March 27-29, 2007
ISGC2007, Taiwan

e-Science for High Energy Physics in Korea

Kihyeon Cho

e-Science Applications Research Team KISTI

Korea Institute of Science and Technology Information

Outline

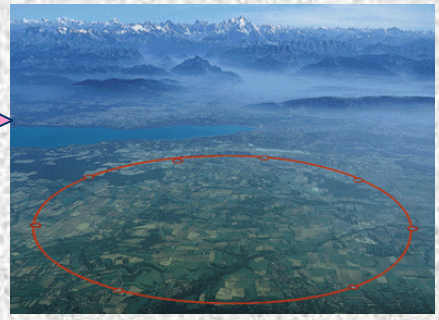
- e-Science for High Energy Physics
- Network
- KISTI-EGEE II & FKPPL(LIA)
- LHC-ALICE Experiment
- CDF Experiment
- Summary

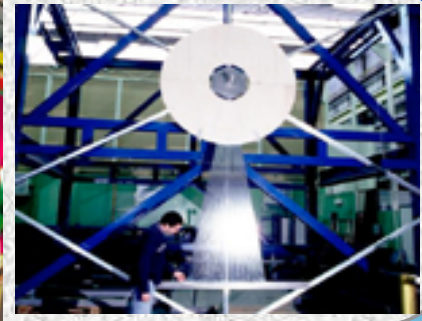
e-Science for HEP

e-Science Applications Research Team

e-Science

High Energy Physics





Middleware

ALICE Tier 2 Center | Bio | CDF | ILC R&D | ...

e-Science IT Team

Supercomputing Support Team

LCG | Linux OS | AIX OS(IBM)

Resource

Storage

Supercomputer, Cluster

Daejeon

Busan

Seoul

Gwangju

KREONET

GLORIAD

e-Science Support Team

Supercomputing Operation Team

Supercomputing Operating Team

Network Team

CDF @FNAL, USA (Current)

ALICE @CERN, Swiss (2007.10)

KISTI

ALICE Tier2 Center

High Energy Physics @KISTI

High Energy Physics Applications

Outline

❖ Goal

- Research for e-Science data center

❖ Contents

- ALICET Tier2 Center
- LCG CAF
- France-Korea Particle physics Laboratory (CDF)

Products

❖ Korea(KISTI)-France(IN2P3) Particle Physics Laboratory (April 2007)

❖ MoU between MOST-CERN (October 2007)

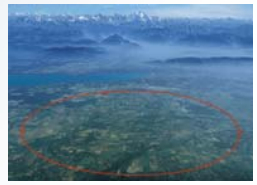
❖ KISTI involves in CDF (January 2007)

❖ Constructing and Leading Particle physics and Nuclear Physics Research Community in Korea (November 2006)

Research Area

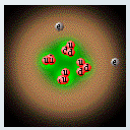
❖ ALICE Tier2 Center

(ALICE Tier2)



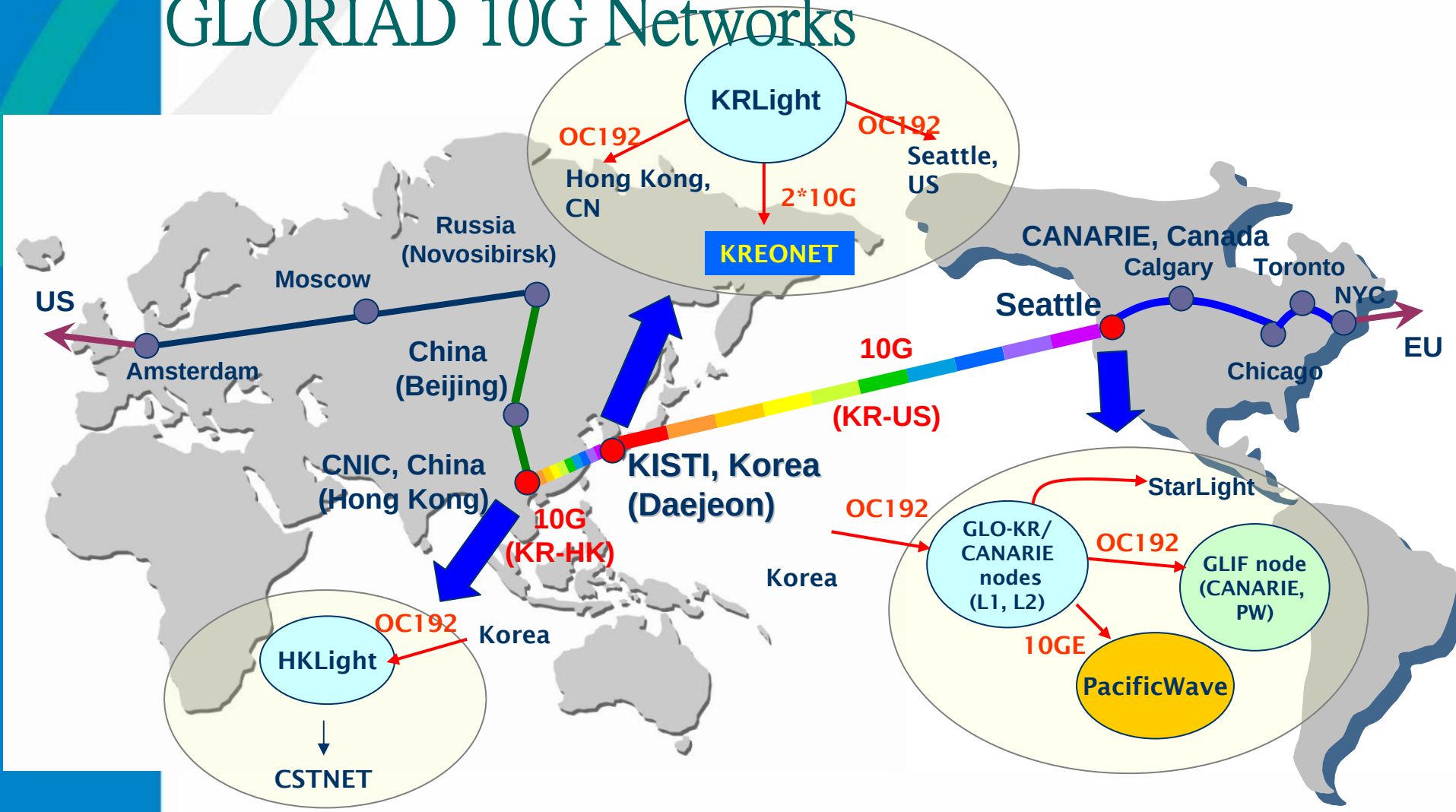
❖ LCG CAF(CDF Analysis Farm) Construction

❖ France-Korea Particle Physics Laboratory (LIA) - CDF

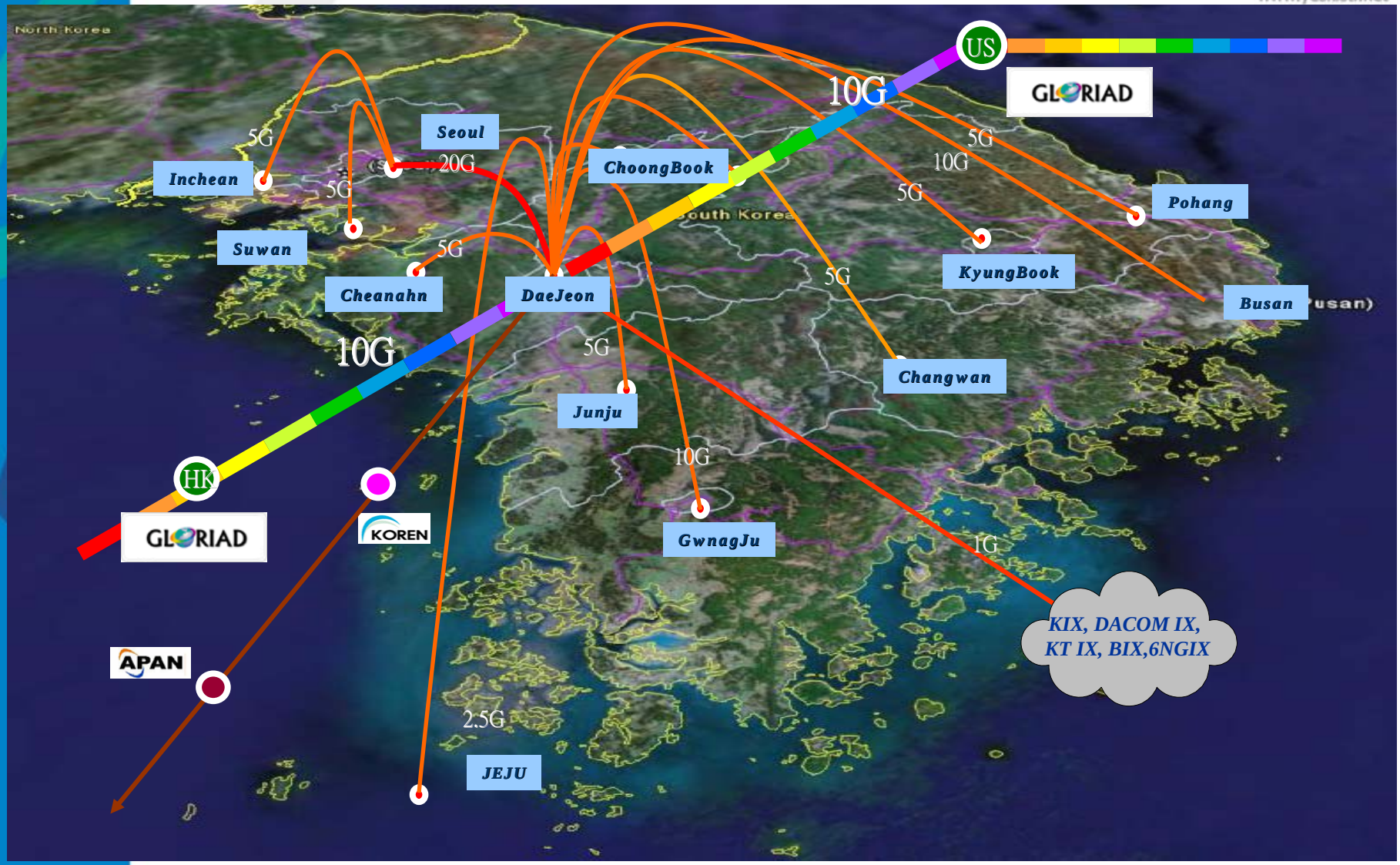


Network

GLORIAD 10G Networks



National Network (Interconnection)



Network for HEP

Backbone Layer

- 15 regional center (14 region)
- Bandwidth: 5Gbps ~
- WDM, ONS, S/W

- HEP connection
  Kyungpook National University
  Sungkyunkwan University
  Kangneung National University
  Postech

KISTI-EGEE II Collaboration

& FKPPL : LIA project

Goal :

- Gain experience with the EGEE middleware and operation procedures
  - Install and operate EGEE middleware (e.g., glite, lcg) on KISTI site
- Facilitate joint research activities between Korea and Europe based on EGEE infrastructure
  - HEP, FusionGrid,…
    - Currently, we are working with the ALICE group
- Investigate the feasibility of EGEE infrastructure for researchers in other scientific and engineering areas in Korea.

Introduction to KISTI-EGEE II collaboration

- EGEE-II partner
  - Unfunded partner in the EGEE-II project
  - Cooperating with CKSC team, another EGEE-II partner in Korea
- Participating area: SA1
  - Focusing on Grid infrastructure collaboration between KISTI and EGEE-II

EGEE-II Collaboration: Current Status

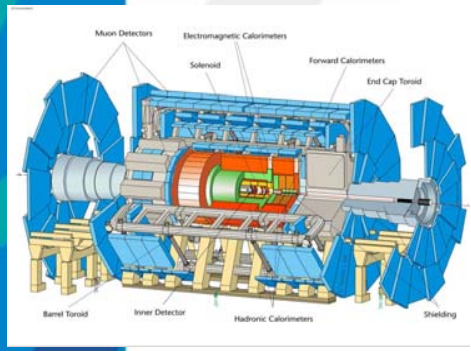
- May, 2006
  - Bob Jones, EGEE-II Project Director, visited KISTI to discuss enhancing collaboration between EGEE-II and KISTI in the areas of Grid infrastructure and applications.
- June, 2006
  - Linux Cluster preparation for EGEE middleware deployment
  - gLite installation and configuration
- July, 2006
  - Internal testing of gLite installation and configuration
- September, 2006
  - Register to APROC for EGEE certification
- October, 2006
  - Installation and configuration of LCG components (lcg-RB, lcg-CE)
  - 10/16: KISTI CA was removed from IGTF repository
- Since December, 2006
  - KISTI site has been approved as an EGEE-certified site, operating production run on a daily basis

FKPPL (France Korea Particle Physics Laboratory) => LIA Project

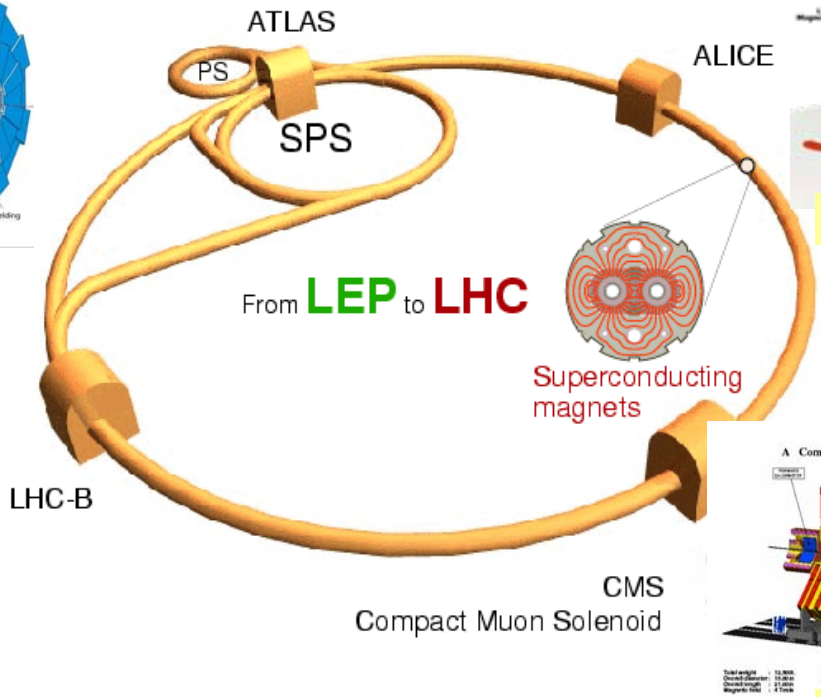
	Leading Group	
	France (IN2P3)	Korea (KISTI)
Co-Directors	Vincent Breton, LPC-Clermont Ferrand	Okhwan Byeon, KISTI
ALICE	Pascal Dupieux, LPC-Clemento Ferrand,	Do-Won Kim, Kangnung N. Univ.
ILC Detector R&D	Jean-Claude Brient, LLR-Ecole Polytechnique,	Jongman Yang, Ewha Univ.
BioInformatics	Vincent Breton, LPC-Clermont Ferrand	Doman Kim, Chonnam Univ.
CDF	Aurore Savoy Navarro, LPNHE/IN2P3-CNRS	Kihyeon Cho, KISTI
Grid Computing	Dominique Boutigny, CC-IN2P3	Soonwook Hwang, KISTI

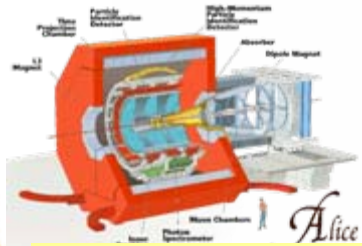
LHC-ALICE @CERN

LHC Exepriment @ CERN

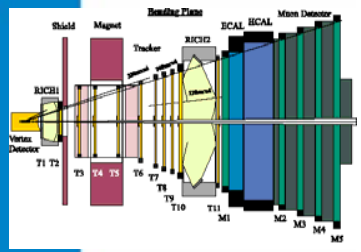


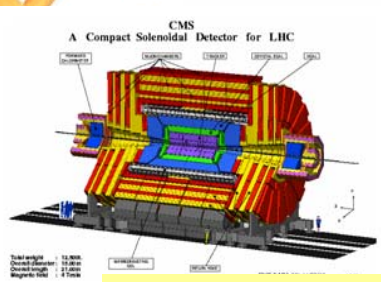
The Large Hadron Collider (LHC)





Tie2 Center @ KISTI



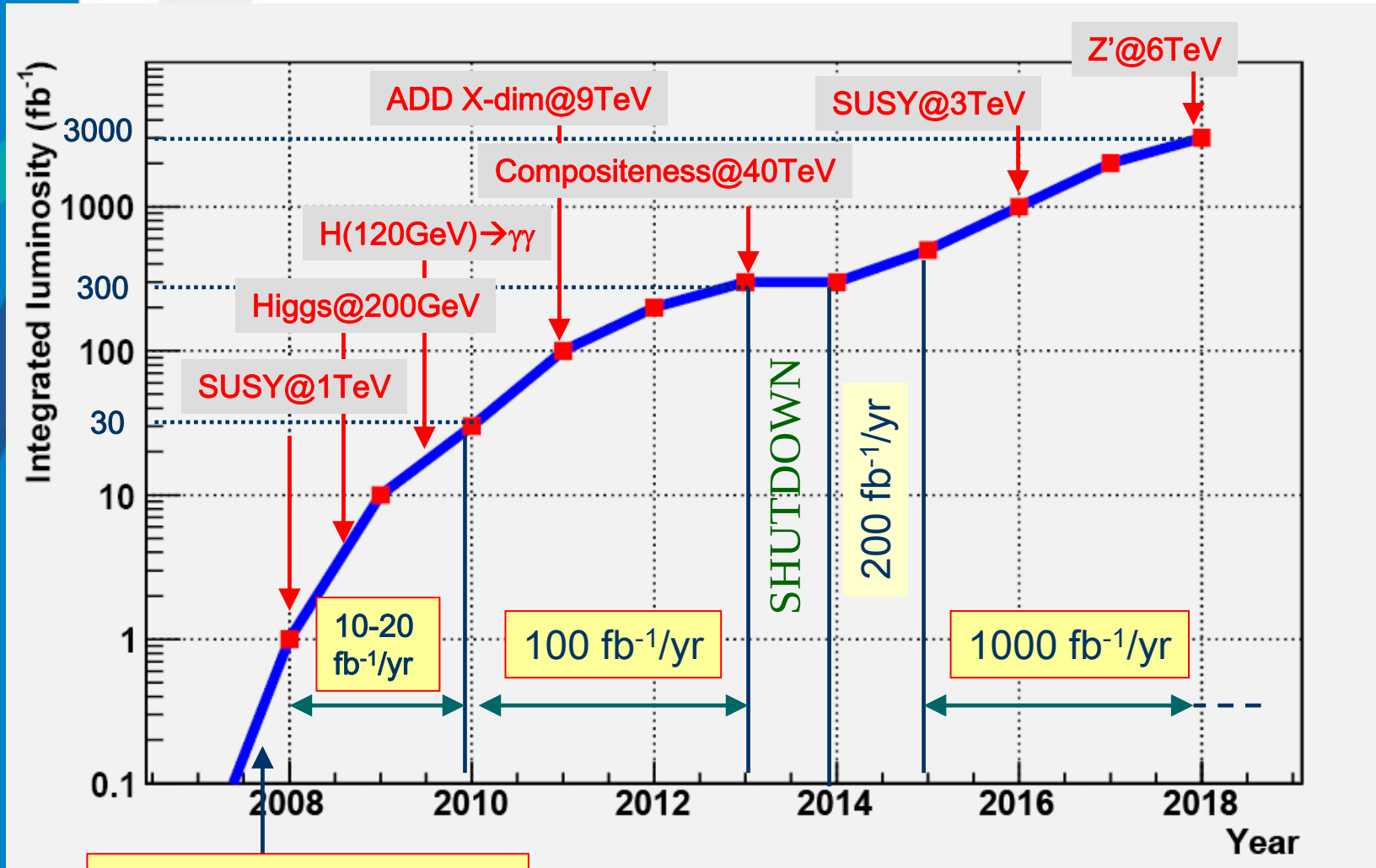


	Beams	Energy		Luminosity
LEP	e+ e-	200	GeV	10^{32} cm^{-2}s^{-1}
LHC	p p	14	TeV	10^{34}
	Pb Pb	1312	TeV	10^{27}

The official Tier 2 center in Korea has not been decided yet.

LHC Luminosity Profile

$L = 10^{33}$ $L = 10^{34}$ SLHC: $L = 10^{35}/cm^2/sec$



1barn= 10^{-28} m^2

LHC-ALICE Collaboration: Current Status and Future Plan

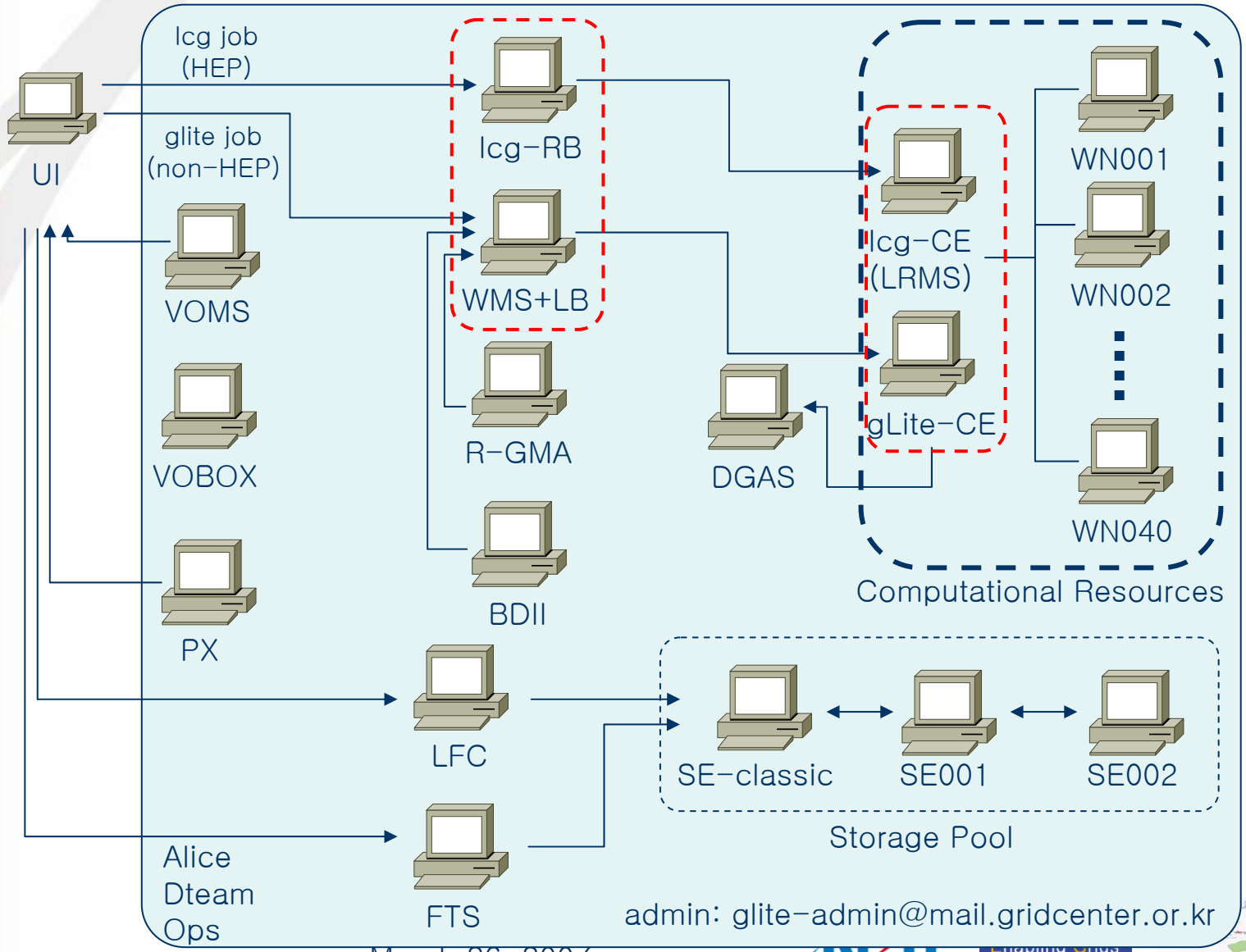
- August, 2006
  - ALICE experiment SW (Aliroot,…) installation
- September, 2006
  - Dr. Federico visited KISTI to discuss the construction of ALICE Tier2 Center in KISTI
- October, 2006
  - ALICE VOBOX installation and testing
- December, 2006
  - Participated in the WLCG Tier-2 workshop in Asia held in Mumbai, presenting the current status of KISTI ALICE Site
- Currently,
  - ALICE testing still going on
  - upgrading the Main Memory of the KISTI cluster into 2GBytes
- October, 2007
  - WLCG MoU between MoST and CERN

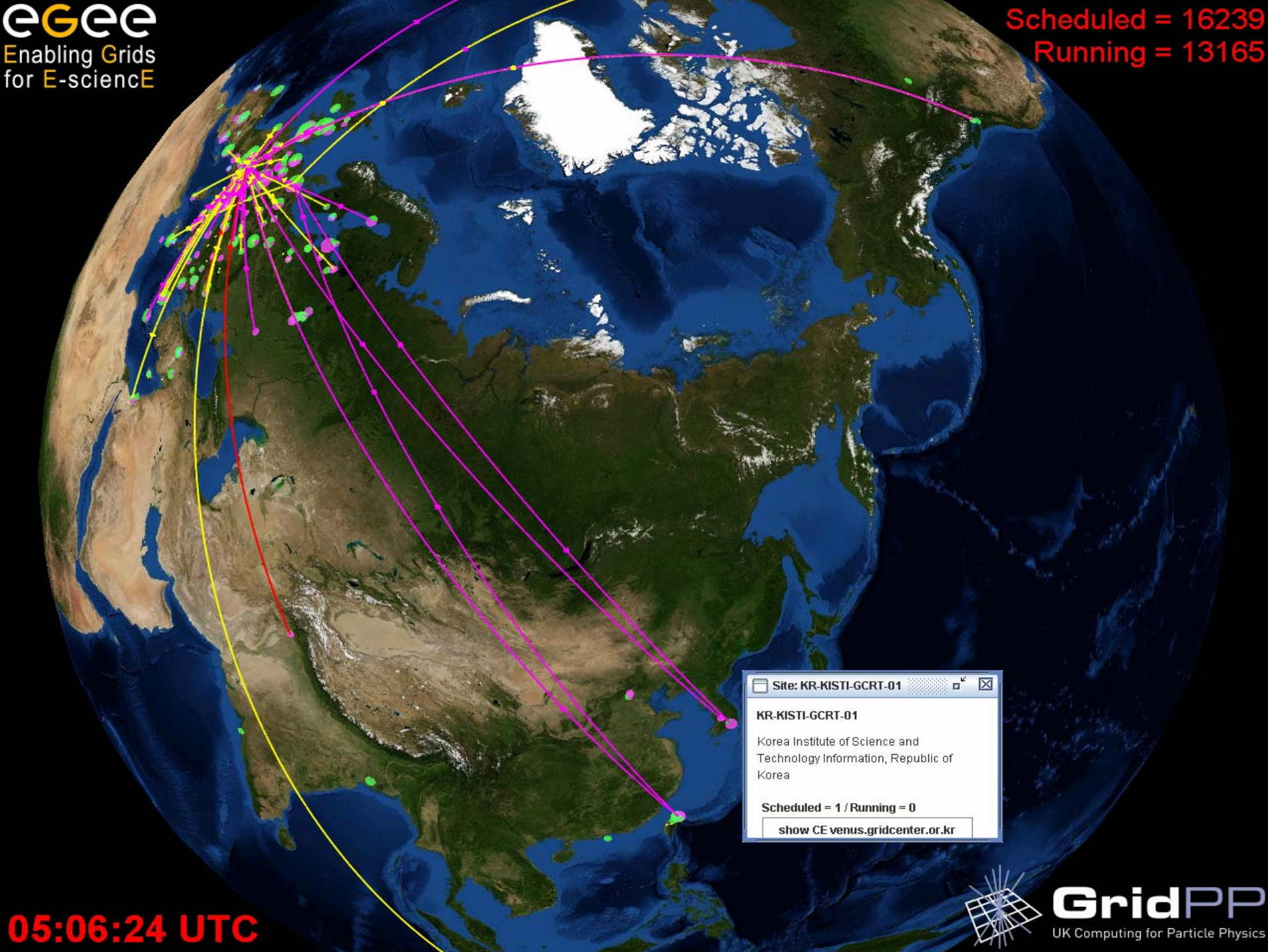
KISTI Testbed Specification

- OS: Scientific Linux 3.0.4
- CPU: Intel® Pentium-IV 2.0GHz
- Memory: 2Gbytge Upgraded
  - Swap Memory: 4GB per all nodes
- Disk: 40GB per all nodes
  - 500GB external storage are shared by CE and all WN as user home directory
- Network: 1Gbit Ethernet

KISTI Testbed for EGEE Deployment

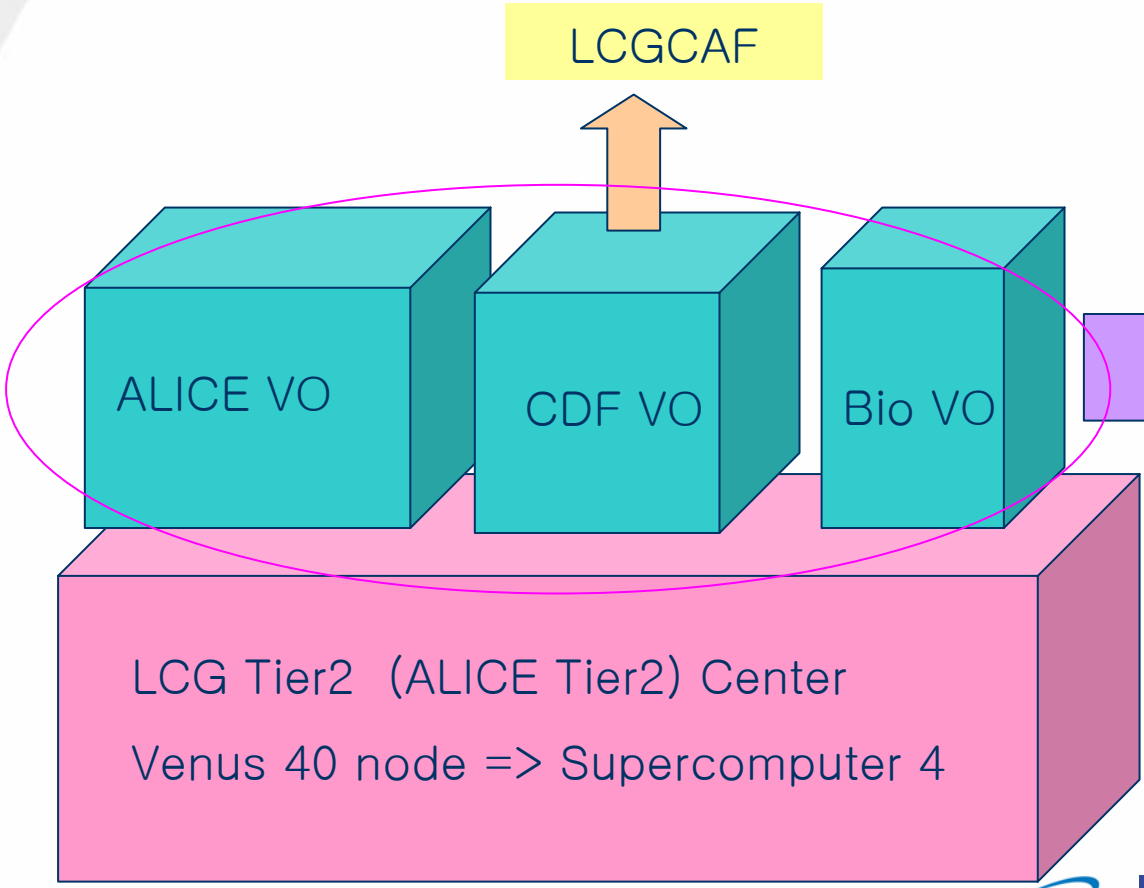
EGEE M/W Deployment on KISTI site




eGee
Enabling Grids
for E-sciencE
Scheduled = 16239
Running = 13165
Site: KR-KISTI-GCRT-01
KR-KISTI-GCRT-01
Korea Institute of Science and Technology Information, Republic of Korea
Scheduled = 1 / Running = 0
show CE venus.gridcenter.or.kr
05:06:24 UTC
GridPP
UK Computing for Particle Physics

LCG Tier 2 Center

Pacific CAF – Taiwan,
Japan, Korea



Korea-France
Particle
Physics
Laboratory

(LIA project)

CDF @Fermilab

Fermilab CDF

20 miles west of Chicago, USA

LIA on CDF

France

Aurore Savoy-Navarro
(LPNHE/IN2P3-CNRS)

Gian Piero

Stephane Tourneur

Thomas Kachelhofer
(CCIN2P3)

A Post-doc (To be hired)

Korea

Kihyeon Cho
(KISTI)

Donghee Kim
(Kyungpook NU)

Intae Yu
(Sungkyunkwan U)

Soo-Bong Kim
(SNU)

CDF Experiment

Total
12 Countries
60 Institutes
~630 Physicists

North America


3 Natl. Labs
25 Universities


2 Universities

Europe


1 Research Lab
6 Universities


1 University


4 Universities


2 Research Labs


1 University


1 University

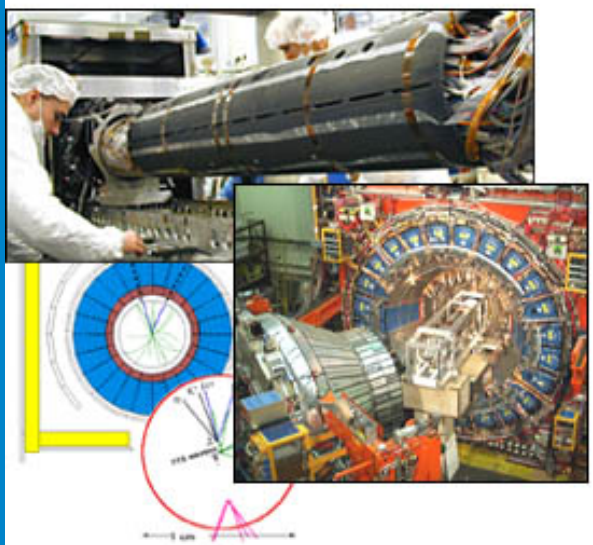
Asia


1 Research Lab
4 Universities


1 University


KOREA

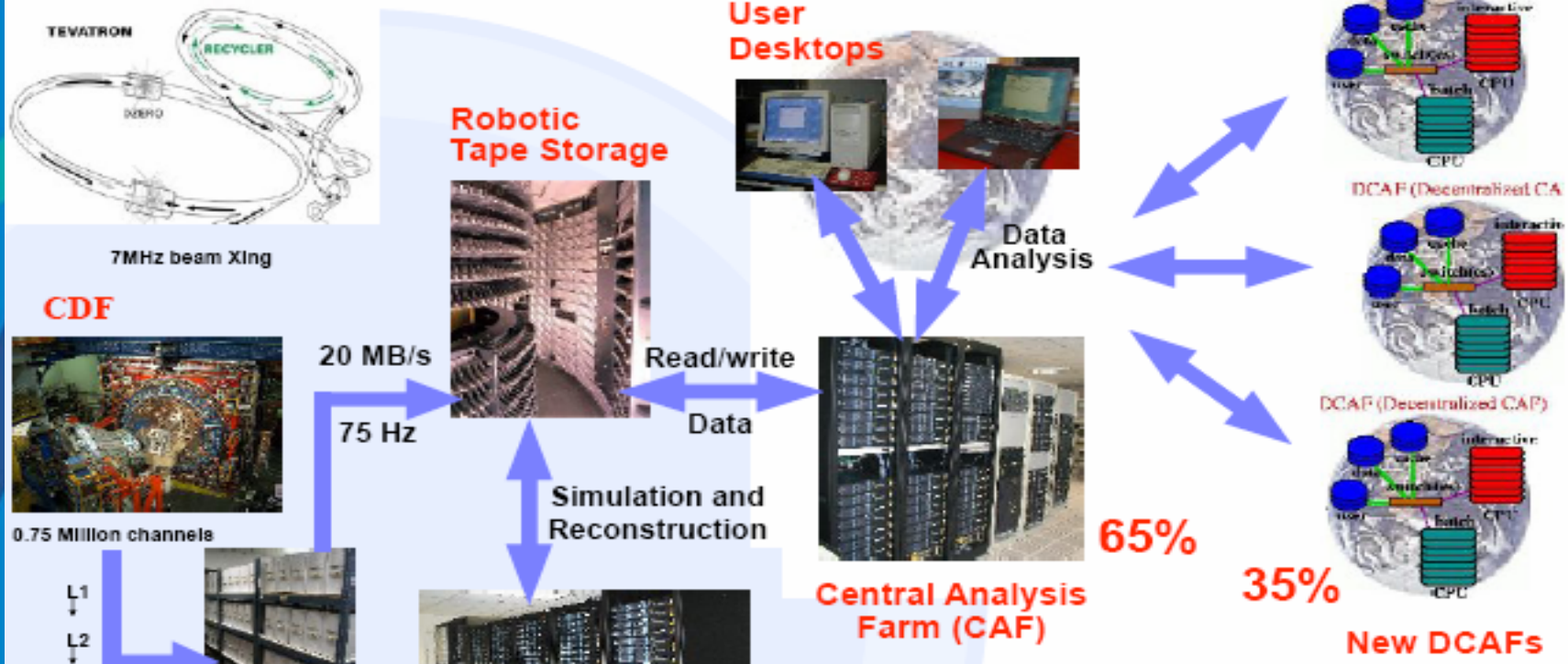
Center for High Energy Physics:
Kyungpook National University
Seoul National University
SungKyunKwan University
KISTI



March 26, 2007

CDF Data Analysis Flow: 2004-05

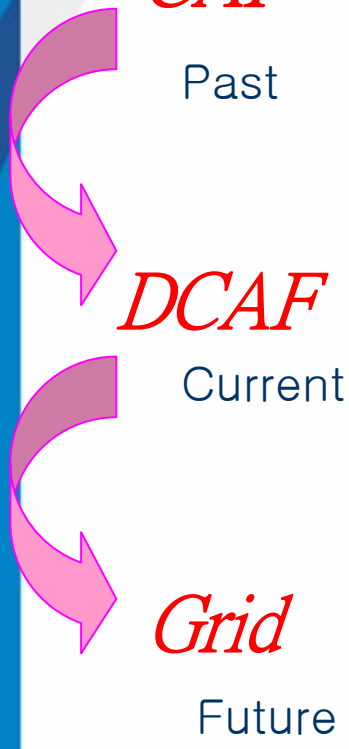
Based on Distributed CDF Analysis Facilities (dCAFs)



Distributed clusters in Taiwan, Korea, Japan, Italy, Germany, Spain, UK, USA, and Canada.

In 2007, DCAF will move on LCG CAF

CDF Grid - Outline



Central Analysis Farm :

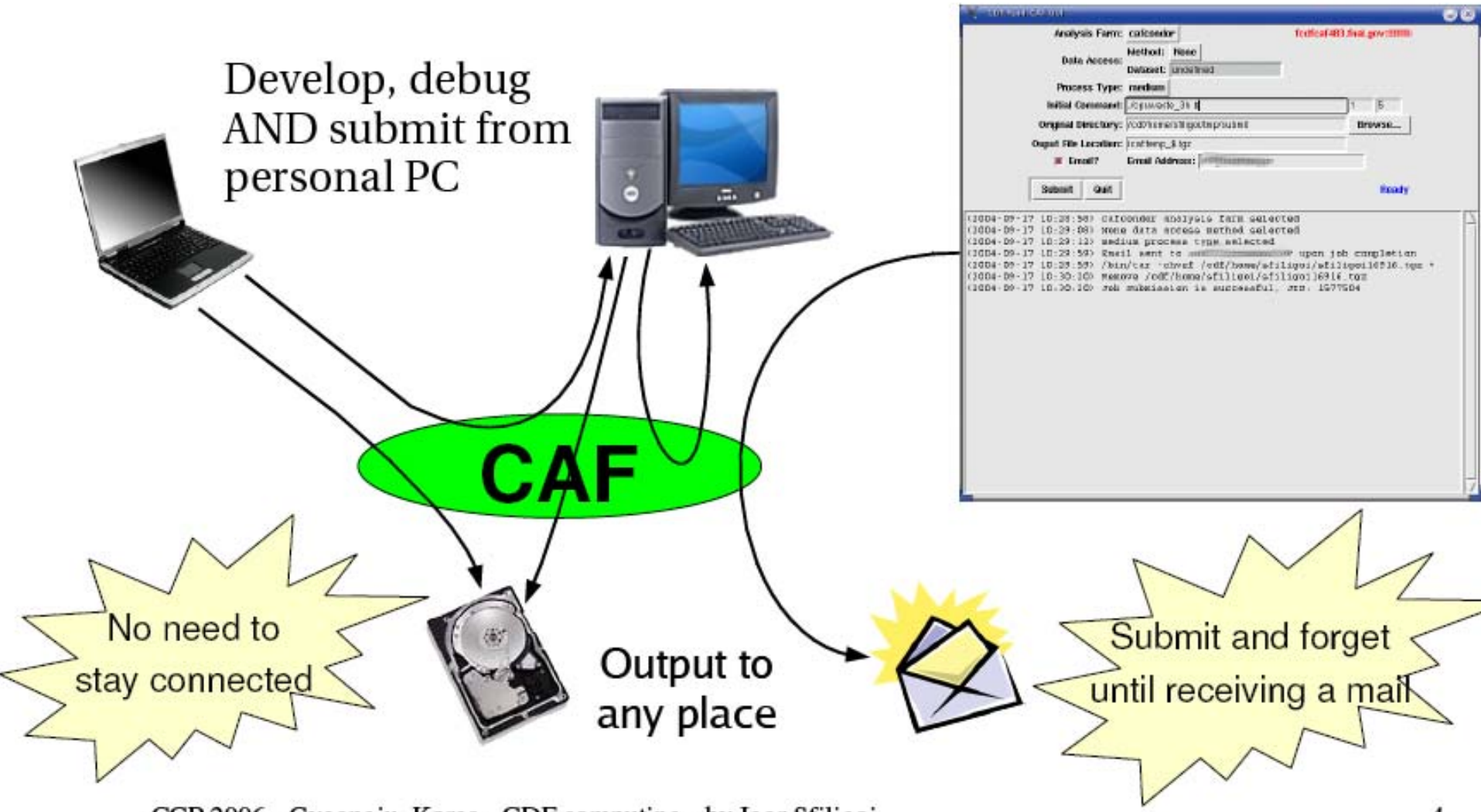
A large central computing resource based on Linux cluster farms with a simple job management scheme at Fermilab.

Decentralized CDF Analysis Farm :

We extended the above model, including its command line interface and GUI, to manage and work with remote resources

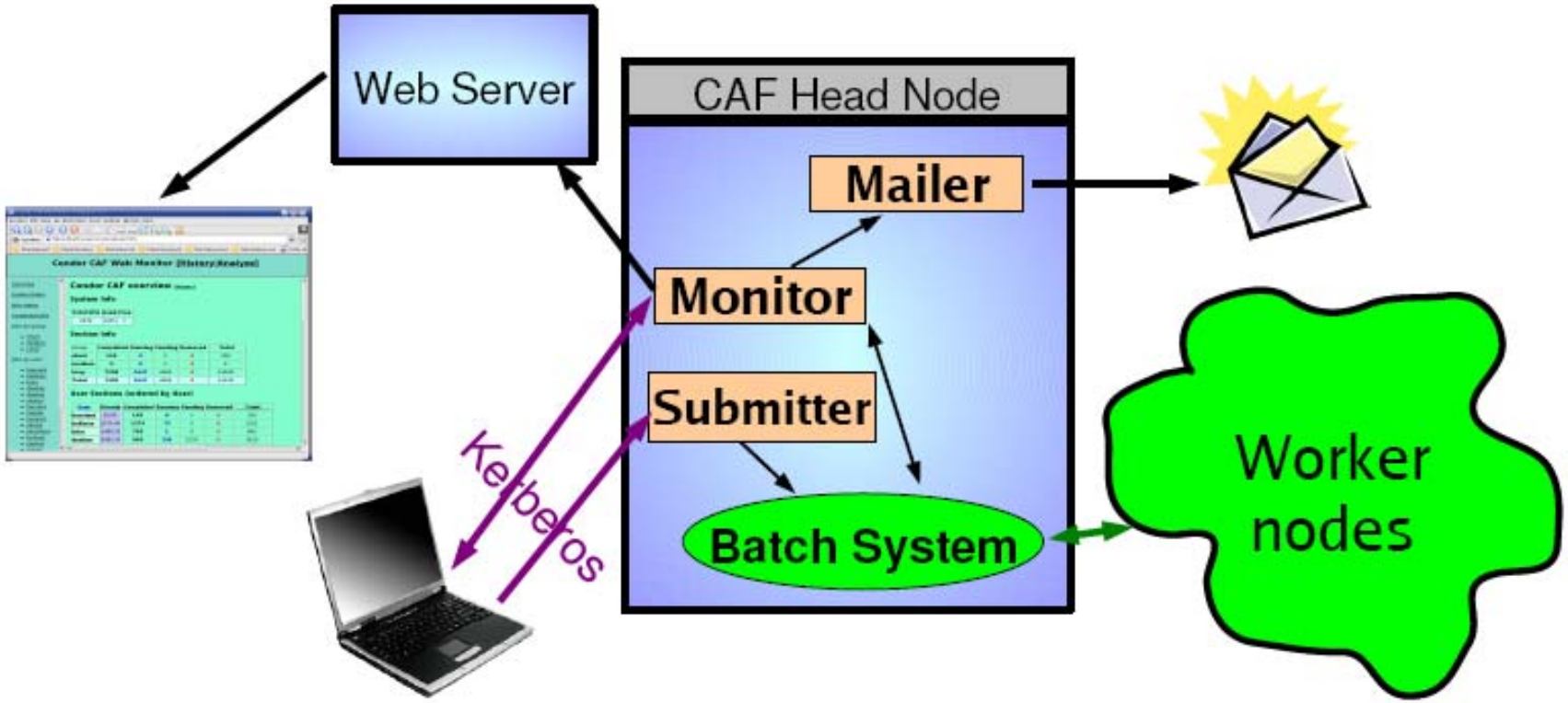
We are now in the process of adapting and converting out work flow to the Grid

CDF Analysis Farm (CAF)



The CAF head node

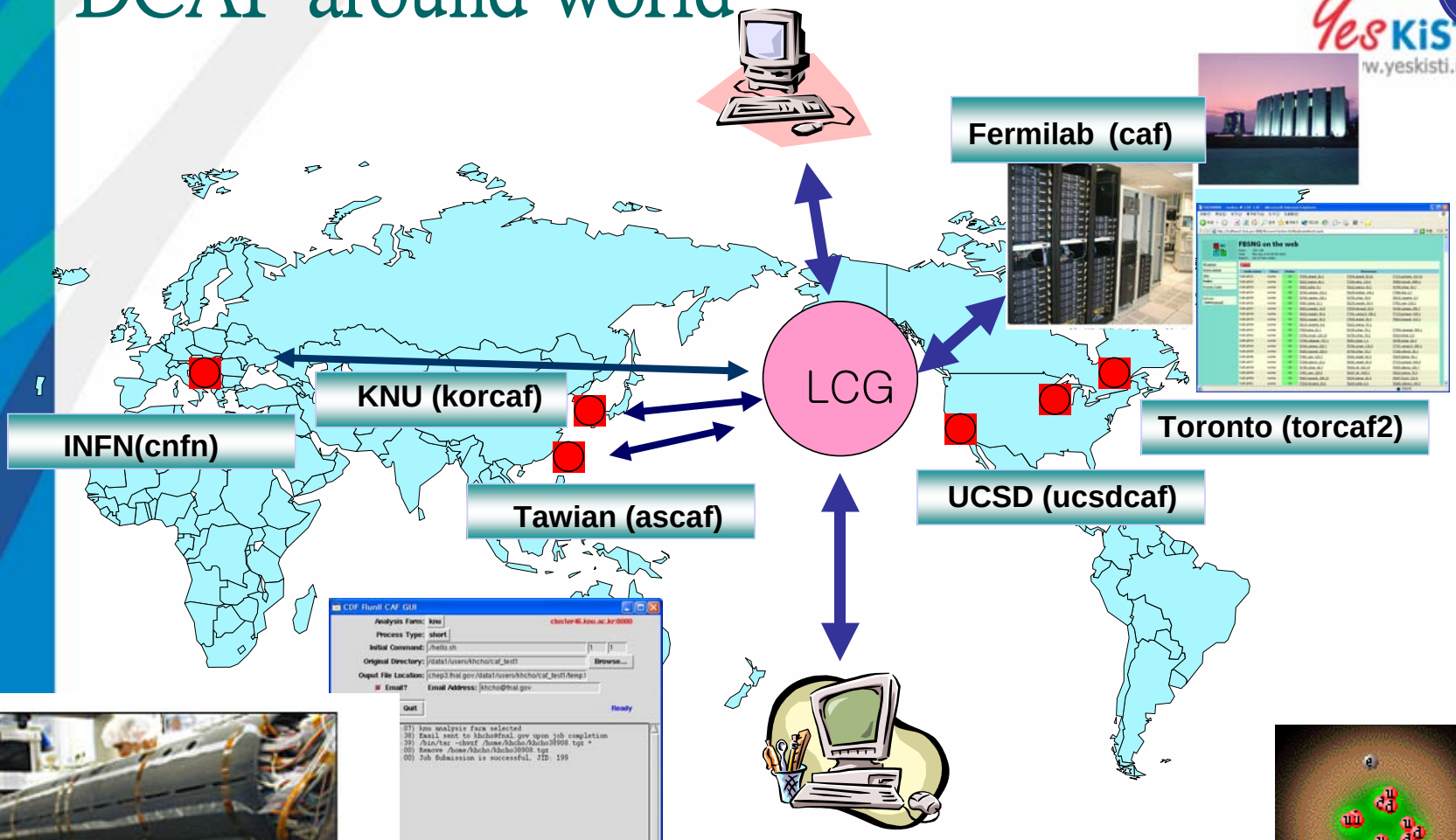
Just a portal

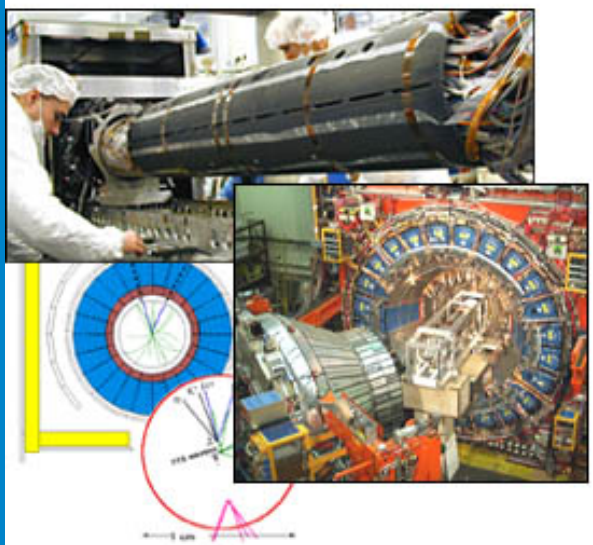


DCAF (Decentralized CDF Analysis Farm)

- **Cluster technology (CAF = “Central analysis farm”)**
- **Extended to remote site (DCAF = Decentralized CDF analysis Farm)**
- **Multiple batch systems supported : converting from FBSNG system to Condor on all DCAFs**
- **SAM data handling system required for offsite DCAFs**

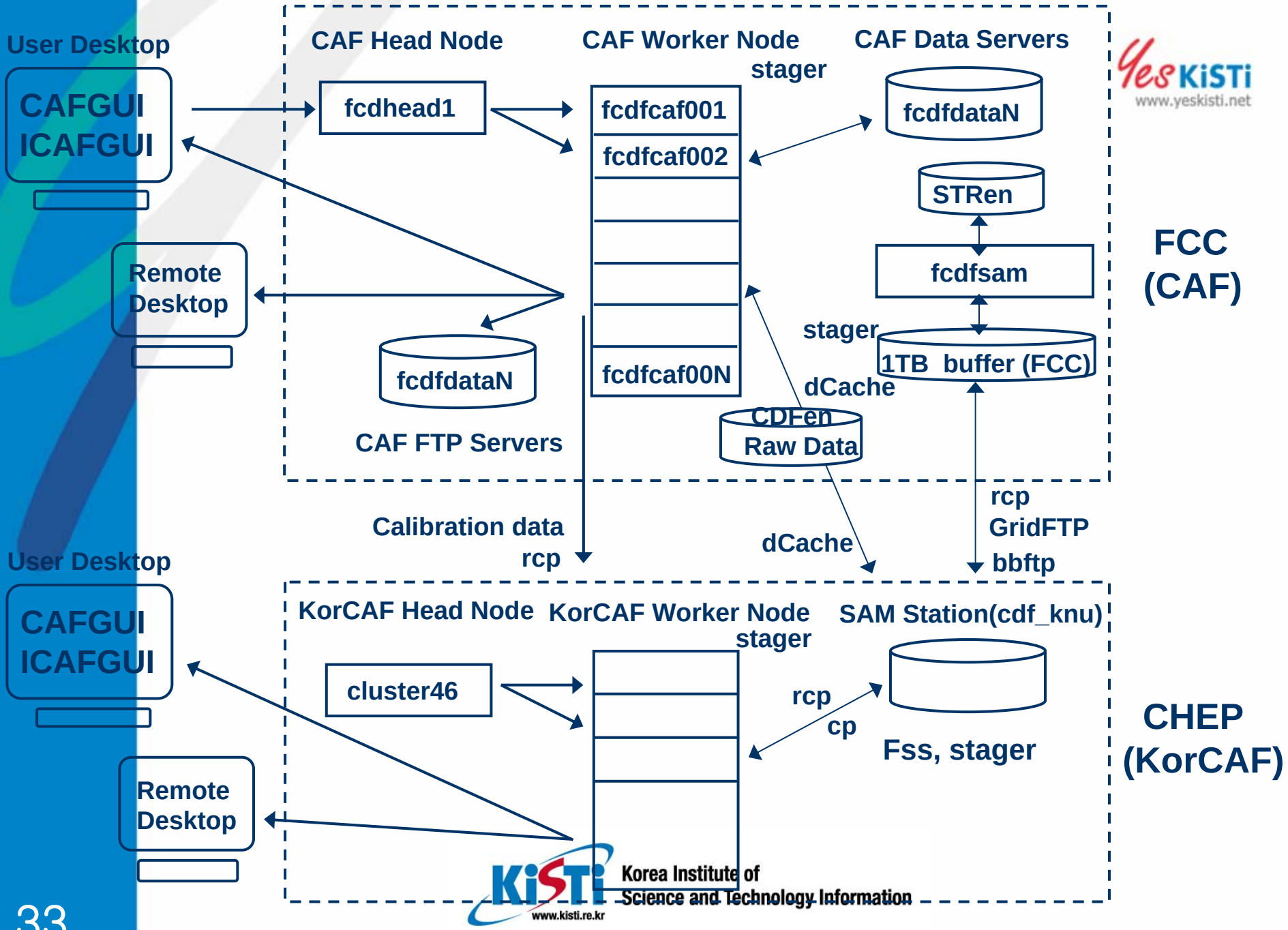
DCAF around world





DCAF (Decentralized CDF Analysis Farm)

March 26, 2007

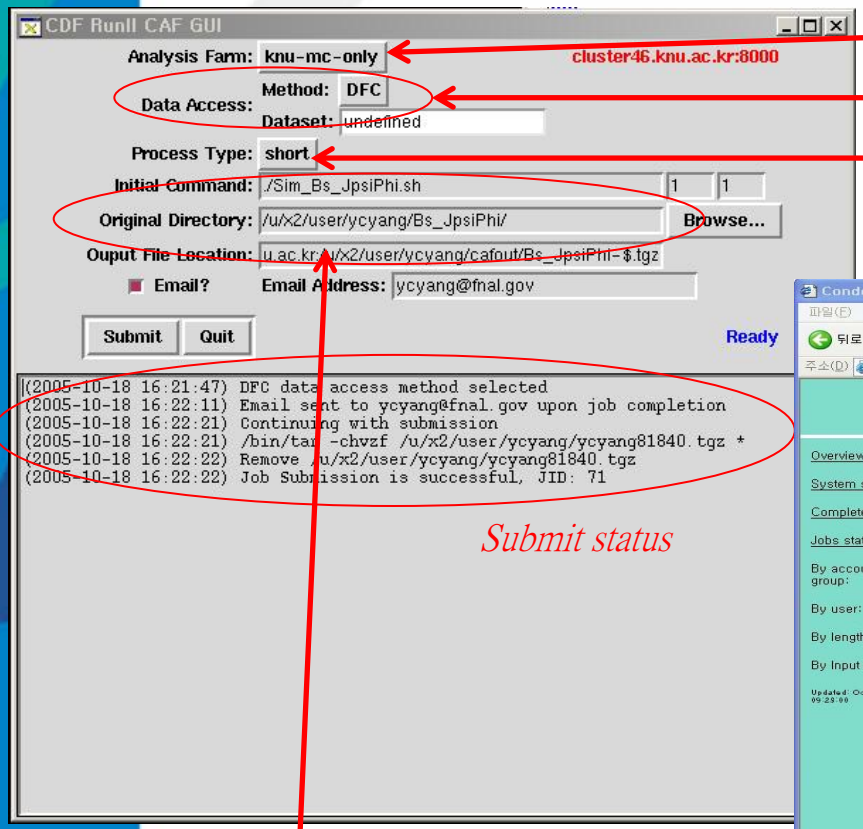

User Desktop
CAFGUI
ICAFGUI
CAF Head Node
fcdhead1
CAF Worker Node
stager
fcdfcaf001
fcdfcaf002
fcdfcaf00N
CAF Data Servers
fcdfdataN
STRen
fcdfsam
stager
1TB buffer (FCC)
Remote
Desktop
fcdfdataN
CAF FTP Servers
dCache
CDFen
Raw Data
FCC
(CAF)
Calibration data
rcp
dCache
rcp
GridFTP
bbftp
User Desktop
CAFGUI
ICAFGUI
KorCAF Head Node
cluster46
KorCAF Worker Node
stager
SAM Station(cdf_knu)
rcp
cp
Fss, stager
Remote
Desktop
CHEP
(KorCAF)
YesKiSTi
www.yeskisti.net
KiSTi
www.kisti.re.kr
Korea Institute of
Science and Technology Information

Current CDF Dedicated Resources

Current Resources [*]			
Cluster Name and Home Page	Monitoring and Direct Information Links	CPU (GHz)	Disk space (TBytes)
Original FNAL CAF	queues, user history, analyze, ganglia, sam station, consumption	1000	370
FNAL CondorCAF (Fermilab)	queues, user history, analyze, ganglia, sam station, consumption	2200	(shared w/CAF)
CNAFCAF (Bologna, Italy)	queues, user history, analyze, resources, network, sam station, datasets, consumption	480	32
KORCAF (KNU, Korea)	queues, user history, ganglia, sam station, datasets, consumption	178	5.1
ASCAF (Academia Sinica, Taiwan)	queues, user history, ganglia, sam station, datasets, consumption	134	3.0
SDSC CondorCAF (San Diego)	queues, user history, analyze, ganglia, sam station, datasets, consumption	380	4.0
HEXCAF (Rutgers)	queues, cpu, sam station, datasets, consumption	100	4.0
TORCAF (Toronto CDF)	queues, user history, analyze, ganglia, disk status, sam station, datasets, consumption	576	10
JPCAF (Tsukuba, Japan)	queues, user history, ganglia, sam station, datasets, consumption	152	10
CANCAF (Cantabria, Spain)	queues, user history, ganglia, sam station	50	1.5
MIT (Boston, USA) (MC only)	queues, user history, analyze	322	3.2
	Current Totals [*]:	5572	448

http://www-cdf.fnal.gov/internal/fastnavigator/fastnavigator.html (2006/Aug)

CAF gui & Monitoring System



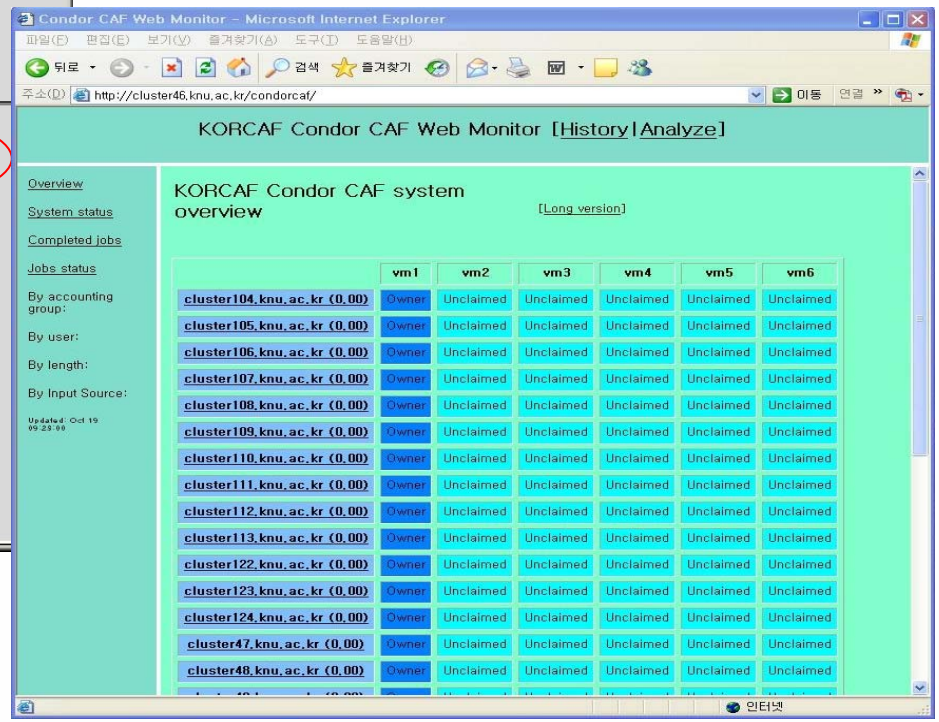
Select farm

Data access

Process type

Submit status

User script , I/O file location

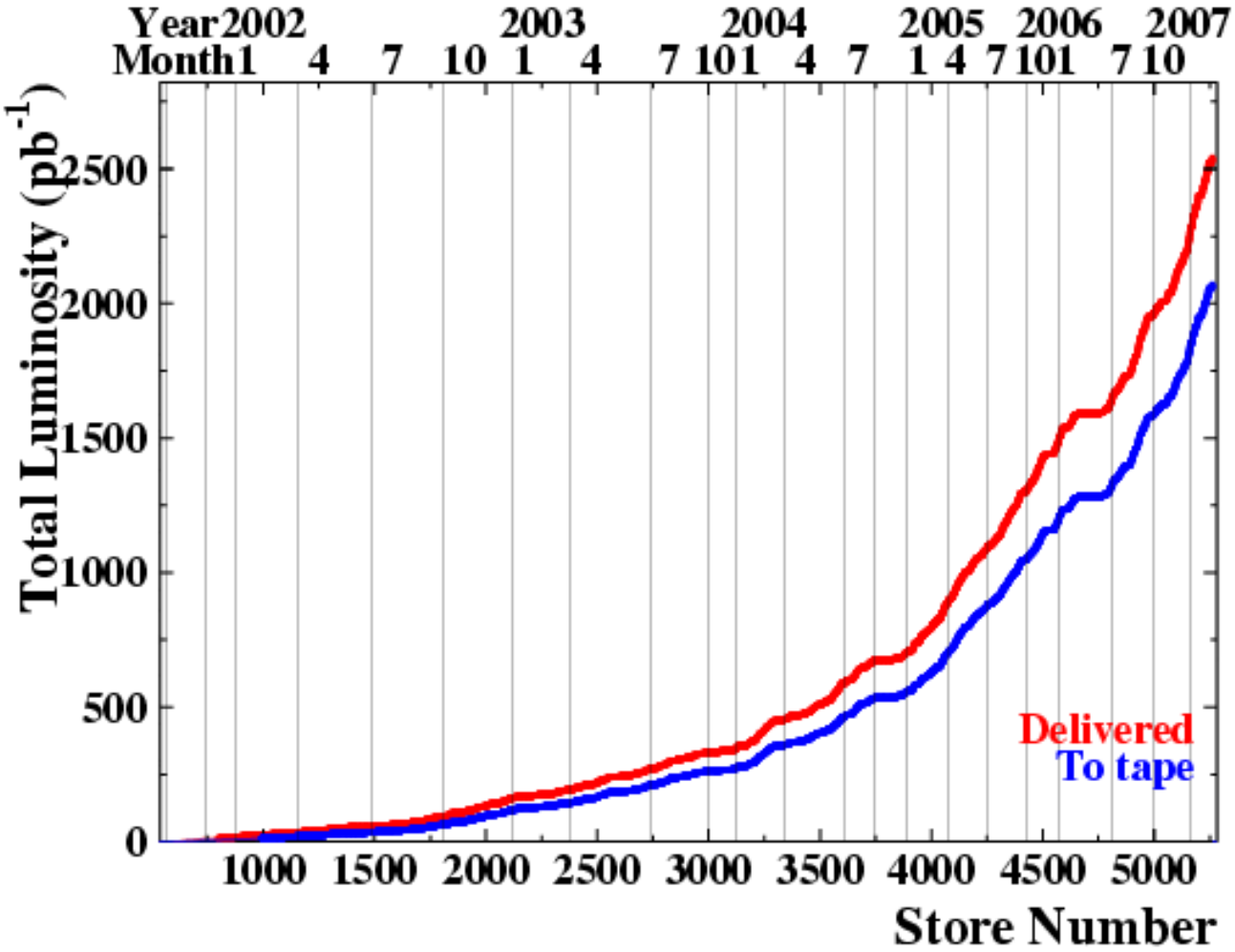


http://cluster46.knu.ac.kr/condorcaf

Functionality for User (KorCAF)

Feature	Status
Self-contained user interface	Yes
Runs arbitrary user code	Yes
Automatic identity management	Yes
Network delivery of results	Yes
Input and output data handling	Yes
Batch system priority management	Yes
Automatic choice of farm	Not yet
Negotiation of resources	Not yet
Runs on arbitrary grid resources	Not yet

CDF Data (Total Luminosity)



Total CDF Computing Requirements

Input Conditions					Resulting Requirements				
Fiscal Year	Int L	Evts	Peak rate		Ana	Reco	Disk	Tape I/O	Tape Vol
	fb^{-1}	x 10^9	MB/s	Hz	THz	THz	PB	GB/s	PB
2003	0.3	0.6	20	80	1.5	0.5	0.2	0.2	0.4
2004	0.7	1.1	20	80	4.0	0.7	0.3	0.5	1.0
2005	1.2	2.4	40	220	7.2	1.0	0.7	0.9	2.0
2006	2.7	4.7	60	360	16	1.4	1.2	1.9	3.3
2007	4.4	7.1	60	360	26	2.8	1.8	3/0	4.9

- ✓ Analysis CPU, disk, tape needs scale with number of events.
- ✓ FNAL portion of analysis CPU assumed at roughly 50% beyond 2005.

Movement to Grid

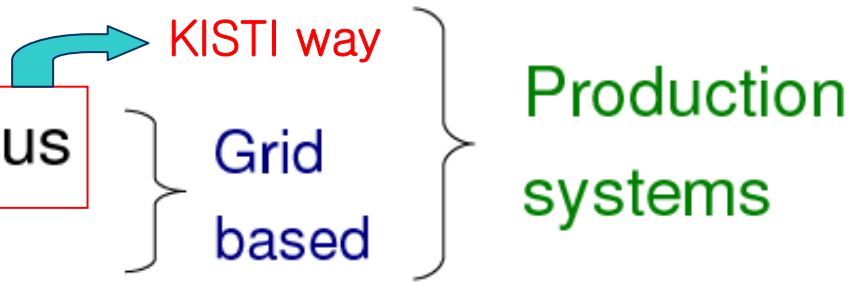
- **It's the world wide trend for HEP experiment.**
- **Need to take advantage of global innovations and resources.**
- **CDF still has a lot of data to be analyzed.**

Cannot continue to expand dedicate resource

USE Grid

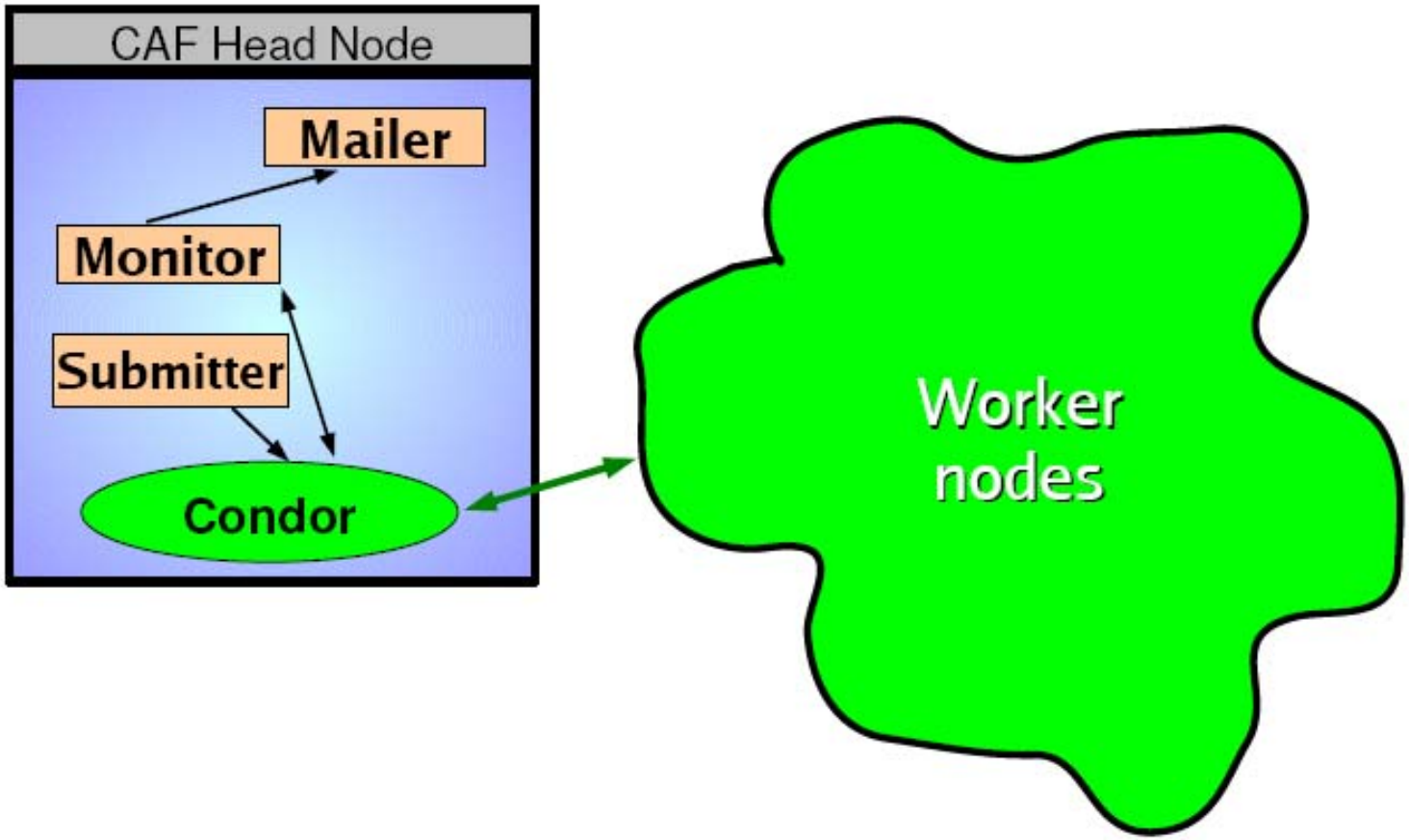
CAF evolution over time

- CAF just a portal
  - Allows to change the underlying batch system without changing the user interface
- CDF used several batch systems
  - FBSNG
  - Condor
  - Condor over Globus
  - gLite WMS

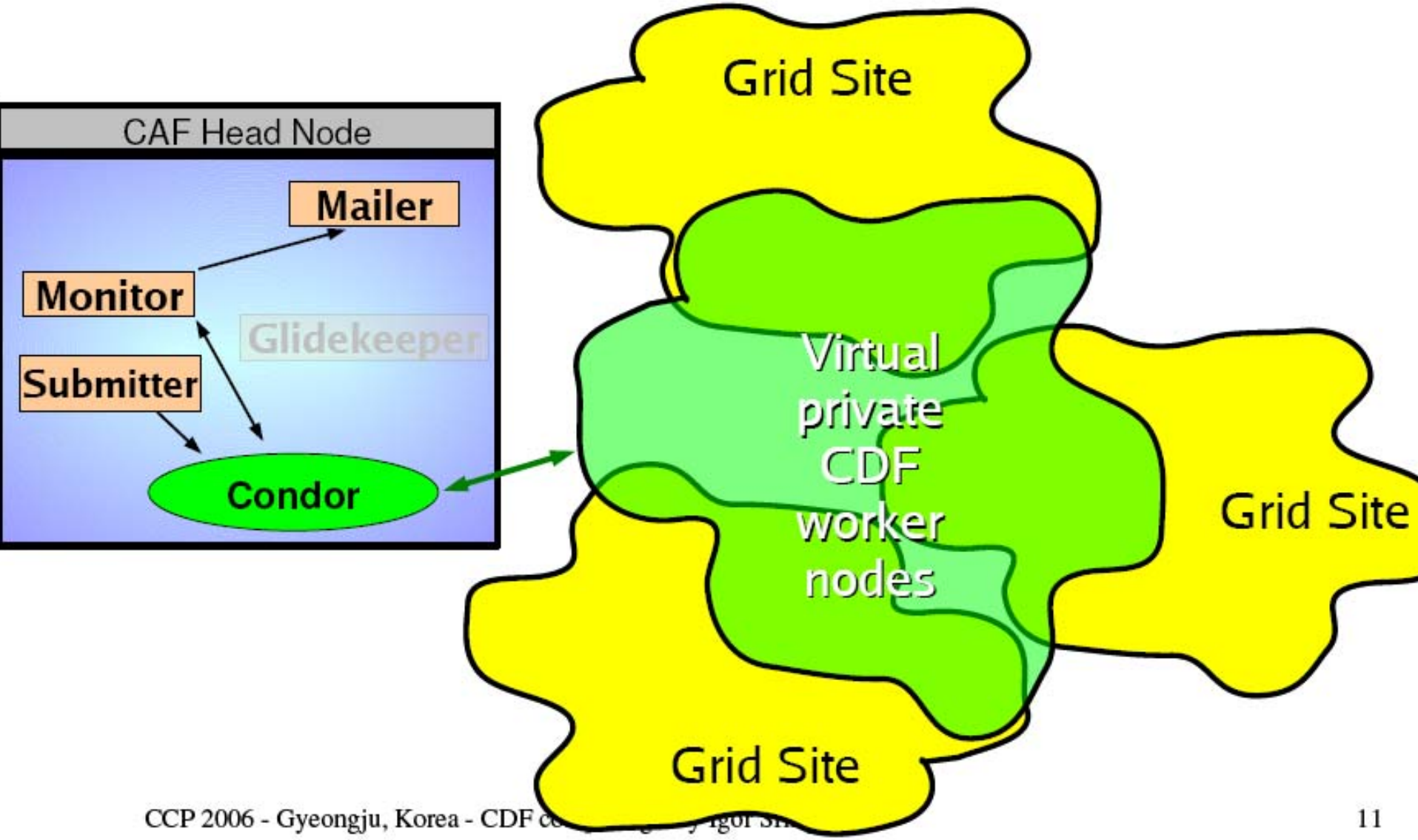


WMS (Workload Management System)

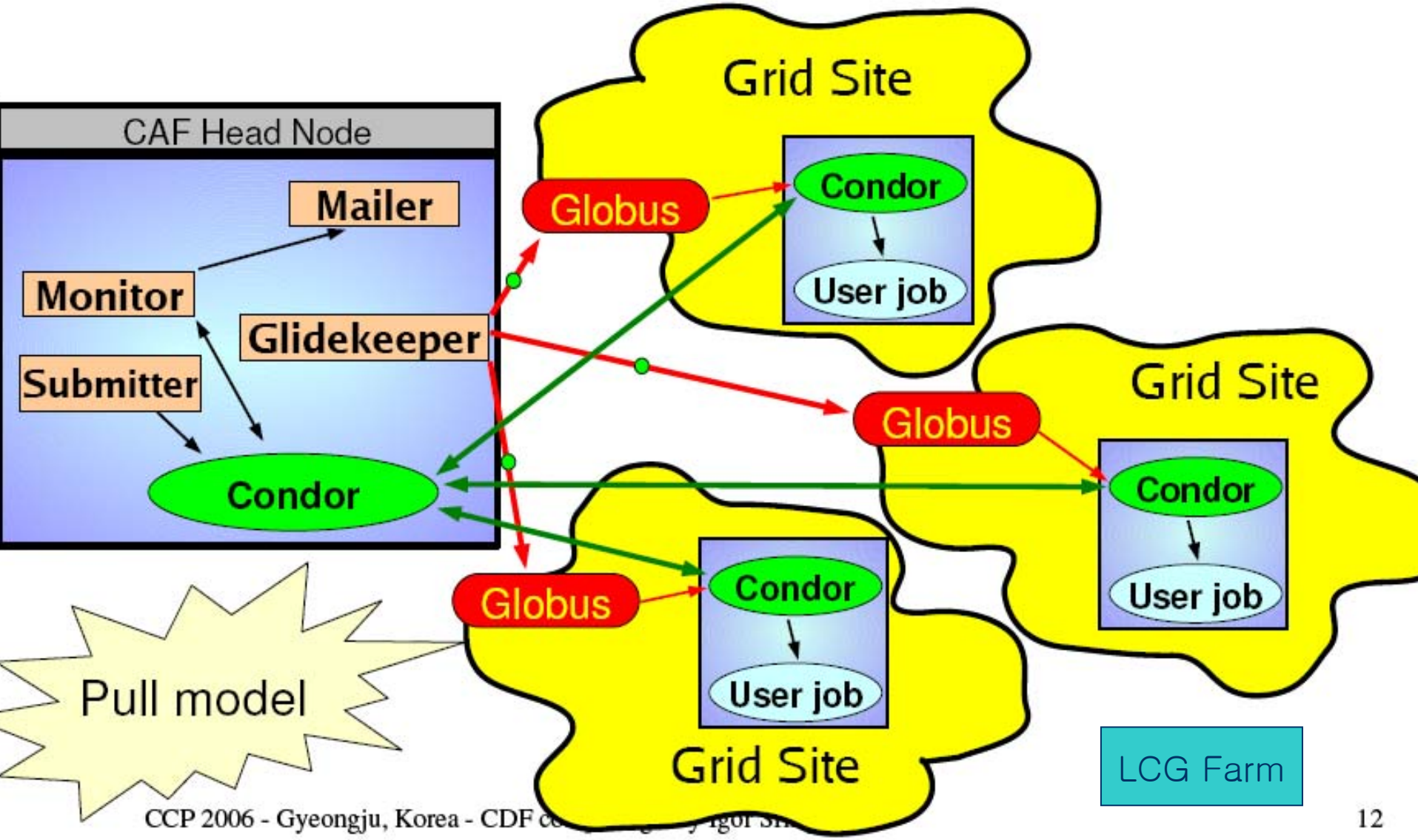
Condor based CAF



Condor based Grid CAF - Overview



Condor based Grid CAF - Details



Condor based Grid Farm

- Pros
  - Real fair share
  - Globally managed user and job priorities
  - Broken nodes kill condor daemons, not users jobs
  - Resource selection done after a batch slot is secured
- Cons
  - Uses a single service proxy for all jobs to enter Grid sites
  - Require outgoing connectivity
  - Not (yet) a blessed Grid service

Grid CAF Summary

- The two Grid CAF is compliment each other:
  1) Condor based Grid CAF is more flexible.
  2) gLite WMS model is more Grid-compliant.

- KISTI way is 1st one.
  - To make Pacific CAF connecting with Taiwan and Japan.

Plan for Pacific CAF @KISTI

Plan	2007								
	3	4	5	6	7	8	9	10	11
Venus 40 node CDF VO Construction									
Supercomputer 4 (Extended to CDF 80 CPU)									
Tuning for CDF									
Hamel 512 CPU Dismantle plan									

Conclusions

- High Energy Physics is one of e-Science Top Brands @ KISTI.
- KISTI is leading for e-Science for High Energy Physics in Korea
- KISTI is the official ALICE Tier2 center and constructing it.
- The official CMS Tier2 center has not been decided yet in Korea. Kyungpook National University has been working on it.
- KISTI participate in CDF experiment and collaborating with Pacific CAF with Taiwan & Japan.
- KISTI ALICE Tier2 center will extend to CDF and Bio VO etc. based on FKPPL.

Thank you!

Kihyeon Cho (cho@kisti.re.kr)