Chapter 14
Big Data Analytics and NoSQL

NoSQL

- Name given to non-relational database technologies developed to address Big Data challenges
- **Key-value (KV) databases** store data as a collection of key-value pairs organized as **buckets** which are the equivalent of tables
- **Document databases** store data in key-value pairs in which the value components are tag-encoded documents grouped into logical groups called **collections**

NoSQL

- **Column-oriented databases** refers to two technologies:
  - **Column-centric storage**: Data stored in blocks which hold data from a single column across many rows
  - **Row-centric storage:** Data stored in block which hold data from all columns of a given set of rows
- **Graph databases** store data on relationship-rich data as a collection of **nodes** and **edges**
  - **Properties** are the attributes of a node or edge of interest to a user
  - **Traversal** is a query in a graph database

TABLE 14.2

NoSQL DATABASES

NoSQL CATEGORY	EXAMPLE DATABASES
Key-value database	Dynamo Riak Redis Voldemort
Document databases	MongoDB CouchDB OrientDB RavenDB
Column-oriented databases	HBase Cassandra Hypertable
Graph databases	Neo4J ArangoDB GraphBase

Figure 14.7- Key-Value Database Storage

FIGURE 14.7 KEY-VALUE DATABASE STORAGE

Bucket = Customer

Key	Value
10010	"LName Ramas FName Alfred Initial A Areacode 615 Phone 844-2573 Balance 0"
10011	"LName Dunne FName Leona Initial K Areacode 713 Phone 894-1238 Balance 0"
10014	"LName Orlando FName Myron Areacode 615 Phone 222-1672 Balance 0"

Figure 14.8- Document Database Tagged Format

FIGURE 14.8 DOCUMENT DATABASE TAGGED FORMAT

Collection = Customer

Key	Document
10010	{LName: "Ramas", FName: "Alfred", Initial: "A", Areacode: "615", Phone: "844-2573", Balance: "0"}
10011	{LName: "Dunne", FName: "Leona", Initial: "K", Areacode: "713", Phone: "894-1238", Balance: "0"}
10014	{LName: "Orlando", FName: "Myron", Areacode: "615", Phone: "222-1672", Balance: "0"}

Figure 14.9- Comparison of Row-Centric and Column-Centric Storage

FIGURE 14.9 COMPARISON OF ROW-CENTRIC AND COLUMN-CENTRIC STORAGE

CUSTOMER relational table

Cus_Code	Cus_LName	Cus_FName	Cus_City	Cus_State
10010	Ramas	Alfred	Nashville	TN
10011	Dunne	Leona	Miami	FL
10012	Smith	Kathy	Boston	MA
10013	Olowski	Paul	Nashville	TN
10014	Orlando	Myron		
10015	O'Brian	Amy	Miami	FL
10016	Brown	James		
10017	Williams	George	Mobile	AL
10018	Farriss	Anne	Opp	AL
10019	Smith	Olette	Nashville	TN

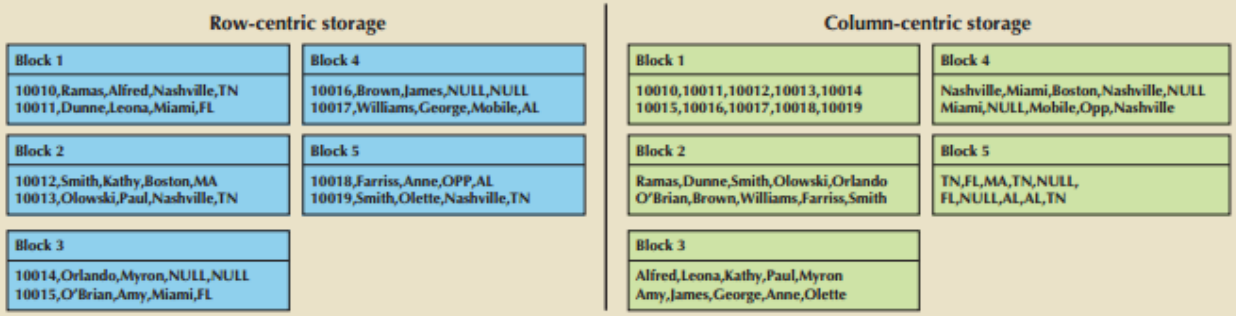
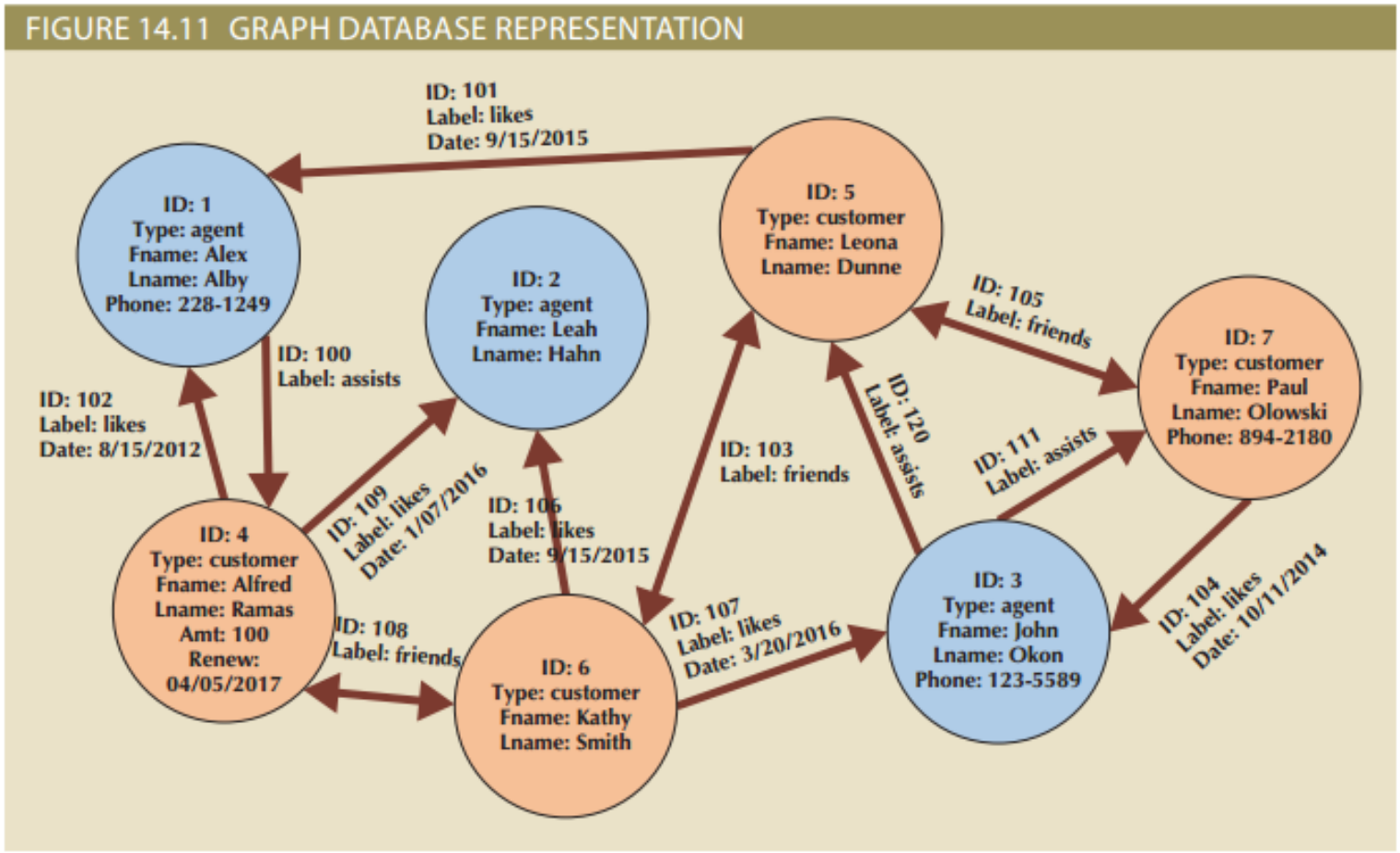


Figure 14.10- Graph Database Representation



NewSQL Databases

- Database model that attempts to provide ACID-compliant transactions across a highly distributed infrastructure
  - Latest technologies to appear in the data management area to address Big Data problems
  - No proven track record
  - Have been adopted by relatively few organizations

Figure 14.12- Extracting Knowledge From Data

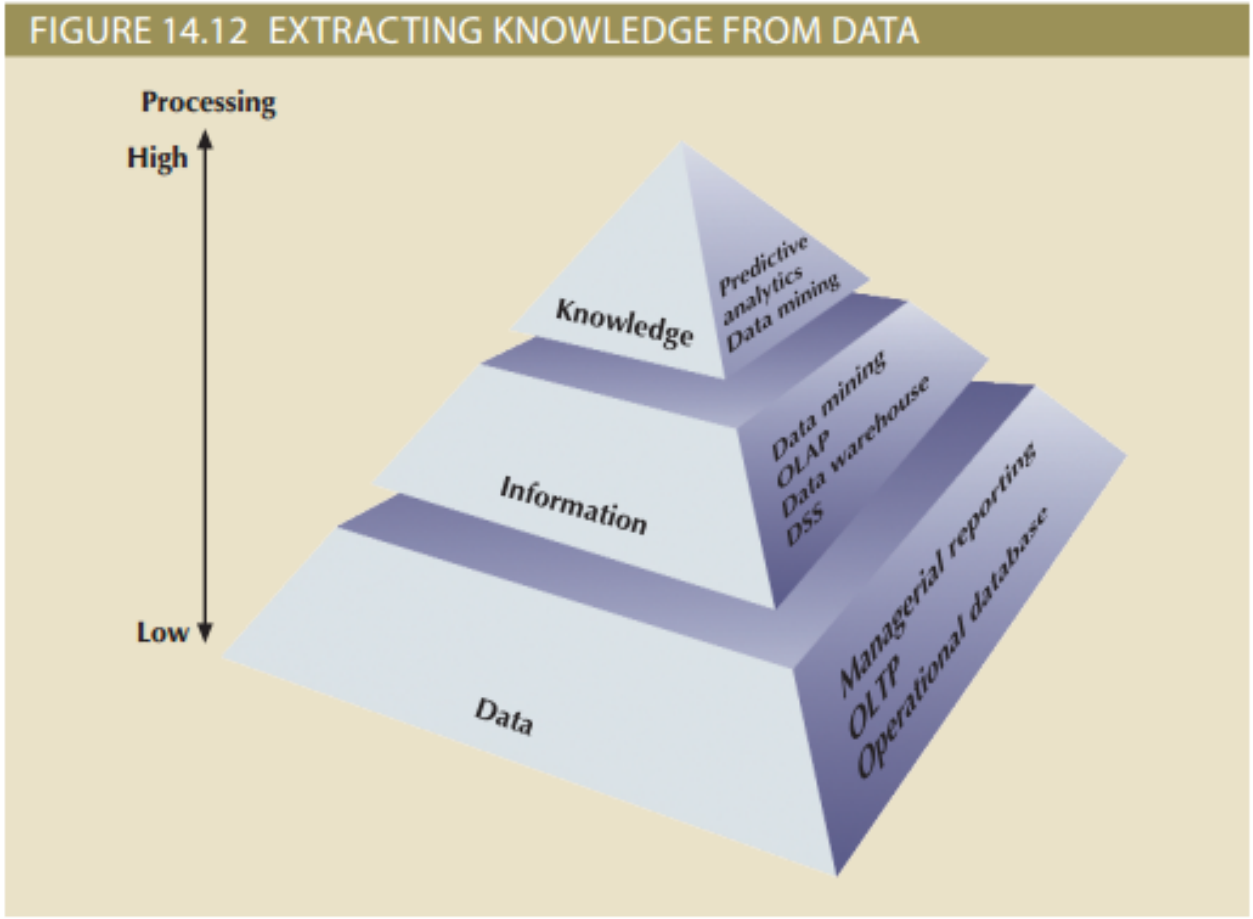
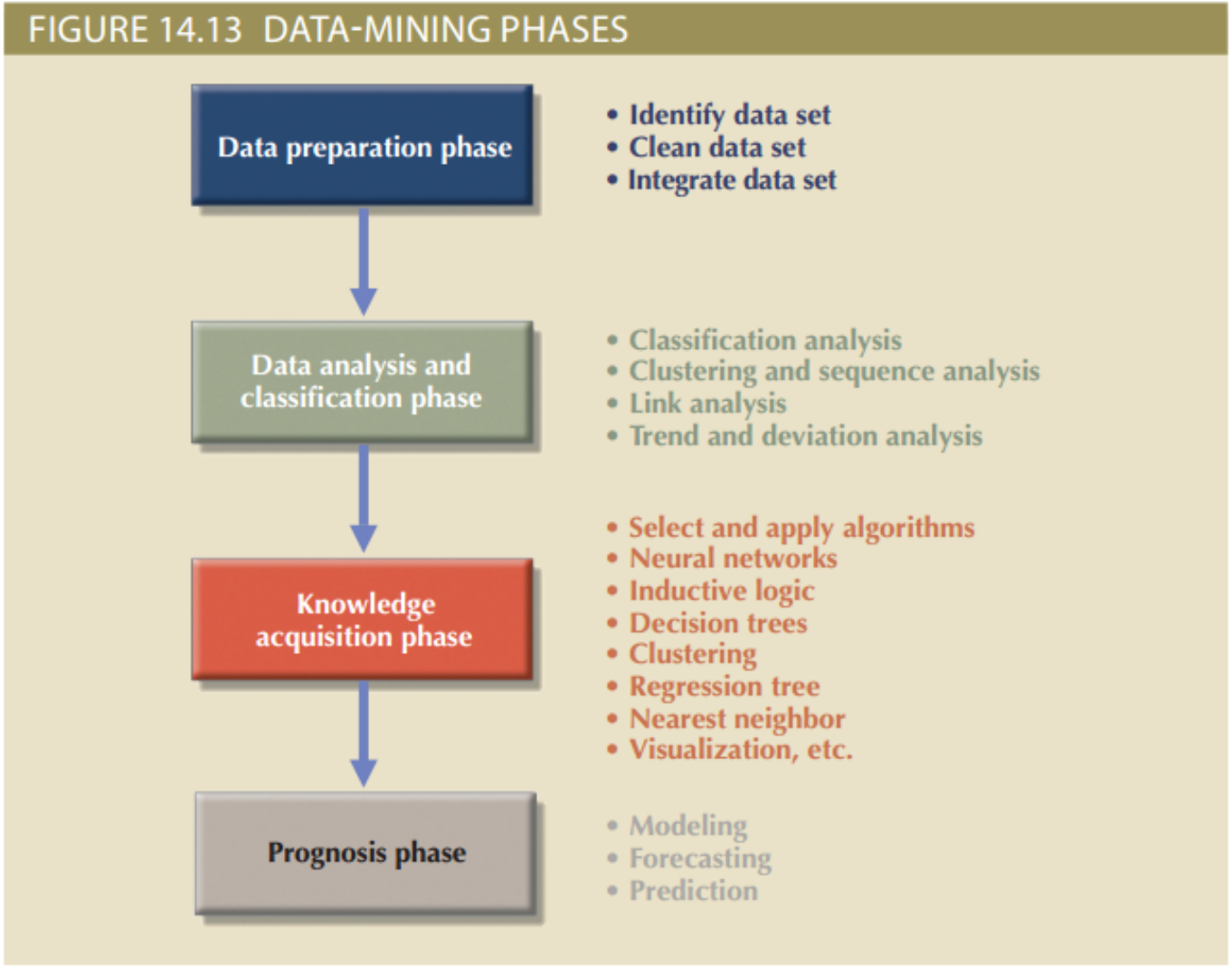


Figure 14.13- Data-Mining Phases



Data Analytics

- Subset of business intelligence (BI) functionality that encompasses mathematical, statistical, and modeling techniques used to extract knowledge from data
  - Continuous spectrum of knowledge acquisition that goes from discovery to explanation to prediction
- **Explanatory analytics** focuses on discovering and explaining data characteristics based on existing data
- **Predictive analytics** focuses on predicting future data outcomes with a high degree of accuracy

Data Mining

- Focuses on the discovery and explanation stages of knowledge acquisition by:
  - Analyzing massive amounts of data to uncover hidden trends, patterns, and relationships
  - Forming computer models to simulate and explain findings and using them to support decision making
- Can be run in two modes:
  - *Guided* – End-user decides techniques to apply to data
  - *Automated* – End-user sets up the tool to run automatically and the data-mining tool applies multiple techniques to find significant relationships

Predictive Analytics

- Refers to the use of advanced mathematical, statistical, and modeling tools to predict future business outcomes with a high degree of accuracy
  - Focuses on creating actionable models to predict future behaviors and events
  - Most BI vendors are dropping the term *data mining* and replacing it with *predictive analytics*
- Models used in customer service, fraud detection, targeted marketing and optimized pricing
  - Can add value in many different ways but needs to be monitored and evaluated to determine return on investment

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<ancient_wonders>
</ancient_wonders>
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<?xml version="1.0"?>
<ancient_wonders>
<wonder>
<name>Colosus of Rhodes</name>
</wonder>
</ancient_wonders>
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Visual Quickstart Guide XML -->
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