Computer System Architecture: Teaching Script

Topic: Computer System Architecture
Level: College/University
Duration: 90 minutes (2 x 45-minute sessions)
Prior Knowledge Required: Basic computer usage, fundamental technology concepts
Key Vocabulary: CPU, RAM, Motherboard, Architecture, Cache, Clock Speed, Storage, PCIe
Learning Objectives:

- Identify and explain the function of core computer components
- Analyze the relationships between different system components
- Evaluate system performance based on component specifications
- Troubleshoot common hardware issues

✓ Deconstructed computer system	✓ Component identification worksheets
✓ Digital presentation system	✓ Physical CPU samples
✓ RAM modules	✓ Storage devices (HDD/SSD)
✓ Large motherboard diagram	✓ Anti-static equipment

Pre-Session Preparation

Room Setup:

- Arrange workstations in U-shape for optimal demonstration visibility
- Set up component display area at front of room
- Ensure proper lighting for detailed component viewing
- Test all digital presentation equipment
- Prepare safety equipment (ESD straps, mats)

Common Student Misconceptions:

- Higher GHz always means better performance
- More RAM automatically improves system speed
- All SSDs perform the same
- Bigger power supplies are always better

Session Introduction (0-10 minutes)

[Display deconstructed computer with components clearly visible]
"Today we're going to explore the heart of modern computing by understanding how these components work together to create a functioning computer system. Who can identify some of the components they see here?"

Opening Activity:

- Have students identify visible components
- Record responses on board in system diagram format
- Begin building connections between components

Engagement Strategies:

- Connect to students' personal devices
- Reference recent technology news
- Share real-world performance scenarios

CPU Architecture Deep Dive (10-25 minutes)

[Hold up physical CPU specimen]
"This small piece of silicon is the brain of every computer. Let's understand what makes it tick."

CPU Fundamentals:

- Clock Speed (GHz)
  - Base clock vs. boost clock
  - Relationship to performance
  - Thermal limitations
- Core Architecture
  - Single vs. multi-core processing
  - Thread handling
  - Instruction pipeline
- Cache System
  - L1, L2, L3 hierarchy
  - Cache latency impact
  - Size vs. speed tradeoffs

Teaching Approaches:

- Visual Learners: Use CPU architecture diagrams
- Kinesthetic Learners: Pipeline simulation activity
- Theoretical Learners: Technical specifications analysis

[Demonstrate CPU installation process]

Safety Focus:

- Proper handling techniques
- Pin protection awareness
- Thermal paste application

Memory Systems (25-40 minutes)

"Memory is the workspace of our computer system. Let's explore how different memory types work together."

Memory Hierarchy:

1. Cache Memory
   - Speed: 0.5-15ns access time
   - Capacity: KB to MB
   - Cost: Highest per GB
2. Main Memory (RAM)
   - Speed: 50-100ns access time
   - Capacity: GB range
   - Volatile storage
3. Storage Memory
   - Speed: ms to μs range
   - Capacity: TB range
   - Non-volatile storage

Interactive Elements:

- Memory hierarchy pyramid building
- Access time comparison activities
- Cost-benefit analysis exercises

Storage Systems (40-55 minutes)

[Display various storage devices: HDD, SSD, M.2 drive]

"Let's explore how modern computers store data permanently and the evolution of storage technology."

Feature	HDD	SATA SSD	NVMe SSD
Speed (Sequential Read)	150-200 MB/s	550-600 MB/s	3500-7000 MB/s
Latency	High (ms)	Low (μs)	Very Low (μs)
Cost per TB	Lowest	Medium	Highest

Hands-on Activity:

1. Storage speed testing demonstration
2. File transfer comparisons
3. Boot time analysis
4. Cost calculation exercise

Motherboard Architecture (55-70 minutes)

"The motherboard is the foundation that connects all components. Understanding its architecture is crucial for system building and troubleshooting."

Critical Components:

- Chipset
  - North Bridge functions
  - South Bridge functions
  - Modern integrated designs
- Bus Systems
  - PCIe lanes and versions
  - DMI interface
  - Memory bus
- Power Delivery
  - VRM design
  - Power phases
  - Cooling requirements

System Integration (70-80 minutes)

Building a Balanced System

Consider the following scenario: A content creator needs a new workstation for video editing and 3D rendering.

System Requirements:

- CPU: High multi-core performance
- RAM: 32GB minimum
- Storage: Fast NVMe + Large capacity
- GPU: Professional grade

Class Discussion Points:

- Component selection rationale
- Budget allocation
- Upgrade paths
- Performance bottlenecks

Performance Optimization (80-85 minutes)

System Tuning:

- BIOS Settings
  - XMP profiles
  - Boot sequence
  - Power management
- Operating System
  - Power plans
  - Process priority
  - Resource allocation
- Monitoring Tools
  - Temperature tracking
  - Performance metrics
  - Resource utilization

Assessment and Review (85-90 minutes)

Knowledge Check:

1. What determines CPU performance besides clock speed?
2. How does cache memory improve system performance?
3. Compare advantages of different storage types.
4. Explain the role of the chipset in modern motherboards.

Hands-on Evaluation:

- Component identification test
- System building simulation
- Performance analysis task
- Troubleshooting scenario

Extended Learning:

- Research current CPU architectures
- Compare system builds within budget constraints
- Analyze real-world benchmark results
- Create system upgrade proposals

Additional Resources

Digital Materials:

- CPU architecture simulators
- Virtual system builder tools
- Performance benchmarking software
- Component compatibility checkers

Further Reading:

- Technical documentation
- Industry white papers
- Performance analysis guides
- Troubleshooting manuals

Assessment and Review (40-45 minutes)

Practical Assessment Tasks

- Component identification quiz
- System building simulation
- Performance analysis worksheet
- Troubleshooting scenarios

Key Learning Points Review

- CPU architecture and performance metrics
- Memory hierarchy and data flow
- Storage solutions and considerations
- System integration principles

Extended Learning

Research Task: Compare and contrast current market CPU architectures, focusing on:

- Performance benchmarks
- Power efficiency
- Cost effectiveness
- Target market segments