MICHIGAN STATE UNIVERSITY

Alpha Presentation

Virtual Appliance Simulator

The Capstone Experience

Team Whirlpool

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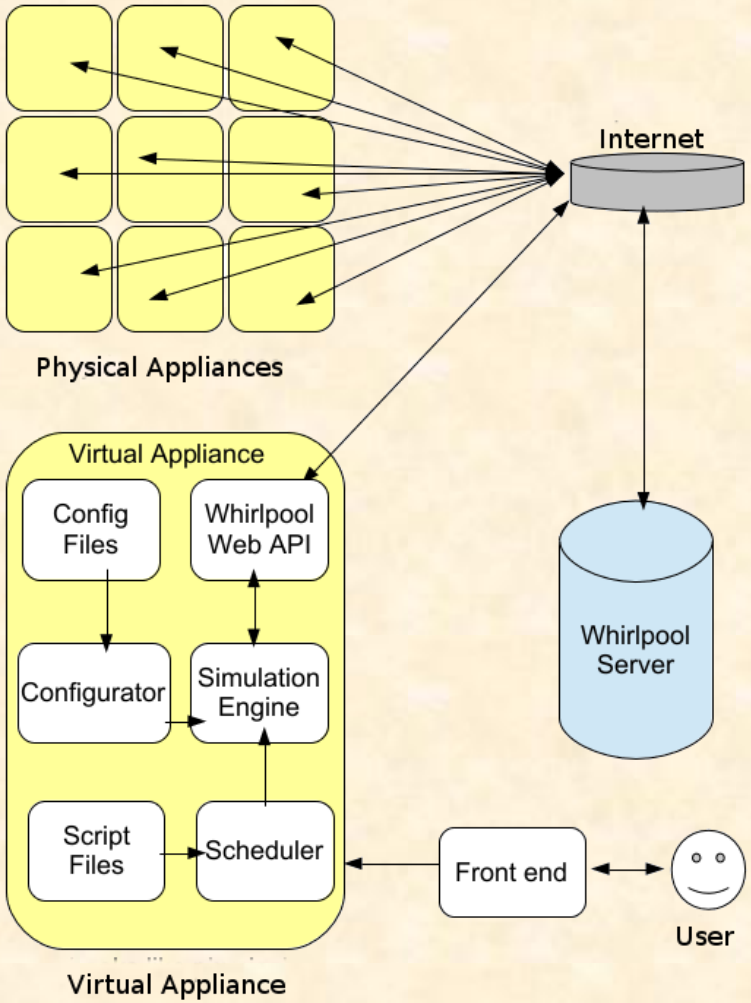
From Students…

…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

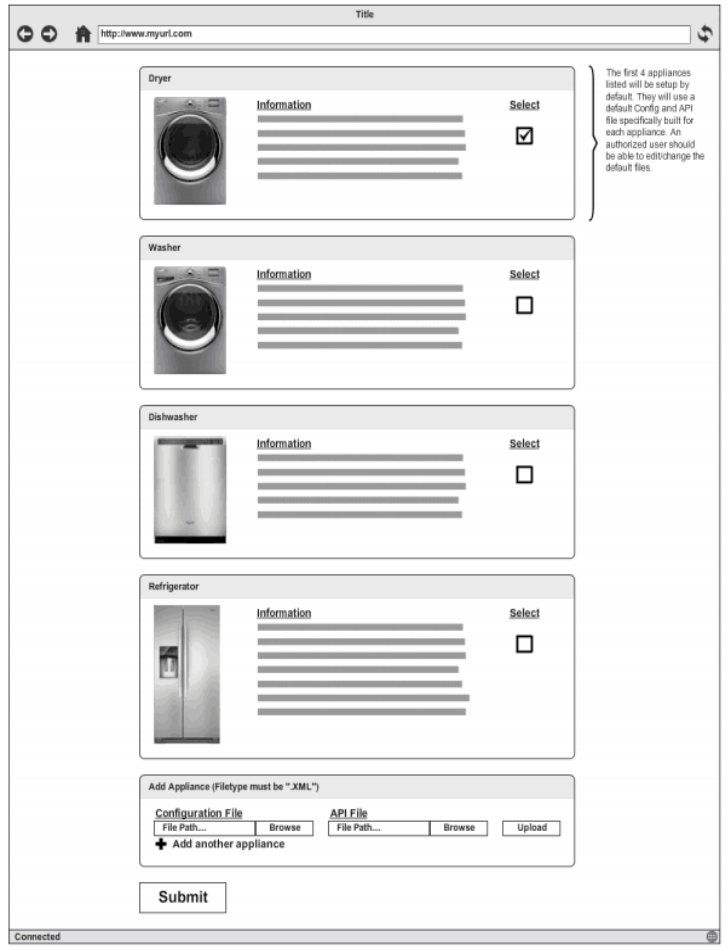
```
Spin Sun Feb 16 12:08:24 EST 2014          0x0000ED000FE62210D2000FF39001E
Drain Sun Feb 16 12:08:25 EST 2014          0x0000ED000FE62210E2000FF39001E
Drain Sun Feb 16 12:08:26 EST 2014          0x0000ED000FE62210E2000FF39001E
Drain Sun Feb 16 12:08:27 EST 2014          0x0000ED000FE62210E2000FF39001E
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

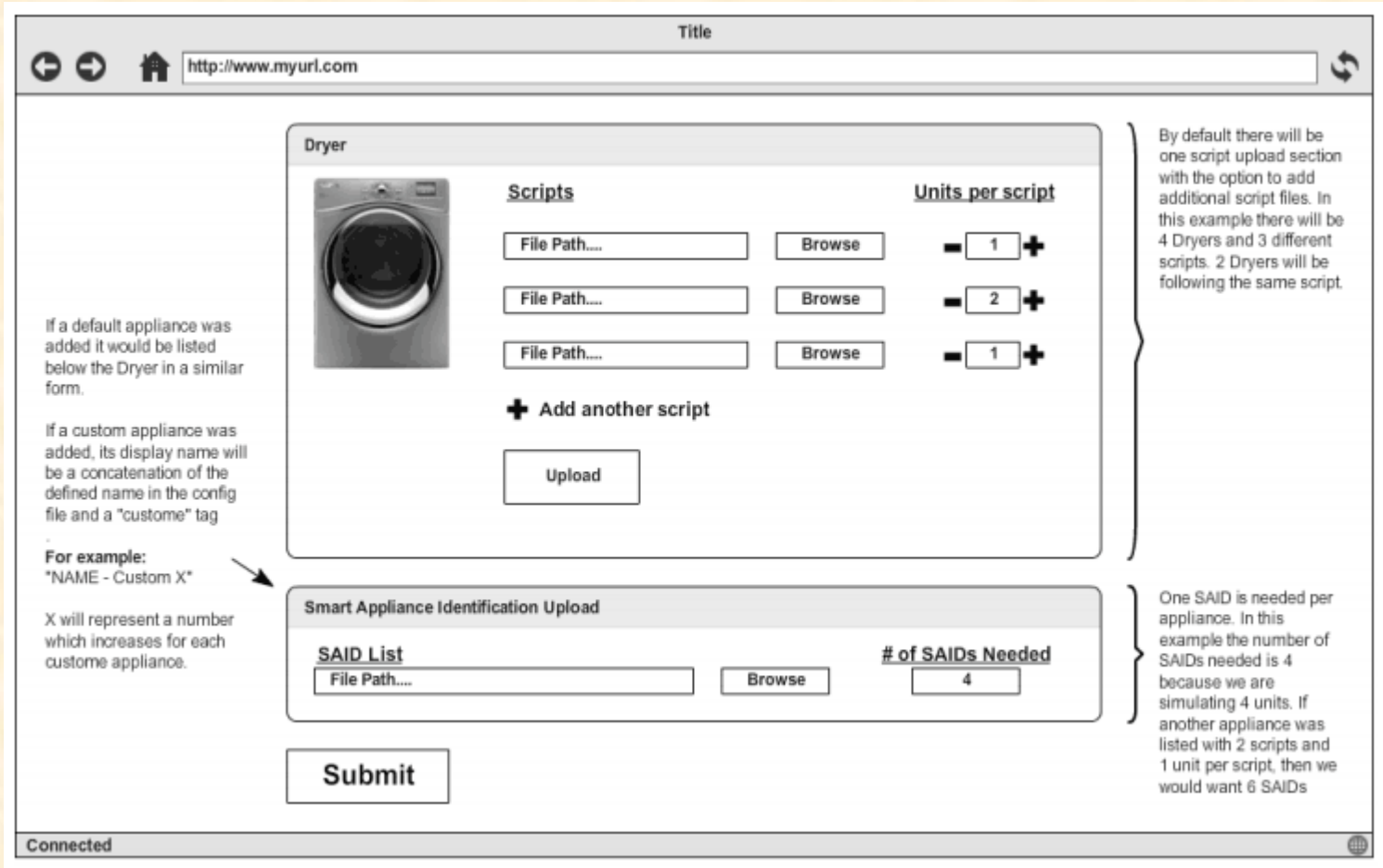
Time Stamp

Data packet (hexadecimal)

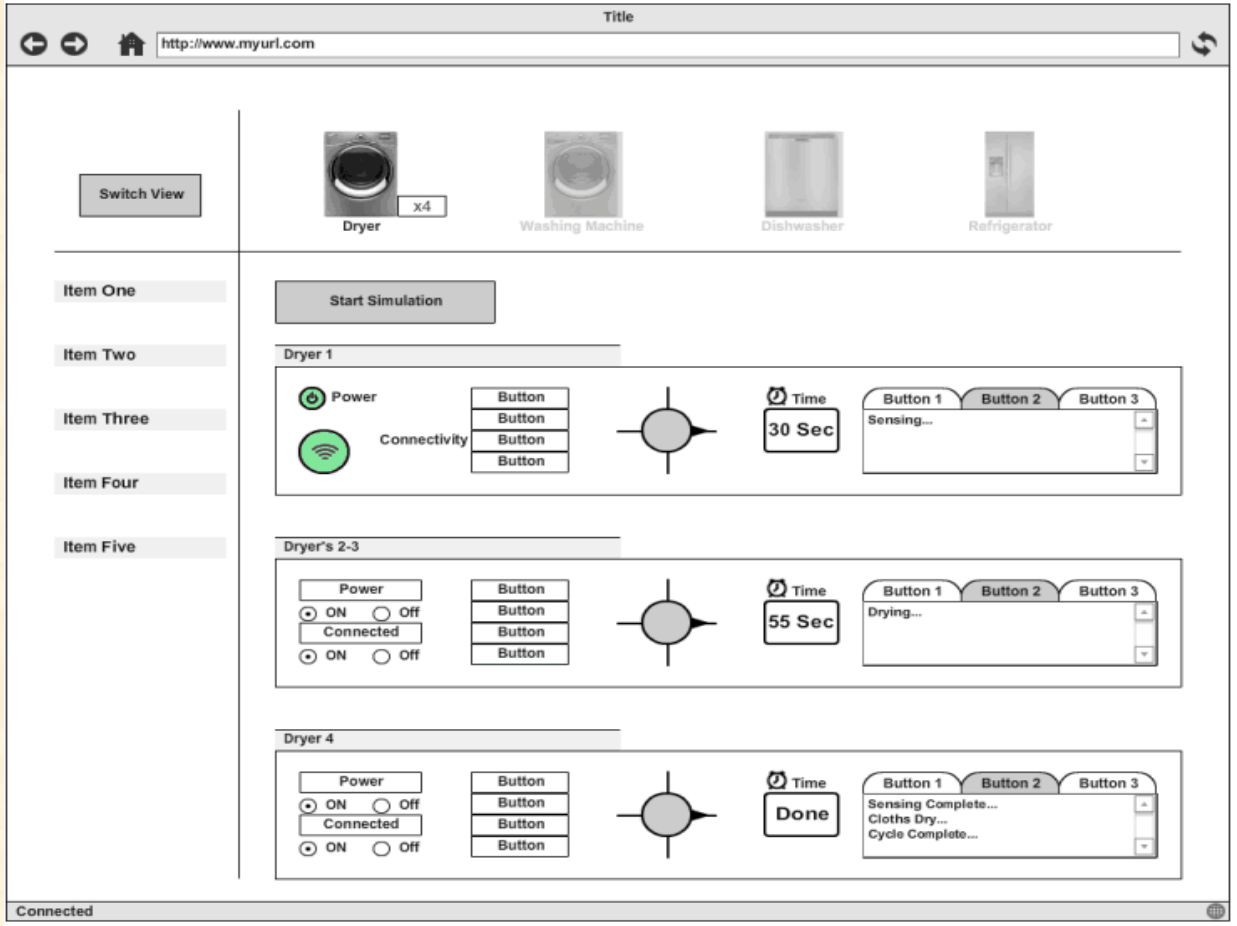
Front End Wire Frames



Front End Wire Frames



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