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Leveraging the Common Information Model for Managing MPLS Networks



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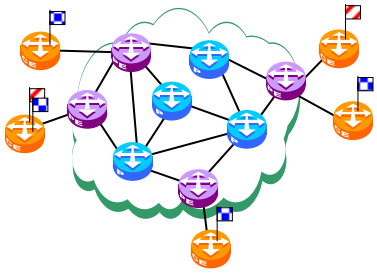
What is MPLS

- MultiProtocol Label Switching is a standards-based technology for speeding up network traffic flow and making it easier to manage
- How?
  - By setting up a specific path for a given sequence of packets
- Why??
  - Label based switching allows routers to make forwarding decisions based on the contents of a simple label, rather than by performing a complex route lookup based on destination IP address



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MPLS Value Proposition for Carriers

Convergence, Revenue

- Convergence
  - Past: Disparate ATM/FR, Ethernet, IP networks
  - Present & Future: Convergence
  - Maintain significant revenue stream
  - Sustain legacy technologies, introduce new over same backbone
- Revenue Enhancement
  - New service possibilities
  - Targeting large enterprises with their own private networks
  - Ability to provide a new type of VPN service with broad QoS/CoS possibilities

**** 80% of carriers currently use some form of MPLS, rising to 92% in 2005***

MPLS Value Proposition for Enterprises

- MPLS allows Enterprises to take advantage of next-generation services from carriers
- VPNs (Virtual Private Networks)
  - Layer 3 MPLS VPNs are a replacement for Frame Relay or ATM Wide Area Network (WAN) services
  - VPLS – Virtual Private LAN Services
    - enable enterprises to provide Ethernet reachability across the WAN
- Self-provisioned MPLS networks
  - Using dark fiber leased from a carrier

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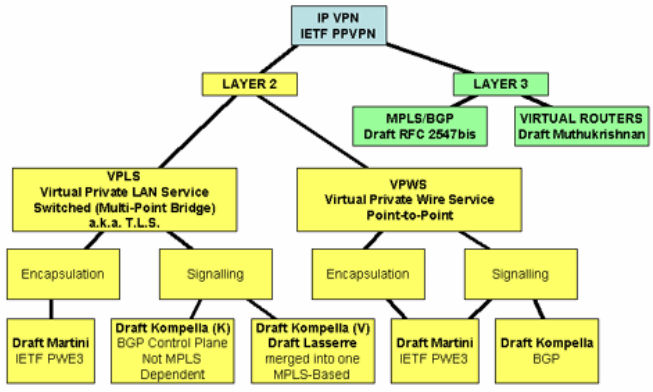
MPLS – Taxonomy

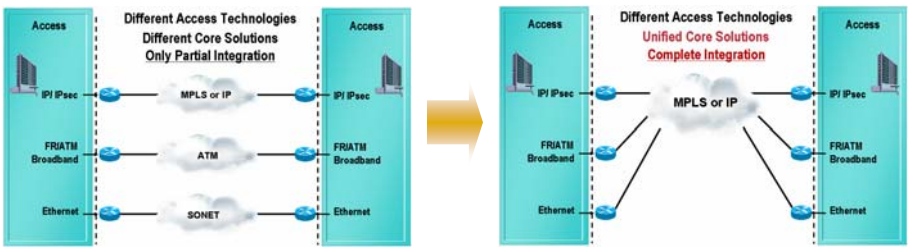


Source : Light Reading

Layer 2 VPNs

Carrier benefits:

- Replace legacy networks (ATM, FR) while maintaining service interface to the customer
- Key enabler for Ethernet WAN
- Martini draft specifies encapsulation for: ATM, FR, Ethernet and HDLC over MPLS
- Simple pt-to-pt tunnel on provider network



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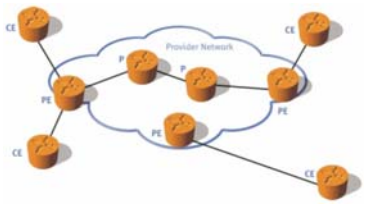
Layer 3 VPNs

Carrier benefits:

- Unified IP infrastructure
- Simplified operations- deployment of ALL services through a single core infrastructure
- Providers can continue to reap profits from legacy traffic, while…
- Deploying new, revenue-generating services more rapidly

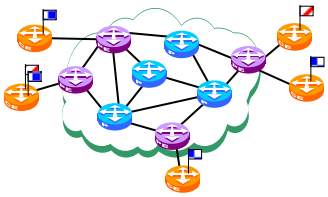
Enterprise benefits

- Outsource VPNs, cost control, bundled SP services



Management Issues in MPLS

- Carriers and enterprises implementing MPLS networks have limited visibility into this domain – need up-to-date management capabilities
- Need to be able to relate network problems to their impacts on the business and the customer
- Manual problem determination leads to long MTTR
- Need a solution scalable to the largest environments
- Must be able to manage this new domain in context of existing environment and in concert with existing tools



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The Common Information Model and MPLS



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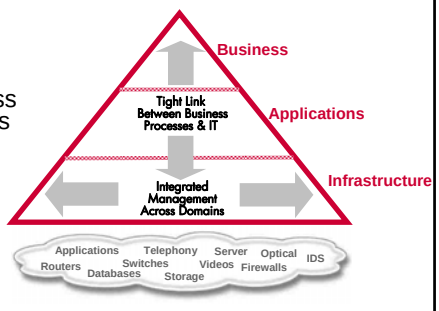
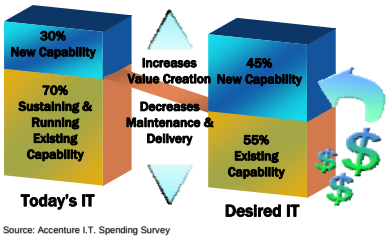
Today, Automation Is Key

- Aligning IT with the business requires
  - Real time actionable information
  - End-to-end service management across increasingly interdependent IT domains
  - Fast launching of business services
  - Low operating cost
  - Minimum business risk
- The challenges
  - Its getting harder every day
  - Increasing
    - **Complexity**
    - **Heterogeneity**
    - **Scale**
    - **Dynamic pace of change**
- Automation is the only way
  - Do more with less
  - Automated root cause analysis





Source: Accenture I.T. Spending Survey

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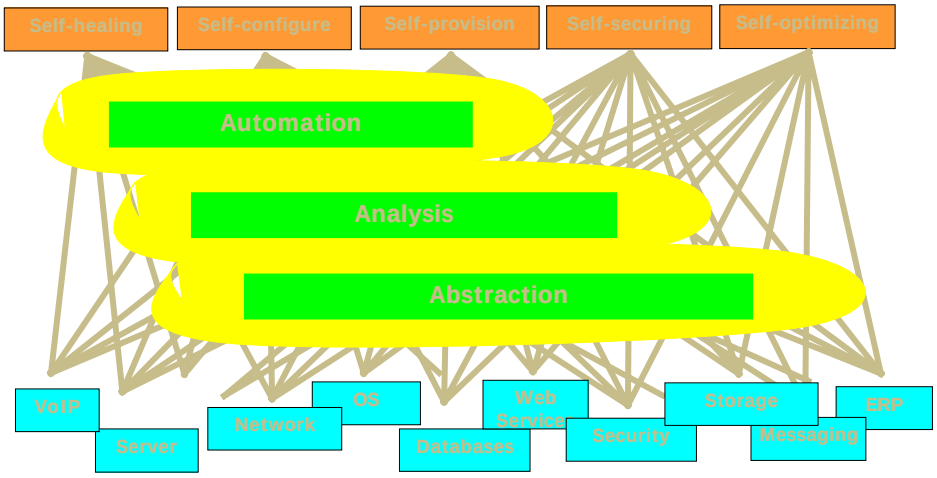
Bridging the Gap to Self Management



The Role of Management Information

- Provide knowledge about managed entities
- Maintain detailed data about the managed system at multiple layers
  - Infrastructure, applications, and the business services
- Rich information model enables powerful solutions at every level
  - Element, network, service and business management
- Common information model makes application development faster

Information Model Requirements

- Model entities and relationships within and across IT domains
- Model logical and physical entities
- Model business entities, the relationships among them, and their relationships to the IT entities
- Model static properties and dynamic behaviors of the managed entities
- Leverage abstraction to handle the complexity and diversity of managed entities

Key Elements of Management Information Model

- Classes
  - Describing managed entities and their relationships
- Repository
  - Representing an instantiation of the information model for a particular managed environment
- Mediation layer
  - Maps abstract classes in the information model to the specifics of real world managed entities
- Discovery
  - Populating the repository
- Modeling language
  - Describing management information in a machine-processable form

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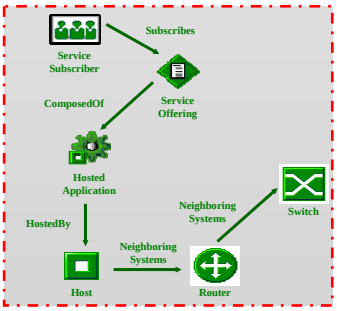
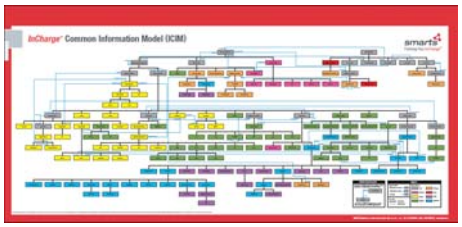
ICIM: The EMC Smarts Common Information Model

- Based on DMTF CIM, extended with rich semantics for integrating and automating management applications
- Comprehensive
  - Models network, systems, applications, services, business entities
  - 100+ classes, 50+ relationships
  - Infinitely extensible via inheritance
- Models the complex web of relationships in the real world:
  - Within entities, across entities
- Models cross-domain relationships
  - Key to service management, end-to-end view
  - Pieces together information from heterogeneous sources
- Abstract
  - To scale to networks of unlimited size and complexity through multiple levels of abstraction
  - To decouple management application logic from the specifics of an ever-increasing stream of vendor products
- Efficient
- Open





ICIM Class Properties

- Attributes
  - Stored or instrumented – this is transparent to applications
- Relationships
  - 1-1, 1-many, many-1, many-many
- Behaviors and Interactions
  - Events – an observable condition
  - Problems – a condition that may cause events
  - Symptom propagation – causality that spreads along relationships
  - Aggregates – a set of evens that is grouped into a single event
- Constraints
  - Assure consistency of assigned values, e.g., speed match at both end of a circuit
- MODEL: Managed Object Definition Language
  - Based on CORBA IDL syntax
  - Compile to C++

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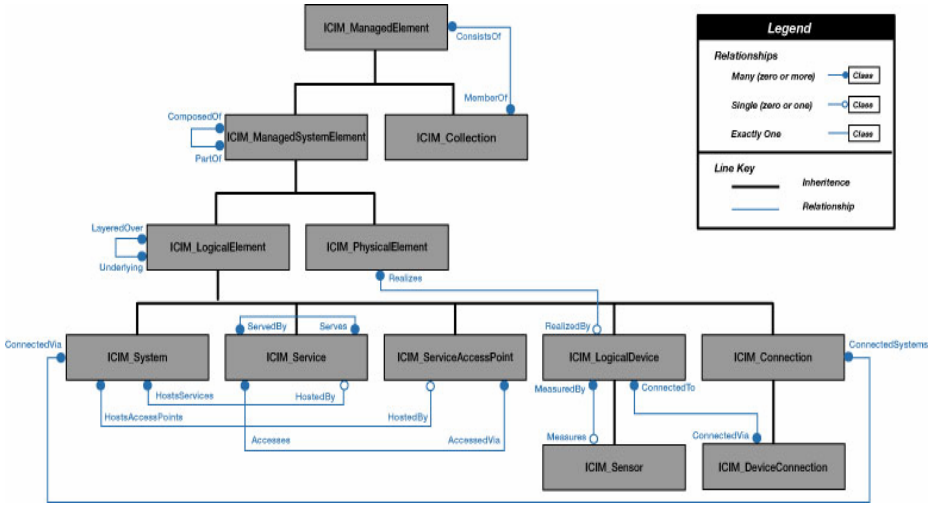
The ICIM Core



Extending ICIM to MPLS, Other Domains

- The ICIM core abstract classes are specialized for specific domain
- Specific extensions for each domain to describe entities related to the domain

IP Technology Objects
- **Switches**

ATM Technology Objects
- **ATM Switches**

Application/Business/Service Objects

Protocol Technology Objects

MPLS
- **P Routers**
- **PE Routers**
- **CE Routers**
- **LSP**
- **LSP Hops**
- **VPNs**
- **VRFs**

Routing
- **BGP Services/Sessions**
- **Route Reflectors (RR)**
- **Route Reflector Clusters**
- **OSPF Services/Sessions**
- **OSPF Areas**
- **OSPF members**

Relationship Types
- **ConnectedVia/ConnectedTo**
- **ParentOf/ChildOf**
- **LayeredOver/Underlying**
- **SwappedFrom/SwappedTo**
- **NextHop/PreviousHop**
- **ImportedBy/Import**

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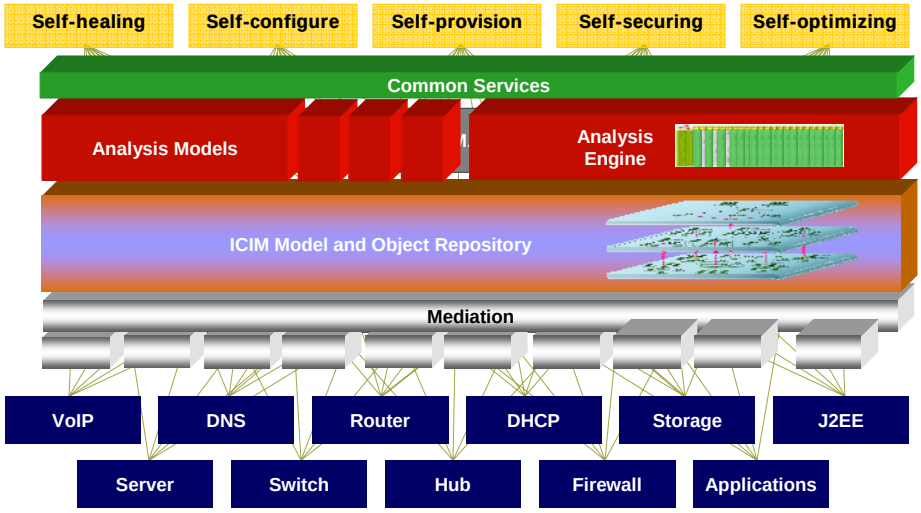
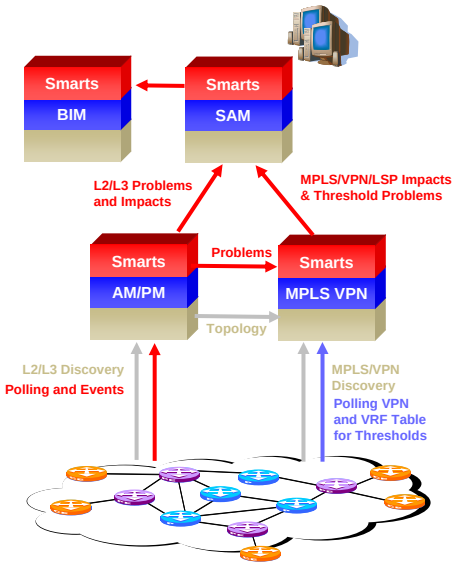
Self Management Gap – Bringing it All Together



EMC Smarts for MPLS VPN – Product Features

- IP AM and PM manage L2/L3 with SAM for consolidation
- Separate MPLS server process can be run distributed as necessary
- Automatic integration with IP AM and SAM
- Automatically discovers MPLS networks
  - P, PE, CE routers
  - LSP, LSP Hops, LSP Segments
  - VPNs, VRFs, Route Targets
- Analyzes impact of connectivity failures on MPLS VPN
- Use BIM for impacts to services and customers
- Visualization of LSPs and VPNs in Global Console
- Polling of VRF tables
- Integrates with provisioning OSS
  - Cisco ISC adapter
- Support for Cisco and Juniper devices
  - SNMP and CLI based
  - Juniper ERX, M/T series.



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Leveraging the Common Information Model for Managing MPLS

- Systems and services supporting MPLS rely on underlying network infrastructure
- Problems in MPLS infrastructure have to be understood in context of the network and applications that supports it
- EMC Smarts approach provides an integrated view of MPLS problems in that context

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