

EDI, UCCnet & RFID

SYNCHRONIZING THE SUPPLY CHAIN



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BY NAHID JILOVEC

EDI, UCCnet & RFID



Nahid Jilovec



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To Gerry

For giving me the courage to lead with my heart

and for showing me things

I never would have seen without you

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Chapter 4

GTIN, GLN, and EPC

TODAY, MANY COMPANIES ARE WORKING FEVERISHLY TO ASSIGN numbers known as Global Location Numbers (GLNs) and Global Trade Item Numbers (GTINs) to their organizations and their products or services. These standards-based numbers serve as unique identifiers of organizations and their affiliates (GLNs) or products and services (GTINs).

GTINs and GLNs make it possible for businesses around the world to accurately and efficiently exchange information about themselves and the items they offer, meeting the information requirements at all points of the supply chain. In this chapter, you'll learn how GTINs and GLNs work to support the supply chain and enable global data synchronization. We'll also explore the Electronic Product Code (EPC), another important mechanism for tracking and managing items uniquely in the supply chain.

EAN/UCC

Two organizations, the Uniform Code Council (UCC) and the European Article Numbering (EAN) association, jointly develop and maintain the GTIN and GLN standards. These two associations also work closely with EPCglobal, a joint venture of the two groups, to define the EPC standards.

The UCC was formed in the United States in the early 1970s to develop a uniform product identification code for the U.S. grocery industry. The result was the Universal Product Code (UPC), a 12-digit item identification code that was first scanned in trade transactions in 1974. Today, numerous industries in North America use the UPC. The UCC oversees the UPC standard and issues and administers standards for ID codes, data carriers, and EDI.

In 1974, various companies across Europe followed suit and formed a council whose goal was the establishment of a unique numbering system for item identification, similar to what the UPC system was for companies in the United States. The result of these efforts was the debut in 1977 of the European Article Numbering system, a 13-digit identification standard. The EAN

association itself was actually founded in 1977 as an international organization based in Brussels, Belgium. Today, this organization, which changed its name to EAN International in 1992, has membership representing 103 countries around the world. In 2002, the UCC became a member of EAN International, representing the companies of North America.

The EAN and UCC work together in the development of standards for bar coding, EDI transaction sets, and XML schemas and are involved in many other supply chain initiatives. These two organizations are also the issuing authorities for company prefix numbers, which enable organizations to create unique reference numbers for themselves worldwide.

The aim of both the EAN and the UCC is to help companies around the world assign unique numbers to items, shipping units, companies, and locations or functional areas within companies. The latest initiative undertaken by EAN/UCC is the administration of GTINs and GLNs to enable the standardization and unique numbering of items and entities around the world.

GTIN

To create globally unique identification for items or services, the EAN/UCC system follows certain rules for putting together the identification data in specific data structures. The most common example is the UPC. This 12-digit code identifies a product and is often scanned, in bar code form, at a point of sale when a customer buys an item. The 13-digit EAN standard functions similarly for companies in Europe. In addition, businesses also use bar code symbologies to identify shipping cartons or pallets, bills of lading, and locations (physical and logical), to name just a few examples.

In recent years, tracking the uniqueness of items using UPC and EAN numbers has become increasingly difficult because of the way companies have assigned the numbers. For example, companies have used 12-digit UPC numbers to identify individual items, inner packs, and outer packs. This practice makes it hard for computer systems to tell whether an item being inventoried or shipped is a unit item, a case, or any other packaging unit. In addition, as companies retire items due to product re-engineering or revision, they sometimes reuse UPC numbers. But when an item bears a UPC that, having once “lived,” exists elsewhere in the supply chain, uniquely identifying that item becomes difficult.

Further complicating matters is the fact that companies that use the EAN numbering scheme must obtain a different, UCC-based number for

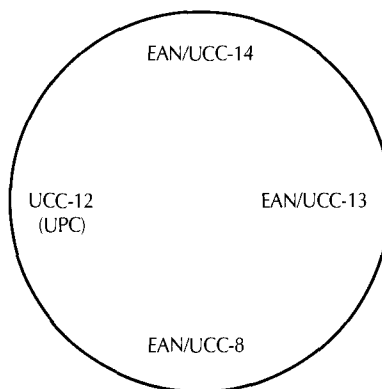
items they want to sell in North America. Last, with the proliferation of items in need of numbering, we could well run out of UPC numbers at the rate they're being assigned. (This issue is being addressed by the UCC's 2005 Sunrise initiative, which we'll discuss further later.)

In an attempt to resolve these issues and evolve the UCC and EAN standards into more of a global standard for bar code symbology, the EAN/UCC partnership developed the 14-digit GTIN format. GTIN, or Global Trade Item Number, is a relatively new term used to identify an item. The GTIN is a 14-digit data field that's assigned to each pertinent hierarchical level, including unit of each, inner or multi-pack, case, outer pack, displayer, pallet layer, pallet, and mixed pallet. Therefore, a unit of a product has a GTIN, a case of that product has a different GTIN, and even case counts of the same product have yet a different GTIN.

It's important to understand that GTIN is not a new symbology or a new standard. Rather, GTIN is a means of standardizing the identification of products across the United States, Canada, and Europe — locations that traditionally have used different symbologies to identify the same product. In the GTIN structure, the same item that is scanned in Canada, the United States, or Europe is uniquely identified with a 14-digit code.

The GTIN structure, which is depicted in Figure 4.1, encompasses the UPC (also known as UCC-12), EAN/UCC-8, EAN/UCC-13, and EAN/UCC-14 identification data structures. So even if a bar code contains only 8 digits (such as with EAN/UCC-8), 12 digits (such as with UCC-12), or 13 digits (such as with EAN/UCC-13), the GTIN represents 14 digits.

FIGURE 4.1
GTIN Structure



To be GTIN-compliant, businesses must right-justify and zero-fill any database that contains currently encoded 8-, 12-, and 13-digit numbers. For a clearer picture of how the various data structures would be represented in a database, see Figure 4.2.

FIGURE 4.2
GTIN Contained in a Database

Data structure	GTIN format (position)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
UCC-12	0	0	X	X	X	X	X	X	X	X	X	X	X	C
EAN/UCC-13	0	X	X	X	X	X	X	X	X	X	X	X	X	C
EAN/UCC-8	0	0	0	0	0	0	X	X	X	X	X	X	X	C
EAN/UCC-14	X	X	X	X	X	X	X	X	X	X	X	X	X	C

Element	Description
1	Packaging indicator
	0 . . .No package hierarchy or for mixed case
	1–8 . .Package level of the base GTIN
	9 . . .Variable measure item
2–13	Company prefix (can be 3–10 digits) + item reference
14	Check digit

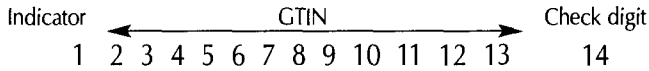
Another important point to note about GTIN is that each item must have a unique GTIN — size large blue shirt, size medium blue shirt, and size small blue shirt, for example, must each be assigned their own number. The case must also have a unique number. If an intermediate package exists for the same item, a unique GTIN is needed for that as well. Even different case counts of the same products must be identified using yet another GTIN. This requirement provides clarity, and thus efficiency, to all points in the supply chain because every variation of a trade item or service is known by a globally unique identifier.

Identifier Elements

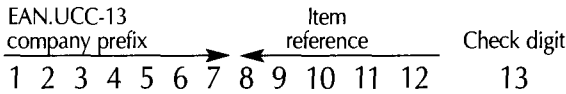
To help you better understand how the GTIN functions in terms of item identification, it is helpful to review the makeup of bar codes. Refer to Figure 4.3 to see the structure of the various symbologies mentioned in this section.

FIGURE 4.3
EAN/UCC Data Structures

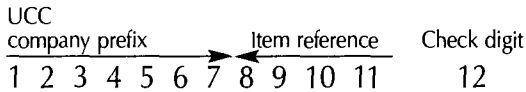
EAN/UCC-14 Data Structure



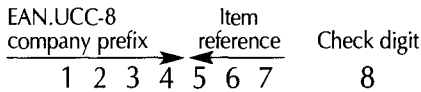
EAN/UCC-13 Data Structure



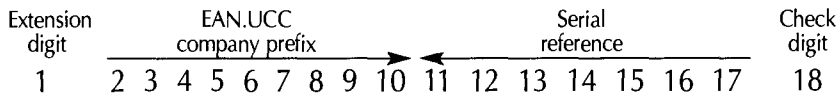
UCC-12 Data Structure



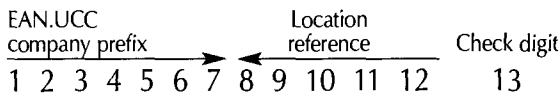
EAN/UCC-8 Data Structure



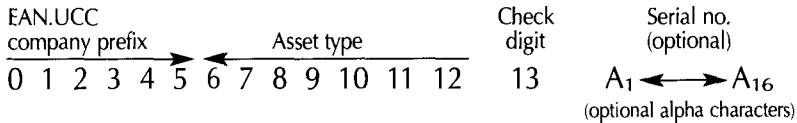
SSCC



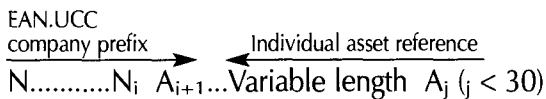
GLN



GRAI



GIAI



The data structure contained within bar code symbologies can include five identifier elements:

- an application identifier
- an indicator digit
- a company prefix
- an item number
- a check digit

The *application identifier* defines the type of bar code, or symbology, being used. Symbologies include UPC, Interleaved 2 of 5 (ITF), UCC-128, and many others. An application identifier is used with some but not all symbologies. For example, application identifiers aren't used with EAN, ITF, or UPC symbologies. Application identifiers define the type of number that follows the identifier. The application identifier 00, for example, signifies a shipping container serial number; the identifier 402 indicates a bill of lading.

Some symbologies use an *indicator digit* to further describe the type of number being used. For example, an indicator digit can be used to denote characteristics such as fixed or variable measurement.

The *company prefix* is a number that uniquely identifies an organization. When added to another number, such as a UPC number, it can uniquely identify a product or shipping container. The UCC and EAN assign company prefix numbers. The two organizations work from different pools of numbers, with the UCC providing prefixes for companies in North America and the EAN doing so for companies in Europe. Company prefixes are variable in length. Prefixes are given for use in the following types of identification numbers:

- Global Location Number — a 13-digit ID that identifies a physical or logical place.
- Global Trade Item Number — a number used to identify items and/or services.
- Bill of Lading (BOL) — a 17-digit ID that identifies a standard bill of lading. The bar code that signifies the BOL is optional and is intended for use by the carriers. The BOL uses the UCC/EAN-128 symbology.
- Serial Shipping Container Code (SSCC) — a code identifying a shipping container. Companies use the SSCC to identify logistics units or any combination of trade items that need to be identified and tracked throughout the supply chain. SSCCs can be applied to cartons, cases, pallets, or containers. The SSCC serial number can safely be

used once and then ideally should remain dormant in a one-year period.

- Global ID Serialized for Trade (GIST) — a code used to identify one-of-a-kind items.
- Global Returnable Asset Identifier (GRAI) — a code used to identify returnable items normally used in the transport and storage of goods.
- Global Individual Asset Identifier (GIAI) — a code used to identify individual assets that are part of the inventory of a given company.

The *item number* element is always assigned by the brand owner. Along with the company prefix, this number creates a globally unique way to identify and label a specific product.

Last, all data structures include a final *check digit* to verify the validity of the number. Check digits are important because they assure us of the accuracy of the bar code. Two common check-digit schemas are Modulo 10 and Modulo 13. Figure 4.4 depicts an example of the UPC Mod 10 check-digit calculation.

FIGURE 4.4
UPC Mod 10 Check Digit



Steps	Calculation
1. Start from the right.	
2. Add even position digits.	$7 + 3 + 0 + 6 + 2 = 18$
3. Add odd position digits.	$9 + 5 + 1 + 8 + 4 + 0 = 27$
4. Multiply odd digits by 3.	$27 \times 3 = 81$
5. Add to even digits.	$81 + 18 = 99$
6. Divide by 10, keeping remainder.	$99 \div 10 = 9, \text{ remainder } 9$
7. Subtract remainder from 10.	$10 - 9 = 1$
8. Check digit is 1 (if 10, use 0).	

Assigning GTINs

The responsibility and ownership of assigning GTINs rests with the manufacturer or brand owner. The manufacturer and the retailer, in addition to all other trading partners in between (e.g., distributors, contract manufacturers), must adjust their internal files and databases to accommodate the

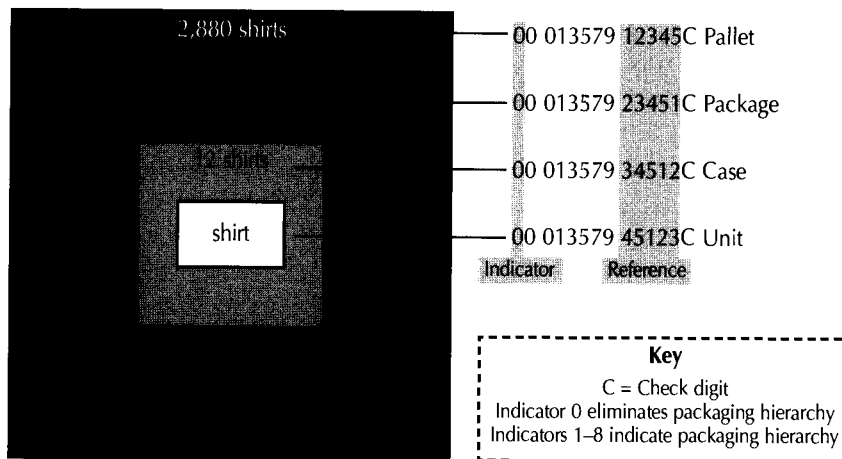
expanded 14-digit item numbering schema. But how about storing the number? One approach many companies have taken is simply to right-justify the existing numbers and pad with zeroes. This practice works fine, but keep in mind that this new 14-digit number now won't match the number in the bar code. Remember, the UPC is still 12 digits long.

Perhaps one of the most confusing issues about GTINs is how to build them. There are, in fact, three ways to assign GTINs:

- the item reference method
- the indicator digit method
- the combination method

The *item reference* method begins with two zeroes followed by a UCC-12 number or an EAN-13 number. In this scheme, each hierarchical level has a different reference number, with two leading zeroes on the left. Figure 4.5A depicts this method.

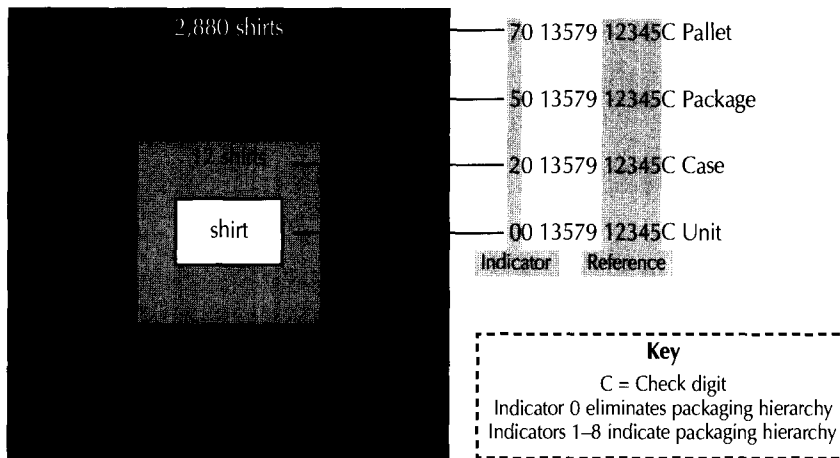
FIGURE 4.5A
GTIN Numbering Using Different References



The *indicator digit* method uses the numbers 1–8 and either the EAN-13 or a zero followed by the UCC-12. With this method, all hierarchical levels of an item use the same UCC-12-type number. The first indicator digit makes the number unique to its related packaging level. The numbers 1–8 can be used for higher levels of packaging, and 9 is reserved for variable measure items. The second digit is always a zero. Figure 4.5B depicts the indicator digit method.

FIGURE 4.5B

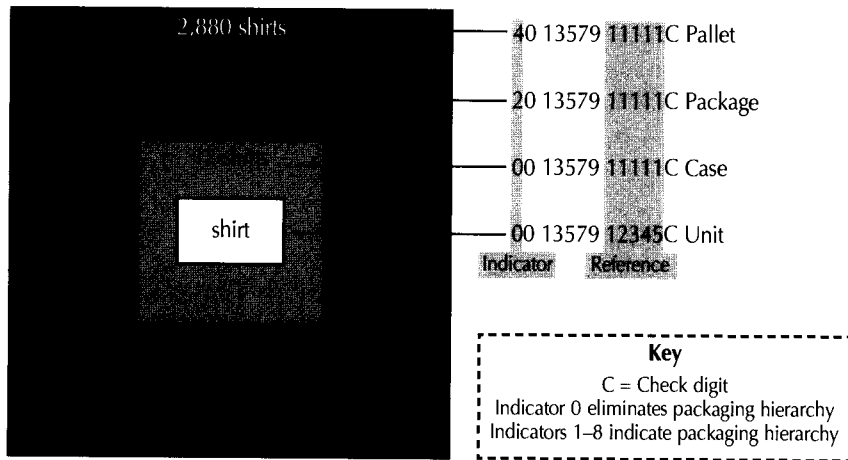
GTIN Numbering Using Same Base Number and Different Indicators



The *combination* method uses a combination of the item reference and indicator digit assignment methods. (The indicator digit can't be used with mixed items.) Using the combination method, you can employ a mixture of indicator and item reference numbers to identify higher levels of packaging. Figure 4.5C depicts the combination method.

The process of building GTINs depends somewhat on your customer base. Although you can assign any number you want to your item and still create a unique trade item number (the combination of your company prefix and this number makes the identifier unique to your organization), that alone may not suffice. In some cases — for example, with Wal-Mart — the GTIN must use the UPC number to identify the item.

FIGURE 4.5C
GTIN Numbering Using a Mix of Indicator and Item Reference



GLN

Like the GTIN, the Global Location Number isn't a new symbology. Rather, it is a new way of identifying a physical, functional, logical, or legal entity. For a customer, a unique GLN must be assigned to the corporation and each division, region, manufacturing facility, distribution center, and even functional area. For the supplier, in addition to these, a unique GLN is required for each distribution center, store, and department.

The GLN can be used to uniquely identify a place, making it useful data to include within a shipping bar code label, for instance. When a shipment is received with a bar code label that contains a GLN, upon scanning, an automated receiving dock can separate and route pallets or packages intended for a specific location for delivery. This practice eliminates errors in items being shipped to the wrong retail store or warehouse, for example.

Figure 4.6 depicts the GLN structure, which uses the 13-digit EAN/UCC. It is composed of three sections. The first is the company prefix, which the UCC or EAN assigns to a company. Next is the location reference, which the company itself assigns to identify unique locations within the company. Together, these two pieces of data comprise 12 digits, each with variable length. The 13th and last digit is, of course, a check digit.

FIGURE 4.6
GLN Structure

EAN/UCC company prefix								Location reference				Check digit
X	X	X	X	X	X	X	X	X	X	X	X	C
1	2	3	4	5	6	7	8	9	10	11	12	13

It's important to understand that, just as with the GTIN, where the manufacturer assigns and owns the GTIN number, the UCC and EAN do *not* assign GLNs. Instead, they assign a company prefix, and the company itself identifies all its locations uniquely using this given number. Most companies use a logical sequential numbering scheme to assign GLNs to, for instance, their distribution centers and their retail shops.

Before March 2000, the UCC used six digits to assign a company prefix. The number of digits issued is now variable and can be anywhere from 6 to 10. This change is an important one for those businesses that currently accommodate a fixed number of 6 for company prefix assignment. To convert a UCC company prefix to EAN/UCC, you simply add a leading zero.

The capture, and in many cases cross-reference, of this data is what is critical to ensuring that the right products are going from the right place to their proper destination. Rather than change their files and databases to use GLNs instead of internally assigned customer or vendor numbers, businesses will likely set up cross-reference tables to map the data. The important point to note is that if you store such cross-reference data in multiple locations or files, routines must exist to ensure that each location or file is updated with the same information when data is changed, added, or deleted.

Changing GLNs and GTINs

GLN and GTIN numbers may change as a result of mergers and acquisitions. If a company changes its status due to a merger or acquisition, it must notify the UCC or EAN within one year. If a company buys a division of an organization whose UCC/EAN company prefix is used in divisions that aren't included in the purchase, the acquiring company is responsible for changing GTINs for the newly acquired divisions within one year. All existing items should retain their GTINs.

If a company buys only a brand or range of items from another company, it can continue to use the GTINs assigned by the selling company for

a short time. However, at its earliest opportunity, the buying organization should use its own numbering scheme to reassign GTINs to the newly acquired items or brand. The seller should not reuse the GTINs it sold for a period of four years.

In instances where a company is split off into two or more separate organizations, a new company prefix should be obtained from the UCC or EAN for each new company. Only one of the split organizations may use the existing company prefix. New GTINs will have to be assigned by the new organizations once the existing stock has been depleted. The spun-off companies cannot reassign any existing GTINs for four years from the date when the GTIN owner last supplied the products that carry those GTIN numbers. This requires that the company that keeps the original company prefix informs the spun-off companies of the date when it is able to release those GTINs.

2005 Sunrise

The use of different UPC and UCC symbologies has caused global inefficiencies in the distribution and sale of products. For this reason, in 1997 the UCC announced, in an initiative known as 2005 Sunrise, that by January 1, 2005, all U.S. and Canadian companies must be able to scan and process all three symbologies used at the point of sale: the 12-digit UPC, EAN-8, and EAN-13.

Beginning on January 1, 2005, retail items in the United States and Canada may be marked with an EAN-8, EAN-13, or UPC code. Outside of North America, no new UCC company prefixes will be assigned to manufacturers to create UPCs for their products, effectively forcing those businesses to mark new products using the EAN-8 and EAN-13 symbologies. Because most scanners can read all three symbologies, this requirement shouldn't cause any issues. However, it's best to check with your product vendor for compliance. Note that in addition to the ability to scan this information, to be GTIN-compliant you must be able to store item data structures of all sizes, whether they are 8, 12, 13, or 14 digits long.

If you're a manufacturer or supplier using UCC-12s within a UPC symbology, you are already prepared for 2005 Sunrise. As a retailer, if you're prepared to store and look up UPCs, EAN-8s, and EAN-13s, you, too, are ready for 2005 Sunrise.

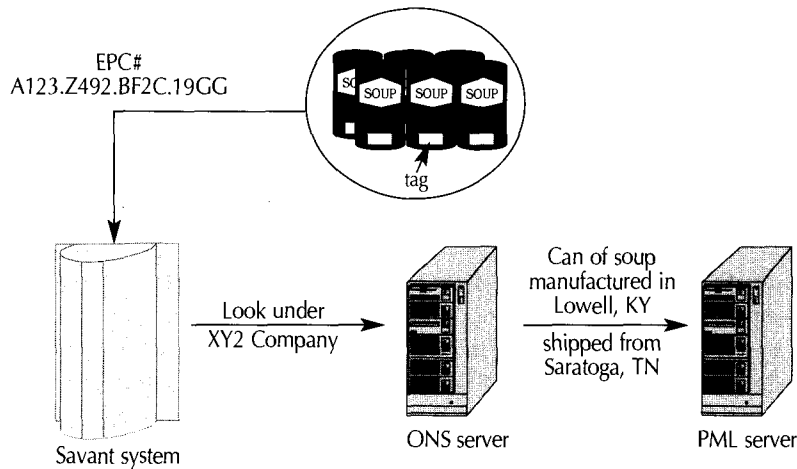
EPC

The Electronic Product Code (EPC) is a GTIN-based standard that has been adopted by the consumer packaged goods (CPG) industry and major retailers. The EPC is a specific instance of a unique product. The same item or GTIN can be stored in different physical or virtual locations (like GLNs). The EPC assigned to a particular item lets us uniquely trace the item using RFID devices or bar code scanners. However, it's important to note that the EPC will be used in the CPG and retail industries regardless of the use of radio frequency technologies. The EPC is a part of the EPC Network, a global network that uses RFID technology and includes five basic components: the EPC, the ID System (EPC tags and readers), Object Name Service (ONS), Physical Markup Language (PML), and Savant.

The EPC is actually encoded in a silicon chip tag to uniquely identify an item in the supply chain of any company, any industry, anywhere in the world. That's powerful! The idea is that when a manufacturer builds a product, it adheres an RFID tag to it with a unique EPC. Once the products are put in cases, each case (and later, pallet) can be tagged with another RFID device containing a unique EPC code.

Once the pallets are loaded on a truck, an RFID reader picks up the EPC signal from the tag antenna and passes the data it has read to a computer that is running Savant software. Figure 4.7 depicts the rest of what follows. Savant now goes to a database called the ONS, which contains the address of the server on which detailed information is kept (you can think of ONS like a reverse telephone directory, where you provide a telephone number and the directory retrieves the name and address tied to that number). The ONS locates the server address for the given EPC number within its network, stored on a PML server. The PML server stores the detailed data regarding specific instances of an item, identified via an EPC within the EPC Network. The Savant software manages the data within and across the organizations in the EPC Network. It basically manages the functions between the tag readers and the enterprise application systems.

FIGURE 4.7
How EPC Works



To use the EPC, companies must subscribe to the EPCglobal organization. This organization, a joint venture between EAN International and the UCC, is leading the industry-driven development and support of the EPC Network. The EPC Network was developed by the Auto-ID Center at the Massachusetts Institute of Technology. As the EPC Network technologies evolve and mature, EPCglobal, or the end users, will continue to work with the academic community to ensure long-term coordination of efforts.

To date, the GTIN has been mapped to a 96-bit EPC standard. On the other hand, the U.S. Department of Defense has defined requirements for a 256-bit EPC, causing suppliers to evaluate all their options before moving forward with implementation. It's expected that EPC use will continue to grow and that EPC will become the primary product coding standard in the CPG sector.

EPCglobal subscription prices depend on annual company revenues. Initially at least, most companies can tweak their GTINs to be used as EPCs. To most companies, the fact that the UCCnet initiative (which relies on GTINs for item identification) and the EPCglobal initiative are different is of major concern. Those who must comply with both initiatives must invest in standards and technologies for both. The silver lining within this challenge is that although the GTIN and EPC standards were created independently, both are managed by the UCC and EAN organizations.

The EPC's use is currently centered in the consumer products industry, but many observers believe that its benefits extend to other industries. By accurately tracking items within their supply chain, all supply chain participants can quickly determine a product's life cycle, origin, current location, and on-hand or in-progress quantities. With that information, warehousing and distribution costs can be lowered, deliveries can be made with greater accuracy, and the shipping and receiving processes (as well as many other business functions) can be executed more efficiently.

It's likely that over the next few years the EPC will be the dominant numbering scheme for the CPG sector, with or without the use of radio frequency aids. However, the standards require more stabilization before widespread adoption is expected. Many have asked whether the EPC will replace bar codes. End users believe that they'll continue to use both. It's therefore likely that we will continue to see bar codes and EPC tags on packages for some time to come.

Conclusion

GTINs and GLNs are another important part of creating a more efficient supply chain. The standardization of item numbers and organizational identifiers further makes it easier for multinational companies to transport and sell products.

GTINs and GLNs are a requirement for global data synchronization efforts, such as the UCCnet initiative. However, as I've mentioned, GTINs and GLNs must happen with or without the UCCnet. The implication of this fact for EDI is that suppliers using UCC-12s should experience no changes in their bar code marking or EDI systems. The X12 committee has approved and added the necessary elements and qualifiers that must be used within EDI transaction sets.

Likewise, the use of the EPC is gaining popularity in the CPG industry, but its full-blown adoption is some time away. The EPC will use EAN/UCC-14s. Imagine a time in the near future when after doing your shopping in your grocery store, you can walk right out with your groceries — no waiting in line. As you leave the store, an RFID reader reads the EPCs on each item you have stored in your cart, simultaneously picking up your credit or debit card number and sending the purchase transaction to your bank. It sounds so futuristic, but soon it's coming to a store near you.

EDI, UCCnet & RFID



EDI, UCCnet & RFID: Synchronizing the Supply Chain

TODAY'S BUSINESSES ARE MORE challenged than ever to improve the accuracy of their business data and the efficiency of their processes. True supply chain collaboration requires every member of the chain to effectively communicate and serve the needs of everyone within the value chain, not just the customer. This communication, in effect, is about the synchronization of business data, with the goal of rendering that information more accurate.

EDI, UCCnet & RFID focuses on three main technology enablers for synchronizing the supply chain: EDI, global data synchronization (using the UCCnet), and RFID. You'll learn about standards for transaction and message creation (including X12, XML, XSL, and RosettaNet); Global Trade Item Numbers (GTINs), Global Location Numbers (GLNs), and the Electronic Product Code (EPC); message transportation media for e-commerce and EDI transactions; software applications required to enable the creation, storage, editing, discarding, and sharing of those messages; software selection; and measures you can take to increase transactional integrity and security. The book also examines the benefits and challenges faced in using EDI, global data synchronization, and RFID, including legal, regulatory, and audit concerns.

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About the Author



A longtime e-commerce authority and business consultant, **Nahid Jilovec** has served in executive roles at Whittmanhart and Qwest Global Services and is a former partner at marchFIRST. For the past 17 years, she has focused her efforts on EDI, electronic commerce, and supply chain automation and has assisted numerous companies with strategic e-commerce planning and implementation efforts. Nahid is a prolific author of articles, an award-winning speaker, and a longtime e-commerce columnist. Her previous books include *The A to Z of EDI: And Its Role in E-Commerce* and *E-business: Thriving in the Electronic Marketplace*.

Nahid Jilovec has crafted *EDI, UCCnet & RFID* with her first-hand knowledge of what it takes to be successful using EDI in today's competitive environment. She has made it easier for not only the technologist but also those new to this area to quickly pick up the subject matter and be successful.

Ken Watson

Director, IT Risk Management,
USC Corporation

With the allure of the Internet past its peak, the real thrust now is harnessing it and other new technologies to empower business in a more rich and lasting fashion. *EDI, UCCnet & RFID* speaks loudly of the need to marry these technologies to real business drivers: market share, back-office efficiencies, or simply pacing your competitors. The cases and discussions are compelling for any professional who needs a go-to book for e-technologies.

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CIO, Applied Graphics Technologies (ACT)

Nahid Jilovec once again delivers clear, comprehensive information designed to help IT professionals support the value needs of their businesses by implementing the right B2B solution at the right time. Effective B2B data exchange represents a nearly limitless frontier related to collapsing supply chain latency, shortening business process timelines, and improving forecasting and financial performance. However, understanding the right approach to data exchange can mean the difference in success or failure. Nahid does an exceptional job of clearly and comprehensively explaining the myriad of choices.

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