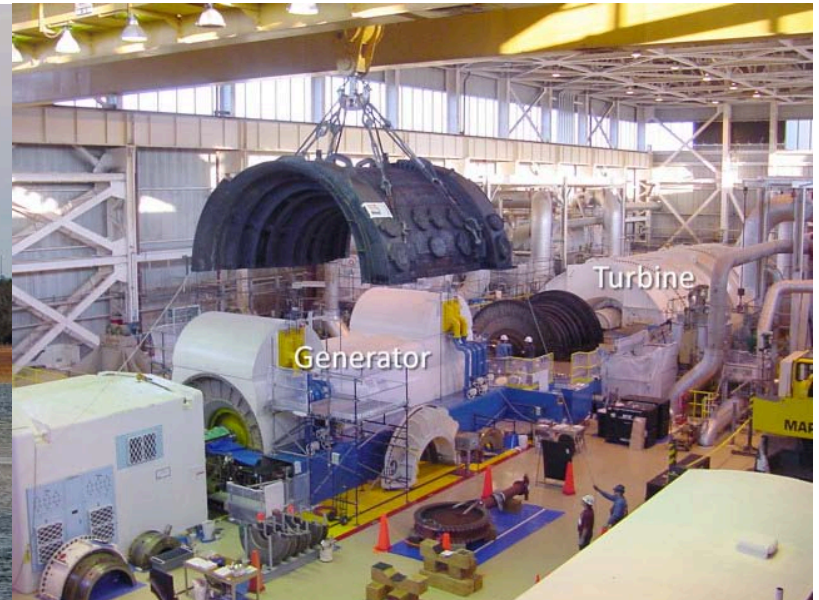


Main Plant Computer System Data Acquisition System Replacement Project

Christopher Chen
Ray Gagnon

Background

- **Seabrook Station, Seabrook, NH**
 - 1 of 5 nuclear power plants in the NextEra Energy fleet
 - Single Unit Plant
 - Westinghouse 4 – Loop PWR ~1300 MWe



Background

- **Existing SAIC, SAIPMS System installed in 1994**
 - Excellent Availability; >99.9% for Unplanned Maintenance
- **Factors driving System Replacement**
 - Obsolete VAX Computers
 - Ancient 386/486-Based HMI PCs
 - RTP G2 supportability issues affecting DAS redundancy
 - Qualified CPU and Power Supply Modules unavailable
 - Non Redundant RTP Power Supplies difficult to adjust over multiple chassis

Background

- **Original DAS System Configuration**
 - DAS equipment (IRTU) located remotely throughout the Plant and connected to DAS LAN via RG-58 Coaxial Cable
 - RTP 7400 Series I/O with Universal Interface. The G2 controls the I/O Bus.
- **DAS Replacement deemed the priority due to G2 issues**
- **Decided to retain RTP I/O after confirming RTP's commitment to support installed components**
- **Decided on a two-phased MPCs replacement, the DAS replacement being Phase 1**

Project

- **Final Project Scope**

- Replace the G2's with RTP 2000-M I/O Controllers and Network Switches to provide a redundant communications path to each RTP I/O Chassis
 - Failure of a single RTP 2000-M reduced to losing a single chassis instead of a whole IRTU.
- Replace the redundant I/O Power Supplies with the standard RTP I/O Chassis Power Supply
- Replace unsupported SAIC DRPI interface card with standard RTP products
- Establish the future MPCCS platform to allow for application development for Phase 2

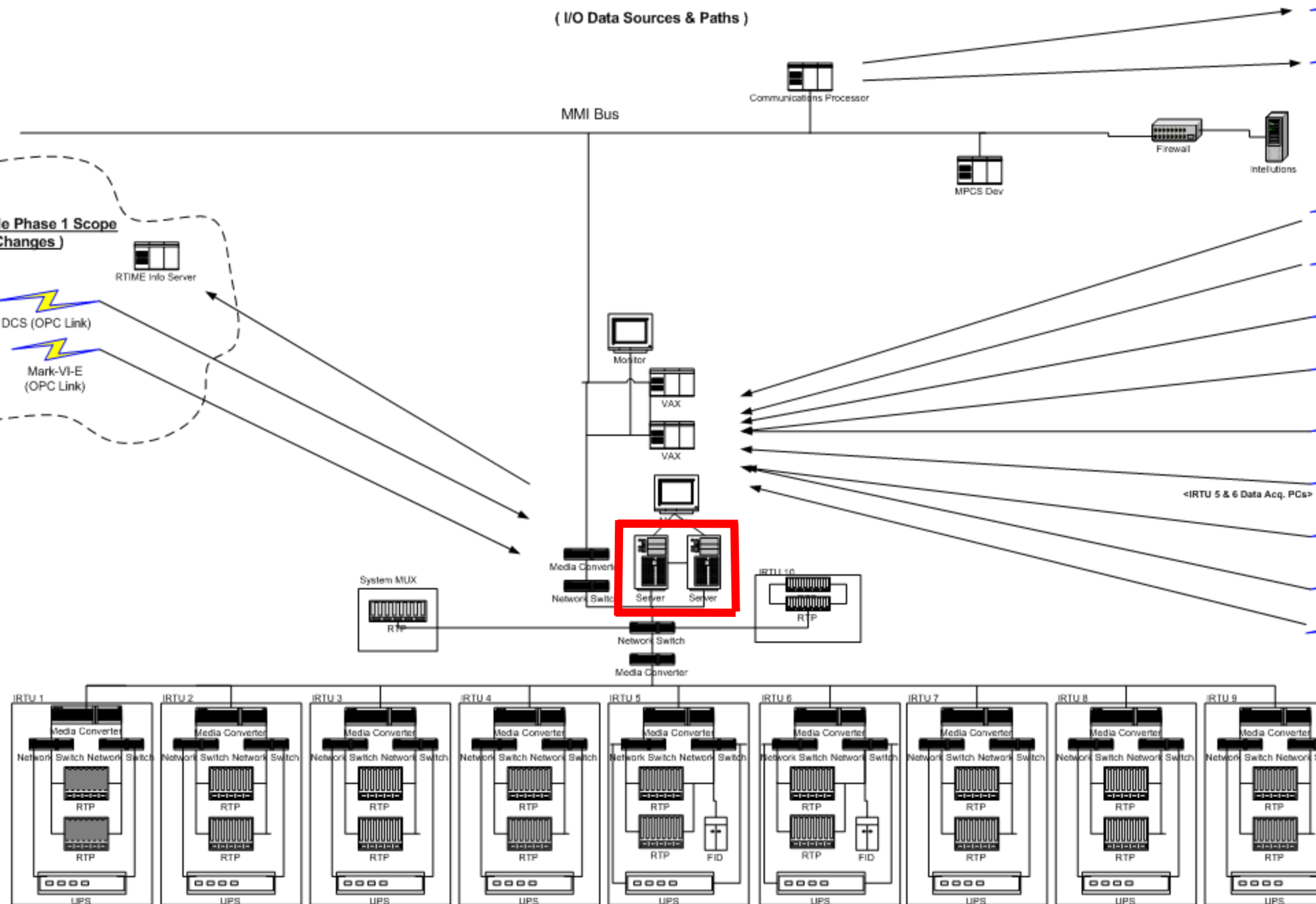
Project

- **Contract Award Process**

- Bid Specification developed in-house
- Pre-Bid meeting with prospective vendors held
- Benchmarking trips were made to utilities with prospective vendor products already operational
- Scientech was awarded the Contract
 - Large installed customer base of Windows Systems
 - Capability of up to 16 databases on a server at one time.
 - Applications coded in ANSI C
 - Proximity of Scientech's Cromwell, CT Office
 - Potential Synergy with Susquehanna Project –
 - Replacement of G2 processors/SAIPMS to R*TIME Comm. Link

Conceptual: End of Phase 1 Configuration

(I/O Data Sources & Paths)



Project

- **Transition from old equipment to new (cont.)**
 - Build RTIME system compatible with current SAIPMS system
 - RTIME database updated for all equivalent fields
 - Three major applications (Populate, DRPI, SRCL) were tweaked for Seabrook.
 - Populate used for automated way to convert the SAIPMS database to an R*TIME database through Microsoft Excel.

Project

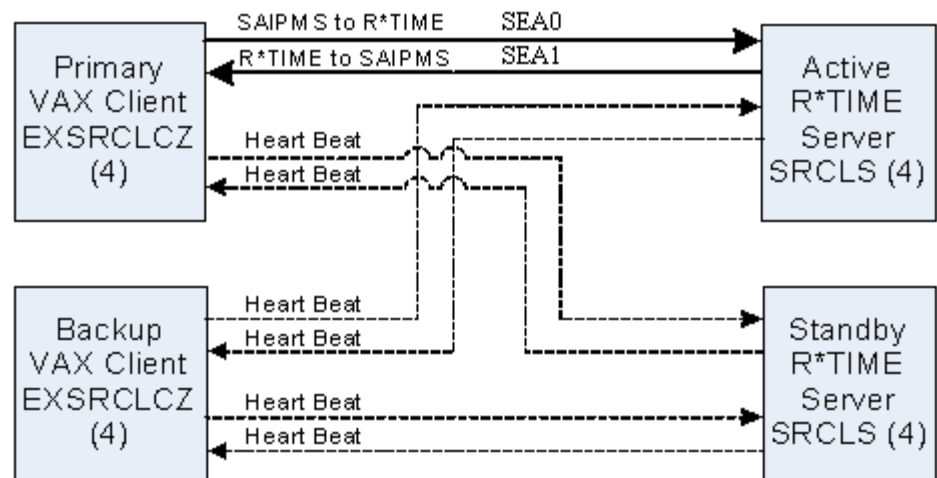
- **Transition from old equipment to new**
 - SAIPMS to RTIME Communication Link
 - 4 instances of the SRCLS application run on each server.
 - R*TIME Active server and VAX Primary server performing transmission of data
 - All other tasks are heartbeat connections waiting as hot standby

A R*TIME Server SRCLS Names

- **srcls_asa** – R*TIME Server A Sender to SAIPMS Host A
- **srcls_asb** – R*TIME Server A Sender to SAIPMS Host B
- **srcls_ara** – R*TIME Server A Receiver from SAIPMS Host A
- **srcls_arb** – R*TIME Server A Receiver from SAIPMS Host B

B R*TIME Server SRCLS Names

- **srcls_bsa** – R*TIME Server B Sender to SAIPMS Host A
- **srcls_bsb** – R*TIME Server B Sender to SAIPMS Host B
- **srcls_bra** – R*TIME Server B Receiver from SAIPMS Host A
- **srcls_brb** – R*TIME Server B Receiver from SAIPMS Host B



```

SRCL.D - Notepad
File Edit Format View Help

[TO_RUNTIME]
**      ! COUNT_BY_SCAN_LEVEL = 0018, 5648, 0288, 0457, 0000 =
**
[100_MS]
COUNT=0018
1B050402 A0290   AI EU ! .1 AI N-42 POWER RANGE OVERPOWER
1A041405 A0705   AI EU ! .1 AI FW-P-37A DISCH PRESS
1B060800 A0707   AI EU ! .1 AI FW-P-37B DISCH PRESS
1C040400 A2712   AI EU ! .1 AI DG1A GEN VLTS
1C040401 A2713   AI EU ! .1 AI DG1A GEN FREQ
1D030107 A2732   AI EU ! .1 AI DG1B GEN VLTS
1D030106 A2733   AI EU ! .1 AI DG1B GEN FREQ
1A060103 A4059   AI EU ! .1 AI N-41 POWER RANGE OVERPOWER
1A060104 A4060   AI EU ! .1 AI N-43 POWER RANGE OVERPOWER
1B050404 A4109   AI EU ! .1 AI N-44 POWER RANGE OVERPOWER
1C040407 A4183   AI EU ! .1 AI DG A ENGINE SPEED
1D030104 A4218   AI EU ! .1 AI SPARE AI #1D030104 REACTIVITY DAT
1D030105 A4219   AI EU ! .1 AI DG B ENGINE SPEED
1D030101 A4222   AI EU ! .1 AI SEPS 4160V COMMON BUS FREQUENCY
**
**      Optimize horn outputs (D0s) to 100 msec for better operator
**
1K010200 OPR1ALM DI EU ! 01 DO PRIMARY   ALARM HORN OUTPUT
1K010202 OPR1RST DI EU ! 01 DO PRIMARY   RESET HORN OUTPUT
1K010201 OSECALM DI EU ! 01 DO SECONDARY ALARM HORN OUTPUT
1K010203 OSECRST DI EU ! 01 DO SECONDARY RESET HORN OUTPUT
**
**
**
**
[1_SECOND]
COUNT=5648
**
**      4 GSC B points for display on DCS from SEA0.
**
NOHWDCHN B8298   DI EU ! GSC OXYGEN CONCENTRATION LO
NOHWDCHN B8299   DI EU ! GSC OXYGEN CONCENTRATION LO LO
NOHWDCHN B8327   DI EU ! GSC VENT HYDROGEN CONCENTRATION HI
NOHWDCHN B8328   DI EU ! GSC VENT HYDROGEN CONCENTRATION HIHI
**
**      Optimize stripchart 8-A0 PIDs to 1-sec for chart range sweep
**
1A010400 OPR1BLUE AI EU ! 60 AO DUAL PEN RECORDER PR1 - BLUE PEN
1A010401 OPR1RED  AI EU ! 60 AO DUAL PEN RECORDER PR1 - RED  PEN
1A010402 OPR2BLUE AI EU ! 60 AO DUAL PEN RECORDER PR2 - BLUE PEN
1A010403 OPR2RED  AI EU ! 60 AO DUAL PEN RECORDER PR2 - RED  PEN
1B011100 OPR3BLUE AI EU ! 60 AO DUAL PEN RECORDER PR3 - BLUE PEN
1B011101 OPR3RED  AI EU ! 60 AO DUAL PEN RECORDER PR3 - RED  PEN

```

Project

- **Transition from old equipment to new (cont.)**

- SAIPMS to RTIME Communication Link

- Points are transferred using an identical SRCL.D file
- File broken up into [TO_RUNTIME] and [TO_SAIPMS]
- Subsections broken into periodic transfer rates

[100MS], [1_SECOND], [5_SECOND], [30_SECOND]

Project

- **Transition from old equipment to new (cont.)**
 - Factory Acceptance Test
 - Use of three databases SEA1, SEA0, SEAT
 - SEA1 normal operation database for SBK.
 - SEAT test database for phase 1 FAT. Contains all scan points in SEA1 and is used in the R*TIME TDBM system to drive data.
 - SEA0 clone of SEA1. Receive data from VAX to provide data validation with SEA1 database.
 - Fully validated point alignment to R*TIME database of all analog/digital inputs/outputs
 - Analog field points checked for proper engineering units and a 5-point check in the valid operating range using the R*TIME TDBM with a 0.2% point tolerance (span of engineering range)
 - Digital field points were validated by manually toggling each channel on a test setup.
 - Calculated points were unchanged and is part of MPCs phase 2
 - Seabrook primarily have SOE points with only 32 that are contact input points

Project

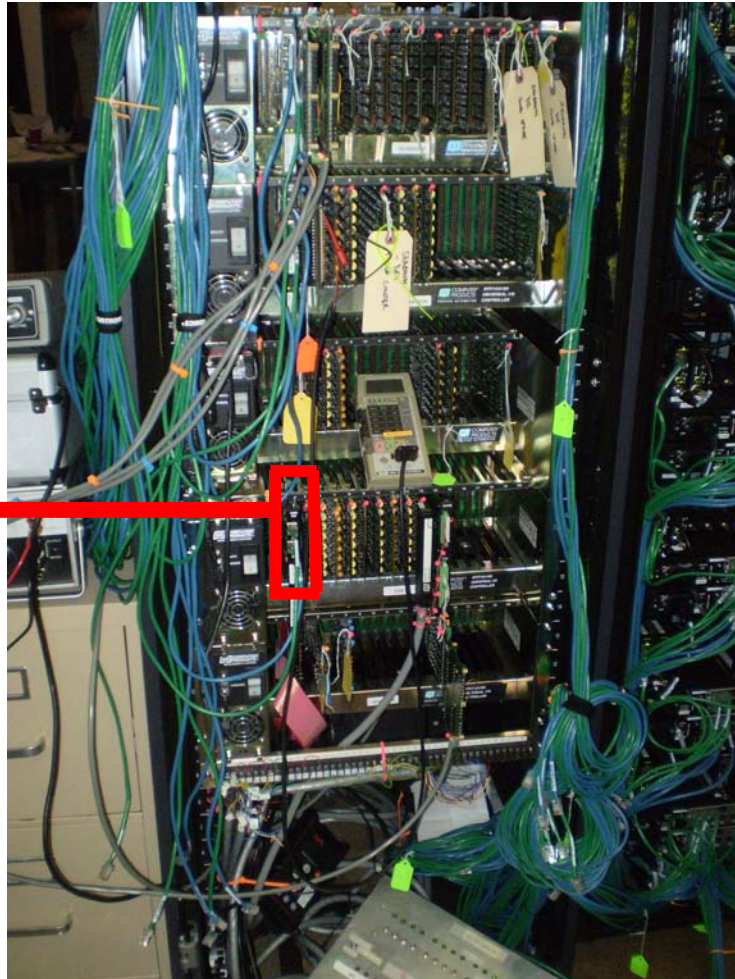
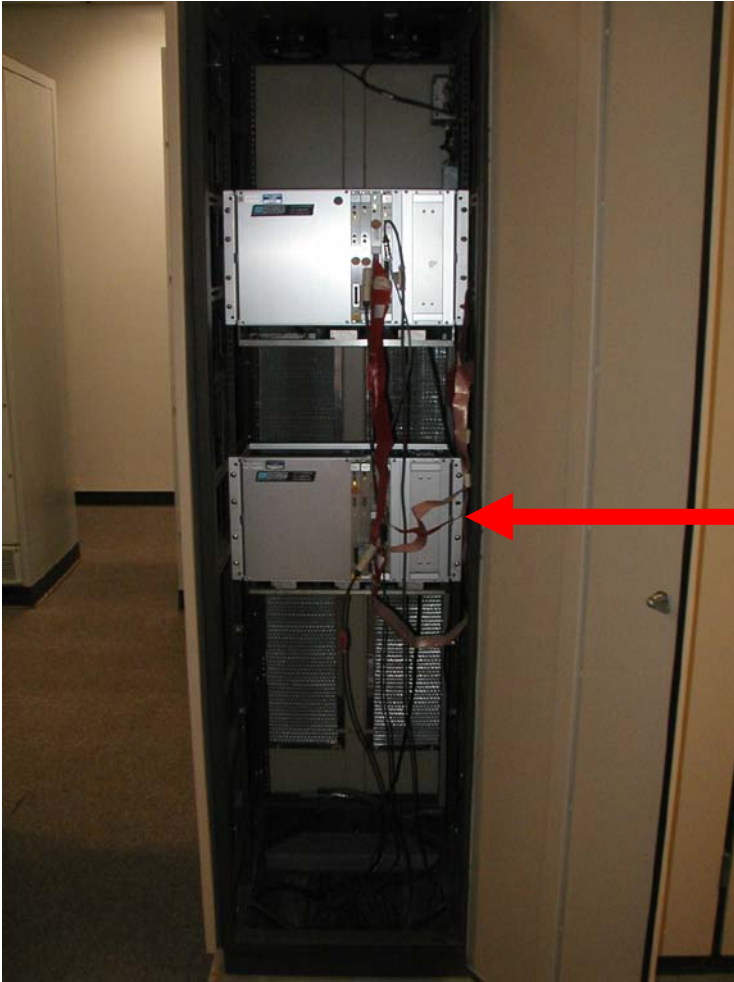
- **Factory Acceptance Test**

- Major Events
 - SAIPMS to R*TIME Communication Link (SRCL) Testing
 - DRPI testing
 - Power Supply Checks

- **Site Acceptance Test**

- Major Events
 - Continued similar tests as FAT.
 - Meshing the VAX's to the RTIME system was a challenge
 - Stability issues with turning on IRTU nodes at same time due to loading
 - In-house application Archive Compare Utility to compare values in SEA0 and SEA1 database prior/after cutover of the new system

Project



Project

- 10 IRTU's 46 Remote Nodes

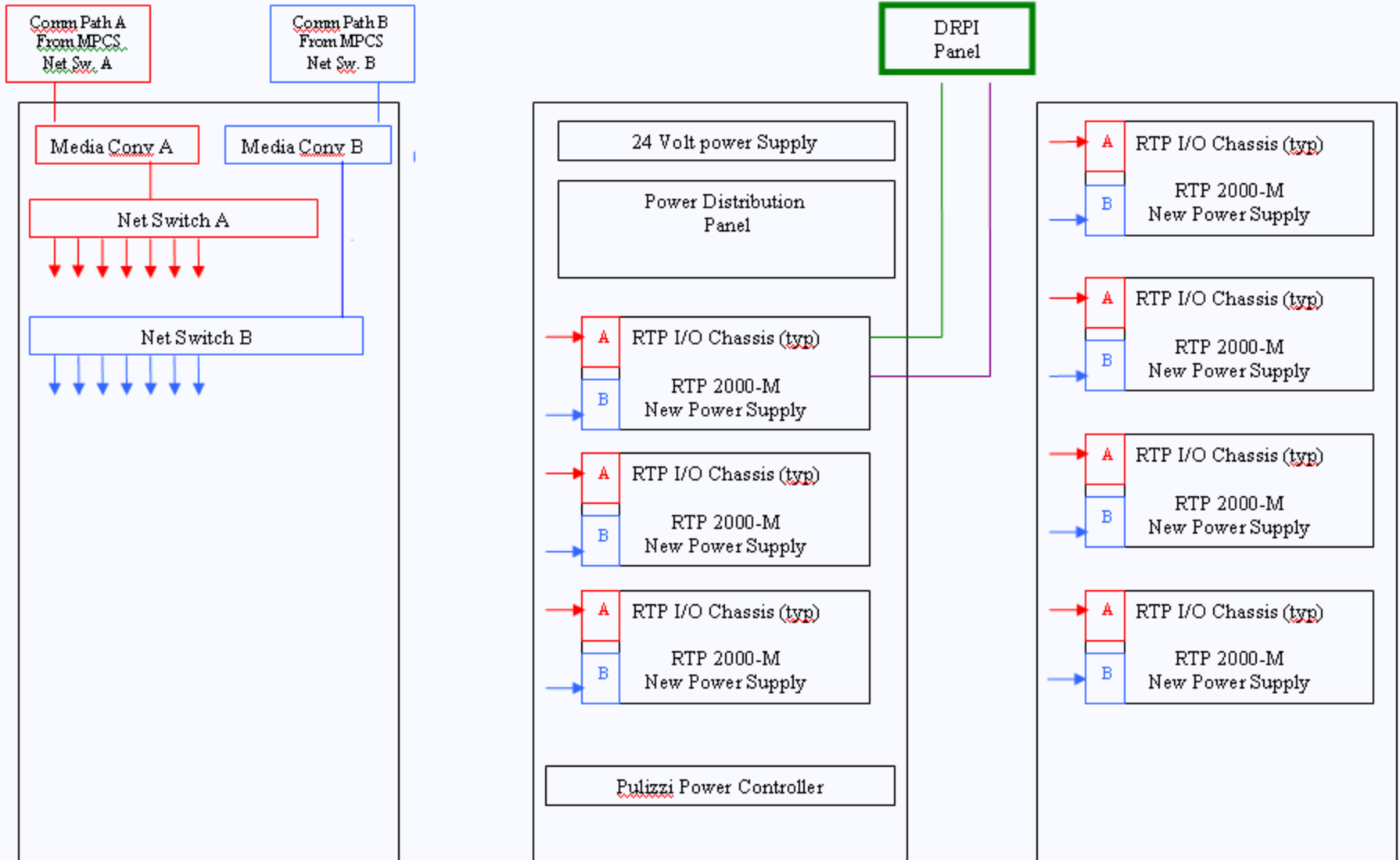


IRTU 1

CP273

CP119

CP121



Project

- **Implementation**

- Challenges

- Changes of Seabrook Project Management during the project
 - Establishment of Seabrook SQA program
 - Preparation of SRS, SVVP, SDD documentation
 - Communication link cutouts (1-2 per day) with much slower VAX systems
 - De-calibration of High impedance (30k Ohm) Westinghouse inputs affected analog input signals by a 0.03% delta
 - Developed a test system to implement calibration constants to the SEA1 RTIME database.
 - Working with OPS department on online MPCs.
 - Cyber Security/Data Diode (future challenge)

Project

- **90 Day MPCCS availability Run**
 - No unplanned issues with hardware/software
 - 100% MPCCS availability
 - Criteria for availability run
 - MPCCS communication link
 - Server Availability
 - 24 volt Power supply
 - Status of each node – RTP2000M

QUESTIONS??