LABEL ACADEMY

# WORKSHOP

RFID IN LABELS AND PACKAGE PRINTING

## Chip Programming and Data Management

## 12 Sept 24

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**ZEBRA TECHNOLOGIES**

# RFID Fundamentals

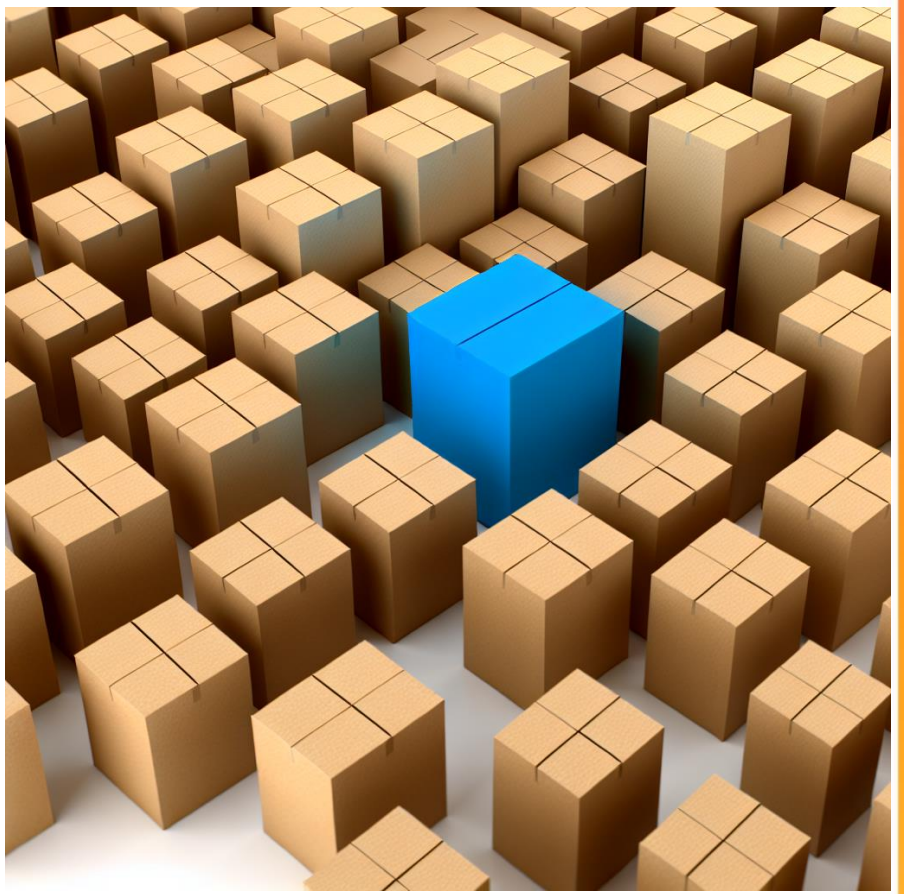
RFID technology works because…

tags are **UNIQUE**

RFID tags can be tracked through

read events…

unlocking their **VALUE**



# RFID Memory Elements

| Memory Bank | Writable? | Notes | Most Common Usage |
|---|---|---|---|
| Reserved | Yes | Contains Kill and Access Password | Permalocking |
| Tag ID (TID) | No | Unique ID<br>Used to generate Chip-based serialization (^RU in ZPL) | Identifies chip, manufacturer, unique serial number |
| EPC | Yes | Primary memory bank for encoding | Encoding 96 bit SGTIN or license plate data |
| User | Yes…if available | Custom data elements | Not commonly used |

# Chip Programming

There are many ways to encode an RFID chip:

# Encoding Considerations

Most RFID tags contain **96 bits** of EPC memory

This is enough to fit:

- 24 Hexadecimal (0-9, A-F) **1234567890123456789OABCD**
- 12 ASCII characters (0-9, A-Z, a-z, -$#,etc.) **LABELEXPO_24**

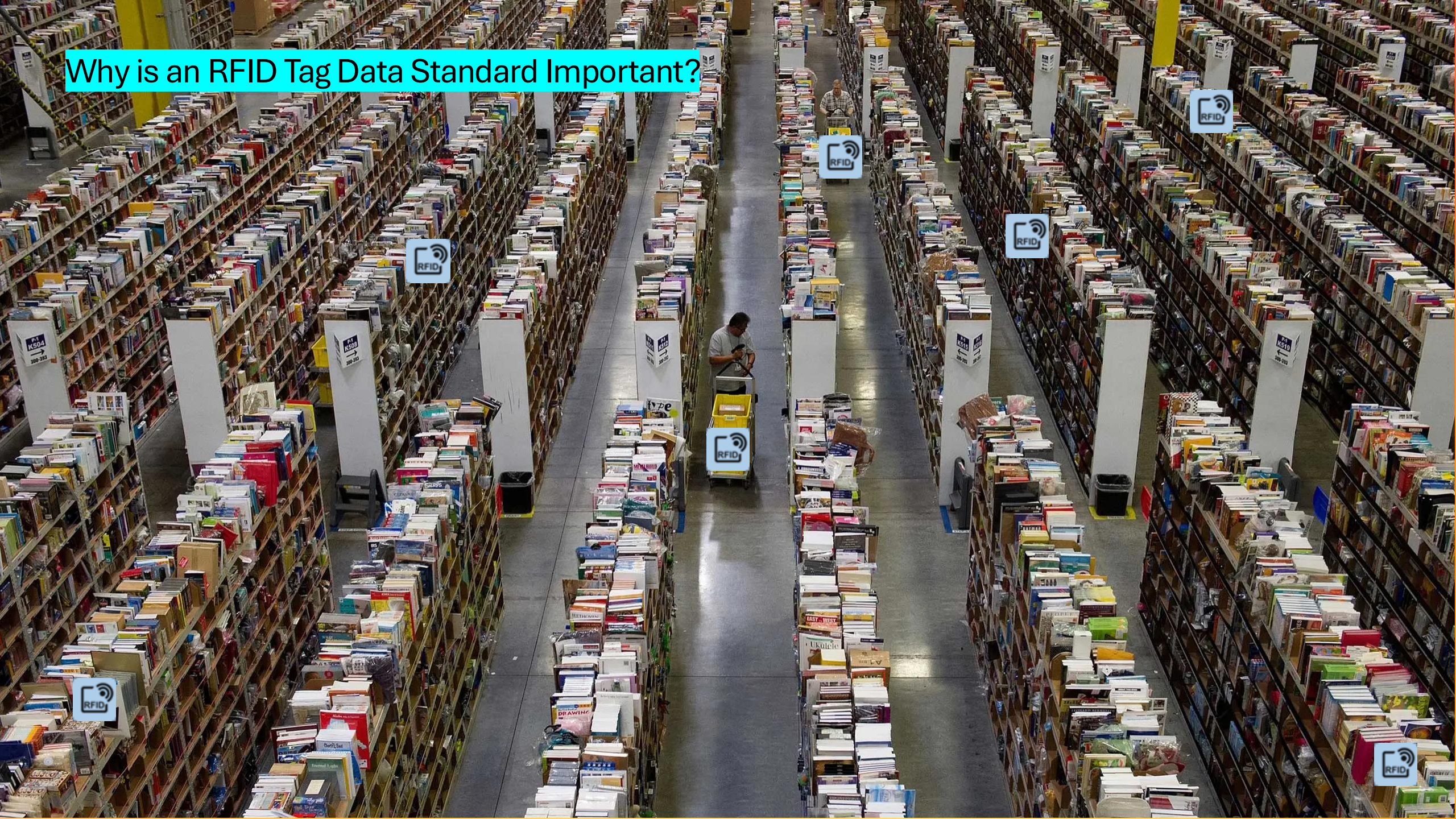
Or….

A Serialized GTIN (SGTIN) with **274 billion** serial numbers

# Things I've heard from users and integrators that make me cringe…

- I'm going to encode everything on my barcode label into the RFID label
- Aren't all tags pre-encoded today?
  - I'm just going to use the pre-encoded tag data.
- Why can't I just use the TID as my data standard?
- I'll just encode ABC123 as a prefix on my tags and filter on that…
  - …but that takes up too much space, how about I just use "AA" ? Or just "A"
- The GS1 system is great, but I don't want to "pay for it"…
  - …so I just made up my own company prefix and will use SGTIN-96.

# Why is an RFID Tag Data Standard Important?



# Why Should an RFID Tag Data Standard be used?

- Ensures interoperability between RFID use cases
- Allows readers to easily filter tags
- Provides scale for open-loop applications
  - 10+ Billion tags/year are encoded with SGTIN 96 for retail items
- Usually focused on the EPC / UII (memory bank 01)

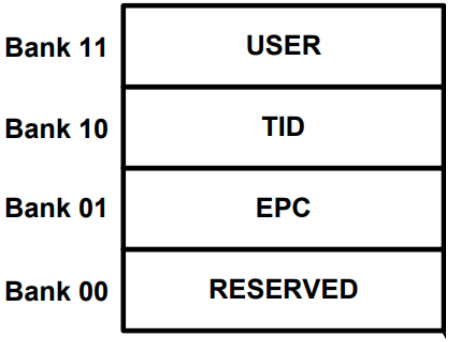


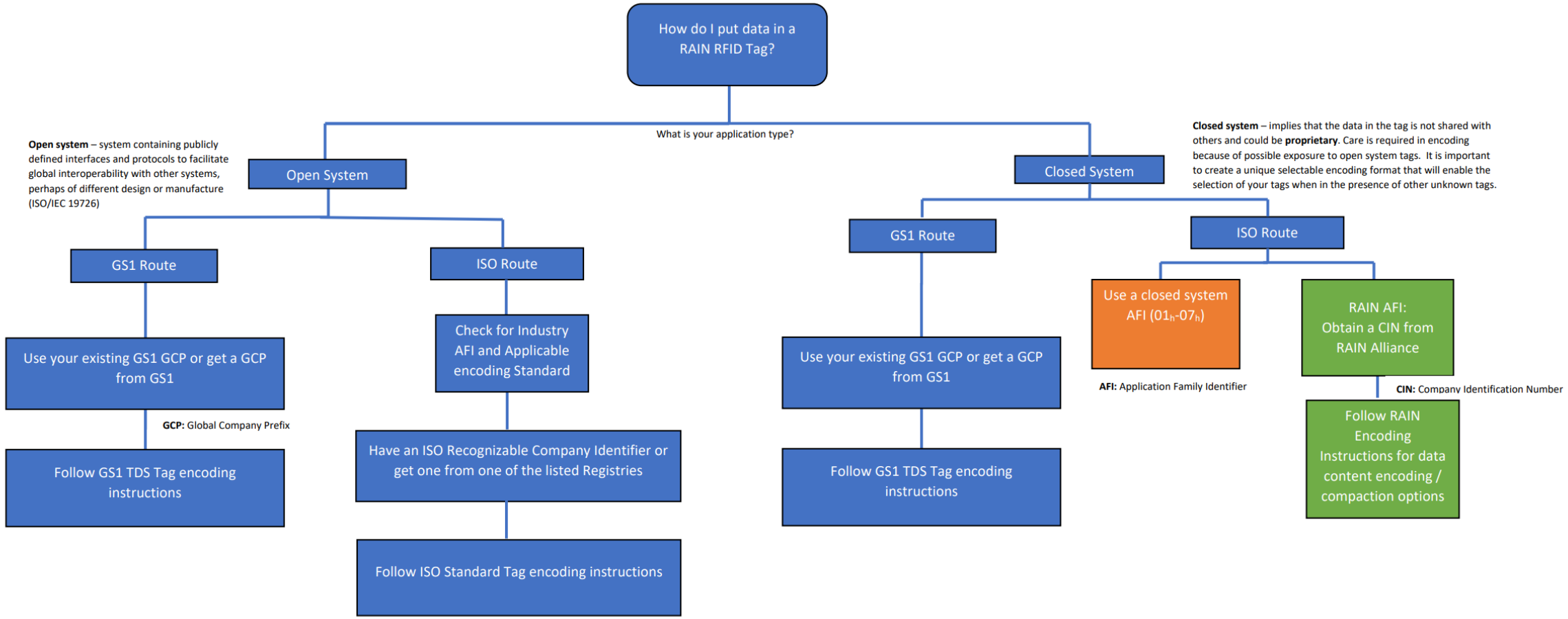

Image Source: EPC Gen2 Air Interface Standard

**SGTIN-96 Example**

urn:epc:id:sgtin: CompanyPrefix.ItemRefAndIndicator.SerialNumber

urn:epc:id:sgtin: 0614141.112345.400

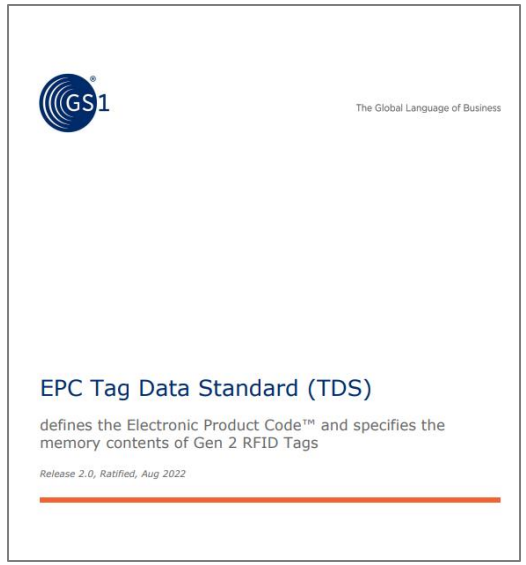
# Selecting a Tag Data Standard

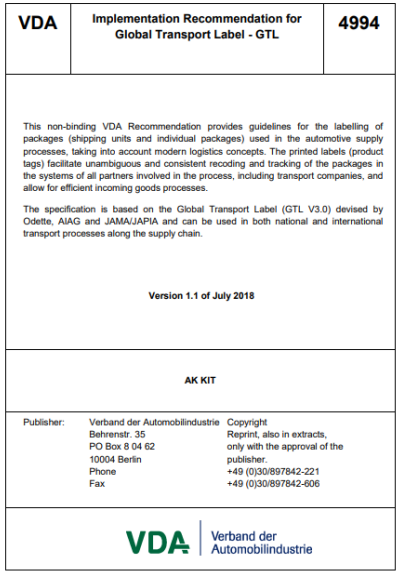


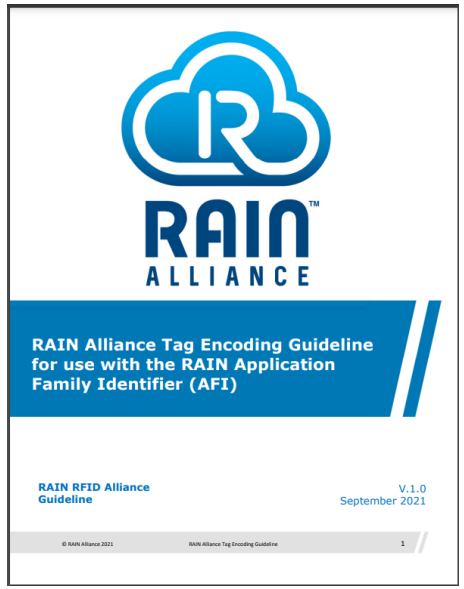

Flowchart Source: https://rainrfid.org/cin/

# Selecting a Tag Data Standard

- If there's an appropriate GS1 standard for your application space – follow it.
- Next, look to ISO-based industry specific organizations – IATA, VDA, MIL-STD-129, etc.
- Use the *RAIN ISO numbering system for anything else* - assets, closed-loop logistics, etc.

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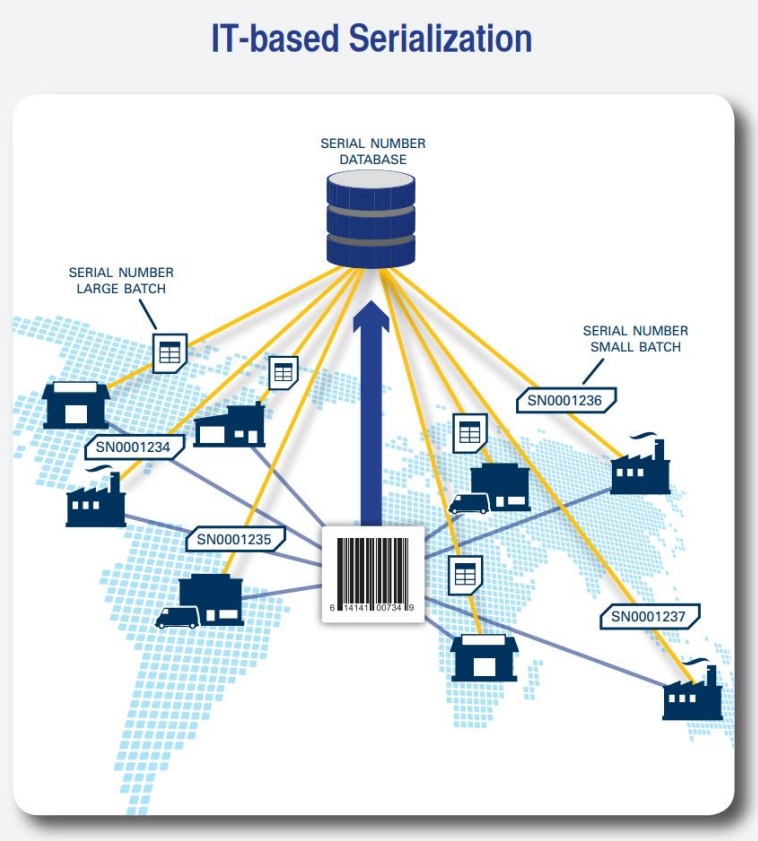
# Serialization Methods




**<u>Dynamic assignment</u>**
Serial numbers assigned by IT as needed

Challenges – Real time assignment depends on robust IT infrastructure

**<u>Static assignment</u>**
Serial numbers assigned in batches

Challenges – Tracking and reassigning serial numbers as business changes

Source – RFID Chip-Based Serialization for Retail
https://www.zebra.com/content/dam/zebra/white-papers/en-us/rfid-serialization-en-us.pdf

# Serialization Methods


## Chip Based Serialization

RFID printer generates serial number from the **Tag ID** serial number (48 bits)

**Tag ID** is unique and may not be changed

Serial numbers lists do not need to be maintained

# Elements of a Successful Encoding Scheme

- Understand what absolutely **needs** to be encoded vs. what could be pushed to the cloud
- Make sure a **data standard** is being used
- Encourage a serialization scheme that is **scalable**

# Thank You