital Expenditure/Operating Expenditure

COTS – Commercial Of The Shelf

eTOM - enhanced Telecommunications Operational Map

ETSI - European telecommunications Standards Institute

FAB - Fulfillment, Assurance and Billing

GIOP - General Inter-ORB Protocol

IIOP - Internet Inter-Orb Protocol - is the implementation of GIOP

ITU-T – International Telecommunication Union – Telecommunications Standardization Sector

Java EE - Java , Enterprise Edition

JBI – Java Business Interface

JCA - Java Connected Architecture

JDBC – Java Database Connectivity

JMS – Java Message System

JSF – Java Server Faces

JSR – Java Specification Request

LDAP – Lightweight Directory Access Protocol

MOM - Message-oriented middleware

NGN - Next Generation Networks

NGOSS - New Generation Operations Support Systems

ODBC – Open Database Connectivity

OSS/J – Operations Support Systems through Java

QOS – Quality of Service

SID - Shared information Data Model

SOA – Service Oriented Architecture

SOAP – Simple Object Access Protocol or Service Oriented Architecture Protocol

SP - Service Provider

TMN - Telecommunications Management Network

TOM - Telecommunications Operational Map

WSDL - Web Services Description Language

XML – extended Markup Language

1. Introduction

The eTOM (enhanced Telecom Operations Map) is a guidebook, the most widely used and accepted standard for business processes in the telecommunication industry. It defines key processes in business activities of Telco and the way these processes can work together. The eTOM was invited by Tele Management Forum and it is still being improved. It is connected to ITIL, which is another common standard in IT business. These both standards are a group of best practices in telecommunication world, but ITIL is more connected with IT companies, which are developing software for Telcos.

The eTOM can be divided on three main groups of business processes:

- ➢ Strategy, infrastructure and product – it includes managing the lifecycle of infrastructure and products
- ➢ Operations – responsible for operation management
- ➢ Enterprise management – covering financial support for first two main groups

These three areas are divided into subgroups, which represent different functions:

- ➢ Strategy & Commit
- ➢ Infrastructure Lifecycle Management
- ➢ Product Lifecycle Management
- ➢ Operations, Support & Readiness
- ➢ Fulfillment
- ➢ Assurance
- ➢ Billing

and are connected with different activities:

- ➢ Marketing & Offer Management
- ➢ Customer Relationship Management
- ➢ Service Development & Management/Operations
- ➢ Resource Development & Management/Operations
- ➢ Supply Chain Development & Management
- ➢ Supplier/Partner Relationship Management

Division of eTOM is multi-level. Higher levels are much more detailed, but standards specification includes only first three levels. The Level 1 eTOM map is presented below.
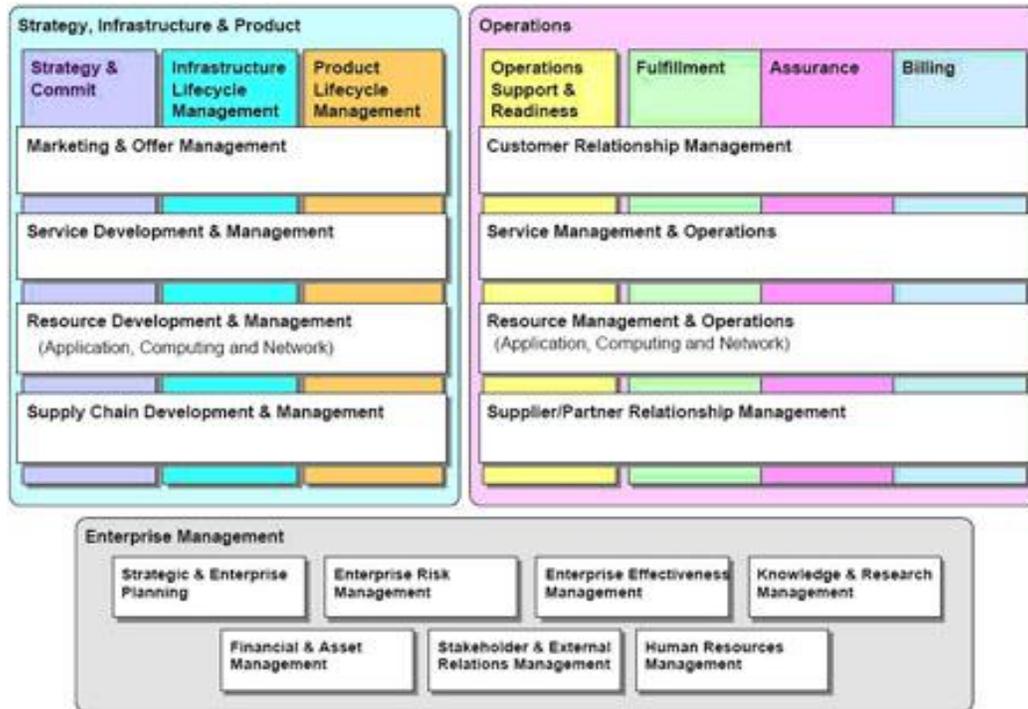
2. Mapping methods and ideas to simplify mapping process

The most important thing in doing process mapping is to fully understand the business process, which was given by Comarch Telco client. We must know relations with other processes; it is critical to know if the process is a separate process or a sub process for another. We should also know what is the purpose and results of a process. Next thing we had been doing was determining with which eTOM layer (resource, service, customer or supplier) process should be connected. We used to do that by investigating process purpose. Knowing of process purpose was also very useful in determining proper column in eTOM. When we knew the column and layer the only thing to do was to use an Interactive eTOM Map and read processes names and if name seemed to correspond with task in client's flow we were comparing the descriptions of processes. If the processes were very similar we were able to get to the next client's task.

Our group has got an idea how to simplify mapping process. We could build SQL based database (or use one already created) and develop some user interface (for example using PHP), which would determine key words density in eTOM processes descriptions. That function will find few processes, which are supposed to be equivalent of client's task and the only think to do is check the description, compare and chose the right process. Unfortunately our team has not got enough time in implement this searching engine. Another way to simplify mapping process is to link some related eTOM process (some processes are usually followed by another processes).

3. Mapped Processes

3.1 Perform Work Order

In this process, a work order:

➢ Is a request for the NCC to perform a specific type of work, e.g. configure a particular type of port, perform a specific cabling or cross-connection, install a piece of equipment, etc.
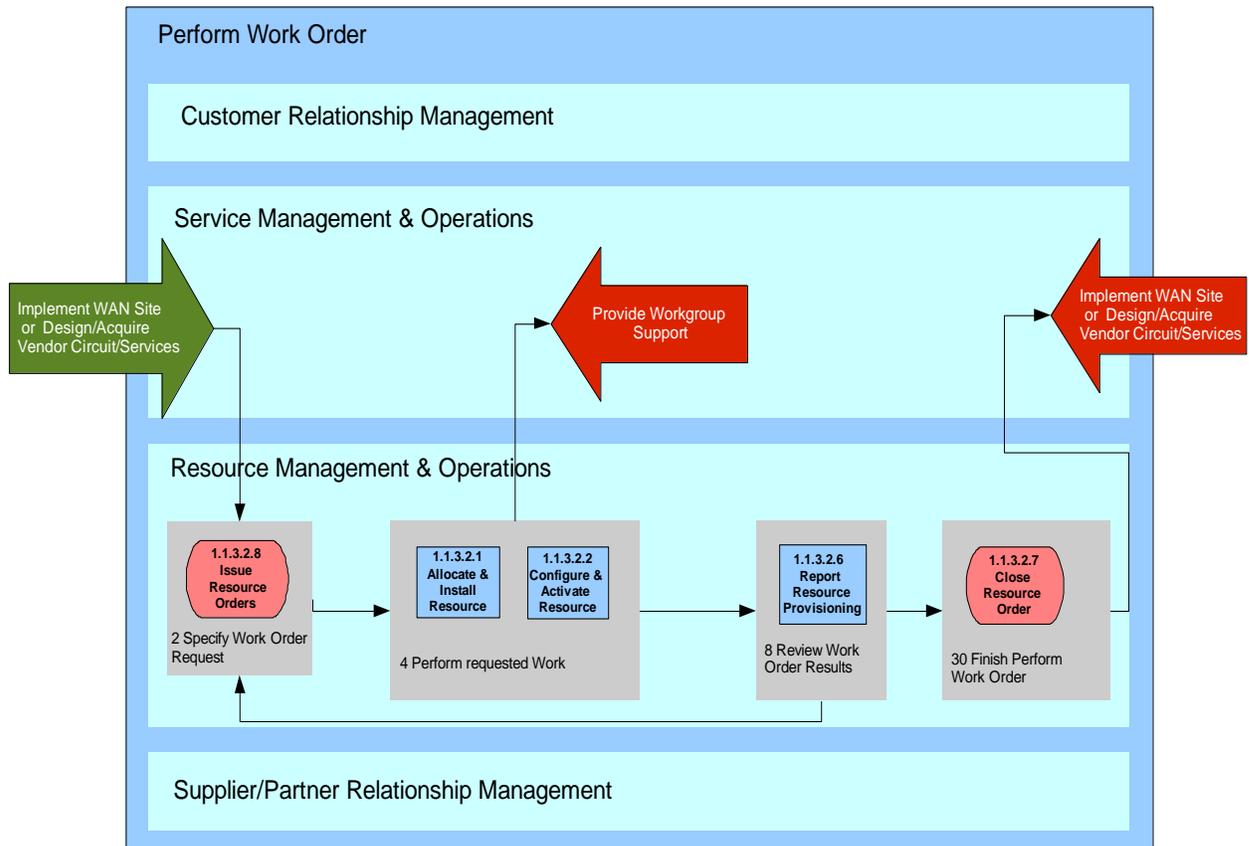
3.2 Assign IP Resources

In this process, an IP resource assignment:

➢ May include one or more new allocations of IP resources to an organization, e.g. to a customer.

➢ May include reclaiming one or more existing allocations of IP resources from an organization, e.g. from a customer.

➢ Does not include new or changed IP port assignments, i.e. assignments of individual IP addresses to ports.

In this process, IP resources:

➢ Includes Class C IP networks, contiguous ranges of more than one Class C IP network, IP sub-nets, i.e. subsets of a Class C IP network.

➢ Excludes single individual IP addresses.

Assign IP Resources

Customer Relationship Management

Service Management & Operations

Implement WAN Service

Implement WAN Service

Resource Management & Operations

3 Clarify IP Requirements
16 Verify IP Resource Assignment Completion

1.1.3.2.8
Issue Resource Order

1 Begin Assign IP Resources

1.1.3.2.5
Track & Manage Resource Provisioning

1.1.3.2.2
Configure & Activate Resource

20 Finish Assign IP Resources

1.1.3.2.1
Allocate & Install Resource

5 Assign IP Resources
7 Review IP Resource Assignments
9 Review IP Resource Assignments
13 Finish IP Resource Assignment

Supplier/Partner Relationship Management

3.3 Implement WAN Service

WAN service implementation:

- May include implementing new service, upgrading existing service and/or removing specific WAN capabilities or services at one or more sites.
- Normally occurs in response to a request from a customer.
- Normally occurs after acceptance of a WAN proposal/quote for the service.
- May occur as part of an internal project.

Implement WAN Service

Customer Relationship Management

CSR

1.1.1.1.8
Support Customer QoS/SLA

If a new/modified or parallel SLA is needed

Prepare SLA

If no creation/modification of an SLA is needed

Request/approval of parallel SLA

1.1.1.7.1
Assess Customer QoS/SLA Performance

When parallel SLA was approved

Service Management & Operations

When parallel SLA was not approved

1.1.2.2.9
Close Service Order

WAN Service Implemented

Internal Project

1.1.2.2.4
Implement, Configure & Activate Service

1.1.2.2.1
Design Solution

1.1.2.2.5
Test Service End-to-End

If OSS information for the service implementation is incomplete

Provide Workgroup Support

If there is more work to be done

Resource Management & Operations

Assign IP Resources

1.1.3.2.5
Track & Manage Resource Provisioning

1.1.3.2.8
Issue Resource Orders

Implement WAN Site

Acquire Equipment

3.4 Implement WAN Site

WAN site implementation:

> ➢ Includes implementing new service, upgrading existing service and/or removing specific WAN capabilities or services at a single operator or customer site.

Implement WAN Site

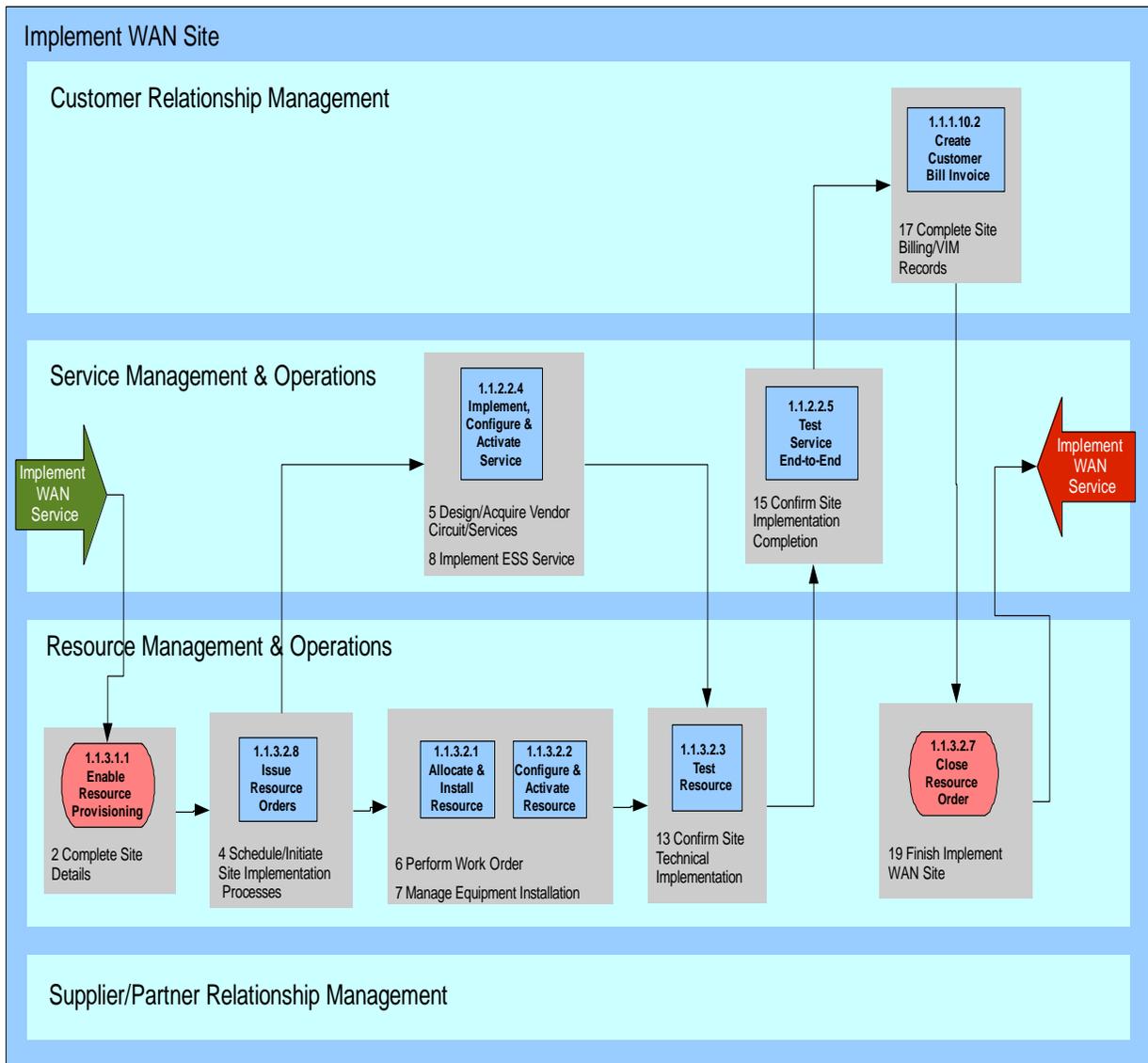### Customer Relationship Management

1.1.1.10.2 Create Customer Bill Invoice

17 Complete Site Billing/VIM Records

Service Management & Operations

Implement WAN Service

1.1.2.2.4 Implement, Configure & Activate Service

5 Design/Acquire Vendor Circuit/Services

8 Implement ESS Service

1.1.2.2.5 Test Service End-to-End

15 Confirm Site Implementation Completion

Implement WAN Service

Resource Management & Operations

1.1.3.1.1 Enable Resource Provisioning

2 Complete Site Details

1.1.3.2.8 Issue Resource Orders

4 Schedule/Initiate Site Implementation Processes

1.1.3.2.1 Allocate & Install Resource

1.1.3.2.2 Configure & Activate Resource

6 Perform Work Order

7 Manage Equipment Installation

1.1.3.2.3 Test Resource

13 Confirm Site Technical Implementation

1.1.3.2.7 Close Resource Order

19 Finish Implement WAN Site

### Supplier/Partner Relationship Management

3.5 Implement ESS Service

In this process, ESS Services may include:

> Security Perimeter Services, i.e. firewall rule management, router access rule management, and domain name service management.

> Secure Gateway Access Services, i.e. Fortress management, and management of all gateways to the SGN.

> Remote Access Services, i.e. VPN management and SecurID token authentication management.

> ESS New Technologies, i.e. technical consulting and scheduling, network and security design reviews, VPN access management, and wireless access management.
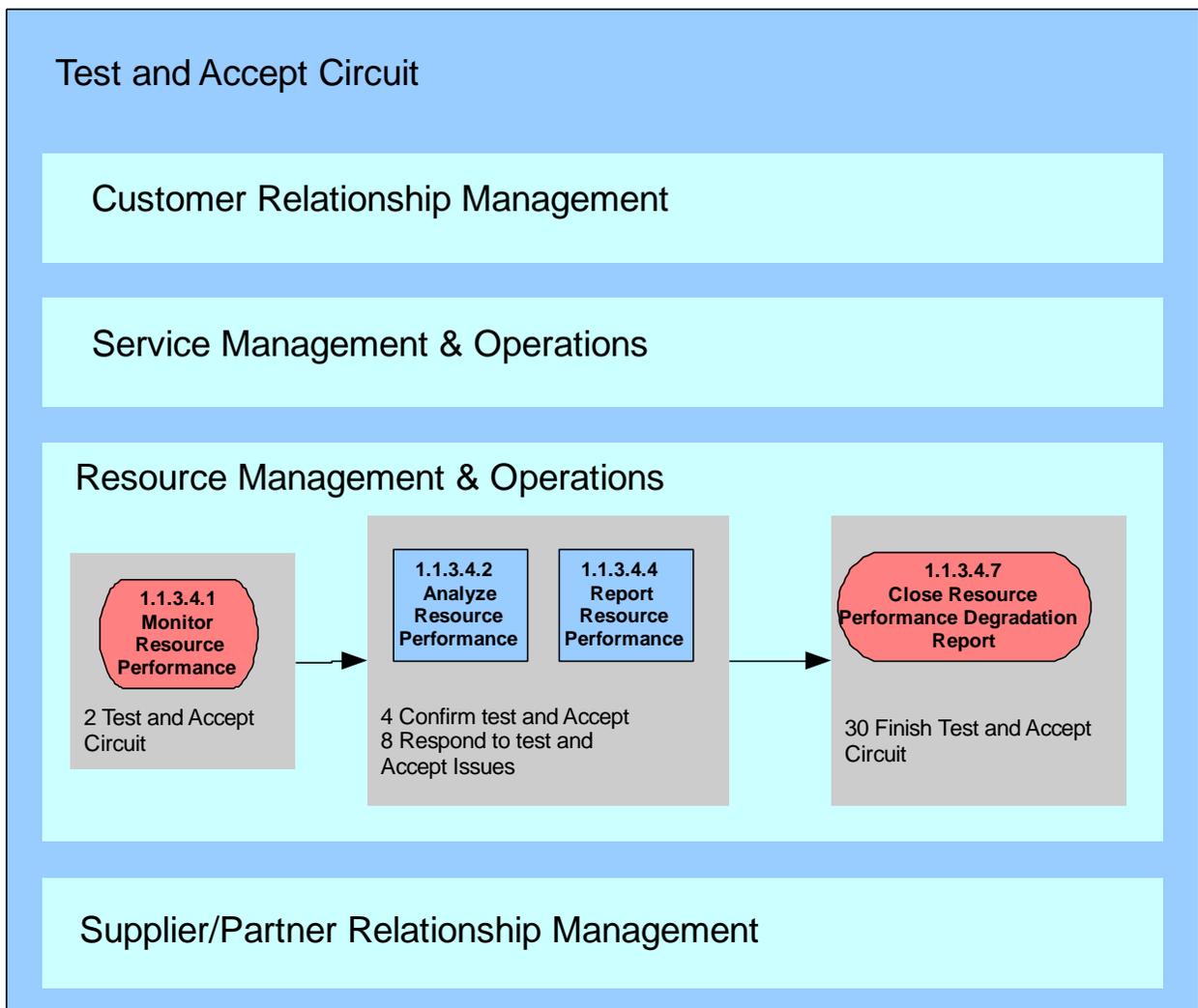
In this process, an ESS service request:

> May be a specific request for a particular type of ESS service, e.g. a firewall rule change.

> May be a non-specific request for one or more ESS services, where ESS must play an active role in defining what ESS services need to be provided to meet the request.
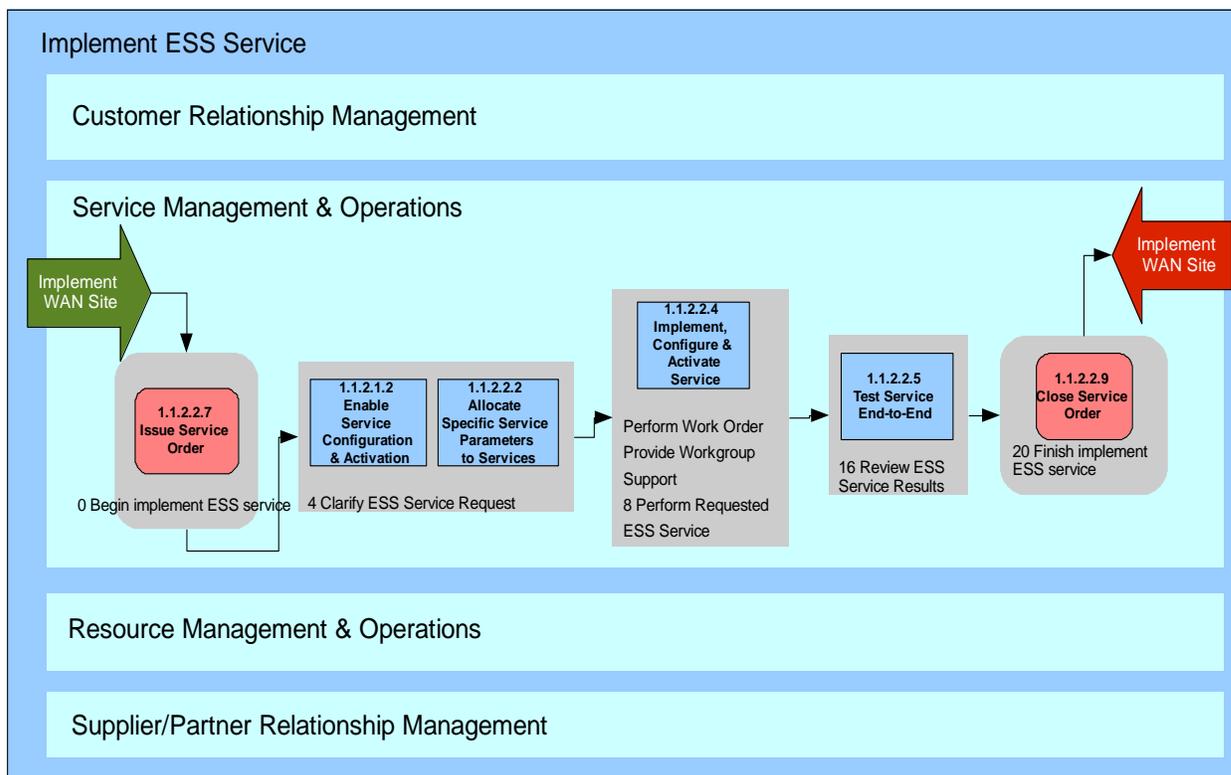
3.6 Test and Accept Circuit

Testing and accepting a circuit may include:
- Testing and accepting a vendor-provided segment with a vendor.
- Testing and accepting an end to end circuit.

Test and Accept Circuit

Customer Relationship Management

Service Management & Operations

Resource Management & Operations

1.1.3.4.1 Monitor Resource Performance

2 Test and Accept Circuit

1.1.3.4.2 Analyze Resource Performance

1.1.3.4.4 Report Resource Performance

4 Confirm test and Accept
8 Respond to test and Accept Issues

1.1.3.4.7 Close Resource Performance Degradation Report

30 Finish Test and Accept Circuit

Supplier/Partner Relationship Management

5. Bibliography

1. www.wikipedia.org

Was very helpful in creating brief description of eTOM in Introduction part of our report.

2. www.tmforum.org

We have found there the Interactive eTOM map, which saved us a lot of time in doing mapping.

3. GB921 D document from TM Forum

This was a document, which contained processes descriptions..

4. Comarch's clients documents