# Data Centers & Efficiency

## 1 Datacenter:

- Are the backbone of many computer systems
- Have long racks in mysterious buildings
- business technology uses them widely
- REASON: Hight compute power for little price (Economy of Scale)
- REASON: Data is in one spot to make things easier
- REASON: System has a consistent bandwidth
- REASON: In total easier support of demanding applications

A typical firt year of a **DC** consists of many failures (overheating, rack failure, rack movement,...)

### 1.1 Costs

- Servers (CPU, Memory / Storage)
- Infrastructure (Power distribution and cooling)
- Power (Electrical utility costs)
- Network (Links, transit and equipment)
- Server costs are the highest
- Datacenters usually have low utilization (10-30%). Because:
  -They are not agile and not every server can do every task
  -Peak load has to be managable
  -This is normal though with many things not only DC (Highways have low utilization aswell)

### 1.2 Other

- Storage: Distributed filesystem or network attached storage
- Network: Very important and usually 1-10 GB/s
- Programmability: What encompases the Map Reduce Programming model? We need appropriate abstractions

## 2 DC Networks & Problems

- Need for uniform high capacity (no need to consider topology when adding servers)
- Network traffic of one service should be unaffected by other service (Performance Isolation)
- Any Server ca have any IP Address for better agility
- Applications get addressed directly

### 2.1 Design Issues

- Applications get addressed directly
- There are **A**pplication **A**ddresses and **L**ocation **A**ddresses
- Most traffic is in the intranet
- Apps should not disturb each other (fairness and isolation)

## 3 Energy Efficiency

- Computers use 2% of worlds energy
- PUE = Power Usage Effectiveness
- Energy should be little and proportional to work
- How?
  -match work to power or power to work -send power to other systems -make disks spin slower or so