1. Early Logic Gates and Their Foundation

- **Logic gates** implement Boolean functions (AND, OR, NOT, NAND, etc.) in hardware
- The invention of the **transistor at Bell Labs** (Shockley, Bardeen & Brattain, 1947) replaced bulky vacuum tubes and became foundational to digital logic
- **Integrated Circuits (ICs)** miniaturized multiple transistors into single chips by Kilby (1958, TI) and Noyce (1959, Fairchild), launching SSI → MSI → LSI → VLSI integration

Sources

- Logic gate (Wikipedia)
- History of the transistor, Integrated circuit, VLSI (Wikipedia)

2. Advances in Semiconductor & Integrated Circuits

- **MOSFETs**, invented at Bell Labs (1955–60), enabled mass production of compact transistors .
- ICs moved from 10s of transistors in SSI to billions in modern VLSI—crucial for today's microprocessors .
- Nanotech milestones include molecule-size transistors and self-assembling nanowires—paving the way for ultra-dense chips

Sources

- *MOSFET/integrated circuit/VLSI history (Wikipedia)*
- *Nanocomputers Get Real (Wired, 2001)*

3. The Birth of Quantum Computing

- **Feynman (1982)** proposed using quantum systems to simulate quantum physics—marking the inception of quantum computing

- **Benioff (1980)** modeled the quantum Turing machine, establishing theoretical foundations

- **Deutsch (1985)** introduced the universal quantum computer and described quantum logic gates

Key Sources

- *Quantum computing history (Wikipedia)* britannica.com

- *Feynman concept & Deutsch gate* from Britannica and Quantumpedia

4. Quantum Logic Gates and Their Impact

- **Quantum logic gates** are reversible, unitary, and vital for quantum circuits

- **Key gates**: Hadamard, Pauli-X/Z, CNOT, and Toffoli – e.g., Tofolli is universal for classical computation when paired with Hadamard

- **Physical implementations**:

    - 1998–2000: Demonstration of quantum gates (CNOT) and algorithms via NMR & ion traps

    - 2015: First silicon two-qubit gate demonstrated in Australia

Sources

- *Quantum logic gate* (Wikipedia)

- *Timeline of quantum computing*

Resources

1. **Strilanc/Quirk (GitHub)**

2. **TechTarget timeline** techtarget.com

3. **Britannica & Quantumpedia** quantumpedia.uk

4. **Wired's "Inside big tech's race…**