MISSION OPERATIONS DIRECTORATE
SYSTEMS DEVELOPMENT AND OPERATIONS DIVISION

NASA Mission Control Center Software Architecture
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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
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