

New features in DB2 Everyplace let you take office resources with you – even when you leave the office behind.



Working Outside the Box

As mobile devices such as personal digital assistants (PDAs), smart phones, and handheld PCs proliferate, so do the applications available for them. Once used primarily for personal information management with simple applications for address books, calendars, and to-do lists, these devices are increasingly called on to support more complex applications that, for example, can browse the Internet or manage information from enterprise databases. PDA access to enterprise data and applications allows many business activities to take place outside the traditional brick-and-mortar office.

But implementing these complex applications on mobile devices poses many challenges. First, mobile devices operate in a somewhat constrained environment. Display, memory, and CPU speed have not yet reached the level of laptops and workstations (although they are heading in that direction). Those limitations can make porting existing enterprise applications to mobile devices difficult. Creating a whole new set of applications for mobile devices isn't very practical: IT departments need to be able to leverage existing applications by porting them to mobile devices or, at the very least, leverage existing database skills. And, the deployed applications have to require no management by the user. A mobile database solution that required field staff (such as insurance adjusters or airline gate agents) to create their own bidirectional indexes or run a REORG would cause more problems than it's worth.

Demands for anytime, anywhere data are changing the landscape of business. Recently, IBM extended and strengthened the capabilities of DB2 Everyplace version 7.2 to help meet the challenges facing mobile applications. Today, businesses can leverage the power of relational technology from "fingerprint"-constrained devices (my term for the tiny amount of space available for mobile applications on cellular phones and PDAs). I'll explain how the enhancements to DB2 Everyplace help you navigate the new terrain.

WHAT IS DB2 EVERYPLACE?

DB2 Everyplace is a small fingerprint (150KB) relational database and synchronization architecture designed to extend relational database functionality and enterprise data to mobile and embedded devices. It uses standard interfaces (such as SQL and JDBC), supports such popular programming languages as C, C++, and Java, and offers a point-and-click CASE tool for rapid application development and prototyping. DB2 Everyplace is compliant with the Synchronization Markup Language (SyncML), an emerging XML-based W3 standard that defines a protocol for synchronization data interchange. Theoretically, SyncML-compliant products could plug into a SyncML infrastructure, making it extensible and open.

Figure 1 shows a typical DB2 Everyplace environment. Three components make up the DB2 Everyplace solution: an application development CASE tool, the DB2 Everyplace database, and the synchronization server (SyncServer).

Each component received enhance-

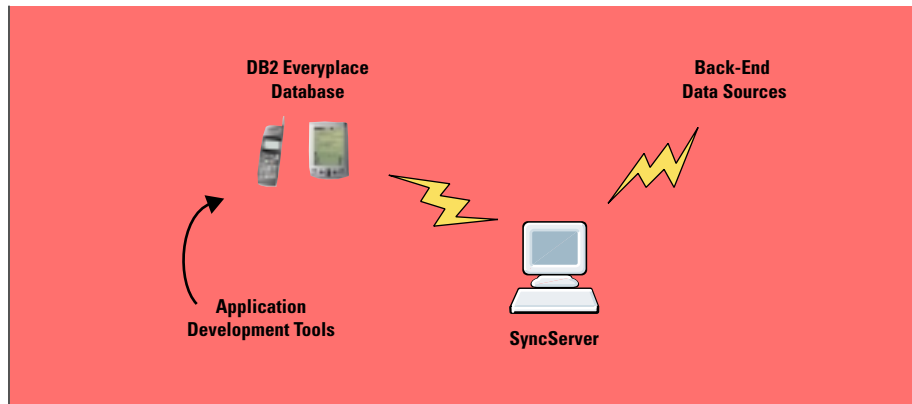


Figure 1: A DB2 Everyplace environment.

IT staff need to leverage existing applications by porting them to mobile devices

ments in DB2 Everyplace v.7.2, which I'll detail for you. *Note:* This article focuses only on the enhancements in the latest release of DB2 Everyplace. If you are not familiar with the functions, features, and benefits of DB2 Everyplace from earlier versions, you can find that information at ibm.com/software/data/db2/everyplace.

DB2 Everyplace v.7.2 introduces enhancements that add increased platform support to the core database engine, extend functionality, and improve performance. New database platforms include the Palm OS 4.0 and Symbian EPOC R6 (Quartz and Crystal) operating systems. Several devices using the Symbian EPOC operating system are expected in the latter part of this year, including the Nokia 9210 Communicator. The complete list of devices DB2 Everyplace supports includes Palm OS, Windows CE/Pocket PC, EPOC R5, EPOC R6, QNX Neutrino, Linux, embedded Linux, and Win32-based platforms. New midtier SyncServer platforms include AIX, Linux, and Solaris.

DB2 Everyplace v.7.2 extends the interoperability of mobile devices in a larger computing environment by enabling data access from any JDBC-compatible database and by supporting the SyncML standard. Performance enhancements allow better handling of synchronization data and the new indexing techniques, which I'll explain.

DB2 Everyplace v.7.2 includes several upgrades for application developers. This release marks the availability of several APIs that enable developers to build au-

tomatic synchronization into applications, access unlimited enterprise data sources, better monitor and manage the synchronization process, and customize data handling on the mobile device. Developers can also write applications in C, C++, or Java using any of the standard development tools, including IBM VisualAge Micro Edition, Metrowerks CodeWarrior, and Microsoft Visual Studio tools.

Let's look at the enhancements to each component in more detail.

DATABASE ENHANCEMENTS

In addition to the increased platform support I mentioned, DB2 Everyplace v.7.2 includes several additional database enhancements.

Remote stored procedure for query.

Specific enhancements to the DB2 Everyplace engine enable support for the Remote Query & Stored Procedure adapter. This adapter lets a DB2 Everyplace application open a new database handle while maintaining its existing handle with the local DB2 Everyplace database. This new database handle is used to invoke a stored procedure on a remote database and receive data back into a DB2 Everyplace table for local manipulation.

As an example of how this feature works in the real world, let's look at a healthcare vertical. A doctor can carry a drug application on his wireless PDA that lets him check drug interactions and write prescriptions. The doctor doesn't carry patient data on the device due to security concerns and storage limitations. When

prescribing a drug, the doctor can retrieve information about the drug (including its interactions with other drugs) locally at the click of a button. The application can then use this adapter to run a stored procedure at the Patient database to retrieve a drug history and verify that the patient has no allergy to the drug and that no dangerous interactions with other drugs the patient is taking will occur. Tapping another button completes the prescription and electronically sends it to a pharmacy to be filled. And this all occurs without the notoriously messy handwriting of the medical professional.

Indexing improvements. Indexing enhancements in this release of DB2 Everyplace include support for bidirectional index scanning. Now, a single index can support several different output ordering queries for a table. Creating an index on a table with multiple columns in the index will allow this one index to support the following ORDER BY operations:

```
ORDER BY X ASC , Y ASC
ORDER BY X ASC , Y DESC
ORDER BY X DESC , Y ASC
ORDER BY X DESC , Y DESC
ORDER BY X ASC
ORDER BY X DESC
```

Earlier versions of DB2 Everyplace required creation of at least four different indexes to support efficient execution of these operations. Apart from the maintenance issues associated with the creation of multiple indexes, a major benefit of this enhancement is the reduced amount of footprint that is dedicated to indexes. One index can now do the work of four — a very important feature considering the constrained architecture associated with pervasive devices.

In addition, the dirty bits used to mark changed data (at the row level) for synchronization by DB2 Everyplace are now indexed. Therefore, when the DB2 Everyplace database synchronization adapter is called on, DB2 Everyplace can assemble the data marked for synchronization in a more timely and efficient manner.

Basic transactions. DB2 Everyplace v.7.2 introduces the notion of atomicity by means of transaction support for the database. There are four requirements of relational databases: atomicity, consistency, independence, and dependability (ACID). A database is considered atomic when it can achieve an all-or-nothing process. For example, something either happens or it doesn't. This process is handled through transactions. Previously, every statement was automatically com-

mitted to the database. Transactions let you execute several statements and then either COMMIT or ROLLBACK all the operations performed within the set of statements. Listing 1 shows an example of a typical transaction using a COMMIT.

Extended DECIMAL and TIME-STAMP support. Earlier versions of DB2 Everyplace supported a 15-character DECIMAL data type in addition to TIME and DATE data types. DB2 Everyplace v.7.2 changes the DECIMAL data type support to 31 characters and introduces a better space management scheme. For example, in earlier versions, a DECIMAL value like 8.32 would require that all 16 bytes of storage be allocated to the data type. Now, DB2 Everyplace will compact the required storage in association with the size of the DECIMAL value; therefore, 8.32 may take as little as 4 bytes of storage, depending on the decimal precision.

The new TIMESTAMP data type uses the format *yyyy-xx-dd-hh-mm.ss.zzzzzz*, where *yyyy* is the year, *xx* is the month, *dd* is the day, *hh* is the hour, *mm* is the minute, *ss* are the seconds, and *zzzzzz* are the microseconds.

SQL enhancements. DB2 Everyplace v.7.2 INSERT operations now support SUBSELECTS, further extending the SQL API to the handheld version of DB2. For example, assume T1 and T2 are tables with the same definition. Consider the following insert:

```
INSERT INTO T2
SELECT *
FROM T1
```

The SUBSELECT of table T1 is used to INSERT all of the rows in table T1 into table T2.

Other SQL extensions to this version of DB2 Everyplace include the IN predicate, LENGTH function, and the RTRIM (right trim) function.

The IN predicate allows operations such as the comparison of values with other values selected or subsetted in a statement. For example, you can use the

following expression:

```
DEPTNO IN ( 'D01' , 'B01' , 'C01' )
```

The LENGTH functions will return the actual length of a VARCHAR, CHAR, or binary large object (BLOB) data type. The RTRIM function will remove blanks from the end of VARCHAR or CHAR string expressions.

Storage support. When running DB2 Everyplace on Windows 32-bit, Linux, or Neutrino operating systems, the DB2 Everyplace database and application can now be run directly from read-only media such as CD-ROMs or ROM chips in embedded devices. A real-world example is an insurance company that has disparate agents across the country, with wireless connectivity that is not robust enough to lend itself to a synchronization solution. Each quarter, sales brokers receive a CD-ROM that contains the complete offerings portfolio and a DB2 Everyplace application that lets them browse, display, and query the data. The DB2 Everyplace application could run directly from the CD-ROM and be completely hidden from the user, or it could be installed on the device and only read data from the CD-ROM. This feature empowers ISVs and roll-your-own application enterprises with the ability to hide the IT infrastructure from lines of business.

DB2 Everyplace v.7.2 also extends support for Compact Flash devices by using the Palm OS version 4 Secondary Storage API to support *all* secondary storage types implemented on Palm OS. This enhancement allows DB2 Everyplace to support databases residing in the TRG Pro Compact Flash slot or in the expansion slots for newer devices, including the Sony CLIE Memory Stick and the upcoming Palm SD Card. DB2 Everyplace can store data on Memory Sticks, Compact Flash Storage Cards, the IBM Microdrive (a Compact Flash device), MMC Storage cards, and SD Storage Cards. Now, pervasive applications have the advantage of applying mobile rela-

```
// autocommit off
SQLSetConnectAttr(...SQL_AUTOCOMMIT_OFF...)
// some update operation
SQLExecDirect(..., "select from employees where salary
> 150000", ...)
SQLExecDirect(..., "insert into employees where salary
> 2500", ...)
// commit the transaction (or rollback)
SQLEndTran(..., SQL_COMMIT)
```

Listing 1: Using transactions for an all-or-nothing approach.

tional techniques to large data sets that exceed the inherent capacity of the pervasive device.

Improved Command Line Processor (CLP) with BLOB support. DB2 Everyplace v.7.2 now includes a CLP application for all supported platforms. This code, included in the sample files that are shipped with DB2 Everyplace, is common across all platforms (including UNICODE and ANSI codepage support). The CLP includes source code for each operating system, has the ability to display BLOB columns (first 50KB), and supports `IMPORT` and `EXPORT` operations. Previous versions of DB2 Everyplace provided a CLP through the Query by Example application that was only available on Palm OS installations.

Most business users will not use the CLP to work with the database; however, it's an example of the true relational functionality on the pervasive device that's available if needed and gives application developers a method of testing and building applications.

DB2 EVERYPLACE APPLICATION DEVELOPMENT

The application development enhancements in this release center on the Mo-

Mobile applications should require no user management.

bile Application Builder (MAB). The MAB, part of the DB2 Everyplace suite, is a point-and-click rapid application development tool that can be used to create DB2 Everyplace applications. It is available as a free download from the Web at www.ibm.com/software/data/db2/everyplace. Previously known as the Personal Application Builder (PAB), MAB was renamed to better reflect its role as a general purpose, quick start mobile application. Various enhancements have been made to the MAB development tool.

Improved BLOB code support. PAB, the earlier version of MAB, required developers to write scripts to retrieve and store BLOB data in the DB2 Everyplace database. DB2 Everyplace v.7.2 now automatically generates code for storing and retrieving BLOBs, shortening the development cycle, and flattening the MAB learning curve.

Sync API support. With DB2 Everyplace v.7.1.1, IBM shipped an IBM Sync

C/C++ interface to allow developers to access client synchronization engine functions. MAB now allows application developers to call these synchronization functions from within applications developed using MAB, without writing a single line of code. Applications developed using MAB now support automated and programmatic access to synchronization functions. For example, instead of exiting the application and launching a synchronization session, a user could tap on an icon, select an option from a pull-down menu, or even rely on event-driven synchronization.

MAB support for DB2 Everyplace database enhancements. The new functions added to the DB2 Everyplace database can be used via MAB. For example, MAB includes functions to use the new `TIMESTAMP` and larger `DECIMAL` data types as well as the `SELECT DISTINCT` and `ORDER BY` operations. MAB also supports DB2 Everyplace databases lo-

Mobile tools are less powerful when used in isolation.

cated at nonlocal paths, such as secondary storage, compact flash, and the IBM Microdrive. Improved error handling and documentation will help users get this tool up and running quickly.

Enhanced sample visiting nurse application (VNApp). The enhanced VN-App, now called VNPlus, includes all of the interface widgets supported by MAB. For example, the enhanced sample application includes a digital signature that represents a nurse's signature on record. A tutorial helps users transform VNApp into the full-featured VNPlus sample and provides guidance on using all of MAB's features.

DB2 EVERYPLACE SYNC SERVER

The enhancements to the DB2 Everyplace v.7.2 SyncServer raise the bar for all synchronized pervasive database solutions on the market.

Additional platform support. DB2 Everyplace v.7.2 expands the supported SyncServer platforms to include AIX, Solaris, and Linux, in addition to Windows NT/2000. DB2 Everyplace SyncServer now supports synchronizing with all client DB2 Everyplace platforms, including Palm OS, Windows CE/Pocket PC, EPOC R5, EPOC R6, QNX Neutrino, Linux and embedded Linux, and Win32-based platforms. Previous versions of DB2 Everyplace on Windows 32-bit operating systems did not support synchronization.

JDBC adapter. Perhaps the single most significant enhancement to DB2 Everyplace v.7.2 is the addition of the powerful JDBC adapter that enables access to any back-end, JDBC-compliant data source, including Oracle, Sybase, SQL Server 2000, Informix, and DB2. The JDBC adapter for SyncServer is a new relational data adapter that works with the existing DB2 Everyplace database client adapter on the mobile device. In earlier versions of DB2 Everyplace, the DB2 Family adapter, which uses Data-Propagator (DPropR), was the only relational data adapter. The JDBC adapter doesn't use DPropR technology. Instead, it relies on custom code created to work with triggers in the source database to maintain a synchronized environment — all transparent to the administrator.

You can create a special implementation of the JDBC adapter with a new PUT

option. This option provides for one-way inserts into the enterprise data source. For example, with this option, a parking enforcement officer could enter a parking ticket into the system, and the ticket information would be sent to the enterprise data server. No information needs to be returned or synchronized with that attendant's PDA. JDBC subscriptions with the PUT option bypass mirror databases and only perform an INSERT on the enterprise data source. If, for some reason, the enterprise data source is not available, the synchronization would fail.

Conflict improvements. Several improvements enhance the conflict handling of the DB2 Everyplace SyncServer and pervasive devices. The SyncServer now logs all rejected rows at the server. This feature gives administrators better insight into situations that cause conflict and enables them to tune a user's synchronization configurations to avoid as many conflicts as possible by formulating business rules for sync time and segregation of data. The enhanced DB2 Everyplace SyncServer now supports a user exit whenever a conflict is logged. When a conflict is detected, the administrator has the option to call some custom code to take additional action in response to a conflict. For example, a user exit could call a mail API to send a message to a system management tool, notify an administrator of the conflict, or even email a user with a conflict notification.

Encryption over the wire. DB2 Everyplace v.7.2 introduces optional encryption for all communications sent out over the TCP/IP connection between the DB2 Everyplace SyncServer and the pervasive device — a necessity for e-business. This encryption prevents unauthorized parties from "sniffing the connection" and logging the data sent between the SyncServer and the pervasive device.

The encryption implemented by DB2 Everyplace v.7.2 is based on the data encryption standard (DES). DES implements symmetric encryption, which means that both the client and server use the same key to encrypt and decrypt the WBXML message. Symmetric keys are quicker than asymmetric keys — a method that uses different encryption keys on each side of the communication wire. Virtual private networks implement asymmet-

ric encryption keys.

An administrator has the option to implement no encryption, 56-bit encryption, or 128-bit encryption, which provides the security level demanded by business models that involve sensitive data such as credit card numbers or health records.

Vertical partitioning columns of source data. The subscription facilities in DB2 Everyplace SyncServer v.7.2 add column partitioning of source data for use in data subscriptions. This allows administrators to select from a large table the columns they want to synchronize to the mobile devices.

A typical example is a Personnel table in the Human Resource's departmental database. A Personnel table may contain information about all employees in the company in columns such as Office_phone number, Office_faxnumber, Email_address, Title, and Salary. Portions of the Personnel table could be used for a company directory lookup application; however, data such as salary information is confidential. Vertical partitioning would allow an administrator to use a table that contains both sensitive data and important business data by selecting just the important business data columns for synchronization to the mobile devices. In our example, the Salary column (the sensitive data) could be left securely inside the enterprise.

MOBILE DEVICE ADMINISTRATION CENTER

DB2 Everyplace v.7.2 includes enhancements to help minimize the management of the pervasive environment. Check Clause support allows for the definition of multiple Check Clauses for columns of a data subscription. The size of the Check Clause field has been extended to 1,024 characters. Existing Check Clauses on the source database can be automatically extracted and stored in the Check Clause field. An administrator can also define Check Clauses for the mobile database using a simple comma-delimited format. All of these enhancements allow administrators to work business rules into the synchronization architecture.

DB2 Everyplace v.7.2 also includes new index management tools in the mobile device administration center (MDAC) that allow administrators to manage the creation of indexes for the tables on mobile devices. For example, an administrator may feel that a new index could improve the policy lookup function in an insurance application. The administrator could define this index, and on the next

client synchronization, the index would be created on the pervasive device. However, once the index is created, it isn't synchronized between the source server and the mobile device. You can define up to 10 columns in one index using a wizard similar to the DB2 Control Center Create Index wizard to point and click the columns to use in the table index, as well as specify index ordering (ascending or descending). Indexes can also be extracted from JDBC source databases, which allow administrators to reuse existing index definitions where possible.

Automated installation of DB2 UDB Workgroup Edition. In earlier versions, you had to have at minimum DB2 Personal Edition installed for the DB2 Everyplace SyncServer. DB2 Everyplace v.7.2 includes the option to automatically install and configure DB2 UDB Workgroup edition as part of the installation.

Publish adapter API and IBM Sync API. The APIs used for client and server Sync Adapters and the IBM Sync API will now be published in the documentation. Open APIs allow developers to expand and enhance DB2 Everyplace SyncServer functionality. The Client Sync Adapter API allows developers to write new adapters to support additional data types, data

handling, and client data sources on the mobile device side of synchronization. Using this open API, developers could write their own adapters to handle the transfer of proprietary data files.

The Server Sync Adapter API allows developers to write new adapters to support additional data types, data handling, and source data sources on the DB2 Everyplace SyncServer side of synchronization. The IBM Sync API allows programmatic access to synchronization functions of the IBM Sync Client synchronization engine. Application developers can now add buttons to automatically start synchronization from within their custom applications, avoiding having to force users to use the IBM Sync Application to perform synchronization.

KEEPING CONNECTIONS OPEN

Mobile computing has become a competitive requirement in today's information-driven economy. Laptops have long been standard equipment for business travelers. Today, handheld devices, some of which can connect through wireless networks, are springing up everywhere. But these powerful mobile tools are limited if used in isolation. A laptop or PDA by itself doesn't do a salesperson much

good if the corporate database changes in the middle of a business trip. To maintain their competitive edge, mobile professionals need seamless access to enterprise data, no matter where they may be.

The true power of pervasive computing resides not in the devices themselves but in their ability to tap into data from other sources. DB2 Everyplace brings the power of DB2 to mobile devices, leveraging their ability to synchronize data with other systems and literally putting enterprise data in the pocket of the mobile workforce. ●

Paul Zikopoulos is a database specialist with the IBM Global Sales Support team with more than six years of DB2 experience. He has written numerous magazine articles and books about DB2 for *DB2 Magazine* and other publications and is a coauthor of the books *DB2 for Dummies* (Hungry Minds Inc., 2000) and *DB2 Fundamentals Certification for Dummies* (Hungry Minds Inc., 2001). You can reach him at paulz_ibm@yahoo.com.

RESOURCES:

DB2 Everyplace

www.ibm.com/software/data/db2/everyplace