Scalable Business Intelligence Architecture for a Multi-campus University in India

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Importance of Data!

Where we will be 5 years from now will depend on how we collect, manage, & use our data!

Latest Developments in India

- **Foreign university bill gets Cabinet nod – 15th March, 2010**
  - Foreign education providers allowed to set up campuses in India & offer degrees
  - A revolution larger than the one in the telecom sector awaits the education sector: Minister of HRD
  - This is a milestone which will enhance choices, increase competition and benchmark quality: Minister of HRD
- **3 other bills to be tabled soon:**
  - Prohibition of Unfair Practices in Technical, Medical Educational Institutions and Universities Bill
  - Educational Tribunal Bill &
  - Accreditation Bill

Latest Developments in India

- National Commission for Higher Education Research (NCHER) act
- An act to provide for the determination, co-ordination, maintenance of standards in, and promotion of, higher education and research, including university education, technical and professional education other than agricultural [and medical] education.

India Fact file

- More than one lakh Indian students go out every year for higher education from India
- Costs a huge foreign exchange outgo to the exchequer

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- 4 Campuses
  - **Pilani**
  - **Dubai, UAE**
  - **Goa**
  - **Hyderabad**
- Headquarters – Pilani (Rajasthan)
- 8000 students on campuses
- 20000 (working professionals) registered in different programmes under the **W**ork **I**ntegrated **L**earning **P**rograms (WILP)[major source of revenue]
- 130 thousand students sign up for the entrance exam each year!

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Flexibilities

- Dual Degree
- Horizontal transfer
- Vertical transfer (to Graduate or Ph.D. programs)
- Inter-campus transfer
- Both semester admissions

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Operational Systems: Present Scenario

- Each functional department/division/unit has developed its own operational system
- Each individual system is mature and is capable of handling any kind of workload
- Excellent stand-alone systems
- Highly heterogeneous systems!
- Difficult to integrate!
- Even if integration is done, replicating it at different campuses is not feasible

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Operational Systems: Present Scenario

- Problems with Replication
  - Different hardware & software requirements
  - Need people with different skill sets to operate different kinds of systems
  - Need to train people to work with different kinds of software
  - It will be like replicating problems than solving them
  - Two layers of distribution for integrating data from all campuses – extremely complex system

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Operational Systems: Present Scenario

- Same data in many applications
- Data redundancy & inconsistencies
- Waste of resources
- Data needs to be exchanged many times a semester between different divisions/units
- No standard framework for data exchange
- No proper interfaces for viewing institution data
- Multiple portals for faculty & students with many logins & passwords

With multiple campuses, the above problems get compounded!

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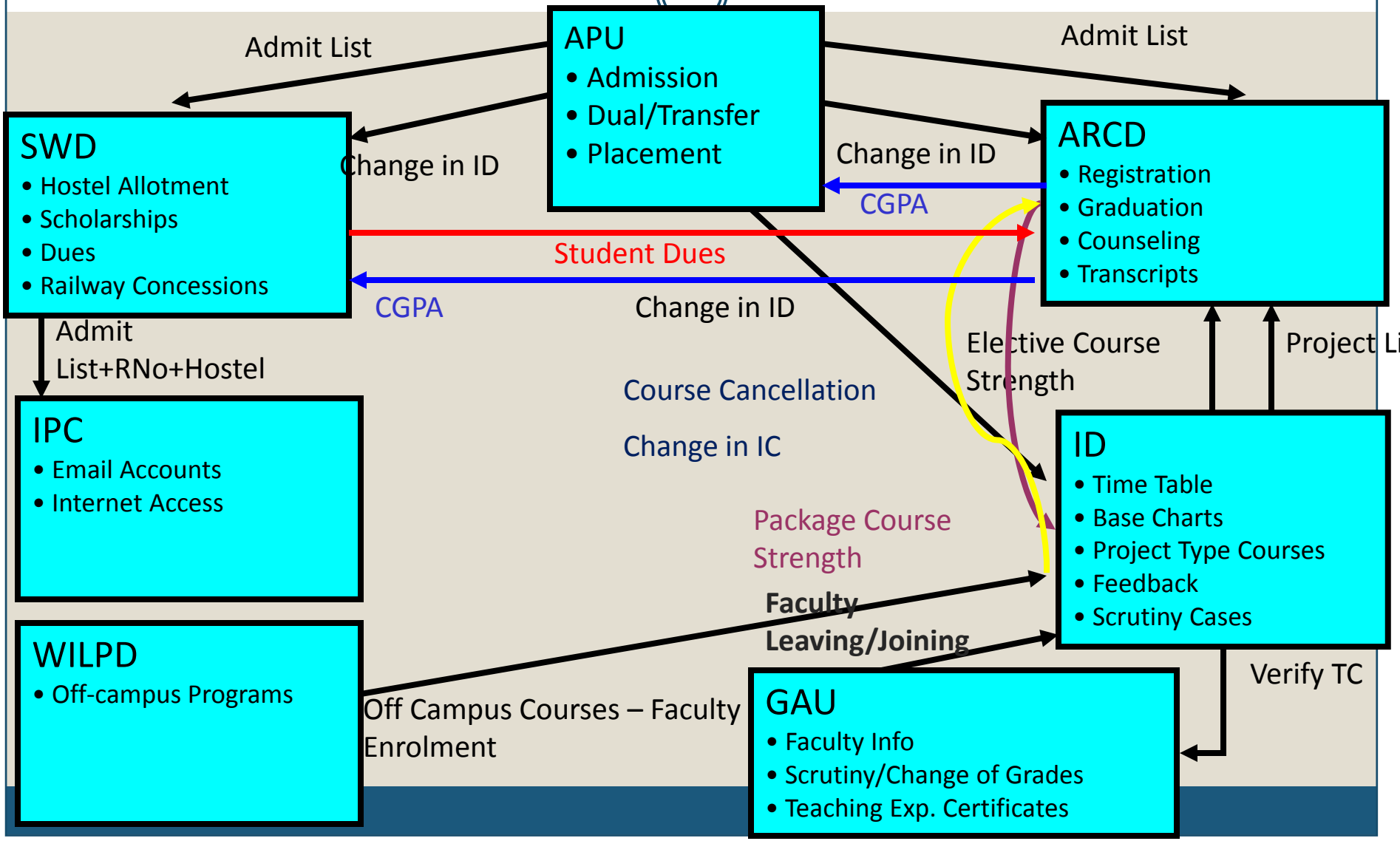
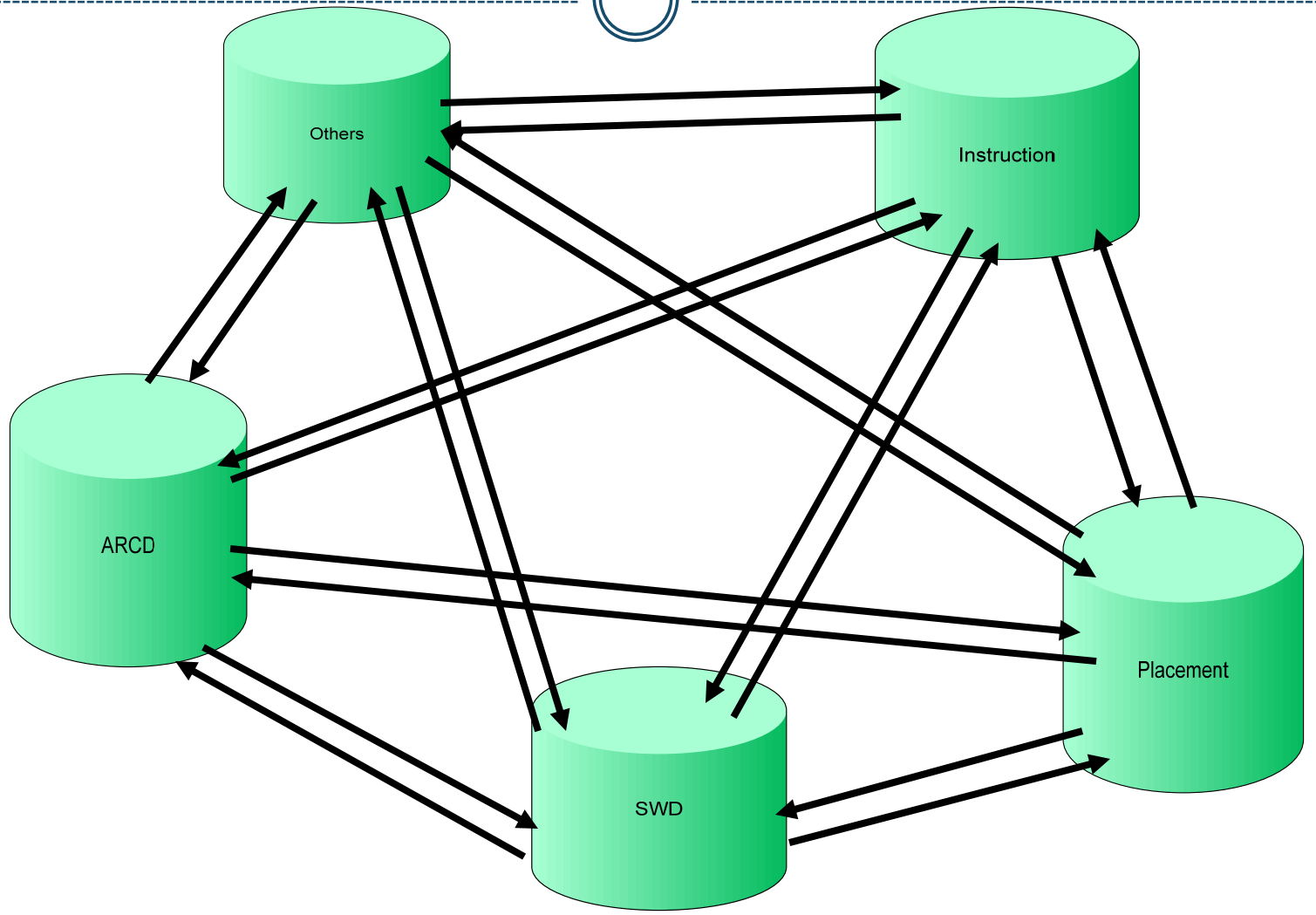
Operational Systems: Present Scenario

- **SECURITY HAZARD: TOO MANY DOORS!!!!**

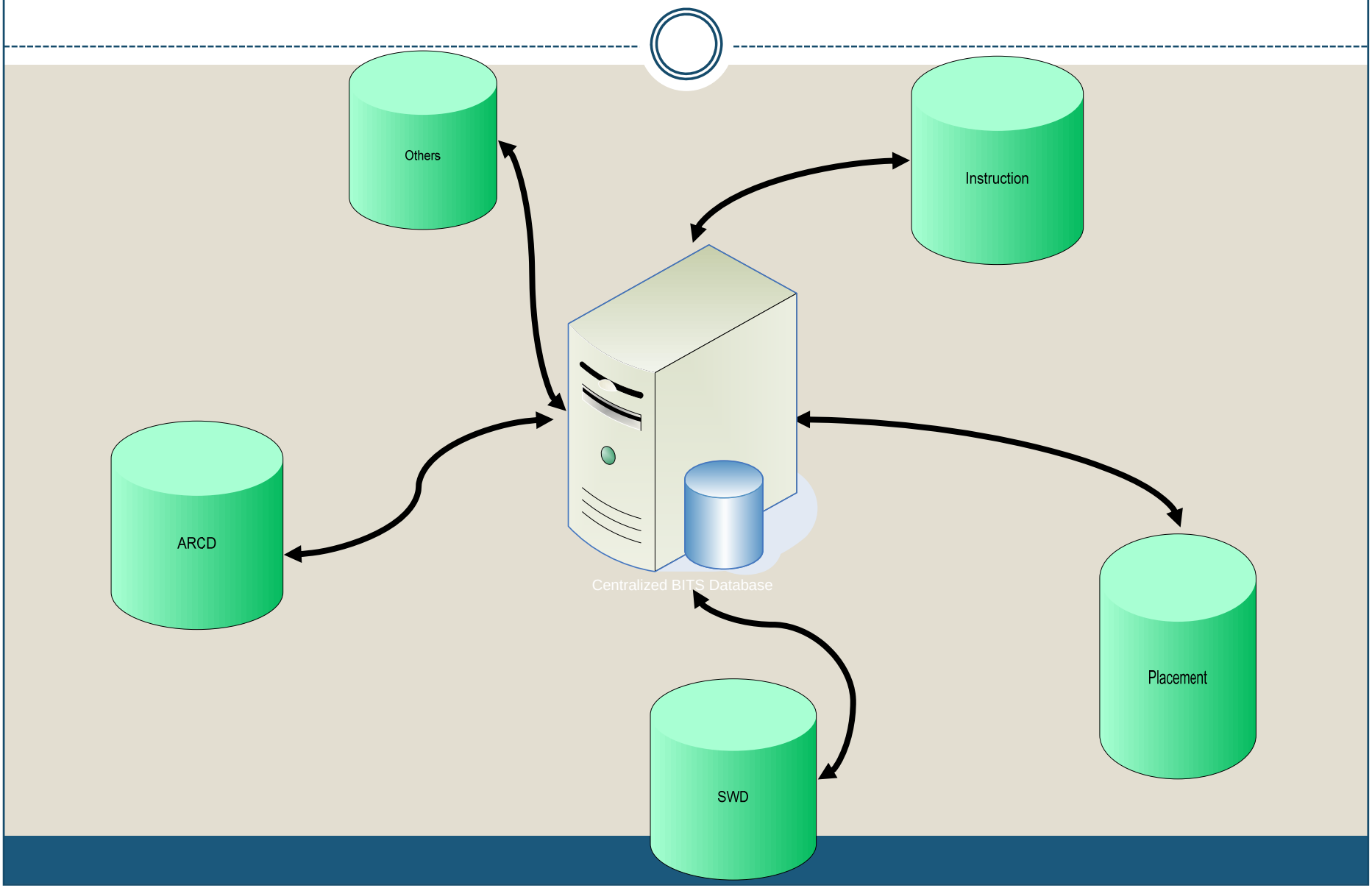
Data Flow/Xchange @ BITS



Present Data Exchange Scenario



Campus Centralized Database

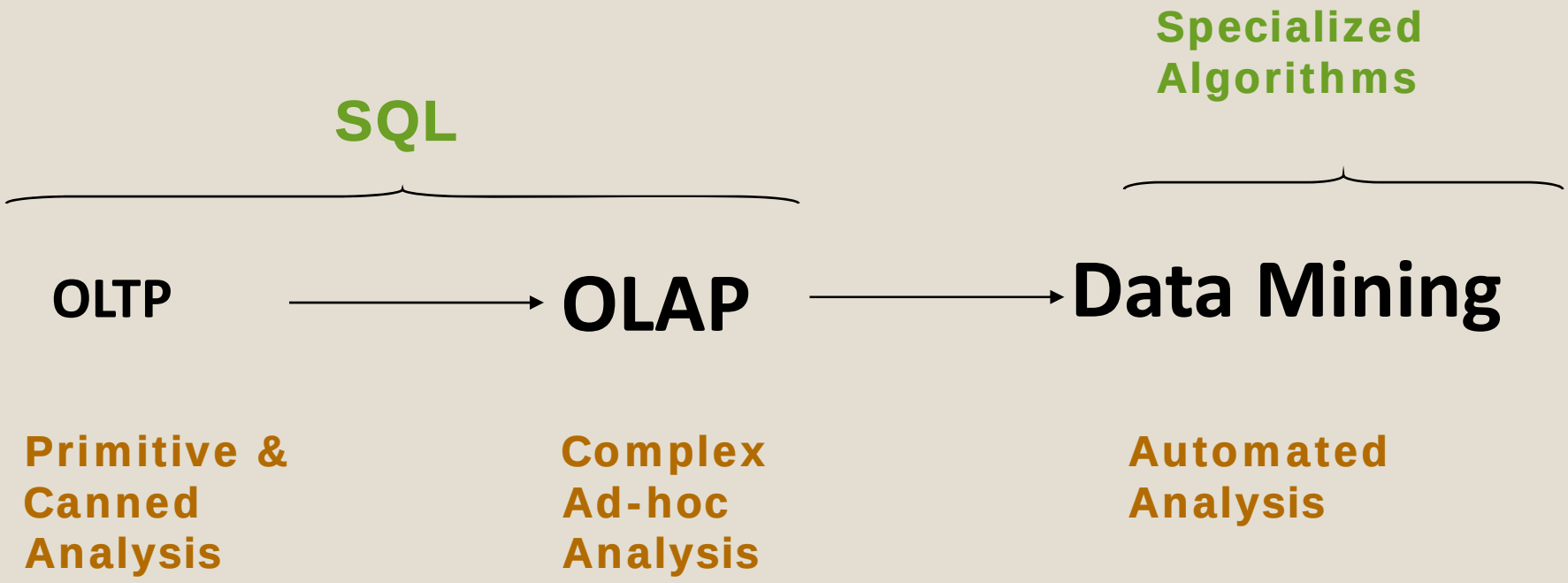


Business Intelligence (BI)

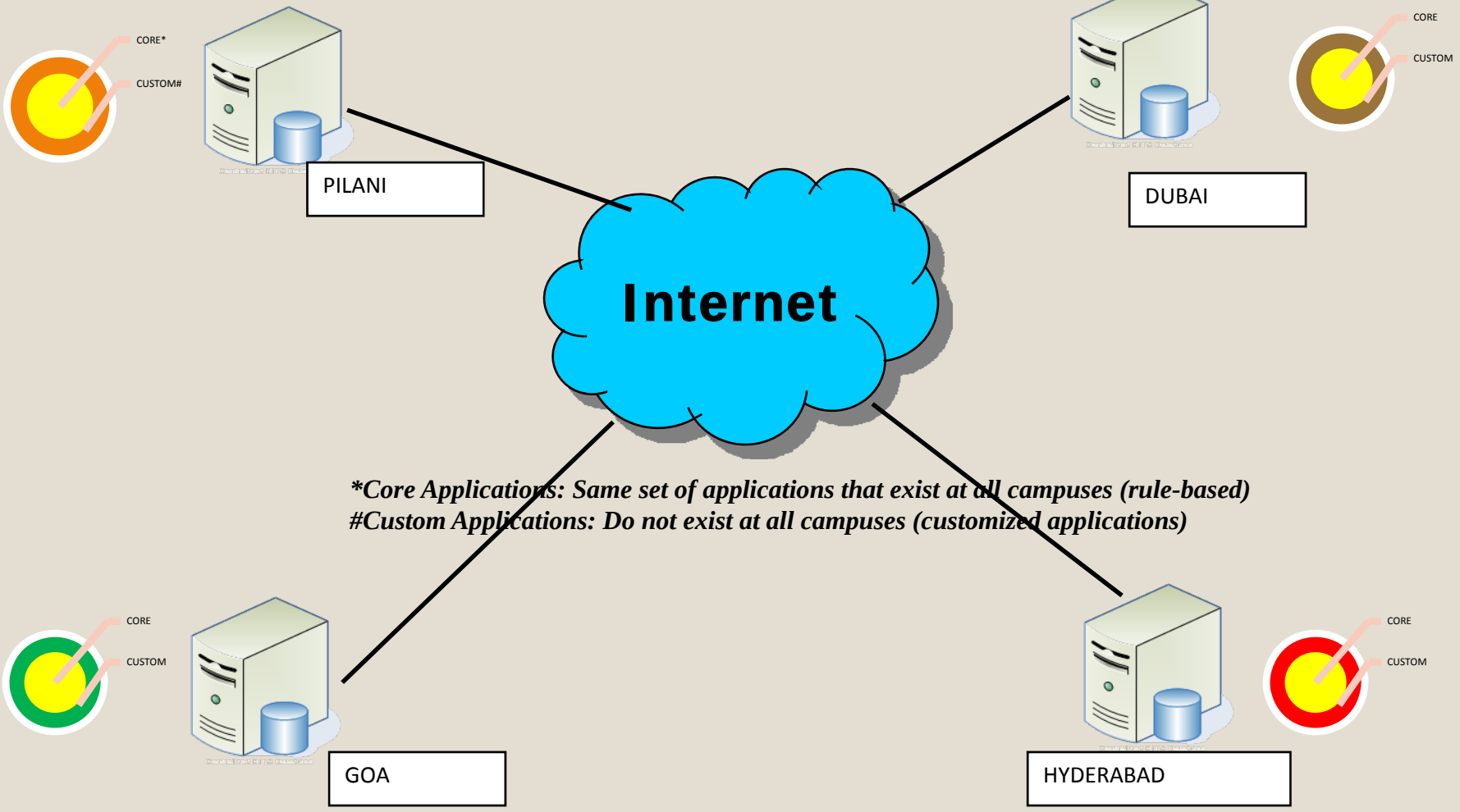
- Its all about making better and more informed decisions
- My definition

  A collection of tools & technologies facilitating decision making in an organization
- 3 important aspects of BI
  - ERP & Operational Systems
  - Enterprise Data Warehouse
  - Data Mining

Business Intelligence: Continuum of Analysis



System Architecture



System Architecture

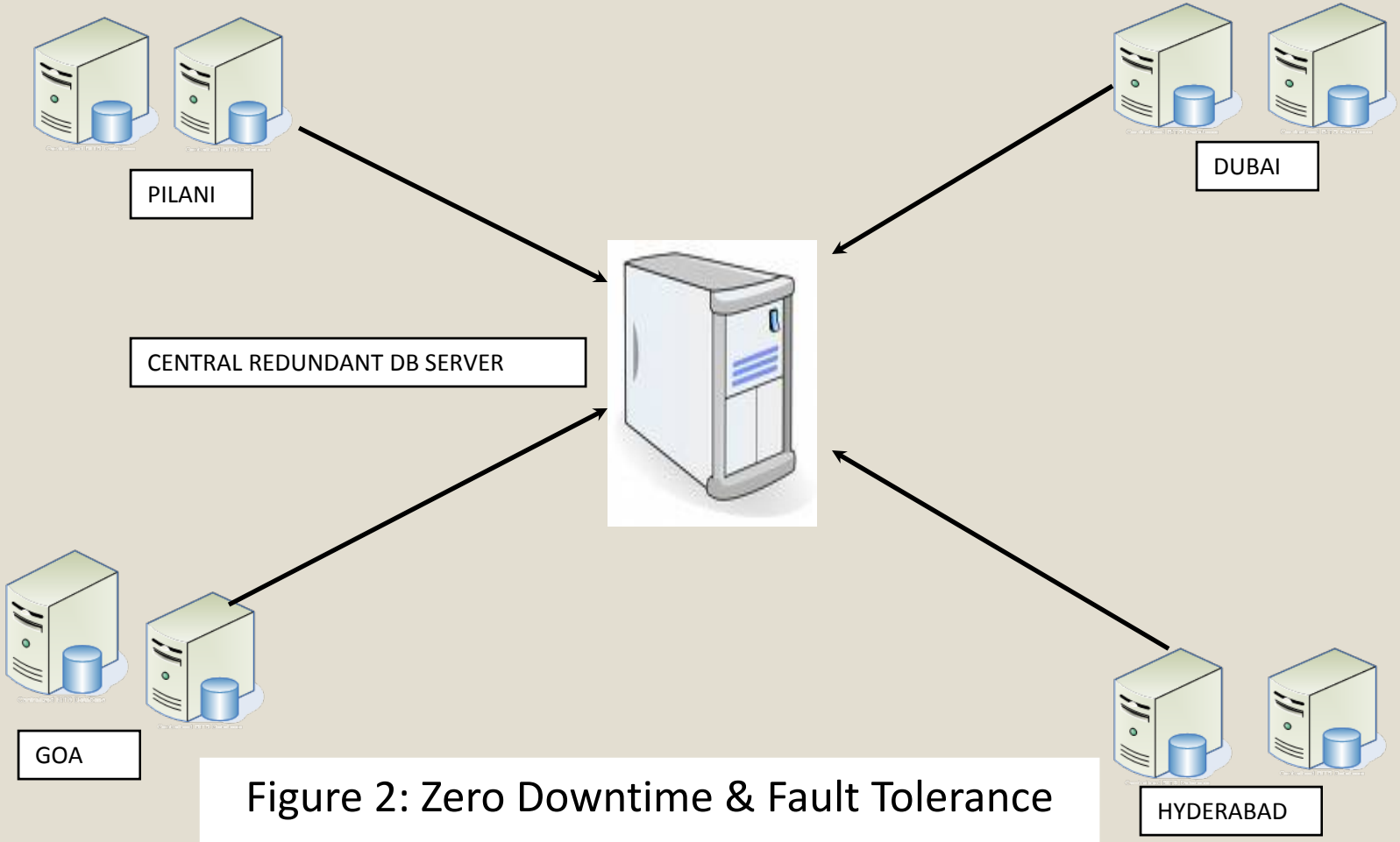


Figure 2: Zero Downtime & Fault Tolerance

BI System Architecture

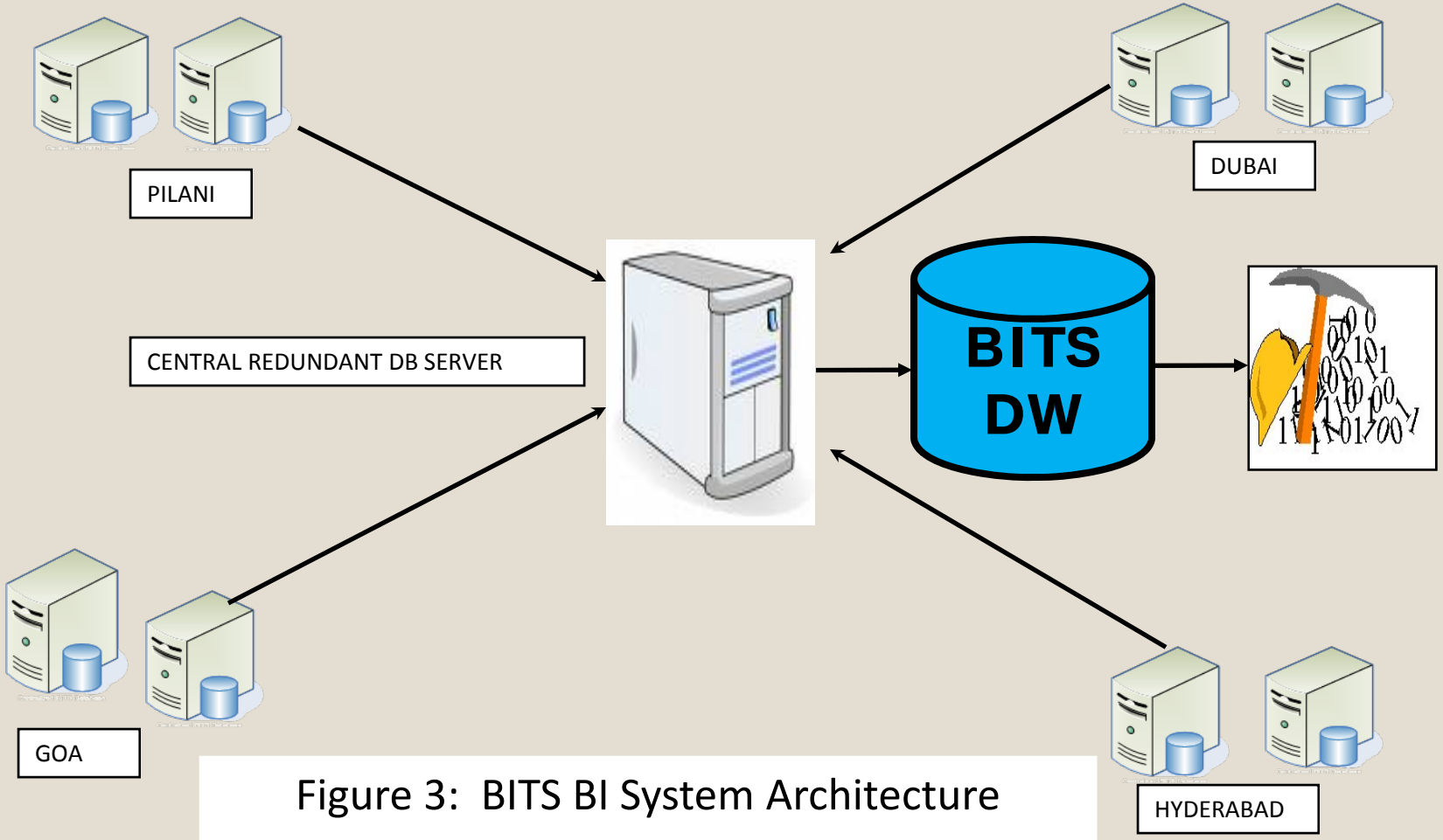


Figure 3: BITS BI System Architecture

BI System Architecture

Some factors that have influenced the design of the system architecture:

- Campuses are geographically distributed
- Most of the time we need to work with data belonging to our campus
- Same education model at all campuses
- Scalability & single day system installation at new campuses
- Zero down time and minimal chance of data loss
- Easy extension to “academic analytics”* (Data Warehousing & Data Mining)

** Philip J Goldstein, ECAR, December 2005*

BI System Architecture: Salient Features

- A 24x7 system.
- Single web portal for all stake holders.
- All relevant & required data/information available on the desktop to all stake holders.
- Increased productivity of all stake holders.
- Each campus has its own database server & a set of core & custom applications.
- Database server at each campus contains data belonging to that campus only. No campus (including Pilani) is burdened with data or applications belonging to other campuses.
- Same system at all campuses. Only data is different at each campus.
- Each campus is part of an Integrated BITS Information system.

BI System Architecture: Salient Features

- Complete autonomy of operations to each campus. No dependence on Pilani for carrying out day-to-day operations.
- No dependence on the Internet for carrying out day-to-day operations.
- Integrated inter-campus information available to the top management through the central backup server.
- Role based access control.
- Zero down time achieved without any manual intervention.
- Central backup server makes the system more fault tolerant.

BI System Architecture: Salient Features

- Central backup server plays dual role.
  - Firstly, it acts as a backup server for all campuses.
  - Secondly, it is the source of data for the downstream data analytics applications for quantitative decision making (Data Warehousing & Data Mining).
- Highly scalable system: The system can be deployed in a single day at a new campus that comes up in future.
- Same system (hardware, software, database, applications) is used at all campuses. Easier to train people in using and maintaining it.

BI System Architecture: Salient Features

- The new system will replace all existing systems. All legacy and currently used systems to be phased out after thoroughly checking the new system. All operations are carried out using the new system.
- Central control, administration, and enhanced security.

Discussion Bullets

- In-house development vs. Bespoke vs. off the shelf
- Centralized vs. Distributed Architecture
- Cloud Computing vs. Conventional Computing
- Open Source vs. Proprietary Software

Final Points

- Multi-campus universities pose challenges of different kinds!
- Overseas campuses add to the complexity
- Dependence on the internet should be minimized, specially in a developing country
- Lack of cyber laws
- Cyber law enforcement is not rigorous in developing countries (data privacy & security)
- People are still not comfortable using open source stack
- Off the shelf solutions don’t work all the time!
- Major problems:
  - People don’t want to give away the control over data: data ownership issues
  - We already have systems in place, why reinvent them

Some Examples

- Analyzing attendance trends across courses, disciplines, & campuses and undergrad vs. grad., compulsory vs. electives (OLAP)
- Identifying weak students early and intervening before it gets too late (Classification – DM)
- What electives to offer? (Association Rules – DM)
- What kind of students we have? (Clustering – DM)
- To find out which candidates would submit fee and join BITS – would help us plan better in terms of preparing waiting list etc. (classification – DM)

University Solution Implementations in India

- **MALVERN, Pa., July 16, 2009** – The Indian Institute of Management Bangalore (IIMB), one of the top-ranked business schools in India, has selected SunGard Higher Education's Banner Unified Digital Campus (UDC) solution to help increase efficiencies in course administration, improve student services, and enhance capabilities for collaboration with institutions in India and worldwide.
- BITS, Pilani on the verge of taking a decision on ERP/BI solution implementation

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Q & A

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