Temporal Database in Depth:
Time and the Data Warehouse

a technical seminar for DBAs, data architects, DBMS implementers, database application programmers, and other database professionals

based on the book
Temporal Data and the Relational Model
by C. J. Date, Hugh Darwen, and Nikos A. Lorentzos
(Morgan Kaufmann 2003)

by

C. J. Date

ABOUT THIS SEMINAR

Two recent trends—the plummeting cost of storage and the widespread adoption of data warehouse technology—have led to an increasing interest in temporal databases; indeed, the idea of maintaining and processing historical data has become not just a goal but a reality for many organizations. As a consequence, the ability to deal properly with the time dimension in databases has become an increasingly important practical problem. Yet today's DBMS products offer absolutely nothing to help with this important requirement. What's more, the database research community has largely failed in this regard as well; many approaches have been proposed, but they have all have proved deficient in one way or another. Help is on its way, however. This seminar describes a new approach to the problem that looks set to address the (surprisingly complicated!) issue of proper temporal support—an approach that, let it be said immediately, fits squarely into the classical relational tradition.

Note: Since no commercial products support that new approach as yet, this seminar might be regarded as somewhat theoretical. But the relational model too was once "just theory"! Learning about the new temporal approach now is like learning about the relational model before there were any relational products. And just as relational knowledge was helpful (with database design, for example) even before there were any relational products, so temporal knowledge can be helpful with similar matters now, even in the current absence of temporal products.
TOPIC OUTLINE

The seminar falls into two parts. Part I, "Laying the Foundations," explains some of the basic problems of temporal databases (some of which are far from obvious, incidentally) and lays the groundwork for solving those problems. Part II, "Building on the Foundations," uses the material from Part I as a basis for addressing a variety of practical issues, including temporal database design, temporal integrity constraints, and temporal querying and updating.

1. Time and the database
   • The running example
   • Timestamped propositions
   • Fundamental questions
   • Constraints and queries
   • Semitemporal data
   • Fully temporal data

2. Intervals and interval attributes
   • Point and interval types
   • Allen's operators
   • Union, intersection, etc.
   • Sample queries
   • EXPAND and COLLAPSE

3. Packing and unpacking relations
   • PACK and UNPACK
   • Sample queries
   • Unpacking on n attributes
   • Packing on n attributes

4. Effect on the relational algebra
   • Existing operations
   • "U_" operations
   • An alternative perspective

5. Temporal database design
   • Current data
   • Historical data
   • Sixth normal form
   • "The moving point now"
   • Current and historical data

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6. Temporal constraints
   - "U_" keys and foreign keys
   - Generic constraints
   - Syntactic shorthands

7. Temporal queries
   - Current data
   - Historical data
   - Current and historical data

8. Temporal updates
   - A propositional interface?
   - Current data
   - Historical data
   - Current and historical data
   - Multiple assignment
   - "U_" updates

9. Stated times and logged times
   - Can history be updated?
   - Audit trails
   - Syntactic shorthands

DURATION

One day (approximately 6 lecture-hours).

WHO SHOULD ATTEND

The seminar is aimed primarily at technical specialists, not managers, though managers should benefit from it too (most of the technical material needed to understand the overall message is included in the seminar itself). Attendees will be expected to be professionally interested in database management. Thus, the target audience includes but is not limited to:

- DBMS designers, implementers, and other vendor personnel
- Database consultants
- Data and database administrators
- Information modelers and database designers
- Database application designers and implementers
- Data warehouse personnel
- Computer science professors specializing in database matters
- Database students, both graduate and undergraduate
- People responsible for DBMS product evaluation and acquisition

Prior attendance at the seminar Database in Depth: Relational Theory for Practitioners is strongly recommended.
OBJECTIVES

On completion of this seminar, attendees will:

• Appreciate the complexities of temporal databases

• Understand how the relational model provides an ideal basis for taming those complexities

• Appreciate the benefits of a truly relational approach to the problem

• Be able to use sound principles in designing and using temporal databases

• Be ready to analyze and evaluate commercial temporal products

DOCUMENTATION

Attendees will receive a workbook containing a copy of the speaker's slides. They will also receive a copy of the book Temporal Data and the Relational Model, by C. J. Date, Hugh Darwen, and Nikos A. Lorentzos (Morgan Kaufmann, 2003).

SPEAKER: Chris Date

C. J. Date is an independent author, lecturer, researcher, and consultant, specializing in relational database technology. He is best known for his book An Introduction to Database Systems (eighth edition, Addison-Wesley, 2004), which has sold some 725,000 copies and is used by several hundred colleges and universities worldwide. He is also the author of many other books on database management, including most recently:

• From Morgan Kaufmann: Temporal Data and the Relational Model (coauthored with Hugh Darwen and Nikos A. Lorentzos, 2003)

• From O'Reilly: Database in Depth: Relational Theory for Practitioners (2005)

• From Addison-Wesley: Databases, Types, and the Relational Model: The Third Manifesto (coauthored with Hugh Darwen, to appear 2006)

Another book, Go Faster! The TransRelational™ Approach to DBMS Implementation, is also due for publication in the near future.

Mr. Date enjoys a reputation that is second to none for his ability to communicate complex technical subjects in a clear and understandable fashion.

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