RFID JOURNAL LIVE!

TRACK AND MANAGE **EVERYTHING**

TENTH ANNUAL CONFERENCE AND EXHIBITION

APR. 3-5, 2012 | WALT DISNEY WORLD SWAN AND DOLPHIN RESORT, ORLANDO, FLA

Crossing the Chasm Toward RFID and Bar Code Co-existence

by
Sprague Ackley
Intermec

Have we crossed the chasm?

- What is a chasm and when is it crossed?
- RFID data compared to bar code
- The two great systems
- Encoding MB01 data in bar code
- The other side of the chasm

What is a chasm and when is it crossed?

According to Webster's:

Chasm

1: a deep cleft in the surface of a planet (as the earth): gorge

2: a marked division, separation, or difference

What is a chasm and when is it crossed?

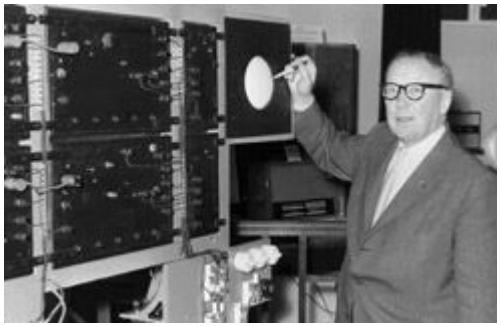
- Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers by Geoffrey Moore - 1991
- The most difficult step is making the transition between the early adopters and mainstream application

What is a chasm and when is it crossed?

- The chasm is crossed when a technology becomes “mainstream”
- A technology is “mainstream” when it is “seamless”

RFID data compared to bar code

- Initially, RFID only encoded a unique set of bits, i.e. not specific letters and/or numbers
- Later, users wanted to encode their own data



- Parallel developments ensued
  - MIT Auto-ID labs → EPCglobal → GS1
  - ISO/IEC 15962

While chip technology marched on …

- UHF Gen 2 has four memory banks (MB)
  - MB00 – kill and access passwords
  - MB01 – primary serialized identity
  - MB10 – Tag ID
  - MB11 – encodes “user” data (AIs or DIs)

While chip technology marched on …

- UHF Gen 2 has four memory banks (MB)
  - MB00 – kill and access passwords
  - ***MB01 – primary serialized identity***
  - MB10 – Tag ID
  - MB11 – encodes “user” data (AIs or DIs)

The two great systems – MB01

- GS1 uses GS1 EPC Tag Data Standard
  - 96 bits (12 bytes), very space efficient
  - All numeric
  - Requires buying a “GS1 Company Prefix”
- ISO uses ISO/IEC 15962
  - Variable in length, less space efficient
  - Can be alpha-numeric
  - Low or zero cost enterprise identification

GS1 encoding (EPC)

- Method for encoding a unique item number broke GS1 rules in place for more than 25 years
- Encoding methods actually prevented data in bar code symbols from being encoded in an RFID tag
- GS1 now “fixing” the inconsistencies

EPC tag encoding overview

- EPC is 12 bytes, for example, in hex

  30 30 25 7B F4 6D 5B 20 00 00 01 90

- 12 bytes is 96 bits

001100000011000000100101011110111111010001101101101101100100000000000000000000000000000000110010000

- Bits are counted and assigned meaning

EPC Header	Filter	Partition
length:8	3	3
bits:00110000	001	100 (7-digits)

EPC tag encoding overview

00110000001100000010010101111011111010001101101101101001000000000000000000000000000000110010000

- GS1 Company Prefix
  - bit length (depends on Partition value): 24 in this example
  - digits: 0614141
- Indicator digit and Item Reference
  - bit length: 20 in this example
  - digits: 112345

Note: GS1 Company Prefix can be 6 to 12 digits

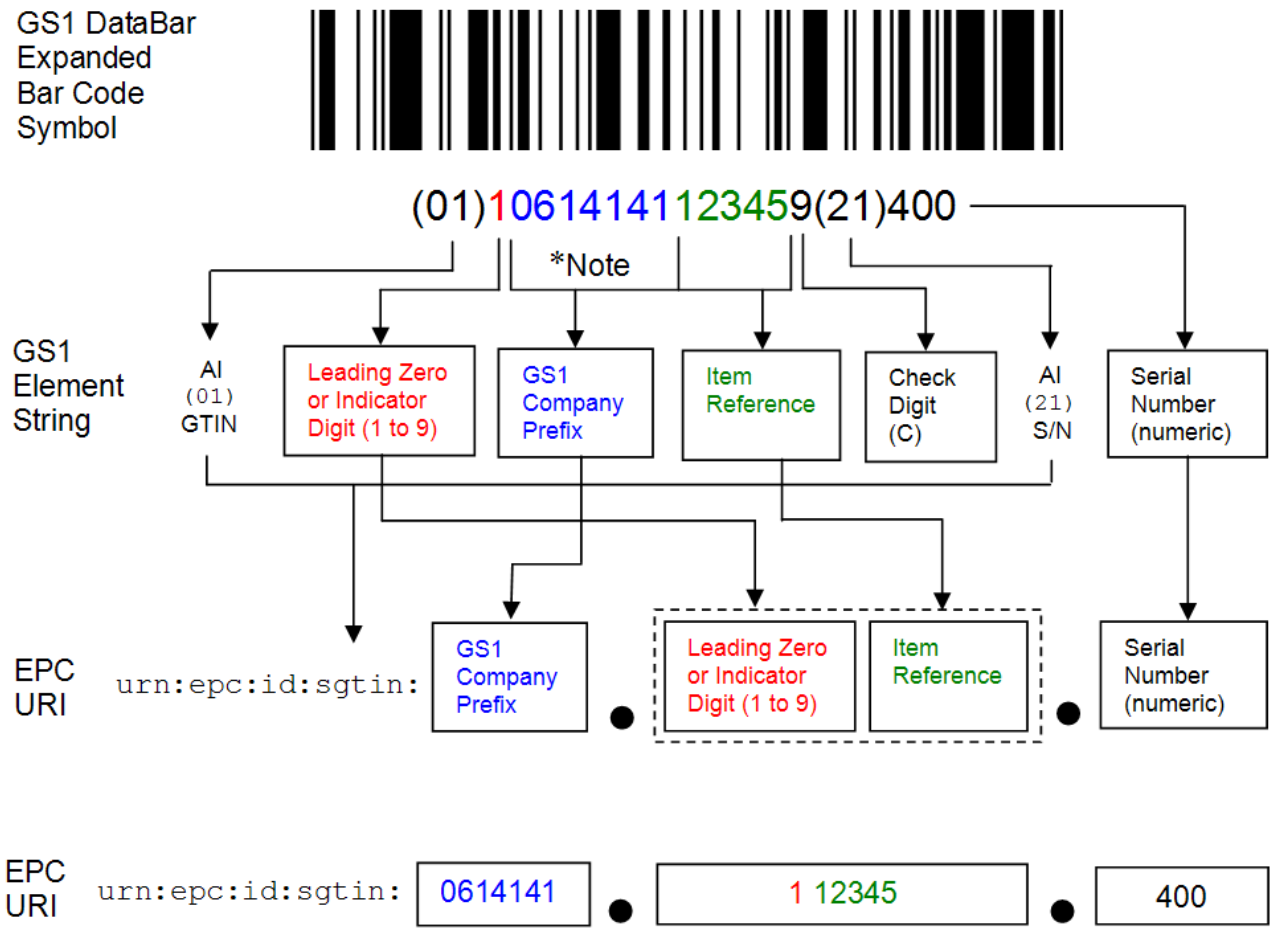
EPC tag encoding overview

00110000001100000010010101111011111101000110110110110110011000000000000000000000000000000110010000

- Serial Number
  - bit length:38 (fixed)
  - bits:00000000000000000000000000110010000
  - digits:400

- EPC
  - URI **urn:epc:id:sgtin: 0614141.112345.400**

Bar code to an EPC tag*



Bar code to an EPC tag*

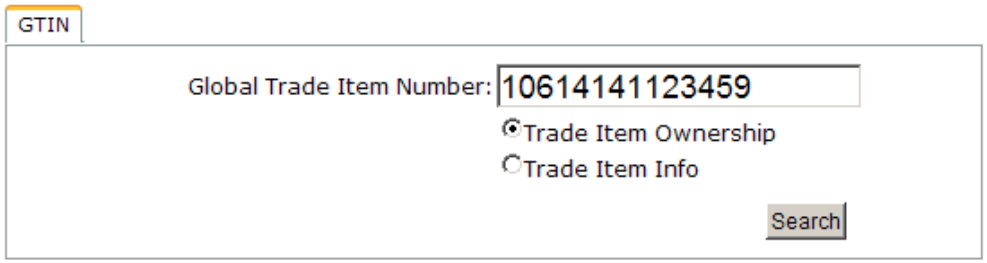
*Note: the number of digits in the GS1 Company Prefix is not known

*The Partition Value must be determined

* Leading digits of the GTIN determine the partition value (e.g. compare with a database of GS1 Company Prefixes)

Bar code to an EPC tag*

- GS1 has on-line tool called GEPIR (Global Electronic Party Information Register)



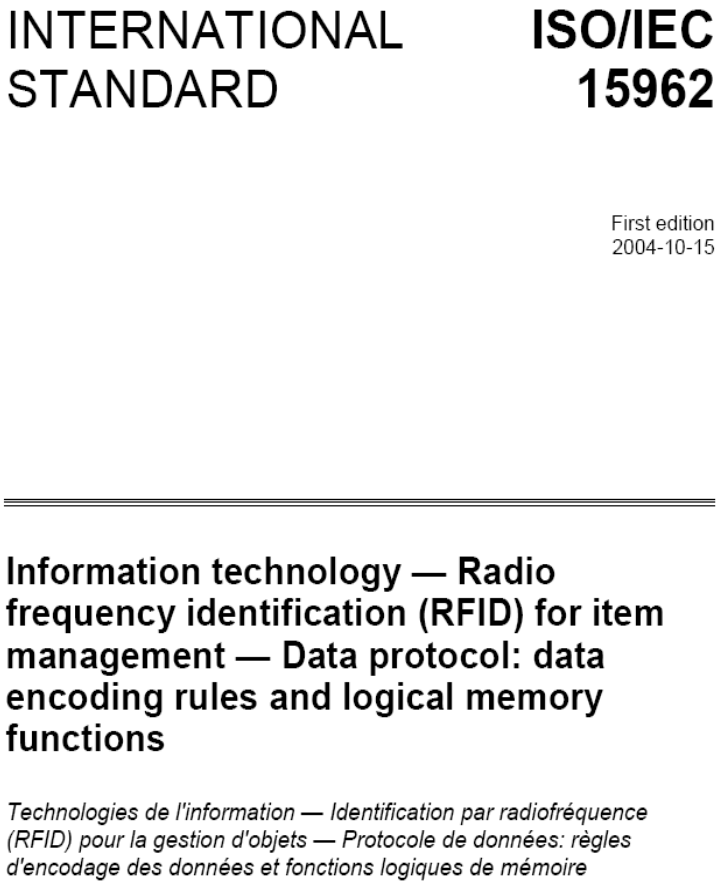
This information is provided on behalf of GS1 US, INC..

GLN	COMPANY	CONTACT	LAST CHANGE	GCP	STATUS	PROVIDER GLN
0614141000005	GS1 US, INC. OH 7887 Washington Village Dr Suite 300 45459 Dayton United States	Tel:(937) 435-3870 Fax:(937) 435-7317		0614141	0	

Responder: 0614141800001, Responses: 1, RC: 0 (No error)

ISO encoding (15962)

- First RFID data encoding standard
- Developed with the idea that "RFID data was different" than bar code data



INTERNATIONAL STANDARD

ISO/IEC 15962

First edition
2004-10-15

Information technology — Radio frequency identification (RFID) for item management — Data protocol: data encoding rules and logical memory functions

Technologies de l'information — Identification par radiofréquence (RFID) pour la gestion d'objets — Protocole de données: règles d'encodage des données et fonctions logiques de mémoire

ISO/IEC 15962

- An elaborate system of "Object IDs" was invented so each piece of data was addressable

1st set (P + OID + O)> > >
> > > >2nd set (P + OID +
O)> > > > > > > > > > > > > >
> 2nd set (P + OID + O)> >
> > > > > > > … … … … …
… … … … … … … … …
… … … … … … … … …
… … … … … … … … …
... nth set (P + OID + O)> >
> > > > > > > > > > > > > > >

- Different encoding methods are flagged by an Application Family Identifier (AFI)
- A particularly simple AFI (A1) is useful for encoding UII data

15962 AFI A1 encoding overview

- UII = **25S**UN**043325711**MH8031200000000001
  - Where 25S is the UII Data Identifier (DI)
  - UN is the issuing agency ID
  - 043325711 is the enterprise ID
  - MH8031200000000001 is the item number and serial number combination
- Each character is replaced by 6-bits
- The bits are grouped into bytes (32x6=192→24)
- Pad to a full byte if necessary with some or all of the string “100000”

15962 AFI A1 encoding overview

- Replace each character with a 6-bit value

2	5	S	U	N	0	4	3
110010	110101	100110	101010	111000	110000	110100	110011
3	2	5	7	1	1	M	H
110011	110010	110101	110111	110001	110001	110100	100000
8	0	3	1	2	0	0	0
111000	110000	110011	110001	110010	110000	110000	110000
0	0	0	0	0	0	0	1
110000	110000	110000	110000	110000	110000	110000	110001

15962 AFI A1 encoding overview

- Group bits into bytes (8-bits) and convert to hex

11001011	10110010	10101010	11100011	11010000	11001100
CB	**59**	**AA**	**E3**	**0D**	**33**
11001111	10110100	11101110	11000111	11101000	10000000
30	**2D**	**77**	**C7**	**1D**	**20**
11100011	11000000	11110001	11001011	11000000	11000000
E3	**C0**	**F1**	**CB**	**C0**	**30**
11000011	11000000	11000000	11000011	11000000	11000100
E3	**C0**	**30**	**E3**	**C0**	**31**

- Insert AFI ($A1_{hex}$) for the final encoded data stream

A1 CB 59 AA E3 0D 33 30 2D 77 C7 1D 20 E3 C0 F1 CB C0 30 E3 C0 30 E3 C0 31

The other side of the chasm

- ISO → Application groups are adopting 15962 with AFI A1 to have a direct method of encoding bar code data in MB01
- GS1 → MIR work group published a guideline (2009)
- GS1 → BC & EPC Interoperability WG completed a user requirements document (2010)
- GS1 → Currently developing an RFID Bar Code Guideline
- GS1 → Currently working on an off-line method of determining the length of the GS1 Company Prefix

The future

“It is difficult to make predictions - particularly about the future.”

(Confucius, Winston Churchill, Groucho Marx, 'Yogi' Berra and several others: Nature 455, 729, 9 October 2008)

The future

- It took almost 20 years for the bar code supermarket system to become ubiquitous and it will probably take about the same time for RFID to do the same
- Applications changing from internal closed-systems to open systems are forcing more emphasis on data interchangeability
- Within the next five years, application data will be data carrier independent

Crossing the Chasm Toward RFID and Bar Code Co-existence

by

Sprague Ackley

Intermec

Thank You

PRODUCED BY RFID JOURNAL