Every microscopic capacitor in a computer is in one of 2 states: charged or not charged (i.e. it holds a one or a zero). When transmitted to another computer via its transistor gate it is a one or a zero

Yes, that is exactly how digital computers process, store, and transmit information at the hardware level. This binary system uses two distinct physical states to represent all digital data.

📌 Core Mechanisms

- **Storage**: Microscopic capacitors inside RAM (Random Access Memory) store an electrical charge.
- **Charged State**: Represents a binary **1** (high voltage).
- **Uncharged State**: Represents a binary **0** (low voltage).
- **Transmission**: Transistors act as physical switches that open or close to pass these voltage levels along.
- **Interpretation**: Receiving circuits read a high-voltage pulse as a 1 and a low-voltage pulse as a 0.

🔍 Key Nuances

- **Dynamic Refreshing**: Capacitors naturally leak charge over time. Computers must constantly recharge (refresh) them thousands of times per second to keep data from disappearing.
- **Alternative Storage**: Not all computer components use capacitors. CPU caches use static flip-flop circuits (SRAM), while flash drives use floating-gate transistors to trap electrons long-term without needing constant power.

To explore this further, would you like to see how these **ones and zeros combine** to form text and images, how **logic gates** perform math with them, or how **network cables** transmit them over long distances?

What switches were used before transistors

Before transistors, computers used **vacuum tubes** and **electromechanical relays** as electronic switches. Vacuum tubes controlled electricity using heat in a vacuum, while relays used physical moving magnets.

💡 Main Pre-Transistor Switches

- **Vacuum Tubes**: Glass tubes that controlled electron flow through a vacuum.
- **Thermionic Emission**: A heated filament released electrons toward a metal plate.
- **Control Grid**: A small voltage on a middle grid blocked or allowed the main current flow.
- **Speed**: Fast enough for early digital computation but generated immense heat.
- **Electromechanical Relays**: Mechanical switches operated by an electromagnet.

- **Magnetic Force**: Electricity in a coil created a magnetic field to pull a switch closed.
- **Physical Movement**: Moving parts made them very slow, loud, and prone to wearing out.

⚠ The Limitations That Led to Transistors

- **Massive Size**: Vacuum tubes were as large as lightbulbs, making computers fill entire rooms.
- **High Failure Rates**: Filaments burned out constantly, requiring frequent manual replacement.
- **Power Hunger**: They drew massive amounts of electricity and required heavy cooling systems.

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