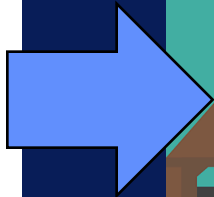
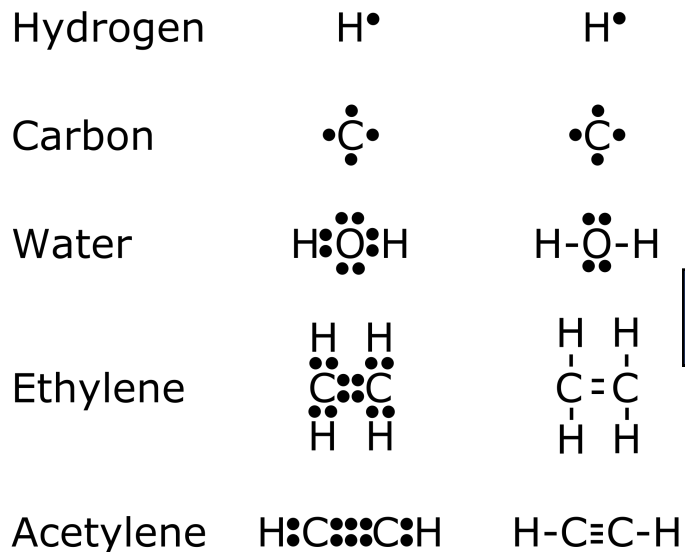


# Scalable Computing over the Internet

**Getting Started:**

**Why do we worry about  
foundations?**

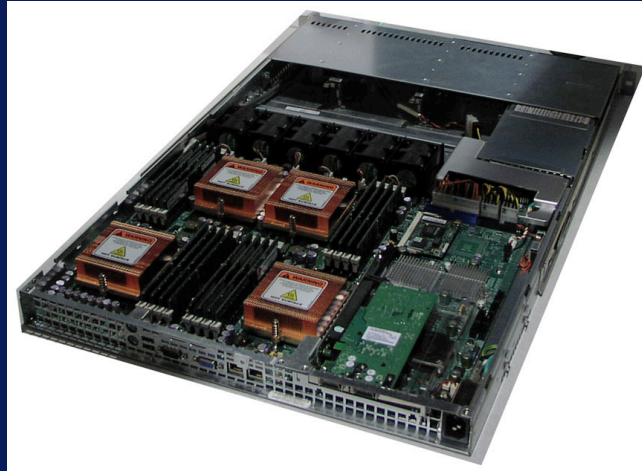
# Chemistry before the tubes!



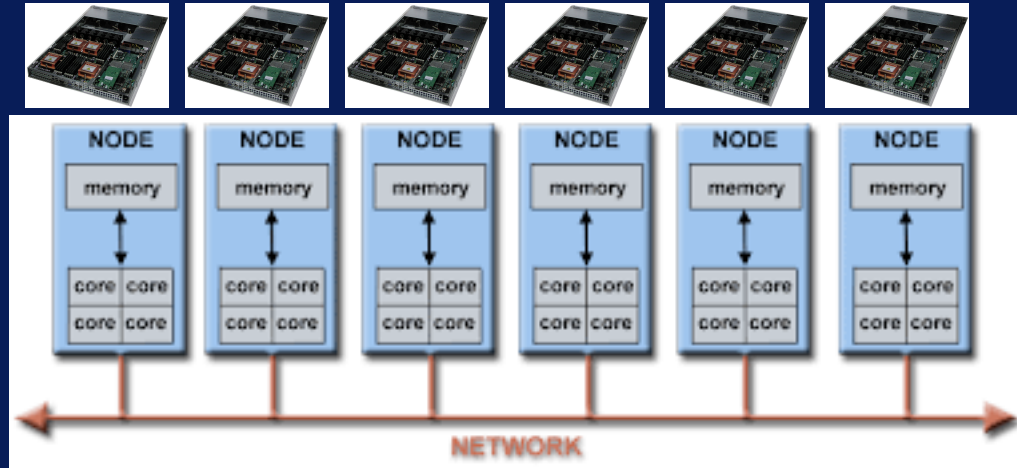
*“It is not the beauty of a building  
you should look at; its the  
construction of the **foundation** that  
will **stand the test of time.**”*

*-- David Allan Coe*

# Single Compute Node



# Parallel Computer



**SDSC Gordon**

**Expensive**

# Commodity Cluster



# Commodity Cluster

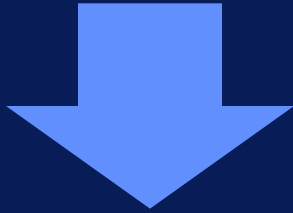


**Affordable**

**Less-specialized**

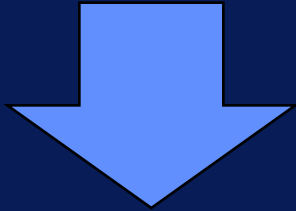


# Commodity Cluster



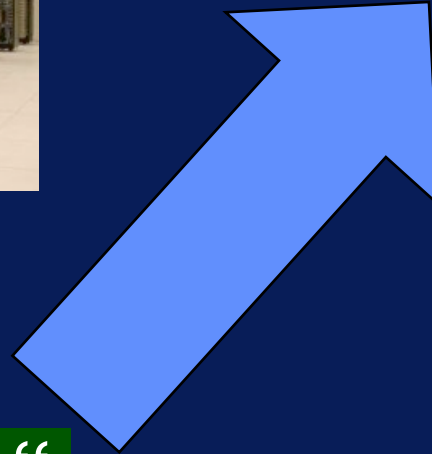
**“Distributed computing”  
over the Internet**

# Commodity Cluster



**“Distributed computing”  
over the Internet**

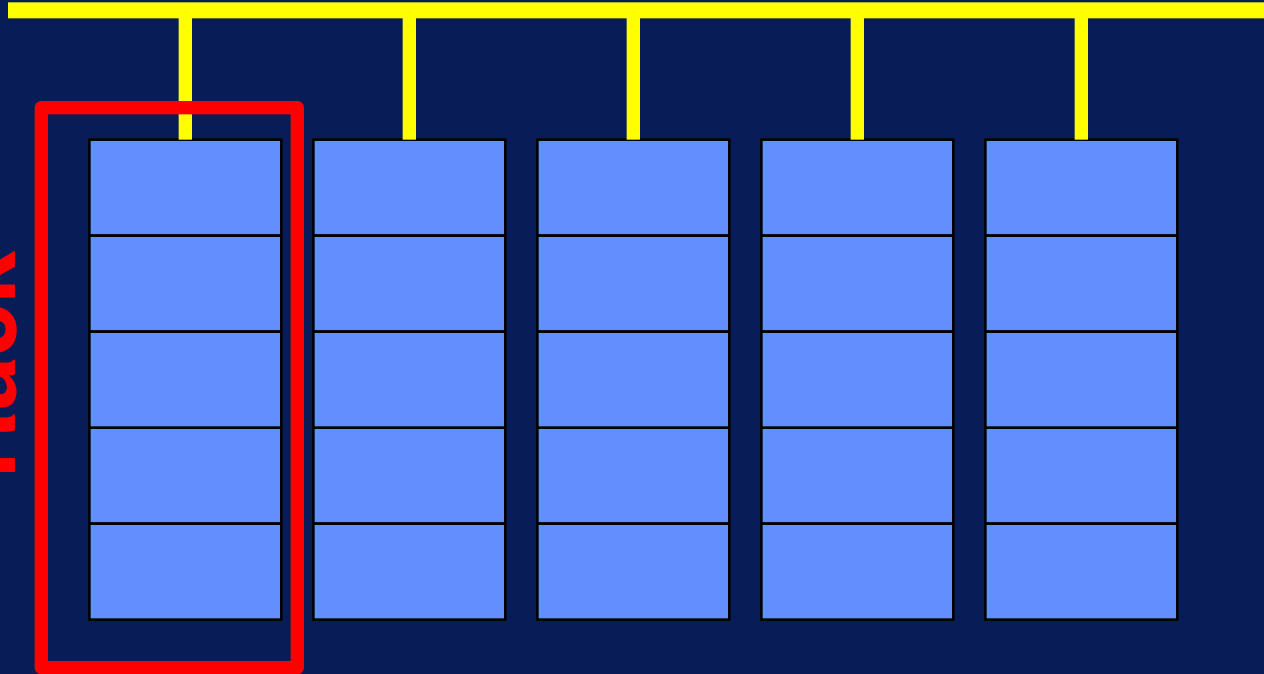
**Reduced  
computing cost**



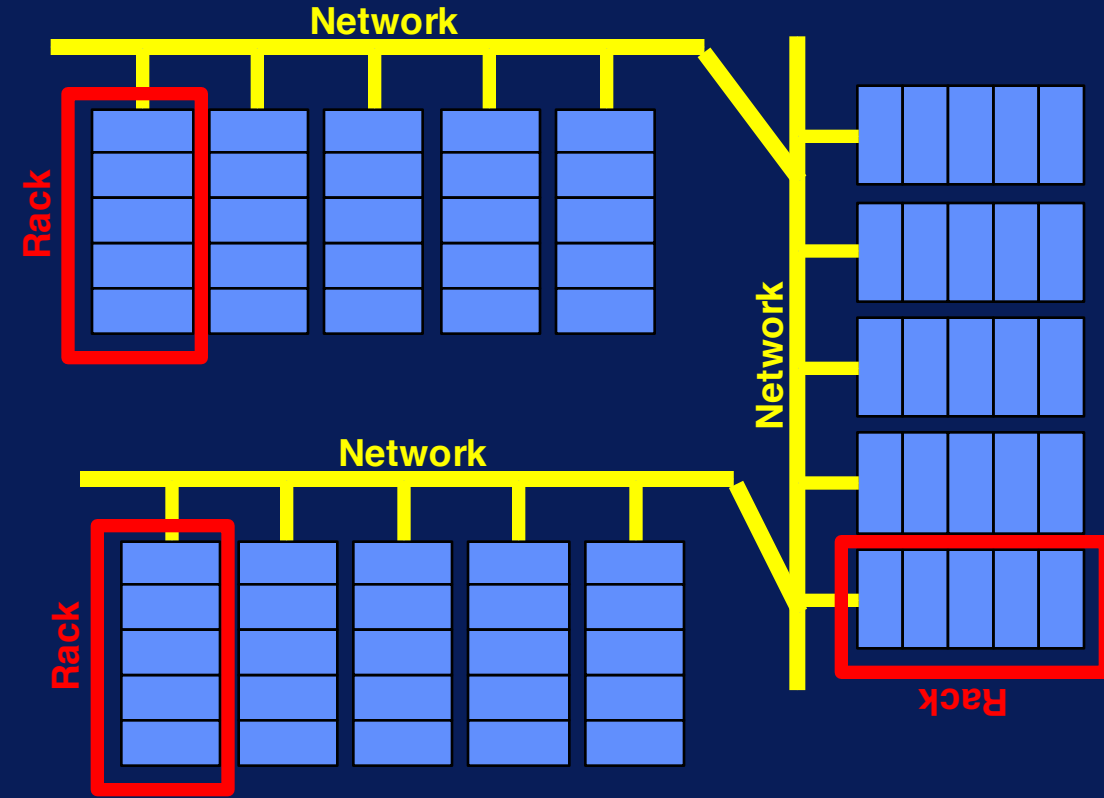
# Architecture of a Commodity Cluster

**Network**

**Rack**

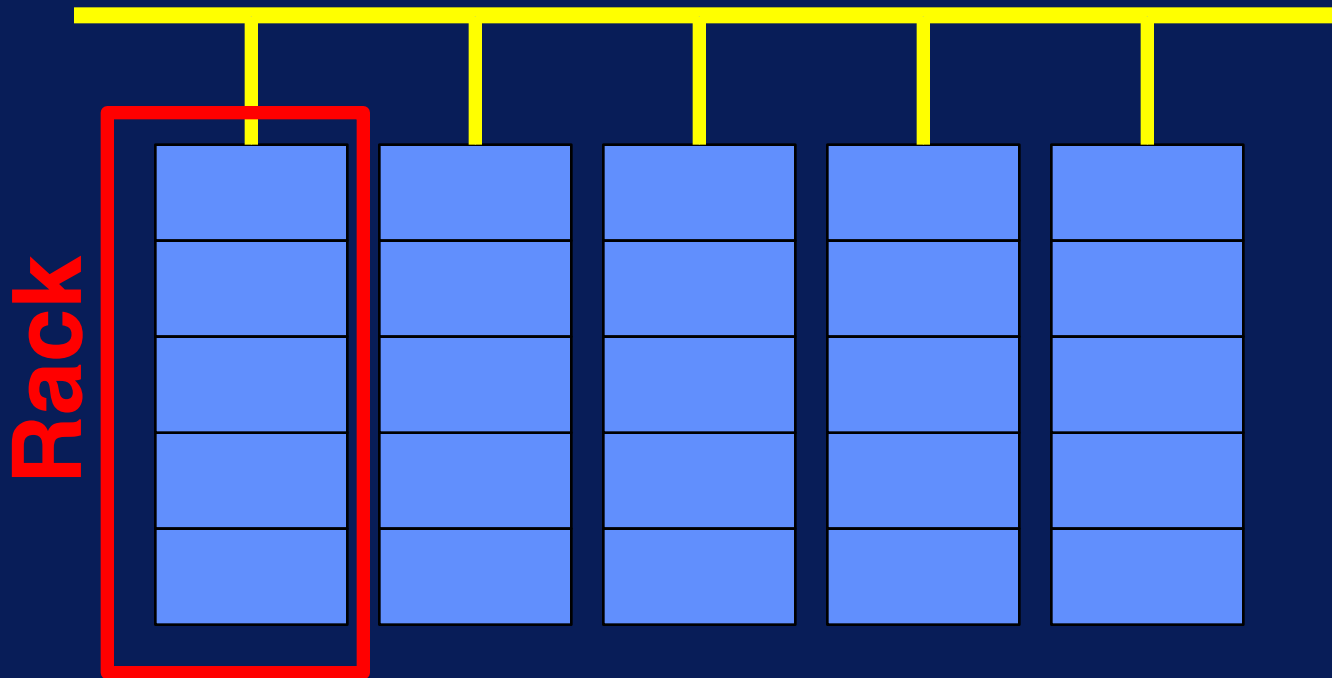


# Distributed Computing

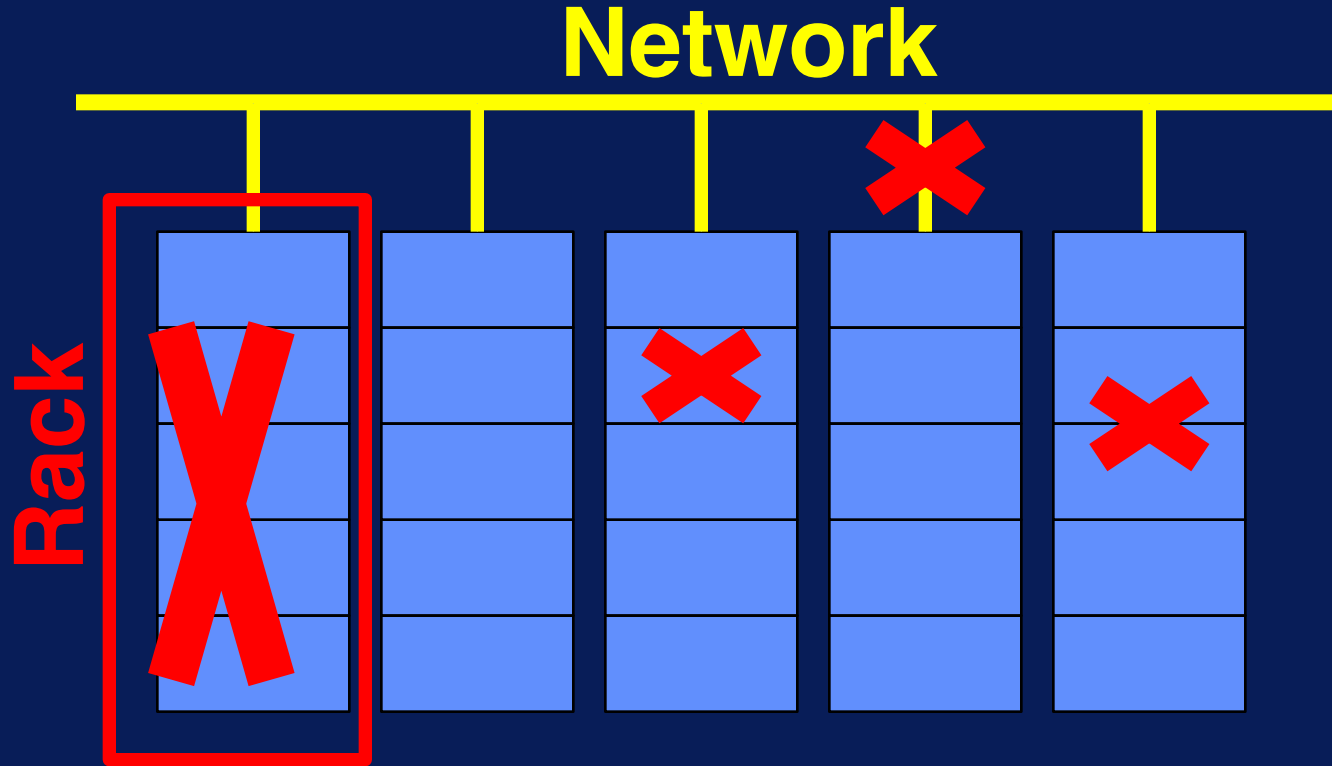


# Enables data-parallelism

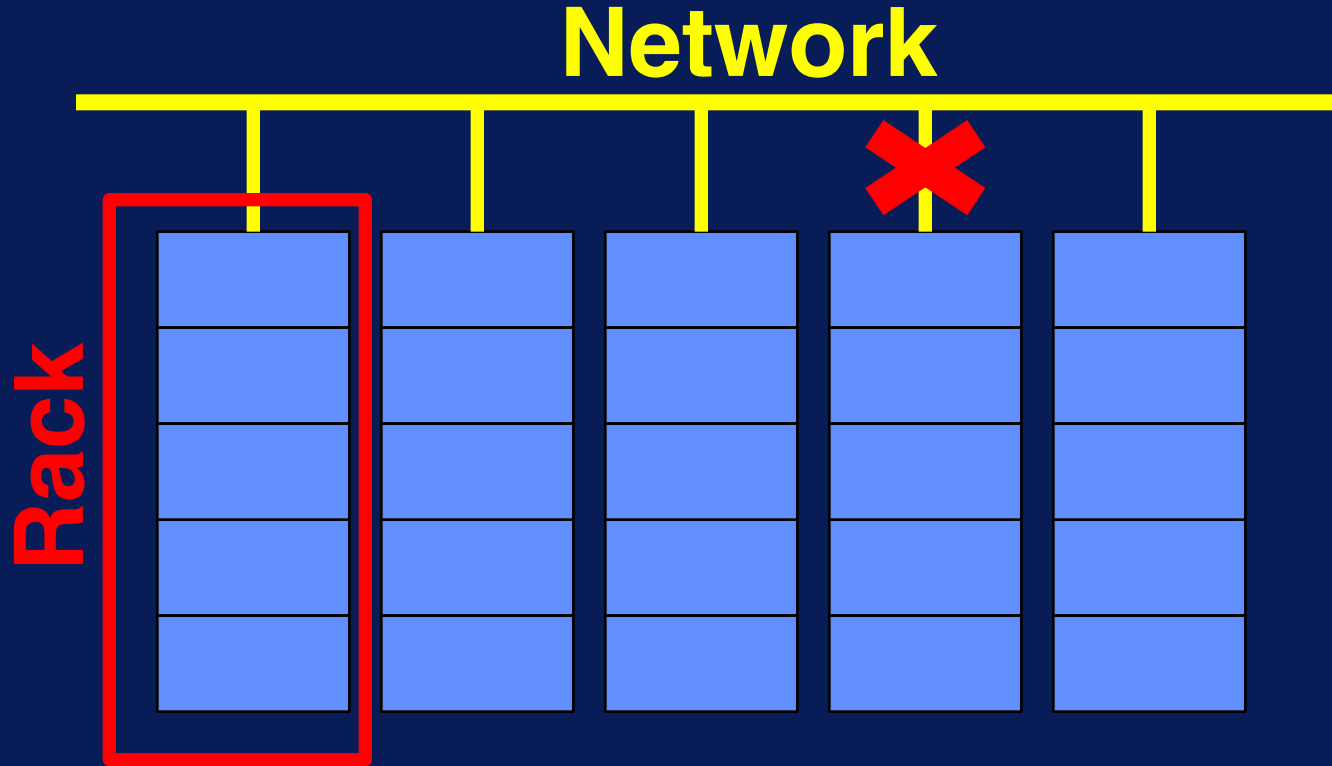
Network



# Common failures in commodity clusters



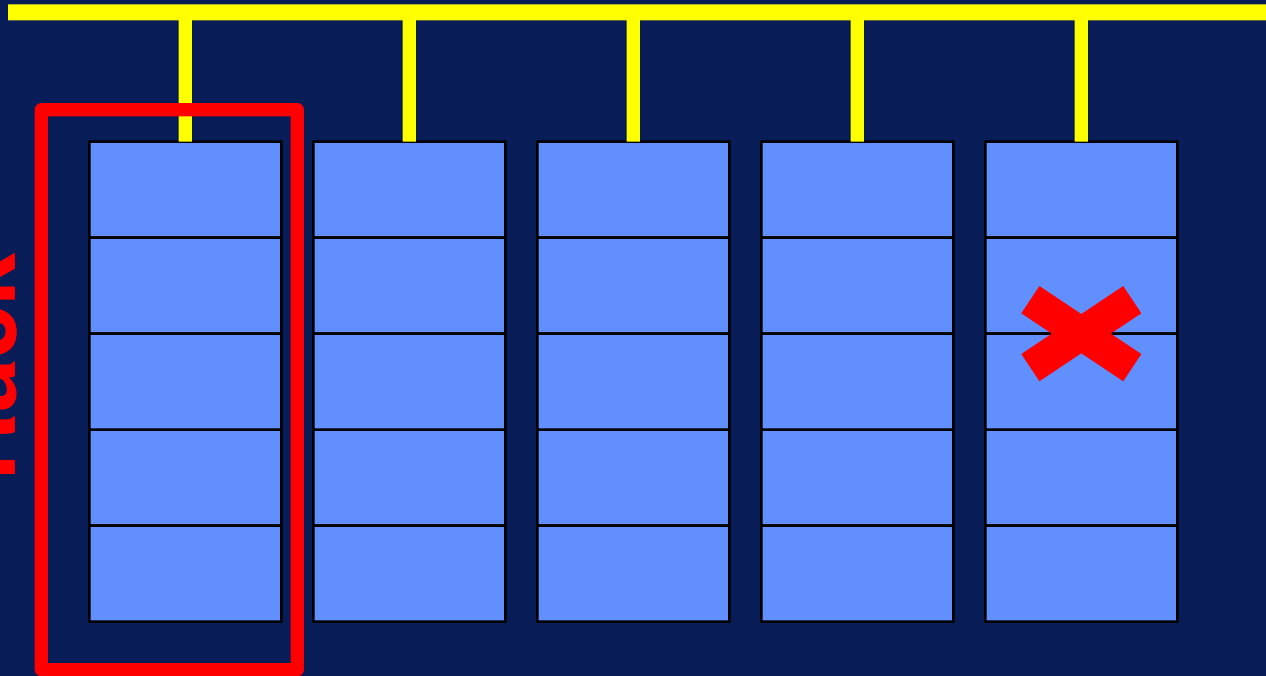
# Common failures in commodity clusters



# Common failures in commodity clusters

Network

Rack





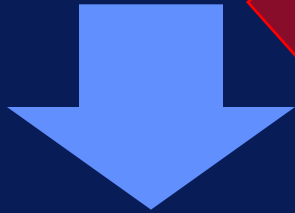


**Failure**

**Complete Restart**

**Failure**

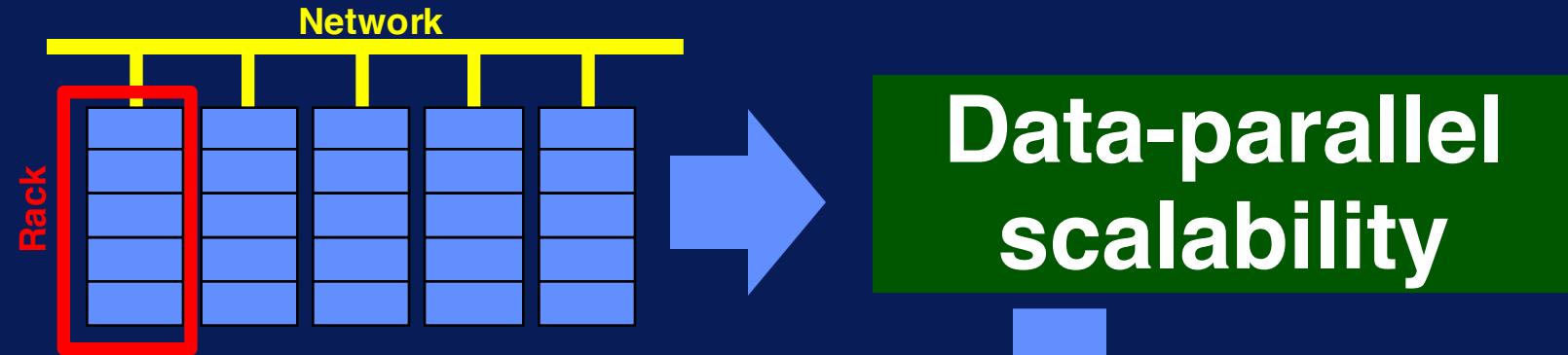
**Complete Restart**



**Redundant  
data storage**



**Data-parallel  
job restart**



**Potential for node-level system failures**

**Redundant  
data storage**

**Data-parallel  
job restart**