Cell Phones using RFID

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Agenda

- Objective
- Current RFID (SCM Video)
- Advantages
- Requirements
- System Design
- Use Case Diagrams
- Activity Diagrams
- Future Work

Objective

- Buy Products, Pay Bills, Lookup information using
  - Cell Phones Internet Access
    - Wireless Access Protocol (WAP)
    - Information Mode (iMode)
  - Radio Frequency Identification (RFID)
  - Uses existing Telecom Network

Definition

- RFID

  – RFID tags are small integrated circuits connected to an antenna, which can respond to an interrogating RF signal with simple identifying information, or with more complex signals depending on the size of the IC.
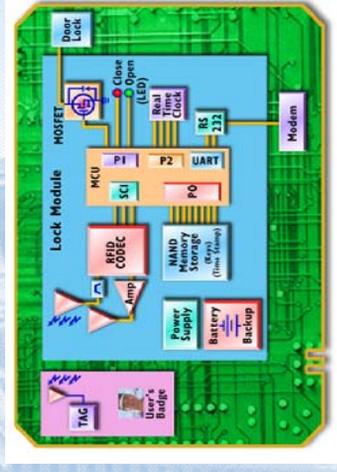
Definitions (contd.)

- Electronic Product Code (EPC)
  - New Industry Standard to Identify any Product

ELECTRONIC PRODUCT CODE TYPE I

01.0000A89.0001bF.0001b9DC0

| Header 8-bits | EPC Manager 28-bits | Object Class 24-bits | Serial Number 36-bits |

RFID Basics

Advantages

- Benefits of Speed:
  - Speed up store receiving, processing, replenishment and returns processing.
  - Notification of units needed on sales floor upon store receipt.
  - Satisfy customer requests immediately by locating products on sales floor and in the stockroom.
  - Faster and more accurate inventory audits.
  - Increased distribution center efficiency and accuracy.

Advantages (contd.)

- Benefits of Visibility
  - Unit, carton and pallet-level visibility throughout supply chain.
  - Immediate identification of exceptions at various delivery points of goods.
  - Visibility to replenish the right product to the right place at the right time.
  - Block receipt of defective and counterfeit merchandise.

Advantages (contd.)

- Benefits of Wireless Transfer
  – Leverage use of existing Cell Phone/Mobile Telecommunication Network
  – Real time availability of information
  – Easy Data visibility
  – Easier access of consumers about products
  – No hassle of carrying credit cards and other personal identification

System Hardware

- Cell Phone
- Product
- RFID Tag
- RFID Reader

Requirements

- Product Requirements
  - EPC Requirements
  - RFID Tag Requirements
- RFID Requirements
  - Used SCM Requirements
- Cell Phone Requirements
  - Operational Scenarios (Product Mode and Finance Mode)

Requirement Gatherings

System Overview

RFID Tag with EPC activated

COMMODITY

14

radio waves

DATA TRANSFER

DATA TRANSFER

rf signal

ANTENNA

RFID SCANNER(READER)

DATA TRANSFER

DATA FLOW

DATA TRANSFER

Satellite dish

DATA TRANSFER

DATA FLOW

DATA FLOW

DATA FLOW

Server

Product with RFID Chip → **RFID Communication** → **Cell Phone with RFID Reader** → **Data**

Data Comm → **Product Mode**

If Payment Required

Payment → **Financial Mode**
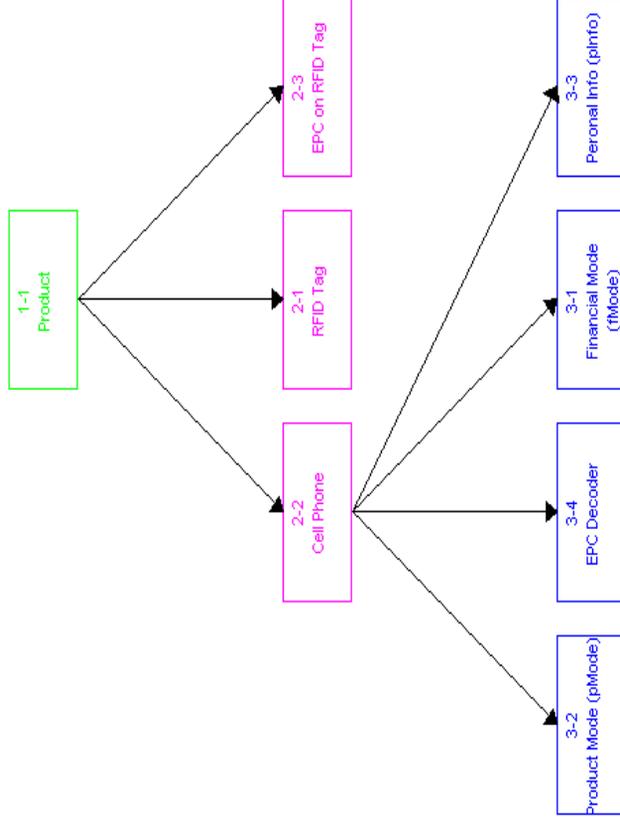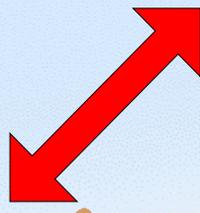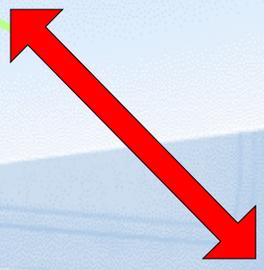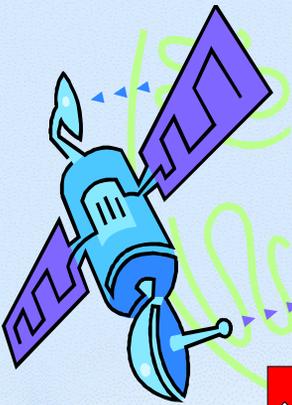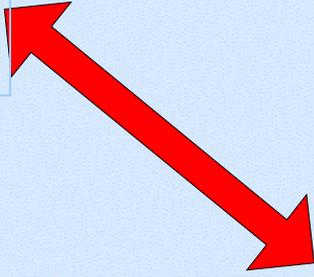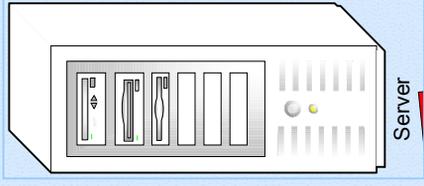
S Y S T E M   D E S I G N
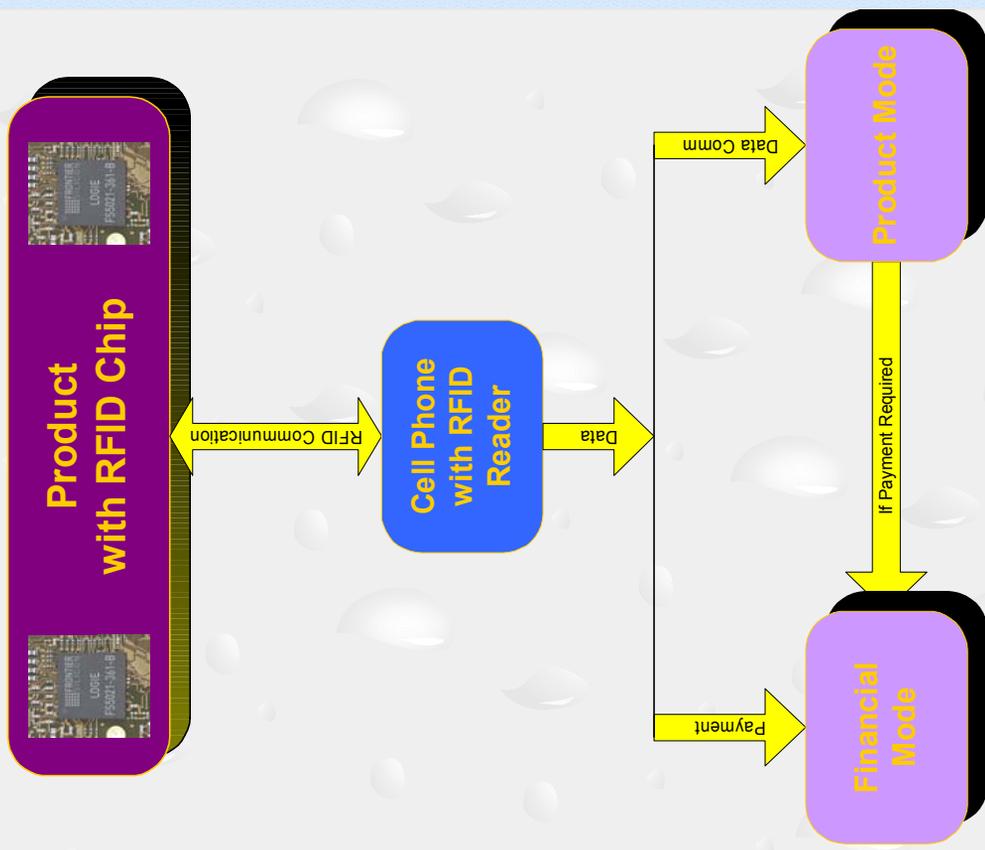
Initial Use Case Diagram

EPC using RFID

Product

Cell Phone

Electronic Product Code (EPC)

Radio Frequency Identification Tag(RFID)

RFID Decoder

fMode

pMode

Satellite

RFID Reader

Server
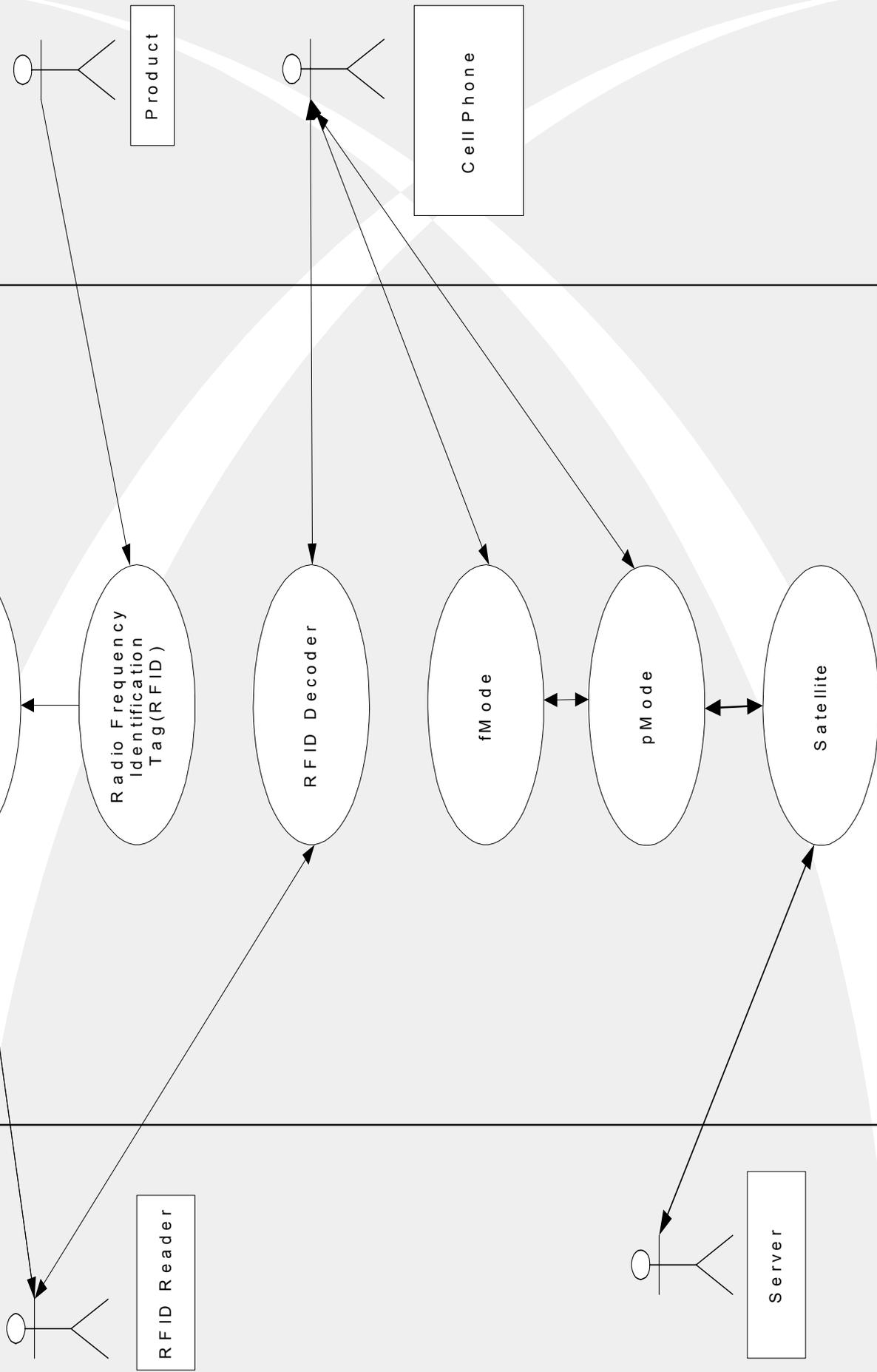
Use Cases # 1

- Retrieve Electronic Product Code

  – Primary Actors
    - Product having RFID Tag, Cell Phone having RFID Reader

  – Pre-conditions
    - Cell Phone power source must be sufficiently charged
   - Product must be in communication range of cell phone having RFID Reader

Product

RFID Reader is placed within range of RFID Tag

RFID Tag is Activated

EPC via Embedded RFID Tag transmitted through Antenna

RFID Reader Receives EPC

Middleware receives EPC

RFID Reader Receives EPC

RFID Reader rerequests EPC

Accurate

Not Accurate
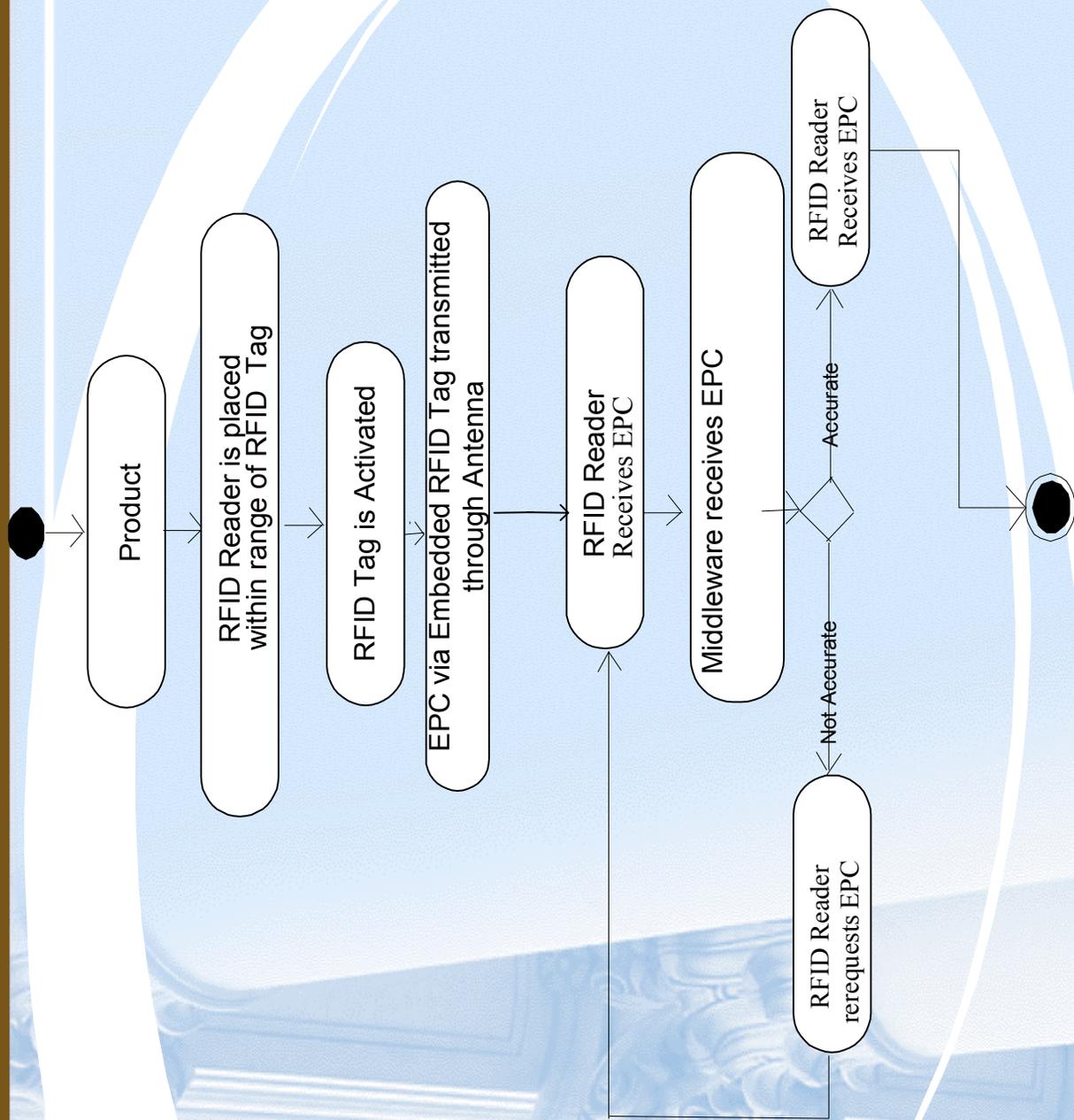
Use Case # 2

- Decode the Electronic Product Code Information into four identifying fields

- Primary Actors
  – Cell Phone having RFID Reader

- Pre-conditions
  – Received EPC should be valid
  – Cell Phone having RFID Reader should be fully charged

```
                    ┌──────────────────┐
                    │  Make sure EPC   │
                    │   on Product     │
                    └──────────────────┘
                             ▲
                             │ No
              ┌──────────────────┐
   ●──────→   │ Product with EPC │
              └──────────────────┘
                      │
                      ▼
                   ◇ RFID Tag Available ◇ ──── Yes ──→ ┌──────────────┐
                                                        │ Read 96 bit  │ ──→ ◉
                                                        │  EPC Code    │
                                                        └──────────────┘
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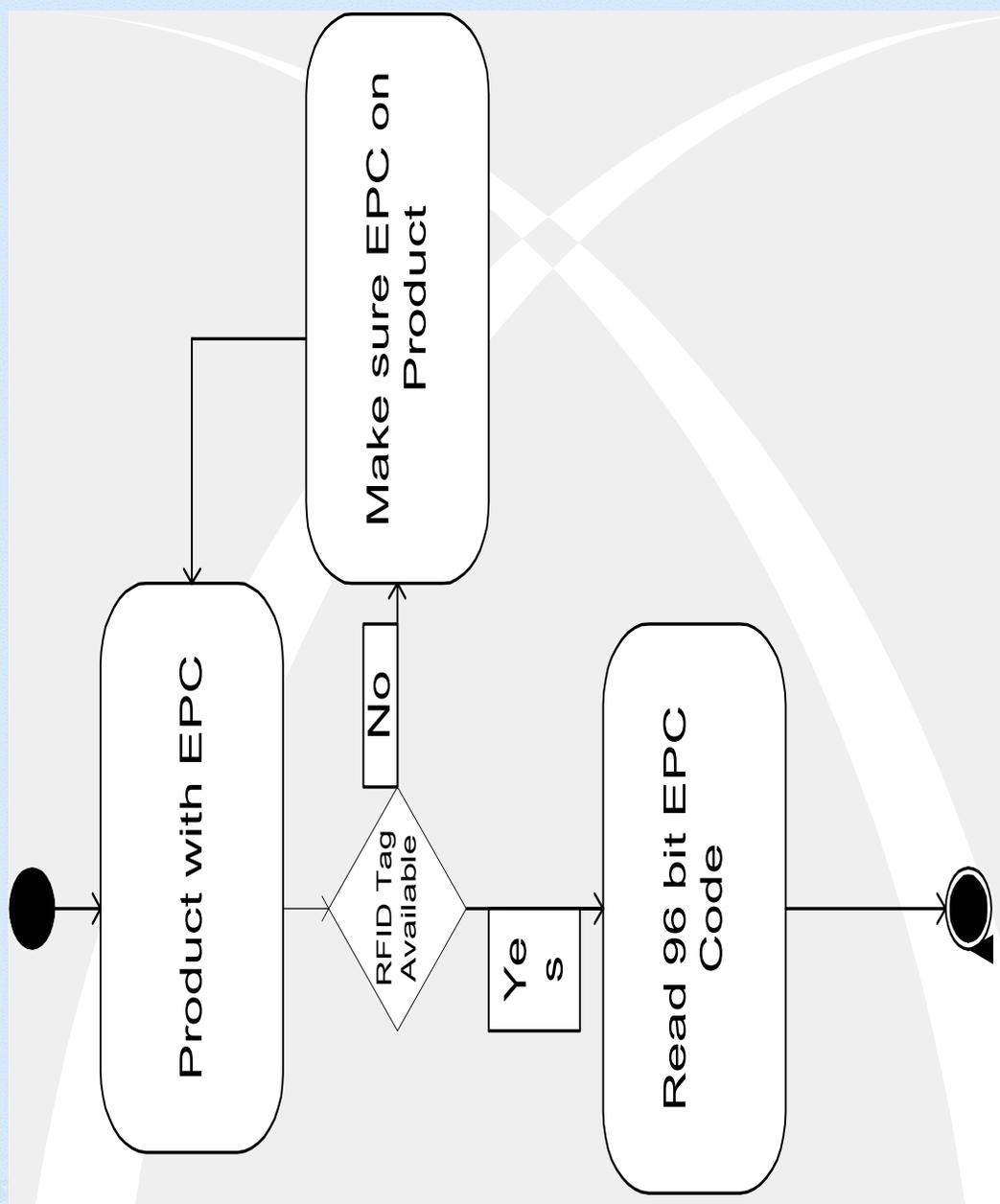
Use Case # 3

- RFID Reader interacts with Cell Phone Operating System

- Primary Actors
  – Cell Phone with RFID Reader

- Pre-conditions
  – Cell Phone is fully charged
  – EPC has been decoded

- Product Scanned
- EPC Decoded
- Operating System interprets information
- If information doesn't exists
- Report to Systems information doesn't exist
- If information exists
- Return request information
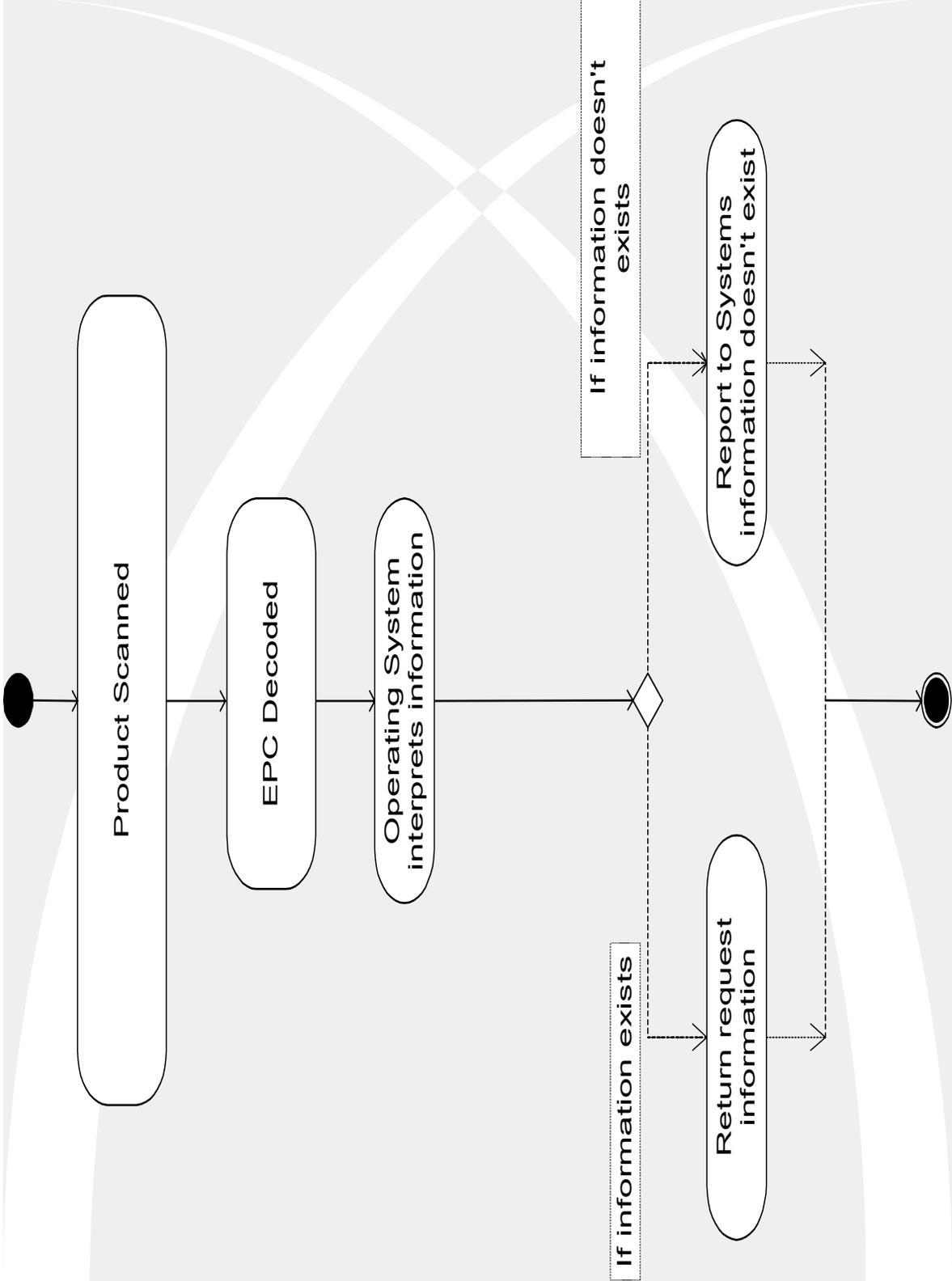
Use Case # 4

- Cell Phone Operating System decides mode

- Primary Actors
  – Cell Phone with RFID Reader
  – Cell Phone Operating System

- Pre-conditions
  – EPC Information Decoded Correctly

Class Diagram

Product
- -objectType
- -objectName
- -epcVal
- -rfidBatt

EPC
- -epcVal

RFID Tag
- -rfidTag

«metaclass»
Cell Phone
- -Operating System
- -RFID Reader

OperatingSystem
- -name
- -isVal
- -verNum

fMode
- -creditCard
- -SSN
- -veriFlag

PersonalInfo
- -Name
- -PersonalInfo

pMode
- -EPC
- -sendFlag
- -prodInfo

EPC Decoding
- -Product Type
- -Header
- -epcManager
- -objectClass
- -serialNumber

Verification
- -isVerified

RFID Reader
- -antenna
- -transponder
- -powerTags

antenna
- -length
- -correspond

transponder
- -memoryType
- -programmingOpt
- -dataOption

powerTags

Conclusion

- Cell Phones used to get product information
- Cell Phones used to buy things on the spot
- Cell Phones used in place of Credit Cards
- How reliable is this information
- How secure is this information

Next Stage

- Identify how RFID Reader to be incorporated into Cell Phones
- Verify Requirements (Traceability Matrix)
- Working on System Design for incorporating RFID Reader in a cell phone operating system (iMode)
- How WAP or iMode can be leveraged to have pMode and fMode
- http://www.nttdocomo.com
- http://www.nokia.com