

**Ministry of Health & Population - Egypt
Central Administration
for Technical Support and Projects
Health Sector Reform Programme**

**MONITORING & EVALUATION SYSTEM
PROGRAMMERS' TRAINING WORKSHOP**

1 - 5 June, 2003



Designing & Implementing OLAP Solutions

Ref: Microsoft Course number :207A

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Member of HCI Team**

Course Outline

- Introduction to OLAP
- Introducing Analysis Manager Wizards
- Building Dimensions
- Using Advanced Dimension Settings
- Working with Cubes and Measures
- Managing Storage
- Processing Dimensions and Cubes
- Working with Virtual Cubes
- Using Excel as an OLAP Client
- Introduction to DTS

Introduction to OLAP

Overview

- Introducing OLAP and Data Warehousing
- Understanding Data Warehouse Design
- Understanding OLAP Models
- Applying OLAP Cubes

- Introducing OLAP and Data Warehousing
 - What is OLAP ?
 - What is a Data Warehouse ?
 - OLTP Source Systems
 - Data Warehouse Characteristics
 - OLAP Characteristics

What is OLAP ?

- OLAP (Online Analytical Processing)
- OLAP transforms raw data to useful information so that it reflects the real factors affecting or enhancing the line of business of the enterprise.
- OLAP and Data Warehouses complement each other.
- The Data Warehouse stores and manages the data, while OLAP converts the stored data into useful information

What is a Data Warehouse ?

- A Data Warehouse is a central repository that stores the data collected from various OLTP applications and other sources
- Raw data is collected, reorganized, stored, and managed into a data warehouse that follows a special schema.
- The Data Warehouse stores the data needed for informative analytical processing over a long historical time perspective

OLTP Source Systems

- OLTP System Characteristics
 - Processes real-time transactions of a business
 - Contains data structures optimized for entries and edits
 - Provides limited decision support capabilities
- OLTP Examples
 - Order tracking
 - Service-based sales
 - Customer service
 - Banking functions
 - Point-of-sales

Data Warehouse Characteristics

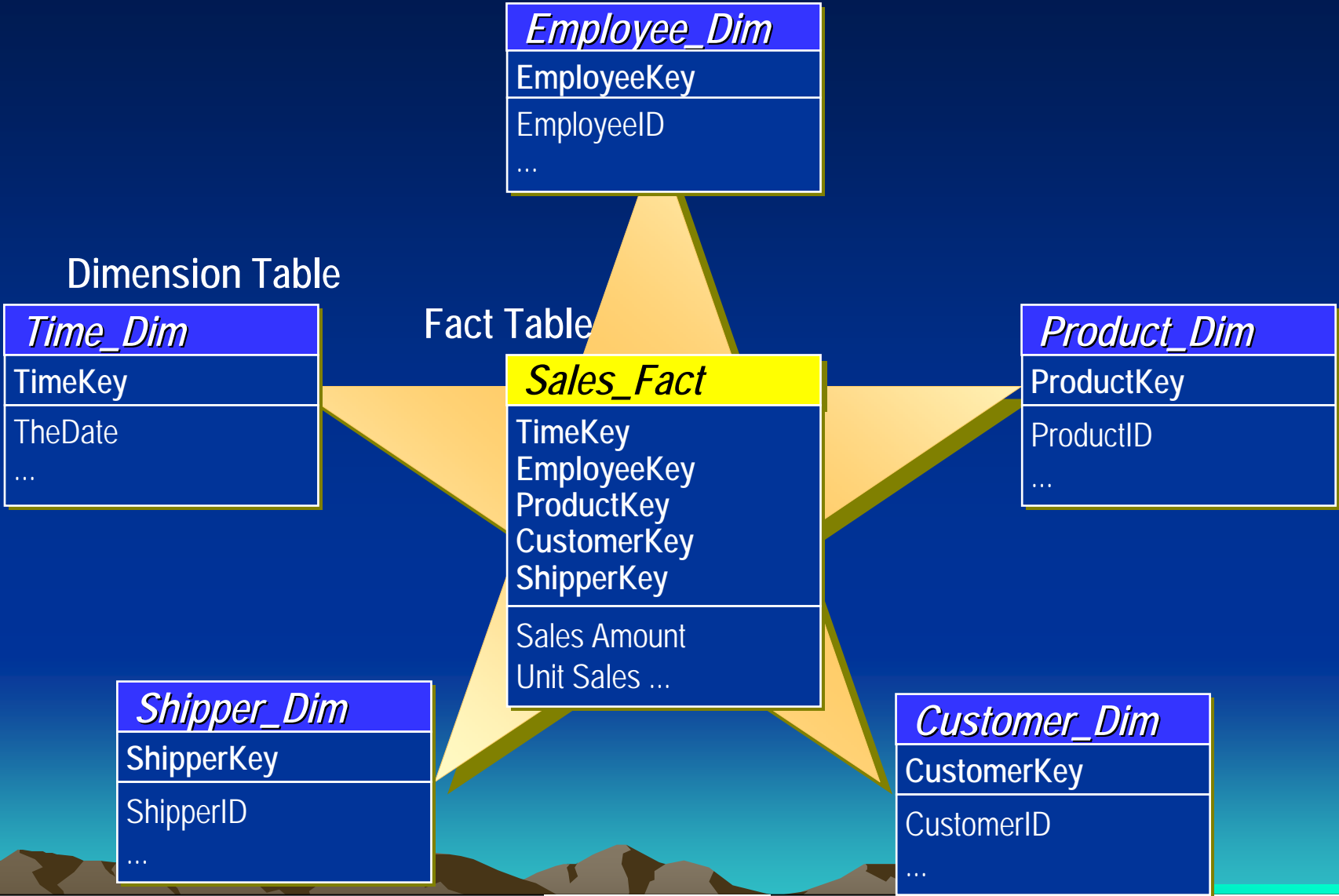
- Provides Data for Business Analysis Processes
- Integrates Data from Heterogeneous Source Systems
- Combines Validated Source Data
- Organizes Data into Non-Volatile, Subject-Specific Groups
- Stores Data in Structures that Are Optimized for Extraction and Querying

OLAP Characteristics

- Optimized Schema for Fast User Queries
- Robust Calculation Engine for Numeric Analysis
- Conceptual, Intuitive Data Model
- Multidimensional View of Data
 - Drill down and drill up
 - Pivot views of data

- Understanding Data Warehouse Design
 - The Star Schema
 - Fact Table Components
 - Dimension Table Characteristics
 - The Snowflake Schema

The Star Schema



Fact Table Components

Dimension Tables

<i>customer_dim</i>		
201	ALFI	Alfreds

<i>product_dim</i>		
25	123	Chai

<i>time_dim</i>	
134	1/1/2000

sales_fact Table

Foreign Keys			Measures	
<i>customer_key</i>	<i>product_key</i>	<i>time_key</i>	<i>quantity_sales</i>	<i>amount_sales</i>
201	25	134	400	10,789

The **grain** of the sales_fact table is defined by the lowest level of detail stored in each dimension

Dimension Table Characteristics

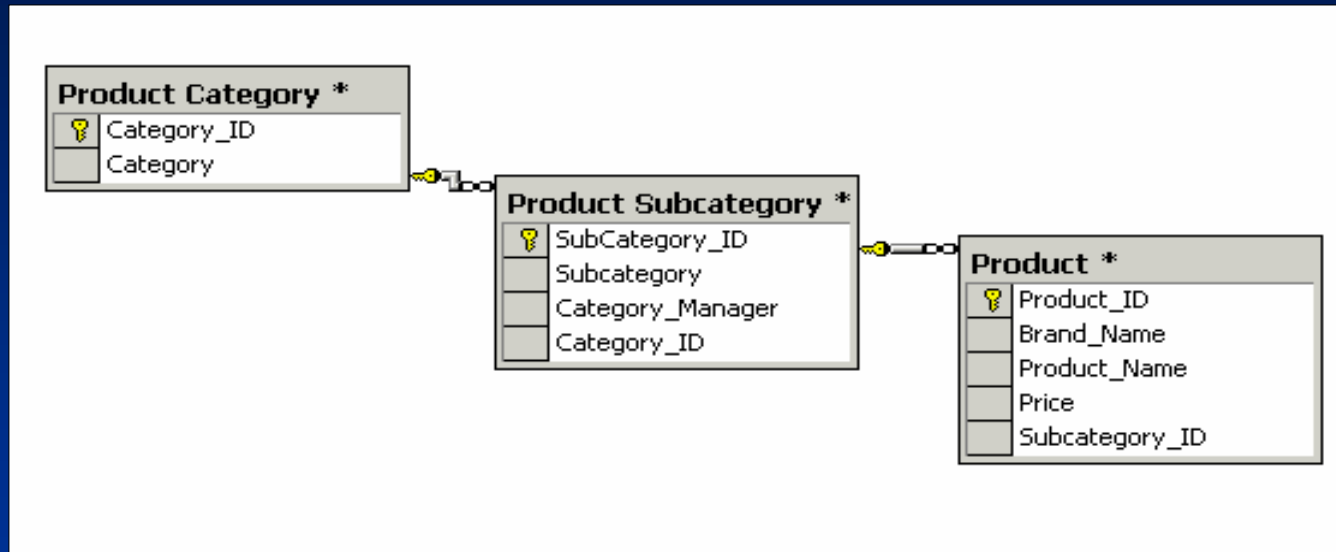
customer *	
🔑	customer_id
	account_num
	lname
	fname
	mi
	address1
	address2
	address3
	address4
	city
	state_province
	postal_code
	country

State *	
🔑	State_ID
	State_Name
	Region
	Country

time_by_day *	
🔑	time_id
	the_date
	the_day
	the_month
	the_year
	day_of_month
	week_of_year
	month_of_year
	quarter
	fiscal_period

- Describes Business Entities
- Contains Attributes That Provide Context to Numeric Data
- Presents Data Organized into Hierarchies

The Snowflake Schema



- Defines Hierarchies by Using Multiple Dimension Tables
- Is More Normalized than a Single Table Dimension
- Is Supported within Analysis Services

- Understanding OLAP Models
 - OLAP Database Components
 - OLAP Dimensions vs. Relational Dimensions
 - Dimension Fundamentals
 - Dimension Family Relationships
 - Cube Measures
 - Relational Data Sources

OLAP Database Components

- Numeric Measures
- Dimensions
- Cubes

OLAP Dimensions vs. Relational Dimensions

OLAP

REGION
West
CA
OR
East
MA
NY

Relational

REGION
West
East

STATE	REGION
CA	West
OR	West
MA	East
NY	East

Dimension Fundamentals

TIME	← time dimension
● Year 1999 2000 2001	← year level ← members
● ● Quarter Q1 Q2 Q3 Q4	← quarter level ← members
● ● ● Month Jan Feb Mar etc.	← month level ← members

Dimension Family Relationships

USA

North West

Oregon

Washington

South West

California

- ◆ USA is the parent of North West and South West
- ◆ North West and South West are children of USA
- ◆ North West and California are descendants of USA
- ◆ North West and USA are ancestors of Washington
- ◆ North West and South West are siblings
- ◆ Oregon and California are cousins
- ◆ All are dimension members



Cube Measures

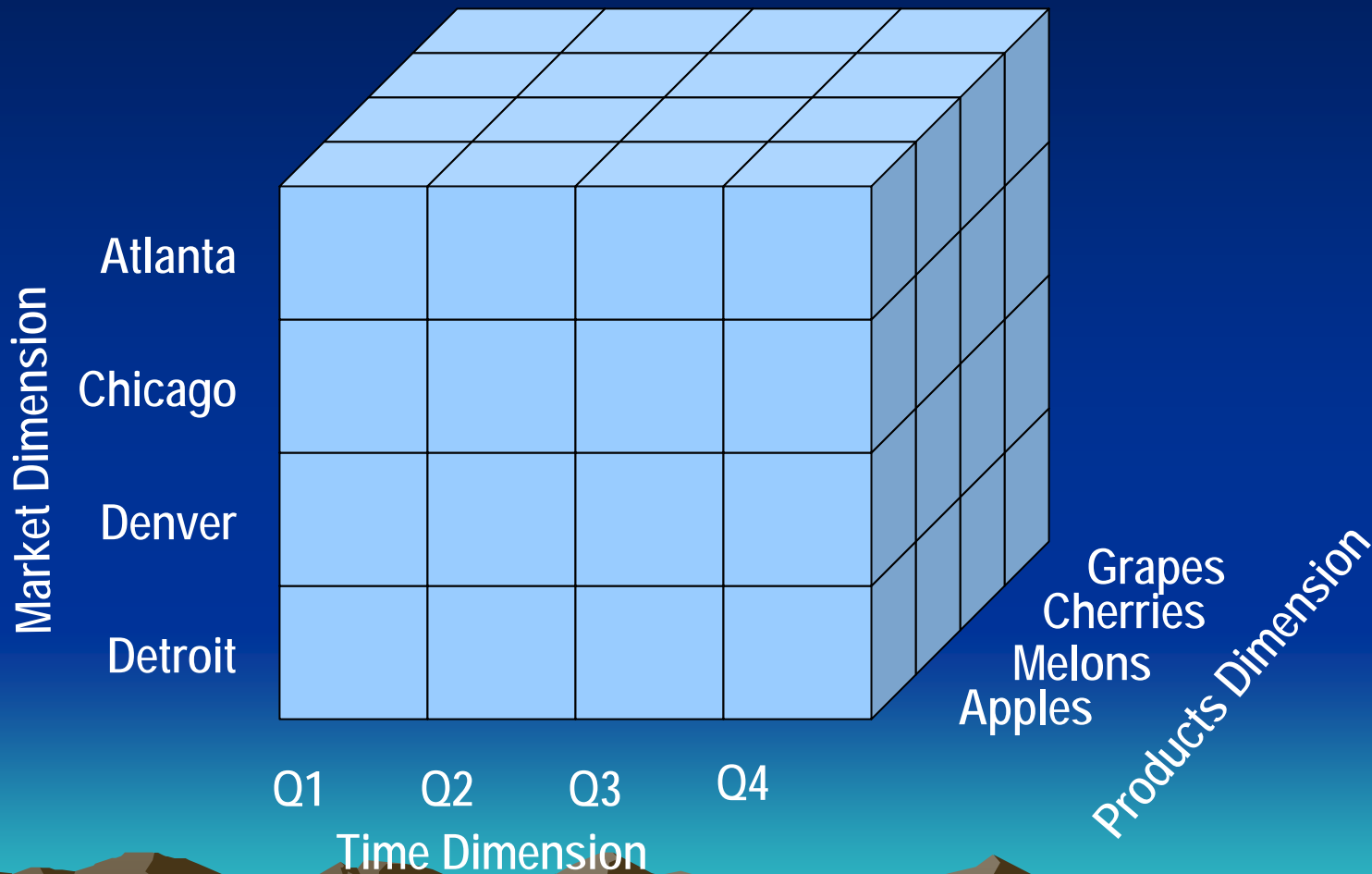
- Are the Numeric Values of Principle Interest
- Correspond to Fact Table *Facts*
- Intersect All Dimensions at All Levels
- Are Aggregated at All Levels of Detail
- Form a Dimension

Relational Data Sources

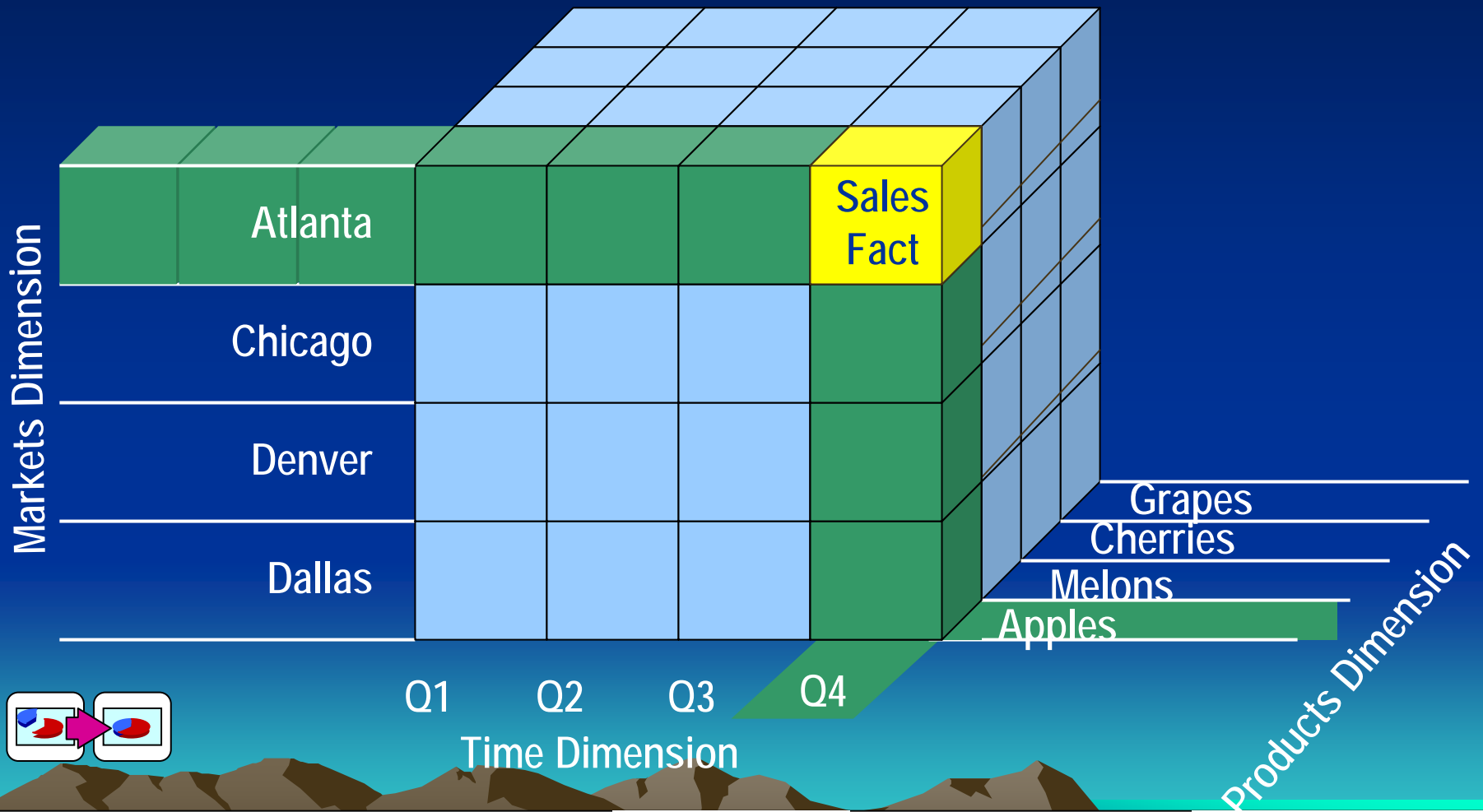
- Star and Snowflake Schemas
 - Are required to build a cube with Analysis Services
- Fact Table
 - Contains measures
 - Contains keys that join to dimension tables
- Dimension Tables
 - Must exist in same database as fact table
 - Contain primary keys that identify each member

- Applying OLAP Cubes
- Defining a Cube
- Querying a Cube
- Defining a Cube Slice
- Working with Dimensions and Hierarchies
- Visualizing Cube Dimensions
- Connecting to an OLAP Cube

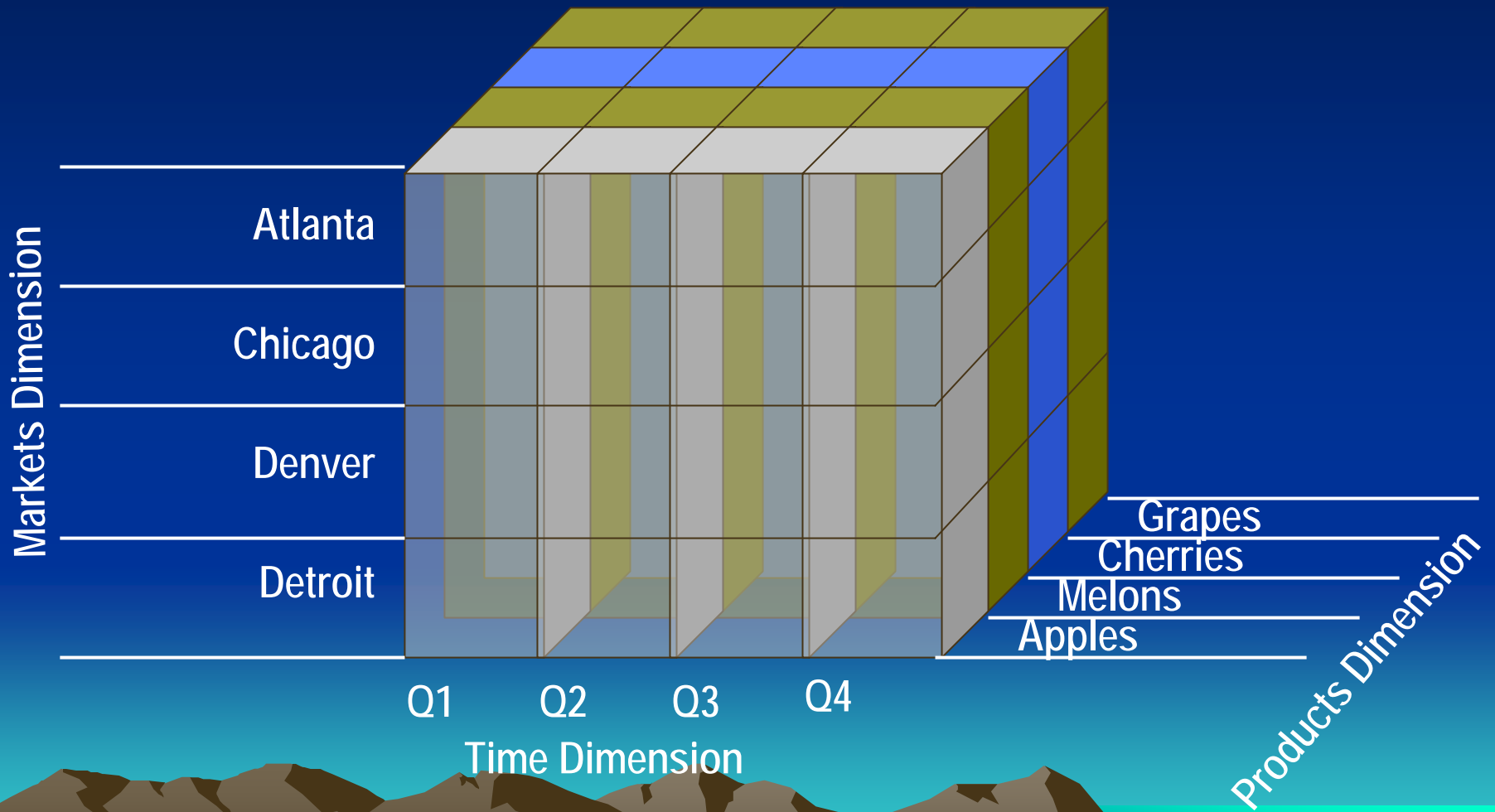
Defining a Cube



Querying a Cube



Defining a Cube Slice



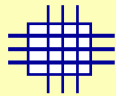
Working with Dimensions and Hierarchies

- Dimensions Allow You to

- Slice



- Dice

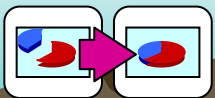


- Hierarchies Allow You to

- Drill Down



- Drill Up



Visualizing Cube Dimensions

File Edit View Insert Format Tools Data Window Help

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JONES

Y-T-D Sales by Region

	Jan	Feb	Mar	Q1	Apr	May	Jun	Q2	Total
Portland	40	761	356	1,158	758	270	837	1,865	3,022
Seattle	38	263	408	709	529	999	528	2,057	2,765
Northwest	609	584	280	1,472	48	322	199	569	2,041
Los Angeles	639	905	407	1,951	854	290	437	1,580	3,531
Phoenix	377	649	635	1,661	271	546	313	1,130	2,791
Southwest	63	722	826	1,611	258	93	147	498	2,108
Total	1,765	3,123	2,555	7,403	1,960	2,251	1,623	5,834	13,237

Gadgets Gizmos Widgets

smith.xls

PHELPS

Y-T-D Sales by Region

	Jan	Feb	Mar	Q1	Apr	May	Jun	Q2	Total
Portland	241	15	640	896	522	293	618	1,433	2,329
Seattle	542	234	696	1,472	986	958	619	2,564	4,036
Northwest	412	116	260	789	297	588	880	1,764	2,553
Los Angeles	194	580	419	1,193	482	739	223	1,444	2,637
Phoenix	419	848	774	2,040	8	271	50	329	2,369
Southwest	865	561	499	1,925	192	530	395	1,117	3,042
Total	2,673	2,339	2,648	7,419	1,965	3,087	2,167	7,218	14,637

Gadgets Gizmos Widgets

phelps.xls

SMITH

Y-T-D Sales by Region

	Jan	Feb	Mar	Q1	Apr	May	Jun	Q2	Total
Portland	186	125	645	956	919	271	17	1,207	2,162
Seattle	266	197	205	668	348	525	802	1,674	2,342
Northwest	96	756	730	1,581	59	560	866	1,485	3,066
Los Angeles	64	150	381	594	311	448	295	1,055	1,648
Phoenix	520	346	597	1,463	369	280	526	1,176	2,639
Southwest	339	436	884	1,759	614	668	615	1,897	3,656
Total	1,472	1,884	2,896	6,065	1,701	2,481	3,104	7,287	13,352

Gadgets Gizmos Widgets

williams.xls

WILLIAMS

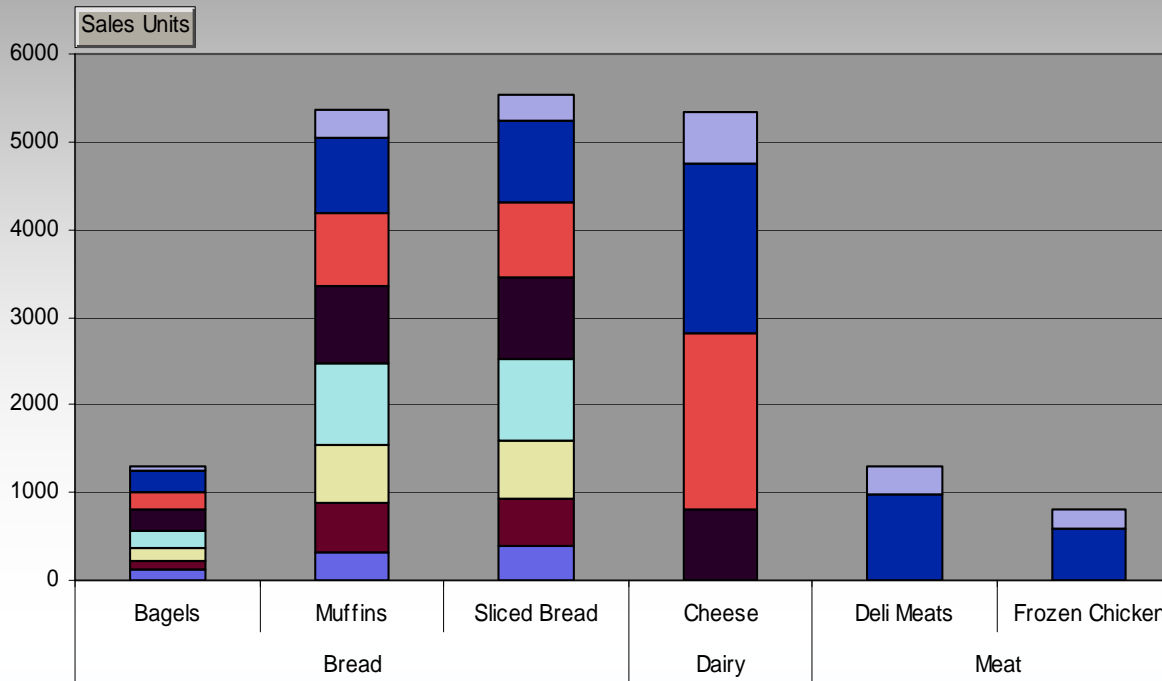
Y-T-D Sales by Region

	Jan	Feb	Mar	Q1	Apr	May	Jun	Q2	Total
Portland	927	849	165	1,941	302	349	990	1,640	3,582
Seattle	606	668	540	1,814	778	257	719	1,755	3,569
Northwest	174	477	18	669	116	193	120	390	1,059
Los Angeles	271	487	599	1,358	780	436	545	1,761	3,119
Phoenix	24	441	627	1,092	731	7	481	1,218	2,311
Southwest	914	799	293	2,006	845	201	579	1,625	3,630
Total	2,917	2,873	2,077	6,939	3,249	1,055	2,444	6,748	13,688

Gadgets Gizmos Widgets

Connecting to an OLAP Cube

State USA



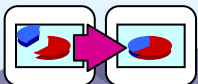
Level 02

Year

Quarter

- Sheri Now mer - 2001 - Quarter 4
- Sheri Now mer - 2001 - Quarter 3
- Sheri Now mer - 2001 - Quarter 2
- Sheri Now mer - 2001 - Quarter 1
- Sheri Now mer - 2000 - Quarter 4
- Sheri Now mer - 2000 - Quarter 3
- Sheri Now mer - 2000 - Quarter 2
- Sheri Now mer - 2000 - Quarter 1

Category Subcategory



Review

- Introducing OLAP and Data Warehousing
- Understanding Data Warehouse Design
- Understanding OLAP Models
- Applying OLAP Cubes