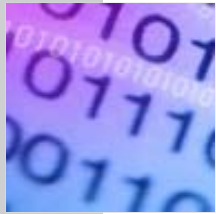
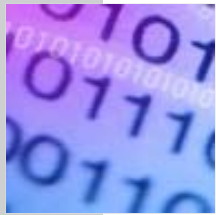


# EPCglobal Architectural Review Committee



# Agenda

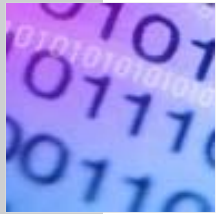
- The Architecture Review Committee (ARC)
- The EPCglobal Architecture Framework
  - Overview
  - Object exchange standards
  - Data exchange standards
  - Infrastructure standards
- Future Directions



# EPCglobal Architecture Review Committee (ARC) - Membership

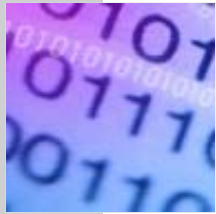
- Twelve members: 3 Technical Steering Committee, 4 Business Steering Committee, 1 Auto ID Labs, 1 GDSN, 3 EPCglobal Staff

Member	Rep	Company
Paul Dietrich	TSC	Impinj
Ken Traub	TSC	BEA Systems
Sanjay Sarma	TSC	MIT/OATsystems
John Williams	Auto ID Labs	MIT
Leo Burstein	BSC	Procter & Gamble
John Garrett	BSC	Tesco Ltd.
Phil Armenio	BSC	Johnson & Johnson
Oleg Ryaboy	BSC	CVS
Johannes Schmidt	GDSN	Kraft
K.K. Suen	EPCglobal	EPCglobal HK
Henri Barthel	EPCglobal	EPCglobal Inc.
Bernie Hogan	EPCglobal	GS1 US



# EPCglobal Architecture Review Committee (ARC) – Primary Roles (1)

- **Overseer of the EPCglobal Network architecture**
  - Standing committee reporting to the EPCglobal President
  - Define the architectural framework for the EPCglobal Network and resolve general architecture issues brought to the ARC
  - Coordinate cross-technology architecture development/reapplication within EPCglobal Network Standards and with other standards bodies as appropriate
  - Maintain the written architecture findings, as necessary.
  - Ensure that all specifications are consistent with the architecture and compatible with each other.
  - Act as a consultative body on the EPCglobal Network Architecture, i.e. Board of Governors, Action Groups, other standards bodies



# EPCglobal Architecture Review Committee (ARC) – Primary Roles (2)

- **Participants in the Standards Development Process (SDP)**
  - In this role, ARC will assess a proposal (represented either as a Use Case or Technical Requirement) vis-à-vis the EPCglobal Network Architecture. This may include drawing on other resources from the EPCglobal community via a request for help to the TSC/BSC. ARC will advise on the impact on existing:
    - Supply Chain Architecture
    - EPCglobal Network Architecture
    - Standards Development Organizations (SDO)



# ARC Request for Finding

- Formal request to the ARC for information
  - Improve effectiveness of Work Groups
  - Reduce Misunderstandings
  - Avoid overlapping work
  - Improve consistency of standards
- Send ARC requests to:  
[ARC\\_request@epclinklist.epcglobalinc.org](mailto:ARC_request@epclinklist.epcglobalinc.org)
- Completed Findings are posted to:  
<http://eroom.uc-council.org/eRoom/facility/EPCglobalStandardsDocuments/>



# ARC Request for Finding (cont'd)

ID	Title	Description	Close Date
ARCR-1	Use of EPCglobal XML Methodology by EPCglobal Reader Protocol 1.0	Analysis of applicability of EAN.UCC XML Design Rules to EPCglobal specifications in general and to Reader Protocol 1.0 specifically	5/12/2005
ARCR-2	Using EPCglobal Numbering Schemes with non-Standard Tag Protocols	Expresses general support for using EPC numbering schemes defined in EPCglobal specifications in situations when information carriers (specifically 433 MHz tags) are not subject to such specifications	6/4/2005
ARCR-3	Resolution of the EPC/AFI Issue for Gen 2 Tags	Suggests changes to Gen 2 tag specification and Tag Data standard to address incompatibility with ISO 18806-C standard.	8/12/2005
ARCR-4	Exploiting UHF Class 1 Gen 2 Features Within the EPCglobal Network	Provides recommendations and clarifies ARC position on addressing additional Gen 2 tag capabilities within EPCglobal architecture framework	8/11/2005
ARCR-5	On the Use of GS1 Company Prefixes as EPC Manager Numbers, and the Discovery of Commissioning Information for an EPC	Analysis of how GS1 company prefixes are used in EPCglobal specifications and core services (specifically ONS), and implications of explicit division between GS1 company prefixes and the rest of the code; errata to July 2005 version of the Architecture Framework document	10/6/2005



# Architectural Framework Document

## Document defines and describes the EPCglobal Architecture Framework

### ***What is this Architecture Framework?***

- Define the EPCglobal Network
- The EPCglobal Architecture Framework is a collection of interrelated standards for:
  - hardware,
  - software, and
  - data interfaces,all in service of a common goal of enhancing the supply chain through the use of Electronic Product Codes (EPCs).

### ***What does this document tell us?***

- Explains the underlying technical principles.
- Identifies the top level architecture of core services, such as Object Name Services (ONS), that are operated by EPCglobal and its delegates.
- Identifies and defines, at a high level, the hardware, software, and data standards that are part of the EPCglobal Architecture Framework and shows how they are inter-related.



# Architectural Framework Document

(cont'd)

## *What groups can best make use of this information?*

- Important to **end-users and manufacturers** interested in RFID implementation and strategic supply chain planning. This document exists to describe the overall architecture, showing how the different components fit together to form a cohesive whole.
- This information provides architectural guidance to **users** and **technology vendors** seeking to implement EPCglobal standards and to use EPCglobal core services.
- Guiding principles for **solution providers** in the technical design of RFID products and services.



# Architectural Framework Document

(cont'd)

## Goals for the EPCglobal Architecture Framework

- ***Maintain the Role of Standards***
  - To Facilitate the exchange of information and physical objects between Trading partners.
  - To Foster the existence of a competitive marketplace for system components.
  - To encourage innovation.
- ***Commitment to Global Standards***
  - Ensures the EPCglobal Architecture Framework will work anywhere in the world.
- ***Other Specific goals described in the document:***
  - ***Open System and Platform Independence***
  - ***Scalability and Extensibility***
  - ***Security***
  - ***Privacy***
  - ***Existing Industry Architectures and Standards***
  - ***Open, Community Process***
  - ***Future elements***



# Architectural Framework Document

(cont'd)

## Underlying Technical Principles

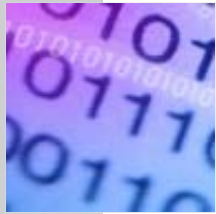
*Underlying principles are intended to provide guidance to all Working Groups as they develop new Standards specifications. Each of these principles are defined in the document.*

- *Unique Identity*
- *Decentralization*
- *Layering of Data Standards*
- *Layering of Software Specifications*
- *Extensibility*

## Architectural Foundations

*This section of the document describes the key design elements of the EPCglobal Architecture Framework.*

- *Electronic Product Code*
- *EPC Manager*
- *EPC Manager Number*
- *Embedding Existing Codes – Tag Data Specifications*
- *Class and Instance Level Data*
- *EPC Information Services – Static Data and Transactional Data*

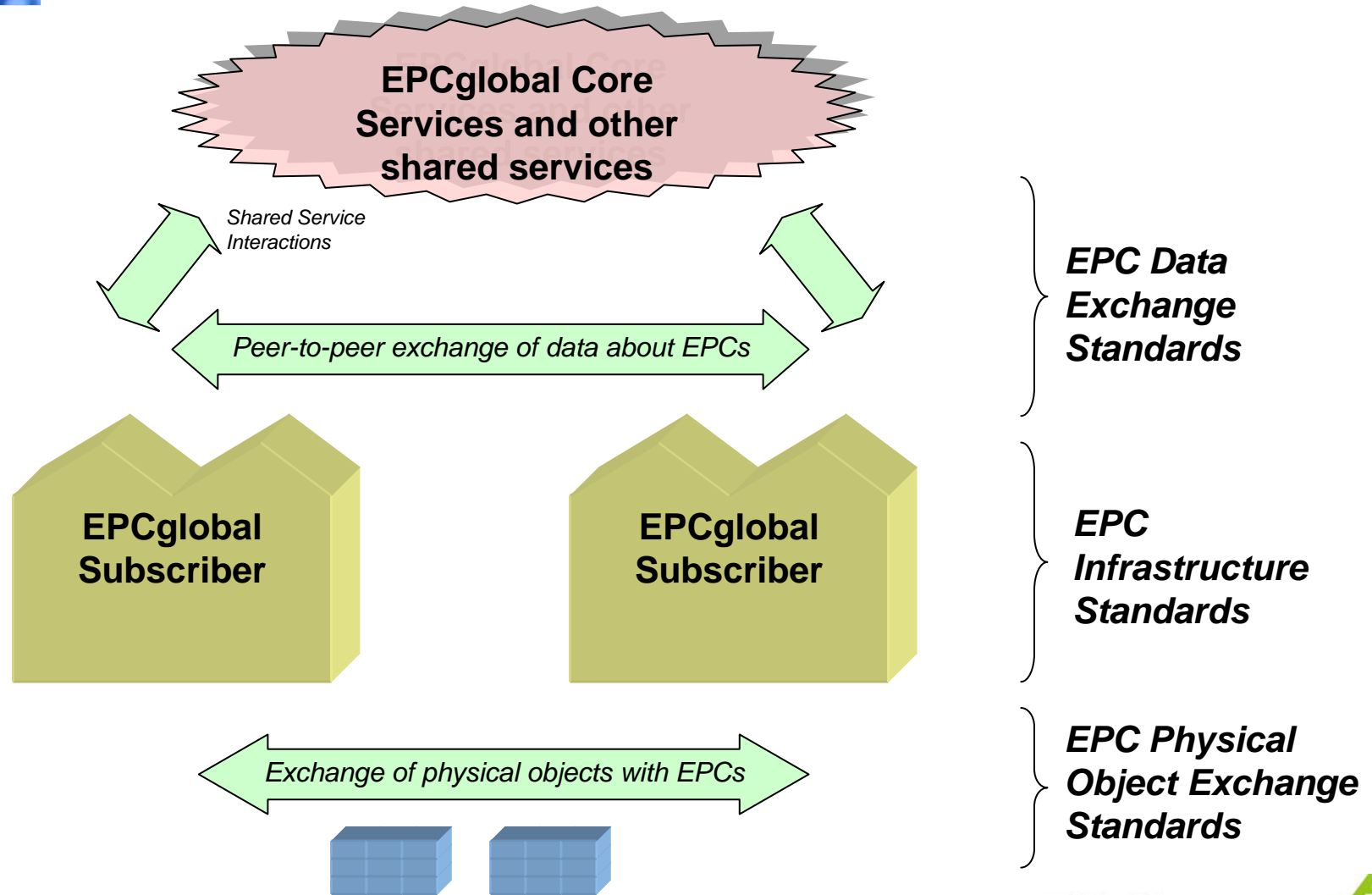


# Agenda

- The Architecture Review Committee (ARC)
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  - Infrastructure standards
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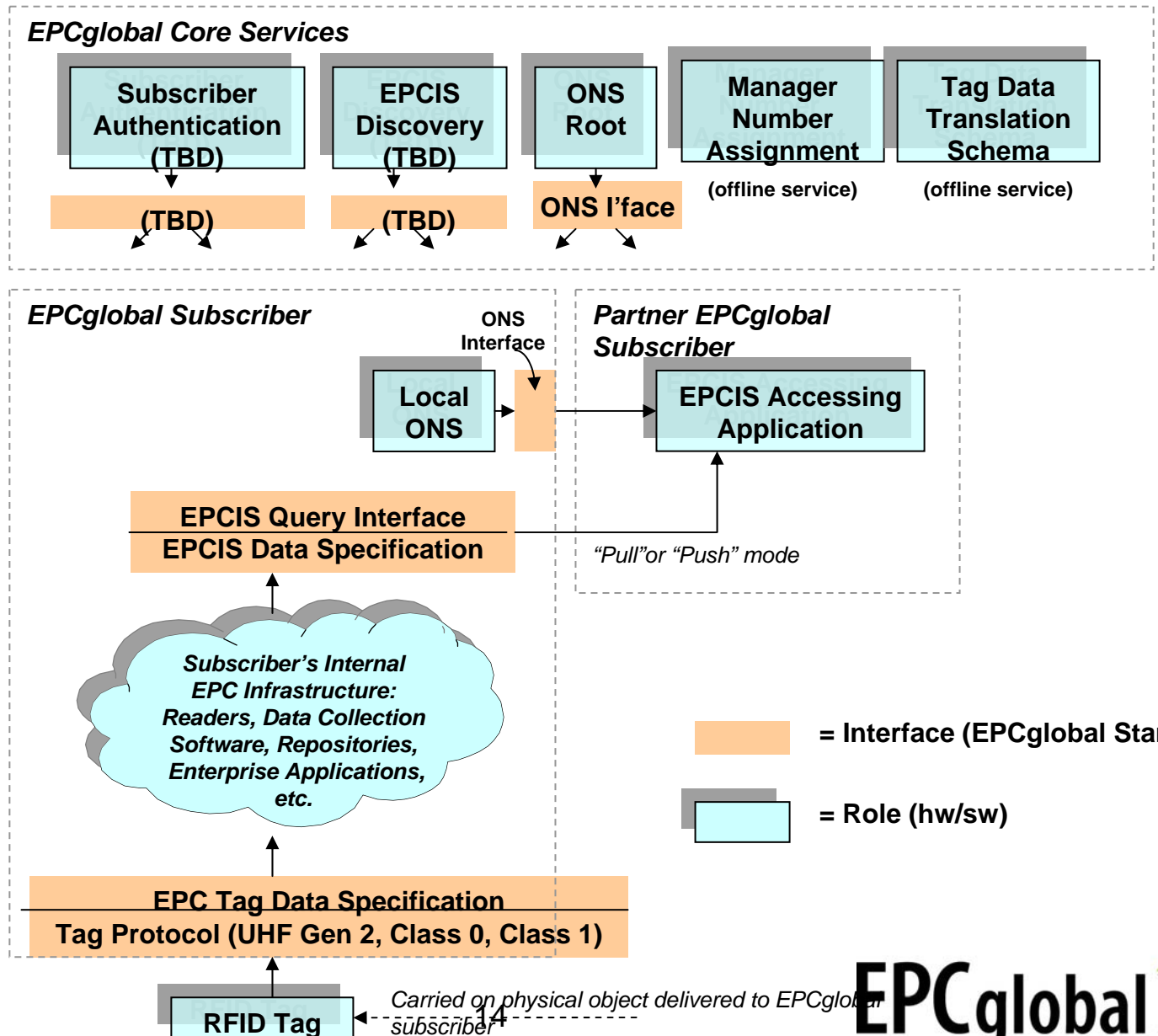


# EPCglobal Standards Overview



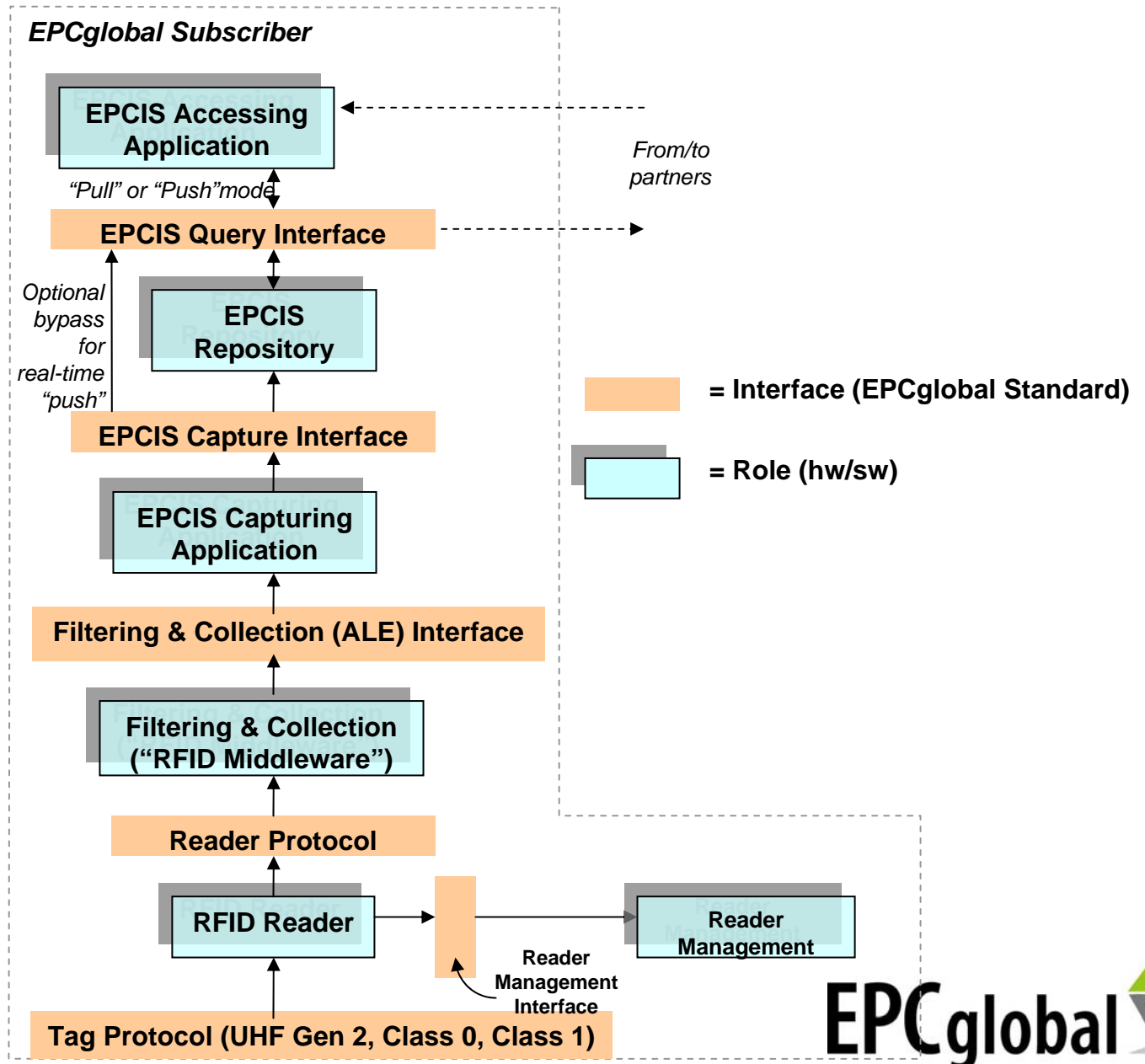


# Inter-enterprise Standards





# Intra-enterprise Standards



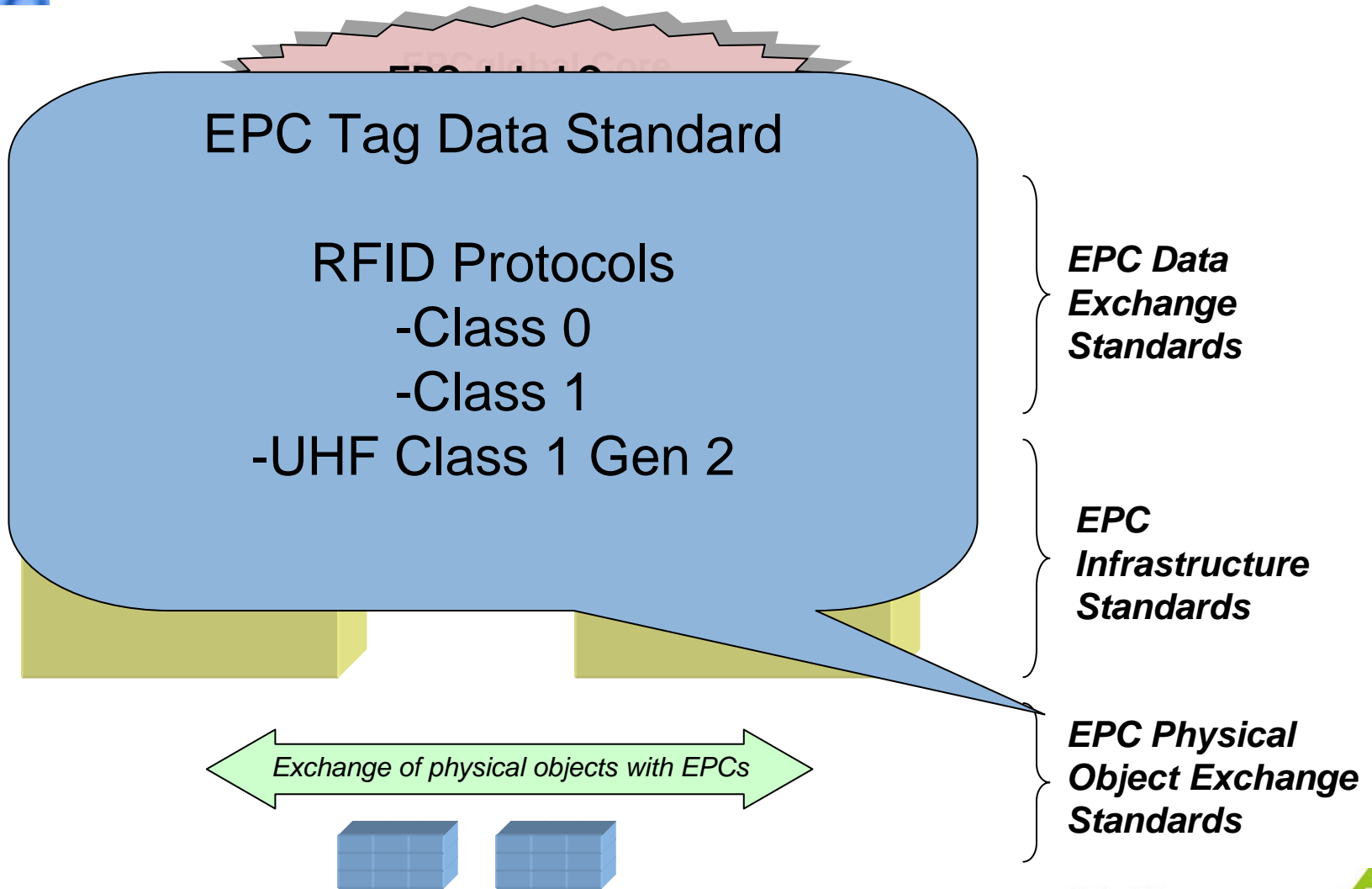


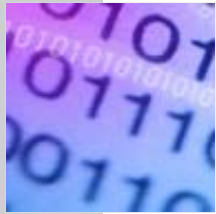
# EPCglobal Standards

Standard	Status	Comments
Tag Data Standard	Version 1.27 Ratified	Replaces version 1.24 Under development 1.3
G2 Air Interface	Version 1.09 Ratified	Certification Completed
Reader Protocol	Under Development 1.1	Under Development 1.2
Tag Data Translation	Under Development 1.0	
Reader Management	Under Development 1.0	
Filtering and Collection (ALE)	Version 1.0 Ratified	Under Development 1.1
EPC Information Services	Under Development 1.0	
Object Naming Service	Version 1.0 Ratified	
Security (EPC IS Security Profile)	Under Development 1.0	



# EPCglobal Standards Overview



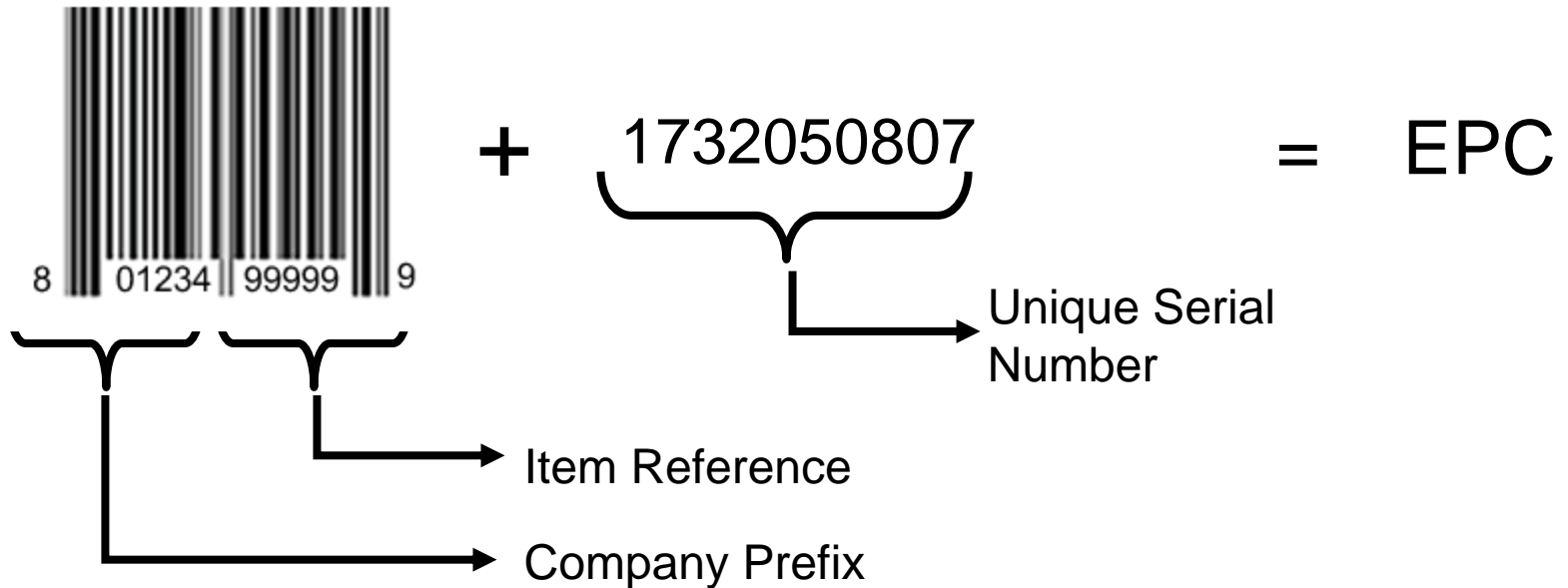


# EPC Tag Data Standards

- Standards for the assignment and encoding of identities for physical objects, locations, loads, assets, etc.
- A federation of different coding schemes
  - EAN.UCC (GS1)
  - DoD (CAGE, DoDAAC)
  - VIN (Auto) [future?]
  - IATA (Airline) [future?]
- Opportunity for supply chain convergence
- Defined representations for
  - Data interchange (text)
  - RFID tag encoding (binary)



# Electronic Product Code



- Every item has distinct serial number
- Capacity for 200 billion serial numbers per item class (on 96-bit tag)
- New business processes based on tracking individual things



# EPCglobal Tag Data Standards (version 1.27)

<b>Identity Type</b>	<b>Tag Encodings</b>	<b>Related Code</b>
GID	GID-96	
SGTIN	SGTIN-64 SGTIN-96	GTIN (with added serial #)
SSCC	SSCC-64 SSCC-96	SSCC
SGLN	SGLN-64 SGLN-96	GLN (with additional serial #)
GRAI	GRAI-64 GRAI-96	GRAI
GIAI	GIAI-64 GIAI-96	GIAI
DoD	DoD-64 DoD-96	CAGE, DoDAAC



# Tag Data Standards - EPC Formats

- Binary – on-tag representation

`001100000111010000100101011110111110100011000100101111100000000000000000000000000000010`

- Tag URI – in software when all tag info needs to be represented

`urn:epc:tag:sgtin-96.3.0614141.100743.2`

- Pure Identity URI – just the EPC

`urn:epc:id:sgtin:0614141.100743.2`



# RFID Protocols

- “Over the Air” interface – tag to reader
- UHF Generation 2 improves upon Auto-ID Center’s Class 0 and Class 1 Standards
  - Worldwide operation
  - Improved performance



# UHF Class 1 Gen 2 Features

Requirement	Gen2 Capability
Global Regulatory Compliance	Europe, North America, Japan, etc.
Operation in Noisy Environments	Multiple Sessions, Dense Reader Modes
Fast Operation	> 1600 tags/sec USA, 600 tags/sec Europe
Privacy Protection	EPC code not broadcasted, 32-Bit Kill Password
Improved Accuracy	Elimination of "Ghost Reads", Adaptive Protocols
Memory <i>Write</i> Capability	> 7 tag/second write rate, Optional User Memory
Group Searches & Filtering	Flexible <i>Select</i> Command
Low Cost	Multi-Vendor Availability
Flexibility	Tolerates Identical EPC numbers & Multiple EPCs
Certified products	Currently Available (starting in Q1 2005)



# How Gen2 works



Step 1.

Reader RF settings:

- Country
- Aggressiveness
- Reader density

Reader is now ready

Tag population

2. Reader selects tags

Selected population

3. Reader does anticollision

Single tag identified

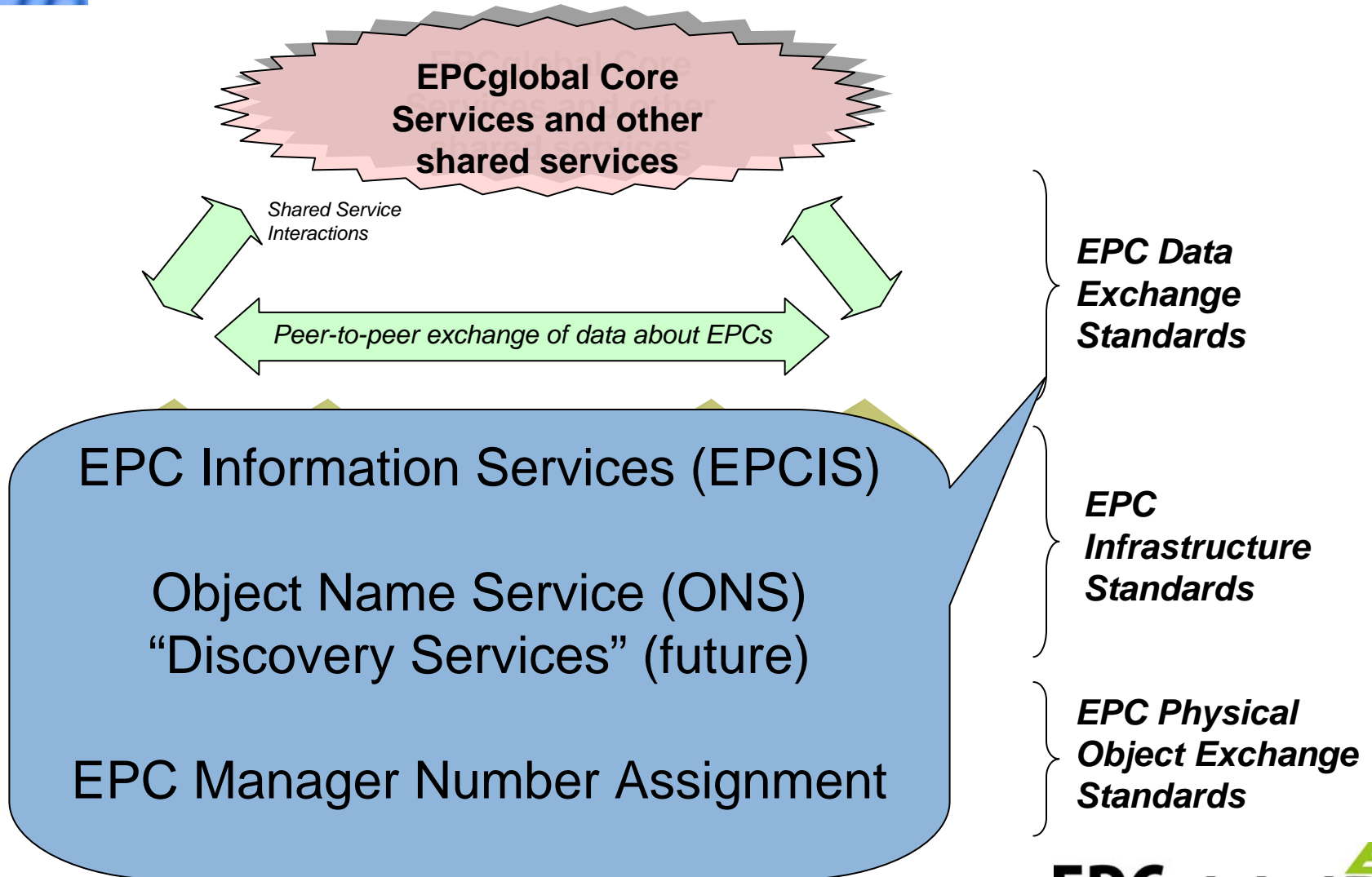
4. Reader accesses tag

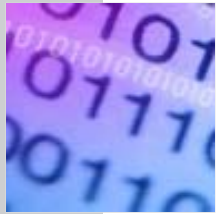
*repeat*

Tag is read/written to/killed



# EPCglobal Standards Overview





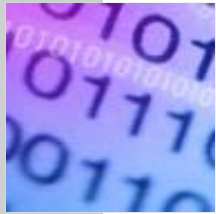
# Software Standards – EPCIS

- EPC Information Services
- Exchange of business-level EPC data:
  - “What, where, when, and why”
  - At business process level
  - Within enterprise and across enterprises
- Defined in layers:
  - Abstract data model (generic)
  - Data definitions (industry-specific)
  - Services (how to create & access)
  - Binding (to specific transport & protocols)
- Supercedes Auto-ID Center PML



# Core EPCIS Event Types

- **Object Events**
  - Observation of a collection of EPCs during Business Step at a Location & Time.
  - *This list of EPCs was observed entering DC #9 at 10:01AM, during Receiving.*
- **Aggregation Events**
  - Physical association of a set of EPCs with a parent EPC along with a Business Step at a Location & Time.
  - *This list of EPCs was just Palletized with this Pallet EPC at Palletizer #27 at 12:32PM.*
- **Quantity Events**
  - Statements about an EPC Class (not individual EPCs), a quantity, a Location & Time.
  - *There were 200 bottles of Brand X cola in store #4123 backroom at 3:20PM.*
- **Transaction Events**
  - Records EPCs associated with a business transaction.
  - *Order number 123 was fulfilled with EPCs x, y and z.*

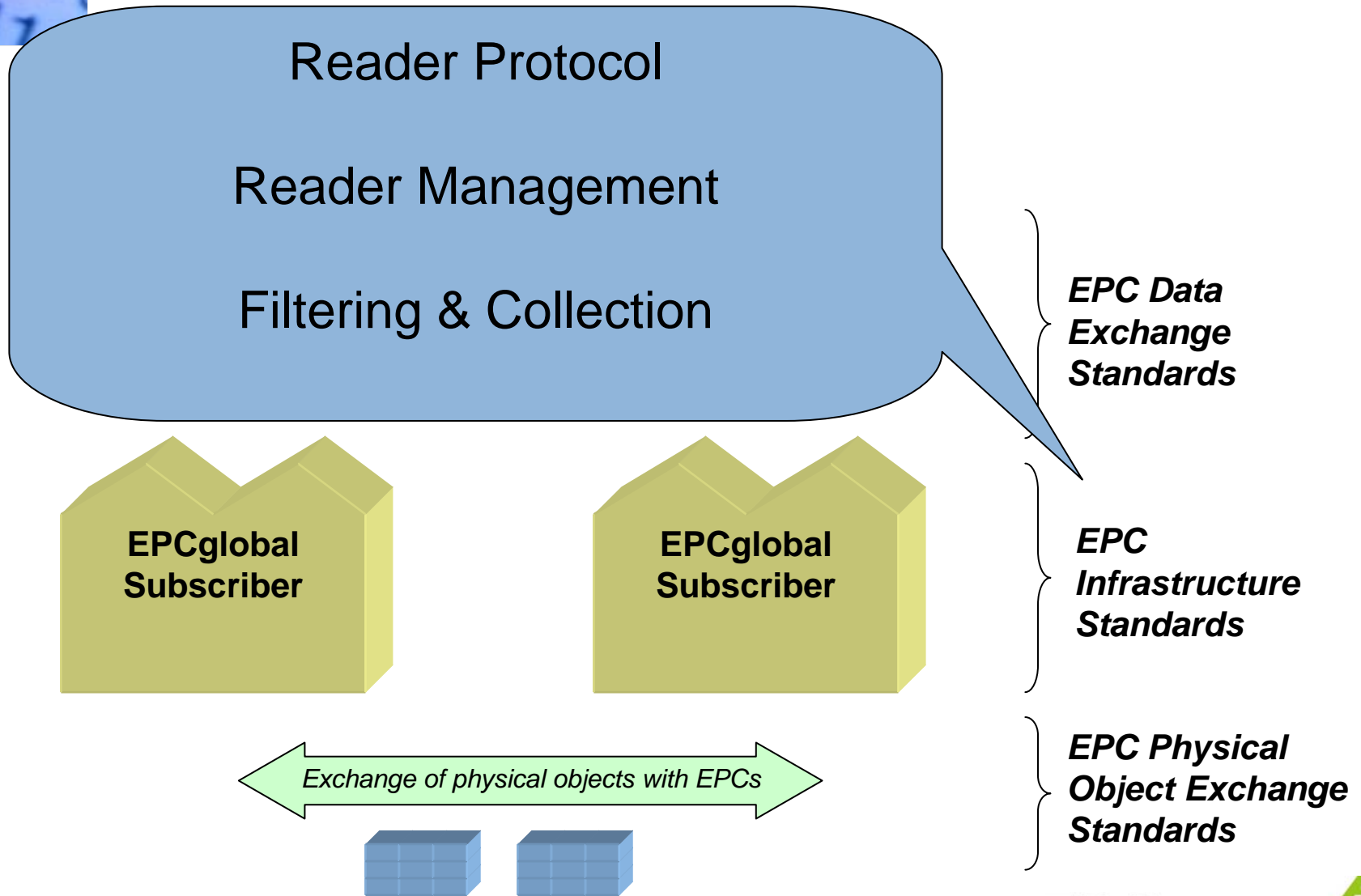


# ONS and Discovery Services

- Given an EPC, how do I locate EPCIS and other services providing data about that EPC?
  - Pre-arrangement (e.g., retailer knows its suppliers)
  - Object Name Service (ONS) – locates EPCIS of issuing authority for EPC (usually a manufacturer)
  - “Discovery Services” – TBD service for identifying multi-party supply chain participants for a given EPC



# EPCglobal Standards Overview





# RFID Reader Specs

- Reader Protocol
  - Defines a standard “wire” protocol for reader to host communication
  - Flexible, extensible command set
  - Variety of transport bindings
- Reader Management
  - Defines standard interface for managing readers

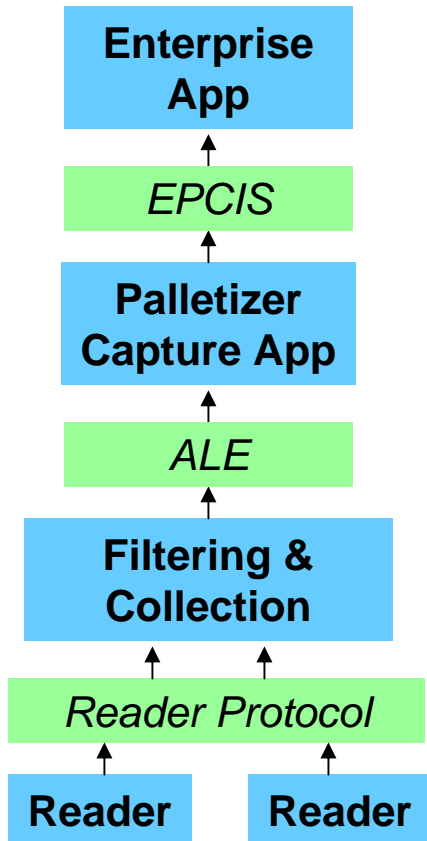
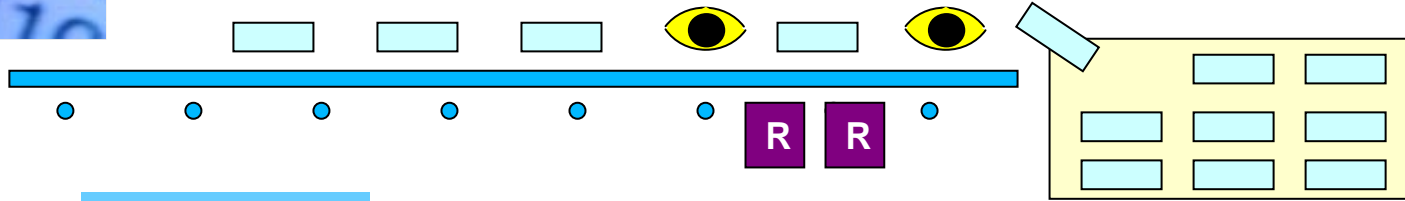


# Filtering & Collection

- Application Level Events (ALE)
- Provides applications with
  - Filtered, aggregated EPC data from multiple real-time sources
  - Declarative query language
  - Synchronous (“pull”) and asynchronous (“push”) data flow
  - Insulation from reader configuration and naming
- Supercedes Auto-ID Center “Savant” specification



# Example – Palletizer



*“at time  $T$ , the association of the following case tags to the following pallet tag was created at palletizer #3, to fulfill order #1234”*

*What, Where, When, Why*

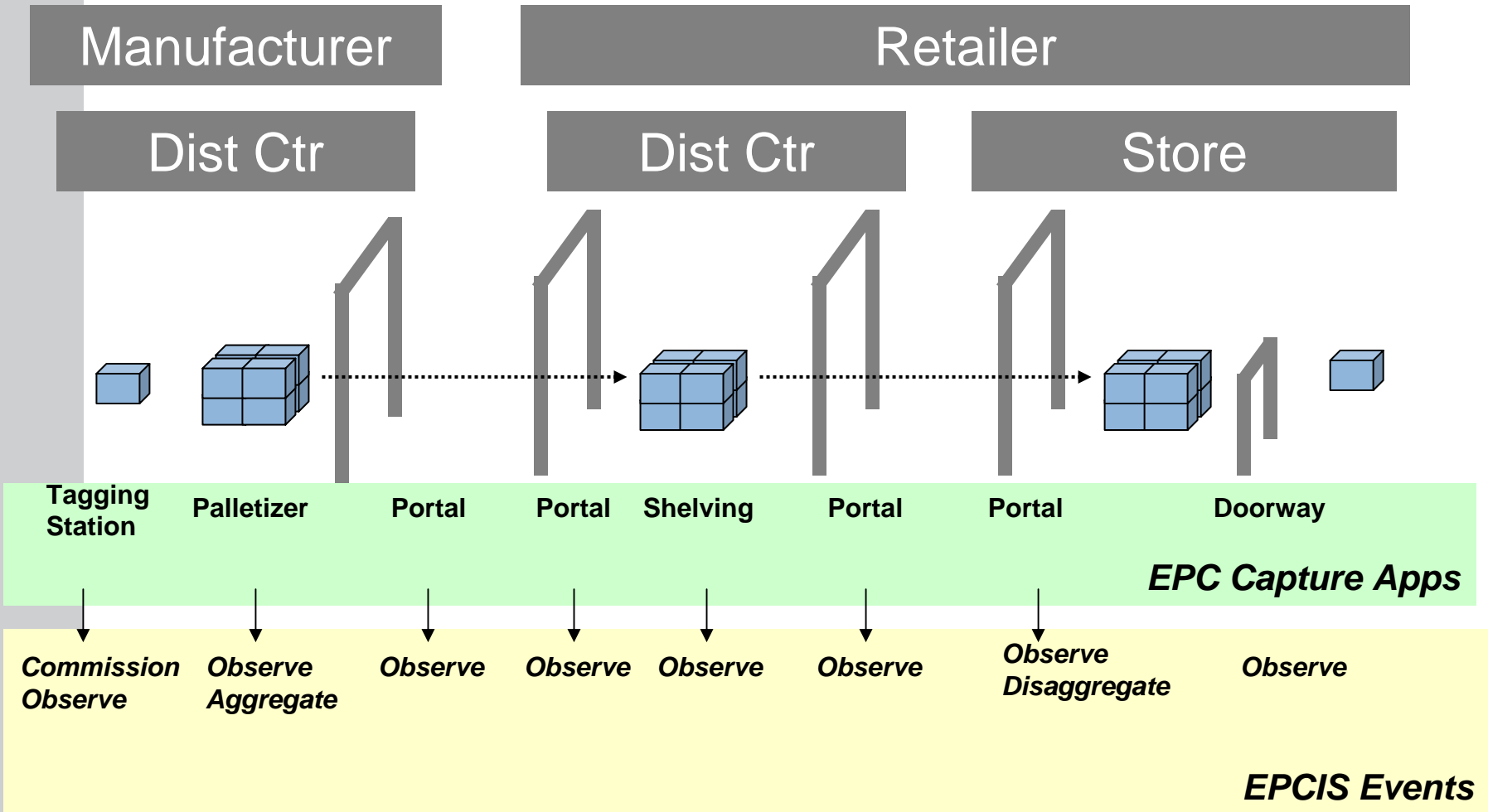
*“between the time the case crossed the first beam and the second beam at location  $L$ , the following tag was read”*

*What, Where, When*

*dozens of individual tag read events from specific antenna*



# RFID Capture Apps





# EPC Data – A Global Resource

Manufacturer

Retailer

Dist Ctr

Dist Ctr

Store

*Commission  
Observe*

*Observe  
Aggregate*

*Observe*

*Observe*

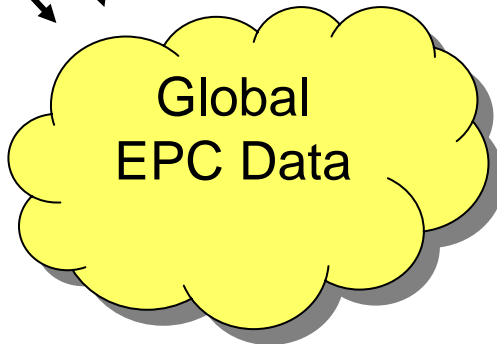
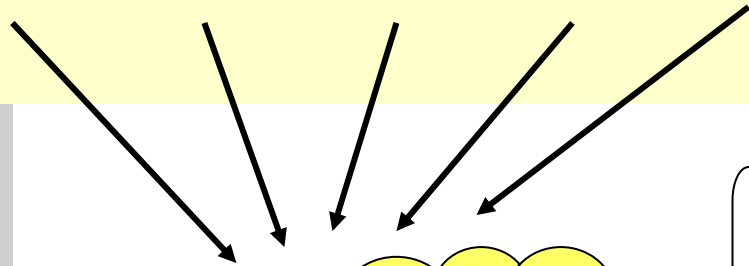
*Observe*

*Observe*

*Observe  
Disaggregate*

*Observe*

**EPCIS Events**

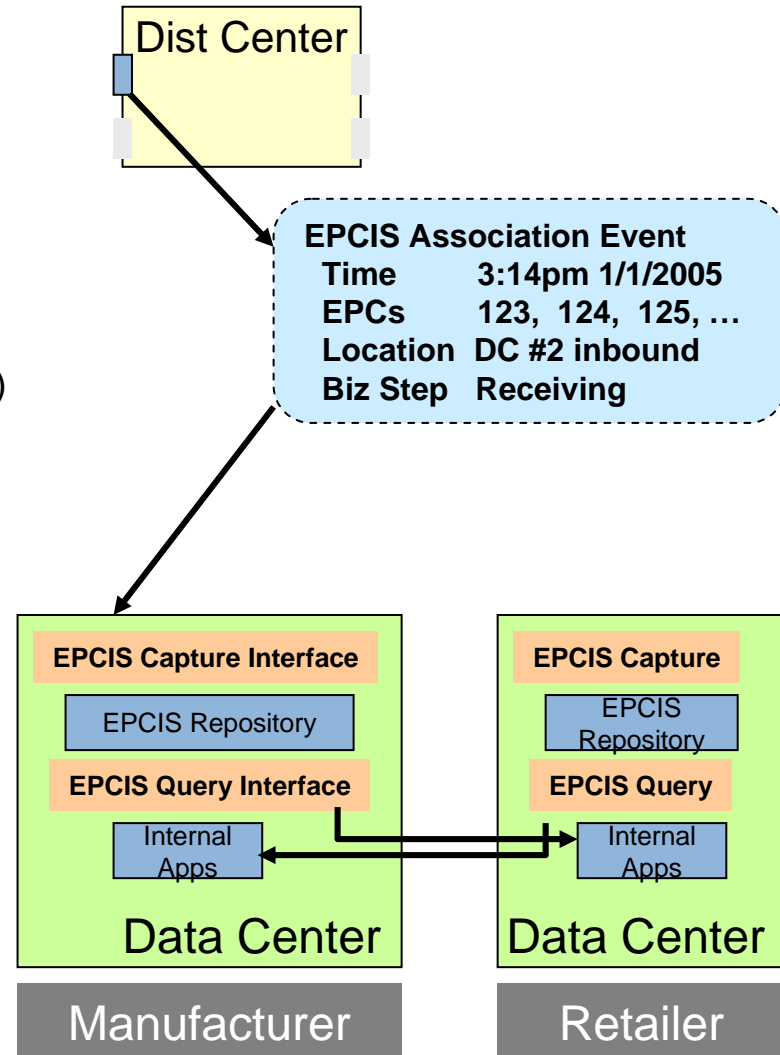


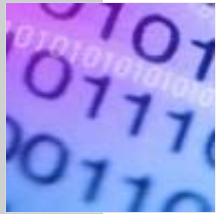
Case #123 of Cherry Hydro		
2/5 1:23pm	Mfr DC #2	Shipping
2/7 4:28am	Retail Store #5 back room	Receiving
2/8 5:23pm	Retail Store #5 front room	Observe



# Challenges Addressed in Current Pilots

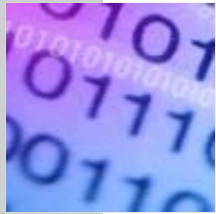
- EPCIS data must be meaningful to partners
  - Capture apps must abstract away from operational details.
- Partners must share understanding
  - Agreed terminology for business steps (“receiving”)
  - Master data to interpret location identifiers (“store #23 back room”)
- Global EPCIS “cloud” implemented by data exchange operations





# Agenda

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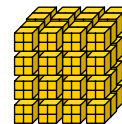
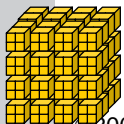
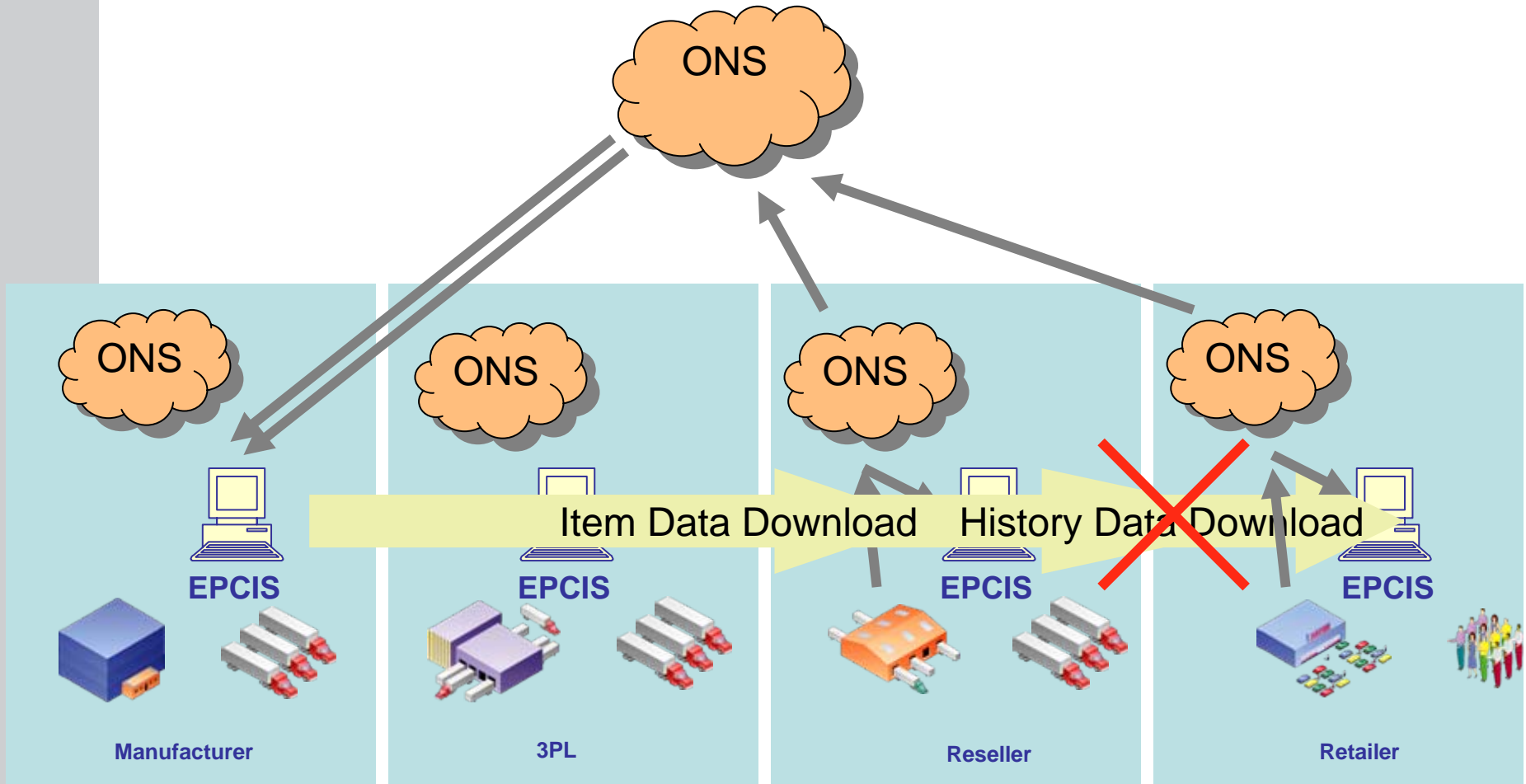


# ONS and Discovery Services

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  - Pre-arrangement (e.g., retailer knows its suppliers)
  - Object Name Service (ONS) – locates EPCIS of issuing authority for EPC (usually a manufacturer)
  - “Discovery Services” – TBD service for identifying multi-party supply chain participants for a given EPC
    - → So how might this work?



# ONS Doesn't Handle Multi-Step Chains



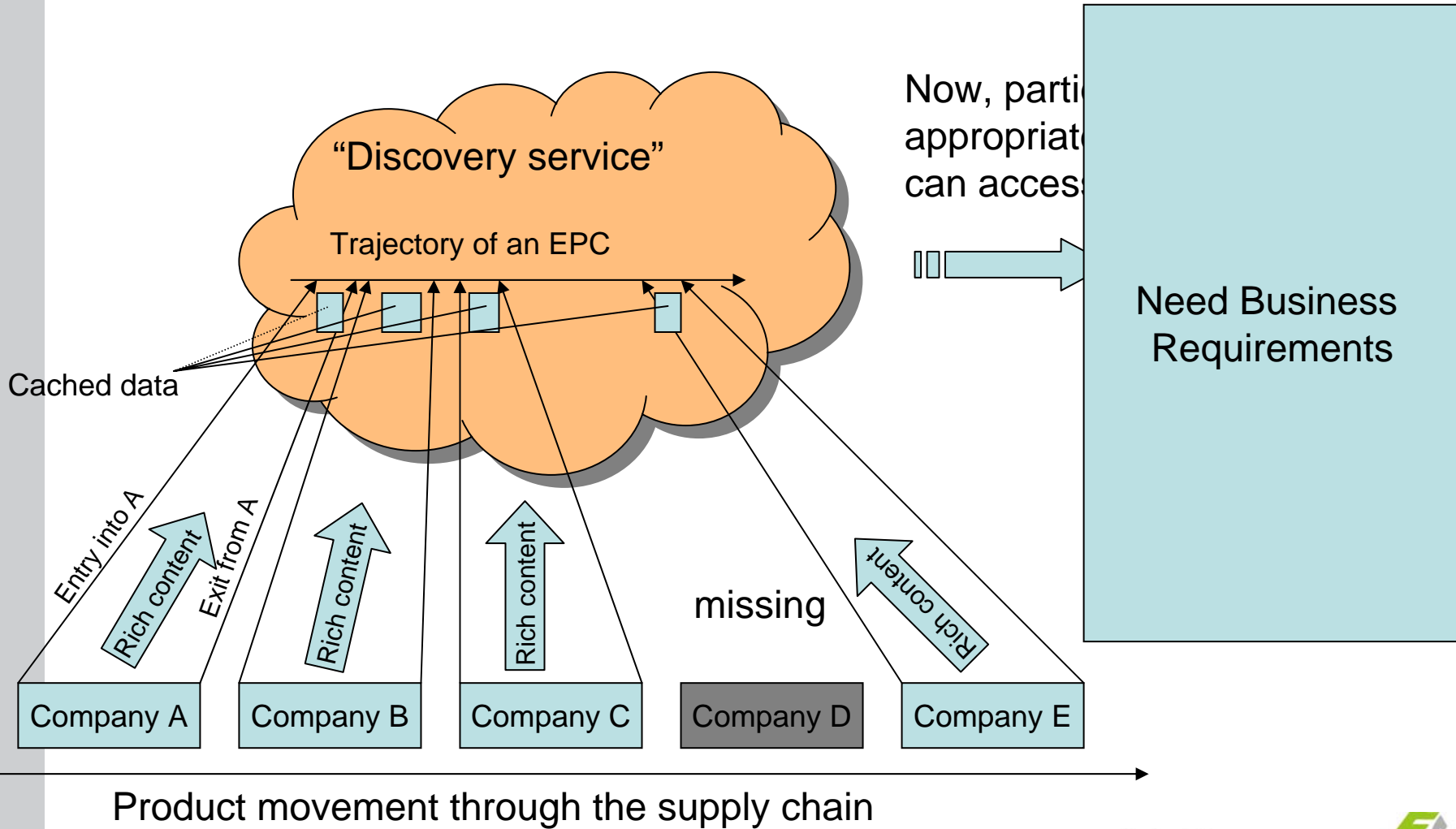


# Source of the problem

- **ONS points to the head-of-the-chain**
  - History needs to be recreated separately
  - Not robust to missing or broken links
  - Difficult to find current owner of EPC
- ONS enables “static discovery”.  
What is missing is “**dynamic discovery.**”



# Some ways to do this





**Any questions?**