



JICSIT2011 / ITAIC 2011 Keynote

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A Dream of Software Engineers -- Service Orientation and Cloud Computing

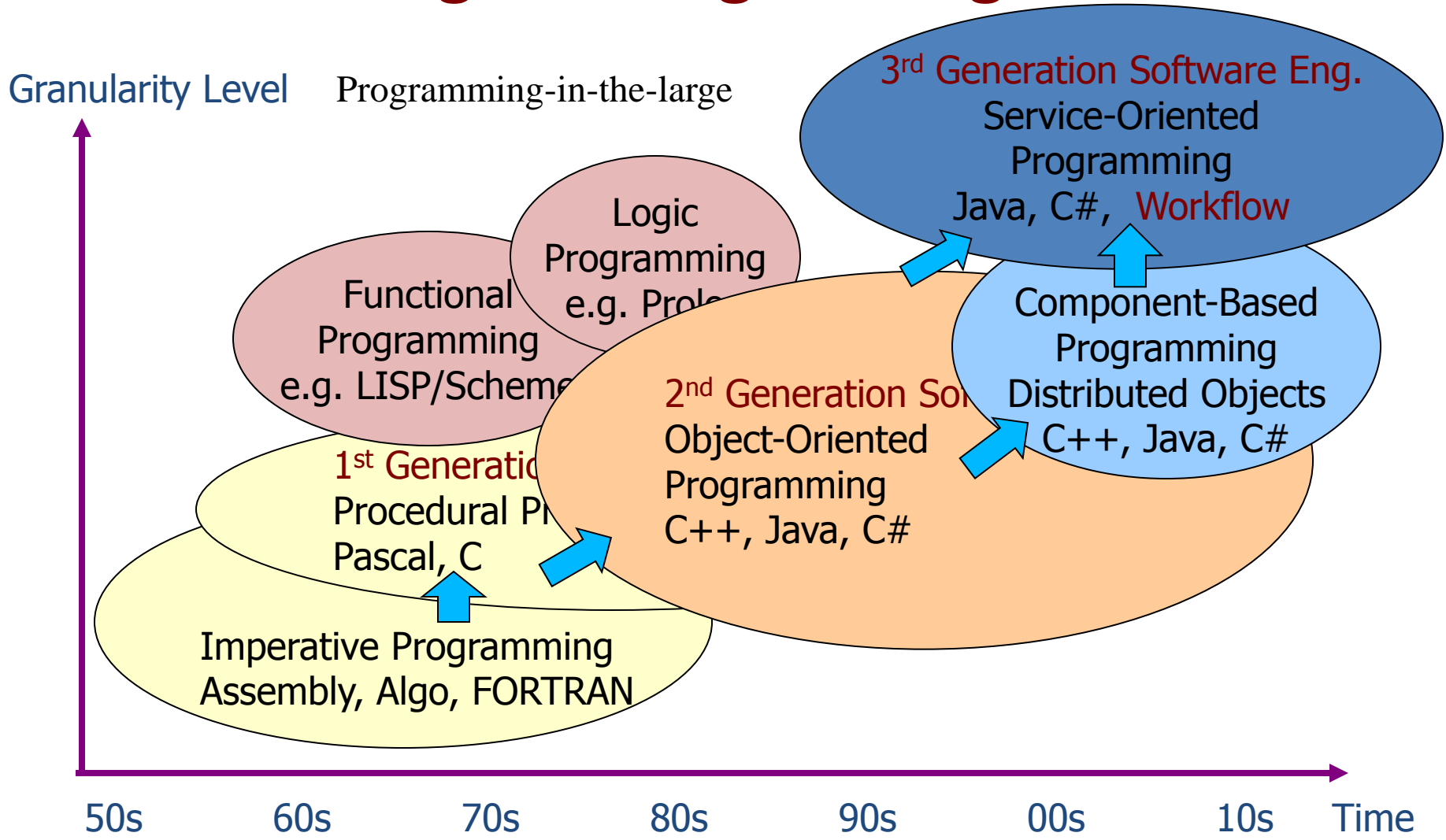
Yinong Chen

Arizona State University, Tempe, Arizona, U.S.A.

Outline

- Introduction
 - Programming Paradigms and Software Engineering
 - Service Orientation vs. Object Orientation
- A Dream of Software Engineers:
Service-Oriented Computing and Workflow-
Based Software Development
- Cloud Computing, we could not even dream
 - Cyber-Physical Device and Robot as a Service
 - ASU Service Repository

Programming Paradigms



The First Generation Software Engineering

- ❖ The features of the first generation
 - Waterfall model
 - Structured programming and design
 - Structured analysis
 - Compilers and interpreters advancement
 - Abstract data types
 - Layered architecture
- ❖ From machine and assembly programming to high-level programming. Significant productivity gain.
- ❖ Main technologies include compilers and OS, software development models, and programming languages
- ❖ Programming languages are the key.

The Second Generation Software Engineering

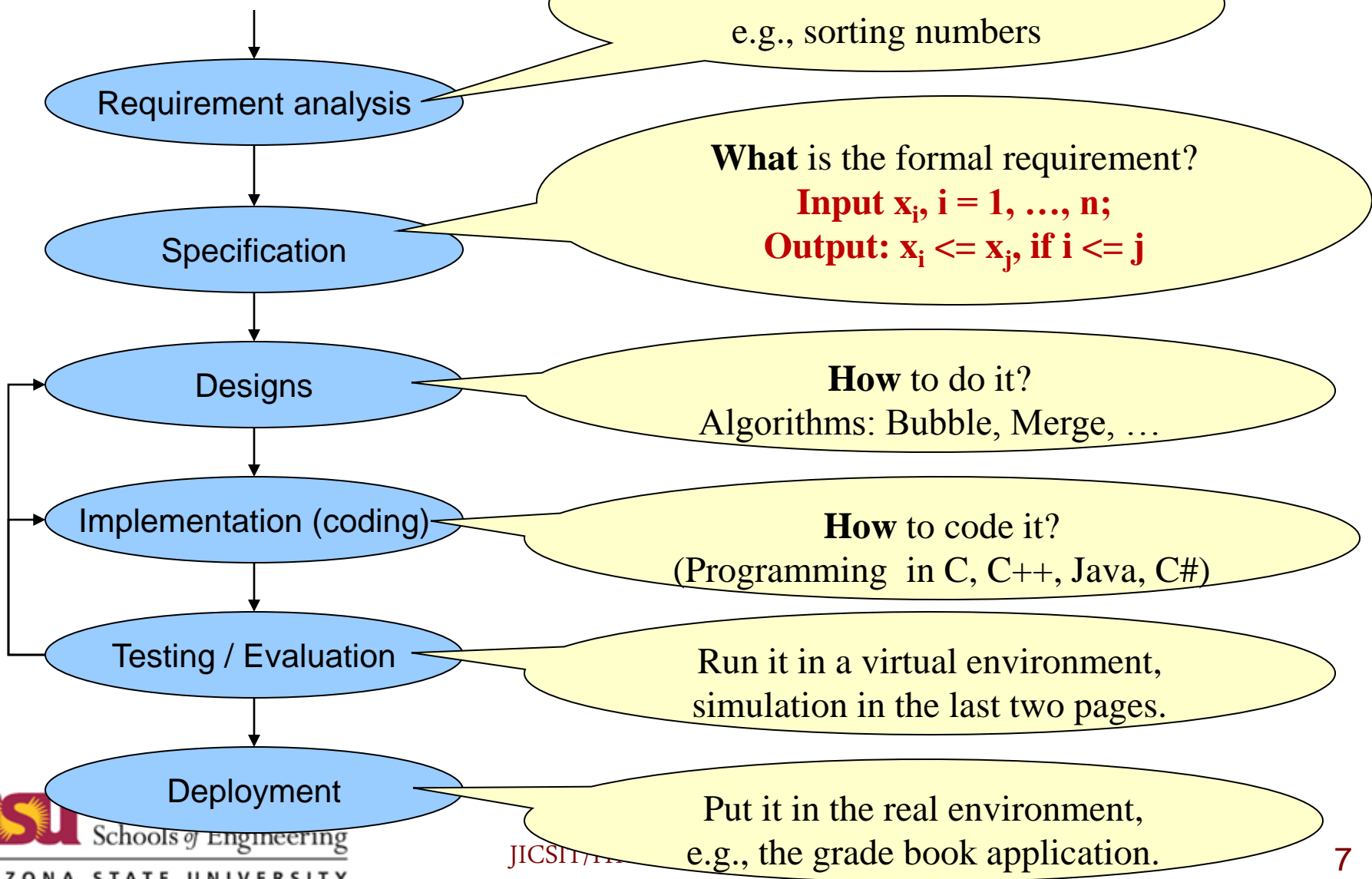
- ❖ The features of the second generation
 - Object-oriented analysis, design, and programming
 - UML (Unified Modeling Language), Agile processes
 - Software architecture patterns and design patterns
 - CMM(Capability Maturity Model) and CMMI (CMM Integration)
 - Model checking
- ❖ Modeling (such as object-oriented modeling) rather than programming is the key technology, and also classification and cataloguing (patterns) best software practices, and refinement of processes. Not just coding.
- ❖ Further productivity gain due to availability of tools, techniques, and documentation.
- ❖ Development process and techniques are the key.

The Third Generation Software Engineering

- ❖ The features of the third generation
 - Service-oriented computing (development + execution combination)
 - Cloud computing and SaaS (Software as a Service) with applications
 - SaaS: development + execution + automated runtime management, including **resource** (sharing) and **security** (privacy) management. It introduces many scientific research questions into software engineering, such as data mining, control theory, and statistics.
- ❖ Expect very rapid software customization and deployment.
- ❖ Platform is the key.

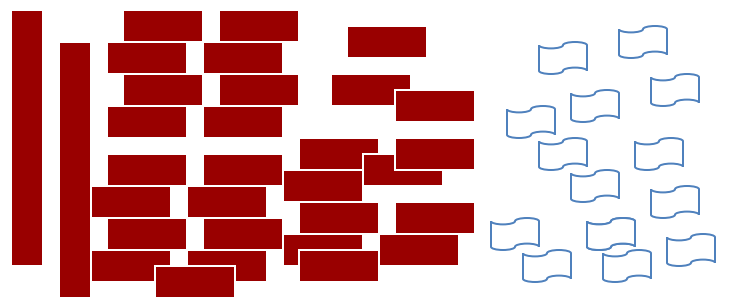
Imperative Software Development

Software Development

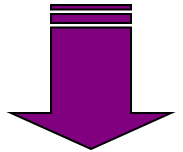
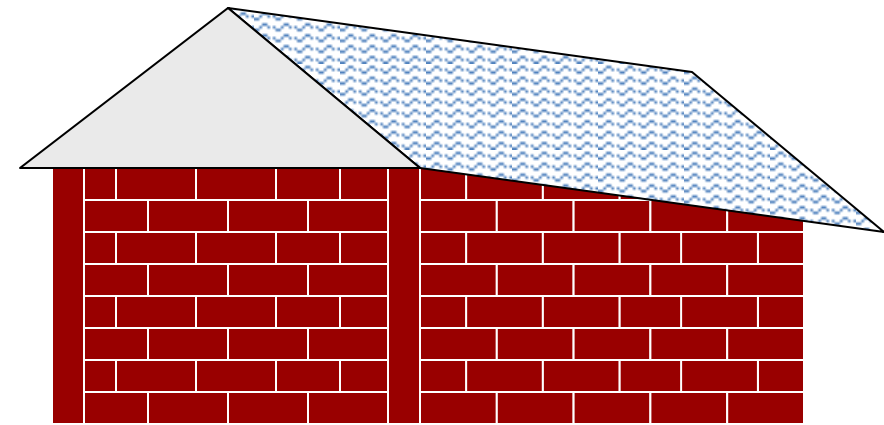
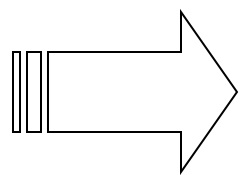


Component-Based Software Development

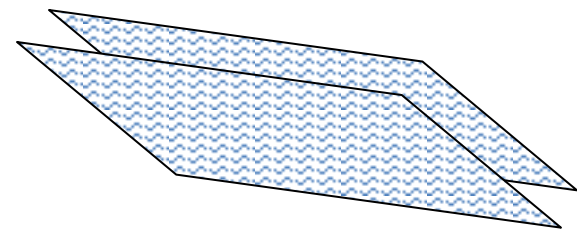
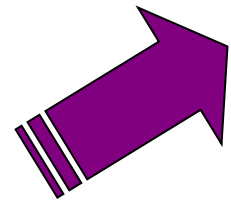
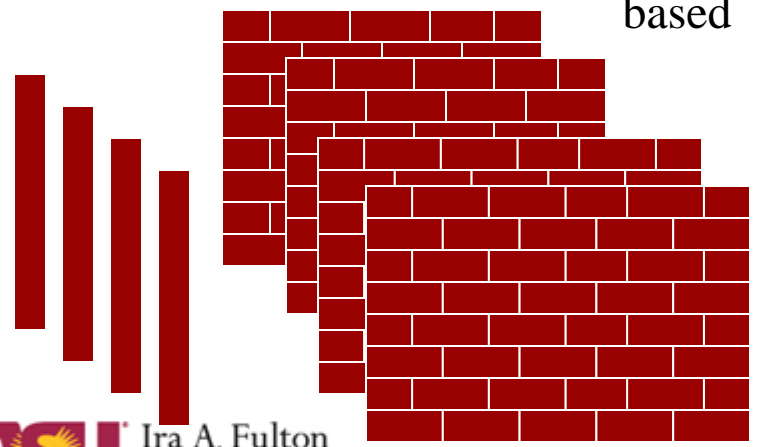
Bricks and Tiles



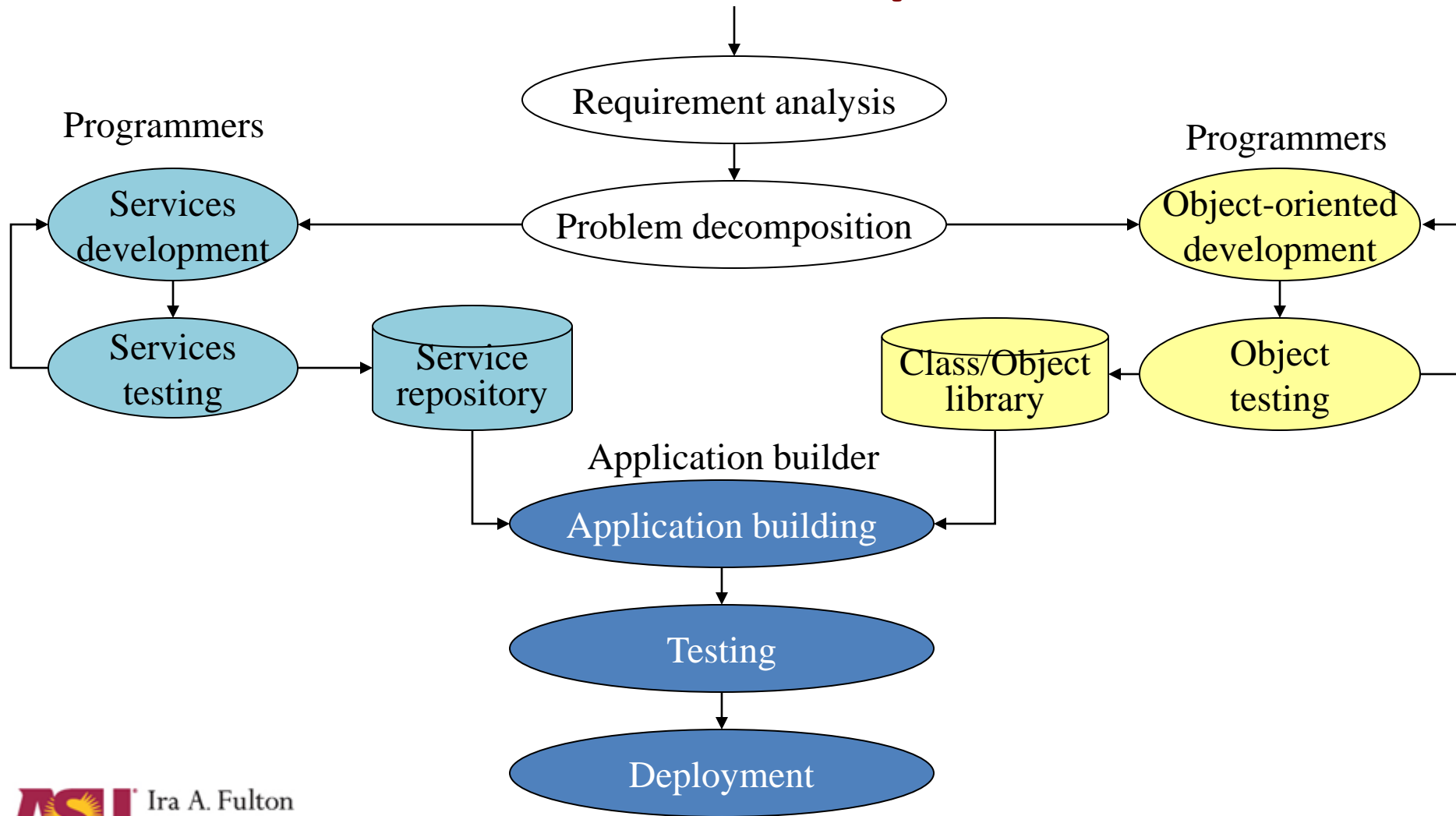
imperative



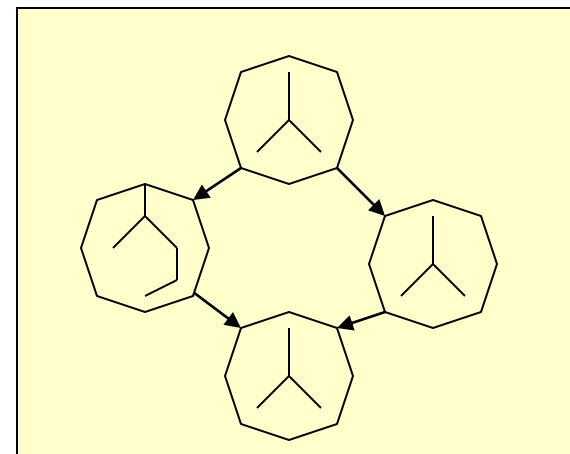
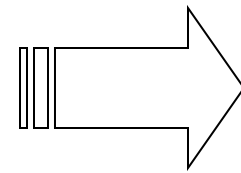
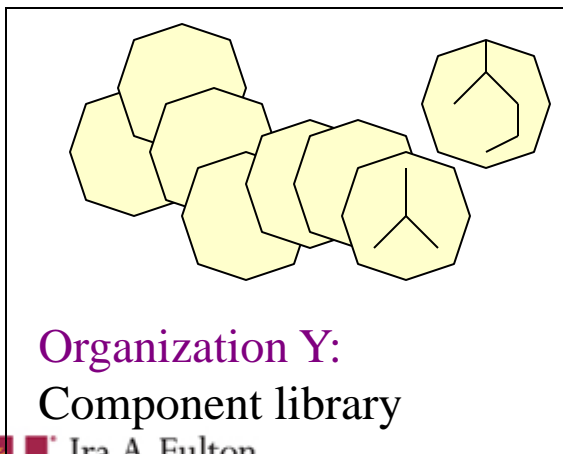
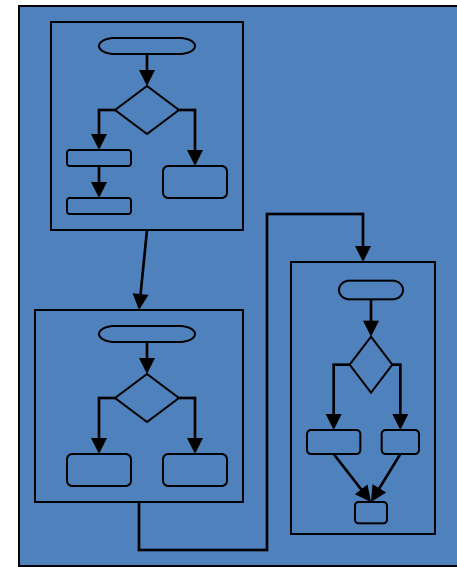
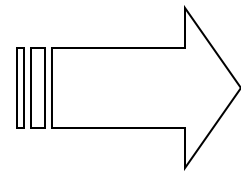
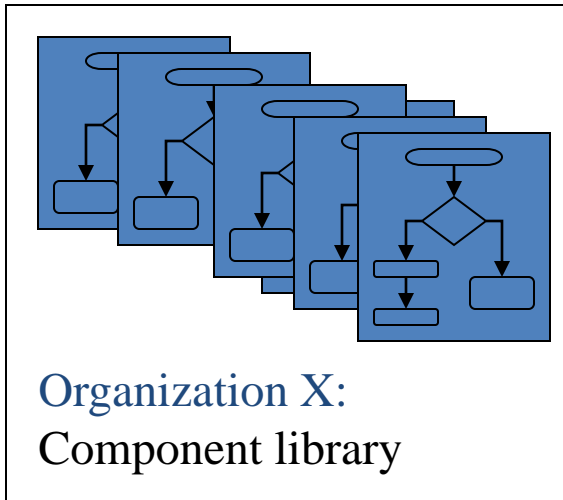
Component-based



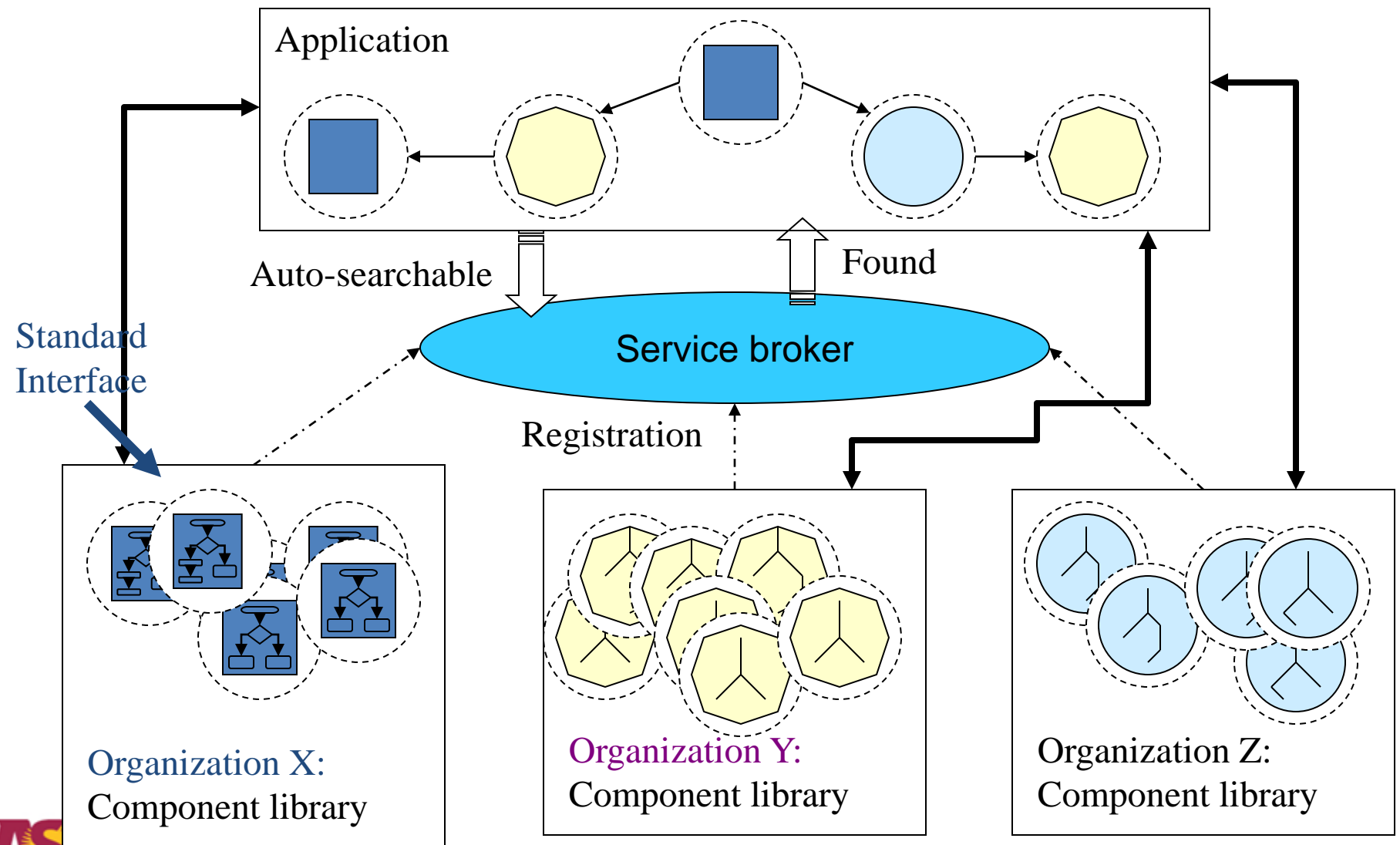
Object-Oriented and Service-Oriented Software Development



Object-Oriented Software Development



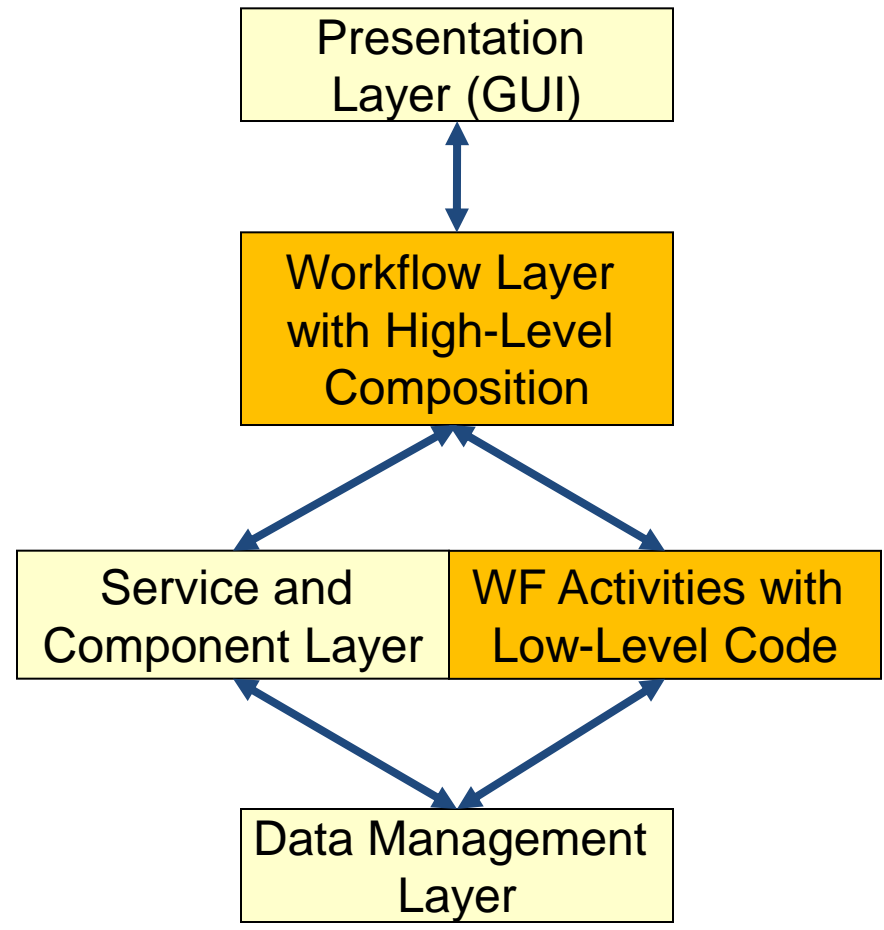
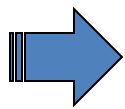
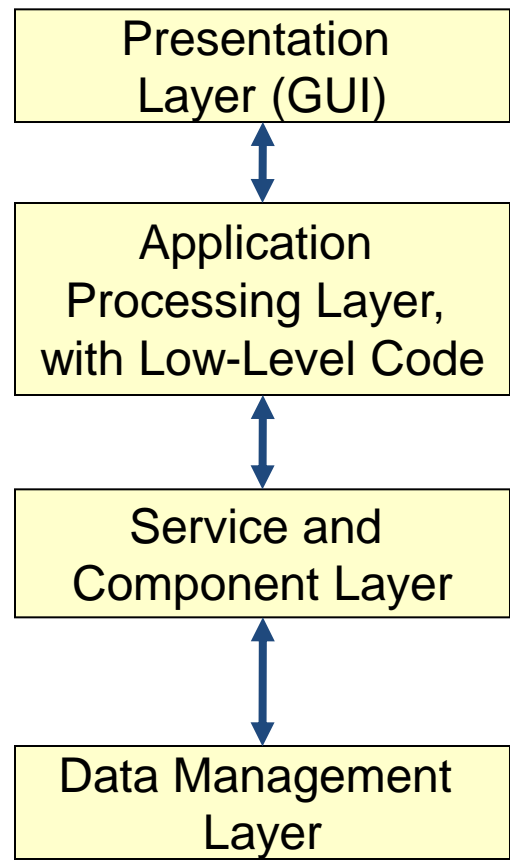
Service-Oriented Software Development



Outline

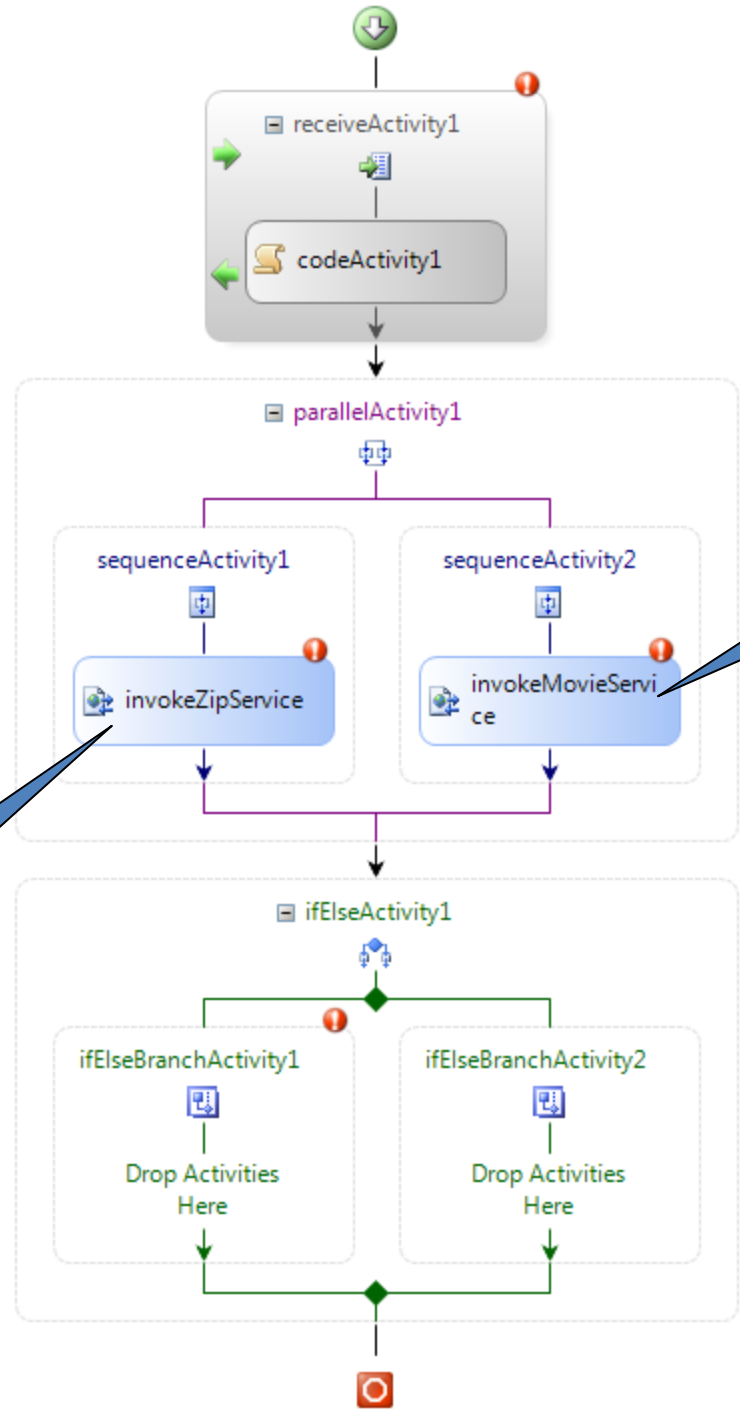
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Clearer Tiered Architecture



Using Flowchart as Code

Movie Service:
<http://www.ignyte.com/webservices/ignyte.whatsshowing.webservice/moviefunctions.asmx>



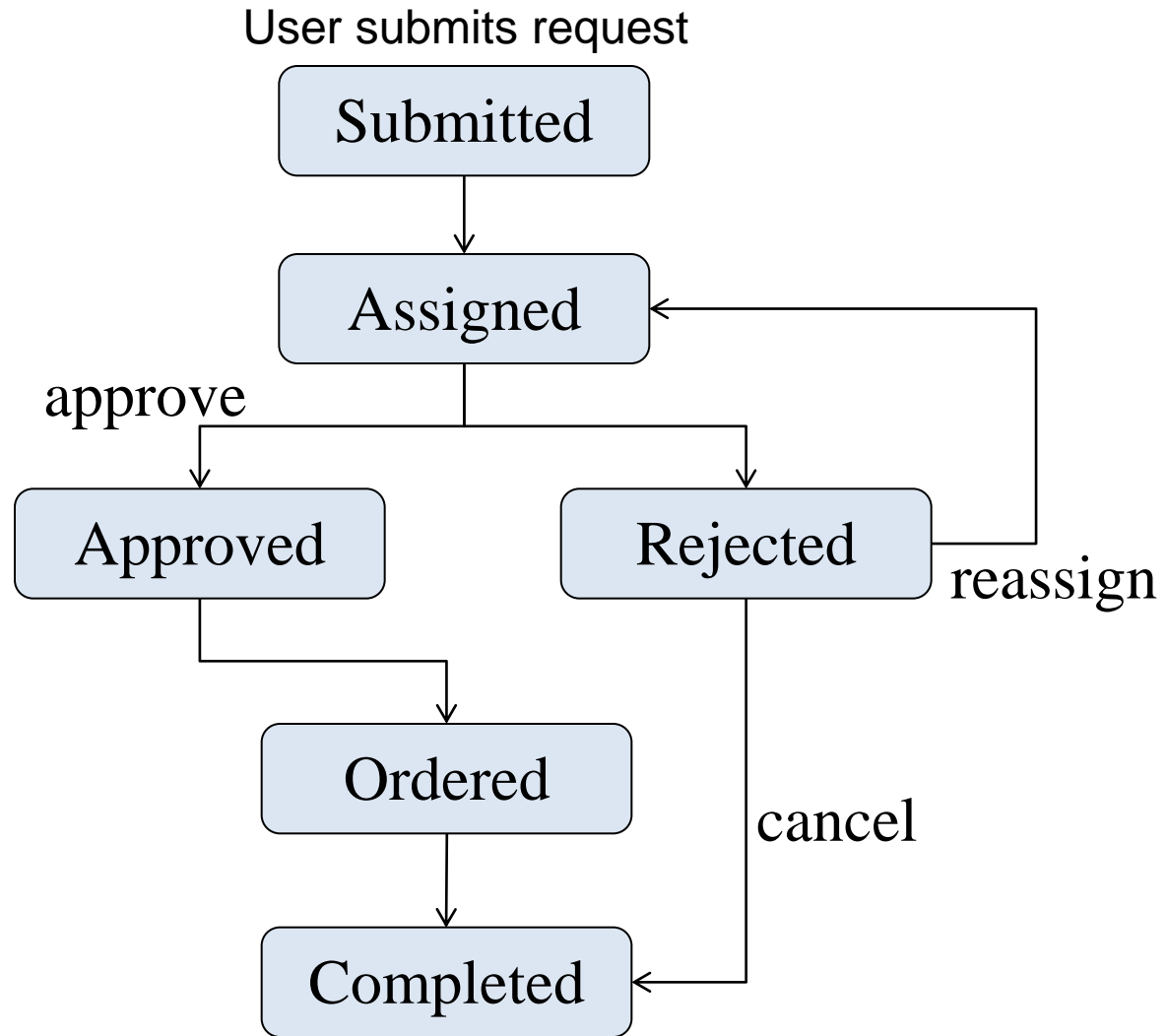
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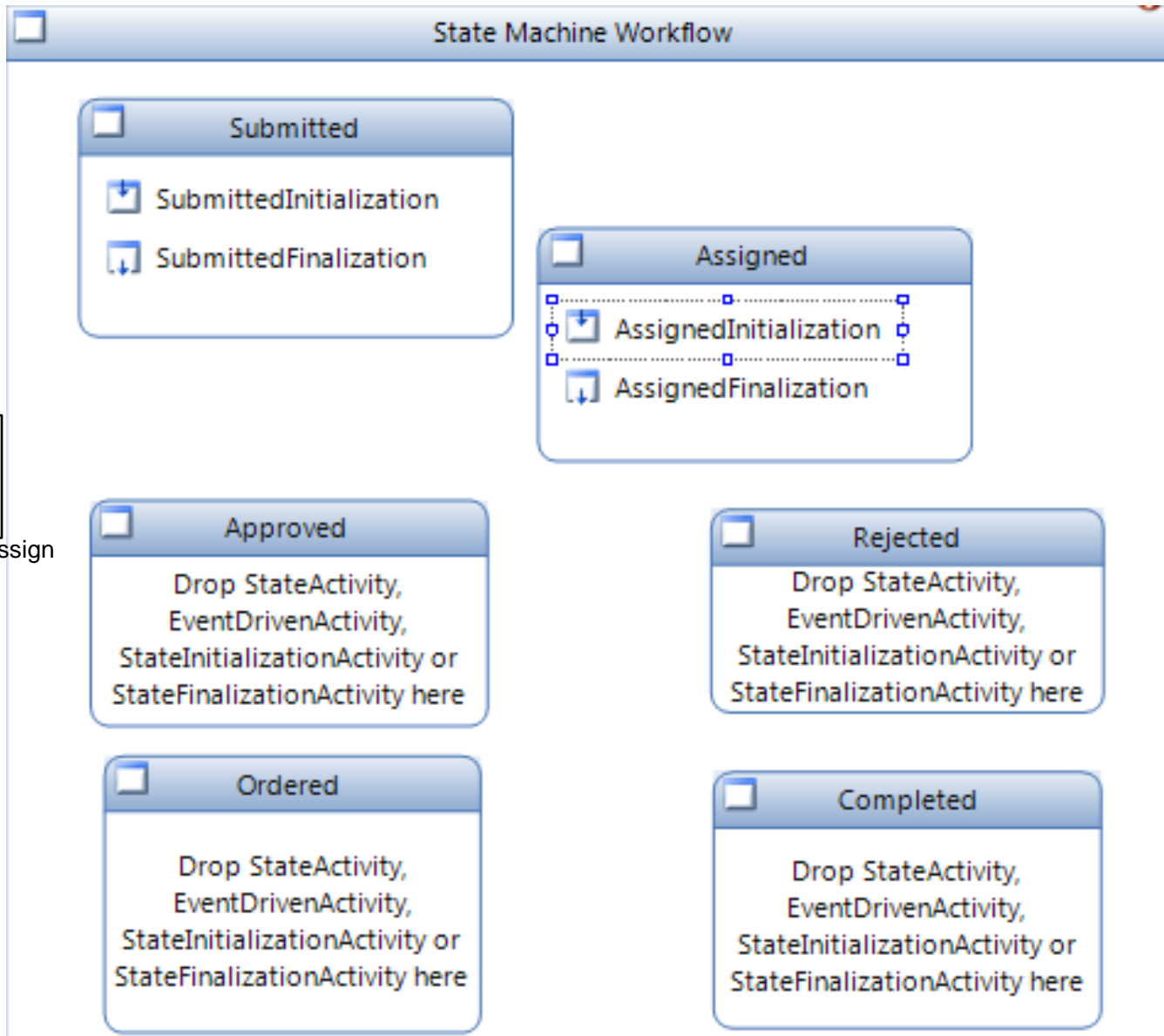
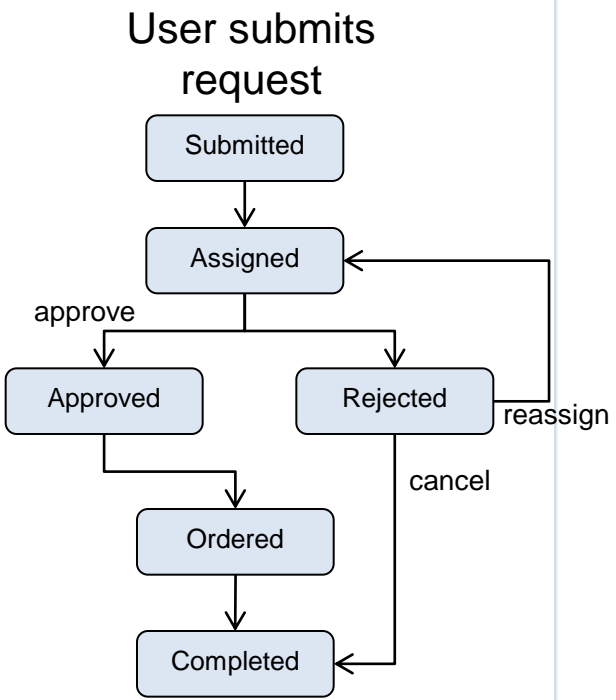
Zip Code Service:
<http://www.webservices.net/uszip.asmx>

Flowchart and Workflow Code

An Online Ordering Process

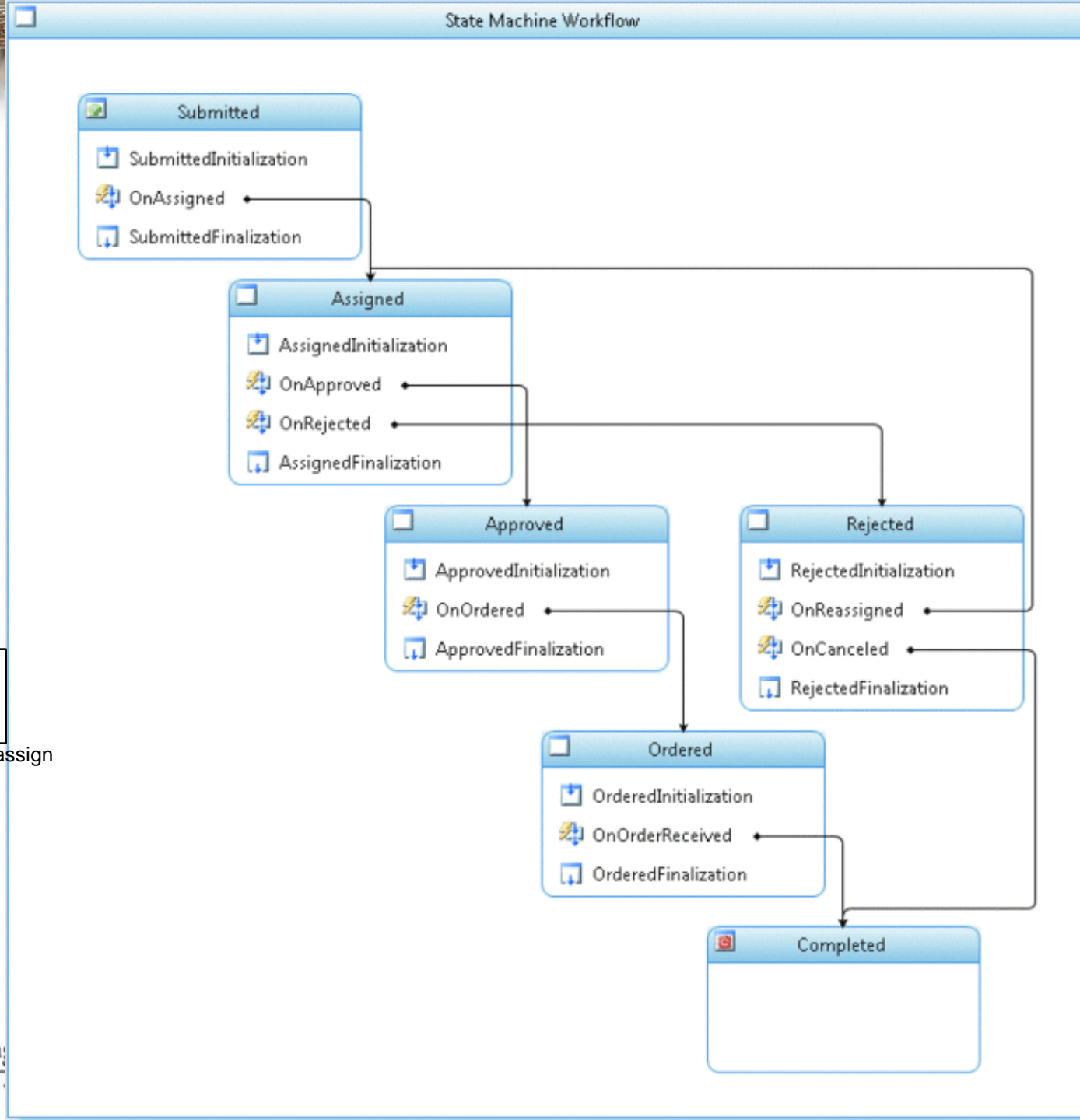
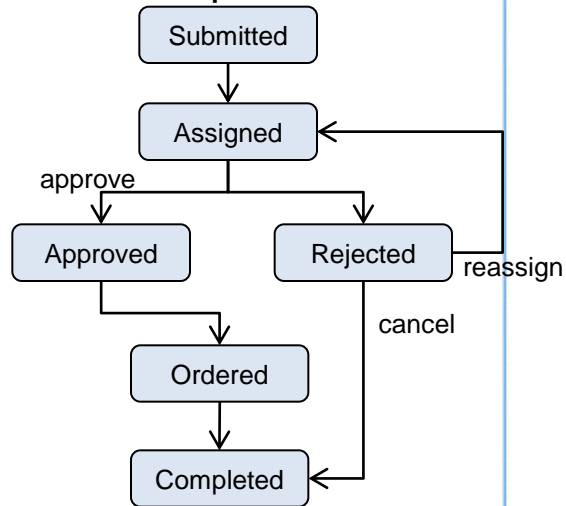


Define the States of a Finite State Machine

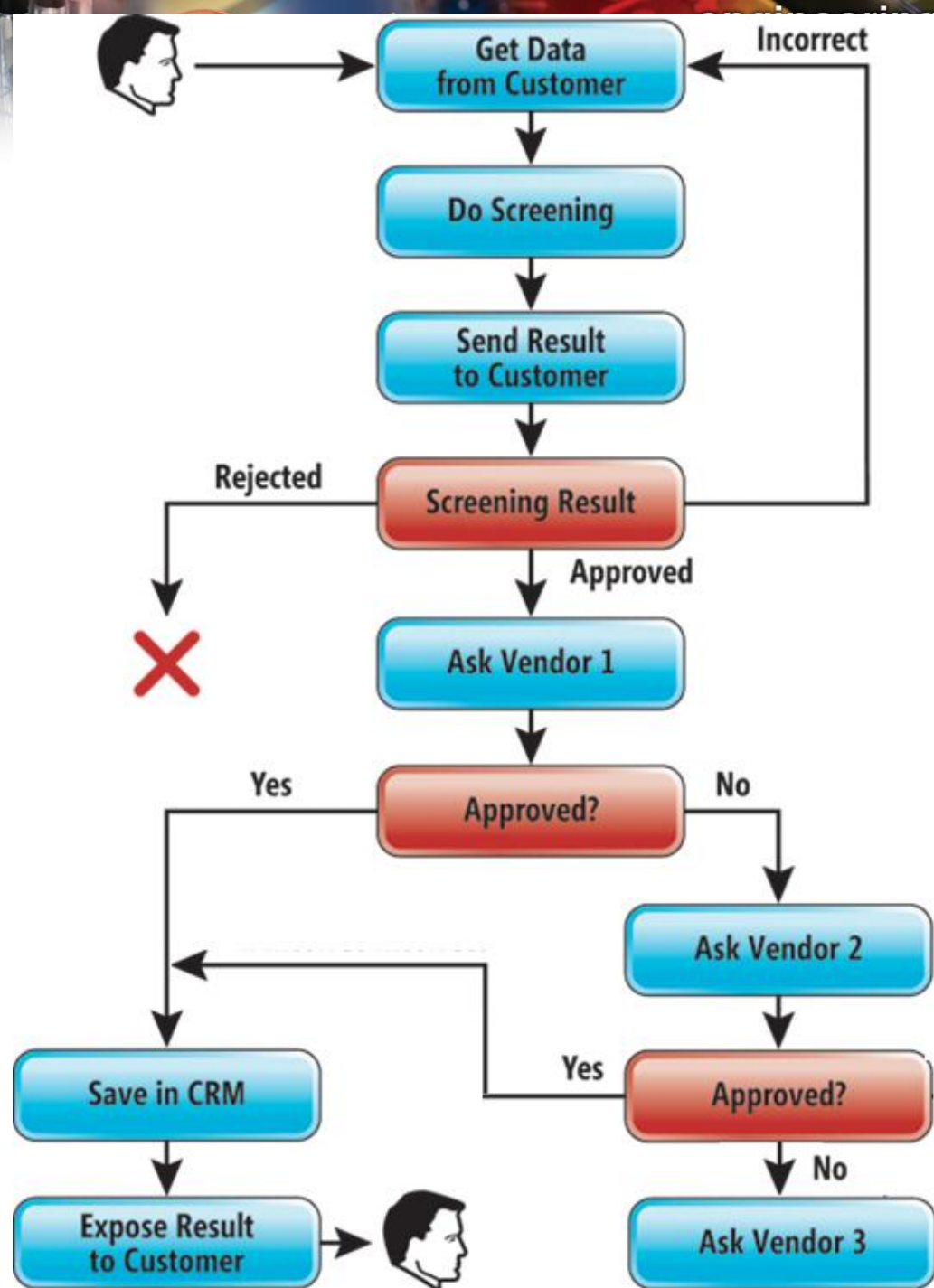


Define the Transitions between the States

User submits request

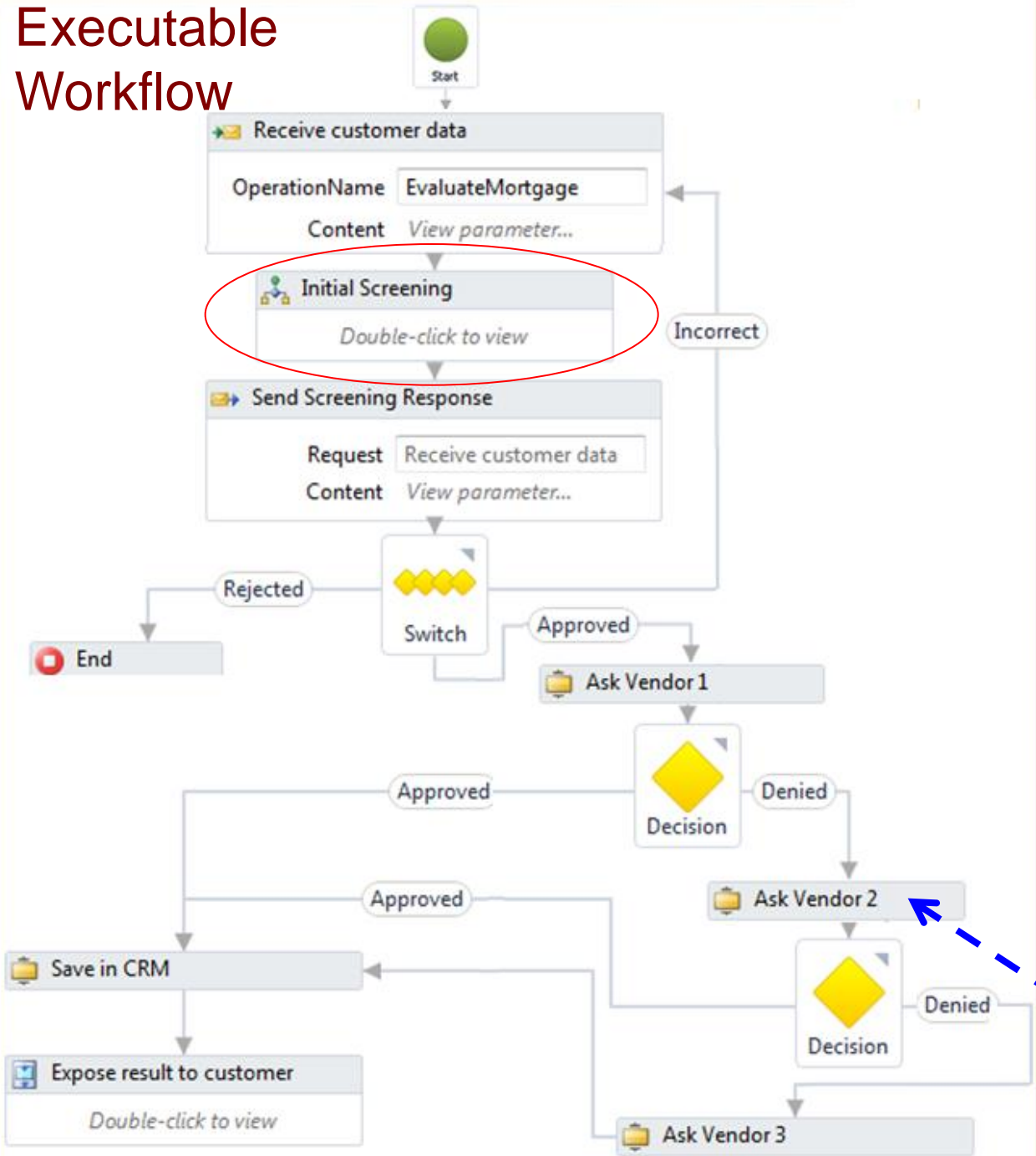


Flowchart of a Mortgage Application Site



Source:
<http://msdn.microsoft.com/en-us/magazine/ff646977.aspx>

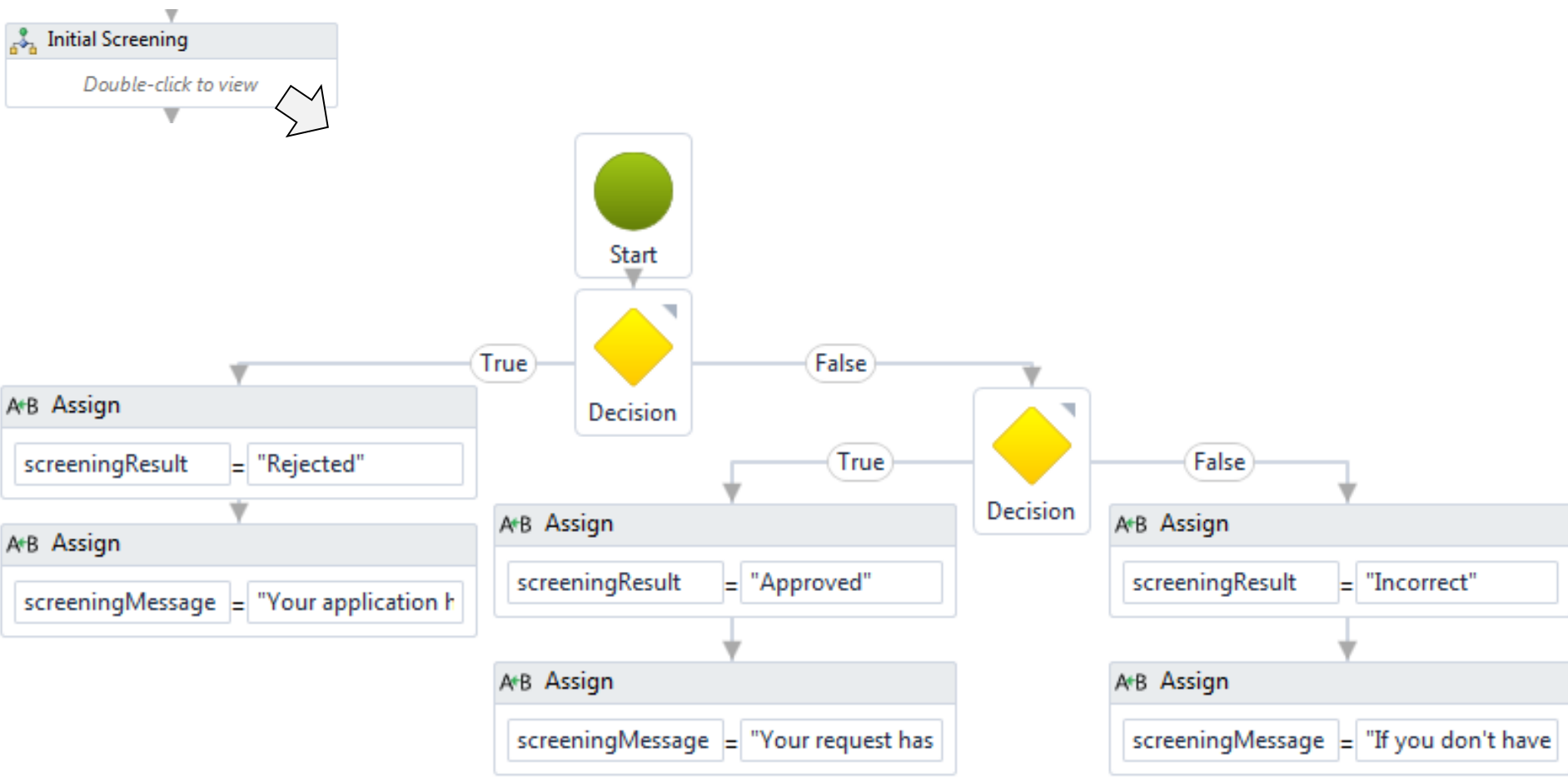
Executable Workflow



Solution Explorer

- MortgageService
 - Properties
 - References
 - Service References
 - Activities
 - App_Data
 - MortgageService.xamlx
 - Web.config
- VendorServices
 - Properties
 - References
 - Service References
 - App_Data
 - IService1.cs
 - Vendor1.svc
 - Vendor2.svc
 - Vendor3.svc
 - Web.config

Open the "Initial Screening" Flowchart



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The U.S. FEDERAL CLOUD COMPUTING STRATEGY

<http://cto.vision.com/wp-content/uploads/2011/02/Federal-Cloud-Computing-Strategy1.pdf>



<http://washingtontechnology.com/articles/2011/02/18/kundra-plan-25-percent-of-it-spending-on-cloud.aspx>

Cloud computing headed for \$20B market

Administration strategy calls for data center reduction to pay for plan

▪ By Kathleen Hickey ▪ Feb 18, 2011

The market for cloud services is about to explode in the government space if Federal CIO Vivek Kundra has his way. His recently released [Federal Cloud Computing Strategy](#) calls for about a quarter of federal IT spending, or \$20 billion, to be committed to cloud systems.

Additionally, under the Cloud First program, agencies will be required to move three services to the cloud within 18 months, adopt a cloud model wherever feasible and evaluate cloud options before making investments.

An estimated \$20 billion of the federal government's \$80 billion in IT spending could be used for cloud computing, Kundra said in the report. The agencies expected to spend the most on cloud technology are the Homeland Security and Treasury departments, at approximately \$2.4 billion apiece, followed by the Defense, Veterans Affairs and Transportation departments. The top contractors at those agencies include companies such as Hewlett-Packard, Computer Sciences Corp., IBM, and Lockheed Martin.

Vivek Kundra's "Cloud First" Policy

<http://www.cloudtweaks.com/2011/04/the-architect-of-the-official-cloud-computing-revolution-%E2%80%93-cio-vivek-kundra/>

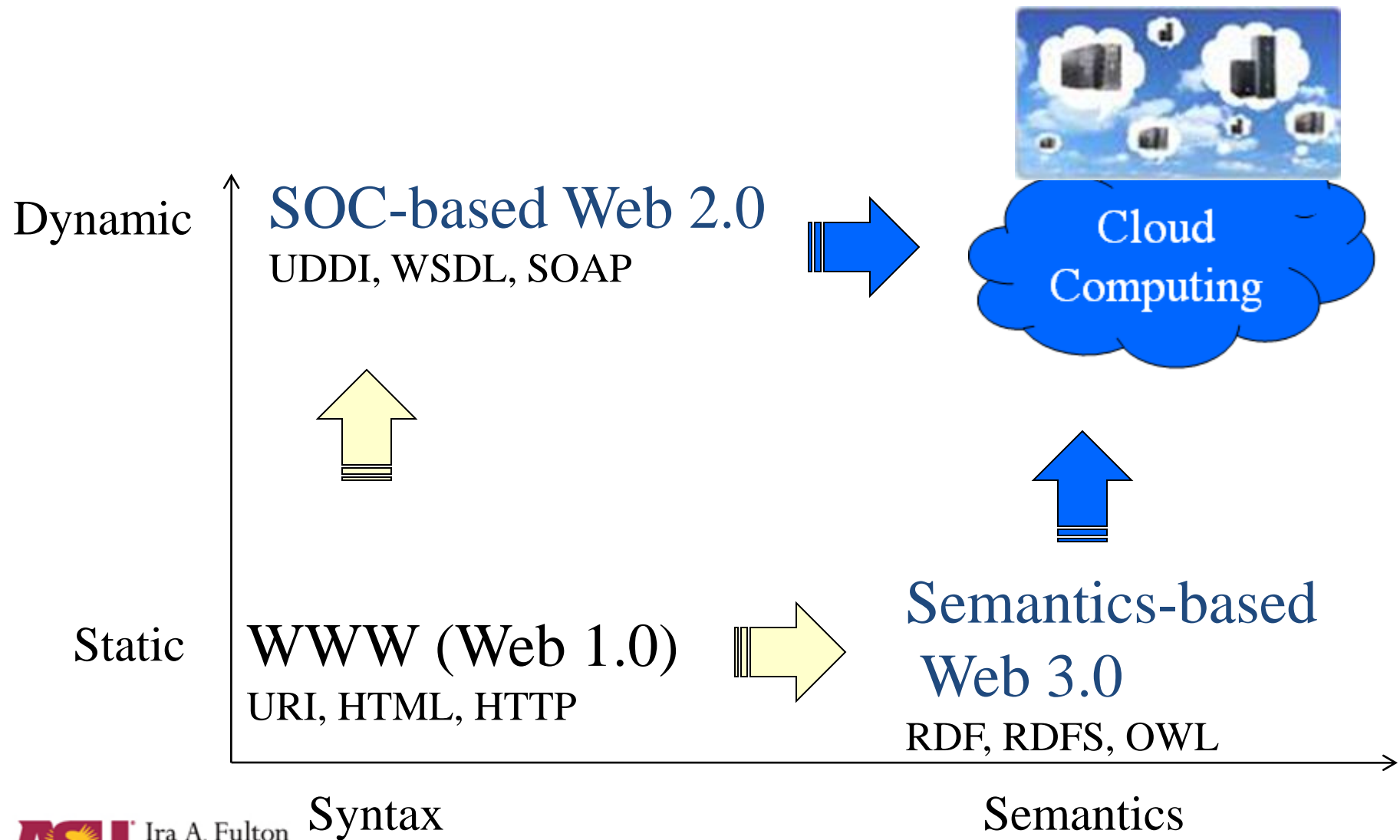
- Government agencies have been asked to consider a cloud computing option first when they planned to launch a new IT project; and they are required to identify three systems they would like to move to the cloud.
- Kundra believes Cloud Computing is the next "Internet" that has changed the world, not just computing!

Essential Characteristics of Cloud Computing

<http://csrc.nist.gov/groups/SNS/cloud-computing/>

- On-demand services,
- Broad network access,
- Resource pooling,
- Rapid elasticity, and
- Measured services
- Minimal management effort

Web 2.0, Web 3.0, and Cloud Computing



Components of Cloud Computing

- ❖ **Software as a Service**
- ❖ **Platform as a Service**
- ❖ **Infrastructure as a Service**
- ❖ **X as a Service**
 - **Test as a Service**
 - **Cyber Physical Devices**
 - **Device as a Service**
 - **Robot as a Service**

X as a Service: What is X?

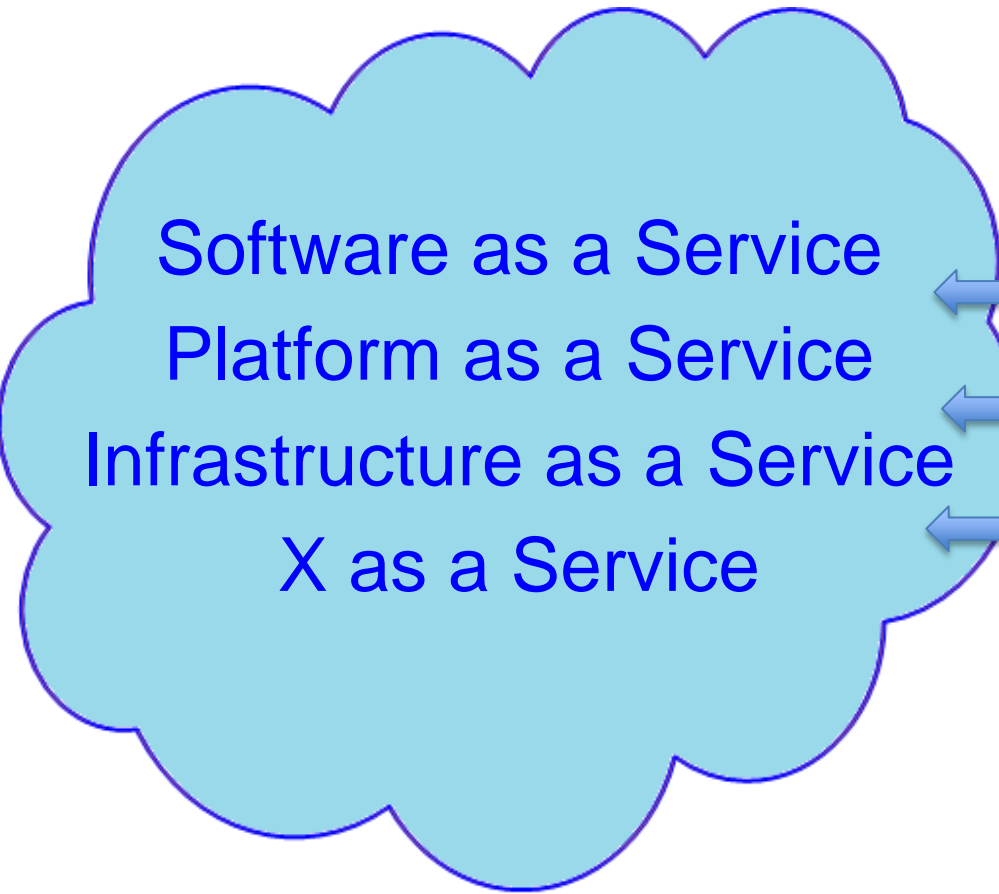
- ❖ X is unknown
- ❖ X is a variable
- ❖ X is a dream
- ❖ X is what we could not even dream
- ❖ X is everything
 - Social networking: We can hide nothing
 - Ontology: Everything can be reasoned of
 - Virtual and reality



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As a Part of Cloud Computing



Software as a Service
Platform as a Service
Infrastructure as a Service
X as a Service

Cyber Physical Devices

Device as a Service

Robot as a Service

Service Interface in
HTTP, URI, REST.
WSDL, SOAP, etc.

Current Efforts in Device Integration: Augmented Reality (1)

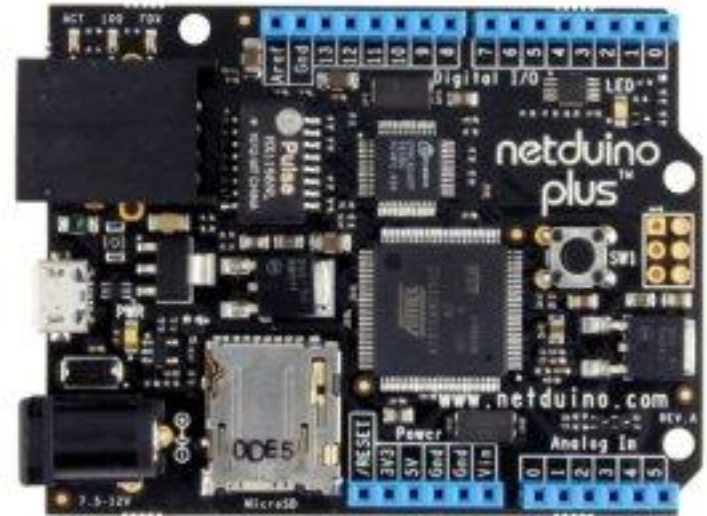
- **Pachube**
 - Data **infrastructure** for users to build their Internet of Things
 - Manage real-time data from sensors, devices, and environments
- **Wikitude** World Browser:
 - Organize and display information about users' surroundings in a mobile camera view.
 - Similar to Pachube, but focus on photos and videos

Current Efforts: Device as a Service (2)

- **Devices Profile for Web Services (DPWS)** defines implementation constraints to enable secure Web Service messaging, discovery, description, and eventing on resource-constrained devices;
- DPWS specification was initially published in 2004 and was submitted for standardization to OASIS in 2008. DPWS 1.1 was approved as OASIS Standard together with WS-Discovery 1.1 and SOAP-over-UDP 1.1 2009;
- Microsoft .Net Framework Class Library defined classes for supporting DPWS device programming

Current Efforts: Device as a Service (2)

- Device with Built-in Service Interface, for example:
- Netduino Plus: Works with .Net Micro Framework to facilitate service to device communication

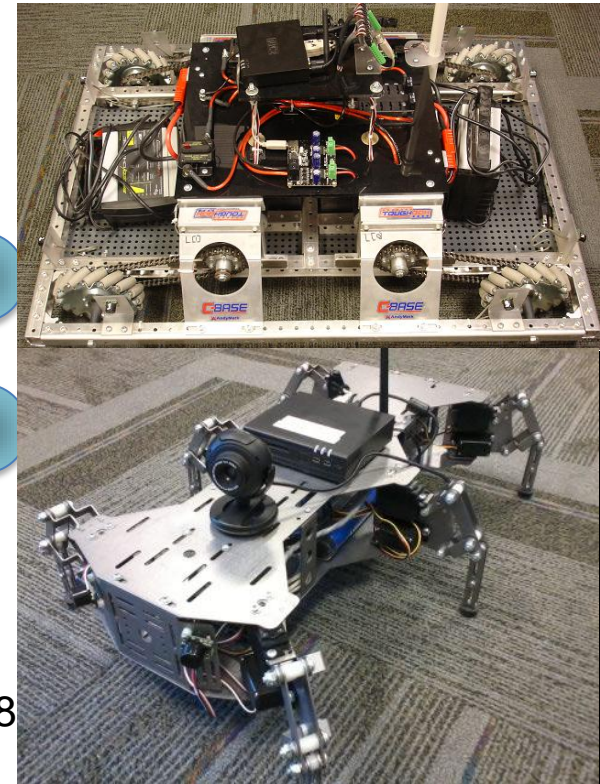
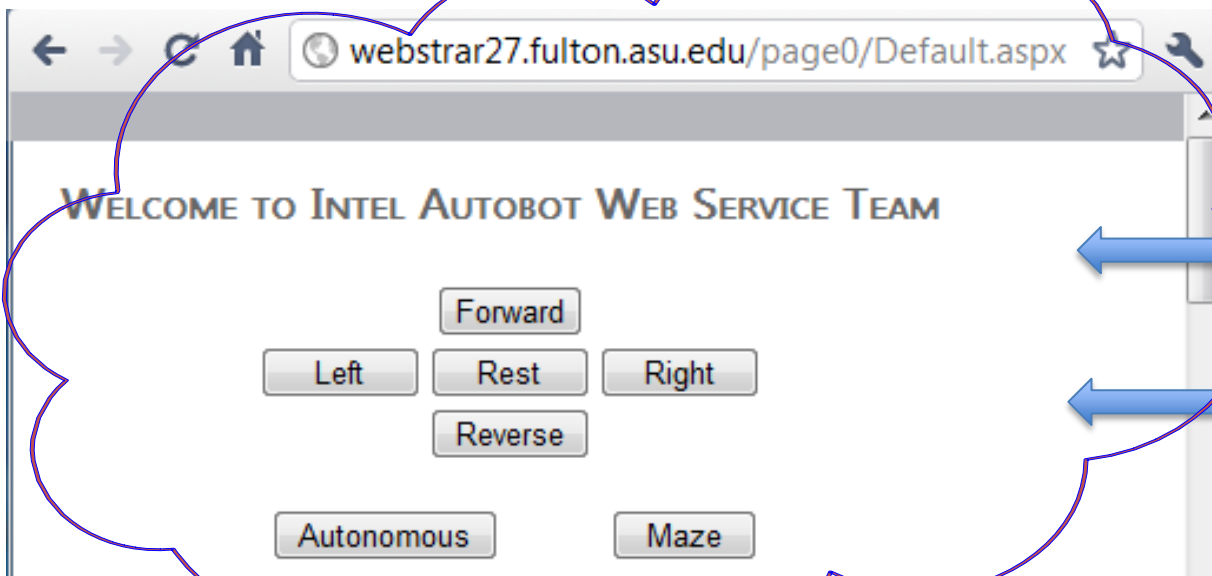


<http://www.amazon.com>

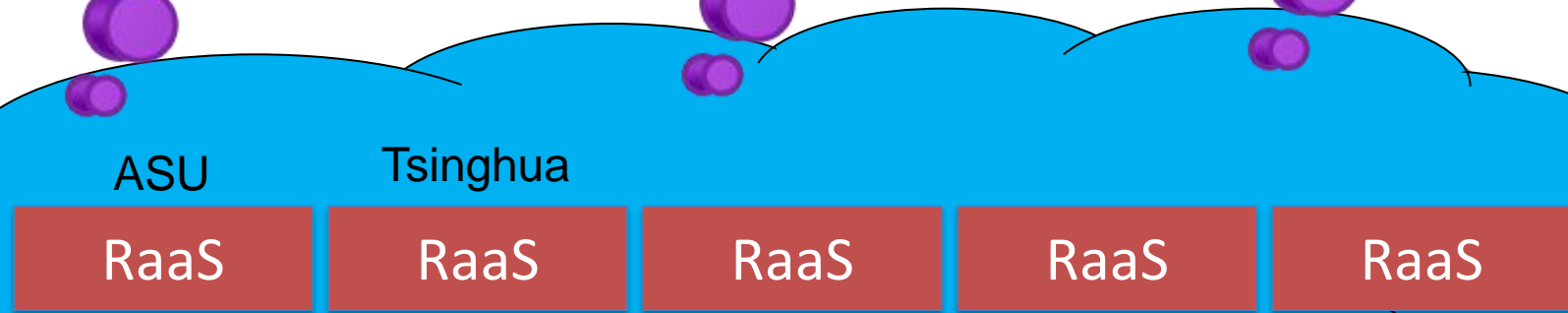
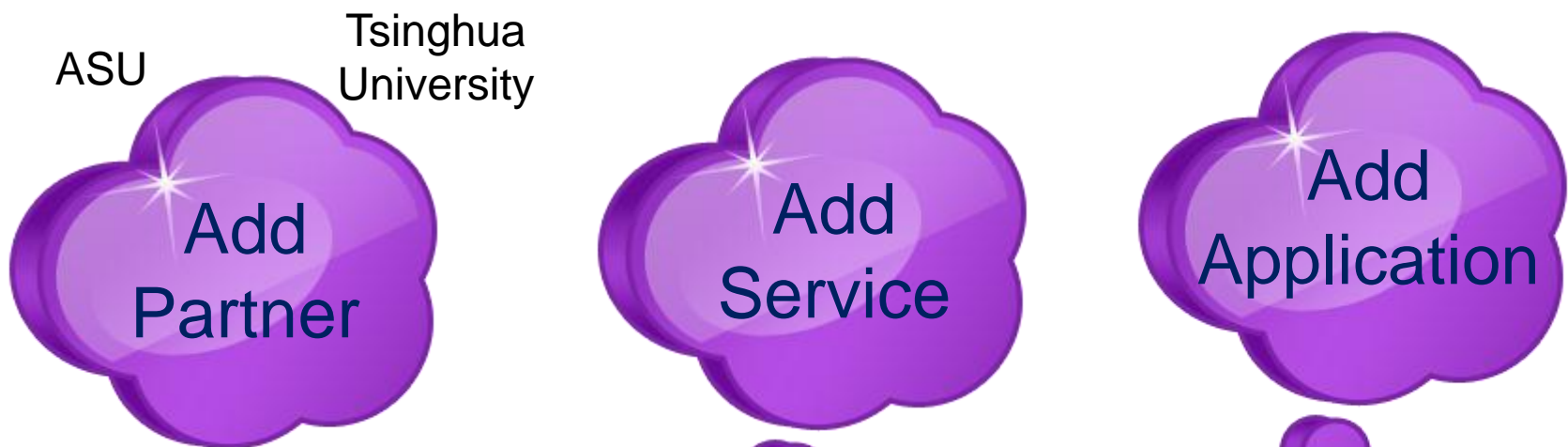
Current Efforts: Robot as a Service (3)

<http://venus.eas.asu.edu/MyRaaS/Default.aspx>

- ASU Implementation of Robot as a Service
- Web service wraps the device drivers
- Web Application access the Web services



Join the Cloud and Develop RaaS



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<http://venus.eas.asu.edu/WSRepository/repository.html>



← → ↻ 🏠

TEXTBOOK
THIRD EDITION

SERVICE-ORIENTED COMPUTING AND WEB SOFTWARE INTEGRATION

FROM PRINCIPLES TO DEVELOPMENT

YINONG CHEN AND WEI-TEK TSAI

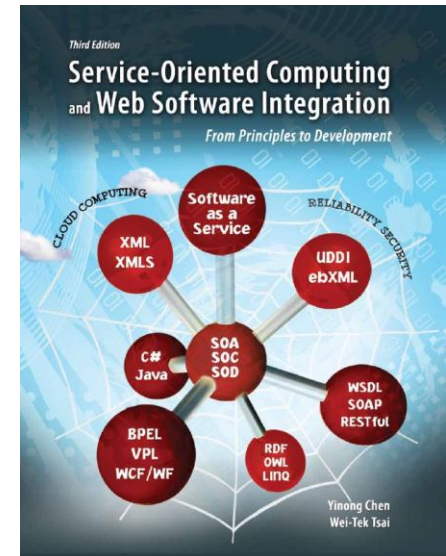
ASU Repository of Web Services and Web Applications

ASU Service Repository

<http://venus.eas.asu.edu/WSRepository/repository.html>

- SOAP/WSDL Services
- RESTful Services
- Workflow services
- Web applications
- Robot as Service:

<http://venus.eas.asu.edu/MyRaaS/Default.aspx>



Crypto service	ASP .Net Encryption and decryption string(string) http://venus.eas.asu.edu/WSRepository/Services/Encryption/Service.aspx
Data caching	Caching disk file contents in browser venus.eas.asu.edu/WSRepository/XMLDocCacheReadWriteApp/Default.aspx
Dynamic graphics	Vending machine, generate graphics without using user control http://venus.eas.asu.edu/WSRepository/CoffeeVender/
Dynamic graphics	Vending machine, generate graphics in user control http://venus.eas.asu.edu/WSRepository/CoffeeMachine/
Forms security	Authentication and authorization application http://venus.eas.asu.edu/WSRepository/FormsSecurity/
Image Verifier	Application that tests the RESTful ImageVerifier service http://venus.eas.asu.edu/WSRepository/Services/ImageVerifier/TryIt.aspx
Image Verifier	Application that tests the WSDL-SOAP ImageVerifier service http://venus.eas.asu.edu/WSRepository/Services/ImageVerifierSvc/TryIt.aspx
Random String	Application that tests the RandomString service http://venus.eas.asu.edu/WSRepository/Services/RandomString/TryIt.aspx
Shopping cart	Enter items to catalogue, add to cart, remove from cart http://venus.eas.asu.edu/WSRepository/SessionOnlineStore/Default.aspx
XML file read write	Save book information into XML file in server http://venus.eas.asu.edu/WSRepository/XMLDocReadWriteApp/Default.aspx





Crypto service in SVC	WCF-based WSDL-SOAP service with two operations: string Encrypt(string); and string Decrypt(string); http://venus.eas.asu.edu/WSRepository/Services/EncryptionWcf/Service.svc
Image Verifier in RESTful	WCF RESTful service with GetImage/3Nt\$@ operation http://venus.eas.asu.edu/WSRepository/Services/ImageVerifier/Service.svc/GetImage/3Nt\$@
Image verifier in SVC	WCF-based WSDL-SOAP service with two operations: Stream GetImage() and GetVerifierString(string length) http://venus.eas.asu.edu/WSRepository/Services/ImageVerifierSvc/Service.svc
Image verifier in workflow	Workflow-based service http://venus.eas.asu.edu/WSRepository/Services/WFImage/WFservice/service1.xamlx Test page: http://venus.eas.asu.edu/WSRepository/Services/WFImage
Messenger service	WCF service with two operations: bool SendMessage(string Username, string Message); and string[] ReceiveMessage(string UserID); http://venus.eas.asu.edu/WSRepository/Services/Messenger/Service.svc
Mortgage Service in Workflow	Microsoft MSDN Magazine mortgage service example in workflow: http://venus.eas.asu.edu/WSRepository/Services/WFService/MortgageService/Service1.xamlx http://venus.eas.asu.edu/WSRepository/Services/WFService/VendorService/VendorX.svc where X is http://venus.eas.asu.edu/WSRepository/Services/WFService/
Number Guess in RESTful	WCF RESTful service with two operations: int secretNumber(int lower, int upper); and string checkNumber(int userNum, int secretNum); http://venus.eas.asu.edu/WSRepository/Services/NumberGuessRest/Service.svc/GetSecretNumber?lower=1&upper=100 http://venus.eas.asu.edu/WSRepository/Services/NumberGuessRest/Service.svc/checkNumber?userNum=23&secretNum=75



Document type	Document type definition example http://venus.eas.asu.edu/WSRepository/xml/instructor.dtd
RDF file	RDF schema definition file http://venus.eas.asu.edu/WSRepository/xml/Courses.rdf
Robot as a Service	A Web application that accesses a Web service implemented in on cyber-physical device, a Parallax Hex Crawler controlled by Atom http://venus.eas.asu.edu/RaaS/Default.aspx http://venus.eas.asu.edu/RaaS/Services.asmx?wsdl
Robot in simulation	Simulated robot with laser sensor in a maze http://venus.eas.asu.edu/roboticscamp/downloads.html
Smart home	A smarthome using simulated cyber-physical devices http://venus.eas.asu.edu/WSRepository/SmartHome/SmartHome.html
XML file	Books stored in XML file http://venus.eas.asu.edu/WSRepository/xml/Courses.xml
XML schema file	Schema of the XML book file http://venus.eas.asu.edu/WSRepository/xml/Course.xsd
XML style sheet	Style sheet for the XML book file http://venus.eas.asu.edu/WSRepository/xml/Courses.xs



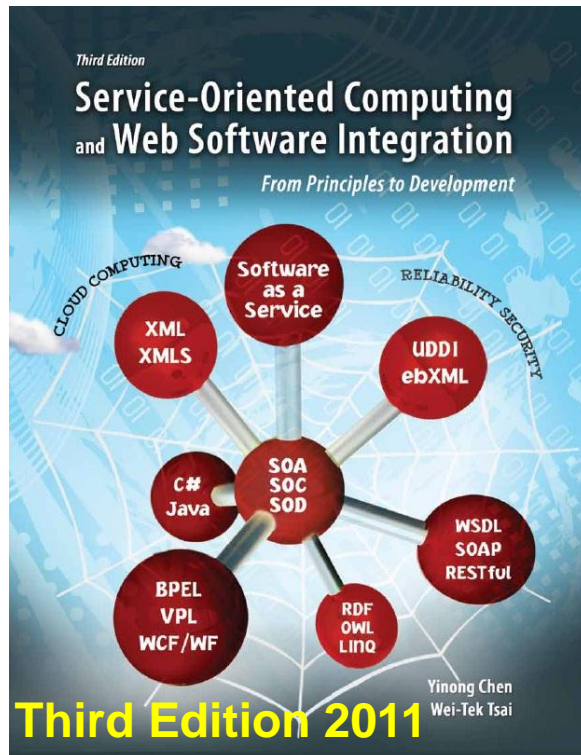
Where to Find the Information?





About 74,600 results (0.33 seconds)

[Advanced search](#)



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Yinong Chen and Yoshiaki Kakuda, Autonomous decentralised systems in web computing environment, Int. J. Critical Computer-Based Systems, Vol. 2, No. ...

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Yinong Chen received Ph.D. from the University of Karlsruhe, Germany, in ...

<https://webapp4.asu.edu/directory/person/328180> - [Cached](#) - [Similar](#)

[Yinong Chen - Ira A. Fulton Schools of Engineering](#) 🔍

Yinong Chen joined ASU in 2001. From 1994 to 2000, he was a lecturer and ...

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