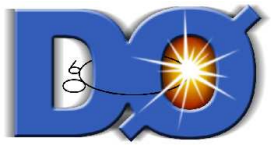
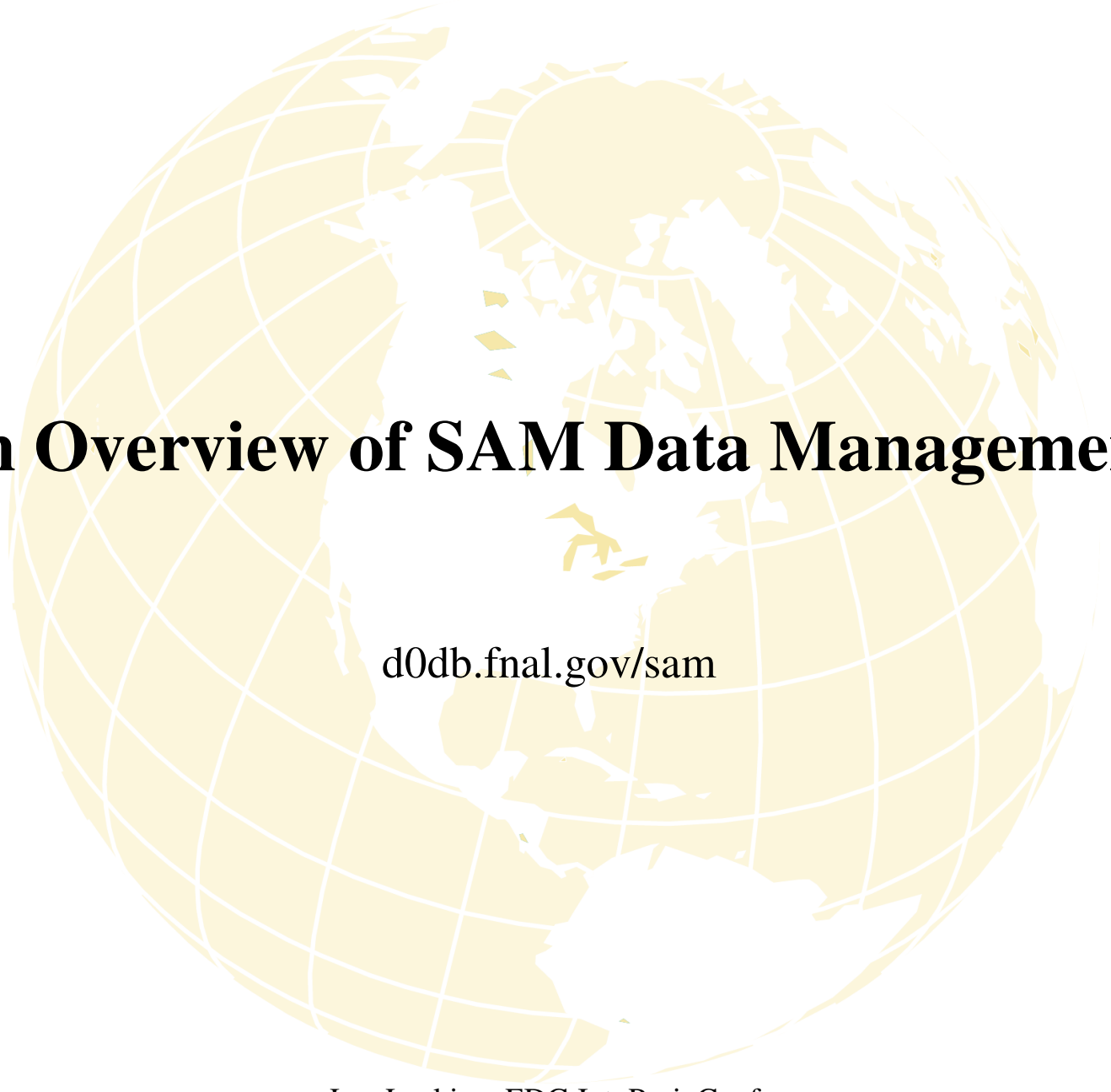


SAM Replica Catalog

EDG
May 12-16, 2003
Lee Lueking
Fermilab
Computing Division

Roadmap of Talk

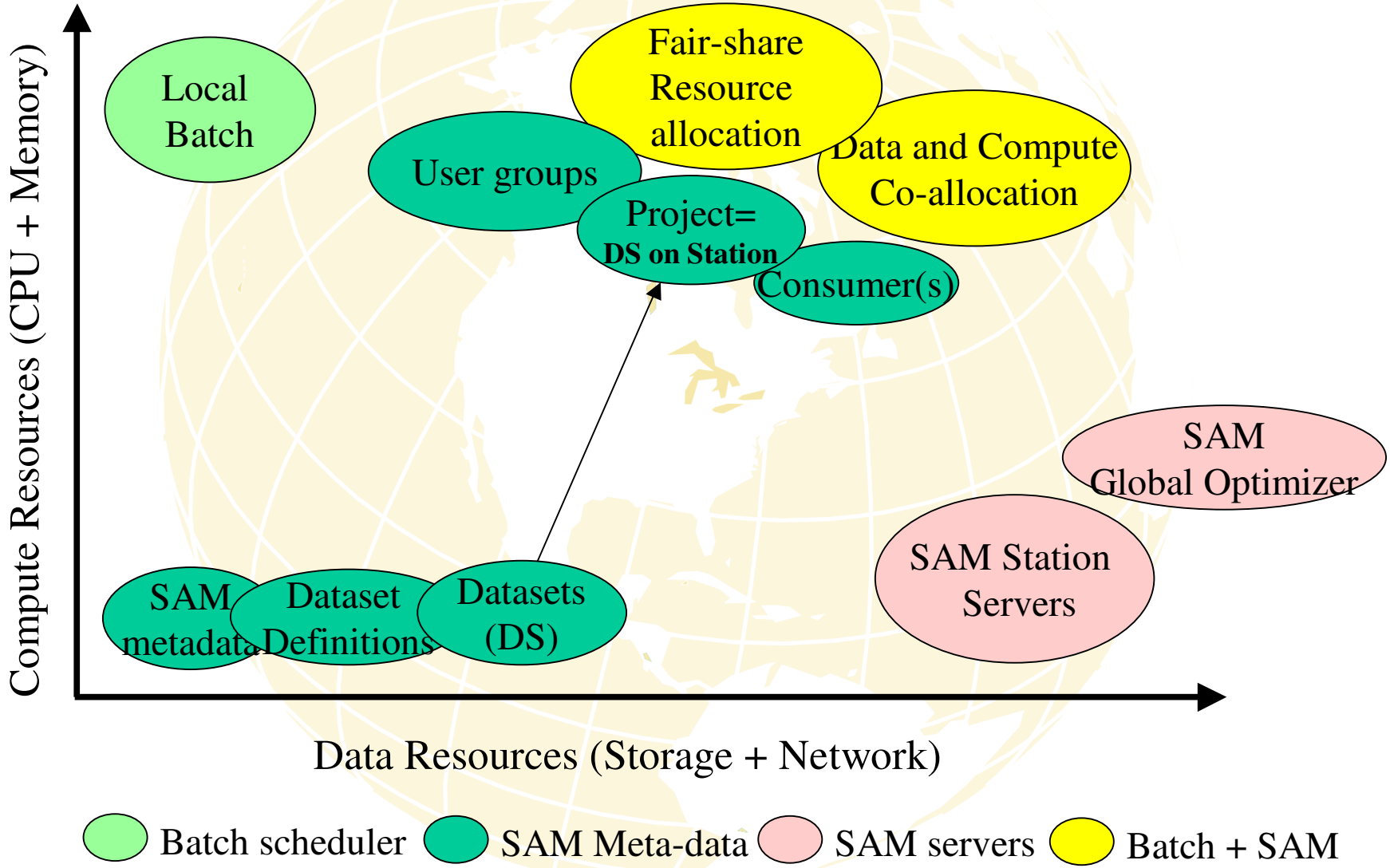
- SAM Data Management Overview
- EDG - SAM Cross Reference
- SAM Features and Use Case Examples
- EDG – SAM Command Reference
- Summary



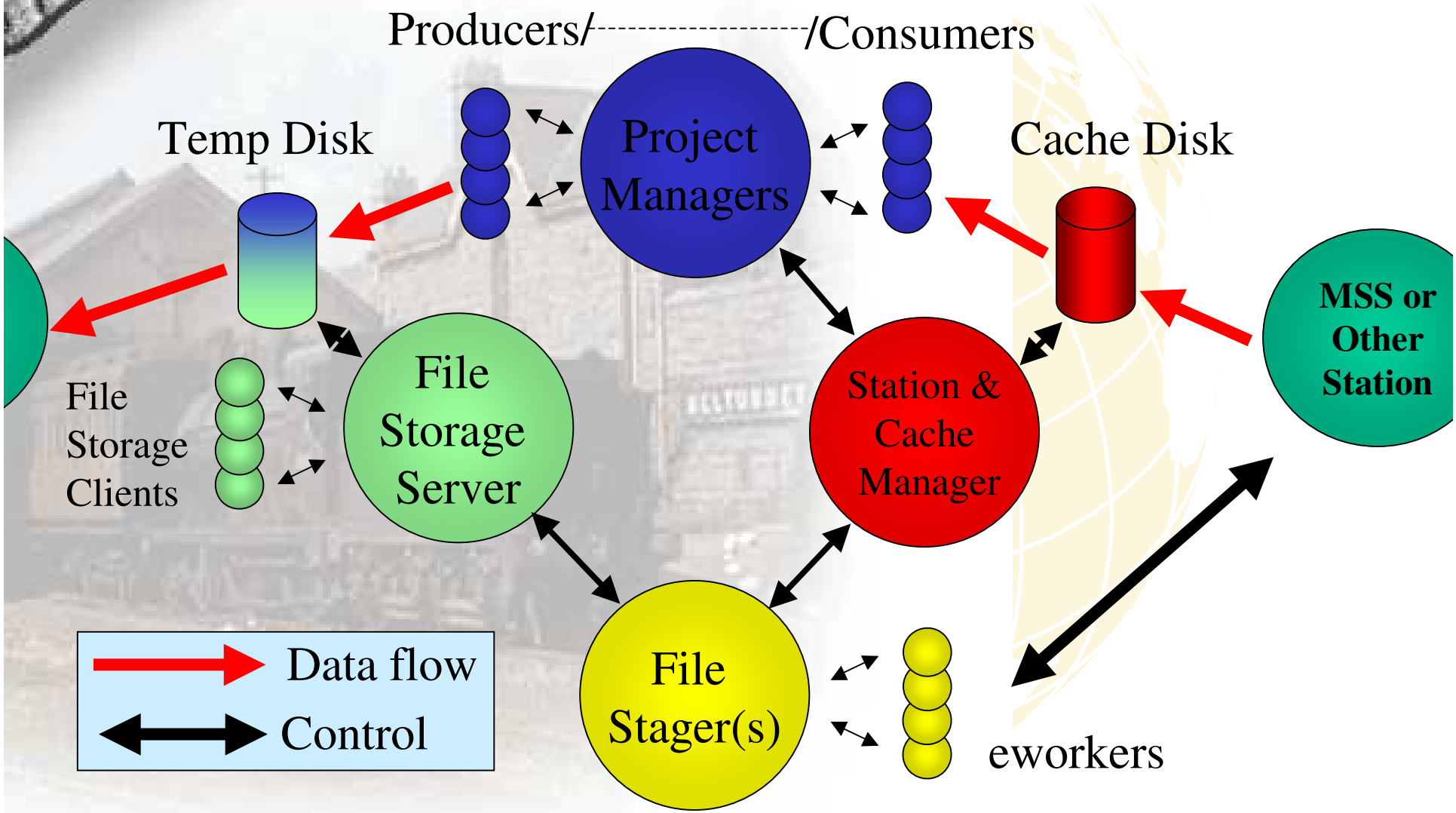
An Overview of SAM Data Management

d0db.fnal.gov/sam

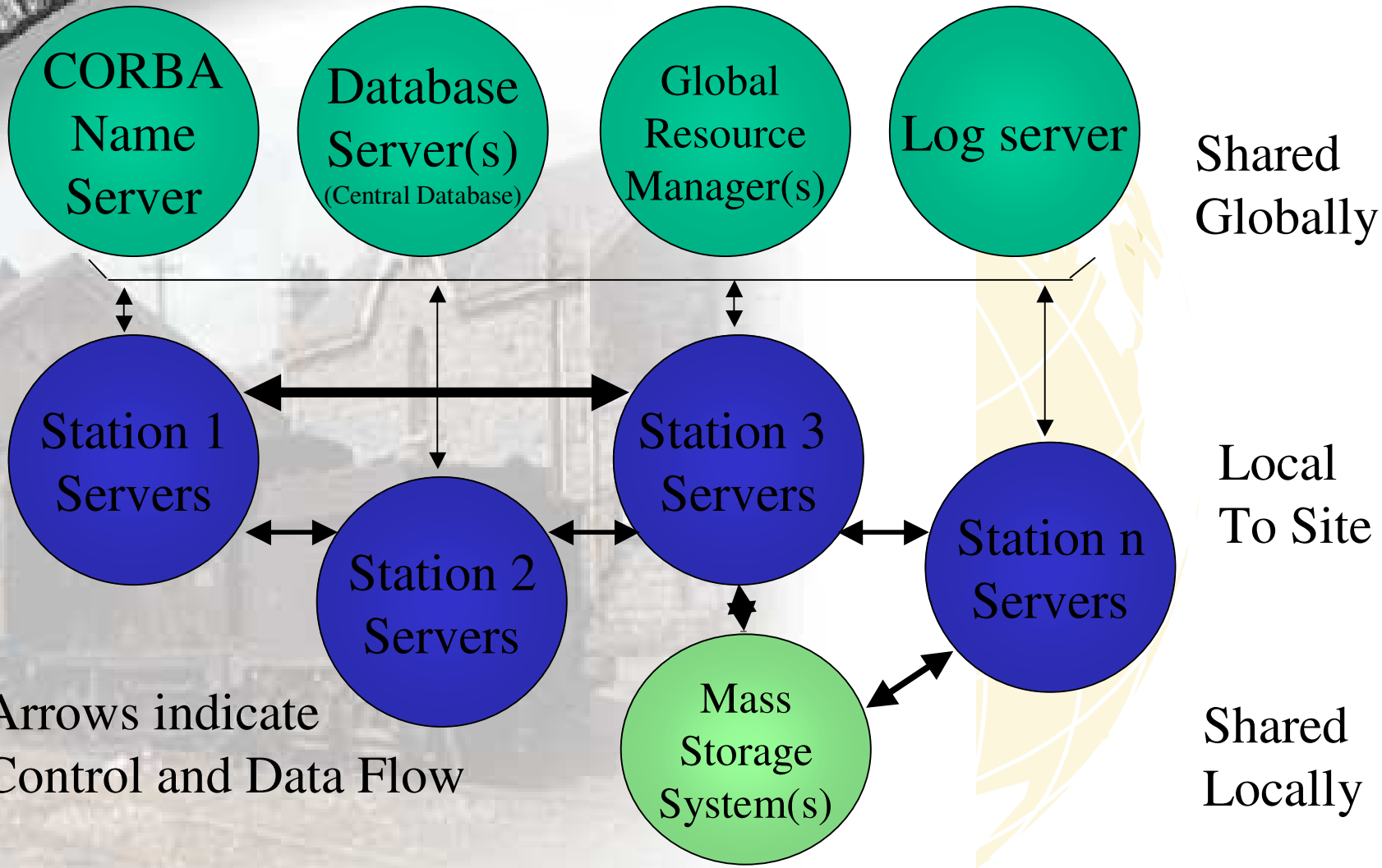
Managing Resources in SAM

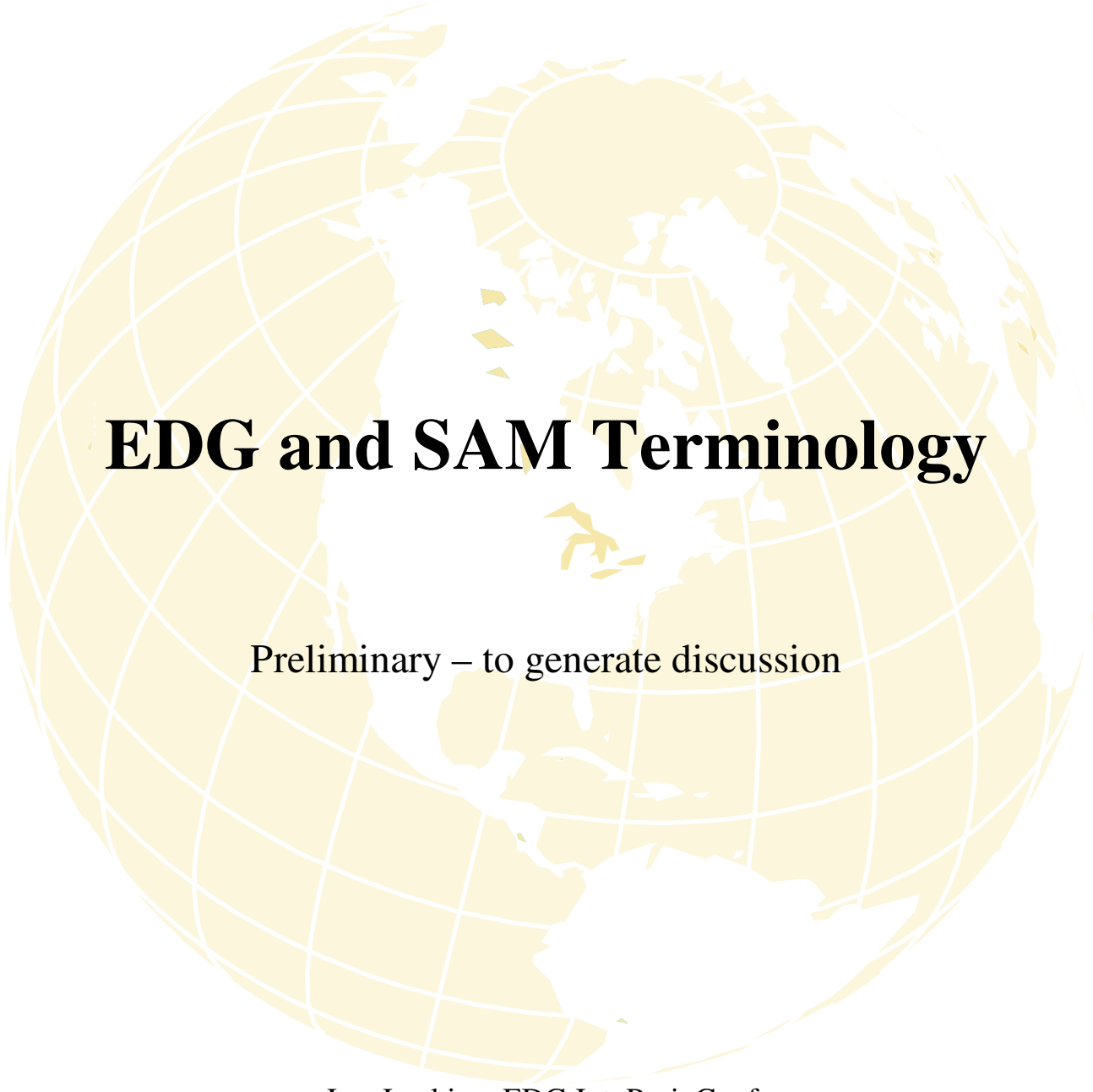


SAM Station Components



SAM as a Distributed System





EDG and SAM Terminology

Preliminary – to generate discussion

Naming Conventions

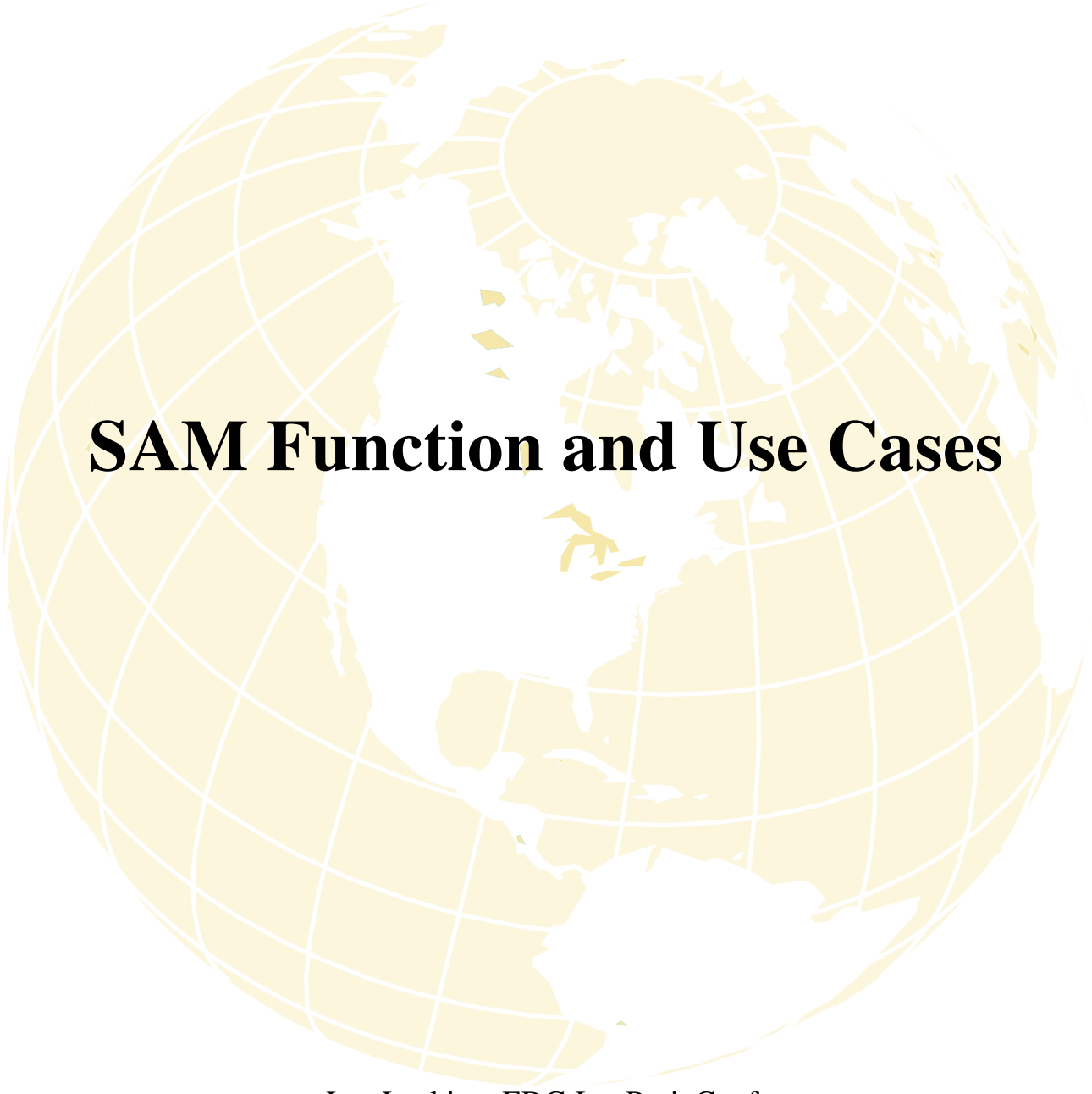
EDG Acronym	EDG Name	SAM Name or comment
SFN	Storage File Name	File Name w/ host or station information
UUID	Universally Unique IDentifier	
GUID	Grid Unique IDentifier	
LFN	Logical File Name	File Name/ Must be unique
TURL	Transport URL	

Data Management

EDG Acronym	EDG Name	SAM Name or Comment
DMS	Data Management Services	SAM provides data management and adapters to storage systems.
RMS	Replica Management Services	Provided through SAM Stations in conjunction with SAM DB and Global Optimizer
RFT	Reliable File Transfer	SAM Stager. Uses retries and CRC to assure reliable transfer
SRM	Storage Resource Manager	SAM Station Cache management. Part of SAM station servers.

Replica Management

EDG Acronym	EDG Name	SAM Name or Comment
ERM	EDG Replica Manager	CORBA IDL's, SAM user interface
RLS	Replica Location Service	Through SAM DB server
LRC	Local Replica Catalog	File Locations table in Central SAM Database
RLI	Replica Location Index	Central Database
RMC	Replica Metadata Catalog	Data_files table in DB
ROS	Replica Optimization Service	SAM Optimizer
RSH	Replica Storage Handler	SAM Station



SAM Function and Use Cases

Storing and Accessing SAM Data and Meta-Data

- ✓ **Sam store**
  - **Description of metadata,**
  - **Auto destination**
  - **Station data forwarding**
- ✓ **The SAM Schema**
  - **tracking file lineage**
  - **The concept of "dimensions"**
- ✓ **SAM data Access**
  - **Using file metadata to create logical sets of files**
  - **Accessing files through projects on SAM stations**
- ✓ **SAM Station file replication and cache management**
  - **Station configurations with and without SAM stagers on workers**

Storing Data

sam store –desc=DescriptionFile.py

- ✓ **Description files**
  - **Physics and file metadata is provided in description files.**
  - **Description files are Python scripts**
  - **Description files are required to store data.**
  - **Latest version of description file uses name – value pairs for more flexibility in adding parameters for data and MC files**
- ✓ **Auto-destination**
  - **A map which relates information in the description file to physical storage location**
- ✓ **File forwarding**
  - **Data is forwarded from source station to designated physical storage location**

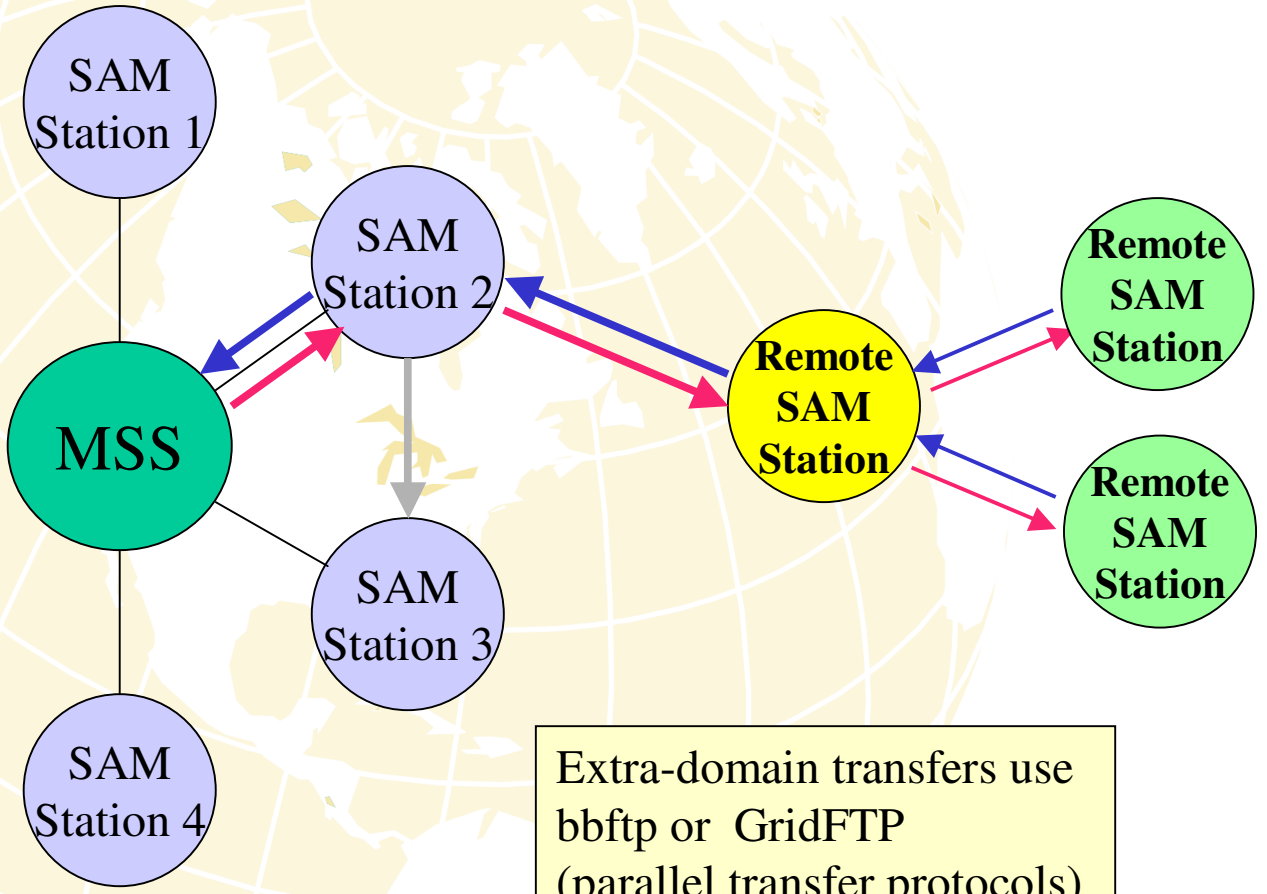
Example Description File

```
from import_classes import *
#
# Generated by runMCwin
#
my_d0gstar   = AppFamily( "simulator","p07.00.05a","d0gstar" )
class MyProcess(ProcFamily):
    group="higgs"
    origin_location="FNAL"
    origin_facility="d0mino"
    produced_for="Qizhong Li"
    phase="group-phase1"
    def __init__(self, stream, param_file, produced_by):
        self.stream=stream
        self.param_file=param_file
        self.produced_by=produced_by
class Simulator(MyProcess):
    appfamily=my_d0gstar
channel = Channel("bbh","bbbb")
minbi = MinBias("none","0.0")
d0g_fil=Simulator(stream="notstreamed",
                  param_file="d0gstar_test185201919.params",
                  produced_by="Avto Kharchilava")
d0g_file_import =SimulatedFile("d0g.pythia_bbh_bbbb1.dat",
    d0g_fil, 65123, Events(1, 500, 500),
   "07/03/2001 17:44", "07/04/2001 05:23",
    "pythia_bbh_bbbb1.dat", 1, 1, channel)
```

Data to and from Remote Sites

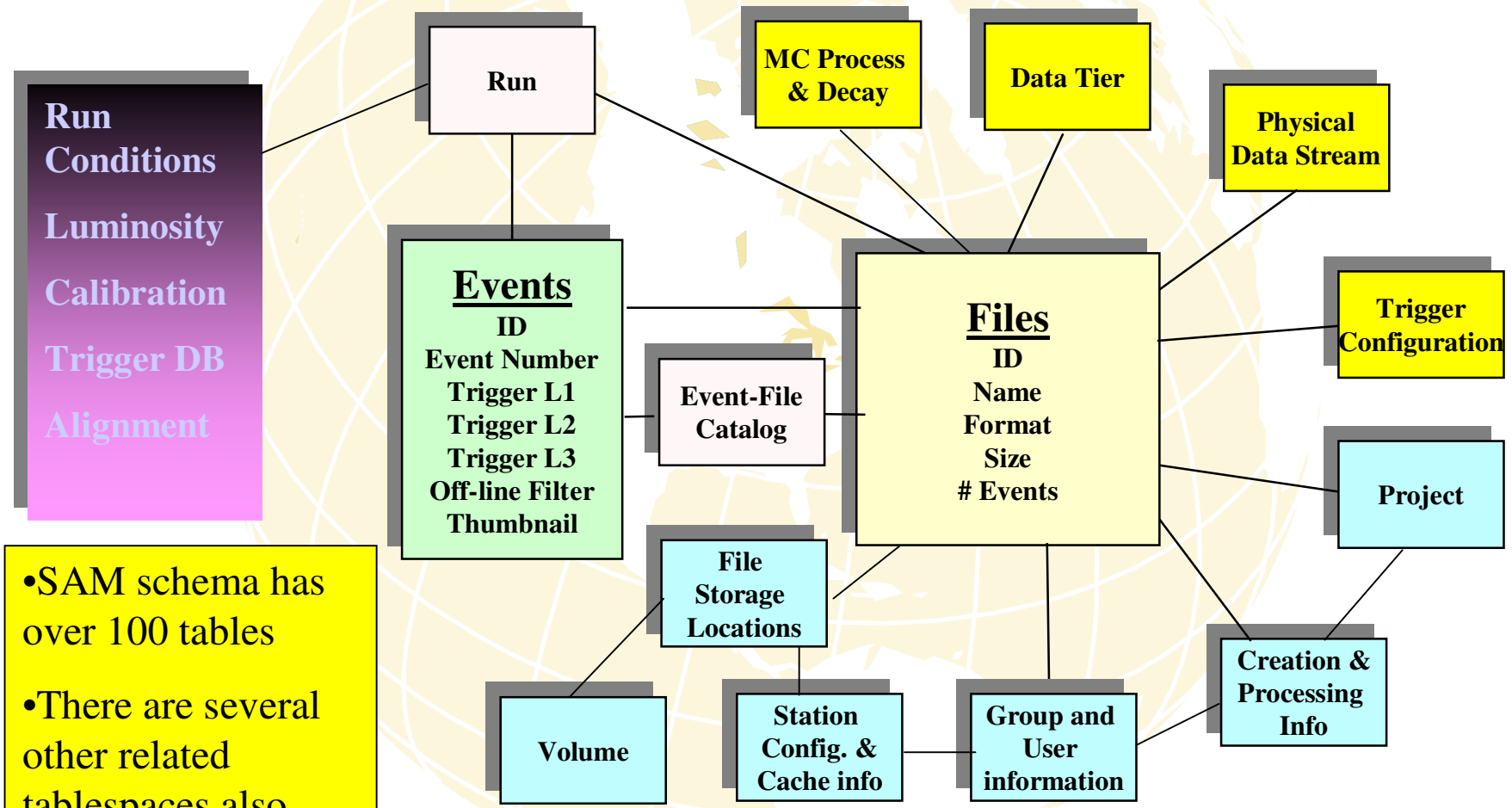
Data Forwarding and Routing

Station Configuration
- **Replica location**
  - **Prefer**
  - **Avoid**
- **Forwarding**
  - **File stores can be forwarded through other stations**
- **Routing**
  - **Routes for file transfers are configurable**



Extra-domain transfers use bbftp or GridFTP (parallel transfer protocols)

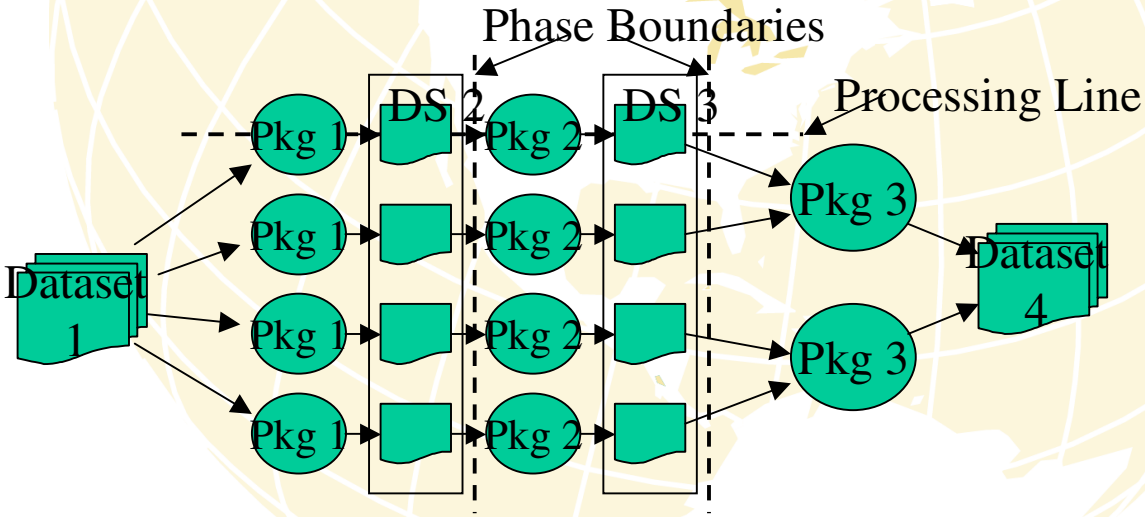
SAM Simplified Database Schema

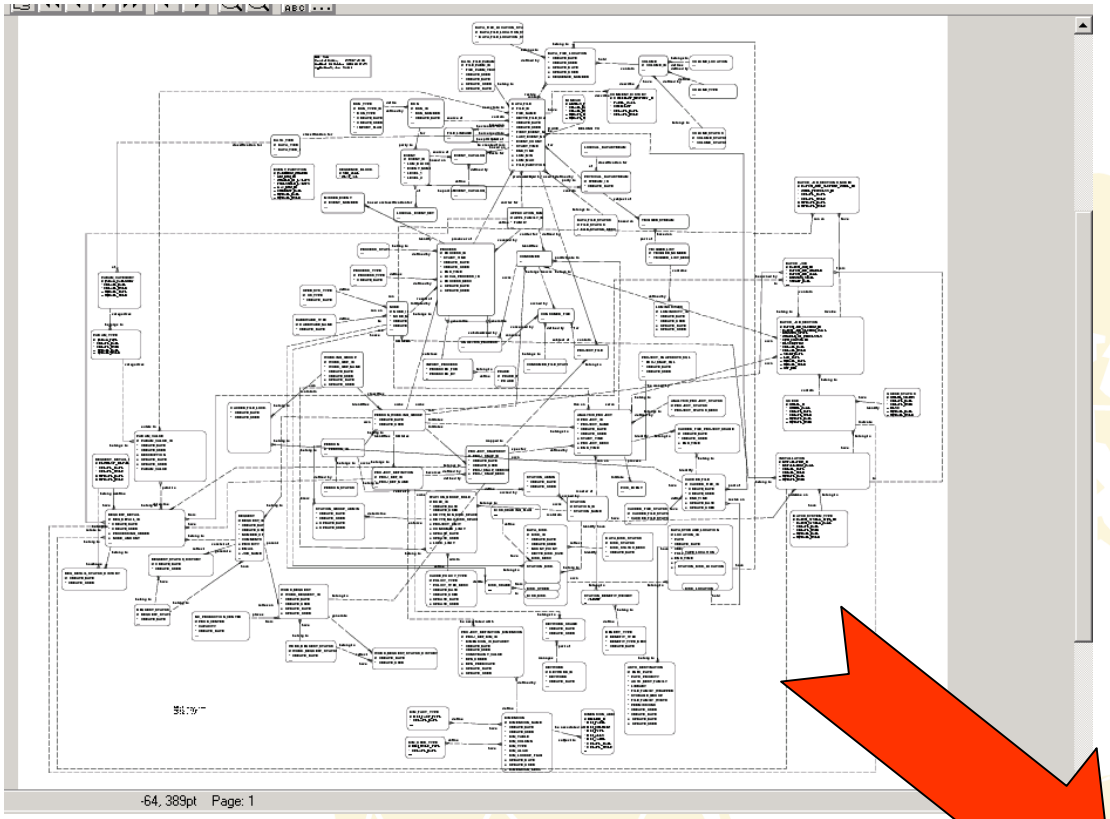


- SAM schema has over 100 tables
- There are several other related tablespaces also available

Tracking File Lineage

- ✓ Application name and version information
- ✓ Parent or parents information
- ✓ File splitting and merging.





Challenge: Transform the complex SAM schema into a form that is user friendly, and avoids badly formed user SQL queries.

Solution: Transform the schema to look like one giant table.

DataFile

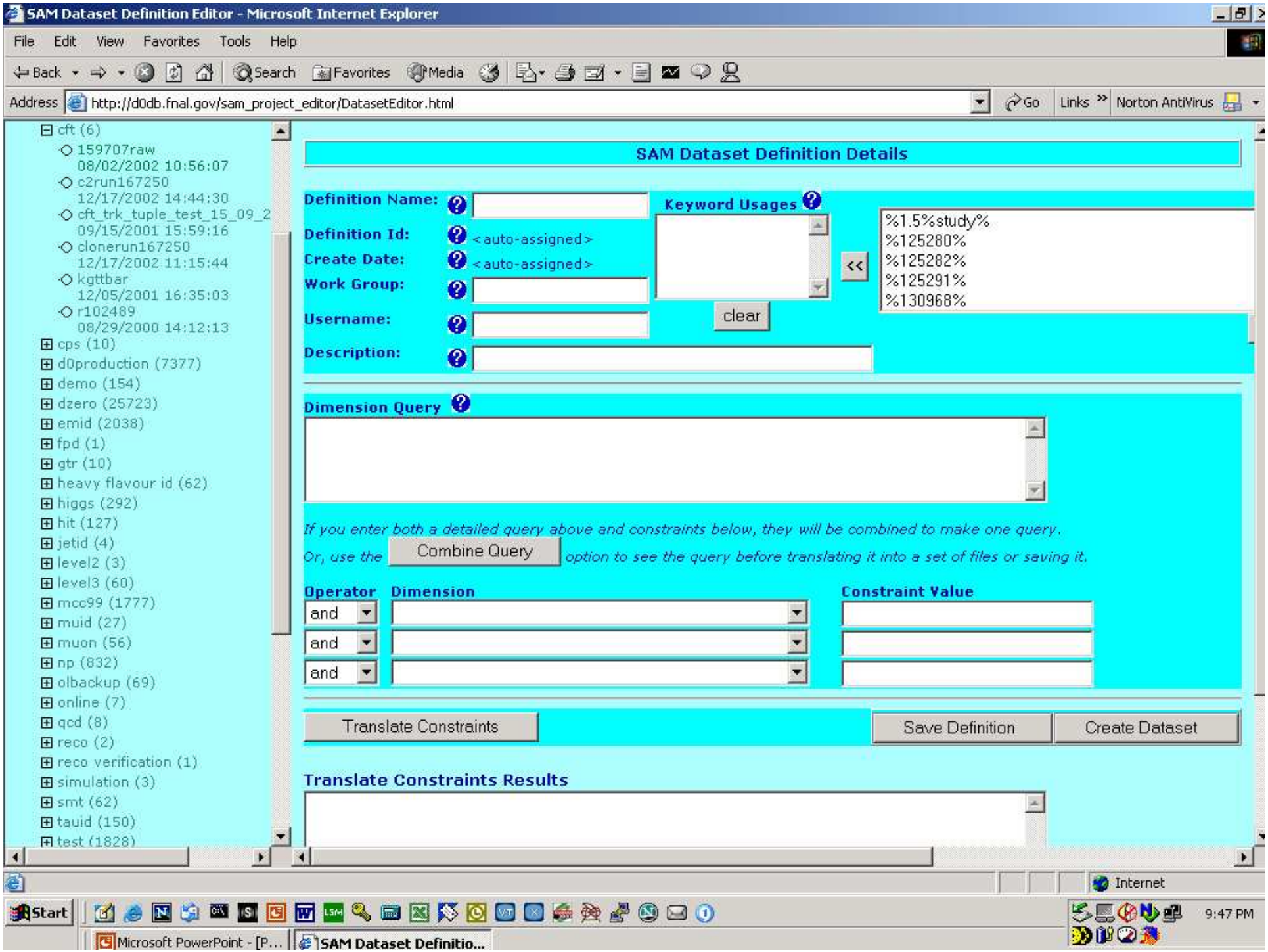
Dimension Name

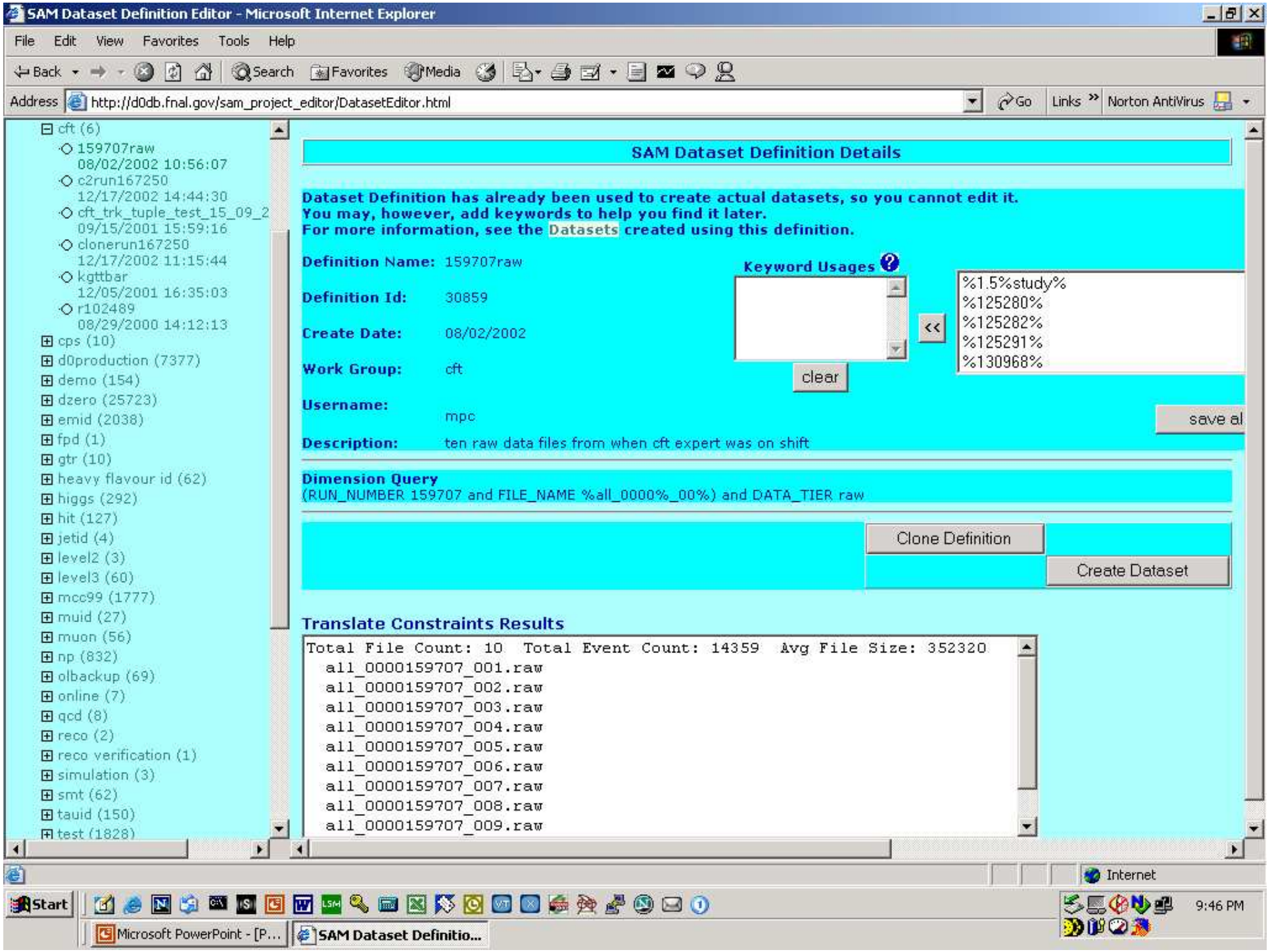
file	Run	Event	Date	Trigger	Apo	App vsn	…
file1							
file2							
file3							
file4							
file5							
filen							

●●●

Accessing Data: Defining Datasets

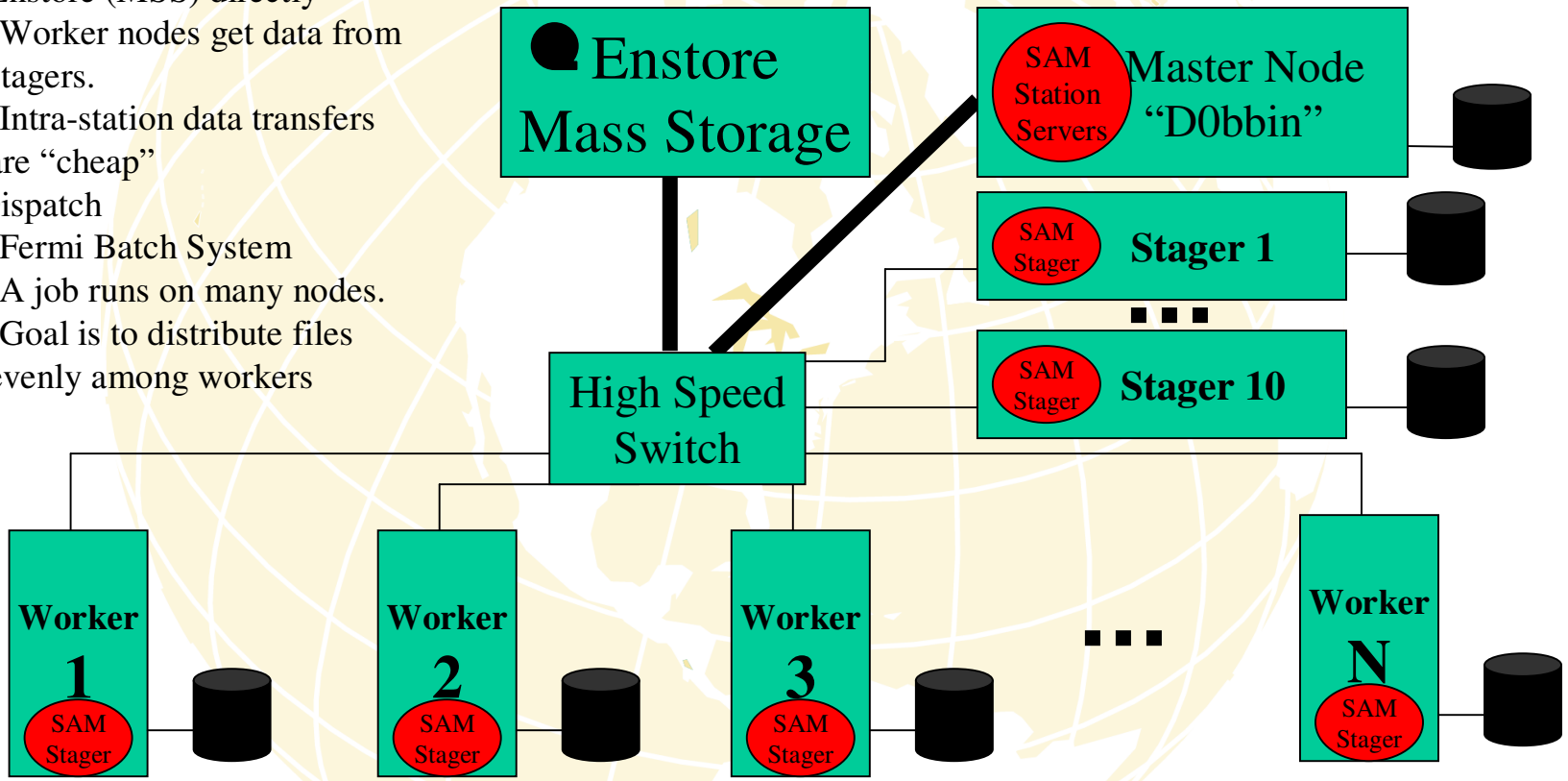
- ✓ There are dozens of dimensions available and they are easily defined.
  - APPL_NAME, APPL_NAME_ANALYZED, CONSUMED_DATE, CONSUMED_STATUS, CONSUMER, CONSUMER_GROUP, CONSUMER_ID, CREATE_DATE, DATASET_DEF_ID, DATASET_DEF_NAME, DATASET_ID, DATASET_VERSION, DATA_FILE_LOCATION_STATUS, DATA_TIER, DATA_TIER_ANALYZED, DELIVERED_STATUS, EVENT_NUMBER, FAMILY, FAMILY_ANALYZED, FILE_ANALYZED, FILE_NAME, FILE_PARTITION, FILE_STATUS, FULL_PATH, LOGICAL_DATASTREAM_NAME, PARAM_TYPE, RUN_ID, RUN_NUMBER, RUN_QUALITY, VERSION, VERSION_ANALYZED, WORK_GRP_NAME , etc., etc., etc.
- ✓ __SET__ : Special dimension allowing you to include an existing dataset definition.
- ✓ Constraint operators:=, !=, >, < >=, <=, like, not like, in, not in, between, is null, is not null
- ✓ Sets operators: and, or, minus, (union, intersection to be added)
- ✓ syntax: --dim="[(]name [conOper] value [setOper name [conOper] value][)] ..."
- ✓ Command line examples:
  - **sam define dataset** --defname=dataset_definition_name --group=work_group_name --dim="(run_number 100930 data_tier digitized) minus physical_datastream_name electron+jet"
  - **sam create dataset** --defname=dataset_definition_name


SAM Dataset Definition Editor - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://d0db.fnal.gov/sam_project_editor/DatasetEditor.html
Go Links Norton AntiVirus
cft (6)
159707raw 08/02/2002 10:56:07
c2run167250 12/17/2002 14:44:30
cft_trk_tuple_test_15_09_2 09/15/2001 15:59:16
clonerun167250 12/17/2002 11:15:44
kgttbar 12/05/2001 16:35:03
r102489 08/29/2000 14:12:13
cps (10)
d0production (7377)
demo (154)
dzero (25723)
emid (2038)
fpd (1)
gtr (10)
heavy flavour id (62)
higgs (292)
hit (127)
jetid (4)
level2 (3)
level3 (60)
mcc99 (1777)
muid (27)
muon (56)
np (832)
olbackup (69)
online (7)
qcd (8)
reco (2)
reco verification (1)
simulation (3)
smt (62)
tauid (150)
test (1828)
SAM Dataset Definition Details
Definition Name:
Definition Id: <auto-assigned>
Create Date: <auto-assigned>
Work Group:
Username:
Description:
Keyword Usages
clear
<<
%1.5%study%
%125280%
%125282%
%125291%
%130968%
Dimension Query
If you enter both a detailed query above and constraints below, they will be combined to make one query.
Or, use the Combine Query option to see the query before translating it into a set of files or saving it.
Operator
Dimension
Constraint Value
and
and
and
Translate Constraints
Save Definition
Create Dataset
Translate Constraints Results
Internet
Start
Microsoft PowerPoint - [P...
SAM Dataset Definitio...
9:47 PM


SAM Dataset Definition Editor - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://d0db.fnal.gov/sam_project_editor/DatasetEditor.html
Go Links Norton AntiVirus
cft (6)
159707raw
08/02/2002 10:56:07
c2run167250
12/17/2002 14:44:30
cft_trk_tuple_test_15_09_2
09/15/2001 15:59:16
clonerun167250
12/17/2002 11:15:44
kgttbar
12/05/2001 16:35:03
r102489
08/29/2000 14:12:13
cps (10)
d0production (7377)
demo (154)
dzero (25723)
emid (2038)
fpd (1)
gtr (10)
heavy flavour id (62)
higgs (292)
hit (127)
jetid (4)
level2 (3)
level3 (60)
mcc99 (1777)
muid (27)
muon (56)
np (832)
olbackup (69)
online (7)
qcd (8)
reco (2)
reco verification (1)
simulation (3)
smt (62)
tauid (150)
test (1828)
SAM Dataset Definition Details
Dataset Definition has already been used to create actual datasets, so you cannot edit it.
You may, however, add keywords to help you find it later.
For more information, see the Datasets created using this definition.
Definition Name: 159707raw
Definition Id: 30859
Create Date: 08/02/2002
Work Group: cft
Username: mpc
Description: ten raw data files from when cft expert was on shift
Keyword Usages
<<
clear
%1.5%study%
%125280%
%125282%
%125291%
%130968%
save al
Dimension Query
(RUN_NUMBER 159707 and FILE_NAME %all_0000%_00%) and DATA_TIER raw
Clone Definition
Create Dataset
Translate Constraints Results
Total File Count: 10 Total Event Count: 14359 Avg File Size: 352320
all_0000159707_001.raw
all_0000159707_002.raw
all_0000159707_003.raw
all_0000159707_004.raw
all_0000159707_005.raw
all_0000159707_006.raw
all_0000159707_007.raw
all_0000159707_008.raw
all_0000159707_009.raw
Internet
Start
Microsoft PowerPoint - [P...
SAM Dataset Definitio...
9:46 PM

SAM Station: Dzero Distributed Cache Reconstruction Farm

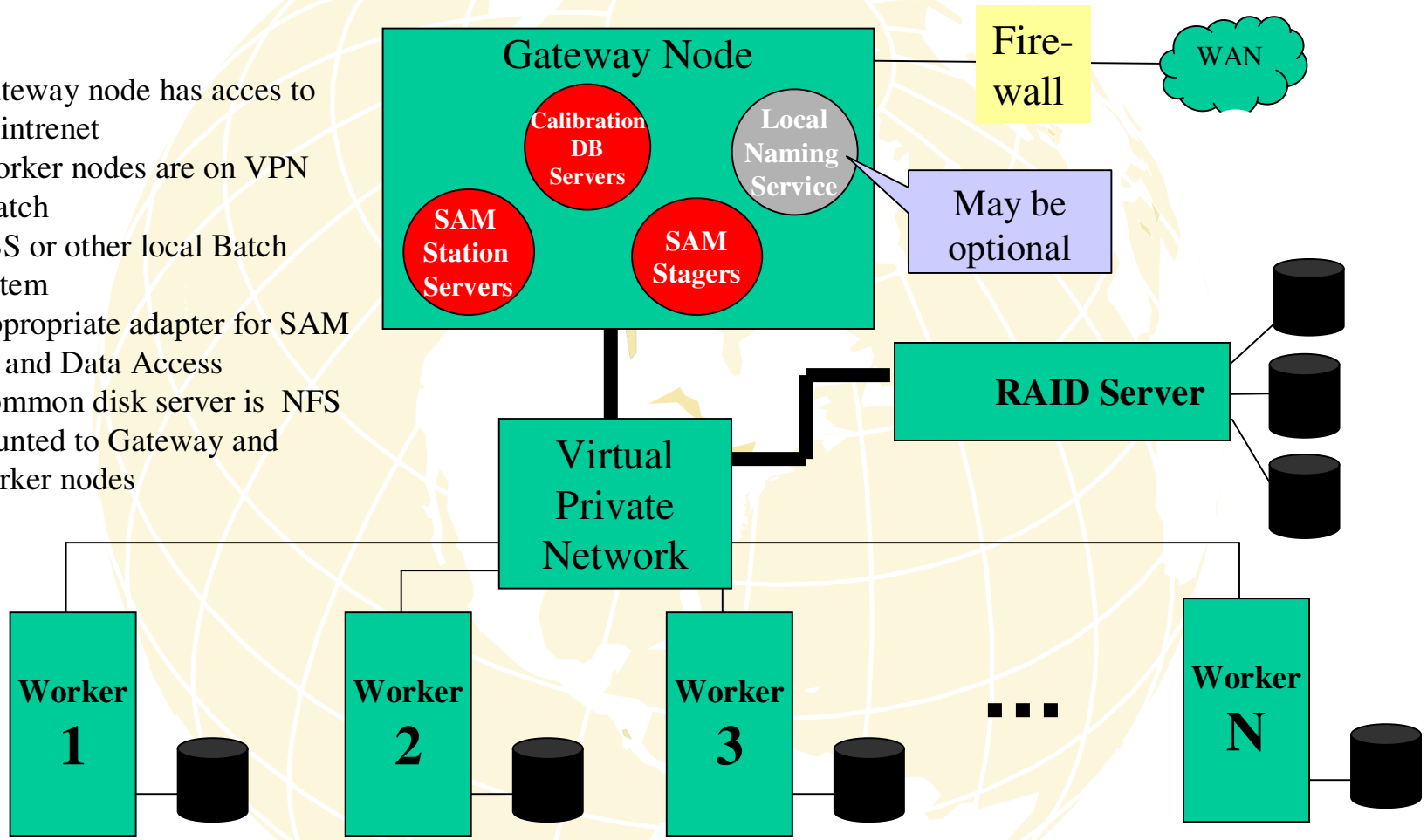
- Network
  - Each Stager Node accesses Enstore (MSS) directly
  - Worker nodes get data from stagers.
  - Intra-station data transfers are "cheap"
- Job Dispatch
  - Fermi Batch System
  - A job runs on many nodes.
  - Goal is to distribute files evenly among workers

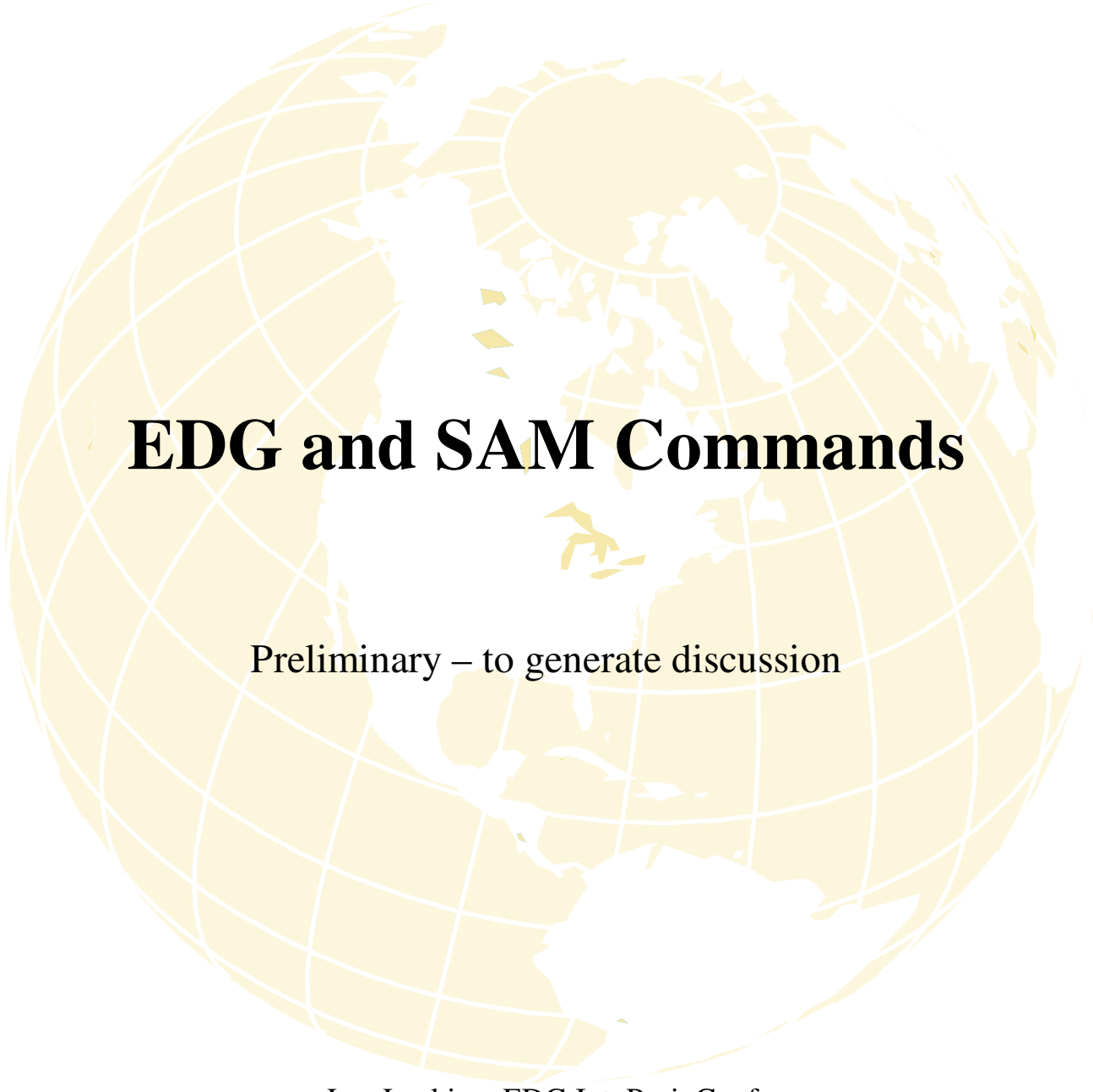


SAM Station: Shared Cache Configuration w/ PN

(used at GridKa and U. Michigan NPACI)

- Network
  - Gateway node has acces to the intrenet
  - Worker nodes are on VPN
- Job Dispatch
  - PBS or other local Batch System
  - Appropriate adapter for SAM
- Software and Data Access
  - Common disk server is NFS mounted to Gateway and Worker nodes





EDG and SAM Commands

Preliminary – to generate discussion

Storage Management Commands

EDG Command	Action	SAM equivalent and Comment
copyAndRegisterFile (cp)	Store and register	Sam store
replicateFile (rep)	Replicate a file	Station cache operation
deleteFile (dEl)	Remove file and unregister	Rm file and “sam undeclare”, Not allowed for files with existing links

Catalog Commands

EDG Command	Action	SAM equivalent and comment
registerFile (rf)	Register file in catalog	Sam declare
registerGUID (rg)	Register file with known GUID in catalog	Sam add location
unregisterFile (uf)	Unregister file from catalog	Sam undeclare, Not allowed for files with existing links
listReplicas (lr)	List replicas	Sam get file location
listGUID (lg)	List GUID of LFN or SFN	
addAlias	Add an LFN alias to existing GUID	

Catalog and File Transfer Commands

EDG Command	Action	SAM equivalent
getBestFile (gbf)	Replicate a file from best source	Done by station in global routing
listBestFile (lbf)	List replica with smallest access cost	
getAccessCost (ac)	List access costs for all replicas	
copyFile (cp)	Copy a file to local destination	Done via project definition and project manager

Additional Related SAM Commands

- ✓ To be filled in on the airplane

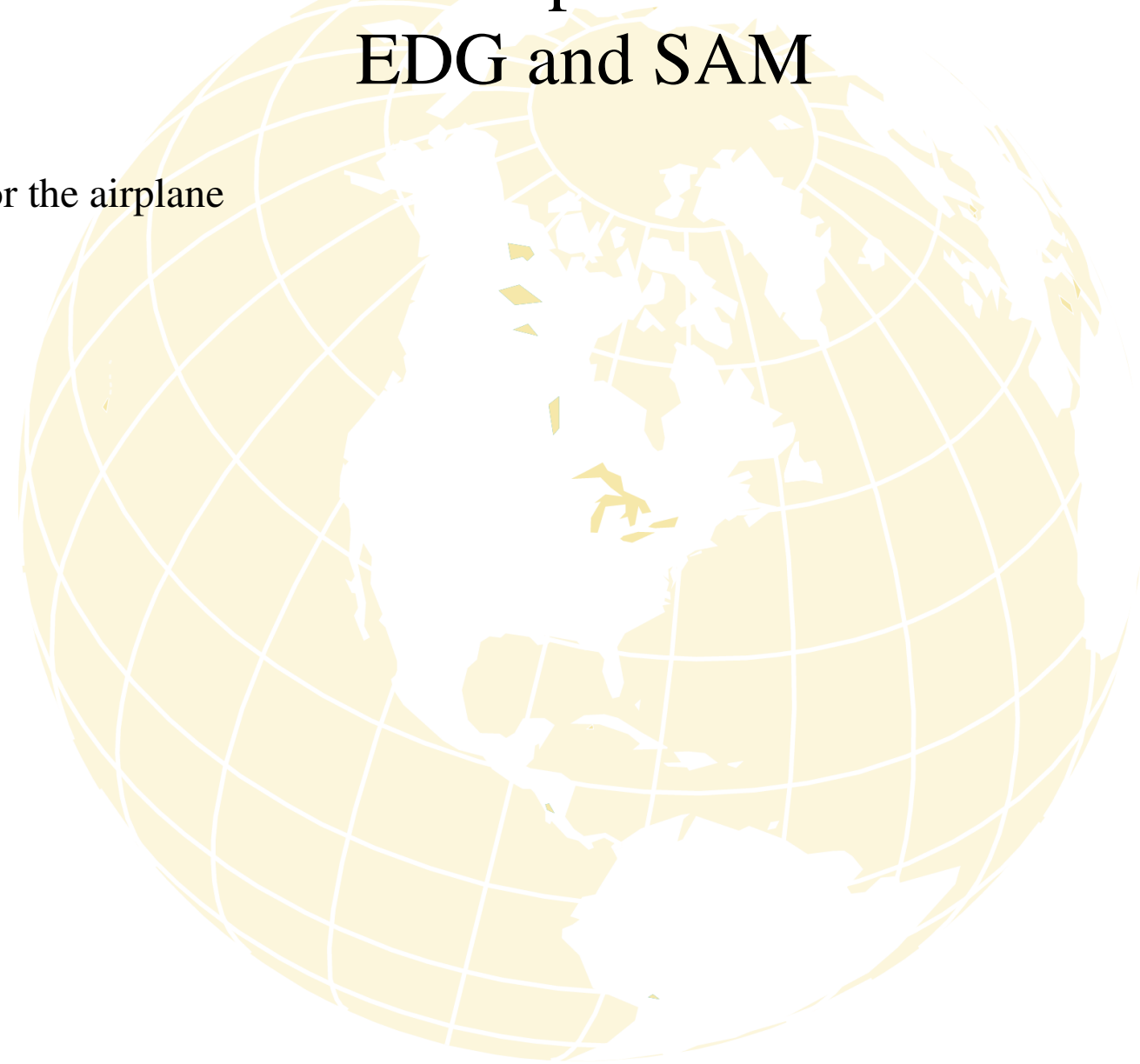
Summary

- ✓ **SAM is distributed, end-to-end Data Management and Handling tool providing the ability to store, and access data and associated metadata information.**
- ✓ **The SAM Database Schema provides many capabilities to maintain physics and processing related information about the data.**
- ✓ **SAM station deployment allows transparent, on-demand, data replication cluster-wide, site-wide, and world-wide.**
- ✓ **There are many commonalities between the EDG and SAM concepts and the commands for management and access can be readily mapped.**
- ✓ **At this meeting we are planting the seeds to achieve the common interfaces which will allow the EDG wp2 and SAM to provide replica services for both EDG and SAM-Grid.**

Thank You

Seeds of Interoperation Between EDG and SAM

- ✓ For the airplane



SAM Features

- ✓ **Flexible and scalable model**
- ✓ **Field hardened code**
- ✓ **Reliable and Fault Tolerant**
- ✓ **Adapters for many local batch systems: LSF, PBS, Condor, FBS**
- ✓ **Adapters for mass storage systems: Enstore (FNAL), HPSS (Lyon), and TSM (GridKa)**
- ✓ **Adapters for Transfer Protocols: cp, rcp, scp, encp, bbftp, GridFTP**
- ✓ **Useful in many cluster computing environments: SMP w/ compute servers, Desktop, private network (PN), NFS shared disk,…**
- ✓ **User interfaces for storing, accessing, and logically organizing data**