



An Architecture for Managing Application Services over Global Networks

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Agenda

- **Introduction:** Evolution of Network Service Providers (NSP)
- **Background:** Typical NSP Management Systems
- **Problem Description:** Application Service Management
- **Architecture:** Service Management Domains, Dependency Analysis
- **Conclusions:** Future Work



Evolution of NSPs

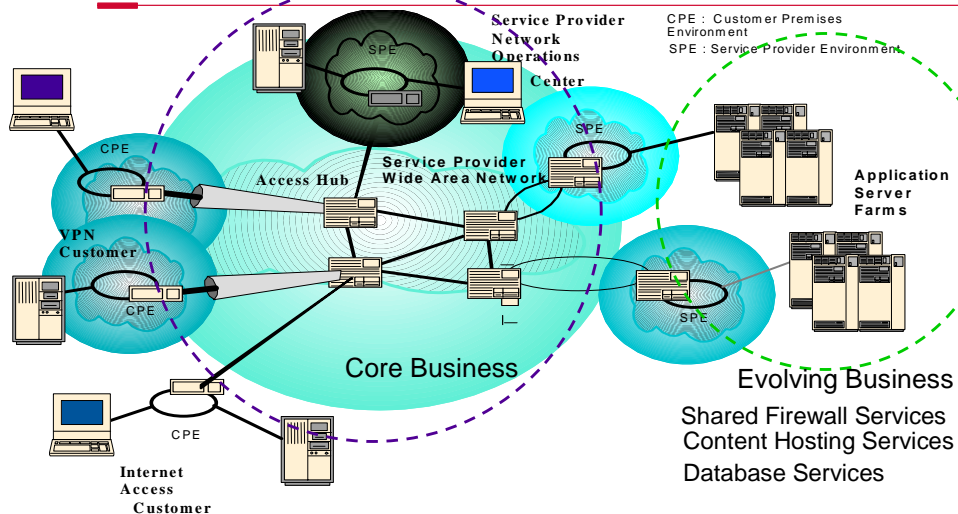
- Network connectivity services have become a commodity
- Network Service Providers (NSP) are evolving to provide shared application services
- From a management point of view NSPs are facing new challenges:
 - Provisioning of end to end managed application services
 - Leveraging of the existing management infrastructure to reduce cost of migration

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A Typical NSP Environment

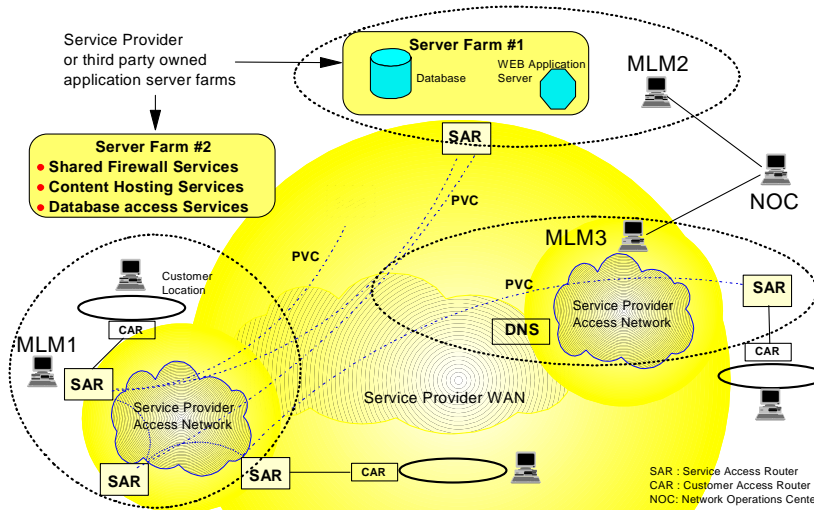


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NSP Environment: Management Perspective

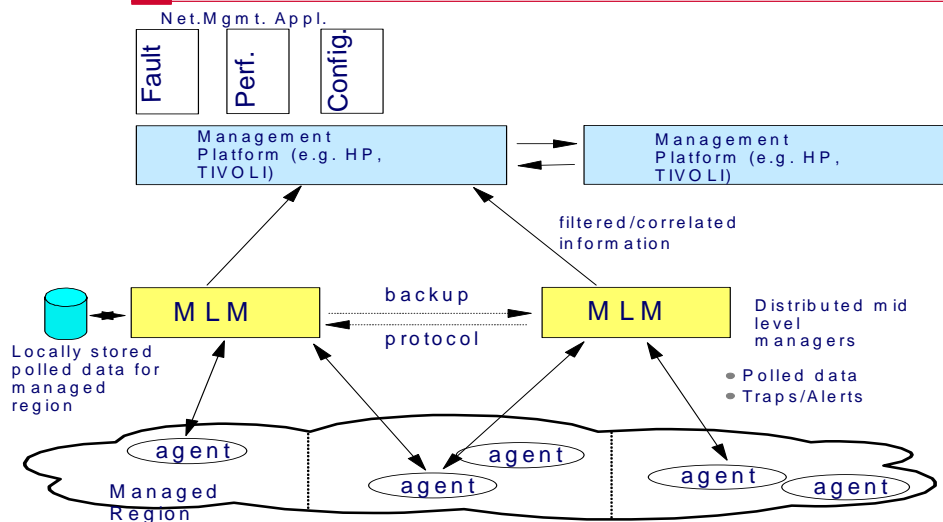


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Hierarchical Network Management for NSPs



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A Typical NSP Network Management Setup

- **Monitored Domains**
 - Each domain consists of network elements and service elements, e.g. links, routers, servers
 - Domains are typically organized according to geographical and organizational boundaries
 - Domains are monitored by a midlevel manager
 - Data collection, filtering and correlation of information performed hierarchically
- **Enhancement for Application Service Management**
 - Application services are composed of and supported by network elements, servers, data bases, other services;
how do you find them?
 - Architecturally, enhance the network monitoring structures to allow correlation of information at an application level;
how do you evolve a typical Net.Mgmt. setup to do this?

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Application Service Management

- **An end to end application service has constituent components that span multiple management domains, thus requiring coordinated monitoring and correlation of information (inter domain management)**
- **Typical Application Management Functions:**
 - Root cause analysis
 - Impact Analysis
- **Approach**
 - Dependency Analysis
 - Service Management Domains

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Dependency Analysis

- **Discover dependencies that an application service has on other services and underlying network resources**
- **Make use of already existing information:**
 - Assume no application-specific instrumentation
- **Two kinds of dependencies:**
 - *Inter-system* (horizontal) dependencies:
 - Provide information on client/server relationships
 - needed for end-to-end problem determination
 - Example: "Resolver (DNS client) is bound to DNS server"
 - *Intra-system* (vertical) dependencies:
 - Occur within a single system
 - Example: "WWW service requires Name service"

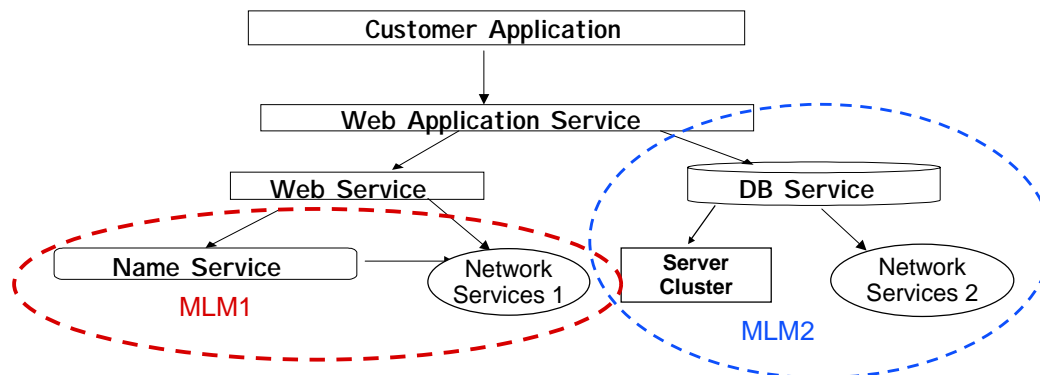
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A Typical Dependency Graph

Example: A typical NSP supported 3 tier application environment

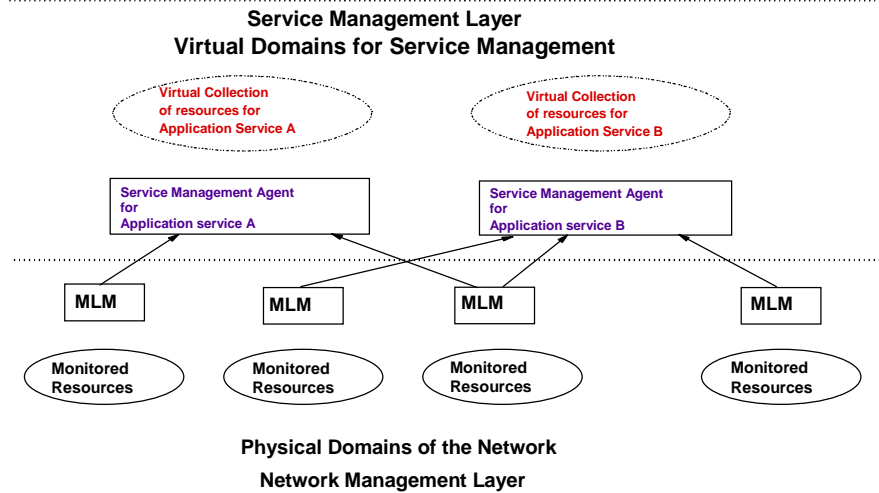


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Service Management Domains



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Application Service Management Architecture: Key Components

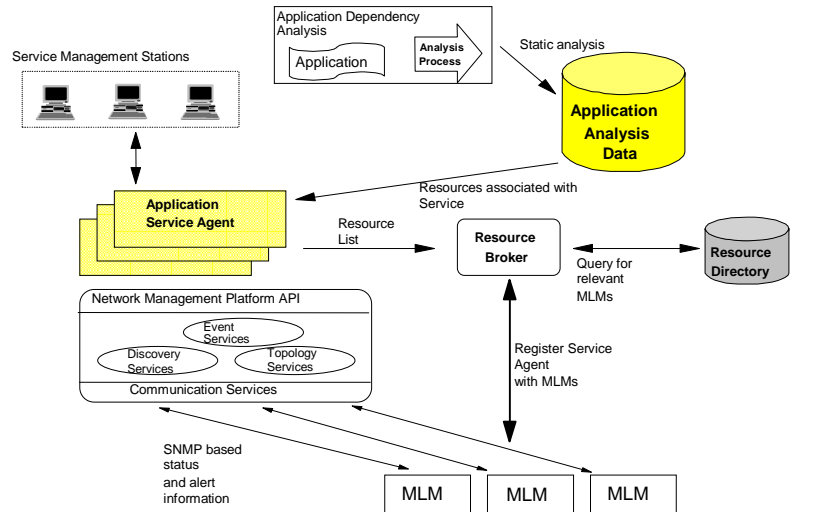
- **Application Service Agent**
 - Responsible for one designated service
 - Monitors a virtual domain consisting of all resources on which this service is dependent
- **Resource Broker**
 - Registration agent for resources and their monitoring agents (MLMs)
 - Establishes association between Application Service Agent and MLMs
- **Resource Directory**
 - Maintains records of MLMs and their associated monitored resources
 - Responds to queries from the resource broker

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Application Service Management Architecture

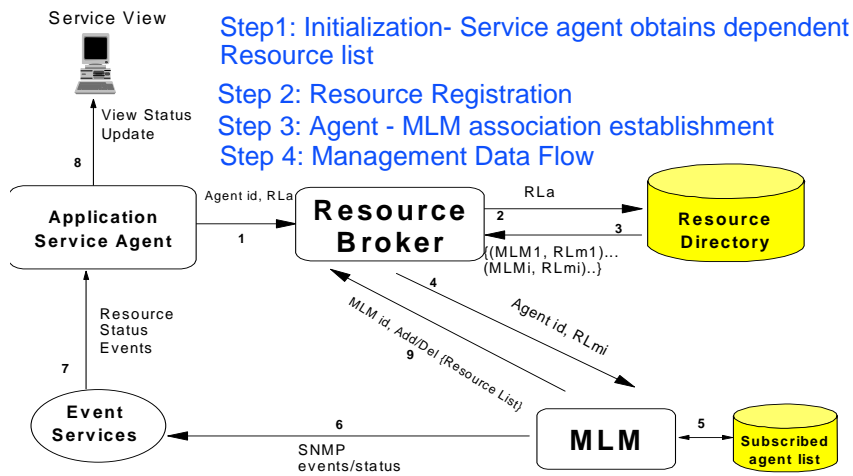


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Application Management Information Flow



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Conclusions

□ Main Points

- Architecture for managing application services
- Implemented as an enhancement to standard network management systems
- Use of dependency information for doing problem determination
- Applied in a real networking service environment

□ Future work:

- Efficient computation of dependencies
 - Cross domain environment
 - Dynamic dependencies
- SLA monitoring and management for application services
- Derivation of monitoring policies, automatic provisioning of monitoring agents to support SLA management needs