



MISSION OPERATIONS DIRECTORATE SYSTEMS DEVELOPMENT AND OPERATIONS DIVISION



NASA Mission Control Center Software Architecture

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Overview

- ▶ The JSC Mission Control Center is faced with two challenges
 - ▶ Supporting multiple simultaneous activities
 - ▶ Updating facility hardware and software without impacting mission operations
- ▶ MCC architecture has incorporated two solutions to meet these challenges



MCC Support

- Multiple Activities sharing same resources simultaneously
 - Including system upgrades and software testing
- Space Shuttle Program (Mission, Sim, and Test)
 - 7 or 8 flights per year
 - 7 to 16 days per flight
 - 40+ hours of sims per wk. some during flight
- Space Station Program (Mission, Sim, and Test)
 - First Flight 11/97 (1A/R)
 - 24 hours, 7 days/wk, 52 wks/yr. for 30 yrs. starting 12/97 with flight STS-88 (2A)
 - 40+ hours of sims per wk.



The COTS Challenge

- In order to take advantage of Industry Standards and to reduce development costs the MCC migrated to a heavy use of COTS
- COTS products include the operating system (DEC UNIX and AIX), network management, display builder (SAMMI), firmware on DEC machines and Front end Processor (IBM RS6000)
- In order to maintain vendor support, MCC must periodically upgrade to the latest version of COTS



The COTS Solution

- During the Space Shuttle era, the MCC could schedule the upgrades between Shuttle missions
 - This would give the user community sufficient time to recompile any user applications prior to flight support
- Space Station does not give us that luxury
- Space Station era will use Physical isolation
 - All upgrades will be implemented on an isolated platform with a minimal set of support equipment
 - Station Ops will migrate to the upgraded platform after verified without interrupting ISS support



Activity Separation

- ▶ The goal is to provide separation via a simple, robust mechanism, so that workstations and other MCC resources need not be dedicated to a specific operation
- ▶ Simplify end-user configuration of workstations
- ▶ Separate resources, transparently to the users, by how they are used
 - ▶ Global
 - ▶ Vehicle or operation type (Mission, Sim, Test)
- ▶ Same configuration description data supports resource isolation



Activity Separation (cont.)

- Separation of resources accounts for isolation of activities while permitting access to common or shared resources
- Security is facilitated by restricting the user accounts on the global servers and workstations



Resource Separation

Activity Isolation separates resources in three ways:

- Node separation
 - Keeps nodes invisible to each other unless required to support
- Point - to - Point Data separation using Name Registration Services
 - Allows software to locate a service function in the MCC domain
 - Activity information is used with service name to provide isolation
 - Transparent to the users



Resource Separation (cont.)

- ▶ Muticast data separation
 - ▶ Activity information is used with data name to provide isolation
 - ▶ Transparent to the users



Node Separation and COTS

- Node separation is only piece applicable to COTS software
- Critical for separating COTs software packages running in the MCC
 - Host table separations is utilized by activity type (i.e... Mission, sim, test)
 - COTs unable to locate any host not located in the table



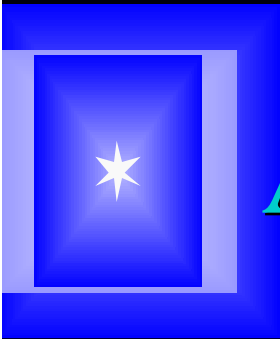
Activity Separation Limitations

- Activity Separation does have a number of limitations
 - NASCOM, external communications network is based on physical or logical constraints
 - Limited shared resources such as the Consolidated Data Select Switch, Giga Switch
 - Common OS, affects baseline upgrades
- Drove the requirement for a physically isolated domain to support Space Station in the MCC



Future Challenges

- As more COTS applications become available existing custom capabilities will have to be continually evaluated for possible replacement
- Vendor and platform instability
 - Constant changing OS, will require determination of backward compatibility and when you should upgrade
 - Older hardware platforms may not support newer software



Attachments