

The EPCglobal Network™

008186

EPCglobal ™

**The EPCglobal Network™:
Overview of Design, Benefits, & Security**

Disclaimer

EPCglobal Inc™ is providing this position paper as a service to interested industries. This position paper was developed through a consensus process of interested parties.

Although efforts have been to assure that the position paper is correct, reliable, and technically accurate, EPCglobal Inc makes NO WARRANTY, EXPRESS OR IMPLIED, THAT THIS POSITION PAPER IS CORRECT, WILL NOT REQUIRE MODIFICATION AS EXPERIENCE AND TECHNOLOGICAL ADVANCES DICTATE, OR WILL BE SUITABLE FOR ANY PURPOSE OR WORKABLE IN ANY APPLICATION, OR OTHERWISE. Use of this position paper is with the understanding that EPCglobal Inc has no liability for any claim to the contrary, or for any damage or loss of any kind or nature.

Table of Contents

1	Introduction	4
2	Radio Frequency Identification (RFID)	4
3	The EPCglobal Network Components	5
4	The EPCglobal Network in Action	6
4.1	Diagram: The EPCglobal Network	7
5	Benefits of the EPCglobal Network	8
6	Implementation: Where Are We Now?	9
7	Security	9
7.1	Electronic Product Code (EPC)	9
7.2	The ID System (EPC tags & readers)	9
7.3	Discovery Services	10
7.4	Network Information	10
8	Conclusion	11

1 Introduction

The Auto-ID Center headquartered at Massachusetts Institute of Technology (MIT), working in conjunction with industry leaders and academic institutions around the world, designed a system for bringing the benefits of Radio Frequency Identification (RFID) to the global supply chain. That system is comprised of the Electronic Product Code™ (EPC), RFID technology and supporting software based upon EPCglobal standards, and is referred to as the EPCglobal Network™.

Once EPC technology was developed, it was always the intention to commercialize it through an experienced, standards-making body. EAN International and the Uniform Code Council, Inc.® (UCC®) were chosen as implementation partners because of their many years of experience in developing and managing global standards. EAN International and the UCC formed EPCglobal Inc™, an open, worldwide, not-for-profit consortium of supply chain partners working to drive global adoption of the EPCglobal Network.

Leveraging existing RFID and Internet technologies, the EPCglobal Network will convey real time data about individual items as they move through the supply chain. As a result, it will provide a pedigree of product movement accessible to authorized users behind firewalls, encoding and other security measures.

Prior to the development of EPCglobal Inc, there was no neutral body to develop globally recognized standards or methods for collecting and communicating such information. In addition, prior to the development of the EPCglobal Network, there was no vehicle for data sharing and communications within global supply chains. With the creation of the EPCglobal Network, there is now a medium within which information can be collected, utilized, and communicated across supply chains, across industry and around the world. As the medium, the EPCglobal Network will provide significant benefits for commerce, security, and consumers alike.

2 Radio Frequency Identification (RFID)

Radio Frequency Identification (RFID) is a technology that identifies objects using radio frequency technology. In its most basic form, RFID requires two components. The first component is a Radio Signal Transponder, or tag, that is attached to an object. The tag consists of a chip that contains identifying information about the object to which it is attached and an antenna to communicate that information via radio waves. The second component is a reader, which creates a radio frequency field that detects radio waves. When a tag passes through a radio frequency field generated by a compatible reader, the tag reflects back to the reader the identifying information about the object to which it is attached, thus identifying that object. Consequently, in an RFID system, there is no line of sight requirement for product identification because RFID tags do not need to be seen by a scanner to be identified.

RFID technology has been utilized for decades. One well-documented use of radio frequency technology dates back to World War II, when the British attached RFID transponders to their own aircraft to enable their radar system to differentiate between their own planes and incoming German aircraft. Throughout the ensuing years, there have been many notable uses of RFID technology in the commercial arena. One museum in Rotterdam uses RFID to guard its priceless paintings. In addition, scores of livestock have been tagged with RFID in order to track them in the event of a disease outbreak. One of the most visible uses of RFID in today's society

is automated toll-collection on turnpikes and bridges, where cars display an RFID tag in their window and tollbooths equipped with readers identify the car and then charge the toll to the correct account as the car passes through the booth.

3 The EPCglobal Network Components

Simply put, the EPCglobal Network is a method for using RFID technology in the global supply chain by using inexpensive RFID tags and readers to pass Electronic Product Code numbers, and then leveraging the Internet to access large amounts of associated information that can be shared among authorized users. There are five components of the EPCglobal Network.

ELECTRONIC PRODUCT CODE (EPC)	Unique number that identifies a specific object in motion in the supply chain.
ID SYSTEM	The ID System consists of EPC tags and EPC readers. EPC tags* are RFID devices that consist of a microchip and an antenna attached to a substrate. The EPC is stored on this tag, which is applied to cases, pallets and/or items. EPC tags communicate their EPCs to EPC readers using RFID. EPC readers communicate with EPC tags via radio waves and deliver information to local business information systems using EPC Middleware.
EPC MIDDLEWARE	EPC Middleware manages real-time read events and information, provides alerts, and manages the basic read information for communication to EPC Information Services (EPC IS) and a company's other existing information systems. EPCglobal is developing a software interface standard for services enabling data exchange between an EPC reader or network of readers and information systems.
DISCOVERY SERVICES	A suite of services that enable users to find data related to a specific EPC and to request access to that data. Object Naming Service (ONS) is one component of Discovery Services.
EPC INFORMATION SERVICES (EPC IS)	Enables users to exchange EPC-related data with trading partners through the EPCglobal Network.

***Although most sectors require only the simplest, lowest cost tag, the potential value of more complicated tags justifies their increased cost in certain industries. For example, the food industry may want to add temperature tracking by adding a temperature sensor on tags. As a result, various tag classifications are being developed in order to accommodate varying levels of complexity.**

4 The EPCglobal Network in Action

Working in coordination, the components defined above provide the ability to capture and share information in the EPCglobal Network. To capture data, inexpensive EPC tags carrying a unique EPC number are affixed to objects in motion in the supply chain. Then, strategically placed EPC readers at gateways throughout the supply chain will read each tagged object as it passes and communicate the EPC number, the time, date and location of the read to the EPCglobal Network. EPC Middleware will control and integrate the EPC tags, readers, and local infrastructure at the individual site.

Once the information is captured as described above, the EPCglobal Network then uses Internet technology to create a network for sharing that information among authorized trading partners in the global supply chain. Discovery Services is a suite of services that enable users to find data related to a specific EPC and to request access to that data. The ONS is one component of Discovery Services. From there, actual access to data in the EPCglobal Network is managed at the local level by the EPC IS where the company itself designates which trading partners have access to its information. The result is a network of information that traces individual product movement in real time.

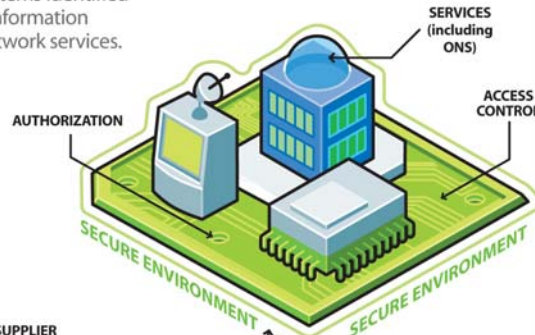
4.1 Diagram: The EPCglobal Network

The EPCglobal Network™



The EPCglobal Network is a secure means to connect servers containing information related to items identified by EPC numbers. The servers, called EPC Information Services or EPCIS, are linked via a set of network services.

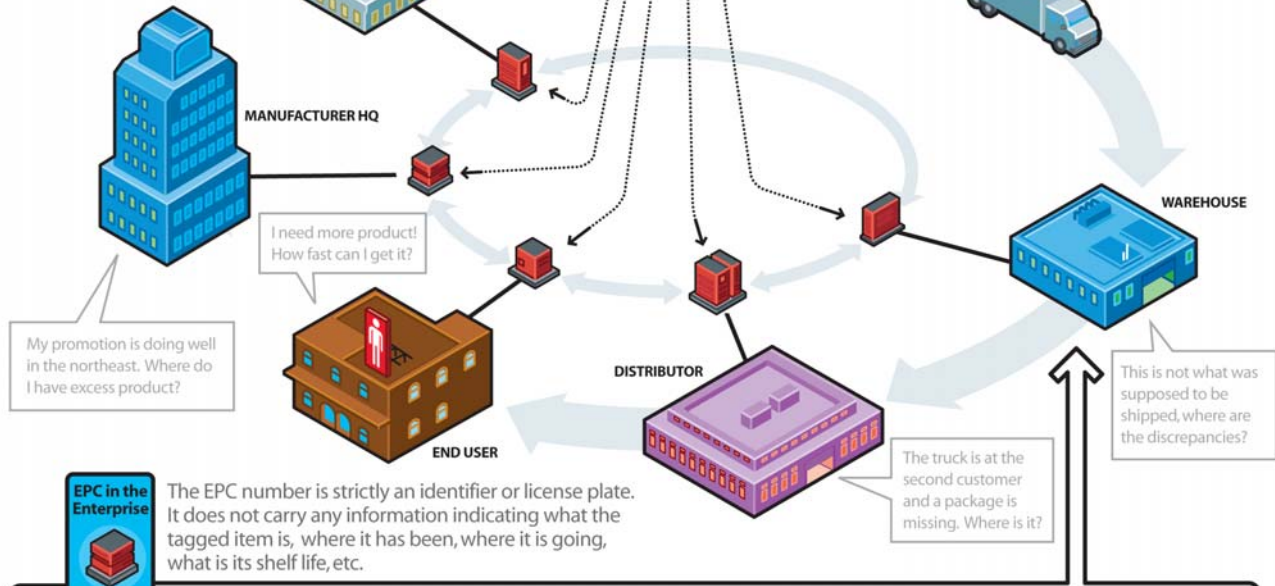
Each participant in the EPCglobal Network will store relevant information related to specific EPC numbers in their own EPCIS servers. In a number of situations, local databases will provide the information that is required. If not, this operation will trigger entries in electronic registries indicating that a specific EPCIS server has information about a particular EPC number. When a User submits a query to the EPCglobal Network, it will send the query to the Registries, which will return the address of the various EPCIS containing the requested information.



Services will support basic transactions like locating information on a tagged item (ONS), identifying the location of a tagged item in the supply chain as well as perform value-added track and trace functions like identifying the pedigree of an item.

Authorization and Access Control provide privacy and data protection by limiting who sees what and when they are allowed to see it. EPCglobal standards will outline the security needed and set expectations of network participants.

I need to recall 10 tagged items. Where are they?



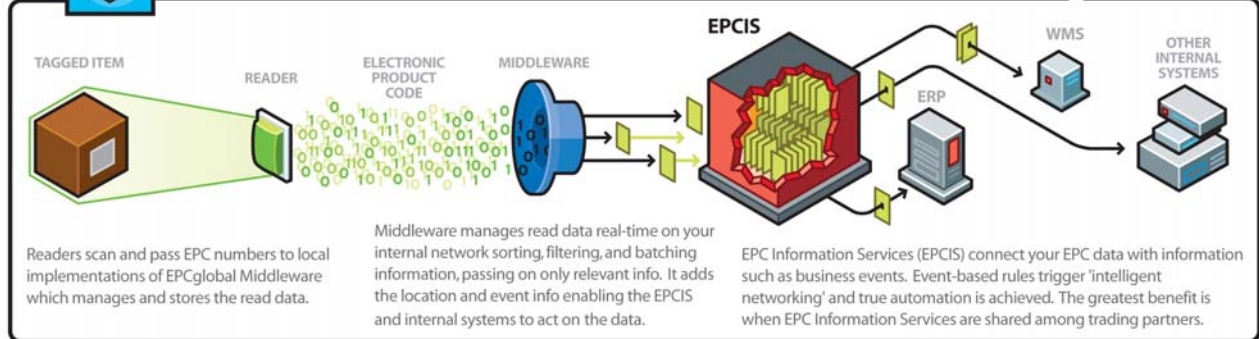
I need more product! How fast can I get it?

My promotion is doing well in the northeast. Where do I have excess product?

The truck is at the second customer and a package is missing. Where is it?

This is not what was supposed to be shipped, where are the discrepancies?

EPC in the Enterprise
The EPC number is strictly an identifier or license plate. It does not carry any information indicating what the tagged item is, where it has been, where it is going, what is its shelf life, etc.



Readers scan and pass EPC numbers to local implementations of EPCglobal Middleware which manages and stores the read data.

Middleware manages read data real-time on your internal network sorting, filtering, and batching information, passing on only relevant info. It adds the location and event info enabling the EPCIS and internal systems to act on the data.

EPC Information Services (EPCIS) connect your EPC data with information such as business events. Event-based rules trigger 'intelligent networking' and true automation is achieved. The greatest benefit is when EPC Information Services are shared among trading partners.

XPLANATIONS™ are simple visual maps and stories that make complex business issues easier to understand. For more information visit XPLANE at www.xplane.com or call 1/800/750-6467.

5 Benefits of the EPCglobal Network

The EPCglobal Network provides three critical advancements to product identification in the supply chain.

- The creation of a unique number for individual objects in motion in the global supply chain. This advancement enables the communication of object-specific information.
- The removal of line of sight requirement for reading product identification numbers. An EPC reader instantly detects all EPC tags passing through its radio frequency field. As a result, it is capable of reading in one glance the EPC of every EPC tagged object. In the case of an object identified with a GTIN, the read would include each EPC tagged item in a container, pallet, or case.
- A network of information that provides real-time object movement data for individual items to authorized and authenticated users.

Even at this early juncture in the development of the EPCglobal Network, many valuable use cases have been identified that span industries. The following table lists some of those industries and the specific use cases identified in each sector.

Industry Sector	Specific Use Examples
Retail	<ul style="list-style-type: none"> ▪ Track and trace ▪ Product recalls ▪ Streamlined shipping and receiving ▪ Automated invoice reconciliation ▪ Shrinkage reduction ▪ Improved demand planning
Healthcare	<ul style="list-style-type: none"> ▪ Red Cross: monitoring blood banks ▪ Hospitals: monitoring medication routes from medicine cabinet to patient ▪ Pharmacy: drug recall (product pedigree) ▪ Prescription drugs: identifying counterfeit or falsely-labeled medications
Logistics	<ul style="list-style-type: none"> ▪ Asset utilization: asset (e.g., containers, trucks, etc.) management, tracking and maintenance ▪ Improving operational efficiencies: volume planning and automated data capture through shipping route ▪ Safety and security: shipment route tracing and positive identification of package contents ▪ Automated customs
Automotive	<ul style="list-style-type: none"> ▪ Capital asset management: container and tool management ▪ Part tracking: inventory management; assembly; theft control; brand authentication; distribution; recall; recycling ▪ Vehicle related: car identification; access control; tire pressure
Food Industry	<ul style="list-style-type: none"> ▪ Mad Cow Disease/Bird Flu: cow/bird pedigree, herd/flock history and details about the release into the food chain ▪ Restaurants: responding to outbreaks of food poisoning
Department of Defense	<ul style="list-style-type: none"> ▪ Supplies and materials management: track and trace; streamlined receiving; etc. ▪ Military assets management: asset utilization, tracking and maintenance
Airline	<ul style="list-style-type: none"> ▪ Baggage handling

6 Implementation: Where Are We Now?

Implementation and adoption of the EPCglobal Network is still in its early stages. Utilization of the EPCglobal Network in the supply chain is occurring gradually with a phased approach to implementation that begins in the Fast Moving Consumer Goods (FMCG) industry at the pallet and case level, not the item level. Phasing provides the necessary time for the business community and solution providers to learn about the network and the technology, and to establish the necessary standards.

To date, numerous industries are researching and beginning to implement components of the EPCglobal Network whose standards have been developed and approved by the EPCglobal community (i.e., the EPC, EPC tags and EPC readers). Companies in the Fast Moving Consumer Goods industry are pilot-testing these network components at the pallet and case level. In addition, the EPCglobal Action Groups, comprised of End Users, Solution Providers and researchers, are serving the on-going effort to develop the standards for optimizing the EPCglobal Network.

7 Security

The EPCglobal Network is in the early stage where significant effort is on-going to analyze and develop the specifications and standards for implementing the network. Even at this early stage, significant attention is paid to security for all aspects of the network. To that end, EPCglobal's Hardware and Software Action Groups are committed to the rigorous examination of all aspects of EPCglobal Network security and to developing appropriate specifications for solutions. Because that work is on-going at this time pursuant to the strict requirements of the EPCglobal Standards Development Process, it would be inappropriate to discuss any specific approach to network security as all aspects of and approaches to network security are being scrutinized. However, an overview of some of the aspects of network security being examined is provided below.

7.1 Electronic Product Code (EPC)

The EPC is the standardized number in the EPCglobal Network. It is derived from a standardized numbering system capable of uniquely identifying individual objects in motion in the global supply chain.

Key points about the security of the EPC:

- The EPC is simply an identification number for a specific object in motion in the supply chain.
- No information beyond the number itself is conveyed in the EPC.
- All information associated with an EPC is found in the EPCglobal Network and is only accessible to authorized users behind firewalls, encoding and other security measures. Thus, without access to the information, the EPC is meaningless.

7.2 The ID System (EPC tags & readers)

The EPC tags contain RFID antennas that communicate the EPC numbers to the EPC readers within the EPCglobal Network. Concerns have been raised about privacy issues when EPC tagged objects move from the supply chain to the consumer. These concerns, as all security issues, are being carefully examined.

Key points about tag security:

- When EPC tags pass through EPC readers throughout the supply chain, the only information collected is the EPC identification and the time, date, and location of the read. (If advanced functionality like a temperature sensor is also on the tag, this information can also be collected.)
- Thus, the EPC tag, in and of itself, does not communicate meaningful information. All information associated with EPC number is found in the EPCglobal Network and is only accessible to authorized users behind firewalls, encoding and other security measures. (*Security regarding access to network information is discussed below.*)
- The majority of consumers today and for the foreseeable future will only come in direct contact with EPC tags if they are buying cases of goods at a retailer who is pilot testing the EPCglobal Network. It will take some time before item level tagging is implemented on a large scale and thus consumer contact with EPC tags will remain limited until that point. This provides the necessary time to properly analyze any perceived privacy risks associated with EPC tagged objects in the consumer's possession and develop the appropriate strategies for addressing those concerns. With interest in RFID and EPC technology growing across industry, this timeframe could change rapidly.

7.3 Discovery Services

As discussed above, Discovery Services is a suite of services that enable users to find data related to a specific EPC and to request access to that data. From there, actual access to data in the EPCglobal Network is managed at the local level by the EPC Information Services (EPC IS) where each company itself designates who has access to its information. (*Security regarding access to network information is discussed below.*)

Key points about Discovery Services security:

- These types of security concerns are not unique to the EPCglobal Network. In fact, they mirror the concerns with any Internet application. The EPCglobal community is working diligently to develop standards and best practices that ensure the security of EPC-related information communicated over the Internet.
- Actual access to information is restricted by the EPC IS to only those users who have authorization.

7.4 Network Information

Each company in the EPCglobal Network owns and controls the data associated with its EPCs. Therefore, actual access to information in the EPCglobal Network is managed at the local level by the EPC IS through which each company itself controls who have access to its information.

Key points about the security of network information:

- The EPC IS will leverage the security services technology necessary for the communication and dissemination of EPC data to only authorized users, including authentication and access control.
- Each company in the EPCglobal Network owns and controls the data associated with its EPCs. As with all corporate information, companies have a vested interest in the security of their information and systems, and are therefore committed to the on-going development of the EPC IS interfaces to security components.

8 Conclusion

The EPCglobal Network will enable the secured collection and communication of real-time, product movement data about individual objects as they travel through the supply chain. Information security is one of the main priorities of the EPCglobal community as it develops the standards for the EPCglobal Network. EPC related information will be protected behind firewalls, encoding and other security measures, and all aspects of and approaches to network security are being scrutinized pursuant to the strict requirements of the EPCglobal Standards Development Process.

Even at this early juncture in the implementation of the EPCglobal Network, many valuable uses for the network have been identified that span industries. The ability to access product movement information in real time about any EPC tagged object optimizes track and trace capabilities and enables greater automation of tracking procedures. The commercial world benefits from improved operations by reducing order fulfillment errors, speeding up sorting, and reducing inventory costs and shrinkage. Moreover, these capabilities provide an invaluable resource to public safety officials in product recall and public health situations, and can be used to enhance customs and port security as well. In addition, consumers will benefit from the reduction in item shortages due to shipping errors, reduction in the costs due to increased vendor efficiencies and increased security through the improved visibility of objects with the supply chain. Serving as a major advancement in product identification, the EPCglobal Network will provide considerable benefits for commerce, national security, public health and safety, and consumers alike.

For additional information, please contact:

Jack Grasso
EPCglobal Inc
Princeton Pike Corporate Center
1009 Lenox Drive, Suite 202
Lawrenceville, NJ 08648
+1.609.620.4555



CORPORATE HEADQUARTERS

Princeton Pike Corporate Center

1009 Lenox Drive, Suite 202

Lawrenceville, New Jersey 08648

+1 937.291.3300 • Fax +1 937.435.7317

www.EPCglobalinc.org



© 2004 EPCglobal Inc