Abstract:

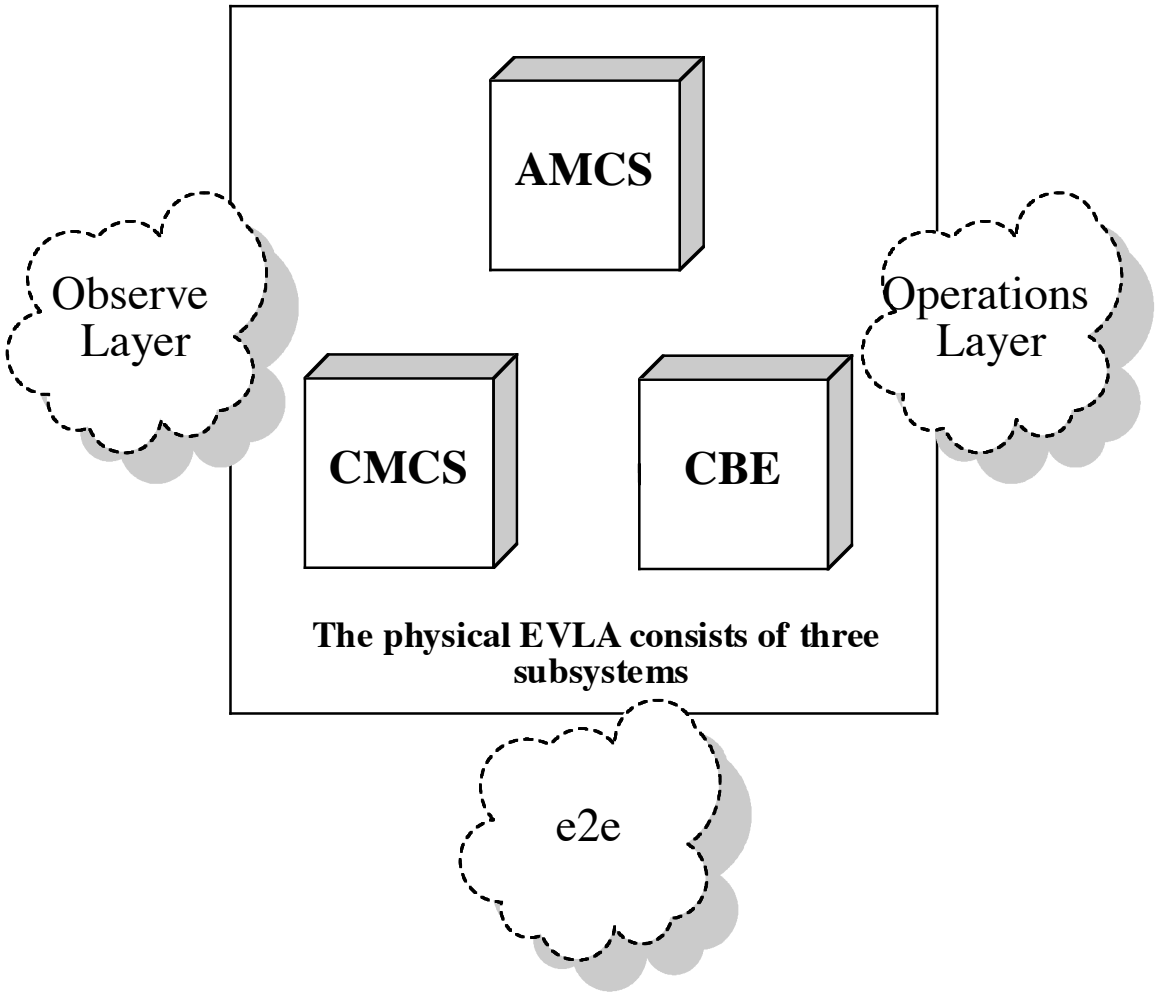
The EVLA Observe Layer is responsible for the scientific operation of the EVLA. In so doing, the Observe Layer must be able to control the various system components such as the antennas, correlator, weather station and whatever else is necessary to perform an observation.

It is the author's belief that the Observe Layer system under current proposal unnecessarily limits itself to control of one antenna type (EVLA) only. This paper will explain why.

First Things First

For the discussion that follows, a general picture of how the author views the EVLA as a system and his interpretation of the current Observe Layer is described first.

The EVLA contains three physical subsystems and several functional layers. The three subsystems are the Antenna Monitor & Control Subsystem (AMCS), Correlator Monitor & Control Subsystem (CMCS) and the Correlator Back End (CBE). Some of the known functional layers are the Archive System, the Observing Layer, the Operations Layer and the services of the e2e system.

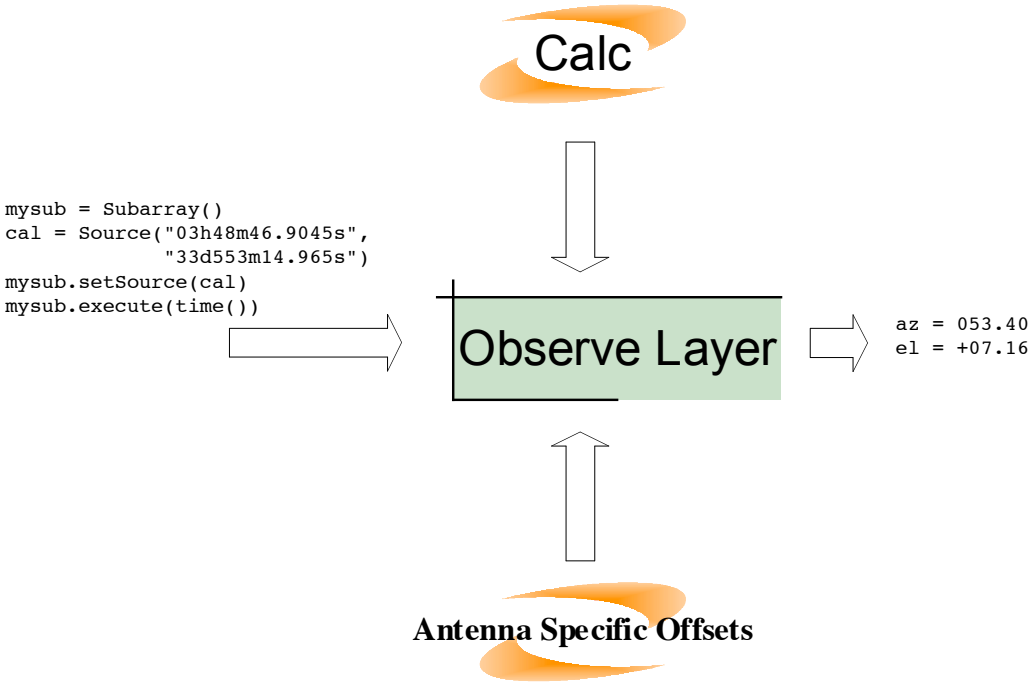


Various 'functional layers' interact with the physical system and with each other.

Each of the physical subsystems (will) provides a means by which users can control and monitor the equipment to which they are attached; in other words, an interface between themselves and the 'outside world'.

The Observe Layer must control each of the physical subsystems in order to perform an observation. The current observe scheme proposed by Barry Clark is beneficial in that it provides the ability to 'program' the system. With high-level constructs such as 'while' loops, an astronomer, using only a few lines of code, can instruct the system to perform specified operations for specified durations of time. The Observe Layer interprets this syntax and issues discreet commands to the system to cause it to behave as the programmer intended. In affect the observe layer transforms the 'analog' observation program into a series of discreet states that the system should be in at specific times.

The Observe Layer has inputs from CALC to transform celestial coordinates into absolute geographical coordinates for each of the antennas in the array. It also has access to offsets and other information specific to each antenna to compensate for things such as sag when positioning them.



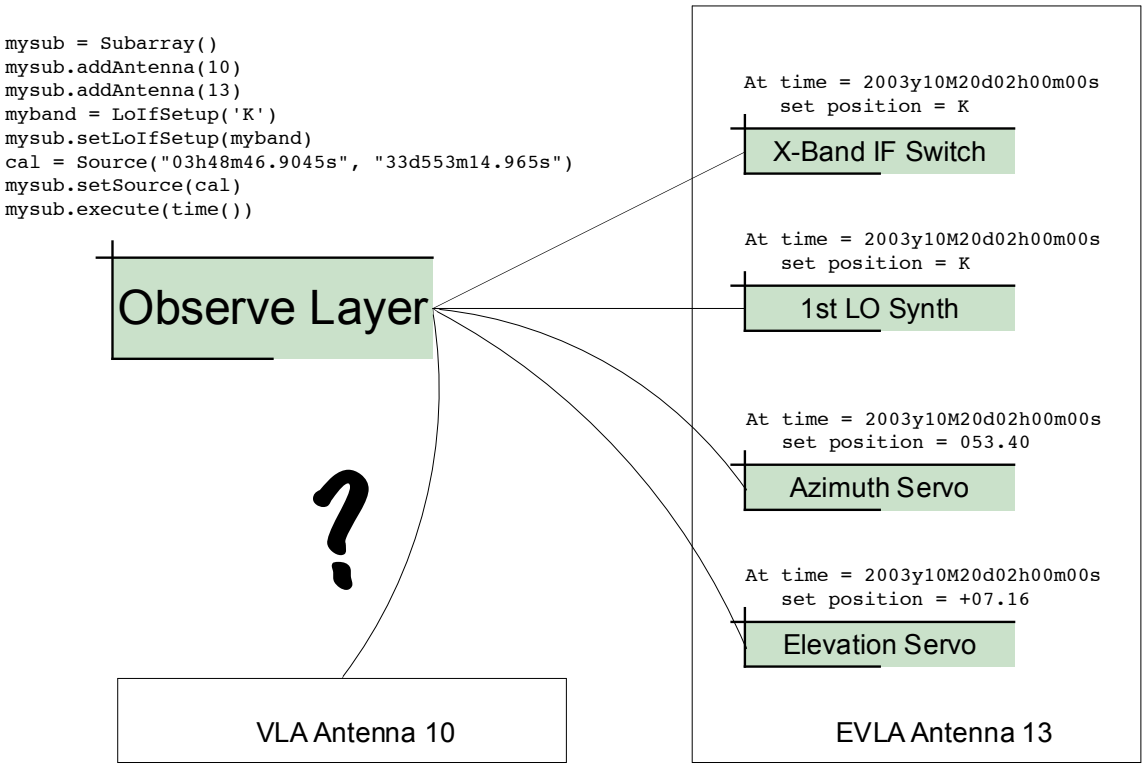
The Observe Layer, using inputs from CALC and Antenna Offsets Tables, converts observation program syntax and values into discreet state values that the system understands.

Houston, We Have a Problem

The AMCS represents the physical equipment that make up the antennas and ancillary equipment such as the weather station. Because the EVLA is transitioning, one antenna at a time, from the current VLA, and because it is planned that the EVLA will add VLBA antennas and possibly the future NMA antennas, it now is, and forever will be, a heterogeneous system with regard to antenna types.

Since the antennas are different, they work differently on the insides. The AMCS is being designed to provide an interface that makes those differences transparent. A client will be able to operate an antenna without having to know how the operation is implemented within the antenna.

The current Observe Layer bypasses this interface and attempts to send commands directly to the *subcomponents* of the EVLA antenna (its MIBs). This makes the Observe Layer system fragile and limited. It will not work with existing VLA antennas (nor future types) without significant changes.



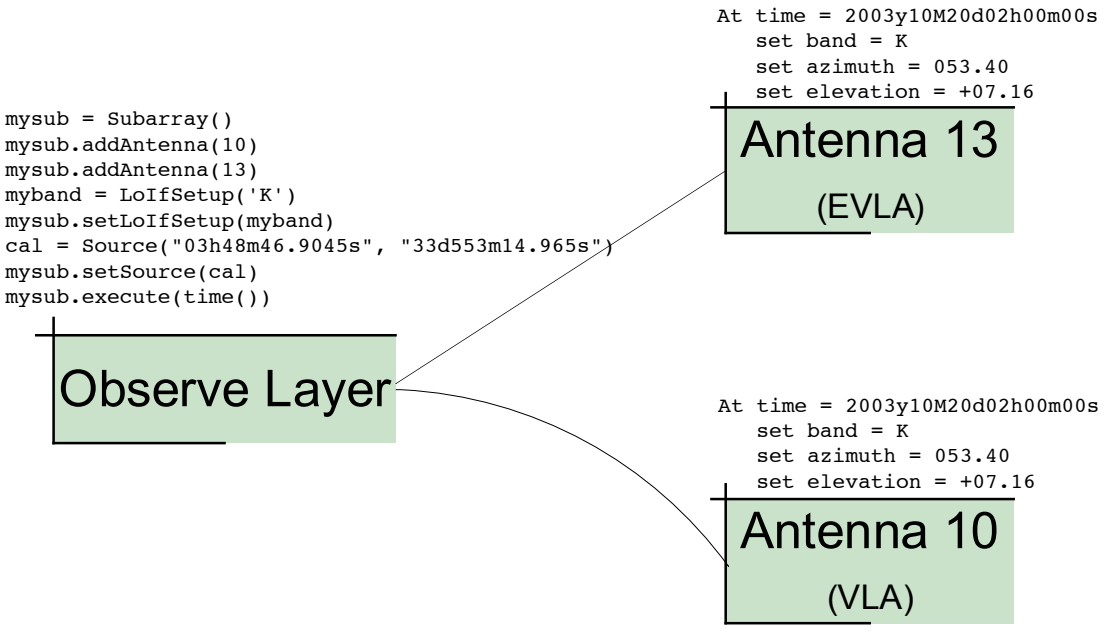
The current Observe Layer communicates directly with EVLA antenna subcomponents. VLA antennas contain different subcomponents so they cannot be controlled by this system without significant changes to it.

Even if the significant changes are made to the Observe Layer software to support other antenna types, the system will have to keep track of what type each antenna is in order to send the correct commands to it. If changes are made to an antenna's subcomponent the Observe Layer will have to at least undergo regression testing and possibly require modification. This breaks the rules of modularity and encapsulation.

How it Ought to Work

To make the differing implementation details transparent to the user, the AMCS is being modeled as a client/server type system. In real-world client/server systems (such as the World Wide Web) the client specifies *what* he wants from the server; the implementation details, of *how* that information is supplied, are hidden within the server and are of no importance to the client.

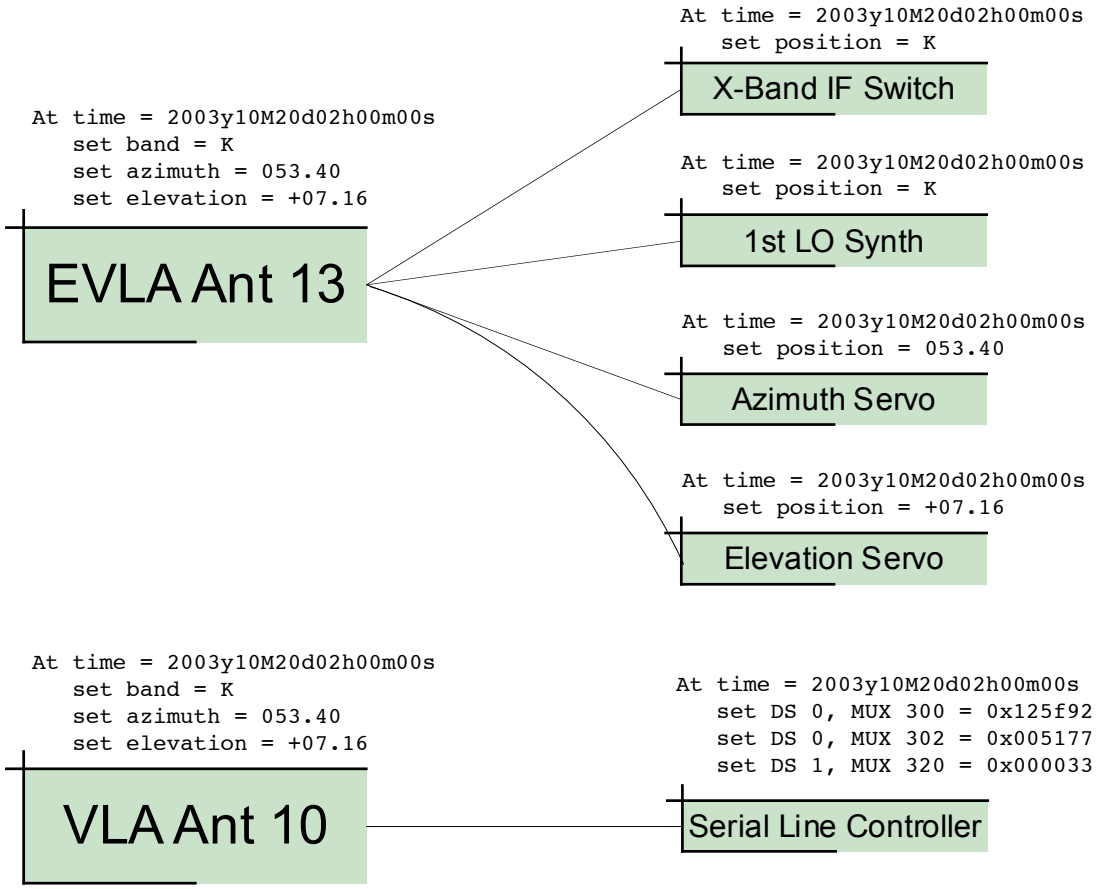
The affect with the AMCS is that a user can operate its different antennas without having to know the specifics of *how* each is controlled. The client tells an antenna *what* to do (i.e. point here, set band to, etc.).



The Observe Layer should communicate with the AMCS Antenna Objects not the antenna subcomponents.

The Observe Layer should naturally only be concerned with controlling antennas and not their subcomponents. The Observe Layer can and should be aware of different antennas' different *capabilities* but not with how they are implemented.

Each antenna in the AMCS is (or will be) represented by a software Antenna Object that knows how to control its subcomponents in order to execute a configuration request.



Each Antenna Object type knows about his own subcomponents and how to control them to implement a configuration request.

The Observe Layer attempts to replace the AMCS antenna object with its own that it calls the *Antenna Physical*. Presently only one 'Antenna Physical' exists in the Observe Layer and that is for the EVLA type antennas. If the Observe Layer wants to control an NMA or VLA or VLBA antenna, it will have to create new Antenna Physicals for those types.

If all EVLA system clients such as e2e and operator screen GUI's are modeled in the same fashion, then they too will have to create a new antenna object for each of the different antenna types with which they communicate. If a tech wishes to operate an antenna for maintenance purposes, he will have to supply his own Antenna Physical objects software in his laptop or PDA. In short, all users will be required to use their own versions of Antenna objects. Bad idea.

The Observe Layer and other functional layers should not attempt to duplicate the processes behind a subsystem's interface but instead use the supplied interface to those processes. After all, the physical subsystems of the EVLA, and not their users, are the experts on their own behavior.

Next Steps

The second part of this document, when completed, will propose an interface that the Observe Layer will be able to use for control of the entire AMCS. Since it will begin as a proposal, the specification will present things more generally - along the lines of concepts. It will be based on the work that has been implemented (somewhat) on the CMP.