



## OLAP Cube Design Solutions HDT808 Four Days

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### Prerequisites

Students should have some experience with relational databases, data warehouses, and star schemas.

### Who Should Attend

This course is targeted at business power users, analysts, and software developers, data modelers, data base analysts, and any other technical or business person who needs to understand how to design, build, and use OLAP cubes for use with multidimensional information systems.

### Course Description

This course provides students with the skills necessary to design, build, and use OLAP cubes. It is based on the Erik Thomsen book OLAP Solutions, Second Edition, Building Multidimensional Information Systems published in 2002 by Wiley Publishing, Inc, ISBN: 0-471-40030-0. The book describes how to design, build, and use OLAP cubes.

### Course Topics

- Chapter 1: The Functional Requirements of OLAP Systems
- Chapter 2: The Limitations of Spreadsheets and SQL
- Chapter 3: Thinking Clearly in N Dimensions
- Chapter 4: Introduction to the LC Model
- Chapter 5: The Internal Structure of a Dimension
- Chapter 6: Hypercubes or Semantic Spaces
- Chapter 7: Multidimensional Formulas
- Chapter 8: Links
- Chapter 9: Analytic Visualization
- Chapter 10: Physical Design of Applications
- Chapter 11: Practical Steps for Designing and Implementing OLAP Models
- Chapter 12: Introduction to the Foodcakes Application Example
- Chapter 13: Purchasing and Currency Exchange
- Chapter 14: Materials Inventory Analysis
- Chapter 15: FCI's Sales and Marketing
- Chapter 16: FCI's Activity-Based Management
- Chapter 17: A Computational Example
- Chapter 18: Multidimensional Guidelines
- Chapter 19: Product Language Comparisons
- Chapter 20: DSS Fusion



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### **Chapter 1: The Functional Requirements of OLAP Systems**

- The Different Meanings of OLAP
- Where OLAP Is Useful
- The Distinction between Transaction and Decision Support Processing
- The Functional Requirements for OLAP
  - User Challenges
  - The Goal-Challenge Matrix
  - Core Logical Requirements
  - Core Physical Requirements

### **Chapter 2: The Limitations of Spreadsheets and SQL**

- The Evolution of OLAP Functionality in Spreadsheets and SQL Databases
- Proving the Point: Some Examples

### **Chapter 3: Thinking Clearly in N Dimensions**

- Lower-Dimensional Data Sets
- Beyond 3 Dimensions
- Multidimensional Type Structures (MTSs)
- Representing Hypercubes on a Computer Screen
- Analytical Views

### **Chapter 4: Introduction to the LC Model**

- Disarray in the OLAP Space
  - Terms Frequently Used to Refer to the Same Thing
  - Open Issues
  - Critique of Implicit Issue-Specific Approaches to OLAP Modeling
- Attributes of an Ideal Model
  - Theoretic Groundedness
  - Completeness
  - Efficiency
  - Analytical Awareness
- Overview of the Located Content (LC) Model
  - A Functional Approach
  - Super Symmetry
  - Type Structures
  - Schemas and Models



## **Chapter 5: The Internal Structure of a Dimension**

- Nonhierarchical Structuring
  - Method of Definition
  - Cardinality
  - Ordering
  - Metrics
- Dimensional Hierarchies
  - Overview
  - Hierarchies in General
  - Ragged Hierarchies
- Referencing Syntax
- Leveled or Symmetric Hierarchies
- Leveled Dimensions with Nominally Ordered Instances
- Leveled Dimensions with Ordinally Ordered Instances
- Leveled Dimensions with Cardinality Ordered Instances: Time and Space
- Constant Scaling Factors
- Multiple Hierarchies per Type
- Pseudolevels
  - Ordering
  - Dummy Members
- Mixed Hierarchies

## **Chapter 6: Hypercubes or Semantic Spaces**

- Meaning and Sparsity
  - Types of Sparsity
  - Defining Application Ranges
- Meaning and Comparability
  - When a New Dimension Needs a New Cube
  - A Single Domain Schema
  - Multidomain Schemas
  - Not Applicable Versus Nonvarying
  - Joining Cubes with Nonconformant Dimensions

## **Chapter 7: Multidimensional Formulas**

- Formulas in a Multidimensional Context
  - Formula Hierarchies or Dependency Trees
  - Cell- and Axis-Based Formulas
  - Precedences
- Multidimensional Formulas
  - Anatomy of a Multidimensional Aggregation Formula
  - Formula Types
  - Formula Complexities



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### **Chapter 8: Links**

- Types of Links
- Structure Tables and Links
- Data Tables and Content Links
  - Row-Member Links
  - Column-Member Links
  - Cell Links
  - Table-Member Links
- Preaggregation

### **Chapter 9: Analytic Visualization**

- What Is Data Visualization?
- The Semantics of Visualization
  - Graphic Versus Tabular-Numeric Representation
  - Picking the Appropriate Visualization Forms
- Using Data Visualization for Decision Making
  - Business Pattern Analysis
- Visualizing Mutidimensional Business Data
  - Subsetting
  - Repeating or Tiled Patterns
- Examples of More Complex Data Visualization Metaphors
  - Product Sales Analysis
  - Credit Car Application Analysis
  - Web Site Traffic Analysis

### **Chapter 10: Physical Design of Applications**

- Data Distribution
  - Within Machines
  - Within an Application
  - Across Machines
  - Across Applications (ROLAP and HOLAP)
  - Across Partitions
- Calculation Distributions
  - Temporal
  - Across Applications and Utilities
- Common Configurations
  - Departmental: Relational Data Mart with a Multidimensional Client
  - Departmental: Multidimensional Server and Client
  - Enterprise: Relational Warehouse, Multidimensional Midtier Server, and Multidimensional Client
  - Enterprise: Relational Warehouse, Multidimensional Midtier Server, Web Server, and Multidimensional Thin Client



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### **Chapter 11: Practical Steps for Designing and Implementing OLAP Models**

#### User Requirements

- Understand the Current Situation
- Useful Questions to Ask
- Questions about the Actual Situation
- Questions about the Problems
- Information about Constraints
- Requirements Documentation

#### Solution Design

- Logical Model Definition
- Cubes and Dimensions
- Links
- Dimension Hierarchies
- Dimension Members
- The Decision Context
- Formulas
- Deciding When and Where to Compute

#### More Complex Aggregations and Analysis

- Nonleaf Input Data
- Nominal Versus Ordinal Versus Cardinal Analysis
- Sparsity
- Auditing

### **Chapter 12: Introduction to the Foodcakes Application Example**

- Preface to the Second Edition
- Introduction to the Foodcakes International Application

### **Chapter 13: Purchasing and Currency Exchange**

- Background Issues
  - Data Sources
- Purchases Cube
  - Locator Dimensions
  - Input Contents
  - Basic Derivations
- Exchange Rate Cube
  - The Dimensions
- Combined Purchasing and Exchange Rates



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### **Chapter 14: Materials Inventory Analysis**

- The Inventory Throughput Cube
  - Data Sources
  - Dimensions
  - Input Contents
  - Viewing Basic Aggregations
  - More Analytical Derivations
  - Systematic Age Tracking
  - Auditing
  - Derived Variables
- Costing
  - Site by Time-Level Costing

### **Chapter 15: FCI's Sales and Marketing**

- Cube Dimensions
- Cube Input Variables
  - Number of Packages Sold: Qty\_Sold (pkg)
  - Return to Qty\_Sold (pkg)
  - List Price per Package (\$/pkg)
- Analyzing Sales
  - Marketing
- Value States

### **Chapter 16: FCI's Activity-Based Management**

- Jane's Presentation
- The Approach
- Business Process and Asset Dimensions
- Calculating Total Cost of Goods Sold
  - Tracking Batch Ids at the Point of Sale
- Calculating Total Costs
  - Introduction
  - The Enterprise Asset Utilization and Cost Cube
- Legal Issues: A Reader Exercise



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### Chapter 17: A Computational Example

How to Work through the Exercise

FCI Dimension Definitions

Global Business Rules

FCI Schemas

Business Process Schemas

Sales and Marketing

Transportation from Product Inventory to Stores

Product Inventory

Transportation from Production to Product Inventory

Production

Materials Inventory

Materials Shipping

Currency Exchange

Purchasing

Cube Views

Sales and Marketing

Transportation from Product Inventory to Stores

Product Inventory

Transportation from Production to Product Inventory

Production

Materials Inventory

Materials Shipping

Currency Exchange

Purchasing

Costs Summary

FCI Cost-Revenue Analysis Calculation Steps by Schema

Sales and Marketing

Transportation from Product Inventory to Stores

Product Inventory

Transportation from Production to Product Inventory

Production

Materials Inventory

Materials Shipping

Currency Exchange

Purchasing



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### **Chapter 18: Multidimensional Guidelines**

- Outline
- Core Logical Features
  - Structure
  - Operations
  - Representations
- Noncore Logical
  - Knowledge-Domain
  - Process-Oriented Domains
- Physical Features
  - Storage and Access
  - Computations
  - Multitier Distribution
  - Optimizations and Efficiencies
  - Platform Issues
  - Multiuser Security

### **Chapter 19: Product Language Comparisons**

- Kickoff Example
- Sample Schemata
- Referencing Examples
  - Referencing a Specific Member
  - Referencing a Parent Member
  - Referencing a Set of Children
  - Previous and Next Members (Lag and Lead)
  - Referring to Ancestors
  - Descendants
- Treatment of Missing and Inapplicable Cells (Instances)
- Handling Calculation Precedence
- Basic Formulas
- Application Ranges in Joined Cubes



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### Chapter 20: DSS Fusion

- Overview of a Unified Architecture

  - The Decision Function Dimension

  - The Media Dimension

  - Internal and External Representation Dimensions

  - Source versus Derived Expressions

  - The DEER Cycle

  - Levels of Abstraction Dimension

  - Data versus Knowledge Dimension

  - Concluding Remarks on a Unified Decision Support Framework

- Smaller, Multifunction Tasks

  - Integrating OLAP and Data Mining or Statistics

  - Business-Driven Analytical Segmentation

  - MD Visualization

  - MD Arrays for Test Retrieval

  - MD Arrays for Data Mining

- A Single More Fully Integrated Example