SEMtech!

Student Engagement & Mentoring in Technology

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## 1. "Build-a-Network" Interactive Simulator

**Objective:** Help students understand how devices and protocols interact in a basic TCP/IP network setup.

**How it Works:**

- Students are given a **virtual workspace** with draggable elements: desktops, laptops, servers, printers, routers, switches, and access points.
- As they connect devices (e.g., using Ethernet or Wi-Fi), the simulator **visually shows packet movement**, IP and MAC address assignments, and the role of DNS in domain lookups.
- Pop-up tooltips and guidance appear when incorrect connections are made (e.g., trying to connect two devices with no router).

**Key Concepts Reinforced:**

- LAN vs. WAN
- IP vs. MAC addressing
- Device-to-device communication flow (packet movement)
- Role of DNS and DHCP

**Assessment Extension:**

- Add a challenge mode: "Your server must reach a website using DNS – build the path and identify the source and destination IPs."

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## 2. "IP Address Validator" Game

**Objective:** Teach students how to identify **valid IPv4 addresses** using exam rules.

**How it Works:**

- Present a series of IP addresses (e.g., 192.168.1.300, 10.10.10.10, 127.0.0.1, 240.1.1.1).
- Students click "Valid" or "Invalid" for each one.
- Provide instant feedback and a short explanation:

  - "Invalid: No octet can be above 255."
  - "Invalid: 127.x.x.x is a reserved loopback address."
  - "Invalid: First octet must be less than 224."
- Track their score and time for gamification.

**Learning Outcome:**

- Internalize test-ready logic to quickly eliminate incorrect address options under exam pressure.

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## 3. "Trace the Packet" Animation + Interactive Quiz

**Objective:** Demonstrate how data travels through a network using TCP/IP.

**How it Works:**

- Students view a **step-by-step animated flow**:
  1. User types a URL in a browser.
  2. DNS query resolves the domain to an IP address.
  3. TCP sets up a connection.
  4. IP splits the message into packets.
  5. Packets are routed via routers/switches.
  6. ARP resolves MAC addresses locally.
- At each step, the animation pauses and prompts a **quick question**:
  - "What does TCP do at this stage?"
  - "What role does ARP play here?"
  - "Which address changes with each hop: IP or MAC?"

**Key Concepts Covered:**

- DNS, TCP/IP, IP vs. MAC address scope
- Packet fragmentation
- Source and destination addressing

**Bonus:**

- Allow students to customize the domain name, see how the DNS resolution changes, and watch packets reroute through different servers.

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## Summary Table

| Activity Name | Core Concept | Interaction Type |
|---|---|---|
| Build-a-Network Simulator | Device roles, network setup, TCP/IP | Drag-and-drop, visual sim |
| IP Address Validator Game | IP addressing rules, test prep | Click-based quiz |
| Trace the Packet Animation | Protocol roles, DNS, TCP/IP, ARP | Animated flow with questions |