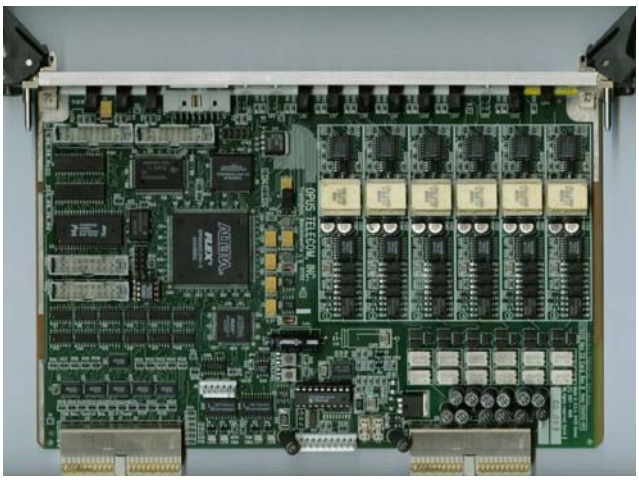
FMU -- 128 line High Reliability Hot Swap Phone Switch

Subscriber Solutions had won a Bureau of Prisons contract to deliver a high reliability modular PBX system and had eighteen months in which to deliver a fully working system. Bolton Engineering worked closely with Subscriber Solutions to create a detailed system specification so that the many subsystems could be designed and tested in parallel.

Boards were designed to be removed from or inserted into the system while the power was running without losing ongoing calls ("hot swapped"). Redundant TDM (Time Division Multiplex) highways and control busses were implemented to ensure that single-point failures did not stop other system elements from working.

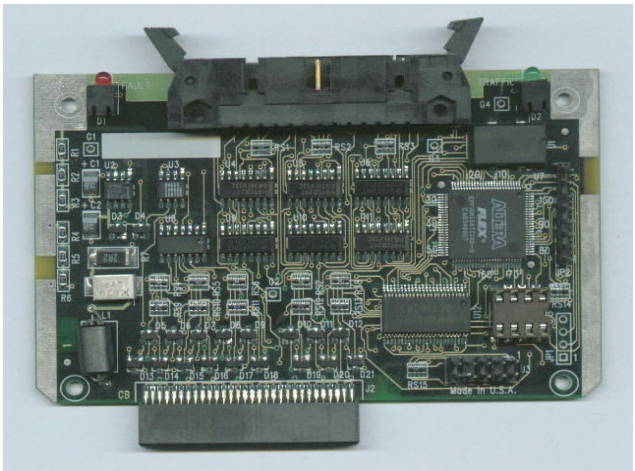
Station Card

- Supports six phones
- Includes one spare interface that may be allocated to any phone line in the event of a failure
- Generates dial tone, plays back voice prompts
- Detects "Yes/No" and DTMF tones
- Interfaces to backplane, supports card hot-swap



Central Office Card

- Connects to six central office lines
- Manages all aspects of phone control
- Generates DTMF, plays back voice prompts, detects call completion/end, detects SIT tones, times calls for billing
- Detects "Yes/No" and DTMF tones
- Interfaces to backplane, supports card hot-swap



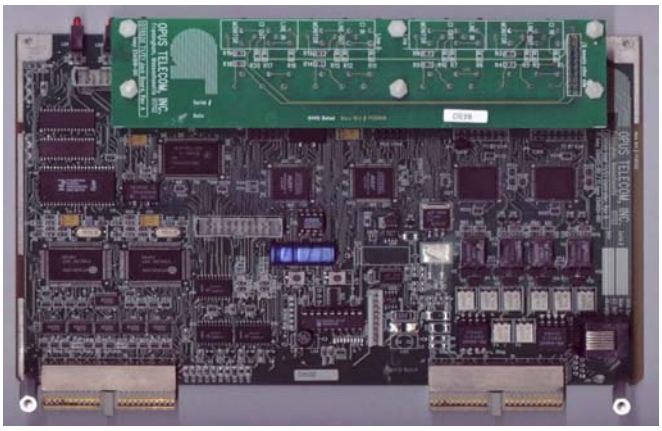
Interchassis Bridge Board

- Connects two separate chassis together over high-speed multiplexed link
- Minimizes frame "slip"
- Detects errors and reports link integrity to CPU
- Interfaces to backplane, supports card hot-swap

72 Stone Place, Melrose MA 02176, tel: (781) 662-1670

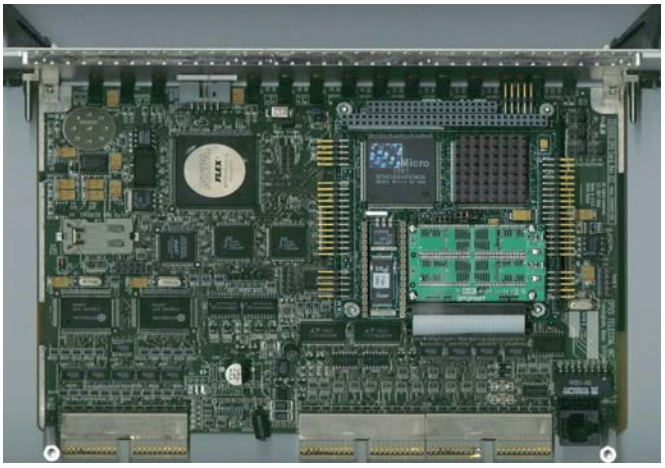
Bolton Engineering, Inc. Workscope

- Translated 400 page customer requirements document into 50 page technical specification
- Designed all schematics, Programmable Logic Devices (9 PLDs) and 5 circuit boards
- Wrote board-level firmware for three boards, and integrated voice / tone detection and generation IP.
- Wrote specification for backplane and power supply
- Tested and qualified design
- Passed all regulatory testing on first testing: FCC parts 15, 68, UL 1459, UL 1950, IEC 1000-4
- Controlled documentation and synchronization between 5 PCB Designs, 9 PLDs, and 3 software sets.
- Produced 70 page hyper-linked product reference guide describing system operation
- Completed project over a fifteen month time frame



T1 / E1 Line

- Interfaces to central office T1/E1 line (48 or 64 DS0 lines)
- Manages facilities link, message channel (TCP/IP), and diagnostics
- Generates DTMF, plays voice prompts, detects call completion/end, detects SIT tones, times calls for billing
- Detects "Yes/No" and DTMF tones
- Interfaces to backplane, supports hot-swap



CPU Card (two per system)

- Runs Linux operating system
- Manages call billing database
- Runs system diagnostics
- Controls TDM bus switching
- Includes two V.35 lines, one ethernet port, V-35, RS-530, RS-232, RS-422 serial interfaces, IDE disk controller
- Generates dial tone, plays voice prompts
- Interfaces to backplane, supports card hot swap

Backplane (not shown)

- Specified by Bolton Engineering, designed by vendor
- Up to 18 cards per backplane
- Up to 2 backplanes per system
- Provides breakout for I/O, station connectors, T1/E1 wiring, and power supply cabling
- Staged backplane connector pins support card hot swap

Power Supply (not shown)

- Specified by Bolton Engineering, designed by vendor
- Supports card hot swap

2 Connector Rd, Andover MA 01810, tel: (978) 474-0600