

ASYA SHKLYAR  
FEBRUARY 2018

RESEARCH COMPUTING  
INFRASTRUCTURE

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POMONA COLLEGE

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# AGENDA

- INITIAL FINDINGS
- CONSIDERATIONS
- RECOMMENDATIONS
- INITIAL BUILDOUT
- NEXT STEPS
- LINKS TO DOCUMENTATION AND REFERENCES

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# INITIAL FINDINGS

- INTERVIEWED: 10 OUT OF 10 PLANNED DEPARTMENTS (AND GREW TO 13)
- SCHEDULED TO INTERVIEW: PHYSICS, BUSINESS
- ALL INTERVIEWED OWN INFRASTRUCTURE
- HALF OF THE INTERVIEWED HAVE REMOTE RESOURCES
- CLOUD USE - ONE KNOWN CASE (LINGUISTICS)
- GPU INTEREST - ALL, ESPECIALLY CHEMISTRY, MATHEMATICS, GEOLOGY, ECONOMICS
- 50+ SOFTWARE PACKAGES USED (COMMERCIAL AND OPEN SOURCE)

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# CONSIDERATIONS

- EXISTING APPLICATIONS ARE NOT PROFILED BUT LEANING TOWARDS RAM-HEAVY USAGE, MIN 256 GB
- THE ENVIRONMENT WILL BE USED BY BOTH FACULTY AND STUDENTS
- INTERACTIVE LOGIN TO NODES AND REMOTE VISUALIZATION ARE NEEDED
- EXISTING VMWARE ENVIRONMENT DOES NOT HAVE GPUS, ONLY HAS BLOCK STORAGE AND NO QOS OR NFS/CIFS
- MOST DATA IS SHARED INTERNALLY AND EXTERNALLY
- NO CENTRALIZED HOME DIRECTORIES - PERMISSIONS ISSUES
- NO INFINIBAND EXPERTISE

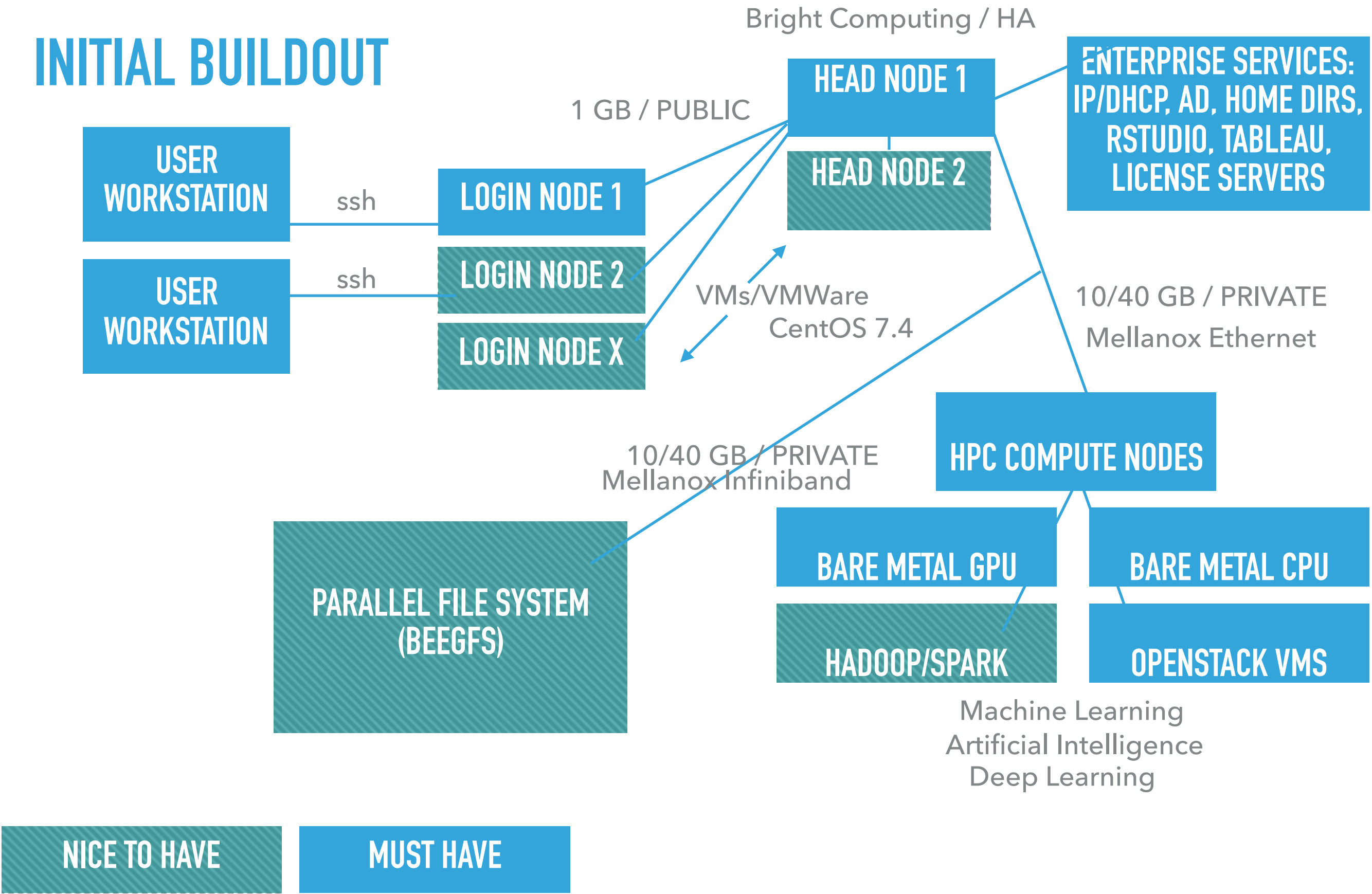
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# RECOMMENDATIONS

- DO NOT BUILD THE HPC ENVIRONMENT USING THE EXISTING ENTERPRISE SETUP
- GET ONE OR TWO SYSTEMS THAT ARE BEST OF BREED AND EXPENSIVE, FULL OF HARDWARE AND FEATURES
- USE GPUS WHENEVER POSSIBLE TO ACCELERATE SOFTWARE AND MINIMIZE THE COST OF CPUS (NVIDIA DGX WITH VOLTA AND PASCAL WITH INDIVIDUAL CARDS)
- USE THE WINDOWS HOME DIRECTORIES FOR NOW (NEE DUNES SERVICES INSTALLED) BUT CONSIDER MOVING TO A ZFS NFS/CIFS APPLIANCE FOR HOSTING THE HPC HOME DIRECTORIES AND PROVIDING POSIX-COMPLIANT INTERFACE FOR USERS OR MOVE ALL HOME DIRECTORIES TO PURE STORAGE (ALL-FLASH)
- BUILD A PARALLEL FILE SYSTEM FOR SCRATCH SPACE AND HIGHER IO
- USE NVIDIA CLOUD (FREE WITH DGX/VOLTA CARDS)\*
- USE MELLANOX ETHERNET SWITCHES (CAN BE CONVERTED TO INFINIBAND WITH A LICENSE)
- CONSIDER BUILDING A DATA LAKE WITH DATA TRANSFER NODES

\* AWS COSTS STILL APPLY

# INITIAL BUILDOUT

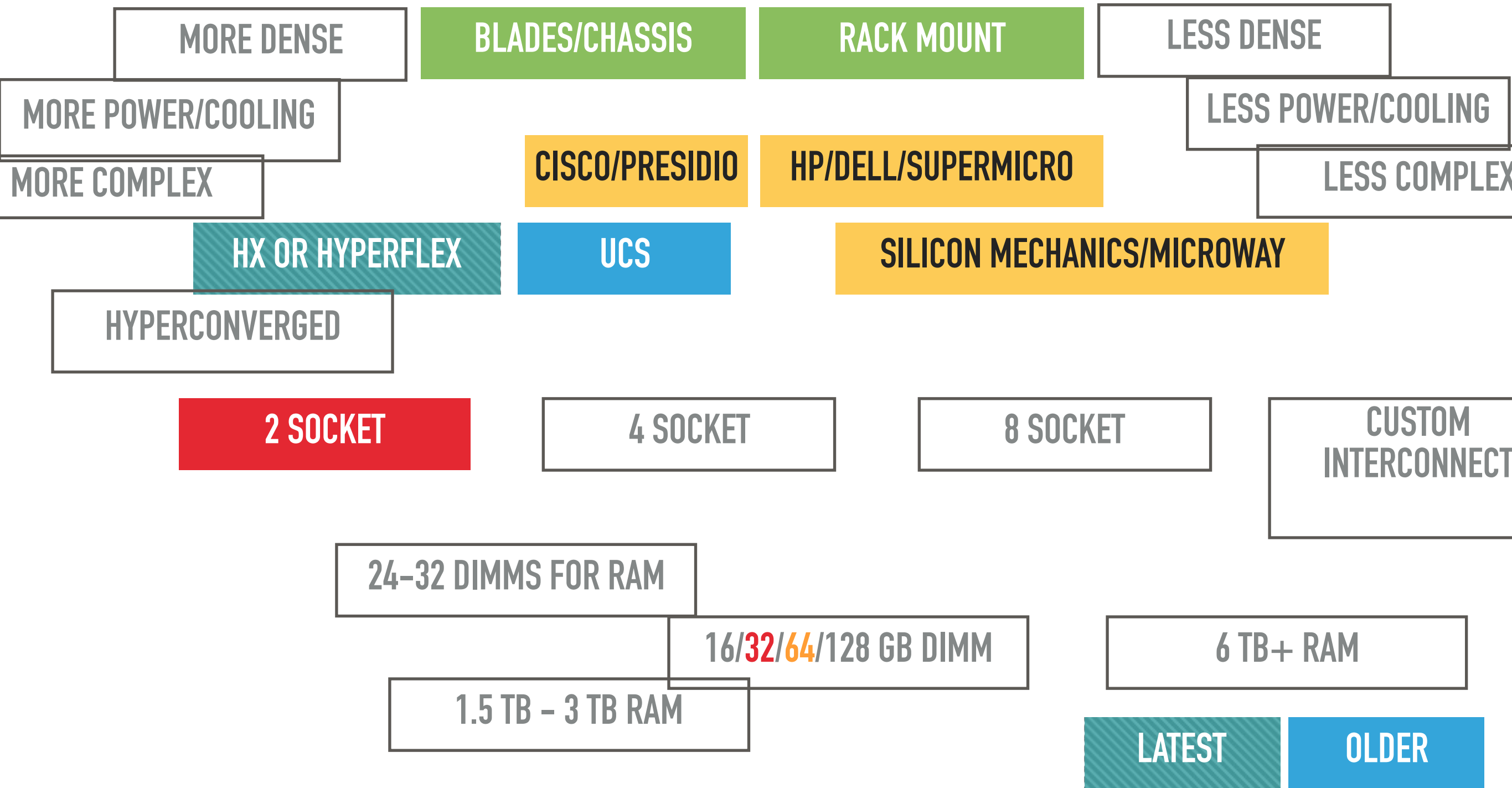


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# PRICING

Bright Computing	20 nodes	\$10,000	Software
Latest CPU/ AMD Epic	1 x 2 socket	\$50,000	Hardware
Latest CPU/ Intel Skylake	1 x 2 socket	\$200,000	Hardware
NVIDIA GPU / Volta	1 x DGX	\$50,000	Hardware
NVIDIA GPU / Pascal	1 card	\$1,500	Hardware

# HARDWARE CHOICES: DENSITY VS MORE RAM





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# HARDWARE CHOICES: CPU

INTEL

AMD

SKYLAKE

28 core per socket

BROADWELL

22-24 core per socket

EPYC

**32 CORE PER SOCKET**

OPTERON ETC

16 core per socket  
No hyper-threading

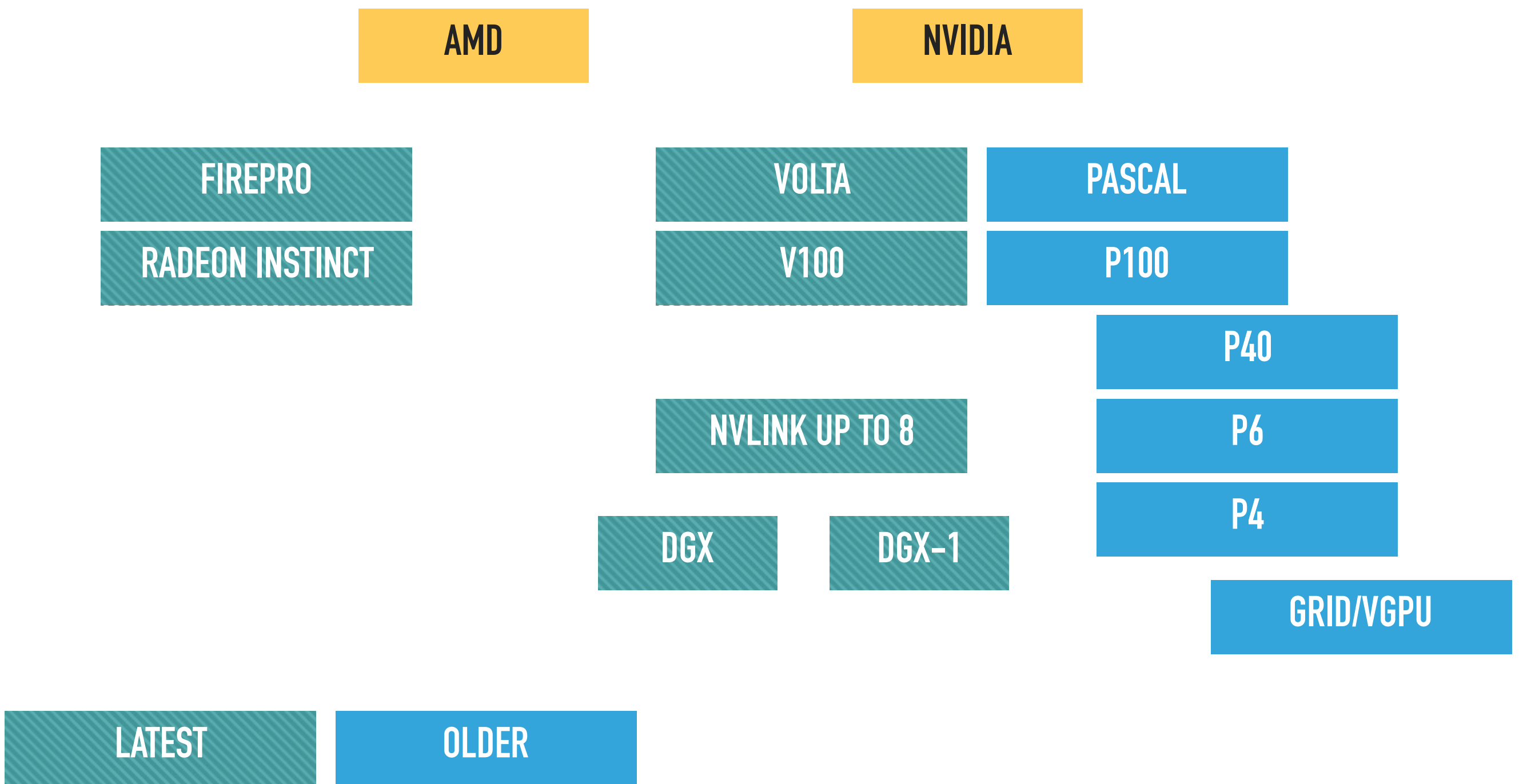
$32 \times 2 = 64$  physical per server

$32 \times 2 \times 2 = 128$  virtual per server

LATEST

OLDER

# HARDWARE CHOICES: GPU



# HARDWARE CHOICES: STORAGE

ROTATING DISK

7200 RPM

10,000 RPM

15,000 RPM

2 TB – 10 TB

200–900 GB

SSD/FLASH

INTEL OPTANE

128–512 GB – 1 TB

UP TO 7.7 TB

SATA

SAS

NVME

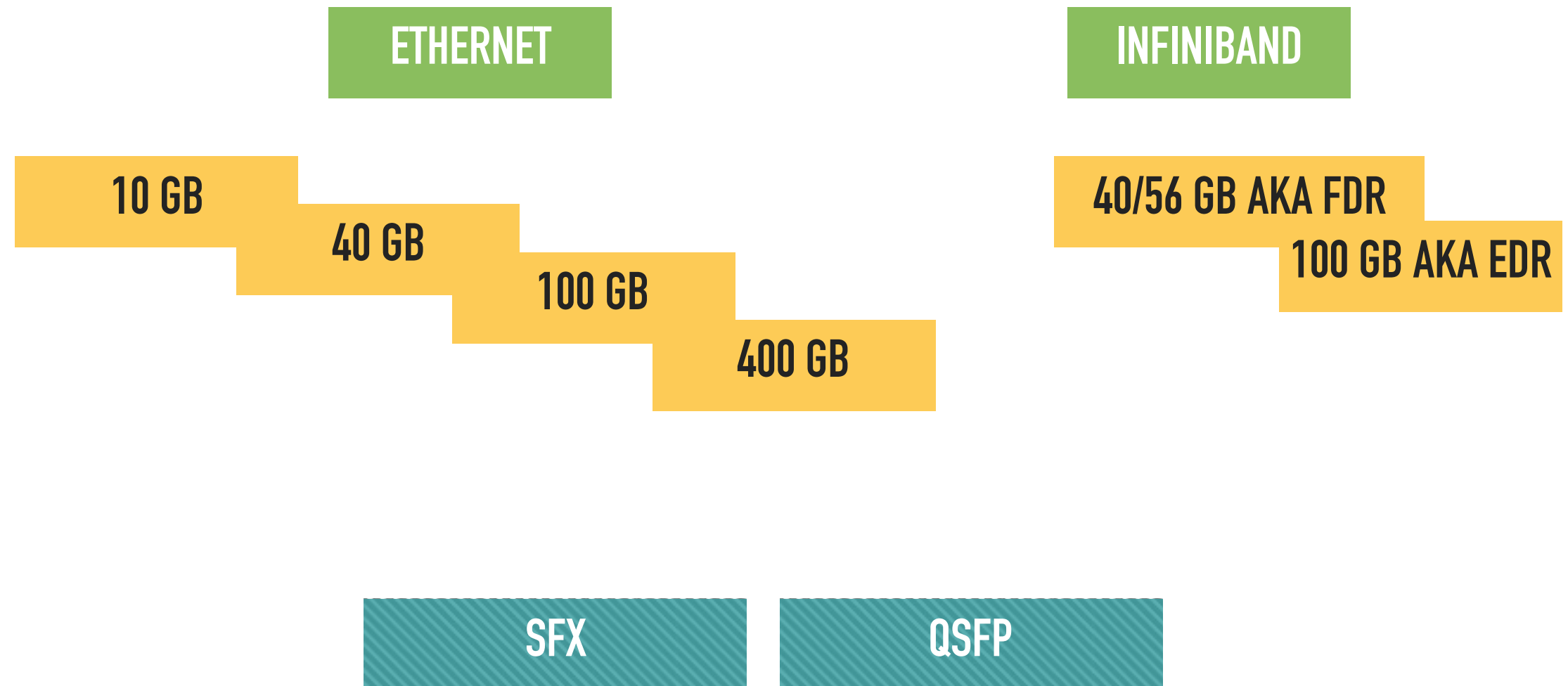
SD

M2

U2

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# HARDWARE CHOICES: NETWORK



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## NEXT STEPS

- HAVE QUOTES FROM 3 VENDORS (PRESIDIO/CISCO/INTEL), (SILICON MECHANICS/AMD), MICROWAVE (DGX)
- CONTINUING INTERVIEWS, DISCOVERY, AND SOFTWARE INVENTORY
- WORKING WITH INFRASTRUCTURE ON VMWARE PROVISIONING PROCESS FOR USER VMS
- WORKING WITH INFRASTRUCTURE ON NETWORK PROVISIONING FOR HPC
- WORKING ON AD/UNIX SERVICES, LOG MANAGEMENT SOLUTION FOR HPC AND CHECK-MK INTEGRATION FOR MONITORING
- FIRST TECHNOLOGY WORKSHOP CONDUCTED, NEXT SCHEDULED MARCH 21 ST
- EXPERIMENT WITH CONTAINERIZING USER APPS (FIRST USE CASE GEOLOGY AND BIOLOGY) AND GPU SPEED UP OF APPLICATIONS
- TESTING TABLEAU FOR CHEMISTRY CURRICULUM
- MEDIA LAB: AR/VR

## LINKS TO DOCUMENTATION AND REFERENCES

Pomona HPC MeindMeister: <https://mm.tt/1014341182?t=Sb9Tlzgb3P>

[Cisco UCS B200 M5 Blade Server Data Sheet](#)

[NVIDIA Volta Tesla V100](#)

[NVIDIA GPU CLOUD](#)

[CMU: http://www.brightcomputing.com/solutions/academic-research](http://www.brightcomputing.com/solutions/academic-research)

[Storage Reference Architecture at UC Irvine](#)

[Mellanox Switches](#)