

# Item Level RFID Tags



## Extend Memory – Not Just an ID



- Expanded memory capacity
  - ◆ Transaction history (e.g., pharmaceutical medicine)
  - ◆ Extended ownership description (e.g., airline luggage)
  - ◆ Content authentication (hash of legal documents)



- Ownership information (~ 512b)
  - ◆ Each ASCII needs 8 bits
  - ◆ Each Chinese character needs 16 bits
  
- Applications
  - ◆ Freight items
    - Luggage
  - ◆ Post mail and packages
  - ◆ Human and animal ID tags
    - Patients tags
    - Students tags
    - Event tags



- Tracking information (1K-2K)
  - ◆ Transactions from manufacturers, distributors to retailers, etc.
  
- Applications:
  - ◆ Product history tracking
    - Pharmaceuticals, food, wine, cigarettes,
  - ◆ Anti-counterfeiting
    - Unique ID and logistic history for each product
    - User verification on the spot, no need of backend database



- Hash-of-content, or even content information
  - ◆ One A4 page of English ~ 4K to 8K bits
  - ◆ One A4 page of Chinese ~ 8 K to 16 K bits
  - ◆ One passport-sized picture ~16K to 32 K bits
  
- Applications
  - ◆ Machine automatic content reading
  - ◆ Authentication
    - Legal documents, such as certificate, diploma, transcripts, etc,
    - Pictures, or finger prints for ID cards



- MTP (multiple time programmable) logic-NVM
  - ◆ CMOS based NVM, up to 1K bits
  - ◆ Pro: No extra mask, low manufacturing cost
  - ◆ Con: Large footprint size
  
- MTP Flash (E<sup>2</sup>PROM)
  - ◆ Up to 128K bits
  - ◆ Pro: small footprint size
  - ◆ Con: Higher manufacturing cost
  
- OTP (one time programmable) NVM
  - ◆ Potentially can go beyond 128K bits
  - ◆ Pro: No extra mask, Low manufacturing cost
  - ◆ Con: One time programming

- EPC Gen-2 has little security mechanism built in
  - ◆ Only 32-bit password for read/write authorization
  - ◆ Plain EPC ID stored and transmitted
  - ◆ Tags may potentially be cloned, intercepted or emulated.
  
- Different levels of security needed for various applications

