# CS 412 Intro. to Data Mining

## Chapter 4. Data Warehousing and On-line Analytical Processing

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# Chapter 4: Data Warehousing and On-line Analytical Processing

- Data Warehouse: Basic Concepts 
- Data Warehouse Modeling: Data Cube and OLAP
- Data Warehouse Design and Usage
- Data Warehouse Implementation
- Summary

# What is a Data Warehouse?

- Defined in many different ways, but not rigorously
  - A decision support database that is maintained separately from the organization's operational database
  - Support information processing by providing a solid platform of consolidated, historical data for analysis
- "A data warehouse is a subject-oriented, integrated, time-variant, and nonvolatile collection of data in support of management's decision-making process."—W. H. Inmon มีเป้าหมายว่าจะสร้าง Data Warehouse มาเพื่ออะไร สร้างมาเพื่อตอบคำถาม, เพื่อ support การตัดสินใจของผู้บริหาร
- Data warehousing:
  - The process of constructing and using data warehouses

# From Tables and Spreadsheets to Data Cubes

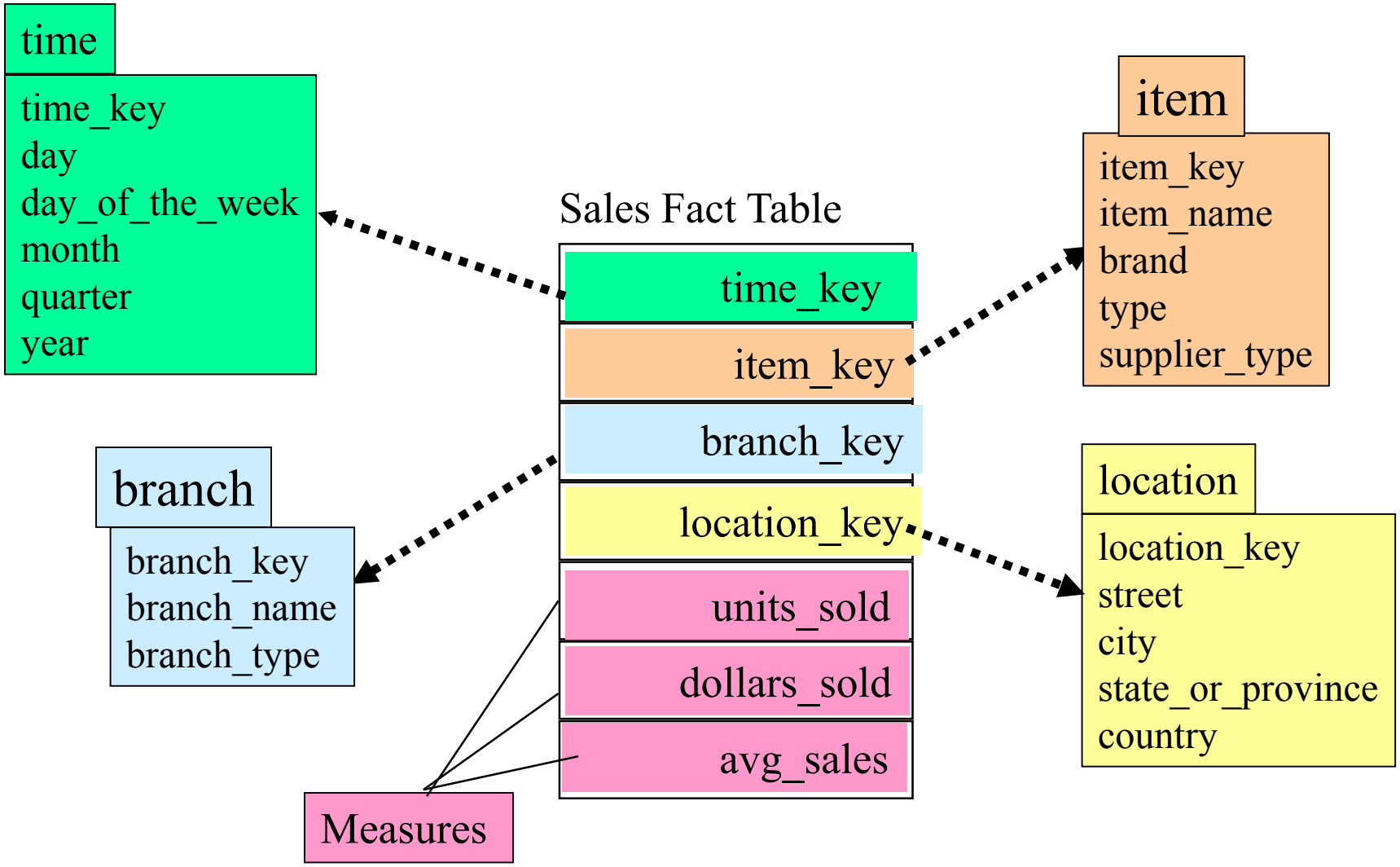
- A **data warehouse** is based on a multidimensional data model which views data in the form of a data cube
- A data cube, such as sales, allows data to be modeled and viewed in multiple dimensions
  - **Dimension tables**, such as item (item_name, brand, type), or time(day, week, month, quarter, year)
  - **Fact table** contains **measures** (such as dollars_sold) and keys to each of the related dimension tables

ตารางเก็บค่าเลขต่างๆ

- **Data cube**: A lattice of cuboids
  - In data warehousing literature, an n-D base cube is called a **base cuboid**
  - The top most 0-D cuboid, which holds the highest-level of summarization, is called the **apex cuboid**
  - The lattice of cuboids forms a **data cube**.

# Star Schema: An Example

มีจุดศูนย์กลาง ทุกอย่างแตกออกจากจุดศูนย์กลาง

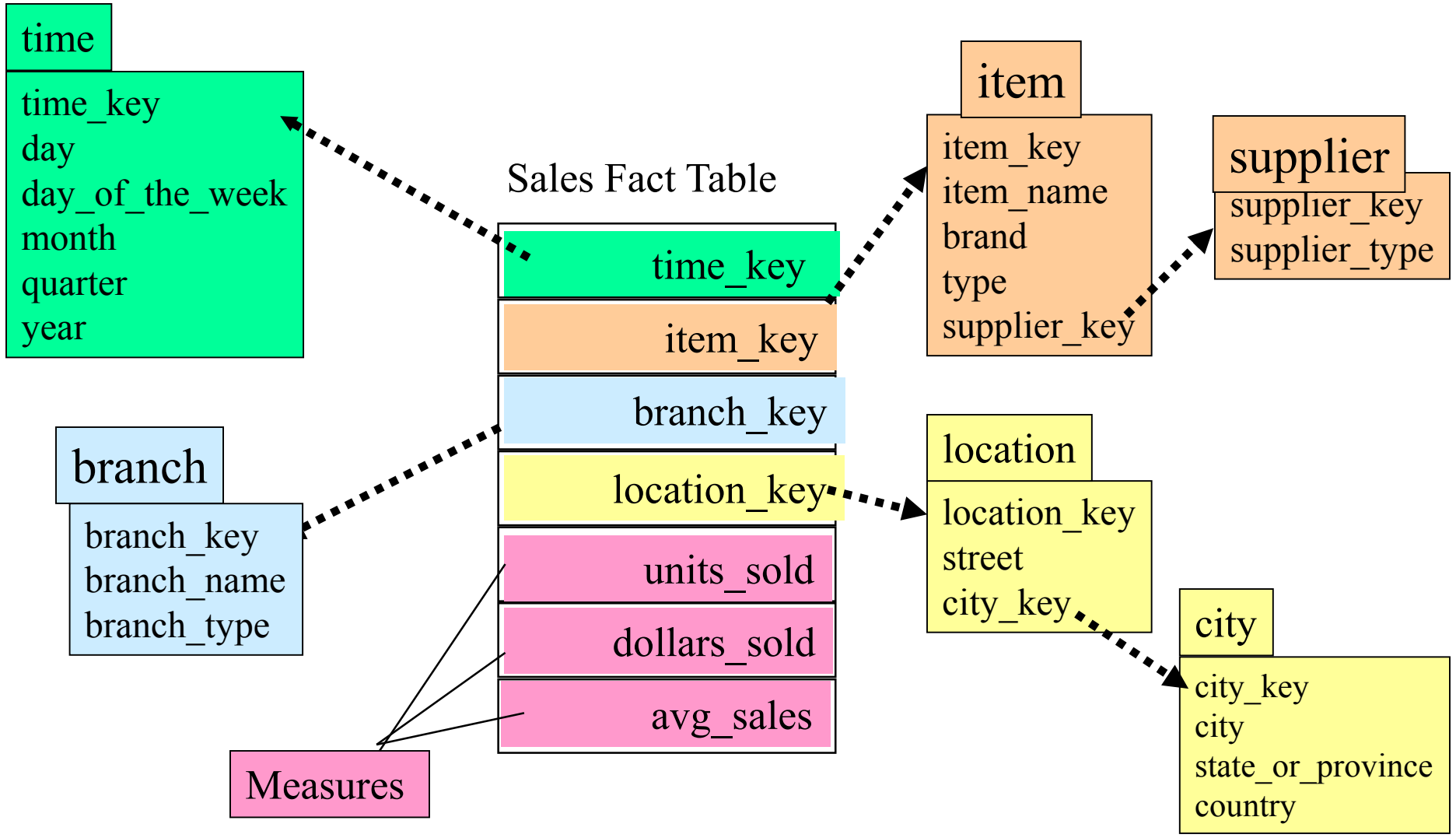





19

# Snowflake Schema: An Example

มีลักษณะคล้ายเกล็ดหิมะ



# Fact Constellation: An Example

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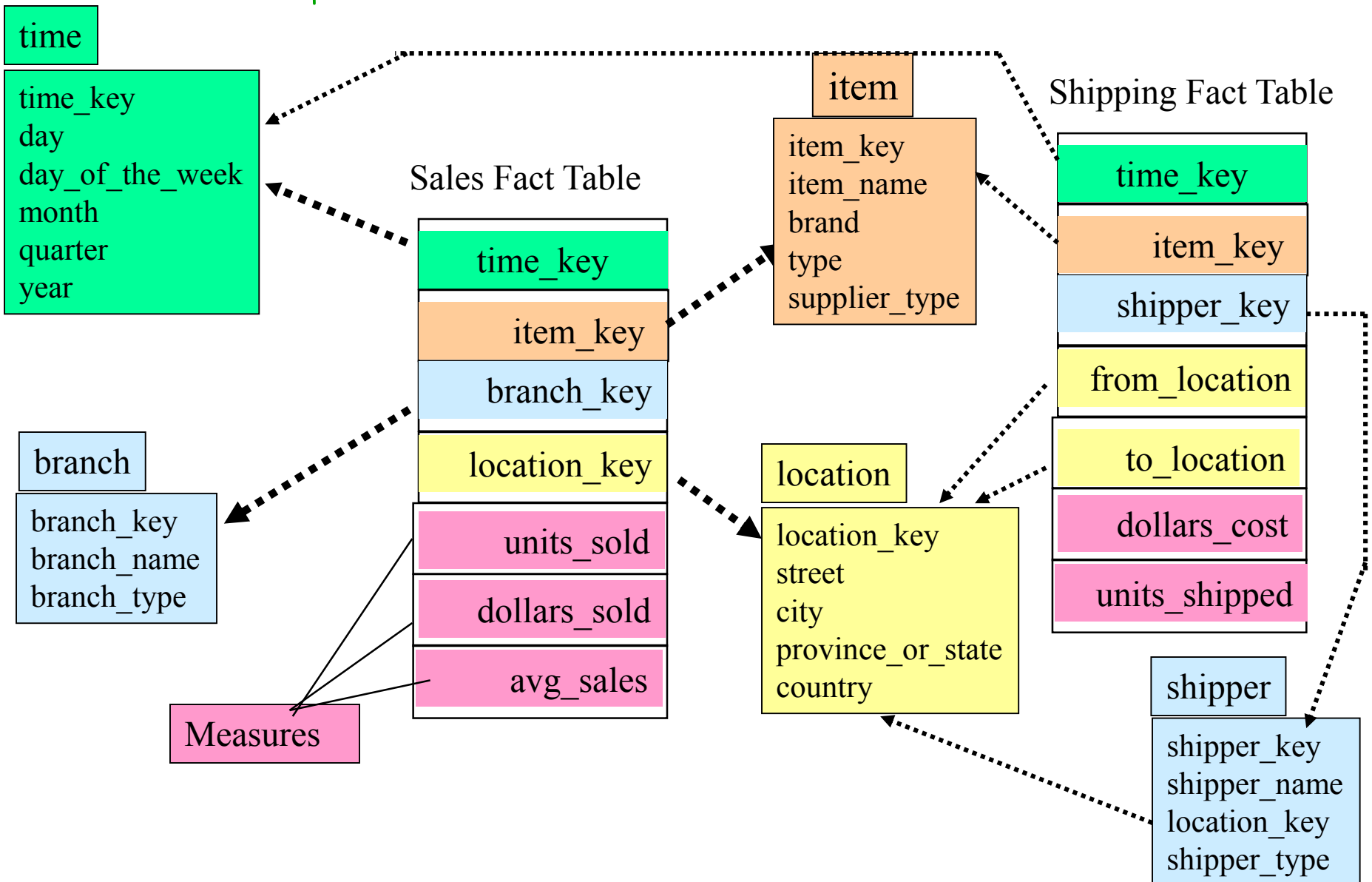
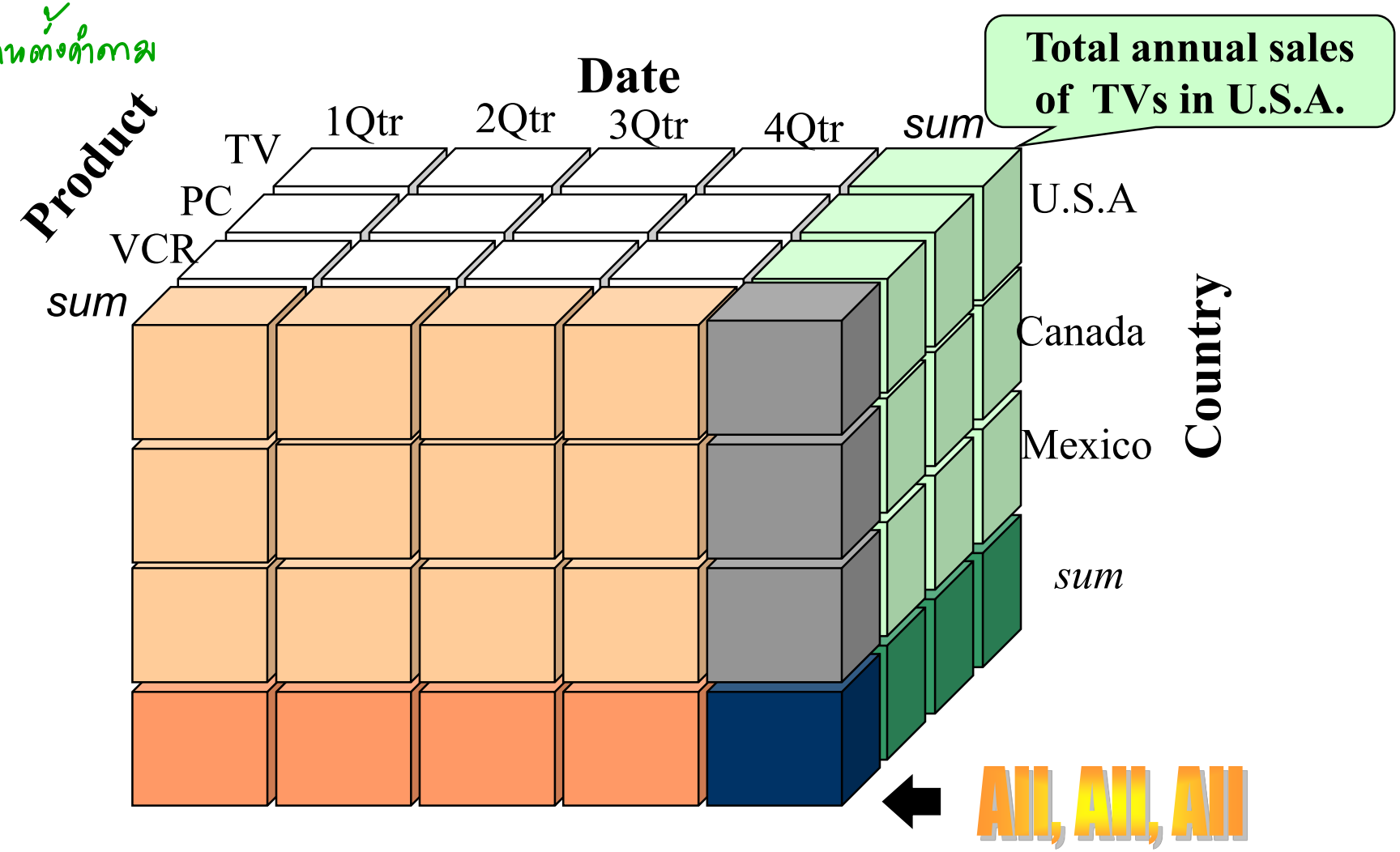


# A Sample Data Cube

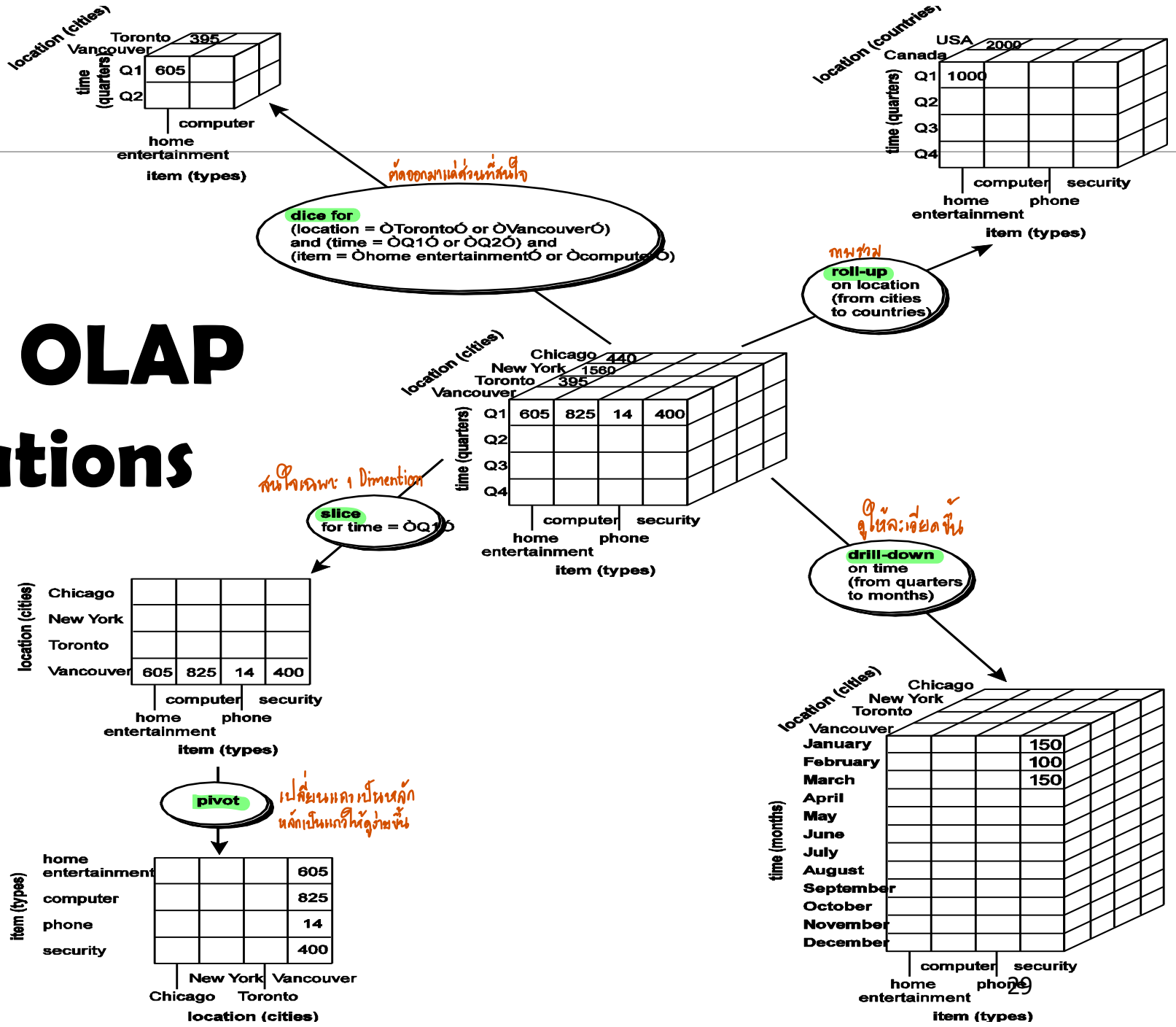
Operation ที่คนตั้งคำถาม



# Typical OLAP Operations

- Roll up (drill-up): summarize data
  - *by climbing up hierarchy or by dimension reduction*
- Drill down (roll down): reverse of roll-up
  - *from higher level summary to lower level summary or detailed data, or introducing new dimensions*
- Slice and dice: *project and select*
- Pivot (rotate):
  - *reorient the cube, visualization, 3D to series of 2D planes*
- Other operations
  - *Drill across: involving (across) more than one fact table*
  - *Drill through: through the bottom level of the cube to its back-end relational tables (using SQL)*

# Typical OLAP Operations





29