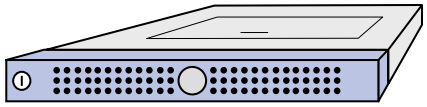
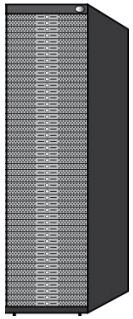
Google Datacenter

Datacenter Organization



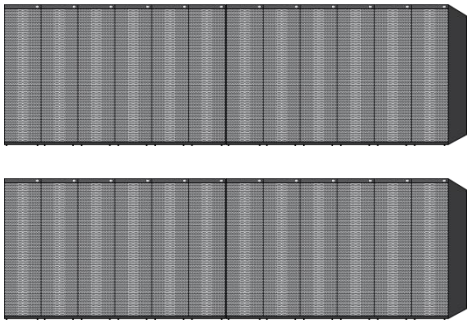
Single server:

- **8-24 cores**
- **DRAM: 16-64GB @ 100ns**
- **Disk: 2 TB @10ms**



Rack:

- **50 machines**
- **DRAM: 800-3200GB @ 300 µs**
- **Disk: 100TB @ 10ms**



Row/cluster:

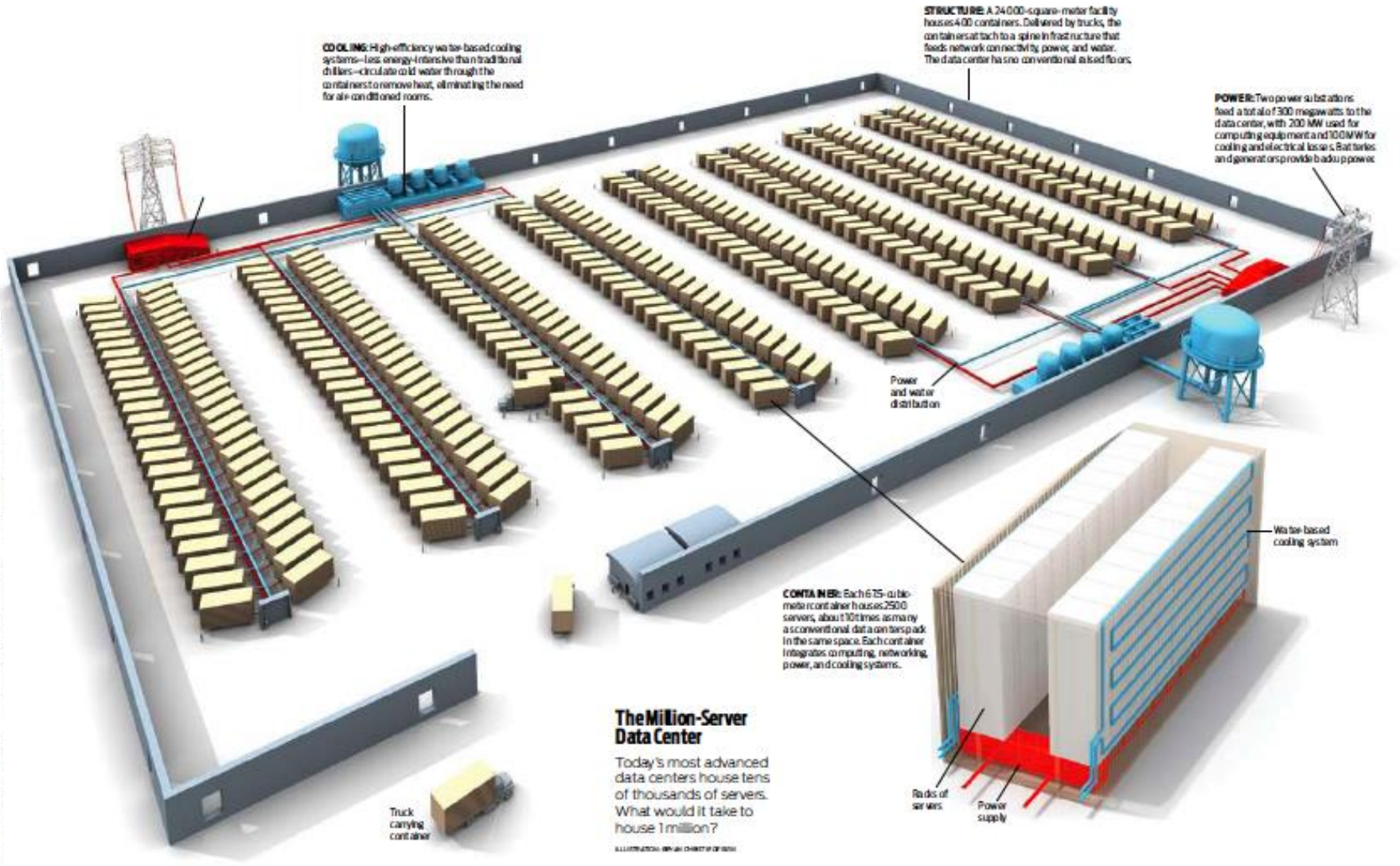
- **30+ racks**
- **DRAM: 24-96TB @ 500 µs**
- **Disk: 3 PB @ 10ms**

Sun Containers

Sun Containers, cont'd

Google Containers

Microsoft Containers



Microsoft Containers, cont'd

Failures are Frequent

Typical first year for a new cluster (Jeff Dean, Google):

- ~0.5 overheating (power down most machines in <5 mins, ~1-2 days to recover)
- ~1 PDU failure (~500-1000 machines suddenly disappear, ~6 hours to come back)
- ~1 rack-move (plenty of warning, ~500-1000 machines powered down, ~6 hours)
- ~1 network rewiring (rolling ~5% of machines down over 2-day span)
- ~20 rack failures (40-80 machines instantly disappear, 1-6 hours to get back)
- ~5 racks go wonky (40-80 machines see 50% packet loss)
- ~8 network maintenances (4 might cause ~30-minute random connectivity losses)
- ~12 router reloads (takes out DNS and external vips for a couple minutes)
- ~3 router failures (have to immediately pull traffic for an hour)
- ~dozens of minor 30-second blips for DNS
- ~1000 individual machine failures
- ~thousands of hard drive failures
- Slow disks, bad memory, misconfigured machines, flaky machines, etc.

- Long distance links: wild dogs, sharks, dead horses, drunken hunters, etc.

How Many Datacenters?

- 1-10 datacenter servers/human?
- 100,000 servers/datacenter

	U.S.	World
Servers	0.3-3B	7-70B
Datacenters	3000-30,000	70,000-700,000

- 80-90% of general-purpose computing will soon be in datacenters?