ArchStudio

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March 3, 2016

CS 490MT/5555
Software Methods and Tools

Outline

- What is ArchStudio
  - Demo
- Related Technologies
  - xADL
  - The Myx Architecture Style and Framework
  - Code separation in ArchStudio

What is ArchStudio

- Architecture-centric software development environment developed by Institute for Software Research (ISR) at University of California, Irvine (UCI).
- Open-source
- Eclipse plug-in
- Integrated tools for software architecture
  - Modeling
  - Visualizing
  - Analyzing
  - Implementing
- Official website: http://isr.uci.edu/projects/archstudio/

More about ArchStudio

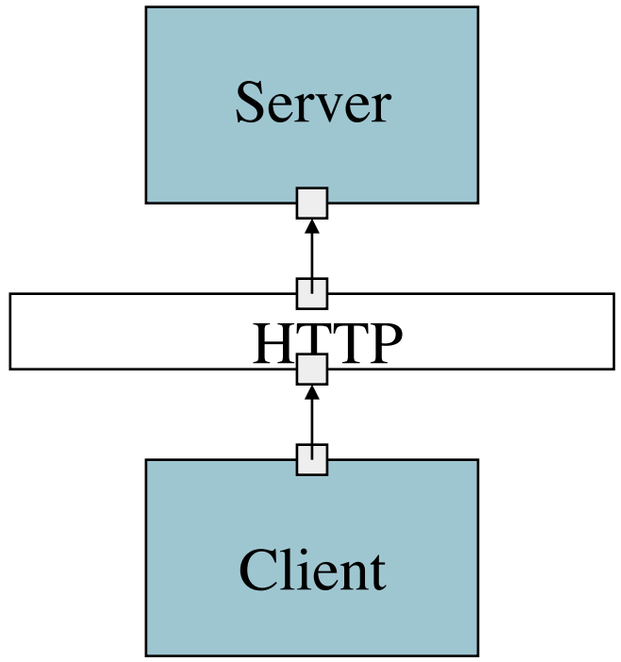
- Lead developer: Dr. Eric M. Dashofy (@Aerospace)
- Being used in a number of universities and several companies.
- The current (published) version is ArchStudio 5.
- In this class, however, we will be using an internal version of ArchStudio 4.
    - The code generator that we need in our lab/ assignment is not included in ArchStudio 5.

xADL (pronounced as Z-A-DL)

- Architectural Description Language in XML developed by ISR at UCI
- This ADL is defined in a set of XML Schemas
- Modeling language behind ArchStudio
- Modular and highly extensible
- Core models:
  - Components (computation)
  - Connectors (communication)
  - Interfaces (the exposed entry and exit points for components and connectors)
  - Configurations (topology)

xADL Core Model

```
<archStructure id="archStructure90164" type="types:ArchStructure">
  <description>main</description>
  <component id="componentffa805157" type="types:Component">
    <description>Server</description>
    <interface id="interfaceffa80123" type="types:Interface">
      <description>getResource</description>
      <direction>in</direction>
    </interface>
  </component>
  <component id="componentffa12852" type="types:Component">
    <description>Client</description>
    <interface id="interfaceffa57518" type="types:Interface">
      <description>getResource</description>
      <direction>out</direction>
    </interface>
  </component>
  <connector id="connectorffa12435" type="types:Connector">
    <description>HTTP</description>
    <interface id="interfaceffa54685" type="types:Interface">
      <description>getResource</description>
      <direction>in</direction>
    </interface>
    <interface id="interfaceffa54686" type="types:Interface">
      <description>getResource</description>
      <direction>out</direction>
    </interface>
  </connector>
</archStructure>
```



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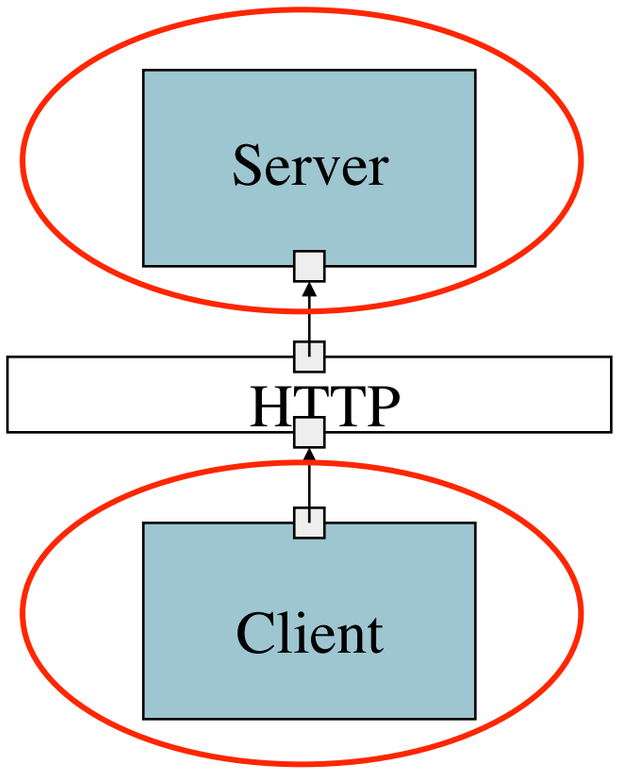

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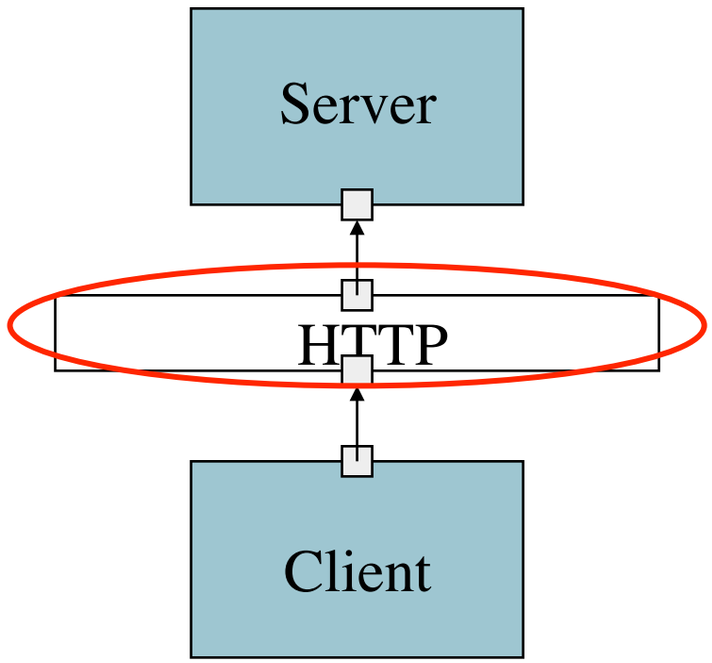

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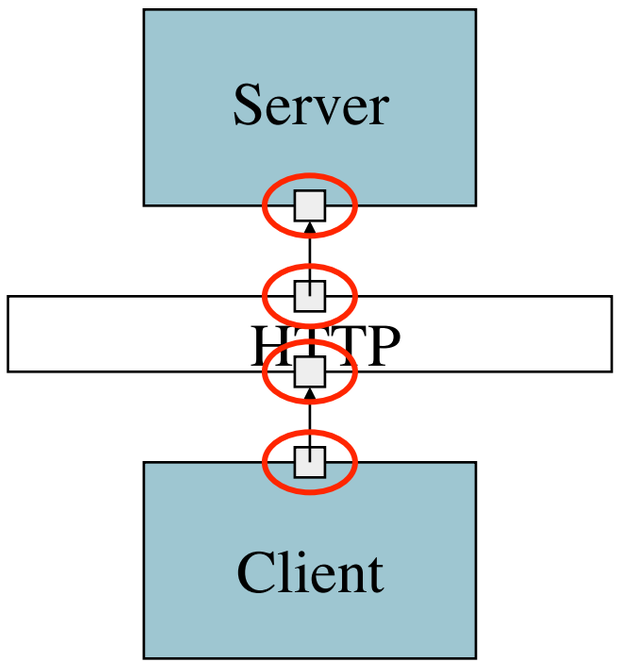


Some highlights of the xADL version that we are using

- Component
  - Implementation - a fully qualified Java class name.
  - Interface
    - Type: InterfaceType
- InterfaceType
  - Implementation - a fully qualified Java interface name.
- Connector
  - Interface
    - Type: InterfaceType
  - Type: ConnectorType
- ConnectorType
  - Implementation - a fully qualified Java class name.

Some highlights, cont.

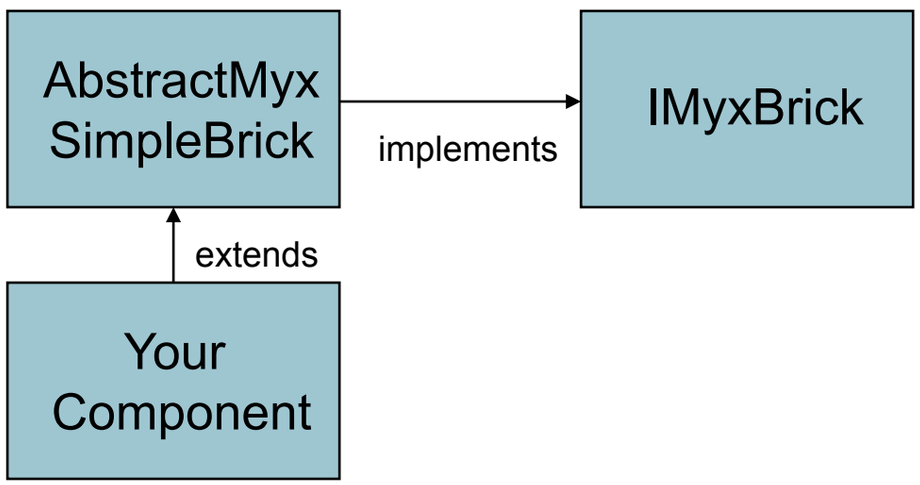
- The implementation information is usually specified in the *Type* elements (e.g. InterfaceType, ConnectorType). The only exception is Component.
- A number of pre-defined or built-in connector types are available (e.g. *EventPump*), and can be reused in different applications.
- In other words, you can simply select a specific connector type when you create a new connector.

Myx.fw Framework

- Myx Architecture Style: support building flexible, high performance tool-integrating environments such as ArchStudio.
- Myx.fw is the supporting framework of the Myx style.
- Currently distributed as an integrated part of ArchStudio, but is also available as a separate package.
- Myx whitepaper: http://isr.uci.edu/projects/archstudio/resources/myx-whitepaper.pdf

Implementing a myx.fw component

- Components have main classes that implement IMyxBrick.
  - They may have as many auxiliary classes as you want.
  - The main class may just be a wrapper for services provided internally.



Implementing a myx.fw component

- Components have three main jobs
  - Store data from the framework (IMyxBrickItems).
  - Implement lifecycle methods (init, begin, end, destroy).
  - Provide true objects for all provided interfaces.

Component Jobs

- Store IMyxBrickItems from the framework
  - The framework needs to store some data about the component along with the component.
  - Abstract base classes take care of this for you.
- Implement lifecycle methods
  - Called by the framework when the architecture is in particular states
    - init(): Brick is created
    - begin(): Brick is wired into the architecture and ready to start
    - end(): Brick is about to be unwired and shut down
    - destroy(): Brick is about to be dismissed

Component Jobs

- Provide true objects for each provided interface
  - Each provided/required interface has a name.
  - The framework will occasionally ask a component "give me the object that corresponds to this provided interface".
  - Likewise, a component may request, from the framework, the true object corresponding to one of its required interfaces.

Code Separation in ArchStudio

- The implementation of each component in ArchStudio is separated in two independent classes: *architecture-prescribed code* and *user-defined code*.
  - Architecture-prescribed code is automatically generated, and cannot be manually edited.
  - User-defined code is manually developed.
  - A Java interface is also automatically generated. It contains the list of operations that architecture-prescribed code expects user-defined code to implement.

Architecture-prescribed code

- Architecture-prescribed code codifies externally visible characteristics of a component (the information prescribed in the architecture about the component).
- Can only be updated via code regeneration if architecture is changed.

```java
/*
 *  Architecture-prescribed code of the
 *  Controller component. IController is
 *  the interface that Controller provides
 *  to the external
 * */
public class ControllerArch implements IController {

    //Reference to user-defined code
    private IControllerImp _imp;

    //References to the required interfaces
    IOperatorStk _operatorStk;
    IOperandStk _operandStk;
    IRegister _register;
    IMathUnit _mathUnit;

    public ControllerArch(){
        _imp = new ControllerImp();
        _imp.setArch(this);
    }

    //Operations declared in the provided interface
    //Method bodies are intentionally left blank
    public void enterOperator(String opcode) {
        _imp.enterOperator(opcode);
    }
    public void enterDigit(String digit) {
        _imp.enterDigit(digit);
    }

}
```

User-defined code

- User-defined code contains implementation details of the operations and attributes generated in the corresponding architecture-prescribed code.
- User-defined code represents the internal implementation of a component.

```java
/*
 * User-defined implementation details
 * IControllerImp comprises the operations that
 * the architecture-prescribed code requests.
 * */
public class ControllerImp implements IControllerImp {

    //Reference to the architecture-prescribed code
    private ControllerArch _arch;

    //This operation is essential for all user-defined code
    public void setArch(ControllerArch arch){
        _arch = arch;
    }
    //Primitive operations to be manually implemented
    public void enterOperator(String opcode) {
    }
    public void enterDigit(String digit) {
    }

}
```