

Software, Computing and Analysis Models at CDF and D0

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Outline

Introduction

CDF and D0 Computing Model

GRID Migration

Summary

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fisica di Atlas e CMS
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Introduction: a thought

"A complex system that works is found to have evolved from a simple system that worked...
A complex system designed from scratch never works and cannot be patched up to make it work. You have to start over, beginning with a working simple system"

G.Booch OO Analysis & Design 2nd ed. Pag. 13

CDF and DO can be such simple system to start with

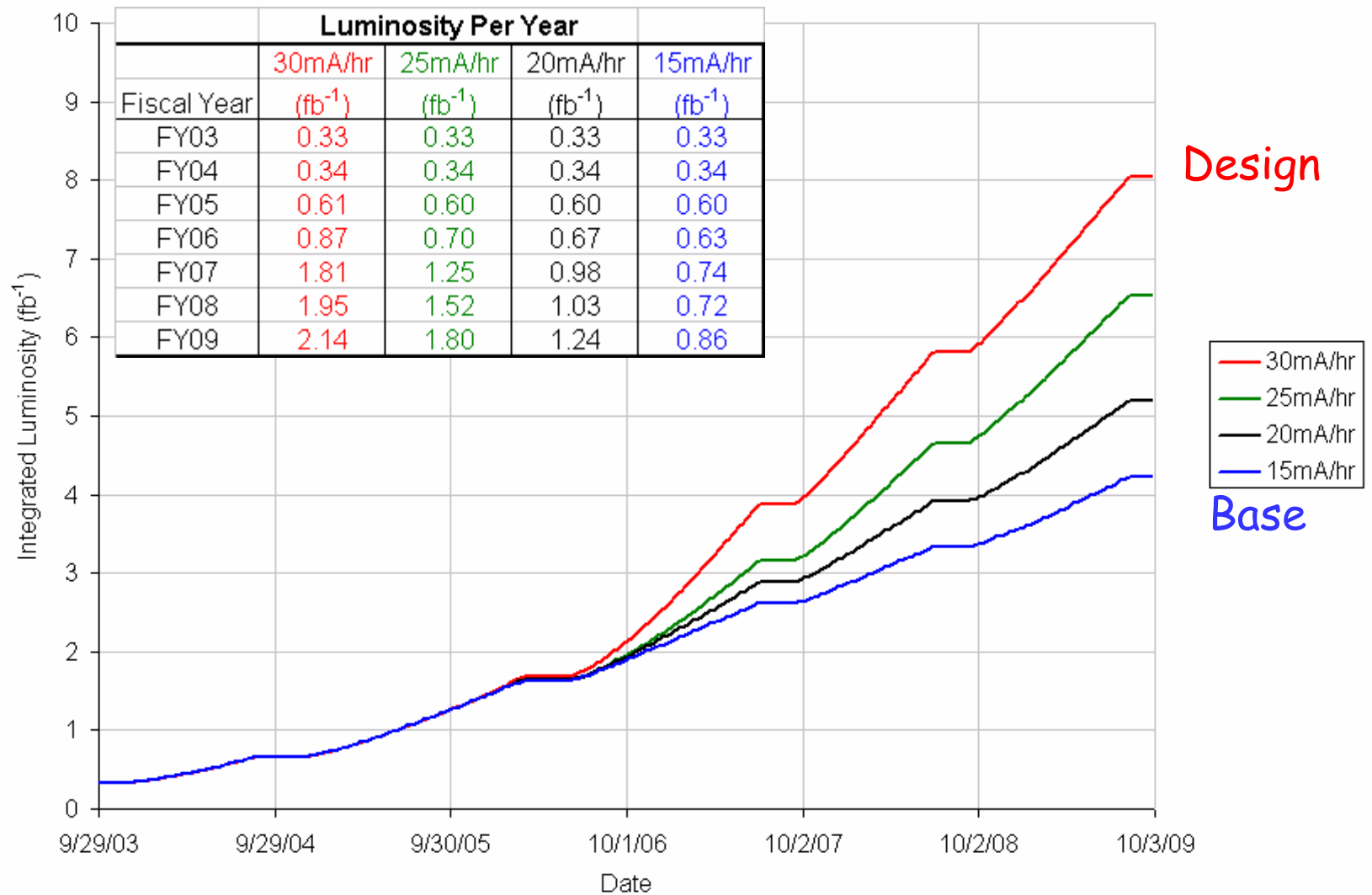
Introduction: Some Numbers

	CDF	D0
Raw data size* (Kbytes/event)	150	250-300
Reco data size (Kbytes/event)	120	200
User format (Kbytes/event)	25-180	20-40
Reco time** (GHz-sec/event)	5(10)	50(120)
User analysis time (GHz-sec/event)	1(3)	1
Peak data rate (Hz)	130(360)	50(100)
Persistent data format	RootIO	TMB,Root

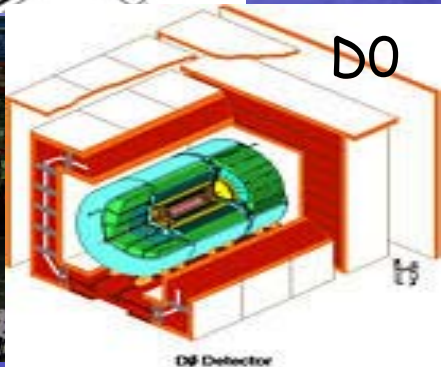
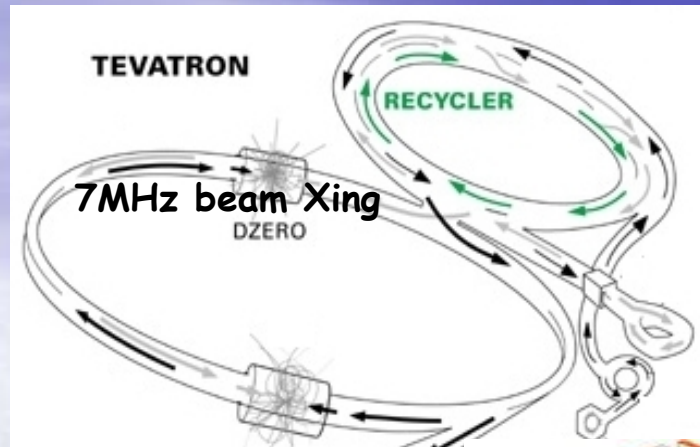
*Raw event size depends upon trigger type and luminosity

**Reconstruction time depends upon raw data size

Introduction: Integrated Luminosity

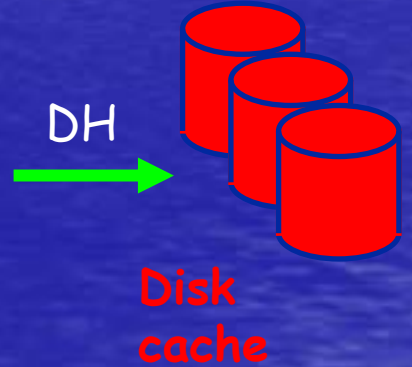
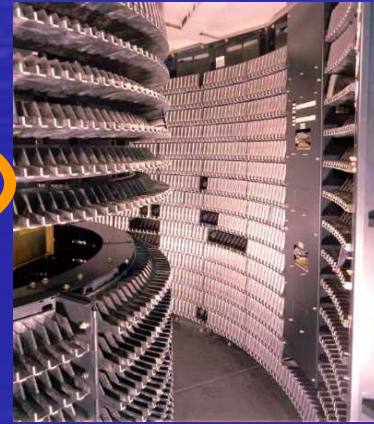


CDF & D0 Computing Model: Data Production flow



Level 3 Trigger
CDF~100 Hz
D0~50 Hz

Data Handling Services
DH



Data Handling Services

SAM: Sequential Access via Metadata

CDF: used dCache then moved to SAM.

DO: use SAM since several years

SAM provides:

- Local and wide area data transport
- Batch adapter support (PBS, Condor, Isf, ..)
- Caching layer
- Comprehensive meta-data to describe collider and Monte Carlo data
 - Simple tools to define user-datasets
- File tracking information
 - Location, delivery and "consumption" status
- Process automation

Production Farms

DO:

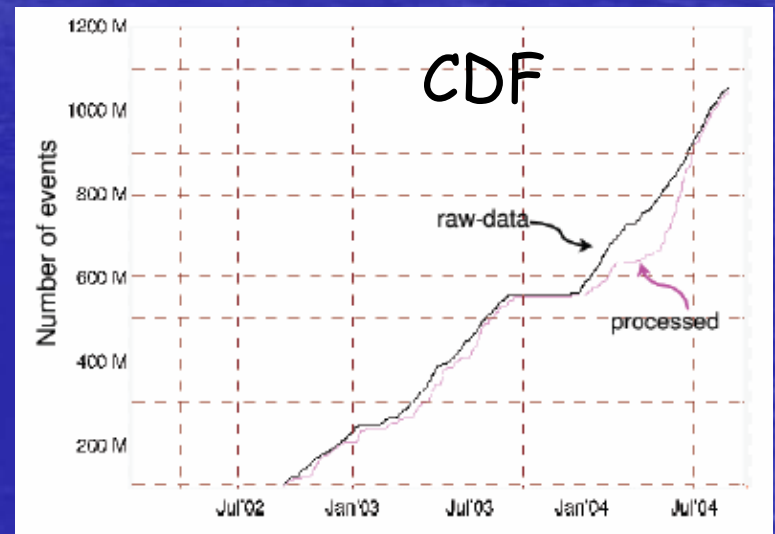
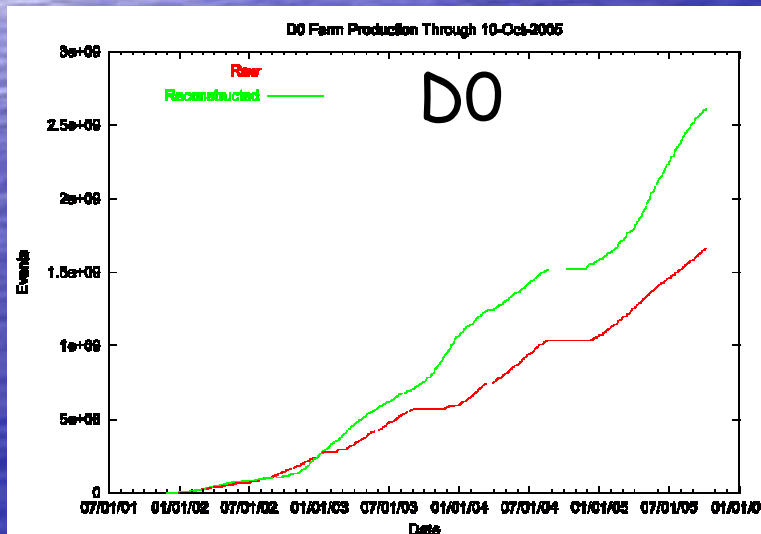
Data: compute capacity 1550 GHz \Rightarrow \sim 2390 GHz soon
Efficiency \sim 80% \sim 24 M events/week

MC: 14M events/month \Rightarrow 2 M events if data reprocessing

CDF:

New SAM based farm, standard CDF code

Data: compute capacity 1200 GHz
 \sim 78 M events/week



CDF & DO Computing Model: Analysis Data flow

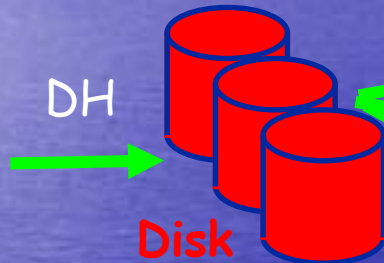
User Desktop



Remote Analysis System
CDF=CAFs DO=Remote Farms



Robotic
Tape Storage



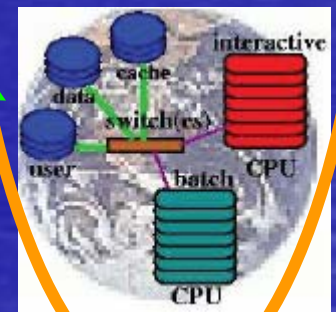
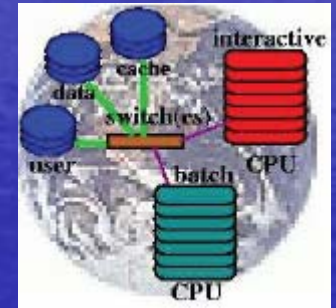
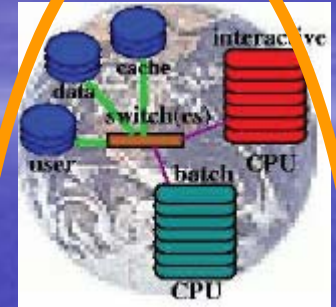
Disk
cache

DH



Central Analysis System

(CDF=Central Analysis Facility CAF, DO=Central Analysis Backend, CluedO)



Central Analysis System

CDF: CAF

- **Primary analysis platform**
 - User analysis: Ntuple creation and analysis
 - Semi-coordinated activities: secondary and tertiary dataset, Monte Carlo Production
- **User experience:**
 - Monitoring
 - Control: hold, resume job, copy output to any machine
 - Quasi-interactive feature: Look a log file on worker node

DO: CAB

- CPU intensive analysis job
- Direct analysis
- Fixing and skimming
- Group organized translation to root format

DO: clued0

- Desktop cluster for interactive work and user analysis

Remote Analysis System

Job Information Monitoring

DO

- Farms based upon **SAMGrid** = **SAM** + **JIM**
- **SAM**: file storage, delivery and metadata cataloging, analysis bookkeeping.
- **JIM** : Job Manager (DO specific installations: SAM station, DB proxy servers, job manager)
- **10 remote sites in operation:**
CCIN2P3 (Lyon) , CMS-FNAL, FZU (Prague), GridKa (Karlsruhe), Imperial OSCER (Oklahoma), SPRACE (Sao Paolo), UTA (Texas, Arlington), WestGrid (Canada), Wisconsin
- Monte Carlo production and data reprocessing

CDF

- dCAF a replica of CAF (specific CDF installation)
- Monte Carlo production and now data analysis

CDF Submission GUI

User's experience

Select site

Specify dataset

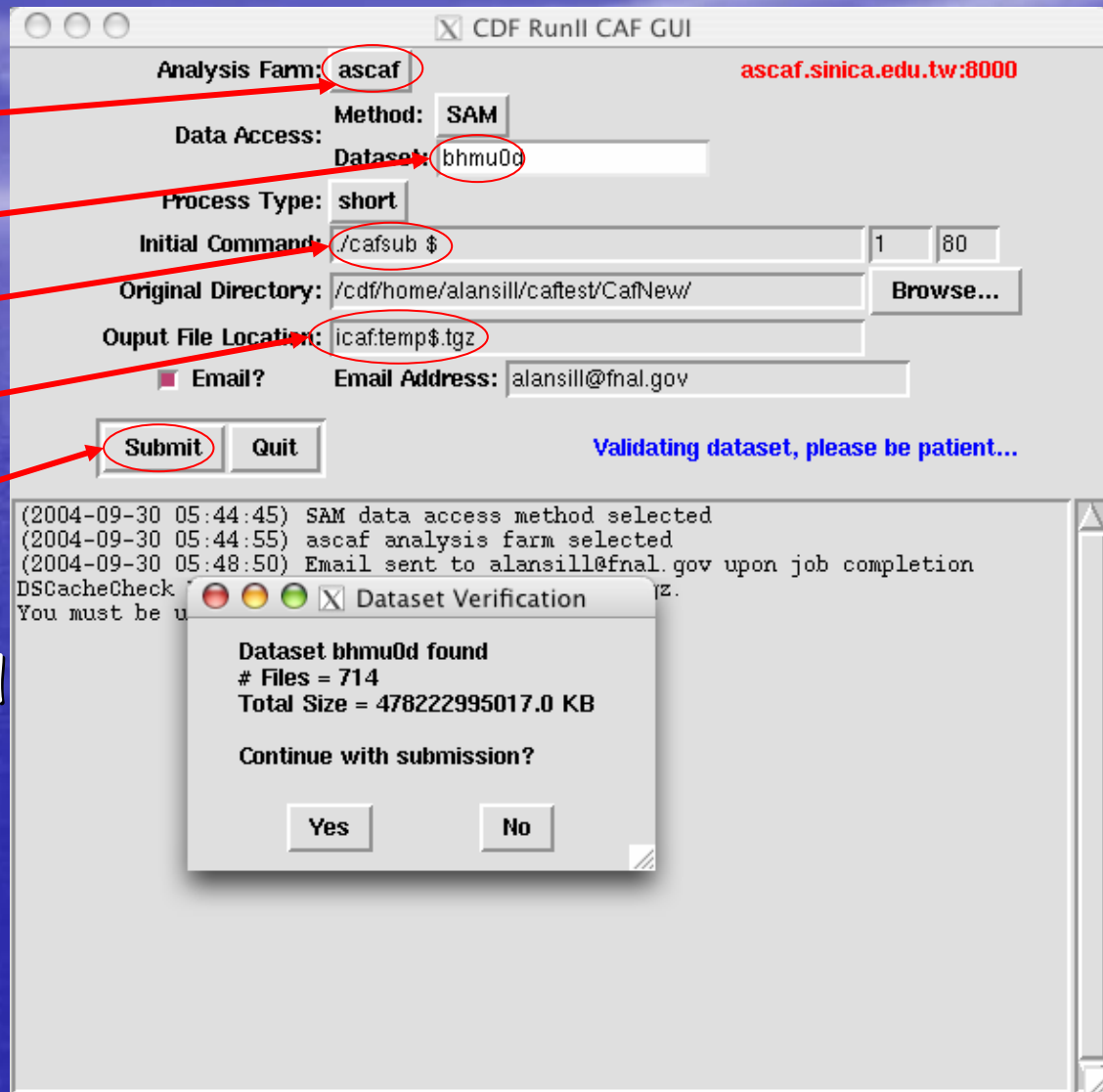
Startup script

Output location

Press "submit"

User's context tarballed
sent to execution site

Same interface used
for GRID submission



CDF & D0 Migration to GRID

Reason to move to a grid computing model

- Need to expand resources luminosity expect to increase by factor 8
- Resource are in dedicated pools, limited expansion and need to be maintained
- Resource at large:
 - in Italy access to ~3X dedicated resources
 - ~30 THz in USA fro GRID

CDF has three projects:

- ✓ **GlideCAF**: MC production on GRID, data processing at T1
- **gLiteCAF**: MC production on GRID
- **OSGCAF**: " (USA)

D0:

- **SAMGrid**: MC production

CDF Migration to GRID: GlideCAF



Condor
protocol

Gatekeeper



Dedicated
resources



Dynamic
resources

CDF Run II CAF GUI

Analysis Farm: **cnaf**

Data Access: **caf**

Process Type: **ascaf-mc-only**

Group: **cnaf**

Initial Command: **jpcaf**

Original Directory: **knu-mc-only**

Output File Location: **mitcaf**

Email?

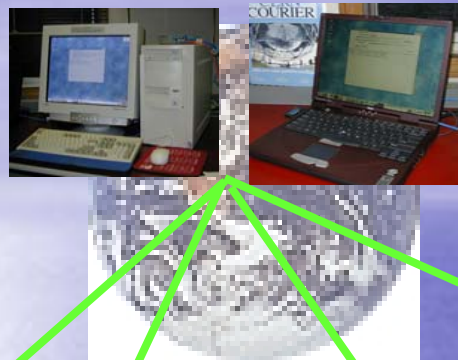
(2005-10-04 10:37:22) SA
(2005-10-04 10:37:34) cr

od selected
elected

ico@pd.infn.it

glidecaf

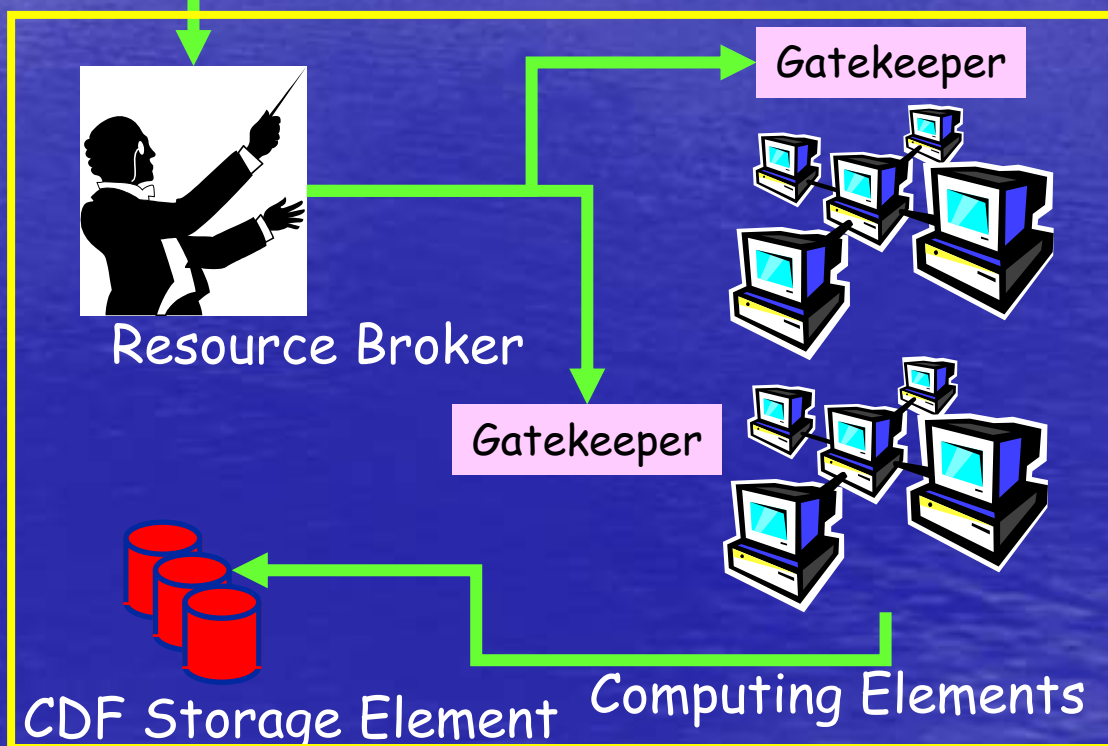
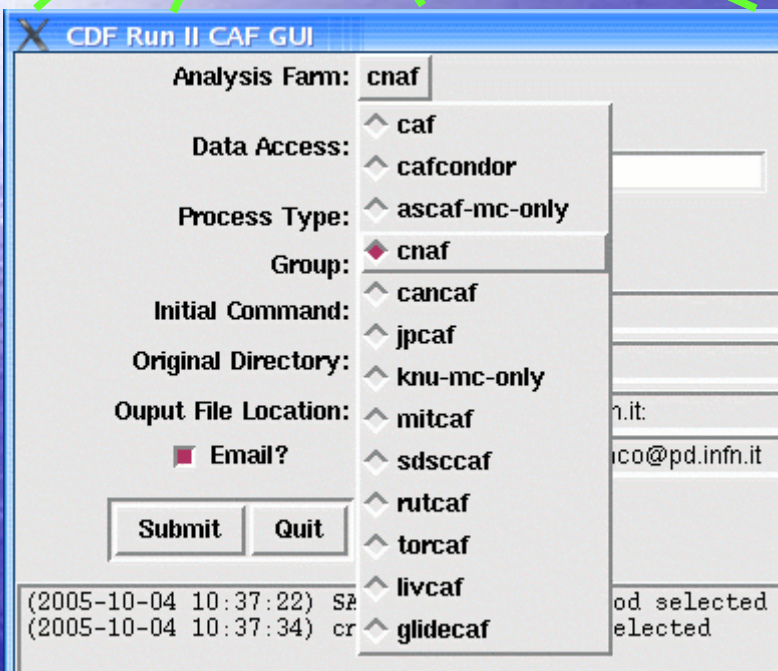
CDF Migration to GRID: gLiteCAF



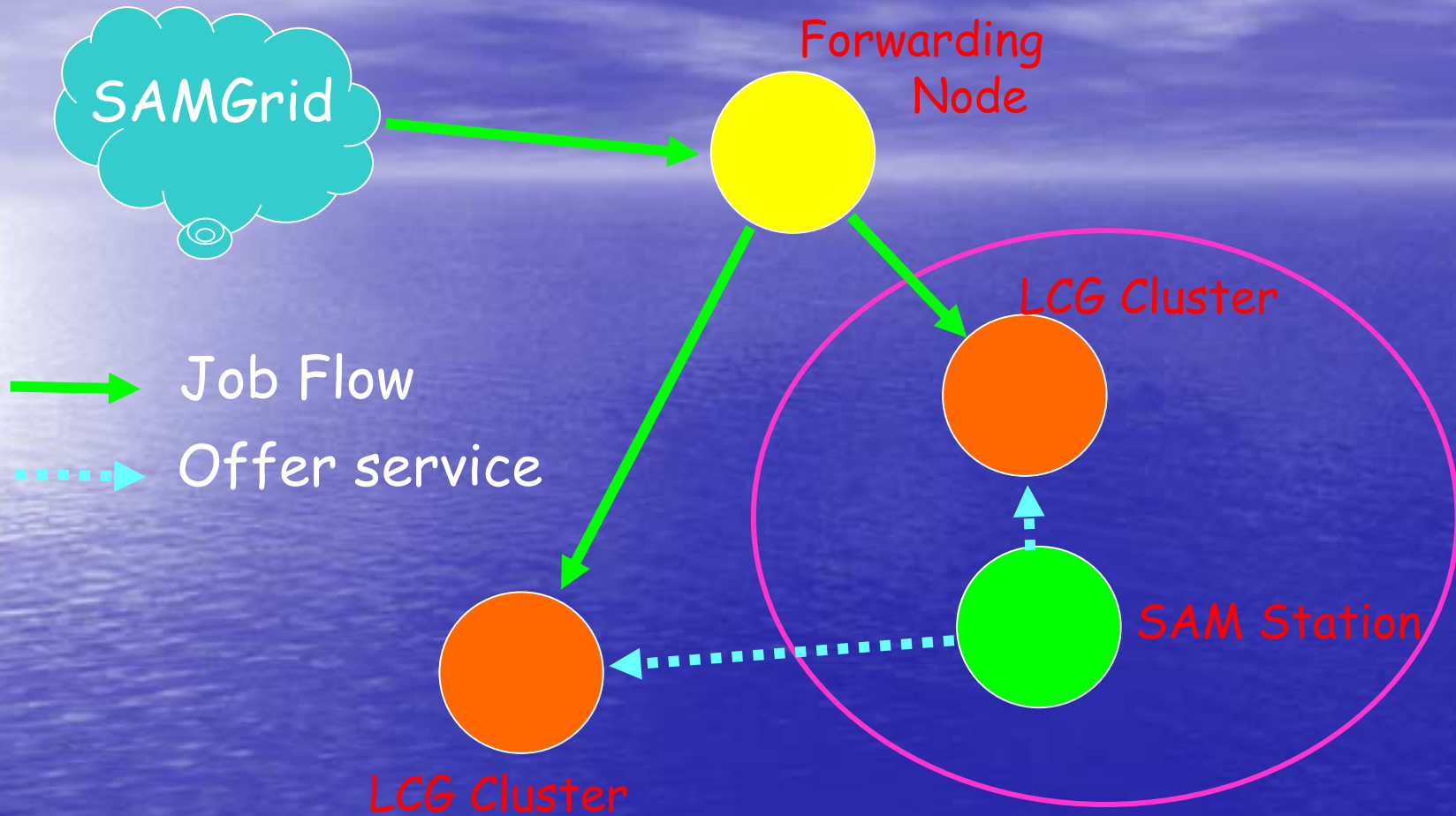
Secure connection
via Kerberos



Head node \cong
User Interface

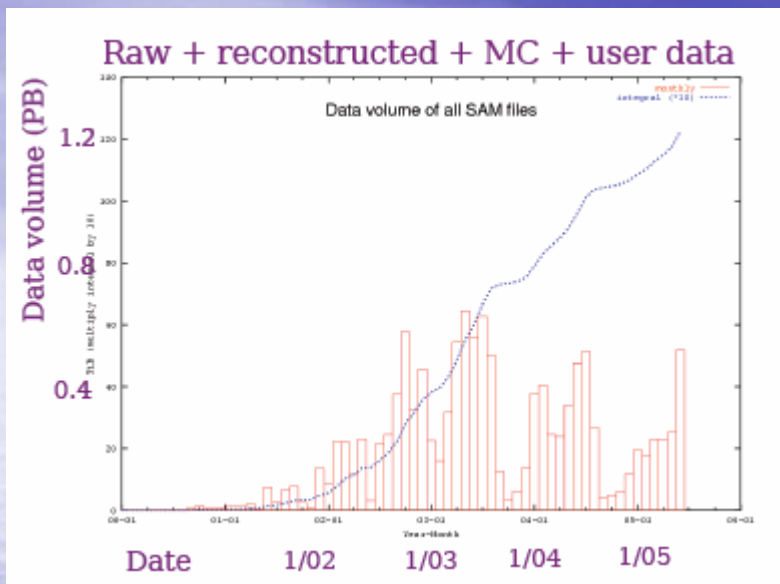


DO Migration to GRID: SAMGrid \Rightarrow LCG



Backup

Introduction: Data volume



Data volume vs. time
 Total 1.2 PB
 Estimated volume of about
 5 PB by 2009

Data logging rate triples from
 2004 to 2006

Event rate quadruples due to

Increase compression

Computing problem not static

More difficult with time

	FY	Int L. (fb ⁻¹)	Evts (10 ⁹)	Peak rate (MB/s) (Hz)	
Actual	2003	0.3	0.6	20	80
	2004	0.7	1.1	20	80
Estimated	2005	1.3	2.4	40	220
	2006	2.2	4.7	60	360
	2007	3.9	7.1	60	360
	2008	6.0	9.5	60	360
	2009	8.2	12	60	360