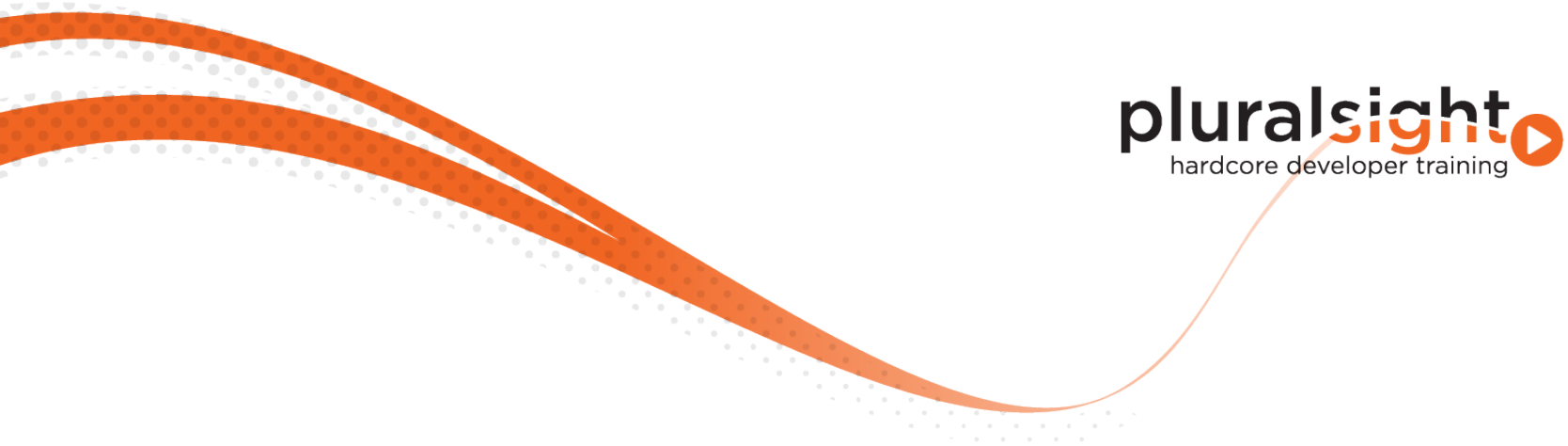
# Understanding Server Hardware

## Module 1: Introduction

Glenn Berry
Glenn@SQLskills.com



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# Why Should You Understand Server Hardware?

- **You need to be able to make the right component choices**
  - Ensure that the server hardware is appropriate for the workload
  - You want the best performance possible for a given budget
  - You want component redundancy to avoid single points of failure
- **You can save a significant amount of money**
  - Hardware costs
  - Software license costs
- **It is important to know how old your existing hardware is**
  - Your existing hardware may be much slower than new hardware
  - New hardware can help alleviate many performance problems
  - Hardware can be more affordable than refactoring or development work

# Introduction

- **What is a server?**
  - Specialized, fault-tolerant hardware designed for sustained, heavy workloads
- **Server form factors**
  - Rack-mount
  - Tower
  - Blade
- **Typical server architectures**
  - Symmetric multiprocessing (SMP)
  - Non-uniform memory access (NUMA)
- **Major server components**
  - Motherboard, processors, memory, internal storage, etc.
- **How are servers different than desktops?**
  - Higher durability, reliability, and scalability

# What is a Server?

- **Durable hardware with reliability, availability and serviceability (RAS) features**
  - Redundant components
  - Hot-swap and hot-add capability
- **Designed for sustained, high-volume usage**
  - Higher processor, memory, and internal storage capacity
  - Higher expansion capacity for external I/O capacity
- **Common server types**
  - Web server, application server, file server, database server
  - Servicing multiple applications and users over a network

# Server Form Factors

- **Rack-mount servers**
  - Standardized width and length to fit four-post racks
    - Typical chassis is 444mm wide, 684mm long
  - Various standard vertical heights
    - 1U, 2U, 4U are the most common sizes
  - Mounting rails for easy servicing

- **Tower servers**
  - Vertical tower with ample space for internal components
  - Commonly used for entry-level servers

- **Blade servers**
  - Multiple blades in a shared, rack-mount chassis
  - Increased server density, possible bottlenecks due to shared chassis

# Typical Server Architectures

- **Symmetrical multiprocessing (SMP)**
  - Uses single, shared system bus for memory access
  - Major scalability bottleneck as number of processors increase
  - Older architecture (pre-Intel Nehalem)
- **Non-uniform memory access (NUMA)**
  - Divides memory into NUMA nodes
  - Processors have fast, direct access to local NUMA node
  - Processors have slower access to remote NUMA node
  - All modern Intel and AMD processors have NUMA support
  - Much better scalability compared to SMP architecture

# Major Server Components

- **Motherboard**
  - Processor socket(s) and chipsets
  - Memory slots and expansion slots
  - Integrated components
- **Processors**
  - Sockets, physical cores, logical cores
- **Memory**
  - Fault tolerant, error-correcting code (ECC)
- **Internal storage**
  - Number and type of drive bays and drives
- **Other components**
  - Fans, power supplies, integrated components

# How are Servers Different than Desktops?

- **Redundant components**
  - Dual power supplies, multiple embedded NICs
- **Hot-swappable components**
  - Power supplies, internal drives, fans
- **More durable components**
  - Higher quality parts, Enterprise-grade components
    - Example: Single-Level Cell (SLC) solid-state drives
- **More expansion capability**
  - More PCI-E expansion slots, more memory slots
  - More internal drive bays

# Summary

- **Servers use durable, specialized hardware**
  - Rack, tower, and blade form factors
  - SMP or NUMA architecture
- **Servers have multiple redundant components**
  - Motherboard, processors, memory
  - Internal storage, power supplies
  - Integrated components
- **Servers are different from desktop machines**
  - Redundant components
  - Greater scalability and expansion capability

# Course Structure

- Module 1: Introduction to Server Hardware
- Module 2: Hardware Identification
- Module 3: Hardware Evaluation
- Module 4: Hardware Selection
- Module 5: Hardware Maintenance
- Module 6: Servers in the Real World