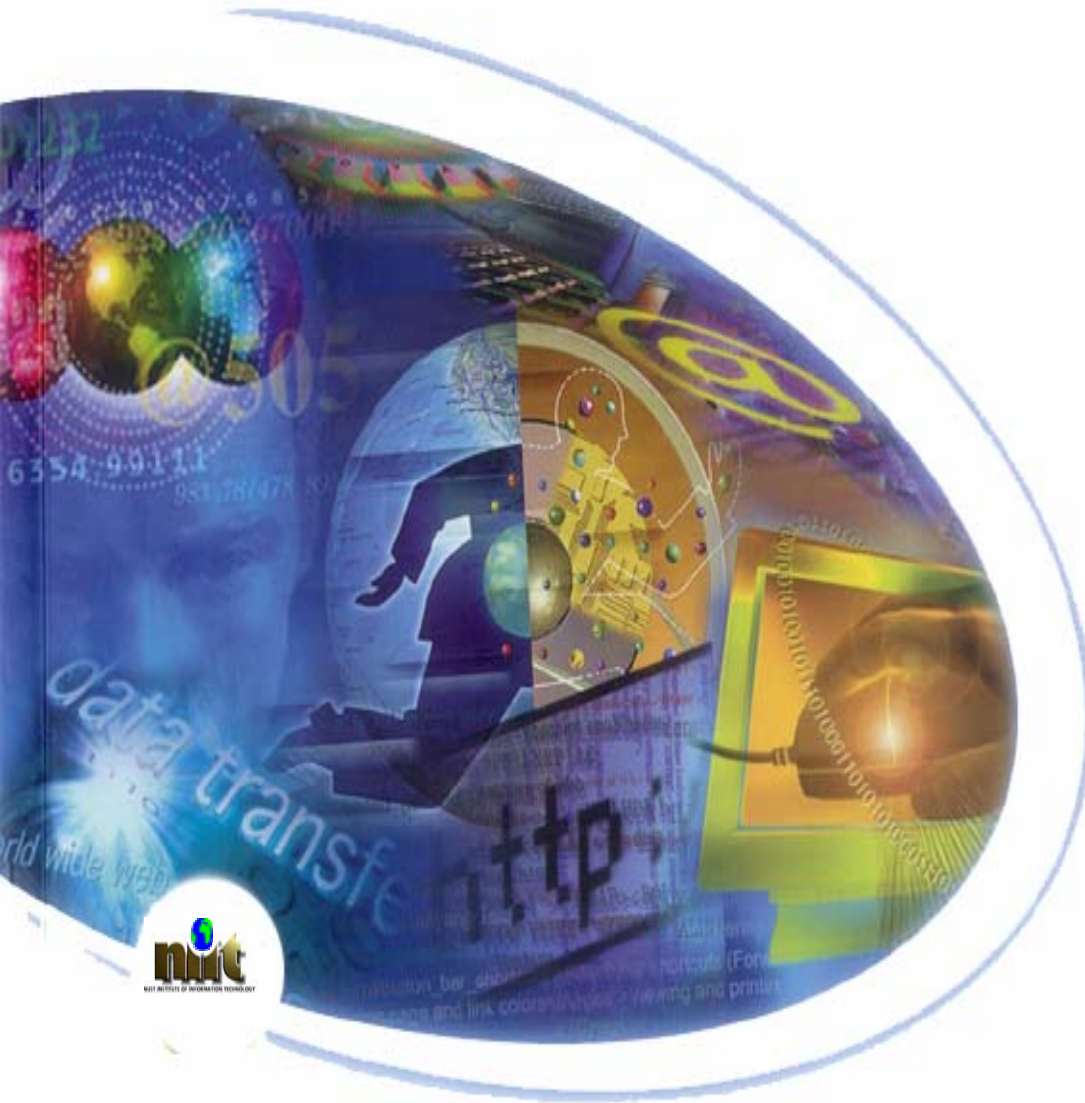


National University of Sciences & Technology



International Collaboration Supporters

- Hafeez Hoorani
- Ian Willers
- Harvey Newman
- Richard McClatchey
- Diether Blechschtmit

Overview

- NUST and Its Programs
- NUST Institute of IT
- GRID Related Research at NUST
- Research Performance Analysis
- Future Vision
- Conclusion



BACKGROUND

- **NUST Established** **1991**
- **NUST Awarded Charter** **1993**



OBJECTIVES OF NUST

- **To develop competent scientific and technical manpower having international level of higher education in order to meet the country's public and private sector needs**





OBJECTIVES OF NUST

- **To help speedy attainment of capability in newly emerging fields of sciences, engineering and technologies, by coordinating technological/scientific areas of national interest**








OBJECTIVES OF NUST




- **To provide a forum for exchange of knowledge amongst the elite from the world of sciences and technology, both within and outside Pakistan**



NUST

**BASED ON DECENTRALIZED
MULTI-CAMPUS CONCEPT**

| COLLEGE/INSTITUTE | SPECIALIZATION |
|---|--|
| <p>1. College Of Civil Engineering Risalpur</p>  | <ul style="list-style-type: none"> • Civil Engineering |
| <p>2. College of Telecomm Rawalpindi</p>  | <ul style="list-style-type: none"> • Telecomm Engg • Computer Software Engg • Cryptology/ Information Security |
| <p>3. College of Electrical & Mechanical Engineering Rawalpindi</p>  | <ul style="list-style-type: none"> • Electrical Engg • Mechanical Engg • Computer Engg • Mechatronics |

| COLLEGE/INSTITUTE | SPECIALIZATION |
|--|--|
| <p>4. College of Marine Engineering Karachi</p>  | <ul style="list-style-type: none">• Electrical & Electronics Engg• Mechanical Engg |
| <p>5. College of Aeronautical Engineering Risalpur</p>  | <ul style="list-style-type: none">• Aerospace Engg• Avionics Engg |
| <p>6. College of Medicine Rawalpindi</p>  | <ul style="list-style-type: none">• Medicine• Surgery• Dentistry |

COLLEGE/INSTITUTE

SPECIALIZATION

7. National Institute of
Transportation
Risalpur



- Geotechnical Engg
- Structural Engg
- Transportation Engg

8. Institute of
Environmental
Science and Engineering
Rawalpindi



- Environmental Engg

9. NUST Institute of
Management Sciences
Rawalpindi



- Technology Management
- International Business
and Marketing
- Finance and Investment

10. NUST Institute of
Information Technology
Rawalpindi



- Object Oriented
Technologies
- Network Technologies
- Databases
- E-Commerce



NUST INSTITUTES BEING ESTABLISHED AT ISLAMABAD (SECTOR H-12)

- **INSTITUTE OF APPLIED ELECTRONICS AND COMPUTING (IAEC)**
- **INSTITUTE OF TELECOMMUNICATIONS**
- **RESEARCH INSTITUTE OF MICROWAVE AND MILLIMETER WAVE
STUDIES (RIMMS)**
- **RESEARCH CENTER OF MODELING AND SIMULATION (RCMS)**
- **INSTITUTE OF GEOGRAPHICAL INFORMATION SYSTEM (IGIS)
INCLUDING REMOTE SENSING AND SATELLITE IMAGERY**
- **NUST INSTITUTE OF INFORMATION TECHNOLOGY AND
MANAGEMENT SCIENCES (NIIT & MS)**





NUST INSTITUTES BEING ESTABLISHED AT ISLAMABAD (SECTOR H-12)

- **CENTER FOR CYBER TECHNOLOGY AND SPECTRUM MANAGEMENT (CCT & SM)**
- **INSTITUTE OF MANUFACTURING ENGINEERING (IME)**
- **CENTER FOR CHEMICAL ENGINEERING AND MATERIAL SCIENCES (CCE&MS)**
- **RELOCATION OF NATIONAL INSTITUTE OF TRANSPORTATION (NIT)**
- **RELOCATION OF INSTITUTE OF ENVIRONMENTAL SCIENCE AND ENGINEERING (IESE)**
- **TECHNOLOGY INCUBATION CENTER (TIC)
FOR COMMERCIALIZATION OF R&D OUTPUT OF NUST**



STONE LAYING CEREMONEY

- Stone laying ceremony of NUST Campus at Sector H-12, Islamabad
- Held on September 23rd 2002
- Plaque unveiled by Gen Pervez Musharraf





NIIT

An Institute with a

PROGRESSIVE

Vision



VISION STATEMENT

The NUST Institute of IT Aspires:

- To be a **center of excellence** for quality IT education, where ideas are challenged.
- To be an institution whose environment fosters **creativity** and **productivity** among all faculty, staff and students.
- To occupy a position of **unique leadership** among national universities in research and scholarly achievements.

Programs Offered



PROGRAMS OFFERED

Post Graduate Programs

- **PhD**
- **MIT**



Under Graduate Programs

- **BIT**
- **BICSE**



Professional Courses





Research Groups



Research Groups

- **Distributed and Grid Computing Group (DGCG)**
(Principal Investigator: Dr. Arshad Ali, Dr. Farooq Ahmad)
- **NIIT Network Research Group (NNRG)**
(Principal Investigator: Dr. S.M.H. Zaidi)
- **Object Oriented and Database Technologies (NOODBaRG)**
(Principal Investigator: Dr. Abaidullah Anwar)
- **Artificial Intelligence Research Group (AIRG)**
(Principal Investigator: Dr. Usama Hassan)



NUST-CERN Collaboration

- Dec 2000: CERN scientists visited NUST
(Hafeez Hoorani, Ian Willers, Richard McClatchey)
- Feb 2001: **WISDOM II** Project started at NUST with CERN and University of West England (UWE) UK
- April 2001: Monalisa module development started with Caltech (Iosif Legrand)



GRID Research Group at NUST





Collaboration Projects

- Little Monalisa and Development for MonaLisa Auto-topology Discovery Module -- **Caltech, USA**
- IP Network Topology Discovery -- **Caltech, USA**
- Grid Enabled Analysis Application for Handheld Devices --**Caltech, USA**
- Java Based Claren Server for Physics Analysis -- **Caltech, USA**
- Data Warehousing Services for Grid -- **Caltech, USA**
- Establishment of CMS Production Centre and LCG Grid deployment -- **CMS CERN**
- Integration of Agents and Web Services in Semantic Grid --**Comtec Japan**
- FIPA Compliant Multi Agent System -- **Comtec Japan**



Little MonALISA



Little MonALISA



- **Introduction**

- System Resource Monitoring Tool
- Monitors End Hosts in a Network

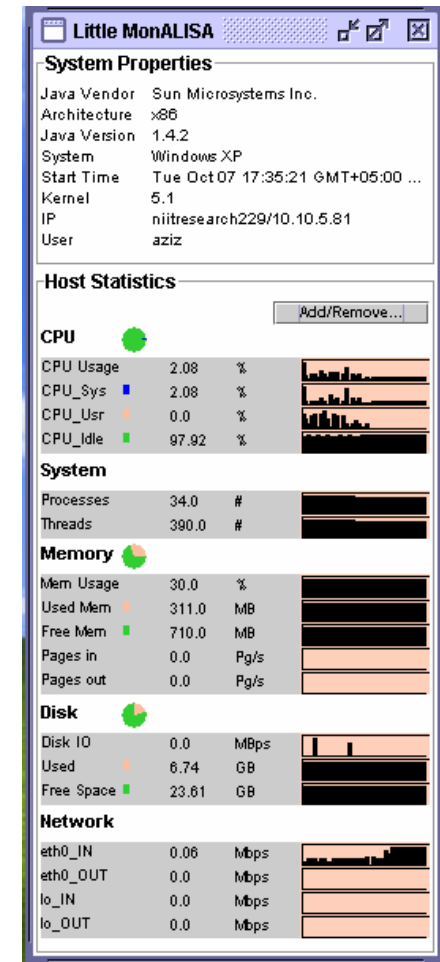
- **Features**

- Platform Independent
- Easy Module Integration
- Dynamic Loading of Modules
- Static Information
- Dynamic Information
- Textual and Graphic representation of parameter values
- Pie Charts for Value Comparison
- Desktop Customization

- **Current Status**

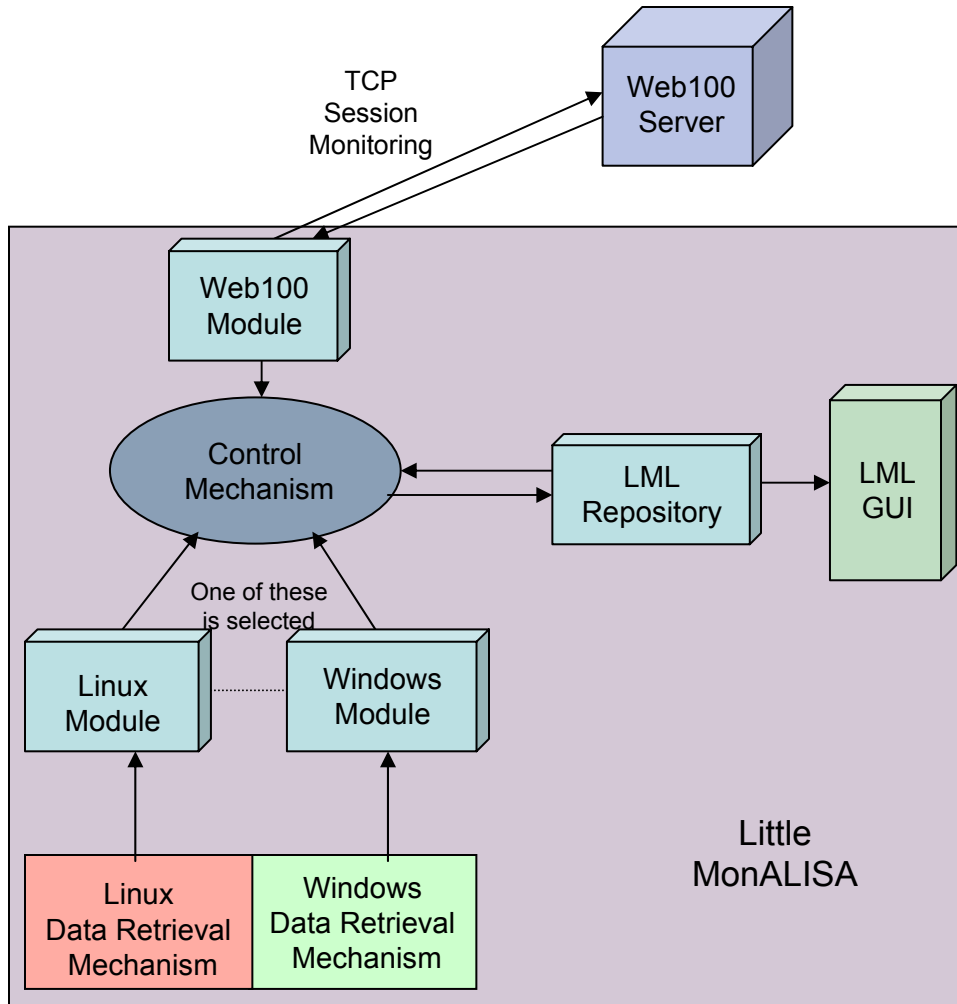
- Application for end host monitoring has been developed

LML GUI





LML Architecture



3-Layered Architecture

- Information Gathering
- Data Repository and Control Mechanism
- Graphical User Interface

Little MonALISA

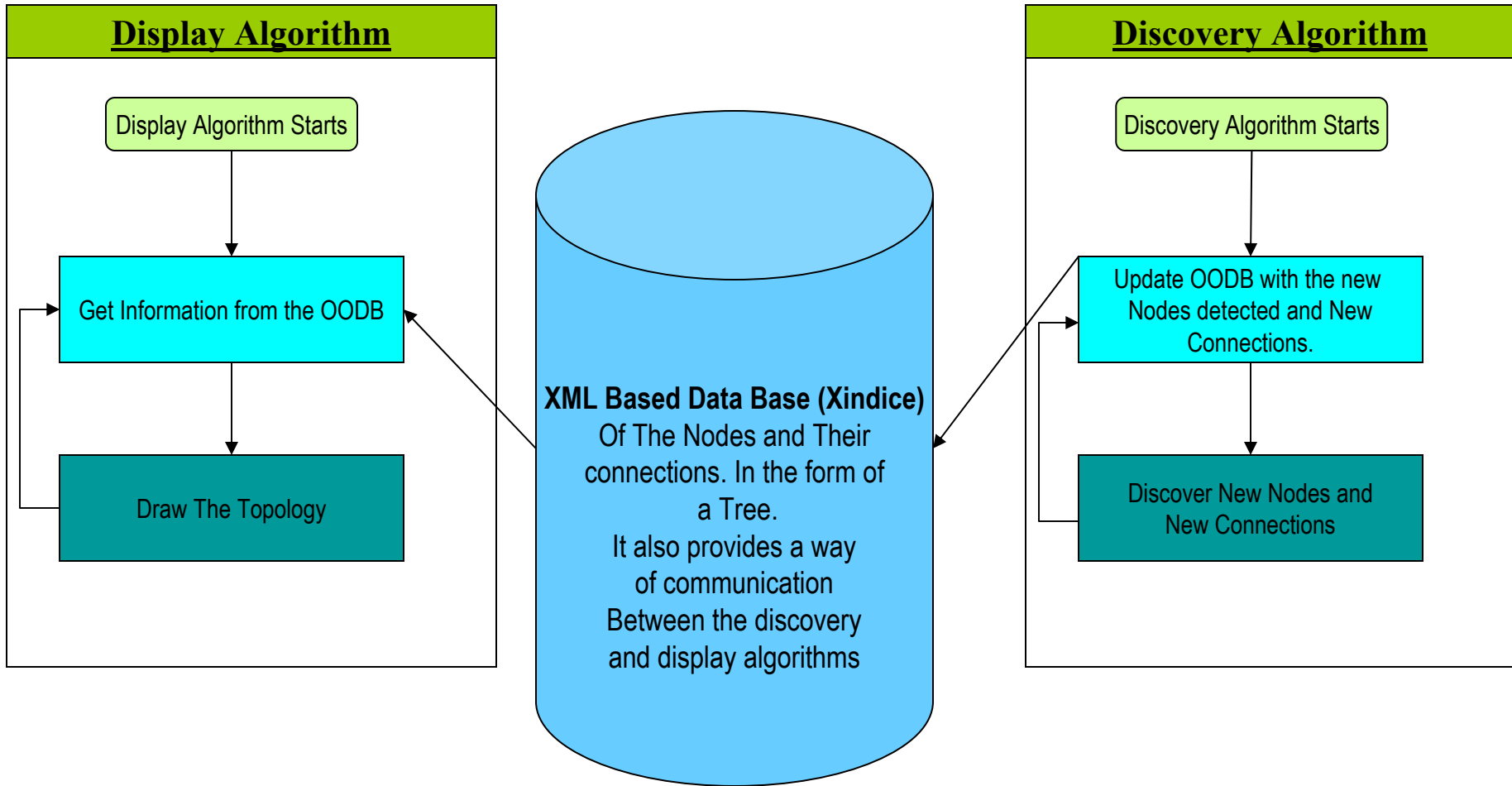
Future Work

- Standalone Installable and Configurable Application
- Integration with MonALISA
 - Discovery, Reporting of Parameters (Repository)
- Enhanced Network Monitoring
 - Web100 for network monitoring and auto tuning
- Security Mechanisms



IP Network Topology Discovery

Architecture





IP Network Topology Discovery



Current Status

- Tested existing Algorithms
- Proposed a new Display and Discovery Algorithm.
- Working on XML Based Database (Xindice).
- Working on creating efficient implementation on ping, trace route, ARP and RARP.

Future Work: Database designing, Implementation of Display and Discovery Algorithms



Grid Enabled Physics Application for Handheld Devices



Grid Enabled Physics Application for Handheld Devices



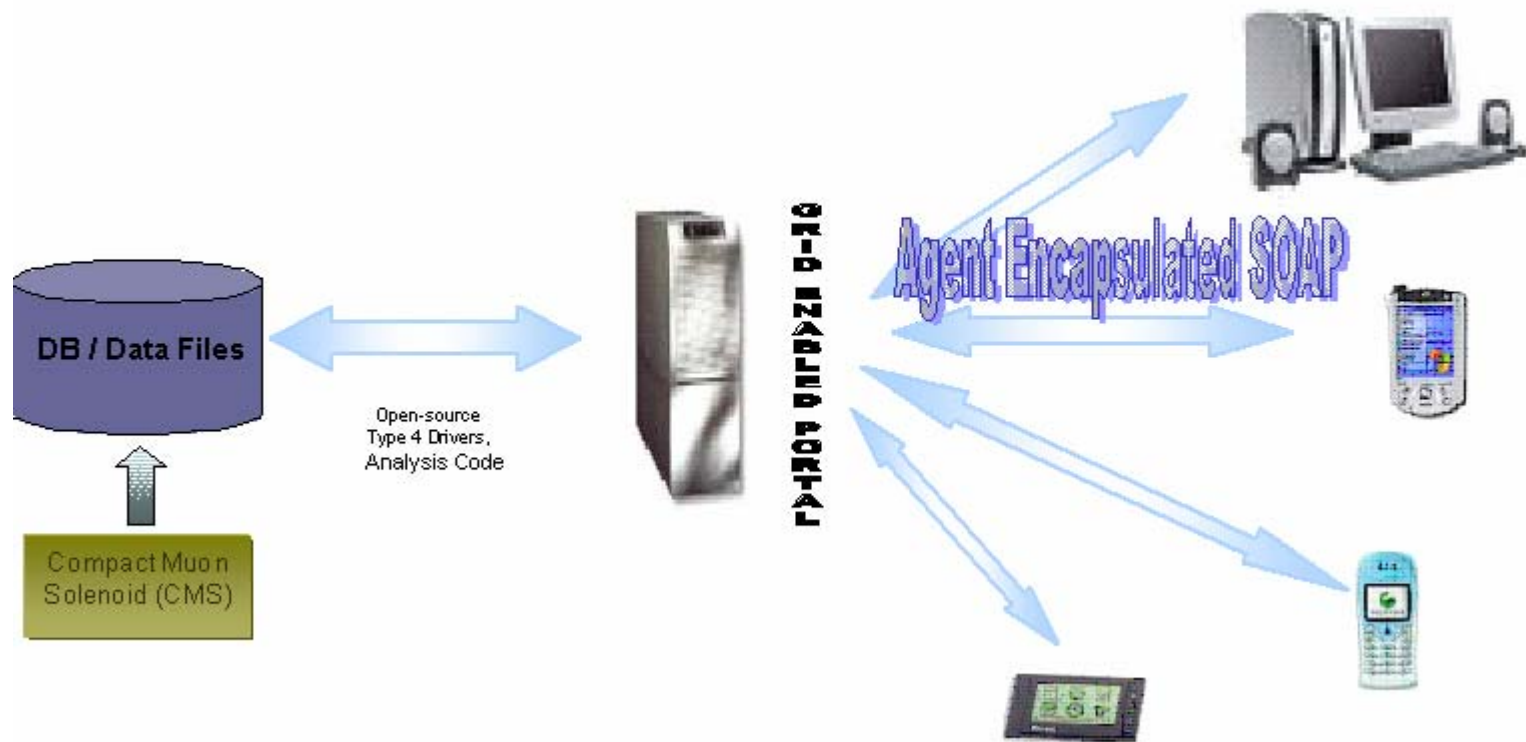
Team Members

- Julian Bunn
- Conrad Steenberg
- Eric Aslakson
- Arshad Ali
- M H Zaidi
- Ashiq Anjum
- Ahsan Ikram
- Atiya Azim
- Haider Altaf
- Rizwan Haider
- Tahir Azim
- Waqas-ur-Rehman





Overall Architecture

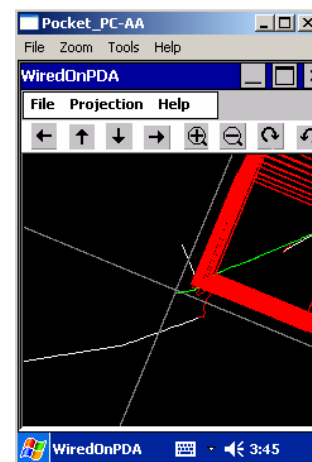
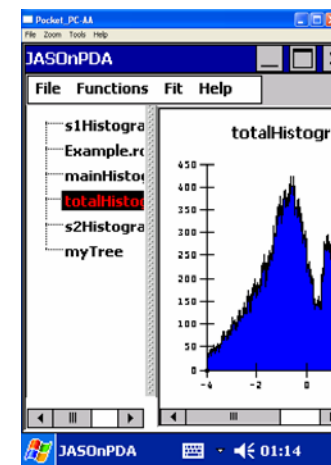




Current Status



- **Two popular analysis apps ported to PDAs**
 - **JASOnPDA**
 - Displays histograms and scatter plots from data in ROOT files
 - ROOT IO rewritten entirely to make it PDA-compatible
 - Authenticates itself with a secure “Grid portal” (Clarens) before accessing the data
 - **WiredOnPDA**
 - 3D display of event data from HepRep2 files
 - Most functionality from WIRED ported including:
 - 2D Translation & Rotation
 - Scaling
 - 3D rotation
 - Projections





Future Directions



- Currently the analysis environment on the PDA is not so “interactive”
- Optimizing algorithms and code for better performance
- Looking at other non-conventional ways of analysing data for a richer, more interactive user experience
 - Remote data analysis
 - Agents
 - Can be transported to data servers, analyze data and return the results
 - Can coordinate to form a load balancing system for optimal performance
- Surveying other JVMs and handheld devices towards which we can extend our work

CERN at

ITU TELECOM **WORLD 2003**
Geneva 12-18 October

Innovating for Tomorrow



Grid analysis demo by Caltech, CERN, KEK (Japan), Sinica (Taiwan), **NUST (Pakistan)**, UERJ (Rio de Janeiro), PUB (Bucharest).

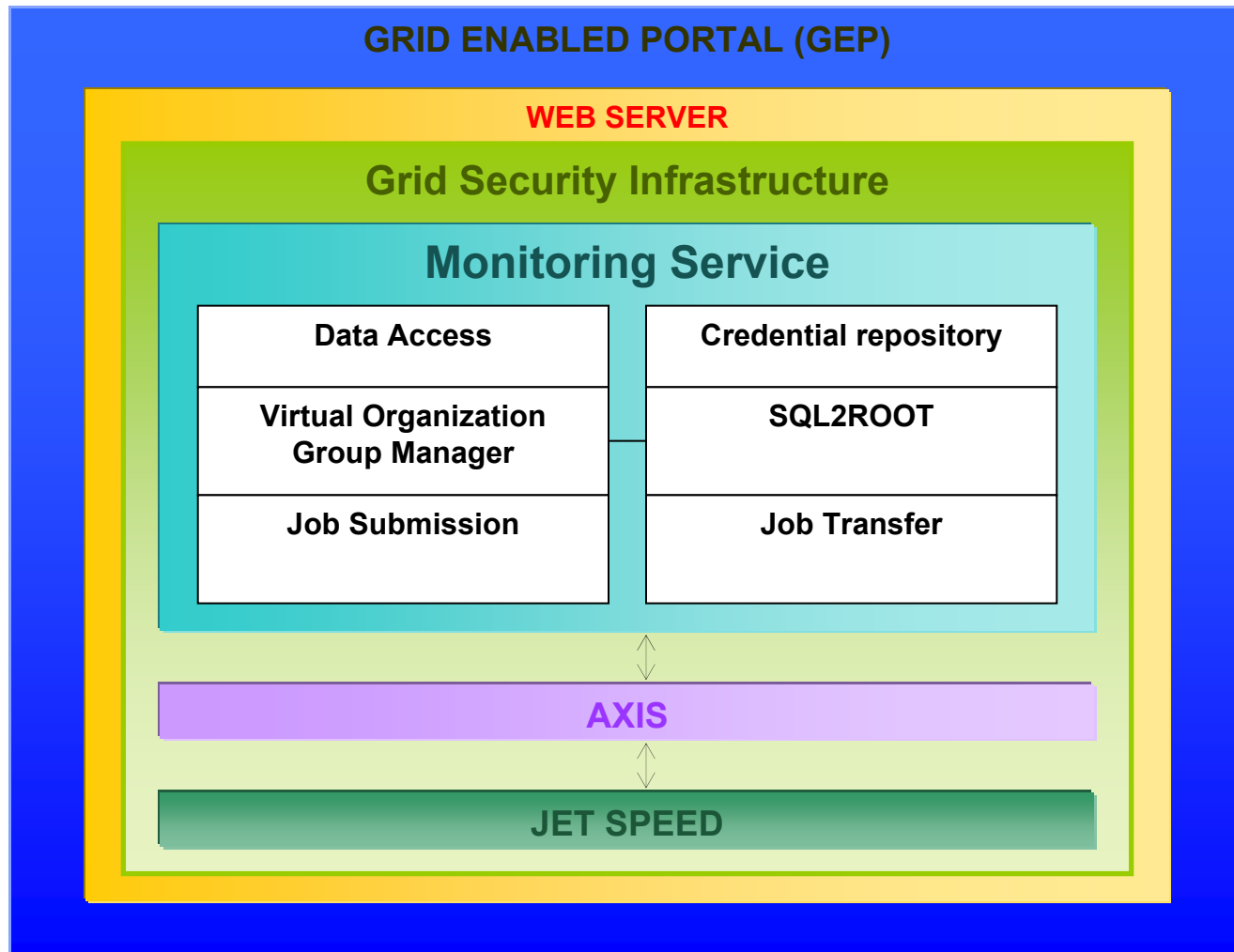


Java Based Claren Server for Physics Analysis

JClarens



JClarens Architecture





Current Status



- Two Dimensions of work:
 - **New architecture and services**
 - Hosting two types of services on Axis (system and file services)
 - Integrated JetSpeed with Axis
 - GSI Layer is providing the security functionality
 - One complete cycle is functional
 - XtremWeb – A Java-based, Open Source P2P framework is ready.
 - **Support for existing Clarens clients**
 - System Methods
 - File Methods
 - Echo Method
 - Proxy methods (in progress)
 - All the above methods have been tested through both Python & Java clients



Future Direction



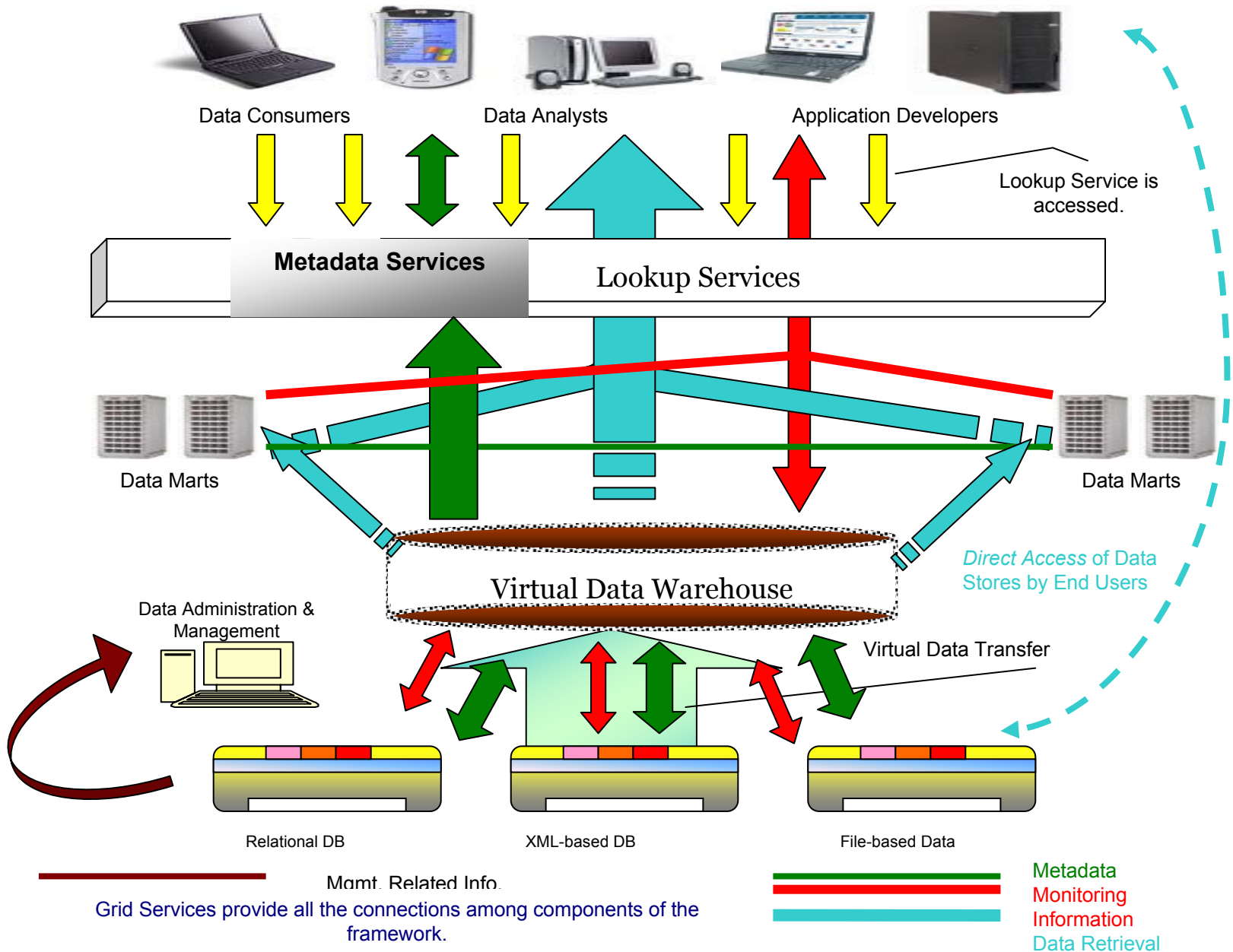
- **Virtual Organization Group Management (VOGM) and Access Control List (ACL) implementation**
- **New Architecture Development**
 - Concentrating on developing several services (SQL2ROOT) and integrating them with in the architecture
 - P2P platform for coordination between JClarens servers
 - Monitoring, Load balancing and Fault Tolerance
- **Agents implementation to access the services in a P2P platform**
- **Integration of Agents and P2P in new architecture**



Data Warehousing Services for Grid

Integration of Databases and Data warehouses in Grid using Grid framework/Web Services

Data Warehousing Services for Grid (Architecture)





Data Warehousing Services for Grid



Current Status:

- Problem Domain Study completed: including Grid, Web services, OGSA, Globus Toolkit, Data Warehousing
- Explored C/C++ Web Services Toolkits
- Web Services created to access, manage, administer data remotely using Apache Axis
- Working on Grid Data Services



- **Future Work**

- Building Web/Grid Services that handle multiple DB.
- Managing and accessing distributed & heterogeneous DB.
- Integrating Data Warehouses and Mediators.
- Integrating Monitoring Services.
- Integrating Metadata search and lookup services.



Establishment of CMS Production Centre at NUST



CMS Production Centre



Team Members

- **Dr. Arshad Ali**
- **Mr. Kamran Munir**
- Fawad Nazir
- Tallal Rabani
- Atif Mehmood
- Adeel Zafar

CMS-CERN Coordinators

Hafeez Hoorani
Ian Willers
Asif Osman





CMS Production Center

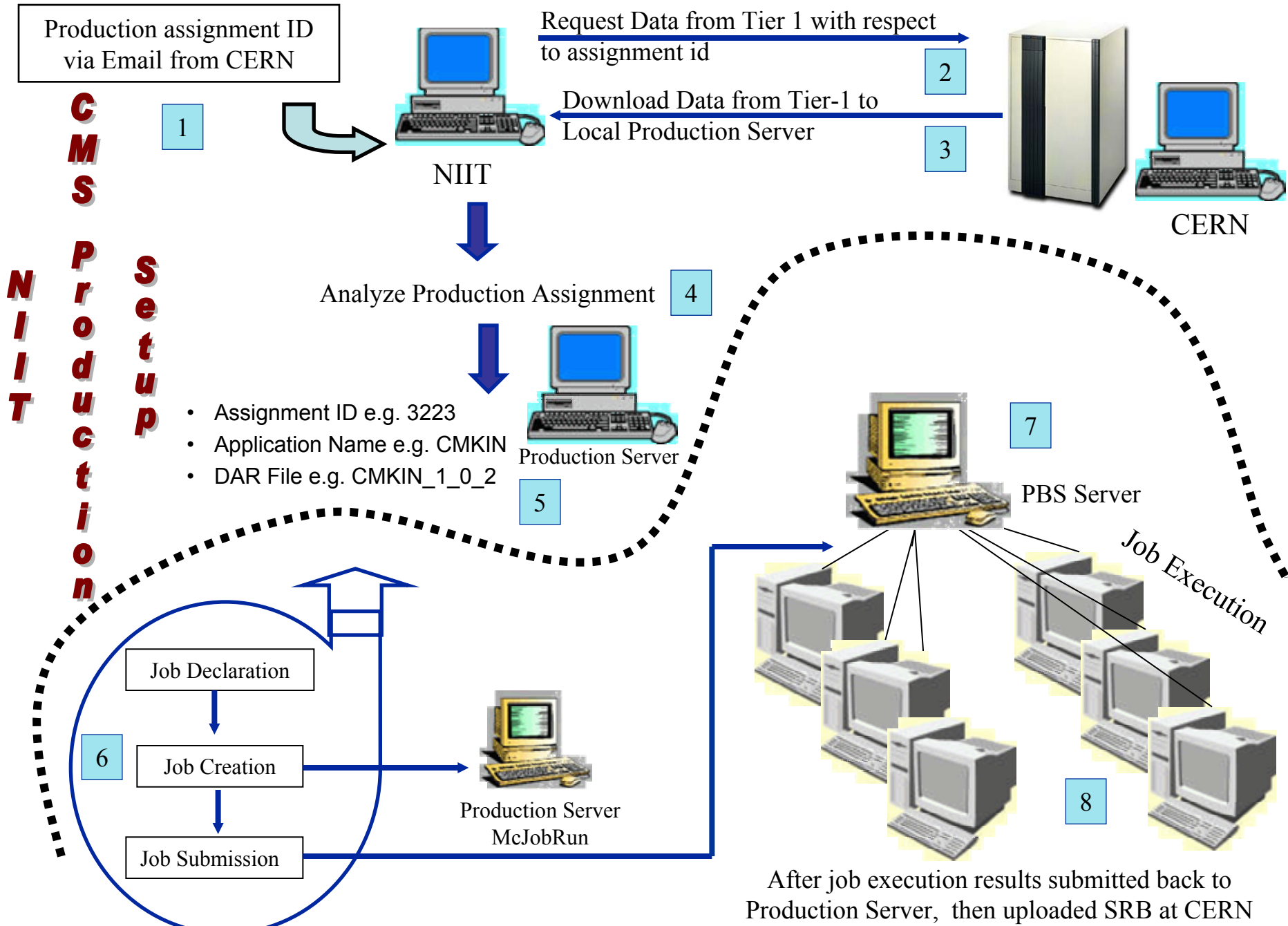


Current Status:

| | |
|-------------------------------|----------------------|
| Production Started: | Fri, October 3, 2003 |
| jetmet Event Produced: | 0.25 Million |
| Data Generated: | 12.23 GB (approx) |
| Data Uploaded at CERN | 8.6 GB (approx) |

Current Hardware Setup:

| | | |
|----------------|---------|------------------------|
| Number of CPUs | 10 | P-4, 2.4Ghz , 1 GB RAM |
| Storage Space | 0.5 TB | |
| Network speed | 384kbps | ISDN |





CMS Production Center

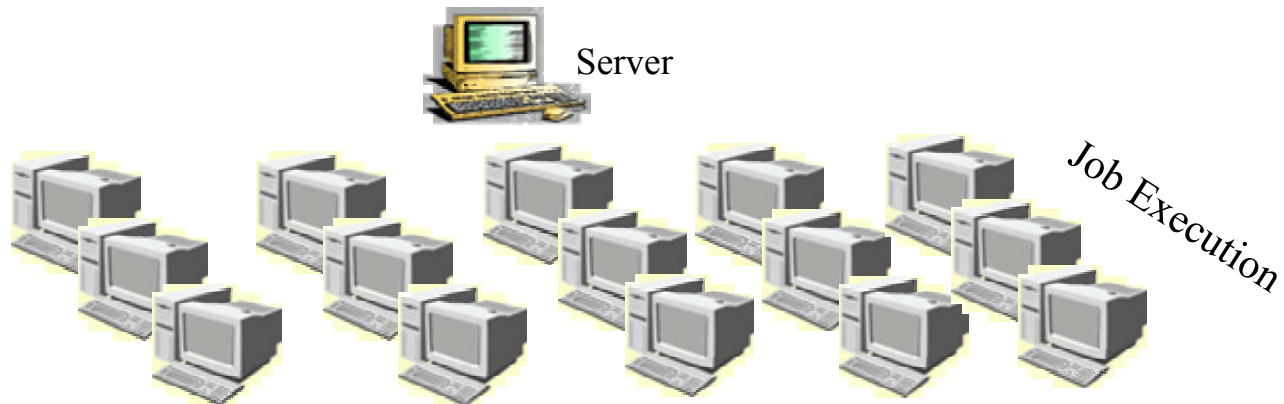


Future Work

Participation in LCG-1 development and deployment

Planning to have (Next Two Months)

| | | |
|-----------------|------|------------------------|
| Number of CPUs | 30 | P-4, 2.4GHz , 1 GB RAM |
| Network speed | 1 MB | ISDN |
| SCSI Tape Drive | 1 | 20/40GB SLR |





Integration of Agents and Web Services in Semantic Grid:



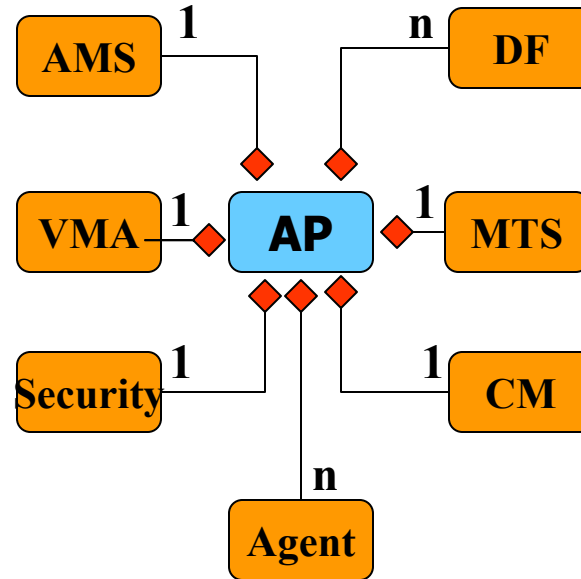
Integration of Agents and Web Services in Semantic Grid:



Team Members

- Dr. Farooq Ahmad
- Dr. Arshad Ali
- Kashif Iqbal
- Aatif Kamal
- Naveed Baqir





Proposed Architecture

Autonomous Decentralized Fault Tolerance
Scalable Directory Facilitator (Hold Services)
Reliable and Scalable Message Transport System



Multi Agent System



Current Status

- Complete Analysis and Design by using UML and XP paradigm.
- Identified Work Packages (AMS, DF etc.)
- Used different design patterns for flexible design
 - Agent Design Patterns (Master/Slave)
 - » Observer Pattern
 - » Command Pattern
 - » Singleton Pattern etc

Development phase: 40% completed



Multi Agent System



Future Work

- Designing and Development of distributed architecture of MAS
- Autonomous Decentralized Fault Tolerant MAS Architecture
- Scalable DF Architecture
- Lightweight MAS Architecture

*Collaboration With Keyung Hee University
Seoul Korea*

Context-aware Self-Managing Component Frameworks

Research Area

Context-awareness

- the presentation of information and services to users, according to Szyperki
 - the automatic execution of a unit of composition with contractually specified interfaces and/or services and/or
 - the tagging of context to information for later retrieval wherever they may be
- dependent on a user software component and is subject to composition by third parties”.*

[Szyperki98]

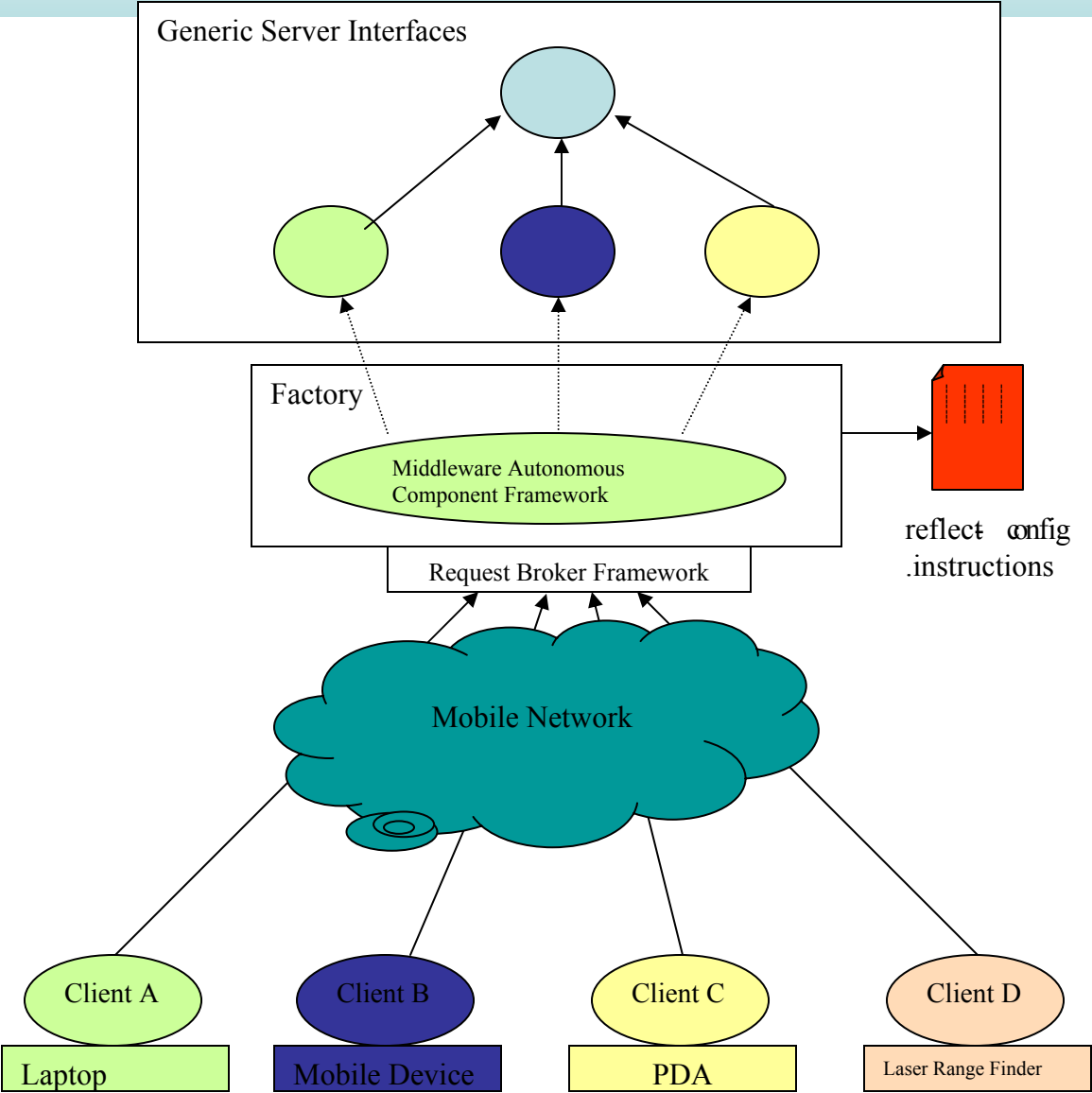
Component

Self-Managing

An application knows it's in need of a component to perform a task given by the user and it's able to adapt its contracts that govern the interaction of a set of components

Frameworks

Architecture



Future Work

- Architecture similar to Open ORB
- The application would replace the component in dynamic environment
- Personality definition/change to make the application adopt new behaviors



Performance Measures



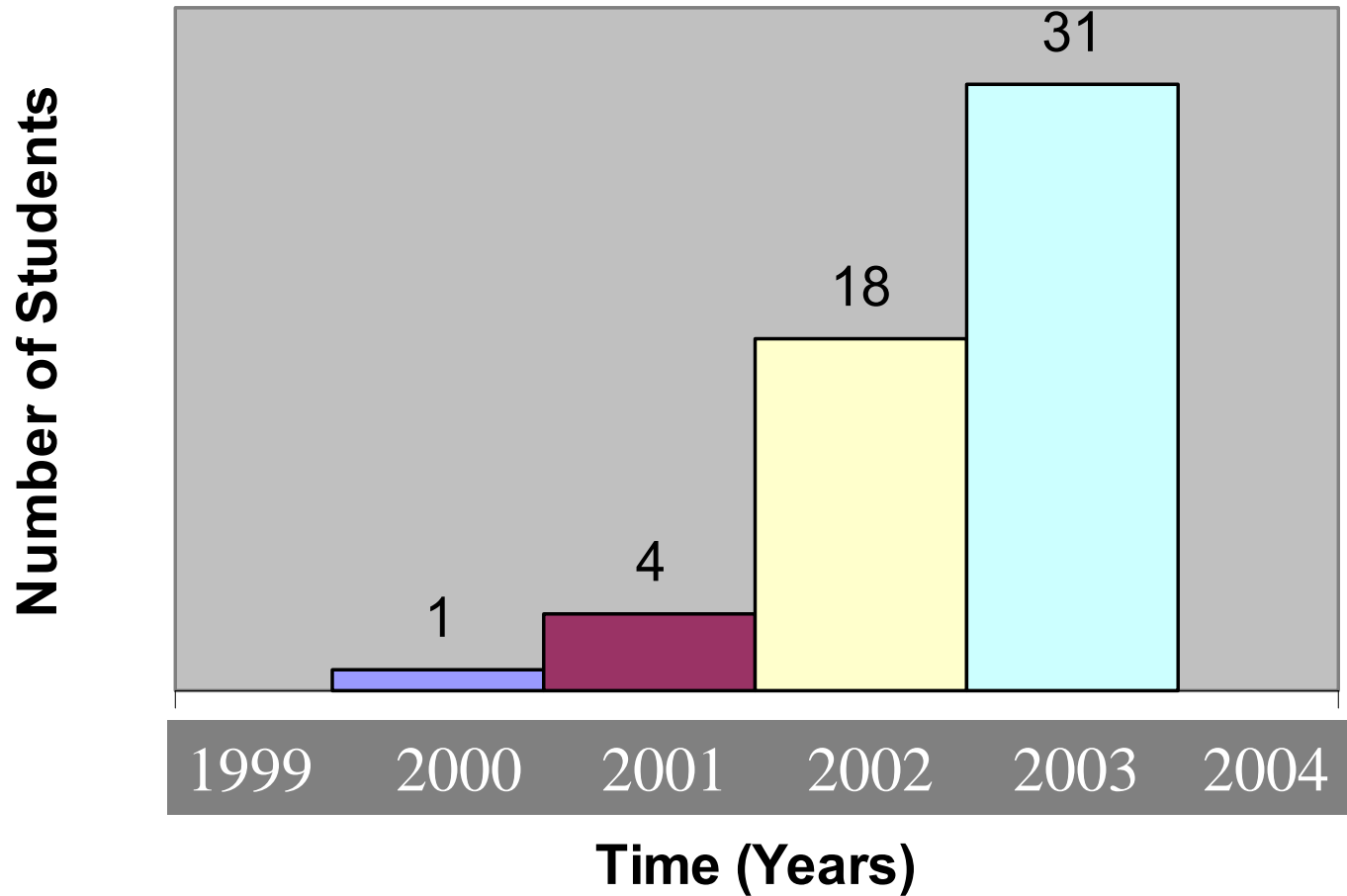
- Need to look at measures of research group success to assess potential
 - No of Research Students (MS/PhD Completed)
 - Research Funding
 - Research Papers Published



Research Team



Number of Researchers at NIIT



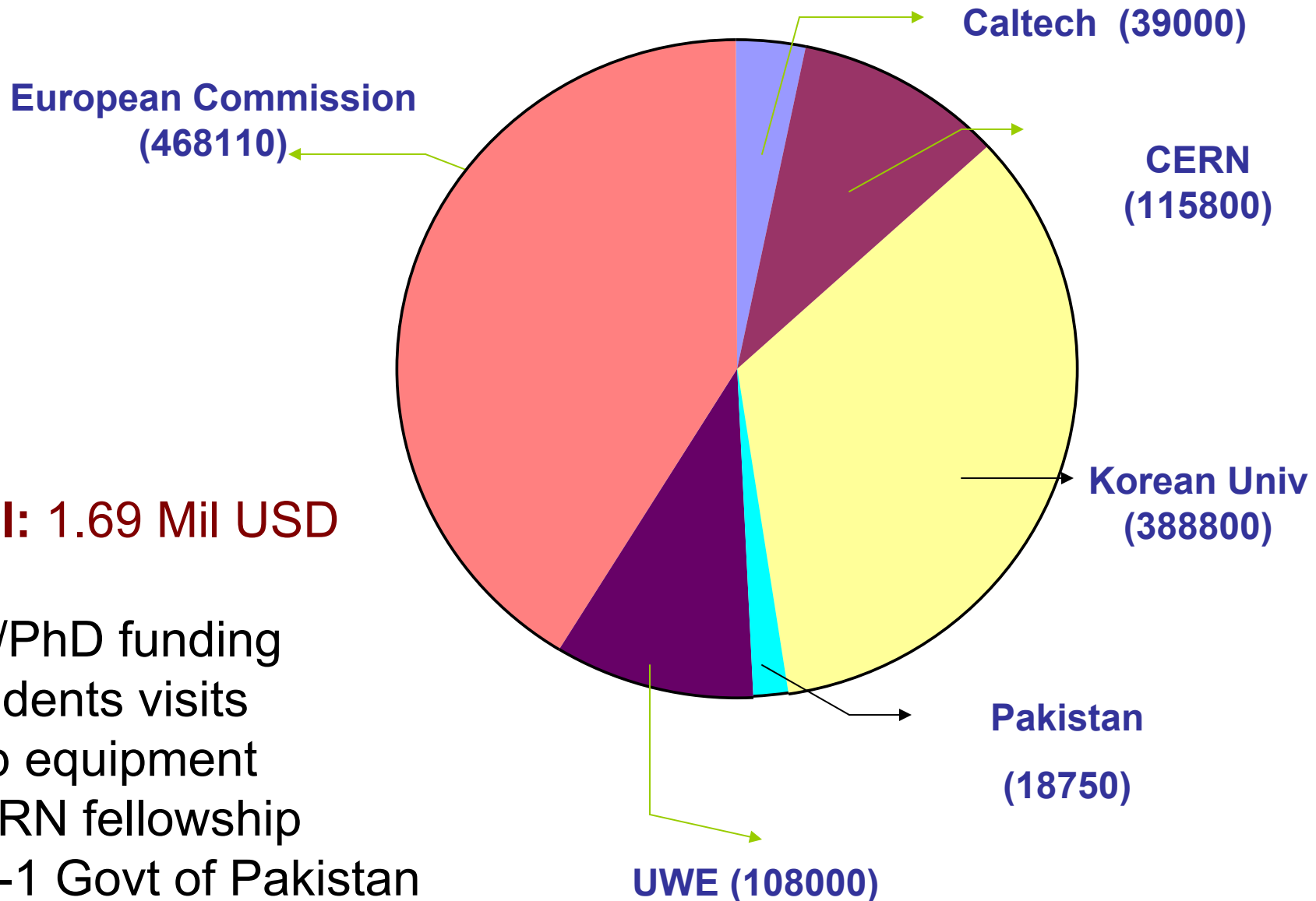


Research Funding in USD



Total: 1.69 Mil USD

- Ms/PhD funding
- Students visits
- Lab equipment
- CERN fellowship
- PC-1 Govt of Pakistan





Research Papers



| Years | International Publications | Internal Papers & Report |
|--------------|-----------------------------------|-------------------------------------|
| 2001 | 0 | 3 |
| 2002 | 3 | 8 |
| 2003 | 4 | 10 |
| Total | 7 | 21 |



SWOT Analysis



Strengths, Weaknesses, Opportunities, Threats

☀ Strengths:

- ☀ **Good research enthusiasm among faculty /students**
- ☀ **Building strong collaboration with CERN, Caltech, UWE UK, UoS France, BIT China and Comtec Japan**
- ☀ **Faculty Expertise development in cutting edge technologies**
- ☀ **Web presence with acclaimed scientific organizations**
- ☀ **Participation in international projects and funding from international agencies**



SWOT Analysis



Strengths, Weaknesses, Opportunities, Threats

- **Weaknesses:**

- ☀ General lack of research culture – Require extra ordinary efforts in generating research interests
- ☀ Low BW connectivity – serious bottleneck
- ☀ Funding constraints
- ☀ No post doctoral fellows- Major research strength
- ☀ Limited expertise in writing research proposals etc



SWOT Analysis



Strengths, Weaknesses, Opportunities, Threats

- **Opportunities:**

- ✿ International level research exposure through:
 - ✿ CERN
 - ✿ Caltech
 - ✿ UWE UK
 - ✿ UoS France, BIT China, Comtec Japan
- ✿ Getting more involved with EU and US funded projects
- ✿ International funding for MS/PhD students
- ✿ Financial revenue



SWOT Analysis



Strengths, Weaknesses, Opportunities, Threats

- **Threats:**

- ☀ Bureaucratic procedures
- ☀ Limited internal/external funding
- ☀ Little or No incentives for researchers
- ☀ Acquisition & retention of high quality researchers

Our strengths are focused research, good international collaboration and boundless enthusiasm!



Future Vision



Future Vision - Five years



- ☀ Strong research culture-- Develop independent research groups**
- ☀ Enhance the scientific profile of NUST among international scientific community**
- ☀ 15+ conference / journal papers per year**
- ☀ Expand local/external funding opportunities**
- ☀ Enhance the PhD output in IT**



Conclusion



- Six students undergoing PhD studies (**UWE, CERN, KOREA**) as continuation of their initial CERN related research conducted at NUST

Nine students benefited from visits to CERN

A rich research culture has been established at NUST

The knowledge gained is being applied in developing a PTCL network monitoring application for real time performance monitoring, fault reporting and congestion control

A Grid enabled knowledge management system being developed at NUST for **Heart Diseases Diagnostics**



Thanks

Email: arshad.ali@niit.edu.pk

URL: www.niit.edu.pk