plan21switchingcenter

Plan 21 Switching Center

A Data Communication Historical Series

By Bob Pollard

Plan 21:

A Western Union Telegraph Company semi-automatic message switching Center. Data Source: A preliminary overview by Don Holtzclaw.

The Plan 21 switching centers were located at many locations throughout the United States in order to provide a store and forward function for the many tributaries (terminals) located in cities and small communities. Larger cities would have more than one office (tributary), therefor; several tributaries within a city(s) would feed into the switching center. Messages were received on a 36A-paper tape Printer/Perforator that punched and printed on "chadless" tape. Chadless tape implied that the holes punched in the tape did not result in the hole remains (chad) being scattered all over the equipment or floor. When the holes were punched in the tape only three quarters of the hole was punched which resulted in the chad being retained or connected to the tape by a small section of chad. This allowed the transmitter mechanical pins to penetrate the holes in the tape and read the tape because the chad was pivoted up, but still connected to the paper tape. The Baudot code was used and the character bits representation was punched across (column) the tape, which required a tape width that would accommodate five bits.

The printer part of the perforator used a print cylinder that rotated (spun) above the tape and a hammer type mechanism hit the paper tape from the bottom and caused the paper tape and print ribbon, which was between the rotating cylinder and paper tape, to strike the print cylinder. Of course, all this was timed in order to print the appropriate character. The matching printed characters lagged (followed) behind the punched characters about a distance of five characters. This was necessary because the beginning of the punched/printed tape would be fed part way into the transmitter mechanism awaiting operator action. The operator could read the address because of the delayed printing function. Without the delay the address would be hidden under the transmitters tape cover.

The cabinets containing the receiving (input) equipment and switching control panel were called switching or receiving turrets. The top level of the cabinet, centrally located on the turret at operator eye level (don’t ask how tall), contained the push button routing switch panel array. There were two receiving positions, top and bottom levels on the right side of the turret and two identical receiving positions on the left side of the turret. One more receiving position was located under the push button panel on the lower level, which allowed for five receiving positions per turret (cabinet). Each receiving position was equipped with a 36-A tape printer-punch (perforator), tape storage bins, and an 8-C tape cross-office transmitter. Any one of the five transmitters could be connected to any sending position in the sending aisles via the push buttons on the turret panel and Switch Room interconnects.

There were two tape storage bins at each receiving position. The first bin temporarily stored tape between the Printer/Perforator and the transmitter until the message was switched cross-office from the transmitter to an operator-selected destination (sending position). The second tape storage bin was used to store (catch) the switched tape messages fed through the transmitter and then was pulled from the tape storage bin by a motor driven tape reel. Both tape bins buffered tape messages on a first-in first out basis.

The punched (perforated) message tape from the 36-A was fed to the first tape storage bin in the receiving turret position. The messages were then "pulled" from the tape storage bin into the 8-C cross-office transmitter. Blank tape between messages was idled through the transmitter until the first punched character was sensed, which caused the transmitter to stop feeding the tape, waiting for the operator to initiate the cross-office switching function.

The printed/punched tape message Routing Indicators (destination) was read by an operator who then selected the destination of the message and switched, pushed the appropriate button on the switch panel, the message to the appropriate sending position "cross-office" via the 8-C transmitter. If the cross-office sending (output) position was busy the transmitter would not start until the sending position became available.

The transmitter was connected to the intended destination sending position reperforator via an array of rotary switches that resided in a Switch Room, affectionately called the "frog-pond". Within the enclosed Switch Room, the constant stepping relays and rack mounted rotary switches sounded like a bevy of lively frogs around a pond at night! The cross-office transmitters and the destination Push Button caused the necessary connection to be made through the electrical stator contacts of a rotary switch that corresponded to the proper sending position.

The rotor/stator cross-office connections were in multi-level layers in order to handle the parallel character bits stepped through the transmitter and allow for the control signal lines connections.

In addition to the Switch Room actions for both receiving and destination connection, there were two relay banks per turret for setting up a connection to the Switch room for both the sending and receiving sides when a push button on the routing panel was depressed by an operator.

The relay banks initiated and maintained the electrical/mechanical logic for processing cross-office electrical control signals, stepping pulses for the transmitters, etc. A sending position was also equipped with a set of relay banks on the back of the sending rack. One bank was used to control and maintain two positions during a cross-office connection. The second relay bank worked with the "transmission line" side of the sending position. There was little or no “electronic” circuitry involved. The Center functional controls and activity was primarily based on electrical/mechanical equipment.

Each sending (output) position contained an automatic numbering and date/time stamp machine that punched a sequential number in the beginning of each message as it was received cross-office. This number was used as a reference for lookup of messages by technicians and/or sending aisle traffic supervisors. A 10-B "re-perforator", that did not print on the tape, received the cross-office transmission from the receive (input) transmitter. Technicians and traffic supervisors had to read the punched "hole" Baudot codes if it was necessary to analyze a sending position problem. It appears the name "Reperforator Message Switching Center" was derived, from the reperforation (duplication) of messages from receiving to sending positions (cross-office).

There was also the ever-present tape storage bin for temporarily holding (buffering) the message tapes as they came from the 10-B reperforator and were being transmitted by the 7-C transmitter.

On the output line (send) side, there was a 5-B Distributor used to serialize the parallel codes of each character on the tape as it stepped through the 7-C transmitter. This was necessary so the message code (bits) could be sent out to the line as a series of sequential coded pulses. A pulse generator device also serviced several sending positions for generating the various timing and stepping pulses for the 10B reperforator and 7-C transmitter.

Usually there were hundreds of lines entering a large center and to limit the total number of lines some out-stations (tributaries) were multiplexed through concentrators, which allowed low activity users to share a receiving (input) or sending (output) position. Basically, including the shared positions, there was one physical receiving perforator and sending transmitter position for each input and output line (tributary). The limit depended on the Switch Room rack space, physical sending racks, and physical receiving turrets.

In Cincinnati the Switching Center room was divided into 4 major receiving "aisle" sections, spread over two aisles. There were 4 to 5 turrets per section spread over the two aisles. However, since many local out-stations (tributaries) came into concentrators, they shared receiving positions with other out-stations. There were two sending aisles, also divided into 4 to 5 sections. Sending aisle positions were "racks" with a sending position on the upper level and a sending position on the lower level.