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Distinguished IT Architect (Open Group certified)

Enterprise IT Architectures

Security

Security – Terminology and Architecture

Security is a critical concern in IT Architecture

- Wherever systems are responsible for important data and processing, there is a risk that misuse of the system leads to a negative outcome for those associated in any way with that system
  - Typically in a commercial setting, IT Architects need to think about protecting our customers (e.g. a bank)
  - … and their customers (e.g. an account holder)
  - (… and both our reputations!)

- The scale of the risk depends on the nature of the organization(s) and the nature of the purpose of the system …

Security & Safety

- Security is a wide and fascinating topic encompassing a vast range of issues, arenas and disciplines
  - from deep mathematics to international espionage

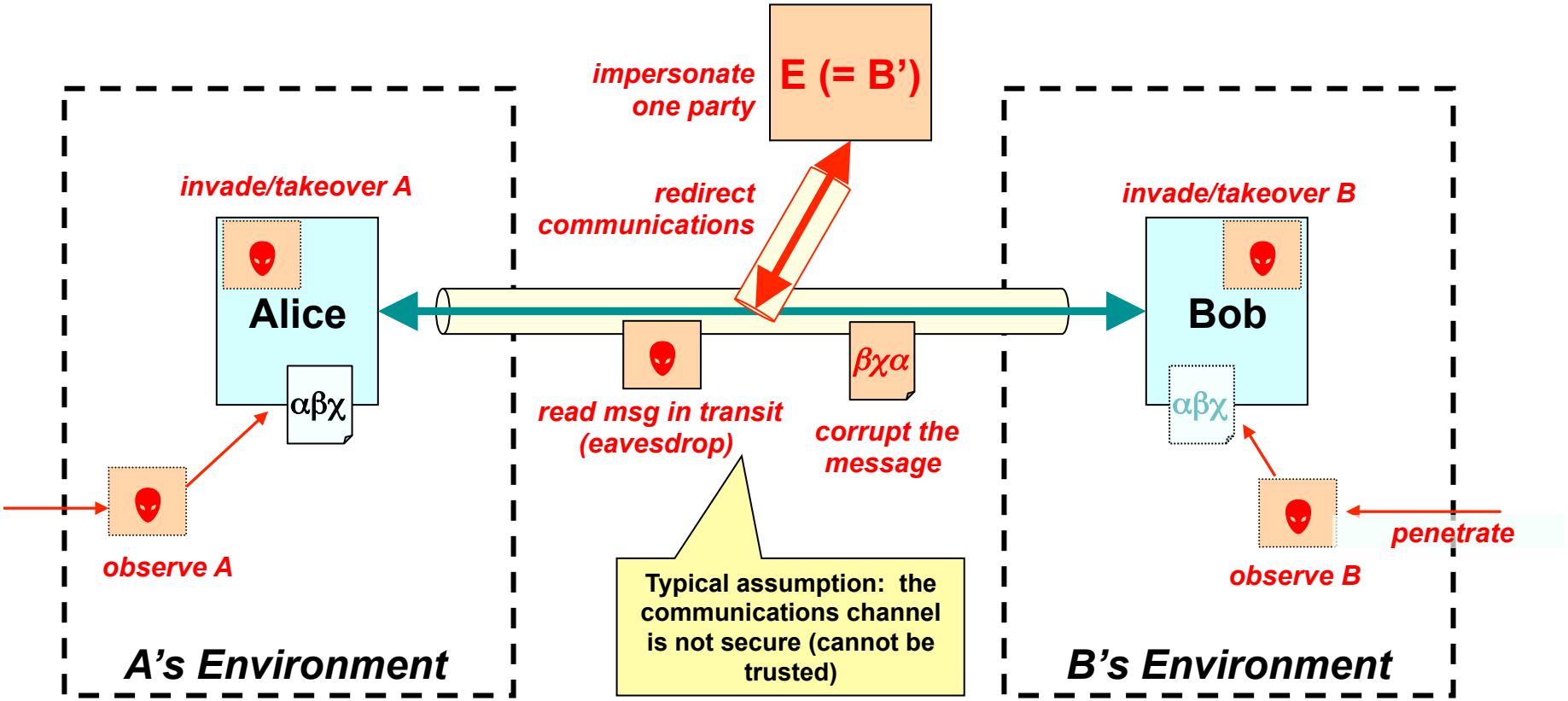
- In IT systems, “security” can be associated with the following qualities:
  - Not open to intentional misuse
  - Not open to accidental misuse
  - Protects the truth – maintains integrity
  - Protects service in the face of attack (overlap with Availability)

- Secure means SAFE:
  - Your data, your assets, your reputation

Broad scope of a “Security Governance, Risk Management, and Compliance”

- People and Identity (e.g. Authentication, Access Control)
- Data and Information (e.g. Cryptography, Data Loss Protection)
- Application and Processes (e.g. Security of Services)
- Network, Server, and Endpoints (e.g. Virtualization, Threat Protection, Malicious Traffic Detection, “Circle of Trust”)
- Physical Infrastructure (e.g. Operational Management)

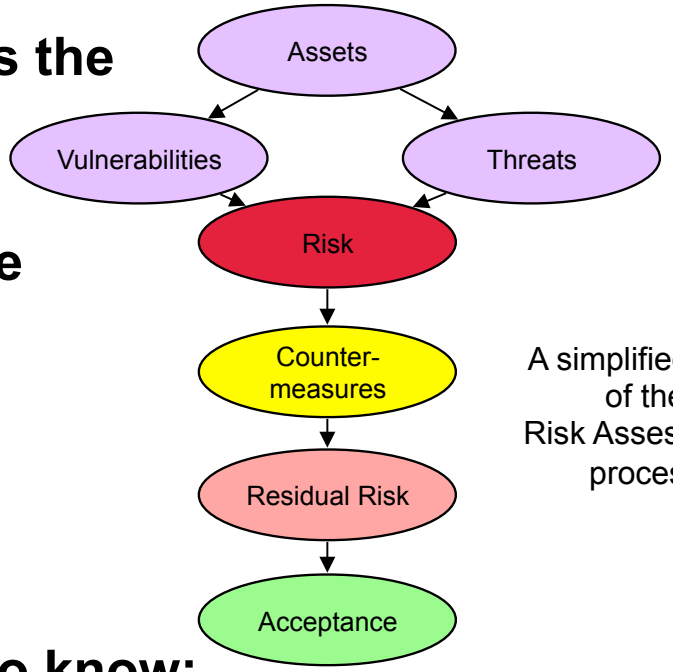
Consider: Alice wants to send a message to Bob (securely)



=> Threats arise at both ends and everywhere in between

Threat assessment needs to be combined with assessment of vulnerabilities to determine risk

- Information security *risk* can be viewed as the *cost* to an organization of *compromise or damage* to an information asset
- There are many ways to assess risk, some formal and *quantitative*, some informal and *qualitative*.
- In all cases, the purpose is to identify significant *threats* and address them through appropriate *countermeasures*
- In general, to assess risk it is necessary to know:
  - *Threats* – the bad things that might happen to an information asset
  - *Vulnerabilities* – the ways those bad things might come to pass
  - *Likelihood* – the probability of a vulnerability being exploited to make a bad thing happen
  - The "*value*" or "*sensitivity*" of the asset – the impact on the organization if a bad thing happened



A simplified view of the Risk Assessment process

A good general approach to tackling IT security is to take a "threat-based" approach

- ***Document assets***:
  Identify and decide what you need to protect. This could be data, intellectual capital, processes, physical resources, or any other thing of value in the organization
- ***Understand threats***:
  Know your enemy. Determine from whom or what are you protecting your system and/or network
- ***Define policy***:
  Create a comprehensive security policy and implementation plan which is appropriate to the level of threat
- ***Implement policies***:
  Apply the security policies to your organization and systems. Update or include security elements and configurations in IT solutions
- ***Monitor policy***:
  Continually monitor to detect any deviation from your policies and take actions if needed

Security is an example of run-time quality and covers these topics

- Safety
  - To reduce or eliminate danger
  - To reduce or eliminate anxiety
  - To reduce or eliminate risk or liability
- Protection
  - To defend against attacks (insider and outsider)
  - To defend against fraud (misuse of assets or identity)
  - To defend tangible assets (IT systems and applications or stored information or information in transit)
  - To defend intangible assets (reputation)
- Assurance
  - To ensure correct and reliable operation
  - To enforce identity and ownership
  - To promote trust

Key Objectives of Security Engineering (1)

- ***Authentication*** **– knowing who**
  - **The process of determining who users (human or otherwise) are and that they are who they claim to be. The most common technique for authenticating is by user ID and password. Others include certificate-based methods or biometrics**

- ***Authorization*** **– knowing what can they do**
  - **The process of establishing the 'rights' that a user has to access and to perform actions on resources. (Simple example – the permissions to read and/or write a file)**

- ***Confidentiality*** **– protecting confidential data**
  - **Ensuring that data classed as confidential is only seen by appropriately authorized parties. Often achieved through cryptography – i.e. encrypting data**

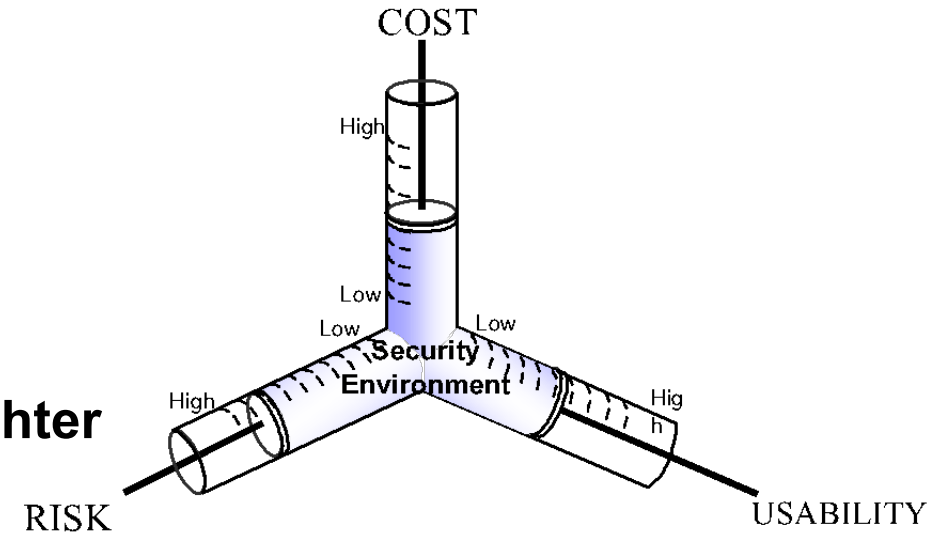
Key Objectives of Security Engineering (2)

- ***Integrity*** **– protecting the "truth"**
  - **The quality of a system whereby data and processing always conforms to the specified rules and constraints within the system**
- ***Auditable*** **– what did they do?**
  - **The trail of evidence proving the activities that have been performed on an internal asset – and attributing this to a known identity. This must be stored in a non-repudiable (tamper proof) format.**
- ***Non-Repudiation*** **– proving what happened happened**
  - **The ability to prove without contradiction that a transaction or event which is recorded as having taking place did take place May need to be able to prove events in a court of law**

Security Architecture is about answering the question "how much security is enough security"

- **From a security perspective, all IT solutions must balance three conflicting factors:**

- ***The risk* –**
  to the organization of operating the IT solution
- ***The cost* –**
  of implementing and operating the security controls in general, the tighter the controls the lower the risk
- ***The usability* –**
  of the solution in general, the tighter the controls, the greater the impact on the users of the system



The resulting set of controls must be, as far as possible "**necessary** and **sufficient**".

Security Services – Standards

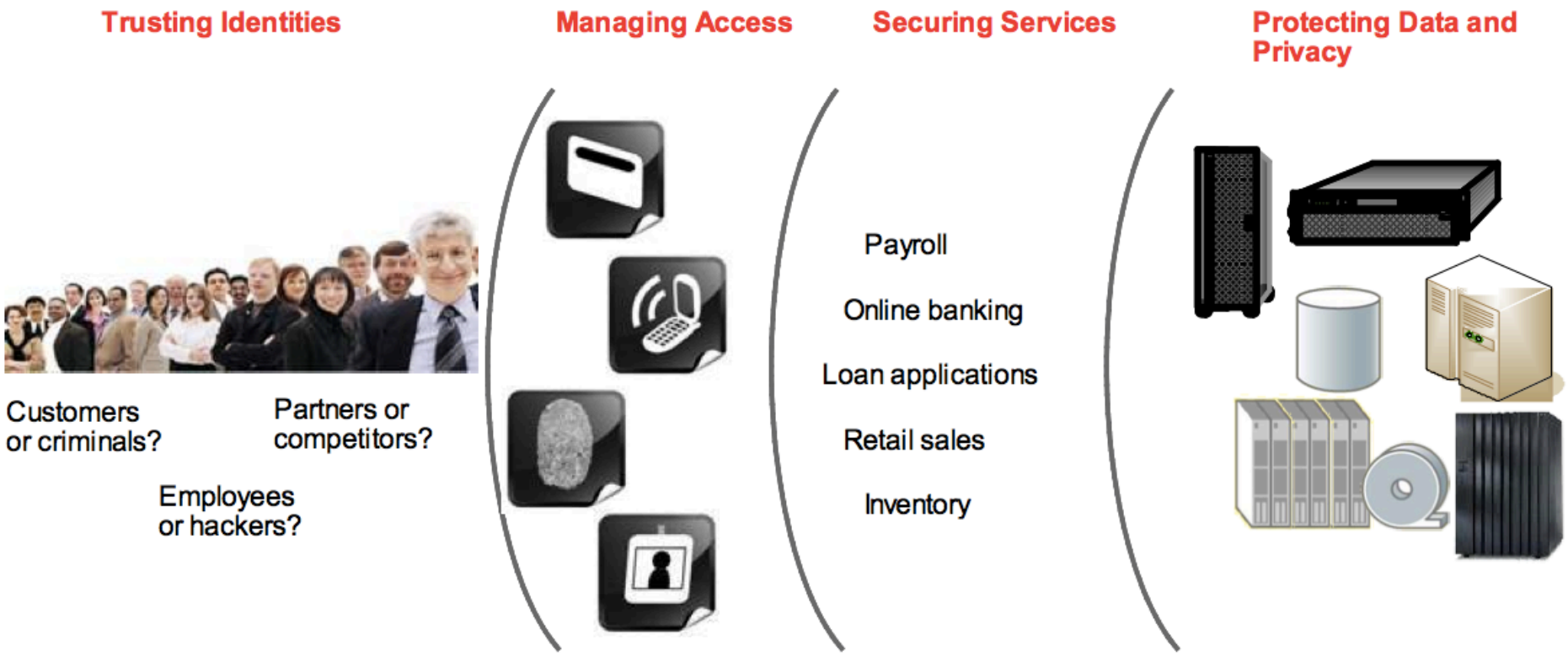
Service	Relevant Standards
Identity Services	IdAS, SPML, SAML, WS-Federation
Authentication Service	WS-Trust, Kerberos, SAML, PKI
Authorization and Privacy Services	XACML, JACC, WS-Authorization, WS-Privacy, WS-Policy, IDEMIX
Audit Service	CBE extensions, Audit web service (in progress), WS-BaseNotification
Message Protection	WS-Security, WS-SecureConversation, PKI, XKMS, WS-SecurityPolicy, SSL/TLS, JSSE/JCE

Security – Basic Infrastructure

Security – Basic Infrastructure

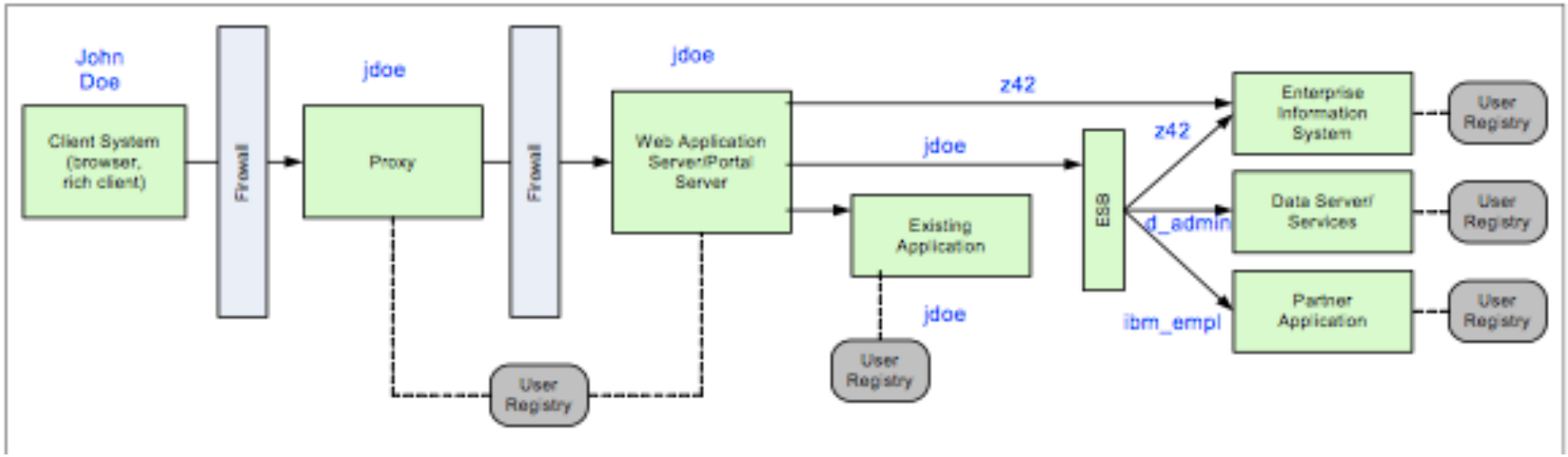
- Providing Functionality
  - Authentication & Authorization
  - Encryption
  - Identity Management
- Integration with Applications and other Functions
  - Integration with various Access Management Functions
  - Diverse Authentication Mechanisms (in the Backend)

People and Identity: Today's *Identity and Access* Challenges



Security has to be applied within a Business context and fused into the fabric of business and not as a widget to solve the next security threat

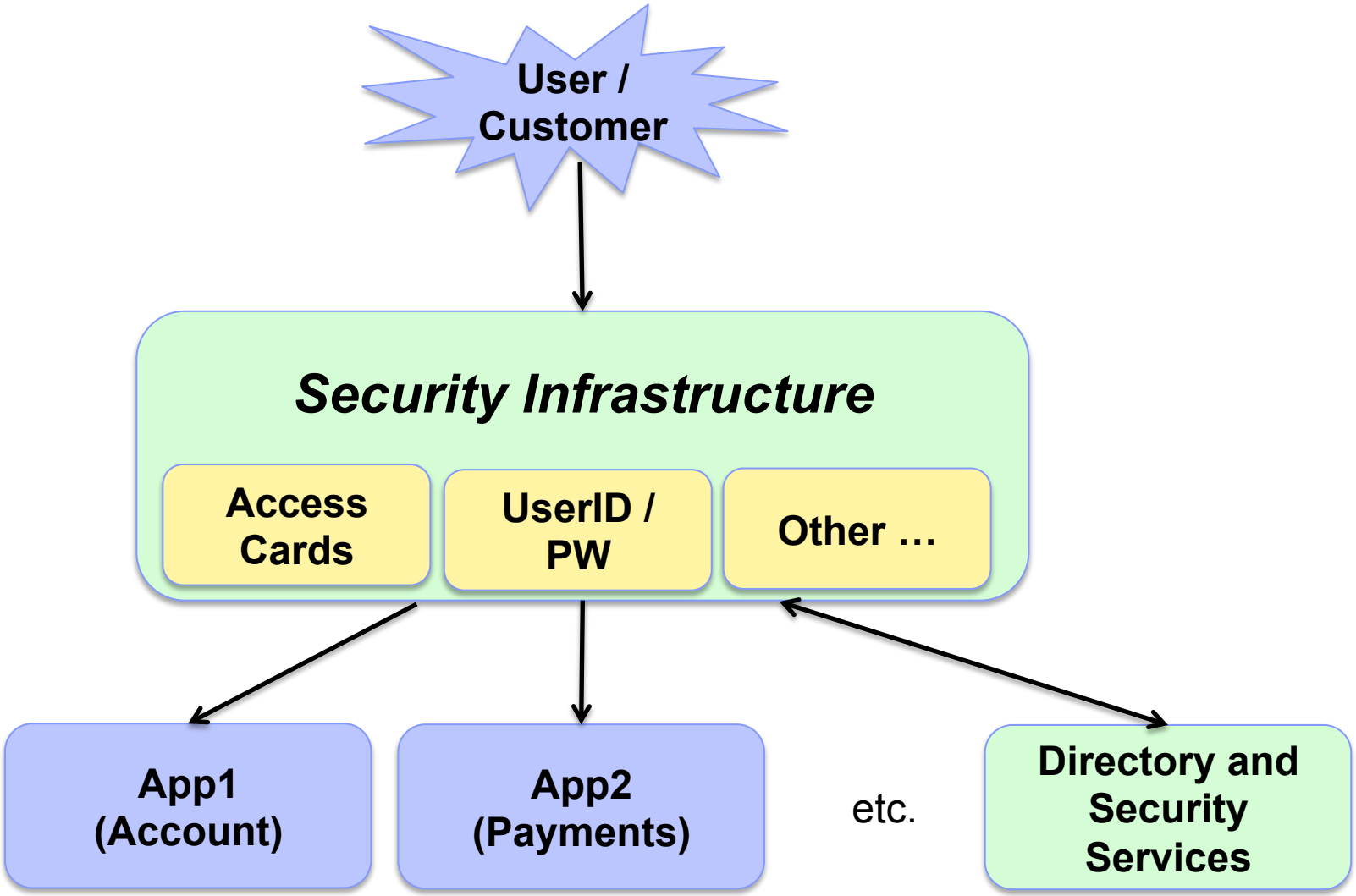
Identity and Access: Various "Identities" for one person



- John Doe with multiple "identities" and roles
- Applications with multiple user registries
- Challenges: Transferring identities, aligning registries, areas of trust
- Reference: http://www.redbooks.ibm.com/abstracts/sg247310.html?Open

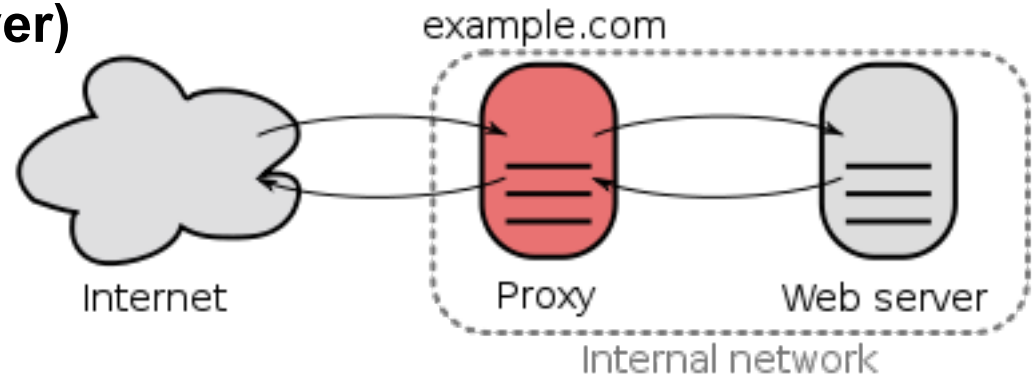
Source: IBM Redbook SOA Security

General Structure of Security-Infrastructure



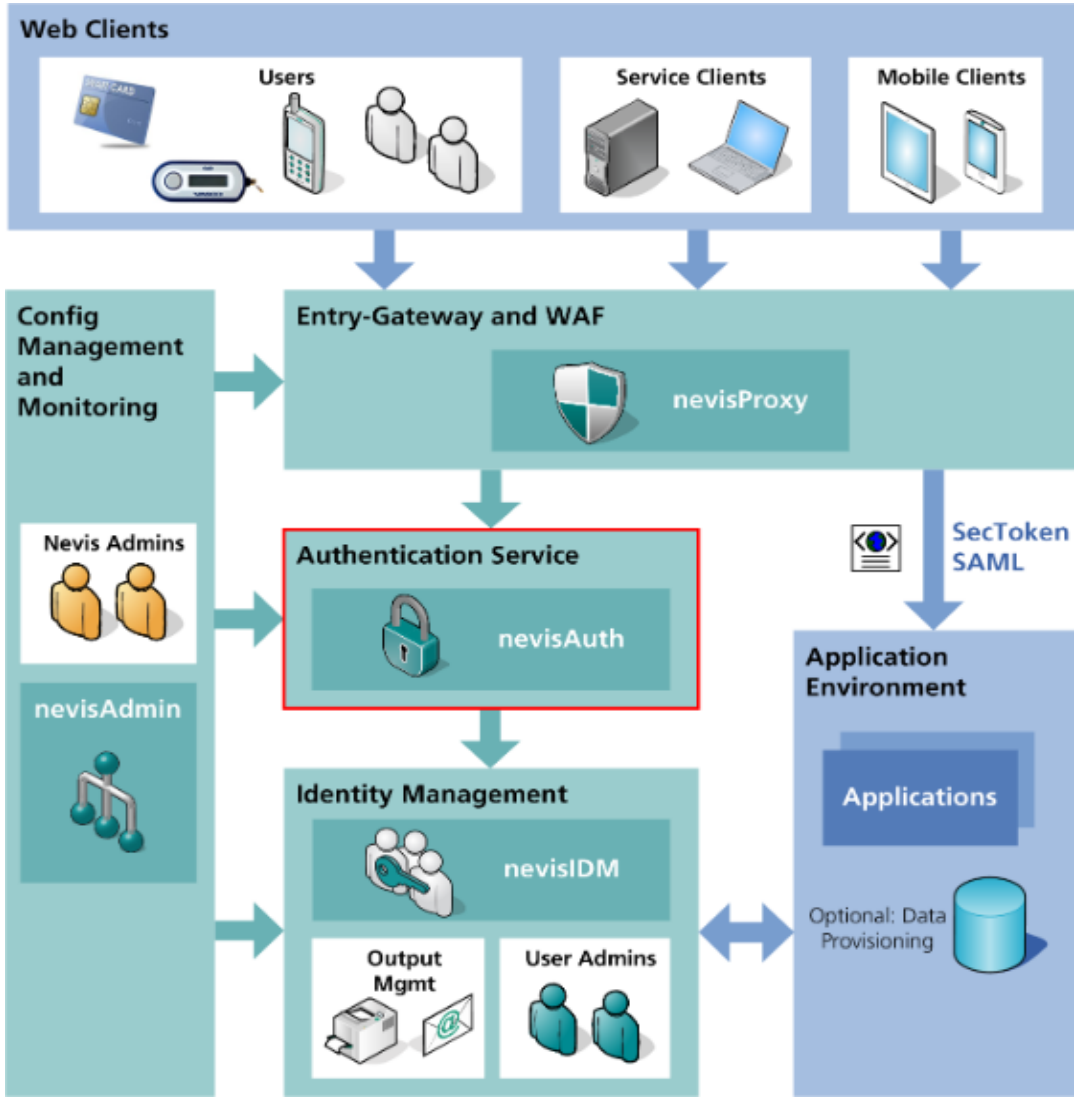
Key Elements: Proxy & Firewall

- (Secure) Reverse Proxy ***protects*** and provides:
  - Session Handling (supporting SSO – Single Sign-on)
  - Authentication (using Security Services and Identity Management)
  - SSL (Secure Sockets Layer)



- Firewall (WAF – Web Application Firewall) provides:
  - Validation of Input and Protocol
  - Content Inspection
  - Filtering of Requests und Responses
  - Encryption

Example of a Security-Infrastructure (AdNovum Nevis)

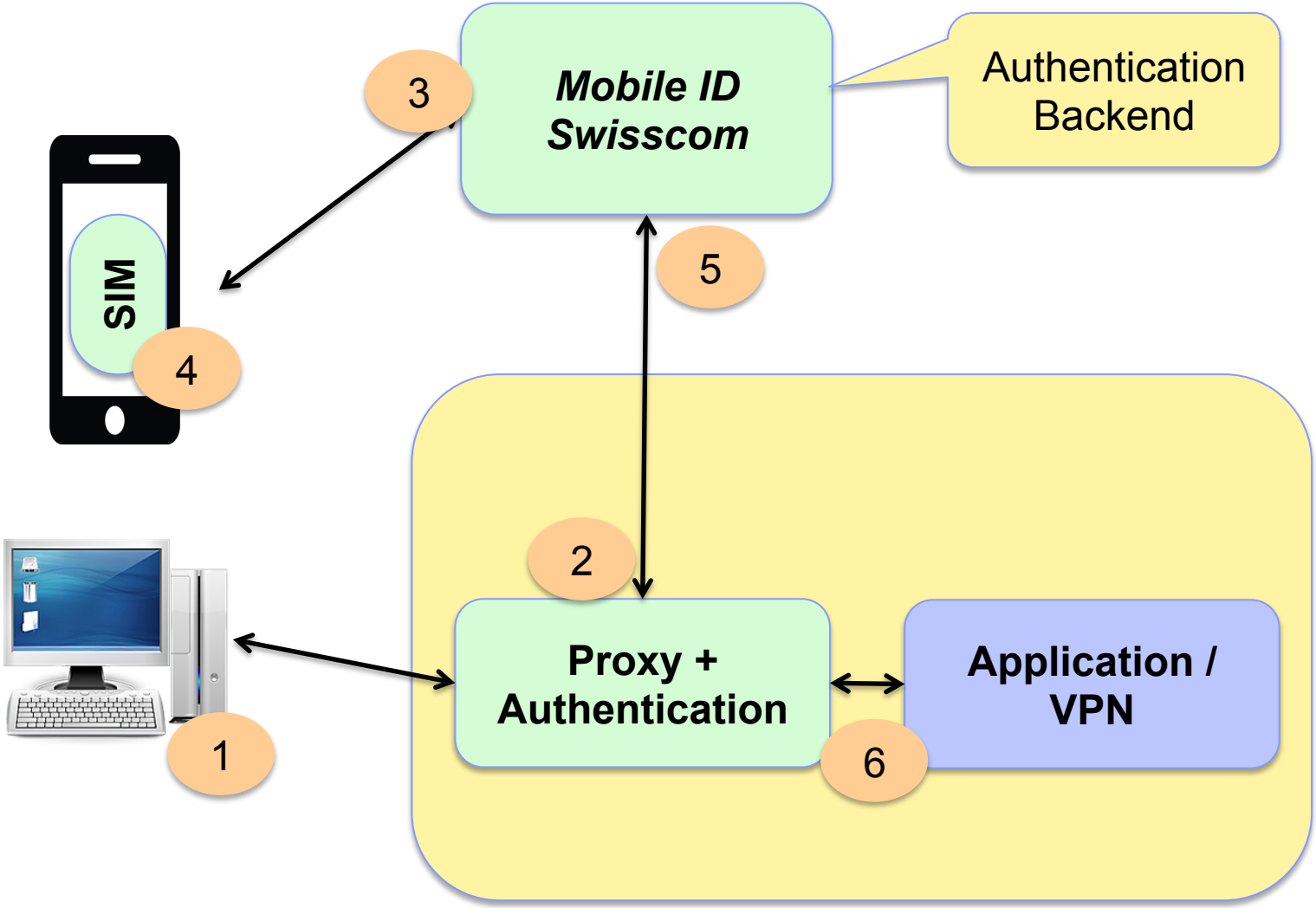


AdNovum

NEVIS

Source: www.adnovum.ch

Example: Mobile ID from Swisscom (with Security Application on SIM-Card)

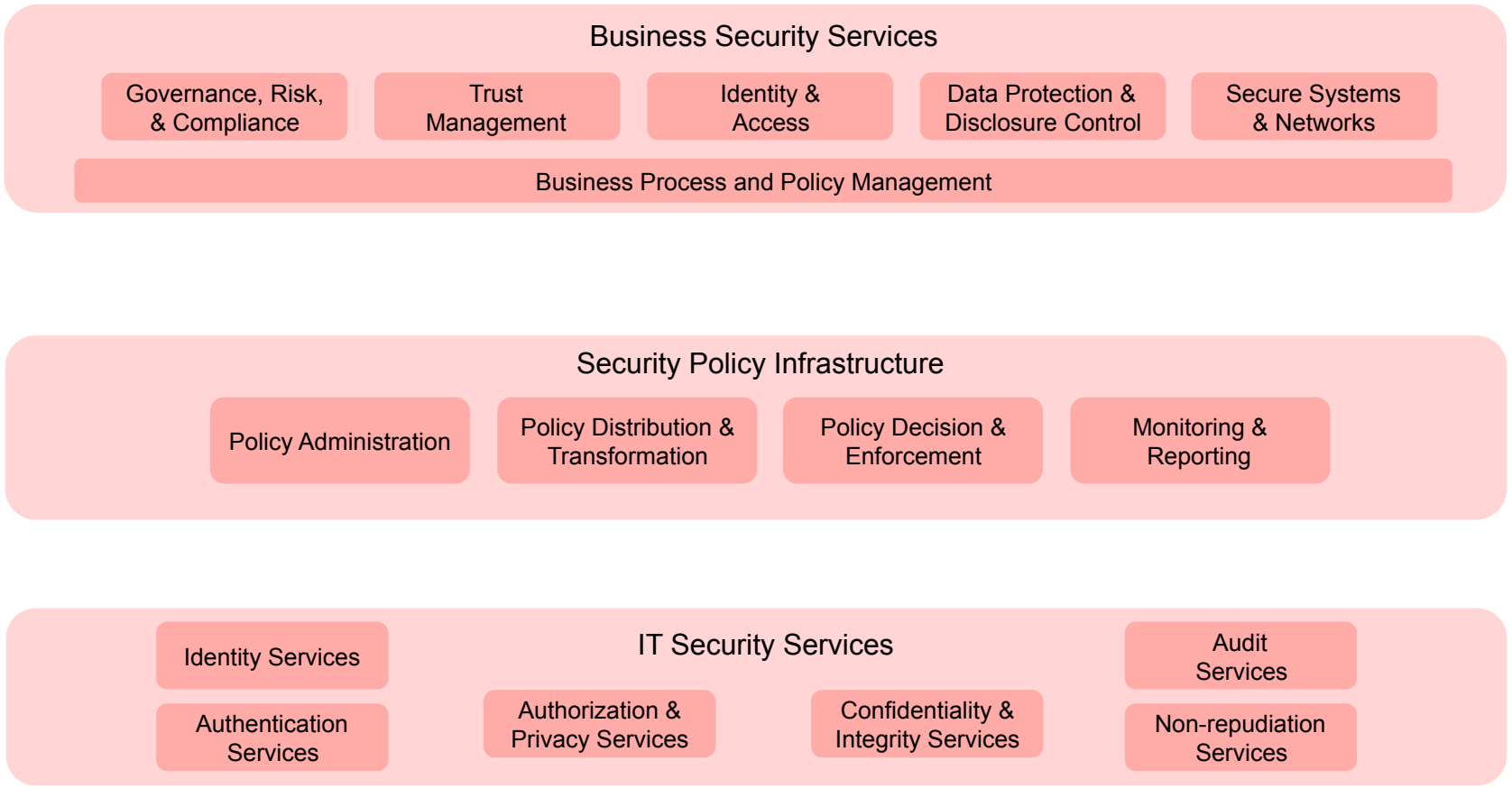


Key Security Challenges of an SOA Environment

- The need for user and service identities and propagation of these identities across the organization.
- The need to seamlessly connect to other organizations on a real-time, transactional basis.
- The need to ensure for composite applications that proper security controls are enacted for each service and when used in combination.
- The need to manage identity and security across a range of systems and services that are implemented in a diverse mix of new and old technologies.
- Protection of data in transit and at rest.
- The need for demonstrable compliance with a growing set of corporate, industry, and regulatory standards.

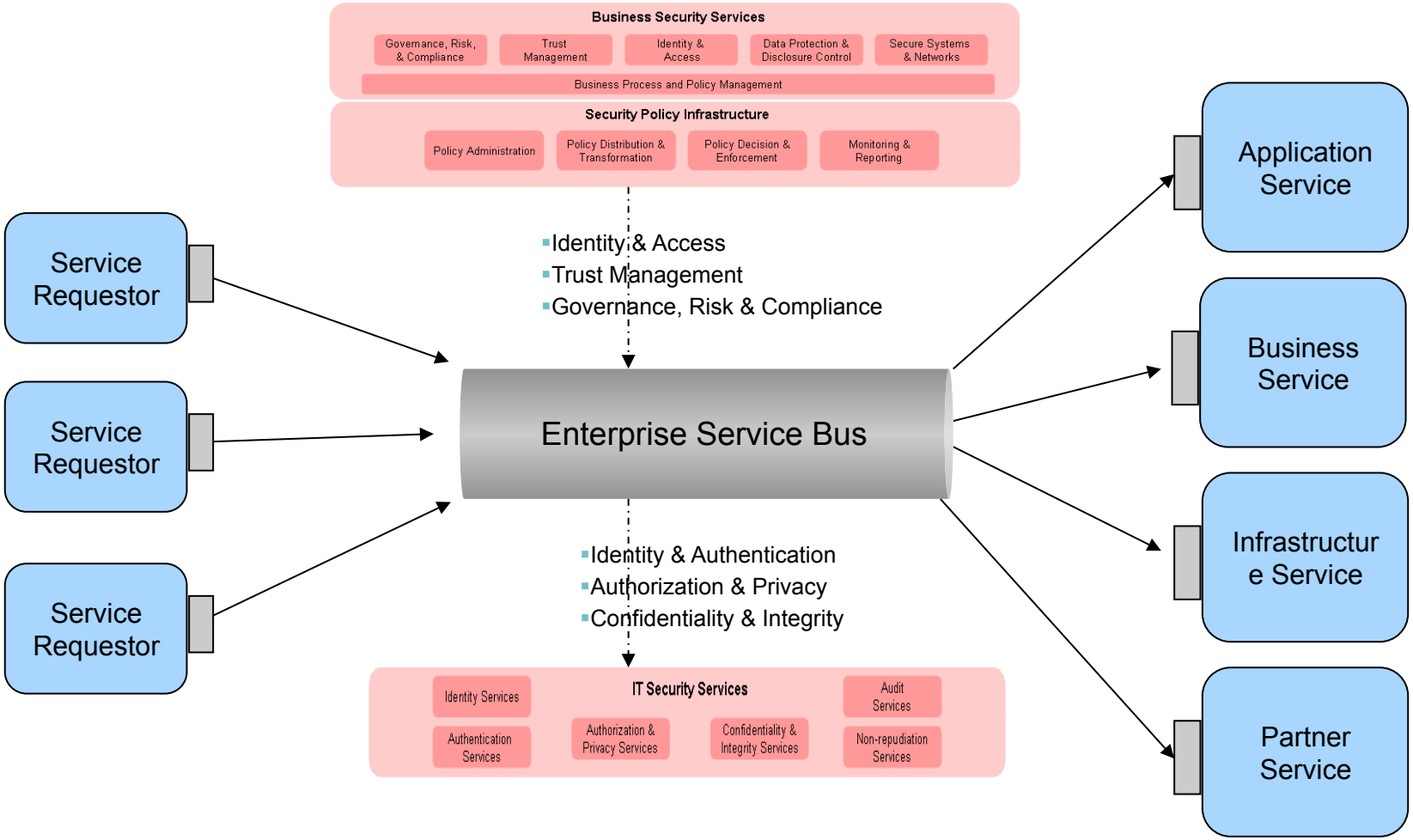
Source: IBM Redbook SOA Security

Security Reference Model (for SOA by IBM)



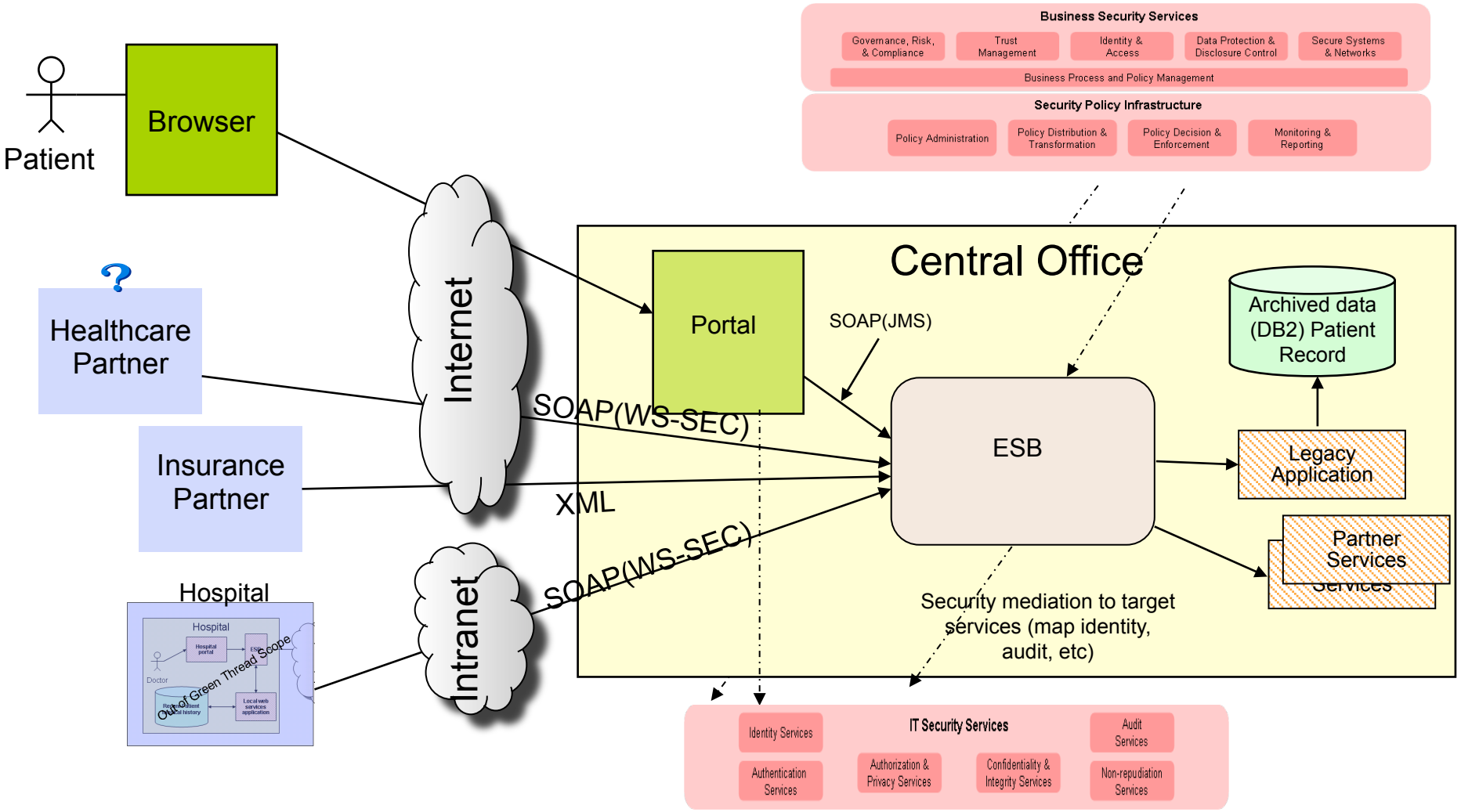
Source: IBM Security Presentation

Services Integration Scenario



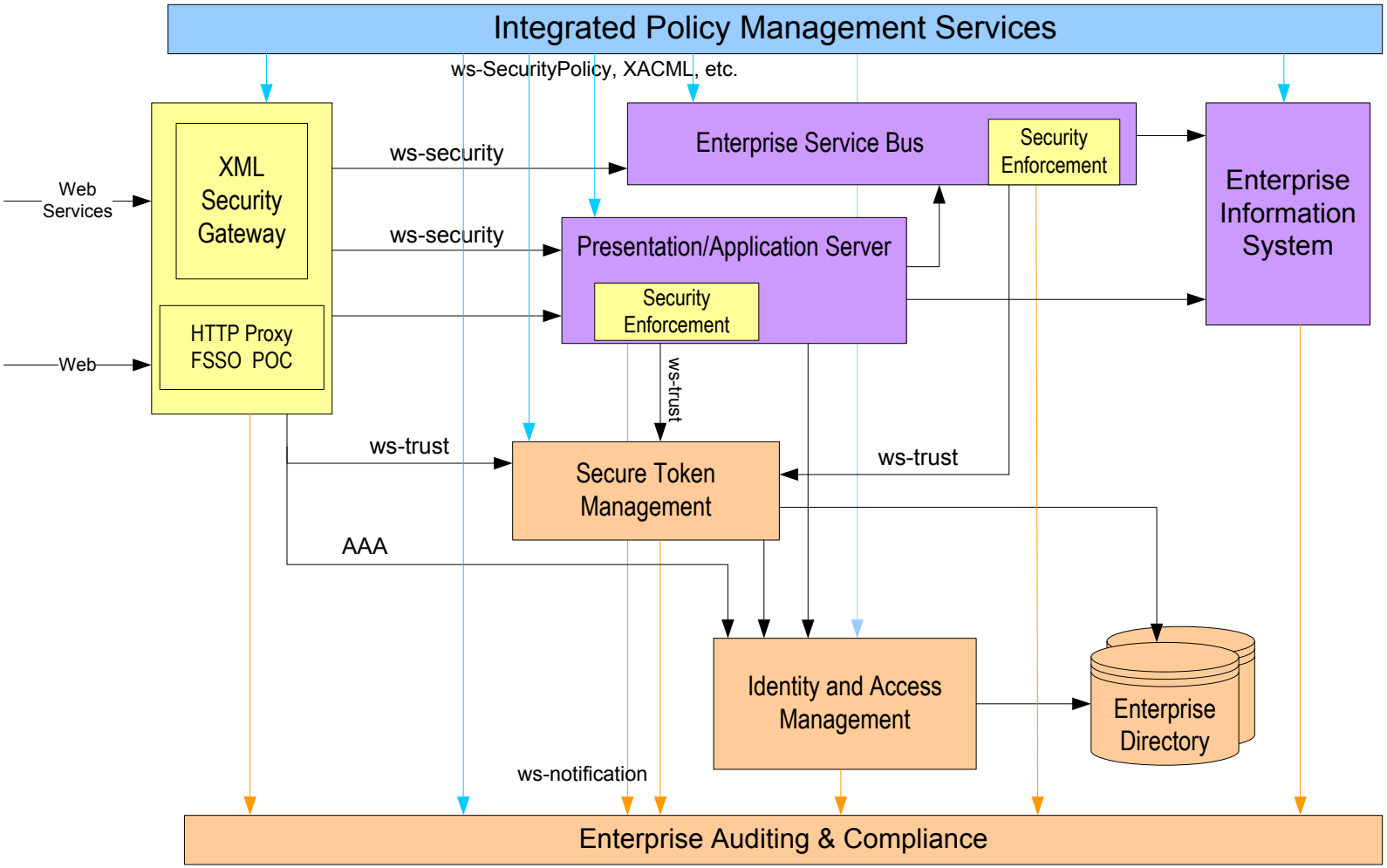
Source: IBM Security Presentation

Service Integration Scenario with Security



Source: IBM Security Presentation

Logical Architecture for Service Integration Scenario



Source: IBM Security Presentation

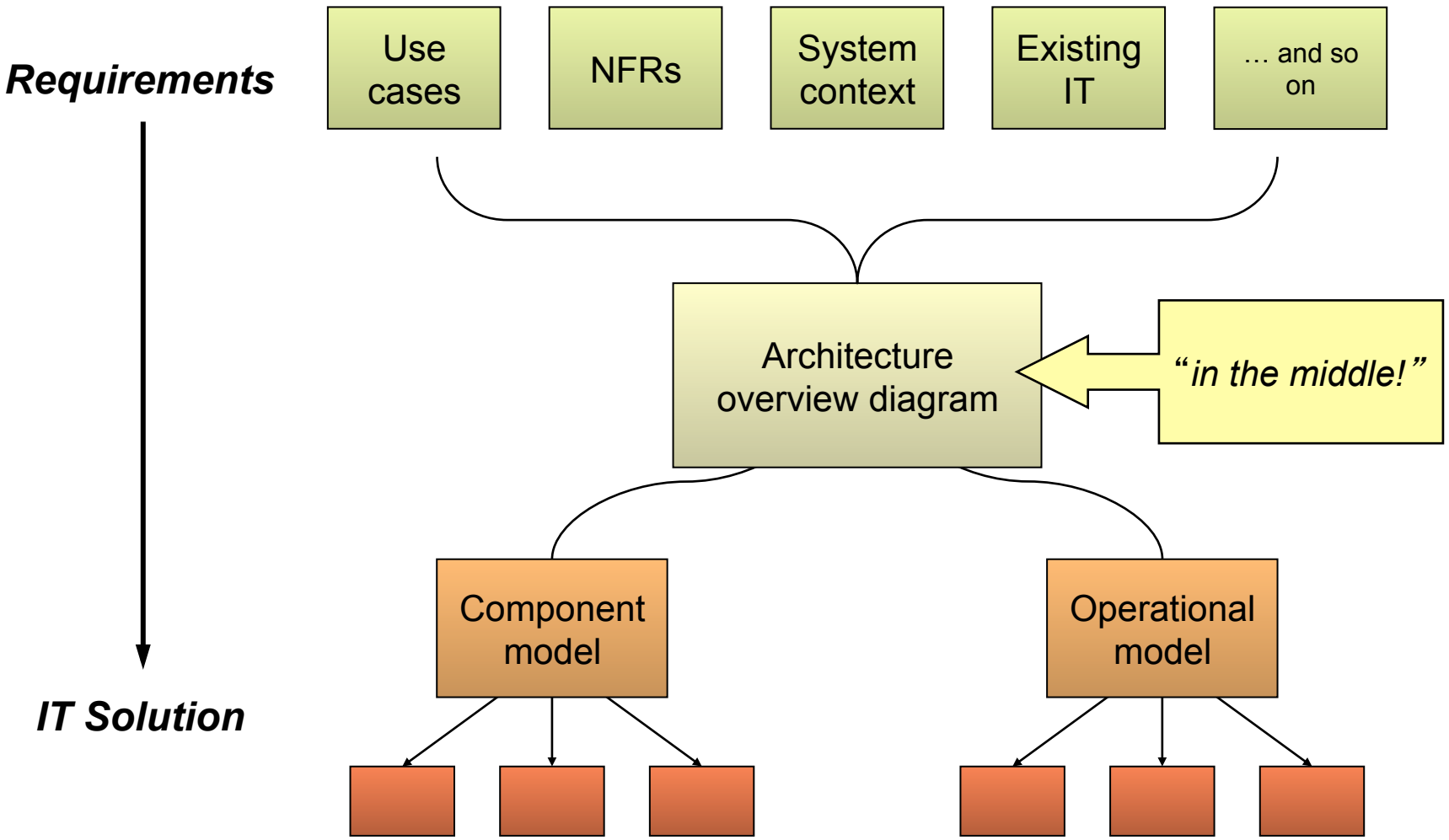
Security in Architecture Overview and Operational Model

Recap – Architecture Overview Diagram

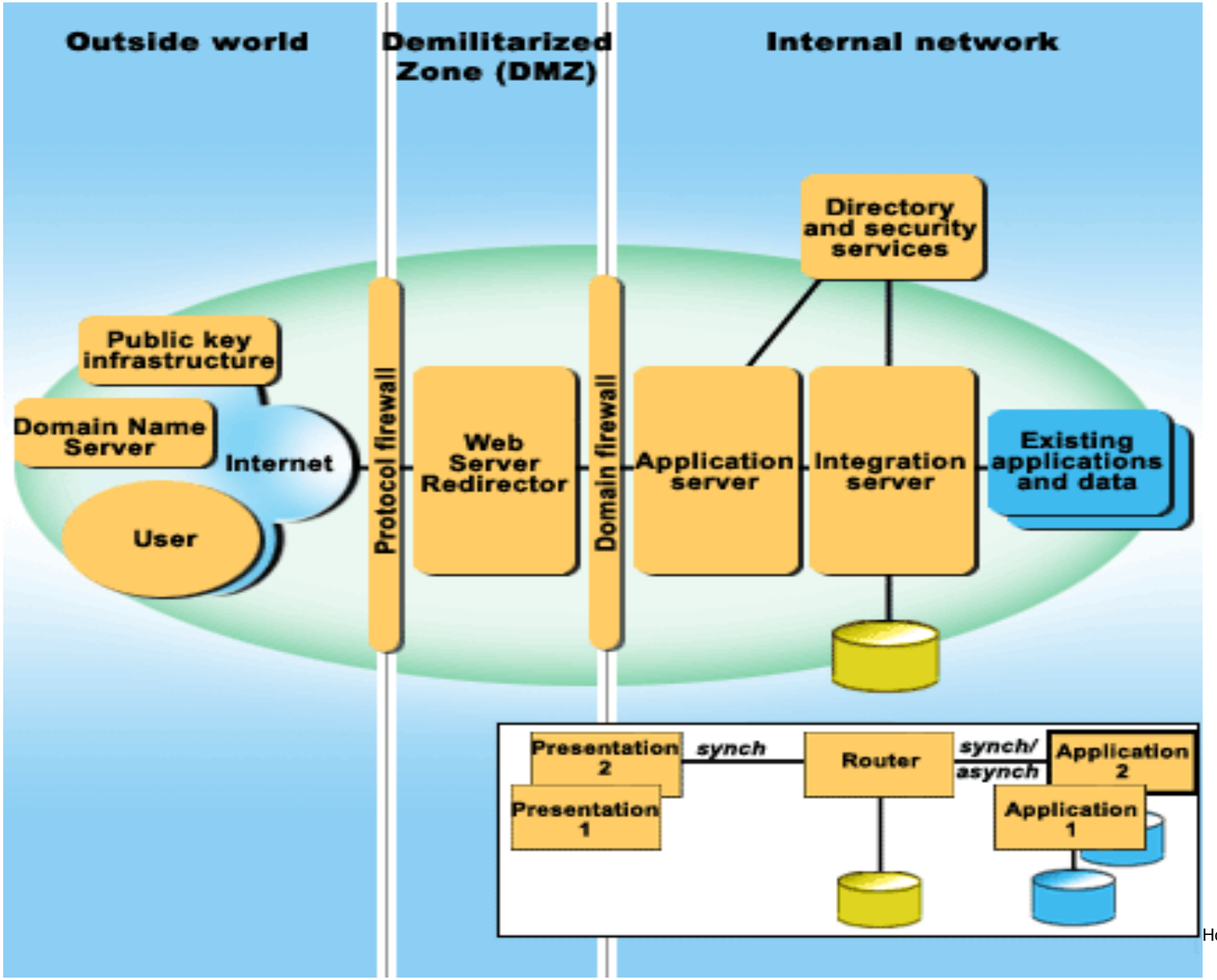
- An Architecture Overview Diagram contains schematic diagrams that represent the governing ideas and building blocks of an IT system.

- An AOD can include both functional and operational concepts.
  - To *communicate* to the sponsor and external stakeholders a conceptual understanding of the intended IT system
  - To provide a *high-level shared vision* of the architecture and scope of the proposed IT system for the development teams
  - To explore and *evaluate alternative architectural options*
  - To enable early recognition and validation of the *implications of the architectural approach*
  - To facilitate *effective communication* between different communities of stakeholders and developers

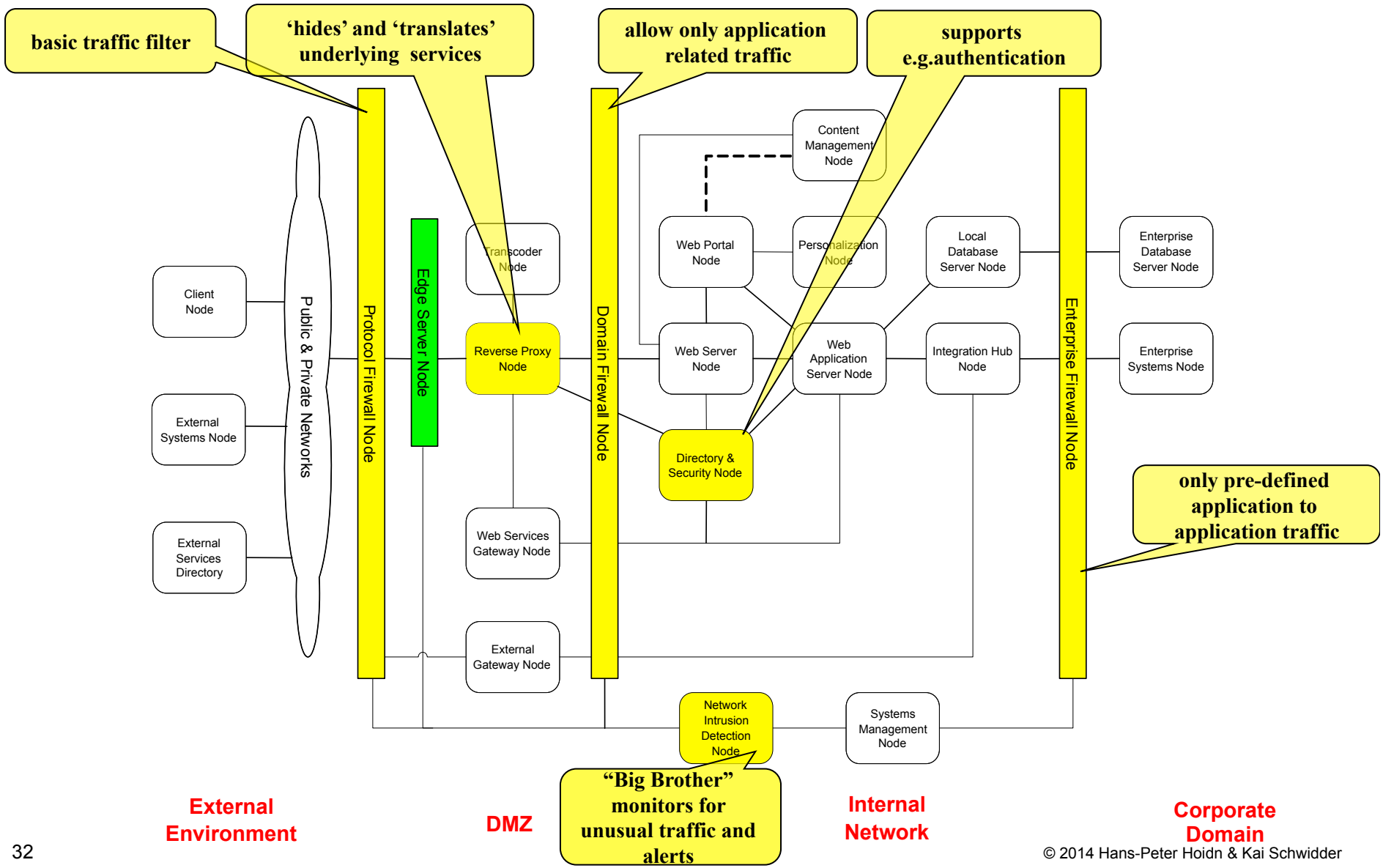
Where does the Architecture Overview Diagram fit?



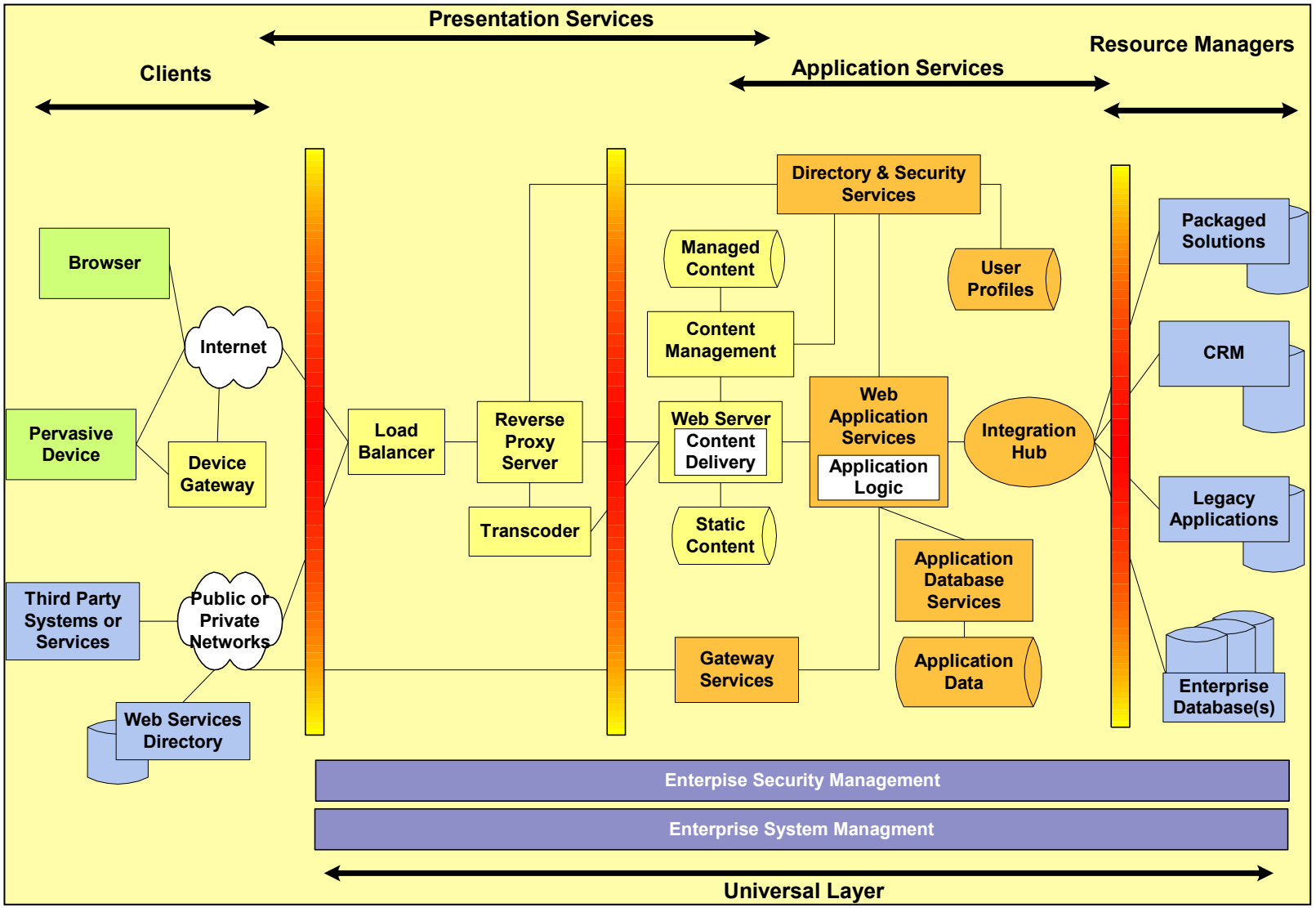
Using Patterns – Example e-Business



Security and access related Nodes in AOD



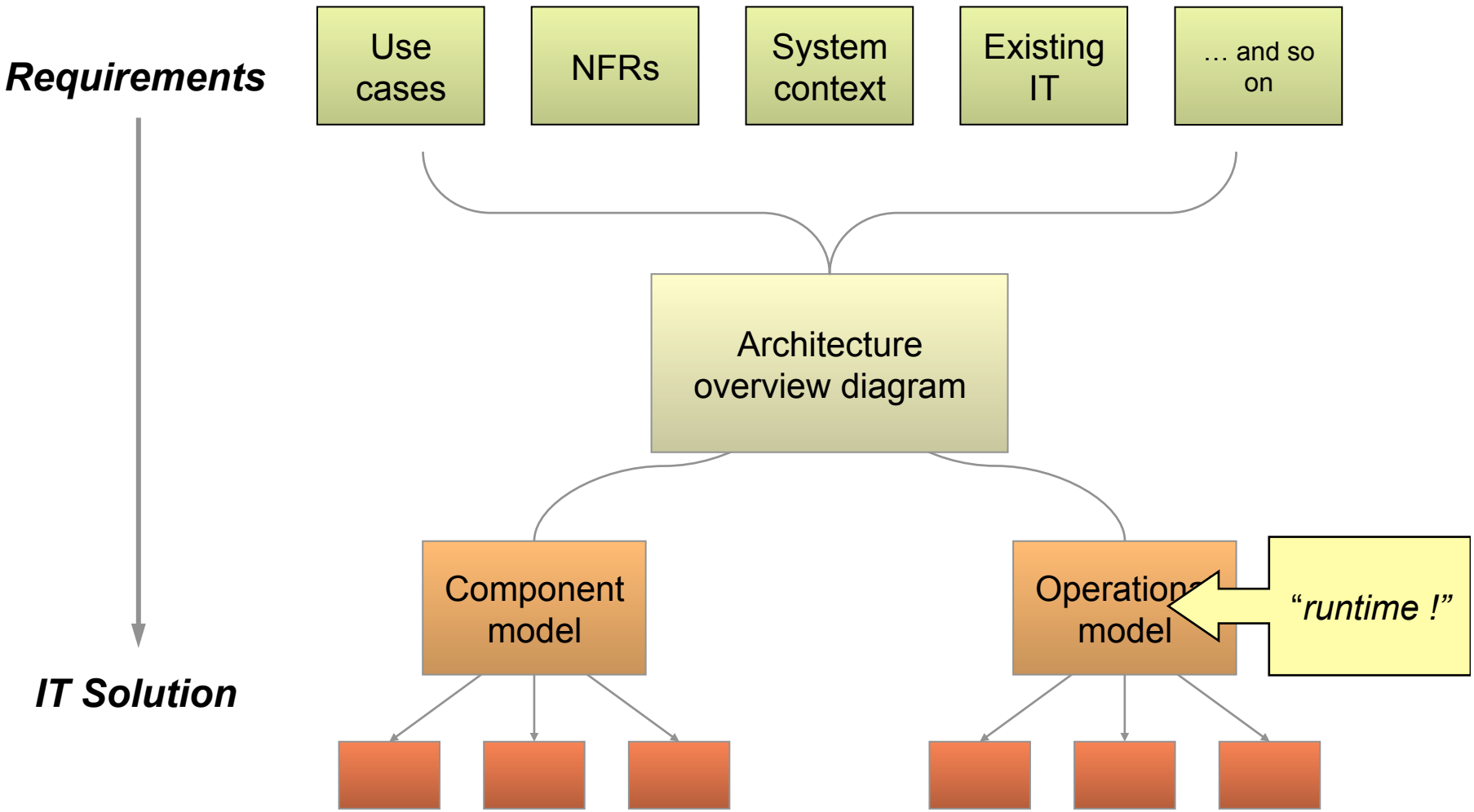
Major Components in the AOD – Example e-Business



Recap – Operational Model

- The ***Operational Model*** **is the key work product created in analyzing the operational aspect of the architecture of an IT System.**
- **Represents how components (described in the component model) are *deployed* across the (geographical) structure of the IT System**
- **Describes how the Service Level Requirements (*SLR*s) are satisfied and how the system will be managed and operated**
- **Is usually documented as *deployment units* (DUs) placed on nodes in locations (static relationships), and their interactions across connections (dynamic behavior)**

Where does the Operational Model fit?



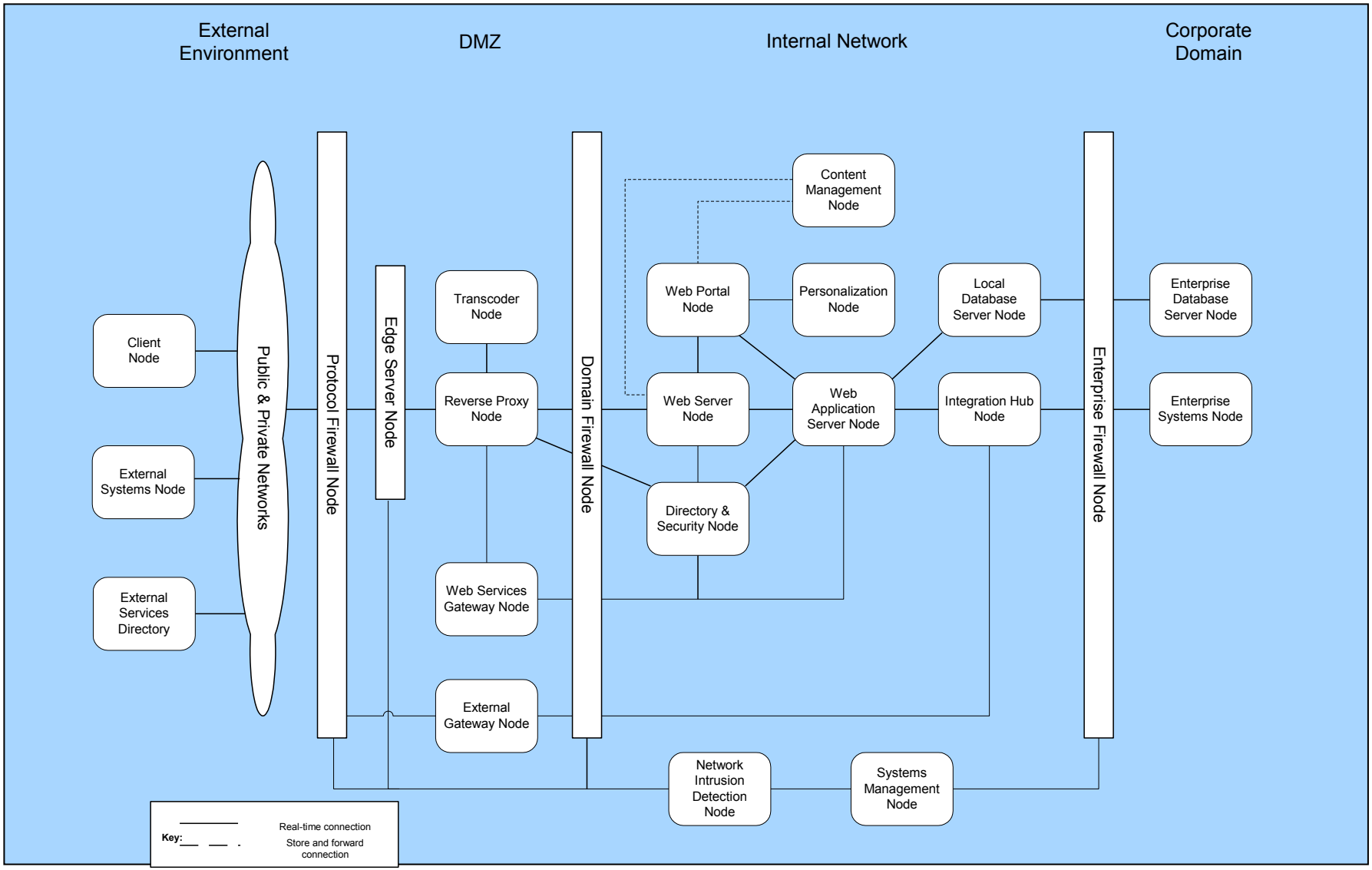
Operational Model Purpose

- The Operational Model can be thought of as the “infrastructure architecture”, documenting the design for:
  - The overall geographic structure of the locations and zones over which the IT system will operate
  - The logical and physical nodes which represent the computers, network components and other devices which comprise the system’s infrastructure
  - The placement of both application and technical components across the system’s locations and nodes
  - The connections between nodes which are required to support the interactions of the components
- At the lowest level (Physical level), the OM ultimately documents:
  - The overall configuration of the technologies and products necessary to deliver the functional and non-functional requirements of the IT system
  - The hardware and software technologies and products which have been selected
  - Sizings and hardware specifications for all the computers, storage devices and networks
- One of the primary concerns of the Operational Model is to ensure the solution meets all the Non-functional Requirements!

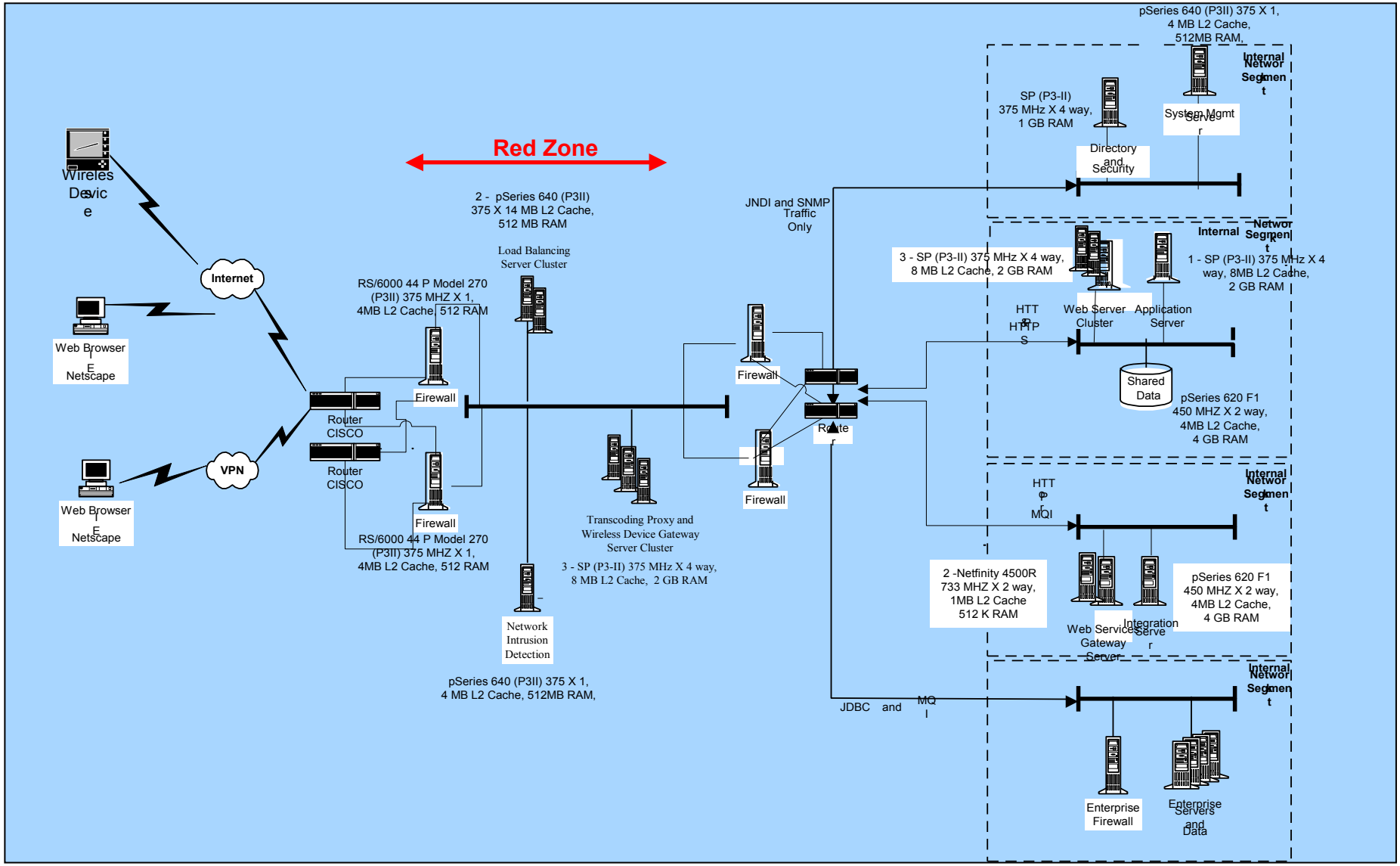
Definitions

- ***Node*** - platform on which software executes
- ***Location*** - type of geographical area or position
- ***Border*** - separates adjacent locations
- ***Zone*** - an area for which a common set of non-functional requirements can be defined
- ***Connection*** - physical data path between nodes (LAN, WAN, dial-up etc)
- ***Deployment Unit*** - one or more components placed together on a node; execution, presentation, data and installation aspects may be separately placed.
- ***Walkthrough*** - description of the flow of a scenario starting from a user all the way through the system and back to the user

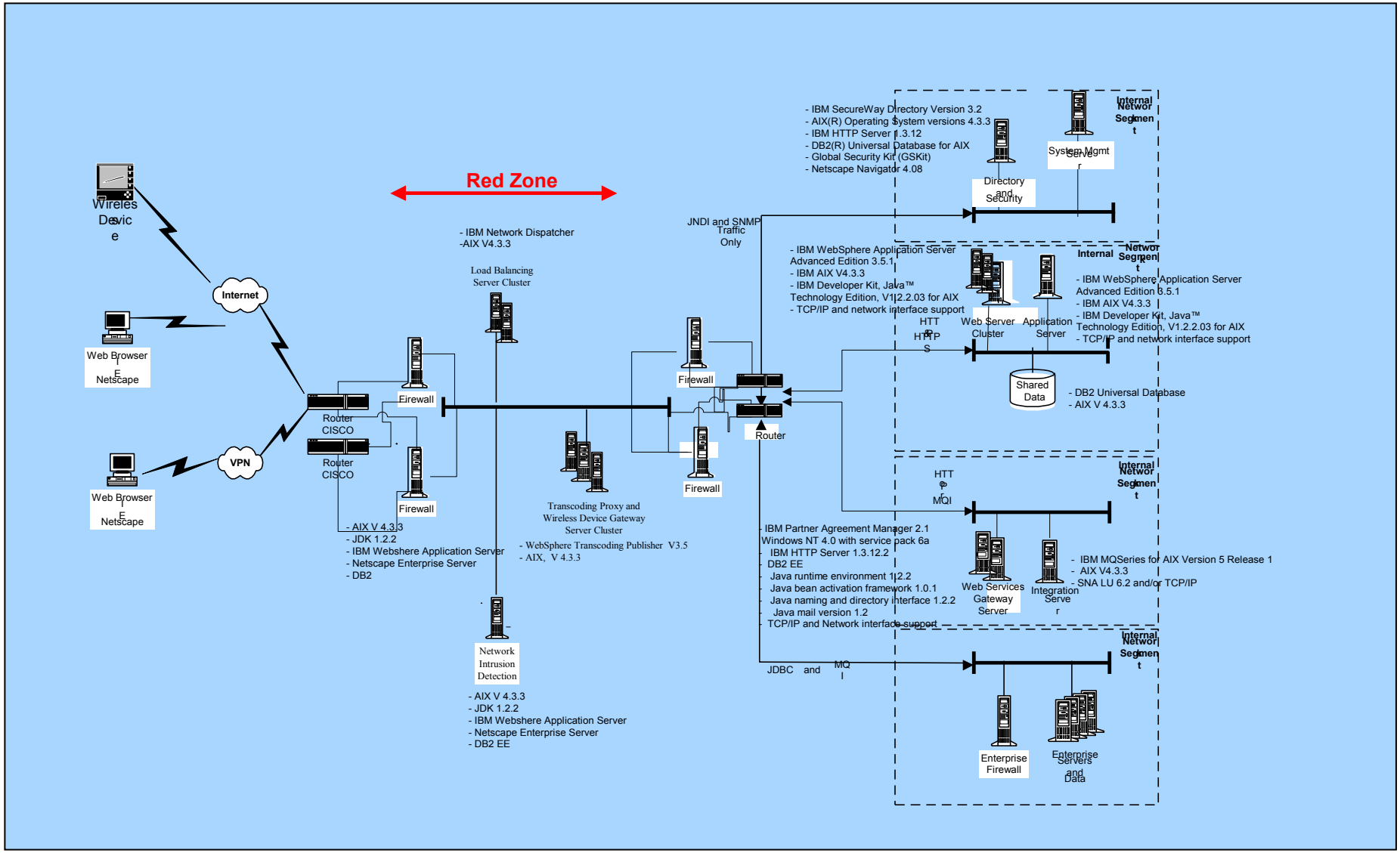
Specification Level Operational Model

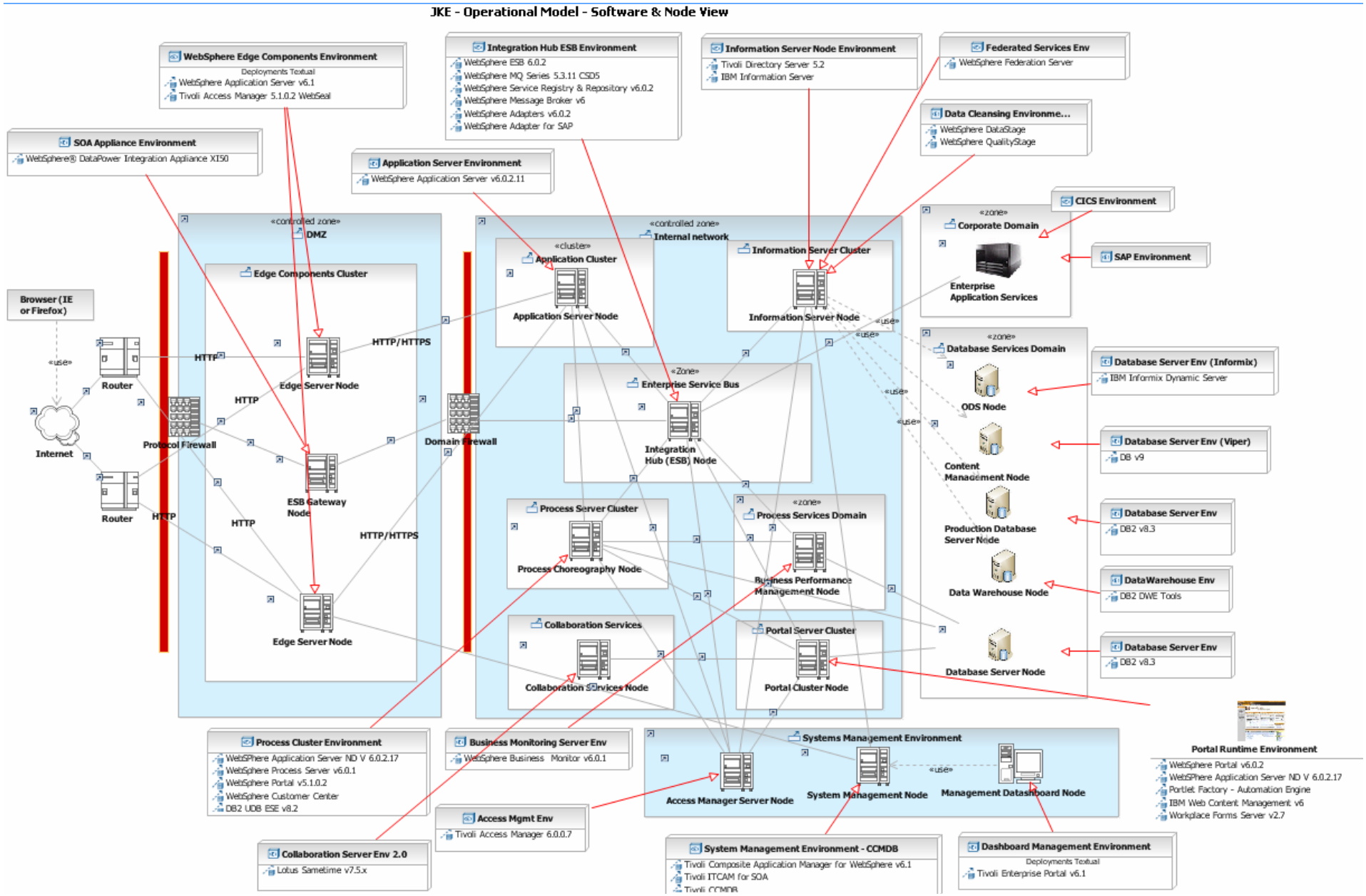


Sample Physical Level Network View



Sample Physical Level Software View




JKE - Operational Model - Software & Node View
WebSphere Edge Components Environment
Deployments Textual
WebSphere Application Server v6.1
Tivoli Access Manager 5.1.0.2 WebSeal
Integration Hub ESB Environment
WebSphere ESB 6.0.2
WebSphere MQ Series 5.3.11 CSD5
WebSphere Service Registry & Repository v6.0.2
WebSphere Message Broker v6
WebSphere Adapters v6.0.2
WebSphere Adapter for SAP
Information Server Node Environment
Tivoli Directory Server 5.2
IBM Information Server
Federated Services Env
WebSphere Federation Server
Data Cleansing Environme...
WebSphere DataStage
WebSphere QualityStage
SOA Appliance Environment
WebSphere® DataPower Integration Appliance XI50
Application Server Environment
WebSphere Application Server v6.0.2.11
CICS Environment
SAP Environment
«controlled zone»
DMZ
Edge Components Cluster
«controlled zone»
Internal network
«cluster»
Application Cluster
Application Server Node
Information Server Cluster
Information Server Node
«zone»
Corporate Domain
Enterprise Application Services
«zone»
Database Services Domain
Database Server Env (Informix)
IBM Informix Dynamic Server
Database Server Env (Viper)
DB v9
Database Server Env
DB2 v8.3
DataWarehouse Env
DB2 DWE Tools
Database Server Env
DB2 v8.3
Browser (IE or Firefox)
«use»
Internet
Router
Router
Protocol Firewall
Domain Firewall
HTTP
HTTP
HTTP
HTTP
HTTP/HTTPS
HTTP/HTTPS
Edge Server Node
ESB Gateway Node
Edge Server Node
«Zone»
Enterprise Service Bus
Integration Hub (ESB) Node
Process Server Cluster
Process Choreography Node
«zone»
Process Services Domain
Business Performance Management Node
Collaboration Services
Collaboration Services Node
Portal Server Cluster
Portal Cluster Node
ODS Node
Content Management Node
Production Database Server Node
Data Warehouse Node
Database Server Node
Process Cluster Environment
WebSphere Application Server ND V 6.0.2.17
WebSphere Process Server v6.0.1
WebSphere Portal v5.1.0.2
WebSphere Customer Center
DB2 UDB ESE v8.2
Business Monitoring Server Env
WebSphere Business Monitor v6.0.1
Systems Management Environment
Access Manager Server Node
System Management Node
Management Datashboard Node
Access Mgmt Env
Tivoli Access Manager 6.0.0.7
Collaboration Server Env 2.0
Lotus Sametime v7.5.x
System Management Environment - CCMDB
Tivoli Composite Application Manager for WebSphere v6.1
Tivoli ITCAM for SOA
Dashboard Management Environment
Deployments Textual
Tivoli Enterprise Portal v6.1
Portal Runtime Environment
WebSphere Portal v6.0.2
WebSphere Application Server ND V 6.0.2.17
Portlet Factory - Automation Engine
IBM Web Content Management v6
Workplace Forms Server v2.7