Eight is Too Many

Improvements Simplification of the Raven Computing System
Eight Hardware Machines

- 3 x ANDOR Camera PCs
- 1 x ALPAO Deformable Mirror PC
- 1 x AO Sequencer Hypervisor
  - AO Sequencer VM
  - AMQP broker VM
- 2 x RTC (one is a backup)
- 1 x InGaAs camera PC
- Lots of Ethernet
Computing Network (Simplified)
Network Added Flexibility

- **Redundant management interface**
  - Aggregated links with automatic failover between rack and bench

- **Redundant computers**
  - Simple to switch to backup RTC
  - Single camera PC failure drops two cameras maximum

- **UDP/Multicast real-time data**
  - Ethernet switch sends traffic where it needs to go
  - Simple to partition RTC
    - Second RTC could run in parallel controlling second science channel
  - RTC from other party can be integrated

- **Service mobility**
  - Pixel processing exploits locality to camera but doesn’t have to
Network Added Pain

- Complicated network topology
  - VLANs, DHCP, multicast domains, channel bonding, clock distribution
- Eight+ machines to manage
- Cabling faults
- Power-up/shutdown sequencing
- Added latency
Camera PC

- Initial design was for PC to only power the camera. Pixel processing done on FPGA.
- Vendors documentation stated up to two cameras per PC.
  - Documentation incorrect, six will apparently work
- Ended up performing pixel processing for two cameras per PC
  - Quicker to develop
  - Easy to change
- Slopes streamed to RTC over Ethernet (UDP/Multicast)
Deformable Mirror PC

Vendor chose interface card with poor Linux support

- Only supported 32-bit platform
  - All other Linux machines in Raven are 64-bit
  - Separate build to support same libraries on 32-bit platform
- Only supported specific kernels
  - NDA with interface card manufacturer to support newer 32-bit kernels

Vendor later produced an Ethernet/USB interface

- Purchased but insufficient time to integrate

DM commands streamed over Ethernet (UDP/Multicast)
InGaAs Camera PC

- GigE Vision like camera
- Vendor supplied Windows 7 PC as a gateway
  - Unsuitable for remote deployment
  - Poor software
  - Difficult to integrate into existing image pipeline
- Replace Windows PC with VM on AO Sequencer Hypervisor
Aside

Vendors develop for attended usage

- General purpose lab use, grad students, desktop users
- Easy to integrate into bench experiment
  - USB, Windows DLLs, basic documentation

Not so easy to operate remotely/integrate into system

Need to ensure products selected can be integrated to a installed system
AO Sequencer

Virtualized environment for easy upgradability/fault tolerance

- If system failed the VM could be migrated to the backup RTC
- Copy of AO sequencer user environment (MATLAB) mirrored at UVic
  - Consistent user experience
- Unknown requirements for AMQP broker
  - Didn’t know resources required for broker so started with a VM, worked fine
RTC

- Bare metal system
- Minimal services installed
- Adequate hardware for most cases
  - Large reconstructor would exceed pipeline deadlines
- Loading large reconstructor from RPG is slow
Proposed Simplification

- Remove Camera PCs
- Remove DM PC
- Remove InGaAs PC
- RTC
  - *Same physical machine*
  - *Add PCIe Expansion Chassis for ANDOR cameras*
- Install ALPAO Ethernet I/O cards in DM electronics chassis
- AO Sequencer
  - AO Sequencer VM
  - InGaAs camera VM
  - *AMQP broker installed on AO Sequencer Hypervisor*
- 5 less physical PCs, 16 less network connections
Proposed Simplification Continued

_less computational power is available due to loss of Camera PCs_

• Each Camera PC is a quad core (12 less cores) although 2 generations older than the RTC cores
• Not an issue for threshold center of gravity
• Correlation centroiding is more demanding
  • Further software optimization is possible

Leverage GPU to make up for loss
New Network Layout
Software Changes To Support Simplification

On RTC

- Install RPM packages for ANDOR camera
- Deploy and start pixel processing services

On AO Sequencer

- Install RPM package for AMQP broker on Hypervisor
- Change configuration file on AOS

Start