VIRTUALIZATION OF CONTROL SYSTEMS

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GENERATION AUTOMATION

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OVERVIEW - VIRTUALIZING

1. THE CHALLENGE
2. THE APPLICATION
3. THE RISKS
4. THE REWARDS
5. THE DEPLOYMENT
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THE CHALLENGE

GENERATION AUTOMATION BY THE NUMBERS:

MAJOR FACILITIES
• 9 HYDRO PLANTS – 23 GENERATORS
• 4 FISH HATCHERIES
• 5 FISH COLLECTION FACILITIES

TOTAL: 18
THE CHALLENGE (CONTINUED)

PLANT CONTROL SYSTEM NETWORKED DEVICES
• 120+ PLC RACKS
• 10+ SCADA SERVERS
• 30+ HMI CLIENTS
• 20+ VARIABLE FREQUENCY DRIVES
• 20+ TEMPERATURE RECORDERS
• 40+ POWER MONITORING DEVICES
• 10+ REMOTE TERMINAL UNITS
• 7 HISTORIAN SERVERS

TOTAL: >260
THE CHALLENGE (CONTINUED)

AUTOMATION ENGINEERING SUPPORT

ENGINEERS: 3
ENGINEERING TECHNICIANS: 1

TOTAL: 4
THE APPLICATION

VIRTUALIZATION: The act of creating a virtual (rather than actual) version of something, including virtual computer hardware platforms, operating systems, storage devices, and computer network resources

“There’s a one in billion chance we’re in base reality”
– Elon Musk, SpaceX and Tesla CEO

“It is there, but it is not there. It is real, but it is not real” – Ram, Tacoma Power Supervisor
**THE APPLICATION (CONTINUED)**

**SERVER [HARDWARE]**

**WINDOWS SERVER 2016 SOFTWARE W/ HYPER-V (VIRTUALIZATION HOST)**

<table>
<thead>
<tr>
<th>Role</th>
<th>Software Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCADA NODE</td>
<td>W7E VIRTUAL OS WITH HMI SCADA SOFTWARE</td>
</tr>
<tr>
<td>DEVELOPMENT</td>
<td>W7E VIRTUAL OS WITH HMI DEV SOFTWARE</td>
</tr>
<tr>
<td>VIEW CLIENT #1</td>
<td>W7E VIRTUAL OS WITH HMI RUNTIME SOFTWARE</td>
</tr>
<tr>
<td>VIEW CLIENT #2</td>
<td>W7E VIRTUAL OS WITH HMI RUNTIME SOFTWARE</td>
</tr>
<tr>
<td>HISTORIAN</td>
<td>W7E VIRTUAL OS WITH HMI HISTORIAN SOFTWARE</td>
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</tbody>
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*REMOTE DESKTOP ENABLED ON THE VIRTUAL MACHINES*
THE APPLICATION (CONTINUED)

RUNS WINDOWS SERVER 2016

192.168.1.1
VM

192.168.1.2
VM

192.168.1.3
VM

192.168.1.4
VM

192.168.1.5
VM

HYPER-V

REMOTE DESKTOP CONNECTION

192.168.1.10
THIN

192.168.1.20
THIN

192.168.1.30
THIN

192.168.1.253
LAPTOP

RUNS WINDOWS EMBEDDED
THE RISKS

1. COST UNCERTAINTY
2. REQUIRES CHANGE
3. ISOLATED NETWORKS
THE REWARDS

HARDWARE BENEFITS:

1. RELIABLE
2. COST EFFECTIVE
3. BASIC
4. FLEXIBLE
5. RESOURCEFUL
THE REWARDS (CONTINUED)

SOFTWARE BENEFITS:

1. SECURE
2. RECOVERABLE
3. EXPANDABLE
4. CONSOLIDATED
5. MOBILE
THE DEPLOYMENT

1. • VIRTUAL MACHINE DEVELOPMENT
   • INSTALL WINDOWS OS

2. • INSTALL HMI SOFTWARE ON VM
   • INCORPORATE SOFT LICENSING

3. • PILOT DEPLOYMENT AT FIRST PLANT
   • INCORPORATE INTO REGULAR UPGRADE CYCLE

4. • DEPLOY ACROSS ALL PROJECTS
   • REFINE BEST PRACTICES
THE LESSON
QUESTIONS?

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