EVLA Monitor & Control

EVLA Advisory Committee

June 10 – 11, 2002

Status

- High level overall software architecture/plan
  - Deferred to address issue of antenna MIB systems software
  - To begin June, 2002
  - To include examination of other codebases, especially the GBT

- Detailed, timelined development plan for test antenna
  - Short term plan developed
  - Full term plan to be developed during June/July, 2002

- Detailed, timelined transition plan
  - Systems Engineer for Software was to develop this plan
  - Plan not completed
  - Socorro-resident Systems Engineer as of 6/17/2002

Status

- Requirements

	target	completed
Antenna monitor & control	03/22/2002	04/04/2002
Correlator monitor & control	04/16/2002	

Vacancy filled 04/14/2002.
Working from Brent Carlson's document of 01/23/2002.

Correlator backend	03/18/2002	04/10/2002
Operational Interface	03/22/2002	04/04/2002
Observing Layer	Vacancy not yet filled.	

Budget

- As of 04/30/2002
  - $385K allocated for FY2002
  - $13.5K actually spent
- As of 06/2002,
  - $100K contract placed for Antenna MIB systems software (06/07/2002).
  - An additional $20K to be spent on Antenna MIB toolset software
  - Approximately $16K to be spent for systems to host Antenna MIB and Correlator MIB development environments.
  - Approximately $5K - $7K to be spent on daughter board for Antenna MIB development board
  - Approximately $12K to be spent on enhanced debugging capabilities for Antenna MIB software development

Recruitment

- Began with four open positions
- Correlator Backend covered by a new hire, Tom Morgan, 01/2002
- Antenna Monitor & Control covered by contributed effort, Kevin Ryan. Need more manpower here.
- Correlator Monitor & Control covered by a lateral transfer, Bruce Rowen, 04/14/2002.
- Now have 3 vacant positions:
  - Replacement for Bruce Rowen (VLBA maintenance & upgrades + 50% EVLA contributed effort)
  - Person to work on Observing Layer
  - Object-Oriented/Distributed Systems
- As of 6/7/2002, about to make offers to 2 candidates
  - Bruce Rowen replacement
  - Observing Layer

Recruitment

- Four offers have been rejected
  - 1, money
  - 1, family issues
  - 1, money & family issues
  - 1, spousal employment
  - Plus one candidate declined to apply on basis of location
- We are getting the right people in the door, but our offers are not accepted.
- We have not yet made an offer that did not involve more than a $10K/yr cut in salary for the candidate.
- Advice & suggestions are welcome.

Conceptual Diagram

- Transparency: EVLA M&C System Strawman Diagram

Antenna Monitor & Control

- Heterogeneous array (Upto 4 different antenna types)
- Ethernet based communications
- Must serve a variety of users from a number of different physical locations
- Performance
  - 100 microsecond command start latency
  - Pointing updates every 50 milliseconds
  - Frequency change within band – 1 sec
  - “Nodding” source switch rate – 1 per 10 sec
  - Hardware responsible for its own safety
- Processors in antenna must be RFI quiet

Antenna Monitor & Control, Antenna MIB

- Infineon TC11IB chip
  - 1.5 Mbytes of on-chip RAM
  - 12 MHZ, sinusoidal external clock
  - Almost all components of all needed peripheral interfaces are on-chip
- Systems software & development environment
  - Accelerated Technology Nucleus PLUS rtos & Nucleus networking software
  - Nucleus PLUS and networking components must be ported to the TC11IB chip
  - Nucleus MNT simulation environment for earlier development of applications software
  - Altium TASKING toolset for compilers, linker, locator, etc
  - OCDS level 1 and level 2 debugging

Antenna Monitor & Control, Antenna MIB, Systems Software

• Nucleus PLUS rtos	45.0 KB
• Nucleus NET network stack	87.0 KB
• Ethernet driver	5.5 KB

	137.5 KB
• Telnet server	35.0 KB
• Shell	35.0 KB

	207.5 KB
• Nucleus WebServ	35.0 KB

	242.5 KB

Correlator Monitor & Control

Hardware

- 300+ Correlator Module Interface Boards (CMIBs)
- 1 Master Correlator Control Computer (MCCC)
- 1 Correlator Power Control Computer (CPCC)
- Copper based networking between MCCC & CMIBs
- Network switches/hubs to isolate traffic

Software

- Virtual Correlator Interface
- CMCS Test Software

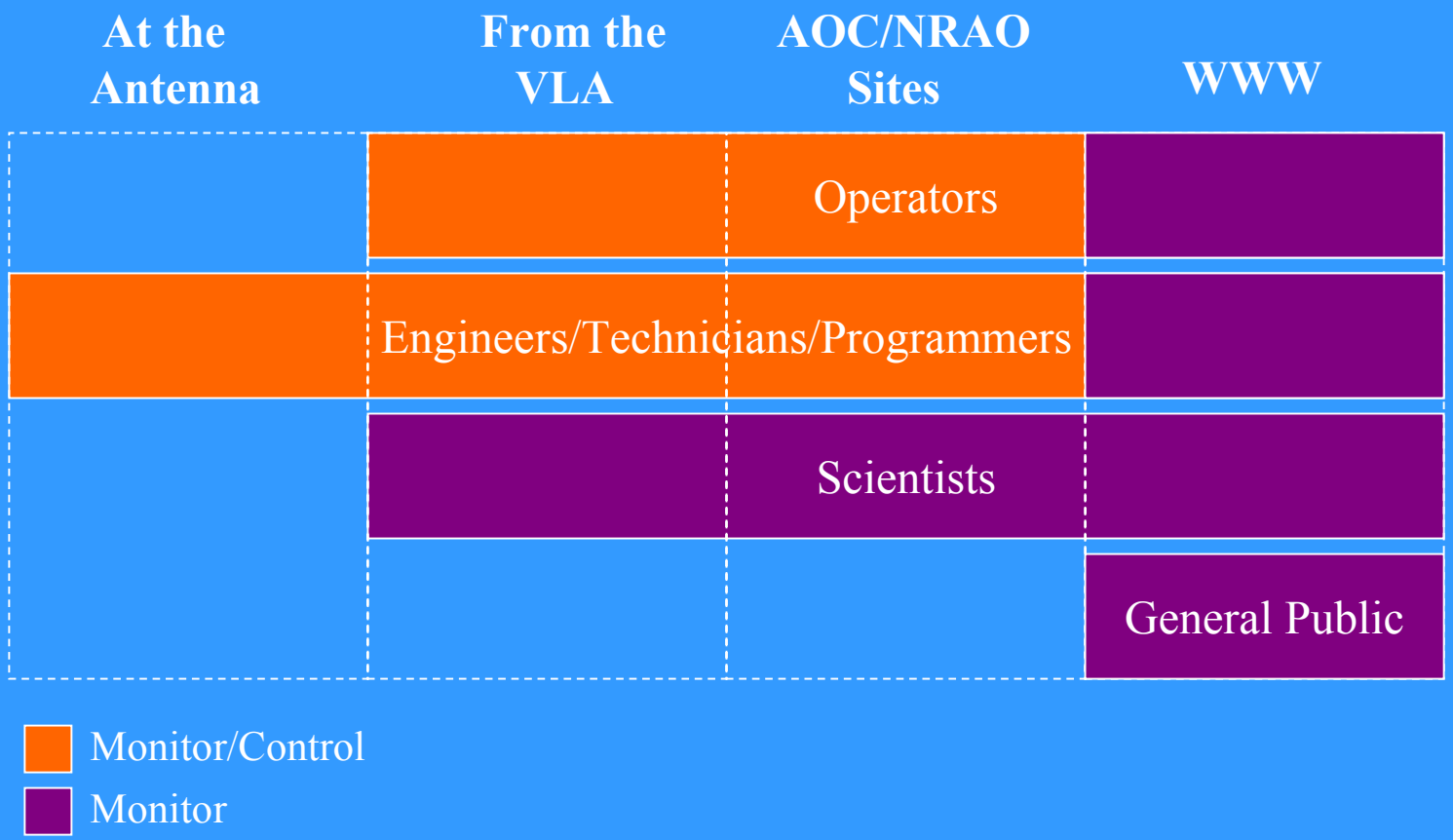
Correlator Monitor & Control

- Transparencies
  - Correlator network diagram
  - Correlator software layers
  - Correlator flow diagram

Operational Interface System, Requirements Overview

- Client Platforms
  - Commodity PCs/Windows/Linux (required), Sun/Solaris
  - Platform independent language (Java)
- Remote Observing
- Installation & Upgrades
  - Java Web Start
- Security
- Robustness
  - System will not crash because of network glitches, broken sockets, reboots of devices, etc
- Reliability (MTBF is TBD)
- Availability
  - 99.5 % (48 hours per year)
- Maintainability
- Usability

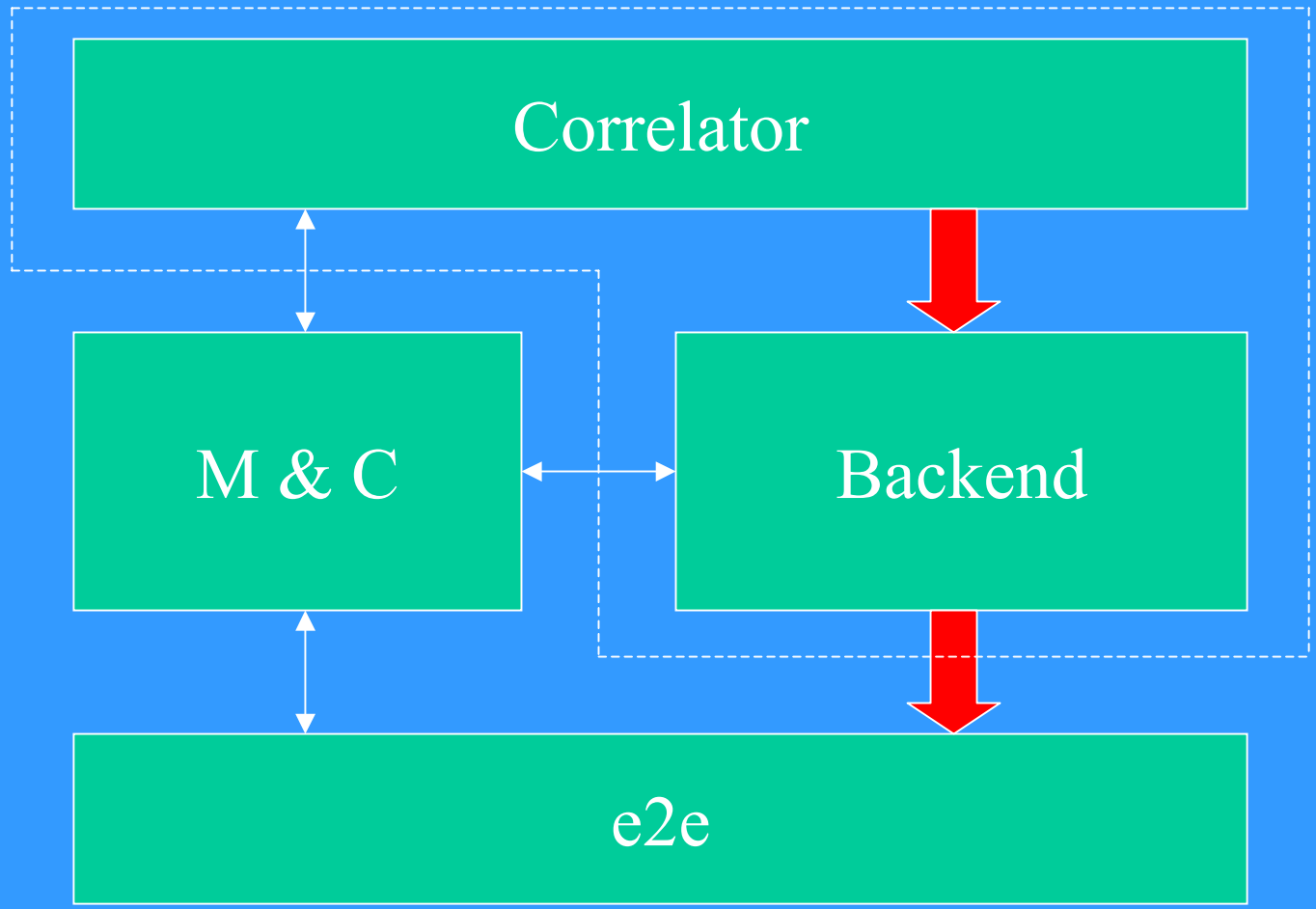
Operational Interface System, User Access



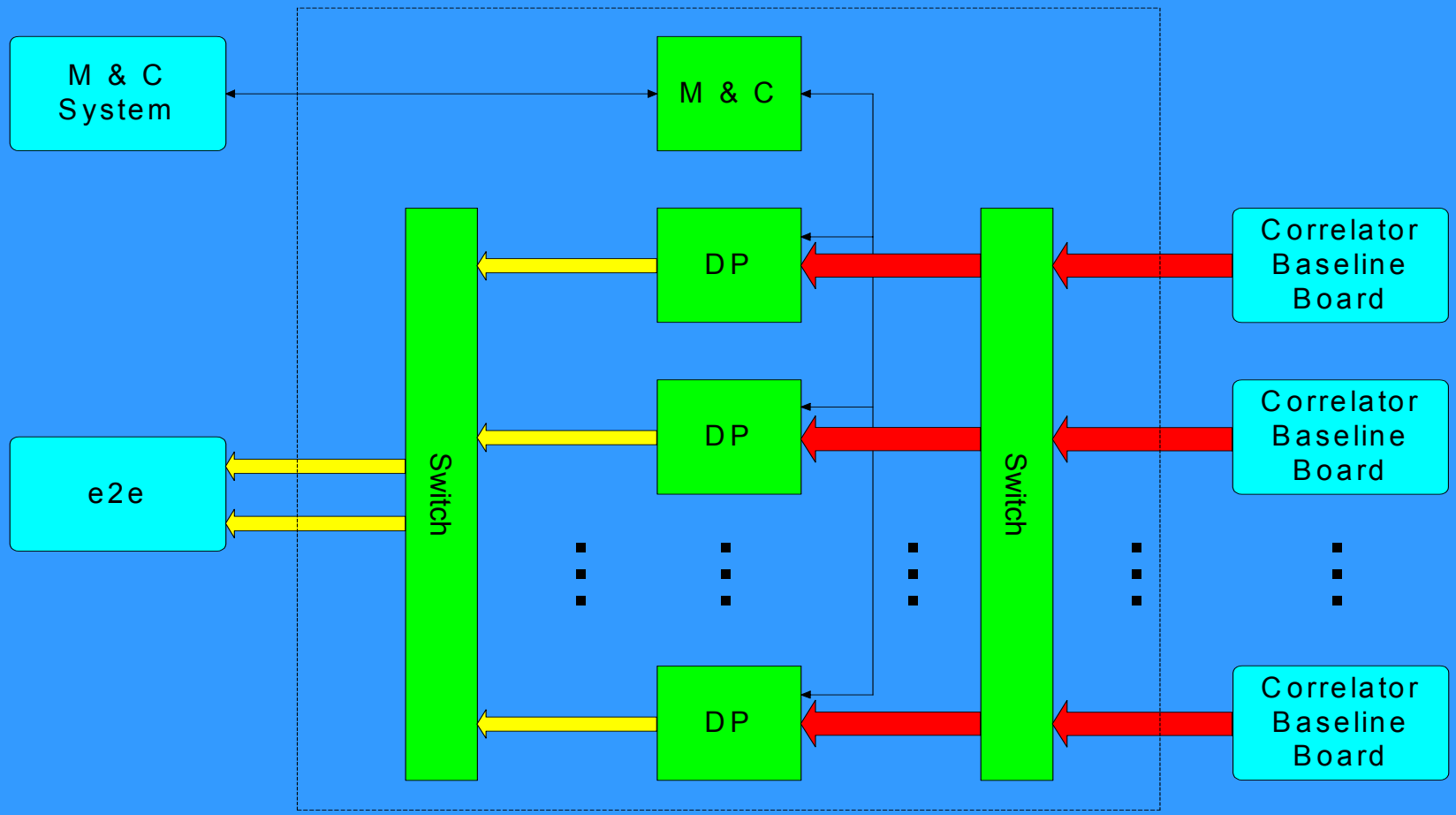
Operational Interface System, Attributes, Issues

- Loosely Coupled & Highly Adaptive
  - Changes to the core M&C system should have no or minimal effect on client
    - Requires highly encapsulated core M&C system
    - Require minimization of interface dependencies
- Discovery based
  - Dynamic discovery of objects/services
  - Requires some form of registration & lookup
  - Could be very useful in the context of a real-time system with many processors that may experience resets & reboots
- One current focus is the issue of how the client software will communicate with the core M&C system
  - Java RMI, CORBA, XML-RPC, SOAP
  - Other observatories ?

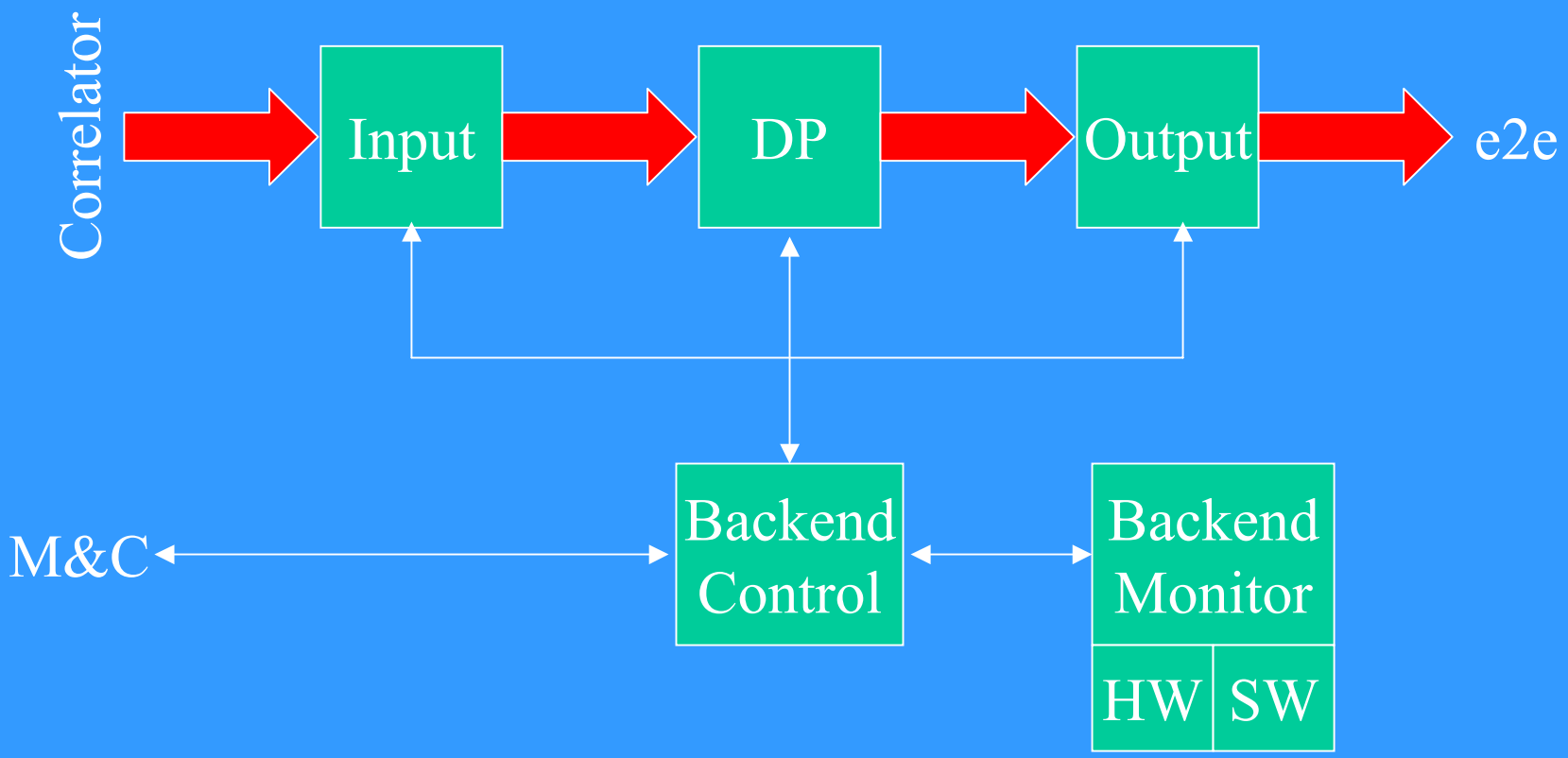
Correlator Backend



Correlator Backend, Overview



Correlator Backend, Major Functions



EVLA M&C Network

- The EVLA M&C Network is large.
  - ~ 57 nodes associated with each antenna: 50 physically located in each antenna + 7 per antenna nodes in the control building. A total of 1539 nodes for 27 antennas
  - ~ 300 nodes for the correlator
  - "Several" crates in the control building
- Will need a short, formal requirements document, especially in the area of security.
- NRAO expenditures currently split across several different cost data sheets under several different WBS headings. Coordination, if not formal integration, is required. We have targeted June/July for this effort.
- Correlator M&C Network components in both the DRAO budget and the NRAO EVLA budget.
- Comments/discussion on the planned use of networks in the EVLA is invited.

EVLA M&C Network

- Transparency: Monitor & Control Network

Test Antenna

Goal – Outfit test antenna with new M & C System Q2 2003

Select AMCS MIB Chip	done
TC11IB development board in-house (late)	done (05/17/2002)
Select systems software for AMCS MIB	done (05/21/2002)
P.O. Req & License Agreement for systems software	done (06/07/2002)
Configure & purchase AMCS MIB development tools	06/21/2002
Delivery of simulation environment	06/21/2002
Daughter board for TC11IB development board	06/21/2002
Begin development of MIB software apps	07/01/2002
Prototype MIB board available	07/15/2002
Port of MIB systems software complete (12 wks)	08/30/2002

Test Antenna

MIB systems software on development board	09/06/2002
MIB systems software onto prototype MIB board	09/13/2002
MIB software apps onto prototype MIB board	09/20/2002
Continued MIB software development	thru 03/2002
Bench test & Integration of AMCS	01/2003-03/2002

We will have approximately 6 months after installation of the MIB RTOS on the prototype MIB board for continuing software development but this development will be intermixed with bench testing.

Test Antenna, Software Tasks

- AMCS MIB
  - Systems Software & Toolset
  - Communication Functions
  - Control & Computation Functions
  - Engineer/Technician Interface Screens
- Test Antenna, Single Dish Phase
  - Command Line Interpreter
  - Timekeeping routines
  - Geometry routines
  - Antenna pointing model
  - Archive for pointing model parameters
  - Archive for monitor data
  - Operator Interface Screens

Test Antenna, Software Tasks

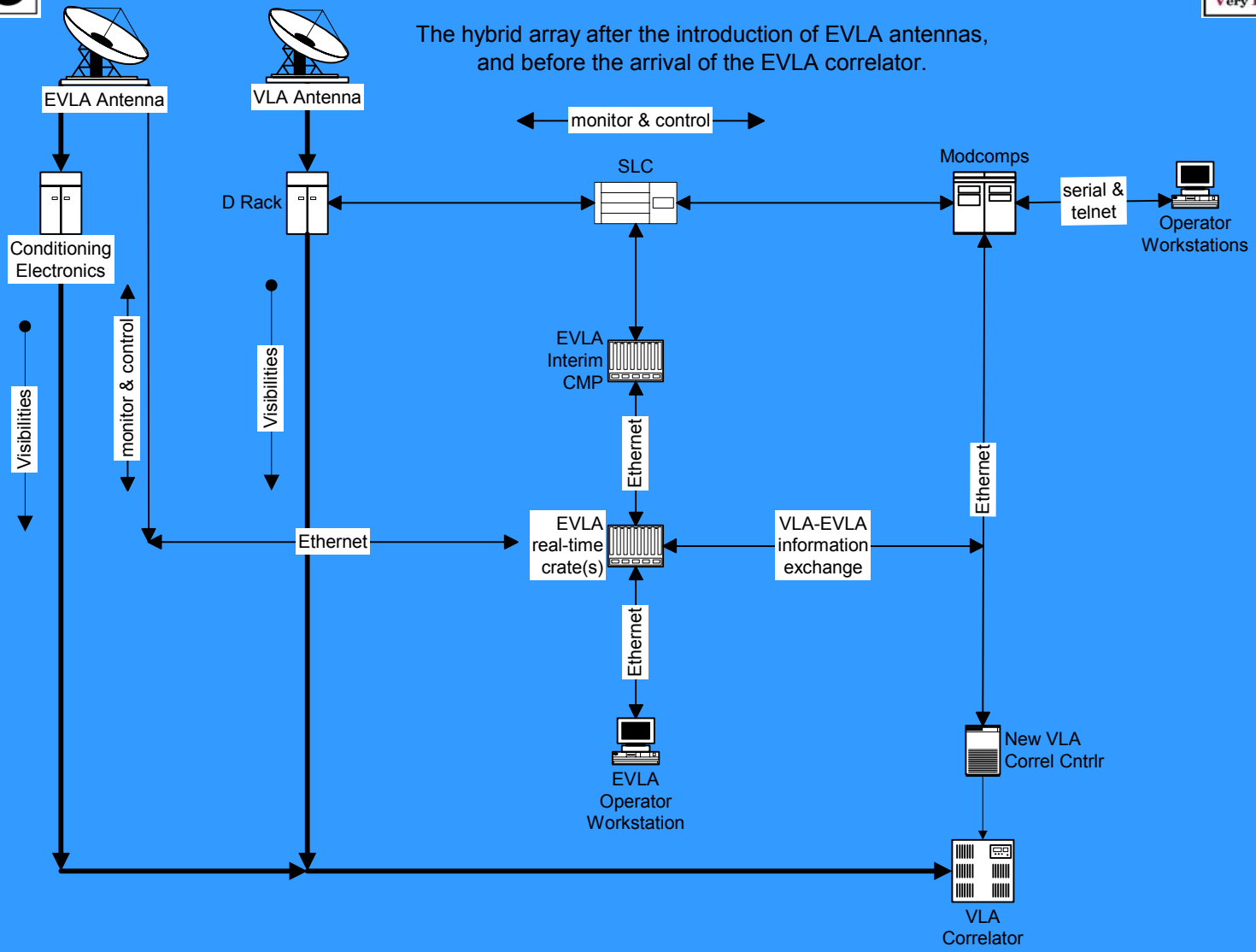
- Test Antenna, Interferometer Phase
  - Translator, Modcomp card input to new system commands
  - Lobe rotator & phase switching drivers
  - Fiber Optic IF system – test, monitor, control
  - Data flagging system

Transition Plan

- Array downtime must be minimized as much as possible during the transition phase.
- Simultaneous operation of EVLA & VLA antennas must be possible (the hybrid array).
  - Control & Monitor processor (CMP)
- OBSERVE/JOBSERVE script files must be usable on the hybrid array.
- Modcomp computers decommissioned as soon as possible
- Control of VLA Correlator by EVLA M&C system possible via the new VLA correlator controller
- Minimize throw-away hardware & software

Transition Plan

The hybrid array after the introduction of EVLA antennas, and before the arrival of the EVLA correlator.



Questions/Issues

- Recruitment
- Antenna MIB: RFI, the chip, the systems software, etc
- Use of Ethernet in the EVLA
- Use of software from the GBT &/or other observatories
- Test antenna schedule/development plan