Service Level Management

Leveraging Your Network Investments

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Table of Contents

contents

List of Exhibits

Case Study

Service Level Management:
Leveraging Your Network Investments

I. Overview

Administrators constantly struggle with enterprise management problems such as deploying a set of increasingly complex services, supporting critical business processes, coping with change, and reducing the cost of ownership. Inadequate management practices are one factor, but better technology, by itself, will not solve these problems.

The major hurdle administrators face is being unable to manage networked resources at the appropriate level to deliver optimum management and business solutions. Networks are deployed by organizations to deliver a set of services to the network users—internal staff and customers. They are a business investment and must be protected, extended, and managed to deliver the best return on investment.

To address strategic enterprise management goals, which are focused on the business requirements that networking satisfies, you must be able to manage more than technology. Each organization has a unique set of processes and requirements that must be adapted to the management system. To do this, we need to evolve to a Service Level Management (SLM) environment.

II. Service Level Management

Service Level Management involves managing networks, systems, and applications to meet specified service goals. Metrics are selected for measuring actual service levels and comparing them with the goals. This is a significant evolutionary step in managing and evaluating networking investments. In the future, Service Level Agreements (SLAs) will become the policies driving a service-level-based management system.

A. Importance of Service Level Management

Making a successful transition to SLM offers an organization the following benefits:

- Increased effectiveness of organizational operations, thereby increasing productivity and sustaining competitive advantage.
- More appropriate communication levels between network administrators and their customers. They share the same language and a similar perspective.
- Simplified network management processes ensure positive changes in the network, servers, or applications resulting in improved service quality. If service quality degrades, there is feedback to drive decisions in a different direction.
- Straightforward accountability—service providers are held to contractual agreements. Organizations can use service levels to determine if they should use internal or external service providers.
- More cost effective—SLM saves money by using network resources wisely, such as extending the lifetime of technology before having to upgrade.
- Investments in new technologies or network capacity are identified with a clear business use.

B. Implementation Difficulties

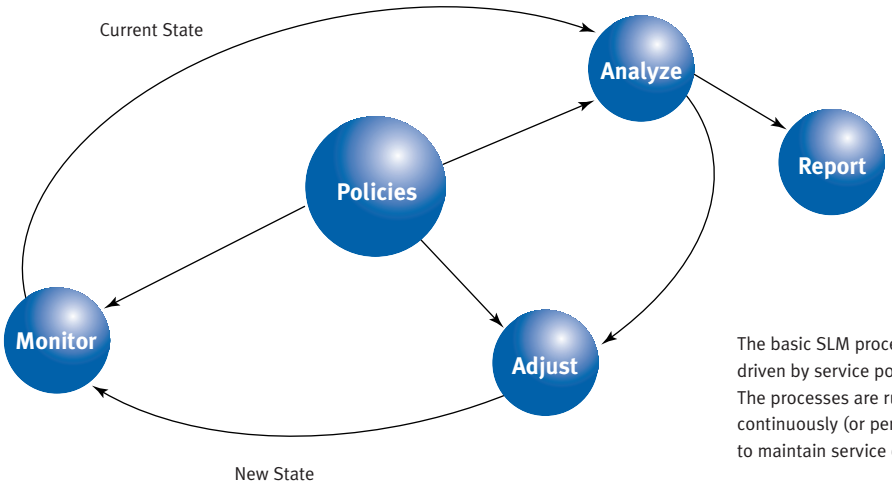
If the potential business and technical benefits of SLM are so attractive, why isn't everyone doing it? Simply because SLM has been difficult to implement and deliver. Administrators are not given the appropriate management tools for SLM. The following sections on **The Service Level Management Process** and **Service Level Management Environment Elements** illustrate the necessary systems approach for success.

C. The Service Level Management Process

SLM is a continuous dynamic, interactive process that maintains an agreed-upon service quality. Policies are the central control mechanism for an SLM environment; they define the rules and constraints on the management system.

For example, there is usually a different policy for dealing with a device failure that risks loss of revenues than for handling a failure that causes minor business loss. Policies control all the processes for managing services; they

Exhibit 1: The Service Level Management Process



The basic SLM processes are driven by service policies. The processes are running continuously (or periodically) to maintain service quality.

determine schedules, the types of information monitored, and the necessary actions to be taken based on criticality, time of day, and other criteria.

There are short-term tactical and long-term strategic processes that are needed. These include the following:

- **Monitoring:** Collecting the necessary information for measurement, evaluation, and feedback
- **Analysis:** Determining if current service levels are meeting or exceeding the specifications in a Service Level Agreement
- **Action:** Taking the appropriate steps to ensure stability of network service levels. Actions include real-time alerts to network operators and activating automated procedures to isolate the problem and restore service levels.
- **Reporting:** Gauging the effectiveness of SLM policies in real time and over longer intervals

Real-time SLM attempts to maintain on-going service quality in a highly dynamic environment by constantly measuring the service quality and reporting potential problems. Policy-driven adjustments are made to ensure that critical applications continue operation when overall capacity is degraded. Long-term tasks are described in the next section.

III. Service Level Management Environment Elements

A series of elements make up an enterprise-level SLM solution. All elements must be tightly integrated to provide maximum value.

A. Service Level Agreements

An essential element for SLM is the Service Level Agreement, an explicit, formal statement indicating what the service providers will deliver to their customers. Service providers include the traditional carriers, Internet service providers, and internal corporate IT organizations. A means to enforce the contract must be available. The management system must take actions to maintain service quality because SLAs are becoming more common within organizations as well as between service providers and customers.

SLAs define the provided services, including the criteria, measurements, and commitments. Standard metrics include availability, mean time to repair, response time, throughput, data volume, jitter, wait time, and more.

The mix of networked applications presents conflicting demands for managing service levels. For example, accessing a page from a remote Web server and moving the page in a specified amount of time may require bursts of 100 Kbps or more. The needed bandwidth is used intermittently, with periods of no activity. In contrast, videoconferencing requires a sustained data rate for an undetermined period of time.

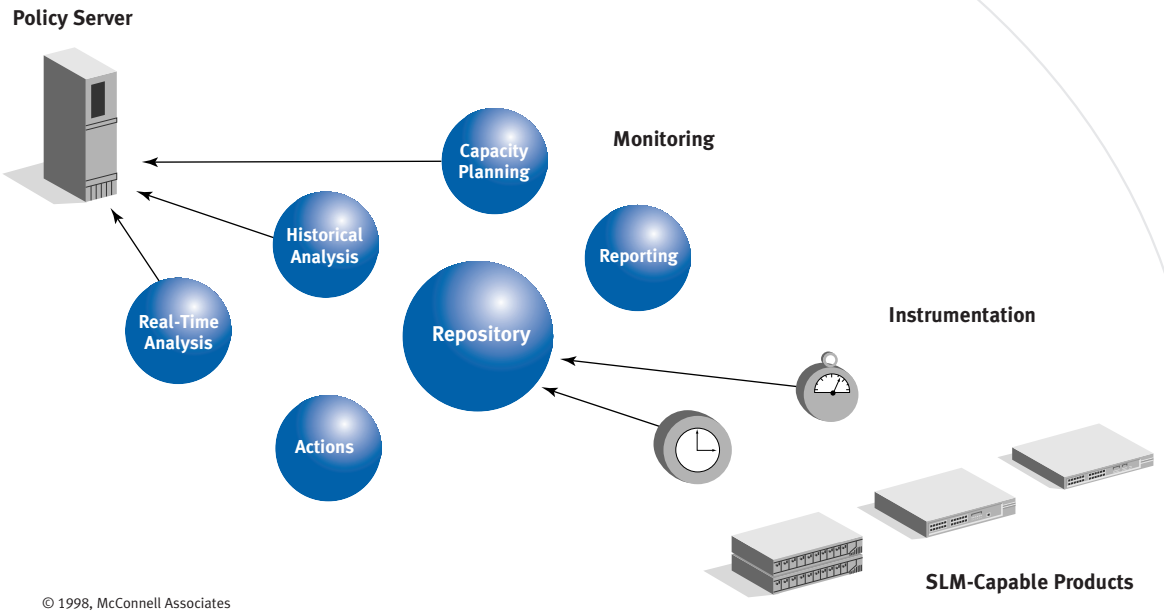
Automated policies are needed to manage different levels of service in a dynamic environment. The management system must respond quickly and accurately when SLAs are in place. For example, if you commit to being available 99.5% of the time in a 24-hour period, your outages cannot exceed 7 minutes per day. Only the speed of intelligent management tools controlled by policies can meet these demands.

B. Service Level Management Capable Products

There is a fundamental need for products to be managed at the service level. This includes intelligent network devices that can carry out the appropriate policies as they forward traffic. The hardware must not only offer high performance, but it must be adaptable and flexible for service management. It will be difficult to build an effective solution if the basic devices cannot recognize different types of application flows and handle them according to policy.

Systems and applications also need appropriate service management features, which are remotely controlled by the management system as adjustments are required. Integrated control of all these elements ensures that network bandwidth and service policies are harmonized with server resource allocations and application features.

Exhibit 2: Service Level Management Environment Elements



C. Policy Servers

Overall control of policy is centralized with specific policies distributed to elements, including network devices, gateways, firewalls, and servers. Individual elements take local actions to enforce policies and provide feedback once the appropriate policies are loaded.

A policy server maintains and distributes policy information to the rest of the management system. The policy server distributes some policies when they are created; others are available on demand, such as those relating to a specific user.

D. Instrumentation

You need enterprisewide instrumentation to collect the information that allows you to enforce policies and maintain service quality. Some instrumentation is embedded in network devices, computer systems, and applications. Other collectors are stand-alone products that are attached where needed.

E. Monitoring

Monitoring serves as a trip wire to alert the management team before service degradation becomes a problem. The relevant service metrics such as response time, latency, jitter, and availability are measured and compared to the active service management policies. Collected information is stored for later analysis.

You must carefully consider all information being collected. For instance, more intelligence in the basic instrumentation reduces traffic loads by only sending alerts when immediate attention is required. Other information is stored locally and delivered when interference with business activities is minimized.

F. Repository

The repository is a core element that other applications use to make decisions and share information. A repository integrates all relevant information about topology, network elements, SLAs and their implementation policies, short-term data, and historical data collected for long-term management needs.

G. Analysis

First-level analysis tools compare the current service quality with the SLAs in force. No further actions are required when service quality is acceptable. Comparisons indicating a potential loss of service quality activate further tools and processes to restore service.

Other tools provide detailed analysis for identifying problems within the transport network, applications, or systems. More sophisticated analysis looks at placement issues. For example, if the data a server needs is crossing a slow WAN link rather than a faster local LAN, then response time increases. The best tools also provide suggestions for adjustments to restore service levels.

H. Actions

Stability is maintained by acting on the results of the analysis. Actions are driven by the service level policies that determine the priorities and resources assigned to users and applications. For instance, increasing traffic levels may activate an intelligent agent to apply new policies that distribute traffic more effectively.

I. Reporting

An organization needs a carefully designed set of hierarchical reports produced at scheduled intervals. For example, upper management may find a summary report satisfactory while the operations team needs more information. It is essential to navigate different levels of detail. The report set will evolve as each organization refines its information needs, so easy customization and extension are key features. Some organizations will use the Web to publish and retrieve reports while other reporting systems will push reports to key staff.

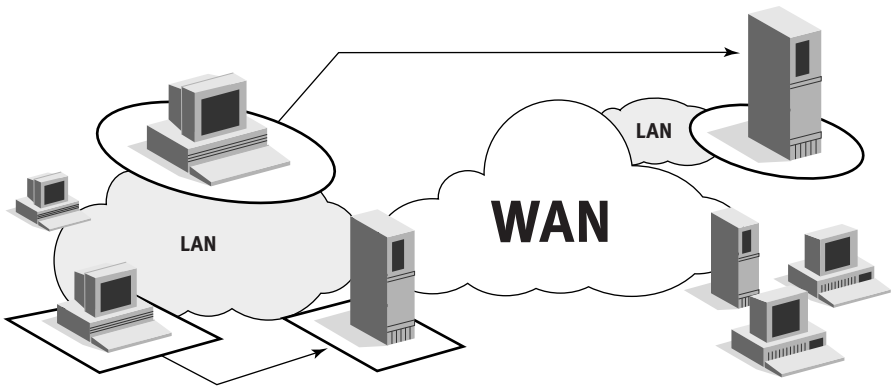
J. Provisioning/Capacity Planning

A management system cannot function with sustained oversubscription of its resources. Capacity planning and resource forecasting tools use historical data in the repository to predict resource problems by projecting trends. Provisioning is scheduled so resources are ready before a crisis occurs. Modeling can define better topologies, optimal additions of links, placement of devices, or changes in loading patterns.

K. Testing

Administrators cannot debug policies in the midst of real failures. Testing tools activate policies without causing a failure. Administrators can verify that the policies are functioning as intended before trouble occurs.

Exhibit 3: Placement Impacts



Placement affects service levels

Analysis can indicate placement problems.

IV. Introducing Service Level Management

Organizations should use a phased-in approach to introduce SLM to gain experience and minimize adverse reactions. Before introducing SLM, it is important to collect information about the environment. This provides you with the information you need to make accurate assessments of the impact and value of SLM when it is introduced. This baselining also helps administrators define and refine their policies.

The next step is to build the infrastructure, which includes the following elements: instrumentation, monitoring, the repository, and reporting. Monitoring collects information, the repository organizes it, and reporting tools deliver information about the environment before SLM is introduced.

Deploying SLM-capable devices is the final part of creating the infrastructure. Devices must have priority queuing capabilities and embedded intelligence.

The network management team gains familiarity with the basic SLM elements while users see the role SLM plays for them through reports.

A. Formal Agreements

The next phase adopts formal SLAs. A SLA should do the following:

- Identify the contracting parties
- Specify service requirements
- Specify service measurements and variations
- Define reporting requirements, including levels of detail, recipients, and schedules
- Specify review cycles with appropriate evaluation criteria
- Clearly define financial commitments and penalties
- Outline policies for escalation, backup, and other actions

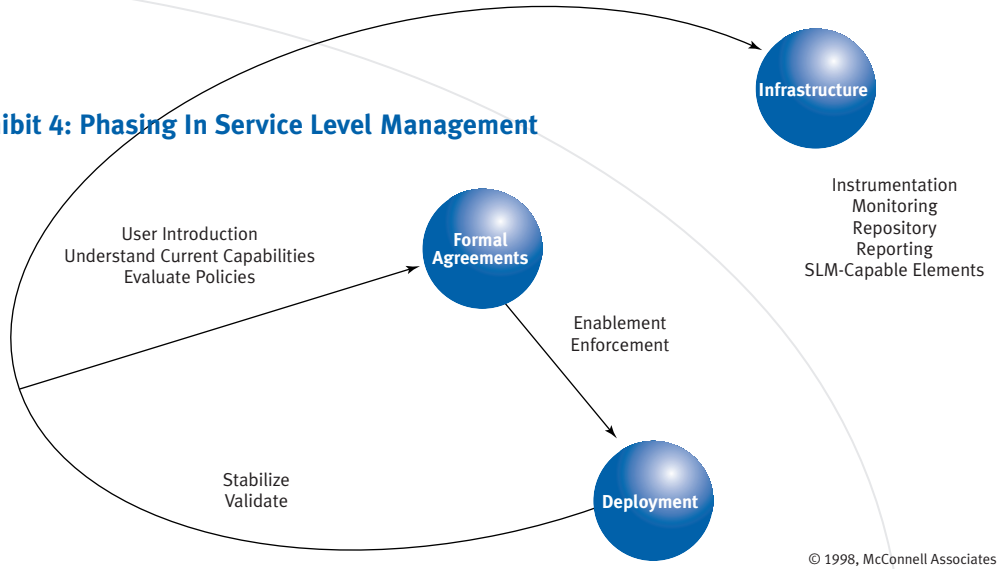
Criteria used for SLM can include the following:

- Response time delivered to a user
- Data volume delivered to a user
- Availability of a service to a user
- Mean time to repair (MTTR)–how long a service outage lasts

B. Phasing In

SLM can be phased in sequentially by groups. Groups can be defined as business units, membership in virtual LANs, regions such as a campus or larger area, or by the services used. Service levels should be stabilized for the current set of users before adding new groups.

Exhibit 4: Phasing In Service Level Management



case study

Case Study

3Com's InfoVista SLM Solution

InfoVista is an industry-leading SLM solution for IT providers. InfoVista's capacity to gather data from SNMP and non-SNMP sources gives IT providers integrated visibility and control of every component within an information system. This uniform environment lets IT providers measure performance of an entire system, and evaluate the level of service based on metrics defined by the organization's SLA.

InfoVista Case Study: Application and Network Performance SLA

InfoVista's capacity to gather data from SNMP and non-SNMP sources gives network managers integrated visibility and control of every component within an information system. This uniform environment lets managers measure performance of an entire system, and evaluate the level of service based on metrics defined in an organization's SLA.

Problem

The Radiology department of a major hospital needs to implement a network-based X-ray Diagnostic Imaging System that delivers X-ray images within a 10-second response time. This response time must include transit time across the network, as well as image processing and display by the application software. The hospital's IT department, which is responsible for measuring and managing the requirements of the system, recognized that regardless of network performance, the response time would be heavily influenced by the performance of the imaging software and the server on which it ran.

InfoVista Solution

During a baseline study of the system under trial, the IT staff used InfoVista's Report Builder and Formula Editor to measure the full system response time (end station, network, server, and application), and to calculate a single metric showing if the 10-second requirement was met.

Result

Through InfoVista's comprehensive reports, the staff discovered that, although the application and server were tuned for optimal performance, the size and volume of the images were too large for the existing shared media network. As a result, the network was upgraded to a switched infrastructure with an ATM backbone, enabling the system to run consistently within the 10-second standard. In addition, InfoVista's performance measurement tools enabled the IT and Radiology departments to develop an SLA that describes meaningful service criteria and to measure conformance with the SLA on an ongoing basis.

V. 3Com and Service Level Management

3Com has been laying the foundation for SLM by introducing many of the pieces. For example, LAN and ATM switches support priority queues and forwarding of packets based on 802.1p tagging or ATM quality of service—the basic hardware-driven capability for delivering different service levels. 3Com has SmartAgent® intelligent agents that provide local policy enforcement in each device as well as sophisticated monitoring and local actions.

3Com's leadership in network interface cards (NICs) and substantial intelligence in Dynamic*Access*® technology services allow NICs to offer other opportunities for SLM. First, they can perform client-centered measurements of traffic volumes and response times. This information supports SLM directly: it measures data from the perspective of the end user. Further refinements would extend control into the attached computer system by having NIC software throttle low-priority traffic when the network is congested.

3Com's partnership with InfoVista provides a scalable data repository used to drive many of the other SLM tools. It is a strategic core element that provides a set of reports as well as data integration, synchronization, and backup capabilities.

Transcend® network management solutions such as Transcend Enterprise Manager provide the overarching framework that supports policy-based SLM. The scalability of the client/server architecture gracefully accommodates growing networks and service demands.

VI. Future Directions

Policies will evolve toward more granularity and extensibility. They will be applied to specific users, in specific locations, at specific times of day, for specific duration, and other criteria optimized to build overall business productivity. Policies will be extended to allow more choices for more precise control of the network.

An overall policy management architecture must evolve for centralized coordination of the many policy agents in devices, customer network management systems, service providers, servers, clients, and applications. The centralized policy server coordinates, synchronizes, updates, filters, and correlates information from the distributed policy agents.

Embedded intelligence is needed at many levels. For example, more sophisticated hardware with priority and queuing mechanisms increases the SLM capabilities of network devices by providing finer levels of prioritization and bandwidth allocation.

This increased intelligence will be accompanied by a higher degree of independence so local actions maintain service quality while reporting potential problems to a remote management site. Client resources increase leverage by exploiting the NIC. More queuing and prioritization within the card allows a higher level of traffic policing at the edge of the networks. Software on the card interacting with resident drivers allows flow control of various priority traffic levels at their source.

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