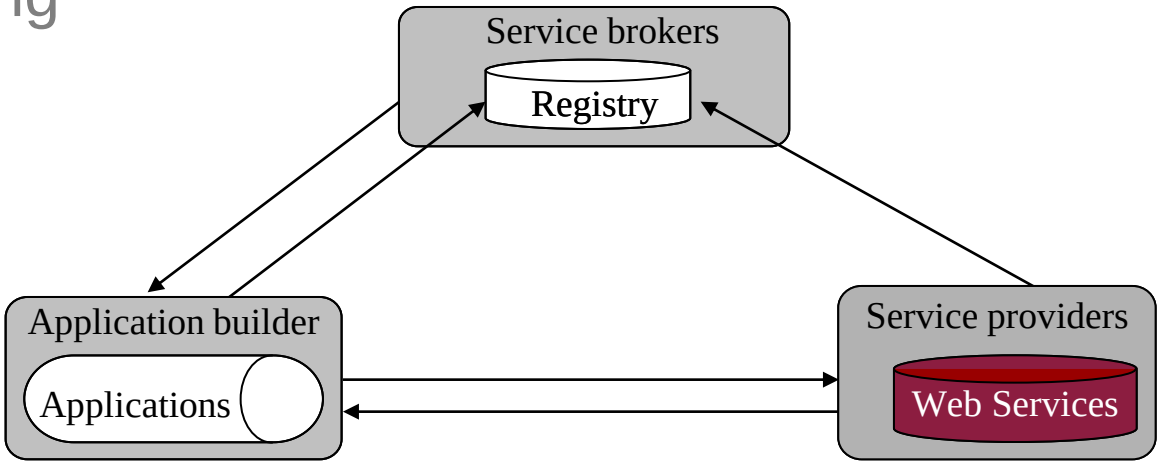
Service-Oriented Software Development

Ira A. Fulton Schools of Engineering
Arizona State University

Overview and Roadmap

Service-Oriented Software Development: Three-party model

- Services and Service Development
- Service Registry and Repository
- Application Building



Web Service (WS)

- Web Services are building blocks of SOC software
  - SOAP/WSDL services have an standard interface in WSDL
  - RESTful services use HTTP without using SOAP/WSDL
- WS can be remotely invoked via a message in a standard protocol, e.g., SOAP, HTTP – It is NOT a remote procedure call
  - Loosely coupled vs. tightly coupled
  - Data flow vs. control flow
- Web Services are platform-independent, it can be written in any languages: Java, C#, C++, Python, etc.
- Every piece of program can be wrapped into a WS
- Every WS can be placed in an internet-searchable repository
- In the near future, most services required will be available (not necessarily free). There is less need of writing new services. However, there is always a need of writing better services.

Main Web Service Authoring Tools (1)

C# Web Services on *Visual Studio*

- Choose a Web Service templates, WCF, WF, etc.
- Define an ordinary class with data members and mainly methods in C#;
- Choose methods to be remotable by adding [operation contract]
- Compile and run the class, service will be generated;
- WSDL file and/or URL of the Web service will be generated;
- SOAP/HTTP call interface will be generated;
- There is little difference with writing a C# class

Less useful

Main Web Service Authoring Tools (2)

Java Web Services

- Define an ordinary class with data members and methods in Java;
- There are different ways to wrap a Java class into a Web service (generate WSDL and SOAP files)
  - NetBeans, Download: https://netbeans.org/
  - Eclipse with WS extension,
  - Java EE,
  - Community projects and third parties, e.g., Apache Tomcat tool,
  - IBM tools such WebSphere, http://www.eclipse.org/webtools/initial-contribution/IBM/evalGuides/WebServicesToolsEval.html
  - JDeveloper / Oracle SOA Suite
  - Manually write host and extract the required information and wrap them into WSDL and SOAP syntax

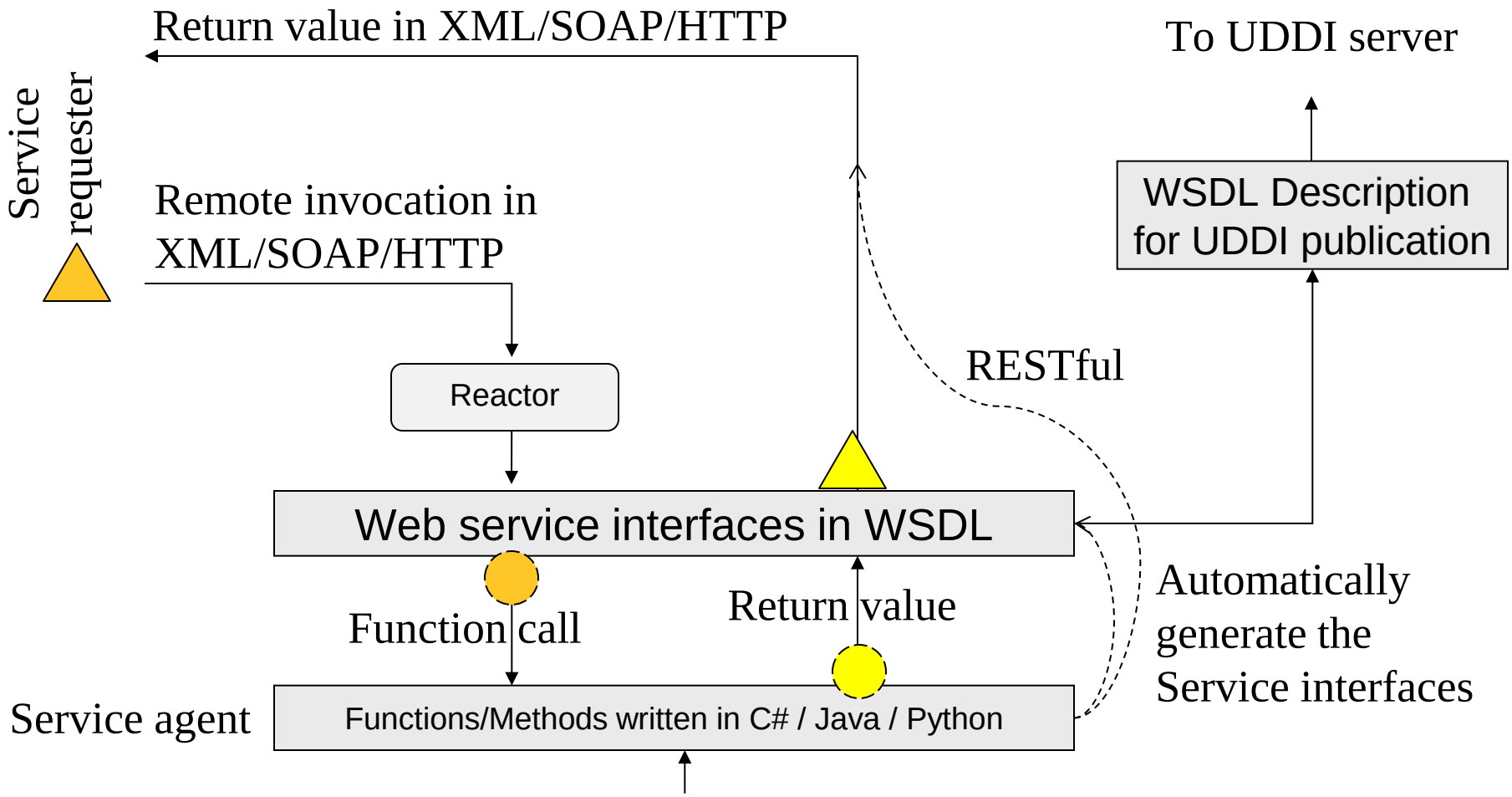
Main Web Service Authoring Tools (3)

Python Web Services

There are different environments for defining Python Web services

- Flask
- Django
- FasrAPI
- CherryPy
- Pyramid
- Visual Studio + Flask:
  https://docs.microsoft.com/en-us/visualstudio/ide/quickstart-python?view=vs-2022
- Visual Studio + Django
  https://docs.microsoft.com/en-us/visualstudio/python/learn-django-in-visual-studio-step-01-project-and-solution?view=vs-2022

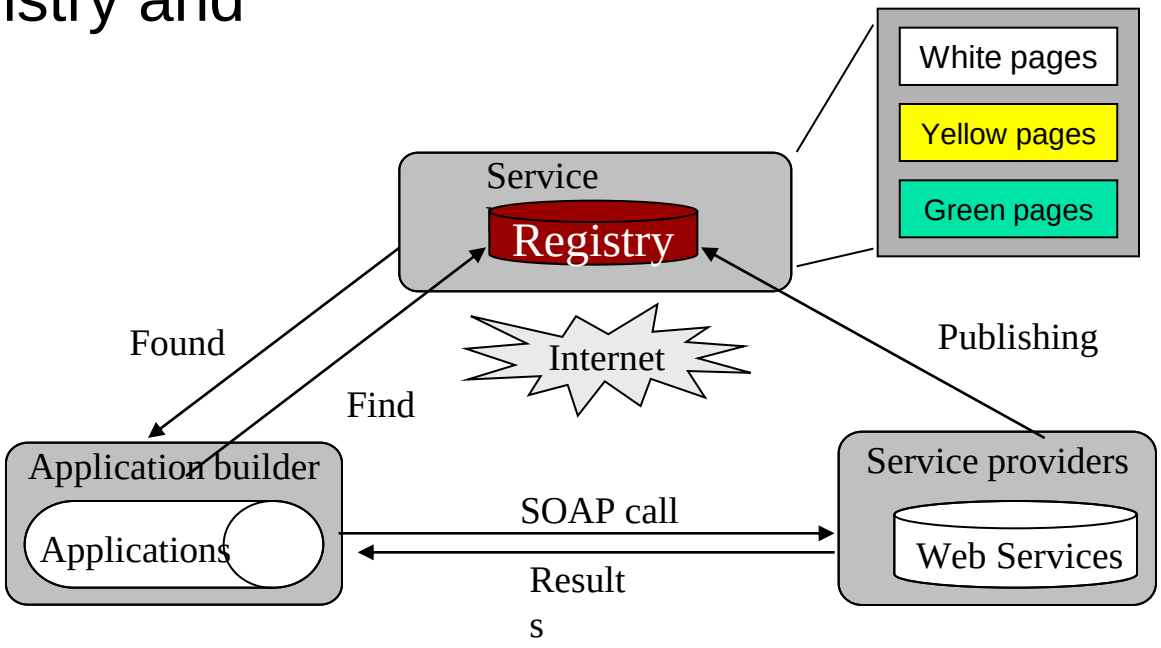
Web Services are Wrapped Classes/Objects



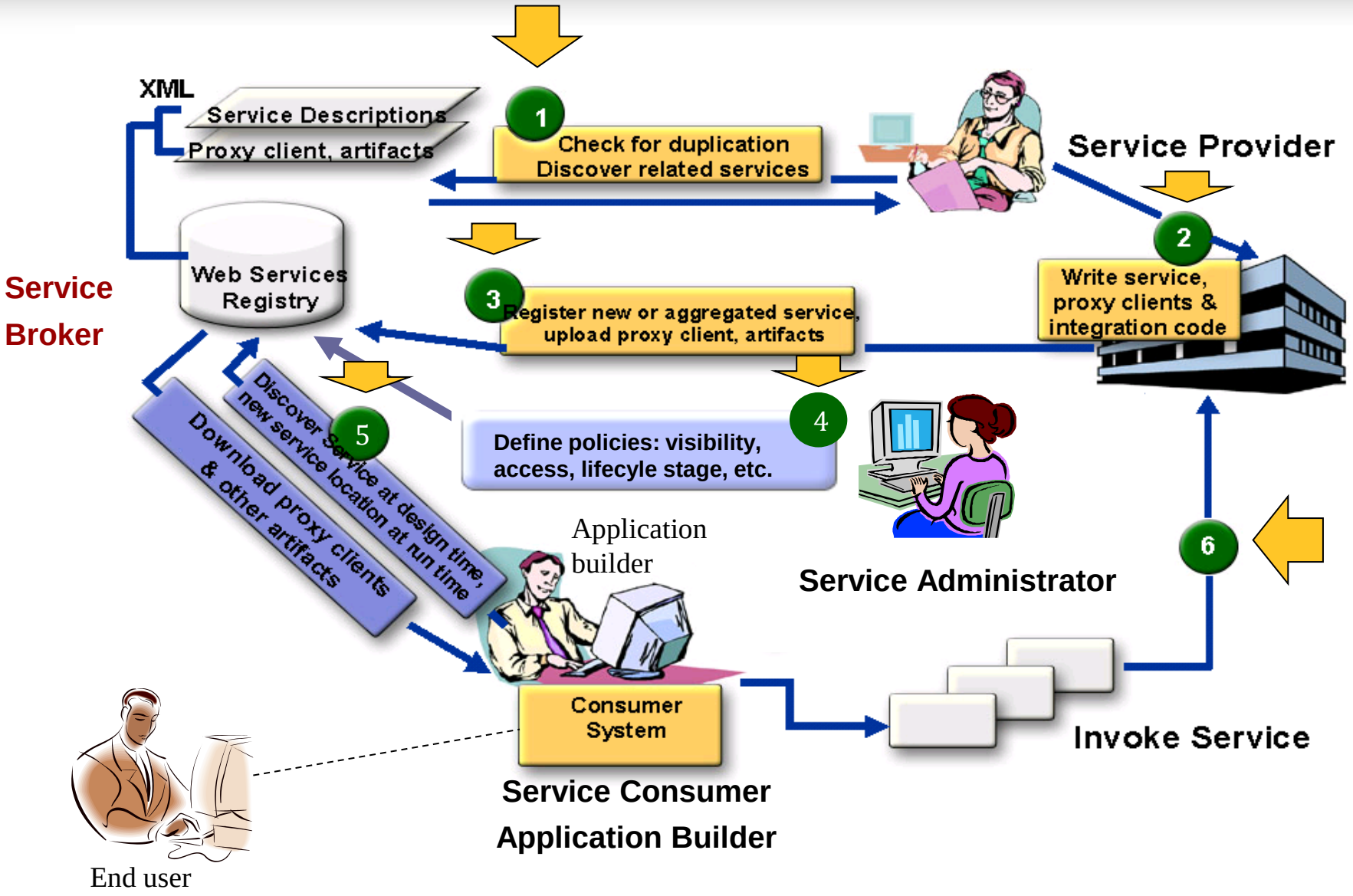
Manually write the functions/methods in the classes in C# or in Java, each function corresponds to a service

Roadmap

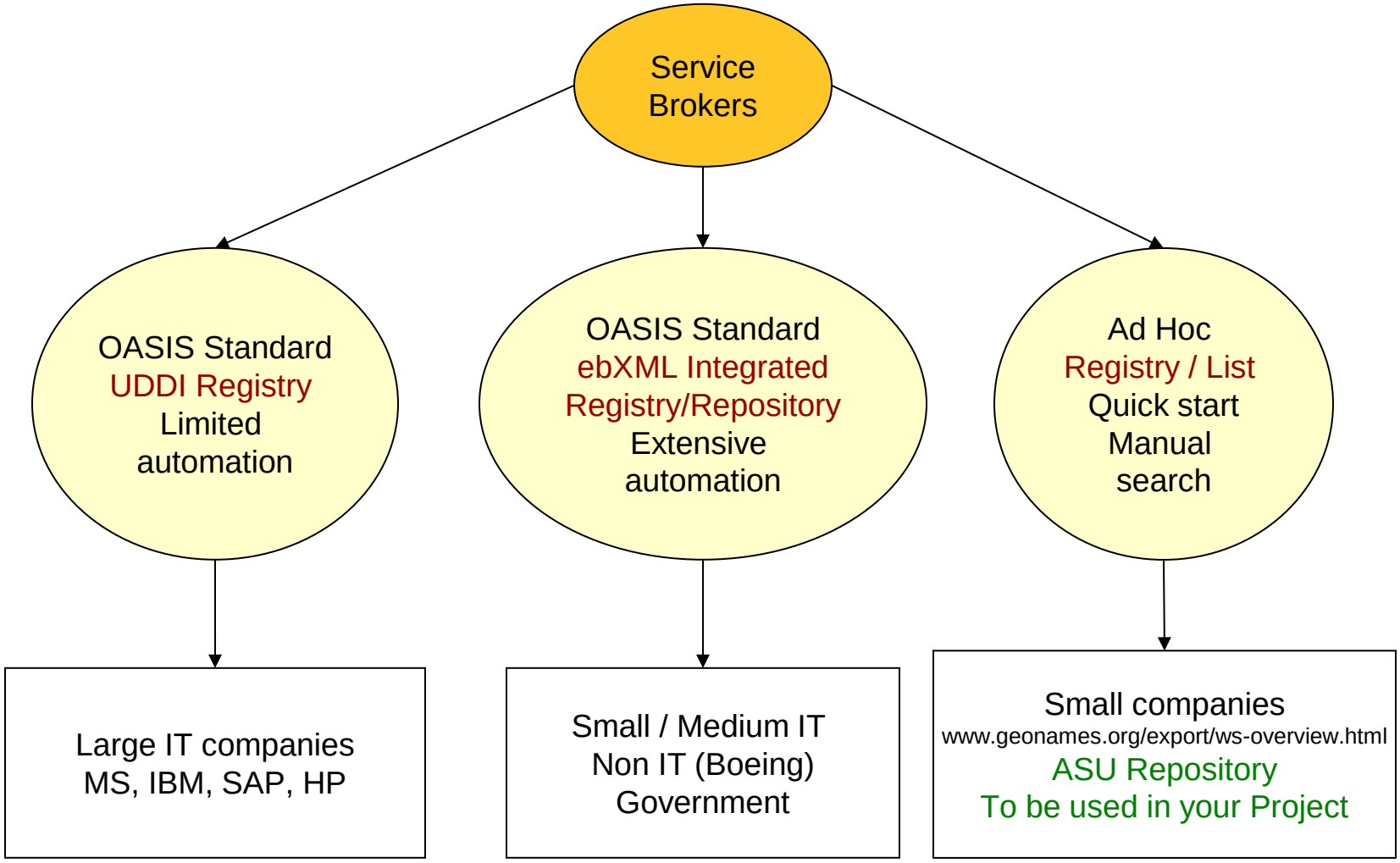
Basic Concepts
XML, SOAP, WSDL
Web Services
Service Broker: Registry and Repository
Application Building
SOA Impact
Myths and Facts



SOA Three Party Model with More Detail



Different Kinds of Service Brokers



Who is OASIS?

- OASIS is a member-led, international non-profit standards consortium;
- Founded under the name "SGML Open" in 1993.
- Thousands of individual and organizational members in 100 countries;
- The largest standards group for SOA and Web services. Most SOA standards are from OASIS
- Supports over 60 technical committees producing royalty-free and RAND (Reasonable and non-discriminatory) licensing in an open process.

UDDI Service Registry

Universal Description, Discovery, and Integration

UDDI registry information is organized in three groups:

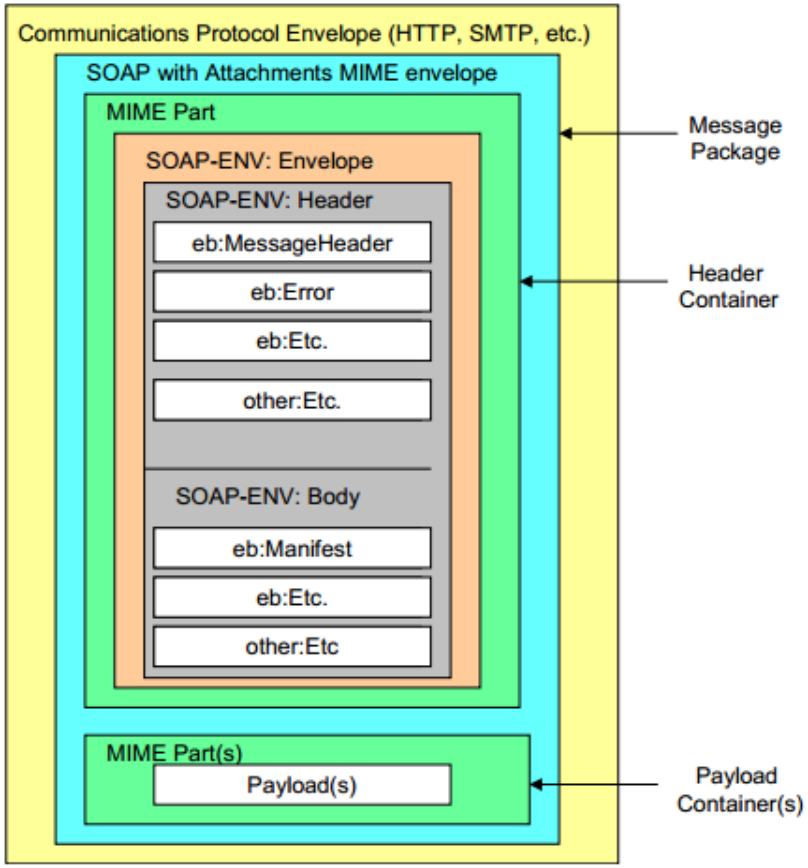
- **White pages** include service provider's name, identify, e.g., the DUNS number, contact information.
- **Yellow pages** include industry type, product and service type, and geographical location.
- **Green pages** include five data structures and APIs for allowing computer programs to read and write (register) UDDI registry.
- We will discuss the full details of UDDI in later modules

ebXML Consists of Five Modules

http://www.ebxml.org/

Similar to BPEL and Workflow Foundation

- Business Process Specification Schema
- Core Components
- Collaboration Protocol Profiles and Agreements (CPPA)
- Message Service
  https://www.oasis-open.org/committees/ebxml-msg/documents/ebMS_v2_0.pdf
- **Registry & Repository**



ebXML Message Format

ebXML Vendor Products

- Sun Microsystems Inc.
- ebXMLsoft Inc.
- CHECKMi
- Digital Artefacts Inc.
- Adobe Systems Inc.
- freebXML Registry (open source)
- Infravio - X-registry
- Xenos Group Inc. – GoXML Registry

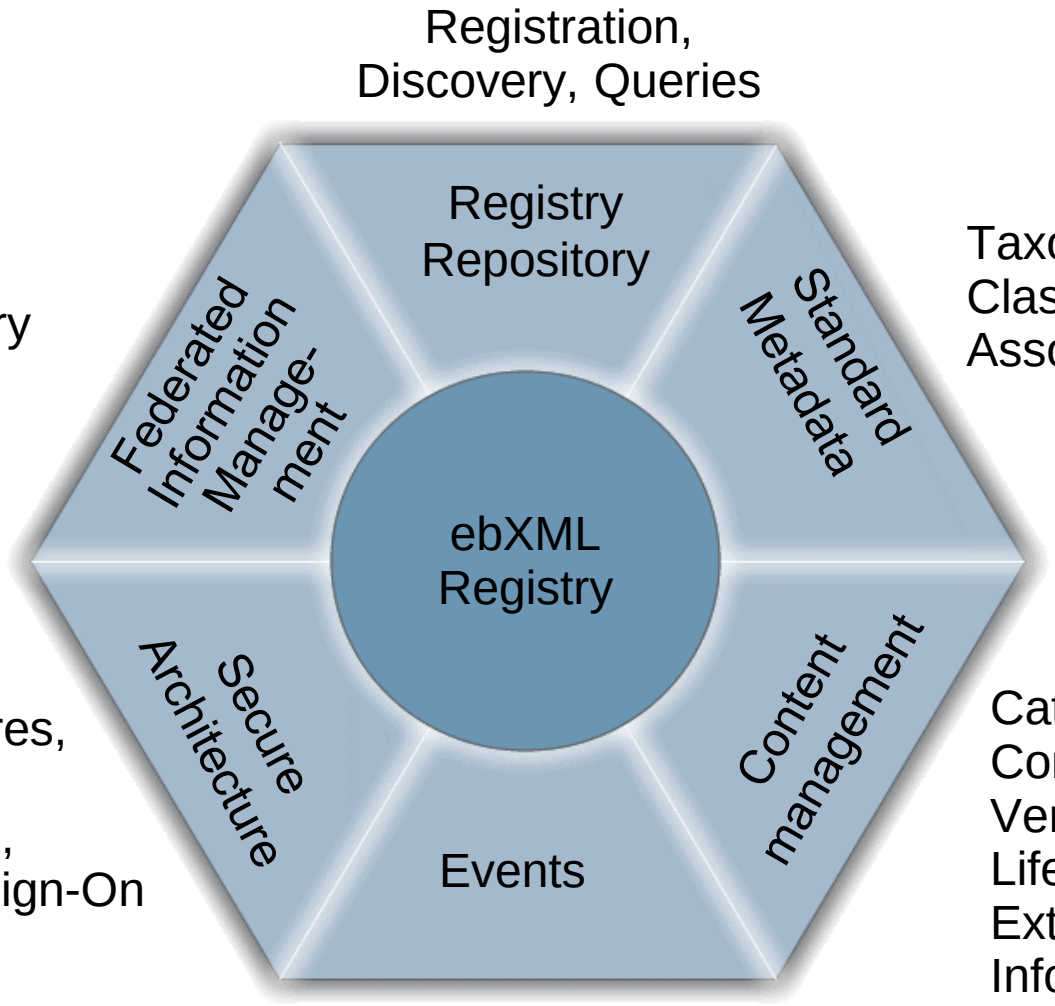
Widely used in healthcare systems and government systems

What is ebXML?

- An SOA **registry** as well as a **repository**
  - Classification of any type of information
  - Managing relationships between information
  - Taxonomy hosting, browsing and validation
  - File/folder organization of information

- A content management system for secure & federated information
  - Provides services for sharing content and metadata between entities in a federated environment
  - Lifecycle Management (LCM) actions logged in an audit trail
  - Supports automatic versioning of object

ebXML Registry Key Features



Need for an Integrated SOA Registry/Repository

- Governance enforced where SOA artifacts are stored
- Registry is not enough – need repository
  - Repository stores the actual artifacts
  - Registry stores metadata about the artifacts

- An integrated registry/repository ensures consistent storage, management, and reuse of artifacts according to organizational policies
- ebXML registry provides an integrated registry/repository
- Empower service providers without their own servers

Federated Information Management

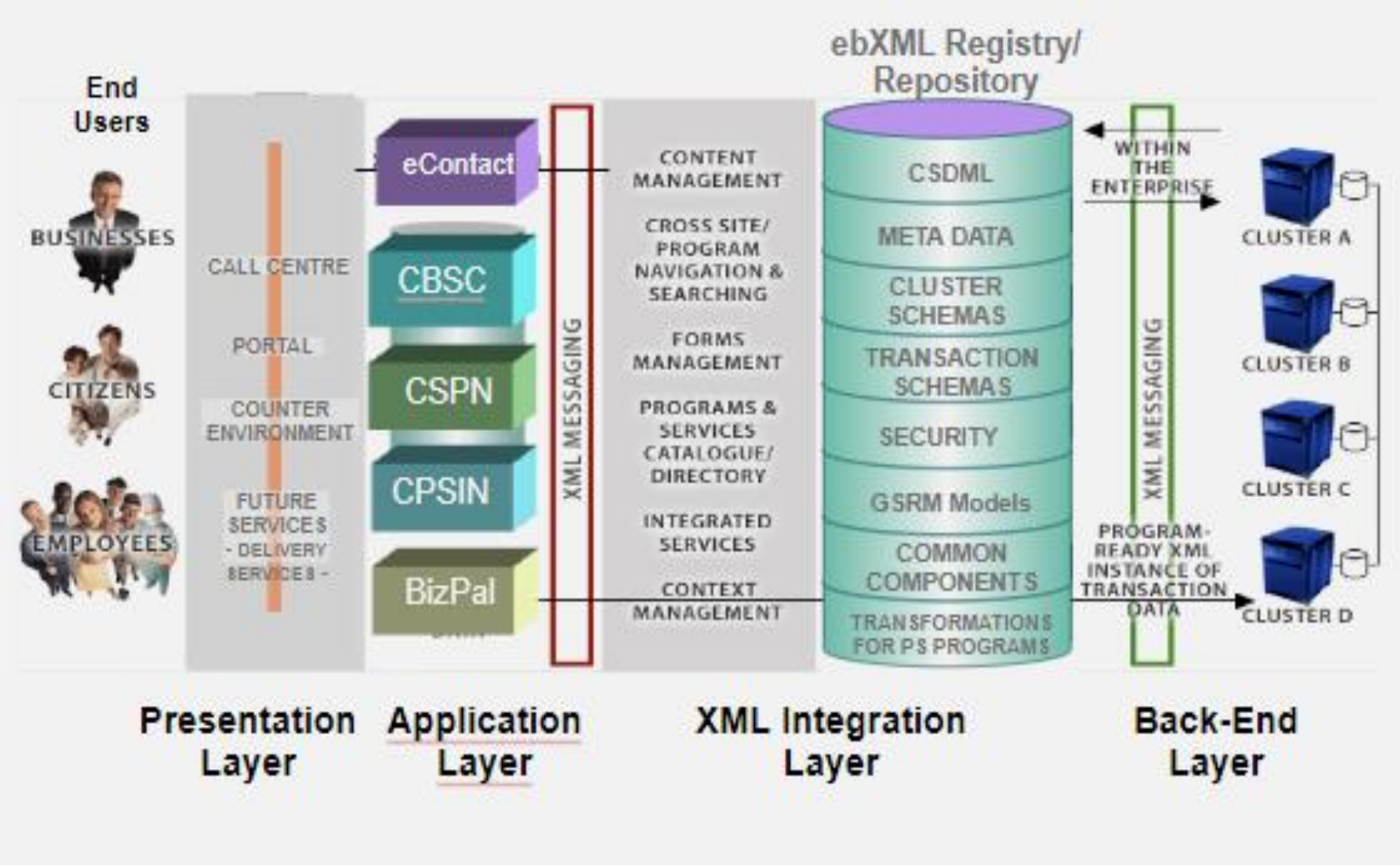
- Multiple ebXML registries may be federated together to
  - appear as a single virtual registry/repository
  - support seamless information integration and sharing
  - allow local autonomy over data

- ebXML federated registry relies on SAML (Security Assertion Markup Language) – the federated identity management standard

Case Study Government of Canada/Ontario

- Vision: Improve service quality to Canadian people and businesses through cost-effective eServices at all levels of government
- Target: Leverage the power of XML to deliver those services via collaboration across jurisdictions
- Strategy: Enable service delivery infrastructure by utilizing a federated registry and repository

Government of Canada's Registry/Repository Enables Four-Tier e-Government Architecture



Source: Government of Canada

ASU Repository of Web Services and Web Applications

http://venus.sod.asu.edu/WSRepository/repository.html

Table C.2 Examples of WCF, RESTful, and Workflow services deployed

Name	Description and deployed URL
Basic Three in SVC	The getting started service with three basic functions: HelloWorld, PiValue, and AbsValue http://venus.sod.asu.edu/WSRepository/Services/BasicThreeSvc/Service.svc
BasicThree in RESTful	WCF RESTful service with PiValue, AbsValue, and add2 operations http://venus.sod.asu.edu/WSRepository/Services/WcfRestService4/Service1/ http://venus.sod.asu.edu/WSRepository/Services/WcfRestService4/Service1/PiValue http://venus.sod.asu.edu/WSRepository/Services/WcfRestService4/Service1/AbsValue?x=-123 http://venus.sod.asu.edu/WSRepository/Services/WcfRestService4/Service1/add2?x=15&y=17
Crypto service in SVC	WCF-based WSDL-SOAP service with two operations: string Encrypt(string); and string Decrypt(string); http://venus.sod.asu.edu/WSRepository/Services/EncryptionWcf/Service.svc
Crypto service in RESTful	RESTful service for encryption and decryption http://venus.sod.asu.edu/WSRepository/Services/EncryptionRest/Service.svc/ http://venus.sod.asu.edu/WSRepository/Services/EncryptionRest/Service.svc/Encrypt?text=Hello http://venus.sod.asu.edu/WSRepository/Services/EncryptionRest/Service.svc/Decrypt?text=AdAqmhVEN2A=
FileService in SVC	WCF-based WSDL-SOAP service that stores a string in the server's file system: void PutStringToFile(string fileName, string value); and string GetStringFromFile(string fileName); Service: http://venus.sod.asu.edu/WSRepository/Services/FileService/service.svc TryIt Page: http://venus.sod.asu.edu/WSRepository/Services/FileServiceTryIt/
Hashh	Hash service using SHA5 string Hash(string value, string salt); http://venus.sod.asu.edu/WSRepository/Services/HashSha512/Service.svc?wsdl To test the service, use the service test tool and enter the WSDL address above http://venus.sod.asu.edu/WSRepository/services/wsTesterTryIt/


Ira A. Fulton Schools of
Engineering
Arizona State University