

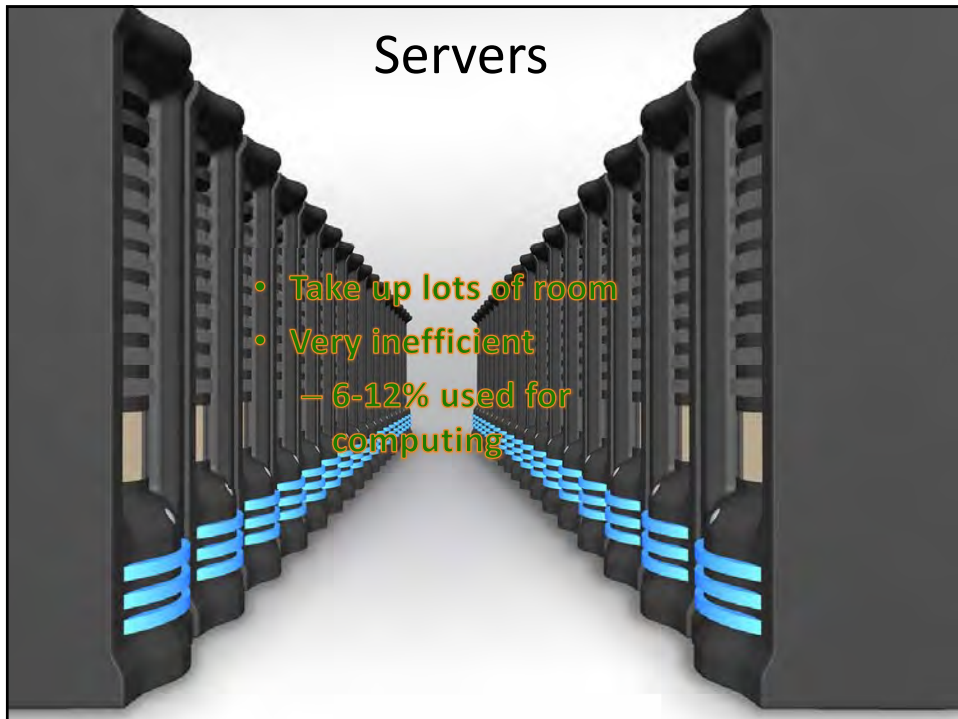
How Does the Internet Work?

- Modems, IPS, Computer network
- Universal Resource Locator (URL)
 - Protocol
 - Server name
 - File name
- Server – massive computer without a Screen or keyboard



Servers

- Take up lots of room
- Very inefficient
 - 6-12% used for computing

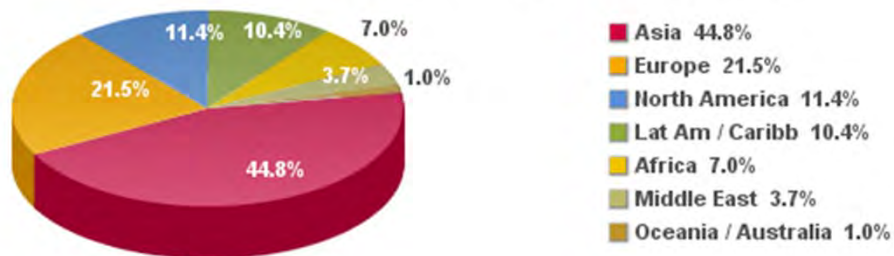


Internet Usage


- Estimated 2,405,518,376 (June 30, 2012)
- 34.4% of world population
- 566.4% growth since 2000
- 1,076,681,059 users in Asia



Internet Users in the World Distribution by World Regions - 2012 Q2



Magnitude of the Problem



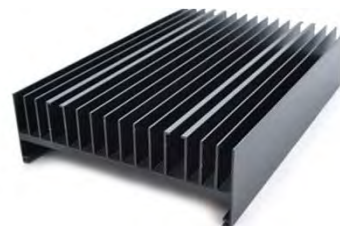
1.1-1.5% — 269 billion kWh
1.7-2.2% — 85.2 billion kWh

Why Do We Need Redundancy?

- Companies are built on their reputations
- Power failures
- Potential server crashes
- Companies are competitive

Current Technology

Heat sinks and fans



Server Cooling Methods

- Free Cooling
- Air-Side Free Cooling
- Adiabatic
- Water-Side Free Cooling



New Technology

- Emersion Technology



Solutions

- Raising the temperature
- Brown Caps
- Optimization
- Running Strategy
- Energy Logic
- Citing Policy
- Carbon Taxes
- Virtual Servers
- Transparency

Solutions Cont'd

- Raising The Temperature
 - Raising the temperature of data centers from 21°C to 27°C uses less energy
 - Recommended method by American Society of Heating, Refrigeration and Air Conditioning Engineers
 - Google employs this method

Solutions Cont'd

- Brown Caps
 - Puts a limit on carbon intensive fuels used by data centers
 - Sets legislation to ensure up to 30% green energy is used by data centers

Solutions Cont'd

- Optimization
 - Technology is available to safely turn off unused servers
 - Allows servers to be powered down while still maintaining fast response times and redundancy
 - Less servers turned on mean less energy required to operate

Solutions Cont'd

- Running Strategy
 - “Follow the moon” strategy
 - Large companies with many data centers
 - Directs high server traffic to datacenters that are in a location where it is nighttime
 - Cooler ambient temperatures – less energy required to cool data center

Server Virtualization

- Typical Data Center set up
 - One job for each server
 - Inefficient
- Physical Server is split
 - Multiple virtual servers
 - Efficient
 - Still has redundancy

Summary