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Standard-based Autonomic System Management

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Notes

- 7 times servers comparing to 10 years ago.
- Purchase Cost is same, management cost is 9 times high
- Technology Cost is being down, People Cost is being up
- In 2008, management cost is 3 times of purchase cost
- Simple IT environment (Manageability)

IT Environment History

- 1980's – ISP (Information Strategy Planning)
  - Usually one mainframe
  - Logical Relationship among Applications is important
  - Computing Power allocation based on Proirities
- 1990's – ITA (Information Technology Architecture)
  - Open System based on Unix
  - Relationship between applications and infrastructure is important
  - Networking standards among unix servers are developed
  - Still slow changes of business environments
  - DA, AA, TA

IT Environment History

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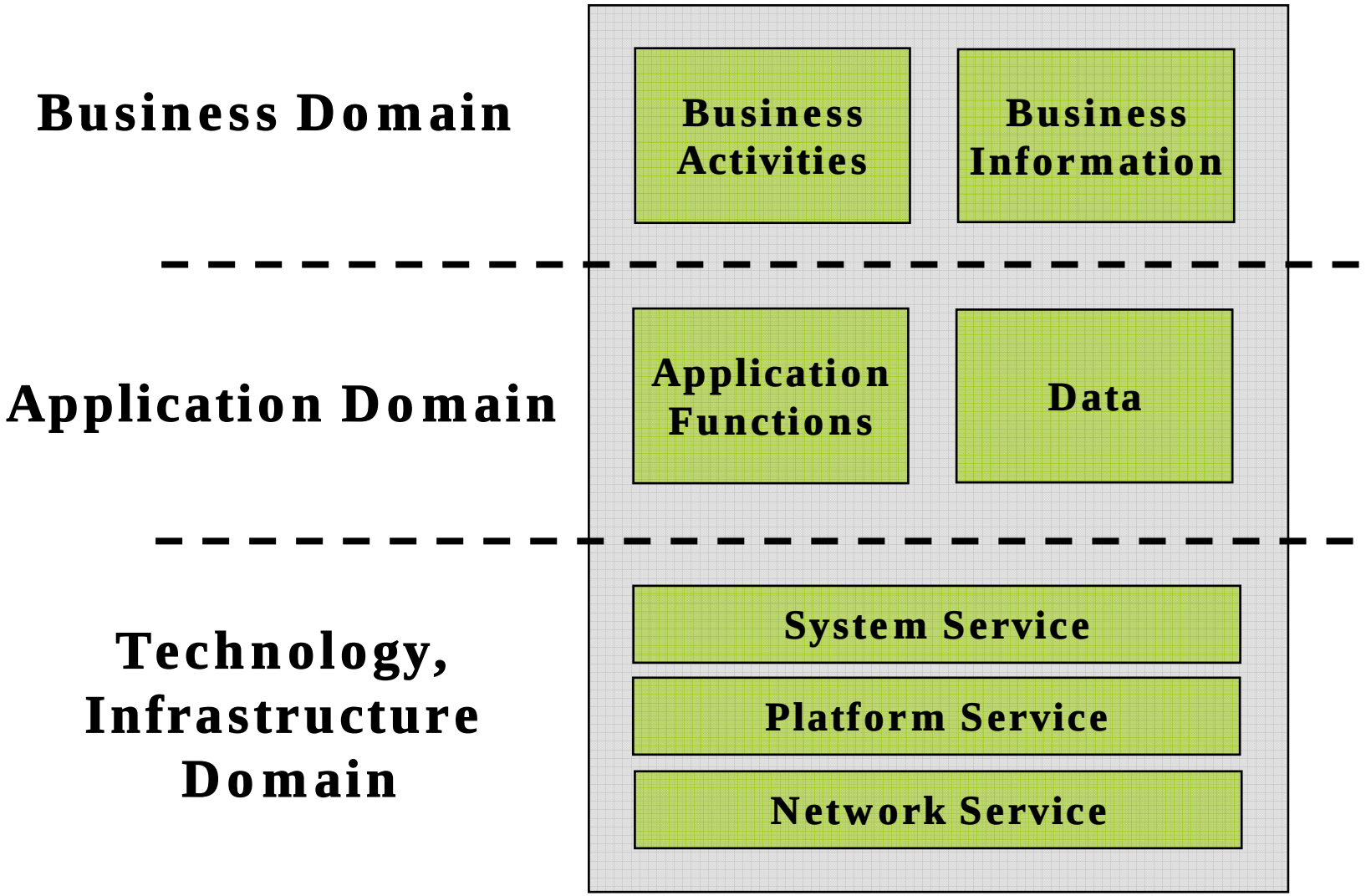
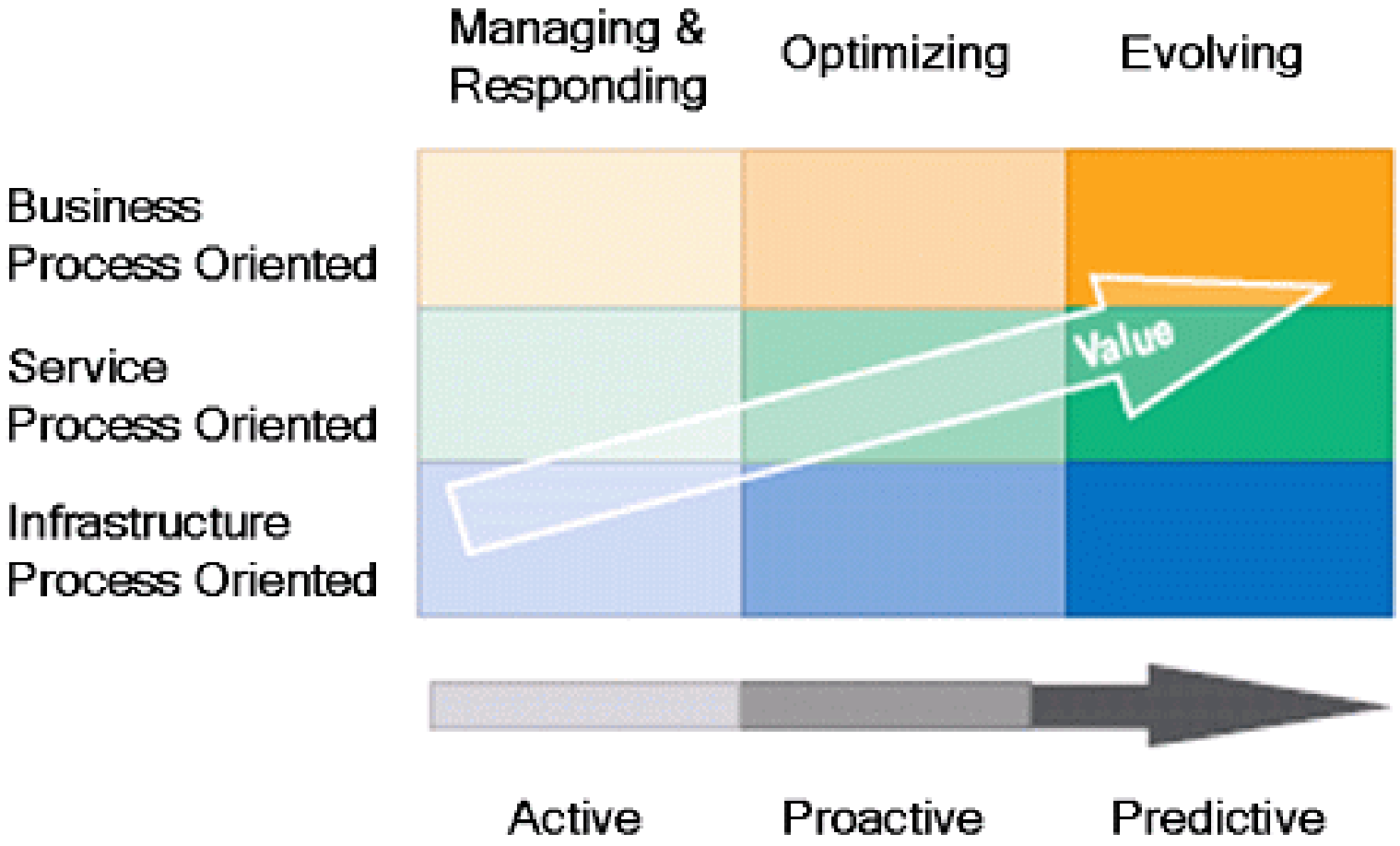
- 2000's – EA (Enterprise Architecture)
  - Rapid globalization
  - Complex business environments → Virtual business
  - Distributed & virtualized information systems are needed
  - Most business models are no more valid than 1 year
  - Combining IT architecture into business architecture is needed
  - Enterprise Architecture = Business Architecture + IT Architecture (Data, Application, Infrastructure)

Enterprise Architecture



IT Alignment with Business Goals



IT Alignment with Business Goals

Summary

- Recent IT buzzwords are related to Business Environments
  - BPO (Business Process Outsourcing)
  - BI (Business Intelligence)
  - BPM (Business Process/Performance Management)
- Enterprise's Requirements
  - Agility → light-speed
  - Cost Reduction → ITO/BPO
- ***Utility Computing (Autonomic Computing)***
  - ***Standards-based Distributed Resource Management***
  - ***Policy-based Autonomous System Management***

Drivers for Utility Computing

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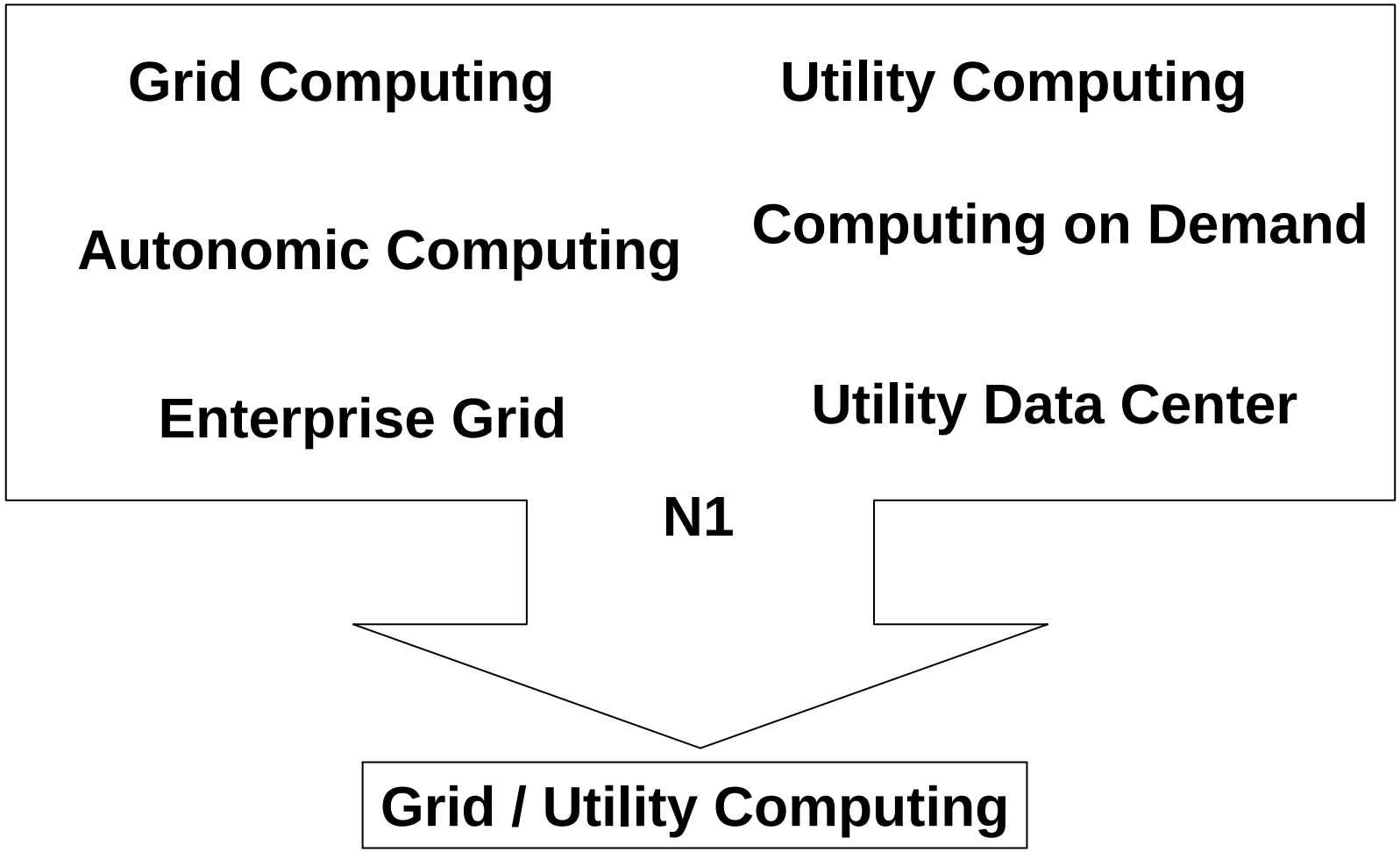
IDC, March 2004

Adoption Drivers	Reasoning
Server consolidation	Hardware cost reduction: Grids become an extension of cycle harvesting that is already under way.
Hardware flexibility	Low risk: Standard boxes can be redeployed if grid does not work.
Linux	Easier development of custom applications allowed by open source; Linux used by early adopters
Clustering applications	Smoother software transition using parallel applications
IT systems management	Managing this growing element of cost becoming more critical than hardware efficiency
Growth of data	Requires data mining and data integration capabilities made possible by grids
Uncertain volatility of workloads	Increases capacity required leading to low utilization of compute resources (cycles and system admin support)

Commercial Grid and Utility Initiatives

- IBM “On Demand Computing”
- HP “Utility Data Center”
- Sun “N1”
- Oracle 10g
- Microsoft DSI
- Veritas

Convergence of definitions



Utility Computing Architecture

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- Should have a service oriented architecture (SOA)
  - To support *federation, composition & incremental evolution*
- Supports the separation of management concerns
  - Clearly defined roles relative to horizontal & vertical domains
- ***Is defined to be policy driven***
  - Rules are explicit and modifiable vs. implicit and immutable
- ***Uses models but is not fixed on only one model by de fault***
  - A common meta-model may be there enabling leverage & inte roperability
  - Need to interoperate within various vendor products and stand ards.
- Is solutions oriented
  - Supports “composable” solutions (building blocks)

Utility Computing Topology

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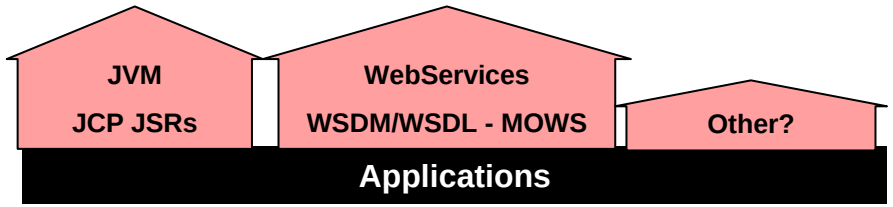
Utility Business Services

Track Resource Utilization, Resource Accounting/Billing, Service Level Monitoring (Availability & Performance)

System Monitoring & Management

- Configuration Visualization and Control(VLANs, LUNs, LunMasks, LunMaps, Zones, Sparing)
- Workflow Policies and Related Automation
- Health/Fault Management
- Security (role base authorization)
- Formatting, Diagnostics, Balancing Load/Path0



O.S. Image Configuration Service

Build/Replicate O.S. Images to support new processors

Application Provisioning Registry

Manifest of System Resources, Dependencies, and Service Levels Required for an Application

CIM

SMI-S, SCSI	Needed	CIM Server, IPMI	Needed	Some SMI-S	Some MIBs
Storage Subsystems Array, Switch, Library, Router, HBA, NAS, Virtualizer	**Database/TP Monitor** App-Table-volume mapping, quiesce, log status, performance	**Processor Complex** Service Proc View: Configuration, Capabilities, State, Boot Initiation	**Operating Sys** Performance, Memory Util., Installed App. Registry, Network Access	**Host Based Storage Sft.** File Sys, Volume Mgmt, Host Disc Resources, Multipath, etc.	**Network** VLANs, subnets, etc.

Veritas Contribution to DMTF UCWG

Key Features of Grid / Utility Computing

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- Virtualization of Resources
  - Storage, networks, and servers
  - Allows for load-balancing and scheduling of resources
- Provisioning / Orchestration
  - Dynamically allocate resources based on SLAs
  - Rapid response to changing needs
- **Metering**
  - Resource consumption
  - Performance simulation / capacity planning
- **Policies**
  - Automation / Workflow
  - Quality of Service

Industry Challenges

- Taxonomy
  - Resolving differences and creating a common set of definitions
- Mapping CIM onto Web Services (WS)
  - WS and SOAP are universally accepted as the low-level infrastructure with which to manage grids
  - Different management model than DMTF
    - Manage services, not objects
    - Services have state and behavior
      - These concepts do not easily fit into the CIM model
  - Different uses of XML
    - CIM (and SMI-S) use XML to encode RPC operations.
      - Rich structure is in MOF
    - Web Services use XML as a carrier of rich structure (WSDL)

What's a standard?

- "Something, such as a practice or a product, that is widely recognized or employed, especially because of its excellence."
- Alternative to proprietary
- Many successful solutions in the IT industry are based on standards
  - The Internet
  - World Wide Web

Standards Related to Autonomic Computing

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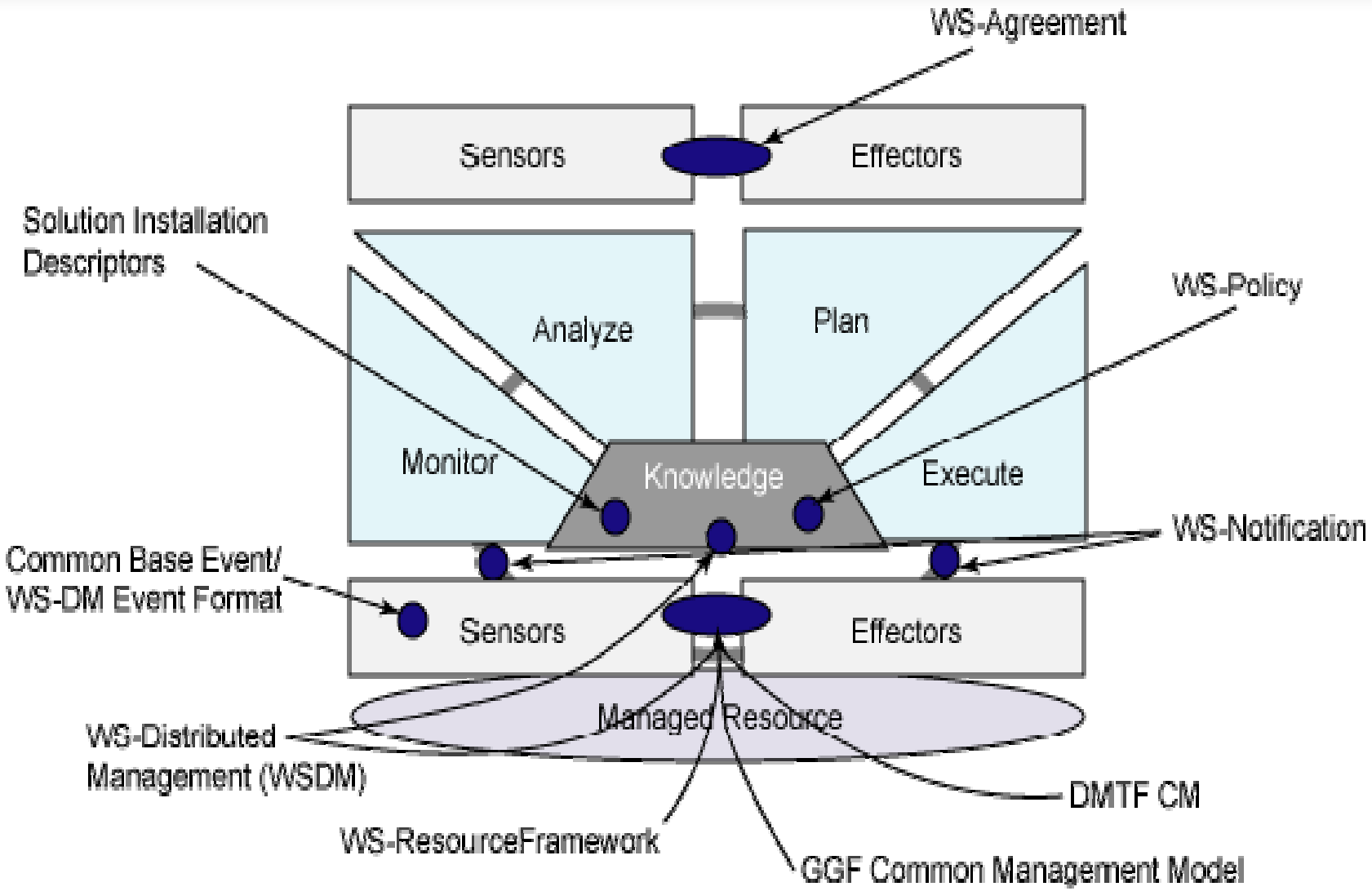

Standards Related to Autonomic Computing

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- DMTF
  - CIM, WS-CIM
  - Application Working Group
  - Utility Computing Working Group
  - Server Management Working Group
- IETF
  - Policy-Core Information Model (RFC 3060)
  - Simple Network Management Protocol (SNMP)

Standards Related to Autonomic Computing

- OASIS
  - Web Services Security (WS-Security)
  - Web Services Distributed Management (WS-DM)
  - Web Services Resource Framework (WS-RF)
  - Web Services Notification (WS-N)
- SNIA
  - Storage Management Initiative Specification (SMI-S)

Standards Related to Autonomic Computing

GGF

- Open Grid Services Architecture (OGSA)
- Open Grid Services Infrastructure (OGSI) → OASIS WS-RF TC
- Open Grid Services Common Management Model → OASIS WS-DM TC
- Grid Resource Allocation Agreement Protocol

The Open Group

- Application Response Measurement (ARM)

Management Models

- Mostly widely accepted management object model is the Common Information Model (CIM) developed by the DMTF
  - The model describes manageable objects (systems, networks, applications, and services)
    - Properties
    - Relationships
    - Methods
    - Allows for vendor extensions
  - Used as the basis for SNIA's SMI-S storage management spec
  - CIM is defined by MOF (Managed Object Format) files
  - CIM is protocol independent, but today, most CIM-based products use XML over HTTP as the protocol (WBEM)

Management Models

- Utility computing (grid computing) is using Web Services for management
  - OASIS Web Services Distributed Management (WSDM) Working Group is defining how to manage using Web Services (SOAP and XML)
  - Web Services uses WSDL (Web Services Description Language) to describe how to access a web service and what operations it can perform
    - One of the three key foundations of Web Services, along with SOAP and UDDI
    - WSDL documents are in XML format
    - Specifically includes:
      - Interface information describing all publicly available functions
      - Data type information for all messages
      - Binding info about the transport protocol
      - Address information for locating the service

Summary of the Current State of Standards

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- Several groups and organizations are pursuing standards for grid/utility
  - Trying to be cooperative and non-overlapping, but this may get difficult as the number of groups increases
  - However, there is a small core of people that span many of the groups
  - IBM has dedicated lots of resources to the standards activities
- Need a simple, but powerful taxonomy that everyone agrees with
  - Disagreements about number of layers and ordering
  - Something like the network stack (L1-L7)
- Some pieces of the puzzle need more attention
  - Application management
  - Security
  - Data Access

Autonomic Computing

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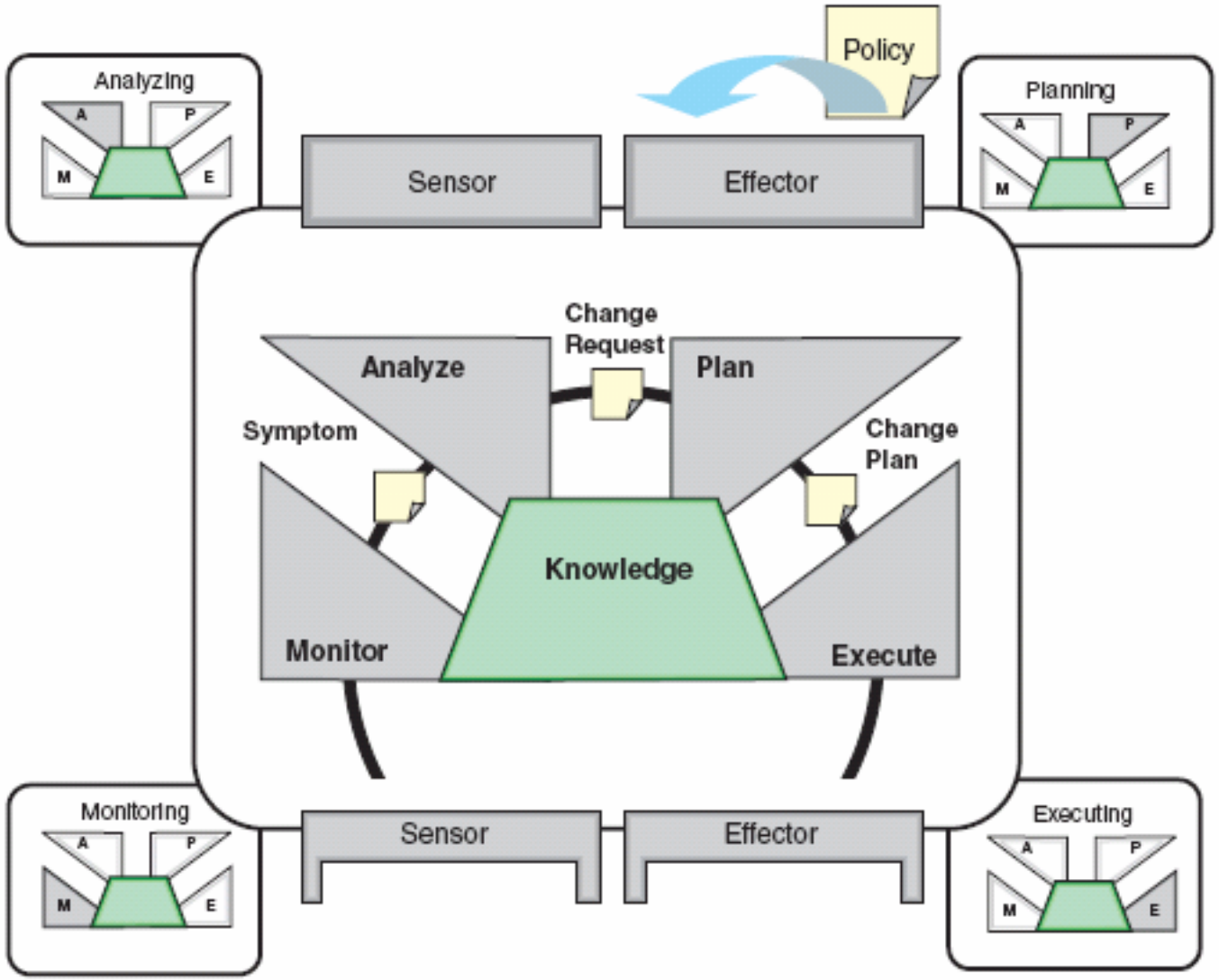
- Human biology → Autonomic nervous system
  - Monitors heartbeat, Checks blood sugar level
  - Keeps body temperature close to 36.5℃
  - w/o any conscious effort
  - Decisions are involuntary

- IT System → Self-managing
  - Monitor event, Control it
  - Anticipate system requirements and resolve problems
  - With minimal human intervention
  - Delegate to the technology according to policies

Control Loop



Control Loop - Monitor

- Collects the details from the managed resources via touchpoints
- Correlates and filters them into symptoms that can be analyzed
- Configuration, status, offered capacity and throughput, …
- Static or changing slowly
- Dynamic or changing continuously through time

Control Loop - Analyze

- Mechanism to observe and analyze situations to determine if some change needs to be made
- Responsible for determining if the autonomic managers can abide by the established policy
- Prediction technique such as time-series forecasting and queueing models
- Complex data analysis and reasoning on the symptoms

Control Loop - Plan

- Creates and selects a procedure to enact a desired alteration in the managed resources
- Generate the appropriate change plan – a desired set of changes for the managed resources
- Passes that change plan to the execute function

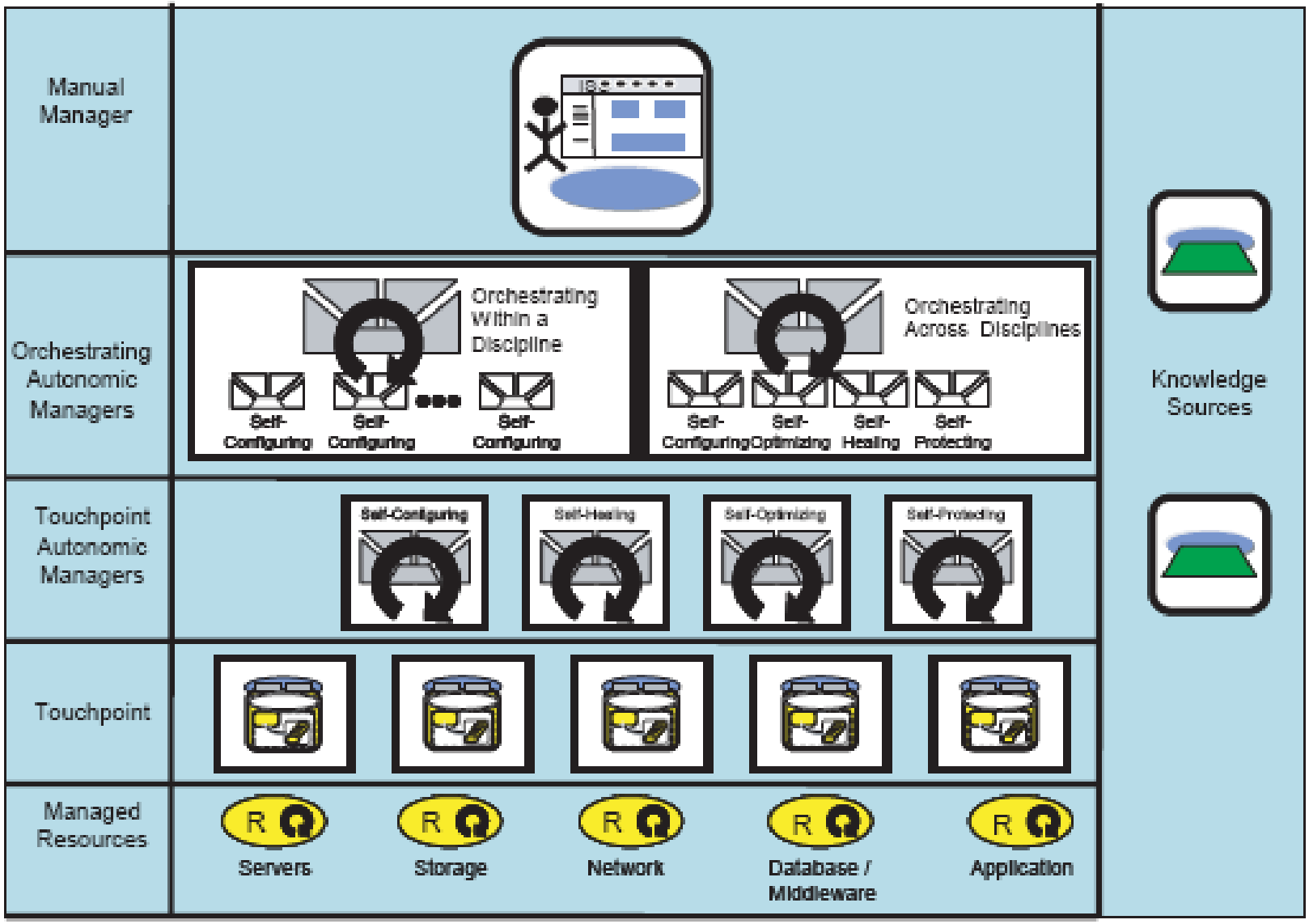
Control Loop - Execute

- Schedule and perform the necessary changes to the system
- Responsible for carrying out the procedure that was generated by the plan function
- Using the touchpoint effector interface of a managed resources
- Involve updating the knowledge that is used autonomic manager

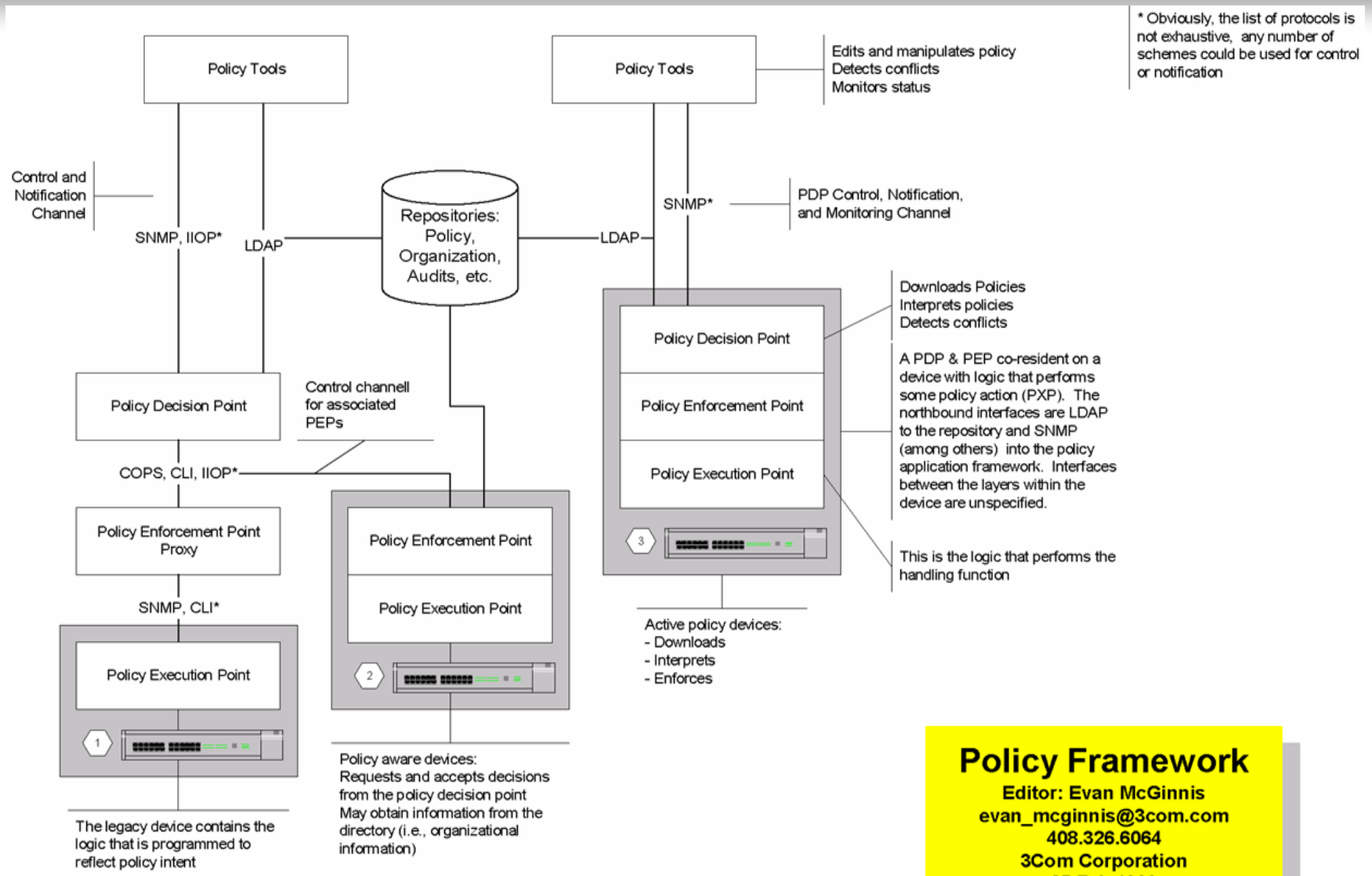
Control Loop - Knowledge

- Data used by the autonomic manager's four function (monitor, analyze, plan, execute) are stored as shared knowledge
- Topology information, historical logs, metrics, symptoms and policies
- Knowledge types
  - Solution Topology Knowledge
  - Policy Knowledge
  - Problem Determination Knowledge

Autonomic Computing Architecture



Policy-based Autonomous Management Framework



Policy Framework

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Autonomic Computing Architecture

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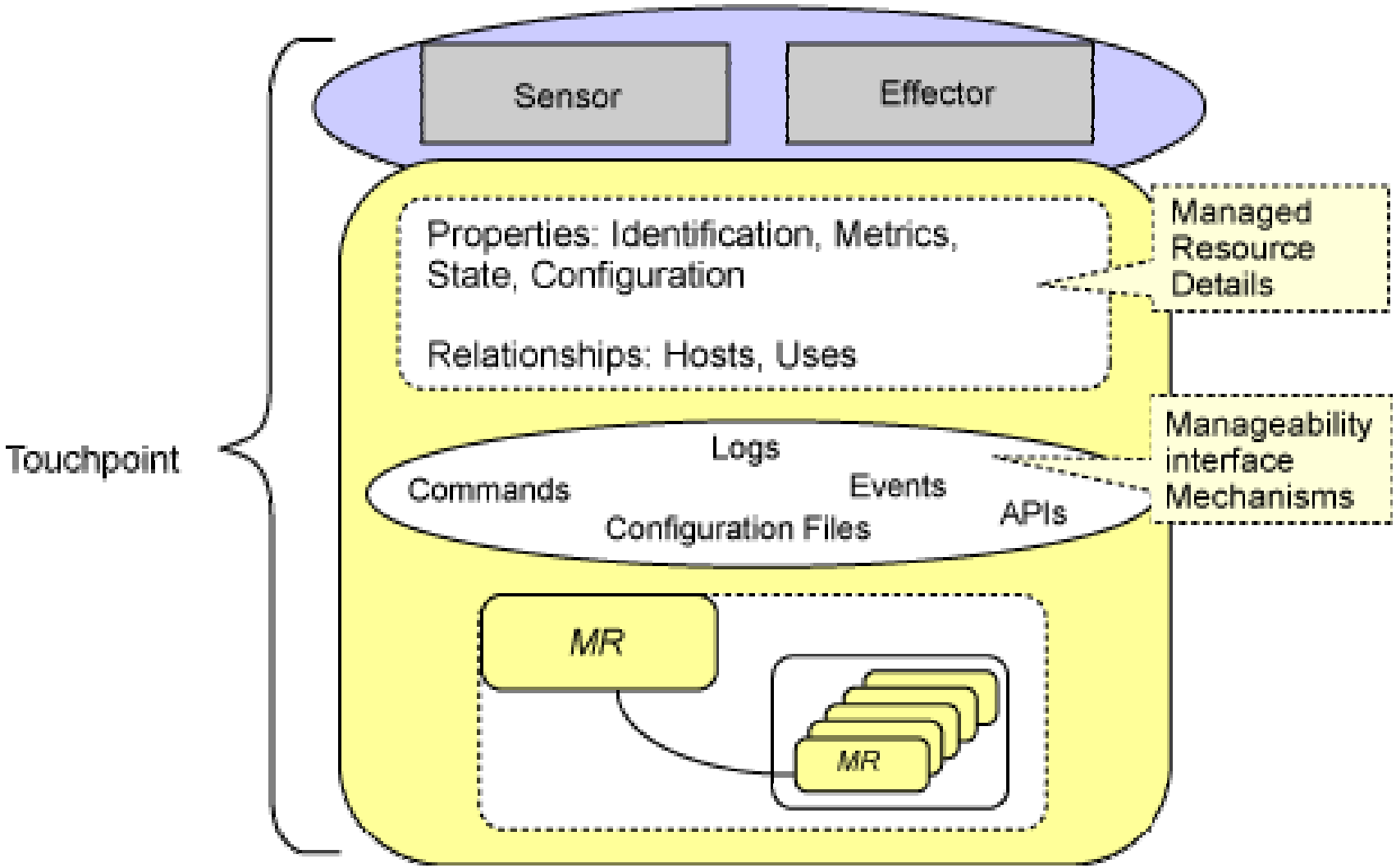
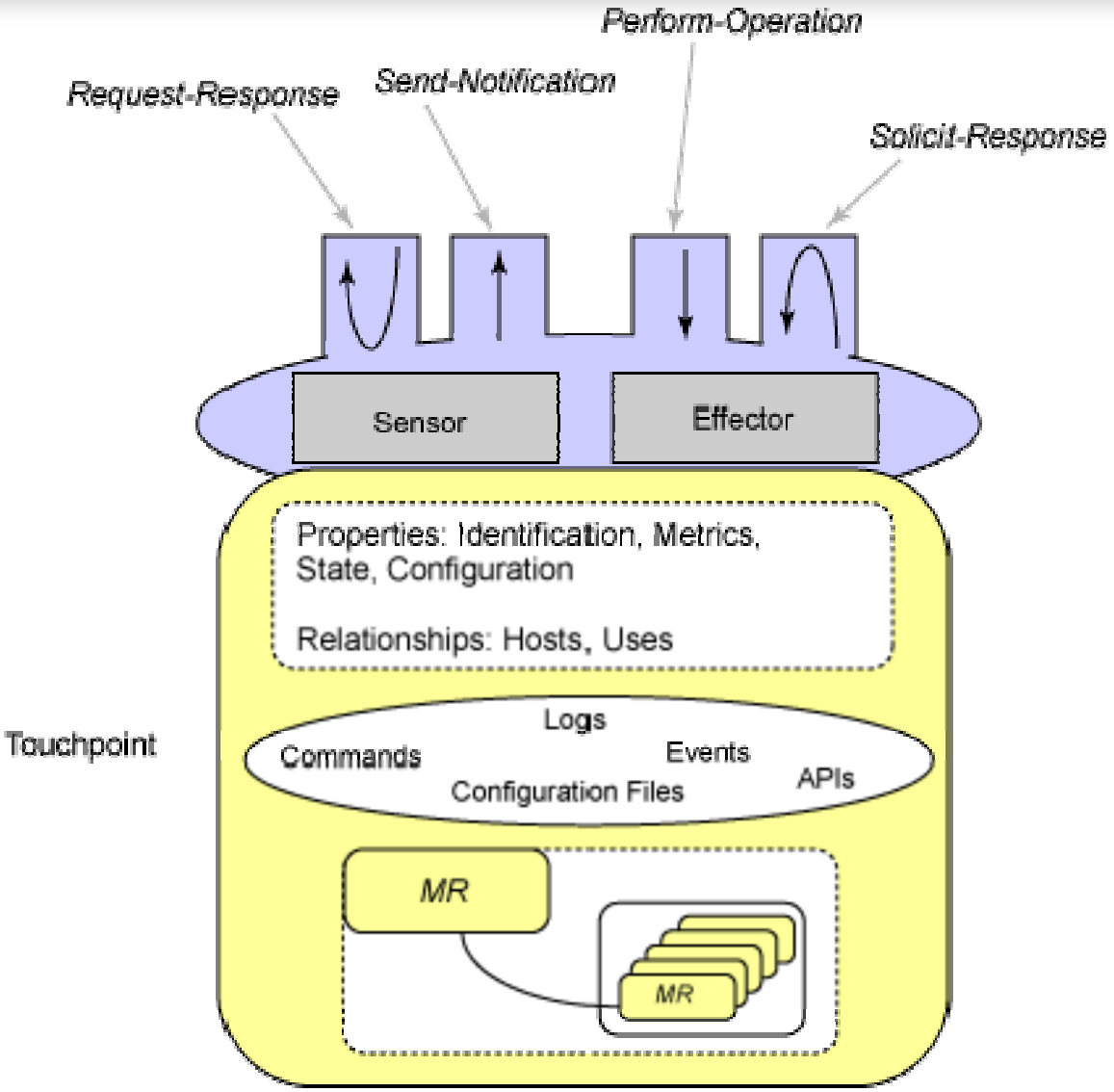
- Manual Managers (Policy Tool)
- Autonomic Managers (Policy Decision Point)
- Touchpoints for managed resources (Policy Enforcement Point)

- Knowledge Sources
  - Knowledge Base
  - Policy Repository

Touchpoint Architecture



Touchpoint Sensor & Effector Interface



Q & A

Question & Answer