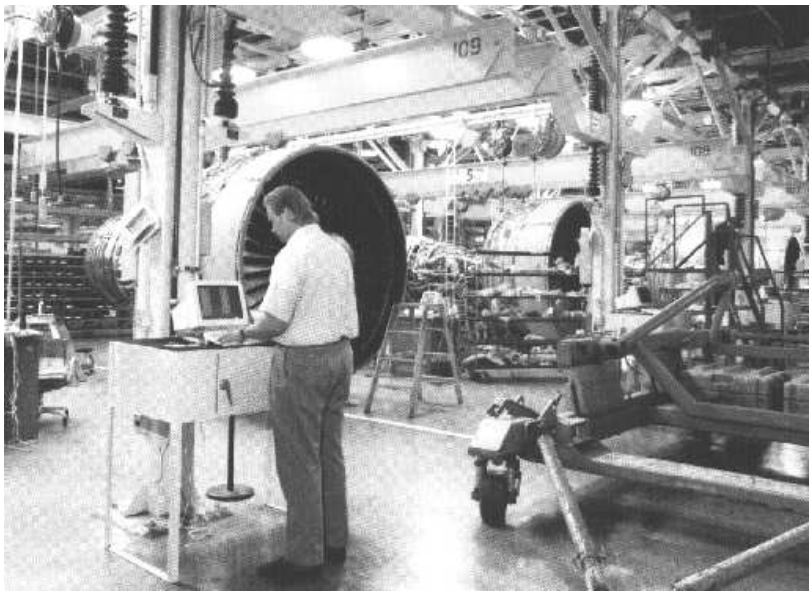
General Electric Aircraft Engine Corporation

DECmessageQ eases move to CIM

"The Queue Adapter was a big advantage to us. We were in a transition and could not replace all our systems at once. DECmessageQ has allowed us to go ahead and build the new applications as opposed to having to first port over our old applications to the new systems."

Scott Guilfoyle, GEAE project leader



The General Electric Aircraft Engine (GEAE) headquarters engine assembly and manufacturing plant at Evendale, Ohio, is deploying Message Oriented Middleware in a strategy that links shop floor control applications with a central MRP II system for all GEAE plants. The ability to accommodate old shop floor applications within a new environment has been critical to the strategy's success.

Meeting the Needs of a Transition

The GEAE plant used DECmessageQ to migrate from factory management applications running on Prime computers due for phase-out.

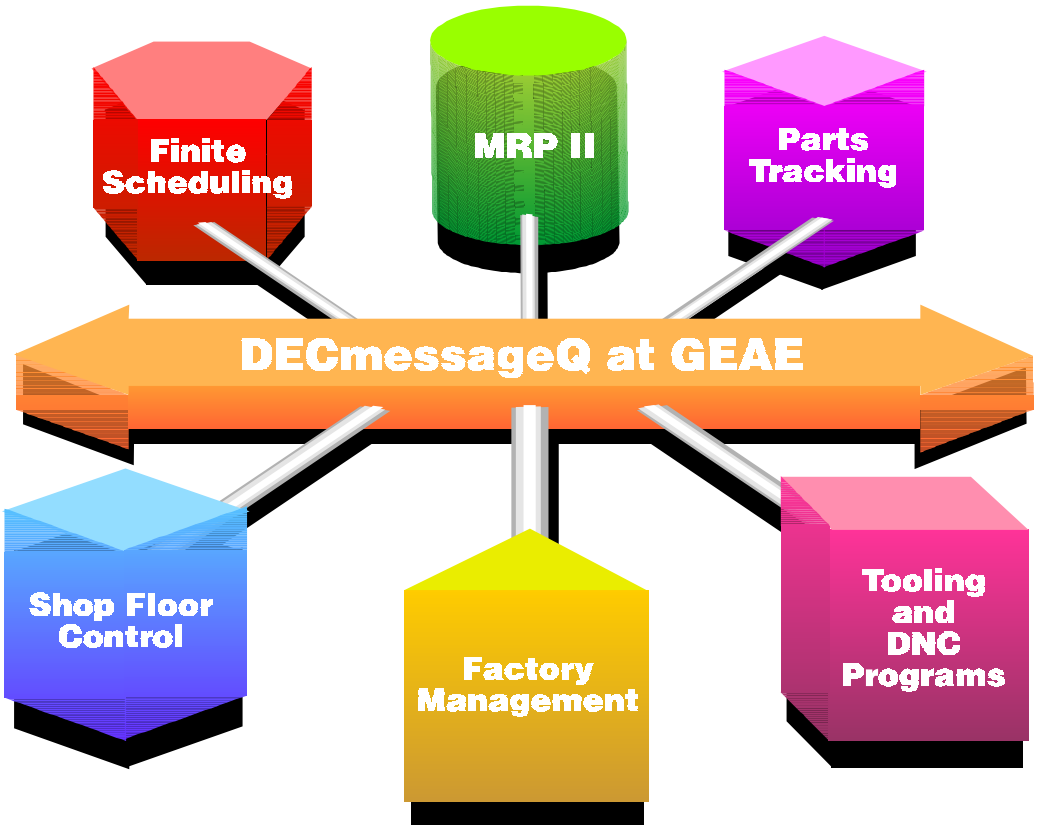
Using the Queue Adapter, the plant has been able to synchronize those applications with the databases on multi-processor systems from Digital.

At the Evendale plant, the factory management system is a client of message queuing services running on a Digital system. The server component "listens" for calls from the factory management system client to put updated data from its database into a queue destined for the database used by the Digital hosted applications.

On the Digital side, DECmessageQ calls were incorporated in software that also reformats the data for the database.

DECmessageQ Queue Adapter client functions are written in C, and can be ported to any system with a C compiler and TCP/IP sockets interface. Both the Queue Adapter and DECmessageQ incorporate all necessary network communications software.

To interface their own software, programmers merely insert the appropriate DECmessageQ calls that send data to or extract it from designated queues. “All we had to do was change one single line of code in the software on the Prime side,” said Guilfoyle.



How the GEAE Implementation Works

Any of the 400 turret lathe, laser drilling, or other component manufacturing stations on the factory floor at the GEAE plant afford one view of the plant’s data flow, of the critical interactions between the plant’s old and new applications, and the reason why the databases that serve them must match.

When an operator starts his shift, he logs into a PC at his station to scan in his badge number, the time and the serial number of the part waiting to be worked on at the station.

The same information is entered on completion of an operation and the start of each new one, providing the essential data that triggers many of the plant’s shop floor control applications.

The information entered at each operator’s station goes to the plant’s factory management system, where it updates the database used by applications such as parts tracking and time-and-attendance. In addition, that information is now passed from the Prime system to a DECmessageQ queue. From there, the data is picked up and fed into a shop database serving finite scheduling, tooling and other newly-installed applications.

“It’s essential that the factory management database is in synch with the shop database.” said Guilfoyle

Based on the data received from the Prime system, the finite scheduling application on the Digital system generates new plant schedules. Integrated with it is an application that loads the appropriate DNC programs into the machines at each manufacturing station according to the schedules.

When an operator at the station scans in a part number, the parts-tracking application on the Prime verifies that the part is ready for the operation about to be performed.

That application’s go-ahead back to the operator’s computer consists of releasing the DNC programs from the Digital system so that the operation can proceed.

A big step forward in progress to CIM

“The old way of keeping data updated was to separately input it into each application from different terminals,” said Virgal Fields, GEAE technical support team leader in component manufacturing.

“Then at night, it was collected and transferred between the applications in the form of batch files. One of the problems we had was that by the time all the data was synchronized, it was 24-hours old. If an operator had finished with a part at 12-noon, it sat there for 12 hours,” Fields said.

Selecting Message Oriented Middleware

Several years ago, the Evendale plant began to write its own messaging interfaces between some systems, using X.25 point-to-point communications lines to connect them. Data transfer was slow, programmers had to set up the X.25 protocols, and the difficulties were such that GEAE limited its implementation to a one-way flow.

Meanwhile, the plant's goals broadened, including a new plan to consolidate all its computer communications over its Ethernet LAN on TCP/IP transport protocols.

"We went to vendors who had program-to-program capability to ask for solutions," Fields said.

"Our criteria were that the solution could be used over our standard TCP/IP data communications link, that it be compatible with all our systems and that it transmit data structures that would be meaningful among applications on different computers," said Fields.

"Digital demonstrated DECmessageQ, and when we said 'What about the Prime systems,' they came up with the Queue Adapter. Now we have a pipe that allows data to be exchanged back and forth in real time."

A dependable method of communication for critical production systems

Reliability features in DECmessageQ were another drawing card, according to Fields. As the plant moves toward greater integration between applications, it also becomes more dependent on the underlying software that makes that possible.

Not only must the plant maintain its two databases in synchronization to keep production moving, but many other applications are interwoven.

For example, several applications separately process data to roll-up into a complete history of each part's manufacture, required by FAA regulations. The sequence of operations performed on each part, the machines and the tools used and a record of any re-work that took place, all must be separately tracked, and accurately included.

To attain maximum reliability, the GEAE plant chose to implement DECmessageQ's Message Recovery Services option which houses queues on disk rather than in volatile main memory. Should a failure occur in an application, the system on which it is running, or if a failure occurs on a communications lines, data in transit is preserved for delivery after the failed elements come back on line.

Integrating the shop floor with MRP II

The Evendale plant uses DECmessageQ's LU6.2 Services to exchange data between its factory floor applications and GEAE's central MRP 11 system for all plants, running on an IBM-compatible mainframe from Amdahl.

The LU6.2 Services option allows applications in the DECmessageQ environment to send and receive messages from programs running under CICS/VS and IMS/VS using IBM APPC (Advanced Program to-Program Communications) conversations over IBM LU6.2 sessions.

"The central MRP II system will blow customer order data down through that link to the distributed systems at each plant and they will send back the parts status data," said Guilfoyle.

In this case, no changes are required in programs on the IBM side to interface them to DECmessageQ. Fields expects all the plants within GEAE, one of the three large aircraft manufacturers worldwide, to adopt DECmessageQ.

"At Evendale, we are selecting the standards and trying to push them out to the satellites," he said. Plants in Wilmington, North Carolina and Lynn, Massachusetts have already installed DECmessageQ, and others will follow, Fields concluded.

Part of Digital's Enterprise Software portfolio, DECmessageQ runs on all major UNIX operating systems, OpenVMS, Windows NT, Macintosh, OS/2, Windows, MS-DOS(R), selected IBM environments via LU6.2, and on a wide variety of industry-leading hardware

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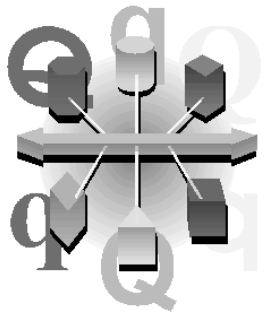

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