IT 609
Network and System Administration

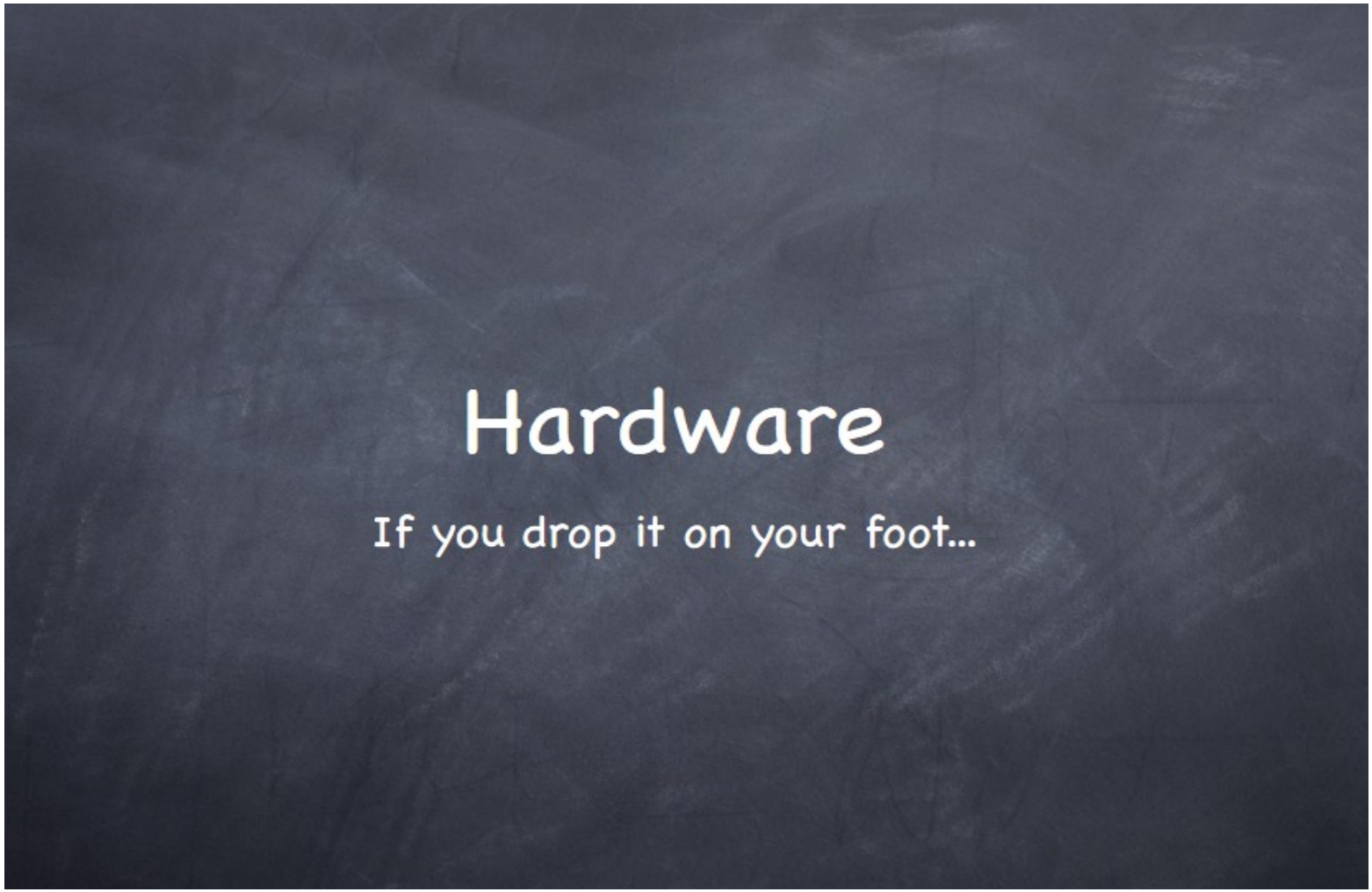
System Hardware

Tuesday September 14, 2021

Section Overview

- Quiz #01 - Review
- Hardware Performance
- VDI

Hardware Performance



Hardware

- The physical components in a computer
  1. Processor
  2. Memory
  3. Input/Output (IO)
  4. Storage

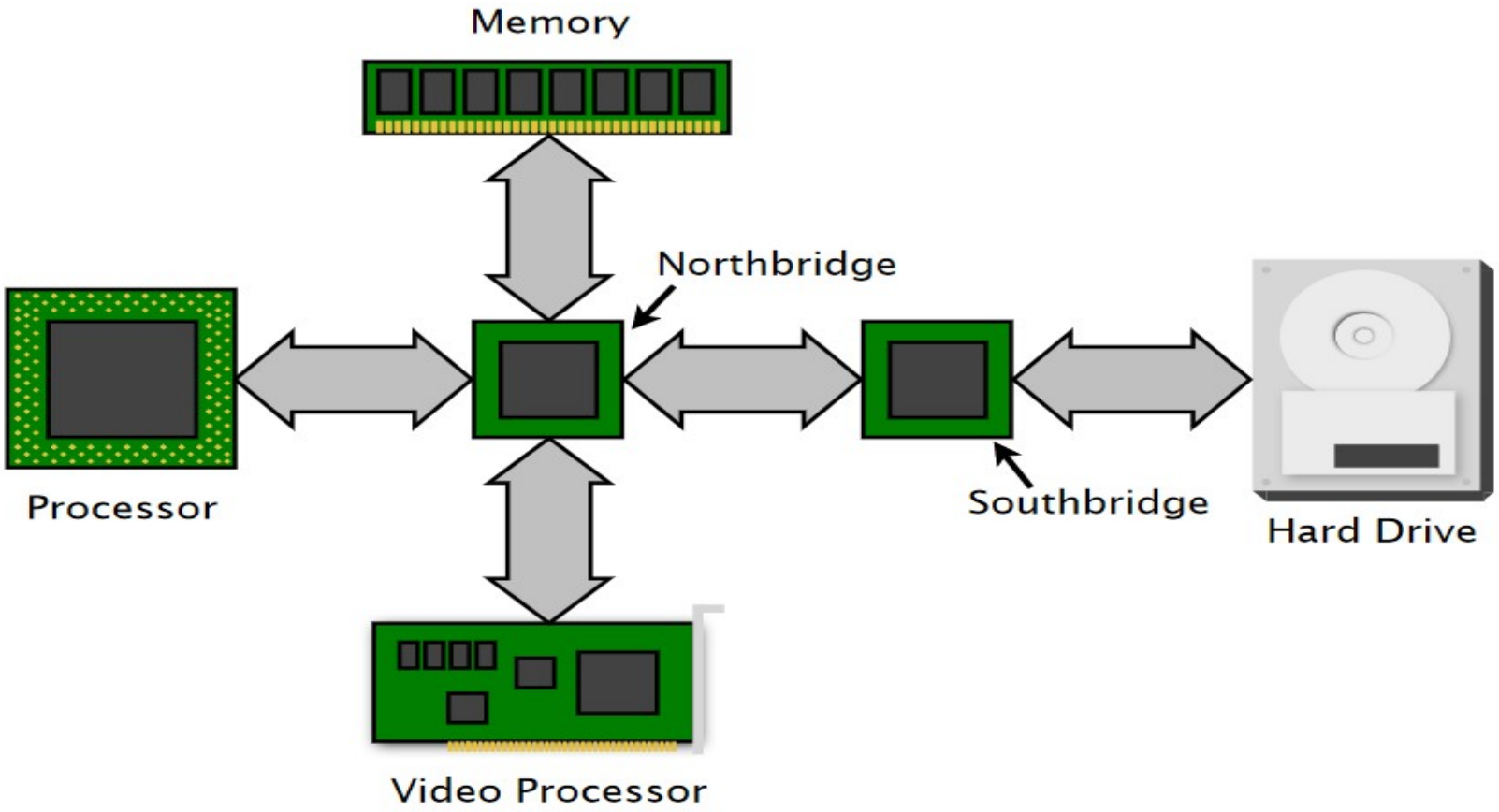
Software

- Instructions for the processor to execute
  1. Loadable
  2. Bootstraping

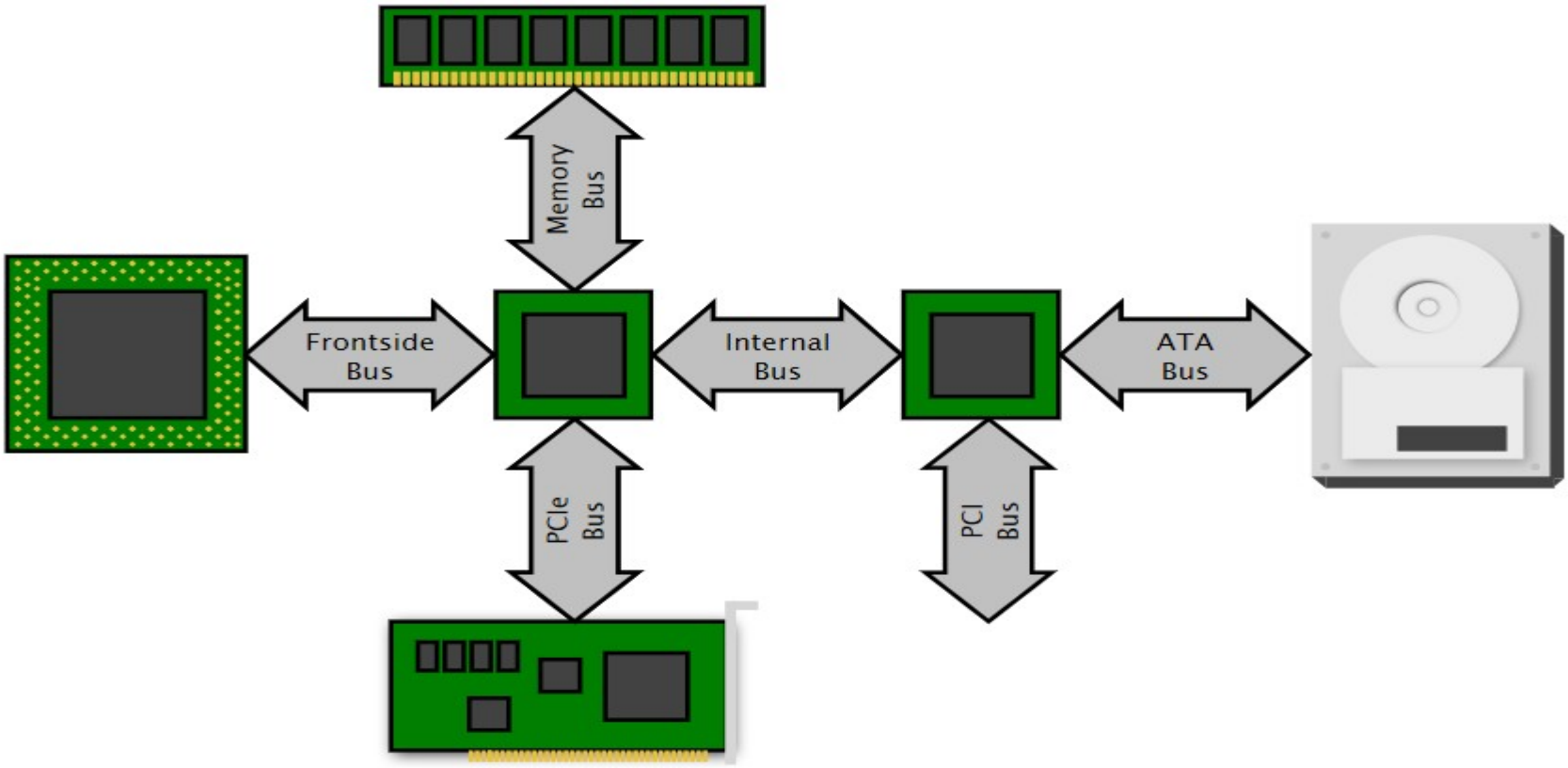
Firmware

- Software that is built-in to the hardware in the form of non-volitile memory

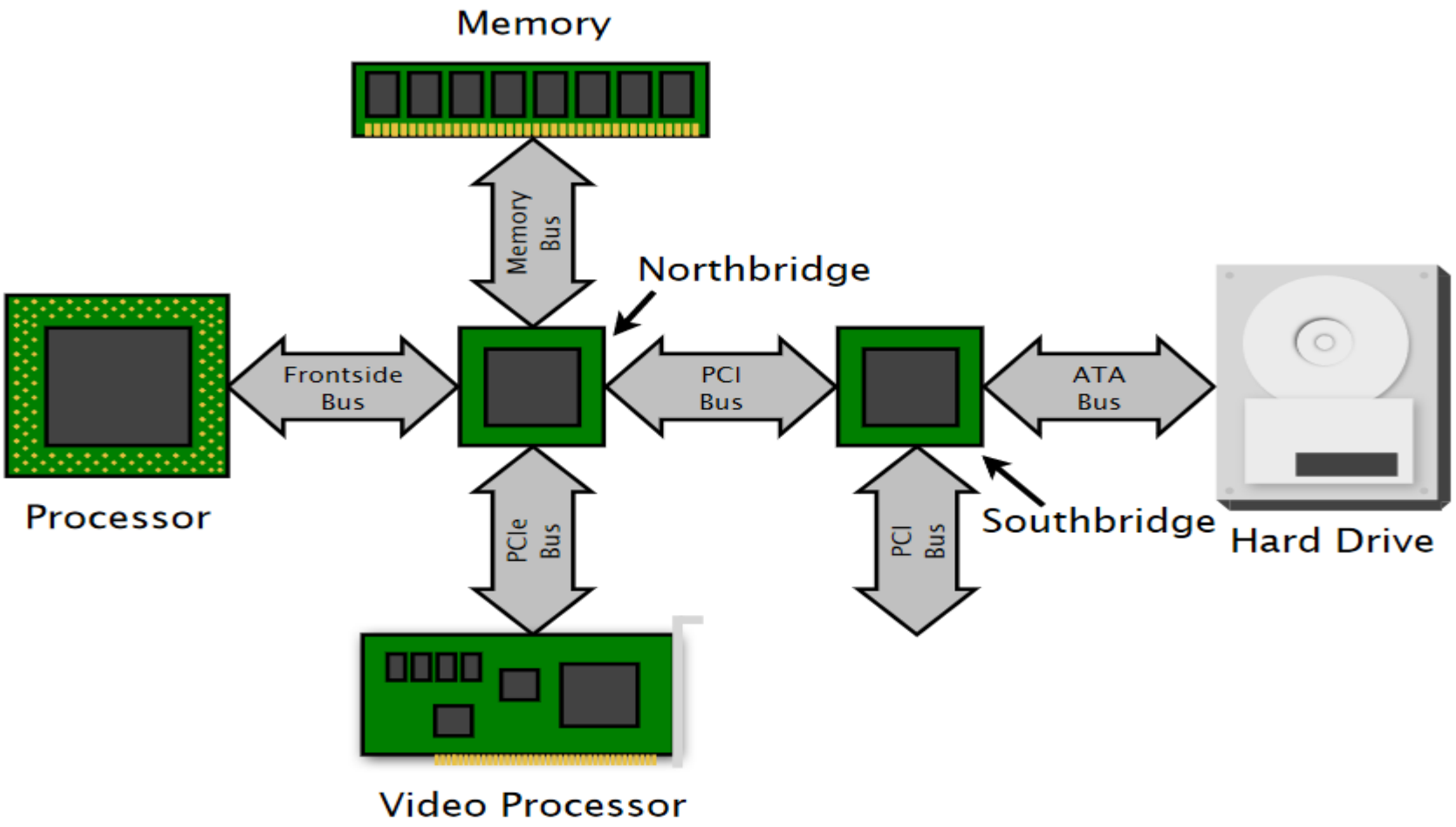
Basic Computer Architecture



Internal Bus Architecture



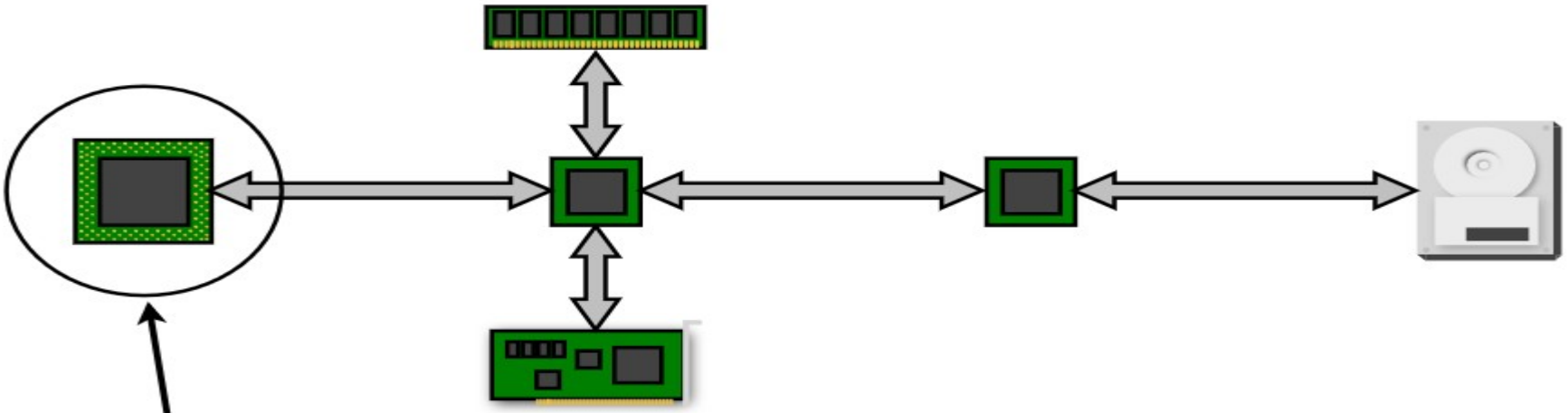
Different Bus Speeds



Different Bus Speeds

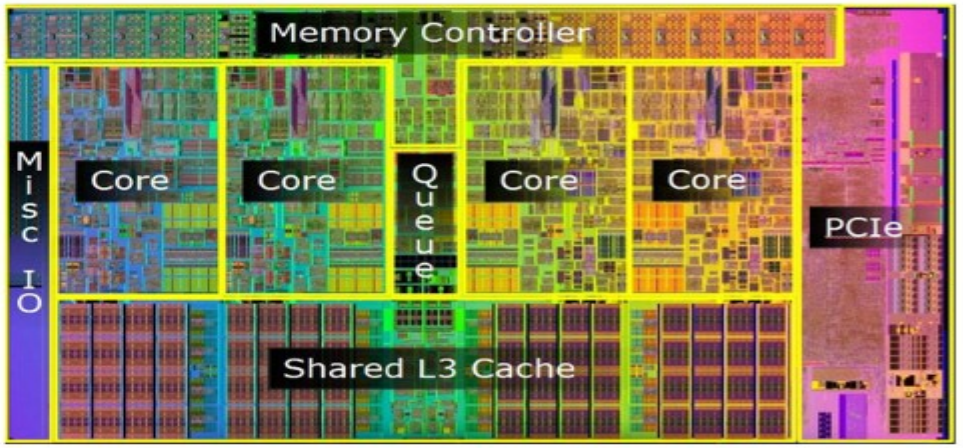
- Northbridge - manages high speed data transfers
- Southbridge - manages slower speed data transfers

The Processor



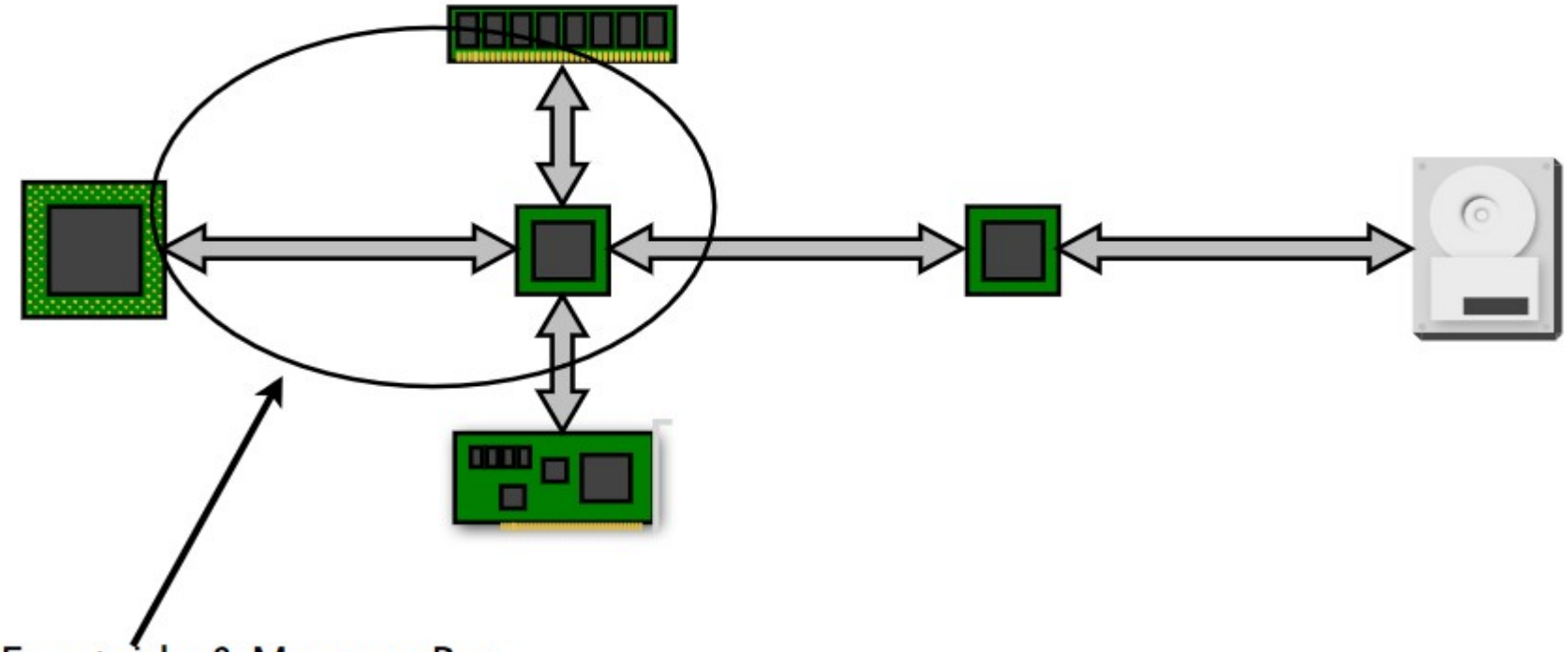
Processor

Performance Factors
- Clock Speed
- Cache Size
- # of Cores
- # of Execution Units
- Branch Prediction
- # of Processors



http://www.pcstats.com/articleview.cfm?articleid=2581&page=4

Northbridge Area

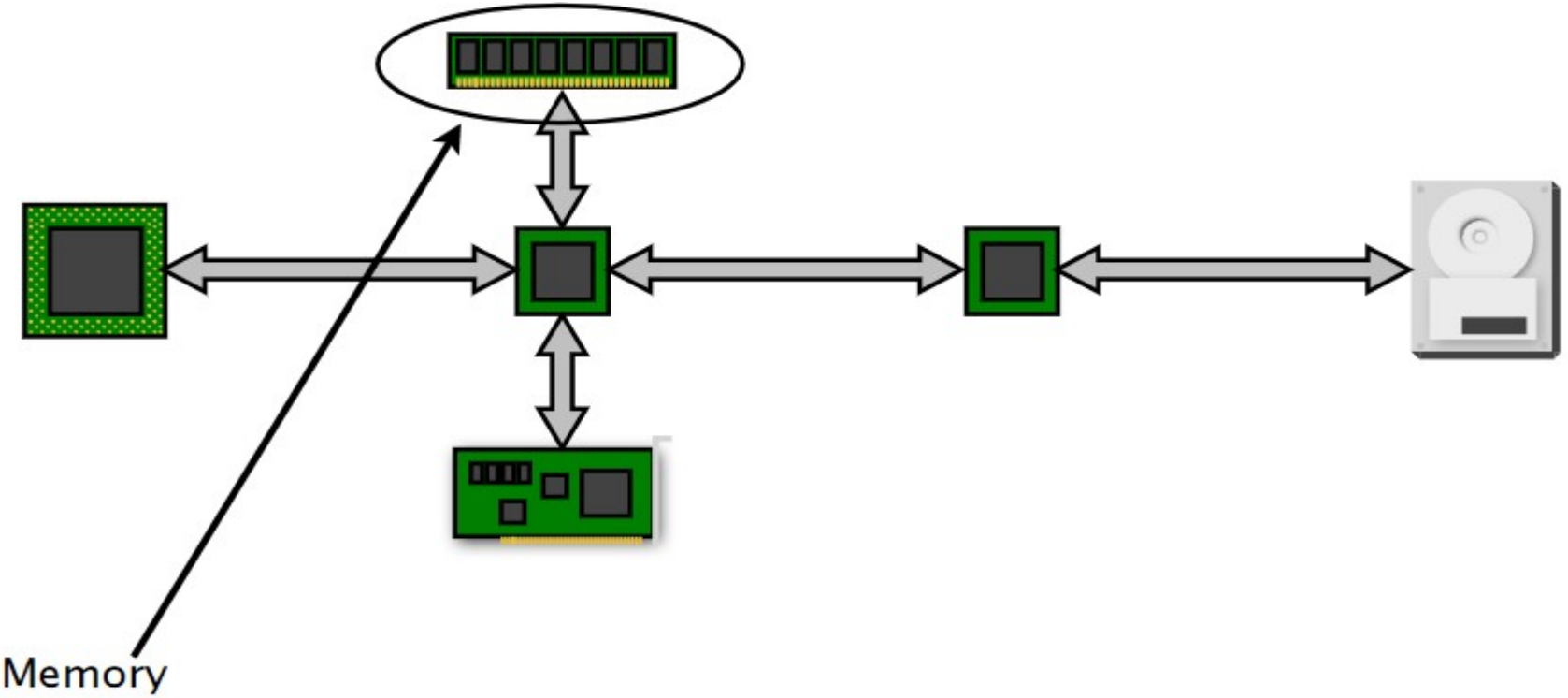


Frontside & Memory Bus

Performance Factors

- Bus Speed
- Bus Width
- Amount of Addressable Memory

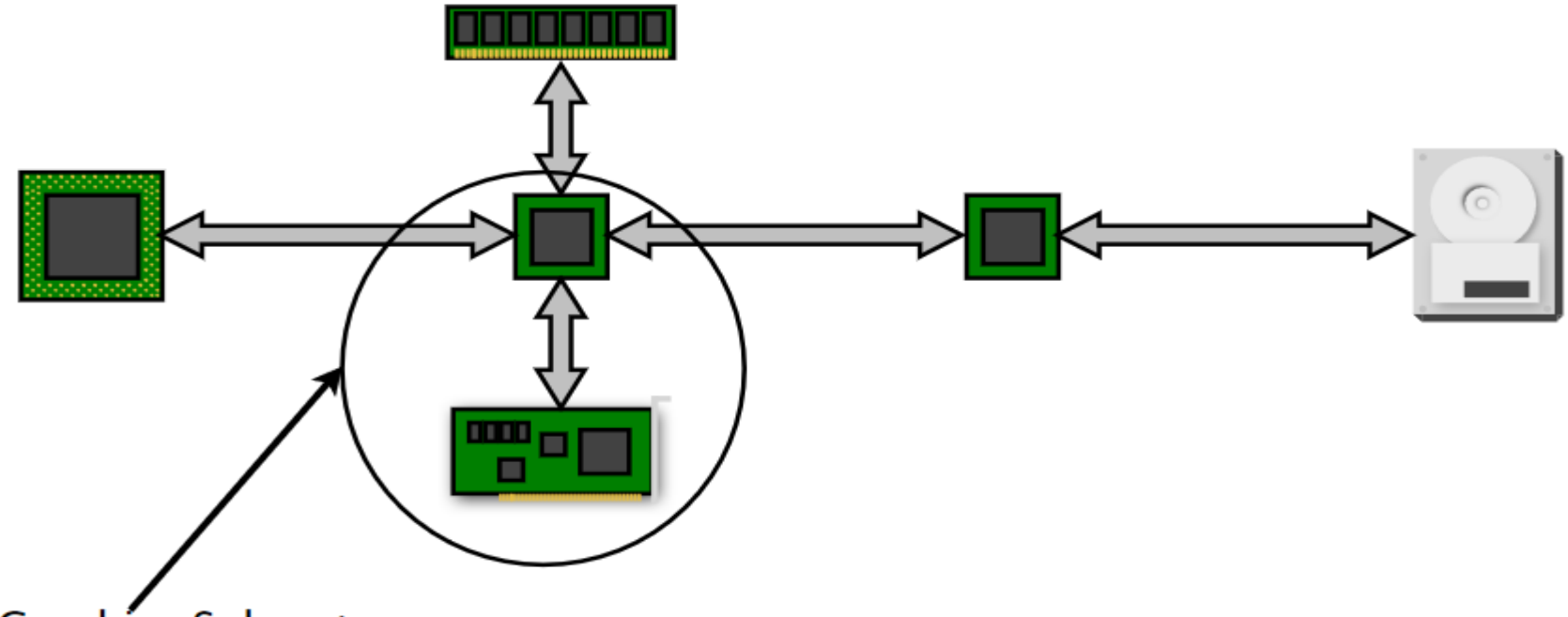
Memory



Performance Factors

- Quantity
- Matched pairs to fill the bus
- Latency

Graphics Subsystem

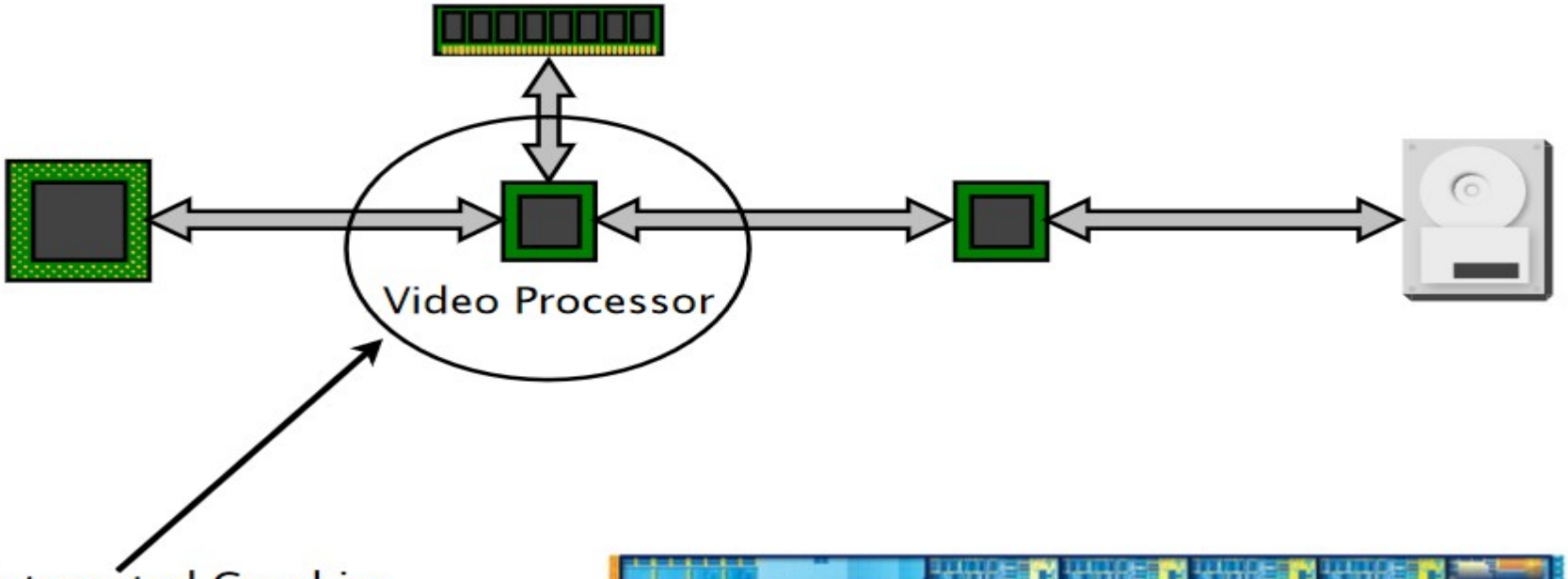


Graphics Subsystem

Performance Factors

- Graphics Processor Speed
- Dedicated Video RAM (VRAM)
- Amount of VRAM
- Ability to off-load OS interface to the GPU
- Ability to off-load other calculations to the GPU

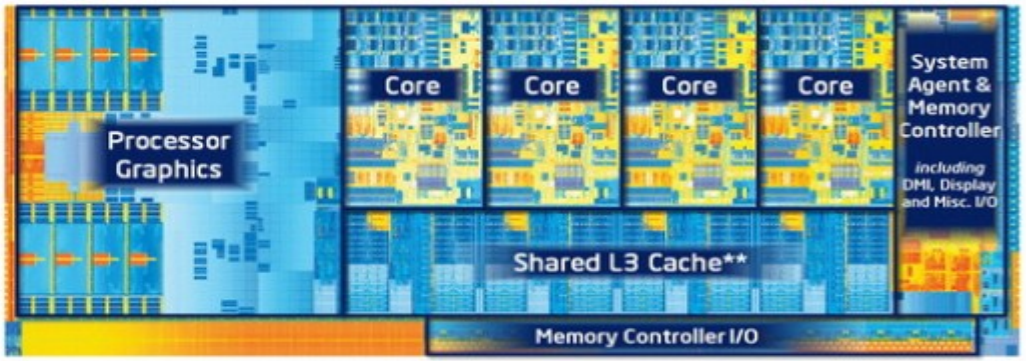
Integrated Graphics



Integrated Graphics

Performance Factors

- Fewer dedicated circuits
- Uses main system RAM
- Amount of system RAM



http://www.techradar.com/reviews/pc-mac/pc-components/processors/intel-core-i5-3570k-1077183/review

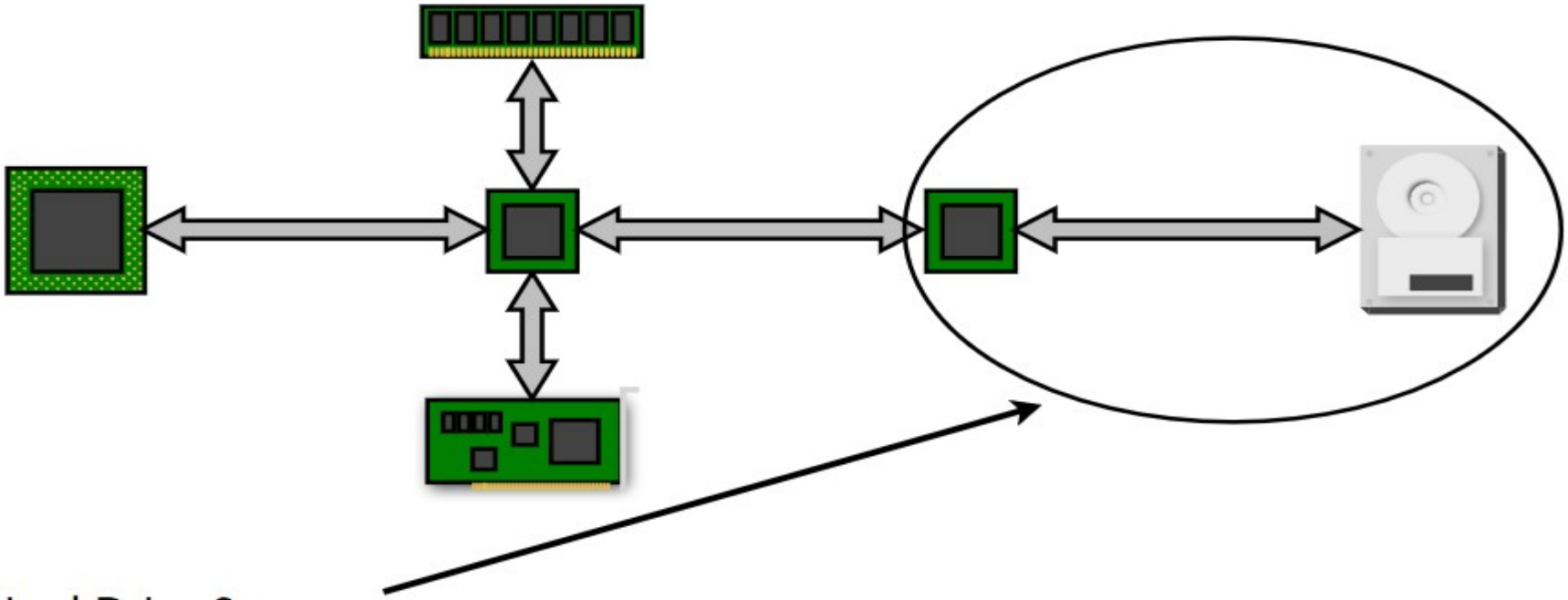
Graphics Performance

	Dedicated or Integrated	Intro Date	BioShock 2	WoW	CoD:MW2
Intel Core i5 HD Graphics	I	Jan 2010	18.8	24.3	18.1
AMD Radeon 5450	D	Feb 2010	33.9	56.1	40
Intel Core i5 HD Graphics 3000	I	Jan 2011	36.1	48.2	42.2
AMD Radeon 5570	D	Feb 2010	36.6	164.4	128.2

Frames/sec. Higher is better.

http://www.anandtech.com/show/4083/the-sandy-bridge-review-intel-core-i7-2600k-i5-2500k-core-i3-2100-tested/

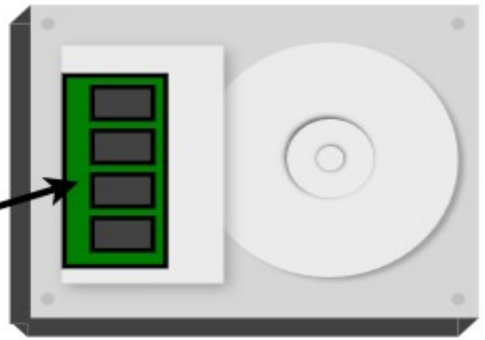
Hard Drive Storage



Hard Drive Storage

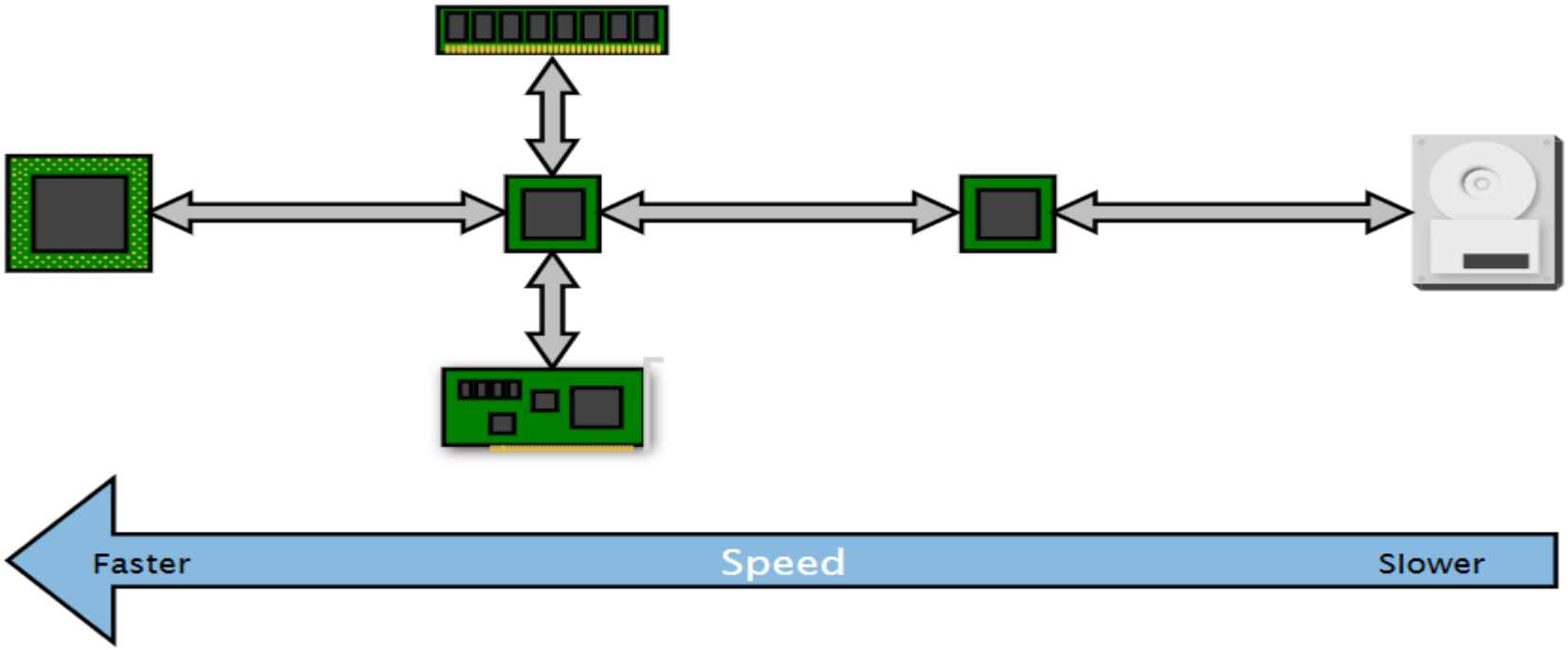
Performance Factors

- Interface
- Spindle Speed (RPMs)
- Cache
- Solid State vs. Spinning Disk



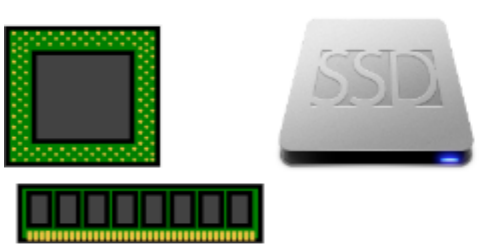
On-drive Read/ Write Cache

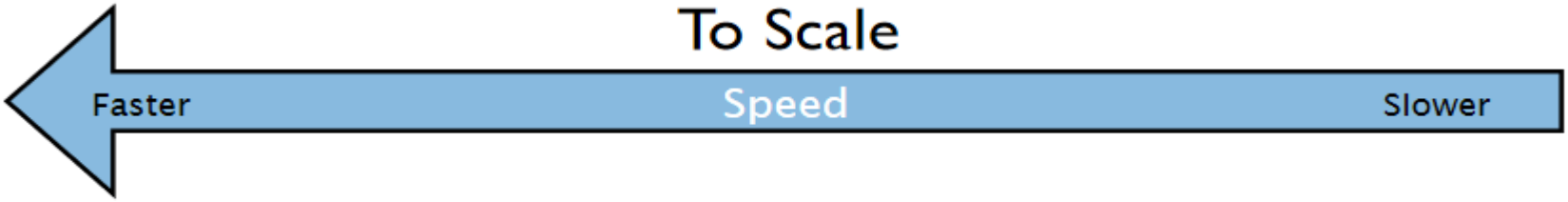
Access Speeds



L1 Cache	Memory Reference	Disk Read 1MB
0.5 ns	100 ns	30,000,000 ns
L2 Cache	Memory Read 1MB	SSD 1MB
7 ns	250,000 ns	5,000,000 ns

Disk Speeds Close to Memory





L1 Cache
0.5 ns

Memory Reference
100 ns

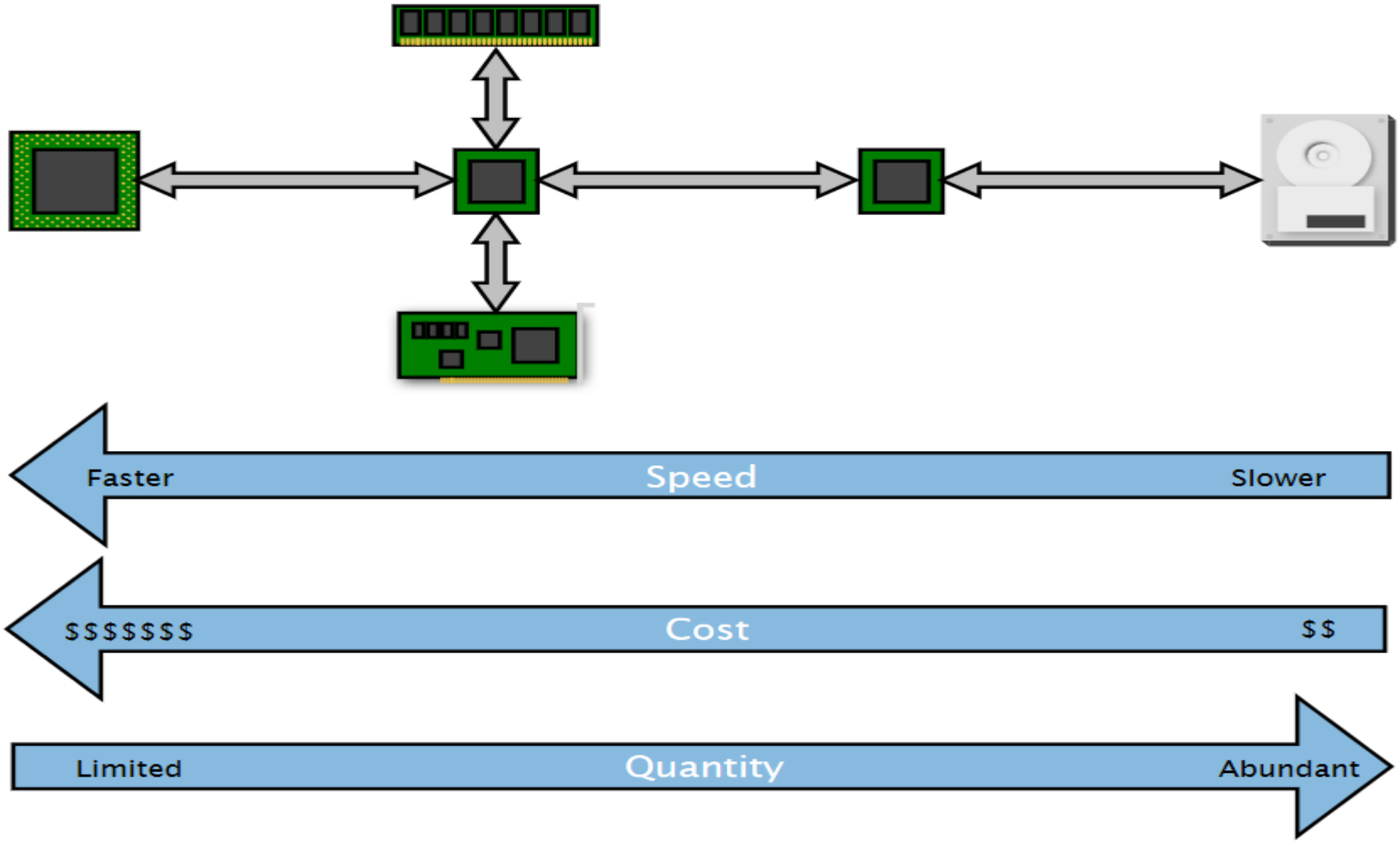
Disk Read 1MB
30,000,000 ns

L2 Cache
7 ns

Memory Read 1MB
250,000 ns

SSD 1MB
5,000,000 ns

Speeds versus Cost



Storage to Enhance Memory

- Virtual Memory
  - All data and instructions in use must be in RAM
  - Expand on limited RAM by writing idle memory pages to disk
  - If too much paging occurs it can cause “thrashing”

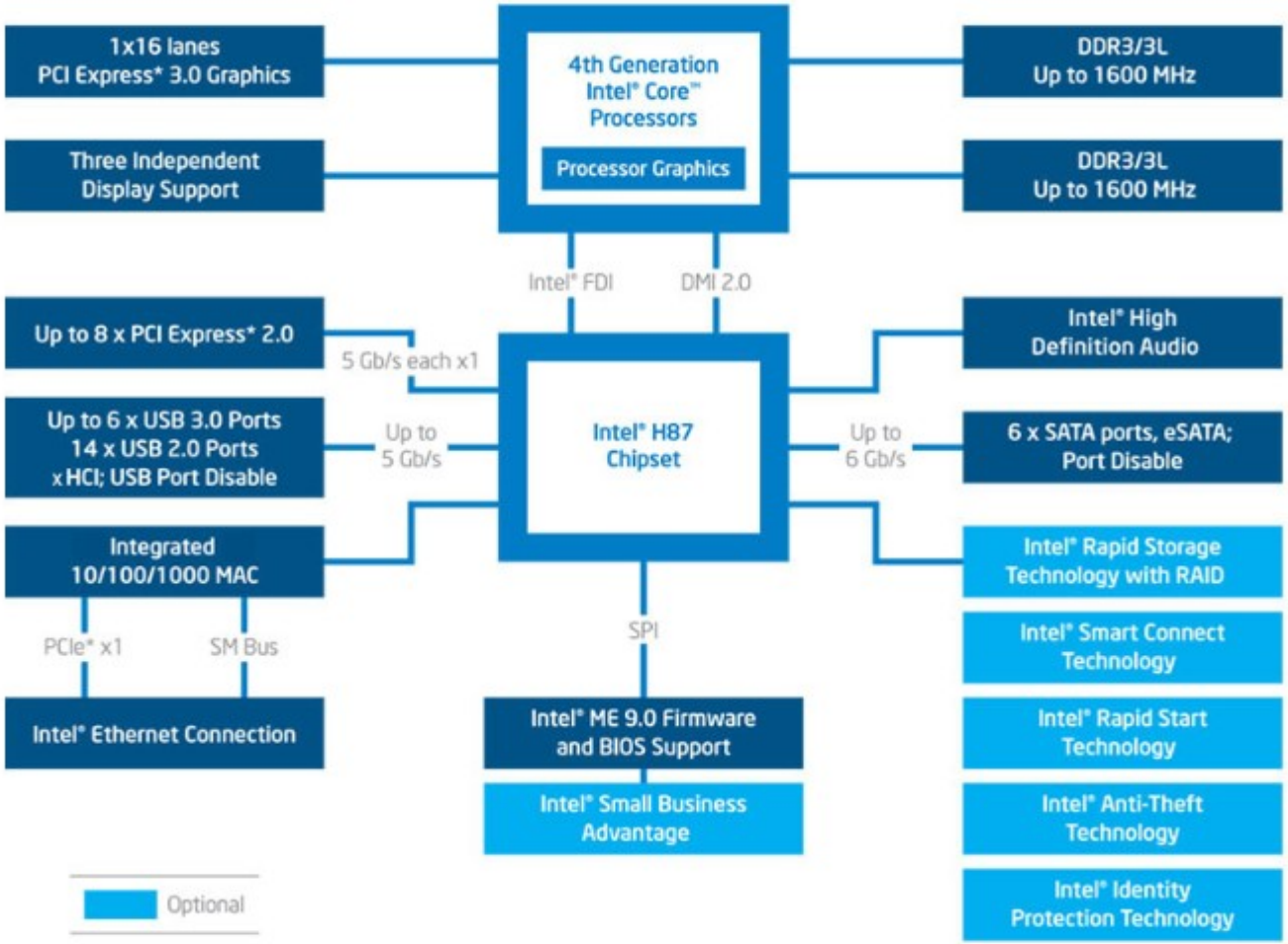
Memory to Enhance Storage

- Disk Cache
  - Read ahead and save disk blocks in memory
  - Latest technologies now allow flash memory devices to act as hard drive caches

Hybrid Disks

- Combines SSD (Solid State Disks) and older spinning disk technologies
  - Good performance at moderate costs
  - Higher Capacities
- Hardware Solutions = One device from the manufacturer
- Software Solutions = Implemented in the OS (e.g. Apple's Fusion Drive)

Two Chip Systems



http://www.intel.com/content/dam/www/public/us/en/images/diagrams/h87-chipset-diagram-3x2.jpg

Performance per Watt

- Raw power isn't always best
  - Mobiles
  - Data Centers
- Lower power consumption by:
  - Slower clock speeds
  - Turn off cores
  - More Integrated components
  - No spinning disks & fans

Laptop\Desktop Specs Today

- Processor
  - Qaud Core; Dual Core (min)
  - Aim for the good Price/Performance
  - Clock speed isn't everything
- Memory
  - 16 GB typical; 8 GB (min)
  - More memory (i.e. 32 GB) often equals better performance (to a point)

Laptop\Desktop Specs Today

- Graphics
  - Integrated Graphics are good enough for most uses
  - Discrete graphics (a GPU) are essential for “Workstation” class apps
- Storage
  - 1 TB typical; 500 GB (min)
  - SSDs are typical now but still costly

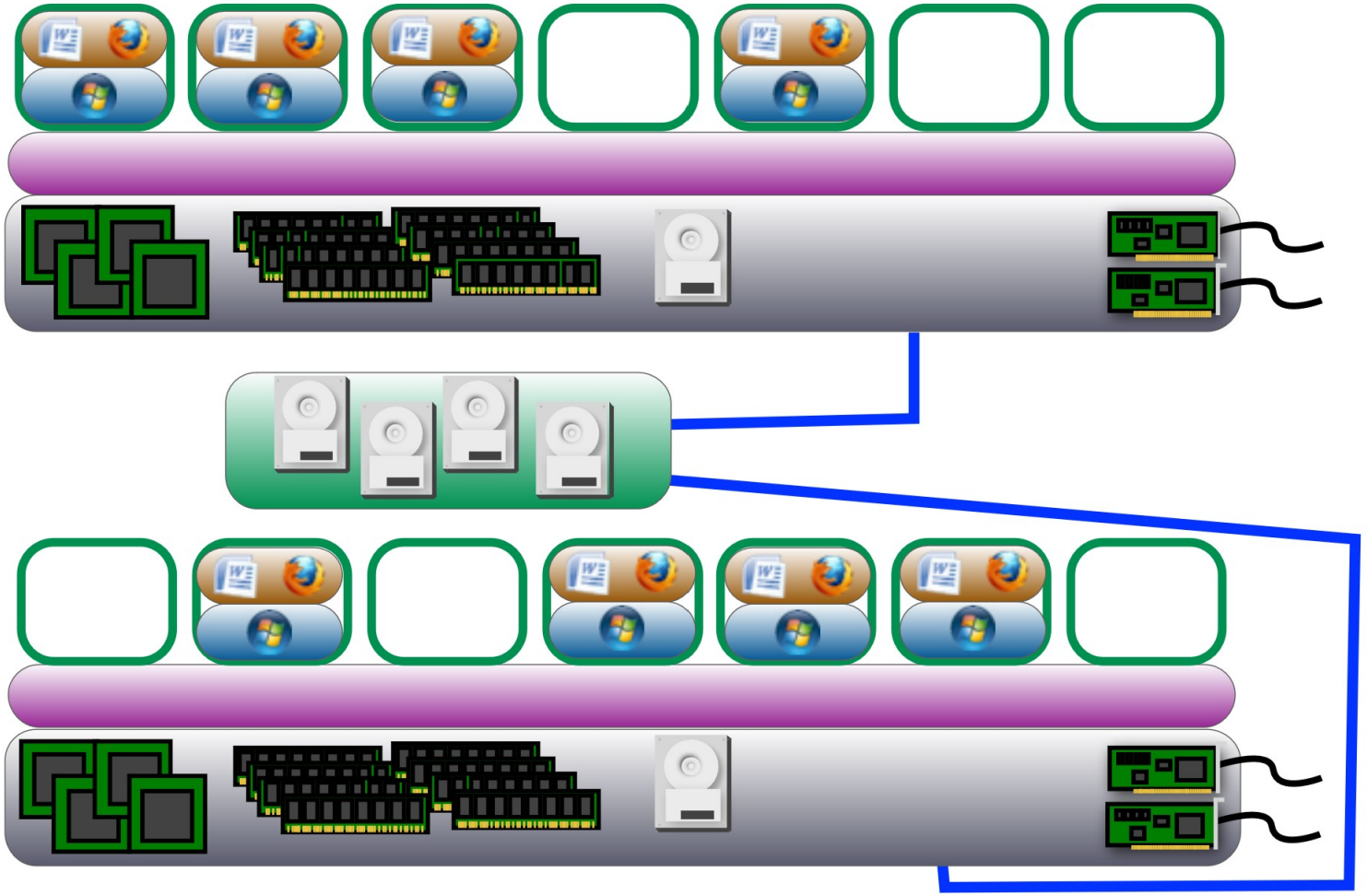
Virtual Desktop Infrastructure

Virtual Desktop Infrastructure VDI

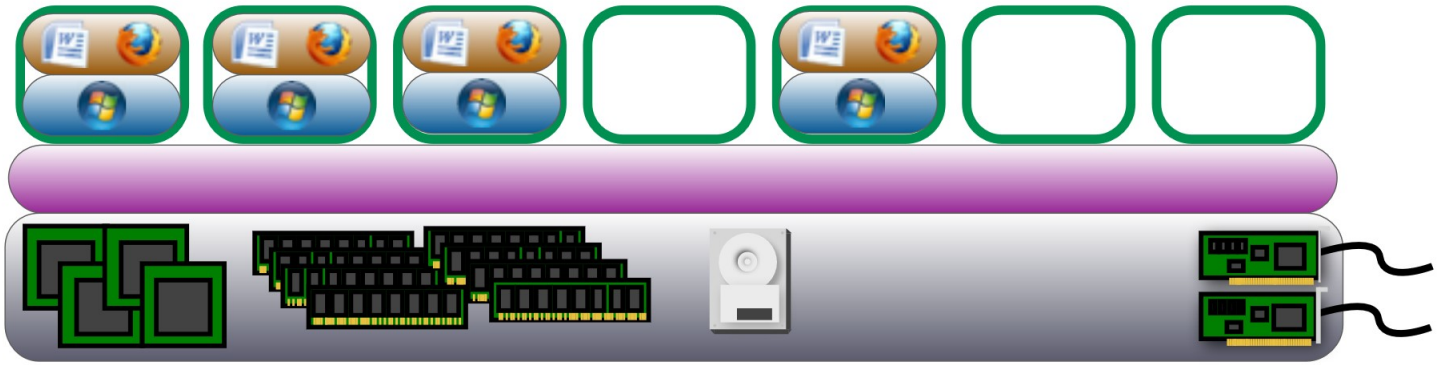
- Analogous to the transition from hardware-based servers to virtual servers
- Traditional Desktops Are:
  - Distributed Resources
  - Complex, with high costs per unit
  - Must be supported locally
  - Resources not always utilized
- VDI Centralizes to enhance management capabilities and reduce support costs

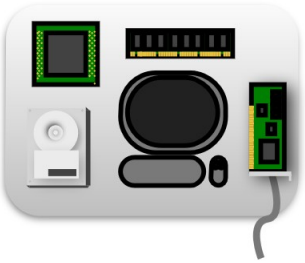
VDI

VDI

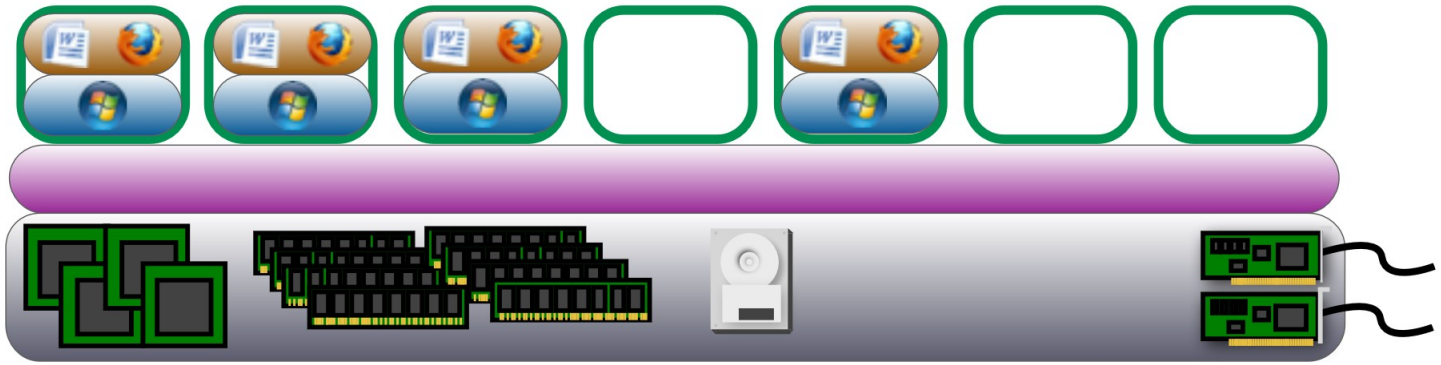


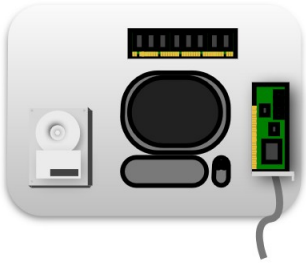
VDI



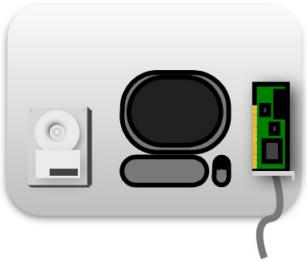


VDI





VDI



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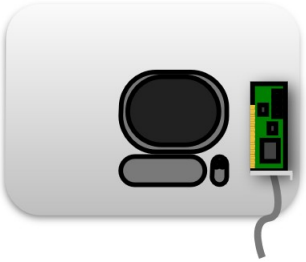
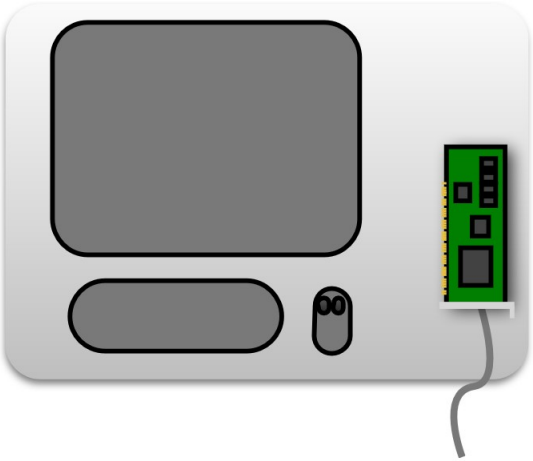
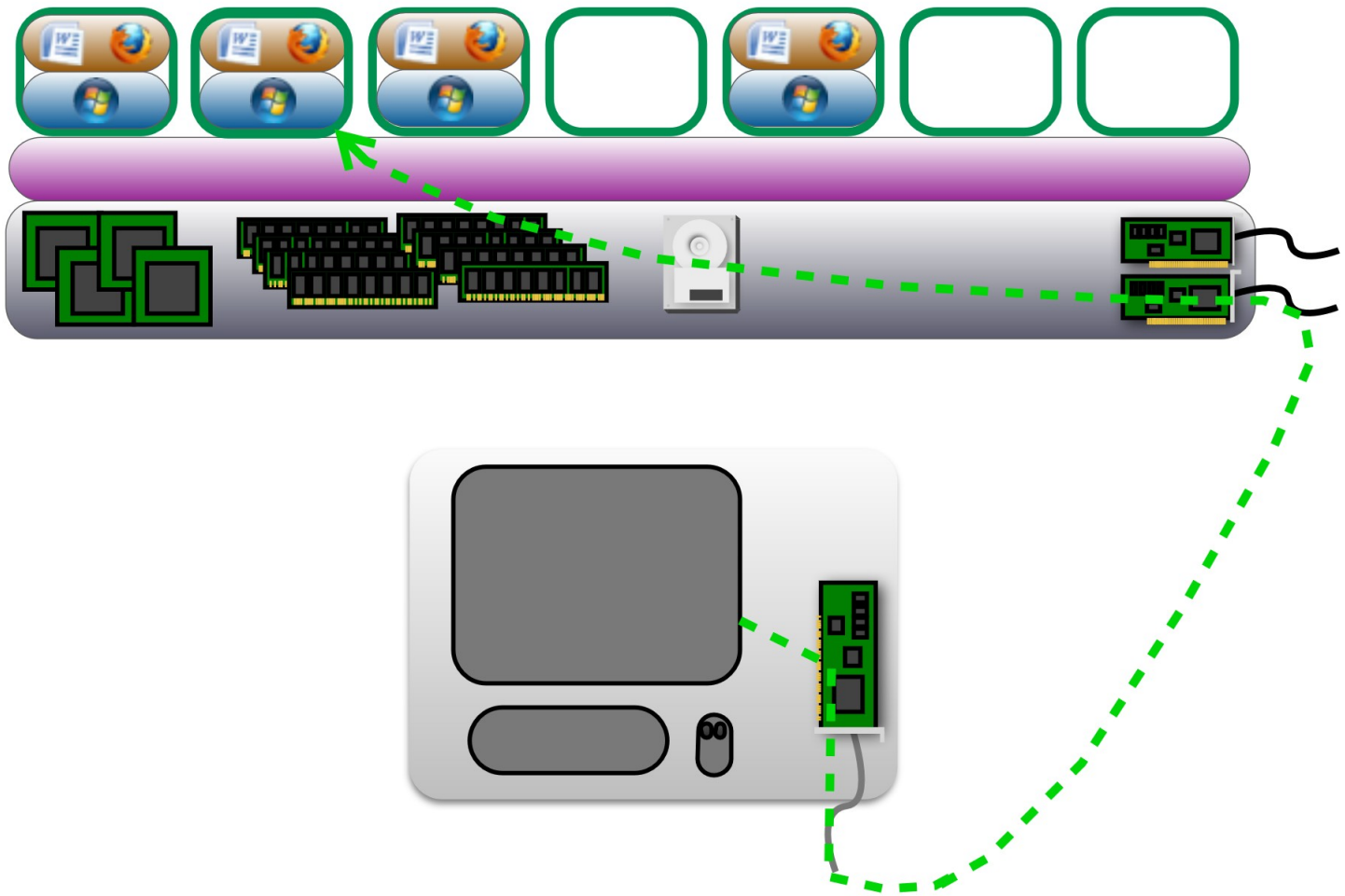


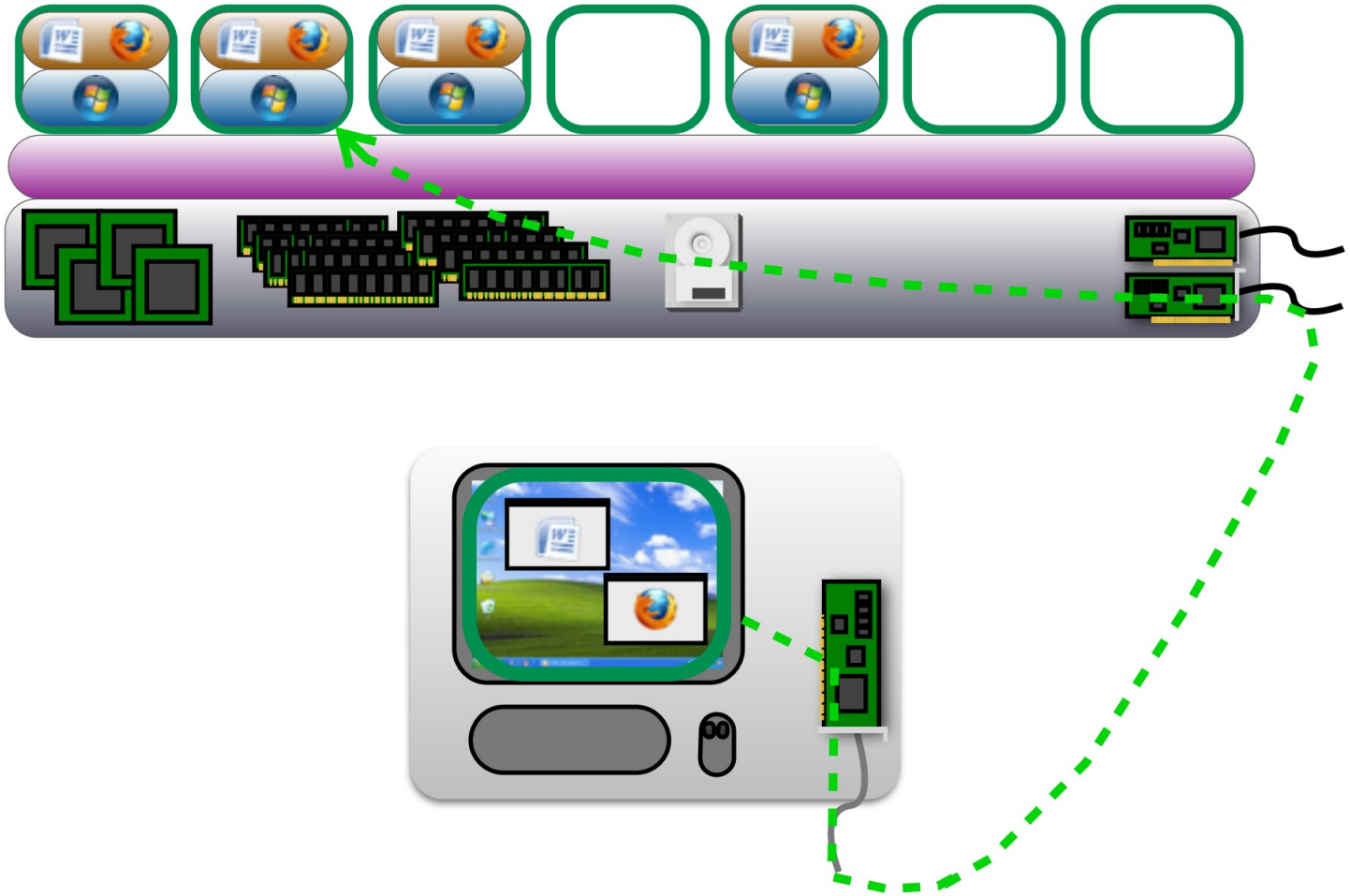
VDI – Thin Client



VDI – Thin Client



VDI – Thin Client



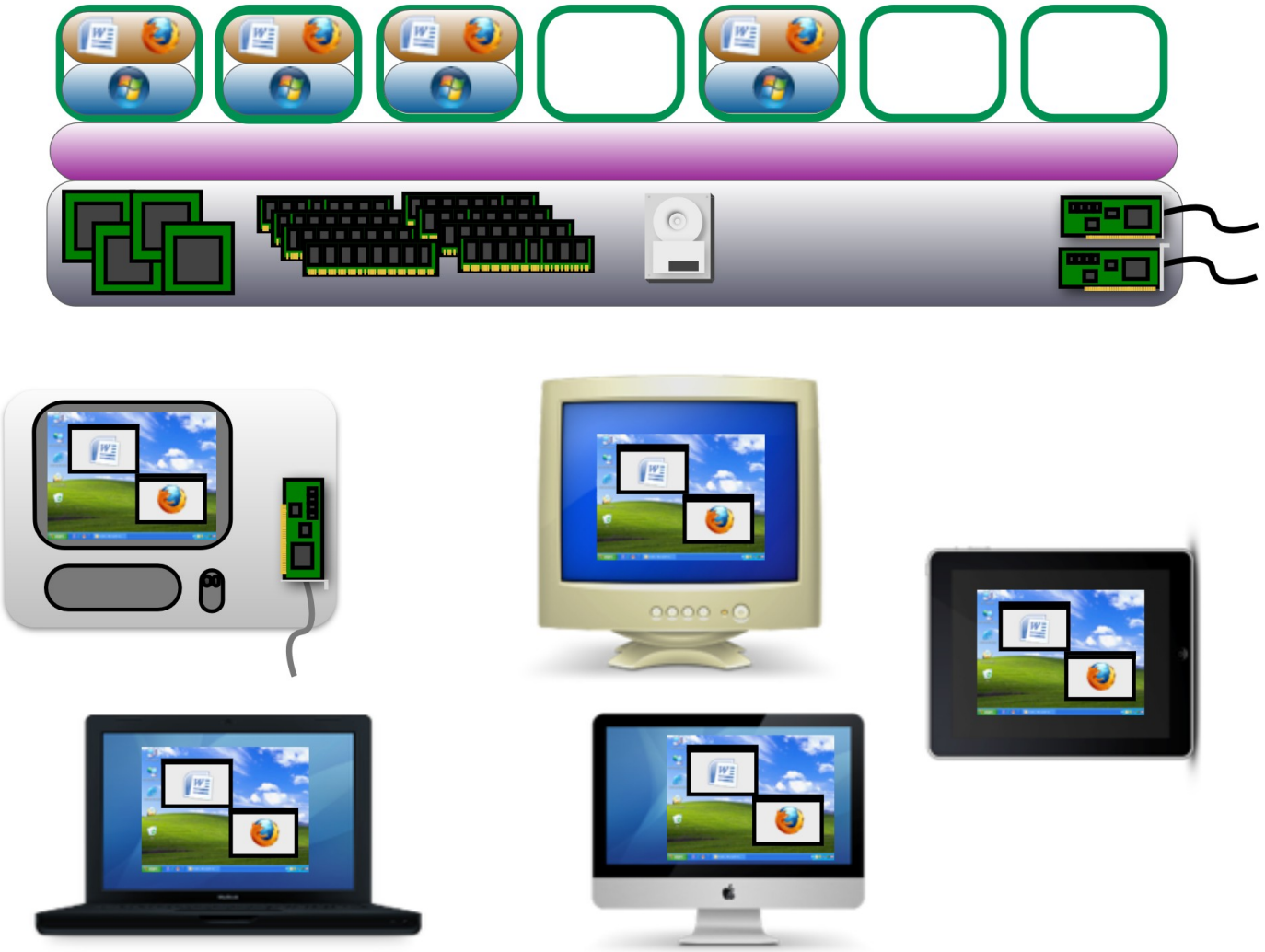
VDI - Thin and Zero Clients

- Dedicated devices that replace desktop computers
- Thin Clients:
  - Has an embedded OS (Linux or Windows)
  - Can connect to a variety of VDI hosts
  - Thin OS must be managed, updated, etc.
- Zero Client:
  - No OS
  - Speaks only one protocol
- Both can be managed via central services to make for quick deployment and provisioning

Virtual Desktops

- Centralized resources and management
- Simple, lost cost end unit (It's a toaster!)
- Setup, installation, patches, etc handled centrally
- Resources are allocated as needed
- Provides the full Windows desktop experience
- Can view and use a virtual desktop from any existing computer, mobile device, or thin client device

Virtual Desktops



Virtual Desktop Infrastructure VDI

- Desktops have different resource requirements than servers
- Loads are distributed differently in time
- Operating system installations should be tuned for a virtual environment
- IOPS can be more critical than processor and memory for performance
- Tools exist to profile desktop computers to “right-size” server infrastructure for virtual desktop transitions

VDI - Limitations

- Totally dependent on the network and central servers
- Resource intensive applications can be a concern
- Graphics applications that require GPU resources are a definite problem
    - It is possible to put a shared GPU on the server, but you are limited to how many clients can use it at once
- Simultaneous use and actions (e.g. boot storms) can reduce performance

Homework Assignment

- Get on to Discord
- Assignment #01 - Hardware Specification