Creating Effective EAI Strategies

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MINNESOTA
Government Information
Technology Symposium

Overview of Presentation

Although still in it infancy, EAI (Enterprise Application Integration) is now becoming a critical technology for many state agencies. Other agencies interested in sharing information will soon have **higher expectations** of your ability to share real-time information quickly and cost effectively. As a result, many state agencies need to start creating **coherent EAI strategies**. This presentation is targeted at managers, project managers and business analysts that are interested in understanding the issues around creating EAI strategies for state agencies.
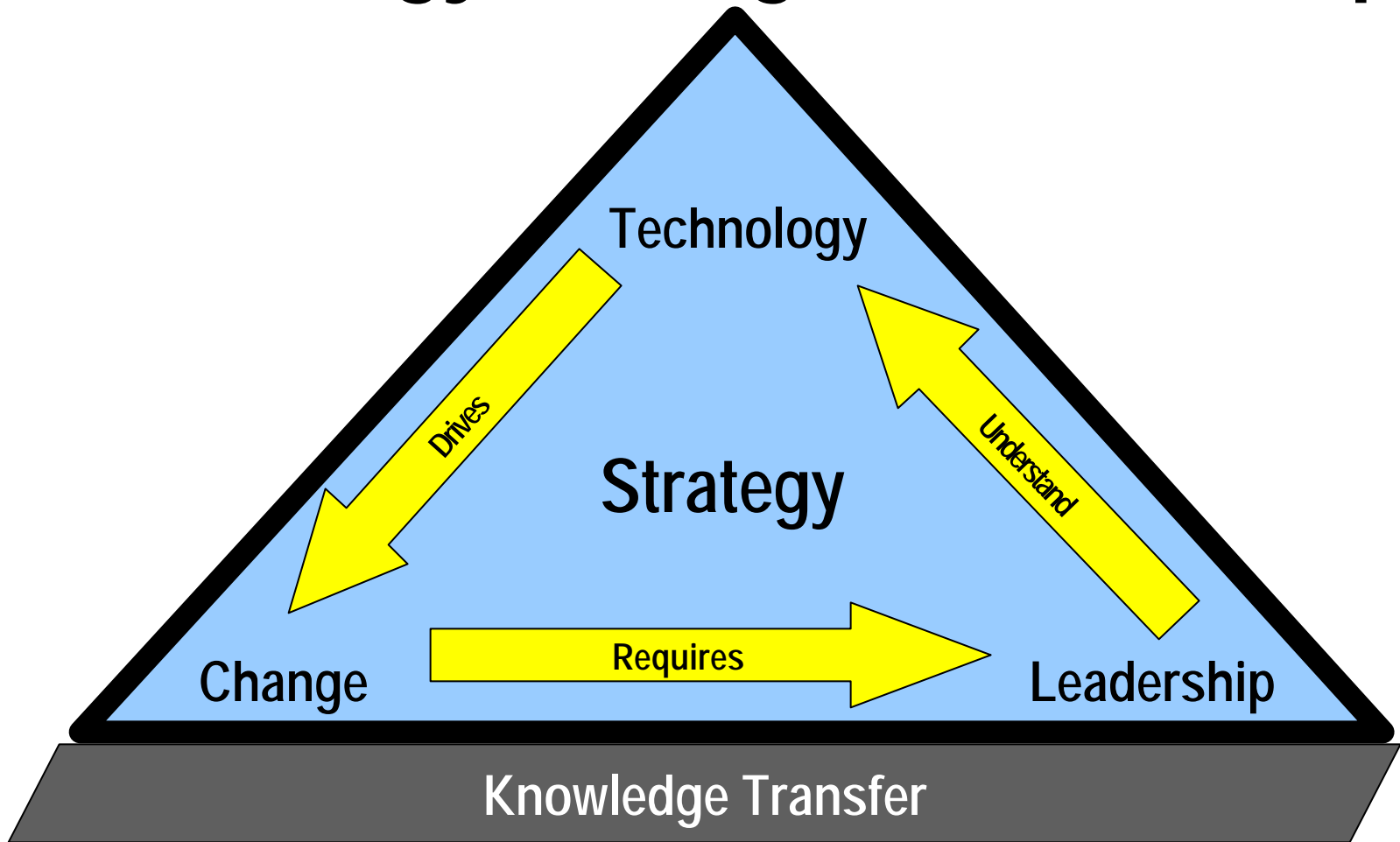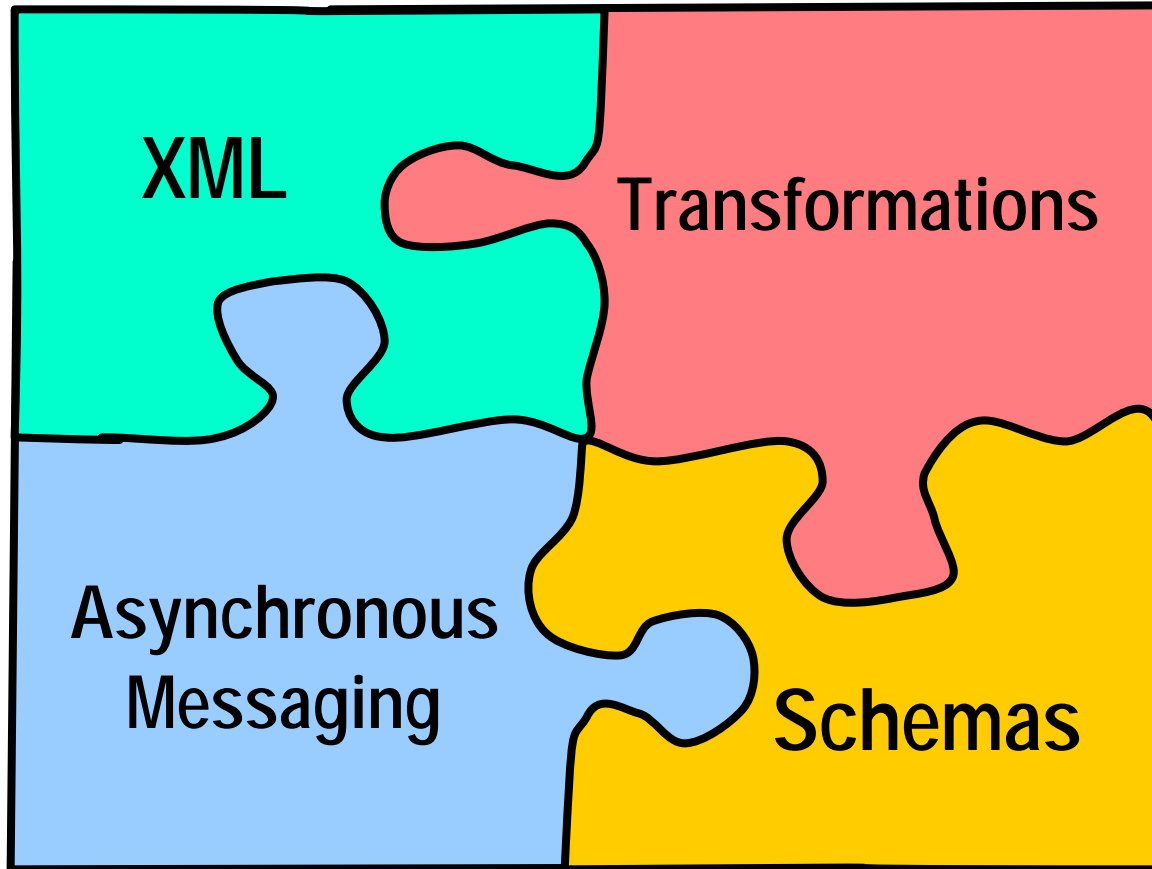
Topics

- **EAI Scope and Approaches**
- **Adapters**
- **Asynchronous messaging**
- **XML, XML Schemas, XML Transforms**
- **Web Services**
- **Publish and subscribe systems**
- **Workflow and orchestration**
- **Case studies**

# Technology, Change & Leadership

The EAI Puzzle

Metcalf's Law

- The **value** of any network rises **exponentially** with the number of organizations connected to it.

- A Fax machine is not very useful if none of your vendors or customers send or receive Faxes.

- EAI will be most effective when all state agencies speak a "common language"

Traditional EAI is Expensive

Initial License Costs

Integration Costs

- Up to 30% of costs of installing enterprise applications are related to integration.
  - *Gartner Group*
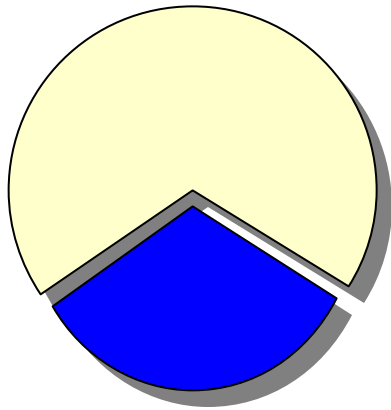
Key EAI Events

Sun's
Jon Bosak

Oracle's
Larry Ellison

Microsoft's
Bill Gates

May 1996

w3c's Dan Connolly challenges Bosak to "Bring SGML to the Web"

March 2001

Ellison says that Oracle will differentiate itself through ease of integration

## July 2002

XML is "more important than programming languages"

"More Important Than Programming Languages"

… in a significant departure from reliance on its programming languages to tie software developers to its Windows operating system, Mr. Gates said the company had come to realize, along with the computer industry, that **programming languages were no longer as important as the XML format**.

- New York Times, July 26th 2002

Dropping the Cost of Integration

$100,000	$10,000
	$10,000
	$10,000
	$10,000
	$10,000
	$10,000
	$10,000
	$10,000
	$10,000
	$10,000
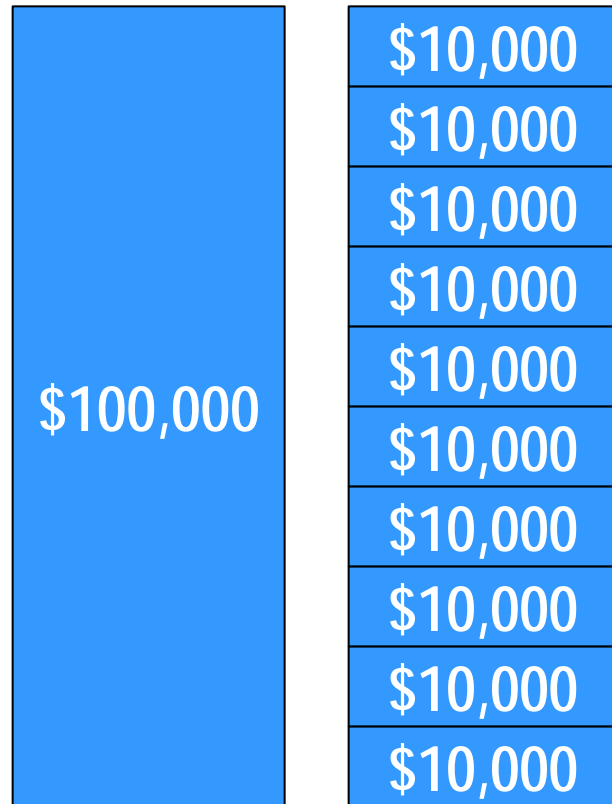
- Web Services will lower the cost of integrating applications by an order of magnitude.

- 10 times aa many applications can share data for the same budget

- Quality of sharing can increase by 10

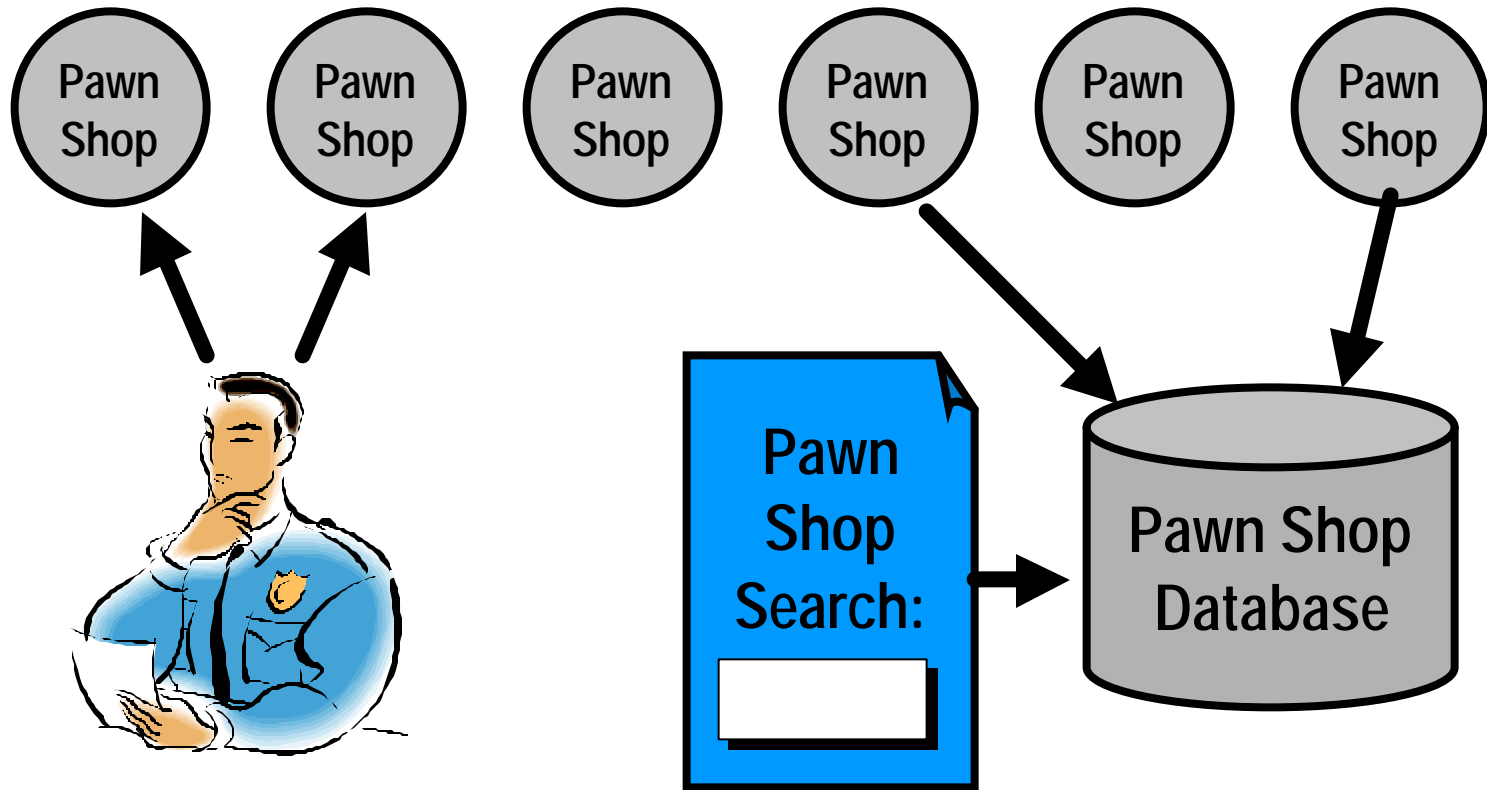- The **VALUE** of information systems that are integrated increases

Define EAI

**Data
(XML)**

**Process
(Web Services)**
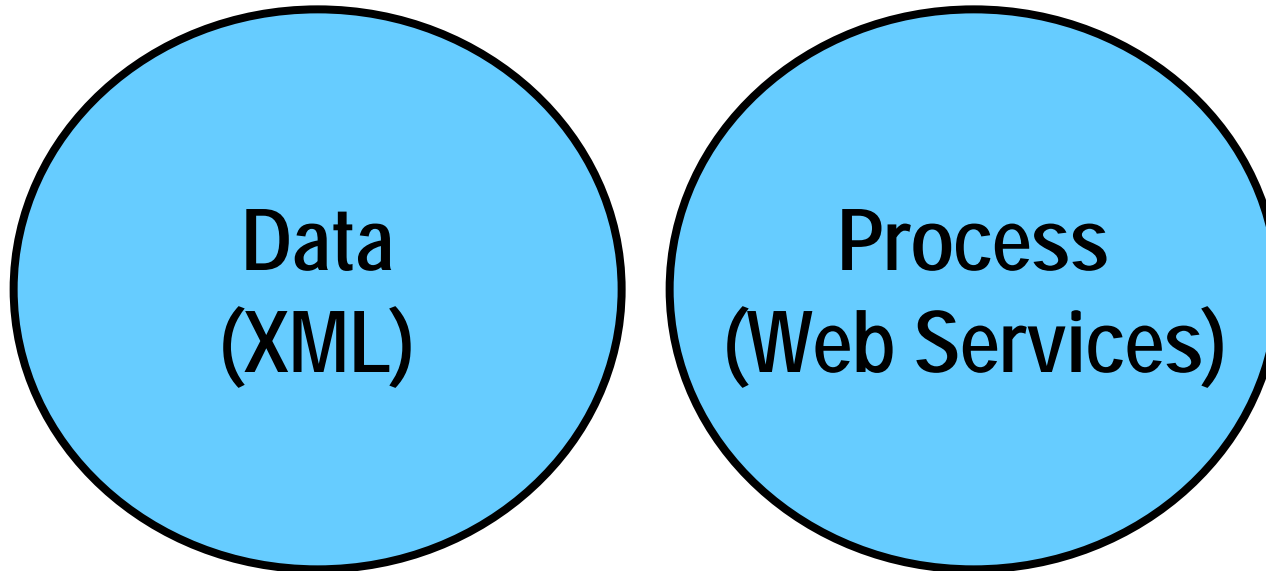
EAI is the art and science of sharing both data and process between any two organizations

Automated Pawn System

Time to call 10 pawn shops vs. time to search a single web page.
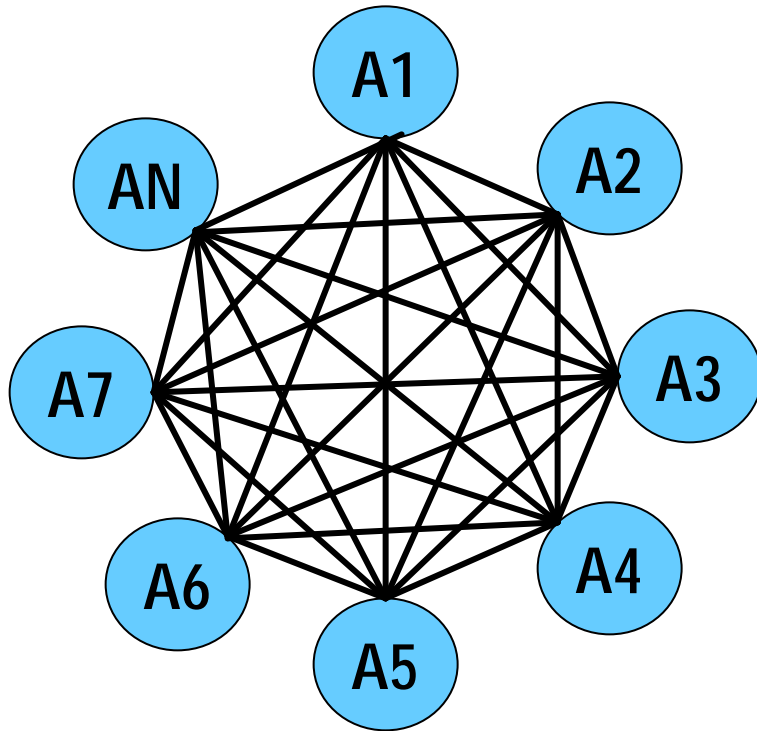
Process Challenge

"We don't share process. It is too hard to share process. We are just beginning to share data and that in itself is really hard…"

…but EAI **will** change this…

What **new** services based around shared processes could your organization offer the public or other state agencies?

The EAI Challenge

A1 A2 AN A3 A7 A4 A6 A5

- N applications that need to communicate with each other

- 1st application needs N-1 connections

- 2nd application needs N-2 connections

- Order of (N*N) point to point connections
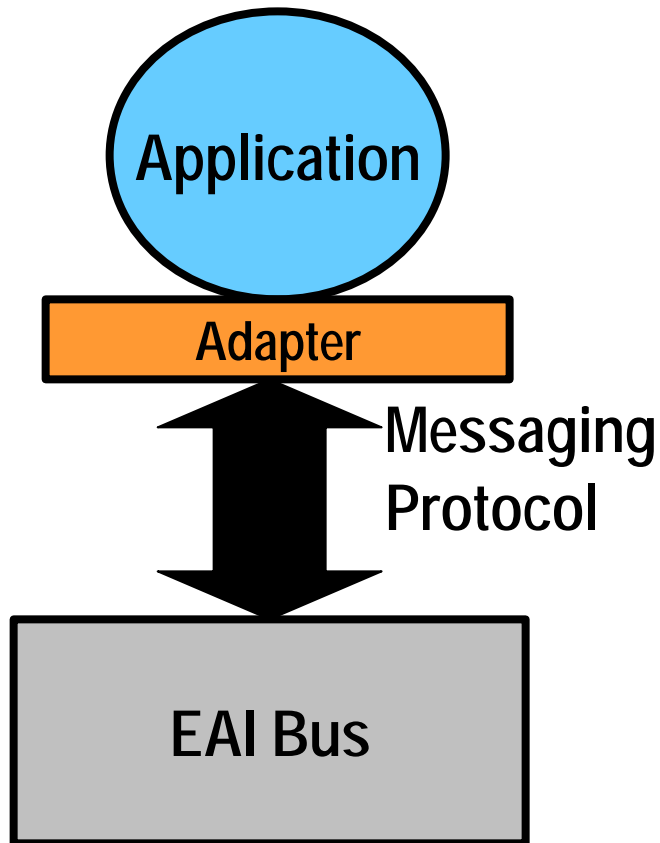
- 50 systems = Order of (2500 interfaces)

The Solution
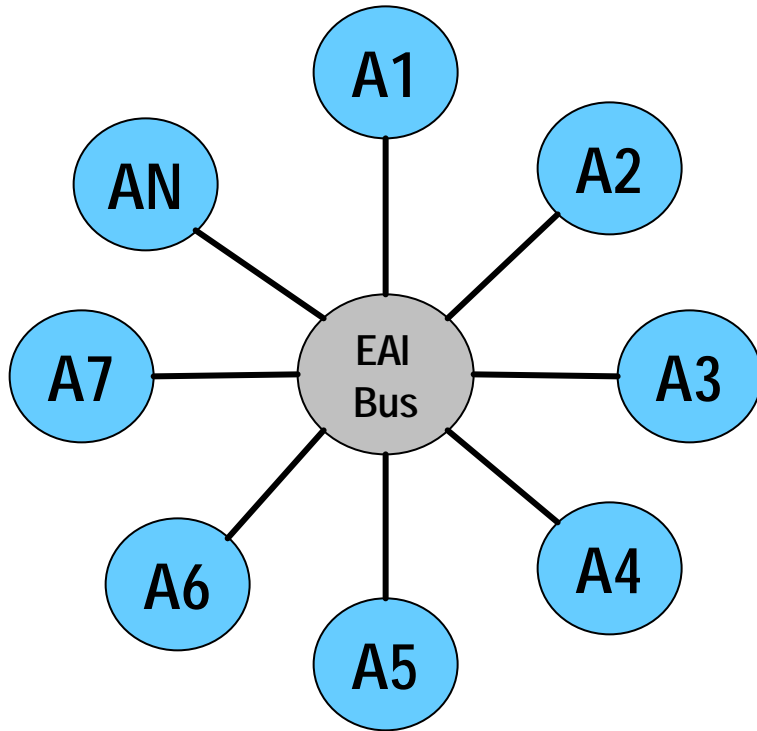
- Build a central EAI information bus that has "adaptors" to each of the applications

- Get each application to send are receive data in a common language

The Adapter

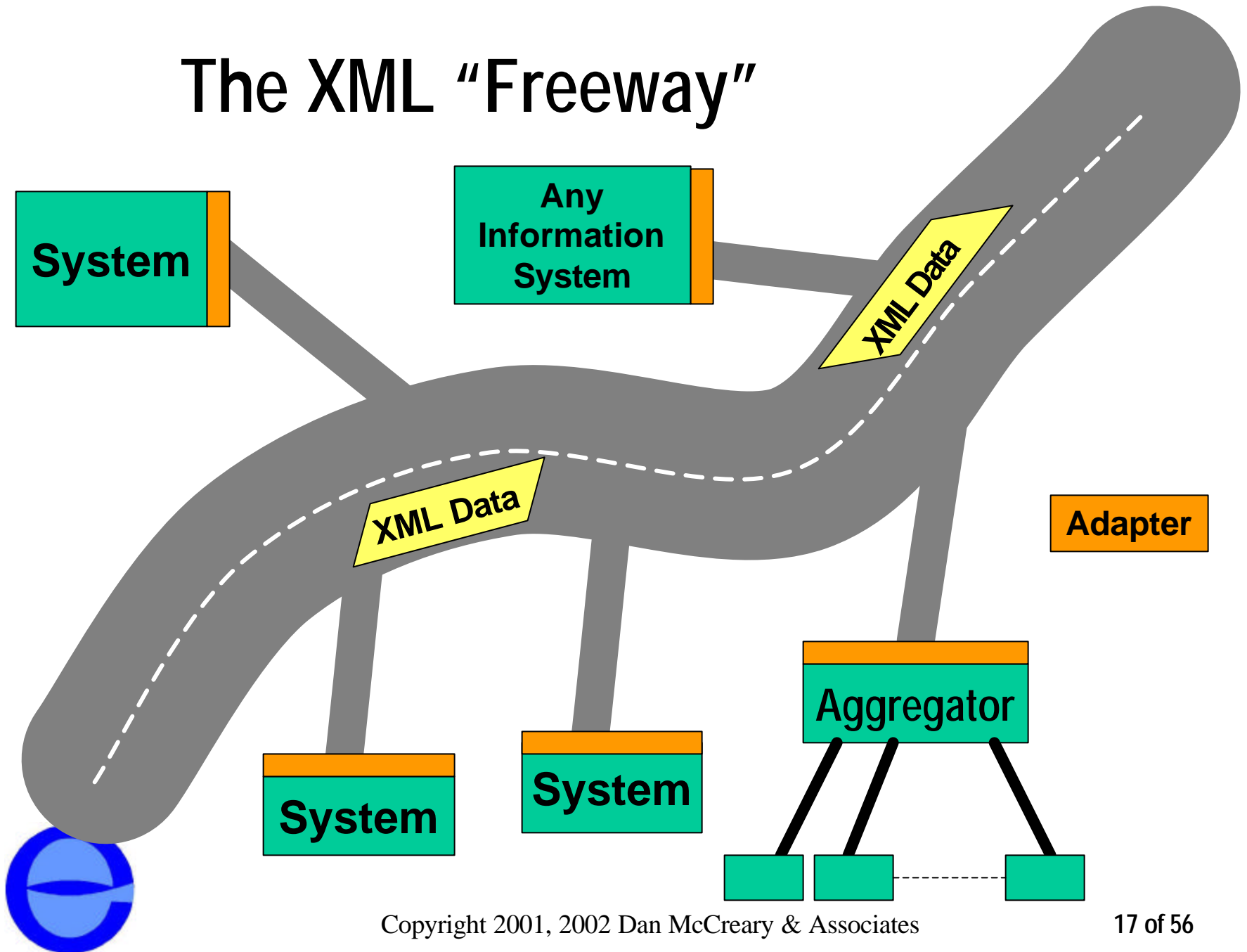## Application

Adapter

Messaging
Protocol

EAI Bus

- How to define an Adaptor for each system so that other applications can "subscribe" to its data and process services

- Make the transport reliable

The XML "Freeway"

System

Any Information System

XML Data

XML Data

Adapter

System

System

Aggregator

Person to Person

Problem Solving

Topics

Sentences

Words

Phonemes

Sound

Computer to Computer

Problem Solving

XML Messages

XML Schemas

XML Tags

XML

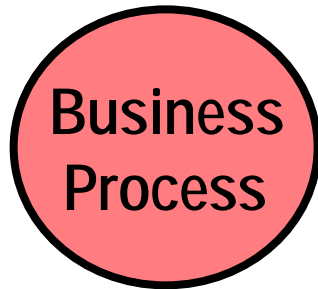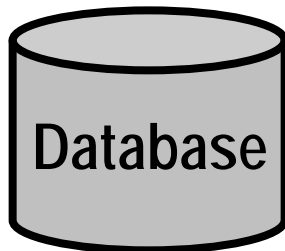**Internet**
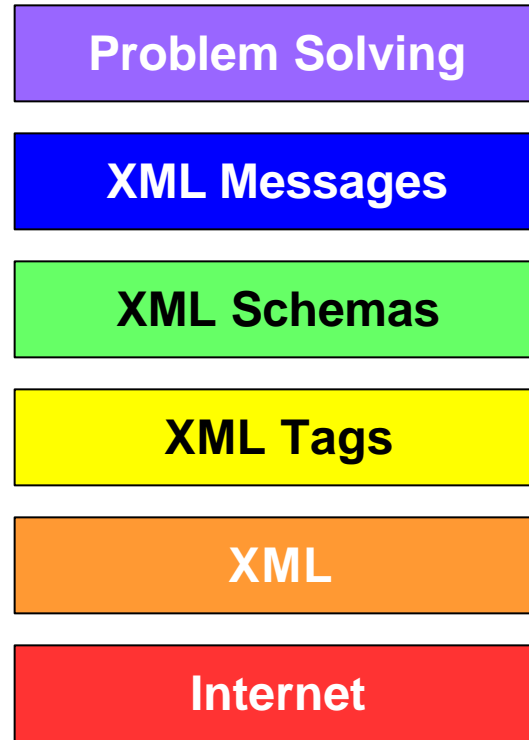
Three EAI Techniques
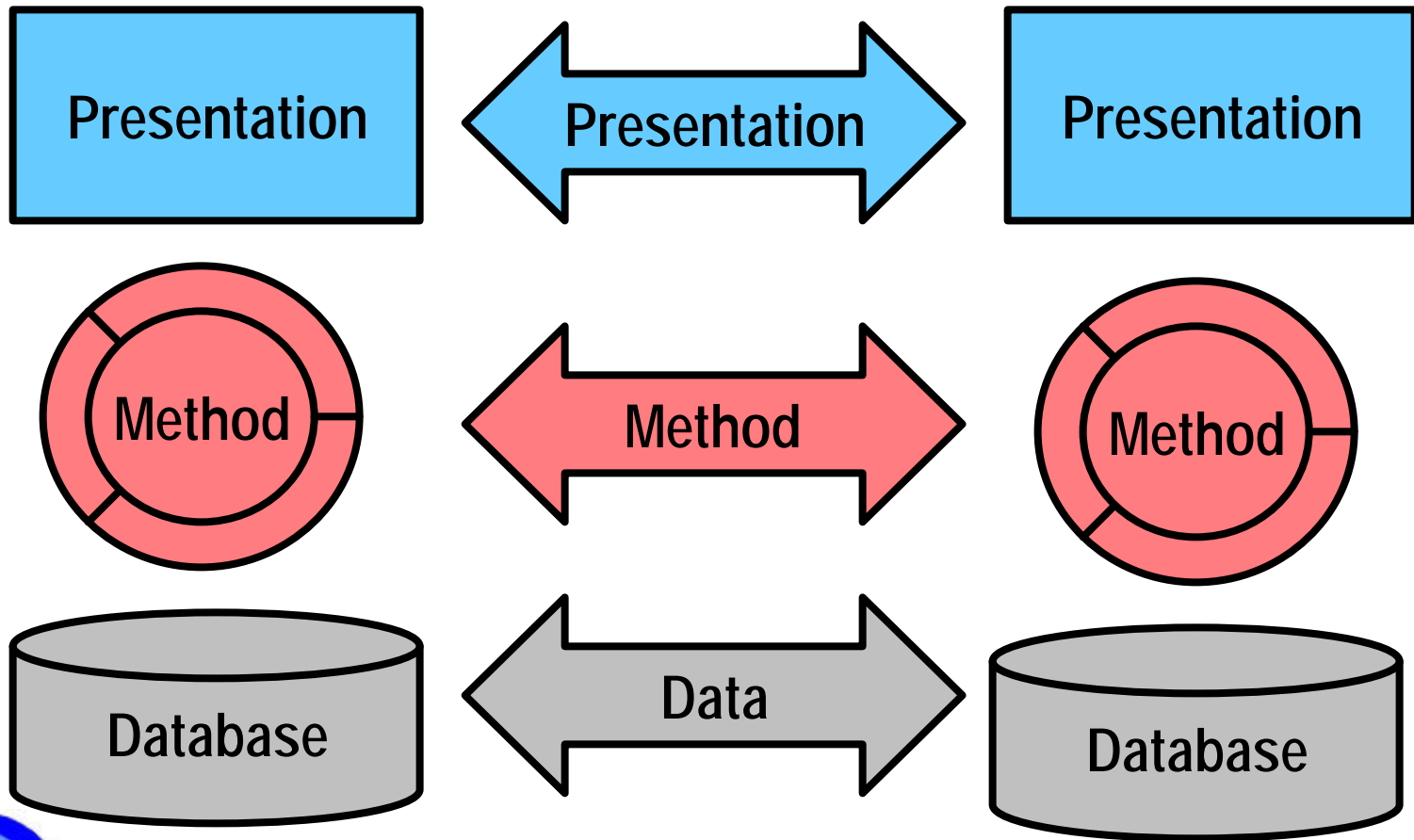
Presentation

Business Process
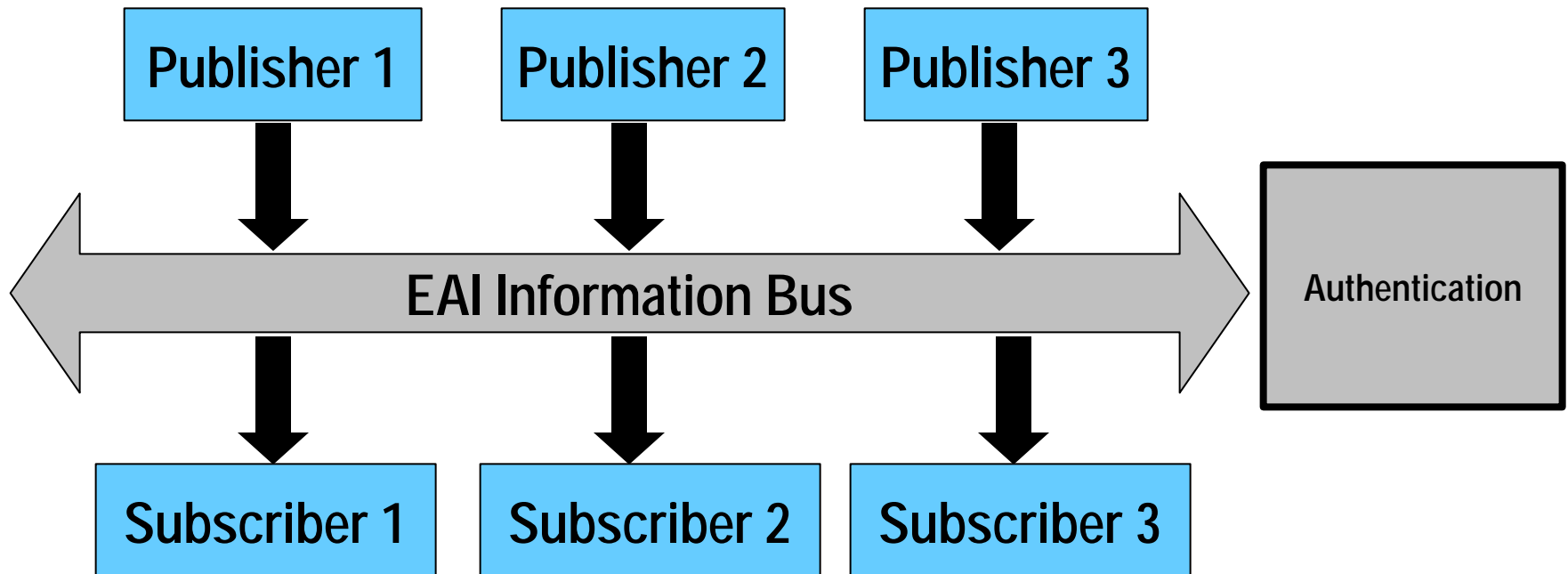
Database

- Presentation
  - User interface
  - Web integration
  - Portal strategies
- Business Process
  - Method level
  - API
- Database
  - SQL integration
  - Stored Procedures

Three EAI Architectures

Publish/Subscribe Securely

Message Brokers

Use of a broker will reduce these integration costs by one-third. During maintenance, when a single change to an application can have a rippling effect on several to several dozen interfaces, use of a broker can reduce costs by two-thirds."

- Gartner Group

Messaging Benefits

- Messaging infrastructure guarantees reliable delivery of a message

- Once and only once delivery

- Messages can have different priority

- Transactional control

- Transactions can be grouped together

- Support of "undo" – reversible operations

Similar to E-mail

Outgoing Mail Server

Header:

To: From: Subject:
Priority: Urgent

Body

Recipients e-Mail Server
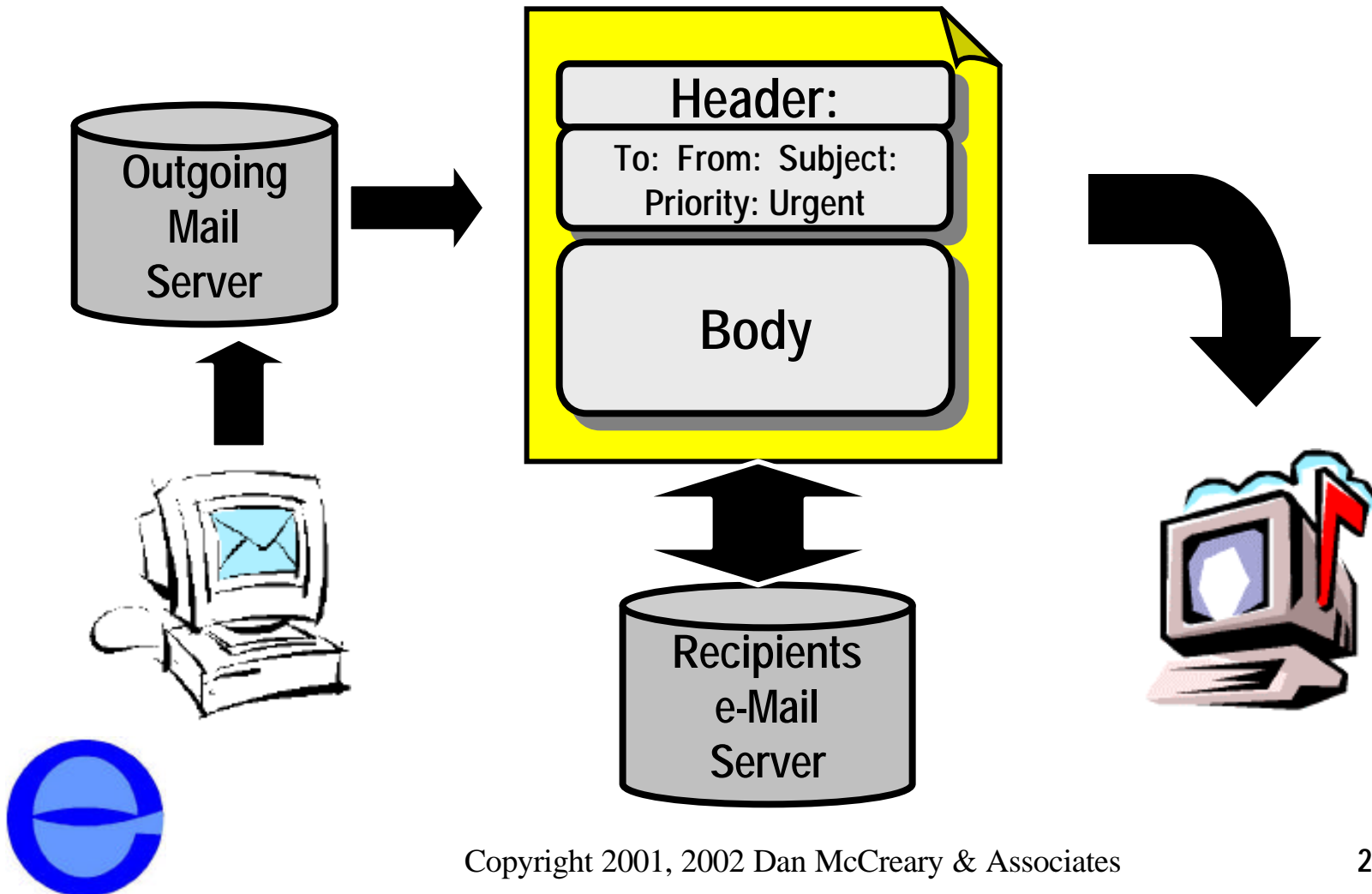
Object to Object Messaging

Header

Properties

Body

Message Queue

Message Example

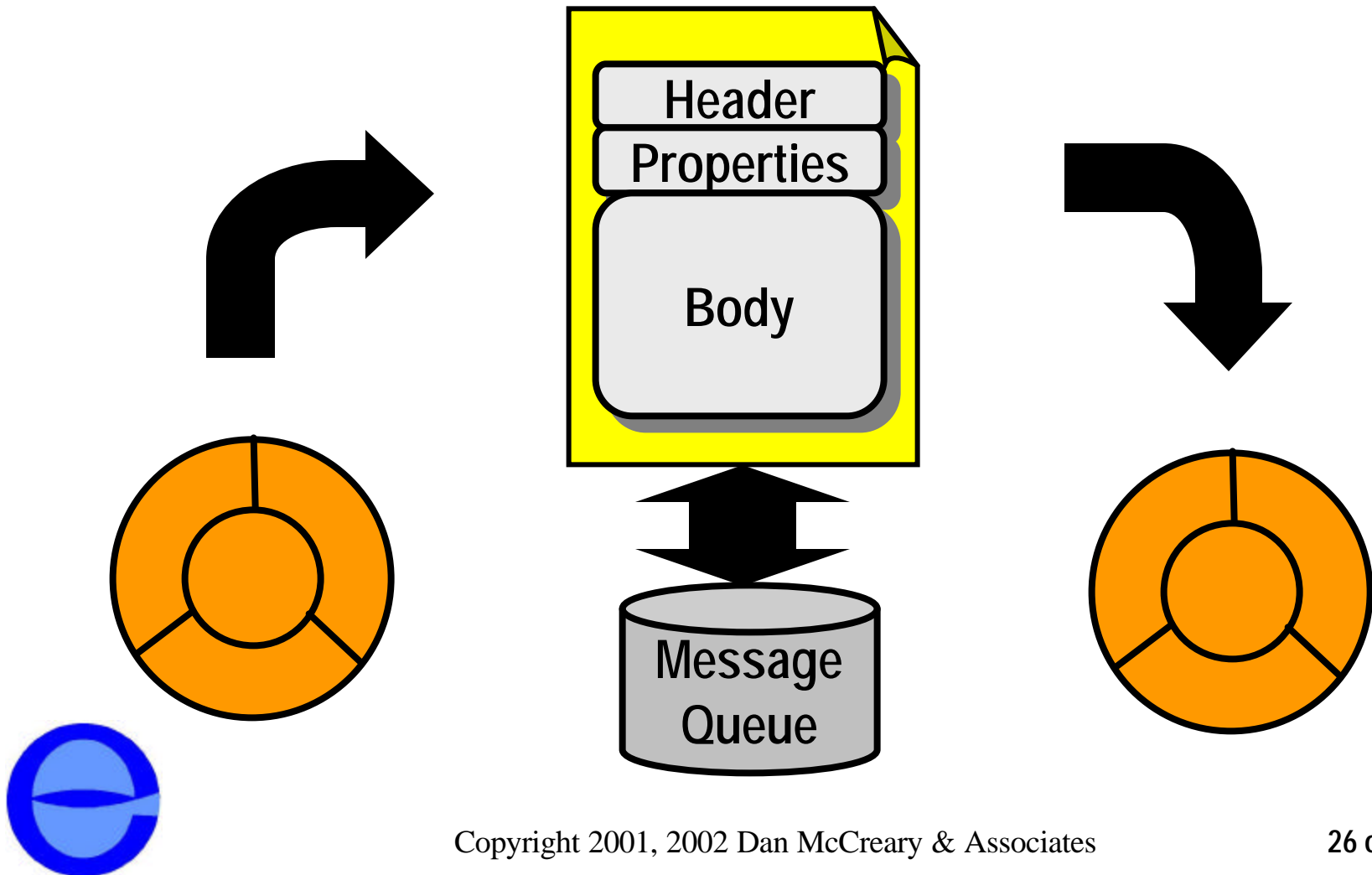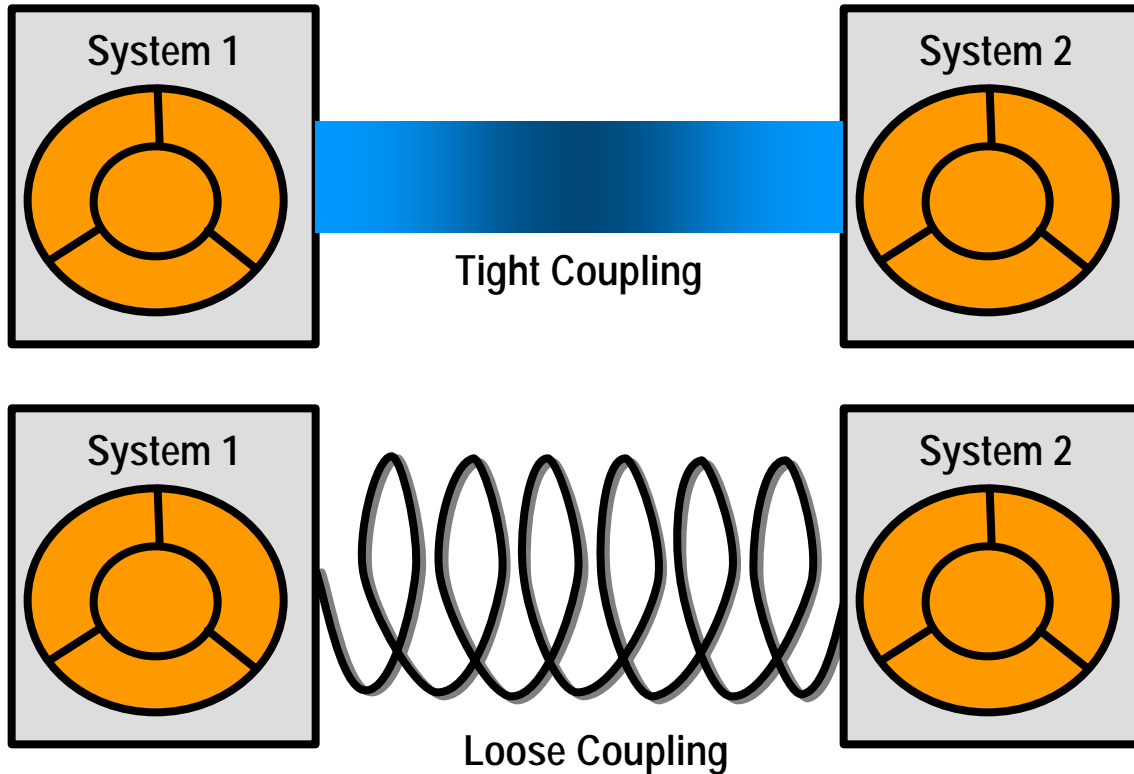To: EAI Publishing Bus

BatchNumber="12345"

```xml
<?xml version="1.0"?>
<Person>
    <lastName>Jones</lastName>
    <firstName>Sam</firstName>
    <birthDate>1980-12-31</birthDate>
</Person>
```

System Coupling

System 1   Tight Coupling   System 2

System 1   Loose Coupling   System 2
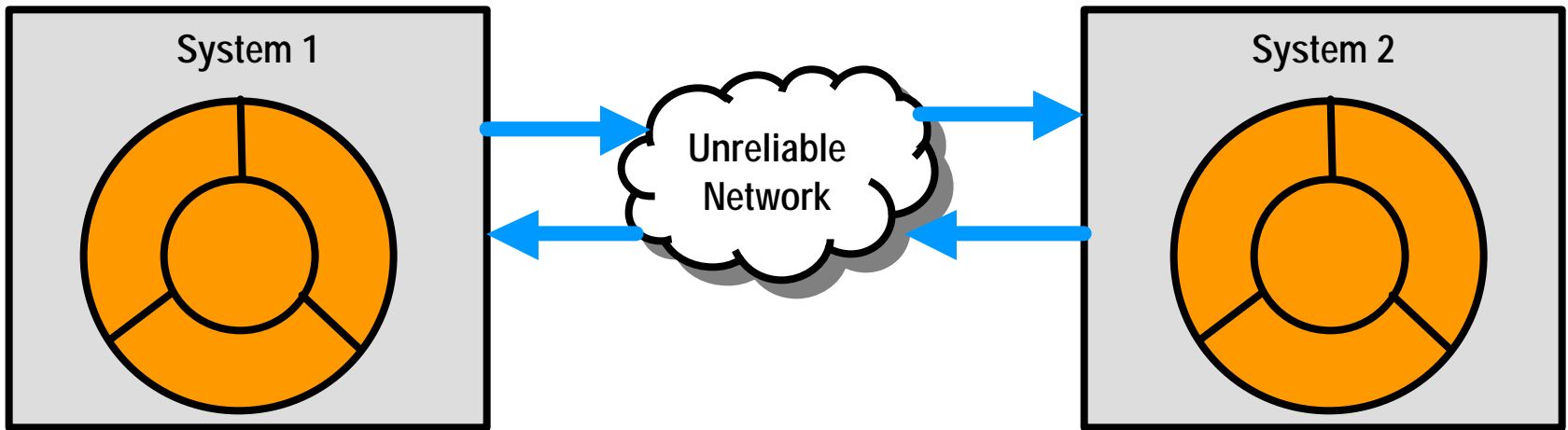
Tightly Coupled Communications

- Sender needs a remote service and calls a remote procedure call
- The sending process "Stops" and waits for a reply
- Synchronous messaging – don't proceed till we are synchronized up
- The sender will "freeze" if the network is down or the sender will have to manually keep trying till the remote system is up and it gets a response
- Remote procedure call (RPC), Java Remote Method Invocation (RMI)

Loosely Coupled Communications

System 1 — Message Queue ← Unreliable Network → System 2 — Message Queue
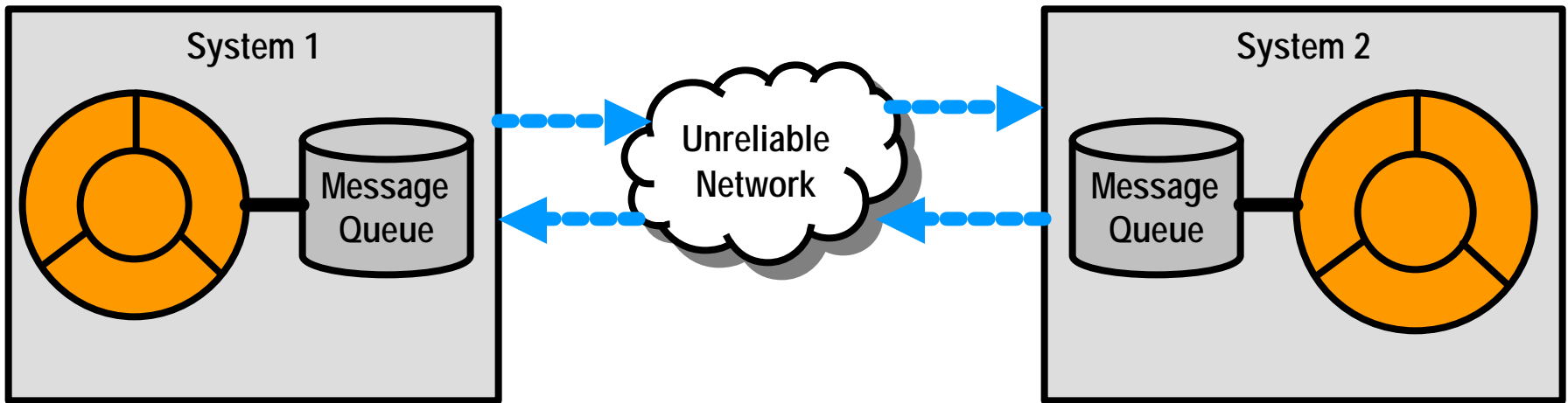
- Programmers just "fire and forget".
- There is no "blocking" of sender's process.
- System 1 just gets a reply message when the data request has been received.
- System can transmit messages to remote systems even when the remote system is down or the network has failed. Messages wait patiently in the queue till the network is back up.
- System administrators can monitor the message queues and be notified of congestions.
- High priority messages can take precedence over large, batch transfers.

APIs are NOT a wire protocols

- Needed: a wire protocol built on top of HTTP for asynchronous messaging between heterogeneous messaging systems.

SAP (JMS)

JMS = Java Messaging Service

Oracle (JMS)

Microsoft MSMQ

Internet

IBM MQSeries

Evolution of EAI

Share process

Share read-write data

Share read-only data
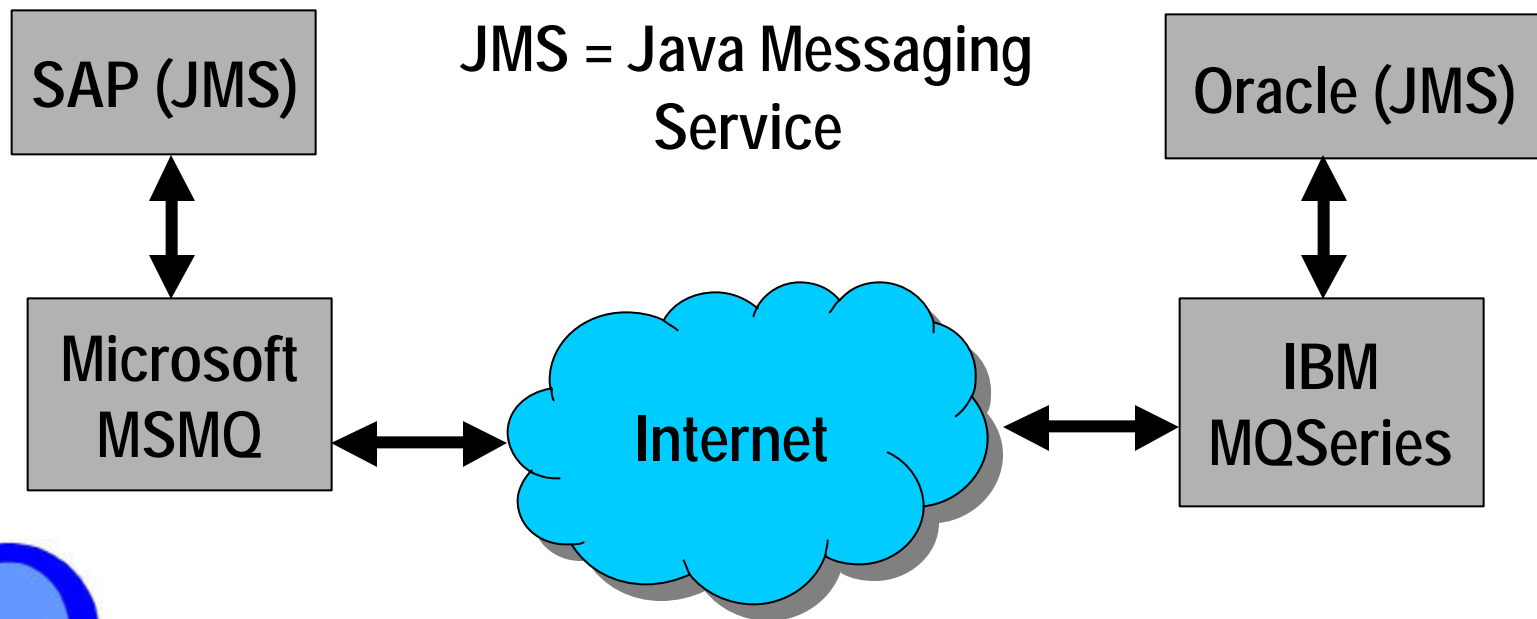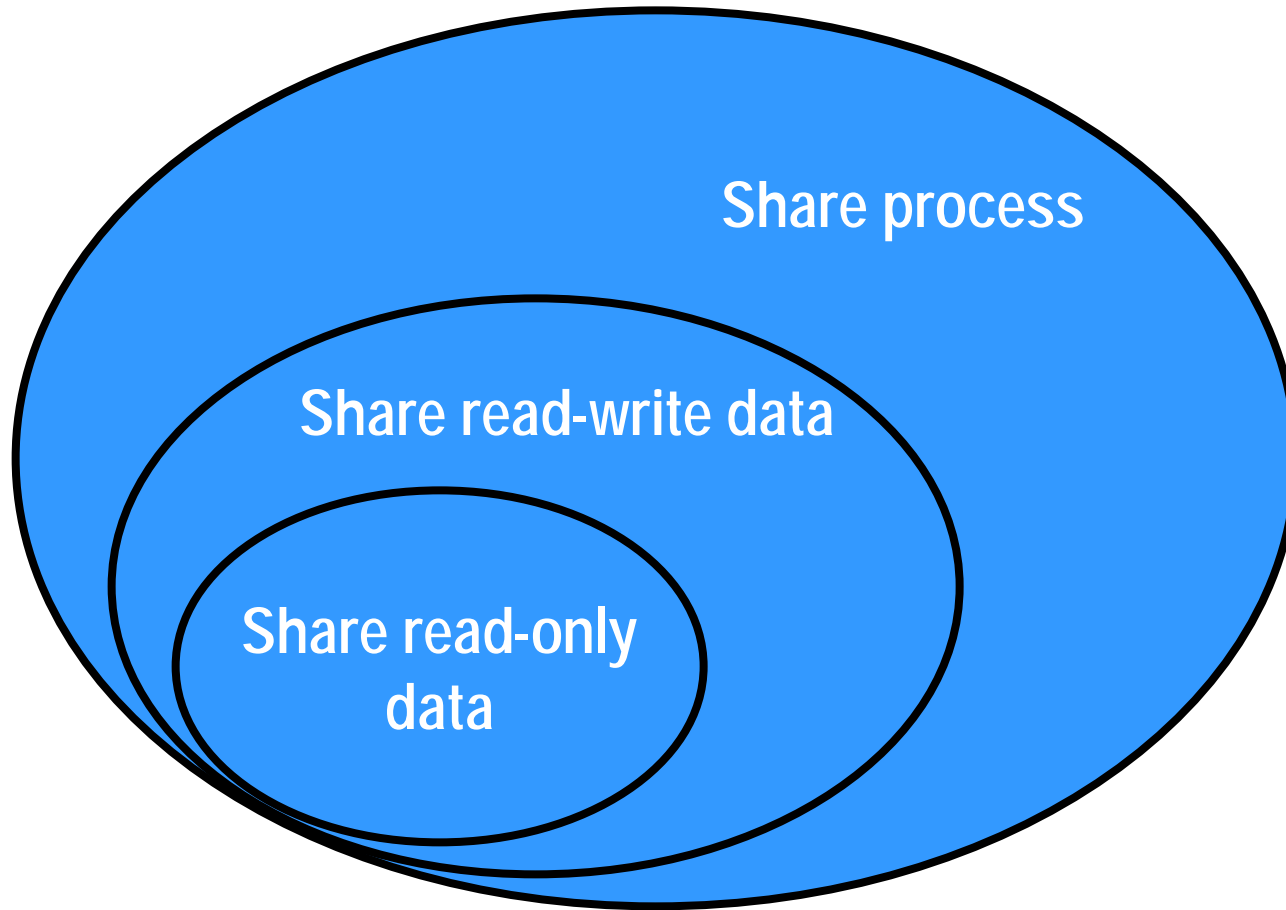
XML Defined

- XML, eXtensible Markup Language, is a data description technology
  - facilitates interchange of data and documents between disparate computing systems
  - Makes information self describing
- Comprised of many parts
  - XML Markup Language
  - XML Schemas
  - XML Transforms

XML Example

```
<?xml version="1.0" ?>
<Signature id="12345">
        <Name>Dan McCreary</Name>
        <Title>President</Title>
        <Company>Dan McCreary & Associates</Company>
        <Phone> (651) 405-9034</Phone>
        <Email>dmccreary@attbi.com</Email>
</Signature >
```
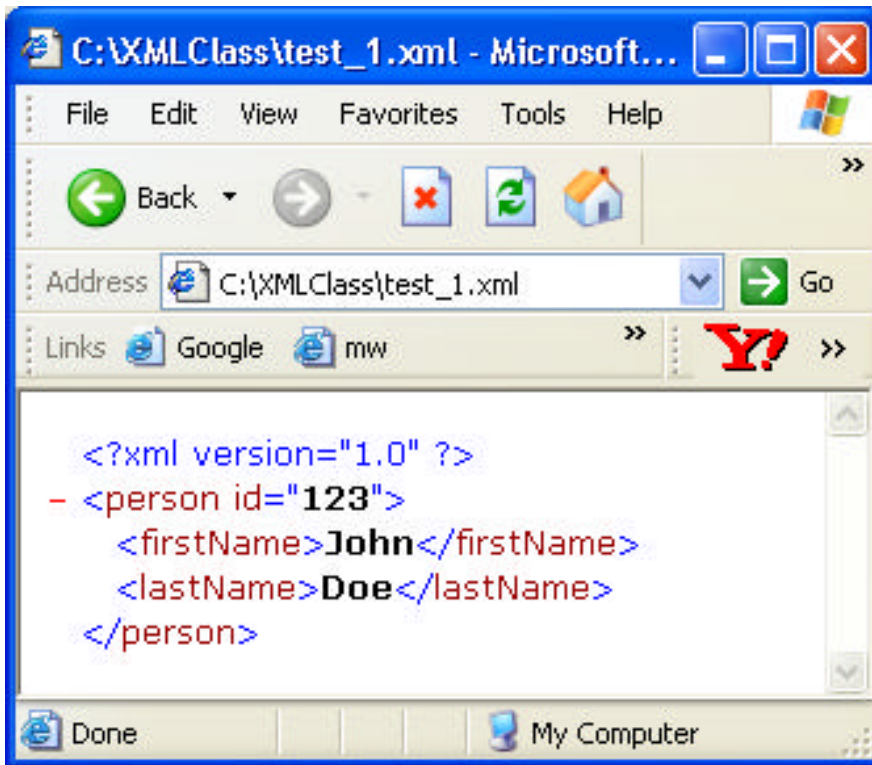
The markup tags are in **red**, delimiters in **blue** (angle brackets); e.g. **<TAG>**Data**</TAG>**

XML is "self describing"

IE includes an XML Parser


```
C:\XMLClass\test_1.xml - Microsoft...
File   Edit   View   Favorites   Tools   Help
Back ·        ×   ↻   🏠
Address  C:\XMLClass\test_1.xml        Go
Links  Google   mw

<?xml version="1.0" ?>
- <person id="123">
    <firstName>John</firstName>
    <lastName>Doe</lastName>
  </person>

Done                          My Computer
```
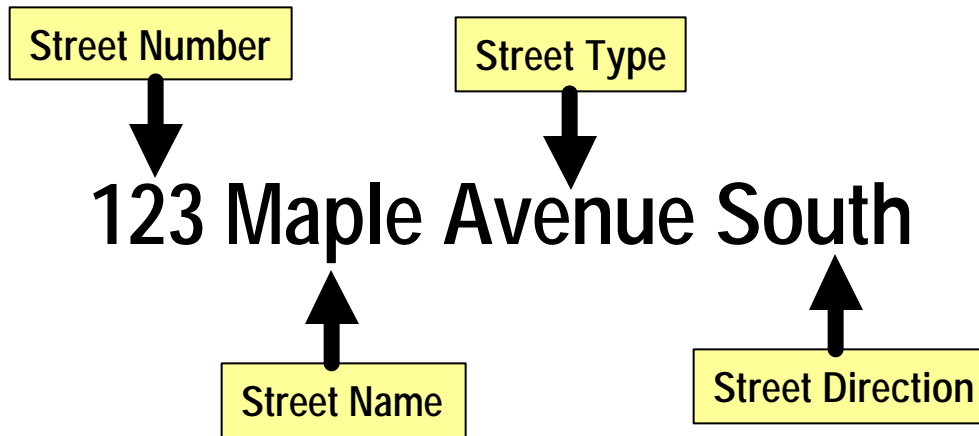
- IE "recognizes" XML syntax
- PIs are in blue
- Angle brackets, equals, quotes and backslashes in blue
- Tags and attributes in red
- Data in black

Note: This will not work in pre-5.0 versions of IE. 6.0 also includes a transform engine.

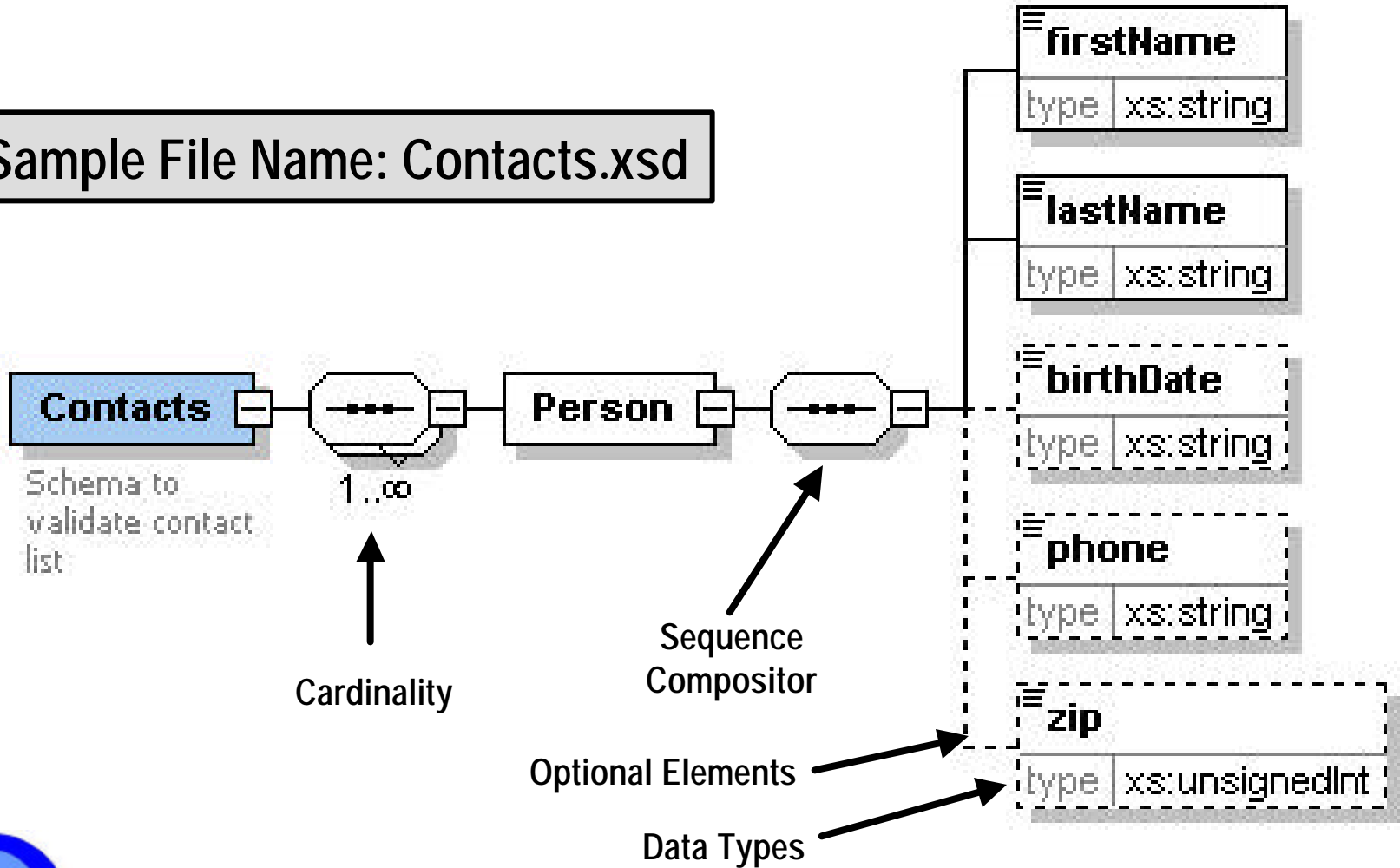# Validation Example: Street Address

Street Number

Street Type

123 Maple Avenue South

Street Name

Street Direction

What additional data integrity checks could be done with an address?

XML Schemas

Sample File Name: Contacts.xsd

firstName	
type	xs:string

lastName	
type	xs:string

Contacts
Schema to validate contact list

1..∞

Person

birthDate	
type	xs:string

phone	
type	xs:string

Cardinality

Sequence Compositor

zip	
type	xs:unsignedInt

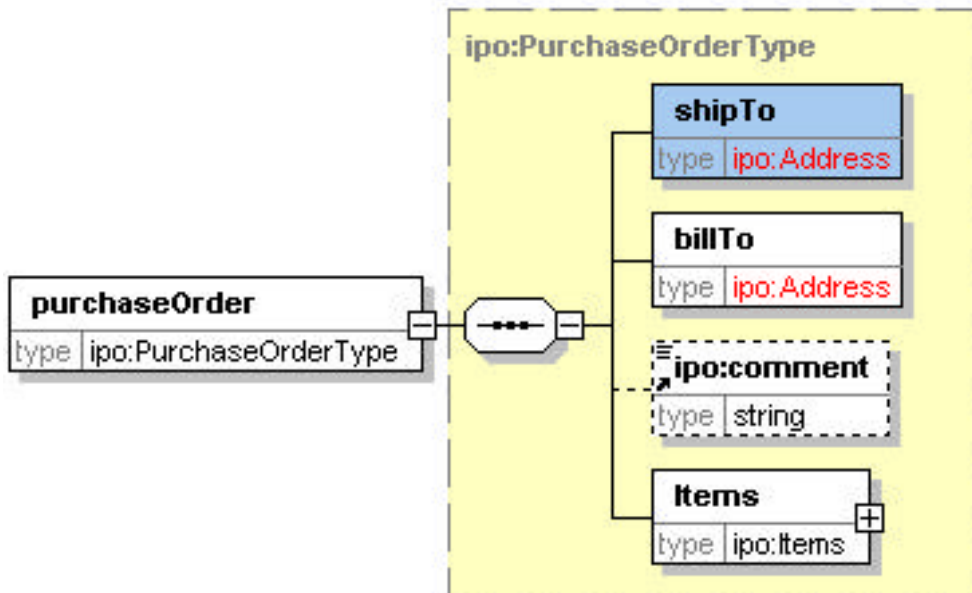Optional Elements

Data Types

Reusable Components

- Global – accessible from other portions of the XML document
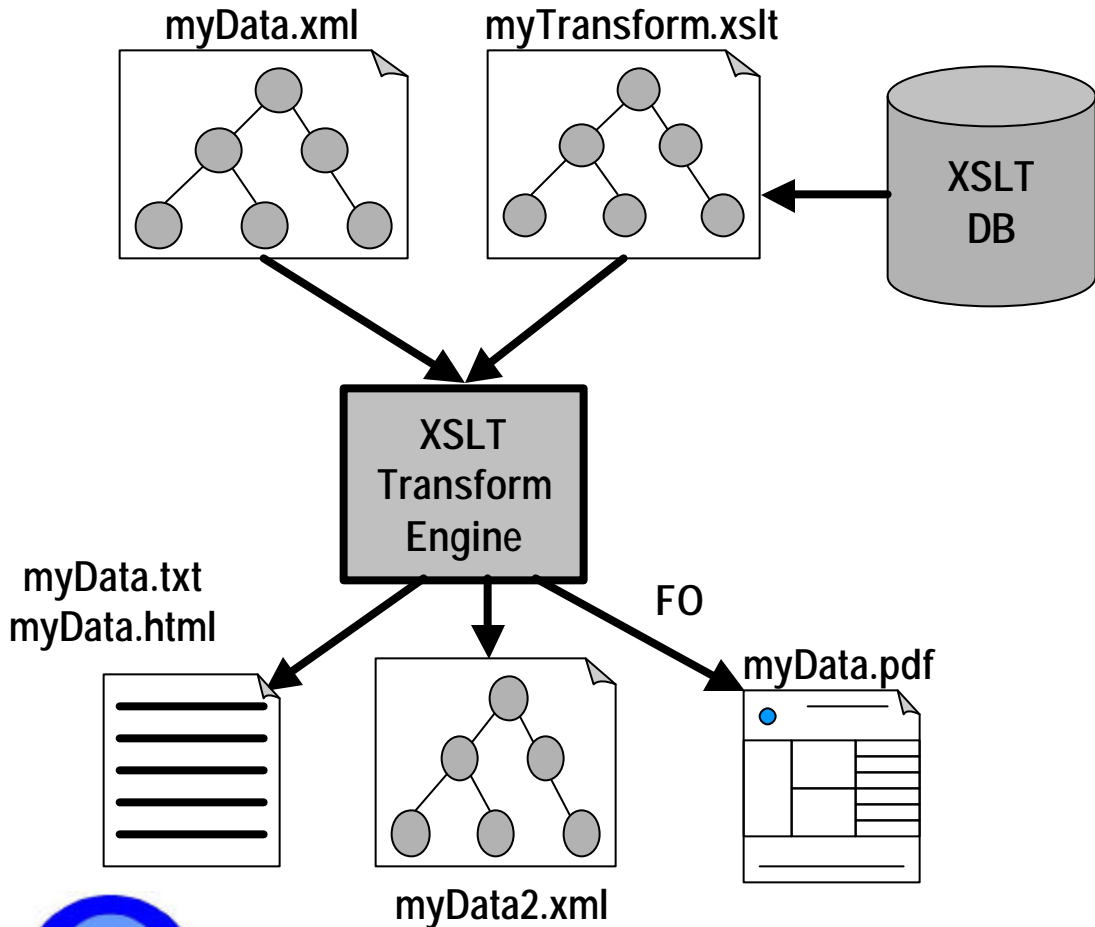- Schema design is the art of creating structures that are reusable

XSL and XSLT

- XSL – XML Style Sheet (similar to cascading style sheets)

- XSLT – full transforms
  - a method for transforming XML documents
  - a method for defining XML parts and patterns using XPath
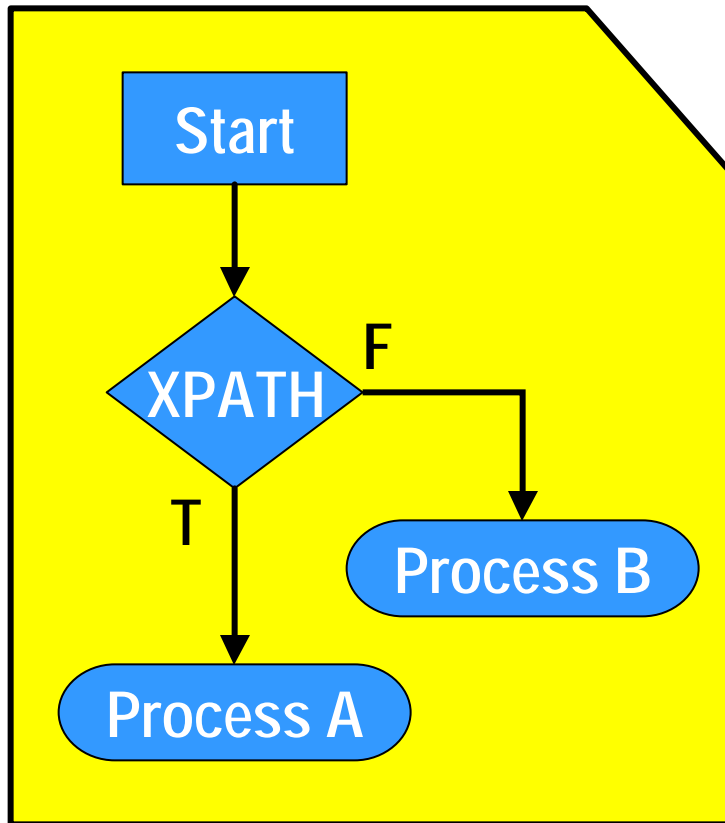 - a method for formatting XML documents. XSL:FO Formatting Objects (FO)

XSLT Architecture

myData.xml   myTransform.xslt

XSLT
DB

XSLT
Transform
Engine

myData.txt
myData.html

FO

myData.pdf

myData2.xml

- Any XML data file can be used as input data

- Apply a transform (XSLT)

- Create any form of output

X-PATH: Querying XML Documents

```
Start
  ↓
XPATH ──F──→ Process B
  │ T
  ↓
Process A
```

- XML Documents received by reliable messaging transport
- Documents have types and known content
- Standard library of XPATH expressions to test document for conditions – workflow
- Workflow stored in XML format

Definitions of Web Services

An API defined using XML over HTTP.

    – Forrester

Software components available over a ubiquitous networks.

    – Gartner

What is a Web Service?

- An business function with an API exposed in XML to the Internet via HTTP

- Works through firewalls

- Is easily discovered using indexes

- Is self documenting

- Can include cost/transaction features to build economic models

Web Services and EAI

Web Services will lower the cost of integrating applications by an order of magnitude.
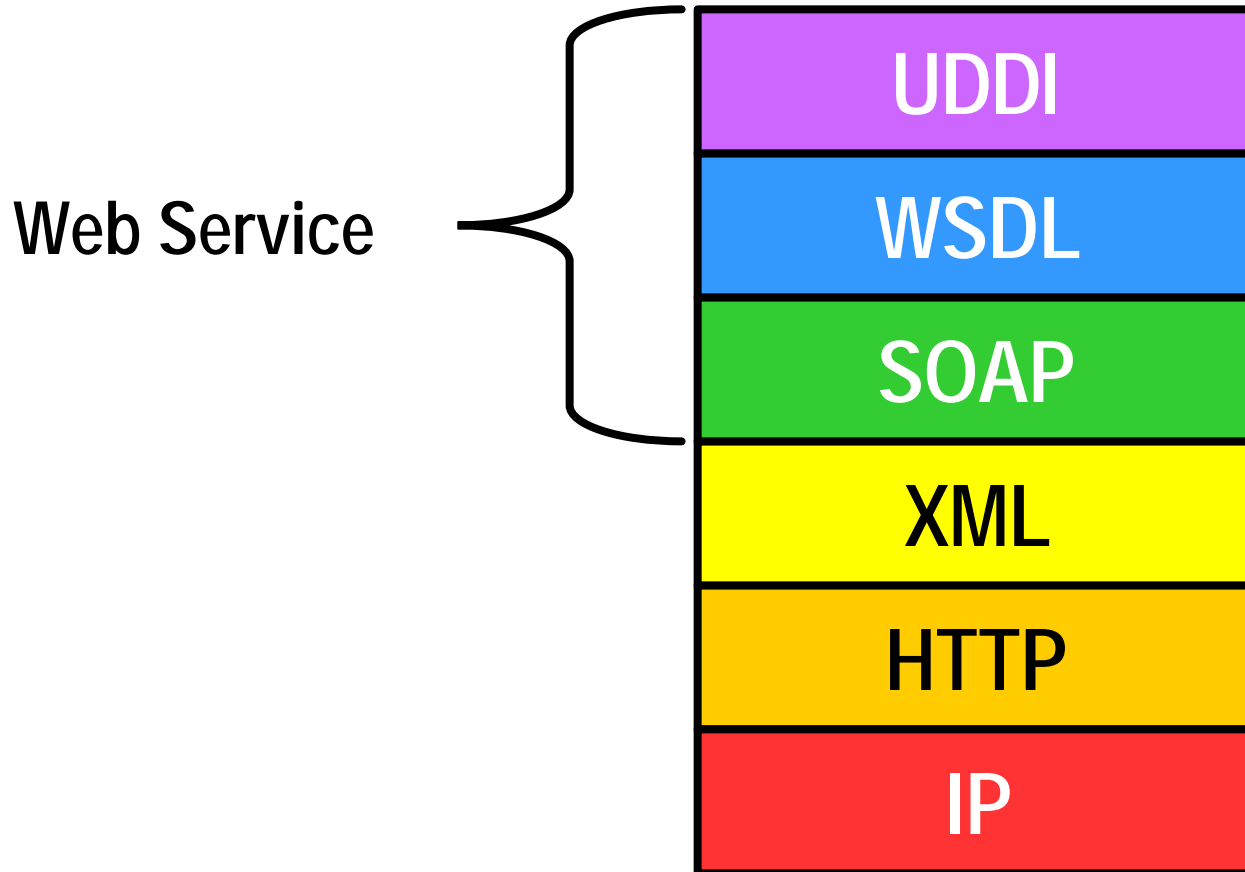
Forrester – July 2001

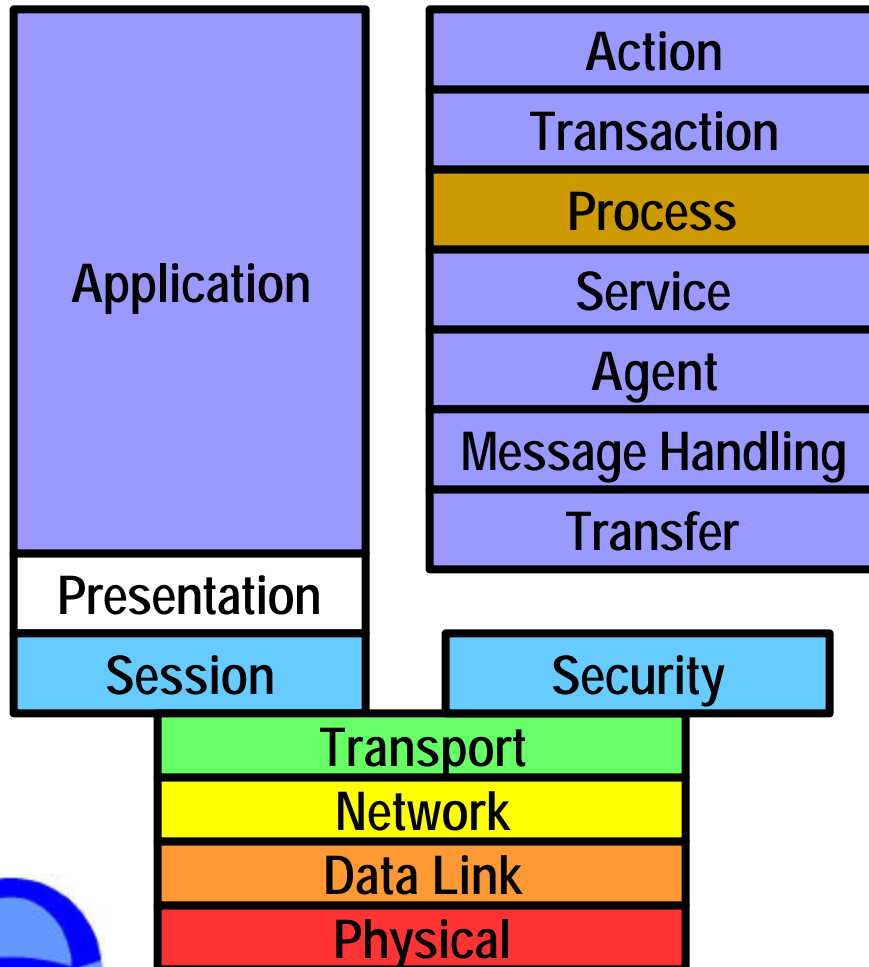*Never mistake a clear view for a short distance.*

Paul Saffo

Institute for the Future
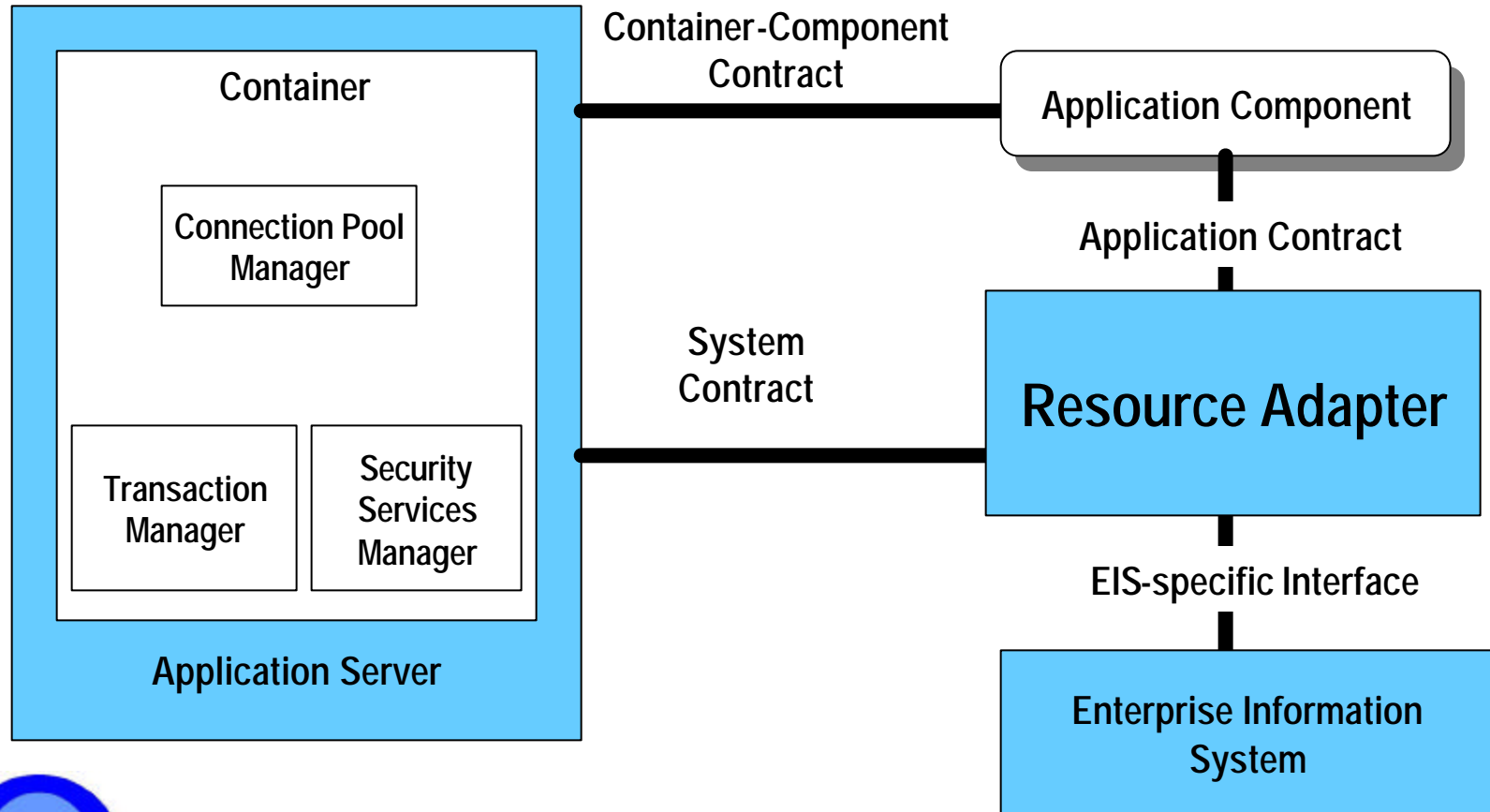
Web Service Protocol Stack

Web Service

| UDDI |
| WSDL |
| SOAP |
| XML |
| HTTP |
| IP |

RosettaNet

Application	Action
	Transaction
	Process
	Service
	Agent
	Message Handling
	Transfer
Presentation	
Session	Security

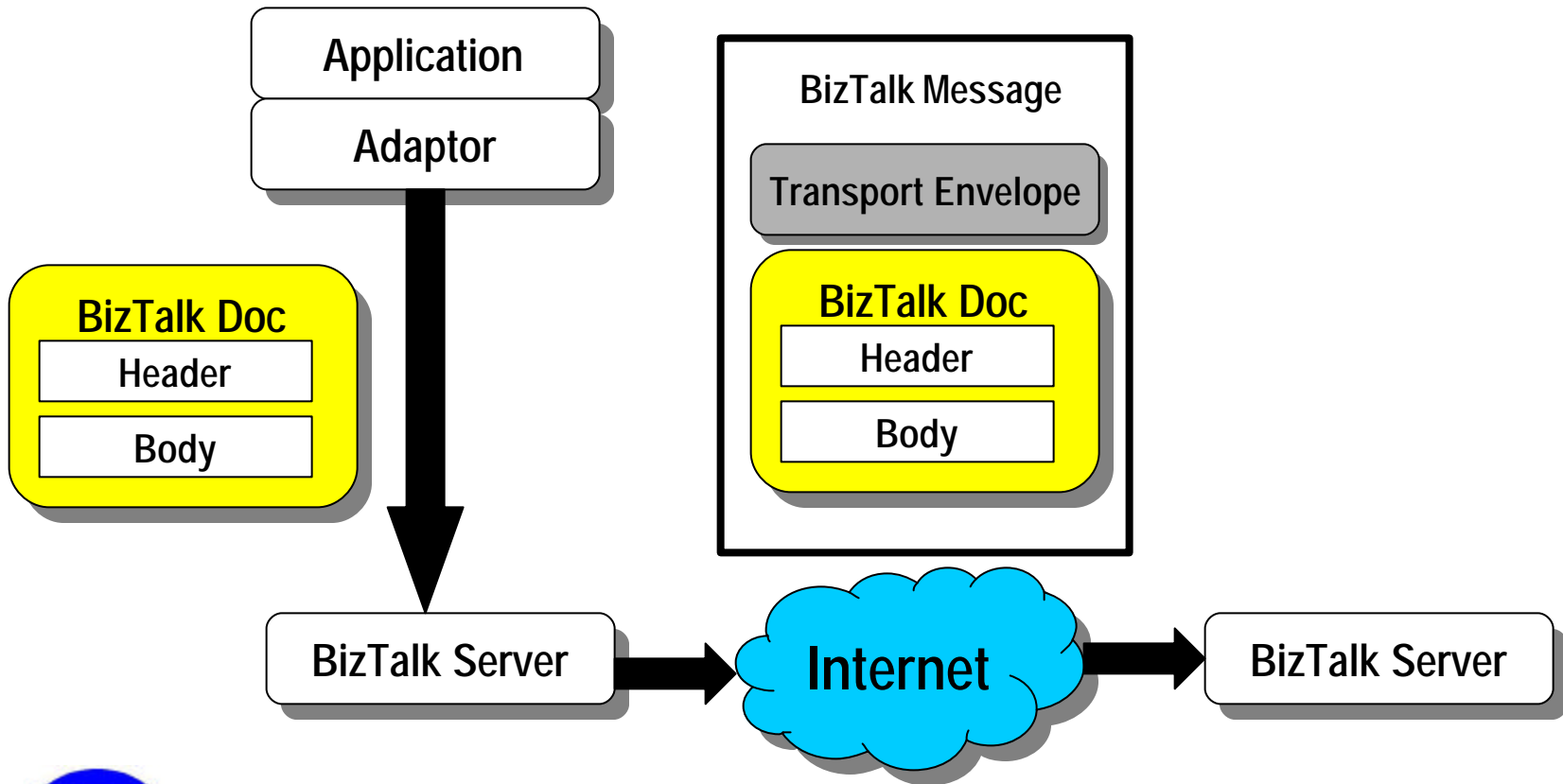Transport
Network
Data Link
Physical

- Agree on bottom six layers of OSI model

- Subdivide application layer into seven distinct layers

JCA: J2EE Connection Architecture

BizTalk Architecture

Application

Adaptor

BizTalk Message

Transport Envelope

BizTalk Doc

Header
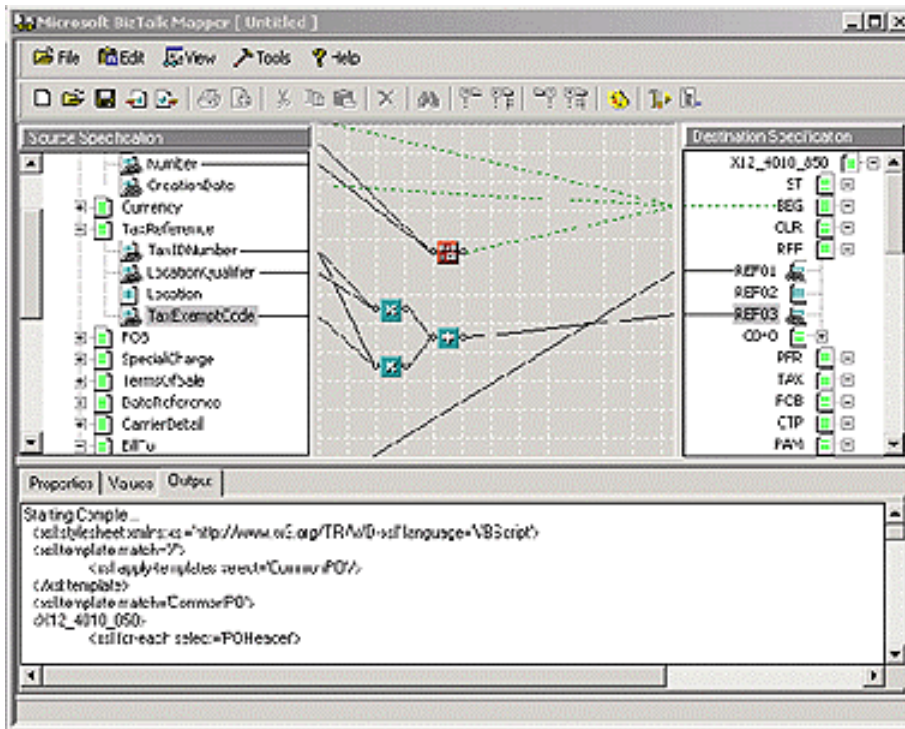
Body

BizTalk Doc

Header

Body

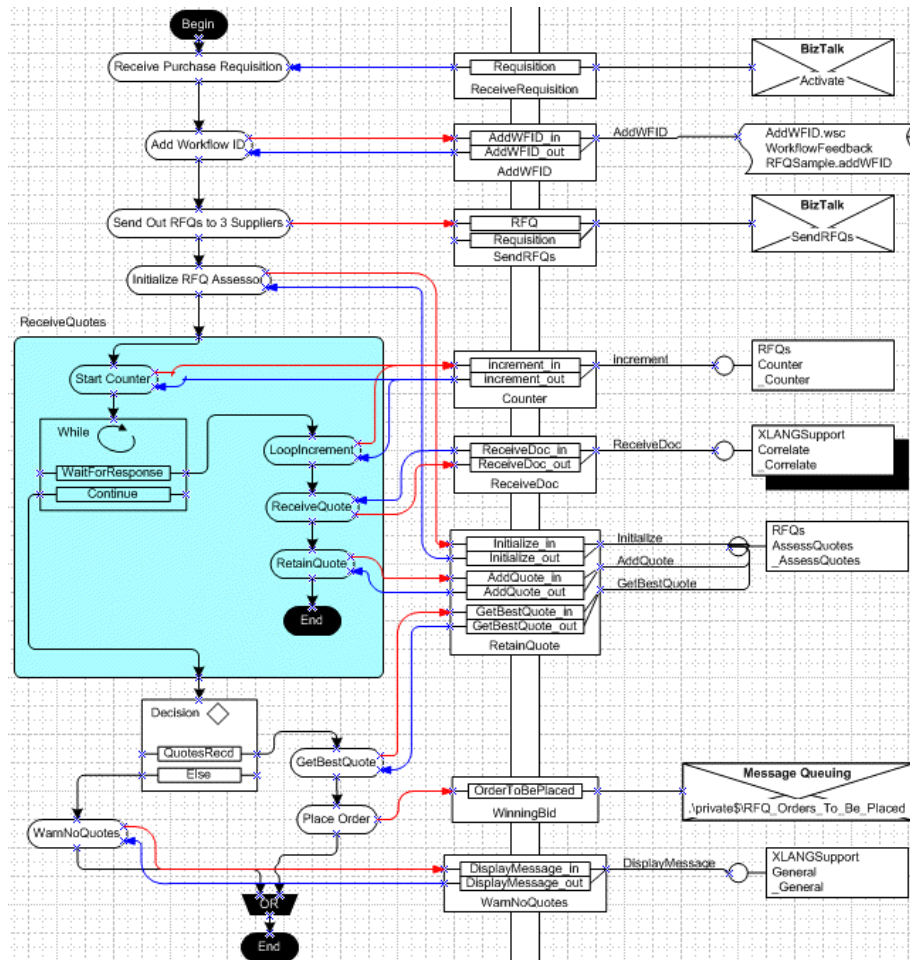BizTalk Server

Internet

BizTalk Server

BizTalk Mapper

- Automatically connects tags where names match or are similar

- Add GUI tool for rule processing

- Simple to do simple transforms (Functoids)

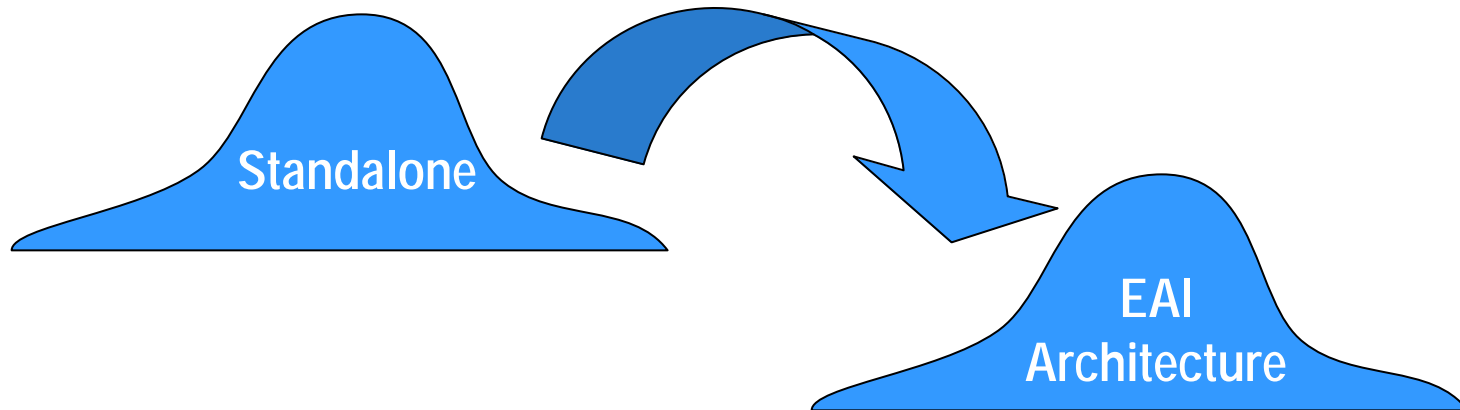- Produces an XSLT

Biztalk Orchestration

XML Business Process Standards

- Business Process Markup Language (BPML)

- Business Process Execution Language (PBEL)

- Business Process Execution Language for Web Services (PBEL4WS)

- Web Services Flow Language (WSFL)

- XML Language (XLANG)

When Do We Make the Leap?

Standalone

EAI Architecture

*Change only happens when the **pain** of holding on is greater than the **fear** of letting go.*

Lower fear by building a **realistic** pilot project.

Steps in Choosing an EAI Strategy

1. Understand your stakeholders needs
2. Educate yourself on the EAI options
3. Describe your data using XML and XML Schemas
4. Select a transport mechanism
5. Build a pilot project
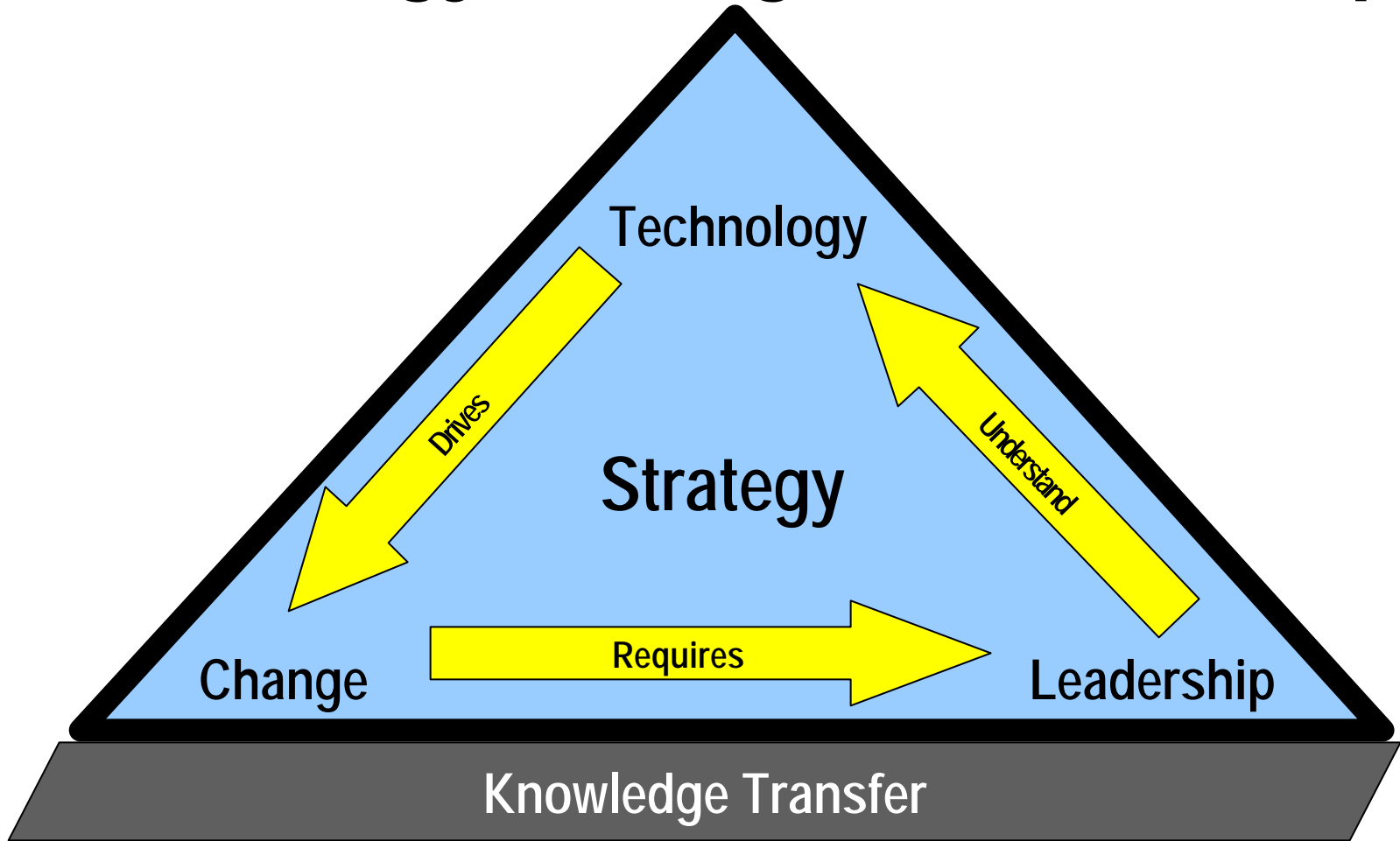6. Evaluate results – Will it scale?
7. Repeat

"If You Give A Kid A Hammer…"

- "…the whole world becomes a nail."
- People solve problems with the tools they know
- EAI and XML are new tools
- The **way** we approach problems is a reflection of the tools we are comfortable with
- Expectations are rising

Technology, Change & Leadership

Thank You!

Please contact me for more information:

- EAI Architecture Analysis
- Infrastructure Audit
- How to select a EAI Pilot Project
- Analysis of EAI Vendors
- Web Services and Portals
- Case Studies, Resource, Tools, Books etc.

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