13 July 2015

Computing resources

Giuseppe Fabio Fortugno

11: repaired with maintenance contract 35K€

11: repaired purchaising the failed part 3: not recoverable fails 25K€

Device	Fail
Disk Array Sata	5 Hard disks 500 GB
Power 520 DB	Hard disk SAS
Server fibm0b	Power supply
Cisco 6506 Detector	Board Ethernet 48 port 10/100FullDuplex
Disk Array Sata	2 Hard disk da 2000GB
Cisco 3500 24+2FE	Completely replaced
Server kdb0a	Service network card
Server fibm0a	A memory bank and a power control card
Tape Library 3494	Robotic arm B Gripper and electronic card
Power 575	Power switching and Turbofan module
Server fibm01	Mother board and power supply
Disk Array Sata	4 Hard disks 750GB
Power5 16 proc	Unrecoverable due to failed part unavailable on market
Power 520 online	SAS controller card
Power 520 online	Processor card
Cisco 3500 48+2	Gas platform switch. Completely replaced.
Cisco 6506	Detector switch - Redundant power supply
Disk Array Sata	7 hard disk 1000 GB
Tape Library 3494	Robotic arm A. Flat cable and related e-card
Power 520 online	SAS Raid5 pci-e card
HMC	Replaced due to unrecoverable fail
Xterminal	Upgrade of Control Room Xterminal, the old ones were too slow
Cisco 6504	48 port Ethernet Module Card
Tape Library 3494	High Voltage power card for redundant module
Disk Array SAS	Card RAID5 cache memory battery pack.

Summary of CPU status

- CPU used for online, offline and servers.

  - New generation P7 & P8: 208 threads

  - Previous generation P6: 208 threads.

  - Very Old generation P5: 96 threads

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Inside the Power architecture a single thread runs upon its own portion of registers, so it is autonomous and isolated inside the core.

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Inside the Power architecture a single thread runs upon its own portion of registers, so it is autonomous and isolated inside the core.

Really different from Intel multithreading architecture. Here the gain will be around 30/40% if it runs two process in multithreading mode into a single core.
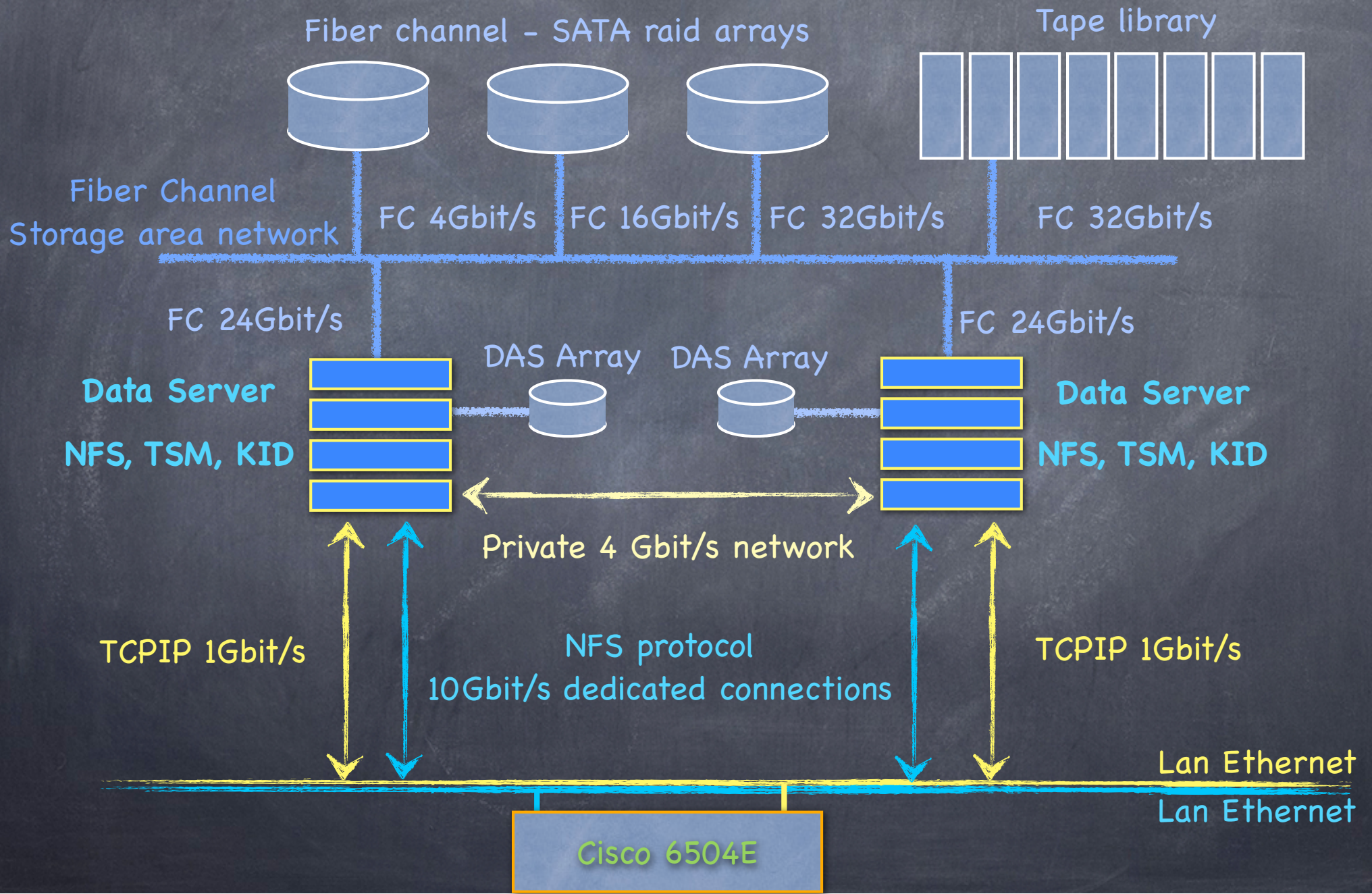
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CISC and RISC architectures use a very different solutions for common problems, and sometimes they are very difficult to compare.
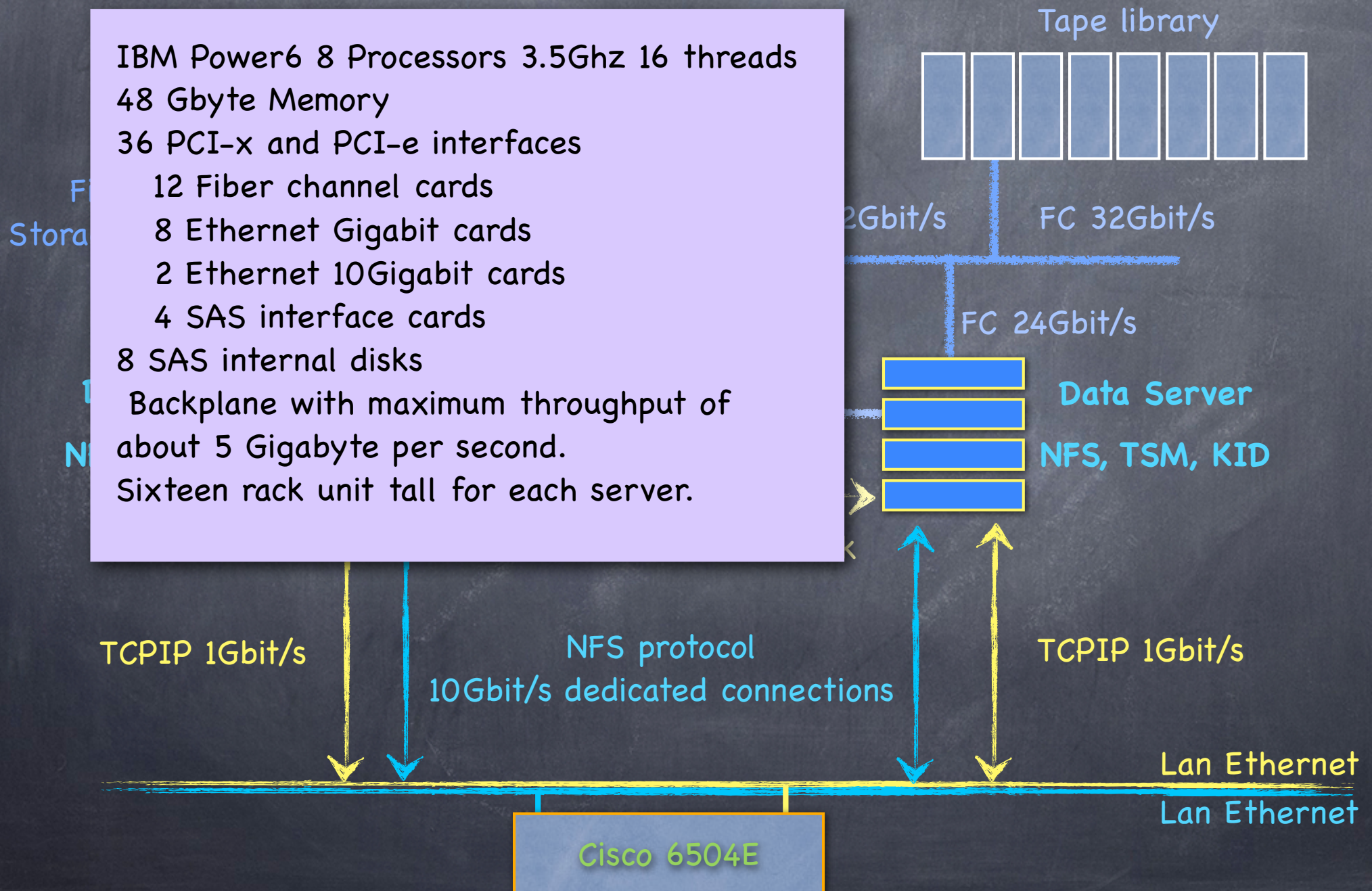
Power7: 16 core – 4 threads each core

Power8: 10 core – 8 threads each core

Kloe Data Servers

Fiber channel - SATA raid arrays

Tape library

Fiber Channel
Storage area network

FC 4Gbit/s   FC 16Gbit/s   FC 32Gbit/s   FC 32Gbit/s

FC 24Gbit/s

FC 24Gbit/s

Data Server

DAS Array   DAS Array

Data Server

NFS, TSM, KID

NFS, TSM, KID

Private 4 Gbit/s network

TCPIP 1Gbit/s

NFS protocol
10Gbit/s dedicated connections

TCPIP 1Gbit/s
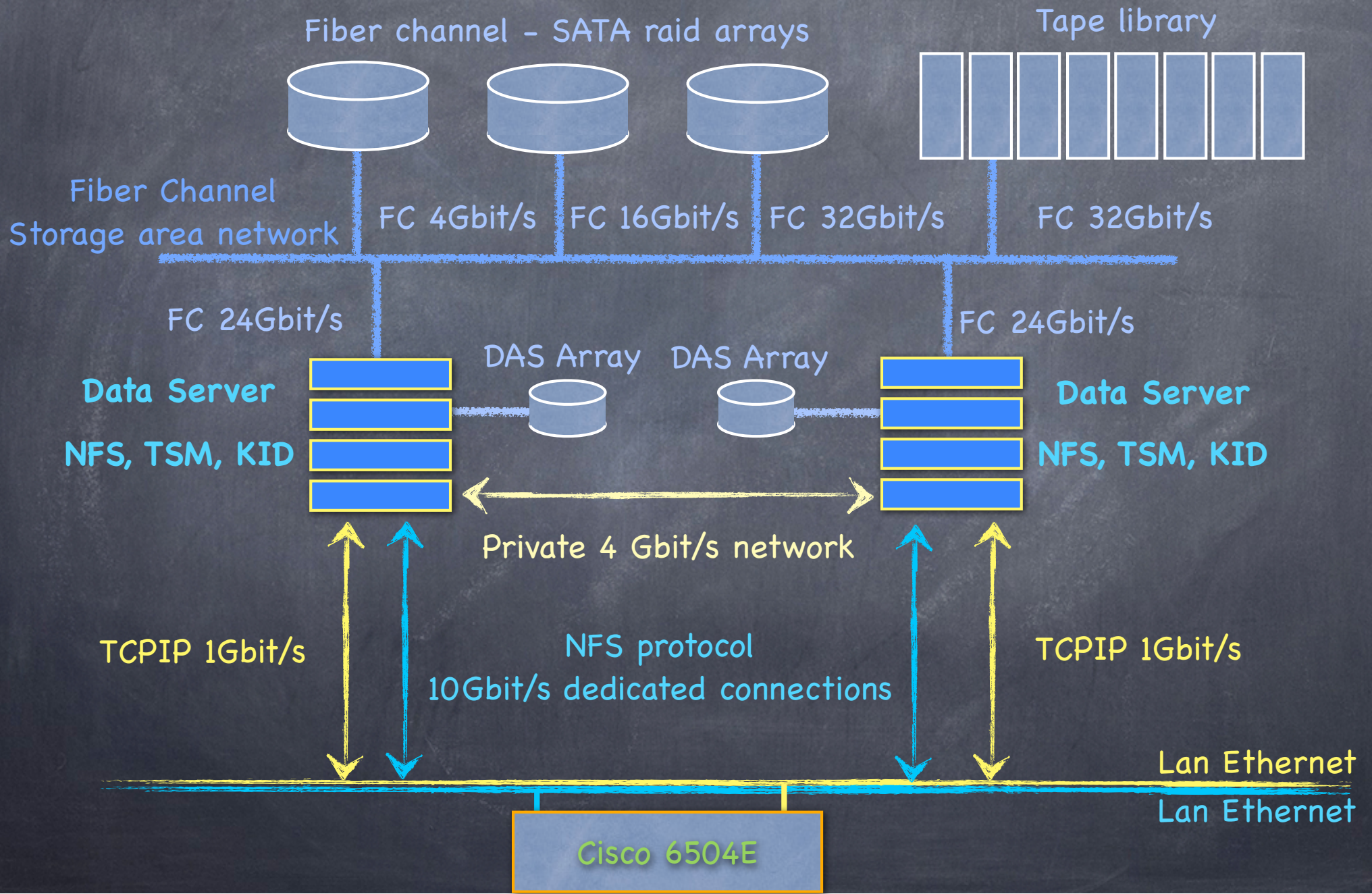
Lan Ethernet

Lan Ethernet
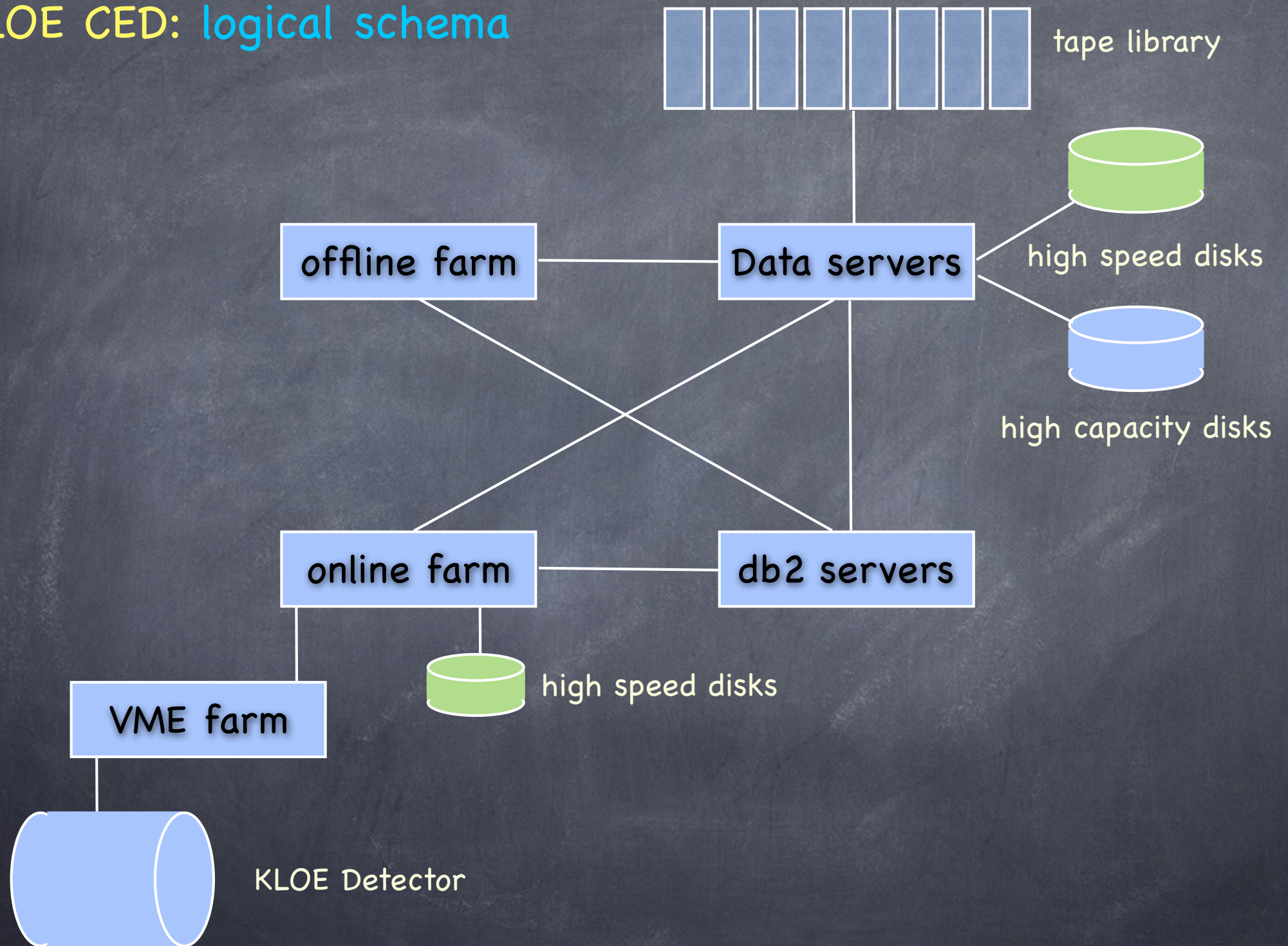
Cisco 6504E

Kloe Data Servers

IBM Power6 8 Processors 3.5Ghz 16 threads
48 Gbyte Memory
36 PCI-x and PCI-e interfaces
    12 Fiber channel cards
    8 Ethernet Gigabit cards
    2 Ethernet 10Gigabit cards
    4 SAS interface cards
8 SAS internal disks
 Backplane with maximum throughput of
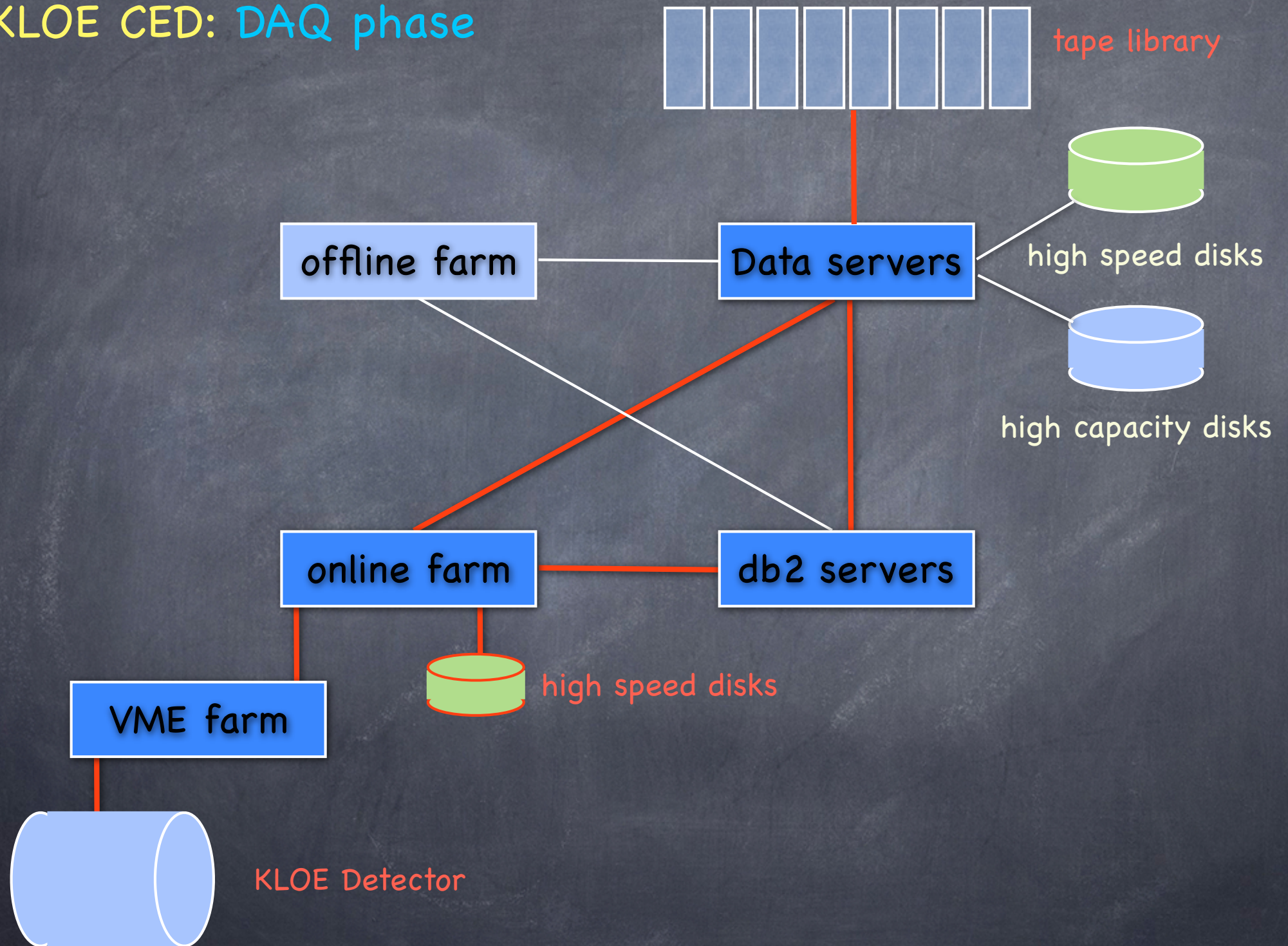about 5 Gigabyte per second.
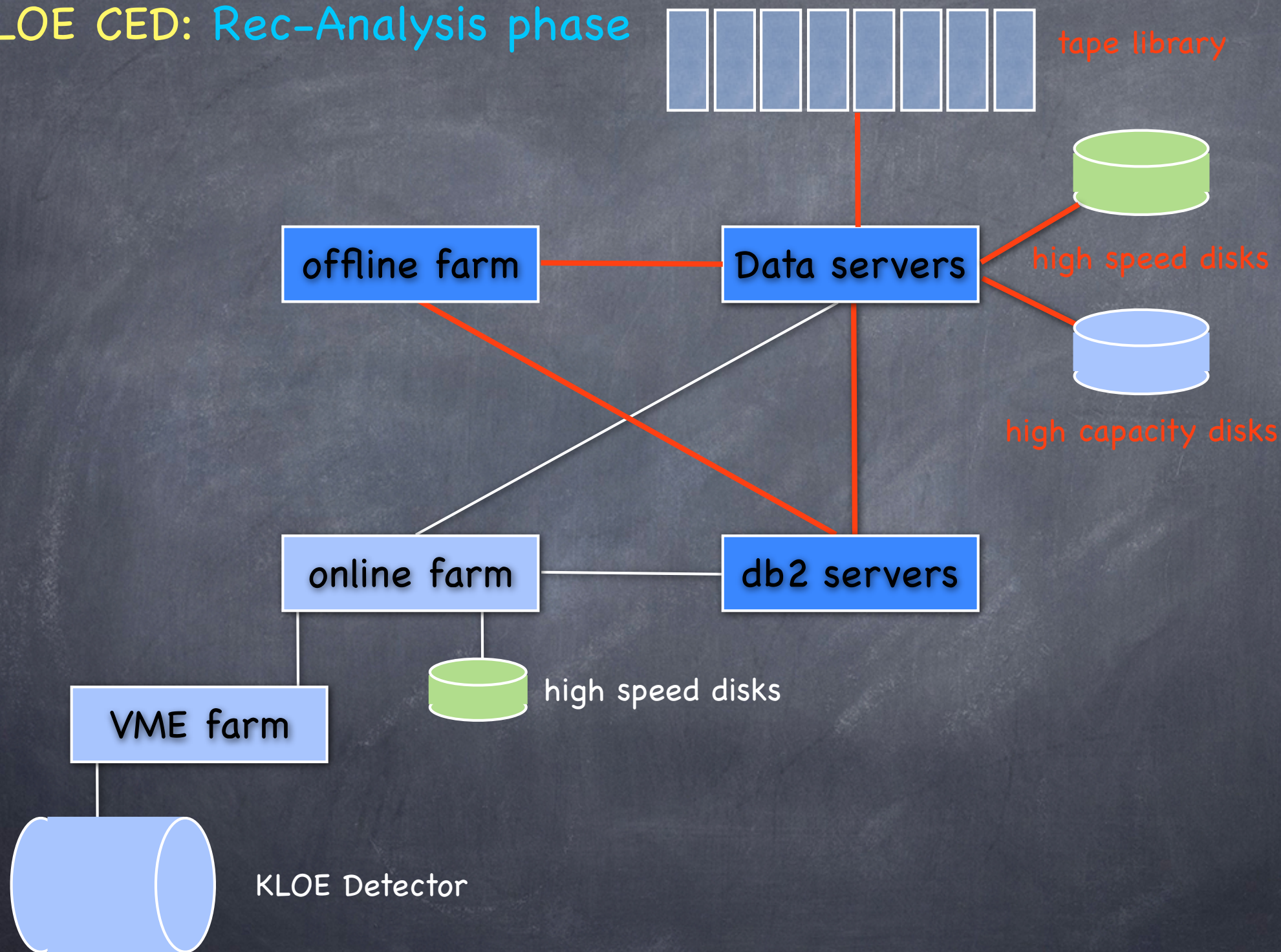Sixteen rack unit tall for each server.

Tape library

FC 32Gbit/s

2Gbit/s

FC 24Gbit/s

Data Server

NFS, TSM, KID

TCPIP 1Gbit/s

NFS protocol
10Gbit/s dedicated connections

TCPIP 1Gbit/s

Lan Ethernet

Lan Ethernet

Cisco 6504E

Kloe Data Servers

Fiber channel - SATA raid arrays

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Fiber Channel
Storage area network

FC 4Gbit/s   FC 16Gbit/s   FC 32Gbit/s   FC 32Gbit/s

FC 24Gbit/s   FC 24Gbit/s

DAS Array   DAS Array

Data Server   **Data Server**

NFS, TSM, KID   **NFS, TSM, KID**

Private 4 Gbit/s network

TCPIP 1Gbit/s   NFS protocol   TCPIP 1Gbit/s
                  10Gbit/s dedicated connections

Lan Ethernet
Lan Ethernet

Cisco 6504E

KLOE CED: logical schema

tape library

offline farm — Data servers

high speed disks

high capacity disks

online farm — db2 servers

high speed disks

VME farm

KLOE Detector

KLOE CED: DAQ phase

KLOE CED: Rec-Analysis phase

tape library

offline farm

Data servers

high speed disks

high capacity disks

online farm

db2 servers

high speed disks

VME farm

KLOE Detector

Kloe DBase

Online and offline kloe db client connection through Ethernet 1 Gbit

Kloe db server

DB2 client

DB2 automatic switchover Cluster

DB

DB2 Server

DB2 Server

DB replica

Sas raid array

DB2 server exclusive connection 1 Gbit/s

Sas raid array

tsm backup

IBM DB2 version 9.5
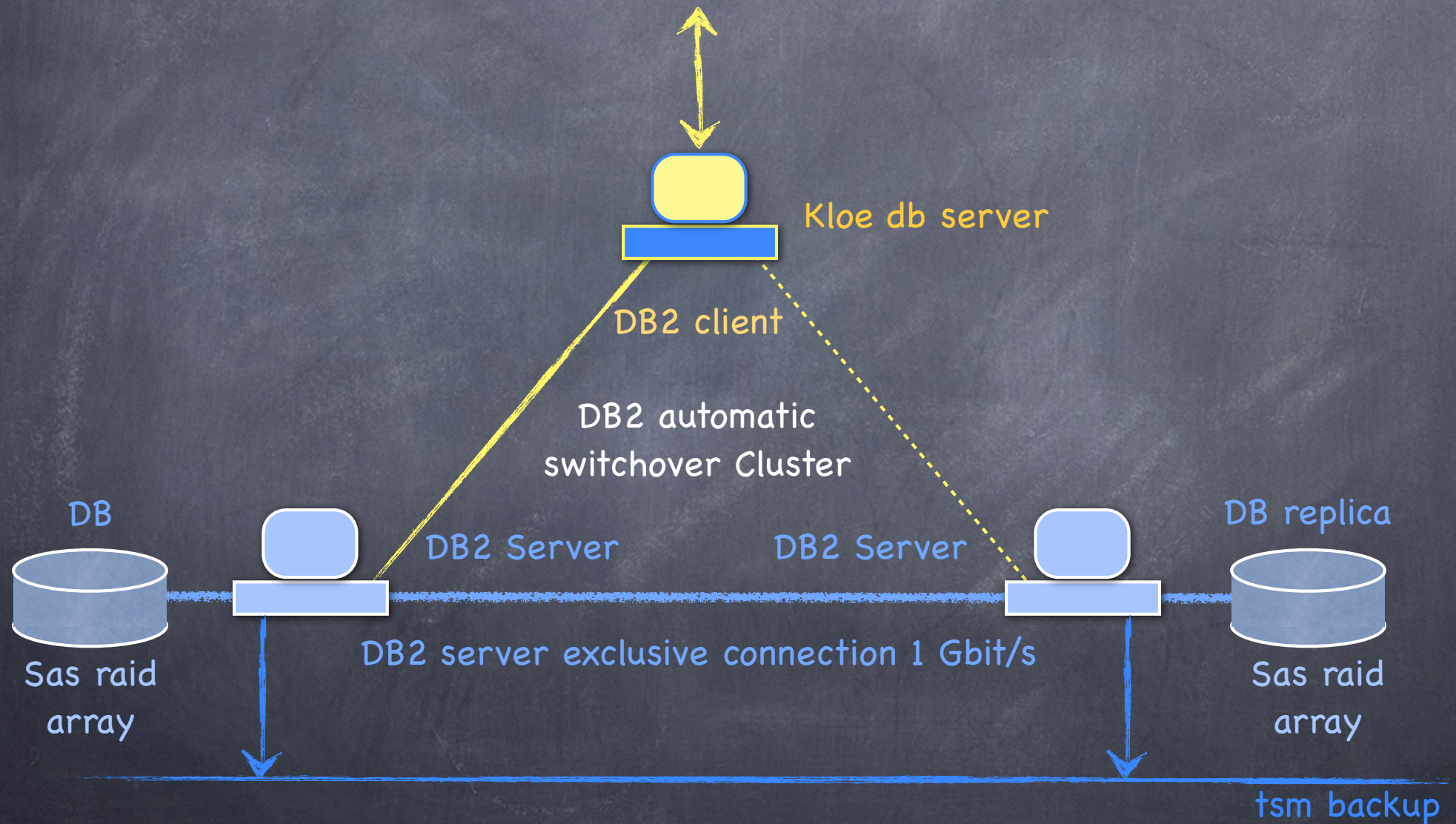
commercial software

AIX Ver. 5.3 – 6.1 – 7.1

TSM Storage Manager

Tivoli Storage Manager – SAN attached storage

IBM DB2 Ver. 9.5

IBM LoadL Leveler 8.1

XLC compiler ver 6.1 – 7.0 – 11.2

XLF compiler ver 7.3 – 8.5 – 13.2

IBM Network install manager ver. 8.2

In 2003, we entered into a trade agreement with IBM called Scholarship program. Because this agreement is still working we do not pay a license fee for any of these programs.

DAQ Actual situation

1 Gb Ethernet
2 Gb Ethernet Channel
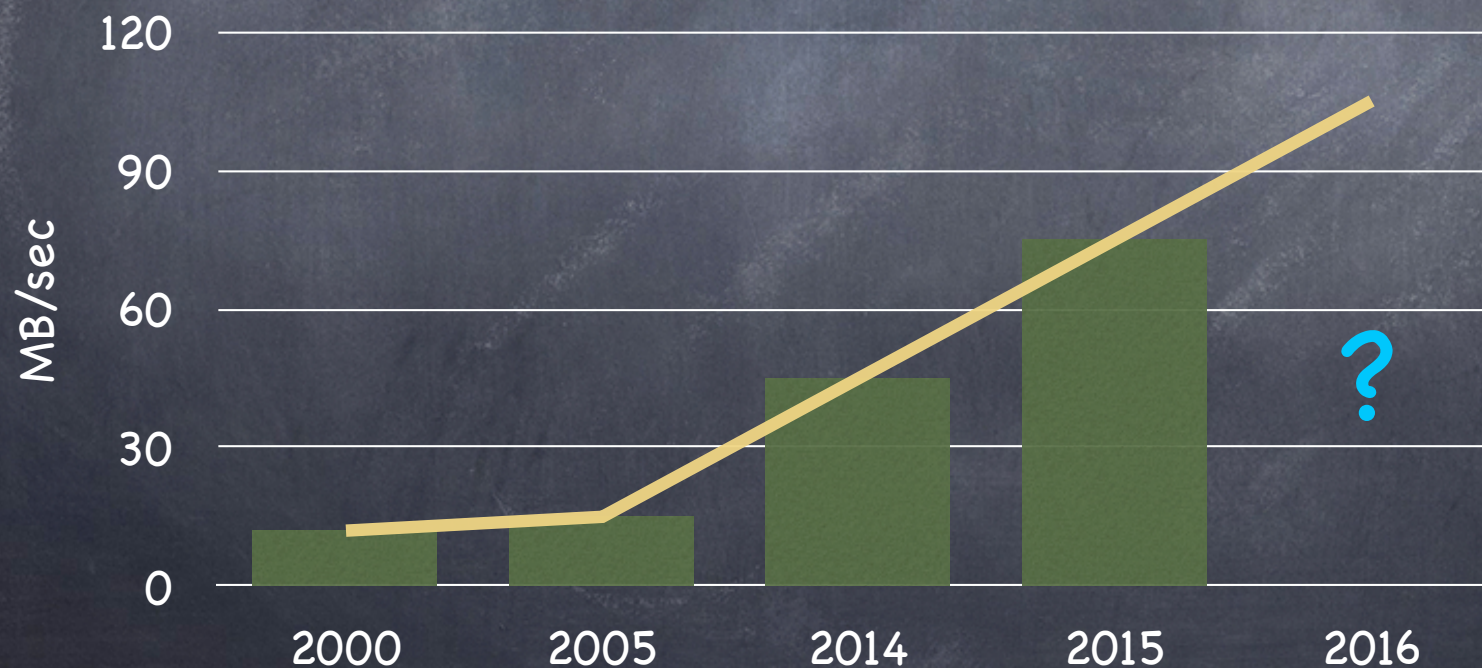4 Gb Ethernet Channel

1 Calibration machine

3 DAQ machines

DAS Array

CED

Cisco 6504E
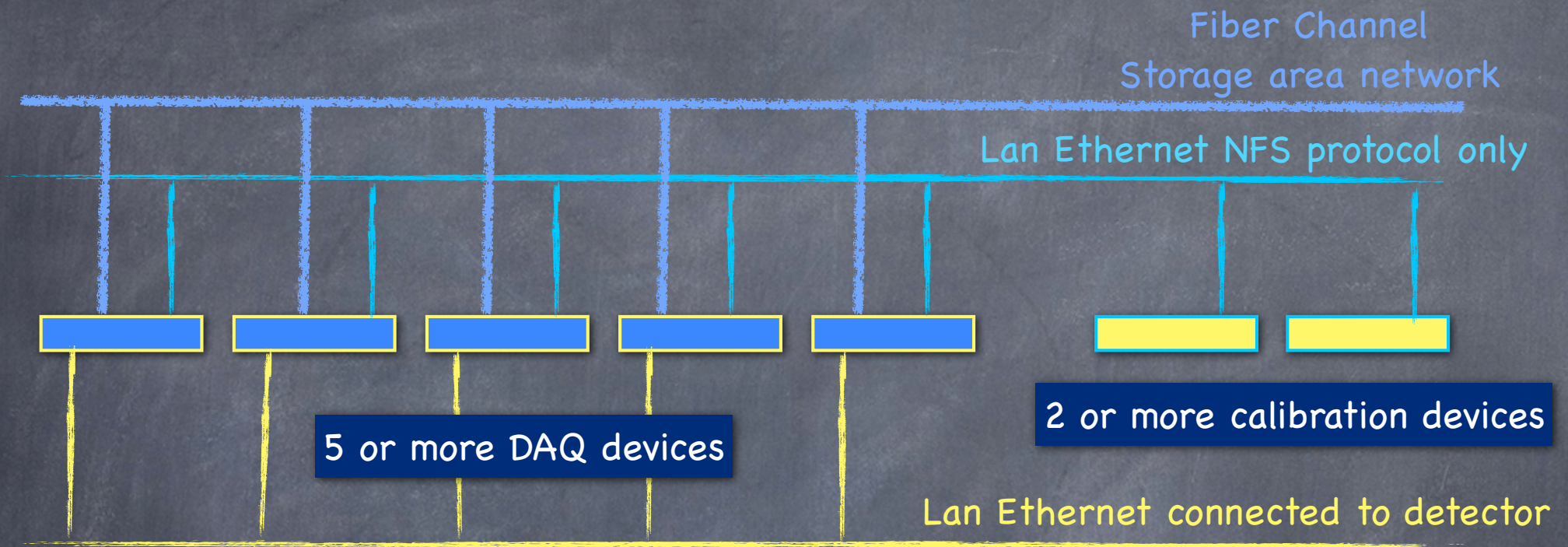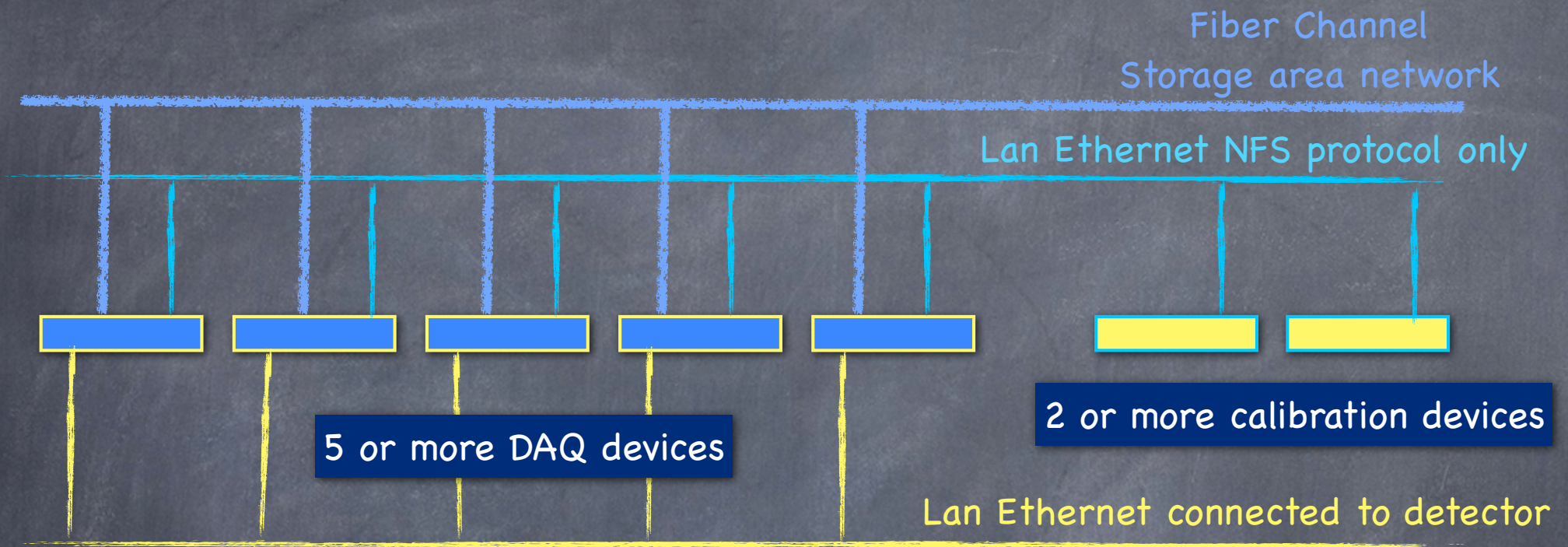
Detector

QcalT

HET

Cisco 3500

Cisco 3500

Cisco 3500

Cisco 6506

Cisco 3500

LET

20 motorola vme on detector
20 Eth GBit connections

DAQ Actual situation

CED

DAS Array

3 DAQ machines

1 Calibration machine

Cisco 6504E

Detector

Cisco 6506

MB/sec

120

90

60

30

0

2000   2005   2014   2015   2016

?

Kloe New possible DAQ

Fiber Channel
Storage area network

Lan Ethernet NFS protocol only

5 or more DAQ devices

2 or more calibration devices

Lan Ethernet connected to detector

The actual DAQ devices are Power6 8 threads and 12Gbyte Mem. with DAS disk (2009)

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The offline migration unlocks a lot of resources for the DAQ.

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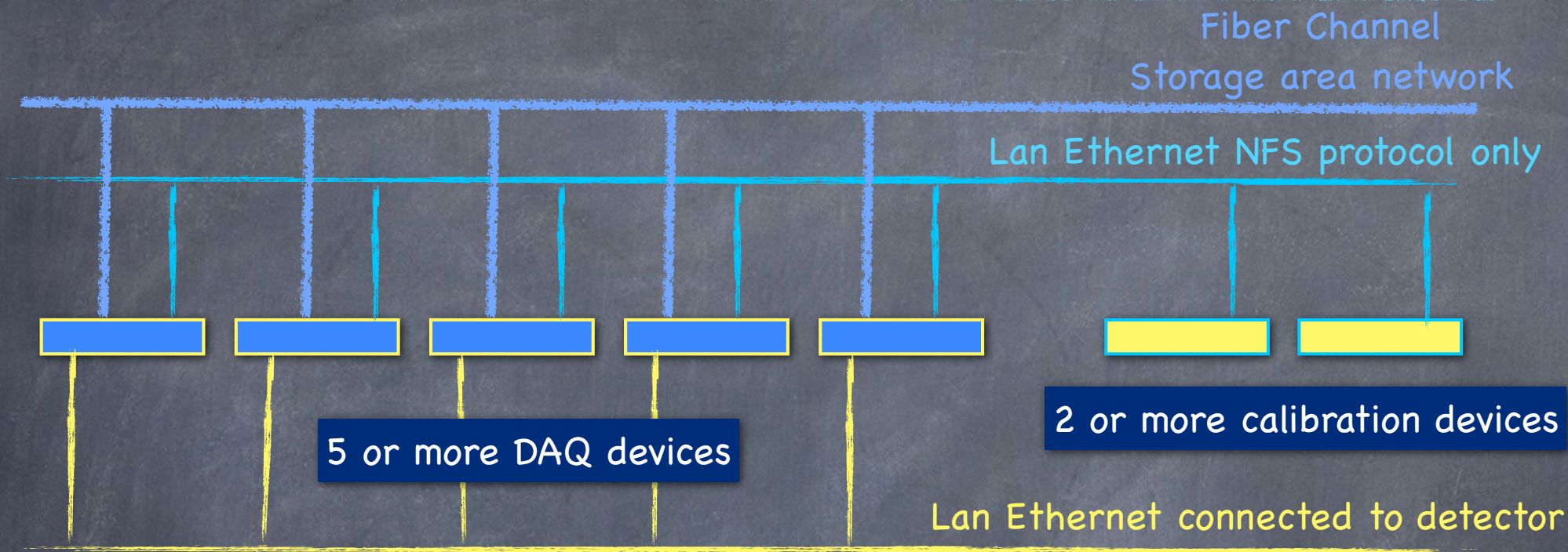
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The power 7 and 8 could be a good candidate to manage the DAQ.
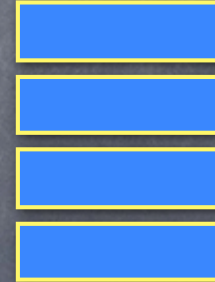They can be equipped with new PCI-e cards and become the new DAQ engine.

The Power7 has 64 threads and 64 Gbyte memory
and it could be splitted in four dynamic partitions with both duties of DAQ.

Kloe New possible DAQ

Power7 2.8 Ghz splitted in Four VM with 16 Thread, 16 Gbyte memory and two PCI-e card each.

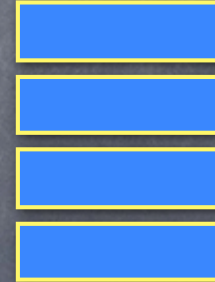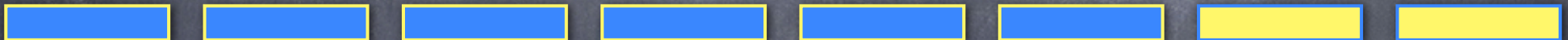Power7 2.8 Ghz splitted in Four VM with 16 Thread, 16 Gbyte memory and two PCI-e card each.

Power8 2.6 Ghz splitted in Four VM with 20 Thread, 16 Gbyte memory and three PCI-e card each.

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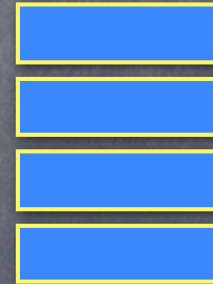
Possible configuration with 2 Power7
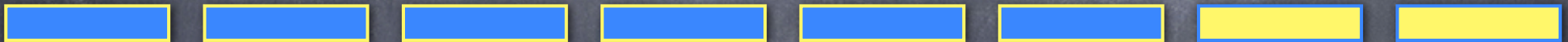
Kloe New possible DAQ

Power7 2.8 Ghz splitted in Four VM with 16 Thread, 16 Gbyte memory and two PCI-e card each.

Power7 2.8 Ghz splitted in Four VM with 16 Thread, 16 Gbyte memory and two PCI-e card each.

Power8 2.6 Ghz splitted in Four VM with 20 Thread, 16 Gbyte memory and three PCI-e card each.

Possible configuration with 2 Power7

Possible configuration with 2 Power7 and 1 Power8

Storage for data acquisition and reduction

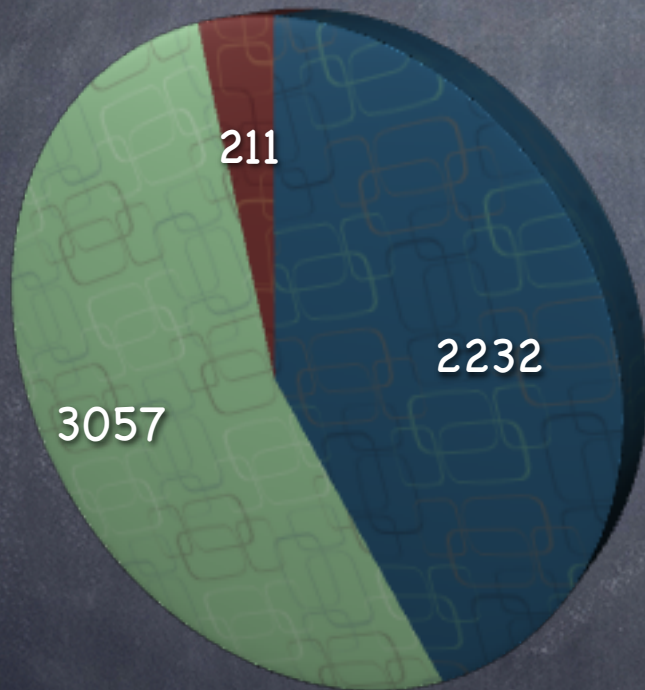Actual storage 150 TByte

SAN and DAS

The newest storage device has more than four years of heavy work on its backs

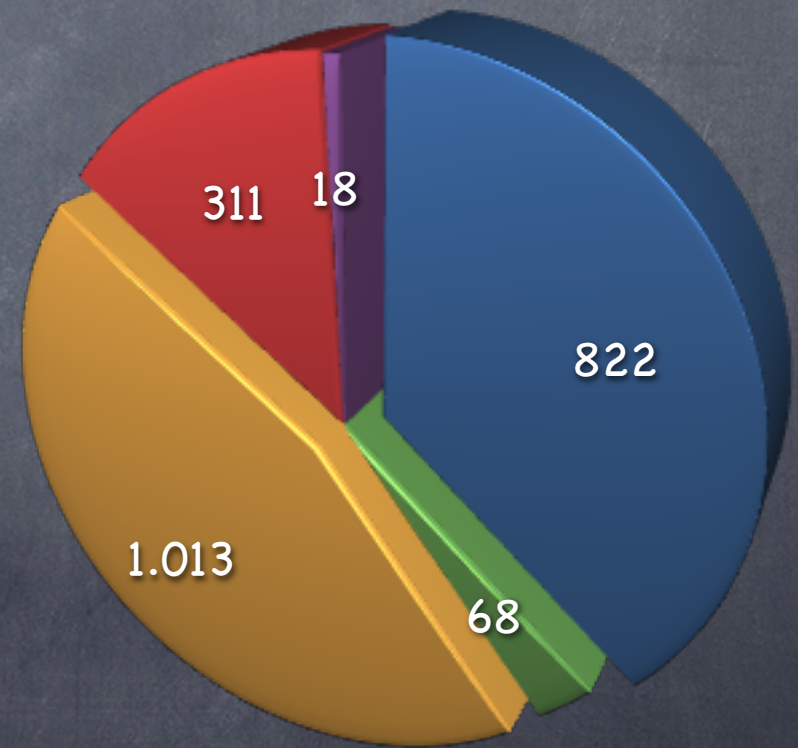New storage: 500 TByte SAN and DAS (160K€)

Library status

Cartridges available:
2443 out of 5500 total slots

Used cartridges
Empty slots
Empty cartridges

211
2232
3057

Raw Data
SW, DB and OS backup.
DST, MC e Analysis
Reconstructed Files
Experiment Conditions

311   18
822
1.013   68

Used cartridges
detail

Library manager

- 8 Fiber channel tape interface drive TS1130

- Tape cartridge used: 2232 for 2691 TByte stored.

  - Average value of 200 mount/dismount every day while the experiment is in non-stop operation mode

- After 8000 mount or after a read-write error the cartridge is automatically emptied and removed by the TSM

- Last year only 3 cartridges were removed by the library manager program due to R/W errors and 4 cartridges were removed because they reached the mount limit

Tape library upgrade

We have three different options
to increase the storage on tape:

→ Leave the tape drives at the same density and buy 2000 tape cartridges or 3000 tape cartridges to add 2 or 3 Petabyte.
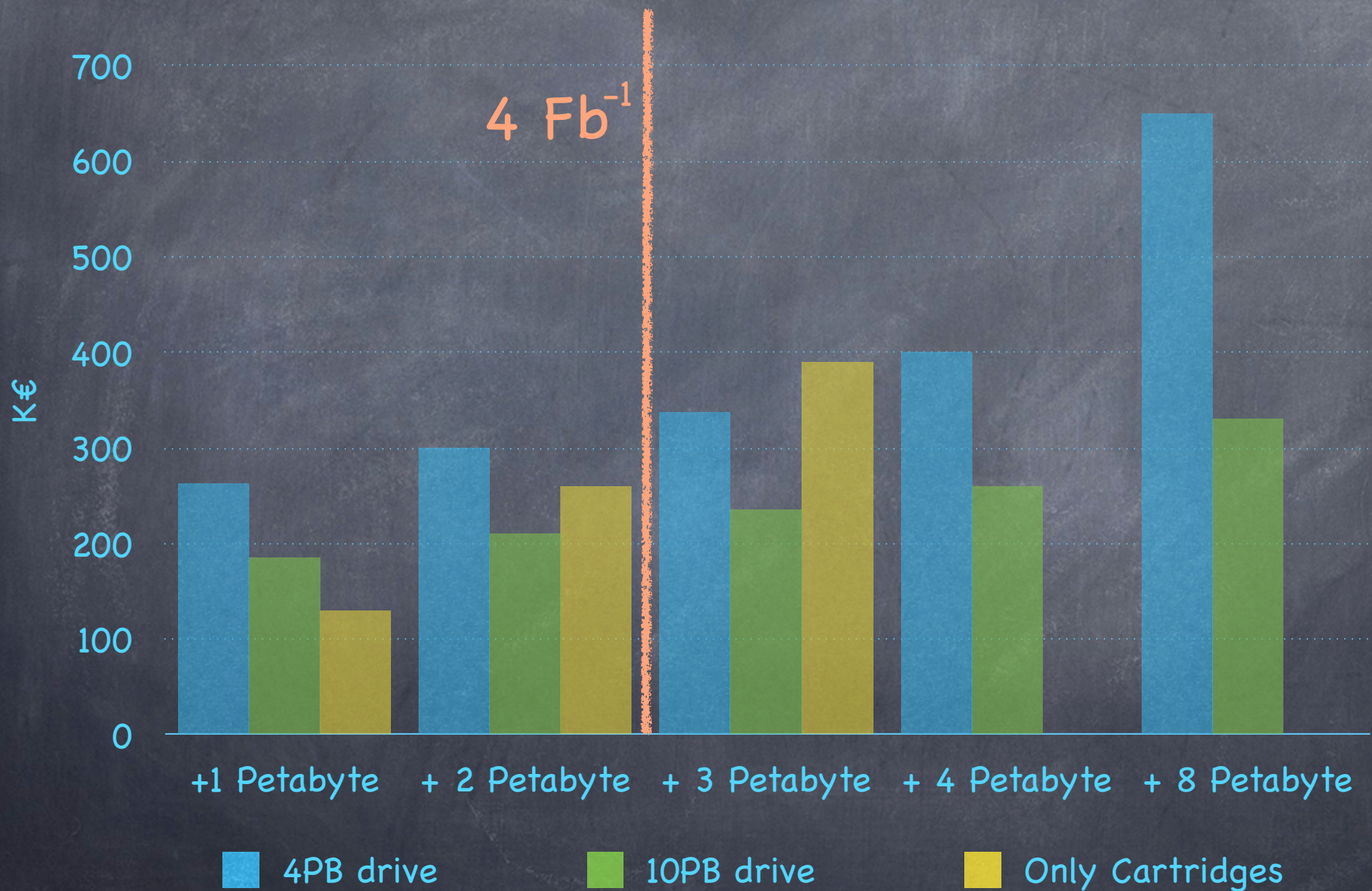
→ Before: upgrade the tape drives to 4 Tbyte tape technology.
   Then: every new petabyte will be obtained adding only 250 new cartridges.

→ Before: upgrade the tape drives to 10 Tbyte tape technology.
   Then: every new petabyte will be obtained adding only 100 new cartridges.

Kloe

2011 computer requests

	2012	2013	2014	2015	2016
Upgrade	80	390	310	280	30
Mainten.	100	100	100	100	100
Total	180	490	410	380	130

Kloe

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	2012	2013	2014	2015	2016
Upgrade	80	390	310	280	30
Mainten.	100	100	100	100	100
Total	180	490	410	380	130

Actual requests

Maintenance: 60K€

More space on tape library

500 Tbyte of DAS and SAN disk: 160K€

One or two new power8 machine: 16K€ each

Some cards PCI-e to trasform the offline machine in online: 5K€

Thank you!

KLOE Room

Xterminal

Cisco 3500

Main Switch Router

Cisco 6504E

HMC

Cisco 3500

Cisco 3500

Gas Platform

Cisco 3500

KLOE Room @lnf

Cisco 3500

LNF CED

Cisco Nexus

Detector

GIB

Cisco 3500

Cisco 3500

Cisco 6506

HET   Cisco 3500   QcalT   Cisco 3500   LET

Ethernet Network

1 Gb Ethernet

2 Gb Ethernet Channel

4 Gb Ethernet Channel