

**CPET 565/CPET 499**  
**Mobile Computing Systems**  
**Lecture on**

**Mobile Application Data,  
Data Requirements, Data Modeling, Data  
Presentation, Business Process Modeling**

**Fall 2014**

**A Specialty Course for Purdue University's M.S. in Technology  
Graduate Program**

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# Mobile Application Data

## ■ Industries:

- Oil & Gas, Government, Utilities, Life Sciences, Manufacturing, Engineering, etc

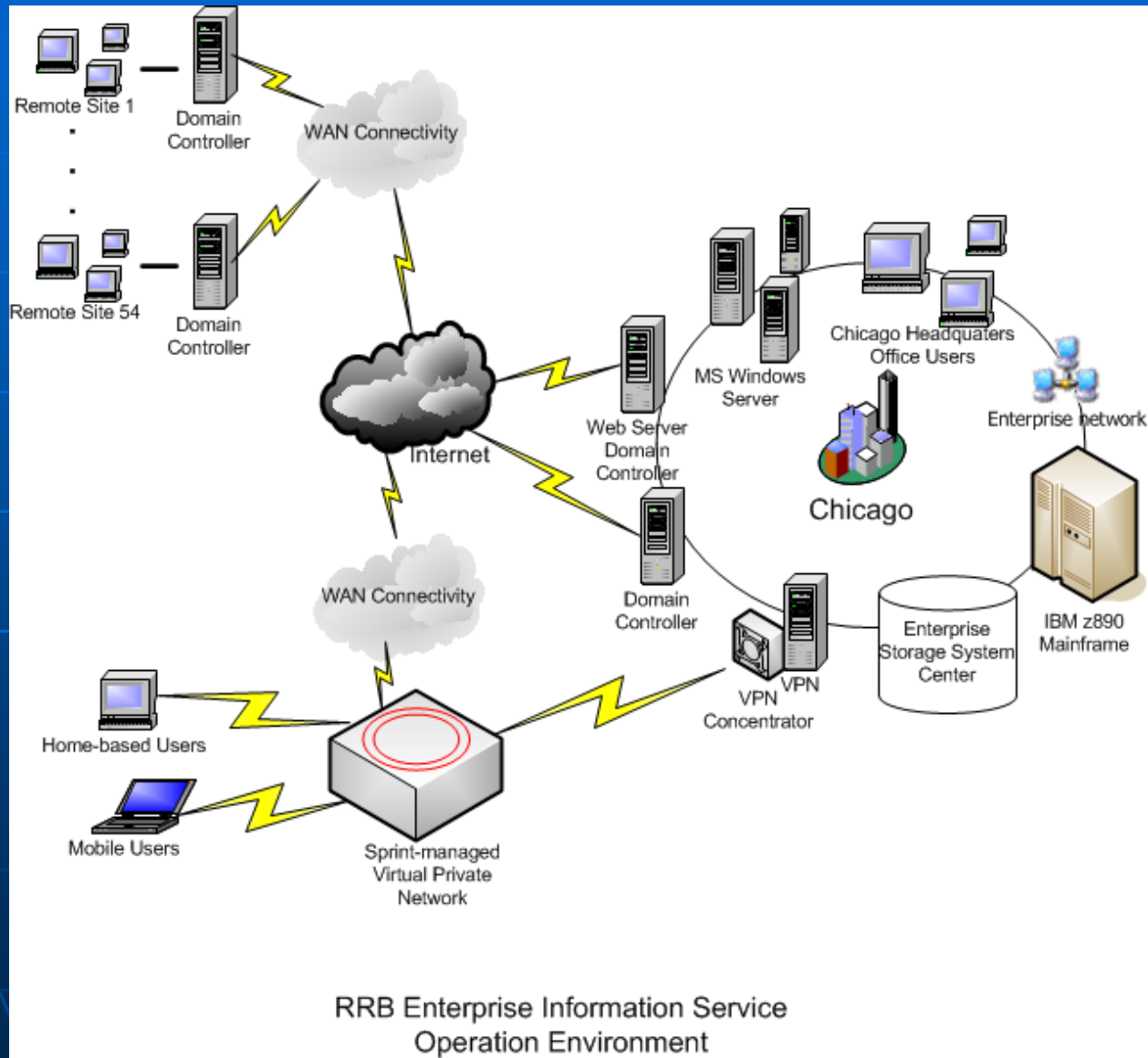
## ■ Applications

- Social media, Messaging
- Mobile Device Management
- Mobile Device Location Identification, Map
- Mobile Device User Data
- Mobile Marketing, Sales, Ordering, Shipping
- Field Survey Data Collections
- Mobile Asset Management
- Mobile Inventory Management
- Mobile Field Services, Mobile Workforce Solutions

# Data and Information

- Driving Directions/Display Maps (GPS and Map integration)
- Contacts
- Customer data
- Product data
- Orders
- Shipping/Shipment
- Workforce scheduling, progress, status, report

# RRB Enterprise Information Service System Architecture



# Mobile Application Data

- Data, Information and Knowledge
  - Data – Values describing facts
  - Information – Useful interpretation of data
  - Knowledge – Ability to act on decisions based on the information
- Data (raw material)
  - Data elements (smallest autonomous communication definition)
    - Data Types (binary, numeric, text, image, video, etc)
    - Size
    - Precision
    - Necessity: Null or not Null
    - Language: English, Spanish, Japanese, Traditional Chinese
    - Restricted domains: Numbers 0-9, Yes or No, days name, etc

# Mobile Application Data

- Data elements (smallest autonomous communication definition)
- Data Types (binary, numeric, text, image, video, etc)
  - A field in a database column
  - Examples: Record no, SS no, GPS coordinates, Message, Sales,
  - Data units
    - numbers, character strings, images, etc
- Information
  - Vehicle safety data
  - Personal Health data

# Intelligent Transportation System

## Connected Vehicle Safety Applications

- **Vehicle Data for USDOT Connected Vehicle Safety Applications, 18<sup>th</sup> World Congress on Intelligent Transport Systems, Oct. 16-20, 2011, [http://www.itsworldcongress.org/techshowcase\\_usdot.html](http://www.itsworldcongress.org/techshowcase_usdot.html)**
  - **V2V Safety System and Vehicle Build for Safety Pilot Project (V2V-SP) use 5.9 GHz Dedicated Short Range Communications (DSRC)**
  - **Safety Applications**
    - **Emergency Electronic Brake Lights (EEBL)**
    - **Forward Collision Warning (FCW)**
    - **Blind Spot Warning/Lane Change Warning (BSW/LCW)**
    - **Do Not Pass Warning (DNPW)**
    - **Intersection Movement Assist (IMA)**
    - **Left Turn Assist (LTA)**

# Collected and Exchanged Vehicle Data (cont.)

- Speed
- Time
- Vehicle's latitude
- Longitude
- Heading angle
- Lateral acceleration
- Longitudinal acceleration
- Yaw rate
- Throttle position
- Brake status
- Steering angle
- Headlight status
- Turn signal status
- Vehicle length
- Vehicle width
- Vehicle mass
- Bumper height
- the number of occupants in the vehicle



# Intelligent Transportation System

## Connected Vehicle Safety Applications

- RITA – U.S. Dept. of Transportation (Research and Innovative Technology Administration),  
[http://www.its.dot.gov/safety\\_pilot/](http://www.its.dot.gov/safety_pilot/)
  - Connected Vehicles Research,  
[http://www.its.dot.gov/connected\\_vehicle/connected\\_vehicle.htm](http://www.its.dot.gov/connected_vehicle/connected_vehicle.htm)
  - Safety Pilot Model Deployment,  
[http://www.its.dot.gov/safety\\_pilot/spmd.htm](http://www.its.dot.gov/safety_pilot/spmd.htm)
    - DSRC (Dedicated Short Range Communication)
    - ITS Videos, Vehicle-to-Vehicle Communications: A New Generation of Driver Assistance Safety,  
[http://www.its.dot.gov/library/media/v2v\\_video.htm](http://www.its.dot.gov/library/media/v2v_video.htm)
- 21<sup>st</sup> World Congress - Detroit 2014, Intelligent Transportation System, Sept. 7-11, 2014,  
<http://itsworldcongress.org/>

# Collected and Exchanged Vehicle Data

- USDOT – National Highway Traffic Safety Administration (NHTSA), DOT HS 811 373, October 2011, [www.nhtsa.gov/DOT/NHTSA/NVS/Crash%2520Avoidance/Technical%2520Publications/2011/811373.pdf](http://www.nhtsa.gov/DOT/NHTSA/NVS/Crash%2520Avoidance/Technical%2520Publications/2011/811373.pdf)
- **Communication Infrastructures**
  - Vehicle-to-Vehicle (V2V), Vehicle to Infrastructure (V2I), Vehicle-to-Consumer Devices (V2D)
- **Collected and Exchanged Data**

# Data Modeling

## ■ Purposes

- Documenting, Designing (Conceptually, Logically, or Physically), Improving
- Guiding and Advising
- Auditing/Enforcing
- Analyzing and Researching
- Communicating

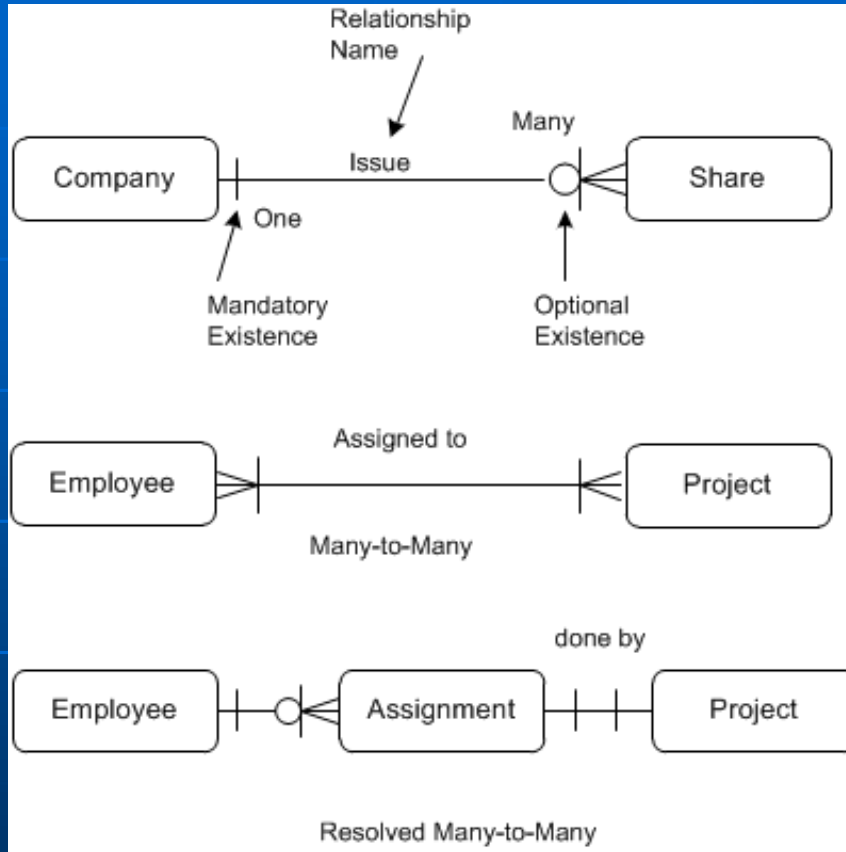
# Data Modeling

- Data Model
  - A collection of high-level data description constructs which hide many low-level storage details
- Semantic data model
  - A more abstract, high-level data model for initial description of the data in an enterprise
- Conceptual models
  - Document high-level business concepts
- Logical data models
  - Document data element rules and structure

# Relational Data Modeling

- Entity-Relationship (ER) data models
  - Describe the data in terms of their relationship
  - Entity
    - An object in the real world
    - Examples: the Sales Department, the Manager, the Sales Agent
    - Described using a set of Attributes
    - Examples: Employee (Name, SS number, Parking lots)
  - Used in Conceptual database design

# Data Modeling – Example 1 (Cardinality – define the number of instances for each entity)



Each Company can issue “zero”, “one”, or many “shares”.

Each Employee can be assigned with one or many Project.

Each Employee can be assigned with zero, one, or many assignment; each assignment is done through one project.

The small vertical line means “one”. The circle means “zero”. The triangle with a line through the middle means “many”.

# Data Modeling: A Business Card Example (Source: Data Modeling Made Simple, by Steve Hoberman, from Technics Publications, LLC, page 10)

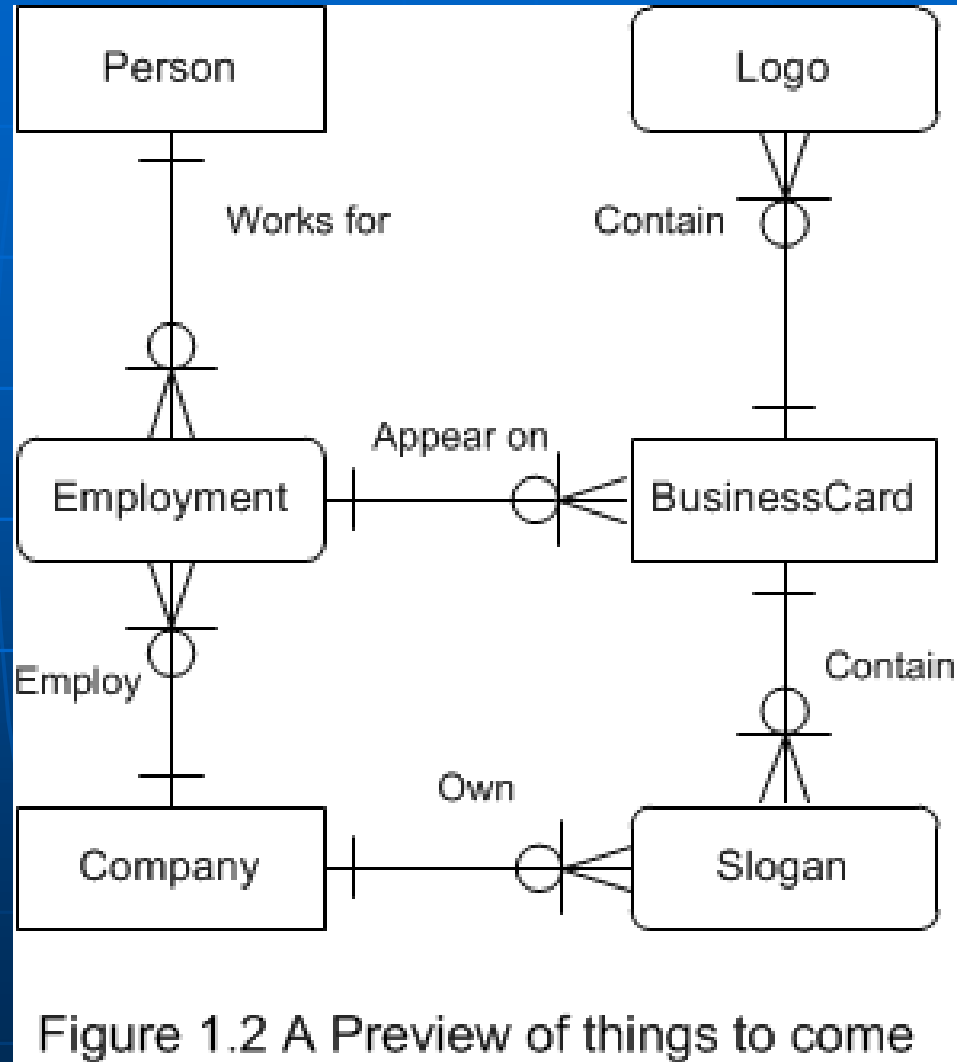
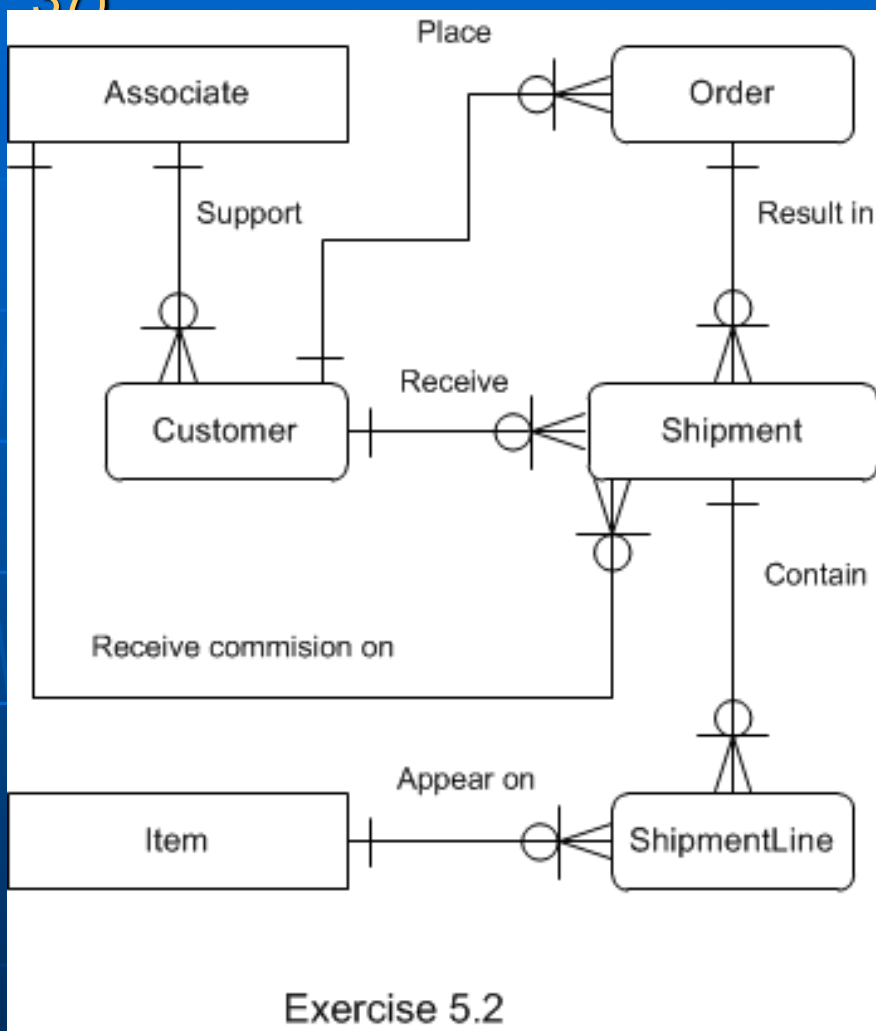


Figure 1.2 A Preview of things to come

# Data Modeling – Example 3 (Source: Data Modeling Made Simple, by Steve Hoberman, from Technics Publications, LLC., page 37)



**Each Product can appear on one or many Order lines.**

**Each Order line can belong to one or many Products.**



# Business Card Model in 3<sup>rd</sup> Normal Form

(Source: Data Modeling Made Simple, by Steve Hoberman, from Technics Publications, LLC, page 73)

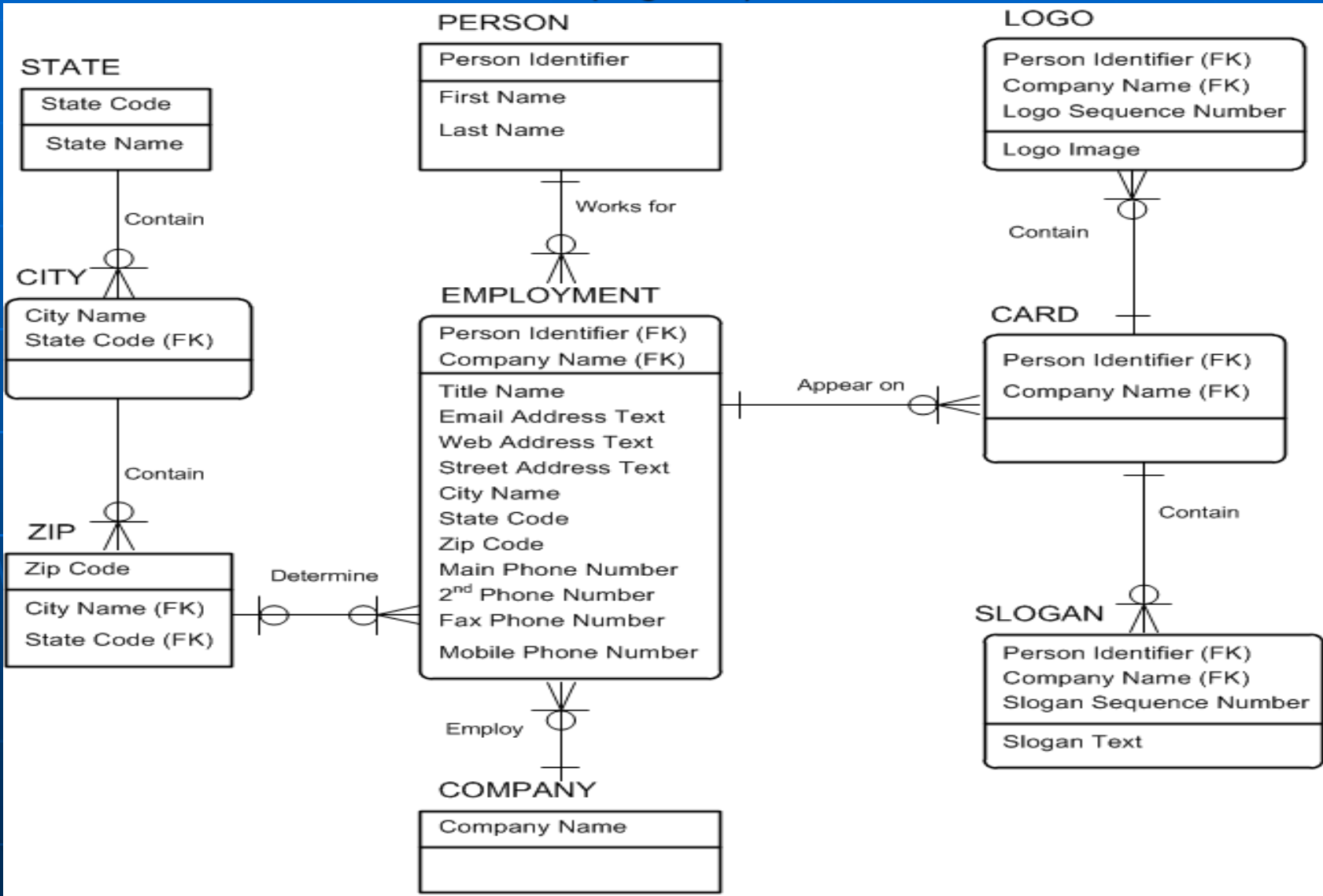


Fig. 8.13 Business Card Model in 3NF

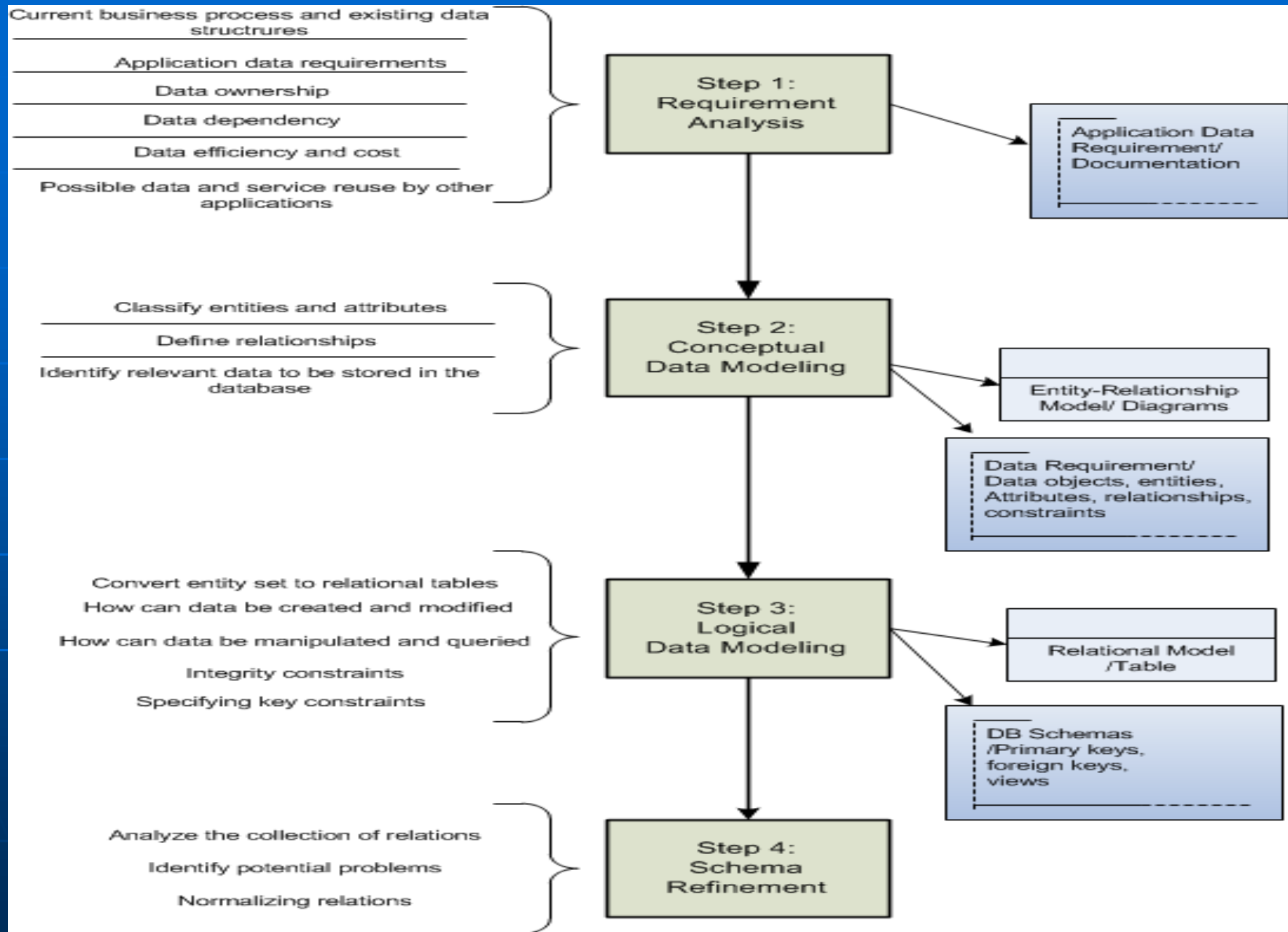
# Relational Data Modeling

- Physical data model
  - For actual design of a database
  - Basis for the code written to create Tables, Views, and integrity constraints
- Security Design

# Data Modeling and Database Design

## Modeling

- 1) Requirement Analysis
- 2) Conceptual Database Design
- 3) Logical Database Design
  - \* Schema refinement
  - \* Normalizing relations
- 4) Physical Database Design
- 5) Security Design

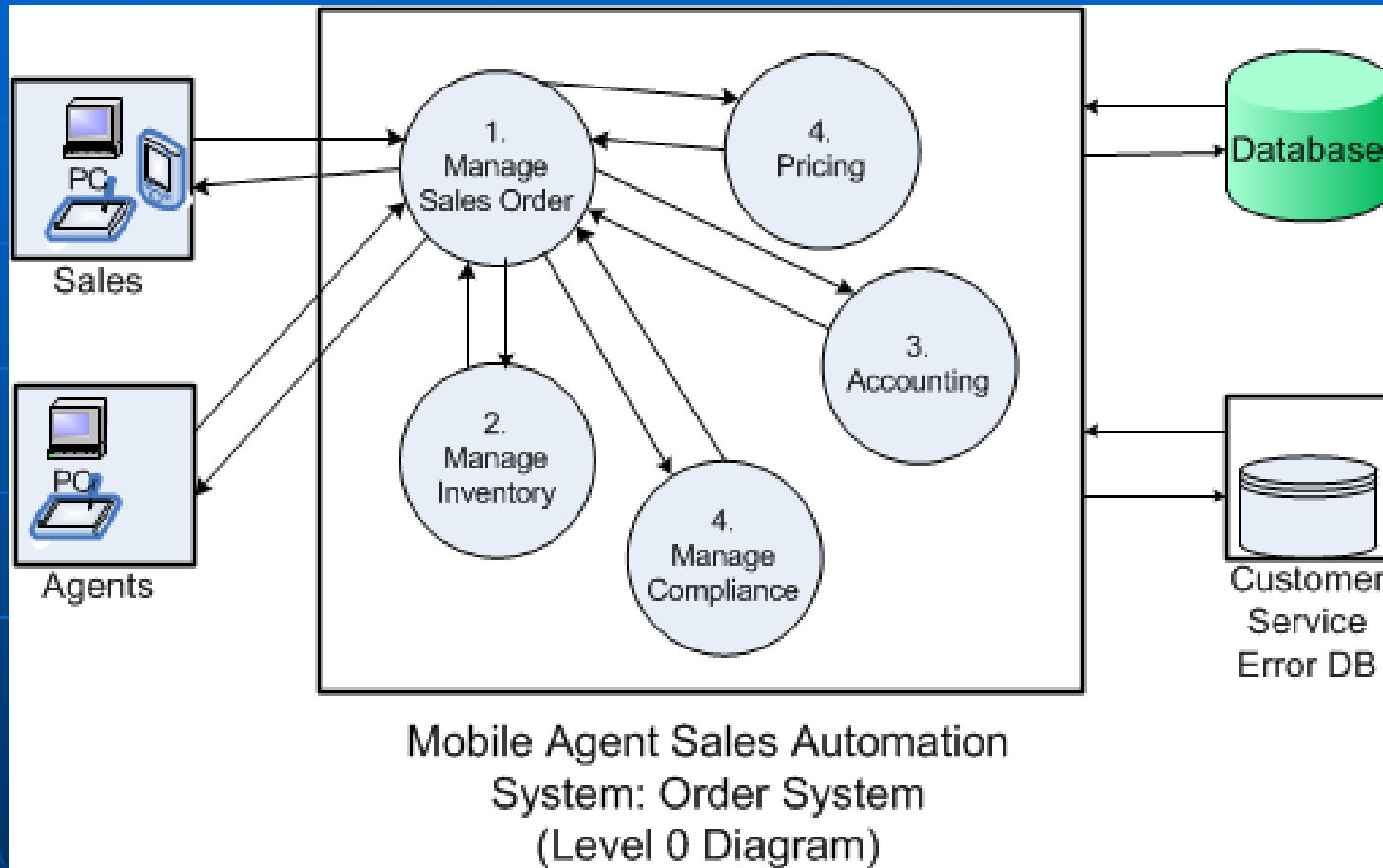


Workflow for Data Modeling

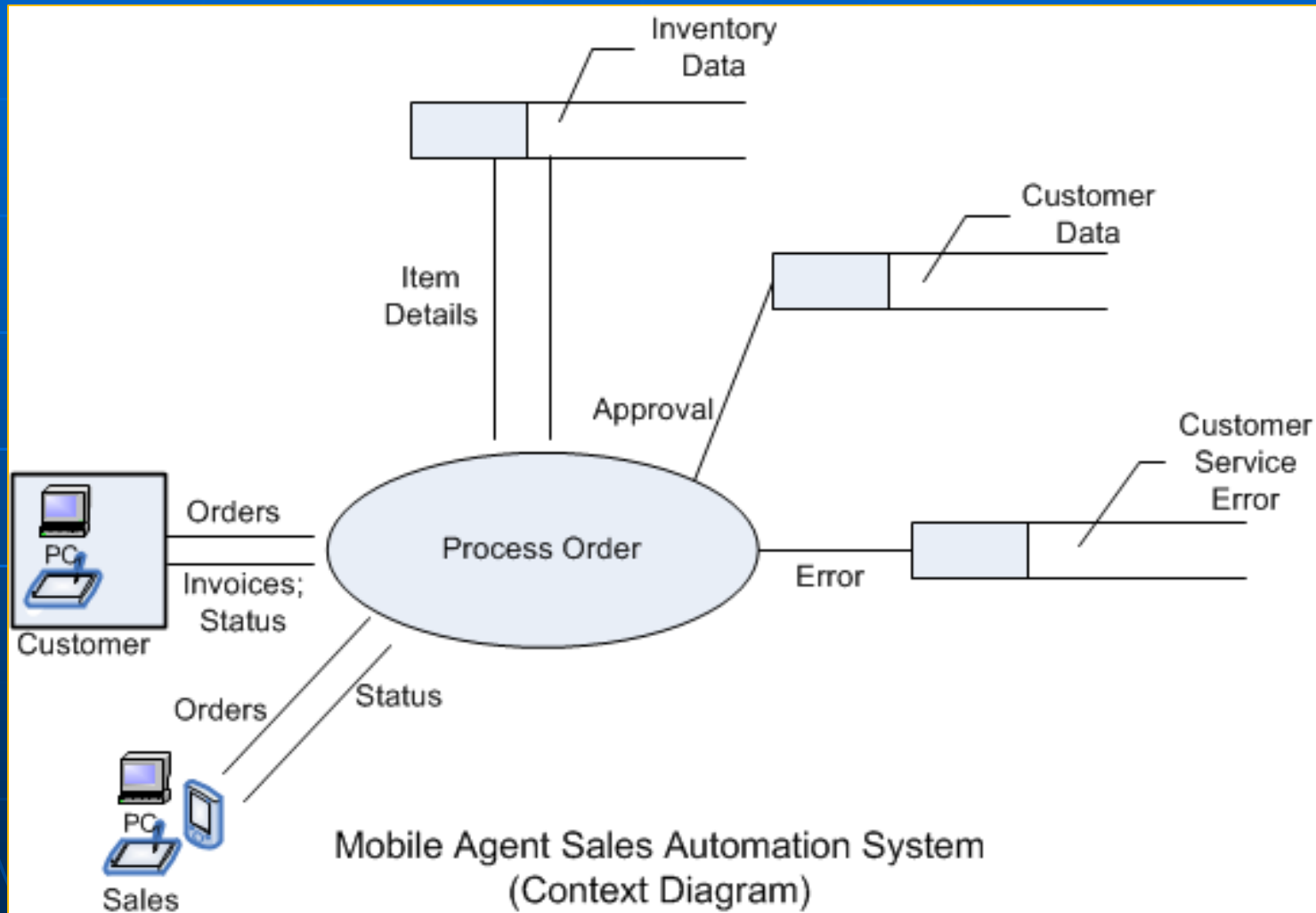
# Other Modeling Tools

- Data Life Cycle
  - Need, Plan
  - Collect, Store
  - Combine, Act
  - Achieve, Remove/Restore
- Activity Modeling
- Process flow
  - Sequencing
  - Dependencies
- Use Cases
  - Functionality description
- Data Integration
  - Mapping source and target

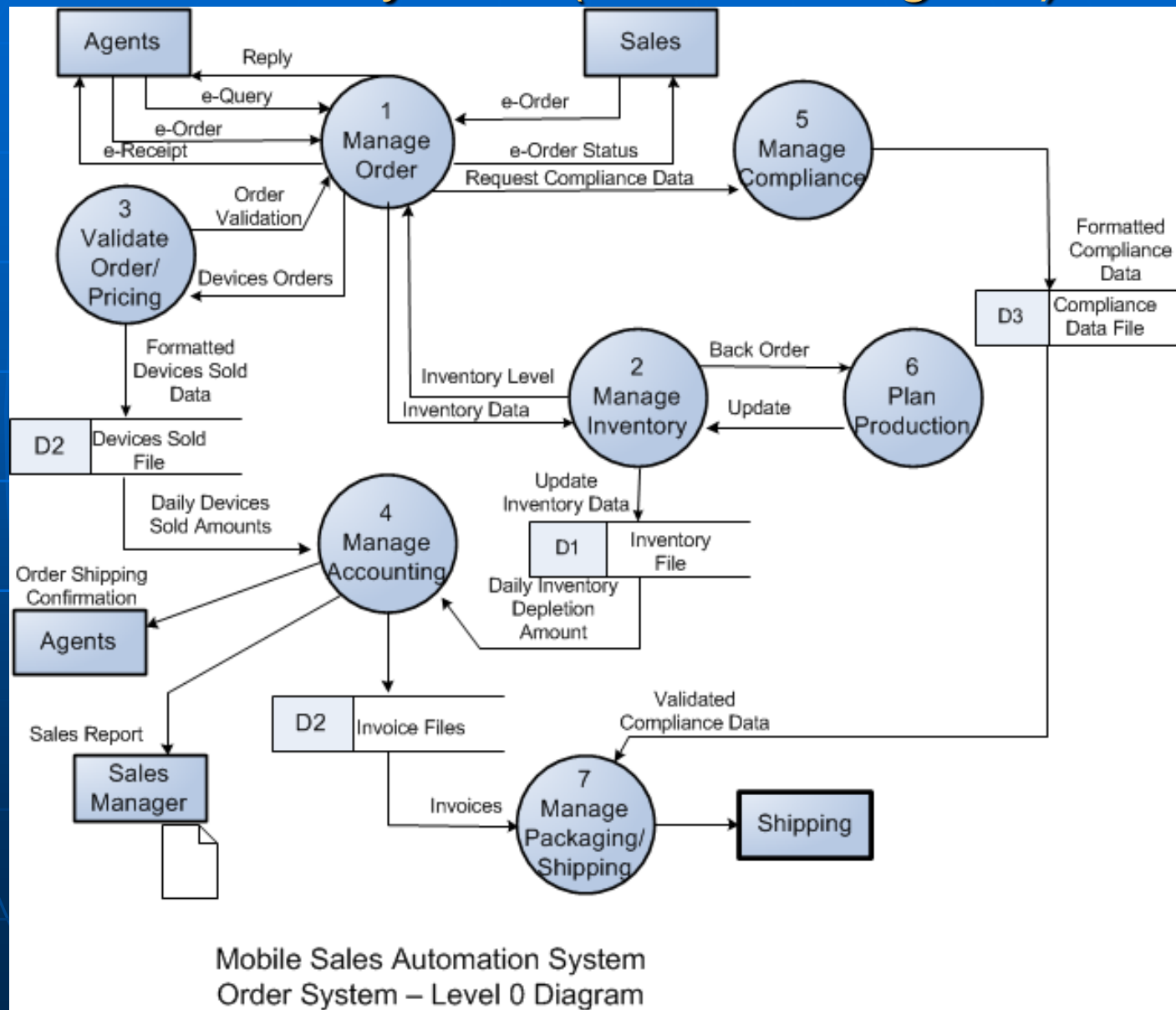
# Mobile Agent Sales Automation Order System (Level 0 Diagram)



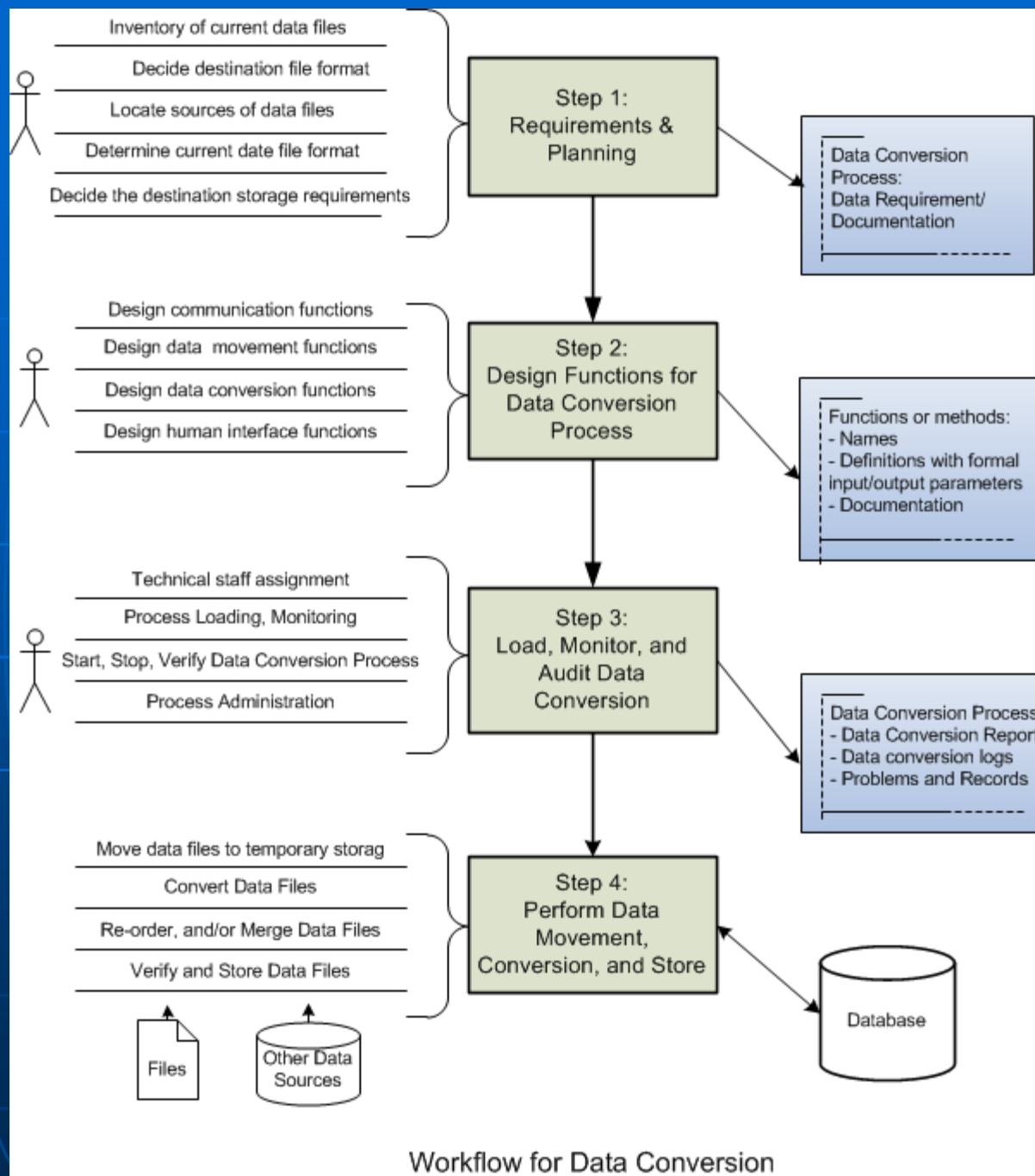
# Mobile Agent Sales Automation



# Mobile Agent Sales Automation Order System (Level 0 Diagram)







Workflow for Data Conversion