



Defining Today's  
Technology Standards;  
Empowering Tomorrow's  
Solutions.



# Make•IT•Wright 20 HACKATHON 23

Training Session #2

Date: January 26, 2023

by AIM North America



# Anti-Trust Policy

It is the policy of the AIM North America to conduct its operations in strict compliance with the antitrust laws. No AIM North America activities shall create even the appearance of a violation of the letter or spirit of the antitrust laws. This policy prohibits any discussion at AIM North America meetings of unpublished commercial terms of sales, unannounced product development or unpublished cost and revenue data of a member. It is not appropriate for members to discuss competitive business terms with an intent to explicitly or implicitly form an agreement or understanding which restricts the exercise of independent business judgement, especially with regard to price, selection of customers, and markets in which it competes.

All attendees are permitted and encouraged to actively participate in all meeting discussions and activities as defined in the AIM North America Member Participation and Collaborative Guidelines. If any participant believes the group is drifting toward impermissible discussion, the topic shall be tabled until the opinion of counsel can be obtained.



# Collaboration and Work Product Policy

AIM North America is proud to be the industry association and authority on barcode, RFID, RTLS and mobile computing, and is on the cutting edge of development in these areas. Our members have a long history of working together to provide a collaborative global influence on emerging technologies and innovation.

AIM North America committee meetings are held for the primary purpose of advancements in our industry, which necessarily involves development of work product intended solely for the public domain. AIM North America has developed this Policy for the protection of its members who engage in this important collaborative effort.

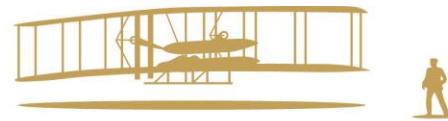
All information shared in this process shall be non-confidential and shared for the common purpose of producing work product for the public domain. No proprietary information, confidential information, or trade secrets should be shared during any AIM North America meeting. Additionally, information developed during AIM North America committee meetings should not be shared with others outside of this collaborative process until finalized and formally announced by AIM North America such as public review or standards documents or finalized issued standards.

These limitations are necessary to protect and safeguard the integrity of the collaborative process, AIM North America members, and AIM North America itself. All meetings shall be conducted in a manner that avoids the appearance of any conduct that might violate this policy.

# Speaker



## Matt Kijowski



**WRIGHT STATE  
UNIVERSITY**

Cyber Systems Program Manager

[matthew.kijowski@wright.edu](mailto:matthew.kijowski@wright.edu)



# Thank You Sponsors



WRIGHT STATE  
UNIVERSITY





# Session 2 Agenda

- 5:30 – 5:45 Networking / Dinner
- 5:45 – 5:55 Welcome / Overview / TY Sponsors
- 5:55 – 6:30 TSC Printronix Thermal Printers....
- 6:30 – 6:40 Break
- 6:40 - 7:00 NOVEXX Printers
- 7:00 – 7:10 TDS 2.0
- 7:10 – 7:20 Encoding / Decoding RFID Tags TDS 2.0
- 7:20 – 7:30 RFID readers / Barcode readers
- 7:30 – 8:00 EPCIS Work Bench and Free EPICS Client Repository PLUS Examples
- 8:00 – 8:15 Wrap-Up / Q&A



Defining Today's  
Technology Standards;  
Empowering Tomorrow's  
Solutions.



# Make•IT•Wright 20 HACKATHON 23

Training Session – Thermal Printers

Date: 26 Jan, 2023

by AIM North America

# Speaker

## Chris Brown

RFID Subject Matter Expert

[cbrown@tscus.com](mailto:cbrown@tscus.com)





# Barcode and RFID Label Printers

What is this thing?

Why does it exist?

What can it do?





# Barcode and RFID Label Printers

Normally called:

- Thermal printer
- Barcode (label) printer
- RFID printer (assuming RFID module)

Lots of lingo: “industrial,” “desktop,” “mobile,” “tabletop”



# Barcode and RFID Label Printers

How do they work?

They all speak (a) language(s)

- Similar idea to basic home or office printer (PCL, PostScript)
- PGL, ZPL, MPCL, etc.

Use the language to tell printer what to do

```
!PTX_SETUP
ENGINE-WIDTH;4050:LENGTH;6000:MIRROR;0.
PTX_END
~PAPER;ROTATE 0
~CONFIG
UPC DESCENDERS;0
END
~CONFIG
CHECK DYNAMIC BCD;0
END
~CREATE;FORM-0;432
SCALE;DOT;300;300
ISET; 'UTF8'
RFWTAG;16;PC
16;H;*3400*
STOP
RFWTAG;96;EPC
96;H;*30105E30A700004000000001*
STOP
BARCODE
C128C;INV;XRD4:4:8:8:12:12:16:16;H7;938;401
"\"12345678"
STOP
FONT;FACE 92250;BOLD 0;SLANT 0
ALPHA
INV;POINT;877;657;12;12;"12345678"
STOP
END
~PAPER;CUT 0;PAUSE 0;TEAR 0
~EXECUTE;FORM-0;1
```



# Barcode and RFID Label Printers

How do you generate this language?

- (Windows) application like BarTender
- Hand-write it (“hard-coding”)
- Many ERPs, WMSs, etc. have language templates already built in

Send the language to the printer via any conventional print method



# Barcode and RFID Label Printers

Let's get this thing set up - “VAR” (Value-Added Reseller)

1. Out of the box, cables, power
2. Load the media (labels and ribbon)
3. Basic printer settings:
  - Thermal Transfer (TT) vs. Direct Thermal (DT), speed, “darkness,” printhead pressure, etc.



# Barcode and RFID Label Printers

Let's get this thing set up – End-User (you)

4. Standard “media” calibration – always done
5. RFID calibration – RFID only
  - What chip?
  - Chip memory sizes
  - Chip attributes and features
  - Inlay placement
  - Optimal RFID powers



# Barcode and RFID Label Printers

Using BarTender to generate basic printer language

- Label dimensions
- Text objects
- Barcode objects
- Data sources
- And a simple RFID object...
- Print quantities



# RFID Encodings



# Questions & Comments

---



# Contact Us



## Chris Brown

RFID Subject Matter Expert

[cbrown@tscus.com](mailto:cbrown@tscus.com)





# Contact us



100 Allegheny Drive  
Suite 105C  
Warrendale, PA 15086  
USA

[info@aim-na.org](mailto:info@aim-na.org)

[www.aim-na.org](http://www.aim-na.org)

+1.724.742.4473



# Session 2 Agenda

- 5:30 – 5:45 Networking / Dinner
- 5:45 – 5:55 Welcome / Overview / TY Sponsors
- 5:55 – 6:30 TSC Printronix Thermal Printers....
- 6:30 – 6:40 Break**
- 6:40 - 7:00 NOVEXX Printers....
- 7:00 – 7:10 Encoding / Decoding RFID Tags TDS 2.0
- 7:10 – 7:25 RFID readers / Barcode readers
- 7:25 – 8:00 EPCIS Work Bench and Free EPICS Client Repository PLUS Examples
- 8:00 – 8:15 Wrap-Up / Q&A



Defining Today's  
Technology Standards;  
Empowering Tomorrow's  
Solutions.



# Make•IT•Wright 20 HACKATHON 23

Training Session #2 – NOVEXX Printers

Date: January 26, 2023

by AIM North America

# Speaker



## Shawn Minehart

Sales Director North America

**NOVEXX**  
**SOLUTIONS**

[shawn.minehart@novexx.com](mailto:shawn.minehart@novexx.com)



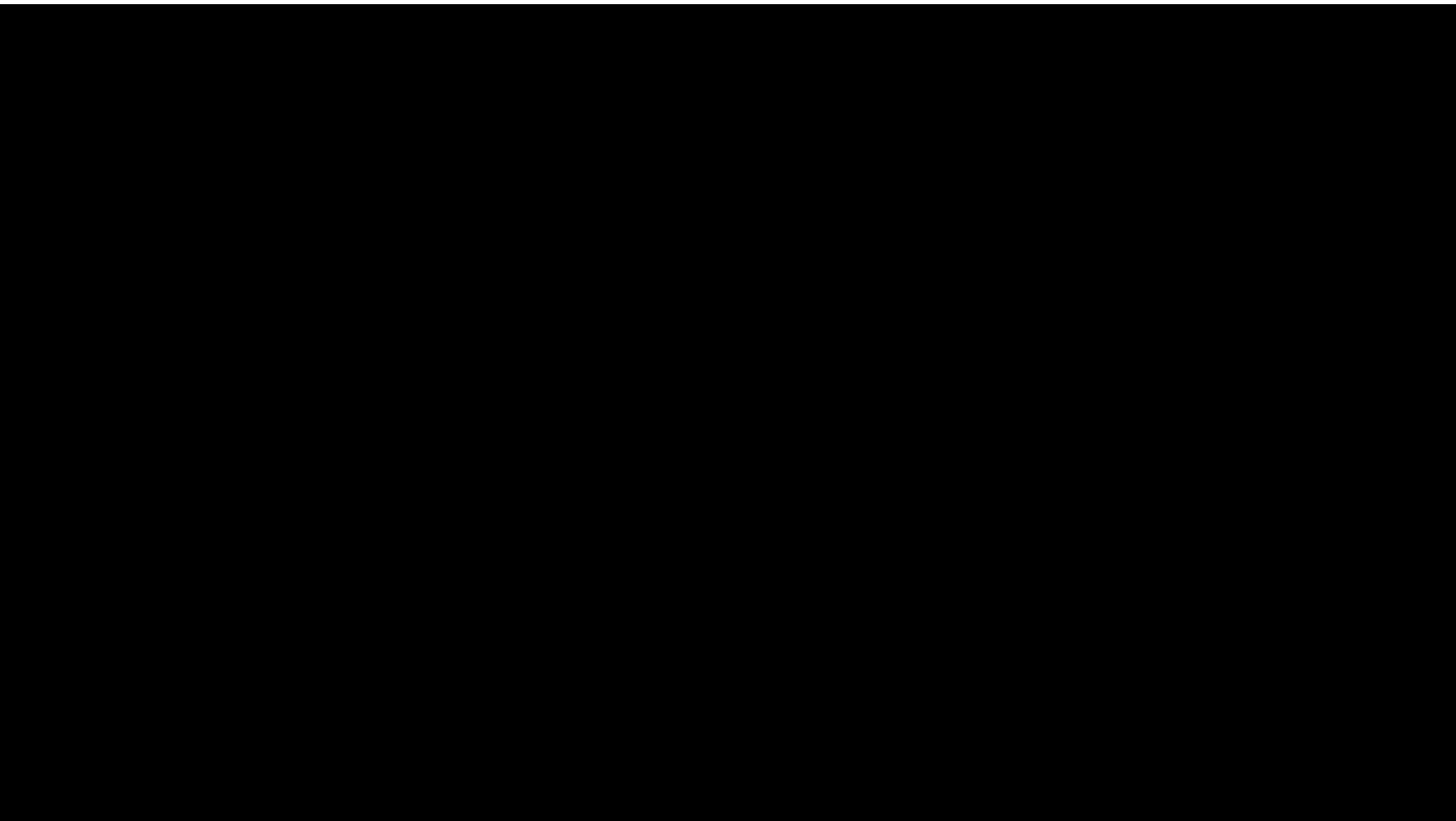
# NOVEXX Solutions XLP 504 With LTSA

- LTSA stands for Light Touch Stepper Applicator
- It is an optional device for the XLP 504 label printers
- LTSA takes over self-adhesive labels from the printer's dispensing unit and applies them to products
- Power is supplied via the printer and the controller is integrated into the firmware





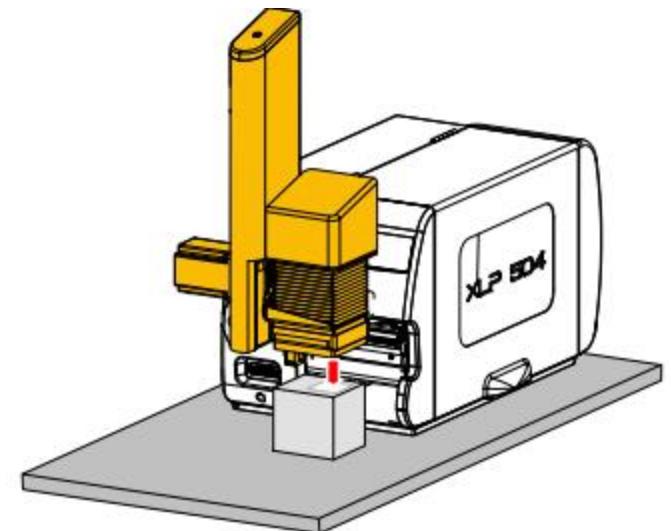
# Video



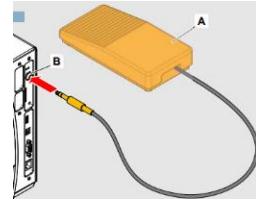
Copyright © 2023 AIM North America. All rights reserved.

The views expressed/presented are that of the individual speaker and do not necessarily represent the views of the speakers' respective company or AIM North America.

- *Light Touch* means that the label is only pressed on lightly because the applicator immediately returns home as soon as it contacts the product
- This allows products with varying heights to be labelled
- The applicator is driven by a stepper motor
- *Working position:* The application direction is vertically from top to bottom





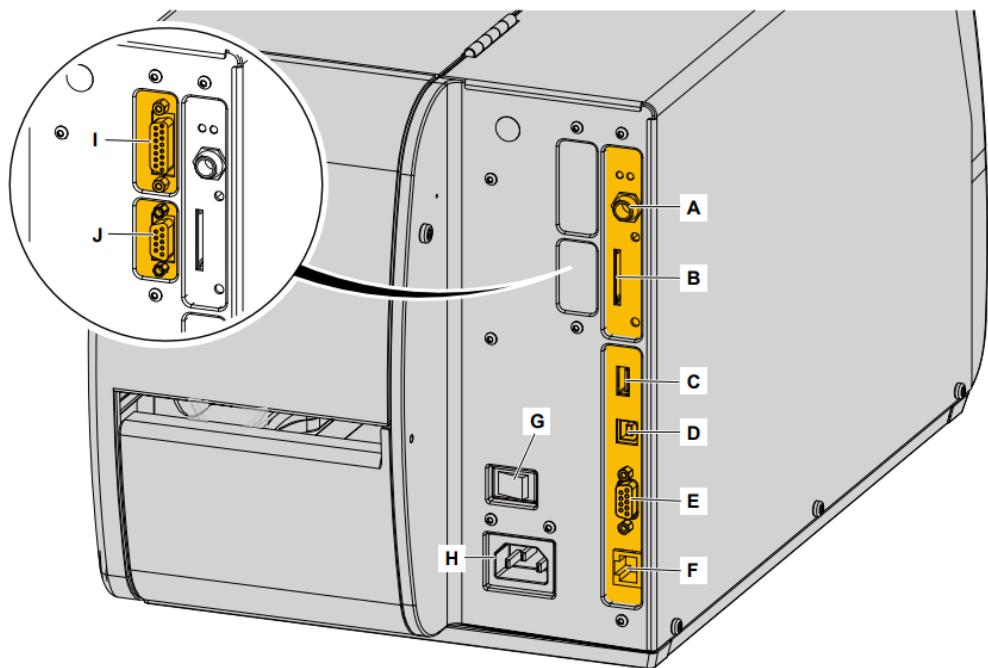
- The application process is triggered by one of the following possibilities:
  - Press a button on the printer operation panel 
  - Easy Plug immediate command (#!D) at the data interface
  - Press an optional foot switch 
  - Optional 5V sensor (less than 100mA draw)

# Functionality

- The LTSA waits in home position in front of the dispensing edge and draws the label onto the foam pad on its underside as soon as it has been dispensed
- The vacuum is generated by a fan
- After the start signal, LTSA moves its pressure plate down until it contacts resistance (product)
- The label is applied firmly to the product and immediately starts its return stroke



# Ports And Connections



- A *Start/stop signal input*: Connections for a foot switch (signal starts printer) or stacker (signal stops printer)
- B *Memory card slot*: For SD cards where you can store fonts, logos, graphics, etc.
- C *USB port (host)*: For USB sticks, keyboards, etc.
- D *USB port (device)*: For serial transfer of printer data
- E *RS232 port*: For serial transfer of printer data
- F *Ethernet port*: Interface for "Ethernet 10/100 Base T" network
- G *Mains power switch*: On/Off switch for printer
- H *Mains socket*: Mains socket for connection to mains using supplied cable
- I *(Option) Signal port*: 4 inputs / 3 outputs on optionally available I/O board
- J *(Option) Serial port*: RS232 or RS422/485 on optionally available I/O board



# Technical Data

- Type of material: Self-adhesive labels
- Label size: min 30x30 mm (1.18") max 80x80 mm (3.15")
- Stroke: 190 mm max (7.48")
- Minimum required stroke (distance between home position and product contact: 30 mm (1.18")
- Application speed: 50 labels/minute



- Application angle:  $90^\circ \pm 3^\circ$
- Application direction: From top to bottom
- Application precision:  $\pm 1 \text{ mm}$
- Application force: 10 N (with  $90^\circ$  application angle)
- Air current source: Blowers

# Contact Us



## Shawn Minehart

Sales Director North America

**NOVEXX**  
**SOLUTIONS**

[shawn.minehart@novexx.com](mailto:shawn.minehart@novexx.com)



Defining Today's  
Technology Standards;  
Empowering Tomorrow's  
Solutions.



# Make•IT•Wright 20 HACKATHON 23

Training Session #2 – TDS 2.0 (Jonathan Gregory)

Date: January 26, 2023

by AIM North America

# Speaker



## Jonathan Gregory

Industry Engagement



[jgregory@gs1us.org](mailto:jgregory@gs1us.org)

# RFID in the Food Industry



# Example: GS1-128 Carton Barcode for Foodservice

Application Identifier (AI): Defines meaning and format of data attributes

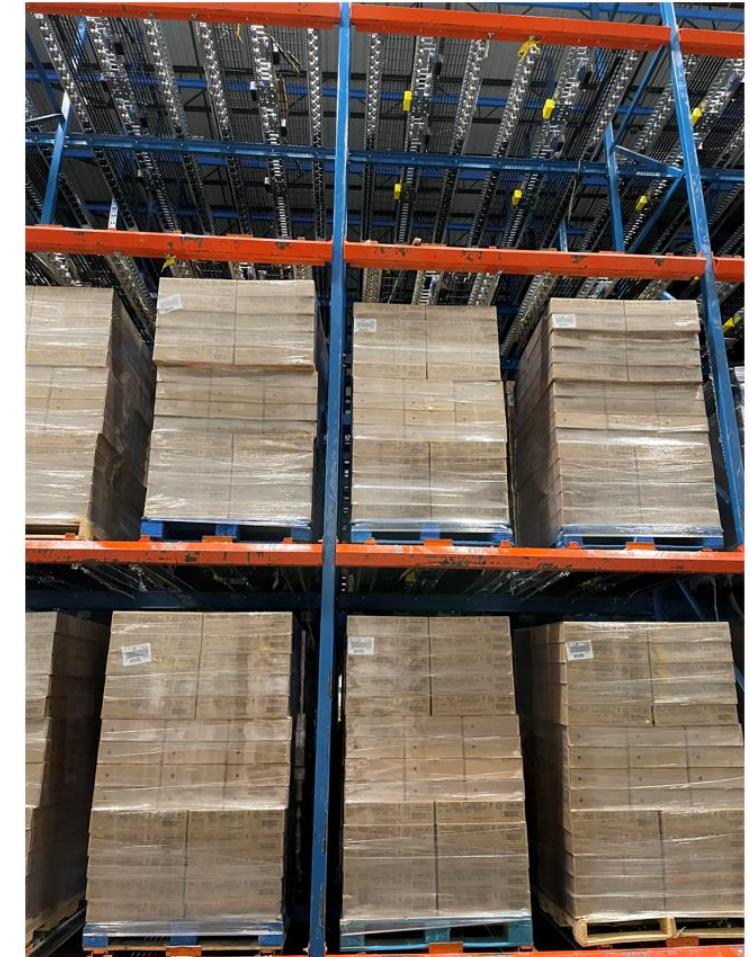
- AI(01) GTIN
- AI(10) Batch/Lot
- AI(17) Expiration Date



(01) 1 0614141 23456 8 (17) 210720 (10) ABC12



# Golden State Foods POC





# Weighing Options

**GTIN & Serial  
(SGTIN-96)**

**Only**

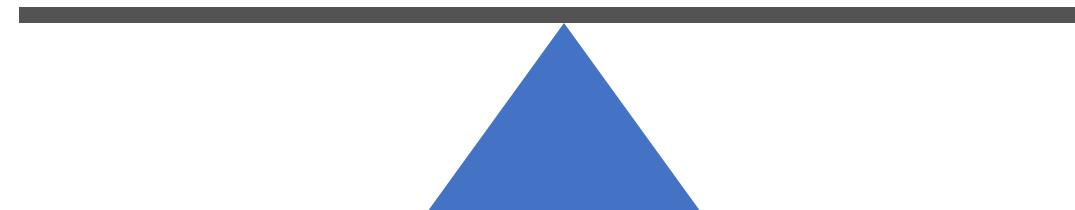
- Requires integration to obtain attribute data

**GTIN, Serial, Batch, Date...  
(DSGTIN+)**

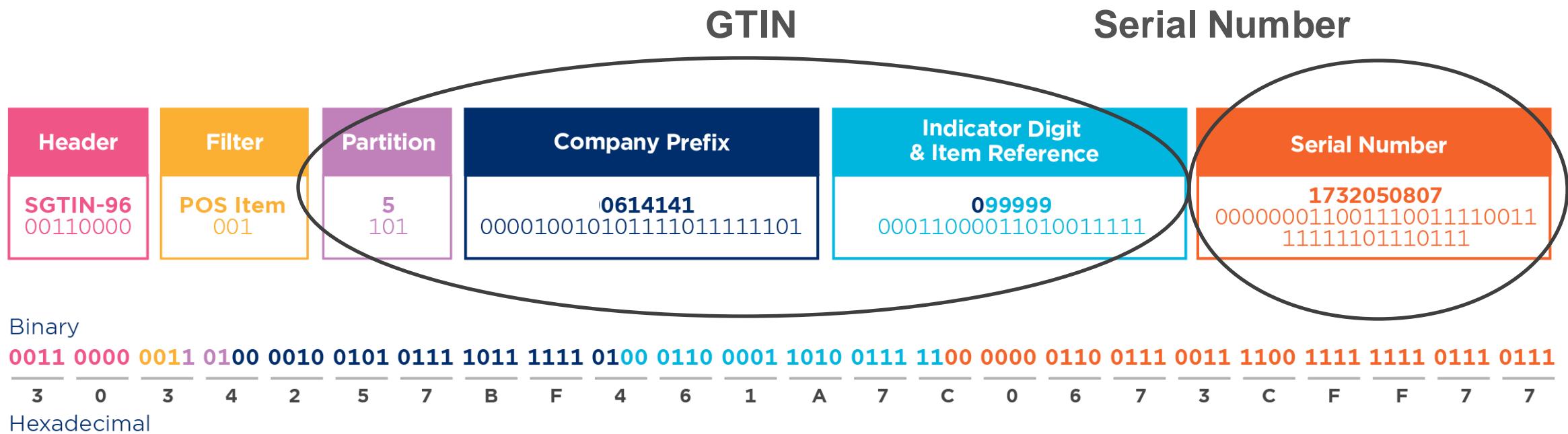
Increased tag memory  
Encode at point of mfg.

Costs

Benefits



# SGTIN-96 Binary Example (not impacted by TDS 2.0)





# DSGTIN+ (9-digit serial number)

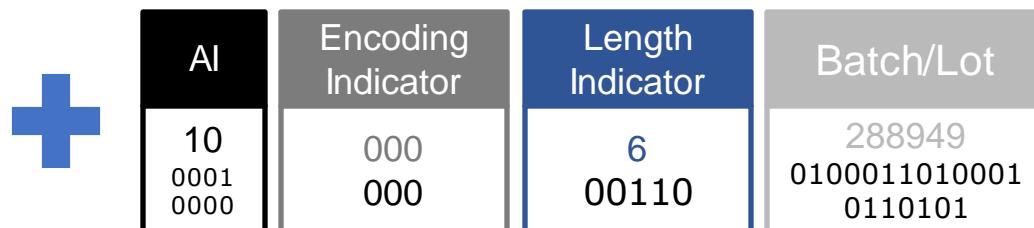
Header	+AIDC Ind.	Filter Value	Date Indicator	Date	GTIN	Encoding Indicator	Length Indicator	Serial Number
DSGTIN+ 111110111	0 0	2 010	0100 0100	220724 0010110 0111 11000	00614141999996 0000 0000 0110 0001 0100 0001 0100 0001 1001 1001 1001 1001 1001 0110	000 000	9 01001	732050807 101011101000100011 010101110111

Bit Count	126
GS1 Element String	
(01)00614141999996(21)732050807(17)220724	
GS1 Digital Link URI	
<a href="https://example.com/01/00614141999996/10/288949/21/732050807?17=220724">https://example.com/01/00614141999996/10/288949/21/732050807?17=220724</a>	



# DSGTIN+AIDC Data (Batch/Lot)

Header	+AIDC Ind.	Filter Value	Date Indicator	Date	GTIN	Encoding Indicator	Length Indicator	Serial Number
DSGTIN+ 11111011	1 1	2 010	0100 0100	220724 0010110 0111 11000	00614141999996 0000 0000 0110 0001 0100 0001 0100 0001 1001 1001 1001 1001 1001 0110	000 000	10 01010	1732050807 00011001110011110 01111111101110111



## Bit Count

166

# GS1 Element String

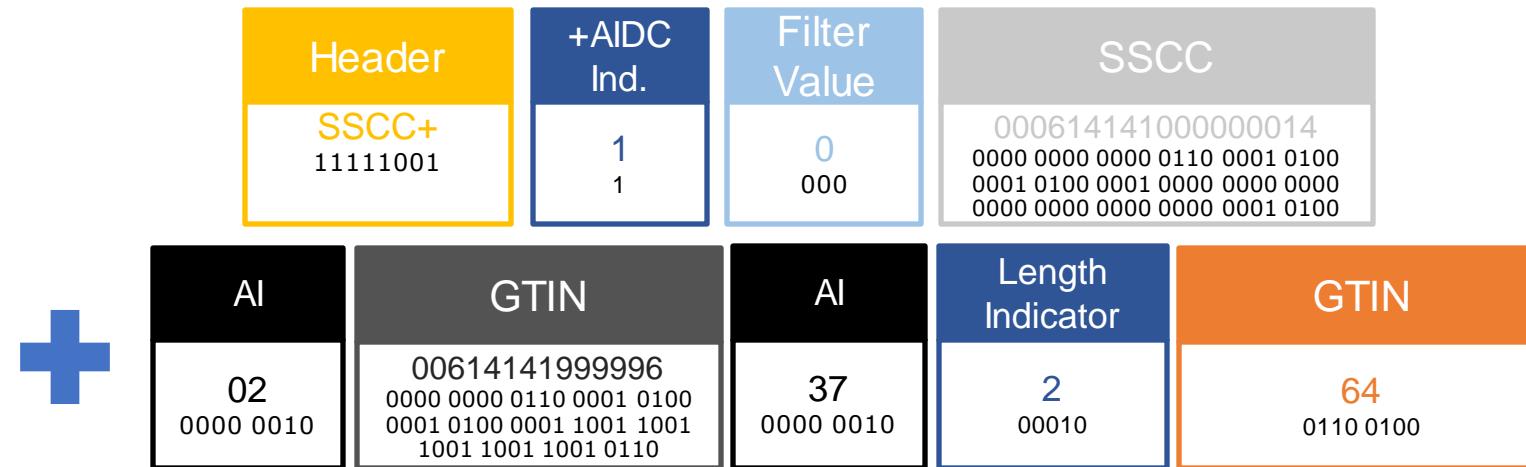
(01)00614141999996(21)1732050807(17)220724(10)288949

# GS1 Digital Link URI

<https://example.com/01/00614141999996/10/288949/21/1732050807?17=220724>



# SSCC+ GTIN, Qty



Bit Count	169
GS1 Element String	
(00)00061414100000014(02)00614141999996(37)64	
GS1 Digital Link URI	
<a href="https://example.com/00/00614141999996?02=00614141999996&amp;37=64">https://example.com/00/00614141999996?02=00614141999996&amp;37=64</a>	



# Thank You!

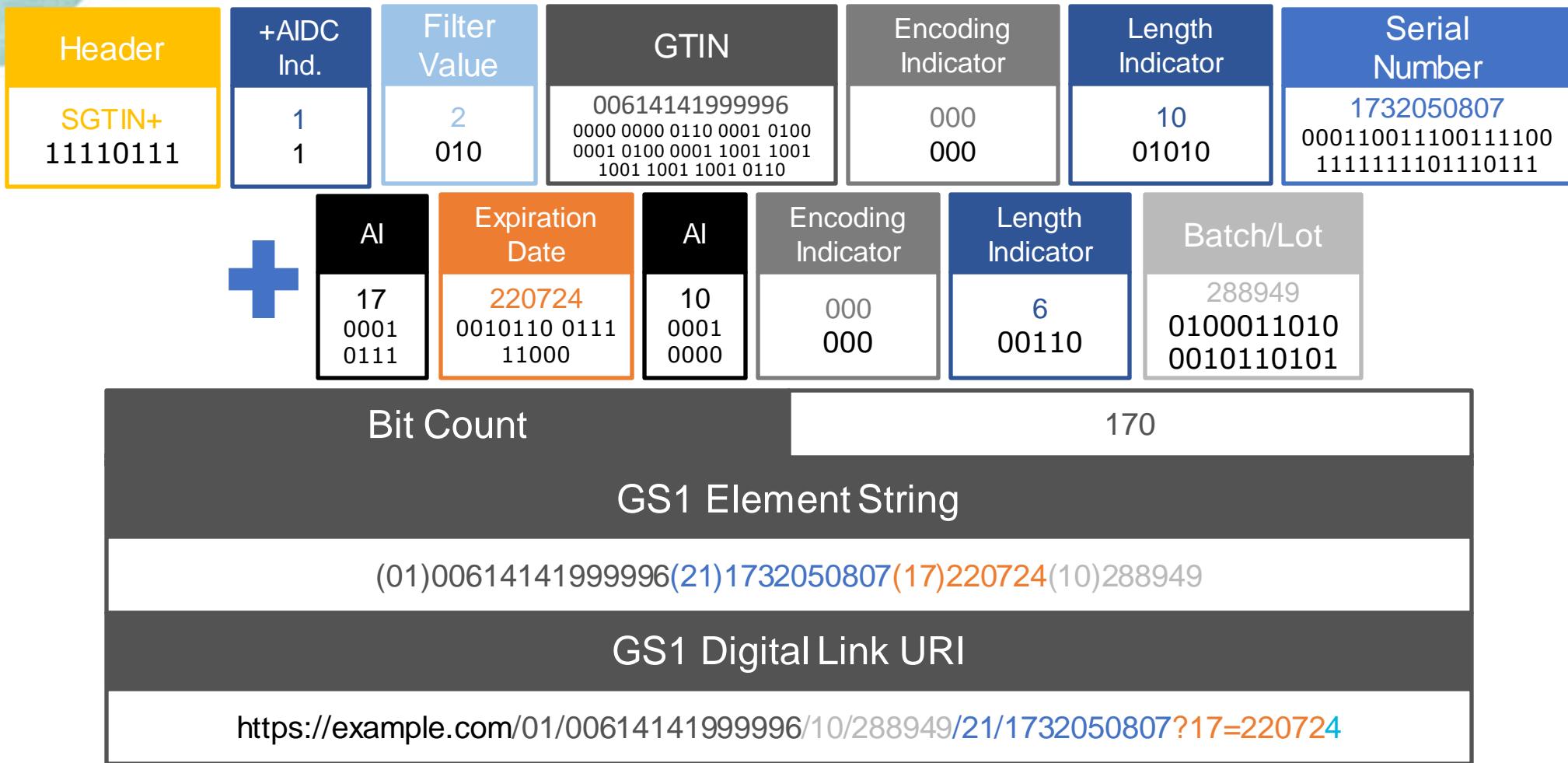


# Appendix

SGTIN+ examples follow



# SGTIN+AIDC Data (Expiry Date, Batch/Lot)





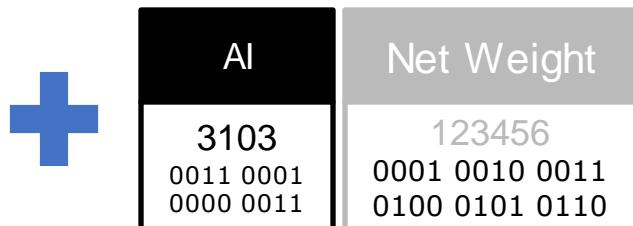
# SGTIN+AIDC Data (Expiry Date, Production Date, Batch/Lot)

Header	+AIDC Ind.	Filter Value	GTIN	Encoding Indicator	Length Indicator	Serial Number
SGTIN+ 11110111	1 1	2 010	00614141999996 0000 0000 0110 0001 0100 0001 0100 0001 1001 1001 1001 1001 1001 0110	000 000	10 01010	1732050807 000110011100111100 1111111101110111
+ AI 17 0001 0111	AI Expiration Date 220724 0010110 0111 11000	AI Production Date 200824 0010100 1000 11000	AI Encoding Indicator 10 0001 0000	Length Indicator 6 00110	Batch/Lot 288949 0100011010 0010110101	
Bit Count		194				



# DSGTIN+AIDC Data (9 Digit Serial & Net Weight)

Header	+AIDC Ind.	Filter Value	Date Indicator	Date	GTIN	Encoding Indicator	Length Indicator	Serial Number
DSGTIN+ 11111011	1 1	1 001	0100 0100	220724 0010110 0111 11000	00614141999996 0000 0000 0110 0001 0100 0001 0100 0001 1001 1001 1001 1001 1001 0110	000 000	9 01001	732050807 101011101000100011 010101110111



Bit Count	166
GS1 Element String	
(01)00614141999996(21)732050807(17)220724(3103)123456	
GS1 Digital Link URI	
<a href="https://example.com/01/00614141999996/10/288949/21/732050807?17=220724?3103=123456">https://example.com/01/00614141999996/10/288949/21/732050807?17=220724?3103=123456</a>	



# Business Value of Encoding Additional Attributes

Contributes to regulatory compliance

Enables precision recall

Enhances traceability

Enhances inventory management

Operational efficiencies

The RFID Advantage provides food industry details for encoding attributes

## The RFID Advantage

A new era of food supply chain operational efficiencies

Foodservice and Retail Grocery industry interest in EPC/RFID has increased significantly

Radio Frequency Identification (RFID) technology, when implemented with GS1 Standards, helps to support fast and accurate data capture and inventory tracking, adding visibility to your supply chain.

When tracking items and cases/cartons, added value is found in capturing attribute data in the RFID data carrier by enabling certain business processes to be performed without the need for manual labor, network connectivity, or systems integration. Therefore, RFID provides benefits in the form of improved supply chain management, recall management, and overall operational efficiencies.

Important: The practices outlined in this document are voluntary, not mandatory. It should be noted that use of the words "must" and "require" throughout this document relate exclusively to technical recommendations for the proper application of the guidelines and standards to support the integrity of your implementation.





# Links

- Tag Data Standard: <https://www.gs1.org/standards/tds>
- Impinj Announcement: <https://www.impinj.com/library/blog/impinj-m780-and-m781-tag-chips-for-industrial-medical-and-food>
- Confidex Announcement: <https://www.confidex.com/confidex-launches-new-tag-upgrades-with-impinj-m780/>
- Related articles:
  - Zebra Blog: <https://www.zebra.com/us/en/blog/posts/2022/there-is-now-a-better-way-to-track-trace-food-thanks-to-gs1-tds.html>
  - RFID Journal: <https://www.rfidjournal.com/standards-group-provides-rfid-guidelines-for-food-services>
  - RFID Journal Q&A: <https://www.rfidjournal.com/question/rfid-encoding-system>
  - IOP Journal Article: <https://iopjournal.com.br/gs1-announces-new-tds-version-2-0/?lang=en>



# Notes

- The term “AI” refers to the GS1 Standard term “Application Identifier”. A list of AIs may be found [here](#). Examples of Application Identifiers include AI (10) batch/lot, AI (17) expiration date, AI (11) production date, ...
- AIDC refers to Automatic Identification and Data Capture. The “+AIDC Indicator” referenced in the diagram is a flag that if set to “1” indicates that there is something added (as depicted in the second line of data following the “+” symbol).
- Here’s an explanation of each element in the order that they appear:
  - Header – indicates the encoding scheme (e.g., SGTIN-96, SGTIN+, DSGTIN+)
  - +AIDC – indicates that additional data is encoded beyond the core EPC identifier (which is composed of the GTIN and Serial)
  - Filter – this is the same as the SGTIN-96 – it indicates if a Point-of-Sale item, case, pallet,...
  - GTIN – this is the product identifier (the SGTIN-96 breaks this into three groups and strips the check digit)
  - Encoding Indicator: indicates the data type of the next value to follow. In these examples, it indicates that the serial number is numeric (as opposed to alpha-numeric, which would consume more bits per character)
  - Length Indicator: the number of digits that follow (in these examples, the serial number is 10 digits, it could be reduced to lower the memory consumption as depicted in the prior slide)
  - Some AIs have set data type and lengths (e.g., AI (17) expiration date is always 6 numeric digits) and therefore do not require the Encoding Indicator or Length Indicator.
- The DSGTIN+ key is recommended for products with date-based management
  - The key places the date in a set position, enabling more streamlined search of tags based on date value
  - The key saves 4 bits as compared to the SGTIN+ because it requires fewer bits to describe the assumed date AI

# Contact Us



## Jonathan Gregory

Industry Engagement



[jgregory@gs1us.org](mailto:jgregory@gs1us.org)



Defining Today's  
Technology Standards;  
Empowering Tomorrow's  
Solutions.



# Make•IT•Wright 20 HACKATHON 23

Training Session #2 – Encoding / Decoding RFID Tags TDS 2.0

Date: January 26, 2023

by AIM North America

# Speaker

## Chris Brown

RFID Subject Matter Expert

[cbrown@tscus.com](mailto:cbrown@tscus.com)





# RFID Encodings



## RFID in more detail

- “RFID” is a generic term
- RAIN RFID (“EPC”)
- GS1 and ISO numbering systems
- Today focus on GS1





# RFID Encodings

RFID in more detail: GS1 “Encoding Schemes”

- aka numbering systems
- Targeted at applications and industries
- Examples:
  - SGTIN-96
  - SGTIN+ (new)
  - DSGTIN+ (new)
  - SSCC+ (new)



EPC Tag Data Standard  
(TDS) 2.0



# RFID Encodings

These are commercially and technically efficient/viable encodings

- Fewer bits means smaller memory chips (cheaper)
- Fewer bits means less over-the-air
- Elements in sequence means efficient reading



# RFID Encodings

Two of the new kids (encodings) on the block:

- DSGTIN+
  - GTIN = Global Trade Item Number
    - GS1 Company Prefix + Item Reference
  - S = serial number
  - D = (prioritized) date
  - + = additional item attributes, GS1 “Application Identifiers” (AI’s)
    - Batch/Lot Nr, etc.
- SSCC+
  - SSCC = GS1 Company Prefix + Serial Reference
  - + = additional item attributes



# RFID Encodings

Using BarTender to generate advanced printer language

- Serial numbers
- DSGTIN+ and SSCC+ not in BarTender yet
  - “Raw” Hex input
- With a little help from an Avery Dennison app...
- (Note memory requirements)

# Questions & Comments

---



# Contact Us



## Chris Brown

RFID Subject Matter Expert

[cbrown@tscus.com](mailto:cbrown@tscus.com)





Defining Today's  
Technology Standards;  
Empowering Tomorrow's  
Solutions.



# Make•IT•Wright 20 HACKATHON 23

Training Session #2 – RFID Readers and Barcode Readers

Date: January 26, 2023

by AIM North America

# Speaker



## Jeanne Duckett

Food Traceability and Transparency,

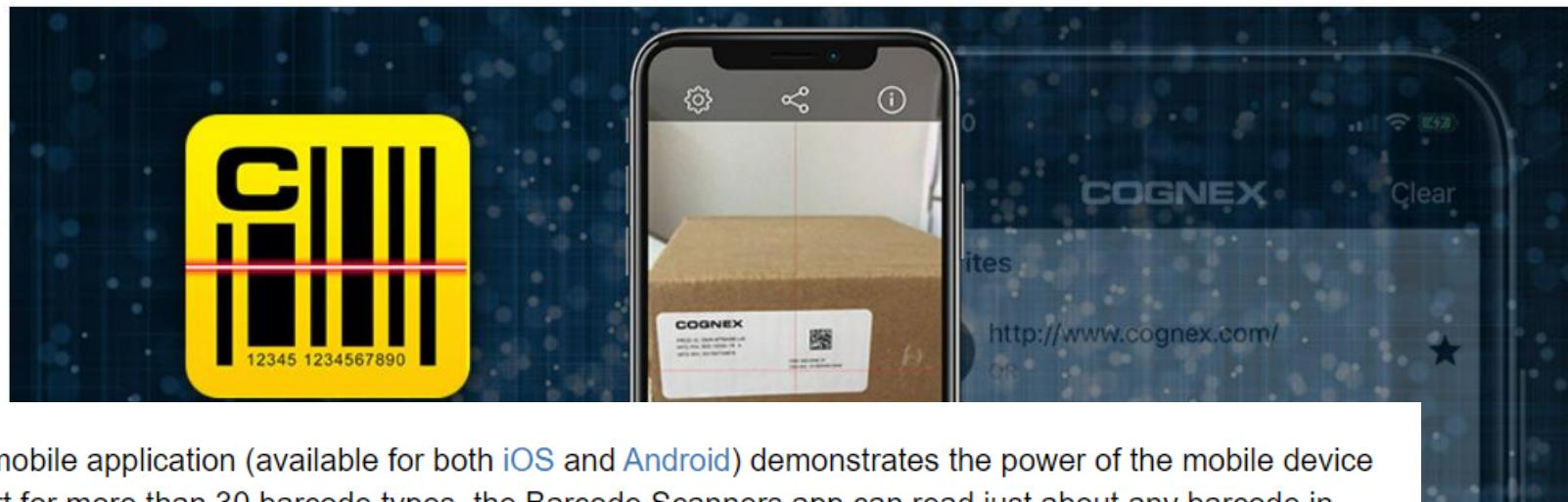


[jeanne.duckett@averydennison.com](mailto:jeanne.duckett@averydennison.com)



# Cognex Smart Device App

## THERE'S EVEN AN APP FOR THAT



The Cognex Barcode Scanners mobile application (available for both [iOS](#) and [Android](#)) demonstrates the power of the mobile device as a barcode reader. With support for more than 30 barcode types, the Barcode Scanners app can read just about any barcode in use today. The Barcode Scanners app can be used to examine the contents of a barcode, search the web, or launch the web browser for barcodes encoding a URL.



Data Matrix



UPC



QR



Code 128



Aztec Code



Interleaved 2 of 5

<https://www.cognex.com/blogs/industrial-barcode-reader/theres-even-an-app-for-that>

The views expressed/presented are that of the individual speaker and do not necessarily represent the views of the speakers' respective company or AIM North America.

# Barcode Scanners

Scanners we have for hackathon are keyboard wedges



NETUM 2D Barcode Scanner





# Barcode Reading – Case Label



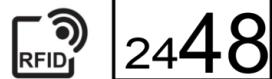
(01) 1 0810055 93101 6 (13) 230201 (10) AB1234 (21) 1

Romaine Lettuce  
20 Count

Pack Date / empaquete le  
Feb 23

Grown In / Cultive en Arizona, USA

US No 1  
HomeGrown Co-Op  
Kalamazoo, MI 49007



2448

## Read Data

01108100559310161323020110AB1234 211

AI – 01 GTIN

Green – 14 digit GTIN

2 digit AI 13 – Packing Date

6 digit date code

2 digit – AI 10 Lot

6 character lot code

2 digit AI 21 Serial Number

1 digit – Serial Code

## Interpreted

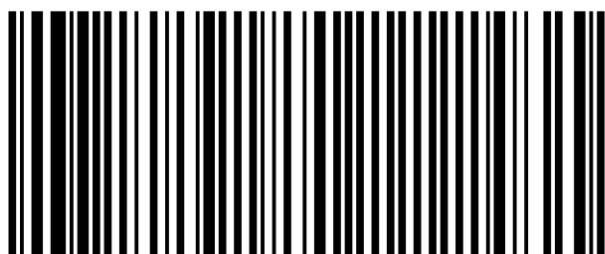
(01) 10810055931016 (13) 230201 (10) AB1234 (21) 1



# Barcode Reading - SSCC

SSCC

085002031700000019



(00) 0 8500203 170000001 9



Read Data

Scanner output – 00085002031700000019

(00) 085002031700000019



# Reading Barcode – GS1 Digital Link



Romaine Tomato Fresh Salad

UPC - 810055939015

Lot - 1234WSU

Ser - 01

Best Before - Feb 15, 2023



Made fresh by Good Processing, Springfield, Ohio

GS1 Digital Link

<https://example.com/01/810055939015/10/123WSU/21/01?17=230215>



# Decoding Barcode

The formats are simple

- 1) Decode manually
- 2) Use a decode library
  - GS1 Barcode Decoder <https://github.com/gs1/gs1-syntax-engine>
  - GS1 Digital Link  
<https://github.com/gs1/interpretGS1scan>
  - Cognix Free Library - <https://cmbdn.cognex.com/>



# RFID Readers

RFID  
Keyboard  
Wedge



Roll over image to zoom in



RFID  
Handheld  
Reader

RFID Portal  
Readers



# Keyboard Wedge RFID Reader

String returned from the reader

FB912E4110810055931016 011027ABC1234

Tag Data Standard 2.0 Demo

File Convert Settings Help About

Header	Filt.	Date	Type	Date	GTIN (H14)	Serial Num. (A20)
DSGTIN+	1	13 Packaging		230201	10810055931016	1

AI	AI Name	Data
<input checked="" type="checkbox"/>	10	BATCH/LOT (A20)
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		

RFID **FB912E4110810055931016011027ABC1234** # Bits **144**

Elem. Str. **(13)230201(01)10810055931016(21)1(10)ABC1234**

Error

Encode Decode El. Str. → Fields Reset Clear Left Clear Right

DSGTINP,1,1,230201,10810055931016,1,10,ABC1234, FB912E4110810055931016011027ABC1234



# Keyboard Wedge RFID Reader

String returned from the reader

FB912E4110810055931016 011027ABC1234

Tag Data Standard 2.0 Demo

File Convert Settings Help About

Header Filt. SSCC (H18)

SSCC+ 1 085002031700000019

AI	AI Name	Data
<input type="checkbox"/>	10	ABC1234
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		

RFID F91085002031700000019000 # Bits 96

Elem. Str. (00)085002031700000019

Error

Encode Decode El. Str. → Fields Reset Clear Left Clear Right

SSCCP, 1, 085002031700000019

F91085002031700000019000



# DSGTIN+ Format – 144 bits

FB 9 1 2E41 10810055931016 01 1 10 27 ABC1234

FB - Header For DSGTIN+

9 - Ext. Attr. Flag (1) + Filter (1)

1 - Date Type (13)

24E1 - Date

10...06 - GTIN

01 - Encoding (0 = binary) and Length (1) for Serial Number

1 - Serial Number

10 - AI for Batch/Lot

27 - Encoding (1 = Hex) + Length (7) for Lot/ Batch

ABC1234 - Date for Lot/Batch



(01) 1 0810055 93101 6 (13) 230201 (10) AB1234 (21) 1

Romaine Lettuce  
20 Count

Pack Date / empaquete le  
Feb 23

Grown In / Cultive en Arizona, USA

US No 1

HomeGrown Co-Op  
Kalamazoo, MI 49007



2448

Source provide to encode/decode date bits



# Keyboard Wedge RFID Reader

String returned from the reader

F91085002031700000019000

Tag Data Standard 2.0 Demo

File Convert Settings Help About

**Header** Filt. SSCC (H18)

SSCC+ 1 085002031700000019

AI	AI Name	Data
<input type="checkbox"/>	10	ABC1234
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		

RFID F91085002031700000019000 # Bits 96

Elem. Str. (00)085002031700000019

Error

**Encode** **Decode** **E. Str. → Fields** **Reset** **Clear Left** **Clear Right**

SSCCP,1,085002031700000019 | F91085002031700000019000



# SSCC+ Format - 128 bits

F9 | 085002031700000019000

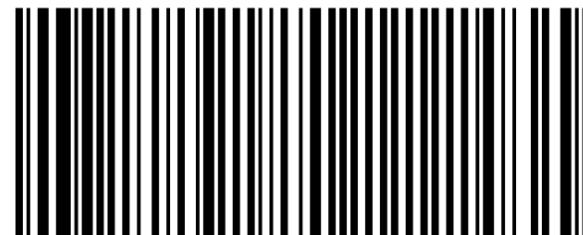
F9 - Header for SSCC+

1 - Ext. Attr. + Filter Assumes Filter = 1)

08...00 - SSCC Data

SSCC

085002031700000019



(00) 0 8500203 170000001 9





# RFID Portals

Zebra FX9600



Impinj R700



Zebra demo app is 123RFID <https://www.zebra.com/us/en/support-downloads/software/utilities/123rfid.html>.  
The SDK files are at <https://www.zebra.com/us/en/support-downloads/rfid/rfid-readers/fx9600.html>.

Impinj demo app is ItemTest

<https://support.impinj.com/hc/en-us/articles/360011676720-Impinj-R700-Reader-Documents-Downloads>  
and their SDK can be found lower down on the page.



# RFID Handhelds

Android Devices -



# Questions & Comments

---



# Contact Us



## Jeanne Duckett

Food Traceability and Transparency,



[jeanne.duckett@averydennison.com](mailto:jeanne.duckett@averydennison.com)



Defining Today's  
Technology Standards;  
Empowering Tomorrow's  
Solutions.



# Make•IT•Wright 20 HACKATHON 23

Training Session #2 –EPCISWorkbench and FreeEPCIS  
Client Repository PLUS Examples

Date: January 26, 2023

by AIM North America

# Speaker



## Jeanne Duckett

Food Traceability and Transparency,



[jeanne.duckett@averydennison.com](mailto:jeanne.duckett@averydennison.com)

# Event-based visibility powered by EPCIS



## EPCIS and CBV Implementation Guideline

Using EPCIS and CBV standards to gain visibility of business processes

*Release 1.2., Ratified, Feb 2017*



# EPCIS: a GS1 “Share” standard

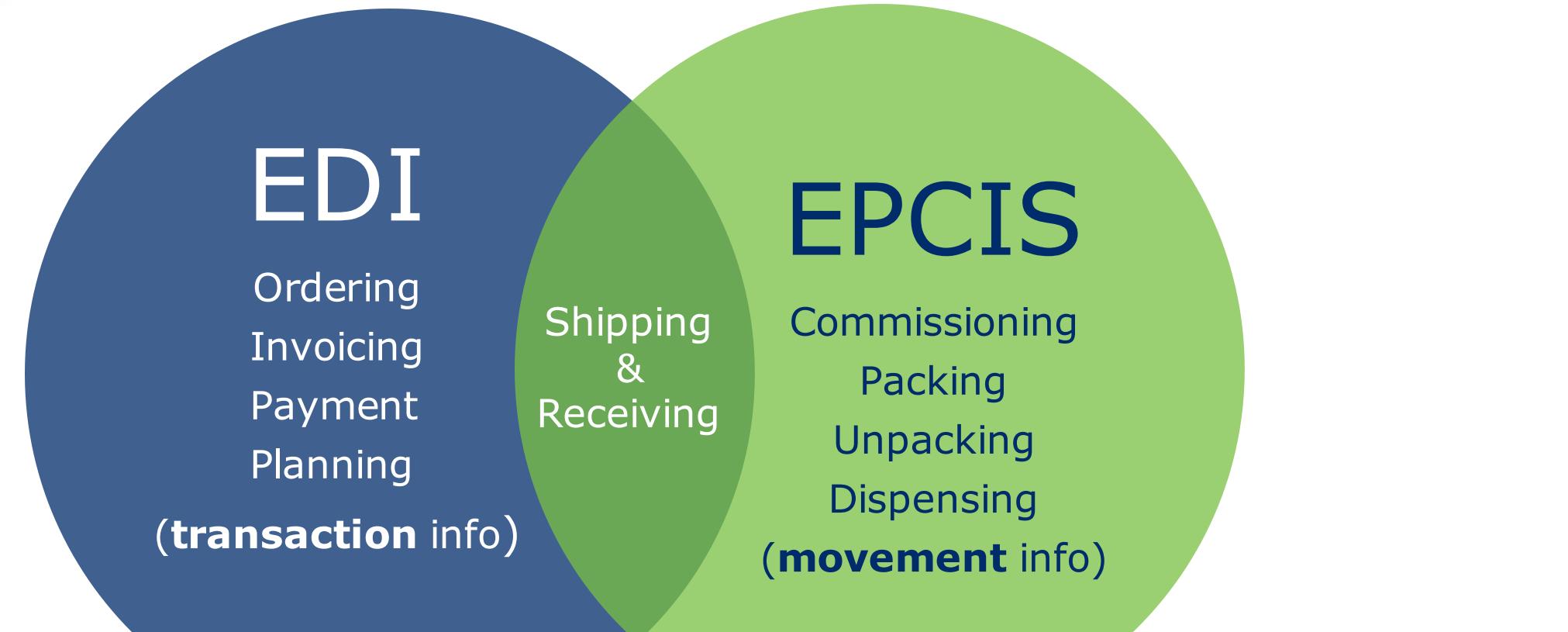




# EPCIS/CBV Introduction

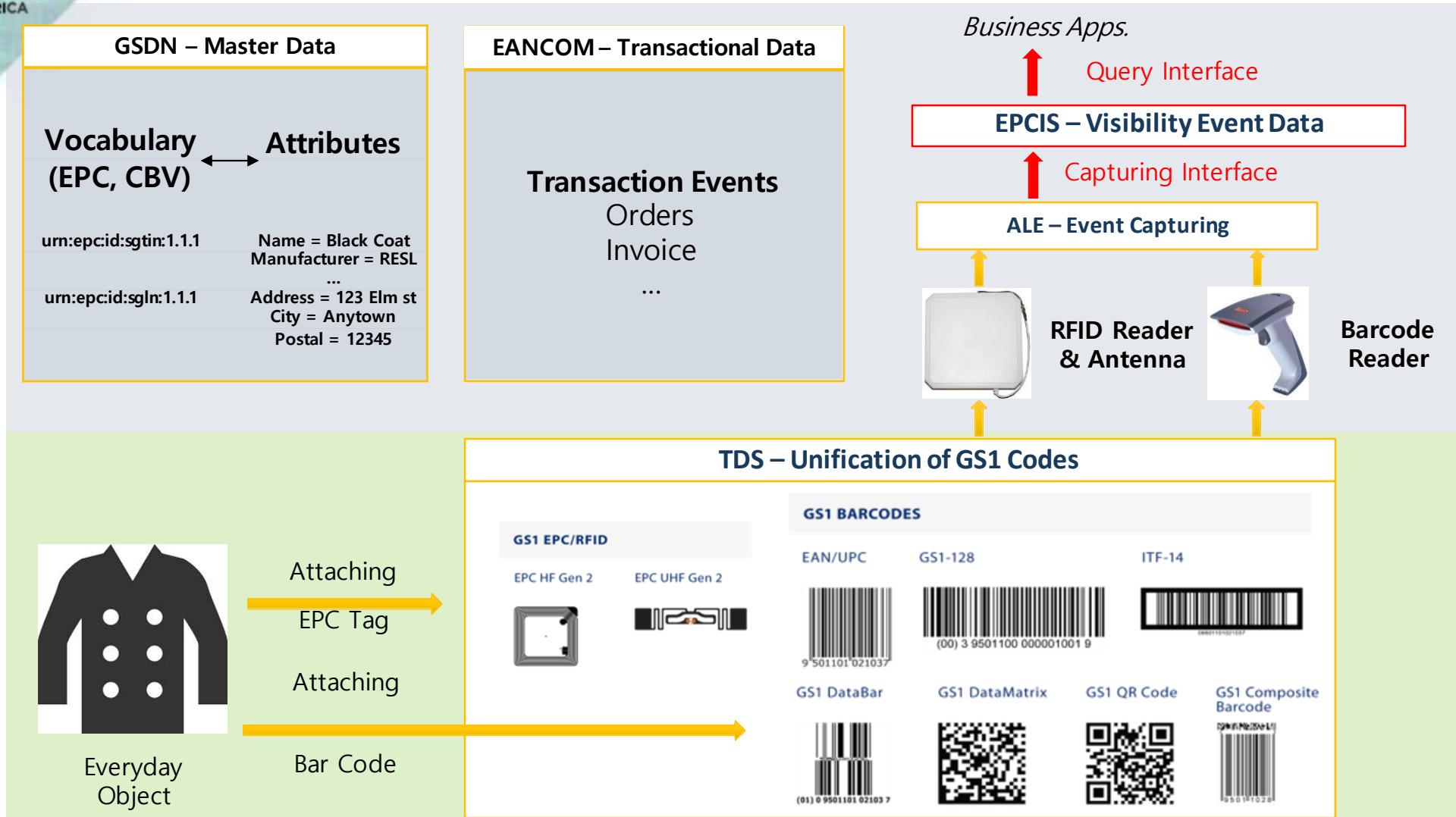
- **Goal of EPCIS**
    - is to enable disparate applications to create and share visibility event data, both within and across enterprises.
- Ultimately, this sharing is aimed at enabling users to gain a shared view of physical or digital **objects** within a relevant business context
- **Physical objects** include trade items (products), logistic units, returnable assets, fixed assets, physical documents, etc. .
  - **Digital objects** include digital trade items (music downloads, electronic books, etc.), digital documents (electronic coupons, etc.) etc. .

# Supply Chain Data Sharing & GS1 Standards



**Master Data**  
Product & location descriptive attributes

# Introduction “Share” Layer of GS1 Standards



# EPCIS enables supply chain visibility



- Defines a framework data model, query & capture interfaces
- Helps **share visibility data** across & between enterprises
- Based on capture of business process steps as "**events**"
- GS1 Keys identify the "what" & "where" of visibility events
  - EPCIS 1.2: encoded as EPC URNs
  - **EPCIS 2.0:** encoded as EPC URNs or subset of GS1 Digital Link URIs
- Data-carrier neutral (works well with GS1 barcodes and EPC/RFID)
- Published as ISO/IEC 19987



# Core Business Vocabulary (CBV)

- Companion standard to EPCIS
- Defines **cross-sector code lists** to populate EPCIS event data
  - Previously defined as URNs and definitions in a PDF standard
  - Each code list will have a Web URI & online definition in **CBV 2.0**
  - Will be published as a JSON-LD dataset + browsable tool
- Ensures a common understanding of data semantics
- Underpins the **interoperability** of EPCIS implementations
- Published as ISO/IEC 19988

# Supply chain visibility with EPCIS

- Tracking

*Where are the vaccines we shipped on 6 October?*

- Tracing

*Which path did this shipment follow on its way to us?*

- Chain of Custody

*Which parties had contact with these products along the way?*

- Inventory Management and Maintenance

*How much vaccine is **available** in inventory?*

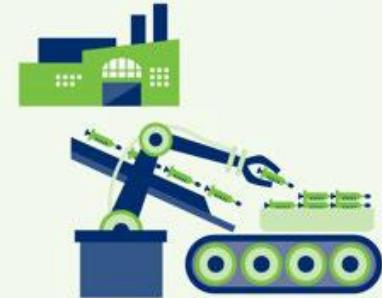
*Which of the vaccines in our inventory **expire** soonest?*

*When are technical components due for **maintenance**?*

- Recall

*Recall batch 133xyz packed on line 22A in week 27 . . .*

## Product Traceability



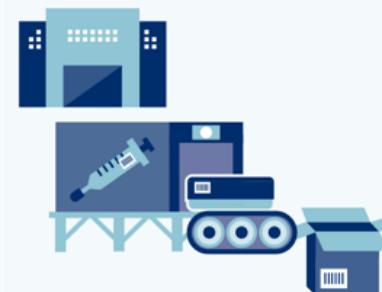
e.g., "Where did a product come from and how was it made?"

## Inventory



e.g., "Is there enough of the product in stock?"

## Product Recall



e.g., "To which customer was a specific product shipped?"



# What information is captured in EPCIS events?

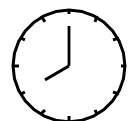
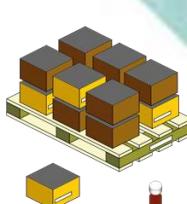
**Who, What, When, Where, How**



Copyright © 2023 AIM North America. All rights reserved.

The views expressed/presented are that of the individual speaker and do not necessarily represent the views of the speakers' respective company or AIM North America.

© GS1 2022



## Dimensions of an EPCIS event

What objects are the subject of event?

*SGTIN, SSCC, GIAI, etc.*

When did this event take place?

*Date, time, time zone*

Where did this occur...

...and Where are the objects after?

*Physical location (GLN)*

Why did this event take place?

*Process step, object status, link to transactions, etc.*

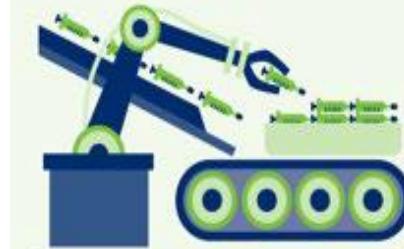
How (~~warm, humid, fast, etc.~~) are these objects?

```
{
  "type": "gs1:MeasurementType-Temperature" , "value" : 26.2, "uom": "CEL" },
  { "type": "gs1:MeasurementType-Humidity" , "value" : 12.2 , "uom": "A93"}, 
  { "type": "gs1:MeasurementType-Speed" , "value": 162.0, "uom":"KMH"},
```

## Manufacturing



Location Identification  
GLN  
Global Location Number  
0614141000036



Item-Level Identification  
DataMatrix

(01) 04012345123456  
(21) AB1234  
(17) 201206  
(10) 20171009

### Event 1

What	GTIN
Where	GLN
When	2017-02-01, 12:15:33
Why	Commissioning

© GS1 2022

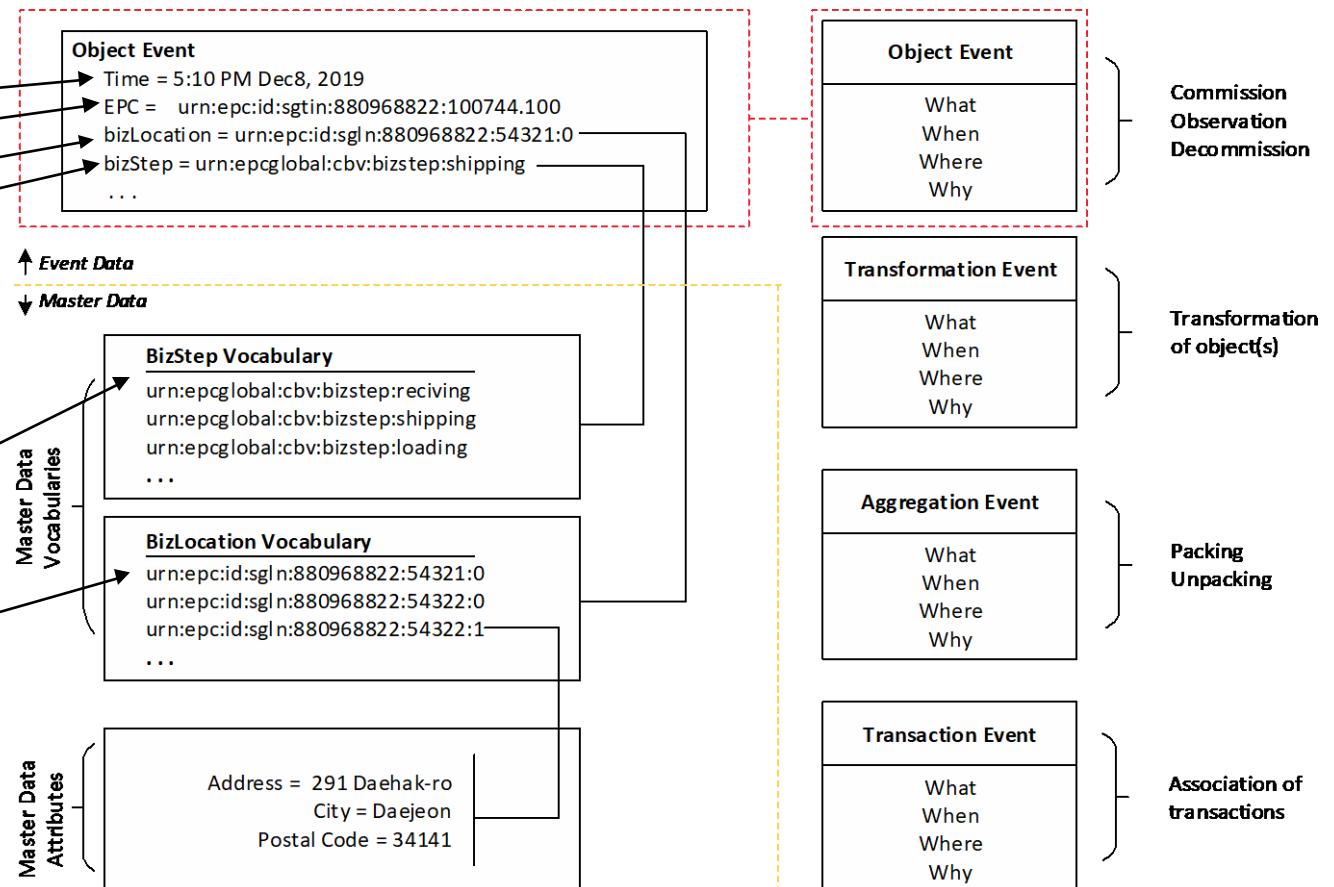
# Anatomy of EPCIS events

The four dimension of EPCIS:

- When
- What
- Where
- Why

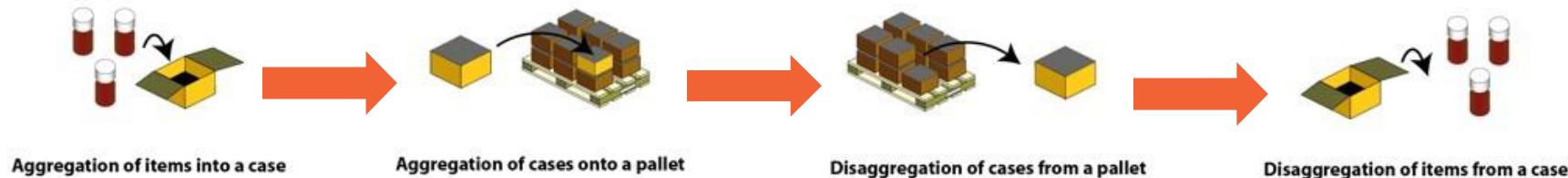
CBV Vocabulary types:

- Standard
- User defined



# EPCIS enables tracking of Aggregation changes

- Parent-Child logistical hierarchy
  - Parent: one containing object
  - Children: one or more contained objects
- Captures **packing** and **unpacking** steps



- Keep track of logistic / packing hierarchies
- Enables the practice of **inference**



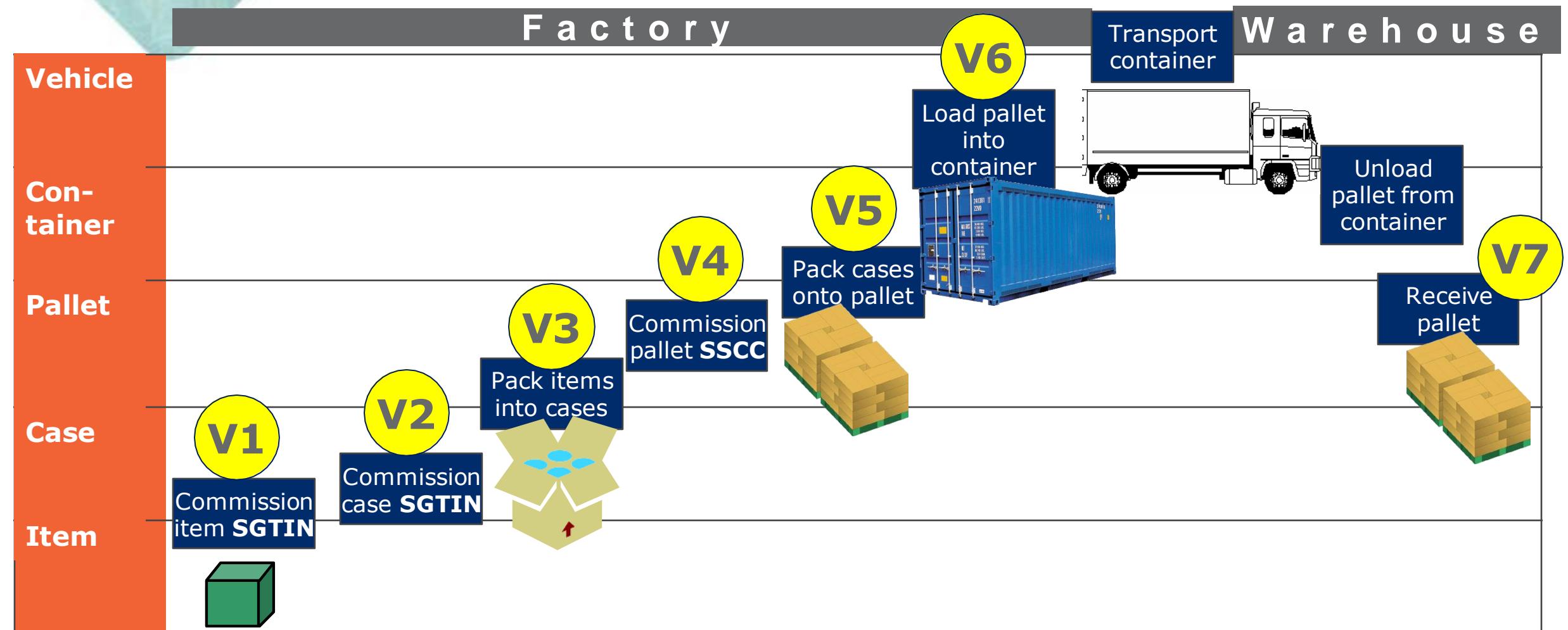


# Designing a visibility system using EPCIS

Implementation Guideline [http://www.gs1.org/docs/epc/EPCIS\\_Guideline.pdf](http://www.gs1.org/docs/epc/EPCIS_Guideline.pdf)

1. Collect visibility goals and requirements
2. Document business process flows
3. Break each process flow into series of discrete steps

# Process Flow Example





# Designing a visibility system using EPCIS

Implementation Guideline [http://www.gs1.org/docs/epc/EPCIS\\_Guideline.pdf](http://www.gs1.org/docs/epc/EPCIS_Guideline.pdf)

1. Collect visibility goals and requirements
2. Document business process flows
3. Break each process flow into series of discrete steps
4. Decide which business steps require visibility events
5. **Model completion of each step as a visibility event**
6. **Decide which data to include in the visibility event**

What info does the  
business application  
need?





# Visibility Data Matrix

## Designing a Visibility System using EPCIS

		Event V1	Event V3	Event V5	Event V6
What	Identifiers	Commission items	Pack items into case	Pack cases onto pallet	Ship pallet
When	Timestamp	24 Sept 2018, 11:27 CEST	24 Sept 2018, 14:09 CEST	25 Sept 2018, 10:24 CEST	25 Sept 2018, 15:19 CEST
Where	Location	packaging line 47	A-frame 21	palletiser 2	dock door 11
Why	Business Step	Commissioning	Packing	Packing	Shipping





# EPCIS in business applications

- Anti-counterfeiting
- Chain of custody/ownership
- Couponing
- Customs clearance
- Recall
- Sales Promotion
- Traceability
- Business Process Optimization
- Exception Management
- Food Freshness
- Asset Management
- Inventory Management
- Process Documentation

# Why align with EPCIS?

- EPCIS provides a standardised way of **exchanging visibility event data** including business context
- EPCIS is an **open standard** supported by an increasing number of implementations and software products
- EPCIS and the Core Business Vocabulary (CBV) are designed to be applicable across **multiple industry sectors**
- EPCIS & CBV are also ISO/IEC standards
  - EPCIS = ISO/IEC 19987
  - CBV = ISO/IEC 19988



- Any questions?





# epcisworkbench.gs1.org

The screenshot shows the EPCIS Workbench interface. At the top left is the GS1 logo. To its right is the title "EPCIS Workbench". Below the title are two buttons: "HOME" and "HELP ▾".

Welcome! The EPCIS Workbench helps you work with EPCIS events, queries, and servers.

The EPCIS Workbench is a free, interactive tool for working with the GS1 Electronic Product Code Information Services (EPCIS) standard. You focus on the business content of EPCIS data instead of technical details.

Use the EPCIS Workbench to decode EPCIS event XML into this:

DATASET INFO		4 EVENTS	0 ERRORS	XML
		EVENT 1 ▾	EVENT 2 ▾	
TYPE	Event Type	Object Event ADD	Aggregation Event ADD	
W	Event Time	2013-03-21 11:47:01.000 GMT-05:00		2010-03-22 11:47:02.000 GMT-05:00
H	Record Time			
E	"What" Dimension	GTIN 00614141382668 <a href="#">Serial 101</a> GTIN 80614141123458 <a href="#">Lot ABC123 (Example case 5)</a> Quantity 6.847 kg	Parent SSCC 006141411234567890 Children GTIN 00614141382668 <a href="#">Serial 101</a> GTIN 00614141382668 <a href="#">Serial 102</a>	
A	Read Point	GLN 0614141000005 Ext 1234		GLN 0614141000005 Ext 9012
W	Biz Location	GLN 0614141000005 (Acme Corp)		GLN 0614141000005 (Acme Corp)
H	Biz Step	Commissioning (CBV)	Packing (CBV)	In Progress
Y	Disposition	Active		

[REGISTER](#)

Or, log in:

E-mail

jeanne.duckett@averydennison.com

Password

.....

[LOGIN](#)

[Forgot Password?](#)

## New features (March 2020)

- ▶ Aligned with EPC Tag Data Standard (TDS) 1.13



# epcisworkbench.gs1.org

Get an account and see what the EPCIS Workbench can do for you.  
It's free!

## Decode

- ▶ Upload a file and decode its contents [SEE A DEMO](#)
- ▶ See all files previously uploaded

## Create

- ▶ Create new EPCIS events [SEE A DEMO](#)
- ▶ Edit the content of EPCIS events
- ▶ Capture events to an EPCIS server [SEE A DEMO](#)

## Query

- ▶ Create a new EPCIS query
- ▶ Query an EPCIS server



## EPCIS Workbench

HOME HELP ▾

Use the EPCIS Workbench to decode EPCIS events...

Here's what raw EPCIS data looks like. Not so easy to read, eh? (click the arrow at the right to continue)

```
DemoExample1.xml - Notepad
File Edit Format View Help
<epcis:EPCISDocument
  xmlns:epcis="urn:epcglobal:epcis:xsd:1"
  xmlns:vwb="http://epcis.vizworkbench.com/ns"
  xmlns:example="http://example.com/epcis/ns/1"
  creationDate="2013-03-15T06:07:08Z"
  schemaVersion="1"> <EPCISBody> <EventList>
    <ObjectEvent> <eventTime>2013-03-21T11:47:01-05:00</eventTime> <eventTimeZoneOffset>-05:00</eventTimeZoneOffset> <epcList>
      <epc>urn:epc:id:sgtin:0614141.038266.101</epc>
      </epcList> <action>ADD</action>
      <bizStep>urn:epcglobal:cbv:bizstep:commissioning</bizStep>
      <disposition>urn:epcglobal:cbv:disp:active</disposition> <readPoint>
        <id>urn:epc:id:sgln:0614141.00000.1234</id>
      </readPoint> <bizLocation>
        <id>urn:epc:id:sgln:0614141.00000.0</id>
      </bizLocation> <extension> <quantityList>
        <quantityElement>
          <epcClass>urn:epc:class:lgtin:0614141.812345.ABC123
        </epcClass> <quantity>6.847</quantity>
        <uom>KGM</uom> </quantityElement> </quantityList>
      </extension> </ObjectEvent> <ObjectEvent>
```

# Upload XML File

Each column is one EPCIS event, with the event type and action clearly indicated.

DATASET INFO		4 EVENTS	0 ERRORS	XML
		EVENT 1 ▾	EVENT 2 ▾	
Type	Event Type	Object Event ADD	Aggregation Event ADD	
When	Event Time	2013-03-21 11:47:01.000 GMT-05:00	2010-03-22 11:47:02.000 GMT-05:00	
What	Record Time	GTIN 00614141382668 Serial 101 GTIN 80614141123458 Lot ABC123 (Example case 5) Quantity 6.847 kg	Parent SSCC 006141411234567890 Children GTIN 00614141382668 Serial 101 GTIN 00614141382668 Serial 102	
Where	Read Point	GLN 061414100005 Ext 1234	GLN 061414100005 Ext 9012 GLN 061414100005 (Acme Corp)	
Why	Biz Location	GLN 061414100005 (Acme Corp)	GLN 061414100005 (Acme Corp)	
	Biz Step	Commissioning (CBV)	Packing (CBV)	
	Disposition	Active	In Progress	



# Create EPCIS Events

Use the EPCIS Workbench to create or edit EPCIS events...

Start by selecting an event type.

The screenshot shows the 'Event Type' section of the EPCIS Workbench. On the left, there is a vertical column of labels: W H E N, W H A T, W H E R E, W H Y, and Extensions. The 'Event Type' row has a dropdown menu open, with 'Object Event' highlighted and circled in red. Other options in the list include 'Choose...', 'Aggregation Event', 'Transaction Event', 'Transformation Event', and 'Quantity Event'. To the right of the dropdown are fields for 'Event ID' (with placeholder text 'Enter an Event ID (seldom needed - see FAQ)'), 'Action' (set to 'Ordinary Event'), 'Event Time' (set to '2017-03-15 14:30:00'), 'Record Time' (set to 'US/Eastern'), and a 'GENERATE' button. Below the dropdown, a message says 'Please choose an event type, above'.

Use the EPCIS Workbench to create or edit EPCIS events...

The editor knows how to encode all GS1 identifiers into EPC URIs. Or, you can enter a URI manually.

The screenshot shows the 'EPCs' section of the EPCIS Workbench. The vertical column of labels includes W H A T, W H E R E, W H Y, and Extensions. The 'EPCs' row has a dropdown menu open, with 'GS1 Key' highlighted and circled in red. Other options in the list include 'SGTIN (AI 01 + AI 21)', 'SSCC (AI 00)', 'GRAI (AI 8003)', 'GIAI (AI 8004)', 'GSRN (AI 8018)', 'GSRNP (AI 8017)', 'GDTI (AI 253)', 'GCN (AI 255)', 'CPI (AI 8010 + AI 8011)', 'Other EPC Identifier', 'GID', 'USDoD', 'ADI', and 'Other'. Below the dropdown, a message says 'Enter a URI manually' and a 'GENERATE' button is visible. The background of the entire interface is light gray with some darker gray vertical bars on the sides.



# Query an EPCIS Server

Sending query "Commision" to an EPCIS query server (as a "Poll" request)

Query Server

AD Test ▾

EXPORT DELETE RENAME EDIT RAW COPY

DATASET INFO

2 EVENTS

0 ERRORS

XML

Name for resulting dataset

EVENT 1 ▾

EVENT 2 ▾

Commision results

SUBMIT

CANCEL

TYPE	Event Type	Object Event ADD	Object Event ADD
WHEN	Event Time	2016-12-01 08:09:23.582 GMT+11:00	2012-04-05 12:35:00.000 GMT+01:00
WHEN	Record Time	2023-01-06 23:01:04.480 GMT	2023-01-23 17:21:48.015 GMT
WHAT	"What" Dimension	GTIN 30048000632679 Lot YFT123 Quantity 5714 kg	GTIN 04098760000015 Lot L1 Quantity 3500 GTIN 04098760000022 Lot L4 Quantity 200



# EPCIS Workbench FAQs

## Frequently Asked Questions

- ▶ General Questions about the EPCIS Workbench
- ▶ Questions about Account Registration
- ▶ Questions about Event ID
- ▶ Questions about Error Declaration
- ▶ Questions about Displaying Product or Location Names

## General Questions about the EPCIS Workbench

### What is the EPCIS Workbench?

The EPCIS Workbench is a free, interactive tool for working with the GS1 Electronic Product Code Information Services (EPCIS) standard. The EPCIS Workbench lets you focus on the business content of EPCIS data instead of the technical details.

### What is Electronic Product Code Information Services (EPCIS)?

EPCIS is a GS1 Standard for Visibility Data. EPCIS data consists of events, where each event is a record of something that happened in the real world. EPCIS data is used to track and trace products, assets, documents, and other things as they move through a business process, especially a business process that spans multiple physical locations and multiple organizations. An EPCIS event records *what* was involved in a business process step, *when* the step took place, *where* it took place, and additional business context that answers the question *"why."*

### How does the EPCIS Workbench help me work with EPCIS?

EPCIS data take the form of an eXtensible Markup Language (XML) document. This format is easy for computers to understand, not so easy for humans. The EPCIS Workbench lets you see the data content of EPCIS data in a format that is more human-friendly.



# FreeEPCIS

Welcome to **FRE**EPCIS, the free EPCIS server for development and test.

Setting up your own EPCIS server is as easy as 1, 2, 3:



**Step 1:** Register for a free account



**Step 2:** Choose your server name and other settings



**Step 3:** That's it! You're ready to go.

## What's the catch?

Your **FRE**EPCIS server is free because it is limited to hold no more than 25 EPCIS events. But other than that, it is a full implementation of EPCIS 1.2.

Click [here](#) to register for your free account. For more information, see the [FAQ](#).



# FreeEPCIS

## EPCIS events

You currently have 14 EPCIS events captured. Your limit is 25 EPCIS events.

[View all events](#)

## Activity

Your most recent capture was on 2023-01-23 12:21:48.

Your most recent query was on 2023-01-23 20:59:00.

[View all activity](#)

## Subscriptions

You have no subscriptions registered. To register a subscription, send a [Subscribe](#) request to your query service URL.

### Settings for your EPCIS repository

#### Server name

The server name you choose will be part of the URLs for the capture and query interface. Your name can contain letters, digits, and hyphens.

#### Choose a name for your server

ADTest

Your capture and query service URLs will be:

- <https://freepcis.gs1.org/server/ADTest/capture>
- <https://freepcis.gs1.org/server/ADTest/query>

#### Security

You can require that clients provide a username and password to your capture or query interface. This is recommended, otherwise anybody may access your EPCIS server.

[Change your settings](#)



# FreeEPCIS FAQ

## Frequently-asked questions

Read on for answers to questions about **FREEEPCIS**.

- General questions about **FREEEPCIS**
- Getting started
- Questions about account settings
- Questions about capturing EPCIS events
- Questions about querying for EPCIS events
- Questions about standing queries

### General questions about **FREEEPCIS**

#### **What is FREEEPCIS?**

**FREEEPCIS** is a free EPCIS repository for development and test.

#### **What is Electronic Product Code Information Services (EPCIS)?**

Electronic Product Code Information Services (EPCIS) is a GS1 Standard for visibility data. EPCIS data consists of events, where each event is a record of something that happened in the real world. EPCIS data is used to track and trace products, assets, documents, and other things as they move through a business process, especially a business process that spans multiple physical locations and multiple organizations. An EPCIS event records what was involved in a business process step, when the step took place, where it took place, and additional business context that answers the question "why."

#### **What is an EPCIS repository?**

An EPCIS repository is a service that lets you *capture* EPCIS event data, and then later *query* for events that match specified query criteria. It's basically a database designed especially for EPCIS data, with web service interfaces for capturing and querying data as specified by the EPCIS standard.

# Questions & Comments

---



# Contact Us



## Jeanne Duckett

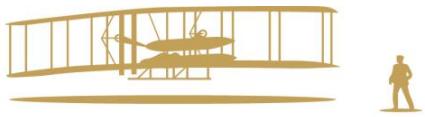
Food Traceability and Transparency,



[jeanne.duckett@averydennison.com](mailto:jeanne.duckett@averydennison.com)



# Thank You Sponsors



WRIGHT STATE  
UNIVERSITY





# Session 3 Agenda

## February 2nd

### Schedule:

5:30 – 5:45	Networking / Dinner
5:45 – 5:55	Welcome / Overview / TY Sponsors
5:55 – 6:45	Label Design Training – Roberto & Elizabeth
6:45 – 6:55	Break
6:55 – 7:25	Decoding the GS1 Digital Link
7:25 – 7:45	Walk through an example of beef supply chain
7:45 – 8:00	GitHub Repository – challenges
8:00 – 8:15	Wrap-Up / Q&A



**Matt Kijowski**  
303 Russ Engineering  
3640 Colonel Glenn Hwy  
Dayton OH 45435

[matthew.kijowski@wright.edu](mailto:matthew.kijowski@wright.edu)

cell: 419-410-5669

# Contact us



100 Allegheny Drive  
Suite 105C  
Warrendale, PA 15086  
USA

[info@aim-na.org](mailto:info@aim-na.org)

[www.aim-na.org](http://www.aim-na.org)

+1.724.742.4473



Defining Today's  
Technology Standards;  
Empowering Tomorrow's  
Solutions.

# THANK YOU!

---

