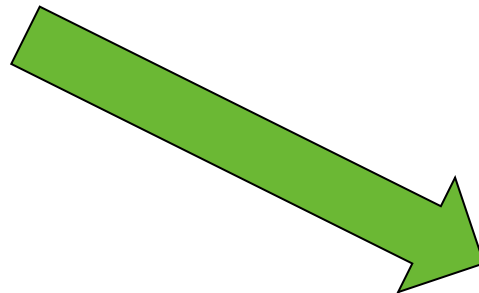
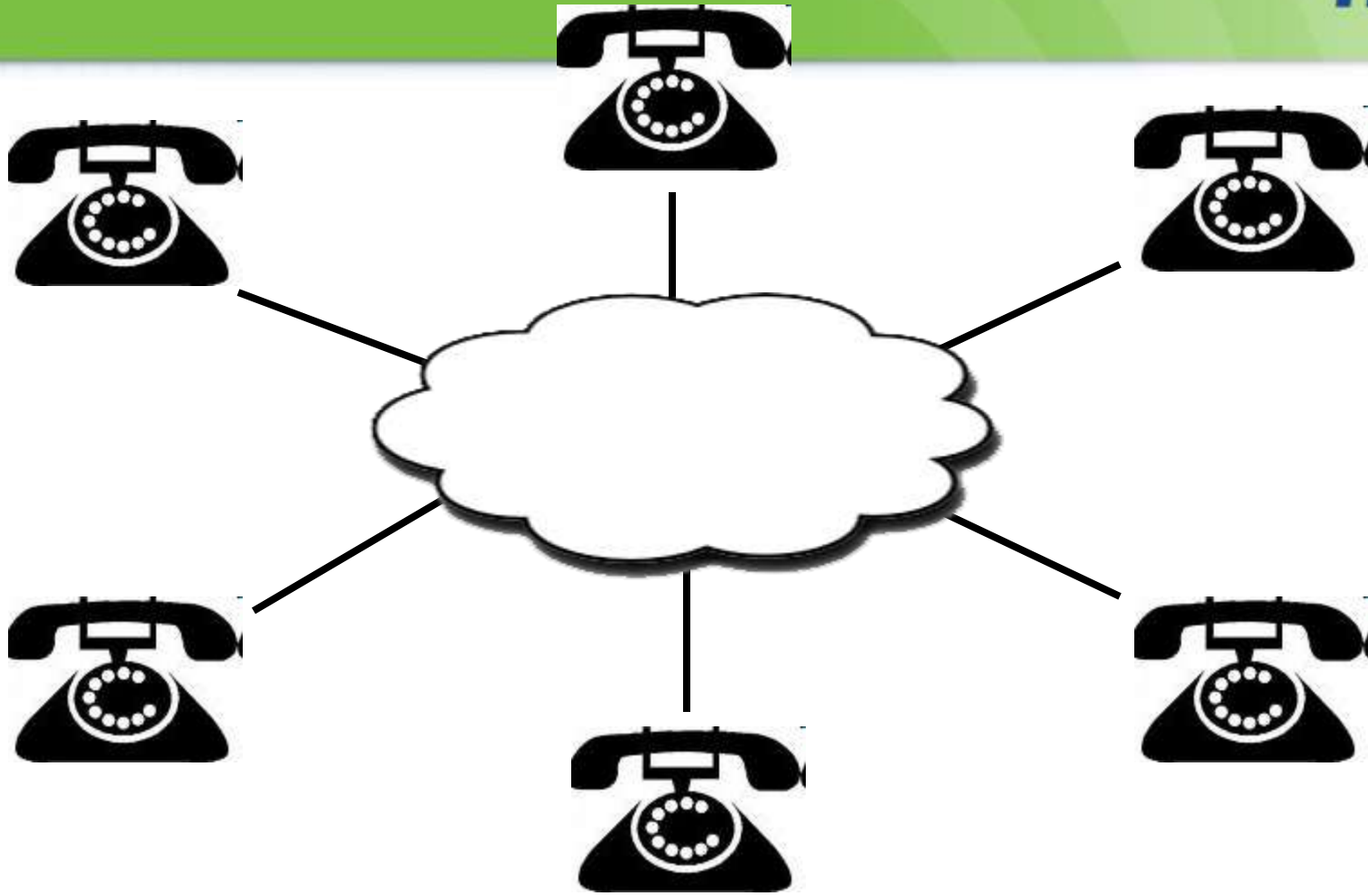


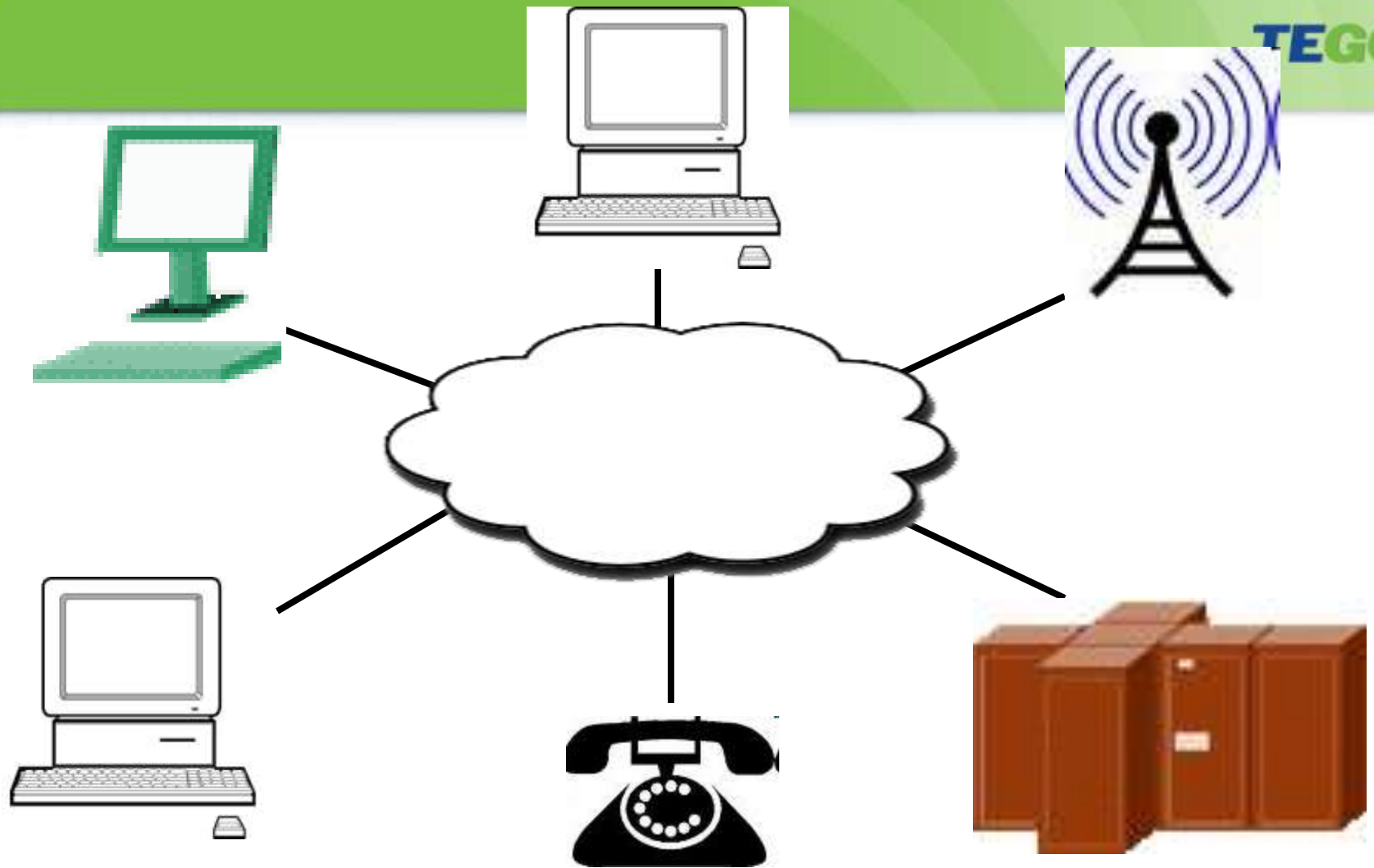


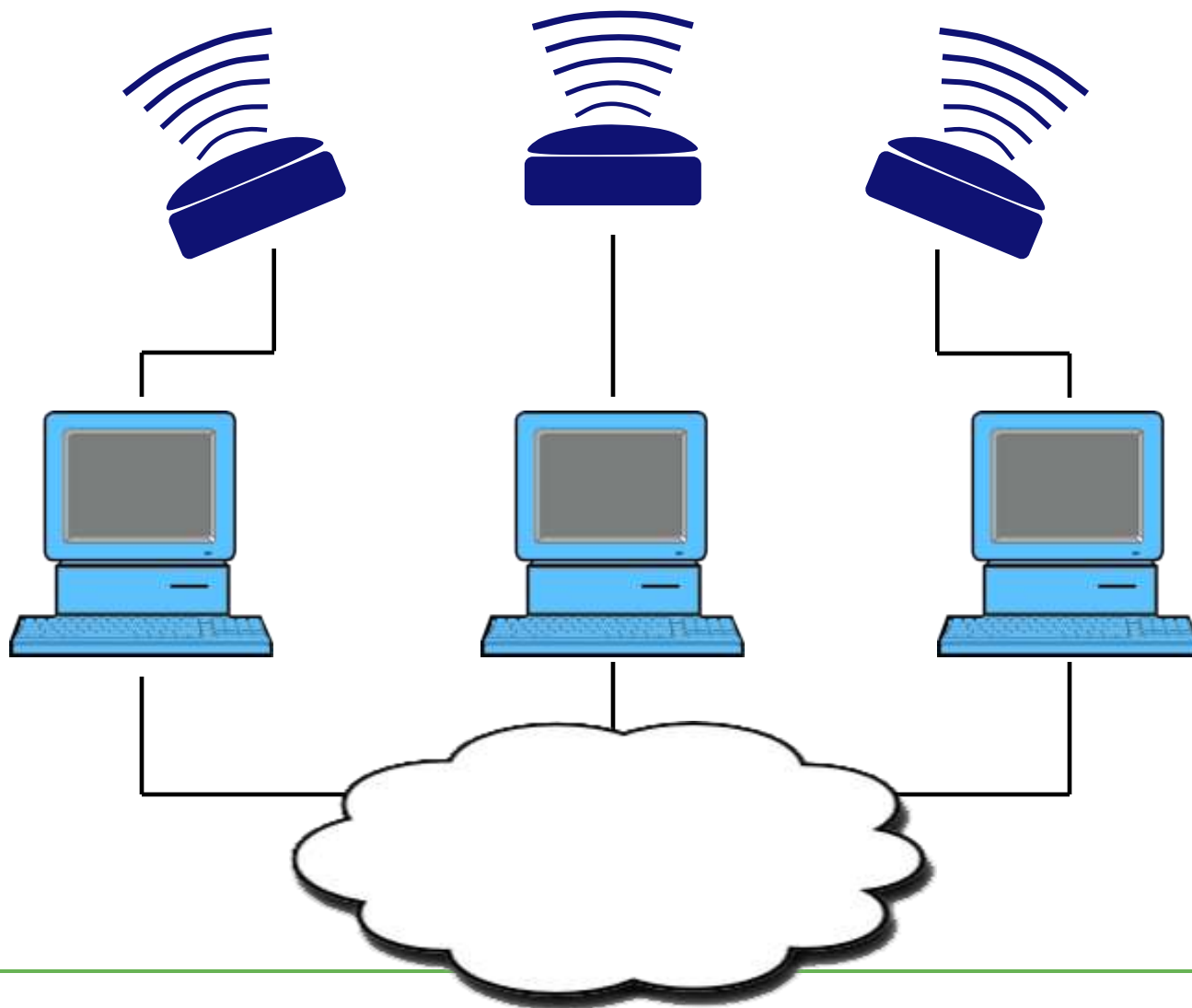
Putting to Work Spec2000 Chapter 9-5, RFID on Parts

June 2011









“All I need is a 96-bit identification number.”

- ATA Proverb

“640K ought to be enough for anybody.”

- Bill Gates

Air Transport Association

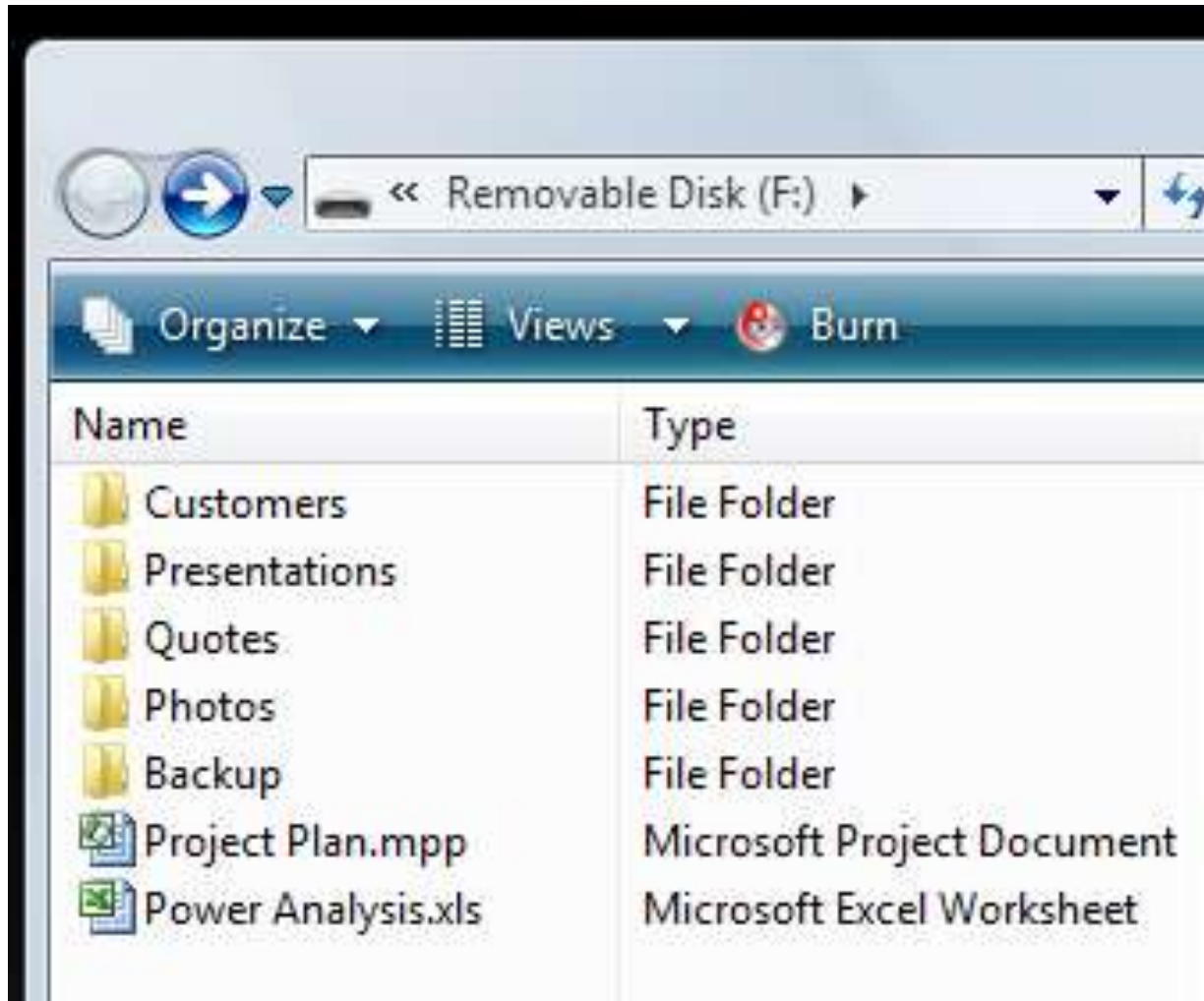
SPEC2000
e-business standards

9-5. Radio Frequency Identification (RFID) on Parts

Movable Storage



Managing Large Storage





Tag Memory Organization

Bank 00	Reserved
Bank 01	EPC
Bank 10	TID
Bank 11	User Memory

File Transfer Systems (FAT, NTFS...)

- **Direct data access (address, data) is not allowed**
 - **All data stored in files**
 - Files are stored in folders or subfolders
 - **Behind the scenes:**
 - File allocation table
 - Stored at a fixed address
 - Holds description and location of files
 - Files
 - Variable length – use a header/trailer mechanism
 - Integrity checks
 - Redundancy
 - Error detection and correction
-

ATA Container Structure (TOC)

- **All Data Stored in Records**
 - Records are variable length
 - Include a header (type) and trailer (CRC check)
 - **Behind the scenes:**
 - Table of Contents
 - Stored at a fixed location
 - Describes stored contents (size, location of records)
 - Integrity checks
 - Redundancy in ToC and header/trailers allows data to be recovered in the event of corruption
 - CRC for error detection/correction
-

TOC Overview

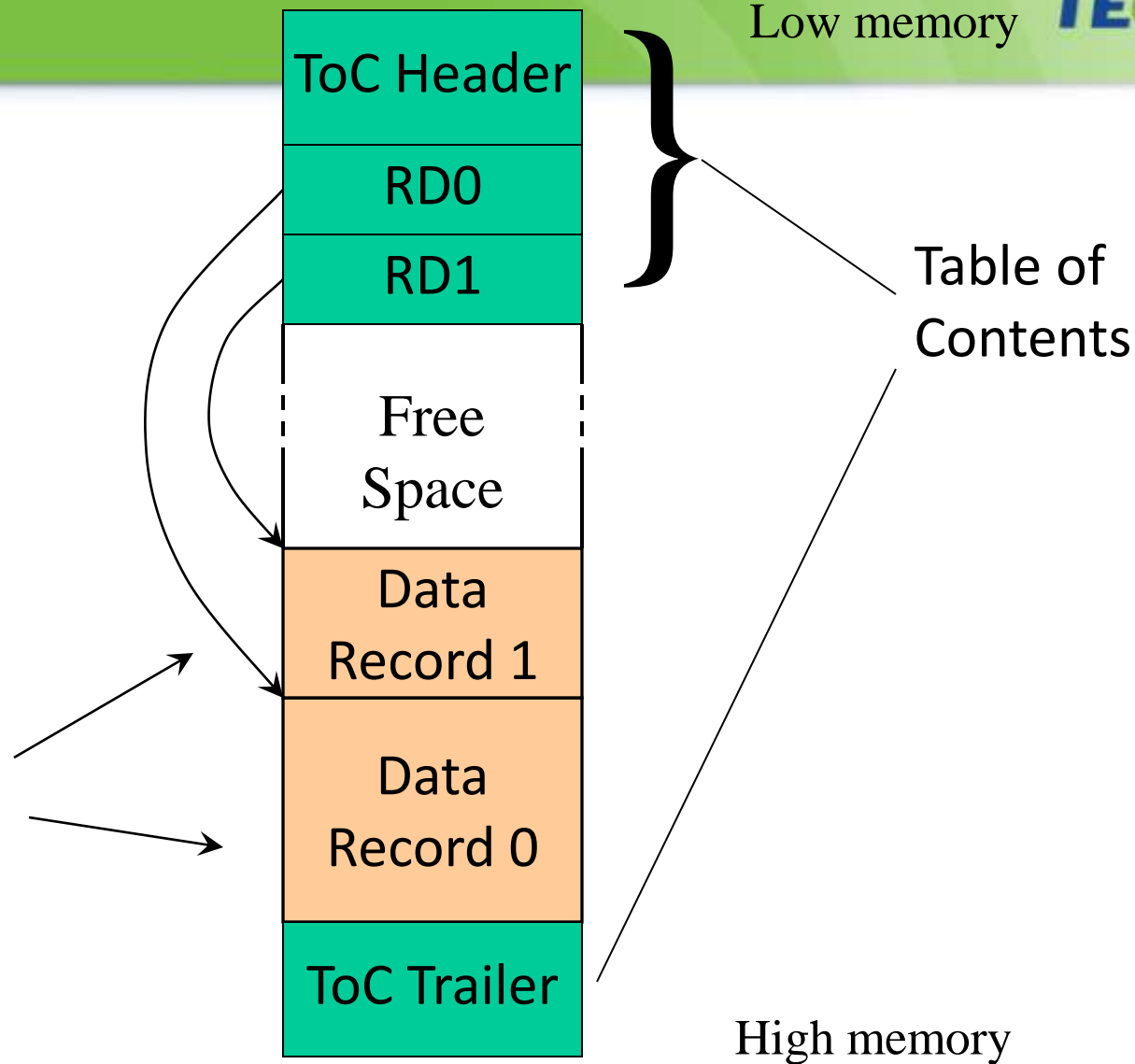


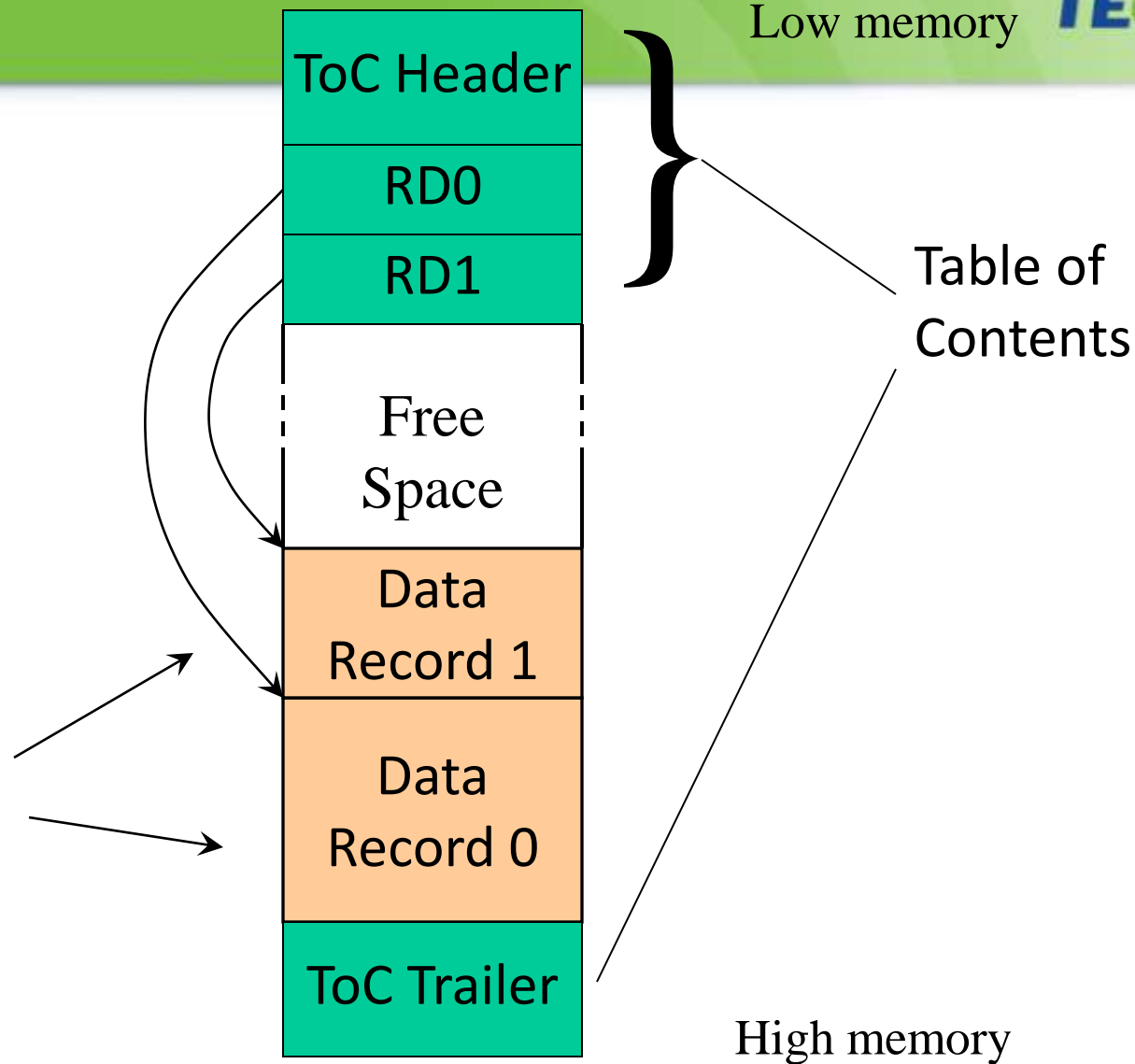
Table of Contents Header/Trailer

Header

ISO/EPC Industry Identifier [16]																															
ToC Major Version [7]					ToC Minor Version [4]				ATA Classification [5]																						
Flags [8]								Size of ToC Header [4]				Size of Record Descriptors [4]																			
Size of User Memory [0:15]																															
Size of User Memory [16:31]																															
<table border="1" style="width:100%; height:20px;"> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>																															
# of Data Records Present [16]																															
CRC over ToC [16]																															

Trailer

TOC Overview



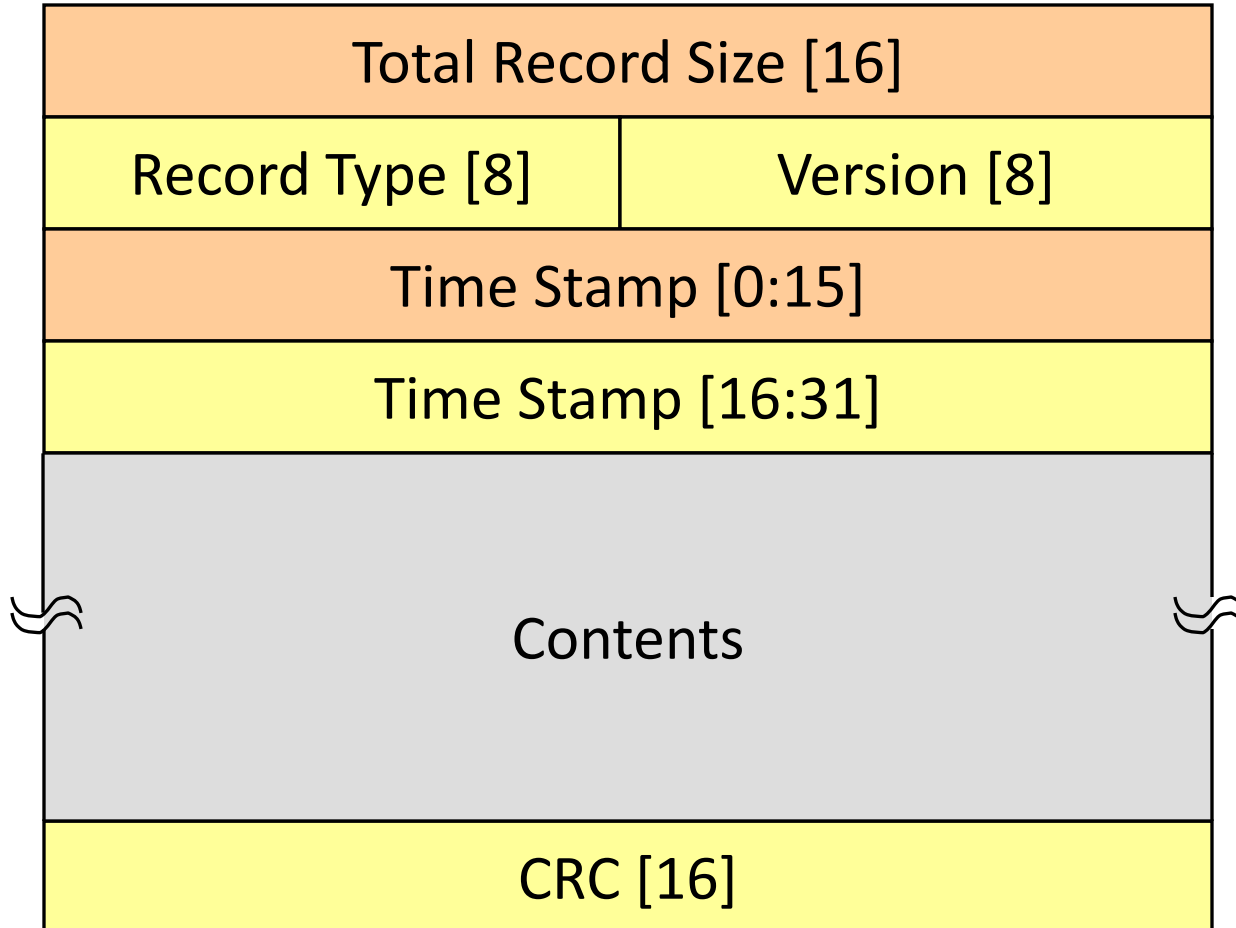
Low memory

Table of Contents

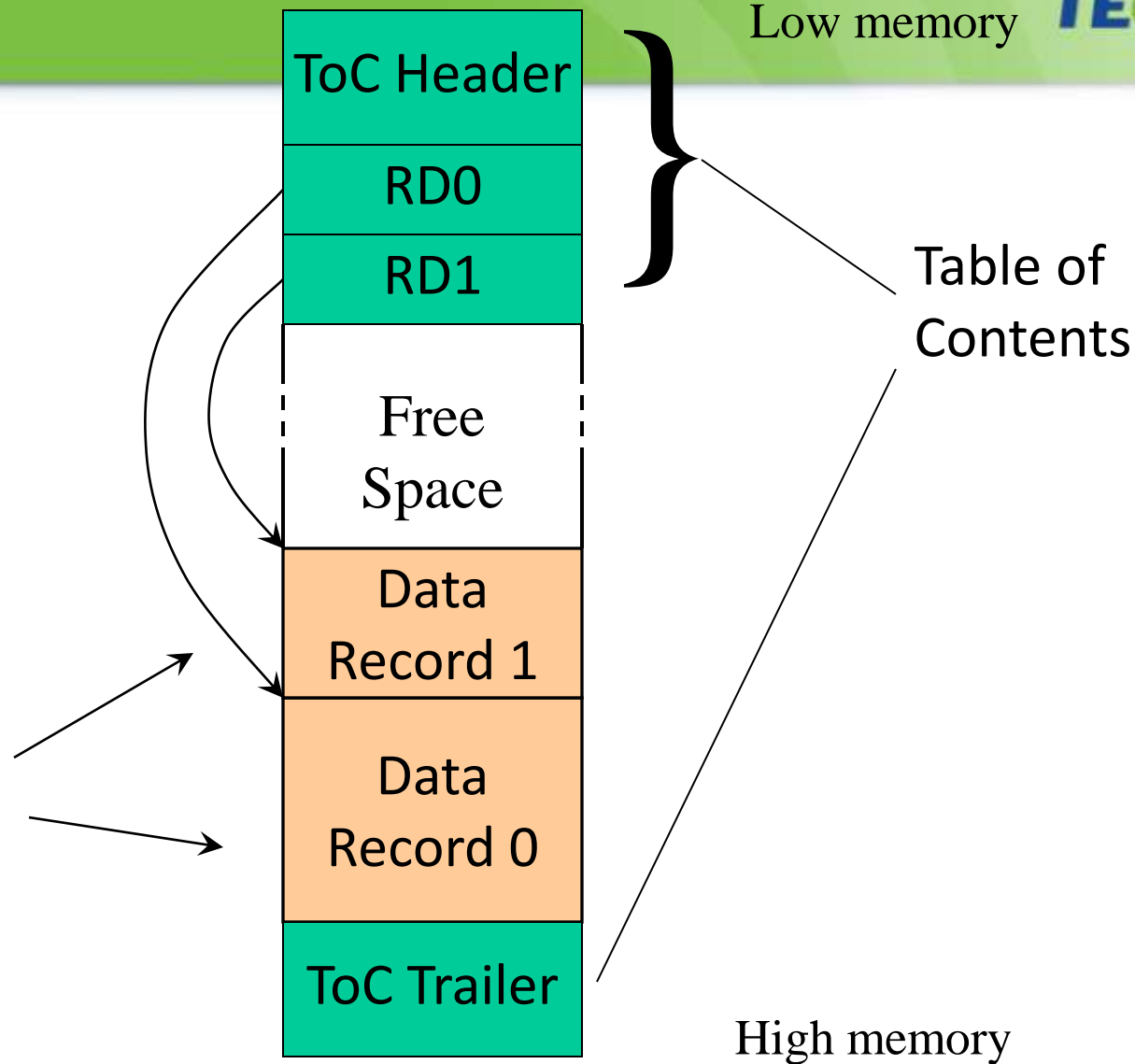
Variable Length Records

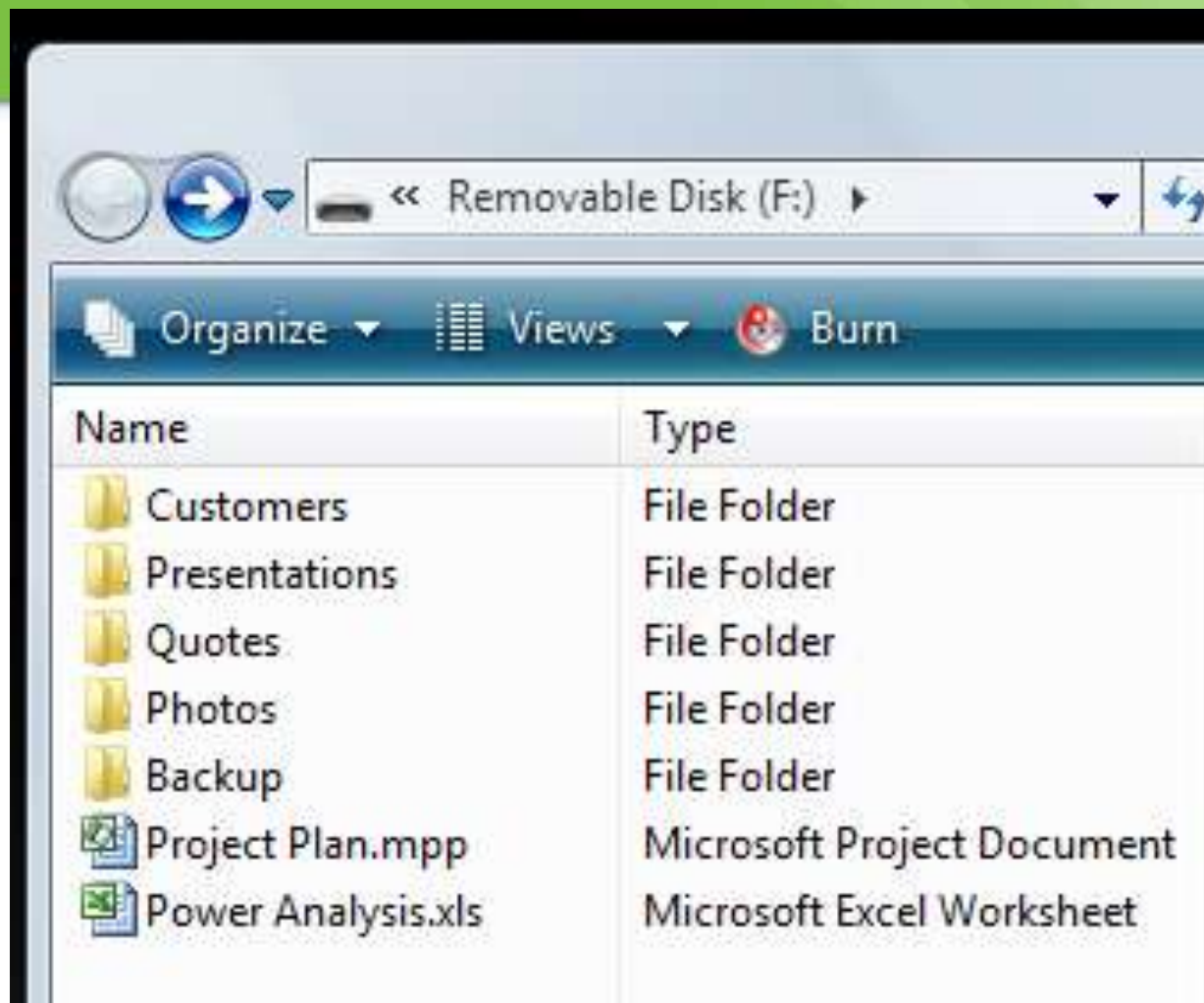
High memory

Data Record

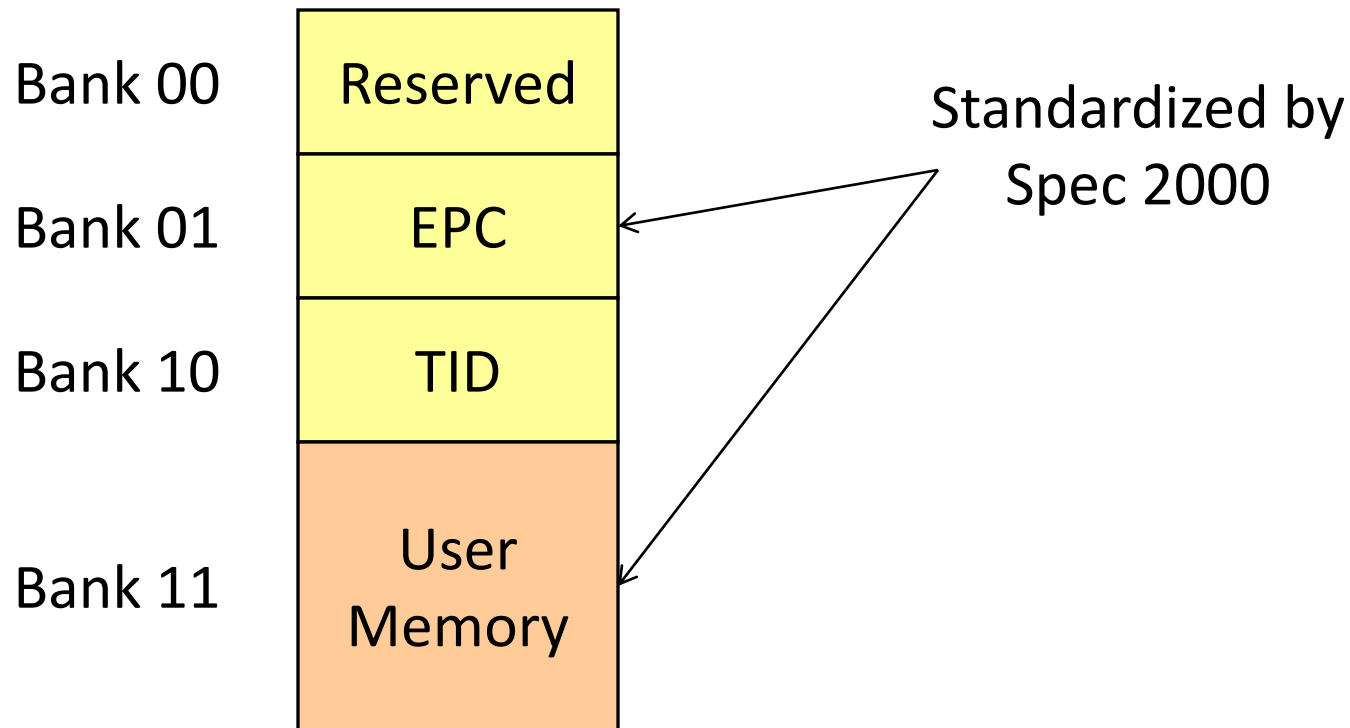


TOC Overview





Tag Memory Organization



EPC Number

Industry Header	Filter Value	Issuing Agency Code # (IAC)	Manager number (CAGE Code or DODACC)	Original Part Number (PNO)	Alphanumeric Serial Number (SEQ or SER)
Defined URN, prevents collisions with other EPC identifiers Could in future be used for multiple industries - but current approval only for Aerospace & Defence	All-numeric value - used to access limited selection of tags within read field	Internal GS1 integer value in table supports lookup to all 36 IAC values registered according to process defined in ISO 15459	Up to 13 characters	Up to 30 characters Equivalent to Item Reference or Object Class	Up to 30 characters
8-bits	6 bits	6 bits	Up to 78 bits	Up to 180 bits	Up to 180 bits

Delimiter (*)

Up to 476 bits

User Memory - Standard Formats

Low Memory
Format

Small ToC

Small Birth Record

High Memory
Format

Regular ToC

Full Birth Record

Part History Record

Mechanic's Comments

Current Data Record

“MFR 12345* SER A16175* PNO XYZ123-7”

4 Record Types

- **Birth Record**
 - One per tag
 - **Part History Record**
 - For each maintenance event
 - **Mechanic's Scratchpad**
 - Rewriteable notepad
 - **Current Data Record**
 - Collection of most recent data items
-

Birth Record

- **The first record written, usually at time of manufacture**
 - **Archival record – cannot be modified**
 - **Mandatory fields:**
 - Manufacturer CAGE Code (MFR)
 - Serial Number (SER)
 - Original Part Number (PNO)
 - UID Construct Number (UIC)
 - Part Description (PDT)
 - Manufacture Date (DMF)
 - International Commodity Code (ICC)
-

Birth Record

- **Conditional Fields**

- Manufacture Weight (WGT)
 - Unit of Measure (UNT)
 - Hazardous Material Code (HAZ)
 - Electrostatic Sensitive Indicator (ESD)
 - Shelf Life Expiration Date (EXP)
 - Lot Number or Enterprise Lot Number (LOT/LTN)
 - Country of Manufacture (CNT)
 - Export Control Classification Number (ECC)
 - Software Indicator (SWI)
 - Original Overlength Part Number (OPN)
 - NATO Stock Number (NSN)
 - Airworthiness Certificate Tracking Number (TDN)
 - Fabricator, if different from MFR (FAB)
 - Modification Level (PML)
-

Part History Record

- **Record of maintenance actions**
 - **Archival Records – never overwritten**
 - **One record per event**
 - Each record can contain many TEIs
 - **New Records are added over the lifetime of the part**
-

Part History Record

■ Mandatory Elements

- ACT – Action code
- ACO – CAGE code
- ACD – Action date
- CND – Condition code

■ Mandatory Action Codes

- INS – installed
- RMV – removed
- RPR – repaired
- OVH – overhauled
- MOD – modified
- INP – inspected
- DMP – Tags replaced, data dump

■ Optional Action Codes

- EXC – exchanged
 - TST – tested by
 - SRV – serviced by
 - WHR – warehoused at
 - SHP – shipped to
 - RCD – received from
 - OTH – others
-

Part History Record – Example Data

- **Action Code : INS (installed)**
 - Next Higher Assembly Part Number (NHA)
 - Aircraft Identification Number (AIN)
 - Aircraft Flight Hours at installation (FHL)
 - Aircraft Flight Cycles at installation (FCL)
 - Location at Aircraft at installation (LAC)
-

Mechanic Scratchpad Record

- Free text area, re-writeable.
 - A single record. May have multiple entries.
 - Each entry includes:
 - Action Company CAGE Code (ACO)
 - Action Date (ACD)
 - Comment (REM)
-

Current Data Record

- **A single re-writable record of latest info**
 - Contents: a few key TEIs
- **Allows for fast access**
 - No need to read all records to find latest part num
- **Manage automatically by the software application**
 - Not directly writeable by the user

Current Part Number (PNR)
Part Modification Level (PML)
Full Length Part Number (MPN)
Location on Aircraft (LAC)
Airline Stock Number (ASN)
Expiration Date (EXP)

Hazardous Material Code (HAZ)
Owner's Code (ONR)
Airworthiness Certificate (TDN)
Software Part Number (SFT)
Condition Code (CND)



Tags

Low Memory Tag – 800 to 1500 bits

High Memory Tag – 4KB, 8KB



Reader

UHF, Class1 Gen2



Application Software

Spec 2000 compliant

Help

Maintenance Station

t Data

Tag
4V792 822-0329-020 167TP3

Read Tag



Part History

Records

Reports

atabase

Current Data Record: SRV
Birth Record

ynchronize Tag



Part History Record 3: 20111015 INS

Part History Record 2: 20111004 RMV

Part History Record 1: 20090814 UPG

aintenance

Add New Record

TEI	Value	Description
ACO	4MTE6	Action Company's CAGE Code
ACD	20111015	Action Date
ACT	INS	Action Code
CND	SRV	Condition Code
REM	CALIB OK	Remarks/Mechanics Comments

Write To Tag

Clear

Proceed

MANDATORY TEIs: ACO, ACT and CND

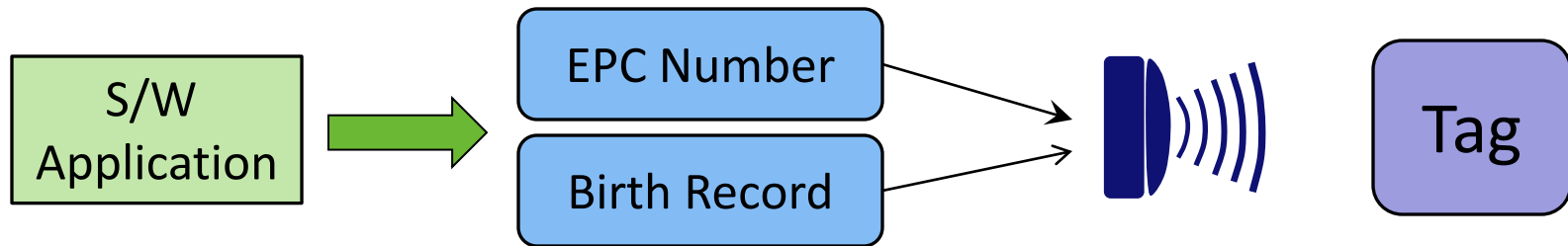
Keyboard

History Record 1: 20090814 UPG

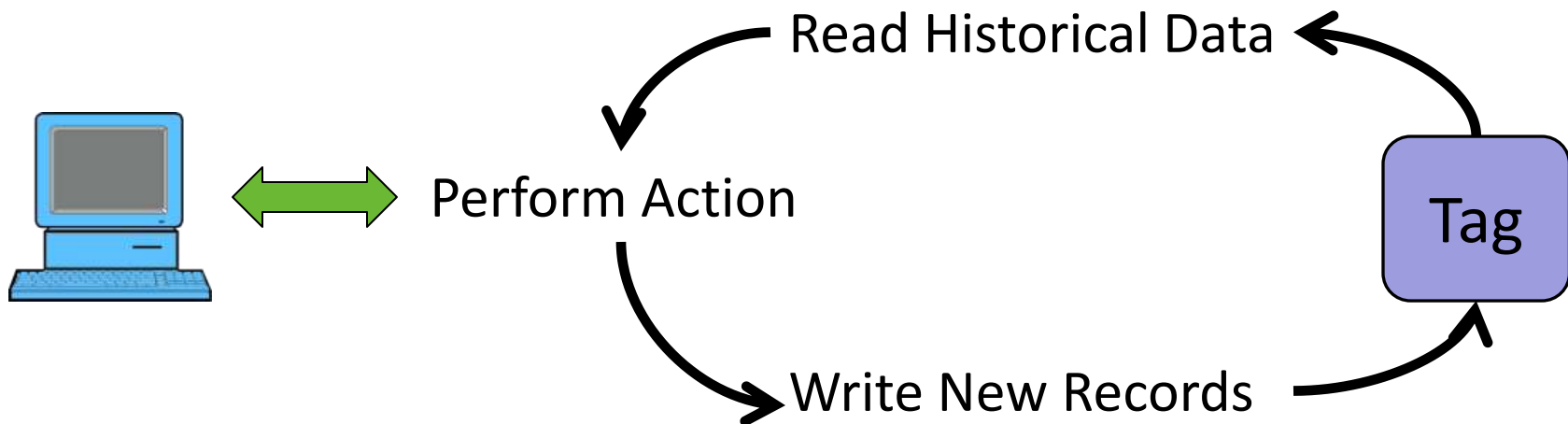
Current Data Record: UNK

History Record 2: 20111004 RMV

Part Manufacturer



Rest of Supply Chain



Birth Record Implementation



Business Data
CAGE, PNO, SER



EPC Number
Birth Record

Enterprise Implementation

