

Scio Systems and LynxOS put the U.S. Mail in its Place



Founded in 1990, Scio Systems, Inc. provides real-time process-control software for the material-handling industry. The company specializes in hard real-time environments in which absolute system determinism and high-level reliability are critical.

Scio Systems' largest customer, the United States Postal Service®, has relied on the company's flagship mail-sorting system for more than a decade to accurately process and distribute parcels nationwide.



For over ten years, the United States Postal Service (USPS) has counted on Scio Systems and LynxOS® to efficiently sort the country's mail.

United States Postal Service (USPS) bulk-mail centers (BMCs) are highly mechanized mail-processing plants that comprise the national bulk-mail system. These facilities distribute parcel post, media mail, standard mail, and periodicals in bulk form.

Scio Systems' fixed mechanization process-control system (FMPCS) is a unique computer hardware-software system that controls USPS sack, parcel, and large parcel sorting machines; timeshare conveyor systems; container-routing (towline) systems; and specialized induction systems. FMPCS computers communicate with each other over an Ethernet local-area network using TCP/IP-based communication protocols. Currently, 21 BMCs operate in the United States, and each contains at least six FMPCS-controlled sorters. FMPCS also runs at 35 processing and distribution centers, eight airport mail centers, four international service facilities, and at the USPS National Center for Employee Development.



The Scio way to sort

A typical FMPCS-controlled primary parcel sorter at a USPS BMC is a carousel tilt-tray sorter approximately 1600 feet long and containing 120 chutes that feed conveyor belts leading to truck docks, slides, or other sorters. A sorter may include roughly 700 trays, and each tray can carry a parcel. Equipped with wheels, the tray assemblies connect to one another to form a chain that moves along a track at about 360 feet/minute, driven by either a bullwheel (a very large toothed wheel) or by linear induction motors. FMPCS software 'knows' the content of every tray and the chute at which the tray should be tripped, and monitors sorter motion using various kinds of encoders. When a tray is aligned with the proper chute, FMPCS software raises a pneumatic tipper arm that tips the tray sideways as it passes by, causing the parcel to slide off the tray and down the chute.

FMPCS software also controls belt-type sorters, which consist of both a long conveyor belt with pushers or paddles that divert a parcel off of the belt and

into a chute, as well as shoe-type sorters designed to handle large or odd-shaped loads. At BMCs, FMPCS software also controls a 'towveyor' system that transports wheeled containers around the facility, taking empty containers to container loaders on the sorters, and full containers to truck docks.

FMPCS computers communicate with a variety of induction equipment, from manual keying stations to automatic parcel singulation and scanning equipment. Because of the generality and configurability inherent in FMPCS software, the same software can run at all FMPCS-supported sites. "As equipment configurations change over time, USPS personnel can simply change the configuration files," said John Dryden, president of Scio Systems. "A less flexible control system would require either recoding or a site visit by a controls vendor. FMPCS requires neither."

Guaranteed real-time determinism

The company's initial involvement with the USPS involved porting a sorter-control system from a proprietary mini-computer platform to a desktop PC. "We went looking for a UNIX[®]-compatible real-time operating system and found LynxOS," said Dryden.

Scio Systems originally selected LynxOS for its guaranteed real-time determinism and POSIX[®] compliance. "We chose LynxOS for our initial sorter controller port and stuck with it as the capabilities of FMPCS expanded because LynxOS has proven to be reliable and stable. We also like its small footprint. While many operating systems require increasingly more

hard drive space and memory with each release, LynxOS and our application still fit on seven diskettes, or a tiny portion of a CD, and run comfortably in 32 MB of RAM."

LynuxWorks' LynxOS real-time operating system (RTOS) blends performance, reliability, and scalability with patented technology for real-time event handling, and provides complete UNIX compatibility. It also meets strict POSIX conformance tests, making its application interfaces compatible with Linux. With a fully preemptable kernel featuring fast, deterministic context switching, LynxOS matched Scio Systems' requirements.

Powered by LynxOS, Scio Systems' mail-sorting system is installed in every USPS BMC in the country. Mail volume at a typical BMC is so large that many USPS sorters run around the clock. "For an application like FMPCS, we must know that sorter-control tasks will run when scheduled every single time, no matter what other activities are going on," said Dryden. "LynxOS provides the level of determinism and reliability that we need."

A decade of partnering

For over ten years, the USPS has counted on Scio Systems and LynxOS to efficiently sort the country's mail. "FMPCS-based sorter controllers run dependably with little or no operator attention. We see no compelling reason to change RTOSs. LynxOS is reliable and stable," said Dryden. "As we work to enhance our software, we certainly don't want to be distracted by operating system issues."

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