CISCO

"Ask not what applications can do for the network, ask what the network can do for applications"
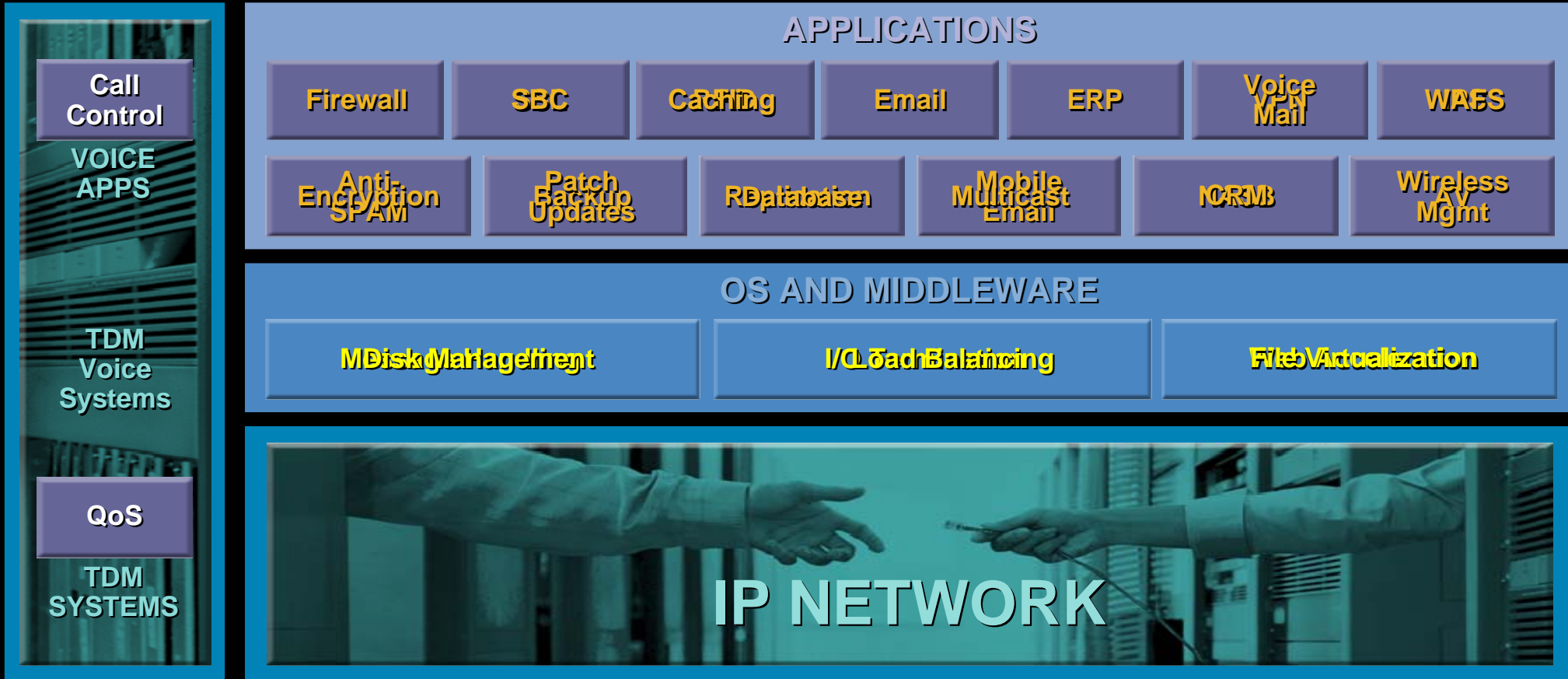
AON - Application Oriented Networking

Pranta Das & Krishna Sankar
AON Architecture & Development
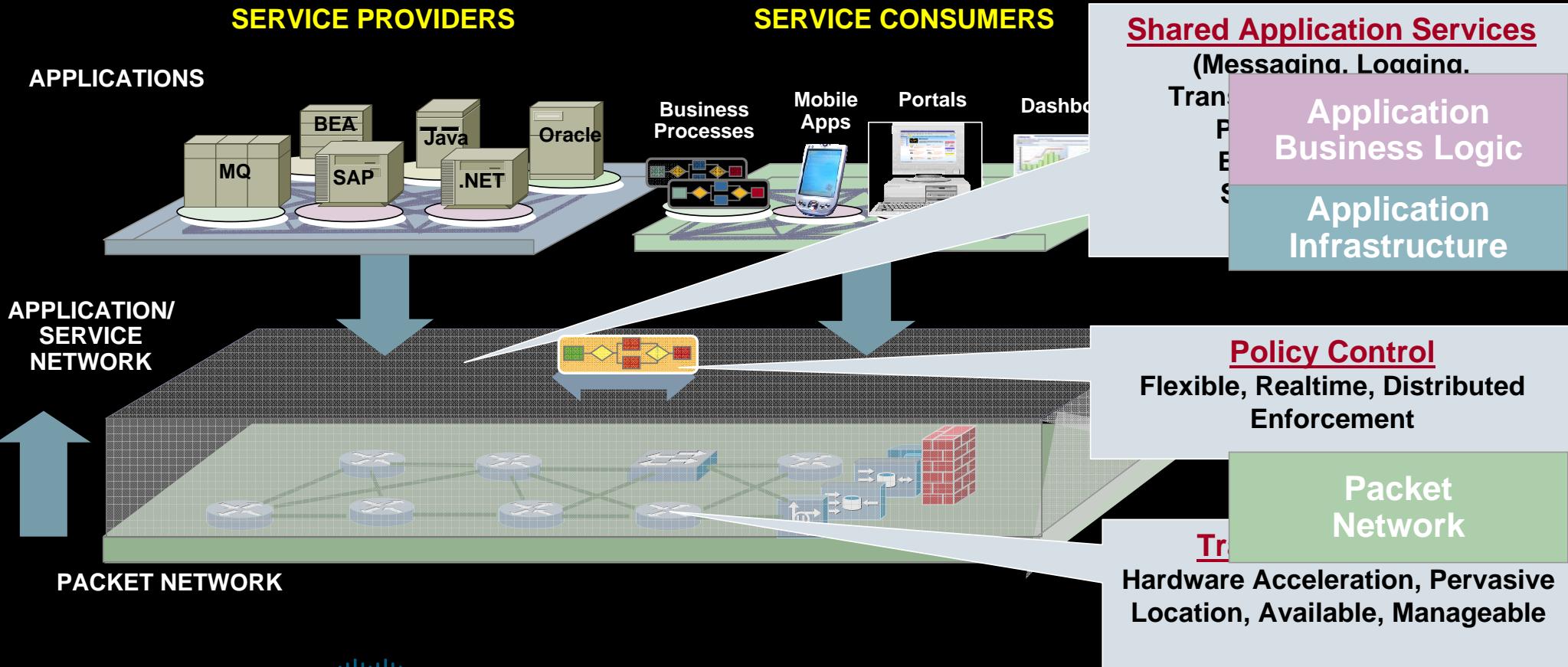**{prdas, ksankar}@cisco.com**

12th International High Performance Transaction Systems (HPTS) Workshop, Asilomar, CA (USA) October 7th – 10th , 2007.
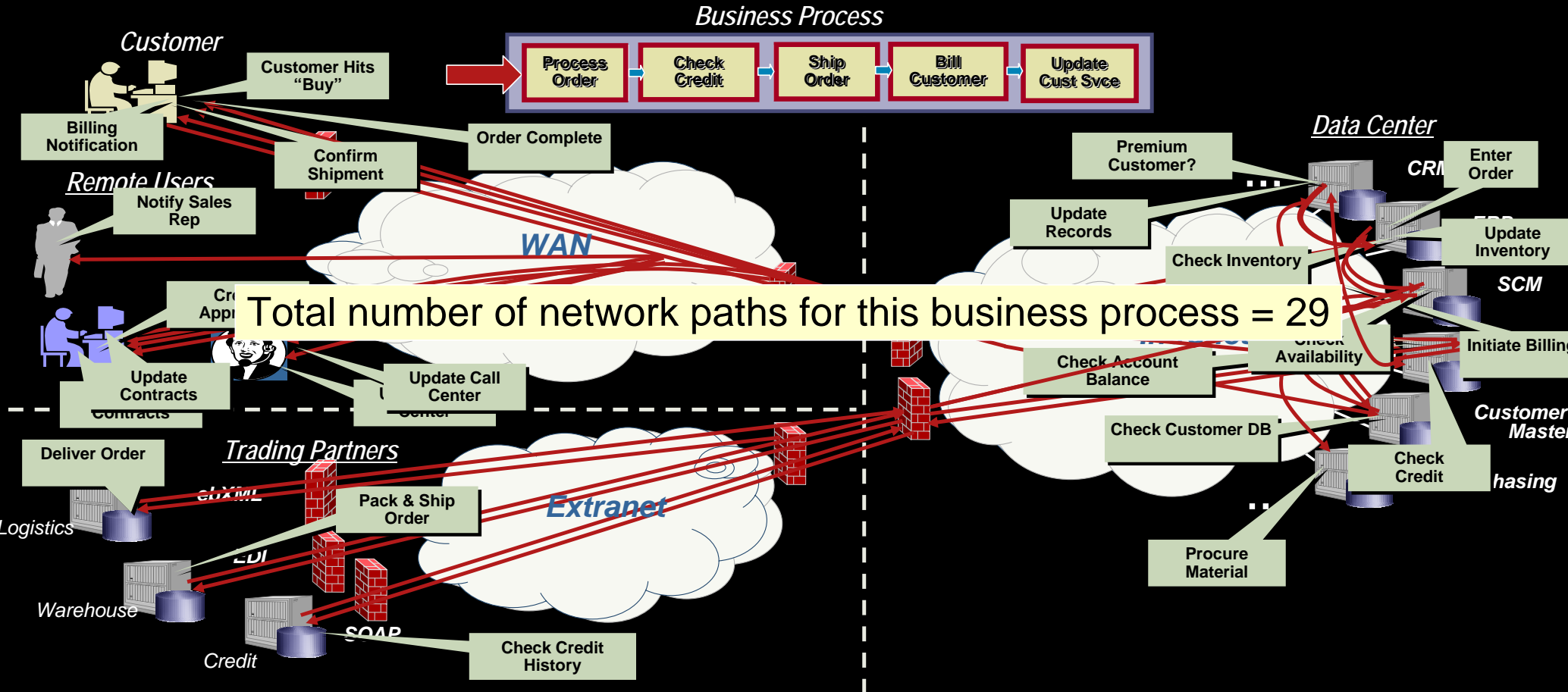**http://www.hpts.ws**

Why the Network?
Intelligence Migrates into the Network

APPLICATIONS

Firewall	SBC	Caching	Email	ERP	Voice Mail	WAFS
Anti-SPAM	Patch Updates	Database	Mobile Email	CRM	Wireless Mgmt

OS AND MIDDLEWARE

Disk Management	Load Balancing	File Virtualization

IP NETWORK

Left panel:

Call Control

VOICE APPS

TDM Voice Systems

QoS

TDM SYSTEMS

AON provides the "Network for Applications"

SERVICE PROVIDERS

SERVICE CONSUMERS

Shared Application Services
(Messaging, Logging,
Tran...

Application Business Logic

Application Infrastructure

APPLICATIONS

BEA
Java
Oracle
MQ
SAP
.NET

Business Processes
Mobile Apps
Portals
Dashbo...

APPLICATION/ SERVICE NETWORK

Policy Control
Flexible, Realtime, Distributed Enforcement

Packet Network

PACKET NETWORK

Tr...
Hardware Acceleration, Pervasive Location, Available, Manageable

Typical Business Process

Business Process

Process Order	→	Check Credit	→	Ship Order	→	Bill Customer	→	Update Cust Svce

Customer

Customer Hits "Buy"

Order Complete

Billing Notification

Confirm Shipment

Remote Users

Notify Sales Rep

WAN

Credit Approval

Total number of network paths for this business process = 29

Update Contracts

Contracts

Update Call Center

Center

Trading Partners

Deliver Order

ebXML

Pack & Ship Order

Extranet

EDI

Logistics

Warehouse

SOAP

Credit

Check Credit History

Data Center

Premium Customer?

CRM

Enter Order

Update Records

Update Inventory

Check Inventory

SCM

Check Account Balance

Check Availability

Initiate Billing

Customer Master

Check Customer DB

Check Credit

hasing

Procure Material

Impacts on the User Experience and IT addressed by Application Networking

Business Process

Customer

Response Time

Rich Content

Bandwidth

Authentication

Application Performance

Data Center

ERP

WAN

Application Collaboration

SCM

Wide Area Utilization

Server Consolidation

Server Load

Multiple Protocols

Accts

Multiple Formats

Customer Master

Edge Visibility

XML

Multiple Platforms

Purchasing

Partners

Extranet

Partner Security

Multiple Gateways

ebXML

Process Integration

Logistics (3PL)

Open/Proprietary Standards

Analytics/ Dashboard

Warehouse

RFID

Credit (ASP)

Business Process: Process Order | Check Credit | Ship Order | Bill Customer | Update Cust Svce

CISCO

Cisco Application-Oriented Networking (AON)

- The first and only network-embedded system for the intelligent routing of application messages

- Moves key application infrastructure functions into the network where they can be easily shared

- Makes message-level communication, visibility, and security pervasive throughout the enterprise

AON *understands* application messages

- **Conventional networks can't interpret message contents**

- **Limited synergy with applications themselves (e.g. QoS, message type)**

- **AON intercepts and processes Inter-application messages**

- **AON reconstructs original message content & context**

- **An AON-enabled Network can understand and interpret message and apply Business Policy**

- **Allows more sophisticated direction of message traffic, optimizes throughput**

- **Synergy with packet network for unique insights/capabilities**

PURCHASE ORDER #: 012345678
FROM: BigWig Co, Anytown
TO: Cisco Systems   DATE: 04/01/05
QTY: 50   PART#: Widget #12345a
PRICE:=$500 ea. TOTAL: = $25,000
DELIVERY: Urgent   SLA:= 2 days

SAP

MFG

1010110010 ... 0100110101

APPLICATION ORIENTED NETWORKING

SAP

MFG

?

10101100101101101101010100110101
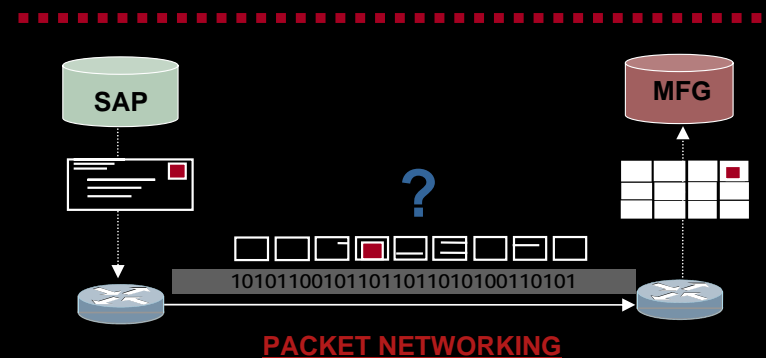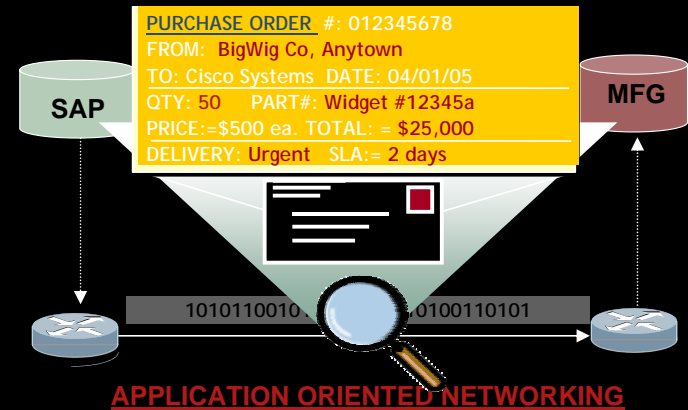
PACKET NETWORKING

New Networking Paradigm: AON Aggregates Packets into Application Messages

Packets in the L2/L3 Network:

| 1011010 | | 1011010 | | 1011010 | | 1011010 | | 1011010 | | 1011010 |

Application Messages in AON Overlay:

- Terminate TCP, Terminate SSL
- Deep inspection of complete payload
- Re-aggregation of multiple packet payloads into original application message (e.g., purchase order)

AON Form Factors

Data Center/Enterprise

- Module for Catalyst 6500 Series Switches
- Scale with multiple modules

Branch Office

- Network Module for Cisco 2800/3700/3800 Routers
- Scale with multiple modules

Network Integrated Appliance

- Performance consolidation
- Flexibility of deployment/ownership

AON Integrated Management with Distributed Deployment and Enforcement

Design-time

Deploy-time

Run-times

ADS (AON Development Studio):
drag and drop GUI to set application communication and security policies
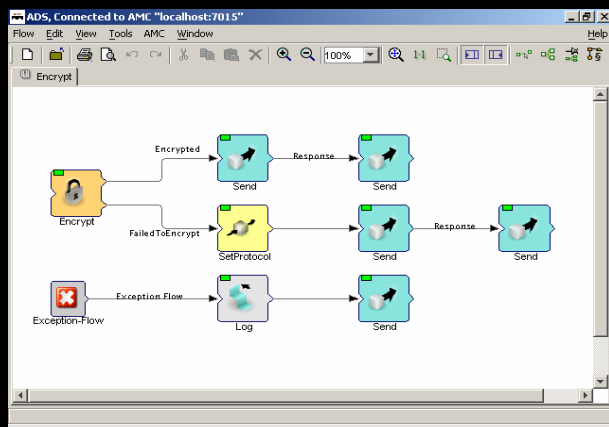
AMC (AON Management Console):
manage AON modules and distribute policies to all AON nodes
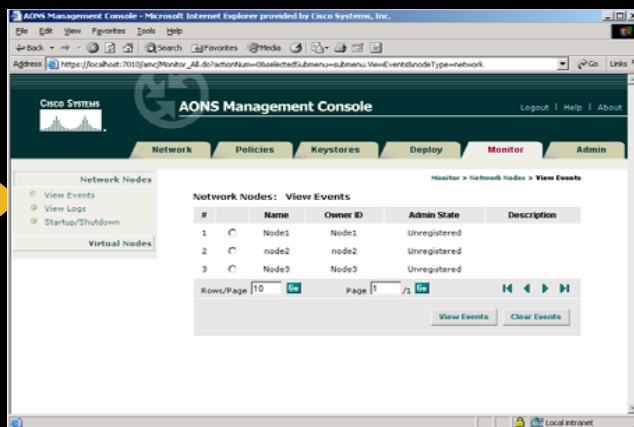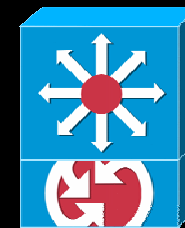
AON Data Center blades

AON Branch Office blades

AON network Integrated appliances

How AON Works: Selective Filtering & Mediation

Message Classification

Selective Redirection

Forwarding Engine (Catalyst 6000)
Route Processor (3700, 2600)

Adapter

Adapter

WCCP

First level of redirection based upon source & destination IP, Port & Protocol

Adapter

Used to create onward application connection or to reconstruct TCP flow to source transparently

Adapter

Two classes (Application and Protocol). Adapters can be 'client' and 'server' forms 'Client' Adapters initiate Policy

Message Type

Redirected traffic reframed by adapter must comply to a message type filter

Policy Execution Plan

If correctly framed and of expected message type then execute a data flow or Policy Execution Plan

AON Operating Modes

Explicit Mode

- AON acts as a proxy, explicitly addressed by caller

Transparent Mode

- AON acts as a transparent proxy, invisible to the caller

Promiscuous Mode

- AON receives copies of application messages with *zero* impact on network flow
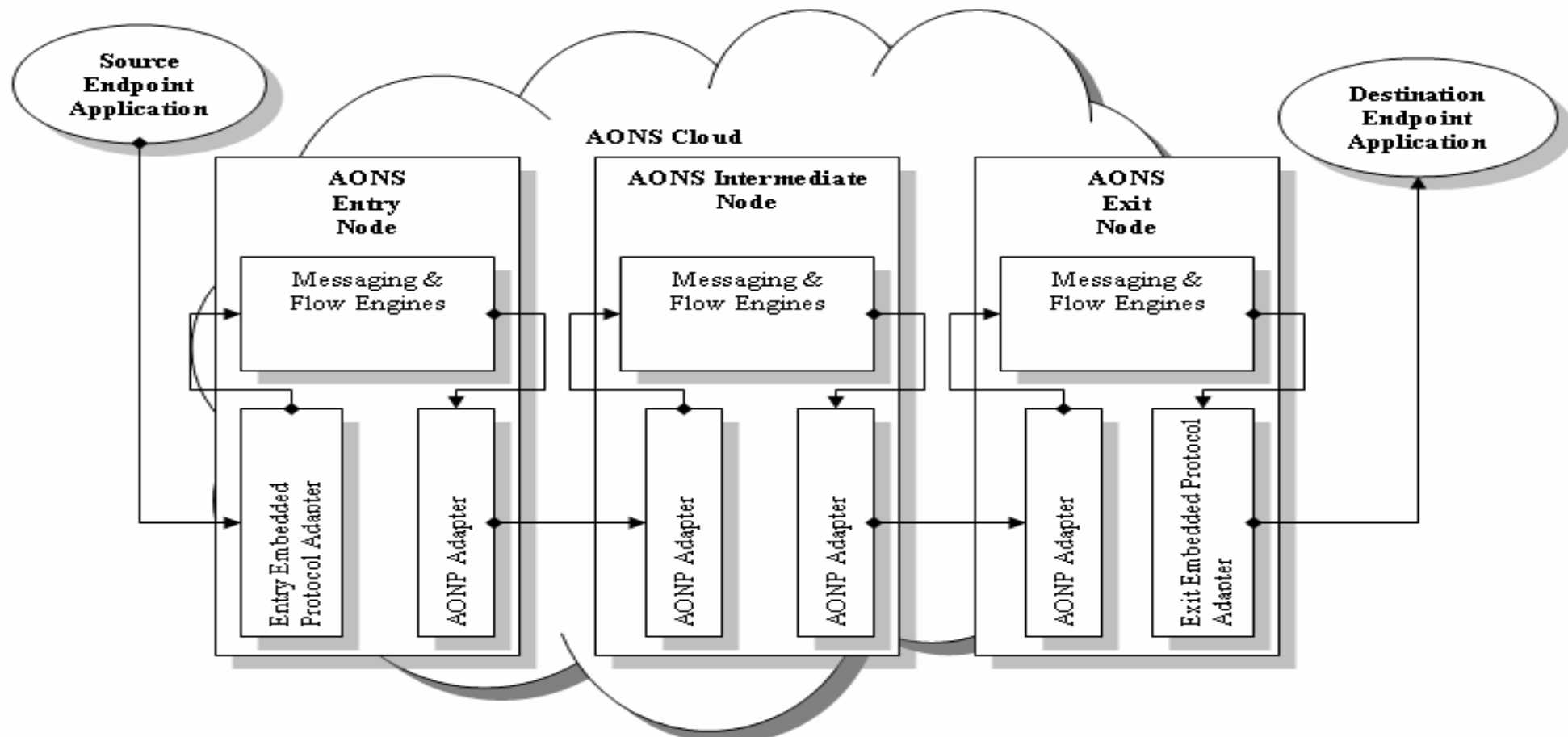
From: App A
To: AON X

From: AON X
To: App B

App A

App B

AON 'X'

From: App A
To: App B

App A

App B

AON 'X'

App A

App B

All Messages between App A & App B

AON 'X'

CISCO
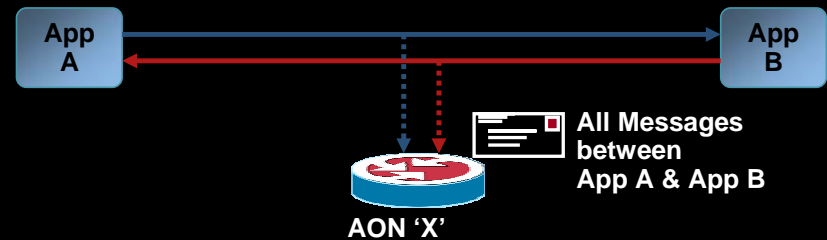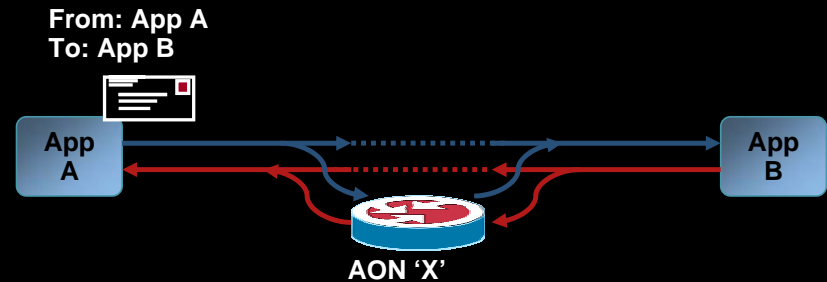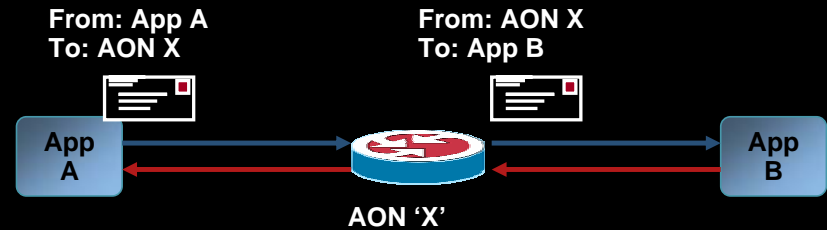
AON Virtual Clusters for Built-in Scalability & High Availability
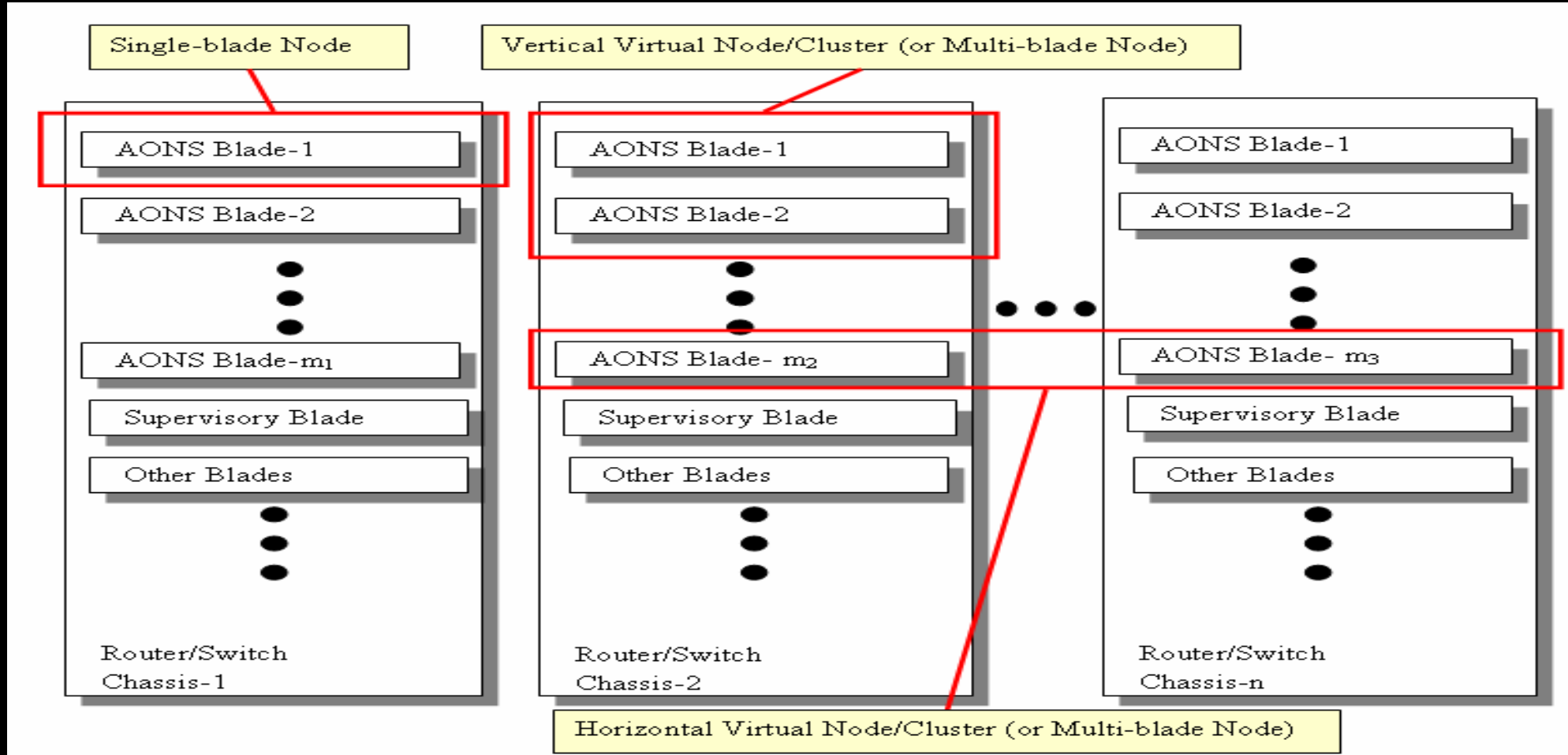
AONS Network Cloud Concept (1 of 2)
- Synchronous transport protocols
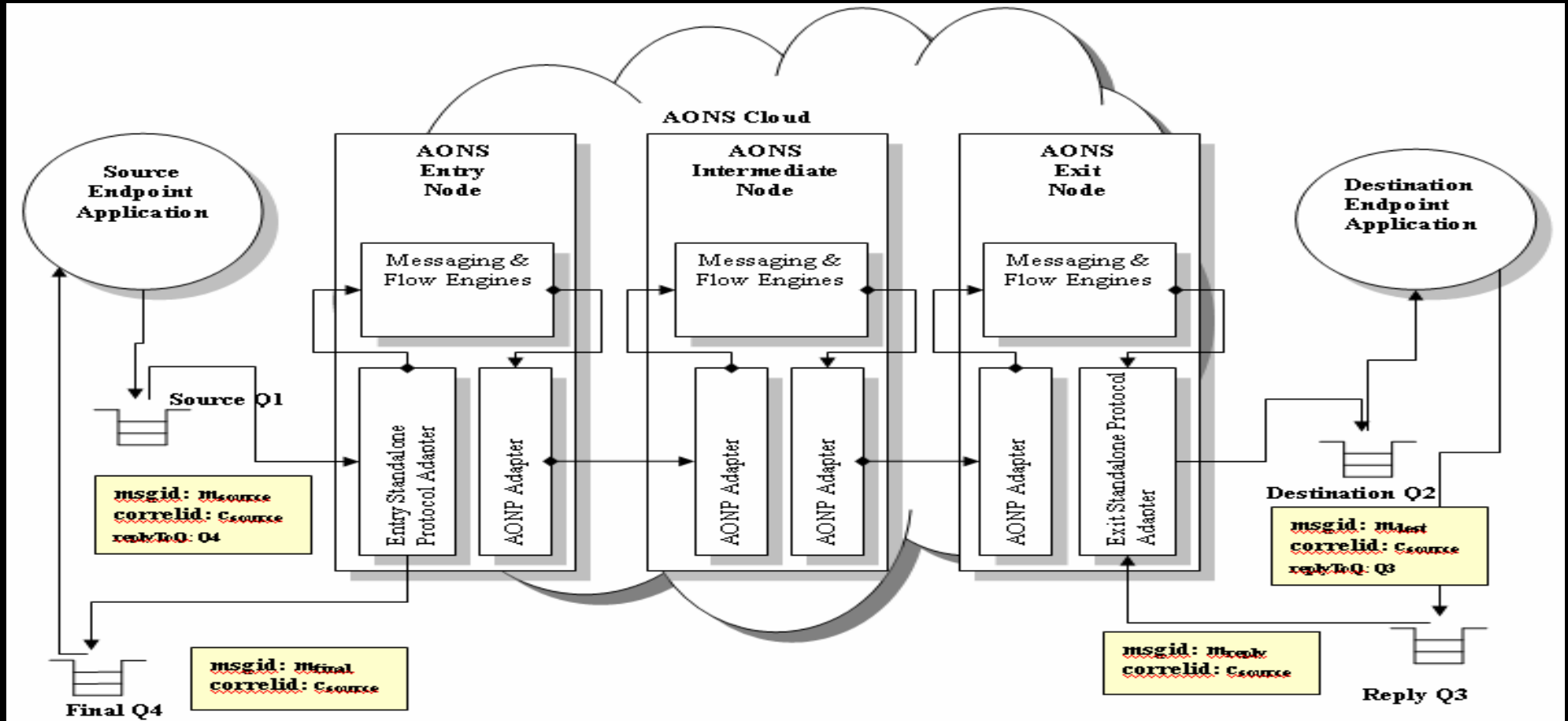
AON Platform Extensibility
- Weaving your Applications into the Intelligent Network

Adapters (ADK)
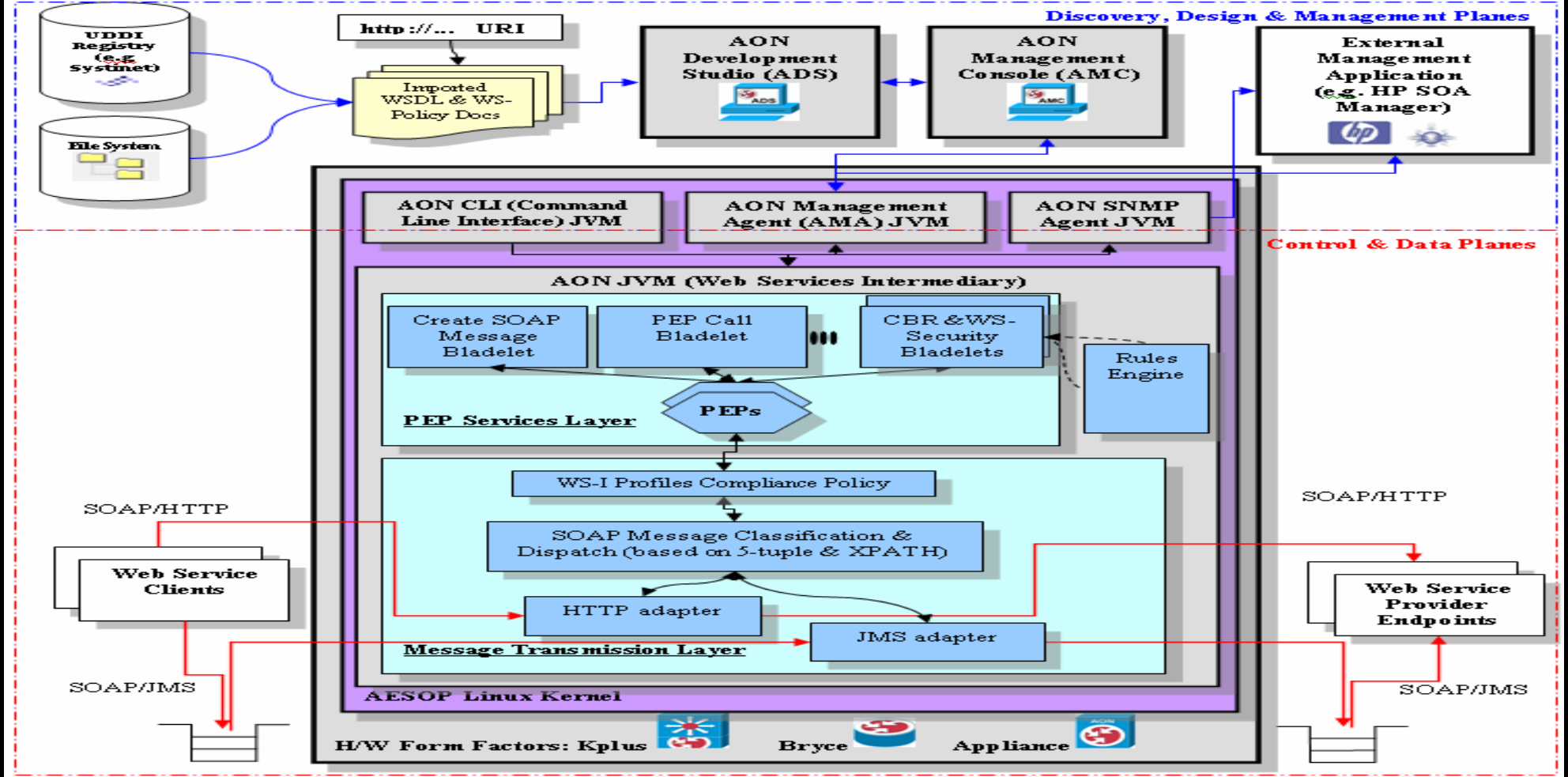
- HTTP/S
- SMTP
- FTP
- SIP
- MQ, JMS
- UDP, etc
.

Bladelets (BDK)

- Encrypt/Decrypt
- Access-DB
- Cache Get/Put
- Balance-Load
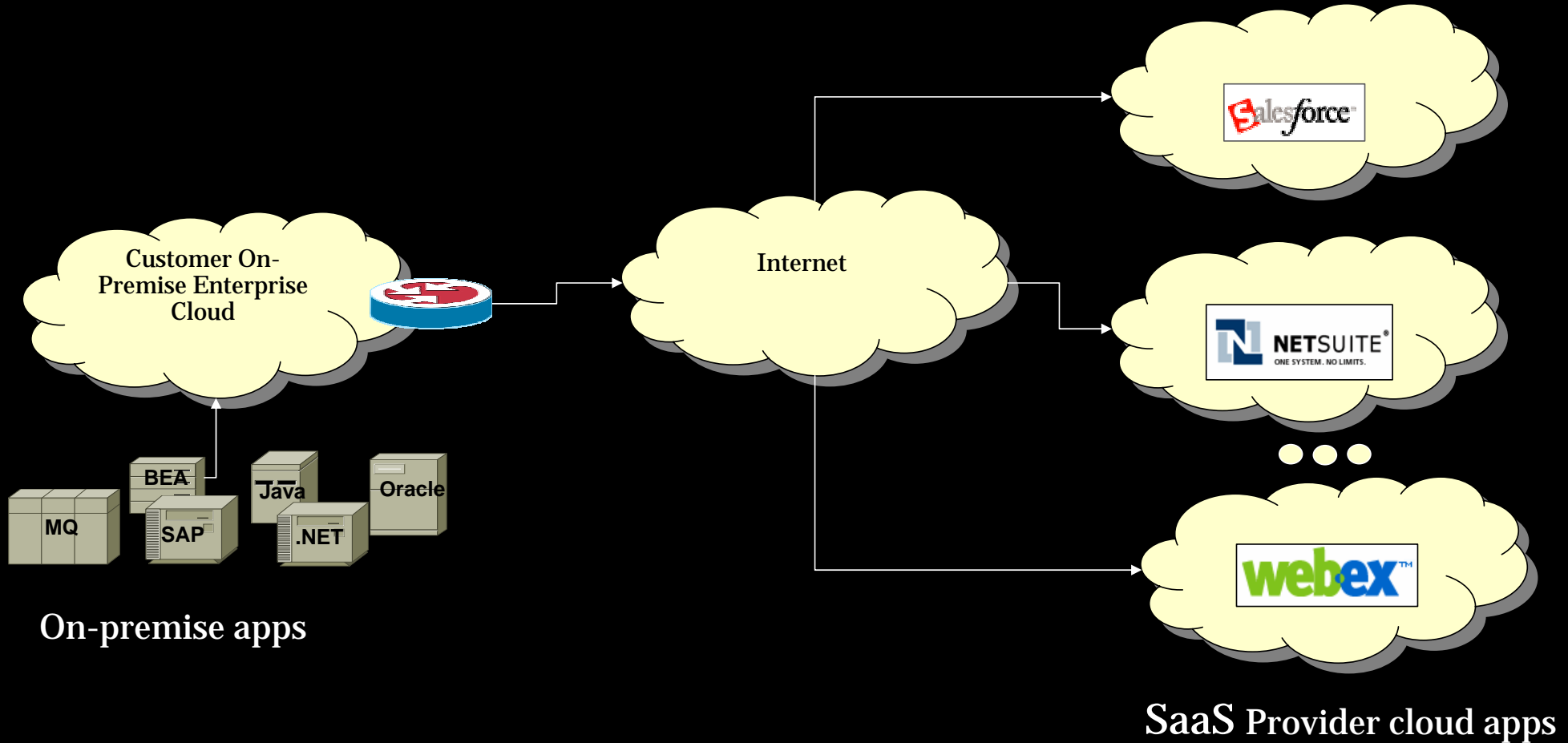- Distribute
- Content-Based Routing, etc.
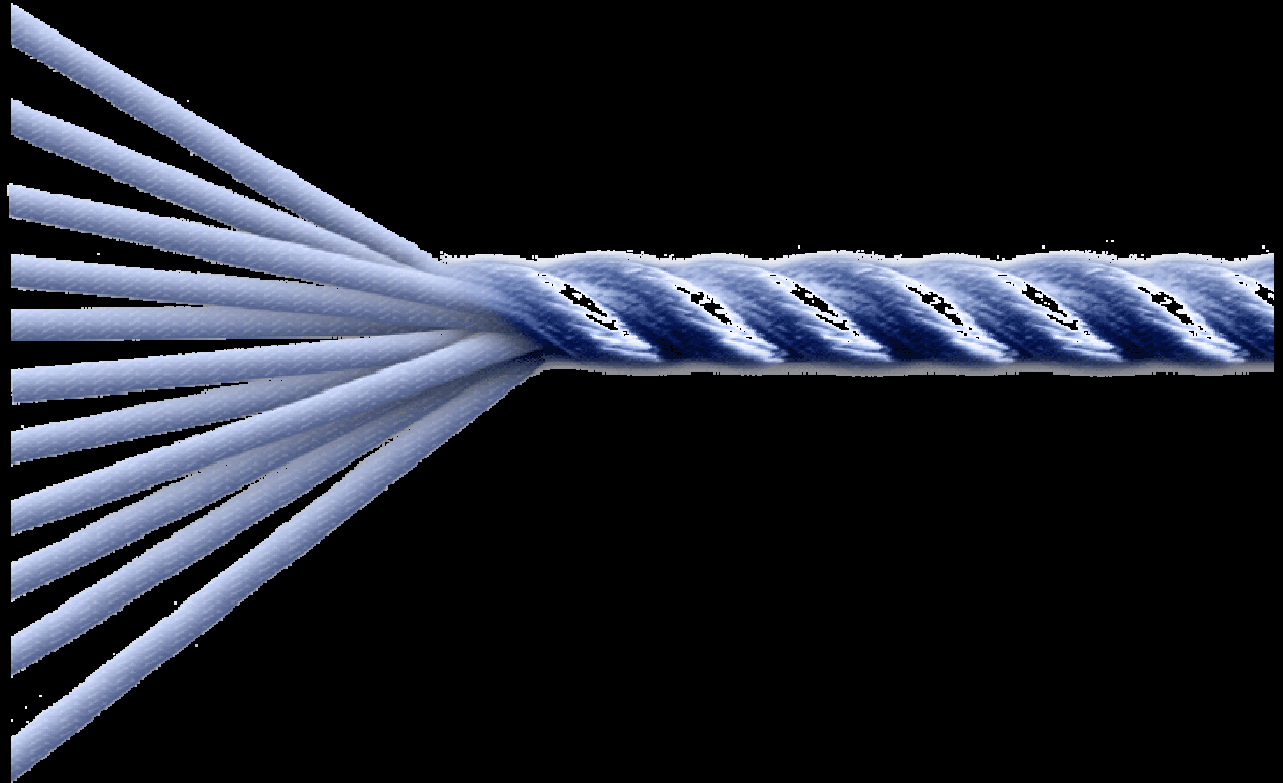
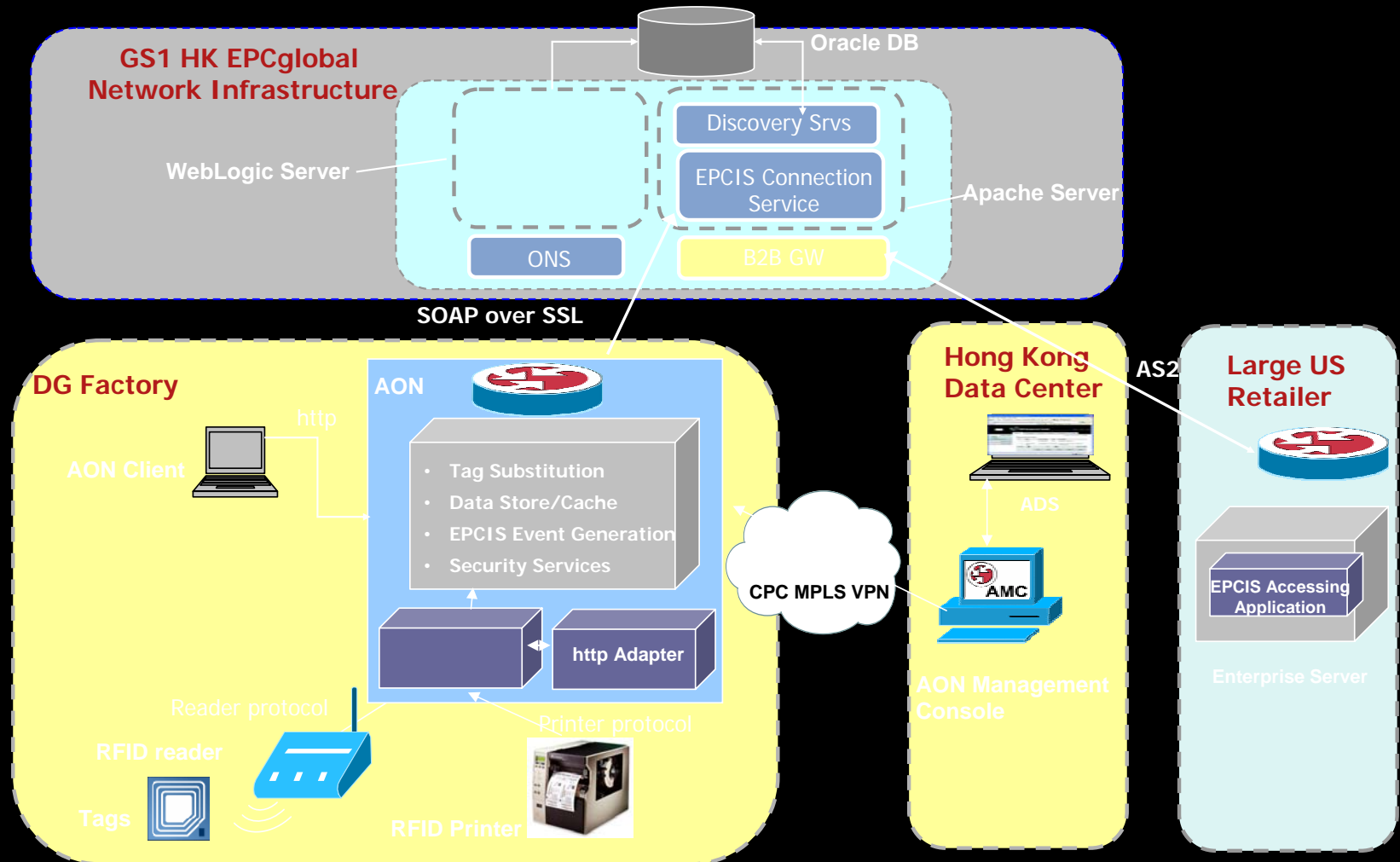# AON as a Web Services Intermediary

AON as a SaaS integration gateway

Customer On-Premise Enterprise Cloud

Internet

On-premise apps

MQ **BEA** **SAP** **Java** **.NET** **Oracle**
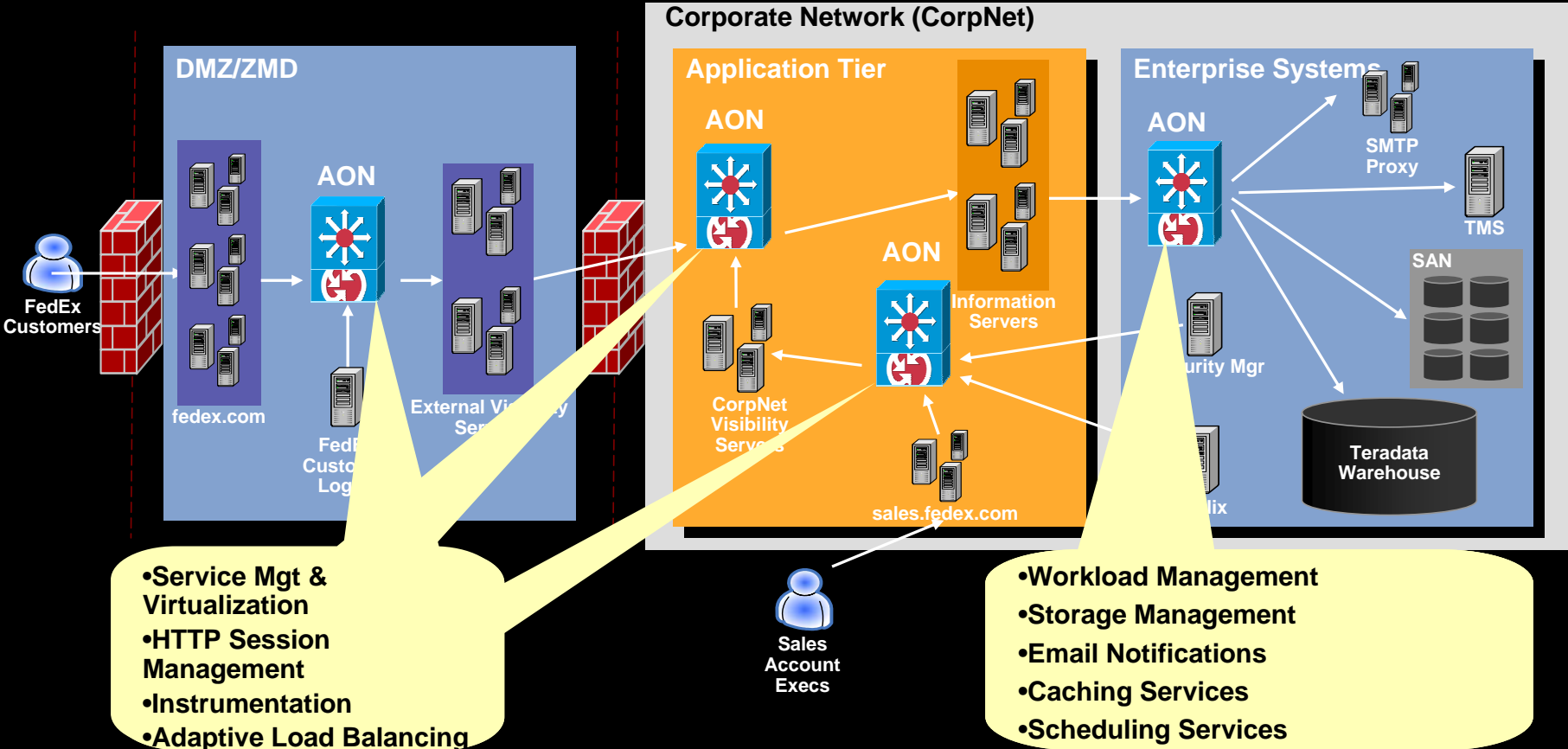
SaaS Provider cloud apps

Sample AON Production Customer Deployment Scenarios

- Retail
  - Hong Kong Manufacturing Company
- Logistics & Global Delivery Services
  - Large US Shipping Company
- Service Providers
  - Italian Telecom Company
  - European Telecom Company
  - US Telecom & E-Commerce Company
- Healthcare
  - Large Municipal Department of Health on the East Coast
- Financial Markets
  - Top Wall Street Investment Bank
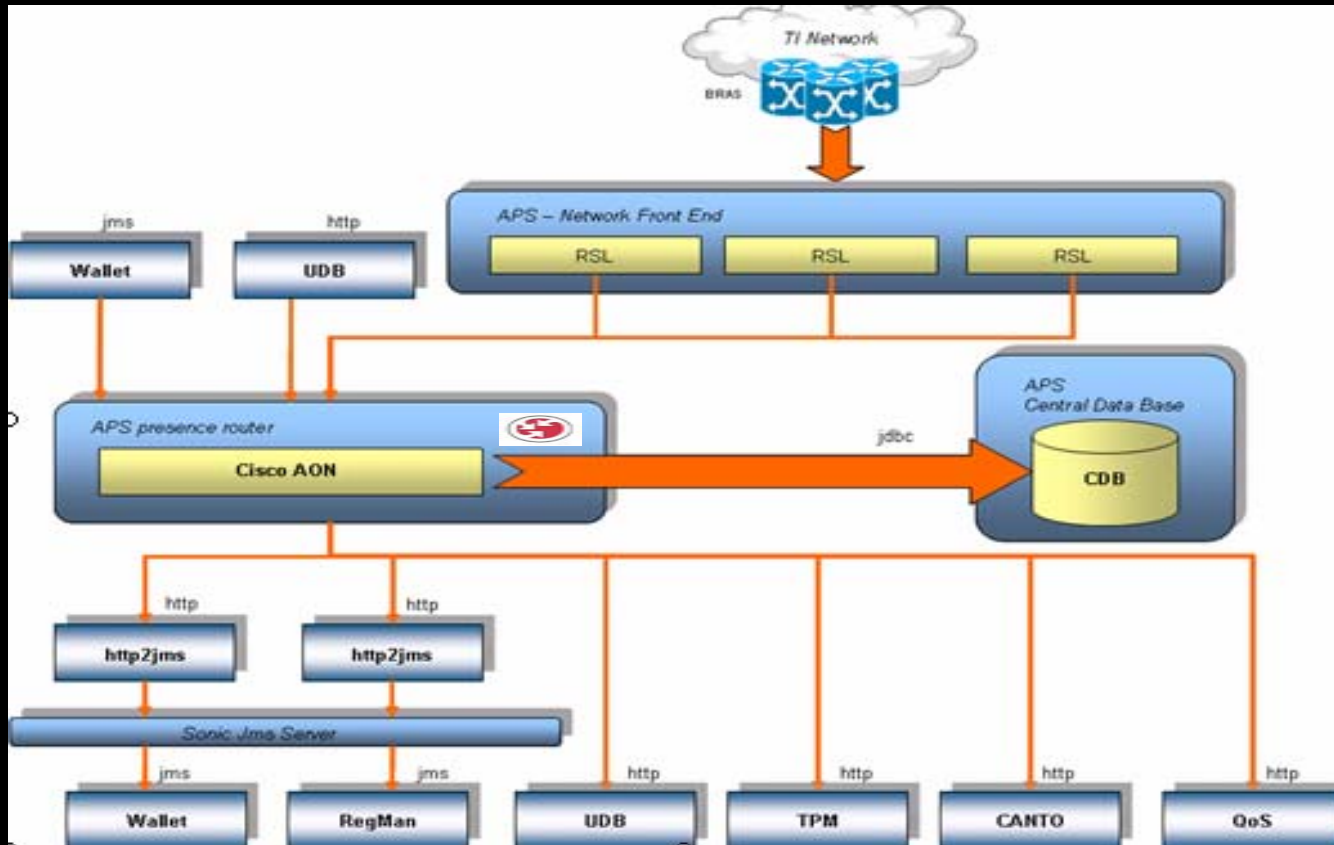- Global Enterprise IT
  - Cisco IT

(Hong Kong Manufacturing Company) RFID EPC Hub Integration

GS1 HK EPCglobal Network Infrastructure

Oracle DB

WebLogic Server

Discovery Srvs

EPCIS Connection Service

Apache Server

ONS

B2B GW

SOAP over SSL

DG Factory

AON

- Tag Substitution
- Data Store/Cache
- EPCIS Event Generation
- Security Services

AON Client

http

http Adapter

Reader protocol

Printer protocol

RFID reader

Tags

RFID Printer

CPC MPLS VPN

Hong Kong Data Center

ADS

AMC

AON Management Console

AS2

Large US Retailer

EPCIS Accessing Application

Enterprise Server

(Large US Shipping Company) Reporting Online System

Corporate Network (CorpNet)

DMZ/ZMD

AON

FedEx Customers

fedex.com

FedEx Customer Log...

External Visibility Ser...

Application Tier

AON

AON

Information Servers

CorpNet Visibility Servers

sales.fedex.com

Sales Account Execs

Enterprise Systems

AON

SMTP Proxy

TMS

SAN

...urity Mgr

Teradata Warehouse

...lix

- •Service Mgt & Virtualization
- •HTTP Session Management
- •Instrumentation
- •Adaptive Load Balancing

- •Workload Management
- •Storage Management
- •Email Notifications
- •Caching Services
- •Scheduling Services

Italian Telecom Company: APS Presence Router

Solution features
- AON has to handle the network presence message and the events coming from other systems.
- Messages contain ADSL Customer data
- AON routes the message to various backend systems:
  - UDB for voip service
  - Regman for access gateway configuration
  - Wallet for prepaid customer
  - QoS for GbE network
  - CPI for managing customer process flag
  - TPM for network monitoring
  - CANTO for traffic monitoring

2007 Cisco WWSP IT Summit

Dec '05, ACT 1 – Comparing AON to Sw ESBs: results

Test Aqualogic + BW	Risposta mail/PAWA		
	Min	**Max**	**Avg**
Test 1: 100 richieste con contemporaneità 3	478	829	529
Test 2: 200 richieste con contemporaneità 5	539	759	601
Test 3: 100 richieste con contemporaneità 3 (una errata ogni 5)	373	1579	429
Test 4: 200 richieste con contemporaneità 5 (due errate ogni 5)	416	631	434

Ripartizione tempo conferme attivazione

Test AON	Risposta mail		
	Min	**Max**	**Avg**
Test 1: 100 create account con contemporaneità 3	68	177	86
Test 2: 200 create account con contemporaneità 5	49	201	90

Ripartizione tempo conferme attivazione

AON 6 times faster than sw ESBs!

Nota: i tempi indicati sono espressi in millisecondi

8
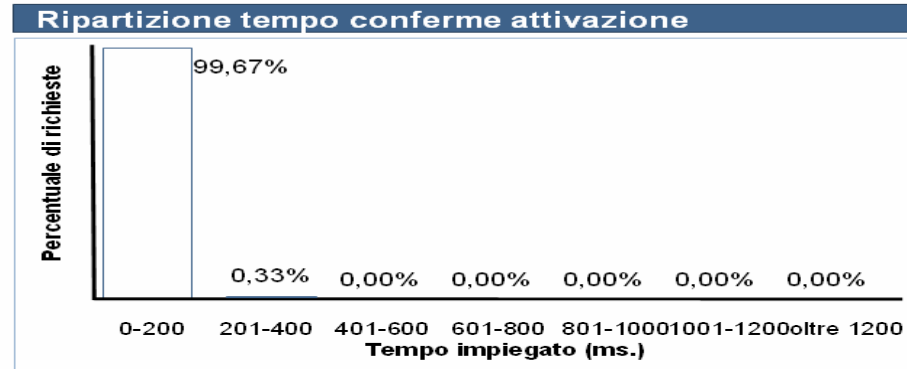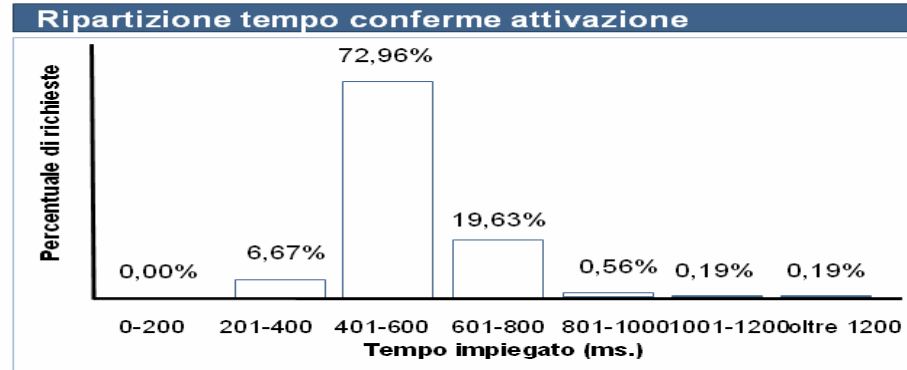
European Telecom Company: Service proxy
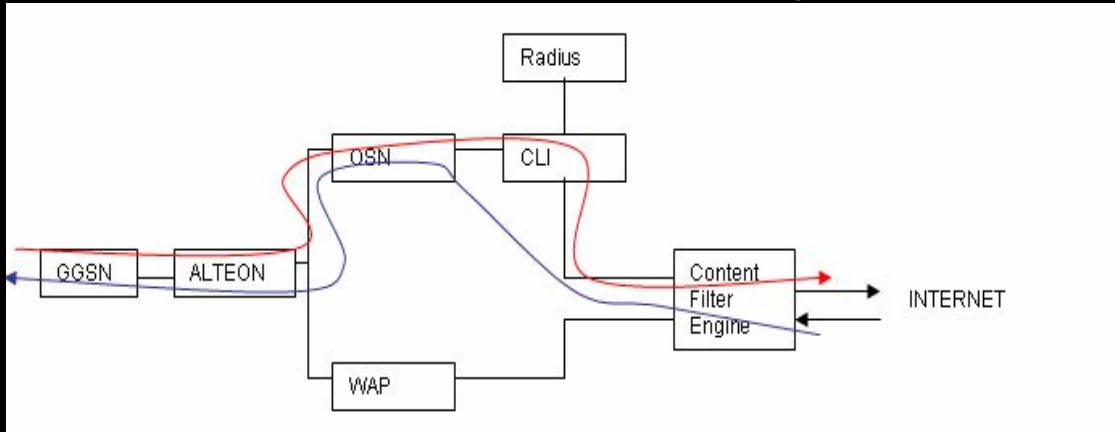
KEY: Alteon: load balancer | OSN: content enrichment | CLI: insertion of MSISDN | Content filter engine: Adult content check
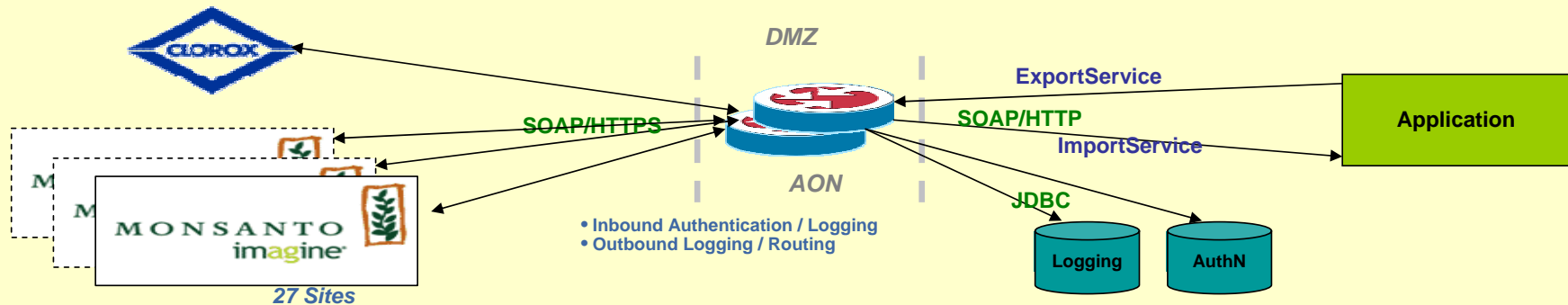

Solution features

▸ Orchestration: AON to provide graphical policy to orchestrate MSISDN insertion, Radius lookup and routing to content filtering / content enrichment engines

▸ Interception: Capture of 'STOP' messages from handset and update of Radius database

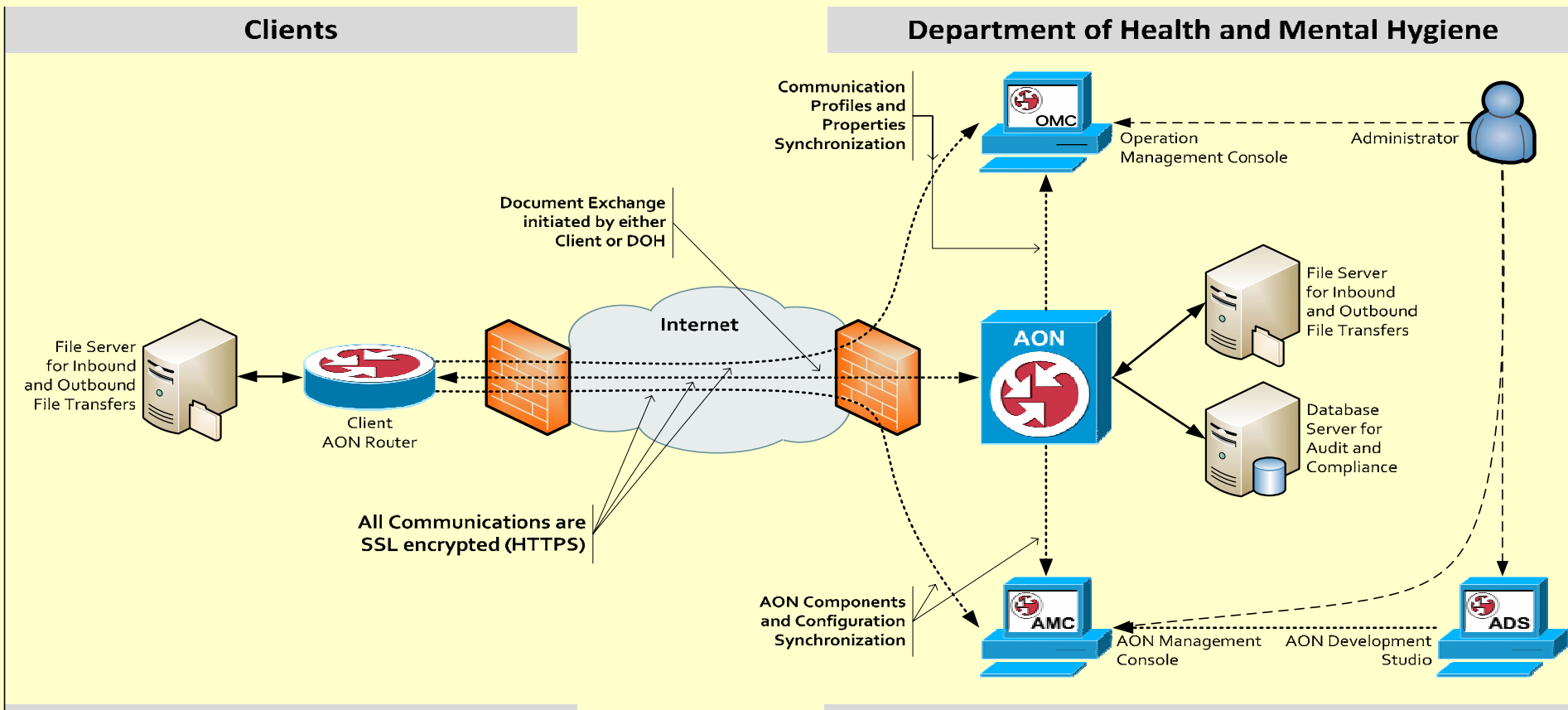▸ Logging: Auditing framework for traffic and policy timings
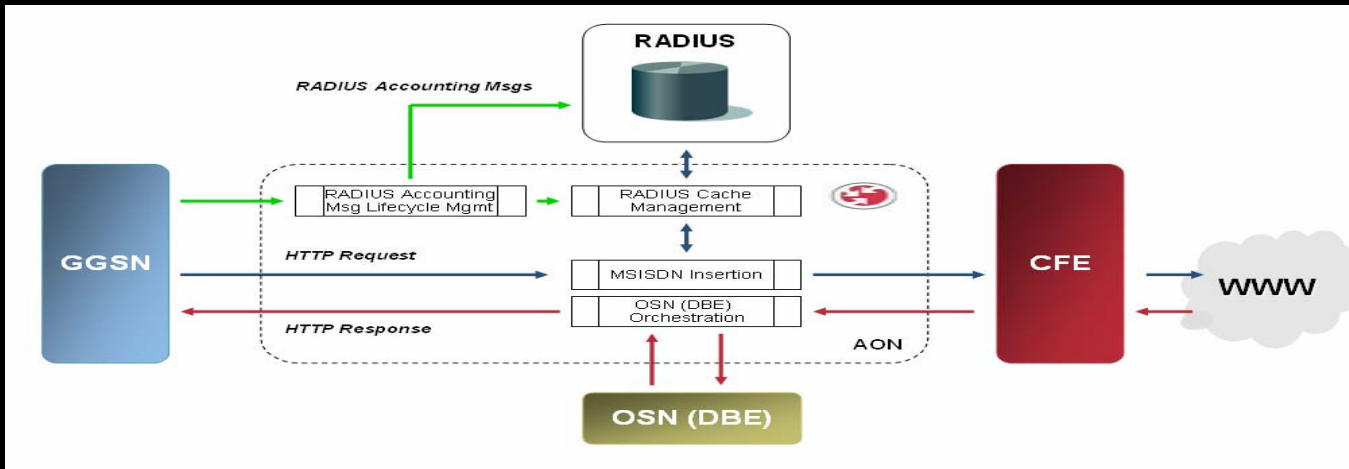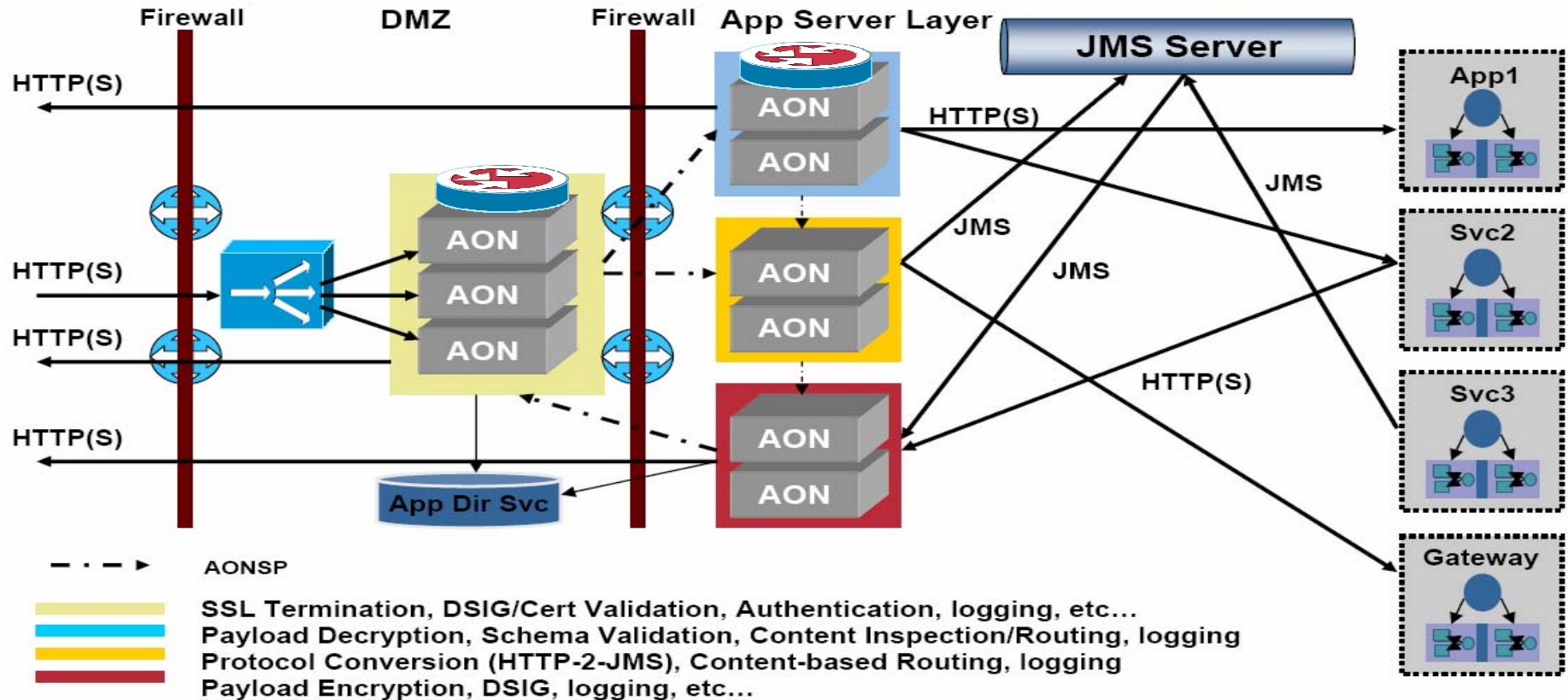
US Telecom & E-Commerce Company B2B gateway

- Provides a collaborative logistics network for transportation management
  - *Simply:* Bringing together Manufacturers, Retailers, and Distributors with Logistics Service Providers
- Introducing Web Services-based Transactions
  - Wants to offload message services to dedicated devices
  - Reduce development time and new customer onboarding
- Using AON to provide B2B gateway services via their network

DMZ

CLOROX

SOAP/HTTPS

ExportService

SOAP/HTTP

ImportService

Application

AON

• Inbound Authentication / Logging
• Outbound Logging / Routing

JDBC

Logging   **AuthN**

MONSANTO imagine

27 Sites

Large Municipal Department of Health on the US East Coast Public Health Information Network Messaging System

Cisco IT (eating our own dog-food)