



Software Research Directions Related to HA/ATCA Ecosystem

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- Start from premise: Ok, we have ATCA/uTCA chassis', needed cards, shelf manager, slot power management, hot swap, demonstrated failover modes, etc.
 - **ie. what Ray Larsen has in mind for ATCA/uTCA development station R&D**
 - **Now what...**
 - **How to use all this as a complete production system where stations will number in thousands (plus many other resources)?**



Managing Resources

- We have a large number of resources to manage.
 - **Hardware (FRU – Field Replaceable Unit)**
 - **Software components**
 - Application and operating system components
- Must provide
 - **Monitoring**
 - **Configuration Management**
- And not just for ATCA/uTCA chassis' and cards, but whole system including routers, switches, filesystems, relational database, etc.
 - **Crosses into traditional IT support domain**



Outstanding Issues (1)

- How to monitor resources remotely?
 - **Out-of-band**
 - More expensive, and can add complexity
 - Can still monitor and reconfigure primary functions in some failure scenarios
 - **In-band**
 - Run risk of not being able to get monitoring/configuration through in failure scenario (ex. Network switch misconfiguration)
 - **Protocols and Standards**
 - SNMP (Simple Network Management Protocol)
 - CIM (Common Information Model)
 - IPMI over RMCP
 - Hybrid?



Outstanding Issues (2)

- How to monitor resources remotely (cont'd)
 - **Management console (aka NMS)**
 - Commercial, OpenNMS, custom ?
 - **Automated diagnosis**
 - Beyond threshold alarms
 - **Where is line between OOB (out-of-band) management and control system itself?**



Outstanding Issues (3)

- How to get at remote serial consoles?
 - **ATCA cards, AMC cards, remote FPGA based devices on ethernet field-bus will all have some kind of serial console.**
 - **IPMI 2.0 has SOL (Serial-over-LAN)**
 - Built into various commercial products
 - What do we need to do for our custom hardware?
 - **And again**
 - Out-of-band or In-band



Outstanding Issues (4)

- How to configure resources remotely?
 - **Loading code/configuration to processors, FPGA's, network switches, etc.**
- Need a “resource model” to keep track of state of hundreds of thousands of FRUs and software components.
 - **For ATCA/uTCA, this includes state of hot-swap finite-state-machine of shelf-manager**



Outstanding Issues (5)

- Software frameworks for HA
 - **Is SAF Compliance important?**
 - **Virtual Machines**
 - Xen
 - **Clustering Software**
 - Heartbeat (linux-ha.org)
 - **HA middleware**
 - OpenClovis
 - GoAhead Self-Reliant
 - UIUC ARMOR
- Where is industry (telecom) going with all this?



Aside on OpenClovis

- Was ClovisSolutions (proprietary software)
- Open-sourced all their products recently
 - **Easily downloaded with well-documented examples of much of their functionality.**
 - **Deployment targets provided for Intel ATCA CPUs provided with Arrow starter kit.**
- Good candidate for exploring SAF-compliant middleware.
- Provides “resource model” as well as many libraries to support checkpointing, failover state management, etc.
- Provides SNMP based resource monitoring



Outstanding Issues (6)

- Given a particular control system (EPICS, DOOCS, Tango, etc), and a framework such as OpenClovis, how do we:
 1. **Instrument the control system software so it can be managed by HA middleware?**
 2. **Checkpoint during the operation of a soft-real time control system?**
 - Or even just suspend operation gracefully
 3. **Design device drivers that can readily hand off their state to a peer?**
- Assuming we deem solution of previous issues relevant to increasing availability...