UniSQL/X Unified Relational and Object–Oriented Database System

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The UniSQL/X unified relational and object–oriented database system is designed to support application development in either a conventional host programming language (such as C), or an object–oriented programming language (such as C++ or Smalltalk). In particular, C++ programmers can take advantage of all the capabilities of UniSQL/X in C++ programming style by using the UniSQL/X C++ Interface. C programmers can access the UniSQL/X database by using the Embedded SQL/X (object–oriented SQL) Preprocessor and/or the UniSQL/X API (call level interface).

The UniSQL/X kernel is designed to fully support a superset of the Core Object Model adopted by the Object Management Group (OMG) consortium. The OMG Core Object Model includes such key object–oriented modeling concepts as encapsulation of data and methods, object identity, multiple inheritance, arbitrary data types, and nested objects.

Application developers, whether or not they use an object–oriented programming language, can reap the benefits of an object–oriented database system, while retaining all the benefits of a relational database system and (an object–oriented superset of) ANSI SQL. Developers no longer spend time working around three critical deficiencies of relational database systems; specifically, the inability to manage arbitrary data types, the inability to naturally model hierarchical data structures, and the inability to deal with aggregate data structures. Further, application developers can take full advantage of methods to encapsulate arbitrary programs with stored data, and multiple inheritance to reuse existing database schema designs and methods.

Just as importantly, application developers can continue to make use of all the database facilities engineered into relational database systems, including views, automatic query optimization, transaction management, concurrency control, dynamic schema evolution, access authorization, trig-

gers, and so forth. The UniSQL/X database language faithfully incorporates the semantic extensions to most of these relational database features necessitated by the richness of the UniSQL/X object model.

UniSQL/X also provides a powerful framework for uniform data management and application development support for virtually all types of multimedia data (e.g., text, images, audio, graphics, etc.), and even physical or logical devices associated with multimedia applications (e.g., scanners, fax machines, satellite links, video cameras and displays, etc.). It even allows large unstructured data to be stored and managed in native operating system files, just as though they were inside the native UniSQL/X database. Further, the multimedia framework is fully integrated with the query processing and transaction management components of UniSQL/X, so that queries against multimedia data are supported and integrity is maintained for updates against multimedia data.

The performance of UniSQL/X at least matches that of the best relational database systems for ANSI SQL queries (multi–table joins, aggregation, grouping, etc.), while at the same time matches that of the best object–oriented database systems in performing navigational access among a cluster of related objects. UniSQL/X achieves its navigational access performance by including a workspace manager in the kernel. The workspace manager transforms such object identifiers to memory pointers when the referred objects are loaded into the virtual memory workspace (this is known as pointer swizzling). Once a cluster of related objects has been loaded into the workspace, it takes a memory pointer lookup to access an object, rather than an explicit query or cursor-based record fetch in a relational database.

UniSQL/X runs as a client/server system. UniSQL/X runs on SUN Sparc and Sparc–compatible workstations under SUN OS 4.1.x and Solris operating system; HP/Apollo 9000/700 and 800 series workstations under HP–UX; and IBM RS/6000 workstations under AIX. The UniSQL/X client is available on MS Windows 3.1.