REPUBLIC POLYTECHNIC

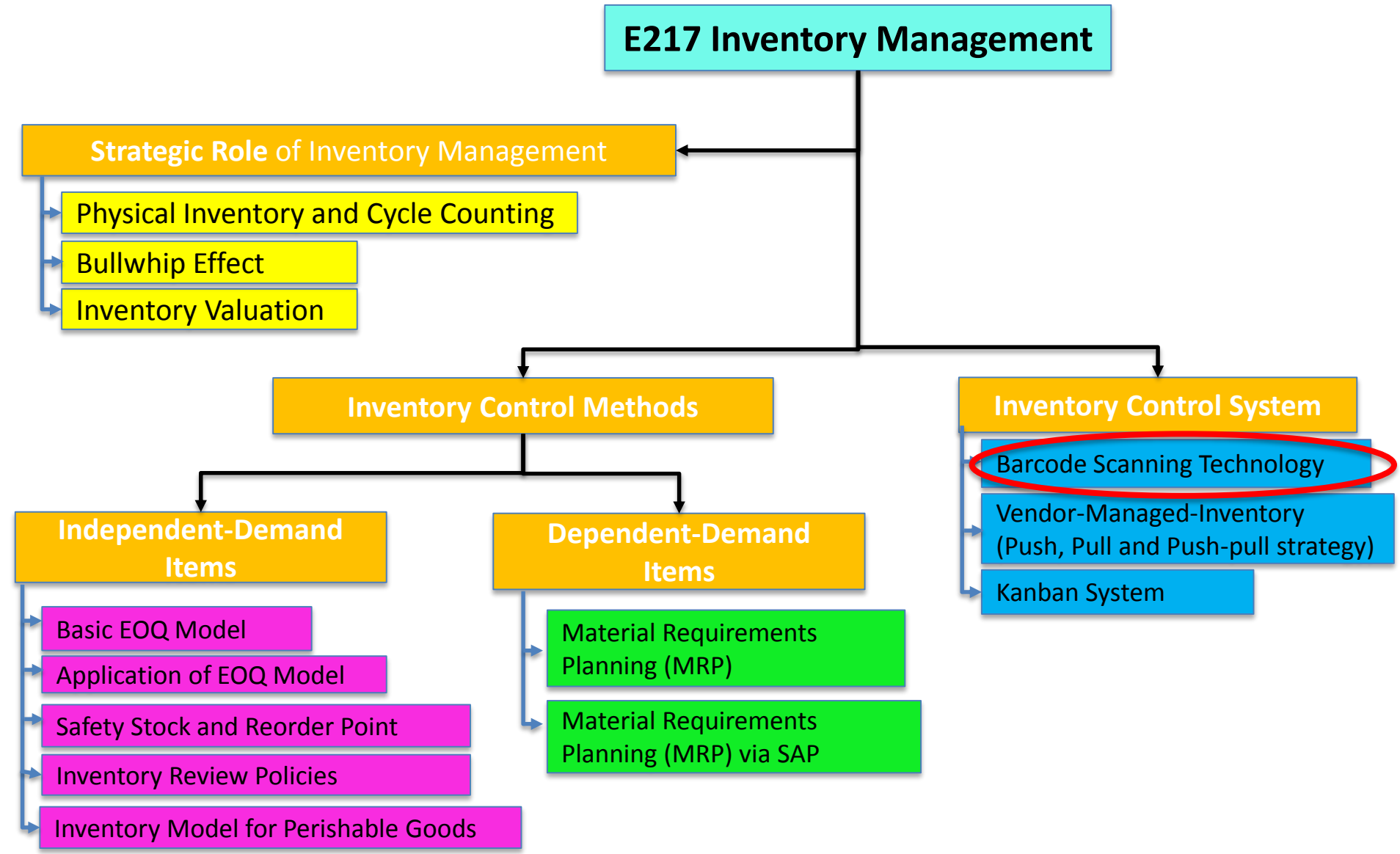
Problem 07

Damage Report

E217 – Inventory Management

SCHOOL OF ENGINEERING

E217 Inventory Management Topic Tree



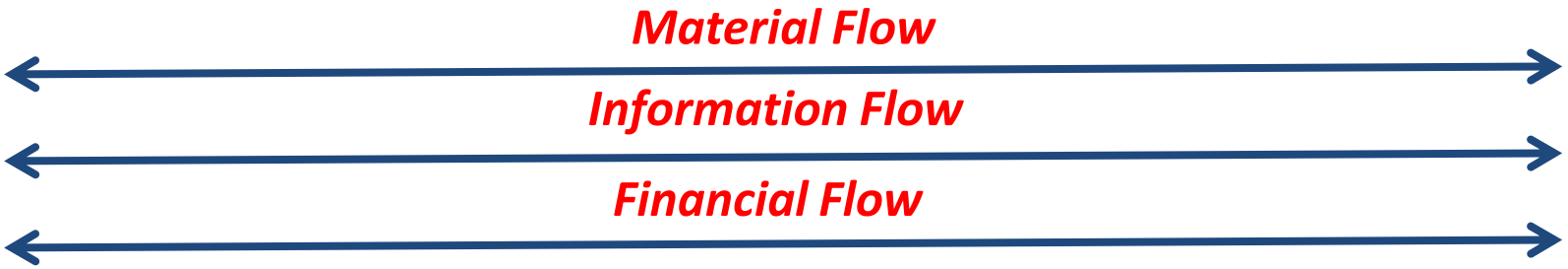
What is Supply Chain ?

- A supply chain is the network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers.

- It spans all movements and storage of raw materials, work-in-process inventory and finished goods from point-of-origin to point-of-consumption.

- For example, a detergent supply chain starts from the raw materials all the way to the consumer.

3 Flows in a Supply Chain



- In a typical supply chain, **material** (products / services) usually flows from left to right.
- Due to the growing importance of reverse logistics (product recall, customers returning products that are unacceptable, damaged, obsolete, etc.), we are seeing a growing trend of material flows from right to left.

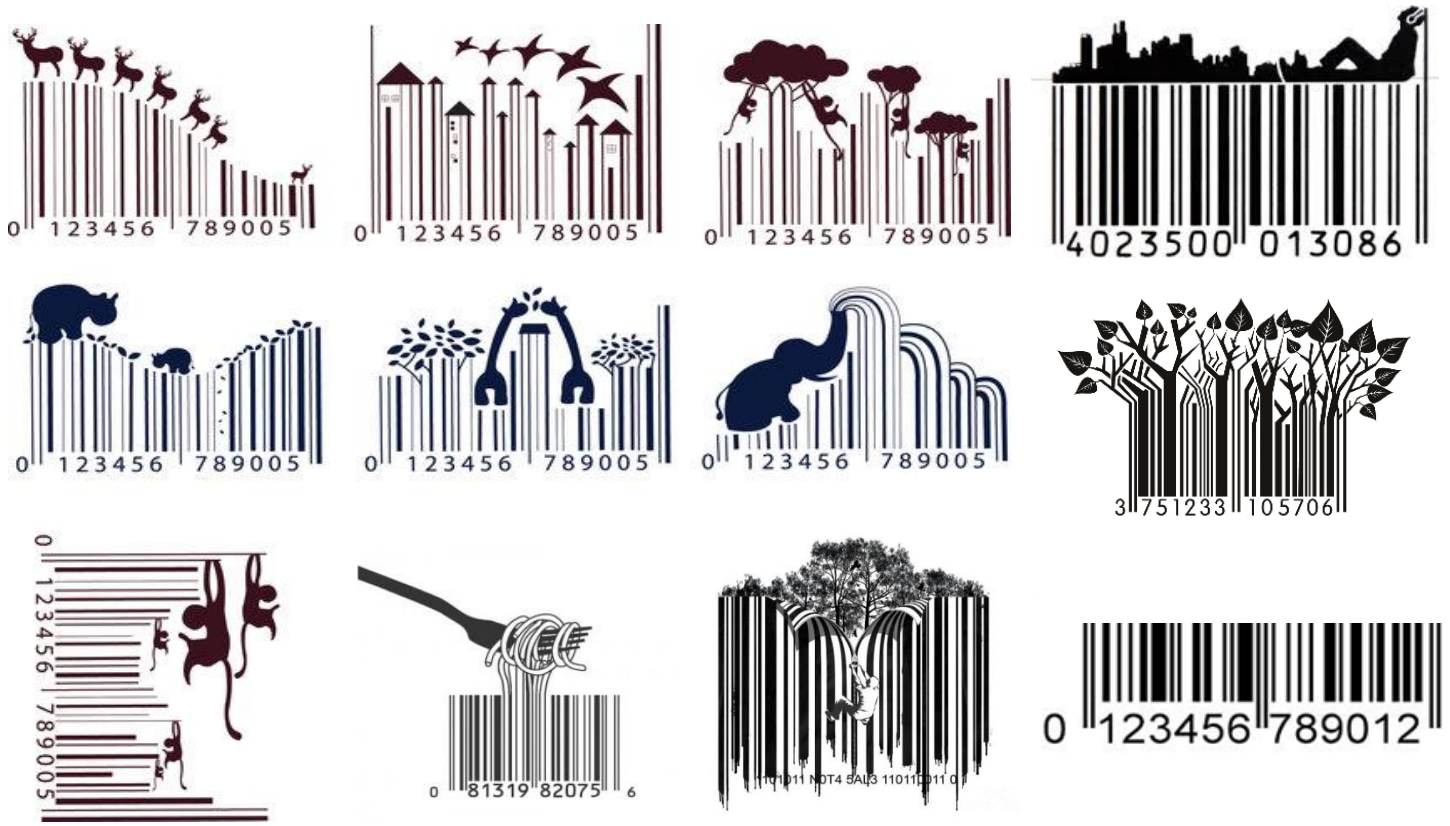
3 Flows in a Supply Chain

- Traditionally we view **information** flowing in the opposite direction of material flow, i.e. right to left (from the customer back to the wholesalers and manufacturers). Examples: customer demand or sales data

- **Information** that flows from left to the right include many forms such as Advance Shipment Notices (ASNs), order status information, inventory availability information, the sharing of sales information on a more real-time basis via Point-of-Sales (POS) system

- **Financial flow –** This refers specifically to cash. Traditionally, financial flow has been viewed as one-directional, from right to left for the payment of goods, services and orders received.

Various Barcodes



- Everyday you see barcodes – on *canned drinks, greeting cards, pens, air tickets, etc.*
- Used in almost every business.

Barcoding Technology

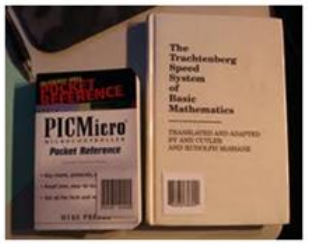
- Barcoding is one of the AIDC (Automatic Identification and Data Collection) technologies
- Reduces human involvement in data entry.
- Thereby reduces error and time.
- Type of barcode to use depends on the industry.
- Consumer products scanned at POS follow UPC/EAN standards, administered by GS1 organization.
- Barcodes can be read by optical scanners called barcode readers *or* as a scanned image by software.
- Series of black bars and white spaces of varying widths are printed on labels to unique identification.
- It measures reflected light and interprets the code into numbers and letters, passed on to a computer.

Barcodes - Common Areas

- Retailing:
  - Point-of-Sale (POS)
  - Sales management
  - Replenishment management
- Production control and management
- Logistics management
- Inventory management
- Hospitals, etc.

Barcodes – Industry Uses





- Uses:

✓ to track assets in an office - *every desk, computer, telephone, copier and desk accessory.*

✓ to track mail - *from the time it arrives in the mail room to the time it is delivered.*

✓ to help security guards - *identify every employee, every door they enter and every room they work in.*

✓ to manage the inventory/products *in a shop.*

✓ to manage and track - *your vehicle fleet and each driver*

Linear (1D) Barcode Symbologies

- The Universal Product Code (UPC) is a barcode symbology that is widely used in North America, and in countries including the UK, Australia, and New Zealand for tracking trade items in stores.

- Widely used UPC has ***2*** parts:

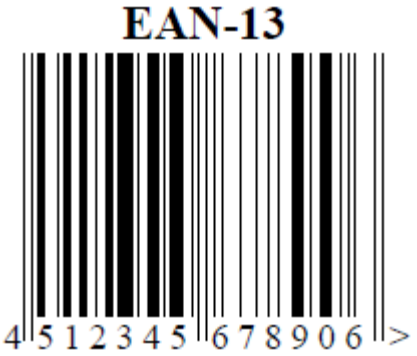
✓ The **machine-readable** bar code: the vertical lines and space.

✓ The **human-readable** 12-digit UPC number:

- The *first six (6)* digits identify the manufacturer. Within them, the first two or three digits represent the country of origin.
- The *next five (5)* digits are the item identification given to that product by the manufacturer. This allows a maximum of 99,999 products that they can make.
- The *12th* digit is a check digit

Linear (1D) Barcode Symbologies

- An EAN-13 barcode (originally European Article Number, but now renamed International Article Number even though the abbreviation EAN has been retained) is a 13 digit (12 + check digit) barcoding standard
- The less commonly used EAN-8 barcodes are used also for marking retail goods; however, they are usually reserved for smaller items, for example confectionery.



Linear (1D) Barcode Symbologies

- ITF-14 is the GS1 implementation of an Interleaved 2 of 5 bar code to encode a Global Trade Item Number. ITF-14 symbols are generally used on packaging levels of a product, such as a case box of 24 cans of soup. The ITF-14 will always encode 14 digits.

- Code 128 is a very high-density barcode symbology. The symbology includes a checksum digit for verification. (A special version of it called GS1-128 is used extensively world wide in shipping and packaging industries.) It is used for alphanumeric or numeric-only barcodes.

Identification of Trade Items

- A trade item is any item (product or service) upon which there is a need to retrieve predefined information and that may be priced, ordered or invoiced at any point in any supply chain. This definition covers raw materials through to end-user products and also includes services, all of which have pre-defined characteristics.

- The trade items are numbered by a **Global Trade Item Number** (GTIN) using four data structures: GTIN-8, GTIN-12, GTIN-13 and GTIN-14. The choice of data structure depends on the nature of the item and on the scope of the user's applications.

- Since January 2005, North American users accept GTIN-13 Identification Numbers and EAN-13 Bar Codes. Prior to this time, companies selling goods in the American and Canadian markets were required to use a GTIN-12 data structure represented in a UPC-A or UPC-E Symbol.

GTIN Numbering Structures

GTIN-13 Data Structure

GS1 Company Prefix → ← Item Reference												Check Digit
N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}

GTIN-13: 5412345000259

GTIN-12 Data Structure

U.P.C. Company Prefix → ← Item Reference										Check Digit
N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}

GTIN-8 Data Structure

GTIN-8 Prefix → ← Item Reference							Check Digit
N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8

GTIN-14 Data Structure

Indicator	GTIN of the items contained (without Check Digit)											Check Digit
N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}	N_{14}

About GS1

Gepir Search

GEPIR (Global Electronic Party Information Registry) is a unique, internet-based service that gives access to basic contact information for companies that are registered users of GS1.

Available on the App Store

GET IT ON Google play

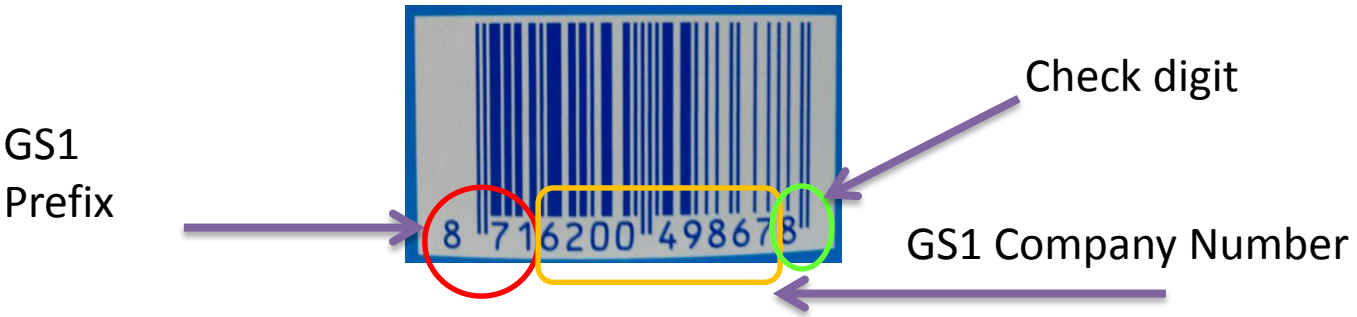
- GS1 Singapore is a not-for-profit organization established in 1987 to implement and administer the global multi-industry GS1 standards-based system of automatic identification (using barcodes, 2D-codes and RFID - radio frequency identification) and communication for products, services, assets and locations.
- In Singapore, GS1 barcodes are used to capture over $5 billion worth of sales at retail point-of-sales (POS) terminals.
- GS1 identification numbers and barcodes permit organizations of any size to order, track, trace, deliver and pay for goods across the supply chain, anywhere in the world.
- GS1 Singapore is here to help Singapore companies become more efficient; our fundamental role apart from allocating GS1 company prefix numbers and Global Location Number, is also to help companies adopt world's best practices in supply chain management.

GS1 Singapore

Inside GTIN

✓ GS1 Company Prefix

- The first two or three digits N1, N2, N3 constitute the GS1 Prefix allocated by GS1 Global Office to each GS1 Member Organisation.
- It does not mean that the item is produced or distributed in the country to which the prefix has been allocated. The GS1 Prefix only denotes the Member Organisation that allocated the Company Number.



✓ Item Reference

- The Item Reference is composed typically of one to six digits.
- It is a non-significant number, which means that the individual digits in the number do not relate to any classification or convey any specific information. The simplest way to allocate Item References is sequentially, that is 000, 001, 002, 003, etc.

Inside GTIN

✓ Check Digit

The Check Digit is the last digit (rightmost) of the GTIN. It is calculated from all other digits in the number, in order to ensure that the bar code has been correctly scanned or that the number is correctly composed

✓ Indicator

This is only used in the GTIN-14 Data Structure. It takes the value 1 to 8 for fixed quantity trade items. The value 9 has a special usage for variable quantity trade items and the value 0 is considered a filler digit that does not change the number itself.

Check Digit Calculation

ID Key Format	Digit positions																
GTIN-8											N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8
GTIN-12							N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}
GTIN-13						N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}
GTIN-14					N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}	N_{14}
GSIN		N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}	N_{14}	N_{15}	N_{16}	N_{17}
SSCC	N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}	N_{14}	N_{15}	N_{16}	N_{17}	N_{18}
Step 1: Multiply value of each position by																		
	x3	x1	x3	x1	x3	x1	x3	x1	x3	x1	x3	x1	x3	x1	x3	x1	x3	
Step 2: Add results together to create **sum**																		
Step 3: Subtract the sum from nearest equal or higher multiple of ten = ***Check Digit***																		

Check Digit: GTIN-12 Example

- GTIN-12 id format:

UPC Barcode

- Step 1:

GTIN-12	N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}
Multiply value of each position by	x3	x1	x3	x1	x3	x1	x3	x1	x3	x1	x3	

= 0*3+8*1+4*3+5*1+0*3+1*1+2*3+4*1+0*3+3*1+1*3

- Step 2: Accumulated result =42
- Step 3: Nearest Equal or Higher Multiple of 10 = 50
  Subtract from nearest multiple of 10 = 50-42 = 8
  Check digit = 8

Check Digit: GTIN-13 Example

- GTIN-13 id format:

EAN Barcode

- Step 1:

GTIN-13	N_1	N_2	N_3	N_4	N_5	N_6	N_7	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}
Multiply value of each position by	x1	x3	x1	x3	x1	x3	x1	x3	x1	x3	x1	x3	

8*1+7*3+1*1+6*3+2*1+0*3+0*1+4*3+9*1+8*3+6*1+7*3

- Step 2: Accumulated result = Sum =122
- Step 3: Nearest Equal or Higher Multiple of 10 = 130
  Subtract from nearest multiple of 10
  = 130- 122 = 8
  Check digit = 8

Check Digit: Other Examples

- **Other examples from worksheet:**

✓ **456104220021234 56X**	**1**	**SSCC Barcode**
✓ **01010101010X**	**5**	**GTIN12**
✓ **120212020202X**	**2**	**GTIN13**
✓ **5212125X**	**8**	**GTIN8**

Types of 2D Barcodes

		QR Code	PDF417	DataMatrix	Maxi Code
					
Developer(country)		DENSO(Japan)	Symbol Technologies (USA)	RVSI Acuity CiMatrix (USA)	UPS (USA)
Type		Matrix	Stacked Bar Code	Matrix	Matrix
Data capacity	Numeric	7,089	2,710	3,116	138
	Alphanumeric	4,296	1,850	2,355	93
	Binary	2,953	1,018	1,556	
	Kanji	1,817	554	778	
Main features		Large capacity, small printout size High speed scan	Large capacity	Small printout size	High speed scan
Main usages		All categories	OA	FA	Logistics
Standardization		AIM International JIS ISO	AIM International ISO	AIM International ISO	AIM International ISO

2D Barcode Applications

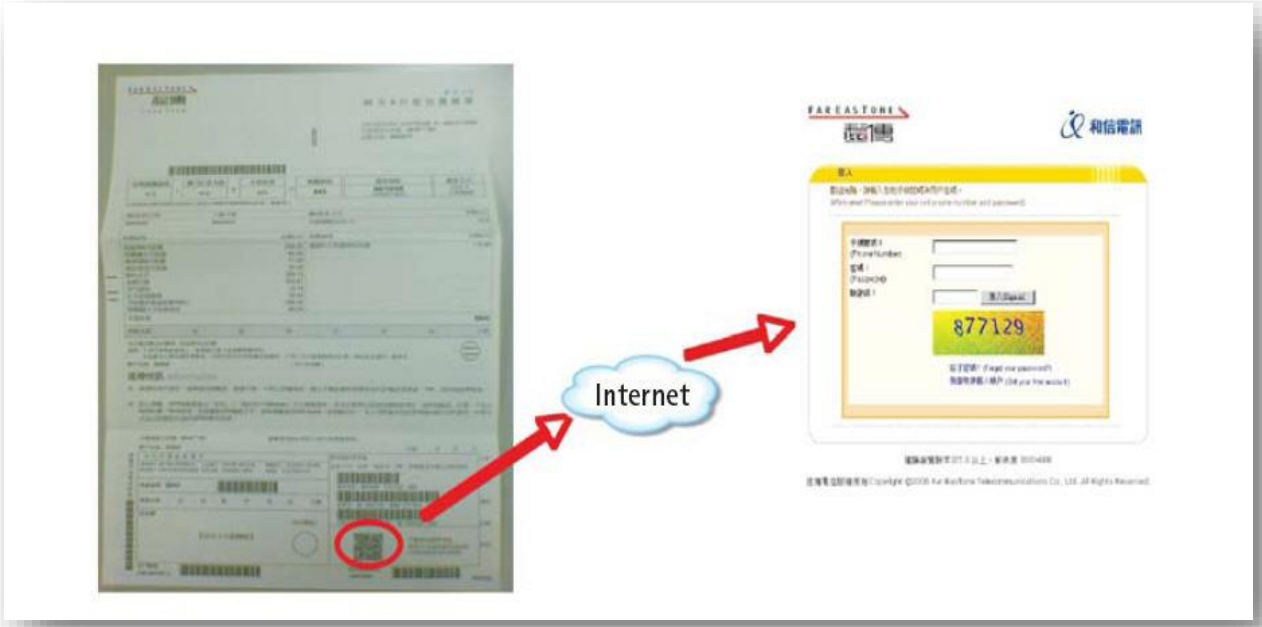
Shipping Control System for Garment Products

Mobile Ticketing

2D Barcode Applications

Jewelry Shop (France)

Bank process management (Thailand)



Payment Slips (Taiwan)

Advertisement (Japan)

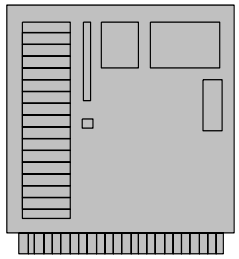
Comparison 1D v.s. 2D barcodes

Code type	2D barcode	1D barcode
Data format	Alphabet, numeric, symbols, photo, voice, finger print, electronic signature	Alphabet, numeric, and symbols (Korean language is not allowed for coding)
Data storage capacity	About 2,000 bytes	About 20 bytes
Data density	High density	Low density
Symbol size	Square (minimization possible)	Symbol length increases as data amount is large (misreading is possible)
Reading out speed	Influenced by data amount	Fast
Reading direction	360 degree (independent of direction)	Only in one direction
Bridging to DB	Not necessary (code itself serves as a data)	Necessary (code serves as a data key)
Error detection and fault correction function	With error finding and restoration function	Error detection is possible (restoration not possible)
Certification of electronic digital signature	Available	Not available
Encryption	Required	Not required

Information Flows in a Barcoding System

2. Scanner sends the UPC number to central computer (i.e. Product Database)

1. Scan the product



3. Central Computer looks up the product details from number

4. Central Computer sends the details to billing.

Problem Statement – Damage Report

- To simplify the damage reporting process, Harry can consider using a mobile application that is capable of scanning industry wide barcode standards (e.g. GS1 Barcodes).

- The mobile application must also have the capability of sharing scanned information and attaching photos and/or documents via a cloud platform or conventional email. The cloud platform needs to be secured for supplier’s access to the damage reports.

- At the end of every duty roster, his inbound receiving team will just need to scan the damage shipment barcode/s and attach damage photos and relevant document using the app to compile the report.

- They can load the completed report to the cloud platform or email the report to the supplier/customer directly for further investigation.

Shoot-Store-Share application

Receiving Team from warehouse

Take Pictures
Add Data

Shoot Store Share

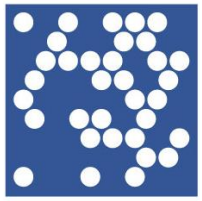
Group
Rename
Resize
Email

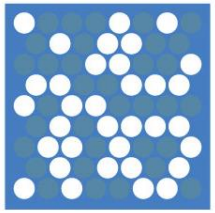
Customer Account Manager (Coordinator)

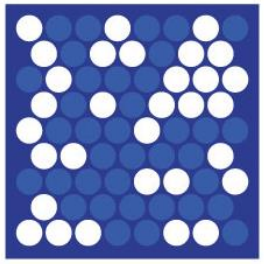
Access
Search
Archive
Download

Cloud-based apps with barcode scanning speeds up the entire process and make information accessible at anytime anywhere

Going Further - WIMO Markers







- Mobile app with 3 different modes of content trigger (UPC/Barcodes, WiMO Markers and WiMO enabled images)
- Example: Sony Pictures launched a campaign enabling moviegoers to interact with 3D content and games via their mobile devices. Moviegoers can use their smartphones to scan the logo and be directed to a mobile site created exclusively for the program.

Learning Objectives

- Describe the activities of a supply chain and the 3 flows in a supply chain
  - Information, Material, Financial
- Describe the purposes and applications of barcodes
- Identify the standards used for barcoding
  - GS1 Barcoding Symbologies and format
    - EAN, UPC, ITF-14, Code-128
  - Barcode verification: Check Digit calculation
  - Linear (1D) Barcodes versus 2D Barcodes
- Describe the flows in a barcoding system

E217 Inventory Management Topic Flow