# Atmospheric Science Data Center
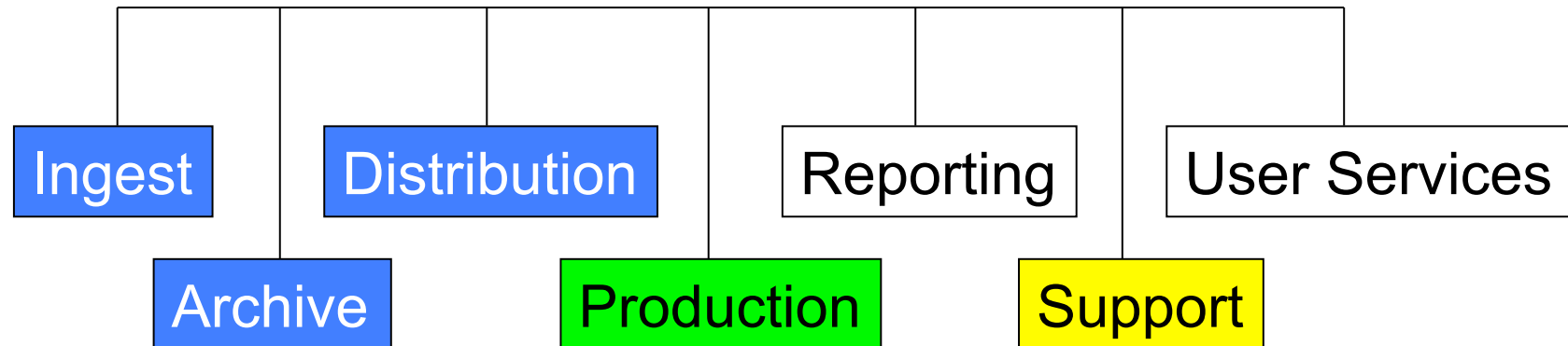
# CERES Science Team Meeting

April 28, 2009

Hampton, VA

# Summary

- ASDC Partners with CERES
  - Evolve CERES Data Products
  - Support Cal/Val of instruments and Data Products
  - Preserve long-term Climate Data Records

- Modernize ASDC
  - Speed access to Data Products
  - Increase capacity to re-process CERES data faster
  - Increase accessibility of Data Products

- Elements
  - ANGe – Storage Management Upgrade
  - AMI – Hardware Modernization
  - PAM – Production Automation Modernization

# ASDC Breakdown

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┌──────┬──────────┬──────────┬──────────┬──────────┐
Ingest   Distribution        Reporting    User Services
     Archive          Production      Support
```

# ASDC Archive Systems

- **Recent Progress**
  - CERES Archive Management migrated to ANGe
  - Problems with ASDC Archive Reliability resolved (StorNext)
  - All Orderable CERES Products at ESDIS Clearinghouse (ECHO)
  - ASDC Order Tool continues to be primary distribution path
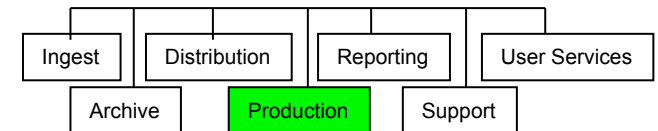
- **Projected Progress**
  - CERES Ingest functions to support FM5 Testing
  - Conversion of ANGe to Disk-based archive
  - Replacement of Tape Libraries with LTO-4 Tape System
  - Migrate data products from tape to disk (1 year)

| Ingest | Distribution | Reporting | User Services |
|---|---|---|---|
| Archive | Production | Support | |
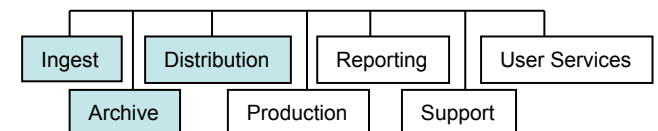
# Production

- Science teams want faster reprocessing turn around
  - MISR looks for 5-10x improvement over previously agreed to capabilities
    - Past rates ~2x-4x
    - Current reprocessing campaign peaking >20x
  - CERES aims for aggressive rates for reprocessing (50-100x)
    - 10x reprocessing rates experienced in the past
    - Currently have over 25 instrument years of data
    - Science need to reprocess all 25 years in a year for new version to be useful

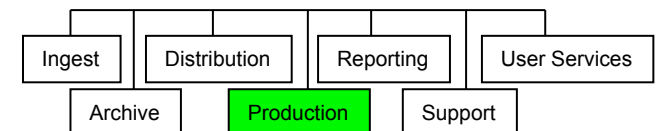| Ingest | Distribution | Reporting | User Services |
|--------|--------------|-----------|---------------|
| Archive | Production | Support | |

# ASDC Production Systems

- ## Recent Progress
  - Improve use of Sun Grid Engine (SGE) in production
  - Hardware upgrade in progress
  - Consolidation of toolkit/cereslib to single location
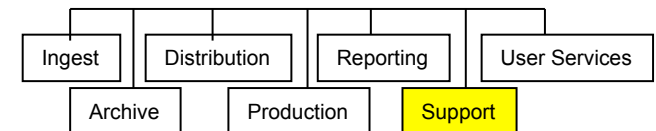
- ## Planned Progress
  - Improve commonality of SCF and Production resources
  - Continue SGE Improvements
  - Complete deployment of disk-based fiberchannel archive
  - Retire warlock (SGI-3800) by end of year

| Ingest | Distribution | Reporting | User Services |
|--------|--------------|-----------|---------------|
| Archive | Production | Support | |

# SCF Support to CERES

- **Tight integration of Science Computing Facility (SCF) with ASDC Resources**
  - Reliable, high speed access to Data Products by SCF
  - Consolidated set of input data, libraries, toolkits
  - Interactive processing by small groups
  - Batch processing using SGE on cluster
  - Improve persistence of user data
    - Revolving backups
    - Permit user archiving of non-production data products

- **Move SCF to B1268C**
  - Air conditioning capacity
  - Stable Electric Power (UPS)

| Ingest | Distribution | Reporting | User Services |
|--------|--------------|-----------|---------------|
| Archive | Production | Support | |

# Hardware Upgrade

- **Replace Data Product Production System**
  - Homogeneous IBM environment, designed integrated
  - ~300 Linux processing nodes acquired
    - Big-endian and Little-endian processors integrated access to disk
  - 1.2 petabytes of raw disk storage
  - High-speed connections between components
    - Fiberchannel through fast, wide switches
  - 5 years prepaid maintenance

- **Backup, Archive and disaster recovery**
  - Replace miscellaneous tape systems with LTO-4 Libraries
  - Compatibility between ASDC/SCF tape systems
  - Auto revolving backup of working files (interactive)
  - Permit users to archive non-Production data products
  - ANGe archives Production Data Products

| Ingest | Distribution | Reporting | User Services |
| --- | --- | --- | --- |
| Archive | Production | Support | |
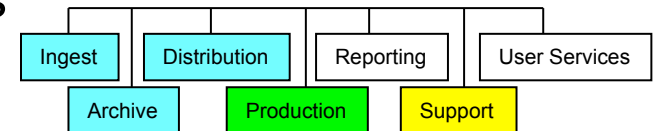
# Schedule for Capabilities

- May 1, 2009

- May 4-8, 2009

- May 14, 2009


- May 15, 2009




- May 21, 2009

- October, 2009

- December, 2009

- December 31, 2009

- SGI3800 Move to B1268c
  - Thunder/lightning replaced

- User Training: IBM, SGE

- PI to provide priority for data product migration to disk

- AMI (IBM) operational
  - SCF Disk/Processors
  - Code Delivery to ASDC
  - Data Product Processing

- FM-5 Interface test (PAN/PDR)

- Tape System Operational

- Data Migration Complete

- Warlock off maintenance

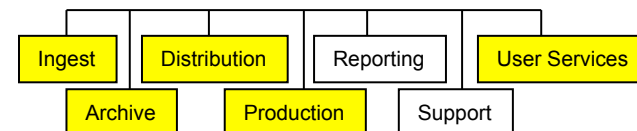Backup Slides

# AMI Initial Operational Capability

- **ASDC**
  - Production Processors available to Operators
  - Ready to accept code delivery
  - Disk System Directories created and data migration started
- **Combined**
  - Consolidated Source of cereslib, toolkit available
  - Limited NFS, AFP, SAMBA access to disks
  - Data Product File Systems
    - Data migrated from earlier disk array
    - New data products available on disk
- **SCF**
  - SCF Processors available to Authorized Users
    - Interactive blades (Power6)
    - SGE Batch processors
  - Initial increment of SCF Disk System available
    - Quotas Assigned to Groups based on Payment
  - Read-only access to ASDC Data Products

| Ingest | Distribution | Reporting | User Services |
| Archive | Production | Support | |
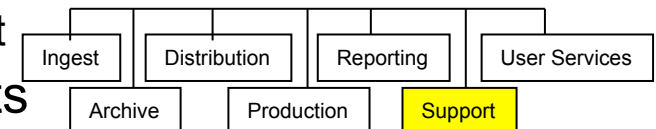
# Plans for Next 1 to 2 Years

- Mature ANGe
- Finalize the setup and configuration of new processing hardware
- Prepare and reprocess MISR data
- Retire and minimize use of CERES SGI processing systems
- Tightly integrate ASDC and CERES SCF
- Automate CERES processing
- Prepare ANGe to support new data providers
- Collaborate with partners to provide for more data fusion

| Ingest | Distribution | Reporting | User Services |
|--------|--------------|-----------|---------------|
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# Plans for Next 3+ Years
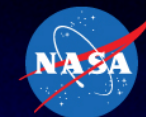
- Continue to modernize ANGe

- Continue to modernize processing and archive environments

- Assume long term preservation of data

- Prepare and reprocess MISR data

- Explore using ANGe flexibility to support external archive requirements

- Continue to collaborate with partners to provide for more data fusion

| Ingest | Distribution | Reporting | User Services |
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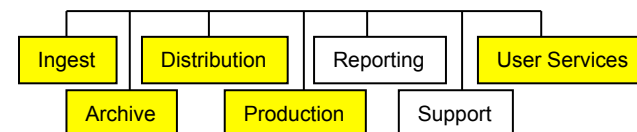
# ASDC & SCF Integrated Architecture

ASDC SDP Production

| Box | Label |
|---|---|
| 56 P6 256GB | |
| 56 P6 256GB | |
| 56 P6 256GB | |
| 56 P6 256GB | |
| 56 P6 256GB | |

**ASDC JBOSS Server & TS-1 & Ingest**

**Common SANhead (NFS) (AFP) (Samba)**

**SCF Cluster (Access through Sun Grid Engine)**

LB1  LB1

**SCF Interactive Processors**

14 4P6@8GB

Db Server  Db Server

64 x86 SMP 256 GB

64 x86 SMP 128 GB

16 x86 HS12 64 GB

64 x86 SMP 256 GB

56 P6 256GB

Instrument | Instrument | ERBE-like | TISA | TISA | SARB | Consodine | SOFA | Clouds | Clouds | WWW | WWW | SRB/Power | SRB/Power

**Fiberchannel Switch**

| 220TB DS4800 | 220TB DS4800 | 220TB DS4800 | 220TB DS4800 | 220TB DS4800 | 220TB DS4800 | 64 x86 SMP 128 GB | | 220TB DS4800 | 220TB DS4800 | 64 x86 SMP 128 GB |

**ASDC Disk Archive (R/W Production) (R/O SCF)**

**ECS DUE Processing**

FC Monitor

**SCF Disk Array**

**Cloud Modeling Cluster (Xu)**

Sim Server

**GPU Experiment (YongHu)**

3755 — Tesla

3755 — Tesla

# Basic System for ASDC

- Permits only running in production by operators, not adhoc by users
- CERES Production Processing System
  - 224 Power6 processors in LINUX (4GB per processor)
  - 128 Xeon SMP in LINUX (4GB per processor)
    - Commercial ADA for Legacy Instrument codes
    - Shared access to memory permits dynamic allocation to processor
    - IDL running on Shared License server
  - Eventually integrate legacy systems
    - 124 Power4 processors in LINUX (2GB per processor)
    - Legacy SGI3800 as interim fix
- Flashflux, SRB processing, MISR reprocessing
- JBOSS Server for ANGe
  - Production 32 Xeon SMP in LINUX (2 GB per processor)
  - Test/development environment matching production which can be re-allocated if needed to production
- Database Server
- Dropbox for ingest
- WWW cluster to deliver data and public information
- DAAC Unique Enhancements for ECS processing
  - MISR subsetting
  - Others
- Storage of Archived data
  - 900TB (usable) RAID-5 in 6 Chassis
    - 200 TB CERES Aqua+Terra
    - 150 TB MODIS Aqua+Terra
    - 150 TB CERES NPP
    - 200 TB VIIRS
  - Expansion capacity to 10 PetaBytes
- Communications
  - Internal Fiberchannel dual 4GB FC for data sharing
  - Control and Monitor via TCP/IP
  - External NFS, Samba, AFP via GB ethernet from multiple file servers
- Support
  - Installation and Checkout by IBM
  - 24x7x365 for 5 years

# Basic System for SCF

- User directed Processing System
  - Interactive IBM Systems
    - 56 Power6 processors assigned to subsystems (interactive) (4GB@)
  - SGE-based batch IBM systems
    - 56 Power6 processors in LINUX cluster (4GB per processor)
    - 64 Xeon SMP in LINUX (4GB per processor)
      - Commercial ADA for Legacy Instrument codes
      - Shared access to memory permits dynamic allocation to processor
  - Replacement for angler (Louis Nguyen)
  - Tesla GPU server processing (Yongxiang Hu)
  - Cloud Modeling System (Kuan-man Xu) (IBM)
  - Global Climate Modeling System (David Consodine) (IBM)
  - RAQMS Modeling System (Jay Al Saadi) (SGI)
  - Legacy systems
    - Continue SGI3800 as interim fix for legacy CERES codes (Norm Loeb)
    - Mac G5 cluster
- Storage
  - IBM Read-only access to ASDC Storage via fiberchannel
  - Read/Write access to User directed IBM storage via fiberchannel
    - 330TB (usable) RAID-5 in 2 Chassis
      - Allocated by Instrument/subsystem team
    - Expansion capacity to 10 PetaBytes
  - Legacy Systems
    - Continue usage of existing legacy Apple SAN systems
- Communications
  - Internal Fiberchannel dual 4GB FC for IBM
  - External NFS, Samba, AFP via GigE from multiple file servers
  - Continued NFS, Samba, AFP via GigE for legacy storage systems
- Support
  - 24x7x365 for 5 year

# Production Use Model

- Minimize idle time on processors
  - Guarantee minimal levels of processer availability to projects based on funding
  - Prioritize production requests

- Encourage homogeneity among supported science team processing environment
  - Suse version of Linux

- Recognize that one size does not fit all
  - Big endian and little endian processors
  - Small number of big files vs large number of small files
  - Hardware not suitable for all needs

| Ingest | Distribution | Reporting | User Services |
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