
THE EPC NETWORK

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OUTLINE

1. What is the EPC Network?
2. Technology building blocks
3. Update on standards development
4. What's available now?



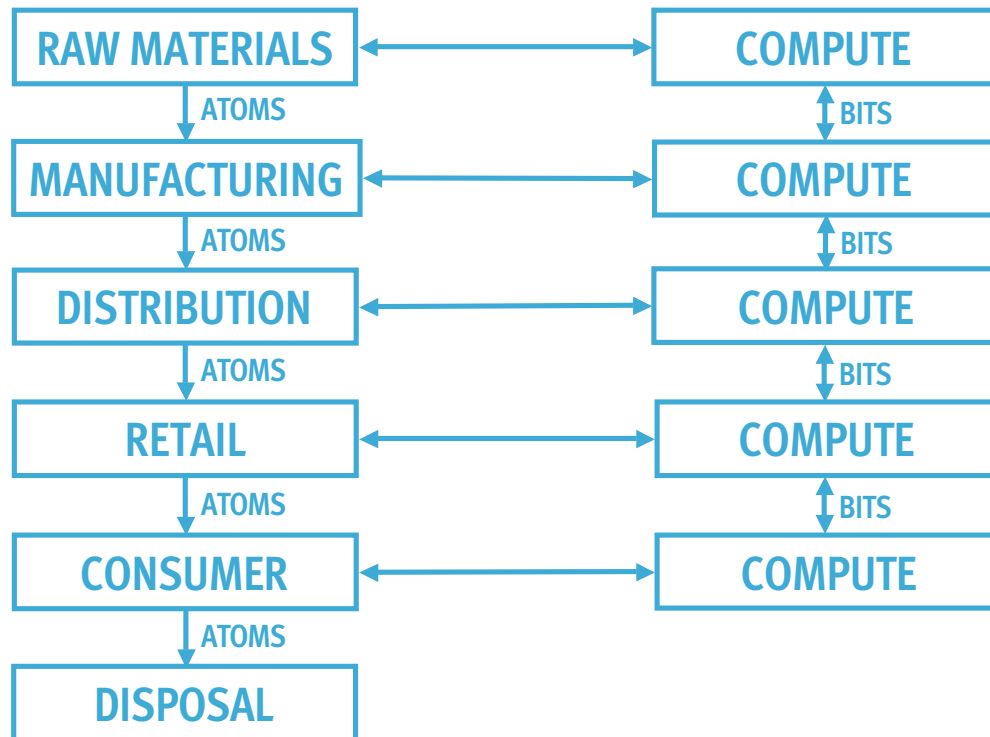
WHAT IS THE EPC NETWORK?

- More than just cheap passive RFID tags and EPC numbers
- A collection of technologies to build an ‘ Internet of Physical Objects ’
- The vision: “Identify any object anywhere automatically”
 - => a global system for widespread RFID deployment based on open standards and a unique identification code for the life of the object
- The vision: “Change the world by merging bits and atoms”
 - => synchronize flows of objects with flows of information about them



NETWORKS OF BITS AND ATOMS

Supply chain:
network of atoms



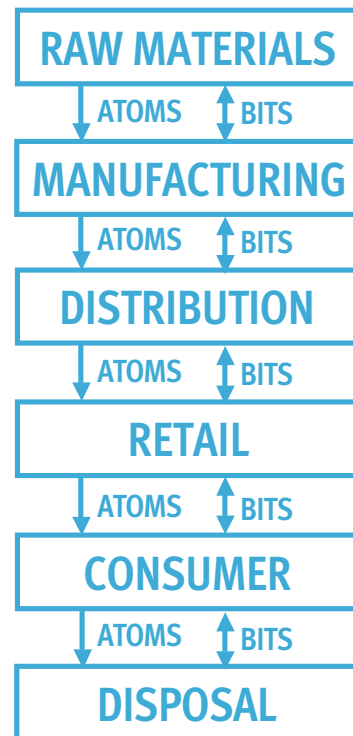
- E-commerce links them
- E-business extends this



NETWORKS OF BITS AND ATOMS

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network of atoms

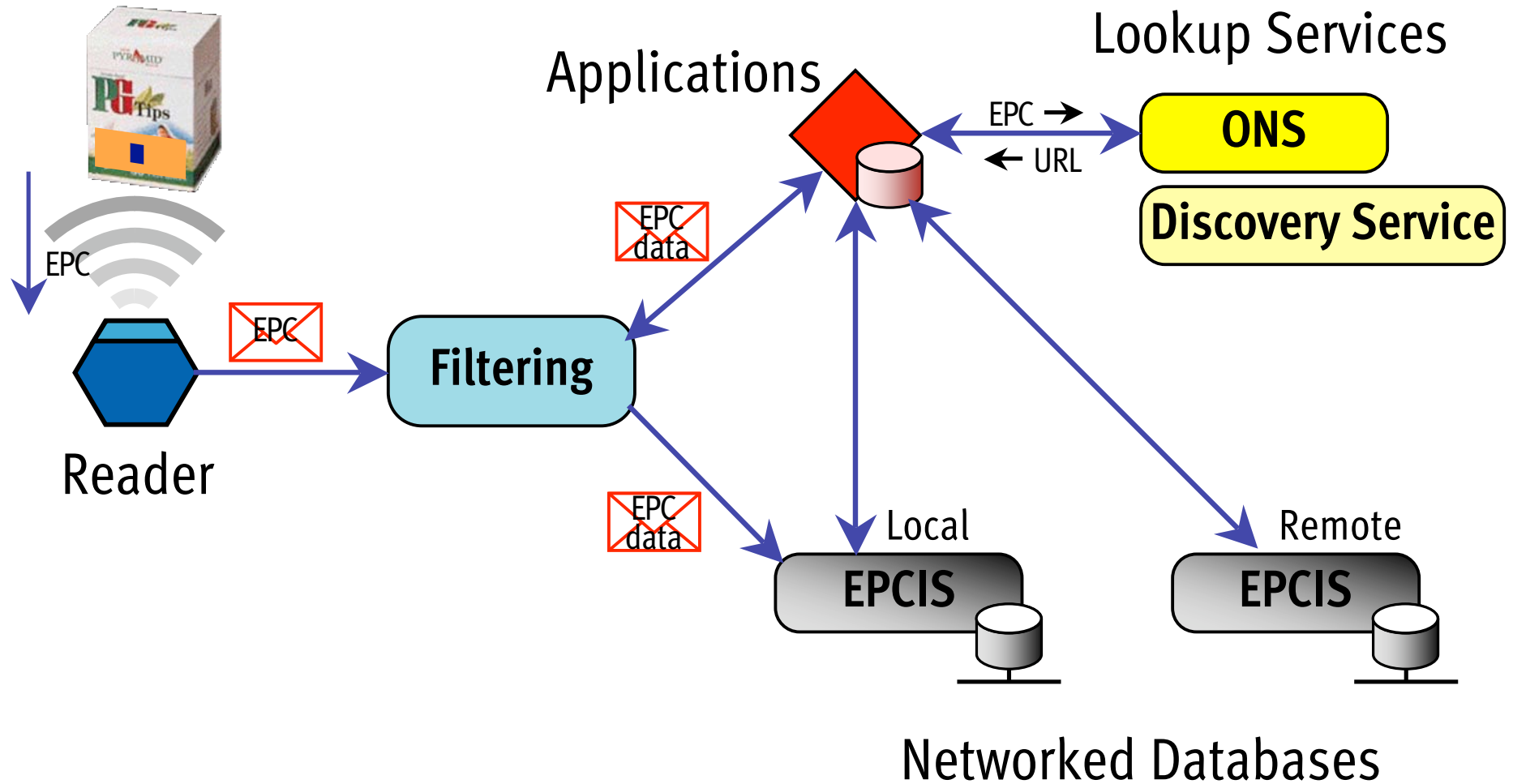
Internet:
network of bits



- EPC Network *merges* them
- ‘Internet of things’
- Everything is networked



TECHNOLOGY BUILDING BLOCKS



TECHNOLOGY BUILDING BLOCKS

1. Uniquely identifying items
 - EPC – electronic product code
2. Detecting the presence and identity of items
 - RFID – radio frequency identification
3. Storing item characteristics and movements
 - EPCIS – EPC information service (networked databases)
4. Passing the information across the network
 - Filtering Layer
5. Finding information within the network
 - ONS – object name service



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EPC – ELECTRONIC PRODUCT CODE

- EPC is a naming scheme for objects
 - Unique identifier for every object – includes serial number
 - Designed to be scaleable & extensible
- Decouple identity from data
 - Only store the EPC on an item
 - Additional information is held in a database and can be accessed using the EPC as a key
- Global, open standard
 - UCC/EAN support



STRUCTURE OF THE EPC

- The EPC can be thought of as the next generation of the barcode
- The barcode usually only goes as far as identifying product type.
- The EPC goes further and gives each instance of a product a unique serial number



01.0000389.000162.000169740

Header	Company Code	Product Code	Serial Number
8 bits	28 bits	24 bits	36 bits



TECHNOLOGY BUILDING BLOCKS

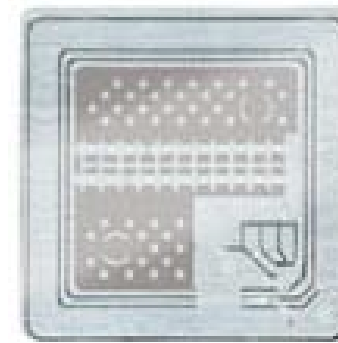
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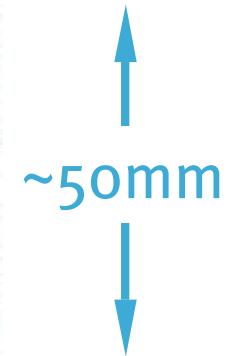
RADIO FREQUENCY IDENTIFICATION (RFID)

- Means of automatically identifying objects
- Two elements to RFID

Reader



Tag



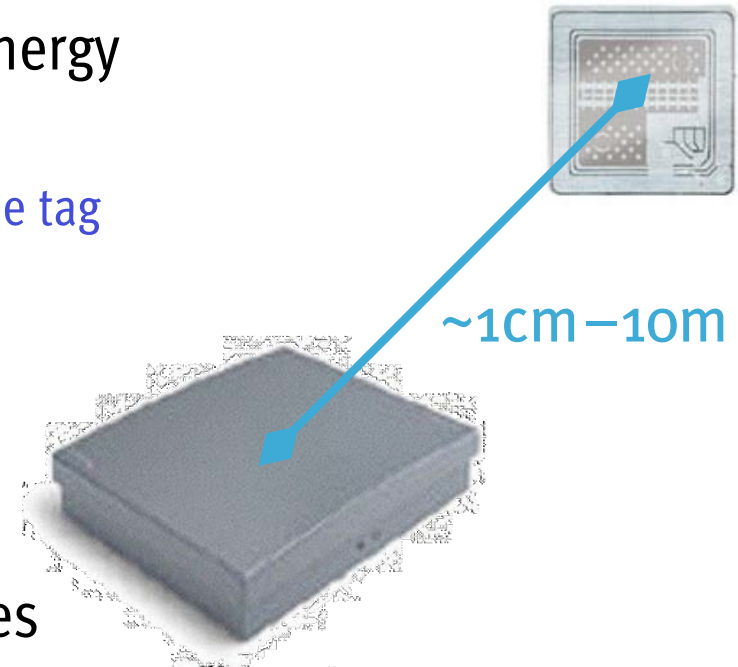
RADIO FREQUENCY IDENTIFICATION (RFID)

- Example:



RADIO FREQUENCY IDENTIFICATION (RFID)

- Reader transmits radio frequency energy
 - Provides power for the tag
 - Enables communication to and from the tag
- Typical operation
 - 64 bits to few kilobits of data
 - Range ~5mm to ~5m
 - 50-500 tags per second
- Significant advantages over barcodes
- Cost is the key



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EPCIS – EPC INFORMATION SERVICE

- Networked database
- Registry for event information and attribute data
- Support for updates and queries with defined interface

‘EPC-Related’ data	
Timestamped event data	Attribute data (often static)
Observations (Tag readings)	Attributes defined at serial level e.g. date of manufacture, expiry
Measurements (sensor data)	
Symbolic Location/Containment	Attributes defined at product level, e.g. mass, dimensions
EPC \leftrightarrow Transaction ID	

TECHNOLOGY BUILDING BLOCKS

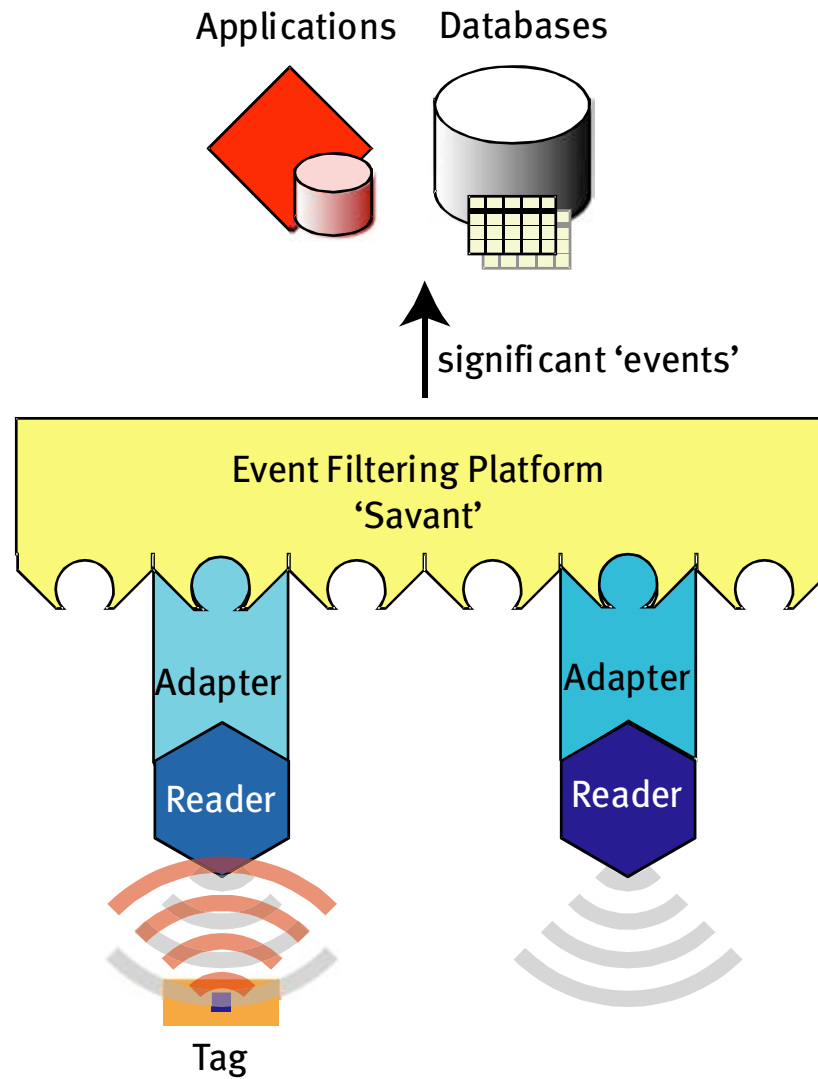
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EVENT FILTERING LAYER

- Software for collecting and filtering RFID data
 - Designed to deal with copious amounts of data
 - Generates higher level “events” based on raw data
 - OS-type platform provides common interface
 - Standardised communication formats
- Need additional middleware above filtering layer
 - More sophisticated processing
 - Interface with Business Information Systems

EVENT FILTERING PLATFORM



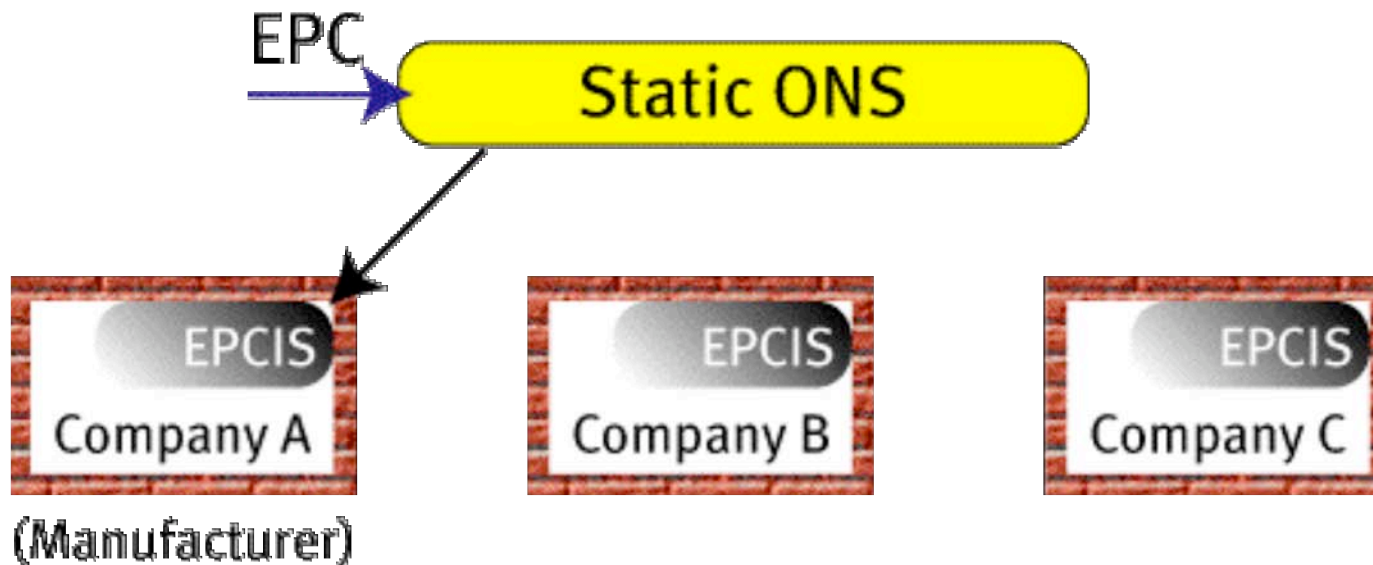
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ONS – OBJECT NAME SERVICE

- Redirection service – telephone book
 - For finding which database relates to a given EPC
- Similar to DNS, with additions

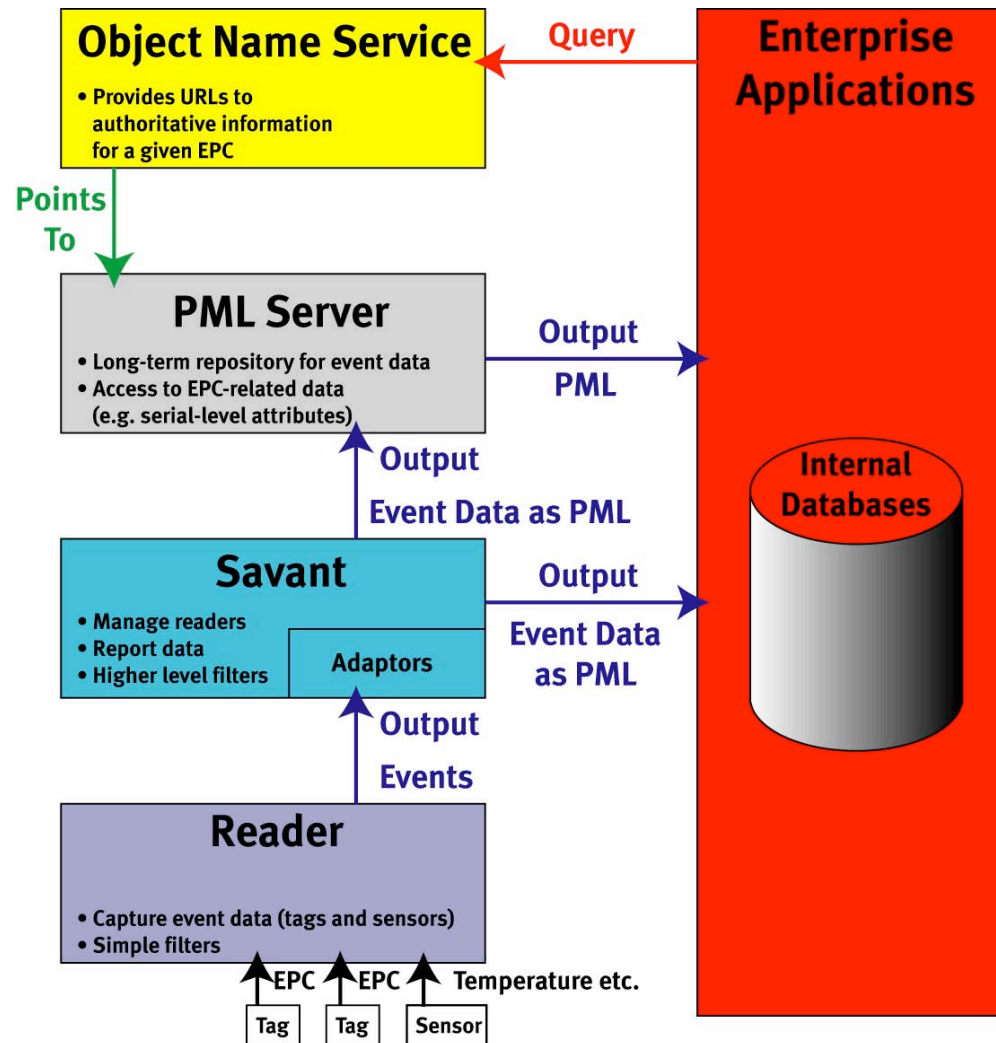


UPDATE ON STANDARDS DEVELOPMENT

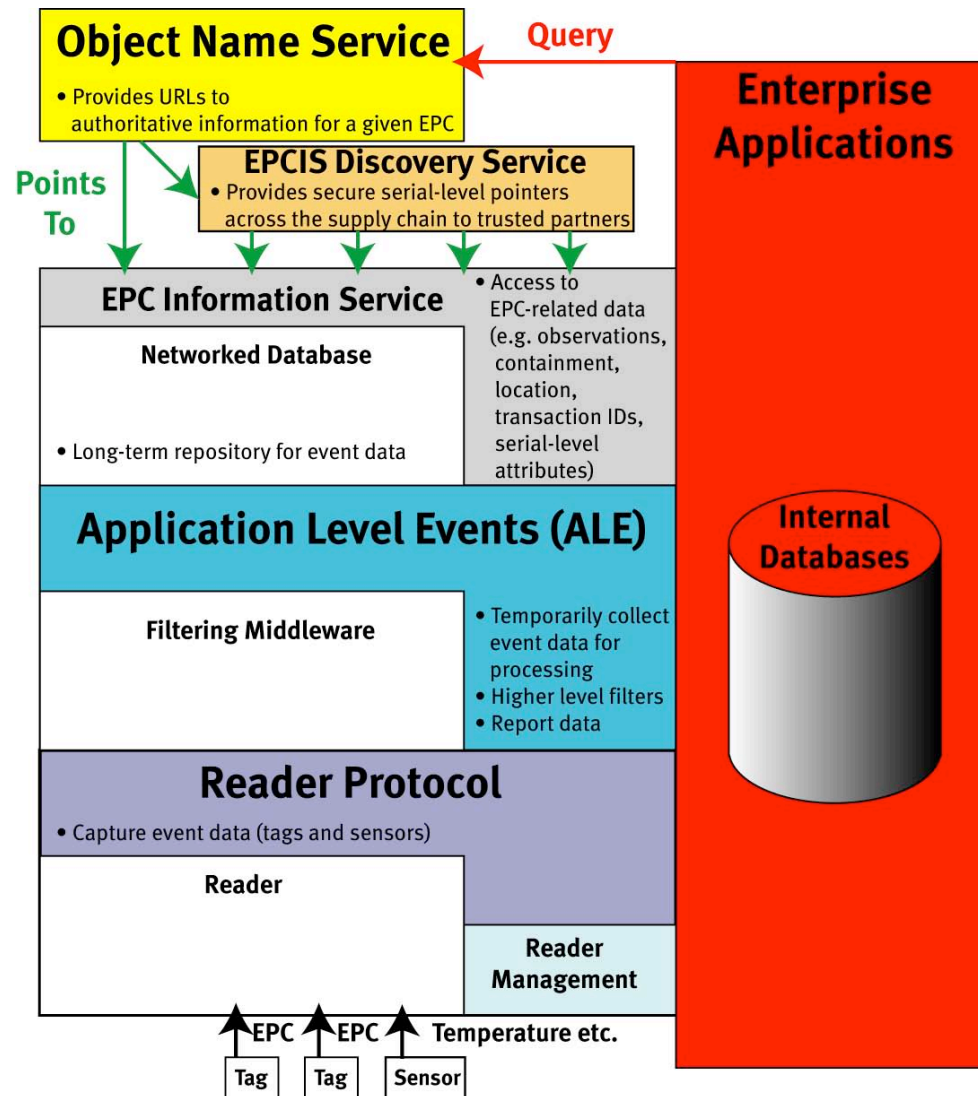
- Version 1.0 specifications were released in September 2003 at the EPC Symposium in Chicago.
- Over the last year, much of the EPC Network is being redefined in terms of interfaces between components.
- This recognizes that hardware and software may fulfill more than one role - e.g. smart readers which do some filtering
- It will also be easier to certify that products comply with particular well-defined interfaces in order to guarantee interoperability
- Many of these interfaces are being defined in terms of web service descriptions (WSDL) and XML schema (XSD).



THE EPC NETWORK - SEPTEMBER 2003



THE EPC NETWORK - SEPTEMBER 2004



CHANGES OVER THE LAST YEAR

The Electronic Product Code (EPC)

- The **Tag Data Standards** specification v1.1 (April 2004) now explains how to encode the following barcode numbers into EPC:
GTIN, SSCC, GLN, GRAI, GIAI
for both 64-bit and 96-bit tags, Class 0 and Class 1
- Companies re-use their existing EAN.UCC Company Prefix as the manager number for EPCs which embed the GTIN, SSCC etc.
- EPCs will be expressed in information systems in URI format
- EPCs now include a ‘fast-filter’ value to allow filtering / suppression based on packaging level etc.

EPC TAG DATA TRANSLATION

SGTIN-96 Encoding

PARTITION VALUES FOR SGTIN-96

	Company Prefix		Item Reference	
	Bits	Digits	Bits	Digits
P	M	L	N	
0	40	12	4	1
1	37	11	7	2
2	34	10	10	3
3	30	9	14	4
4	27	8	17	5
5	24	7	20	6
6	20	6	24	7
P	M	L	N	

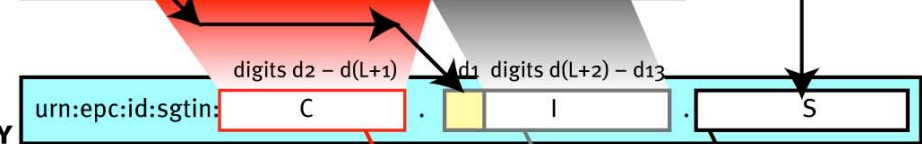
P=4 M=27

Convert to binary, left-pad with zeros to reach 3 bits

L=8
L = length of Company Prefix
Item Reference



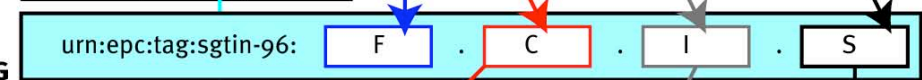
PURE IDENTITY



FILTER VALUES

Type	Binary Value	Decimal Value
Other	000	0
Item	001	1
Inner Pack	010	2
Case	011	3
Load/Pallet	100	4

TAG ENCODING

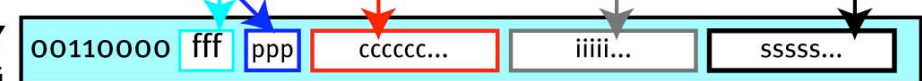


Convert to binary, left-pad with zeros to reach M bits

Convert to binary, left-pad with zeros to reach [44-M] bits

Convert to binary, left-pad with zeros to reach 38 bits

BINARY STRING



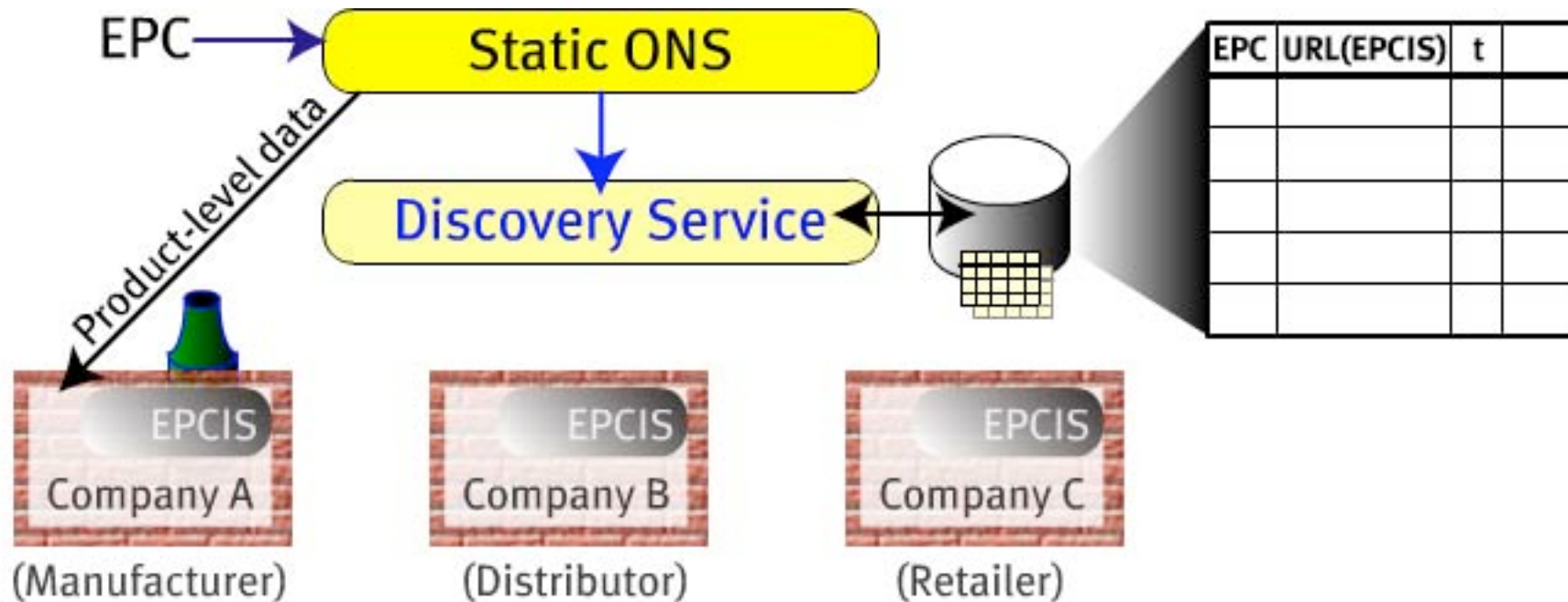
CHANGES OVER THE LAST YEAR

Object Name Service (ONS)

- The **Object Name Service** specification v1.0 does not provide serial-level pointers - only class-level ('SKU-level') pointers.
- ONS queries are simply DNS queries for NAPTR (Type 35) DNS records based on querying for a hostname formed from a re-arrangement of the pure-identity URI format of EPC. ONS no longer has a bit-level pre-resolver.
- For serial-level pointers which change very dynamically, it may be inappropriate to use DNS technology.
- To provide serial-level track & trace across the supply chain, the **EPCIS Discovery Service** is under development

EPCIS DISCOVERY SERVICE

- The registry is updated by each custodian on handover, with serial-level EPC lookup

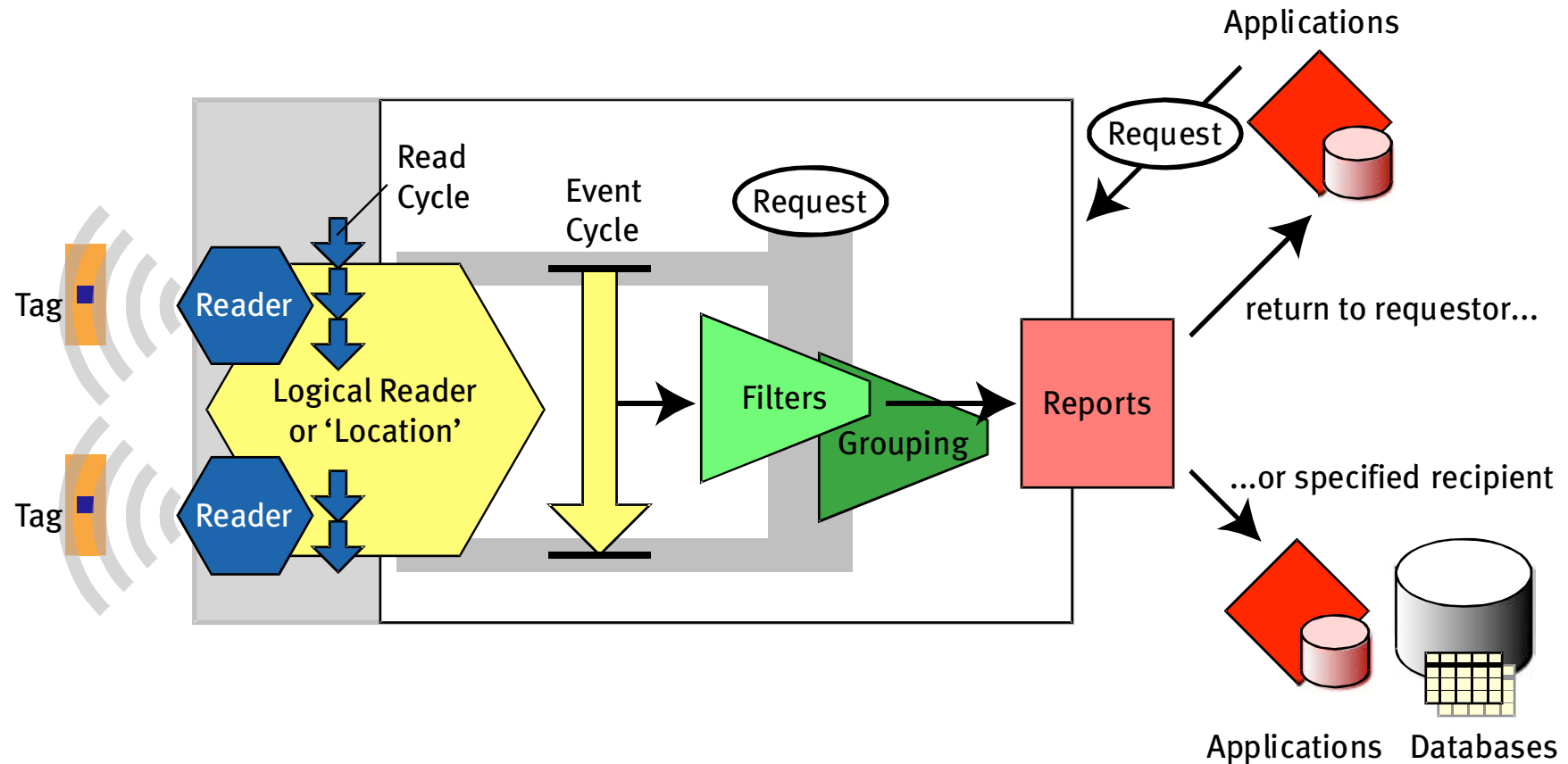


CHANGES OVER THE LAST YEAR

Filtering, Collection & Reporting (formerly 'Savant' - now 'Application Level Events', ALE)

- ALE defines a web-service (WSDL) interface for clients to access the filtering layer, as well as well-defined XML schema for the reports
- Clients can request reports either on one-off or recurring basis, both polling and publish/subscribe are supported.
- Clients specify the boundaries (start/stop time/triggers) of the collection & reporting period ('event cycle'), which filtering and grouping (e.g. by product class / GTIN) to apply, and where to send the report (requestor or third party)
- Reports contain a single timestamp, indicate which logical reader, and a list of EPCs containing no duplicates - may be current set or changes since last event cycle (appearances / disappearances)

'APPLICATION LEVEL EVENTS' (ALE)



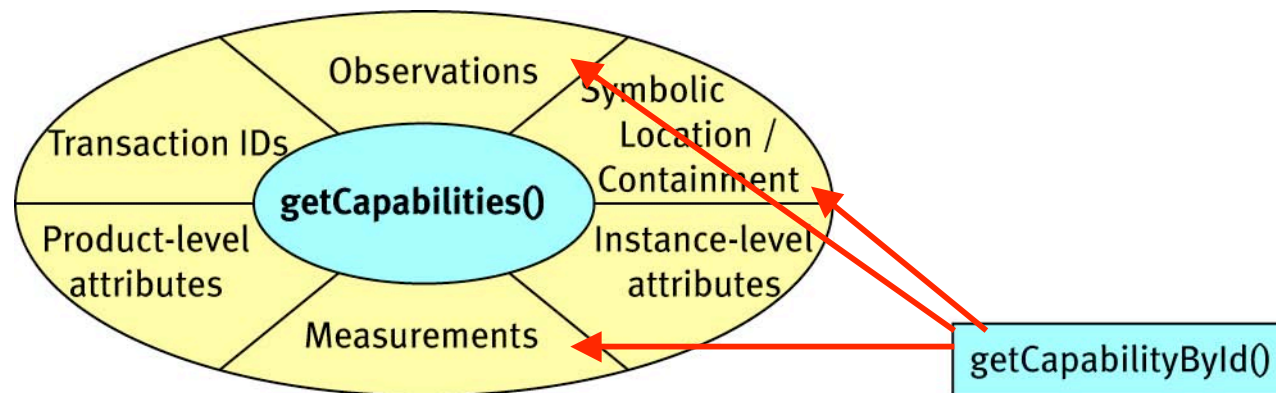
CHANGES OVER THE LAST YEAR

Physical Markup Language (PML) and PML Service - now XML schema and EPC Information Service (EPCIS)

- No further work on Physical Markup Language. Application Level Events (ALE) and Reader Protocol define their own XML Schema - but ALE v1.0 reports do not contain as much granularity as PML did.
- EPC Information Service replaces the PML Server/Service and provides a client-side web-service interface to allow applications to query and provide updates to networked databases which store EPC-related data.
- The data models (relationships about observations, location, containment, business transactions) are under development and query/update methods are being formulated.

EPCIS - MODULAR DESIGN

- Modular design for EPCIS specification:



- Registered interface descriptions for each method or capability
 - specifies function names, input parameters, return values
 - probably in terms of WSDL files and existing XML schema for attributes (object properties)

EPC NETWORK: WHAT'S AVAILABLE NOW? - HARDWARE

- 64-bit passive tags (Class 0, Class 1) - mainly UHF
- 96-bit tags coming soon
- UHF Generation 2 protocol being finalised - next generation tags available within 6-12 months
- Readers are available - but check for upgradeability and whether they can read multiple frequencies, protocols



EPC NETWORK: WHAT'S AVAILABLE NOW? - SOFTWARE

- Object Name Service (ONS) is live - managed by Verisign Inc. under contract to EPCglobal.
- EPC Tag Data Standards explain how to convert your existing EAN.UCC barcode numbers into EPC tags - and extensible translation tools are under development.
- Many vendors have prototypes of networked databases and supply chain registries - but EPCIS standards are still under development - so it's important to check:
 - your upgrade options and
 - their involvement in ongoing standards development



WHAT'S AVAILABLE NOW?

- FURTHER INFORMATION AND TRAINING

- www.epcglobalinc.org
- www.autoidlabs.org
- or attend 'easyEPC for Implementers' tomorrow! (Oct 14th)

