# Summary

Here's a comprehensive summary of the provided text on Electronic Switching Systems (ESS), covering key aspects from their historical context to specific examples like the 4ESS and 5ESS.

\*\*I.

Introduction and Historical Context:\*\*  
  
\* \*\*Definition:\*\* An Electronic Switching System (ESS) is a telephone switch utilizing solid-state electronics and computerized control to connect telephone circuits and establish calls.

It marked a significant advancement over earlier technologies.

\* \*\*Pre-ESS Era:\*\* Before the 1950s, telephone switches relied on electro-mechanical relay systems (e.g., Strowger switches) and analog voice paths.

These were slower and less efficient.

\*\*II.

Early Electronic Switching Systems (1960s):\*\*  
  
\* \*\*First Generation:\*\* These were not fully digital but used reed relay-operated metallic paths or crossbar switches controlled by Stored Program Control (SPC) systems.

\* \*\*Stored Program Control (SPC):\*\* SPC systems used computers to control switching functions, providing greater flexibility and features compared to electromechanical systems.

\*\*III.

Reed Relays: A Key Component in Early ESS:\*\*  
  
\* \*\*Structure:\*\* Reed relays consist of a reed switch, a coil for generating a magnetic field, an optional diode for back EMF protection, and an encapsulating package with connection terminals.

\* \*\*Advantages:\*\*  
 \* Low-resistance metallic switch path: Ensures minimal signal loss.

\* Inherent isolation: Provides electrical isolation between the control voltage and the signal being switched, preventing interference.

\* \*\*Reed Switch Details:\*\*  
 \* Two shaped metal blades (typically a 50:50 nickel-iron alloy).

\* A glass envelope: Provides a hermetic seal, preventing contaminants from entering the critical contact area.

\* Normally open (contacts are separated) in their resting state.

\* \*\*Operation:\*\* When a magnetic field is applied, the blades are attracted to each other, closing the gap and making electrical contact.

\* \*\*Durability and Reliability:\*\* The reed switch has only one moving part (the deflection of the blades), reducing wear and tear.

The hermetically sealed envelope protects the contacts from external contamination, resulting in long mechanical life and high reliability.

\*\*IV.

Early Adoption:\*\*  
  
\* \*\*First Trial:\*\* The first all-electronic central office customer trial commenced in Morris, Illinois, in November 1960 by Bell Laboratories.

\* \*\*First Large-Scale ESS:\*\* The Number One Electronic Switching System (1ESS) of the Bell System went into service in Succasunna, New Jersey, in May 1965.

\*\*V.

Transition to Digital Telephony:\*\*  
  
\* \*\*MOS Technology and PCM:\*\* The adoption of metal-oxide-semiconductor (MOS) technology and pulse-code modulation (PCM) in the 1970s facilitated the transition from analog to digital telephony.

\* \*\*Pulse-Code Modulation (PCM):\*\* PCM involves sampling the analog voice signal and converting each sample into a digital code.

\* \*\*Digital Representation:\*\* Later ESS implemented digital representation of audio signals on subscriber loops by digitizing the analog signals and processing the resulting data for transmission between central offices.

\*\*VI.

Time-Division Multiplexing (TDM):\*\*  
  
\* \*\*Efficiency:\*\* Time-division multiplexing (TDM) allowed the simultaneous transmission of multiple telephone calls on a single wire connection between central offices or other electronic switches.

\* \*\*Capacity Improvement:\*\* TDM dramatically improved the capacity of the telephone network by dividing the transmission channel into time slots, each allocated to a different call.

\*\*VII.

Evolution and Modern Switches:\*\*  
  
\* \*\*Semiconductor Components:\*\* With the advancement of digital electronics starting in the 1960s, telephone switches increasingly used semiconductor device components.

\* \*\*Elimination of Older Systems:\*\* By the late 20th century, most telephone exchanges without TDM processing were eliminated.

\* \*\*Historical Distinction:\*\* The term "electronic switching system" became largely a historical distinction for the older SPC systems.

Modern switches are almost exclusively digital.

\*\*VIII.

4ESS Electronic Switching System:\*\*  
  
\* \*\*Definition:\*\* The No.

4 Electronic Switching System (4ESS) was a Class 4 telephone ESS, the first digital electronic toll switch introduced by Western Electric.

\* \*\*Introduction:\*\* It was introduced in Chicago in January 1976, replacing the 4A crossbar switch.

\* \*\*Deployment:\*\* The last of the 145 systems in the AT&T network was installed in 1999 in Atlanta.

\* \*\*Ownership:\*\* At the time of the Bell System divestiture, most of the 4ESS switches became assets of AT&T as part of the long-distance network, while others remained in the Regional Bell Operating Companies (RBOCs).

\* \*\*Architecture:\*\*  
 \* \*\*Processor:\*\* The CPU of the switch, including central control, call stores, and program stores.

Early versions used the same 1A processor as the contemporaneous improved 1AESS switch.

All existing switches have been subsequently upgraded to use the 1B processor.

\* \*\*File Store (later 4EAPS):\*\* Provides long-term storage of processor programs and office data.

The 4EAPS is a 3B computer running 4EAPS application software on the DMERT operating system.

\* \*\*Peripheral Units:\*\* Interface to the central control and include CCIS terminal, signal processors, time-slot interchanges (TSI), and time-multiplexed switches (TMS).

\* \*\*4EAPS and CNI Ring:\*\* The 4EAPS originally just provided "file store," but soon it also provided access to the common-network interface ring (CNI ring) to provide common-channel signaling (CCS).

\*\*IX.

5ESS Switching System:\*\*  
  
\* \*\*Definition:\*\* The 5ESS Switching System is a Class 5 telephone ESS developed by Western Electric for AT&T and the Bell System in the United States.

\* \*\*Introduction:\*\* It came into service in 1982, and updated versions are still produced today.

\* \*\*Architecture:\*\*  
 \* \*\*Administrative Module (AM):\*\* Contains the central computers (AT&T 3B series running UNIX-RTR).

It is built on the 3B21D platform and is used to load software to the many microprocessors throughout the switch and to provide high-speed control functions.

\* \*\*Communications Module (CM):\*\* Forms the central time switch of the exchange.

5ESS uses a time-space-time (TST) topology.

\* \*\*Switching Module (SM):\*\* Performs multiplexing, analog and digital coding, and other work to interface with external equipment.

Each has a controller, a small computer with duplicated CPUs and memories, like most common equipment of the exchange, for redundancy.

\* \*\*Time-Space-Time (TST) Topology:\*\* The Time-Slot-Interchangers (TSI) in the Switching Modules assign each phone call to a time slot for routing through the CM.

\* \*\*Signaling:\*\*  
 \* Common Network Interface (CNI) Ring  
 \* Packet Switching Unit (PSU)-based SS7 Signaling  
\* \*\*OAMP:\*\* Operations, Administration, Maintenance, and Provisioning.

These are the functions required to manage and operate the 5ESS switch.

\*\*Significant Takeaways:\*\*  
  
\* ESS represents a major technological leap from electro-mechanical switches to computerized, solid-state systems.

\* The evolution of ESS was driven by the need for increased capacity, flexibility, and new features.

\* Key technologies like reed relays, SPC, PCM, and TDM were crucial in the development of ESS.

\* The 4ESS and 5ESS are examples of successful ESS implementations that significantly impacted the telecommunications industry.

\* Modern switches are almost exclusively digital, making the term "electronic switching system" largely a historical distinction.