



GALGOTIAS
UNIVERSITY

**School of Computing
Science and Engineering**

Program: Btech

Course Code: CSCC3050

Course Name: Cloud Organization &
Architecture

DATA CENTER

Introduction

WHAT IS A DATA CENTER

Data centers provide a range on information technology services

- ▶ These services include:
 - ▶ Email
 - ▶ Data storage and management
 - ▶ Web hosting
 - ▶ Application Hosting

WHAT IS A DATA CENTER

- ▶ Data centers are *designed* to house information systems and related components such as:
 - ▶ Servers
 - ▶ Routers
 - ▶ Storage
 - ▶ Uninterruptable power supplies (UPS)
 - ▶ Cooling Units
 - ▶ Power Distribution Unit (PDU)
- ▶ Data centers have unique and typically large power requirements
- ▶ They are often raised floor designs to accommodate the large amount of cables required.

DATA CENTER BENEFITS

▶ Economies of Scale

- ▶ Purchasing savings based on large purchases
- ▶ Dedicated IT staff
- ▶ Shared resources

▶ Security

▶ Physical

- ▶ Limited access to servers
- ▶ Surveillance

▶ Virtual

- ▶ Firewalls
- ▶ Anti-virus
- ▶ Password Protection

Tier Level	Data center classification
1	<ul style="list-style-type: none"> • Single non-redundant distribution path serving the IT equipment • Non-redundant capacity components • Basic site infrastructure guaranteeing 99.671% availability
2	<ul style="list-style-type: none"> • Fulfills all Tier 1 requirements • Redundant site infrastructure capacity components guaranteeing 99.741% availability
3	<ul style="list-style-type: none"> • Fulfills all Tier 1 and Tier 2 requirements • Multiple independent distribution paths serving the IT equipment • All it equipment must be dual-powered and fully compatible with the topology of a site's architecture • Concurrently maintainable site infrastructure guaranteeing 99.982% availability
4	<ul style="list-style-type: none"> • Fulfills all Tier 1, Tier 2, and Tire 3 requirements • All cooling equipment is independently dual-powered, including chillers and heating, ventilation and air-conditioning (HVAC) systems • Fault tolerant site infrastructure with electrical power storage and distribution facilities guaranteeing 99.995% availability

DATA CENTER vs. CLOUD

- ▶ Data Centers
 - ▶ Require specialized equipment and knowledge
 - ▶ Owner maintains complete control over hardware and software
 - ▶ Highly customized
 - ▶ Component of a cloud
- ▶ Cloud computing offers computing as a utility service
 - ▶ Self service, Pay per use
 - ▶ Platform independent
 - ▶ Requires no specialized knowledge in computing
 - ▶ Often represents outsourcing as a Risk Transference Strategy
 - ▶ Composed of many data centers

CLOUD SERVICES

▶ Types of service offered

- ▶ Infrastructure as a service (IaaS) ex. Servers, Networking, etc.
- ▶ Platform as a service (PaaS) ex. Windows, Red Hat, etc.
- ▶ Application or Software as a service (SaaS) ex. Email, Oracle, MSWord etc.

DATA CENTER COMPONENTS: LOCATION

▶ Important considerations

- ▶ Frequency of conditions likely to result in disaster situations
- ▶ Distance from energy source
- ▶ Reliability of energy source
- ▶ Climate
 - ▶ Choosing a location with a cool, mild climate, provides the possibility of a data center that does not require air conditioning units.

DATA CENTERS

▶ Microsoft Tour

- ▶ <http://www.globalfoundationservices.com/infrastructure/videos.html>

▶ Purdue Data Centers

- ▶ Research Computing Cluster Steele <http://www.rcac.purdue.edu/userinfo/resources/steele/userguide.cfm>

- ▶ Currently housed in a HP Pod container <http://www.flickr.com/photos/vax-o-matic/sets/72157624103673857/>

- ▶ ITAP Data Centers Service Catalog <http://www.itap.purdue.edu/service/catalog/alpha/>

▶ Cisco Richardson Interactive data center tour

- ▶ http://www.cisco.com/web/about/ciscoitatwork/data_center/flash/dc_experience/rdc_tour.html

DATA CENTER COMPONENTS: BUILDING

- ▶ The building is important because it will effect the efficiency of the data center
- ▶ There are many ways to have an efficient building
 - ▶ Yahoo Chicken Coop
 - ▶ Designed to take advantage of “free cooling”
 - ▶ PUE 1.1



DATA CENTER COMPONENTS: COOLING

- ▶ Servers create heat
 - ▶ Historically servers have been susceptible to heat damage
 - ▶ According to James Hamilton of Amazon the average exhaust from servers is 115 degrees Fahrenheit
- ▶ Approximately half of the power consumed in the data center is used in cooling
- ▶ Cooling Options
 - ▶ Computer Room Air Conditioning (CRAC)
 - ▶ Liquid Cooling
 - ▶ Air Side Economizers



DATA CENTER COMPONENTS: UPS

▶ Uninterruptable Power Supply (UPS)

- ▶ Conditions power
- ▶ Provides power to avoid outages during power failure lasting seconds or minutes
- ▶ Provides time to shutdown, failover, or initiate backup power for longer outages

▶ Traditional data center UPS

- ▶ The pictured UPS will provide 80 minutes of power. Typical is about 15 minutes
- ▶ Double conversion
- ▶ These are often comprised of multitudes of batteries.
 - ▶ Batteries are better for longer outages, many short outages will reduce the life of a battery based UPS

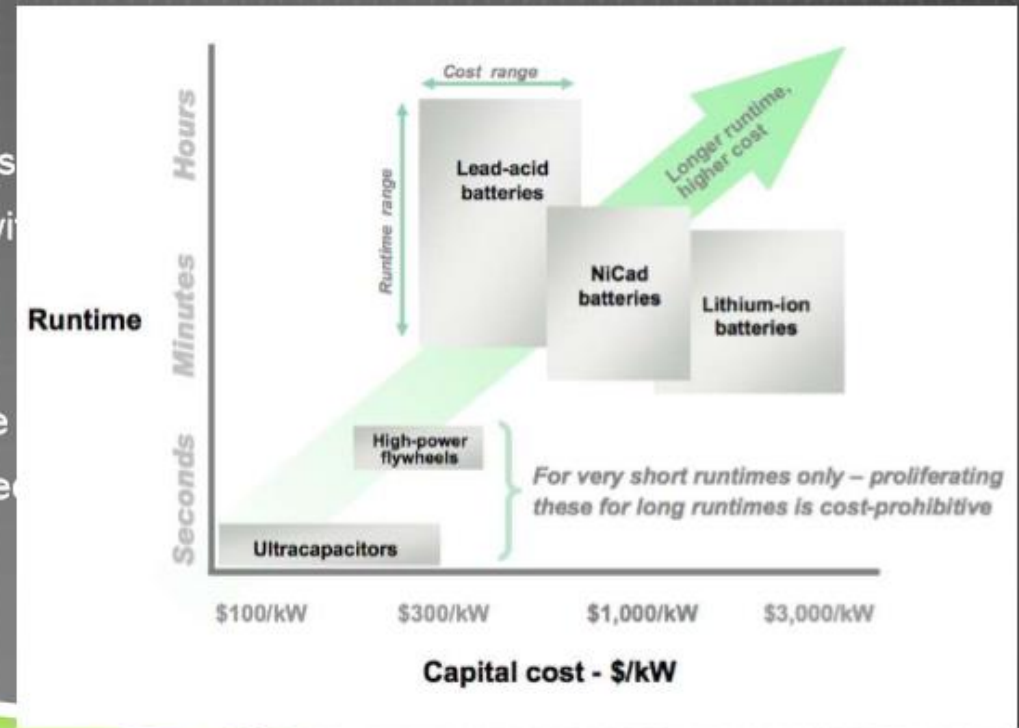


DATA CENTER COMPONENTS: UPS (CONTINUED)

- ▶ Alternatives to battery based UPS
 - ▶ Flywheel
 - ▶ Rotary
 - ▶ Ultracapacitor

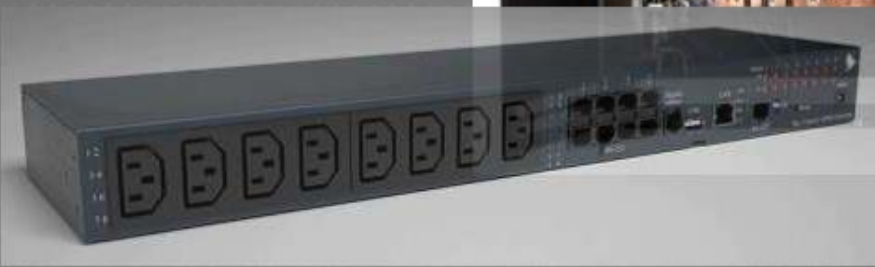
▶ The non-battery options are useful for situations with numerous short outages

- ▶ Ultracapacitors require little maintenance and are advantageous in unmanned remote sites.



POWER DISTRIBUTION UNIT (PDU)

- ▶ Transforms the voltage to standard voltage for distribution
 - ▶ 480V to 120V or 277V
 - ▶ Distributed via power outlets
 - ▶ Provides power monitoring and additional power conditioning
- ▶ Types of PDU
 - ▶ Panel
 - ▶ Room
 - ▶ Rack



DATA CENTER COMPONENTS: BACKUP POWER

- ▶ Grid-based additional power service provider
- ▶ Batteries
- ▶ Diesel generators

Backup power has traditionally been a requirement for maintaining uptime for tiered facilities. Some larger organizations are able to compensate for outages by rerouting traffic to working nodes.



Thank You