Plant Process Computer Virtualization

Replacing Obsolete Alpha Servers with Industry Standard Intel Servers Using Hardware Emulation Software
Oconee Nuclear Station Plant Process Computers

OAC – Operator Aid Computer
- Hardware: Hewlett-Packard DS-25
- Operating System: OpenVMS 7.3
- Application Software: DS&S SAIPMS
- Replaced DEC AlphaServer 2100
- Initial install 1997, upgrade 2006
- Rack space: 11U
- Plant has 7 DS-25s, 2 per unit + 1 at Keowee Hydro
- Simulator used 4 DS-25s
Oconee Nuclear Station Plant Process Computers

PMC – Process Monitor Computer
• Hardware: DEC AlphaServer 1200
• Operating System: OpenVMS 7.1
• Application Software: DS&S SAIPMS
• Installed 1999
• Plant has 3 PMC systems, 1 per unit
• Simulator used 3 PMC servers
Alpha Processor

- 64 Bit RISC Processor
- Introduced 1992
- Development stopped 2004
- Sales ended April 2007
This is an illustration of the evolution of our Plant Monitoring System (PMS). The colours depict the various hardware platforms and operating systems on which PMS has run. The nuclear plants for which that platform was delivered are listed in the bars.
How do you deal with hardware obsolescence?
Solution to hardware obsolescence? Search eBay for used equipment.
Solution to hardware obsolescence?
Maintain hardware boneyard
Another solution.
Before

Now
Before

Now

SAIPMS Application

OpenVMS OS

Alpha Hardware Emulation Software

Small Linux Kernel

Intel Hardware
Hardware resources

- Console Port
- Network Ports
- SCSI Devices

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<th>SAIPMS Application</th>
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Small Linux Kernel

Intel Hardware
### Console Port

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<td>Port 10000</td>
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Telnet

192.168.1.100,10000
Each virtual system can be assigned to a dedicated network port on the host server.
Each virtual system can be connected to a virtual network switch which is bound to a single network connection on the host server.
SCSI Controller & External Tape Drive

Allows ability to read DDS2/DDS4 tapes from the plant.
Dell R630 Rackmount Servers

- RAID 1 Mirrored Drive Set
- Solid State Hard Drives
- Redundant Power Supplies
Disaster Recovery

- Power Off Virtual Server
- Virtual Disks are Stored as Files
- Files are the Same Size as the Physical Disk being Emulated
- Compress Files
- Save Files
- Save Hardware Configuration File
- Virtual Tapes
Conclusion

- Hardware Emulation Effective Solution
- No software porting required
- Minimal testing requirements
- Quick to implement
  - Project Approved October 2, 2017
  - Completed December 4, 2017