POLITECNICO DI MILANO

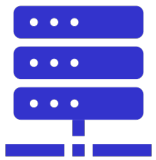
Computing Infrastructure





Storage

The topics of the course: what are we going to see today?



HW Infrastructures:

System-level: Computing Infrastructures and Data Center Architectures, Rack/Structure;

Node-level: Server (computation, HW accelerators), **Storage (Type, technology),** Networking (architecture and technology);

Building-level: Cooling systems, power supply, failure recovery

SW Infrastructures:

Virtualization: Process/System VM, Virtualization Mechanisms (Hypervisor, Para/Full virtualization)

Computing Architectures: Cloud Computing (types, characteristics), Edge/Fog Computing, X-as-a service

Methods:

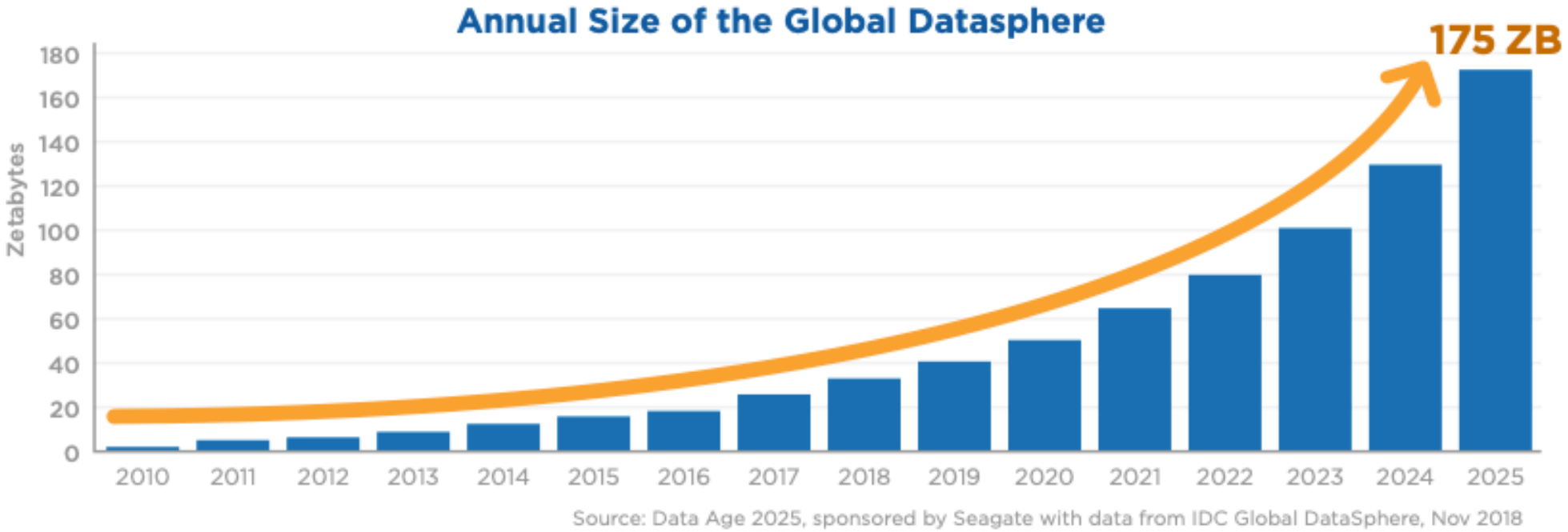
Reliability and availability of datacenters (definition, fundamental laws, RBDs)

Disk performance (Type, Performance, RAID)

Scalability and performance of datacenters (definitions, fundamental laws, queuing network theory)

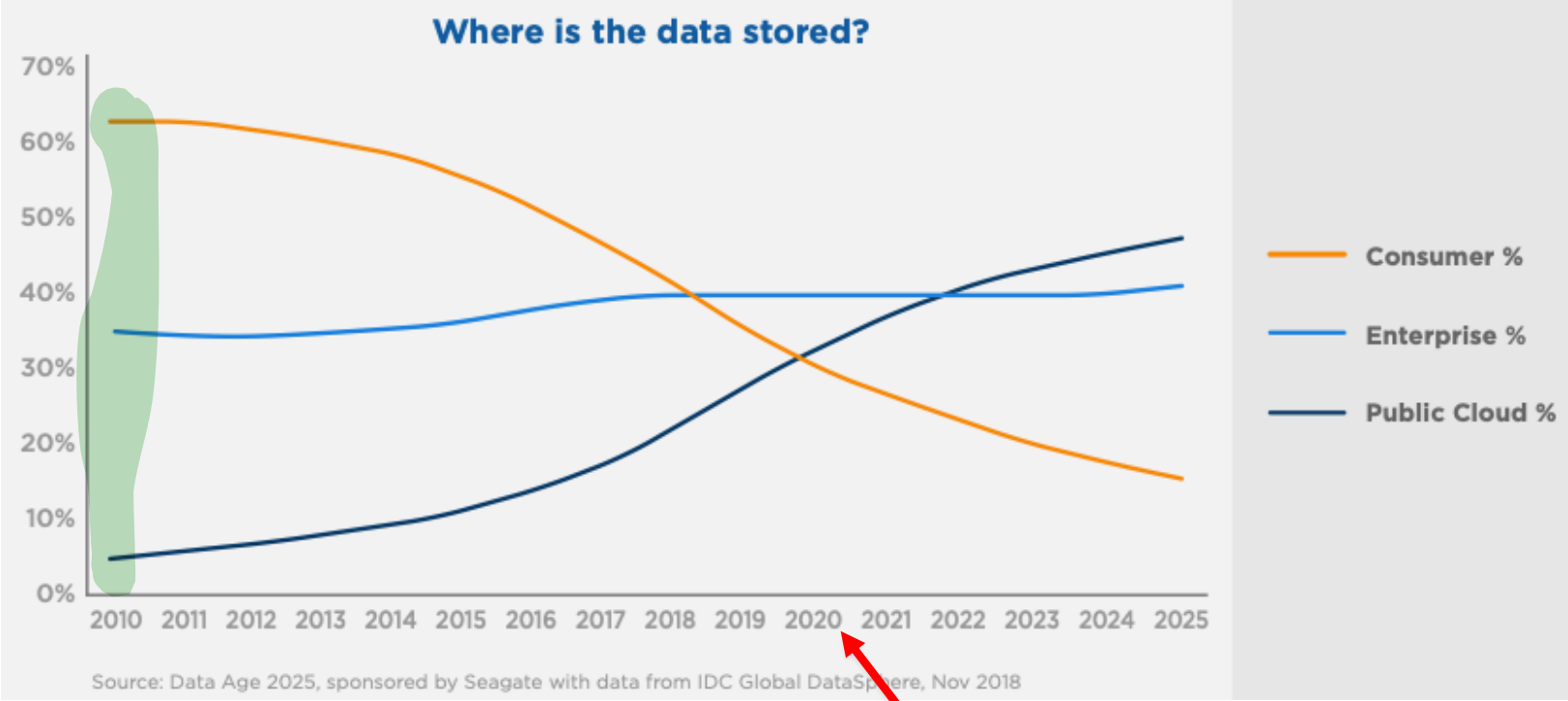
Some Trends…

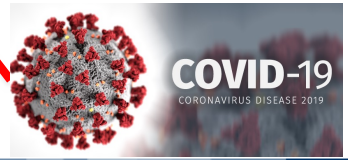
- Data-driven world
  - 80s-90s data was primarily generated by humans
  - Nowadays machines generate data at an unprecedented rate
    - Not only Media (image/video/audio/socialmedia) as big-data source
    - Sensors, surveillance cameras, digital medical imaging devices…
    - Industry4.0 and AI



Some More Trends…

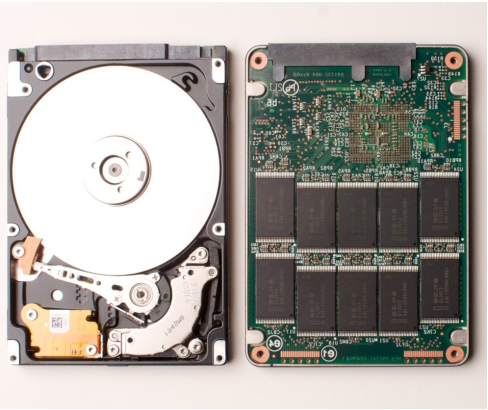
- The growt favors the centralized storage strategy
  - Limiting redundant data
  - Automatizing replication & backup
  - Reducing management costs

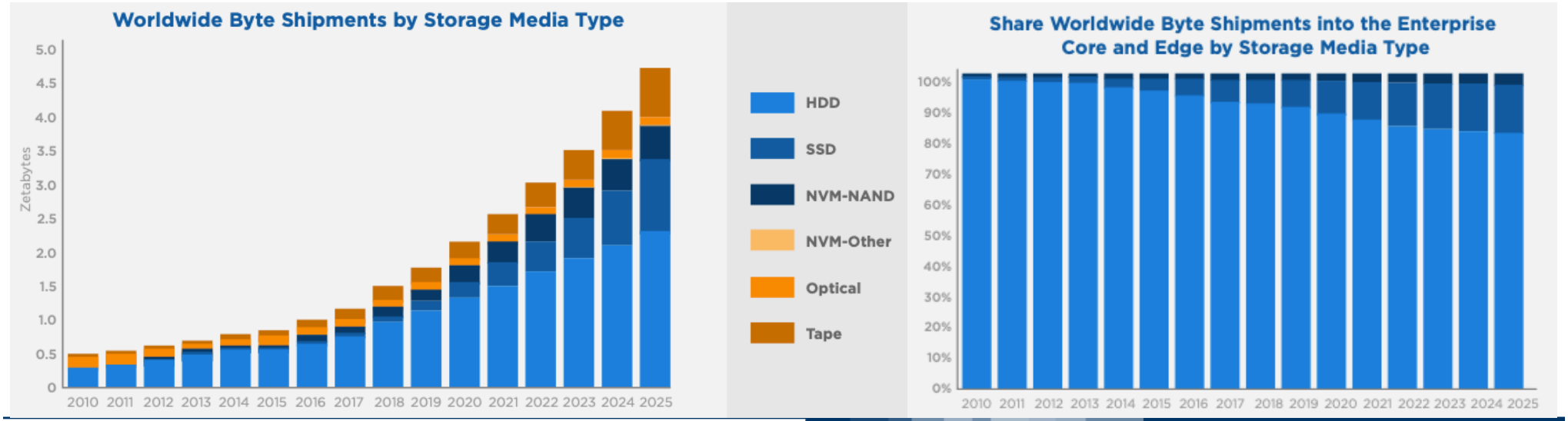




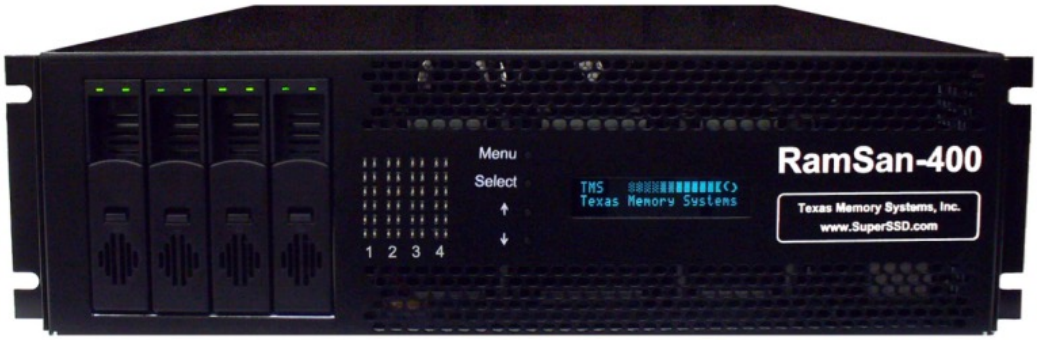
Storage Technologies

- Storage technology is dominated by HDDs
  - Magnetic disks with mechanical interactions
- «Recent» technology advancement brought SSDs
  - No mechanical or moving parts
  - Built out of transistors (NAND flash-based devices)
- NVMe - Non-Volatile Memory Express
  - Latest industry-standard to run PCIe SSDs
- Tapes … *will never die*





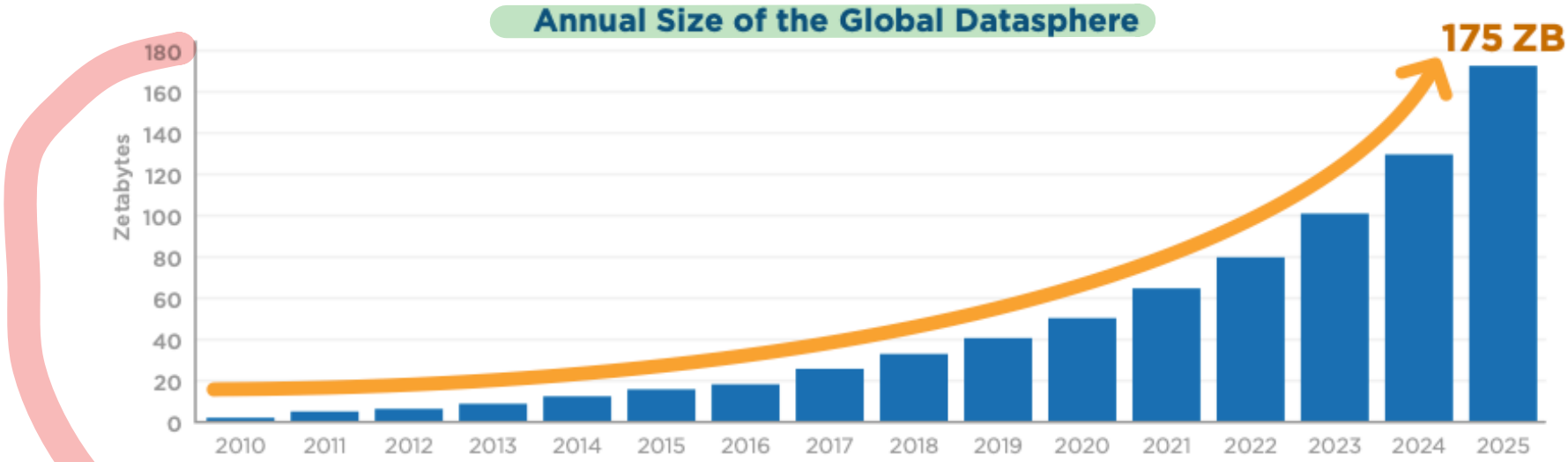
Hybrid solutions (HDD + SSD)

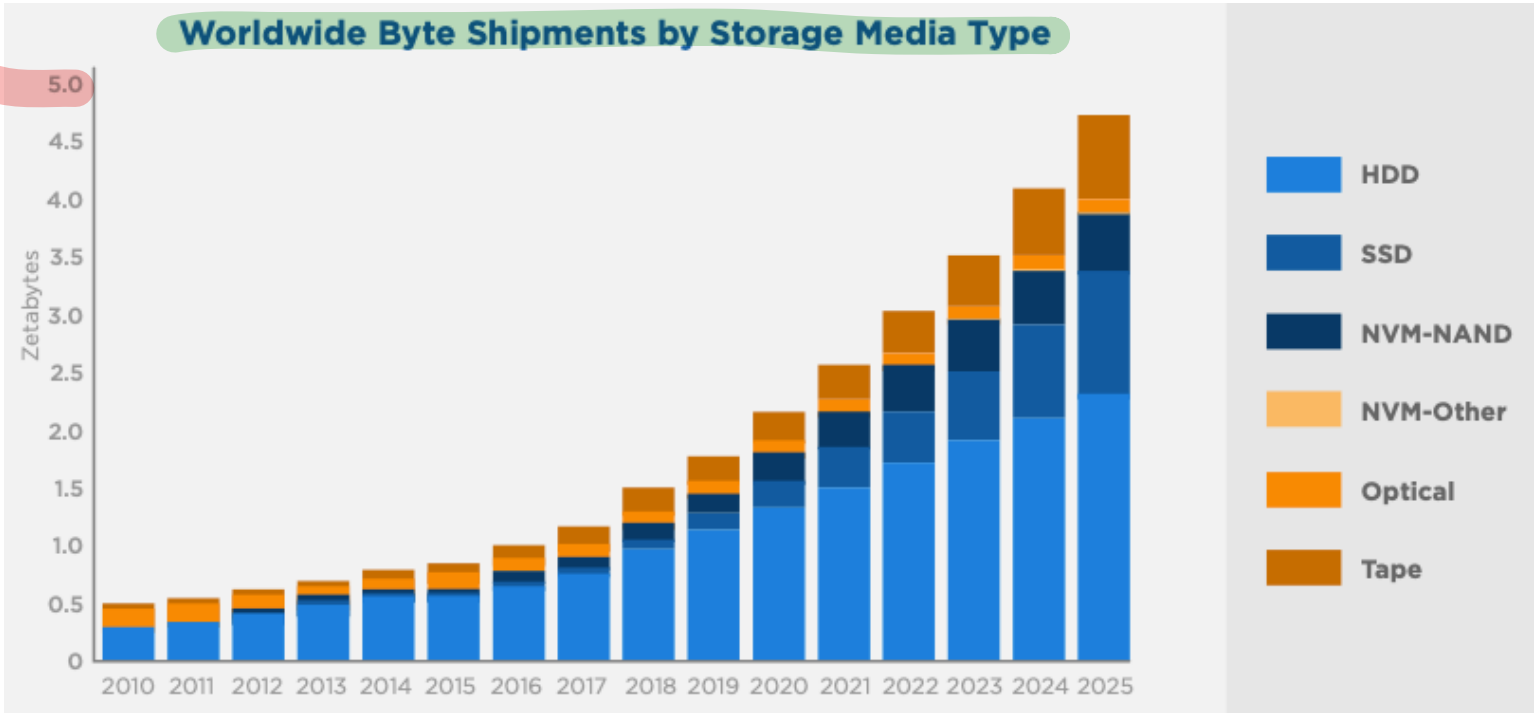


Some large storage servers use SSD as a cache for several HDD. Some mainboards of the latest generation have the same feature: the combine a small SSD with a large HDD to have a faster disk.

Some HDD manufacturers produce Solid State *Hybrid Disks* (SSHD) that combine a small SDD with a large HDD in a single unit.

Do you see anything strange here?









A server for a datacenter: an example

An example of Server for a Datacenter

Descrizione
RB120: Server 1U Dual Socket Intel GPU – 2 bays SAS/SATA + 2 internal

1 x 1U – 2 x SAS/SATA – Ridondante 2000W
1U Rackmount Black Chassis. 2000W Redundant Power Supplies. 43mm (H) x 437mm (W) x 894mm (D). N. 2 Hot-swap 2.5" SAS/SATA drive bays, n. 2 Internal 2.5" drive bays.

1 x Dual Xeon Scalable – C621 – Server GPU
Proprietary Motherboard. Intel® C621 chipset. Dual Socket P (FCLGA3647). Support up to 165W TDP. N. 12 DIMM Slots supported Memory Types: 2666/2400/2133MHz RDIMM, LRDIMM and 3DS ECC LRDIMM modules. Optimal memory configuration: Six memory channels per CPU.

E4 COMPUTER ENGINEERING

2 x Xeon 8-Core 4110 2,1Ghz 11MB
Intel® Xeon® Silver 4110 Processor. 8Cores. 16Threads. FCLGA3647 Socket.11MB L3. 2,1Ghz Base Frequency. 85W max. TDP. DDR4-2400 Memory type.

6 x DDR4-2666 Reg. ECC 16 GB module
Full brand memory, tested and certified by manufacturer for thorough compatibility with proposed system. The real operating speed depends on the processor's model and on the number of the installed modules. Better performances are achieved through a proper channel configuration.

1 x Intel C621 SATA III 4 ports #

1 x SEAGATE 2TB 2,5" SATA III 7.200RPM
Seagate Enterprise Capacity hard disk drive. Form factor: 2,5''. Capacity: 2TB. Interface: 512N SATA 6Gb/s. Buffer: 128MB. Rotational Speed: 7200RPM. Max. Sustained Transfer Rate (MB/s): 136MB/. 2Million-hour MTBF.

1 x Intel S4500 240GB 2,5" SSD SATA III
Intel® SSD DC S4500 Series. Sequential Read (up to): 500MB/s. Sequential Write (up to): 190MB/s. Random Read (100% Span): 69000 IOPS. Random Write (100% Span): 16000 IOPS. Endurance Rating (Lifetime Writes): 0.62 PBW.

1 x Backplane 2 bays SAS/SATA