# Empress Offers an Effective Embedded Database Solution

By Craig S. Mullins

When it comes to computerized systems, there are many different types of applications, each with its own distinct requirements. Some require a bevy of bells and whistles to provide the needed service levels. Enterprise applications characterized by complexity and high volume typically require high availability and multiple tiers to meet the business requirements of the enterprise. But others benefit more from simplicity and ease of administration than from layers of functionality and complexity. Developers sometimes struggle when it comes to determining how best to manage the data needs of such applications. Frequently, these types of applications can benefit from an "embedded database" solution.

But what is an embedded database system? An embedded database system is one that can be linked with a client application, so that the application and the DBMS run in a single address space. By embedding the database into the application the application can be deployed as a single unified program that is functional, efficient, and self-contained. This approach differs from that of standard database management systems (such as DB2, Oracle, and SQL Server) that run as a separate process and require the application to connect to the DBMS using a form of inter process communication.

What is the advantage of embedding the database system with the application? Basically, by linking the application to the database, the delivered application system can gain from a reduction in overall complexity and a minimized cost of administration. An embedded database system is potentially most useful in a constrained system.

For example, consider the data needs of a standalone appliance or piece of equipment. Embedded databases have been used to provide the data requirements of applications ranging from intelligent switches and routers to bank teller systems to commercial appliances like DVRs (digital video recorders) to complex medical instruments and equipment. Chances are that most people rely on technology powered by embedded databases on a weekly, or even a daily basis.

As the integration of technology into consumer appliances becomes more pervasive, you will hear more and more about embedded database technology. You don't need all the bells & whistles and the accompanying overhead required of an enterprise DBMS running on your toaster! But a little embedded database hooked up to your TV that captures your viewing habits, reviews the schedule, and recommends programs to watch would be helpful. In fact, my TiVo does just that. It isn't in my TV yet, but it is attached to it. Eventually the technology will be made simple enough, and self-managing enough, that it can be embedded in home products without it causing problems. I mean, do you really want to have to explain to your Mom how a database problem brought down the TV and now she can't watch "The Guiding Light"?

As a more down-to-earth example, think of a web hosting application. The complexity of an enterprise database server is not necessarily warranted for such situations. Instead, an embedded database providing quick access to data is more desirable.

Keep in mind, though, that the embedded universe is very diverse. One embedded application might need to store a large amount of data, but require a small amount of memory. Another might require only a small amount of storage. Flexibility while minimizing resource consumption and administration requirements is necessary in the embedded DBMS market.

## Enter Empress

Clearly, the success factors for an embedded database solution differ from classic, enterprise database needs. Projects that require an embedded database need to be able to rely on their vendor's understanding of their special needs.

One successful vendor in the embedded DBMS market is Empress Software, Inc. Founded in 1979, Empress Software, Inc. is a privately held company that markets the Empress embedded DBMS directly to end-users, as well as through OEMs, VARs, and distributors worldwide.

The Empress embedded DBMS offers reliability and power within a small footprint as is required for an embedded database. Empress is configurable and the footprint of the database depends on the options you need. Delivering performance and service within a small amount of memory and disk is the hallmark of the Empress DBMS engine.

## Functionality

Sometimes technicians unfamiliar with the concept tend to dismiss embeddable solutions as lacking the functionality of a real DBMS, but that is not so with Empress. The Empress DBMS provides the features and functionality that you have come to expect with relational database systems. The full range of data types is available including 3 types of character data, decimal, currency, integer, date, time, and even multimedia data. Indeed, Empress is highly capable of managing the data requirements of demanding applications such as weather forecasting, space exploration, flight simulation and geographical information systems. Empress has also been utilized extensively in more traditional applications such as financial and banking systems, ERP systems, and Point of Sale systems.

Furthermore, Empress provides data integrity features like declarative referential integrity, range check constraints, and triggers that are sometimes lacking in early or "small" DBMS products.

Empress supports a robust implementation of SQL, as well. Features like outer join, EXCEPT, and INTERSECT, as well as a nice selection of aggregate and built-in functions make writing SQL in Empress a snap if you are familiar with the SQL implementation of other popular SQL DBMS products.

And you can access your Empress data using your favorite language, too. Empress supports a variety of different APIs in several programming languages, providing developers with flexibility and choice. APIs are available for Java, C, C++, HTML, and Fortran. And for C programming, there are multiple APIs from which to choose. Applications developed using these APIs may be run in standalone and/or server modes.

To assist with embedding your Empress databases, you can choose to use the optional Embedded Real-Time (ERT) Toolkit. The ERT Toolkit is a C language API that simplifies development by providing a number of abstract data objects in Empress.

## Resource Requirements

Keeping in mind the requirements for an embedded database, low resource consumption is important. Empress is highly modular; its footprint size depends on the host operating system and the options chosen for each Empress implementation. Indeed, Empress can work inside as little as 1MB memory. Keep in mind that a non-embeddable DBMS will require many megabytes at startup to store the database kernel, as well as to satisfy its caching and buffering requirements.

Of course, additional memory can improve performance of certain applications. In keeping with the flexibility required of embedded applications, Empress offers a utility that lets users enhance performance using Shared Memory, an operating system feature that allows several processes to share a specified section of main memory. By using Shared Memory to reduce file I/O, database performance can be improved.

You can even set up your Empress embedded databases to enable dirty reads. This can speed up performance by reading data from the database without any concern for locking. Of course, this can also cause data integrity problems because the "dirty" reader may be reading data that is not committed and stored in the database. This is not the place to get into a long discussion of dirty reads (sometimes called "uncommitted reads"); suffice it to say that supporting such a feature furthers the assertion that Empress is indeed a full-function DBMS, even if it is embeddable.

## Administrative Features

Empress eschews artificial constraints on the embedded databases you will need to support. Basically, sizes are limited only by the availability of virtual memory on your system and the constraints of your operating system, file systems, and hardware. To cite an example, a single Empress database can occupy an entire file system – or it can span several file systems if need be.

As we discussed in the introduction to this review, embedded solutions mandate that minimal database administration and system management be required. But in keeping with the flexibility theme, Empress offers database administration parameters and system variables to exert some control the Empress environment. Using these parameters and variables the DBA

can specify things like block size, logging requirements, and instrumentation details using the DBA parameters; and configuration details like directory and file locations, date format, and other aspects of operational behavior using the system variables. But in-depth monitoring and tweaking of the parameters is not required such as in many of the classic enterprise DBMS products. The goal is "set it and forget it" with these.

Empress also offers additional utilities for easing administration, including tasks for controlling database creation, database integrity checking, and so on. There are, of course, utilities for moving data, as well as backing data up and recovering it. Empress is, after all, a full function DBMS. Furthermore, if you need to replicate data from one database to another, the Empress Replication Server provides powerful features for distributing data from a source database to target database(s).

## Platform Support

Empress offers flexibility in terms of the platforms on which it will run, as well. The Empress DBMS is available in both client and server modes for all major UNIX, Linux, Free BSD, Windows and Real-Time platforms including: major UNIX implementations (Sun Solaris, HP-UX, IBM AIX, Compaq Tru64 UNIX, SGI IRIX, etc.), popular Linux distributions (Red Hat, SUSE, FreeBSD, etc.), Windows (NT, 2000, XP), Mac OS X, and a wide array of real-time environments (QNX 4 & 6, Lynx O/S, Bluecat, RTLinux, MontaVista, etc.). Of course, this list is not comprehensive, so be sure to contact Empress if your favorite platform is not shown here.

Empress is available for many combinations of hardware and operating systems. The Empress DBMS can be deployed on entry-level workstations as well as on high-end 64-bit multi-processor servers.

## Industry Implementations

Empress boasts an impressive list of clients, which have used the embedded DBMS to support a varied and interesting list of applications and systems. For example, the Advanced Battlefield Computer System (ABACUS), a war game simulation, uses the Empress embedded DBMS to store thousands of pieces of information from weapon system ranges, to weather conditions, to vehicle loading time. ABACUS is an internationally NATO used training application that can be tailored to meet the specific demands of a variety of organizations, both military and civilian.

Another creative application of Empress is to support an automated weather distribution system. In the Satellite and Radar Data Ingest for the Automated Weather Distribution System, weather satellite image data and radar summary data are gathered at the U.S. Air Force Global Weather Center in Nebraska. The satellite image data is stored in mapped image databases using Empress.

Empress has even been used to help power space exploration projects. For example, the Empress embedded DBMS was used within POINTER (Planetary Observation Instrument Targeting, Encounter Reconnaissance), a subsystem of the Mission Sequence System (MSS) for the Galileo project. Empress was chosen because of its ability of quickly process huge amounts of bulk data such as, cloud and gas formations, temperatures, and instrumentation readings.

## Summary

Empress is embeddable. That means that you can include the Empress database engine linked to the application that uses it; you do not need to run a database server to use Empress.

Of course, you can also run Empress as a server, if you wish. For the embedded market, though, a server is not wanted or needed due to its complexity. Empress databases have been embedded into applications by many organizations from small to large. Empress' customers run their medical systems, network routers, nuclear power plant monitors, satellite management systems, and more using embedded Empress databases.

In short, Empress offers a reliable, powerful and cost-effective solution for embedding databases across a wide variety of platforms. You would do well to use it for the data needs of your embedded applications.