STATE OF CALIFORNIA
ATSS/DS
SYSTEM DESCRIPTION

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1. GENERAL

1.01 This section provides an overall description of the State of California Automatic Telecommunications Switching System arranged for Data Services (ATSS/DS).

1.02 (Reserved for future use)

2. INTRODUCTION

2.01 The State of California ATSS/DS is part of the Statewide Data Switching Network (DSN). It utilizes the DSN to interconnect digital terminals/stations and computer ports located at various state agencies and colleges throughout California (Fig. 1). (Complete description of the DSN is covered in Sections 314-900-918PT thru 314-900-999PT.)

2.02 There are 19 campus locations throughout the state that connect to the network. Each campus location interfaces with the network via a (M3212-1) multiplexer. The trunk feeds between the multiplexer and the (M3201-2) data switch will utilize 208- and 209-type data sets depending on the requirements of the individual campus. The switch locations in the primary configuration are as follows:

Sacramento — 1407 J Street, Central Office

Los Angeles — 111 North Union Avenue, Room B-1, Central Office

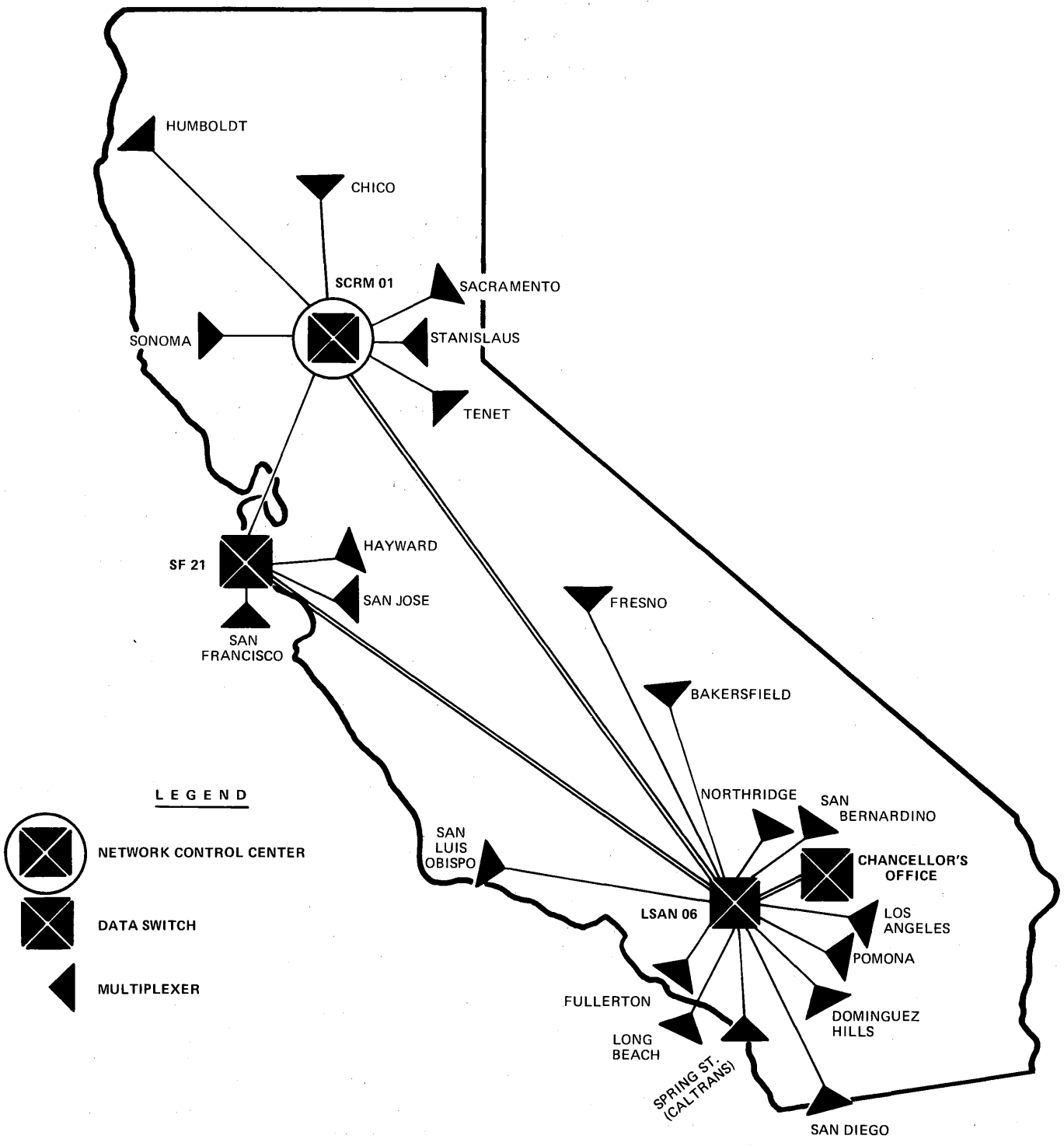
Los Angeles — State University, Data Center (Chancellor's Office) 27th Floor, CA Fed Bldg
5670 Wilshire Boulevard

San Francisco — 611 Folsom Street, 5th Floor

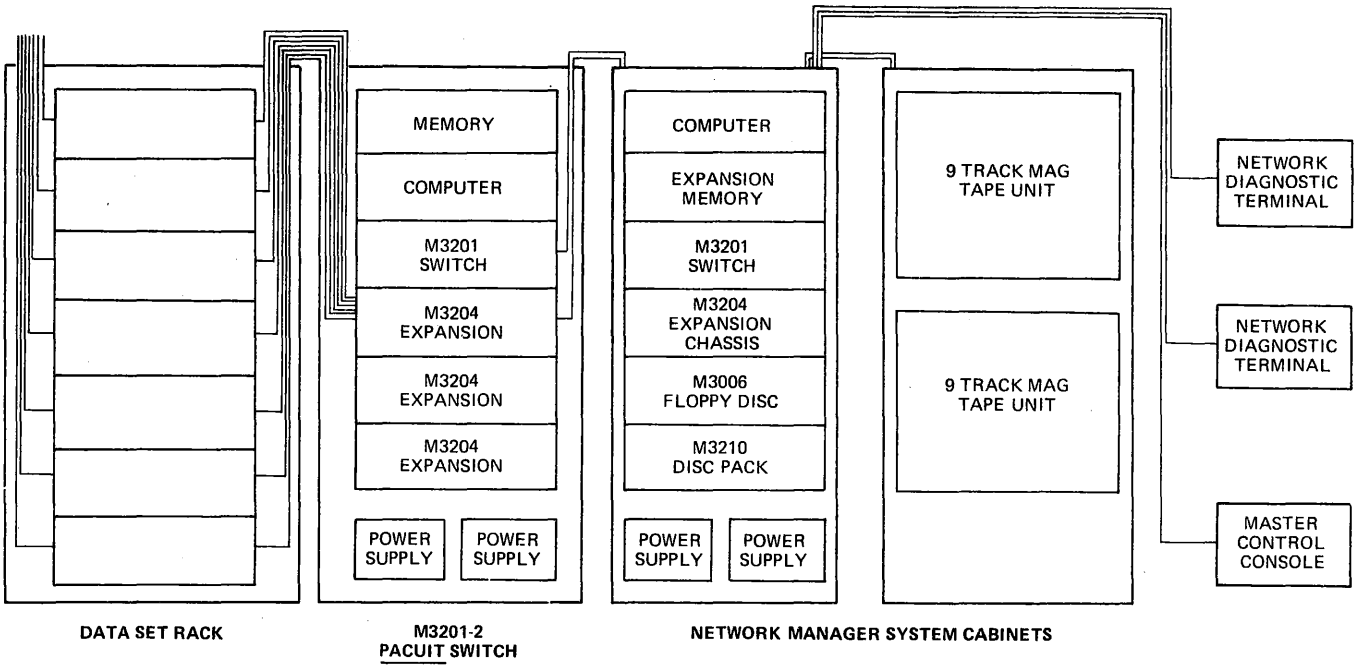
2.03 The trunks between switches are initially a combination of voiceband 209-type data set links at 9600 b/s and a wideband 303-type data set link at 230.4 kb/s via T-carrier.

2.04 The Network Manager System (NMS) described in Section 314-900-918PT will be colocated with the (M3201-2) data switch at the Sacramento location. (See Fig. 2).

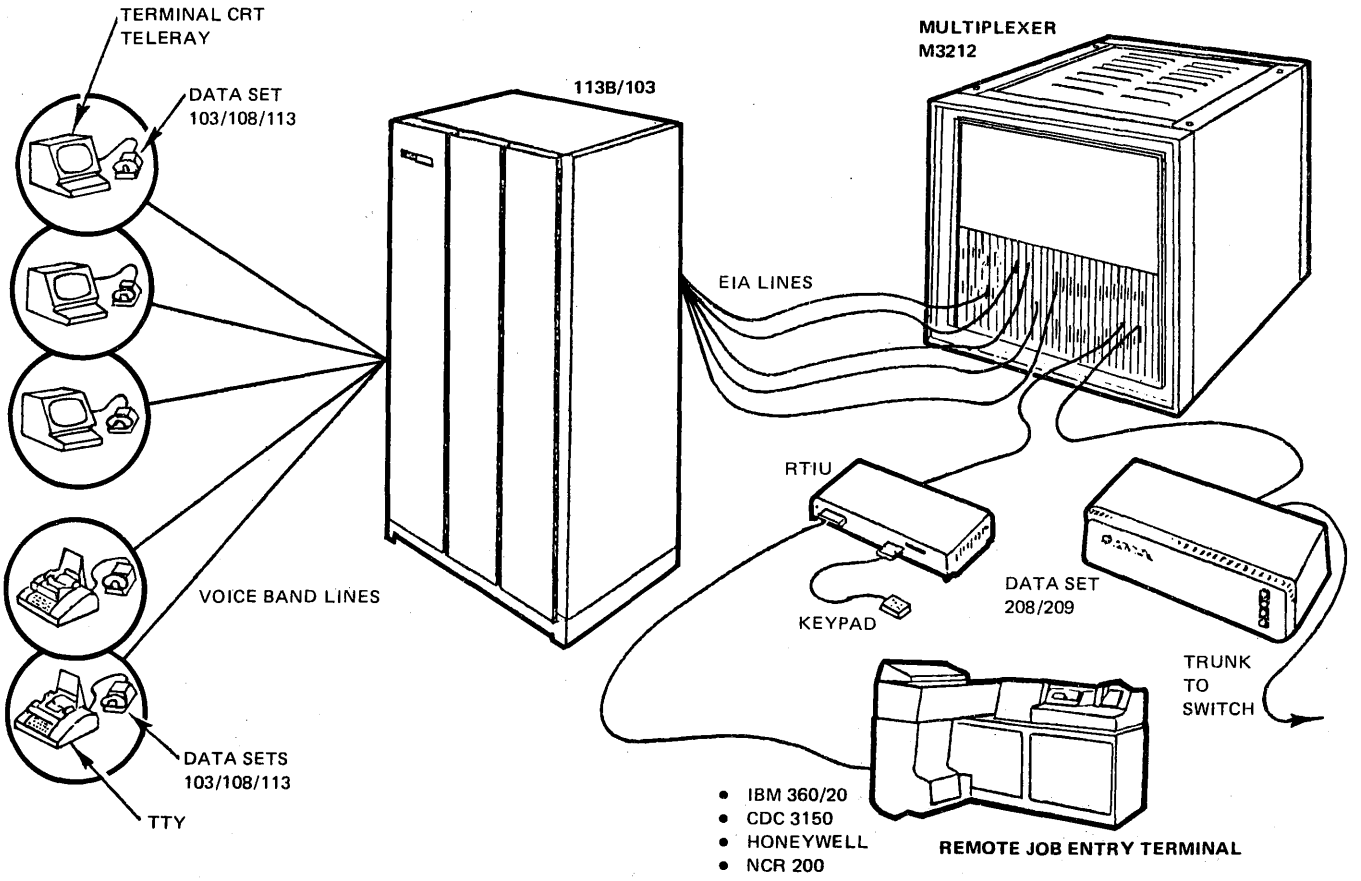
2.05 Figure 3 is a typical campus configuration used throughout this system. Both asynchronous and synchronous terminals are used. Asynchronous terminals are Teleray cathode ray tube (CRT) and Model 33 ASR Teletypewriters (TTYs) that are input to the network via voicegrade data sets to the (M3212-1) multiplexer. Synchronous terminals are known as RJE (Remote Job Entry) terminals. The various manufacturer types presently being used at the 19 campus locations are listed in Table A.



State of California ATSS/DS System
Fig. 1



Sacramento Central Office Location
Fig. 2



Typical Campus Configuration
Fig. 3

2.06 The synchronous terminals will interface to the network via the (M671) Remote Terminal Interface Unit (RTIU) covered in Section 314-900-956PT. The RTIU and RJE terminals are located adjacent to the (M3212-1) multiplexer (within 50 feet EIA cable).

TABLE A
SYNCHRONOUS TERMINAL TYPES

LOCATION	MANUFACTURER
1 Humboldt	Control Data 3150
2 Chico	Control Data 3150
3 Sacramento	Control Data 3150
4 Sonoma (2 terminals)	NCR Model 200
5 Hayward	Control Data 3150
6 San Jose	Control Data 3150
7 San Francisco	Control Data 3150
8 Fresno	Control Data 3150
9 Stanislaus	IBM 360/20
10 San Luis Obispo	IBM 360/40
11 Los Angeles	Control Data 3150
12 Bakersfield	IBM 360/20
13 San Bernardino	IBM 360/20
14 Fullerton	Control Data 3150
15 Long Beach	Control Data 3150
16 Dominguez Hills	Honeywell Model 200
17 Northridge	Control Data 3100
18 Pomono	Control Data 3150
19 San Diego	IBM 360/40

3. SYSTEM DESCRIPTION

(A) GENERAL

3.01 ATSS/DS provides a network capable of interconnecting digital data terminals and computers. The system utilizes data switches to concentrate, multiplex, and route traffic. These switches are connected via high speed data lines (4.8 to 56 kb/s). Time division multiplexers are used at remote locations to provide efficient use of facilities by concentrating access lines required to support the network. A network control center (NCC) provides system management, diagnostics, and control. Data is normally transmitted over the shortest available route, or if this route is busy, any other alternate route connecting the various switches.

3.02 Terminals or stations are typically TTYs, CRT devices, and RJE terminals. Terminals may be connected to switches either directly, by appropriate data sets and lines, or via remote multiplexers. The multiplexers provide remote concentration of several terminals, combining the output of these terminals over one or more synchronous data lines to the network data switch.

3.03 The system allows for expansion and addition of data switches and multiplexers. Multiplexers may be converted to switches as required by growth.

3.04 Security is provided by partitioning. This restricts user terminals from making improper connections. Partitioning is provided by assigning terminals to originating access groups and restricting these to specific terminating stations or computer ports.

3.05 The system is transparent to all data transfer; that is, the individual character codes will have no effect on the transmission after a connection is established. Initially, neither speed nor code conversion will be provided. Therefore, all terminals and computer ports that are assigned to the same access group must be compatible with each other.

3.06 The system uses standard EIA-RS232C interfaces for connection to communications terminals and lines. Provisions to interconnect with the "*Dataphone*®" Digital Service (DDS) are also incorporated into this network.

3.07 Other features which are available in the System include sign-on queuing, autobaud and echoplex for the user ports as well as error detection, retransmission, and automatic alternate routing on the trunk lines between switches.

3.08 The system is capable of establishing traffic priorities between switches. Top priority would be provided by reserving a spectrum on the line for a select access group. This group would then have service equivalent to a private line regardless of other traffic usage on the same line. In addition, asynchronous terminals can be assigned priority over synchronous terminals. Under this condition, as more asynchronous terminals are assigned line spectrum the traffic from the synchronous terminals will be restricted.

3.09 A minimum of 300 bauds of line spectrum will be reserved for each synchronous terminal to prevent it from timing out under heavy load conditions. Traffic from such synchronous terminals will be controlled by the RTIU.

3.10 The simultaneous assignment of asynchronous terminals to line spectrum is limited to that available. This will prevent system overload under normal operating conditions.

3.11 Diagnostic reports of any major failures will be automatically received in printed form for review by the System Manager. In addition, error rates exceeding preset threshold levels will be reported automatically. Cumulative error totals for the current day and hour will be transferred to the NCC and summaries will be available to the System Manager on demand.

(B) FEATURES

3.12 ATSS/DS provides two modes of switching data traffic, the packet mode and the circuit switch mode. The packet mode provides error detection and retransmission between calling and called switches, and provides maximum line utilization for interactive type traffic. This is the most efficient scheme in the current state of the art. Data from user terminals or host processors is assembled in packets at the originating switch and disassembled at the terminating switch.

3.13 Circuit switching is used for high density traffic that maintains its own error detection and correction scheme (ie, synchronous traffic). Using the circuit switch mode reduces transmission delay and maximizes line utilization by directly connecting the host to the transmission terminal.

3.14 System security is provided by partitioning. This prevents user terminals from placing unauthorized connections. Partitioning is provided by assigning terminals to access groups. Assignments are resident in software tables, in each data switch, for all terminals and computer ports served by that switch. These assignments may be changed only from the System Manager's terminal in the NCC. The tables define all access groups with which each terminal or computer port is permitted to establish a connection. Both calling terminal switch and called terminal switch must verify the table assignment before the connection is established. All tables will periodically be checked against the NCC master file. This check will serve to verify changes, giving constant background surveillance of unauthorized attempts to modify tables. Up to 60 access groups are available for partitioning.

3.15 Security from casual monitoring of data on the trunks between switches is provided by the use of variable length packets. Characters from one terminal are interleaved with characters from other terminals on a continuously varying basis. Such assignments within packets will vary with the number of connections between the same serving switches, and is also dependent on the activity of those terminals.

3.16 The system is transparent to the codes and protocol used by the terminals or computer ports at each end of a connection, thus, if the two devices are compatible, and would successfully communicate with each other back to back, with the appropriate modems in between, they can also successfully communicate with each other through the DS network.

3.17 Automatic alternate routing is available for traffic between switches whenever more than one trunk route is provided. Alternate trunk routes may be direct or via other switches (tandem). Alternate routes may be assigned for automatic load leveling, if the State so specifies.

3.18 Users bidding for service to asynchronous switch ports will be connected to the extent that the aggregate asynchronous traffic offered does not exceed the trunk capacity. Bids exceeding this level will be placed in queue and users will be connected on a first-in, first-out basis.

3.19 For packet switching, error detection and correction is provided by the system for asynchronous traffic between switches. This is accomplished by collecting into packets the asynchronous traffic from all ports on a switch which have the same destination switch, and transmitting these packets with two appended CRCs (error detecting codes). In the event of a faulty transmission, a negative acknowledgement is returned from the destination switch and the packet is retransmitted.

3.20 If desired, a switch port or a multiplex port will be configured to echo characters as received from the terminal, providing a second error detection capability. This feature is available only

for full duplex terminals connected over full duplex facilities. A terminal served by a switch port will have the character returned from that switch port. A terminal served by a multiplexer port has the character echoed from the multiplexer.

3.21 Switch or multiplex ports can also be configured to monitor the parity bit, appended to each character, from terminals directly terminated on that switch or multiplexer. Both even and odd parity are supported by the system. A temporary record is maintained in the switch each time a parity error is detected. The switch will notify the NCC whenever a certain parity error threshold, measured in parity errors per unit time, is exceeded by any terminal. The System Manger may then disable the offending terminal at the customer's option.

3.22 No error correction is provided by the System for synchronous traffic, as synchronous terminals generally have built-in error detection and retransmission. If ATSS/DS were to duplicate error correction, the line utilization would be decreased and transmission delay increased.

3.23 The System establishes and maintains on magnetic tape a record, available weekly, of the following information on all calls:

Attempt time	Called Station
Connect time	Calling Station
Holding time	Initial Routing (for
Date	interswitch calls)

3.24 An asynchronous port can be configured to support terminals of different speeds via autobaud capability.

3.25 The packet mode of transmission between switches has an error rate objective in excess of one error in 108 bits. The error rate objective for the circuit switch mode of transmission is equal to that of existing facilities.

3.26 The transmission turnaround delay is measured, beginning at the time the last bit of a test character is received at the originating switch, continuing as the test character is transmitted to the terminating switch, looped back through the EIA interface at the terminating switch, and ending as the first bit is received back at the originating switch. Transmission delay in the packet mode, caused by the packing and unpacking of data for error detection, is not expected to exceed 300 ms in 90% of all transmissions. The circuit switch mode, used for a single switch, or for intermediate switches on a tandem link, or for synchronous traffic, is characterized by minimal delay of 3 to 4 ms depending on line speed. Transmission delay increases in order to maintain high reliability (low error rate), when increased system loading causes degrading line conditions.

3.27 Switches are designed to meet an objective of better than 98% availability. Terminals or computer ports directly served by a switch can, therefore, expect this type of reliability. Terminals of computer ports served through a multiplexer may experience more frequent failures, because alternate routing and retransmission facilities are not provided between multiplexers and switches.

4. MAINTENANCE PROCEDURES

4.01 Procedures and responsibilities for the overall maintenance of the State of California ATSS/DS System are covered in detail in Section 314-900-901PT.