High-performance Linux Systems for Air Traffic Management

Mike Popescu
Ed Jennings
Concurrent Computer Corporation, Integrated Solutions Division

Air traffic control agencies and organizations throughout the world are today facing the challenges of improving and extending existing Air Traffic Management (ATM) control systems, at the same time attempting to reduce the operational service charges per unit aircraft. Increases in service and safety requirements, rapid economic growth in developing countries, existing route bottlenecks and higher traffic in general require ATM investments that go beyond a simple technological upgrade. All of these needs face the pressures of budgetary restrictions imposed by the current worldwide economic slow down.

Computer systems are utilized in most functions of existing ATM systems. Thus the computer plays a major role in achieving the above objectives, both as a core technology and as a cost factor. Building upon state-of-the-art hardware and software can greatly contribute toward reaching the intended functionality at minimum costs.

ATM projects are large, very complex and have long life cycles. During their life cycle, ATMs need to undergo frequent upgrades and changes. While some ATM sites use modern hardware and software technology, others rely on older heterogeneous connections of different computers. These systems may be from different manufacturers or belong to a completely different computer system generation. They often run different versions of an operating system or a different operating system altogether.

During an ATM life cycle, it was often more economic to add new functionality to an existing computer system rather than totally replace or upgrade the existing system. Usually these enhancements were implemented using new add-on technology or better-suited equipment that differed from the base system, e.g. high-performance networks and storage subsystems. This upgrade methodology inherently led to the wide variety of heterogeneous systems.

The above approach reflected the attempt of many ATM project managers to minimize expenditure and protect existing investment. As long as most systems remained proprietary, it was difficult to develop an optimal upgrade strategy. Their tendency was to buy from large, long-established companies under the assumption that such a hardware or software provider could ensure spare parts and support for the entire life cycle of the project. In today's world, many of those prevalent platform suppliers no longer exist.

With the evolution of lower-cost, commercial-off-the-shelf equipment, a major step forward was achieved in hardware upgrade solutions. With hardware standards like VME and PCI and state-of-the-art microprocessor technology, very powerful multiprocessor systems could be purchased at a third or less of the cost of the old proprietary systems.

Operating systems today remain the discriminating factor. There are basically three operating system choices -- UNIX, Linux and Windows. UNIX-based operating systems have prevailed in complex applications like ATM due to the power, maturity and robustness of UNIX. UNIX typi-

cally runs on more expensive platforms and not on low-cost PC hardware. Adding PC-based subsystems to a UNIX project means incorporating a second operating system (e.g. Windows) along with different operator interfaces, programming environments, file system types and training needs.

Neither UNIX nor Windows offer reassuring investment protection for the future. UNIX originally evolved as an open operating system, however, today most UNIX-based systems are very proprietary. There is also no assurance for long term support for any particular version of Windows.

The best solution lies in the open source movement, i.e. Linux and GNU. Linux has grown to be a solid alternative to UNIX and is underway toward becoming the "better UNIX". Today Linux runs on most commercial server platforms and most brand name PCs. Many manufacturers actively promote Linux on their systems due to the wide range of both open source and commercial applications that are available for Linux.

The Linux open source policy allows a user to possess and secure source code, thus eliminating a basic concern about dependency on a particular software supplier and the long-term maintainability of the deployed software. There are commercial companies that offer Linux maintenance support, therefore ATM project managers do not have to hire software engineers to maintain the operating system.

Subsystems within an ATM system often require a real-time operating system. In the past, adding real-time features to the UNIX operating system was the domain of companies that specialized in real-time systems. Today such companies, for example Concurrent Computer Corporation, have added their real-time enhancements system to Linux and now offer real-time Linux versions. Most of these companies have maintained an open source policy and ship their Linux source code with the computer system.

Today’s program managers for ATM projects may wish to review the advantages of Linux in their projects. Such advantages include low-cost multiprocessor hardware, available life cycle support, and a wide range of open source development tools and applications.