

**MICHIGAN STATE**  

---

**U N I V E R S I T Y**

# Alpha Presentation

## Virtual Appliance Simulator

### The Capstone Experience

Team Whirlpool

Lisa Kelly

Evan Liang

Cody Littlely

Department of Computer Science and Engineering  
Michigan State University

Spring 2014



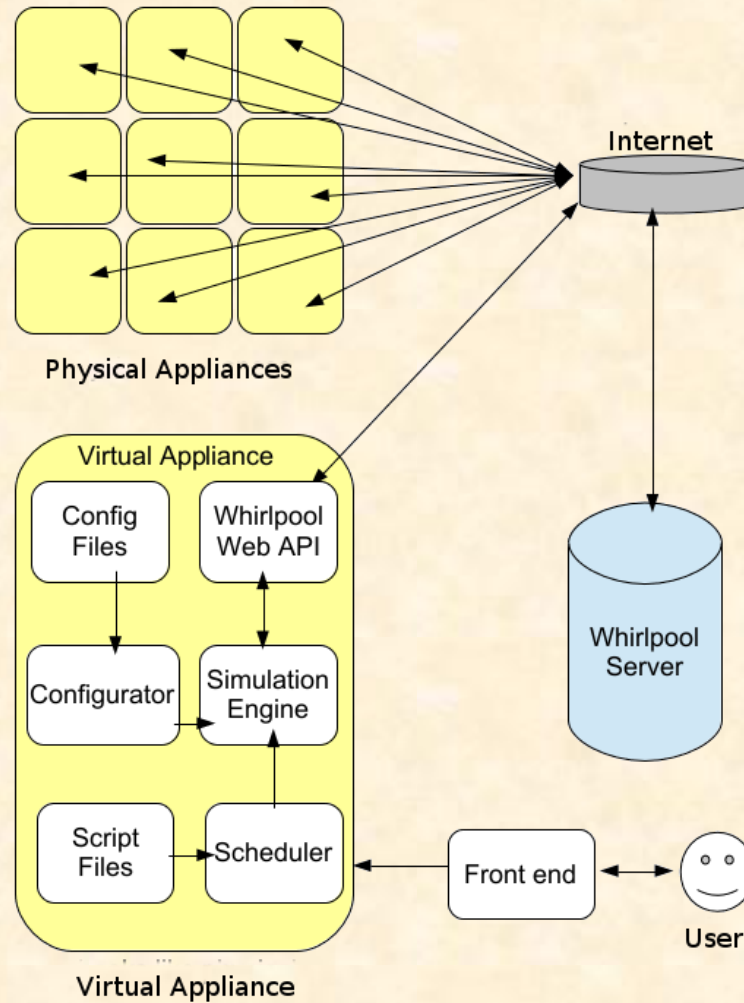
*From Students...  
...to Professionals*

# Project Overview

---

- Purpose
  - Decouple Software from Hardware
  - Facilitate Mass Product Testing
- Method
  - Create networked virtual appliances
  - Provide scripting capabilities
  - Facilitate easy access through web accessible front end

# System Architecture



# Example Appliance: Washer

```

<root>
  <Device ID="1" Name="Washer" DisplayName="Washer">
    <Messages>
      <Message ID="1" Name="PublishStatus" MessageType="Internal">
        <HeaderPacket />
        Publish System Status
      </Message>
      <Message ID="2" Name="PublishCycleSelected" MessageType="Internal">
        <HeaderPacket />
        Publish Cycle Selected
      </Message>
    </Messages>

    <DeviceSettings>
      <SerialPortSettings />
      <Wi-FiSettings />
      <ArrayentSettings />
    </DeviceSettings>

    <Commands>
      <HeartBeatCommand ID="0" Name="Beat" CommandType="heartbeat" API="" Opcode="" Payload="" Length="" Interval="1000"/>
      <RequestCommands>
        <Command ID="1" Name="PowerOn" CommandType="Command/Event" API="" Opcode="" Payload="" Length="" IsFeedback="" CommandDelay="" IsFragmented="" />
        <Command ID="2" Name="Reset" CommandType="Command/Event" API="" Opcode="" Payload="" Length="" IsFeedback="" CommandDelay="" IsFragmented="" />
        <Command ID="3" Name="Start" CommandType="Command/Event" API="" Opcode="" Payload="" Length="" IsFeedback="" CommandDelay="" IsFragmented="" />
      </RequestCommands>
      <ResponseCommands>
        <Command ID="1" Name="OpenDoor" CommandType="Event/Feedback" API="" Opcode="" Payload="" Length="" IsFeedback="" CommandDelay="" IsFragmented="" />
        <Command ID="2" Name="CloseDoor" CommandType="Event/Feedback" API="" Opcode="" Payload="" Length="" IsFeedback="" CommandDelay="" IsFragmented="" />
      </ResponseCommands>
    </Commands>

    <CycleStates>
      <CycleState ID="1" CycleStateName="Fill" CommandType="Feedback/Command" API="E6" Opcode="22" Payload="10B2000FF39001E" Length="000F" IsFeedback="1" Duration="3000" IsFragmented="" />
      <CycleState ID="2" CycleStateName="Wash" CommandType="Feedback/Command" API="E6" Opcode="22" Payload="10C2000FF39001E" Length="000F" IsFeedback="1" Duration="8000" IsFragmented="" />
      <CycleState ID="3" CycleStateName="Spin" CommandType="Feedback/Command" API="E6" Opcode="22" Payload="10D2000FF39001E" Length="000F" IsFeedback="1" Duration="6000" IsFragmented="" />
      <CycleState ID="4" CycleStateName="Drain" CommandType="Feedback/Command" API="E6" Opcode="22" Payload="10E2000FF39001E" Length="000F" IsFeedback="1" Duration="2000" IsFragmented="" />
      <CycleState ID="5" CycleStateName="Rinse" CommandType="Feedback/Command" API="E6" Opcode="22" Payload="10F2000FF39001E" Length="000F" IsFeedback="1" Duration="5000" IsFragmented="" />
    </CycleStates>
  </Device>
</root>

```



# Example Script File

```
<root>
  <Device ID="1" Name="Washer" DisplayName="Washer">
    <ActionStates>
      <Actions Type="CycleState" ID="1" Name="Fill" Duration="6000" />
      <Actions Type="CycleState" ID="2" Name="Wash" Duration="2000" />
      <Actions Type="CycleState" ID="3" Name="Spin" Duration="3000" />
      <Actions Type="CycleState" ID="4" Name="Drain" Duration="4000" />
      <Actions Type="CycleState" ID="1" Name="Fill" Duration="6000" />
      <Actions Type="CycleState" ID="2" Name="Wash" Duration="2000" />
      <Actions Type="CycleState" ID="3" Name="Spin" Duration="3000" />
      <Actions Type="CycleState" ID="4" Name="Drain" Duration="4000" />
    </ActionStates>
  </Device>
</root>
```



# Simulation Output

```

Spin Sun Feb 16 12:08:24 EST 2014      0x0000ED000FE62210D2000FF39001E
Drain Sun Feb 16 12:08:25 EST 2014     0x0000ED000FE62210E2000FF39001E
Drain Sun Feb 16 12:08:26 EST 2014     0x0000ED000FE62210E2000FF39001E
Drain Sun Feb 16 12:08:27 EST 2014     0x0000ED000FE62210E2000FF39001E
Drain Sun Feb 16 12:08:28 EST 2014     0x0000ED000FE62210E2000FF39001E
Fill Sun Feb 16 12:08:29 EST 2014      0x0000ED000FE62210B2000FF39001E
Fill Sun Feb 16 12:08:30 EST 2014      0x0000ED000FE62210B2000FF39001E
Fill Sun Feb 16 12:08:31 EST 2014      0x0000ED000FE62210B2000FF39001E
Fill Sun Feb 16 12:08:32 EST 2014      0x0000ED000FE62210B2000FF39001E
Fill Sun Feb 16 12:08:33 EST 2014      0x0000ED000FE62210B2000FF39001E
Fill Sun Feb 16 12:08:34 EST 2014      0x0000ED000FE62210B2000FF39001E
Wash Sun Feb 16 12:08:35 EST 2014       0x0000ED000FE62210C2000FF39001E
Wash Sun Feb 16 12:08:36 EST 2014       0x0000ED000FE62210C2000FF39001E
Spin Sun Feb 16 12:08:37 EST 2014       0x0000ED000FE62210D2000FF39001E
Spin Sun Feb 16 12:08:38 EST 2014       0x0000ED000FE62210D2000FF39001E
Spin Sun Feb 16 12:08:39 EST 2014       0x0000ED000FE62210D2000FF39001E
Drain Sun Feb 16 12:08:40 EST 2014       0x0000ED000FE62210E2000FF39001E
Drain Sun Feb 16 12:08:41 EST 2014       0x0000ED000FE62210E2000FF39001E
Drain Sun Feb 16 12:08:42 EST 2014       0x0000ED000FE62210E2000FF39001E
Drain Sun Feb 16 12:08:43 EST 2014       0x0000ED000FE62210E2000FF39001E

```

Cycle Name

Time Stamp

Data packet (hexadecimal)



# Front End Wire Frames

http://www.myurl.com

**Dryer**

Information

Select

**Washer**

Information

Select

**Dishwasher**

Information

Select

**Refrigerator**

Information

Select

The first 4 appliances listed will be setup by default. They will use a default Config and API file specifically built for each appliance. An authorized user should be able to edit/change the default files.

Add Appliance (Filetype must be ".XML")

Configuration File  Browse  API File  Browse

+ Add another appliance

Connected



# Front End Wire Frames

Title
http://www.myurl.com

If a default appliance was added it would be listed below the Dryer in a similar form.

If a custom appliance was added, its display name will be a concatenation of the defined name in the config file and a "custom" tag

**For example:**  
"NAME - Custom X"

X will represent a number which increases for each custom appliance.

**Dryer**

Scripts	Units per script		
File Path... <input style="width: 150px;" type="text"/>	Browse <input type="button" value="Browse"/> <input style="width: 40px; text-align: center;" type="text" value="1"/> <input 1px="" border-bottom:="" gray;"="" solid="" type="button" value="+&lt;/input&gt;&lt;/td&gt; &lt;/tr&gt; &lt;tr&gt; &lt;td style="/> File Path... <input style="width: 150px;" type="text"/>	Browse <input type="button" value="Browse"/> <input style="width: 40px; text-align: center;" type="text" value="2"/> <input 1px="" border-bottom:="" gray;"="" solid="" type="button" value="+&lt;/input&gt;&lt;/td&gt; &lt;/tr&gt; &lt;tr&gt; &lt;td style="/> File Path... <input style="width: 150px;" type="text"/>	Browse <input type="button" value="Browse"/> <input style="width: 40px; text-align: center;" type="text" value="1"/> <input 5px;"="" center;="" margin-top:="" text-align:="" type="button" value="+&lt;/input&gt;&lt;/td&gt; &lt;/tr&gt; &lt;/tbody&gt; &lt;/table&gt; &lt;p style="/> <b>+ Add another script</b> <p style="text-align: center; margin-top: 10px;"><input type="button" value="Upload"/></p>

By default there will be one script upload section with the option to add additional script files. In this example there will be 4 Dryers and 3 different scripts. 2 Dryers will be following the same script.

**Smart Appliance Identification Upload**

SAID List	# of SAIDs Needed
File Path... <input style="width: 150px;" type="text"/>	Browse <input type="button" value="Browse"/> <input style="width: 40px; text-align: center;" type="text" value="4"/>

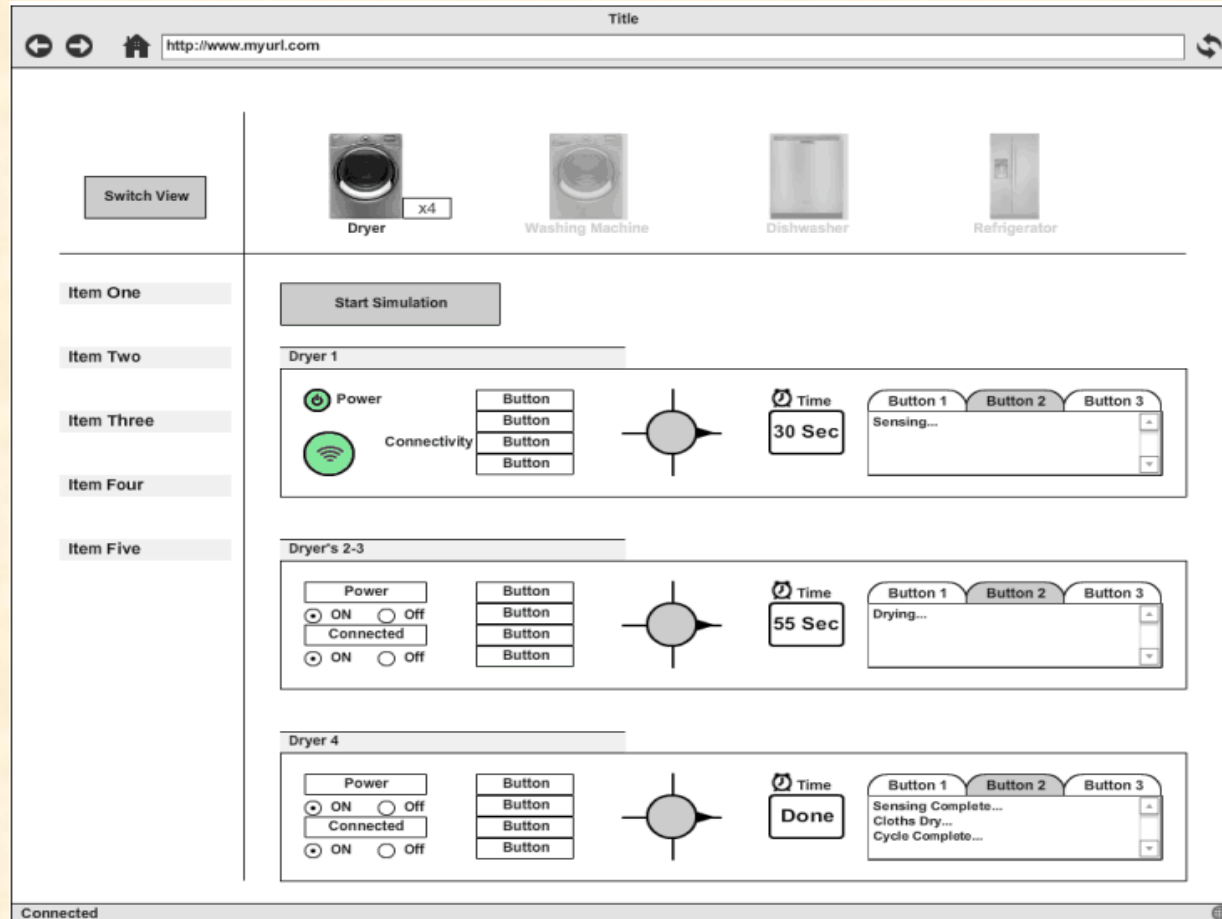
One SAID is needed per appliance. In this example the number of SAIDs needed is 4 because we are simulating 4 units. If another appliance was listed with 2 scripts and 1 unit per script, then we would want 6 SAIDs

Connected
🌐





# Front End Wire Frames



# Mitigated Risks

- ✓ Lack of Java experience
  - Got book on Java, will read as needed
  - Online tutorials
- ✓ No existing simulation package
  - Start design early
- ✓ Large project scope
  - Break it into parts with the client; prioritize
- ✓ Current APIs in .Net
  - Search with Google for best way to translate



# What's left to do?

---

- Interface with Whirlpool servers
- Control system via the front end
- Run multiple simulations in parallel
- Generate more comprehensive scripts
- General testing and debugging

