

Management vernetzter IT-Systeme

Kapitel: 8 WEB-Based Management

Web Based Management

❑ Idee

- Nutzung von Web-Techniken (html, XML, http, browser, Java) für Managementzwecke

❑ Web Based Enterprise Management Initiative (WBEM):

- Microsoft, Intel, Compaq, Cisco, DMTF,...
- CIM MOF XML (früher HMMS, HMMP)
- siehe: www.dmtf.org

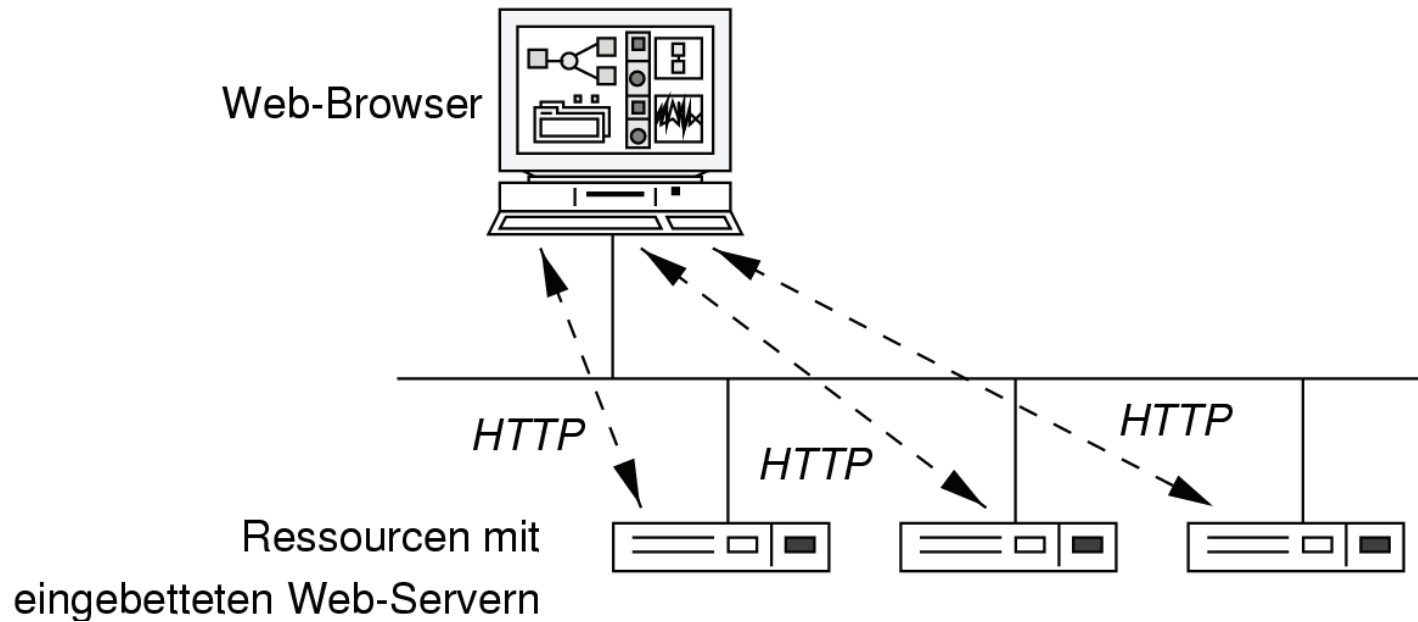
❑ Java Management API (JMAPI):

- Sun, Javasoft, Bay Networks, 3Com,...
- Java enabled Web browser, AVM, RMI, AWT
- siehe: java.sun.com/products/JavaManagement

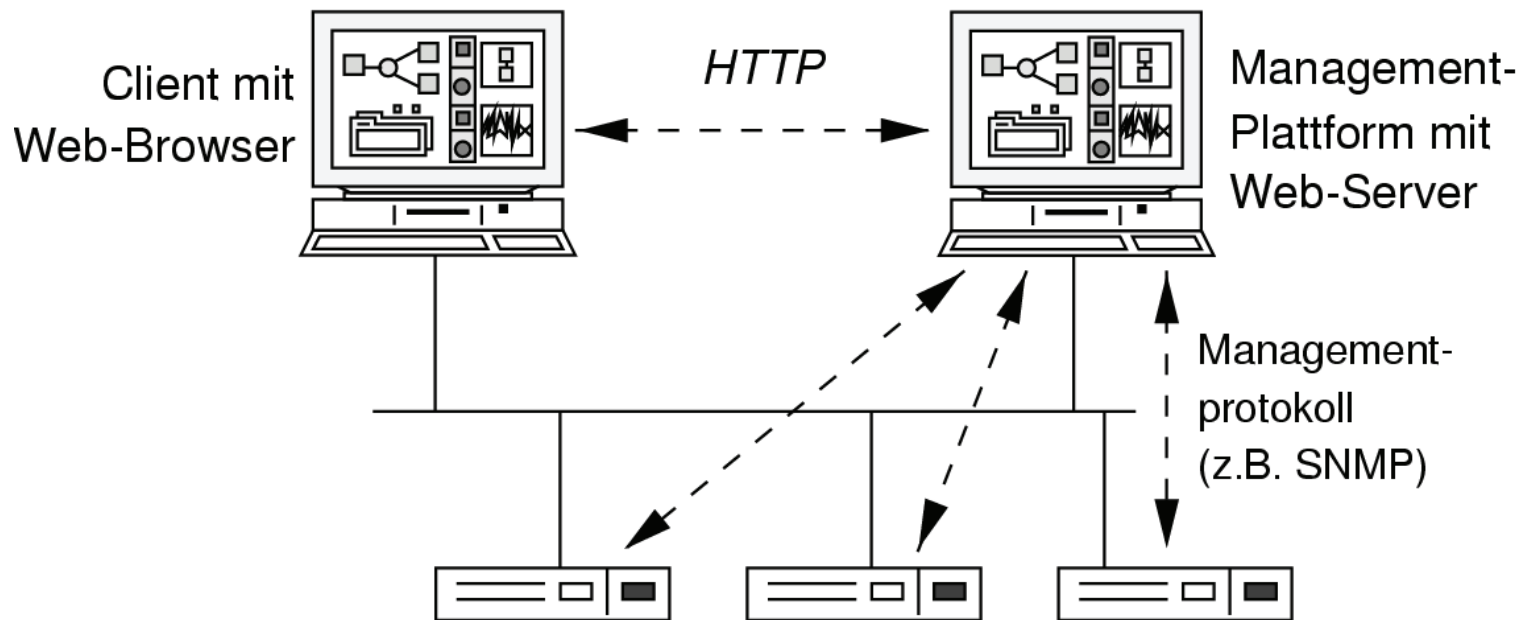
❑ WebService Distributed Management (WSDM)

- OASIS WSDM, DMTF, GGF
- SOA based management

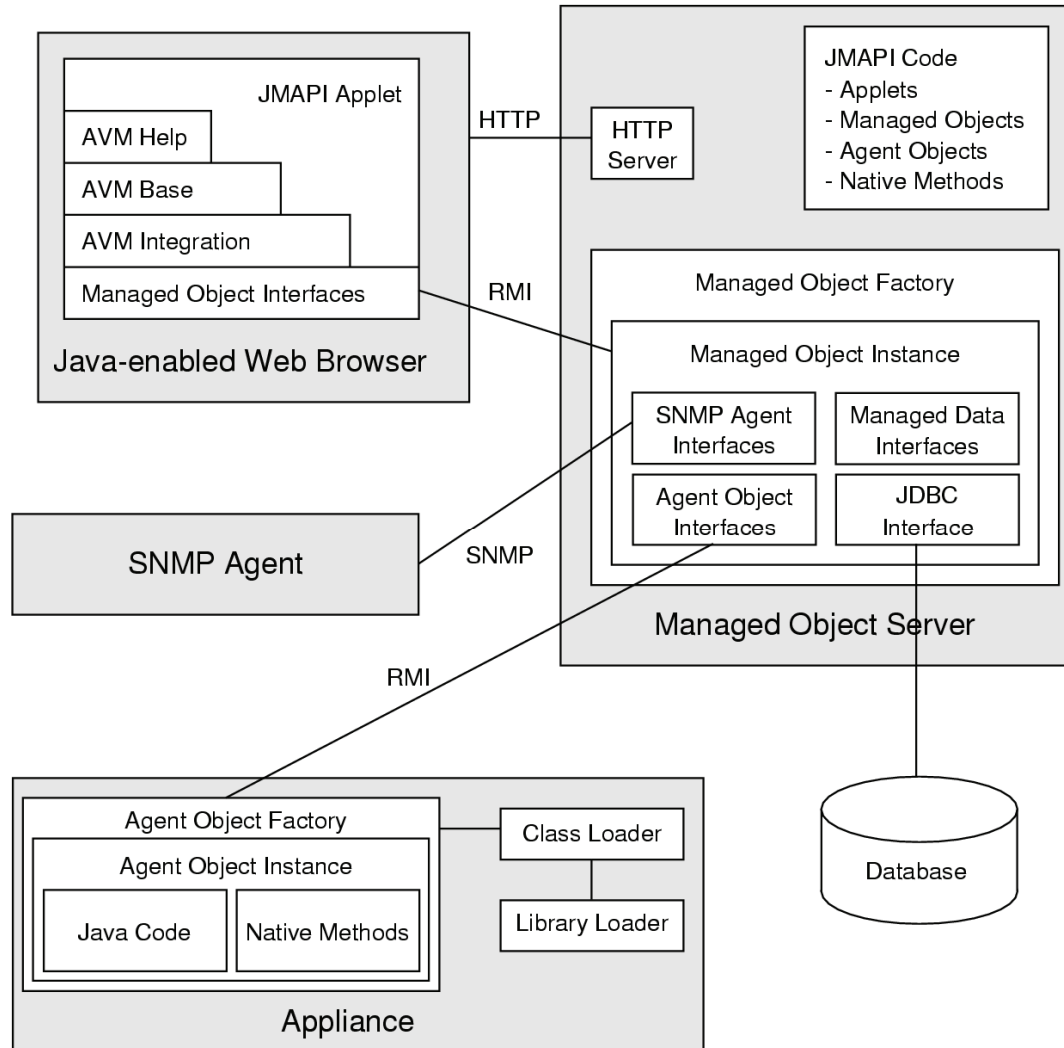
Web-based Management mit eingebetteten Web-Servern



Web-based Management mit Proxy



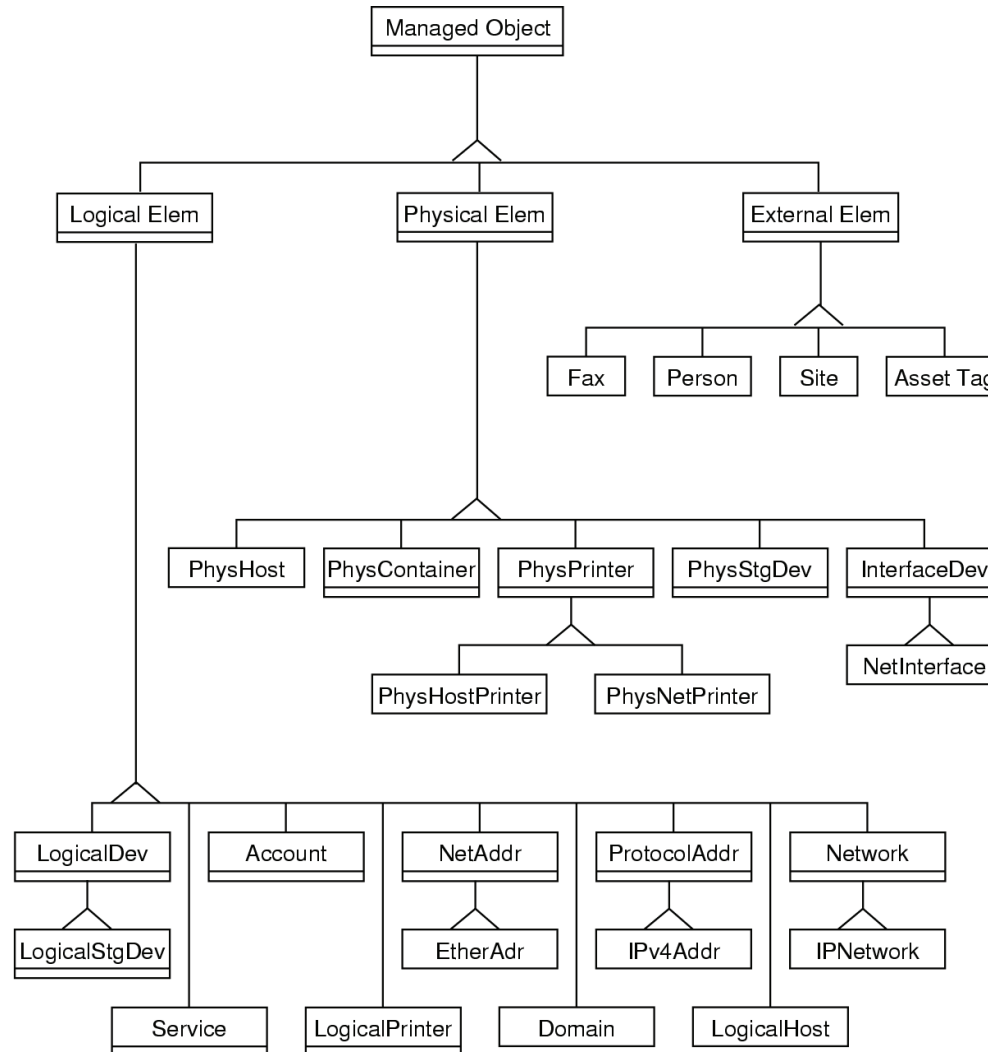
Architektur der JMAPI



JMAPI Objektmodell

- ❑ Verfeinerung des Objektmodells von JAVA
- ❑ Modell für MOs vorgegeben durch Schnittstelle *ManagedObject*
- ❑ Objekte sind Agenten-Objekte oder Datenbankobjekte, residieren im Server
- ❑ Schnittstellen-Methoden
 - Zugriff auf Attribute
 - Verwaltung von Beziehungen
 - Management von Ereignismeldungen
 - Abwicklung von Transaktionen

JMAPI – Object Model



JMAPI: Architecture Components (1)

❑ Browser User Interface:

- Admin View Module (AVM): classes for the development of JMAPI-based applets extending the AWT (abstract window toolkit). AVM Help, AVM Base, AVM Integration
- Managed Object Interfaces: use RMI to perform remote management methods.
- Java-enabled Web Browser: commercial web browser

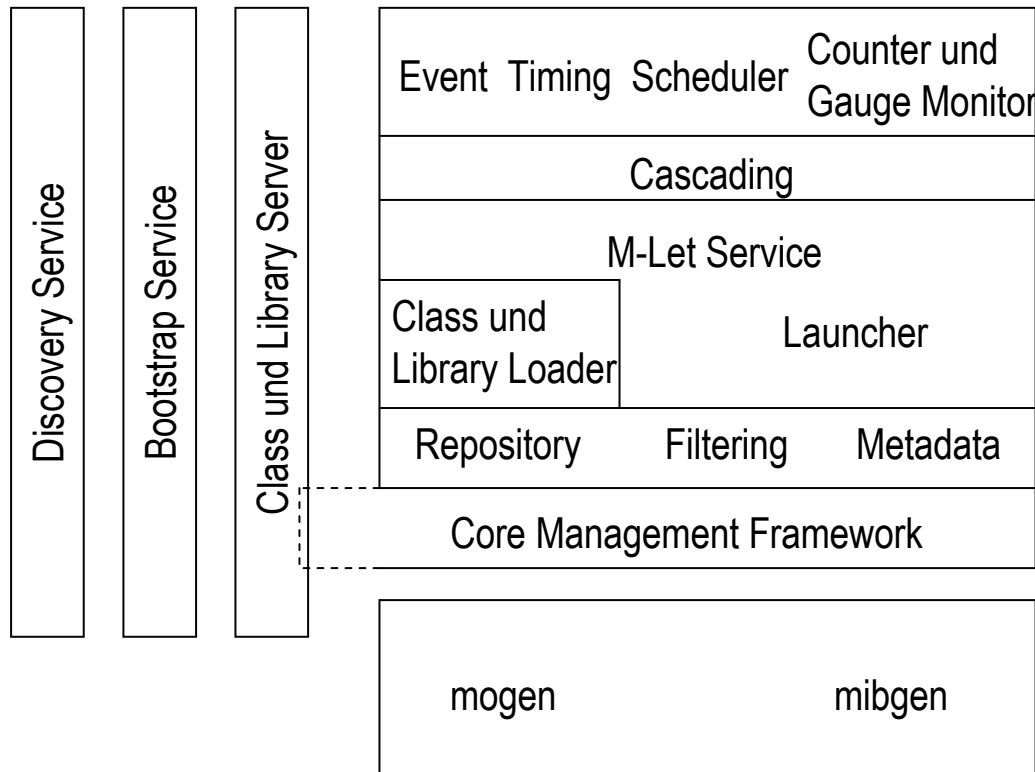
❑ Appliance: (managed system)

- Agent Object Factory: creates and maintains instances of agent objects
- Agent Object Instance: are RMI remote objects that call Java classes or native methods (SNMP) to implement a management operation.

JMAPI: Architecture Components (2)

- ❑ Admin Runtime Module: provides active instantiated management objects.
 - HTTP server: necessary to use a web browser
 - Managed Object Factory: implements actual management operations through interactions with Agent Object Interfaces and Managed Data Interfaces.
 - Managed Data Interfaces: support mapping attributes of extensions to the Base Object Interfaces to a relational database; implemented on a subset of the Java Database Connectivity (JDBC)
 - Agent Object Interfaces: interfaces to agent objects residing on the appliance
 - Notification Dispatcher: filtering and forwarding of events from the appliance

JDMK Plattformdienste



vordefinierte Managementfunktionen

Strukturierungsdienst

Updatemechanismen, Versionsverwaltung

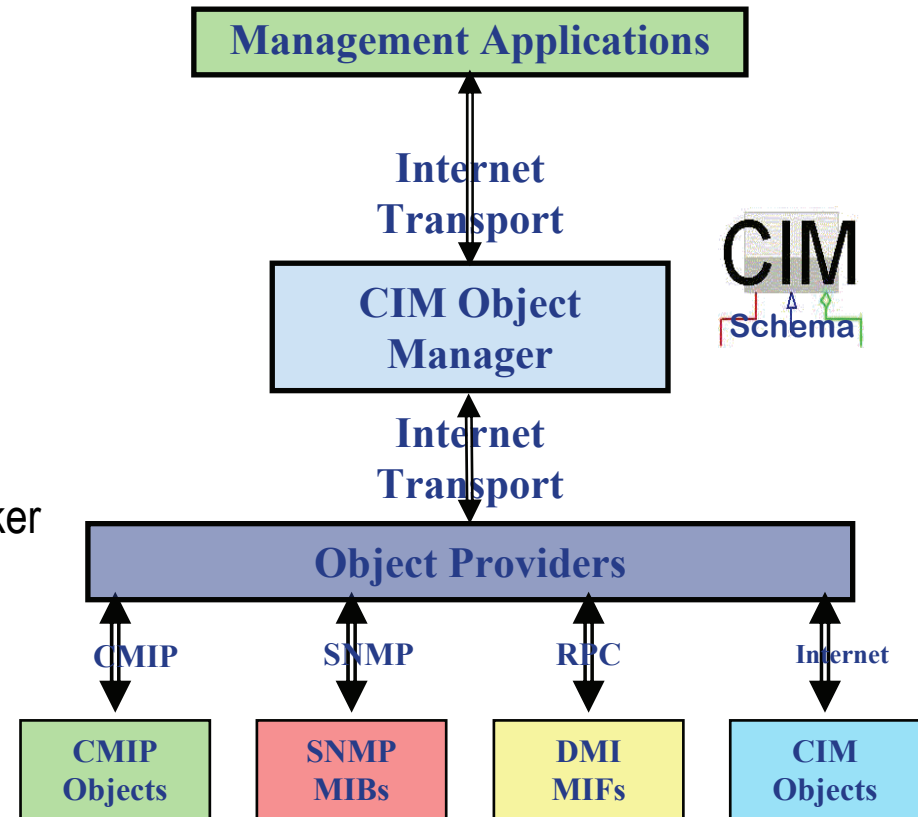
dynamische Erweiterung der Agenten

Basisdienste

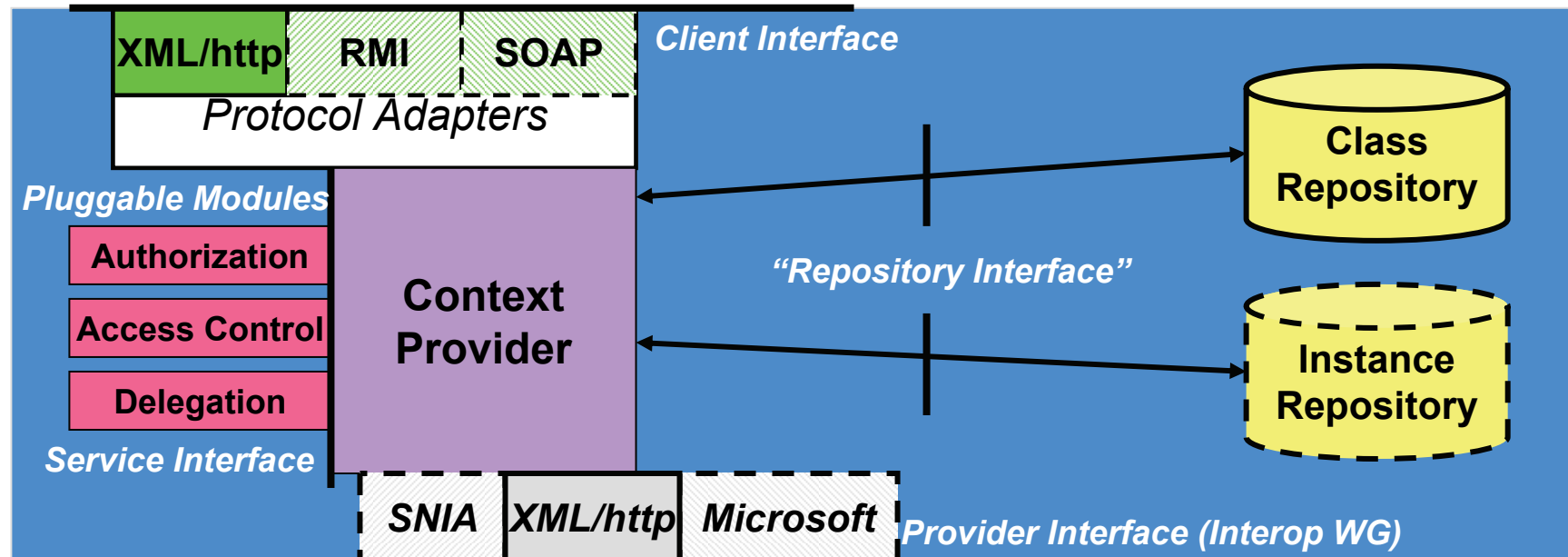
Entwicklungswerkzeuge

Web-based Enterprise Management (WBEM)

- Information Model
 - CIM Schema (Core, System,...)
- Communication Model
 - CIM Operations over HTTP
- Transport Encoding
 - XMLcim – CIM/XML mapping
- Function Model (Generic Management Services)
 - TOG Manageability Services Broker
- Event Model
 - CIM indications (new in 2.5)
- CIM Object Manager (CIMOM)
 - Today: confined to a single host
 - Distributed CIMOMs planned
- Object Providers
 - Instrumentation subagents



Architecture of a CIMOM: TOG MSB



- Manageability Services Broker is a PD implementation of the OpenGroup
- Pluggable Modules: dynamic service extensions, (cf. Apache modules)
- Provider IF: Allows Interoperability with various Providers
- Repository IF: Provider IF + 2 methods for Namespace creation/deletion
- Today: Functionality similar to AgentX main agent

WBEM

❑ Architektur:

- Client, Server (CIM ObjectManager, Provider)

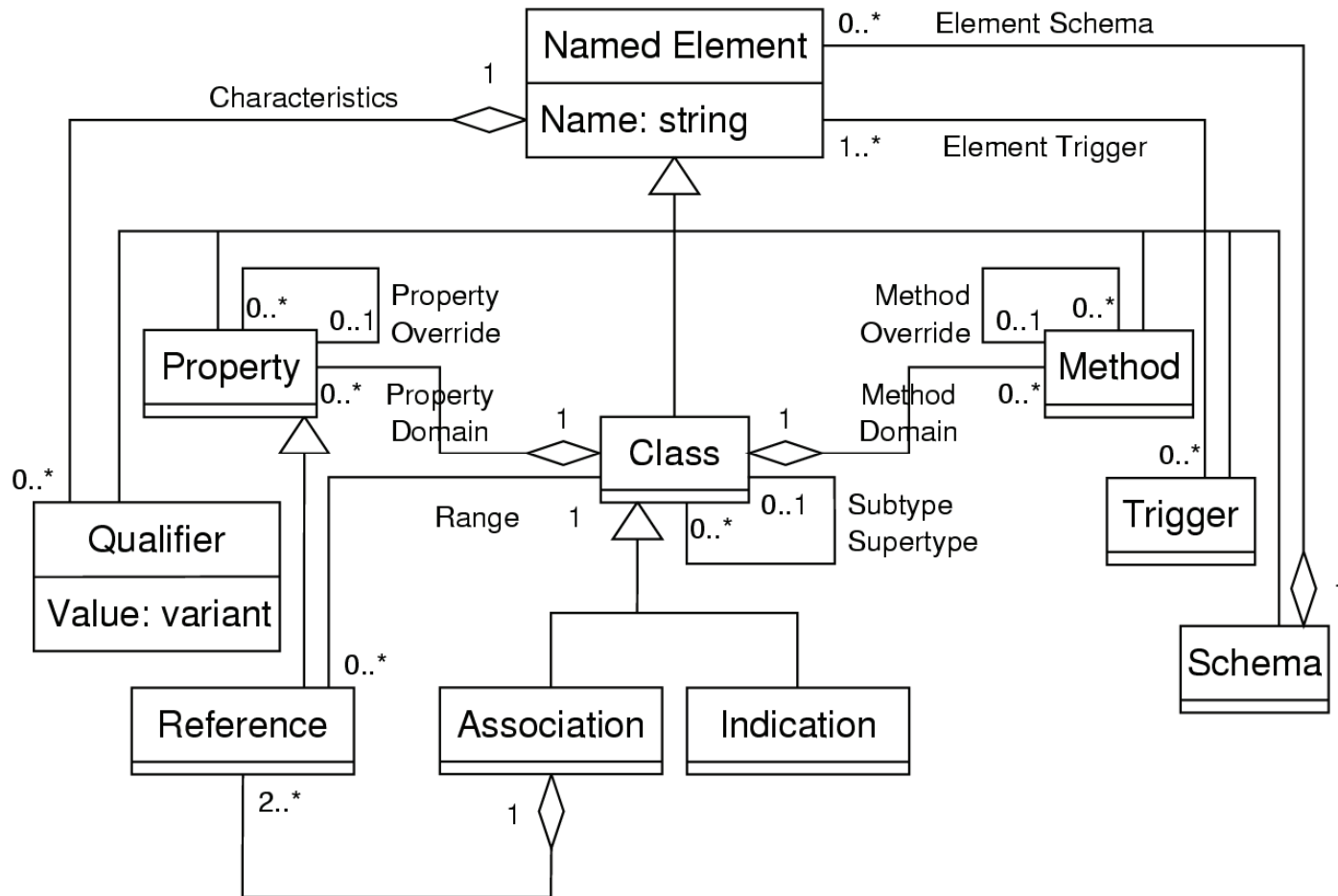
❑ Protokoll:

- früher HMMP bzw. DCOM, dann HTTP-NG

❑ Informationsmodell CIM

- Meta-Schema (beschrieben mit UML)
- Syntax für MO-Beschreibung (MOF), vergleichbar GDMO oder SMI
- Vererbungshierarchie mit drei Schichten (Core Model, Common Model, Extension Schema)
- Repräsentation von CIM in XML mittels DTD und XSL
- Weiterentwicklung wird von DMTF betrieben

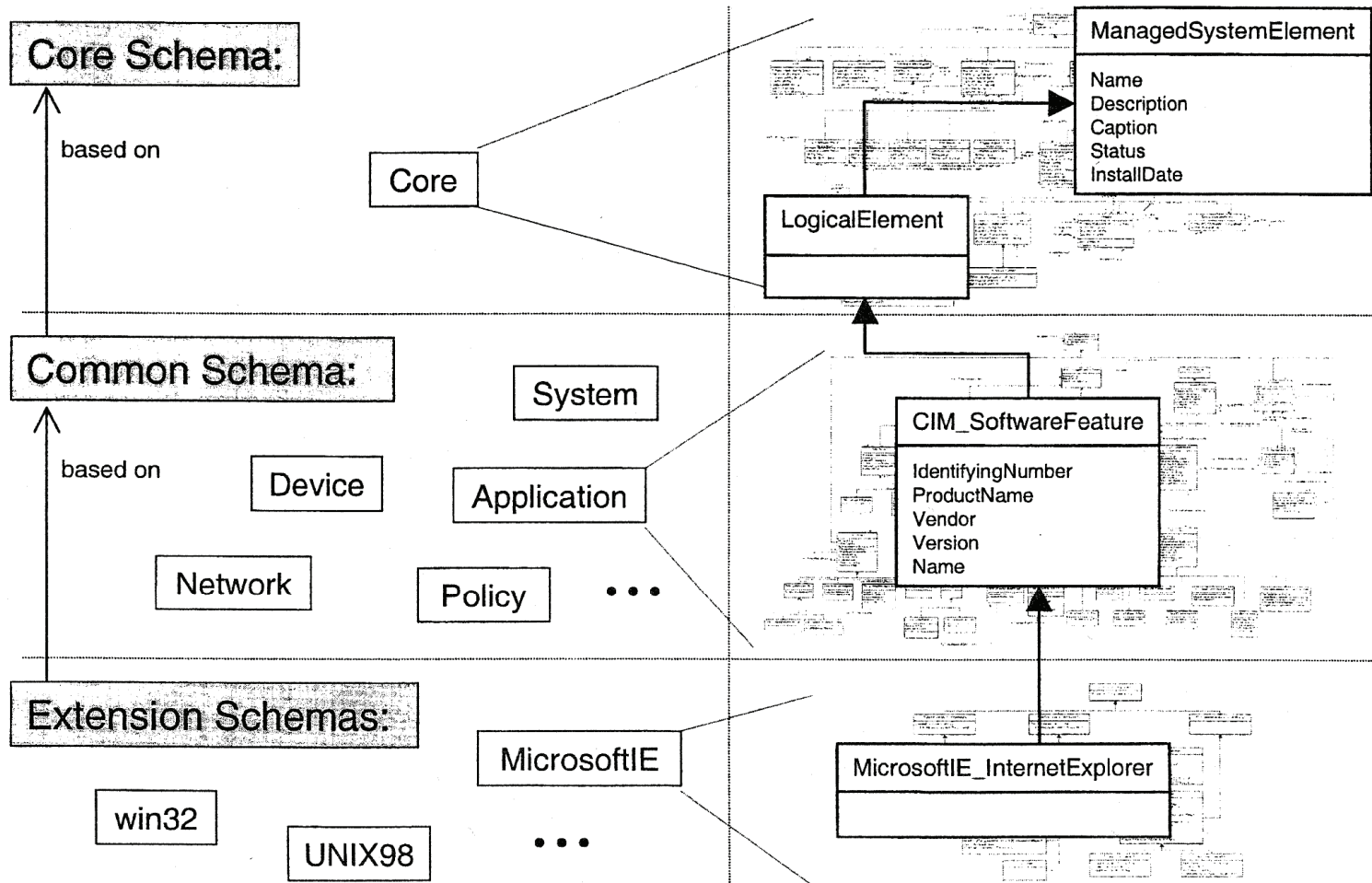
Aufbau des CIM Metaschema



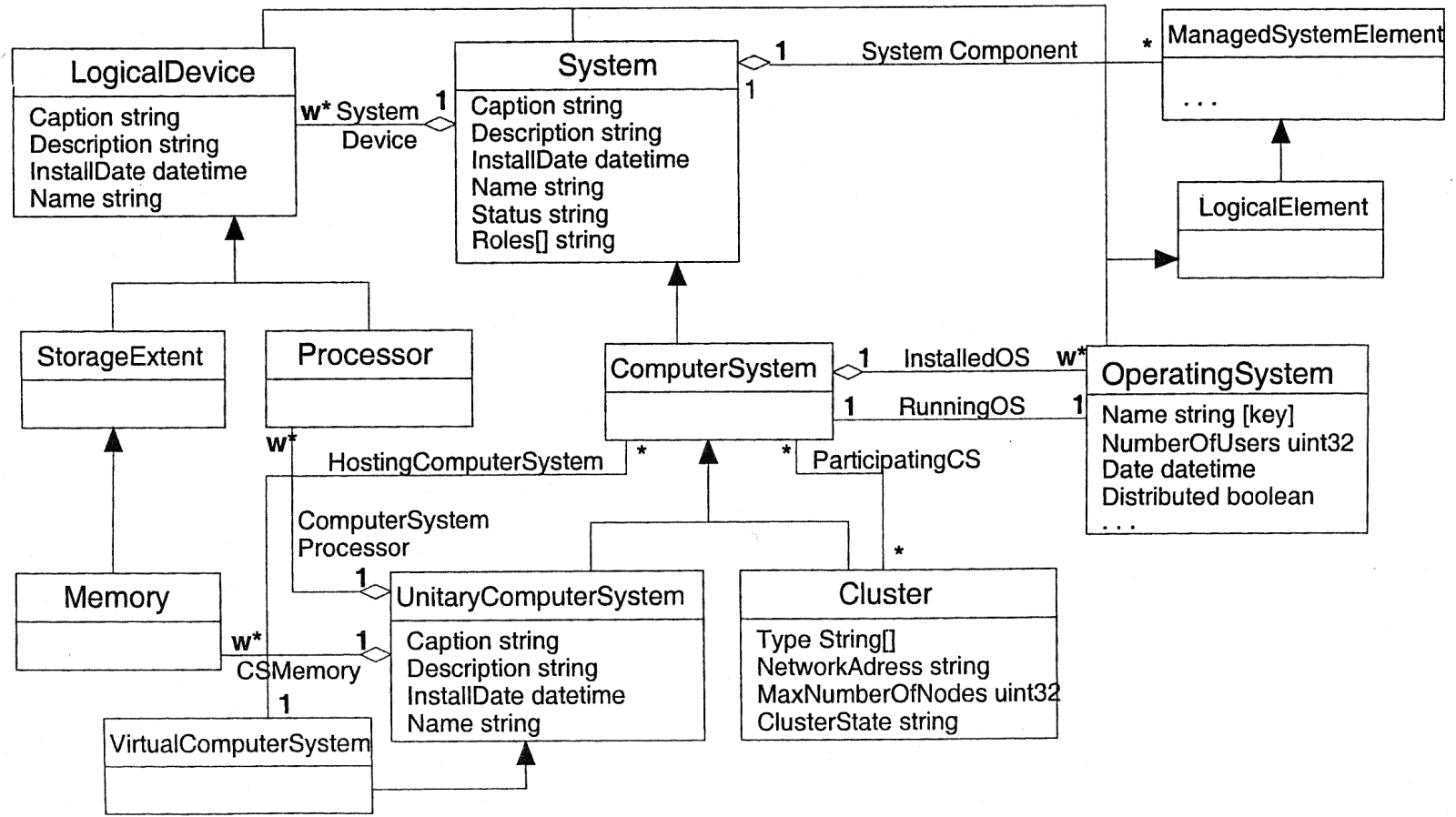
CIM Aufteilung

- ❑ Core Schema
beschreibt grundlegende Aspekte des Managements von Systemen
- ❑ Common Schema
beschreibt Aspekte eines bestimmten Teilgebietes des Managements (z.B. Netzwerke, Applikationen,...), jedoch unabhängig von einer bestimmten Technologie oder Implementierung
- ❑ Extension Schema
beschreibt technologie-abhängige Aspekte des Management-
Informations-Modells, bietet Möglichkeit zur Erweiterung

Common Information Model (CIM)

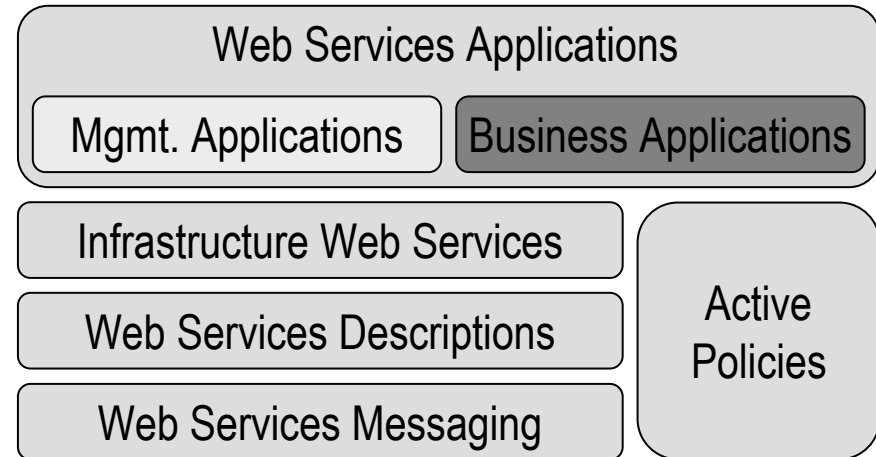


CIM System Schema



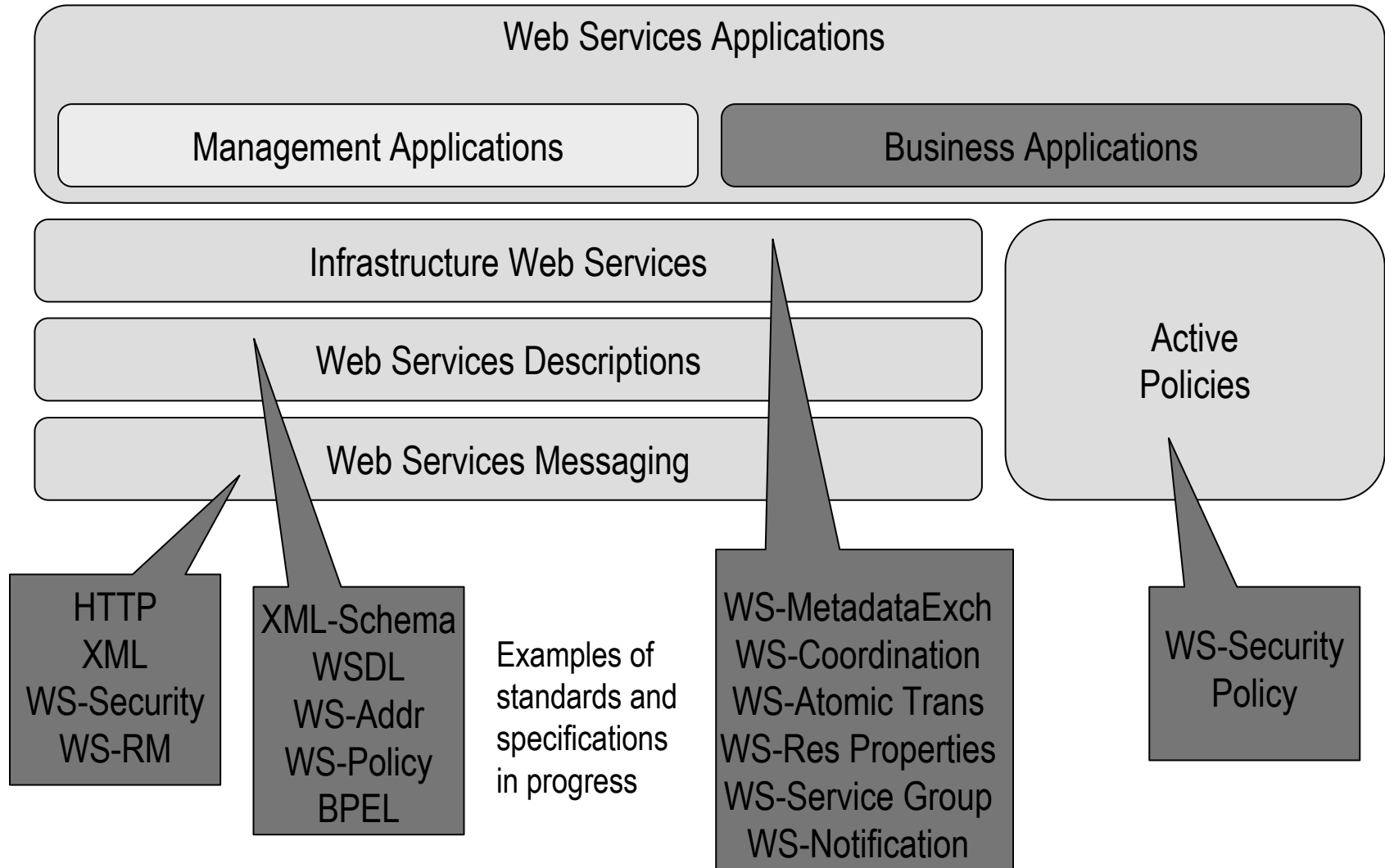
Foundation for SOA Based Management: Web Services

- ❑ Standards based approach to resource manageability to help simplify the integration of management solution for both existing systems and systems based upon emerging Service- Oriented Architectures (SOA)
- ❑ Web services based architecture to help facilitate integration and interoperability across different management models and technologies in a platform and language-neutral way
- ❑ “Protocol Level” Interoperability
- ❑ IT Management is a Web services application



- ❑ Distributed system interoperability and integration
- ❑ Rich metadata and self description
- ❑ Abstraction and encapsulation
- ❑ Platform and programming language neutral
- ❑ Industry Standards
- ❑ Runtime leverage
- ❑ Tooling leverage
- ❑ Dynamic (Public/Find/Bind) and Loose Coupling

Foundation - Web Services Architecture



Web Services: Protokollstapel

Web Service Application

Service Discovery / Publication | UDDI

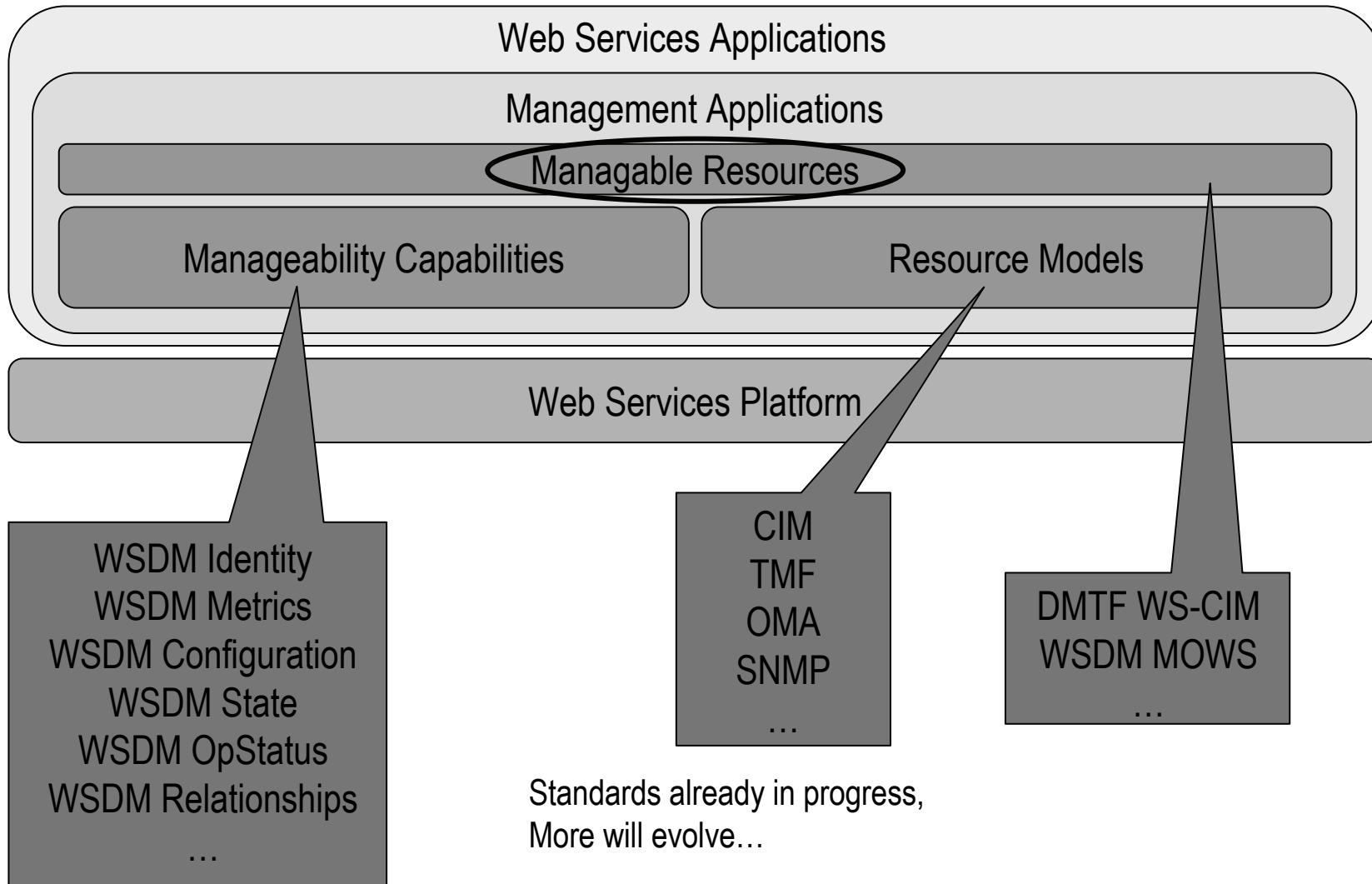
Service Description using XML | WDSL

XML based Messaging / Packaging | SOAP

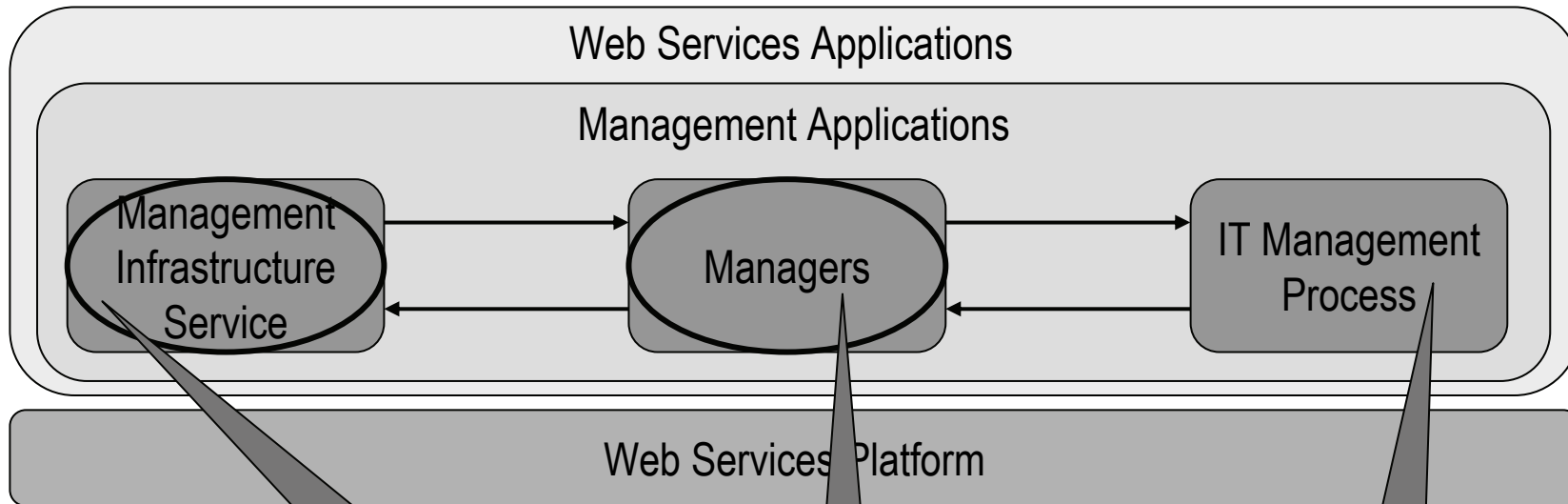
Application Transport Protocols | HTTP / SMTP

Internet Network / Transport | TCP / IP

Resources



Managers



Examples of what may evolve in managers, what standards are needed is to be determined

- Metering
- Monitoring Svcs
- Event Mediators
- Metric Mediators
- Inv. Scanning
- Policy Enforces
- Policy Mgrs

Monitor Provision

Configuration

A Common Platform for Management

Web Services & Management Requirements

DMTF

- access to CIM resource models
- description of CIM resource models
- Focus on resource models

OASIS WSDM

- access to manageable resources
- description of manageable resources
- Focus on manageability

GGF

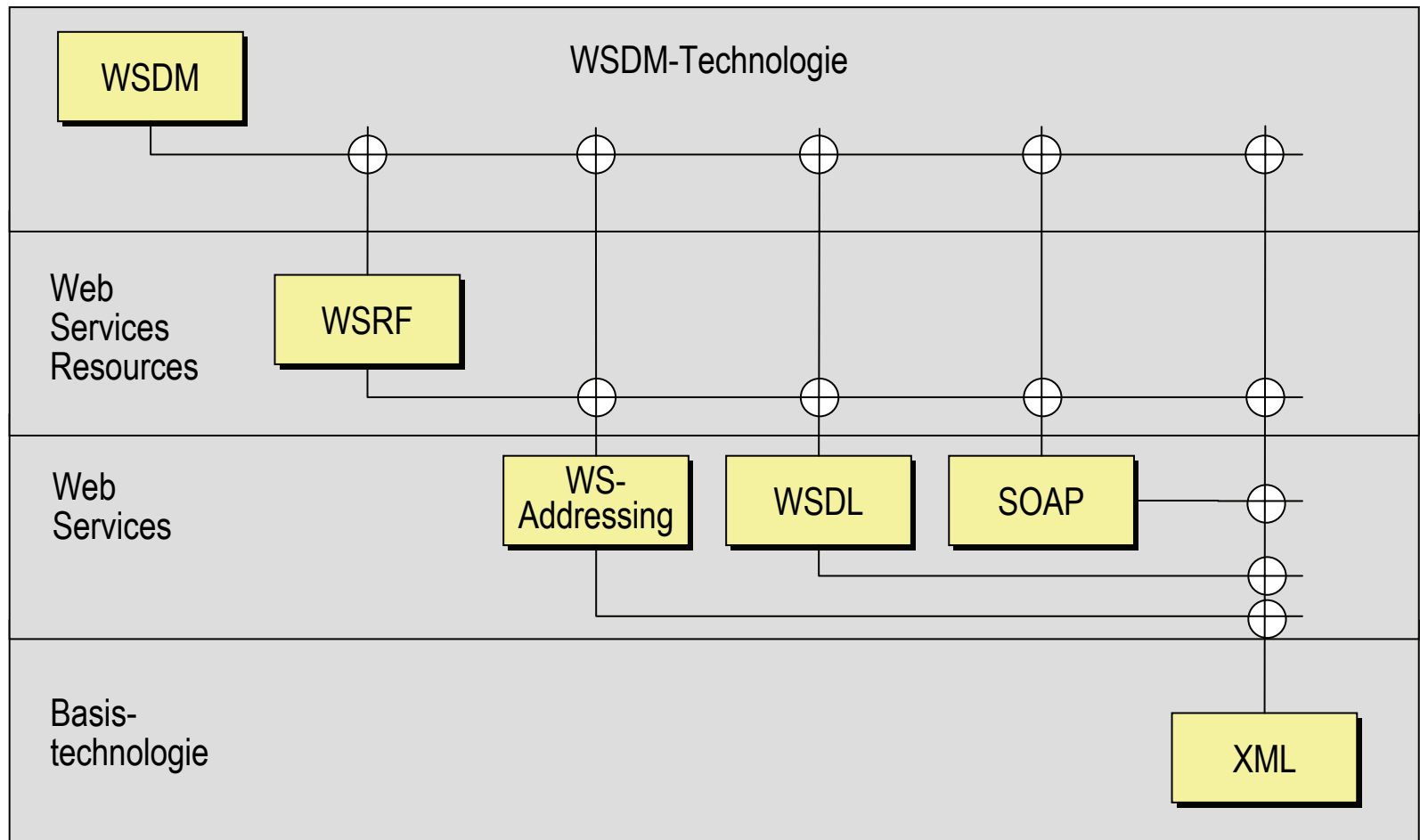
- access to virtual resources
- description of virtual resources
- Focus on grid application

Multiple management standards communities need a common management platform of Web Service to access resources in a common way

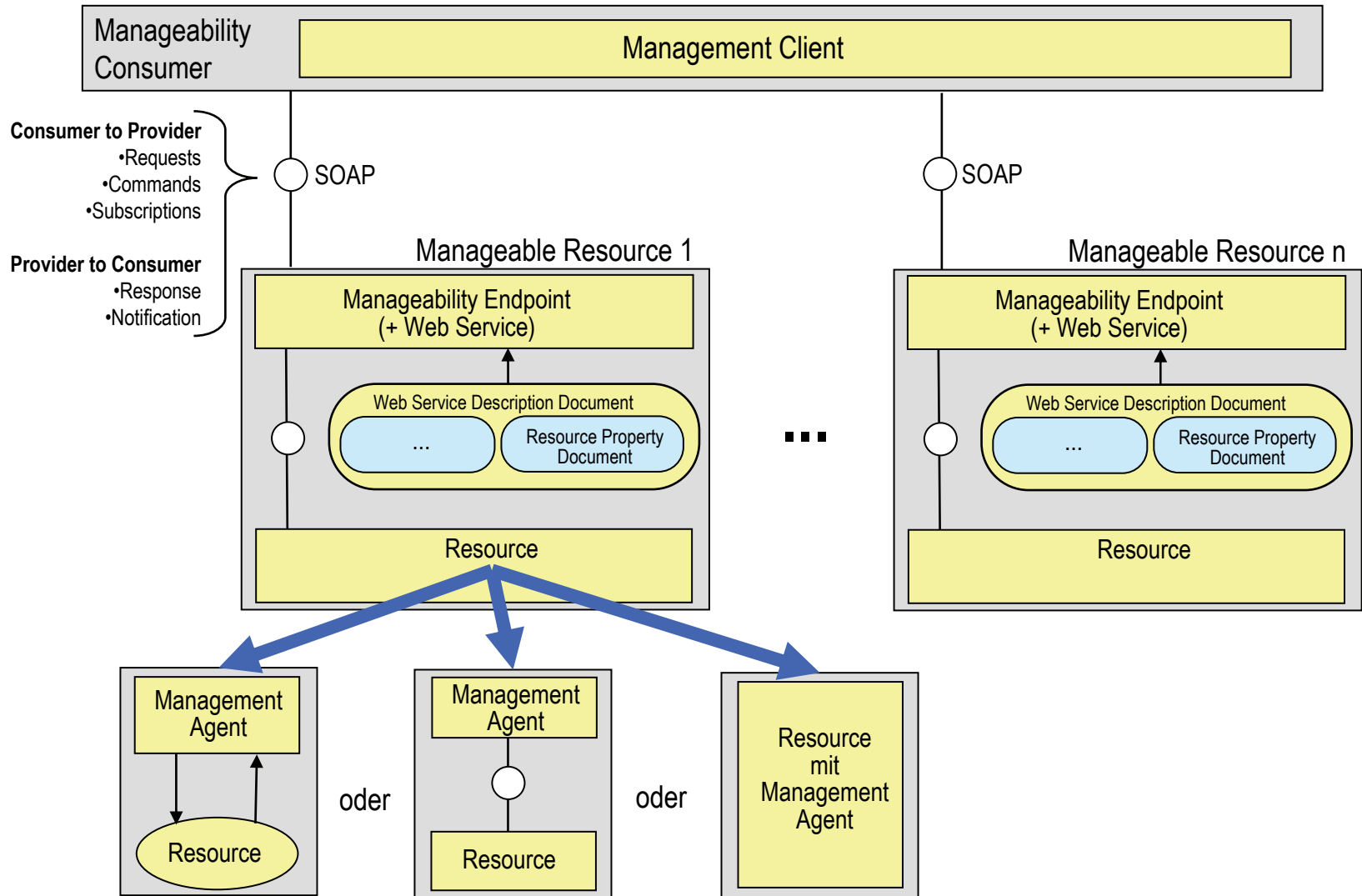
WSDM-Terminologie

- MUWS: Management Using Web Services
- MOWS: Management Of Web Services
- Web Service Endpoint: spezielle Adresse, um auf Web Services zugreifen zu können
- WS-Resource: Web Service, der die XML Repräsentation einer Ressource offen legt
- Manageable Resource: WS-Resource mit „Manageability Capabilities“
- Manageability Endpoint: WS-Endpoint, über den eine „manageable resource“ gemanagt werden kann

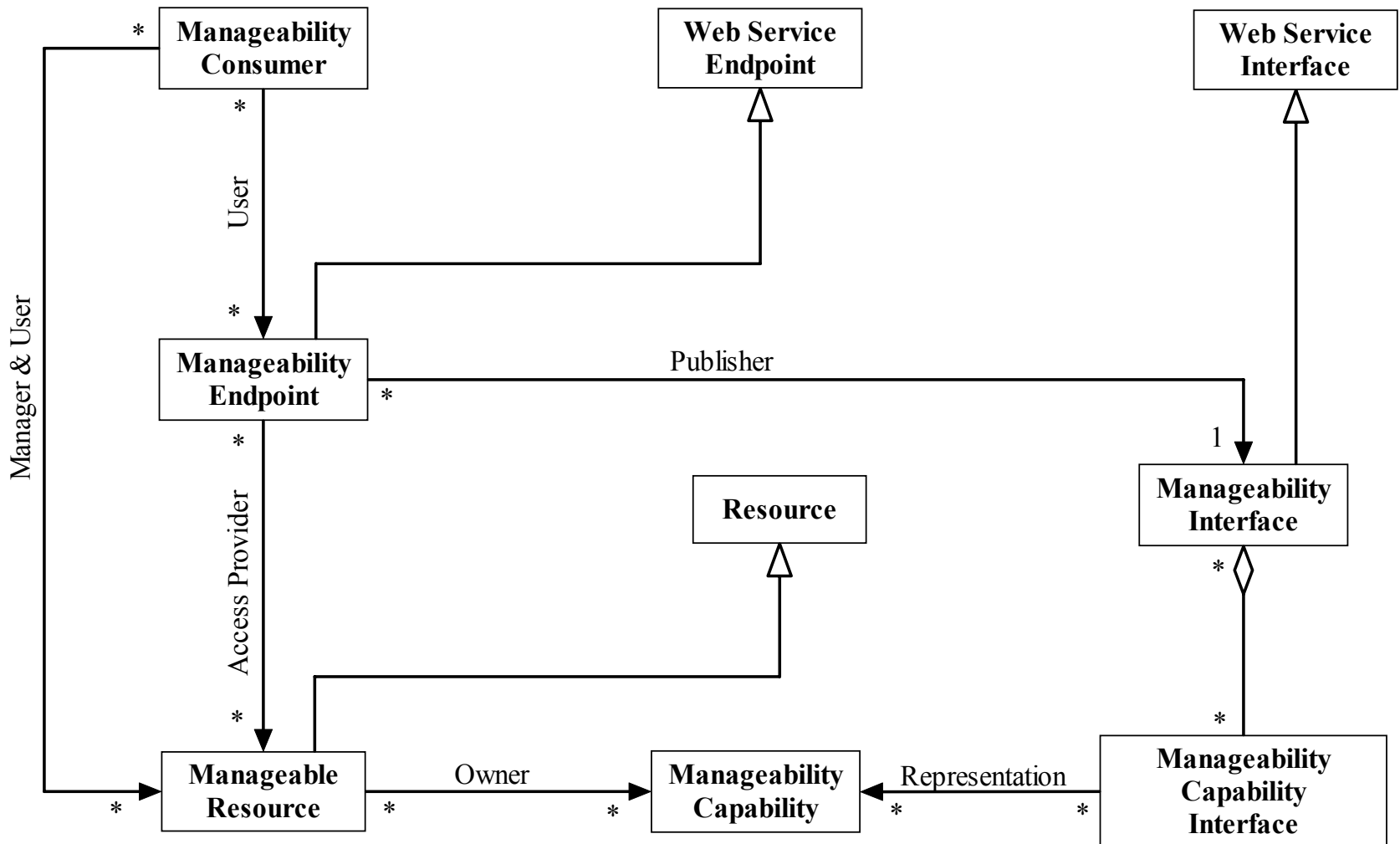
WSDM Technology Stack



WSDM-Architektur (nur MUWS)



Abhängigkeiten (nur MUWS)



Management Using Web Services: Key Concepts

- Profile on use of WS-Resource Framework and WS-Notification
- Resource management model agnostic
- Advice on advertising in discovering WSDM manageable resources
- Standard management event format
- Resource Identification
- Captures common resource management aspects from models

Management Using Web Services (MUWS)

□ Management Foundations

- Meta information
 - WS-Resource Metadata Descriptor in WS-Resource Framework
 - Additional descriptive information about interfaces
 - resources, properties, operations, notifications
- Relationships
 - Association between to IT resources
 - Relationship expression schema and property
- Management Event Format
 - XML format, carry events from any source
- Discovery
 - Creating manageable resources from traditional discovery engines
 - Finding resources
 - Introspection on manageability capabilities

Management Using Web Services

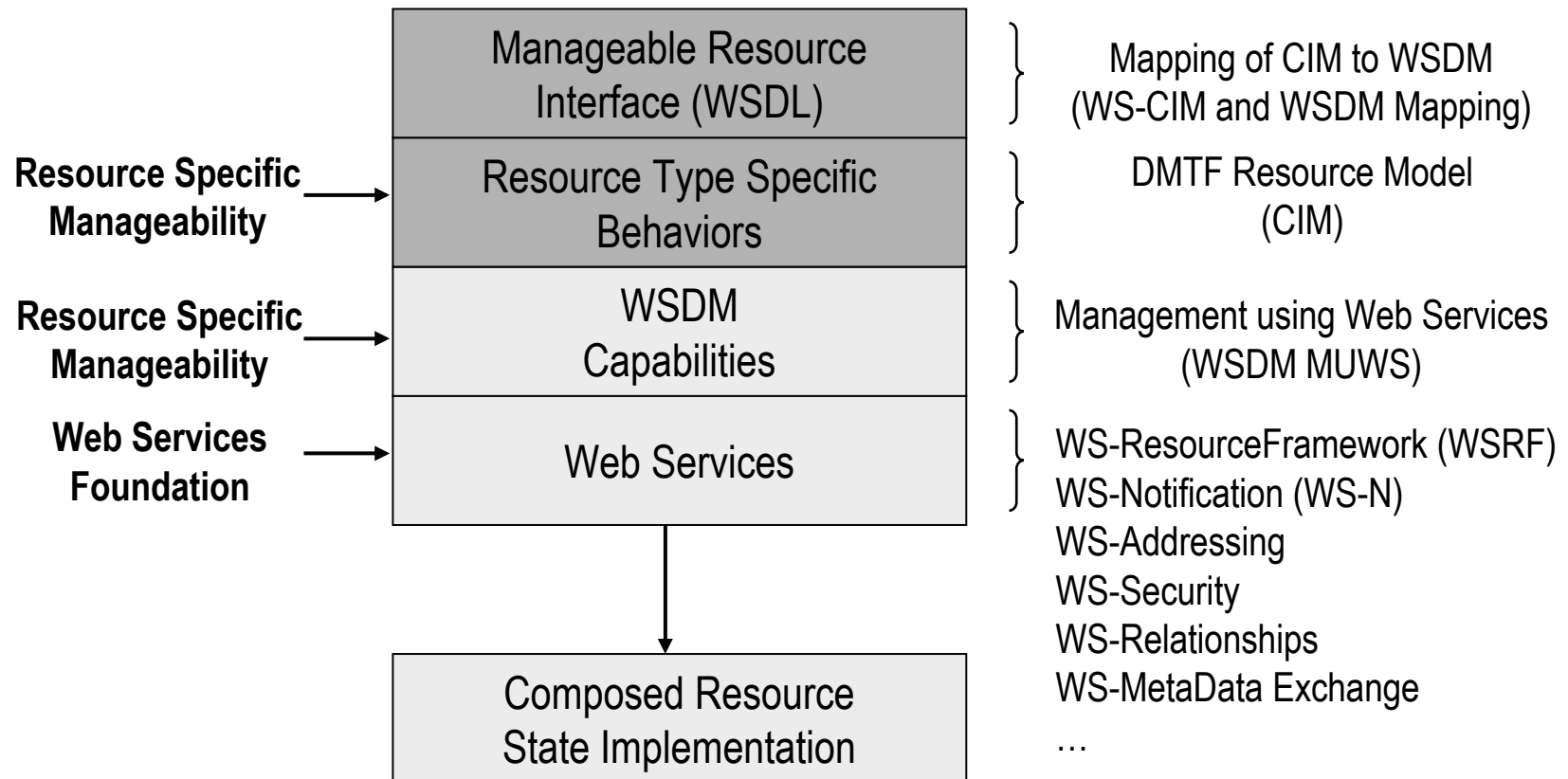
- ❑ Capabilities – Set of descriptions to enable a management task
- ❑ WSDL, WS-Resource documents, Meta Information, Policies, Notification topics
 - Identity, Description
 - Manageability Characteristics
 - Metrics
 - Operational Status, State
 - Configuration
 - Correlatable Names
 - Relationships

Management Using Web Services

❑ Manageable Resource

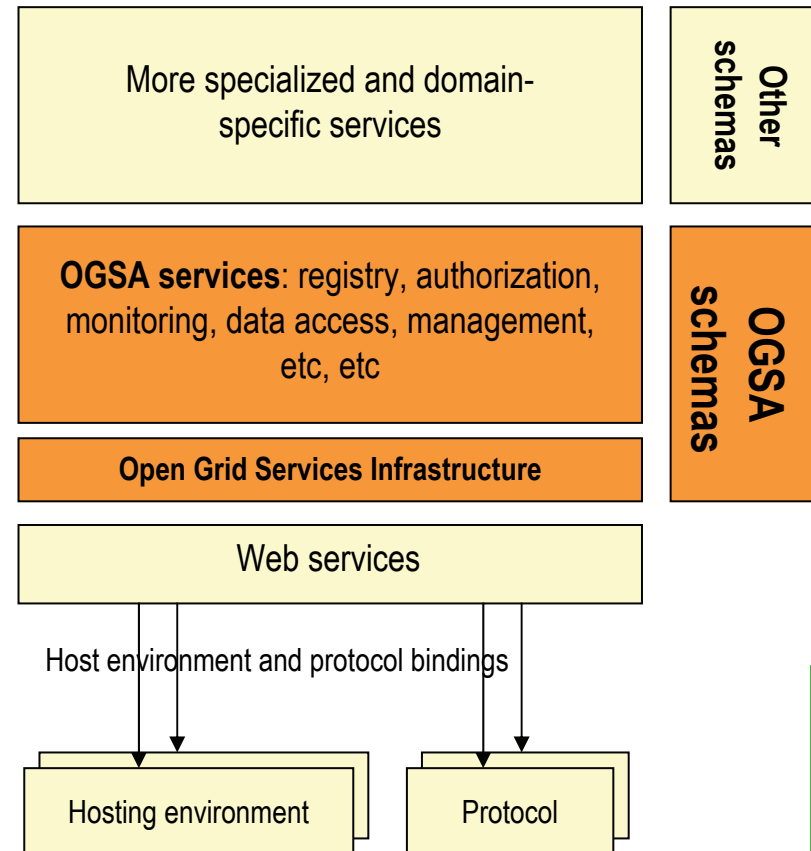
- Is a Web Service
 - Described by WSDL, WS-Resource Properties, Meta information, Policies
 - Is a WS-RF WS-Resource
 - Must support WSDM's Identity capability with properties (ResourceID)
 - Advertises the properties/operations (message exchanges) of the resource to be managed

Layers of a Manageable Resource Mixing in a Model



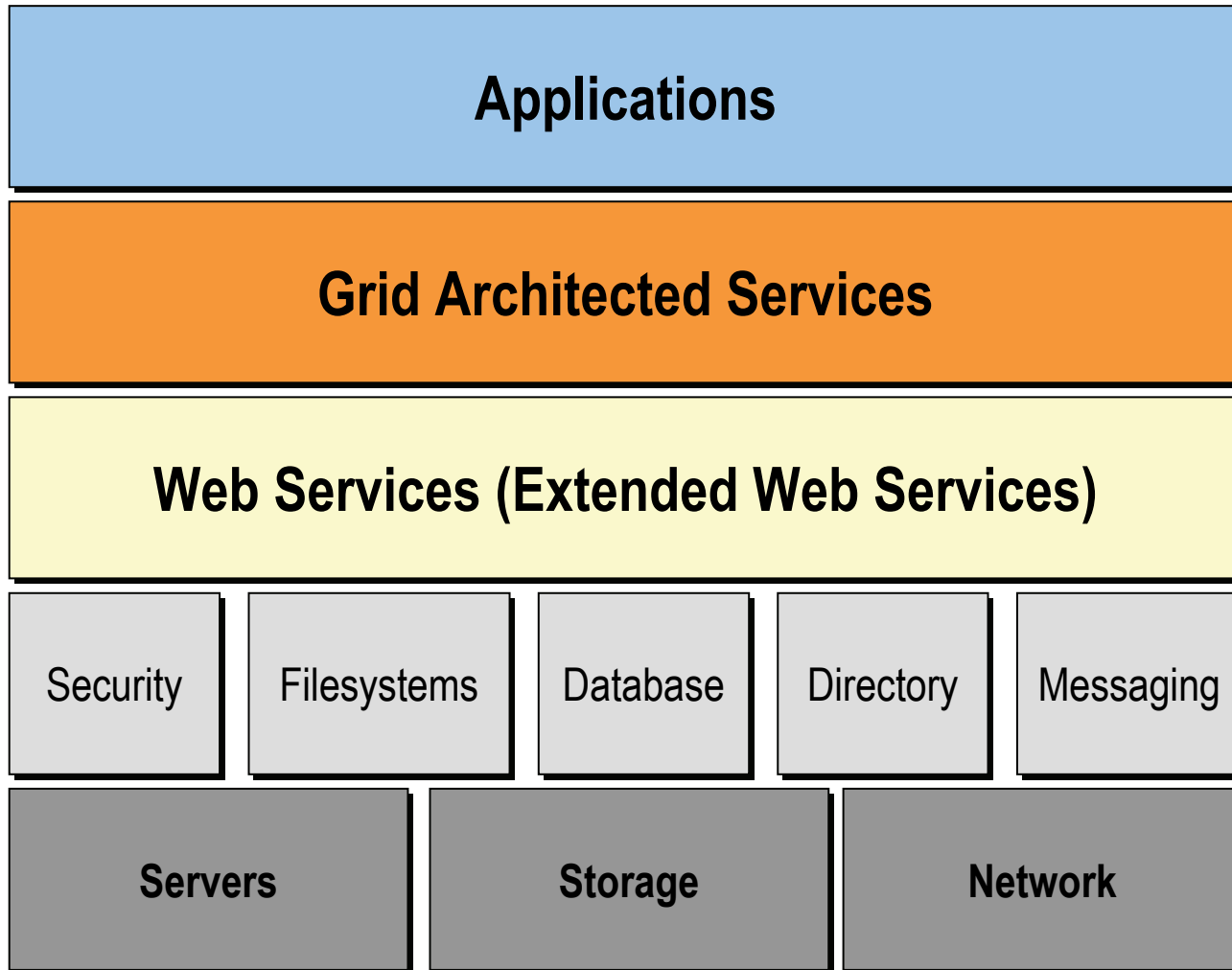
Open Grid Services Architecture (1)

- ❑ Development of the resource oriented layered grid architecture towards service orientation and alignment with Web Services technologies
 - defined in GGF documents referring to OGSA/OGSI



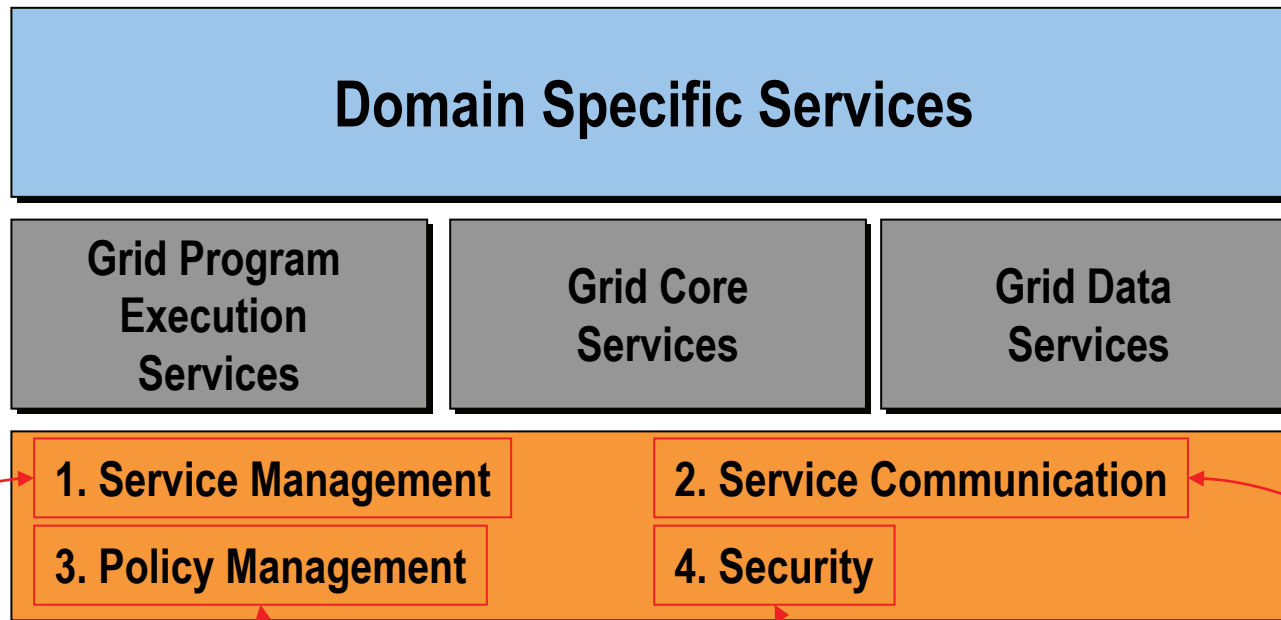
Source: Foster, Kesselman, Tuecke, 2004

Open Grid Services Architecture (2)



Open Grid Services Architecture (3)

❑ Grid Architected Services



Provisioning and deploying components, collecting and exchanging data

General framework for creation, negotiation, management of policies

Support, integrate and unify diff security models to enable systems to interoperate securely

Supports basic method for grid services to communicate with each other

Open Grid Service Architecture (4)

- ❑ Concept is that a Grid Service is an extended Web service that implements standard interfaces, behaviors, and conventions that collectively can be transmit (i.e. created, altered, destroyed) and stateful (i.e., allow for identifying service instances).
- ❑ OGSA defines the architecture, whose principal elements are OGSi (Open Grid Services Infrastructure), OGSA Services, and OGSA schemas.
- ❑ OGSi specification defines the interfaces, behaviors, and conventions that control how Grid services can be created, named, monitored etc. OGSi can be used to describe a variety of resource layer and collective layer components
- ❑ Encapsulating service operations behind a common message-oriented service interface encourage service virtualization, by isolating users from details of service implementation and location. OGSA encourage code reuse by grouping operations of common behaviors.

Open Grid Service Architecture (5)

- ❑ OGSA uses WDSL (Web service definition language) as IDL
- ❑ A well-defined IDL separates concerns between service interface and implementation. This simplifies the manipulation and management of services w.r.t.
 - service discovery (creating and maintaining service registries)
 - service composition (composition of complex tasks and workflows, support of multiple protocol bindings)
 - interface extension (e.g. for adding implementation-specific while also supporting the common service functionality)
 - specialization (e.g. to use different implementations)

Using Web Services for Grid Management (1)

❑ Benefits of WS:

- easily scalable
- loosely-coupled interaction among services and clients
- easily relocated, updated, replaced
- support for heterogeneous environments, independent of platform, programming language, binding
- SW industry is rapidly adopting WS to virtualize service access by using common XML-based standards: WDSL, SOAP, UDDI, ebXML, WS Security

❑ Grid services are (extended) Web services

- service lifecycles (create, alter, delete, transient services)
- state values (partially long-lived)
- management operations needed for WS itself and not only for the resource it represents (e.g. metrics, relationships for root cause analysis, events, configuration)

Using Web Services for Grid Management (2)

- ❑ Special infrastructure services must be managed:
 - Handle resolvers
 - Factories
 - Registries
 - Program execution services
- ❑ Using WS for management
 - Provides mechanisms to discover manageable resources (services and their manageability capabilities)
 - does **not** define a new management model, but makes use of existing management information models like e.g. CIM, MIB, and leverages existing technologies relevant for management, e.g. events, policies, security issues etc.

Using Web Services for Grid Management (3)

- ❑ WSMF (Web Services Management Framework) is a set of specifications that address management of IT resources including Web services and Grid services using Web services (WSMF 2.0, published July 2003, <http://devresource.hp.com/wsmf>).
- ❑ WSMF is under development by WSDM (WS Distributed Management), a Technical Committee of OASIS, a global consortium for XML & WS. Define specifications for management of WS and management using WS
- ❑ GGF-CMM (Common Management Model) is a GGF working group concerned with Grid management, since October 2003 collaborating with OASIS/WSDM