







• **Los Alamos**  
NATIONAL LABORATORY  
— EST. 1943 —

Delivering science and technology  
to protect our nation  
and promote world stability

# Preparing your cluster hardware

Lab 1

Presented by CSCNSI





## Agenda

- Your cluster hardware overview
- Cable installation
- Today's tasks

# Your cluster hardware overview

# We will be working in the 1<sup>st</sup> floor server room

- You must be accompanied by an instructor or mentor in this room
- Do not touch equipment that is not in your rack
- Aside from running power cables to your servers, do not touch power equipment
- Stay in the vicinity of your rack

# Each team gets their own rack of equipment



- Standard “42U” server rack
- Has 42 rack units (“U”) of rails in front and back to mount equipment
- Has removable doors (front/back)
  - We will remove the doors for cabling, but must put them back when we’re done
  - We will demonstrate how to do this
- *Never leave your objects, cables, etc. outside your rack!*

# Equipment in your racks (top to bottom)

- 1 APC Rack PDU
- 1 Dell Ethernet switch
  - Used for cluster node booting, provisioning & management
- 1 Mellanox InfiniBand switch
  - Used for high-speed communications
- 1 KVM/Console
  - Monitor/keyboard pulls out of the front of the rack
  - KVM connects to server(s) in the back
- 11 Dell Servers (PowerEdge R730)
  - These are our “nodes”
  - The top node will be our “master” node to control the others



# The PDU distributes rack power to equipment



- 3 Phase 208V 50A PDU
- Has remote control (but we won't use it)
- Uses C13/C14 plugs
- Each phase has its own circuit breaker
- *Your rack will not be powered until it is cabled and inspected.*

# Your ethernet switch provides node booting, provisioning & management



We'll use this block for the "Cluster LAN" (Blue Ethernet)

...and this one for BMCs (Purple Ethernet)

- 24 Port 1 Gbps ethernet switch
- We will connect both ethernet on the node ("Cluster LAN") and the management BMC port to this switch
- It's a good idea to connect node 1 to the first port, 2 to the second, etc.
- We will treat these as *unmanaged* switches.

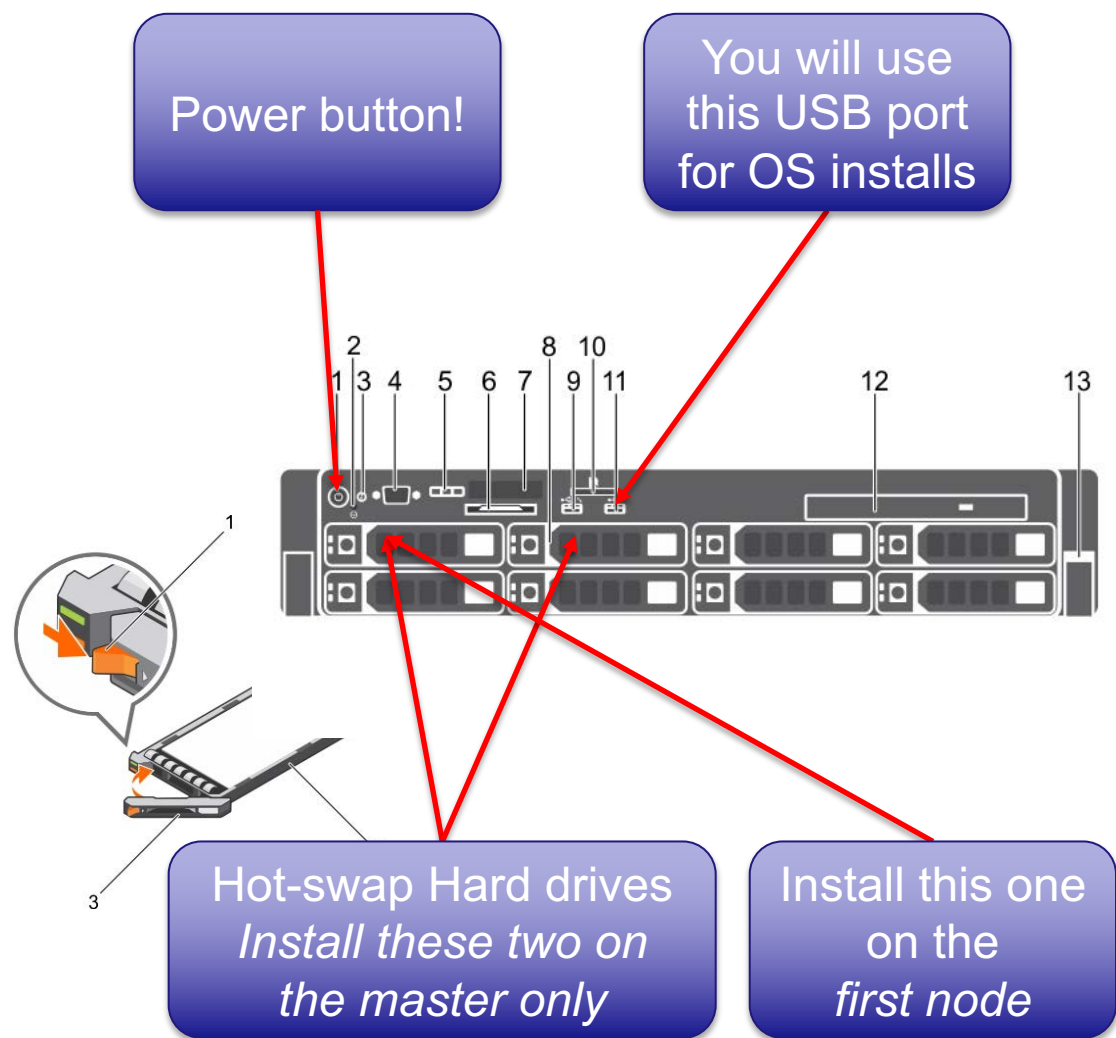
# Mellanox EDR Infiniband Switch (36 Port)



- Provides high-speed communication for HPC applications (100 Gbps, 90 ns)
- Uses a special cable
- We'll cover details on Infiniband a bit later



# The Dell R730 server (Front)



## 1. Power button

2. NMI button

3. System identification button

4. Video connector

5. LCD menu buttons

6. Information tag

7. LCD panel

## 8. Hard drives

9. USB management port/iDRAC Direct

10. vFlash media card slot

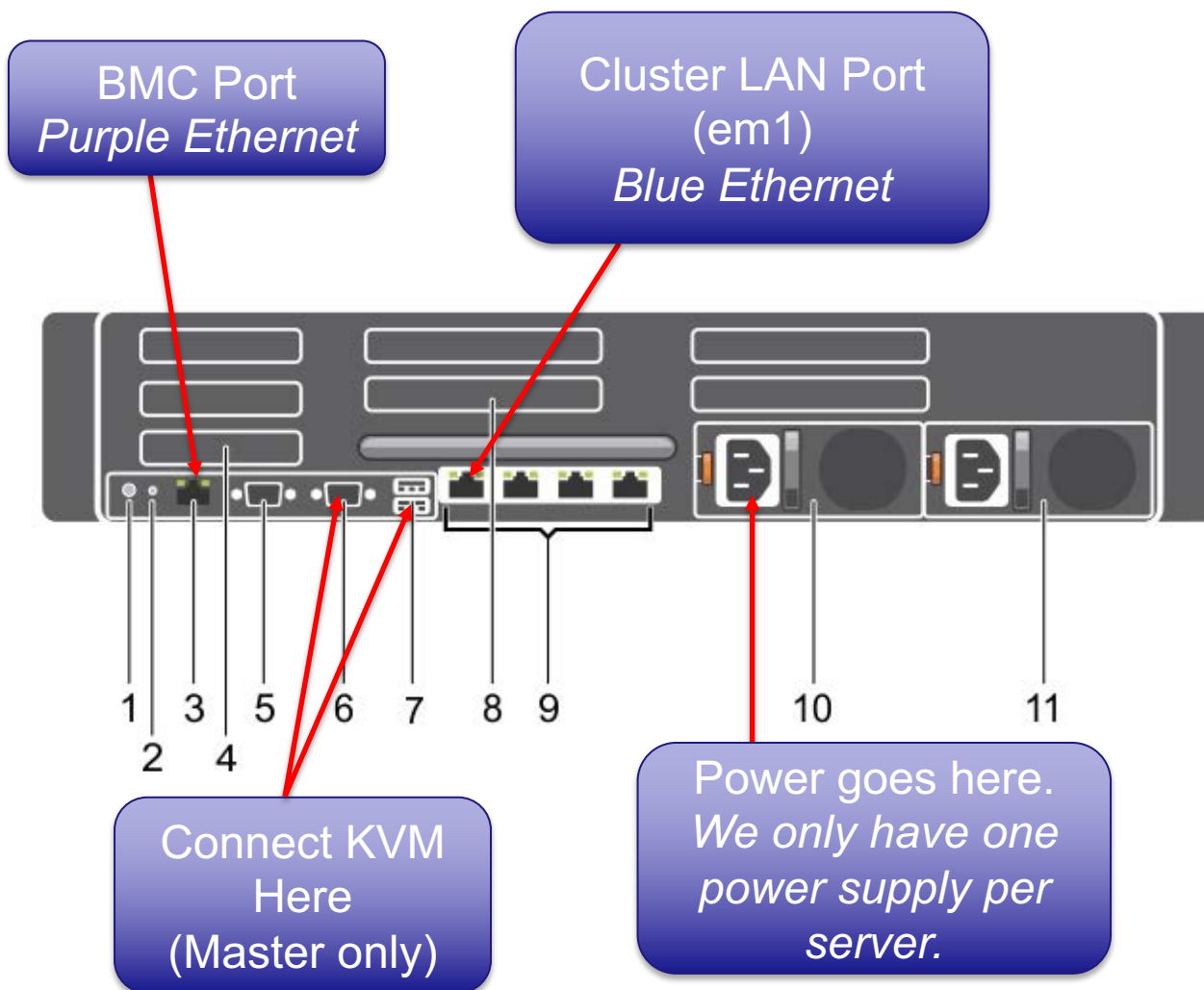
## 11. USB port

12. Optical drive

13. Quick Sync



# The Dell R730 server (Back)



1. System identification button
2. System identification connector
3. **iDRAC8 Enterprise port**
4. Half-height PCIe expansion card slot
5. Serial connector
6. **Video connector**
7. **USB port**
8. Full-height PCIe expansion card slot
9. **Ethernet connector**
10. **Power supply unit 1**
11. Power supply unit 2

# The “master” node is special

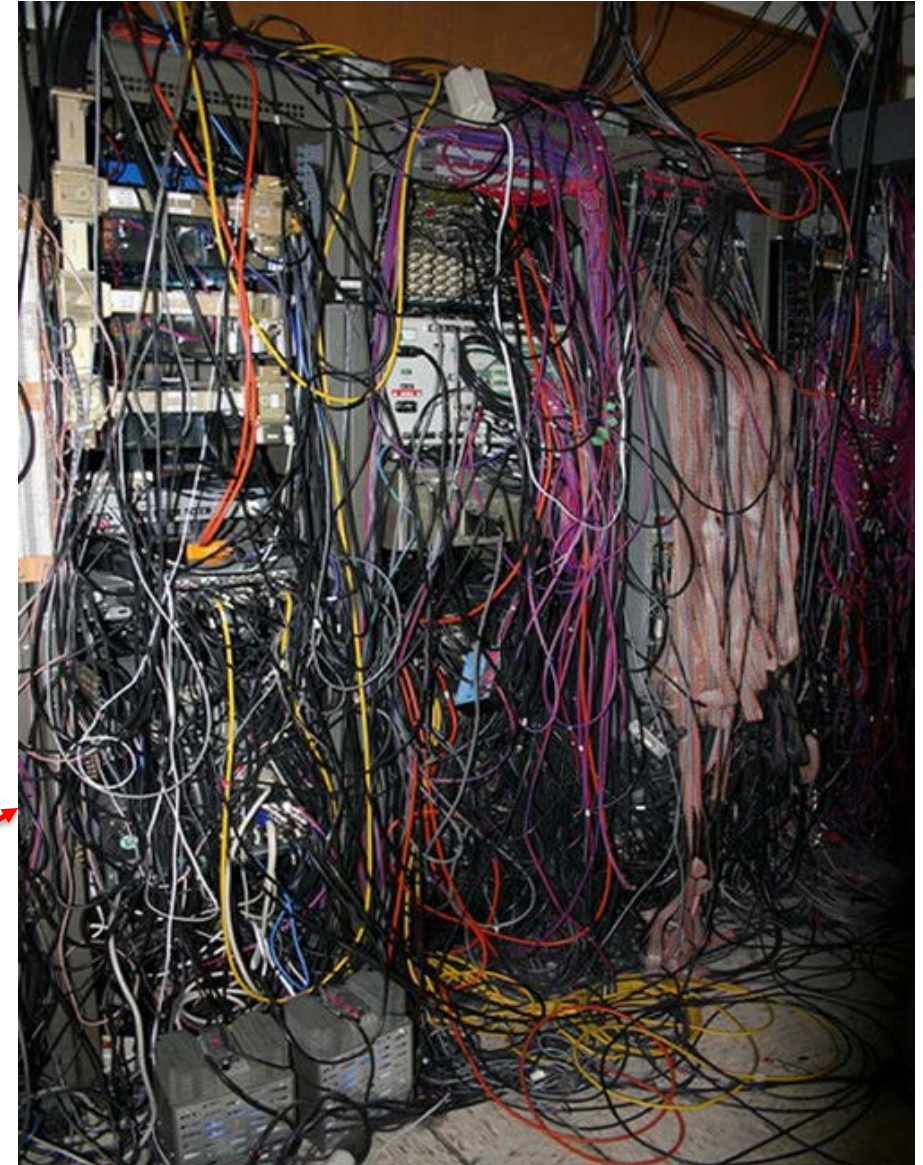
- Your “master” node is the top node
- It will control the other nodes
- You will install 2 of the 3 supplied hard drives in this node
  - These will be used to make a mirrored pair (RAID1)
- Later, you will install Linux on this system
- The orange ethernet cable will plug into the second ethernet port (em2) for this node only, to provide access to the outside network

# Cable installation

# Orderly cabling is very important!

- At large scale, systems can contain 10's of thousands of cables
  - Need to be easy to trace
  - Need to be easy to replace
  - Need to be neatly installed not to snag or break
- Even at *our* scale, bad cabling *will* lead to headaches for you later!

Don't do this!

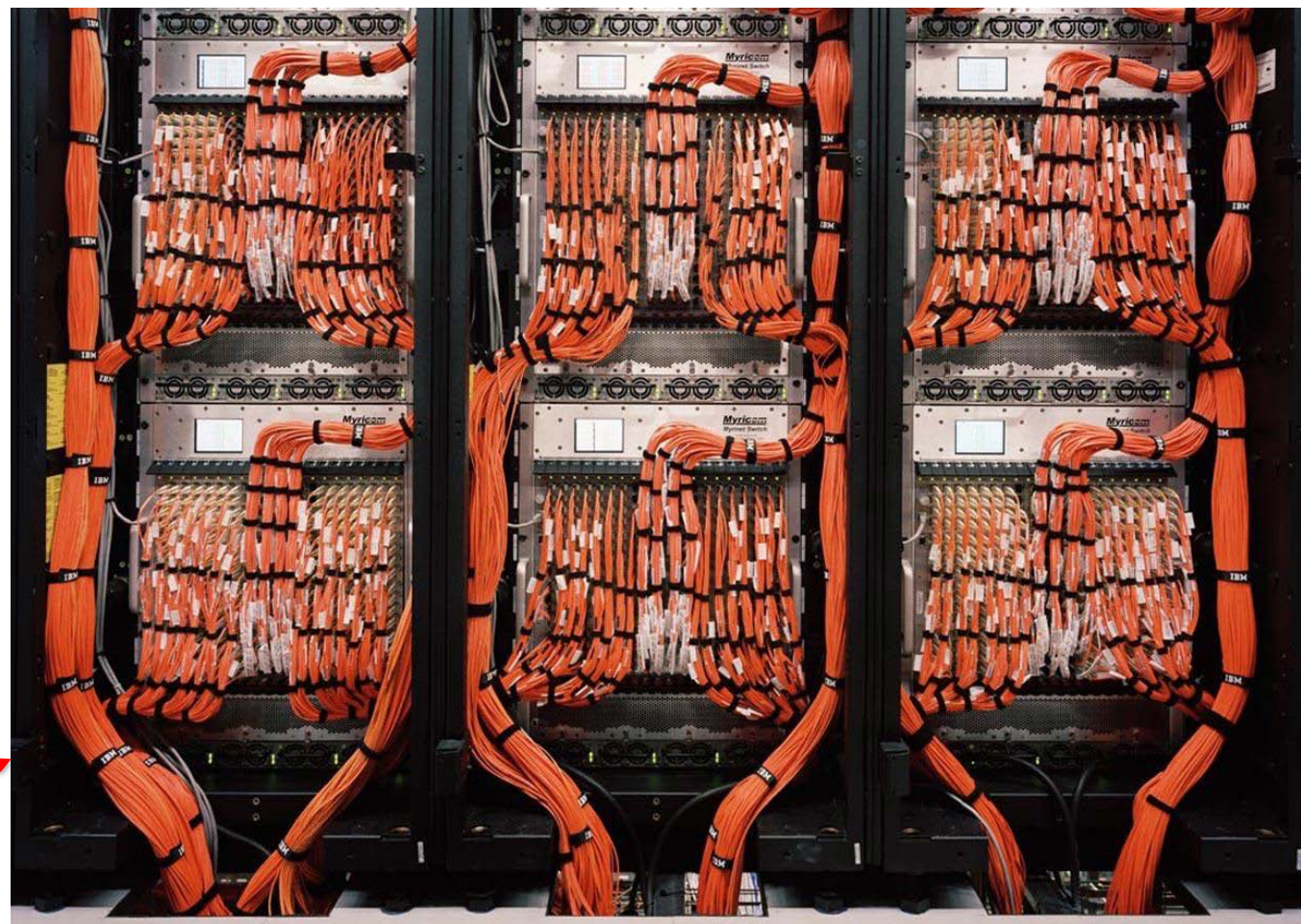




# Cables should be...

- Labeled
- Bundled
- Organized
- *We will give you an example*

DO this!



# Cable labels should...

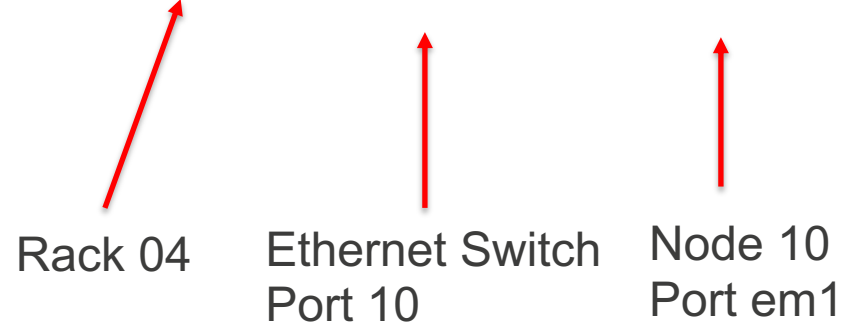
- Be easily readable
- Be on *both* ends of the cable
- Indicate where *both* sides connect on *both* labels
- Use a consistent naming scheme
- Be updated when changes occur
- *Note: for the sake of time, you do not have to label power cables though this would normally be done.*



# Our labeling scheme

- Rack
  - Rack 5 = R05
- Switch type + SW
  - Ethernet = ESW
  - Infiniband = IBSW
- Switch Port
- Node
  - Node 4 = N04
- Node port
  - Em2 = E2
  - BMC = BMC

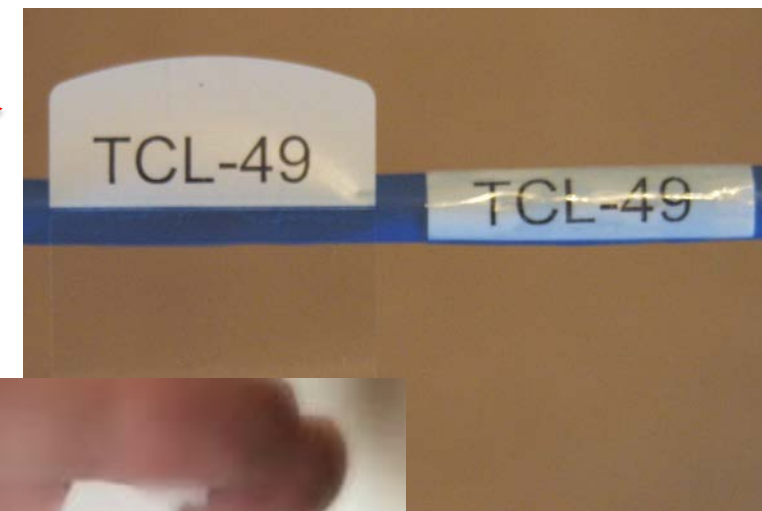
## • R04-ESW10-N10E1



# Label Wrapping vs. Flagging

- **Wrapping**

- Durable
- Easy to pull through
- Hard to remove



- **Flagging**

- Less tidy
- Easier to remove





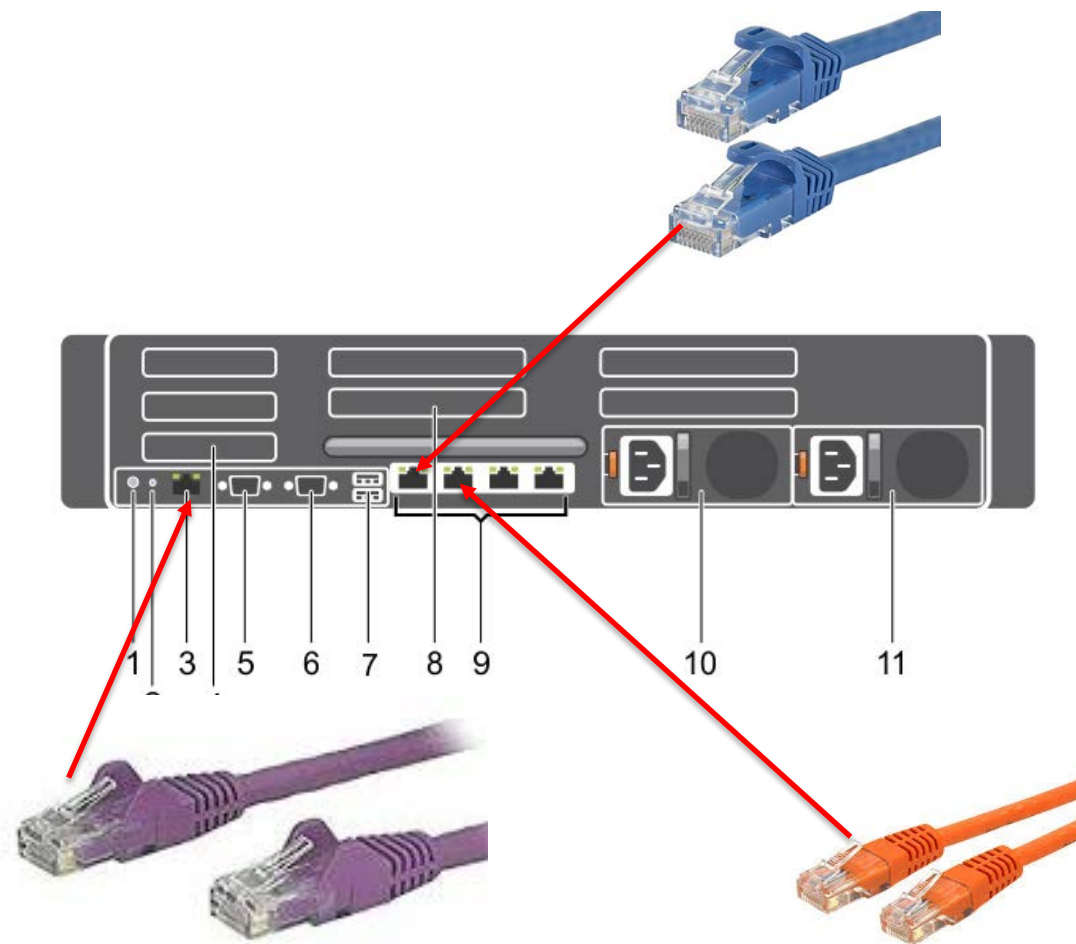
# Power cables

- Run along the right side of your rack
- Balance the connections across the 3 phases
  - The PDU has 3 banks of connectors, one for each phase
  - Try to connect an equal number to each phase
  - If you don't you could blow the circuit in an overloaded phase
  - This is also important for balancing power across the server room



# Ethernet cables

- Run on the *left* side of the rack
- **Blue** cables go to the first ethernet port
  - Master in port 12
  - Nodes in ports 1-10 sequentially
- **Purple** cables go to the iDRAC/BMC port
  - No need to plugin the master
  - Nodes in ports 13-22 (i.e.  $n - 12$ )
- One **orange** ethernet for the master only (into port 2)
- *Don't bend too tight*
- *Don't break the connector clips*



# Infiniband cables

- Run on left side
- Special QSFP28 connector
- Should click when inserted properly
- One to each node (including master)
- Node 1 -> Port 1, etc.
- **Not** bidirectional:
  - The blue tab goes:
    - UP in the *top* row
    - DOWN in the *bottom* row
- *Do not bend too tightly! Minimum ~3" bend radius.*



# Today's tasks

- Install power cables
- Label & install:
  - Cluster LAN cables (blue ethernet)
  - BMC cables (purple ethernet)
  - 1 Orange uplink cable (to master)
- Install 2 hard drives in the master
- Install 1 hard drive in the next node (node1)
- **Even if you can't finish today, make sure the master is fully cabled!**
- *If you finish, let us know.*
  - *If your rack passes inspection, we will turn on its power*
- *If you're not certain what to do, ask questions!*



Questions?