Fujitsu Service-Oriented Architecture (SOA)
A Web Services Framework
Introduction
Retaining customers depends on continuously supporting new types of services. The more services a customer purchases from a single provider, the less likely that customer is to switch to another provider. Enterprises are also demanding a more comprehensive service environment, including efficient platforms for problem resolution and online access to critical service information and statistics. As a result, competition among providers comes down to an evaluation of service delivery and support capabilities:
- How quickly are new services deployed?
- How fast are troubles resolved?
- Does the service provider offer web portals and online resources that give users up-to-the-minute status and efficient feedback channels?
- Are SLAs being met and correctly reflected in the billing systems?
- Does the provider offer high-touch capabilities such as web portals for saving time when ordering services, paying bills, entering support requests, viewing status and performance, or managing traffic?

To increase customer satisfaction, reduce churn, and ultimately increase profits by generating more service revenues, a service provider must have all the right answers to these questions. Going beyond basic services to provide portals and other time-saving tools for customers has become a major differentiator when enterprises are evaluating providers. Many RFPPs from Fortune 500 companies are aggressively stating requirements in these areas, including demands that web portals be a part of the overall networking solution. Service providers today recognize the necessity to meet these needs since these accounts represent a significant portion of today’s business.

Operations Challenges
The customer-facing network becomes increasingly complex as service providers race to roll out more high-value services and incorporate customer-friendly capabilities and portals. On the customer-facing side of the network, providers must deal with enterprise networks that connect with multiple vendors and involve diverse protocols and a broad range of tools and portals. On the operations-facing side of the network, budget pressures are driving convergence to a single IP/MPLS backbone. Balancing convergence with the work of rolling out new services puts the operations organization into an unenviable position. In particular, service providers are challenged to overcome several obstacles:
- Multiple legacy OSS/BSS systems cannot be extended quickly enough to support the emerging services or customer portals, leaving providers unable to deliver adequate network management services to all customers and introducing inefficiencies into the in-house operations.
- A lack of standards for management integration results in service providers developing niche applications to meet customer demands. This exacerbates the challenge with multiple OSS systems and no effective means of interoperability.
- Business applications have evolved to rely on disparate databases, making it difficult to integrate functions or adjust to changing business requirements. Validating accurate transactions is also made difficult by the lack of interoperability among applications.
- A lack of skilled developers constrains a service provider’s ability to support its OSS solutions.
Solution: Service Oriented Architectures and Web-Based Services

Service providers are turning to a new networking paradigm to overcome these business challenges. Network management teams are being asked to evolve networks to SOAs. The conventions encompassed by SOAs enable an infrastructure in which discreet business functions can be organized into interoperable, standards-based services. By organizing around services instead of applications, an SOA improves productivity, agility, and speed for both traditional IT tasks and the service provider’s business as a whole. The service provider can respond more rapidly to customer demand and deliver optimal user experiences.

SOA principles have been broadly discussed for years. On the networking side, the earliest implementations of service-oriented frameworks were based on CORBA. Even with the CORBA framework, the protocol was still so tightly coupled to the application that it was difficult to develop flexible, dynamic value-added services or efficiently roll out services. In response, the TMF recognized that a different object-based model would allow service providers to more rapidly and efficiently develop web-based services. The resulting TMF854 specification defines the mechanisms for web-based services within an SOA. Many service providers are taking advantage of the TMF854 standard conventions to reduce dependencies on proprietary data formats, and converge on an efficient back-office operations strategy.

XML/SOAP: Communications and Exchanging Data

Within an SOA, SOAP provides the conventions for service-to-service communications. TMF854 also includes XML, a simple data description language. Comprised of a set of rules and guidelines, XML describes structured data in plain text rather than a variety of proprietary representations. Figure 1 illustrates the XML mechanism for integrating back-office systems for service delivery, and lowering the cost of operations. Development efforts that take advantage of XML can be reduced from months to weeks, and enable service providers to dynamically add applications based on web services. The relative simplicity of XML has also led to an excellent pool of XML-proficient developers.

Figure 1
Benefits of XML/SOAP
The SOA constructs offer service providers several significant benefits:

• Streamlined development: Instead of taking years, services can be deployed within months. XML/SOAP facilitates interoperability across platforms, programming languages, and applications for integrating a variety of existing and new modular elements. The network environment can be shifted from tightly coupled systems (such as CORBA) to a more loosely coupled Internet environment.
• Managed services: XML/SOAP introduces application awareness that facilitates the deployment of managed services.
• Leverages IP and legacy networks: The SOA constructs form a middleware overlay on existing networks, extracting more value and profitability from past investments.
• Higher value services: XML/SOAP allows the linking of content fields to create innovative service offerings (web portals, bandwidth management for point-of-sale applications) and bill them accordingly.

Higher value services such as portals and web-based applications offer service providers new sources of revenue. By using XML/SOAP, an existing IP infrastructure can support new services for an expanded portfolio. SOAs also lend themselves to a variety of high-touch self-management capabilities—bill viewing, service ordering, SLA monitoring—which reduce the overhead on call centers and support teams.
Fujitsu SOA

Recognizing the challenges faced by service providers and the opportunities associated with SOA trends, Fujitsu has taken the lead in the Layer 2.5 space by introducing XML/SOAP compliant interfaces on its advanced EMS platform. The NETSMART® 6400 EMS acts as a critical link between network elements (southbound) and business and management systems (northbound) as shown in Figure 2. Providing this connection using XML/SOAP-compliant mechanisms promotes web-based service efficiencies in the service provider’s network.

Figure 2
The information gathered for the back-office billing and provisioning systems can also enable the delivery and management of new revenue-generating services. Service providers can leverage IP/MPLS backbones, deriving more returns on investments by overlaying value-added applications and distributing them using web-based services. The NETSMART 6400 EMS enables competitive differentiation for service providers by taking advantage of the key features of the FLASHWAVE® 6400 Layer 2.5 Aggregation Switch. The FLASHWAVE 6400 system provides vital traffic management capabilities and supports services with rates ranging from 32 Kbps to 2.5 Gbps on a single port. A service provider can define and offer up to 1000 service profiles per port. Built-in QoS functionality guarantees that traffic is prioritized correctly—high-priority applications, voice, and best-effort traffic—and transported reliably. The NETSMART 6400 EMS takes the complexity out of design by allowing the user to set up service profiles with all of the appropriate parameters for service delivery. The NETSMART 6400 EMS foundation exposes this service information in an easy-to-use format. Service providers can monitor the information as part of the administration of services, or make it available to enterprises as part of the service.

The flexible, scalable XML/SOAP framework enables very fast service turn-on times (in as little as a month or two), and allows new services to be rolled out on existing hardware. Without changing equipment, service portfolios can be expanded dynamically.

The robust Fujitsu QoS features also give the NETSMART 6400 EMS the ability to control and monitor the flow of high-priority traffic and customer circuits. The software provides access to configurable, fine-grained parameters for defining priority levels and policies, making it easy to adjust and tune configurations on the fly. A reporting function provides visibility to network managers or customers, for monitoring or proving compliance with SLAs.

The statistics can also provide service provider sales teams with compelling information for selling additional bandwidth and services, by clearly measuring the current traffic and usage levels by user, circuit, or service.
A Complete, Standards-Based Solution

By taking advantage of SOAP, the NETSMART 6400 EMS platform software allows client-to-provider interactions including high-touch capabilities to be more efficiently implemented for dynamic applications and services. SOAP provides a mechanism for linking directories to each other, regardless of their underlying differences. The benefit is that if service providers have an existing model with TL1 and CORBA, they can put XML/SOAP on top of this model and be able to adapt the current architecture and take advantage of what XML has to offer. Back-office systems can be linked with business systems to deploy a new service. For example, a customer list in XML format can be linked to customer circuit and usage entries in an EMS, ensuring that customers are billed accurately for network usage.

To provide a complete SOA foundational software layer, the Fujitsu toolkit integrates leading XML/SOAP solutions and an industry-leading design:

- SOAP infrastructure: Apache Axis is an implementation of SOAP used by many companies as a reliable and stable base on which to implement Java Web services, and Apache is one of the leading vendors to provide this.
- Java: JMS/JBOSS and JDK

All of these TMF854-compliant components are included with the NETSMART 6400 EMS platform, and are automatically started with the EMS. The NETSMART 6400 EMS platform also includes sample code to enable quick development for service providers.

To ensure continued compliance with the evolving industry standards, Fujitsu is an active member of the TMF. With the earliest possible access to proposed specifications, Fujitsu can drive the standards to meet the needs of the service provider market, and align Fujitsu product development efforts with interface standards.

The Fujitsu NETSMART 6400 EMS solution provides comprehensive FCAPS support for all functional areas. With the NETSMART 6400 EMS software, service providers have easy access to all of these categories of metrics through the standard XML interface. A broad range of services can be delivered and these service profiles can then be extended to customer portals. Having support for FCAPS on a single application platform simplifies the support and delivery of these services. Over a common infrastructure, service providers have the flexibility to dynamically tailor services to the customer base while minimizing operations costs and avoiding the need for additional software layers for each new service.
Mapping Customers to Circuits/Services

The NETSMART 6400 EMS lets service providers map individual customers to circuits on the FLASHWAVE 6400 switches. Services can be turned on for designated customers only, and metrics tracked by customer. This function is managed by the NETSMART 6400 EMS, but is implemented in hardware on the actual switch. This implementation provides easier set-up and a better, more dynamic method of partitioning the switch hardware by splitting circuits among multiple customers. The flexibility and fine-grained control enable a broad range of web-based services and streamline management and billing for the services. This information can be managed to deliver stringent SLA requirements, and demonstrate the robustness of the overall network.

The NETSMART 6400 EMS and the FLASHWAVE 6400 Switch

The Fujitsu FLASHWAVE 6400 Layer 2.5 Aggregation Switch provides superior depth and scalability in terms of deploying services, enabling a service provider to develop more than 1000 services per physical link. This drastically reduces the amount of equipment needed to deploy and support a wide range of services.

The NETSMART 6400 EMS software simplifies set up with standard, pre-engineered profiles for provisioning various service levels. With all the necessary parameters built into these predefined profiles, service providers can achieve very fast service start-up times for differentiated services by using the default priorities, queuing, and SLAs. The monitoring/reporting functions verify that services are performing at levels that result in customer satisfaction, or indicate where changes are required to fine-tune particular services.

In addition to fast service deployments, the NETSMART 6400 EMS and the FLASHWAVE 6400 switch delivers operational savings as the service portfolio expands. By supporting all services from a single user interface, the support staff requirements can be minimized and support procedures abbreviated.

Service providers’ customers will also derive benefits from the combination of the NETSMART 6400 EMS and the FLASHWAVE 6400 switch:

- Enterprise applications: The platforms simplify the development of business applications that require links with partner web sites or applications. The user interfaces can also be designed with simplified web browser access, allowing a single login for viewing information from a combination of systems or web sites. Consider the example of a travel site that provides links to car rental and hotel reservation sites. Without XML capabilities, these applications would be much more complex and require much longer development times.

- Web portals: The FLASHWAVE 6400 switch can efficiently aggregate traffic and hand it off for transport over the core network. Using the NETSMART 6400 EMS, providers can rapidly set up service profiles per port to maximize efficiency over the switches being deployed. Access to the QoS features allows the definition of different priority classes and guarantees satisfactory performance over the customer portals.
Conclusion
The NETSMART 6400 EMS product demonstrates the Fujitsu commitment to Layer 2.5 leadership by giving service providers a solid migration path to a network-wide SOA strategy. The strengths of the Fujitsu solution include:

• A standards-based approach to northbound integration using TMF854 conventions.
• Access to the FLASHWAVE 6400 advanced service quality and availability management features for enabling differentiated services.
• The ability for service providers to extend high-touch services to end-users through portals and other interactive web services.

The NETSMART 6400 EMS, as a long-term solution, provides exceptional value for building next-generation service-aware networks. Predefined service profiles and fast provisioning speed time-to-market for new services, and facilitate the deployment of end-to-end services over converged infrastructures.
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<tr>
<th>Acronyms</th>
<th>Descriptor</th>
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<tbody>
<tr>
<td>BSS</td>
<td>Business Support System</td>
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<tr>
<td>CORBA</td>
<td>Common Object Request Broker Architecture</td>
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<td>FCAPS</td>
<td>Fault, Configuration, Accounting, Performance, and Security</td>
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<tr>
<td>IP</td>
<td>Internet Protocol</td>
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<td>IT</td>
<td>Information Technology</td>
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<td>JDK</td>
<td>Java Development Toolkit</td>
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<td>JMS</td>
<td>Java Message Service</td>
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<td>MPLS</td>
<td>Multi-Protocol Label Switching</td>
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<tr>
<td>EMS</td>
<td>Network Management System</td>
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<tr>
<td>OSS</td>
<td>Operations Support System</td>
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<td>QoS</td>
<td>Quality of Service</td>
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<td>RFP</td>
<td>Request for Proposal</td>
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<td>Service Level Agreement</td>
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<td>SOA</td>
<td>Service-Oriented Architecture</td>
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<td>SOAP</td>
<td>Simple Object Access Protocol</td>
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<td>TMF</td>
<td>Telemangement Forum</td>
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<tr>
<td>XML</td>
<td>Extensible Mark-up Language</td>
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