

 **U** *Connect*[®]
C o n f e r e n c e

May 21-23, 2003 • Disney's Swan & Dolphin Hotel • Orlando, FL

Where Solutions Meet the Supply Chain

Session 14



Friday
9.30AM

The EPC Network, RFID and Data

Presented by:

Chris Hook, Uniform Code Council

May 23rd, 2003

Presentation Overview

- **Overview of the EPC Network**
- **Field Tests**
- **“Auto-ID, Inc.” – Next Steps**
- **Code “Mapping” Considerations**
- **Market Development Thoughts**

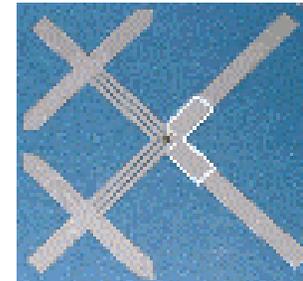
EPC Network – What?

ETags	The data carriers. RFID tags in various form factors. which carry EPCs.
Reader	The data capture device; portable or fixed (installed), connected to a Savant or network.
EPC	Electronic Product Code: the code carried by the data carrier; the globally unique pointer for making enquiries about the item associated with the EPC.
Savant	Servers which act as local repositories for EPCs and associated information, and which support sophisticated, flexible middleware for serving PML queries.
ONS	Object Name Service; the distributed resource that “knows” where information about EPCs is held (just like DNS).
PML	Physical Markup Language; like XML, with XQL query structure to allow structured querying and reporting of EPCs and attributed data.

EPC Network – What?

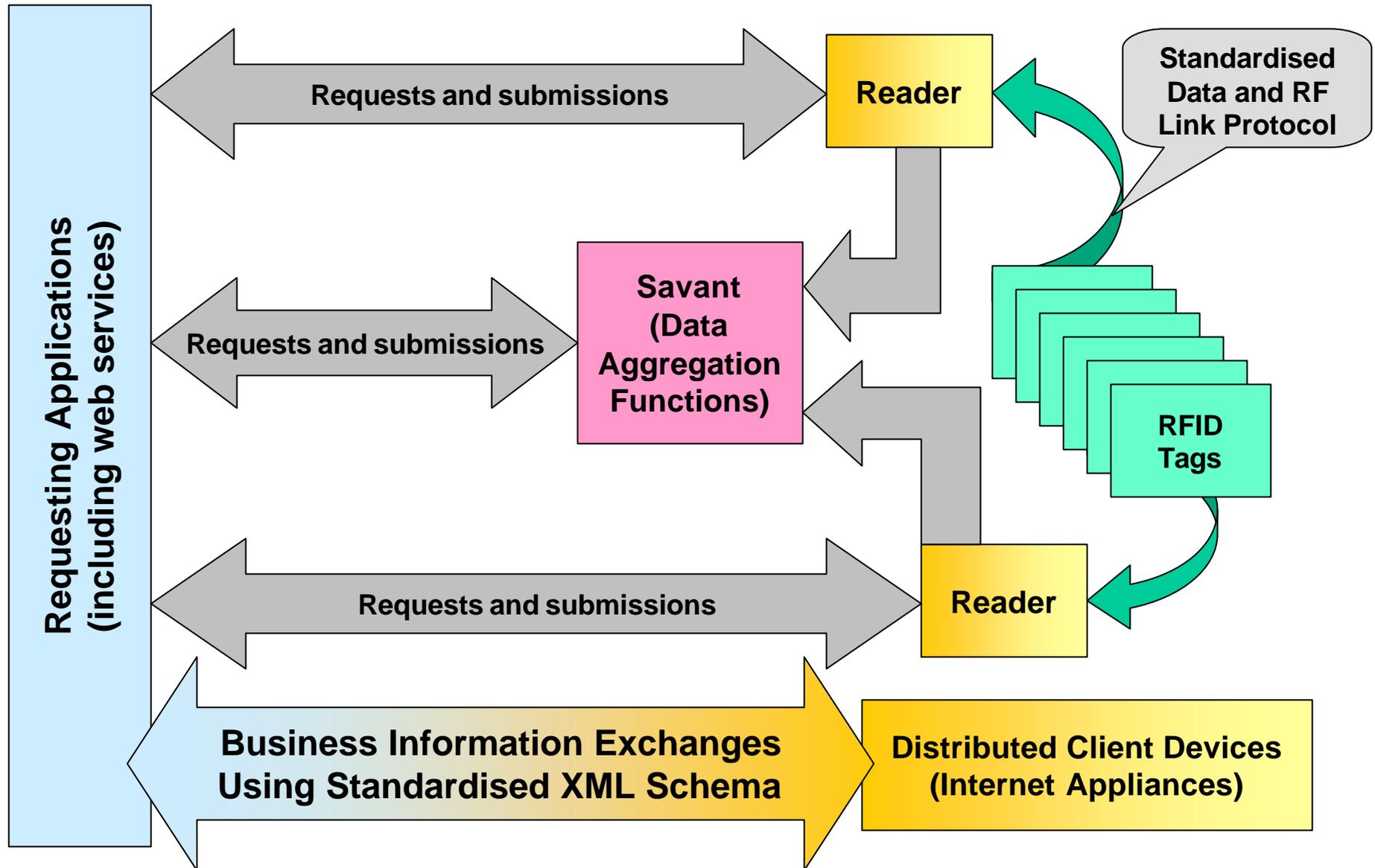
- **Cheap, high performance RFID tag chips and tags enable the EPC vision**
- **Serialized items can be individually tracked across traditional trading boundaries in a standardized way and with unprecedented automation**

What do Tags Look Like?



“Smart labels” is the common term

A General Connectivity Model



MIT Auto-ID Center - Status

- **Now just under 100 sponsors**
- **Technical specifications**
 - **For all components of the EPC Network**
- **Phased field tests:**
 - **Rationale: internal learning & development**
 - **Phase 1 – Pallets: completed**
 - **Phase 2 – Boxes / totes: completed**
 - **Phase 3 – Items: just commenced**



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Field Test Objectives

- **“Internal” testing and learning**
 - **Building to “reference implementations”**
- **Three phases of experimentation**
- **Refinements of EPC components**
- **Sharing of results with co-sponsors**
- **Source material for white papers**

Field Test Sponsors

End-User

Chep
International Paper
Johnson & Johnson
Procter & Gamble
The Gillette Company
Unilever
Wal*Mart
Mead Westvaco
YFY
Coca Cola
Dai Nippon Printing
Kimberly Clark
Home Depot
Kraft Foods
Target
Toppan
Nestlé Purina
Kodak

Technology

Invensys
NCR
SAP
Sensormatic (Tyco)
Sun Microsystems
Alien Technology
Markem
Rafsec
Savi Technology
Checkpoint Systems
Philips Semiconductors
RF Saw
Matrics
Siemens/Dematic

Field Test Applications

- **Focused on retail supply chain**
 - **From manufacturer to consumer**
- **Consumer product availability**
- **Theft prediction and apprehension**
- **Freshness and OoD monitoring**
- **Automatic inventory at case level**
- **Safe and secure supply chain**

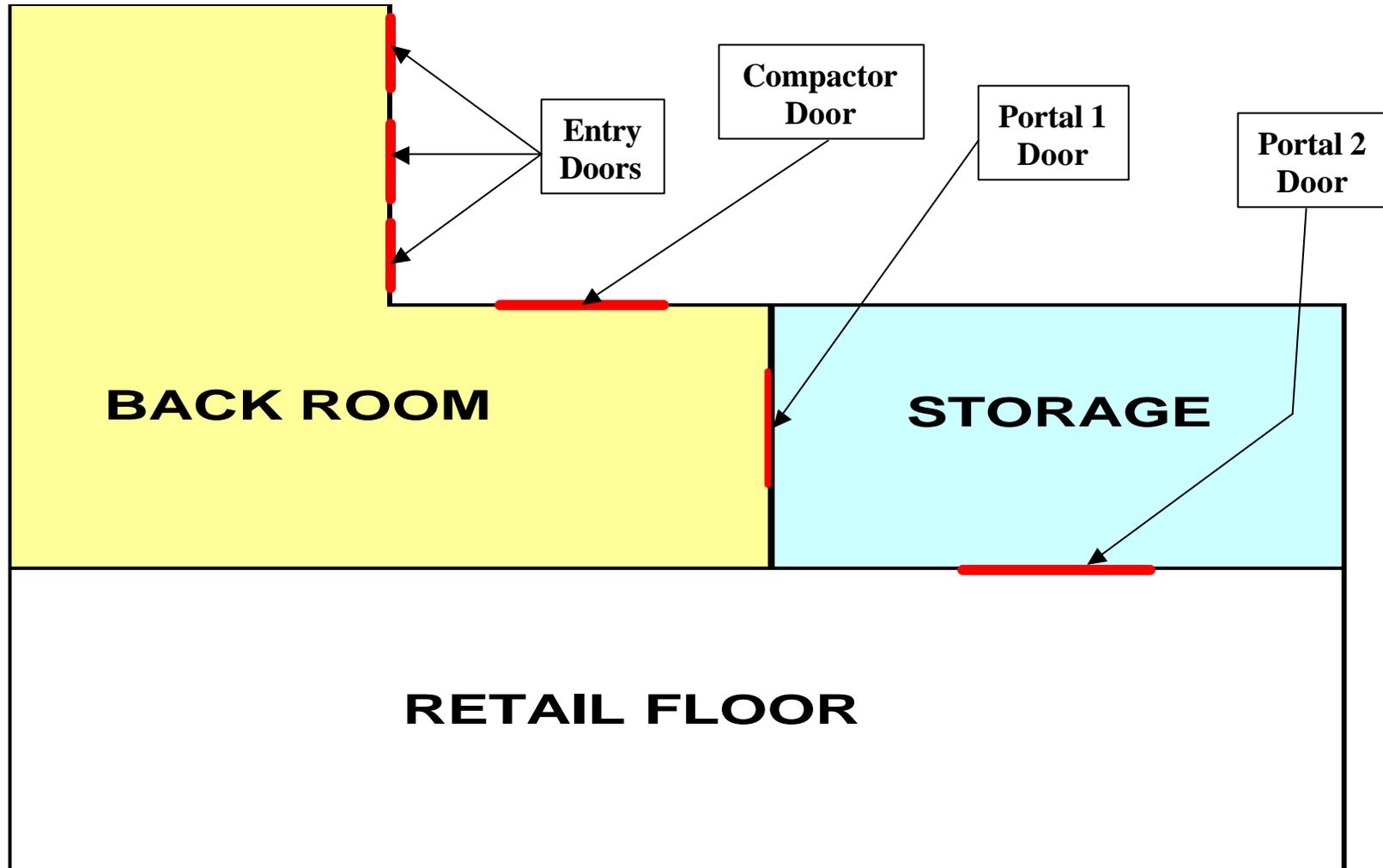
Field Test Applications

- **Phase I:**
 - Pallets (manufacturer? DC? store)
 - Evaluate ONS and Savant
 - Evaluate COTS products
- **Phase II:**
 - Cartons, cases, pallets
 - Test aggregation models
 - Test new EPC RFID products
 - Load the system (EPC Network)

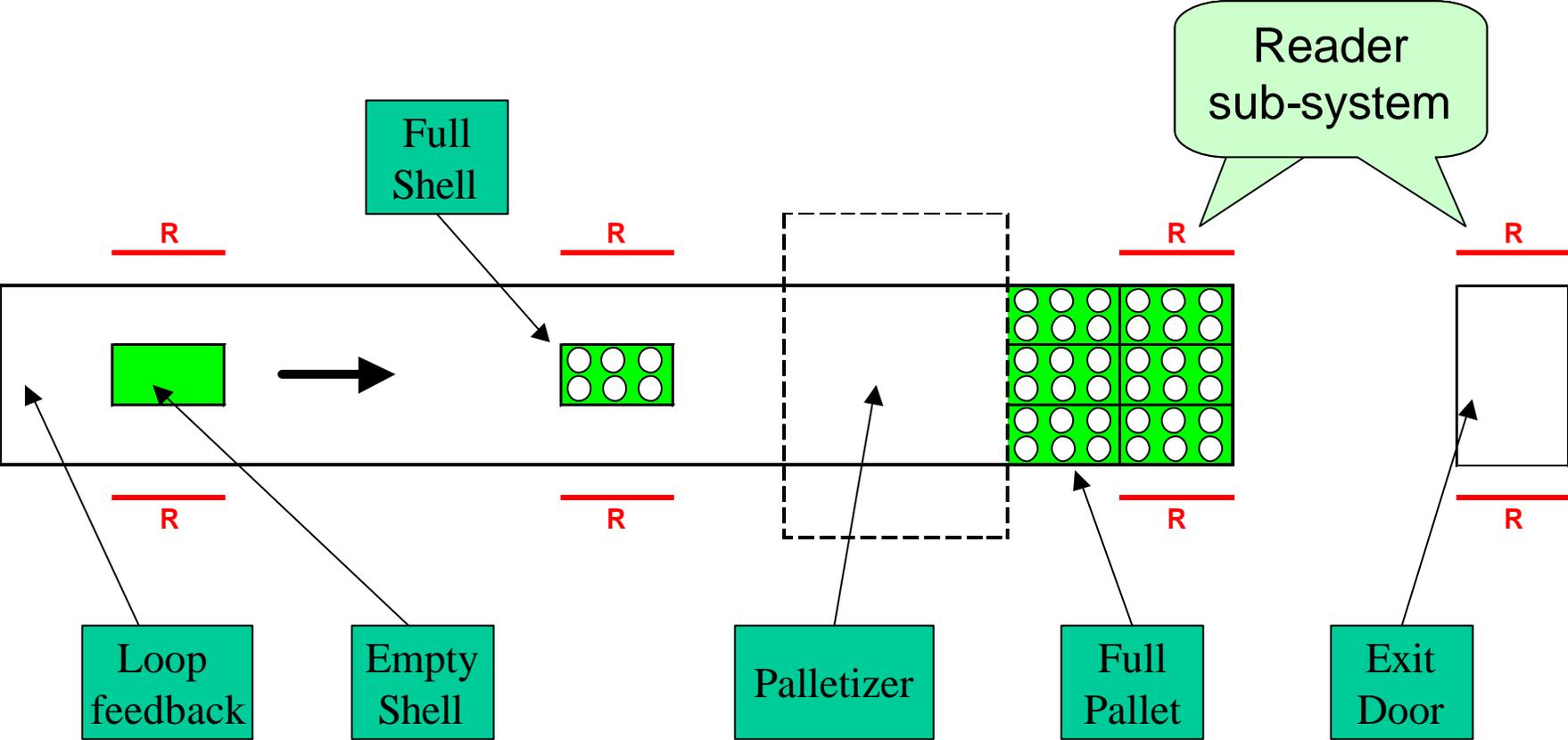
Field Test Applications

- **Phase III:**
 - Evaluate item tagging using low cost tags
 - Examine both HF and UHF RFID systems
 - Develop “smart shelves”
 - Tagging many differing item types

Example Retail Store Layout



Bottling and Distribution Center



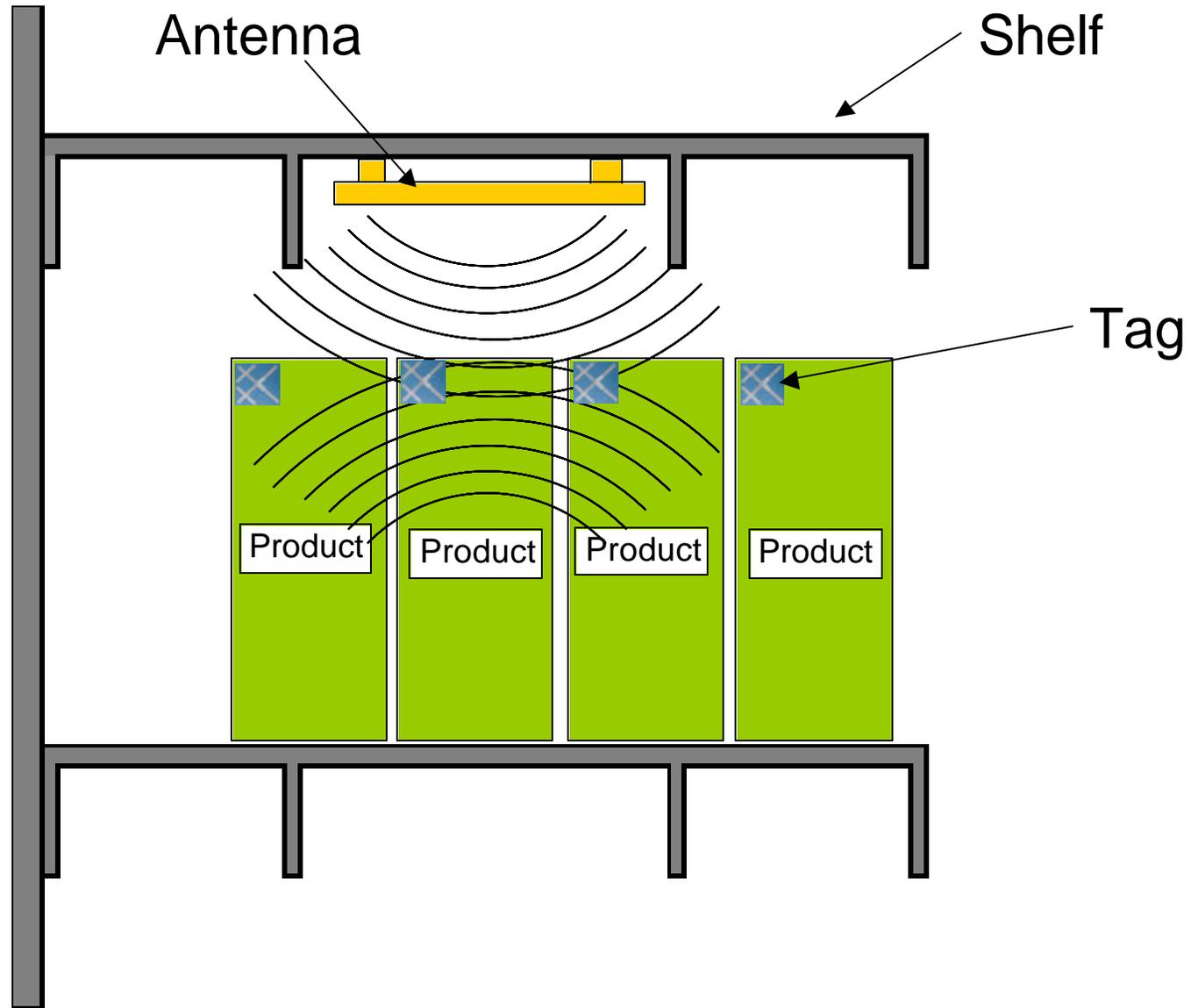
Bottling and Distribution

- **Key lessons learned:**
 - Tag format
 - Tag placement
 - Reader antenna positioning
 - Operational feedback is essential
 - Handling exceptions requires method
- **Sub-systems must be optimized**
 - Initial reading results were < 100%
 - Optimization gave 100 % reading accuracy

Products in Phase III

- **Aerosol cans**
- **Razors and razor blades**
- **Liquid soap**
- **Shampoo**
- **Cosmetics**
- **Soda (bottles)**
- **Baby wipes**
- **Dog food (bags)**
- **DVD players**
- **Photographic film**
- **Sticking plasters**

“Smart Shelf” Antenna



Smart Shelf Antenna



Phase III – Next Steps

- **Bear in mind this is “new learning”**
- **Initial results show great promise**
- **Refine “smart shelf” sub-system**
- **Experiment with other product types**
- **Critically evaluate performance**
- **Publish results**

Field Tests: Summary

- **Allowed refinement of components**
- **Additional “private” testing performed**
 - **Not part of formal Field Tests:**
 - **Metro “store of the future”**
 - **Chep**
 - **Gillette and CVS**
- **Common objective:**
 - **Drive towards “reference implementations”**
- **“EPC compliance” remains the end-game**
- **This work will continue**

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Auto-ID, Inc. – Next Steps

- **UCC and EAN to commercialize EPC**
 - **Contract signed**
 - **Driving to create “EPC Network v1.0”**
- **Jointly managed initiative**
- **Transition plan formulated**
- **Building the team**
 - **New President, Dicki Lulay**



Marketing and Communications

- **We have retained Fleishman-Hillard**
 - Forums, symposiums
 - Website, press and analyst briefings
- **Expectations must be managed**
- **Gearing up for September “launch”**
 - EPC Symposium, Chicago, September 16th
 - Sign up at the UCC booth



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Use of EPC Partitions



- **Header**
 - Defines data type
 - Indicates code partitions
 - Used to partition sub-domains
- **EPC Manager**
 - Indicates originator of EPC
- **Object Class**
 - As needed by the segment / application
- **Serial Number**
 - As determined by the segment / application

EPC Domain & “Sub-Domains”

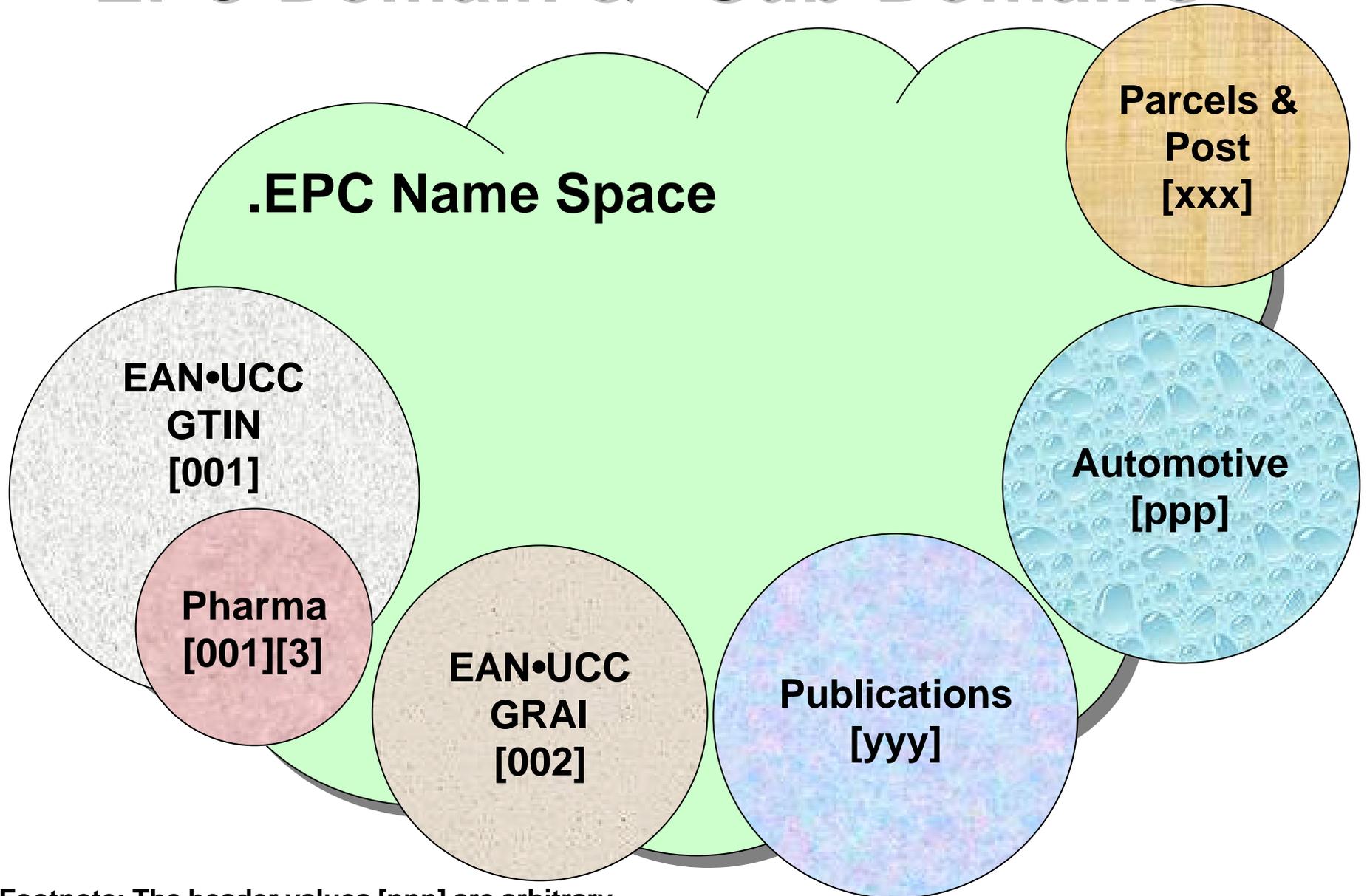
- A sub-domain:
 - Fragmented code space with unique numbers
- Problem analogy
 - US motor vehicle registration
 - Unrelated agencies
 - Established systems in place
 - Very similar code structures
 - KJ146T (NJ) and BJ733R (NY) – or is it...?
 - Nothing in the “LP code” identifies state
 - Explicit “issuing authority” ID required



What You Are About to See...

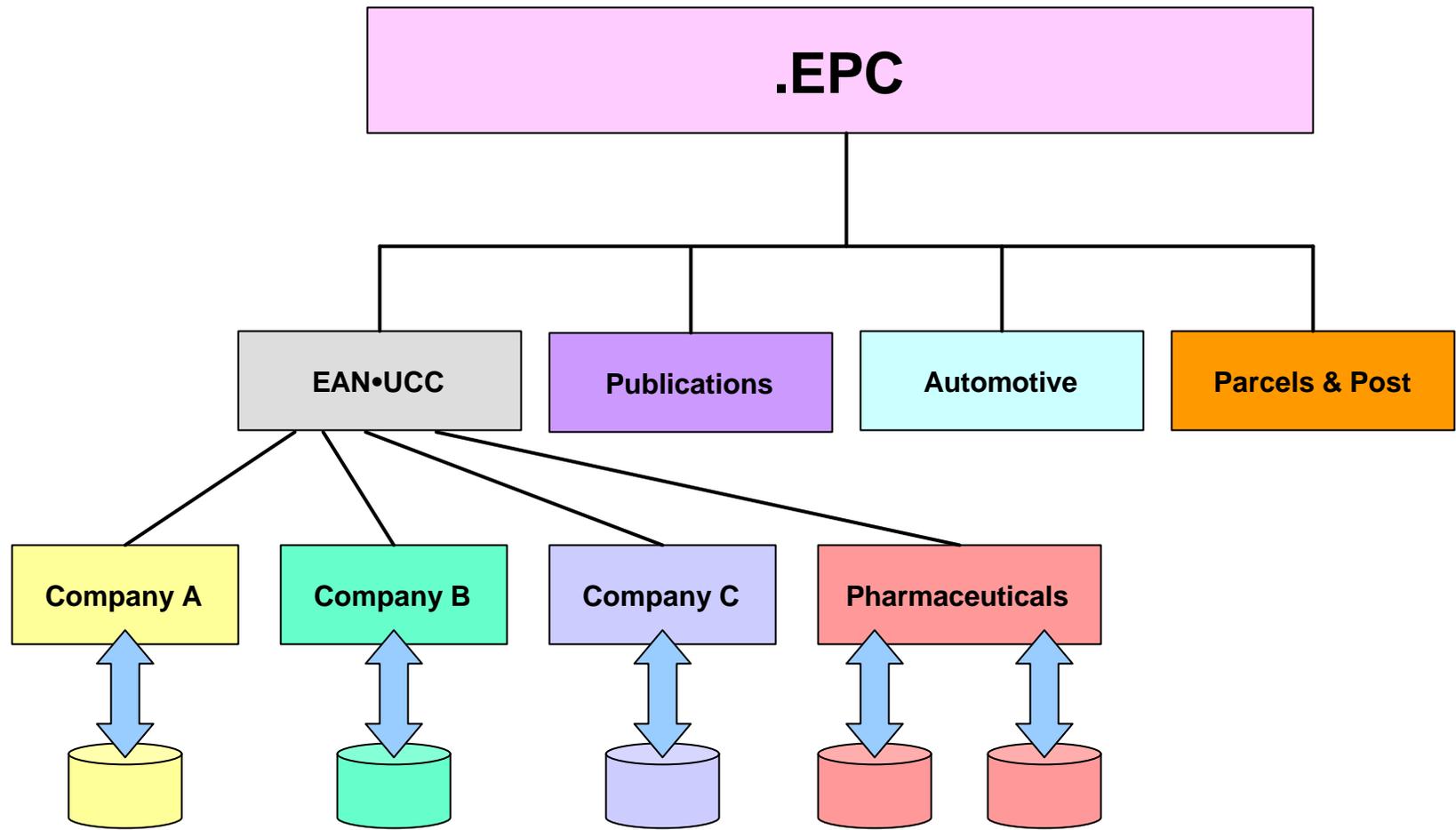
- **All that is presented here is just “works in progress”, and not a statement of final specifications for code mapping schemes**
- **EPC is not just for EAN•UCC members**
- **The devil is in the detail**

EPC Domain & “Sub-Domains”



Footnote: The header values [nnn] are arbitrary

EPC Domain & “Sub-Domains”



EPC-64

Element	Header	EPC Manager	Object Class	Serial Number
Bits	2	28	24	10
Value ₁₀	0-3	0- 268,435,455	0-16,777,215	0-1,023

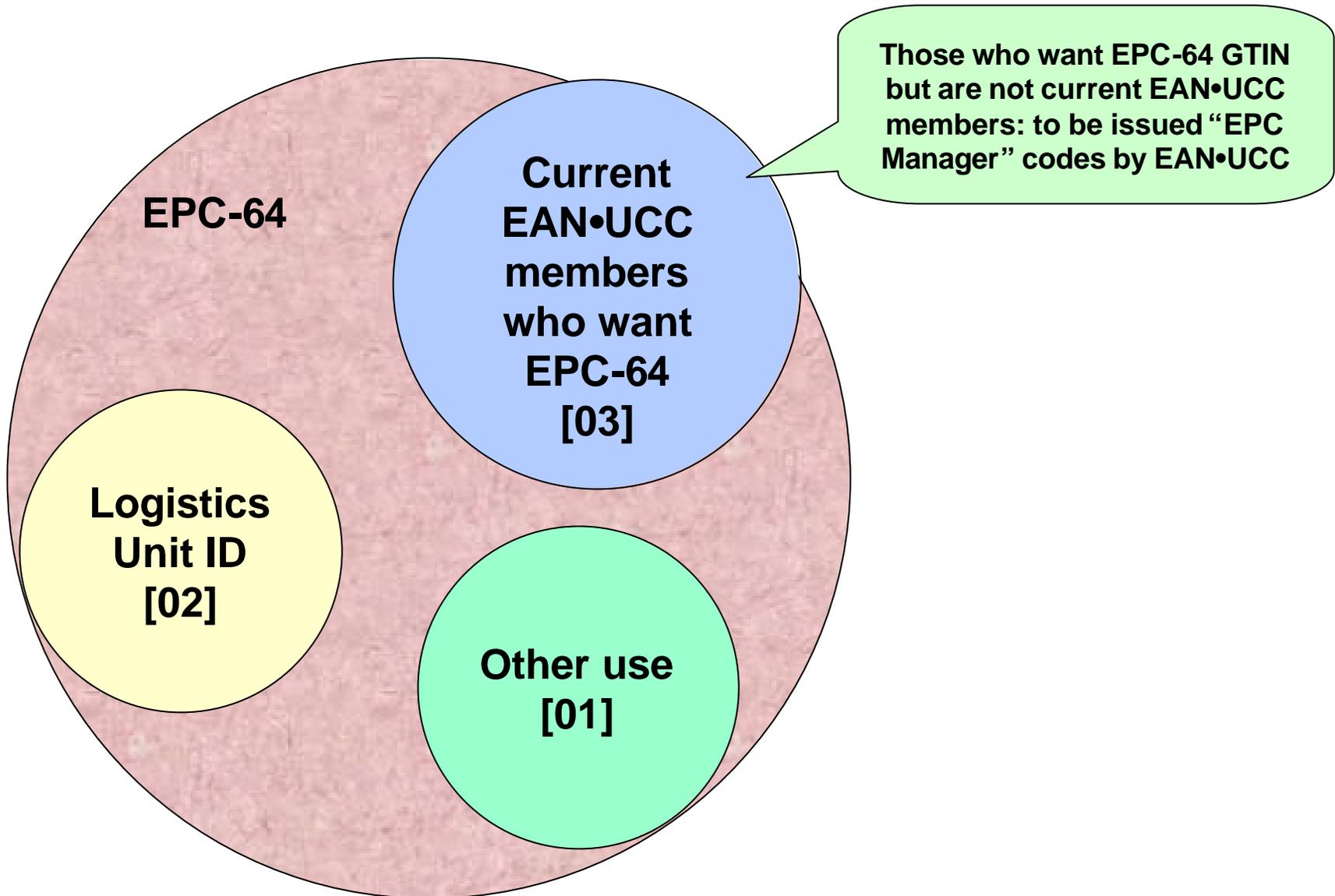
- **64 bits is all we have now**
- **Header 01,10,11 = EPC-64**
 - 64 bit tags may be “flushed out” over time
 - No long term sacrifice of code space
- **Header 00xxxxxx = EPC-96, etc.**
- **Must maintain partitions**
 - Sorting, grouping, searching, routing

EPC-64

Element	Header	EPC Manager	Object Class	Serial Number
Bits	2	28	24	10
Value ₁₀	0-3	0-268,435,455	0-16,777,215	0-1,023

- **Restricted serialization space**
- **Limited room for “sub-domains”**
 - Does not fit well in an open world
 - May compromise “the big picture”
 - Code duplication in unrelated sub-domains?
- **Standardization requires structure**
 - Structure means overhead

EPC-64 – Potential Users





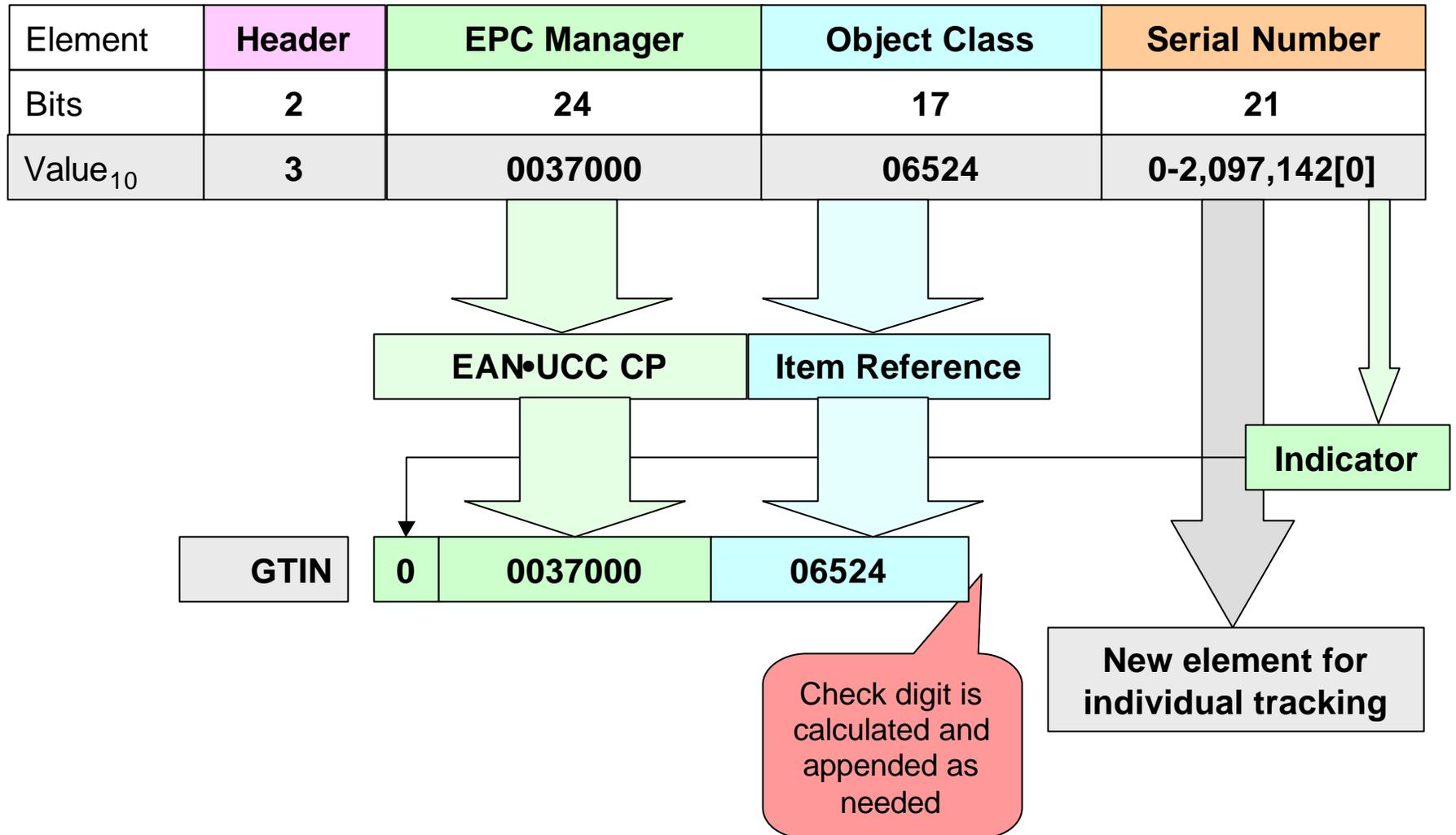
EPC-64: EAN•UCC GTIN

Element	Header	EPC Manager	Object Class	Serial Number
Bits	2	24	17	21
Value ₁₀	3	0-16,777,215	0-131,071	(0-2,097,142)+[0-9]
		EAN•UCC CP	Item Reference	Indicator

- **GTIN with least constraint is #1 concern**
- **Maintains basic code partitions**
- **Supports EAN•UCC GTIN (serialized)**
 - GTIN is implied by the header code
 - Space for serialization is relatively limited
 - Check digit to be reconstructed
 - Indicator Digit value appended to serial #



EPC-64: EAN•UCC GTIN



EPC-96

Element	Header	EPC Manager	Object Class	Serial Number
Bits	8	28	24	36
Value ₁₀	0-255	0-268,435,455	0-16,777,215	0-68,719,476,735

- **Good generic structure**
- **Works well for open environments**
- **Supports sub-domains**
 - **Adequate scope for global use**
- **Partitions must be maintained**
- **Code compatibility with EPC-64**
- **EPC-96 tags available very soon**



EPC-96: EAN•UCC

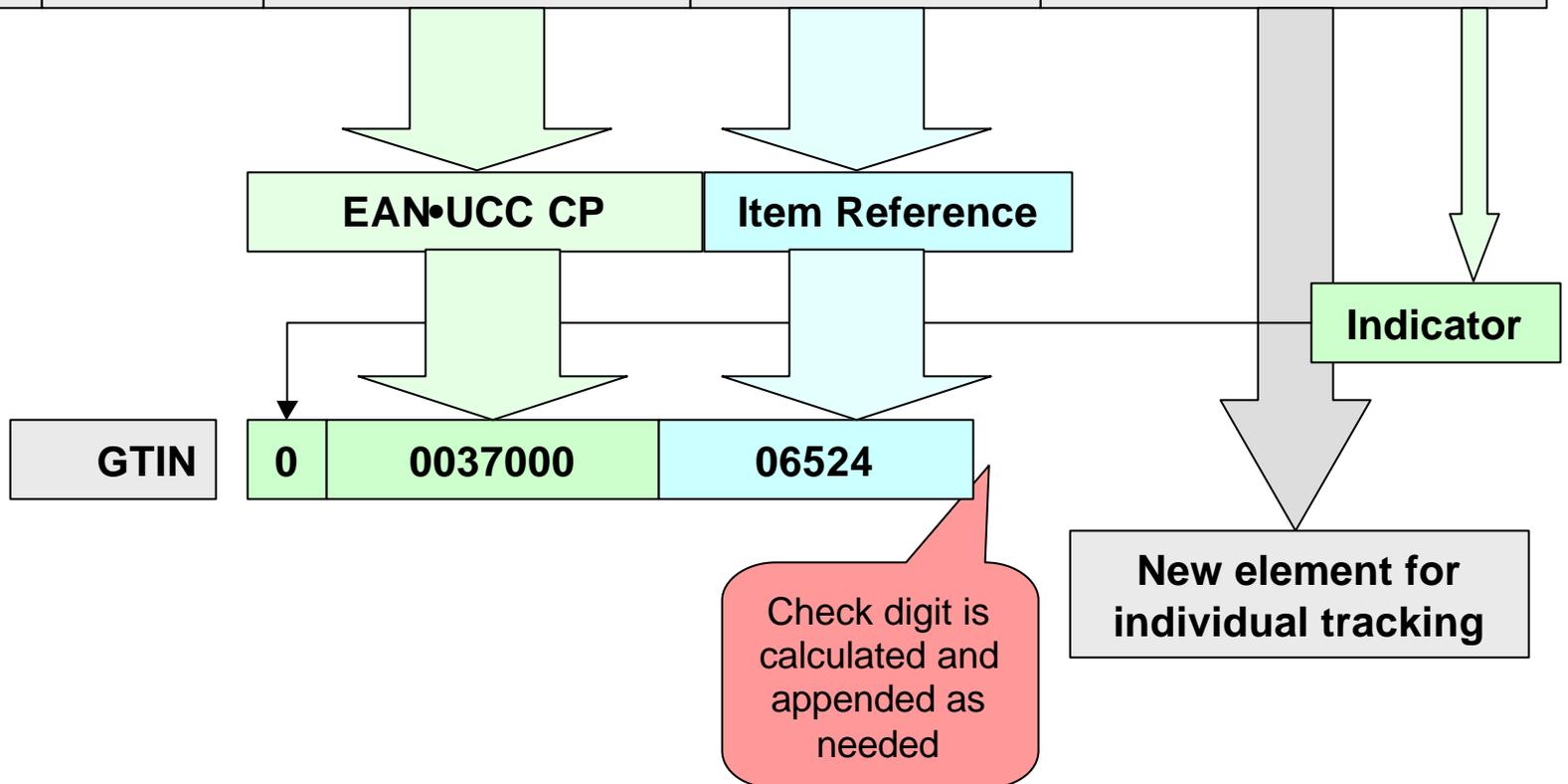
Element	Header	EPC Manager	Object Class	Serial Number
Bits	8	34	20	34
Value ₁₀	001	0-17,179,869,183	0-1,048,575	0-17,179,869,174+[0-9]

- **EAN•UCC keys implied by header value**
 - **SSCC, GTIN, GRAI, GIAI, GSRN, GLN**
- **Partitions determined by Header**
- **All other information carried in PML**
- **A good model for other sub-domains**



EPC-96: EAN•UCC GTIN

Element	Header	EPC Manager	Object Class	Serial Number
Bits	8	34	20	34
Value ₁₀	001	0-17,179,869,183	0-1,048,575	0-17,179,869,174+[0-9]





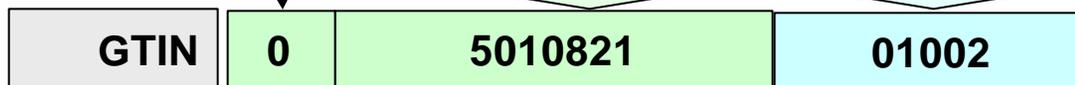
EPC-96: EAN•UCC GTIN

Element	Header	EPC Manager	Object Class	Serial Number
Bits	8	34	20	34
Value ₁₀	001	0037000	06524	0-17,179,869,174+[0]



Procter & Gamble Bounty[®] paper towels 15 pack

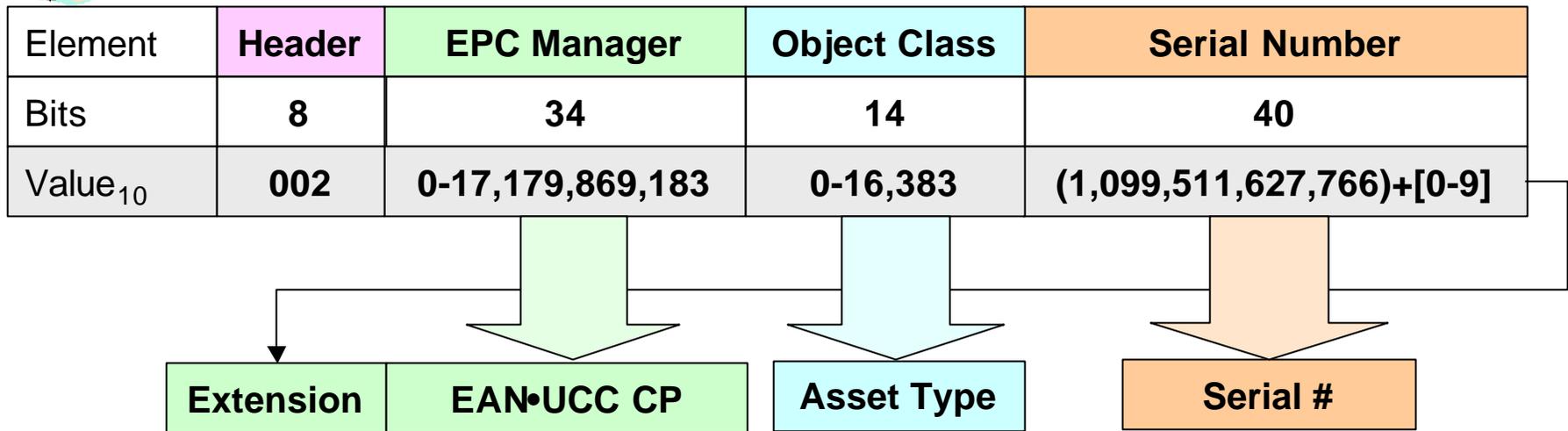
Element	Header	EPC Manager	Object Class	Serial Number
Bits	8	34	20	34
Value ₁₀	001	5010821	01002	0-17,179,869,174+[0]



Glenryck[®] Pilchards 425g tin



EPC-96: EAN•UCC GRAI



- **Serial Number restricted to 13 digits**
 - **GRAI definition is for an 1...16 serial number**
 - Code compaction scheme to be applied
 - **Extension Digit placed as for GTIN**



EPC-96: Automotive

Header	EPC Manager	Object Class	Serial Number
8	??	??	??

- **VIN structure examples:**
 - J H M ED923 2 M S 002001
 - Y S 3 EF48Z 1 X 3 048140
- **Last 6 places are always numeric**
 - VIN can fit in 86 bits!
- **Direct embedding possible, but...**
 - Too many “partitions”?
- **Details tbd by industry experts**

EPC-96: EAN•UCC

- **Conclusions:**
 - **Supports all primary EAN•UCC keys**
 - Practically no restriction to any key
 - **Meets #1 concern over “GTIN mapping”**
 - GTIN embedded directly in EPC structure
 - Does not impact purity of EPC design
 - **Sensible placement of Indicator Digit**
 - **Model looks good for others**

Remember...

- **All this is work in progress**
- **EPC Network is not just about EAN•UCC**
- **We'll work diligently with all EPC users**

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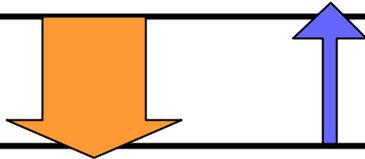
Market Development Thoughts

- **Applicable data standards exist:**
 - EAN•UCC keys and attributes
 - Other communities (such as automotive)
- **Infrastructure change has inertia**
- **Evolution rather than “big bang”**
 - Realise operational benefits now
 - Leverage investments in AIDC
- **Identify the low-hanging fruits**

Market Development Thoughts

Manufacturer

Sourcing
In-process
Front



Back
In-store: Out-of- stock/Inventory
Front-of-store

Retailer

Relative benefit	Relative risk, cost	Points of contact
\$	M	Many
\$\$	M	Few
\$\$\$	L	Few

\$\$\$	L	Few
\$\$	M	Few
\$	H	Many

Summary

- **Groundbreaking research at MIT**
 - **Low cost, high performance RFID is key**
- **Track & trace serialized items**
 - **Track things differently and more efficiently**
- **Commercialization plans formulated**
 - **Open and inclusive**
- **Passionate desire to maintain momentum**
- **EPC standards will facilitate adoption**



Seeking to Keep it Familiar...

The data structure

Start Character A, B, or C	Function 1 Character (FNC1)	Element String		Symbol Check Character	Stop Character
		Application Identifier	Data Field (s)		

Some user data

10614114100041

In a bar code today



In an RFID tag today



In a bar code tomorrow



In the future...



Questions...



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