



IN PARTNERSHIP WITH



# EPC

## CONNECTION

**Fourth Annual EPCglobal North America Conference & Exhibition**

**OCTOBER 2-4, 2007 ♦ DONALD E. STEPHENS CONVENTION CENTER ♦ CHICAGO, IL**



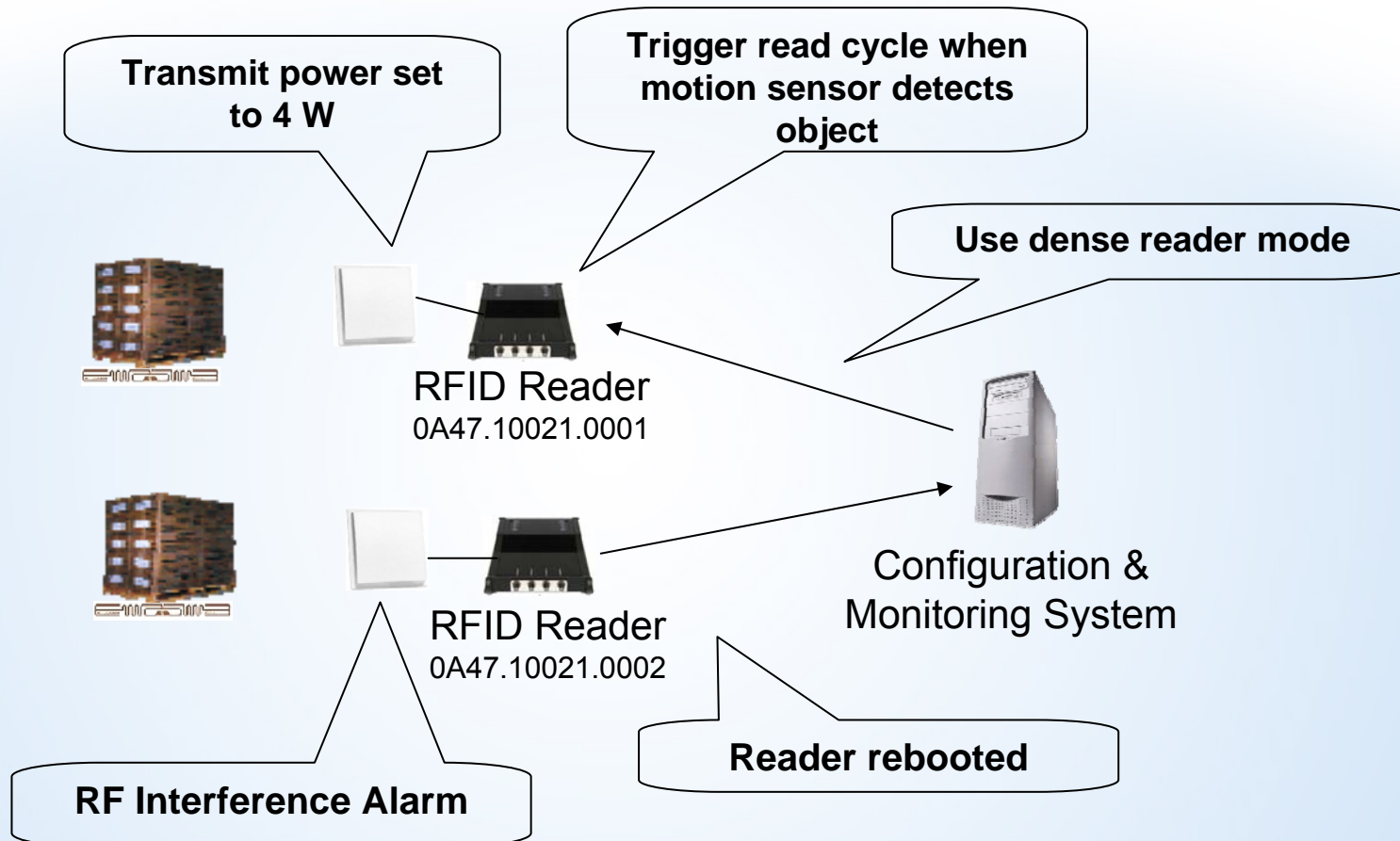
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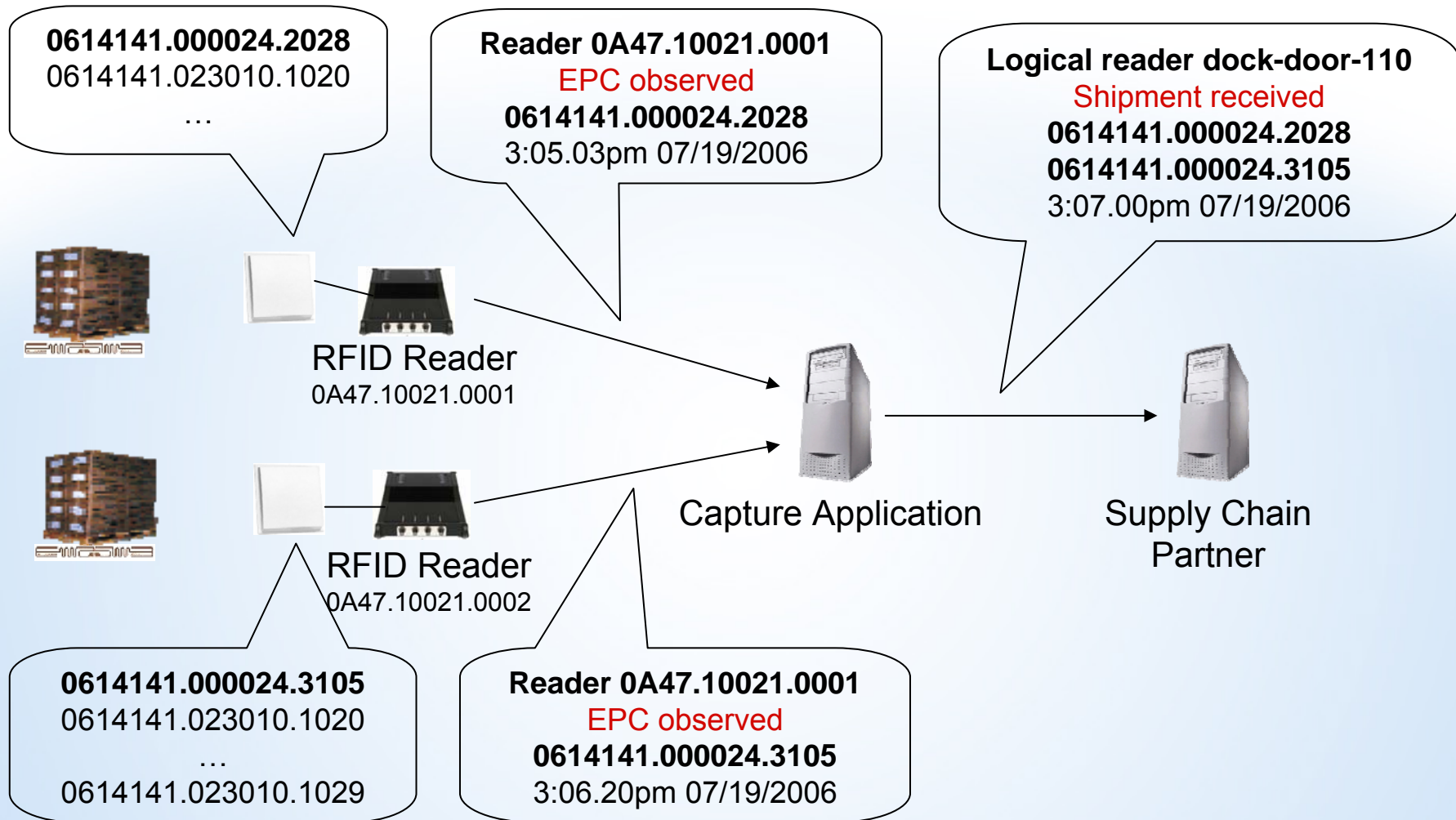
# How to Prepare for EPC Data Cost-Effectively

Christian Floerkemeier – MIT Auto-ID Lab

# Configuration & Monitoring



# Data Management



# Accada

- EPCglobal community developed a number of standards to address these issues:
  - ALE, RP, RM, LLRP, TDT, EPCIS
- Open Source Project **Accada** provides implementation of these standards

# Accada: Objective and Target Audience

- **Objective**

- Educate EPCNetwork users
- Drive adoption
- Promote research

- **Target Audience**

- EPC Novices
- System Integrators
- University Research Groups and Commercial R&D

# Background

- Based on RFID middleware work started at the Swiss Auto-ID lab back in **2003** in the days of the Auto-ID Center (PML, Savant, ...)

→ Initiated by the Auto-ID Lab St. Gallen/ETH Zurich, but it is **today** an **independent open source** effort

- With contributions from:
  - **other** Auto-ID Labs (Cambridge, MIT)
  - **external** open source developers

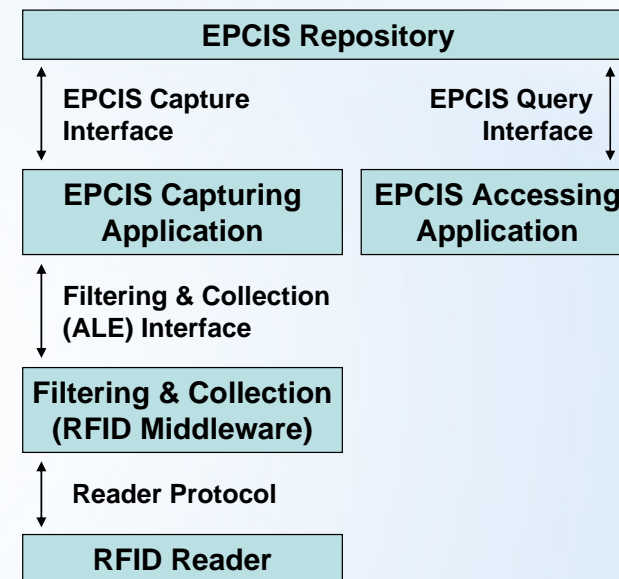
# Objective of this talk

- Show how you can use the Accada Prototyping Platform to **prepare** for EPC deployments
- Present 3 **case studies**:
  - Accada Tag Data Translation
  - Accada EPC Information Service
  - Accada Virtual Reader

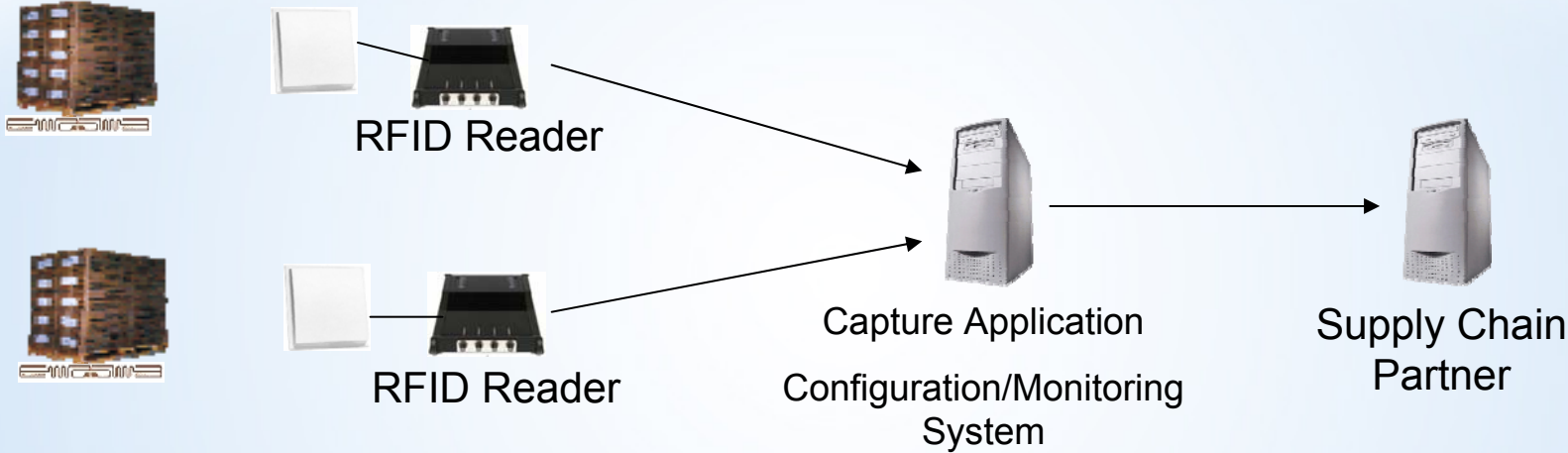


# Status – Specifications Supported

- Reader protocols (**RP** & **RM** & **(LLRP)**)
  - Control and management of RFID readers
- Filtering & Collection (**ALE1.0**)
  - Filtering and aggregation of captured RFID data
- EPC Information Services (**EPCIS**)
  - EPC Business event exchange among business partners
- Tag Data Translation (**TDT**)
  - Translation between different EPC representations



# Status – Specifications Supported



# TDT - What is an EPC?

An EPC is a globally unique identifier for an object



urn:epc:id:gid:123789.302414.169740



URN Prefix  
indicates  
coding scheme  
e.g. SGTIN, SSCC etc.  
8 bits (header)  
~ 254 schemes + more



EPC Manager  
indicates  
company  
(manufacturer)  
e.g. 28 bits  
>268 million



Object Class  
indicates  
product -type  
(‘SKU’)  
e.g. 24 bits  
> 16 million



Serial Number  
unique for each  
instance of  
a product  
e.g. 36 bits  
> 68 billion

Source: Mark Harrison – Auto-ID Lab Cambridge University



# Tag Data Translation (TDT) Specification

TDT is designed to provide the encoding/decoding rules for  
EPC

**unambiguously in machine-readable format**

Allows **flexible conversion** between

binary  $\leftrightarrow$  tag-encoding URI  $\leftrightarrow$  pure-identity URI

**at any layer of the EPC Network technology stack, as appropriate**

Source: Mark Harrison – Auto-ID Lab Cambridge University



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# TDT implementation is not straightforward!!!

## SGTIN-96 Decoding

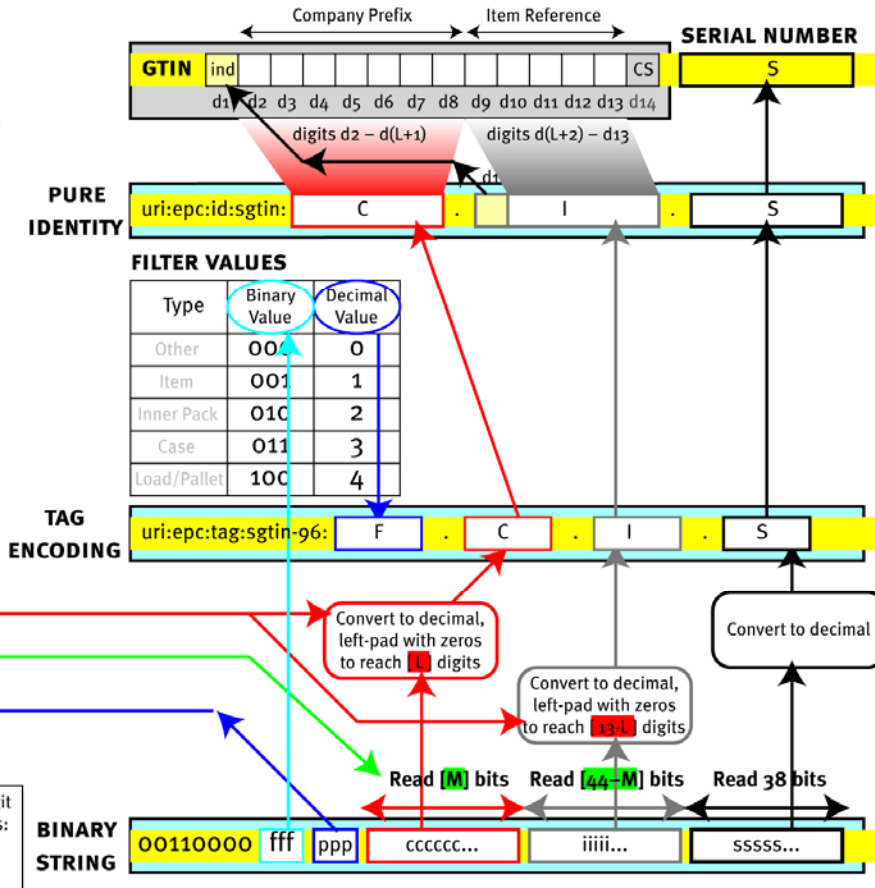
PARTITION VALUES FOR SGTIN-96

	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 L=8

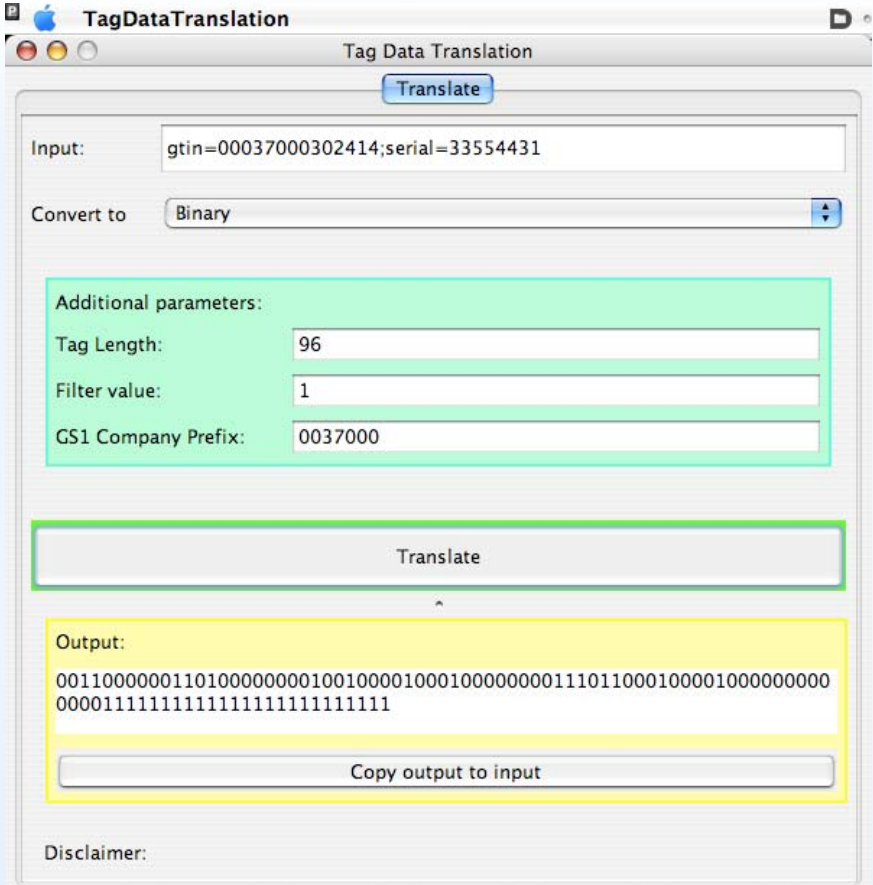
Convert to decimal

N.B. The checksum CS which is the fourteenth digit of the traditional GTIN needs to be recalculated as:  
 $d_{14} = CS = [-3(d_1+d_3+d_5+d_7+d_9+d_{11}+d_{13}) - (d_2+d_4+d_6+d_8+d_{10}+d_{12})] \text{ mod } 10$



Source: Mark Harrison – Auto-ID Lab Cambridge University

# Accada provides a **free** TDT implementation



Source: Mark Harrison – Auto-ID Lab Cambridge University

# Benefits of Accada TDT

- Generic translation & validation software:
  - Less need for bespoke solutions
  - Lower re-engineering costs to support new identifiers
    - ↳ Translation is commoditized
    - ↳ More robust, fewer errors
- Upgrading is as easy as dropping in new XML definition files and re-starting the software/device
  - ↳ Future proof



# Overview

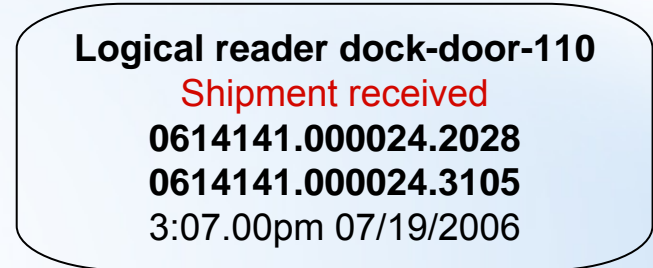
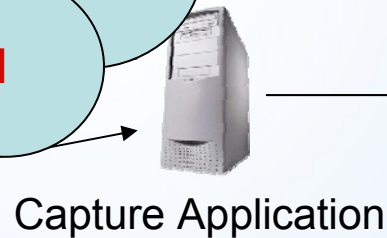
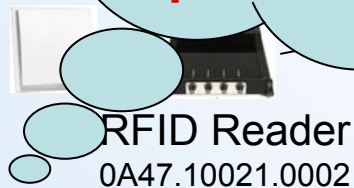
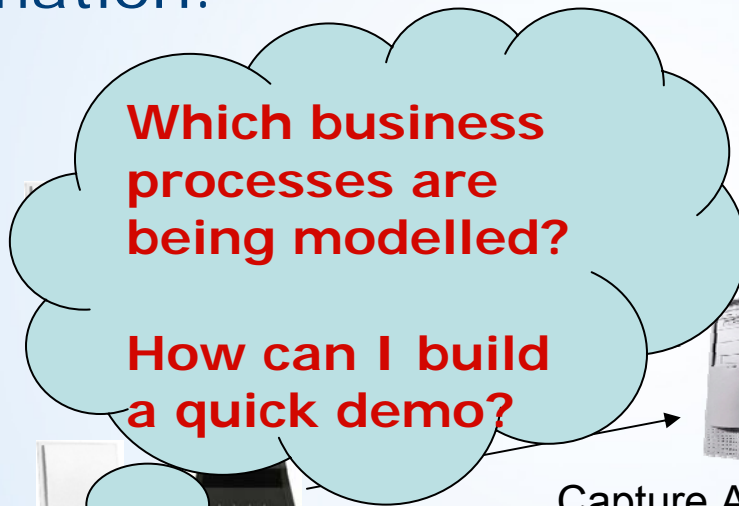
- Accada Tag Data Translation
- **Accada EPC Information Service**
- Accada Virtual Reader

# EPC Information Service

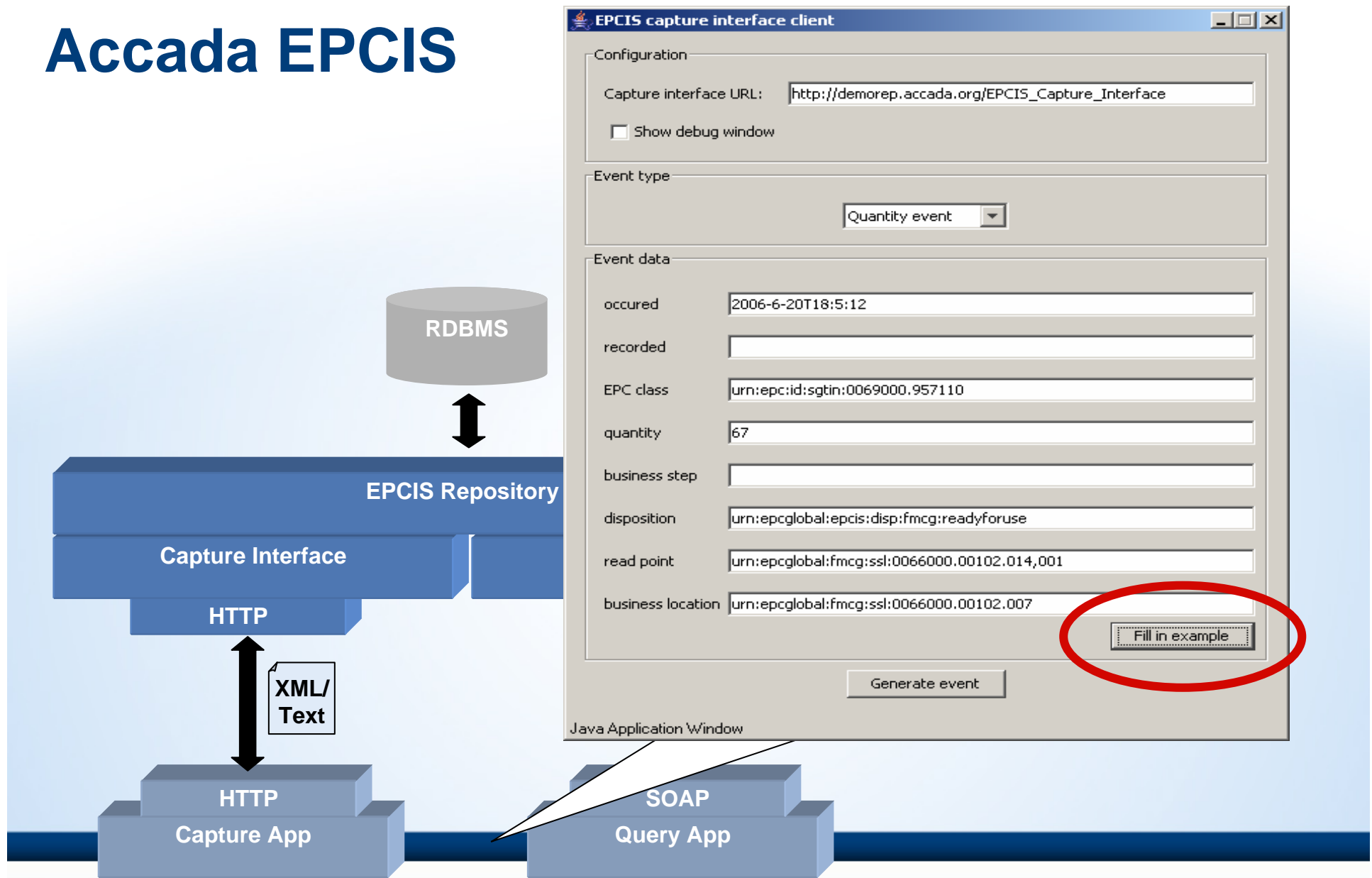
- EPC Information Services (EPCIS) is a new breakthrough for **trading partners** to share information.
- EPCIS is now a **ratified** EPCglobal standard
  - Data model for product movement events in the life of uniquely identified objects
  - Interfaces for capture and query of events

# EPC Information Service

EPC Information Services (EPCIS) is a new technology for trading partners to share information.



# Accada EPCIS




Choose example

DEMO 1: Prototype has been assigned a new EPC  
 DEMO 2: Prototype passed reader in QA lab  
 DEMO 3: Prototype finished QA process.  
 DEMO 4: Reader and other products are aggregated onto a pallet.  
 DEMO 5: Tag has been read at port of Kaohsiung together with other tags  
 DEMO 6: Tag has been read at port of Rotterdam together with other tags  
 Object has passed a reader during the manufacturing process  
 An object has been assigned a new EPC

Fill in

Java Application Window

occured	2006-09-20T06:36:17
EPCs	urn:epc:id:sgtin:0057000.123780.7788
action	ADD
business step	urn:accada:demo:bizstep:fmcg:production
disposition	urn:accada:demo:disp:fmcg:pendingQA
read point	urn:accada:demo:fmcg:ssl:0037000.00729.210,432
business location	urn:accada:demo:fmcg:ssl:0037000.00729.210
business transaction	

Fill in example

Generate event

Java Application Window

# Accada EPCIS

**EPCIS query interface client**

Configuration

Query interface URL:  Info

Show debug window

Events to be returned

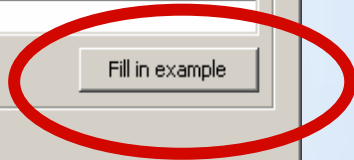
ObjectEvents  AggregationEvents  QuantityEvents  TransactionEvents

Query arguments

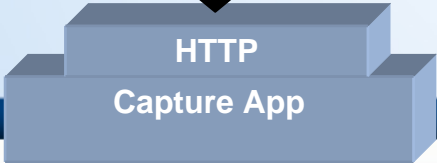
action =

parent EPC =

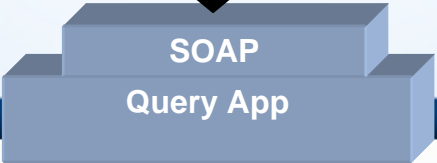
ignore



XML/  
Text



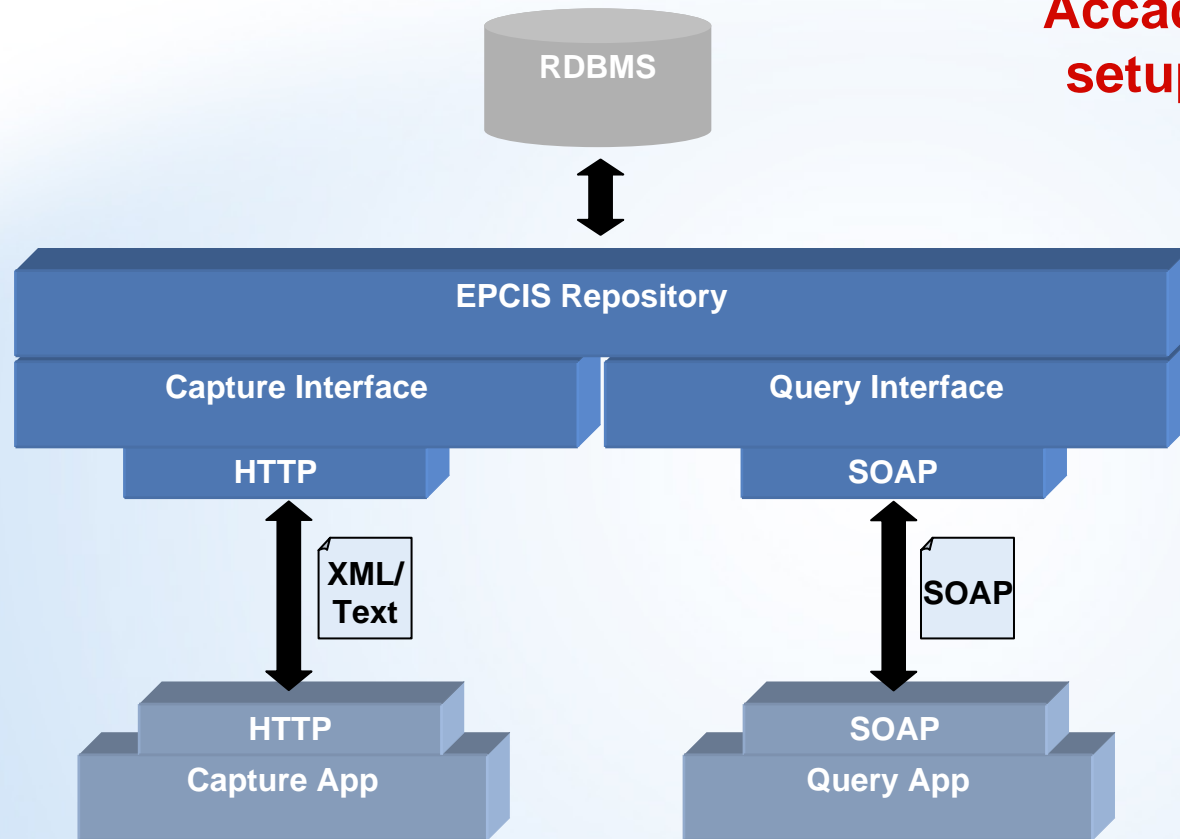
SOAP



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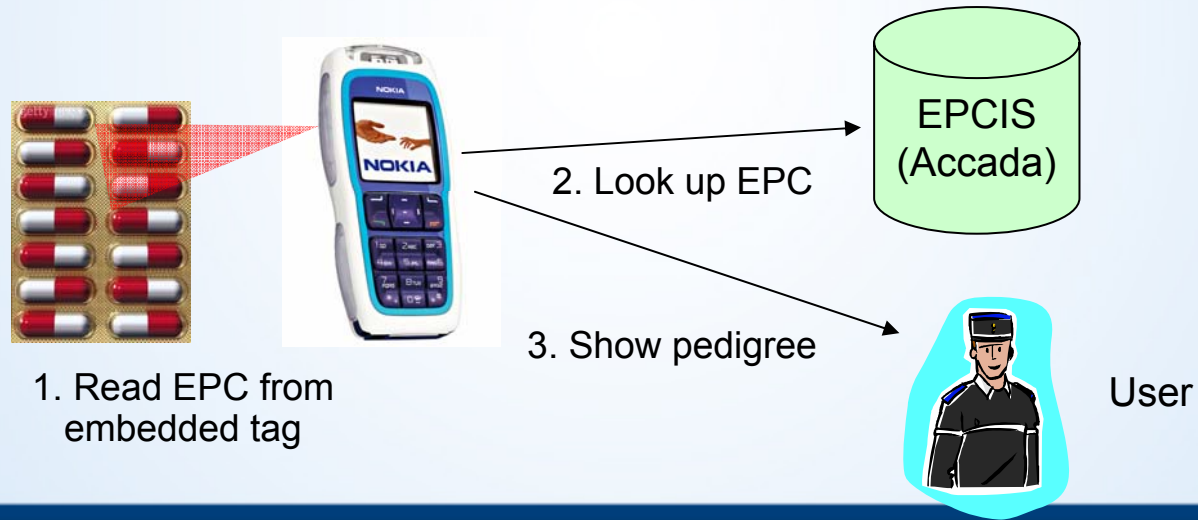
# How can Accada EPCIS can help prototyping?

Accada EPCIS is easy to setup – well-suited for prototyping



# How can Accada EPCIS can help prototyping?

- Read EPC with mobile phone built-in RFID reader
- Check pedigree in manufacturer EPCIS
  - If item was produced and shipped



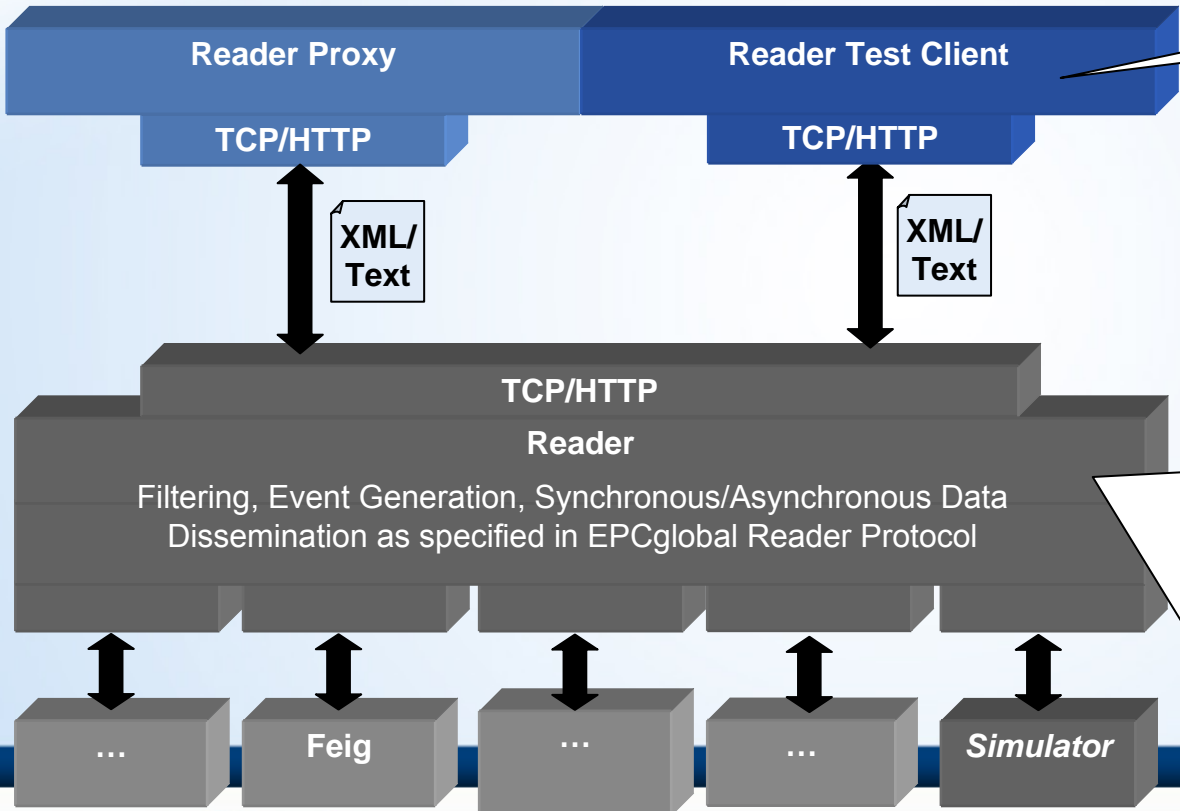


# Overview

- Accada Tag Data Translation
- Accada EPC Information Service
- **Accada Virtual Reader**

# Accada Reader Module

Tool Support:  
- Java Proxy Library  
- Graphical Test Client



Implements All **Mandatory** and **Optional** Features of the EPCglobal Reader Protocol Version 1.1:  
- TCP and HTTP Transport Binding  
- XML and Text Message Binding  
- Tag Filtering  
- Event Generation  
- Notification Channels

Supports SNMP binding of EPCglobal Reader Management Spec



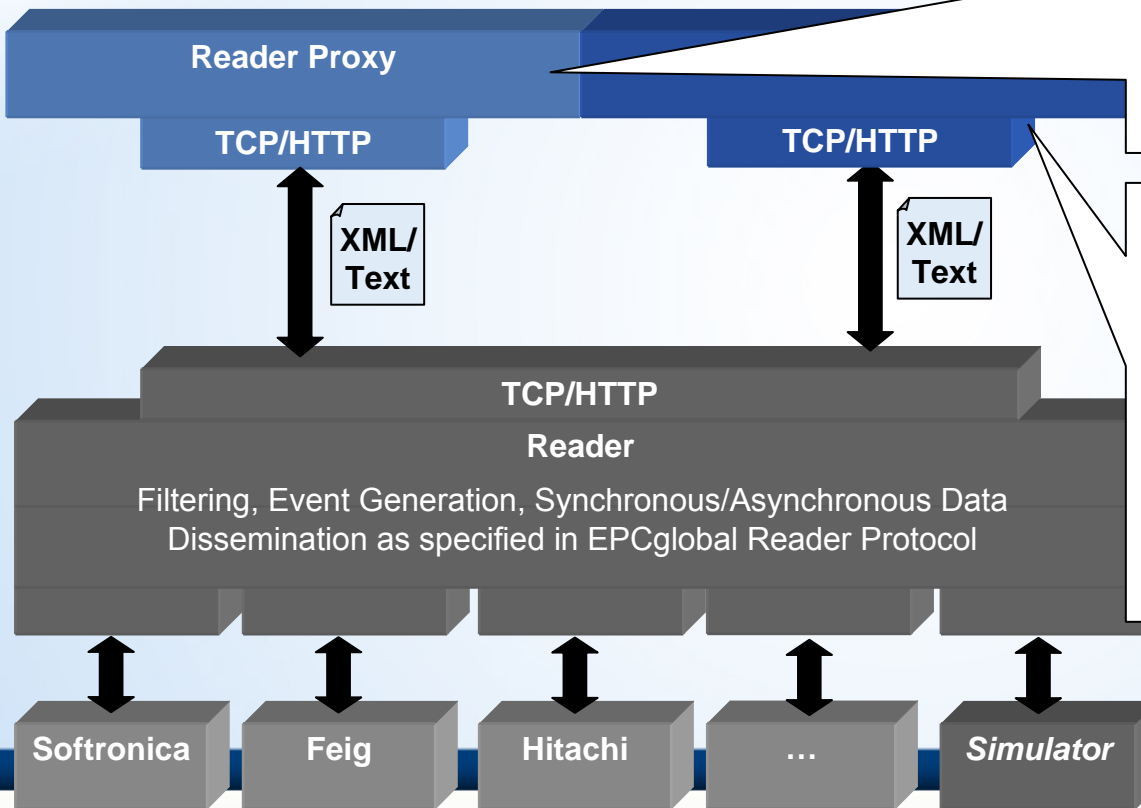
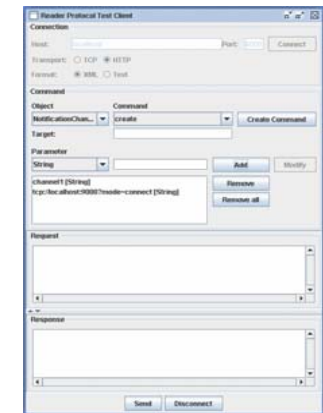
# Reader Module

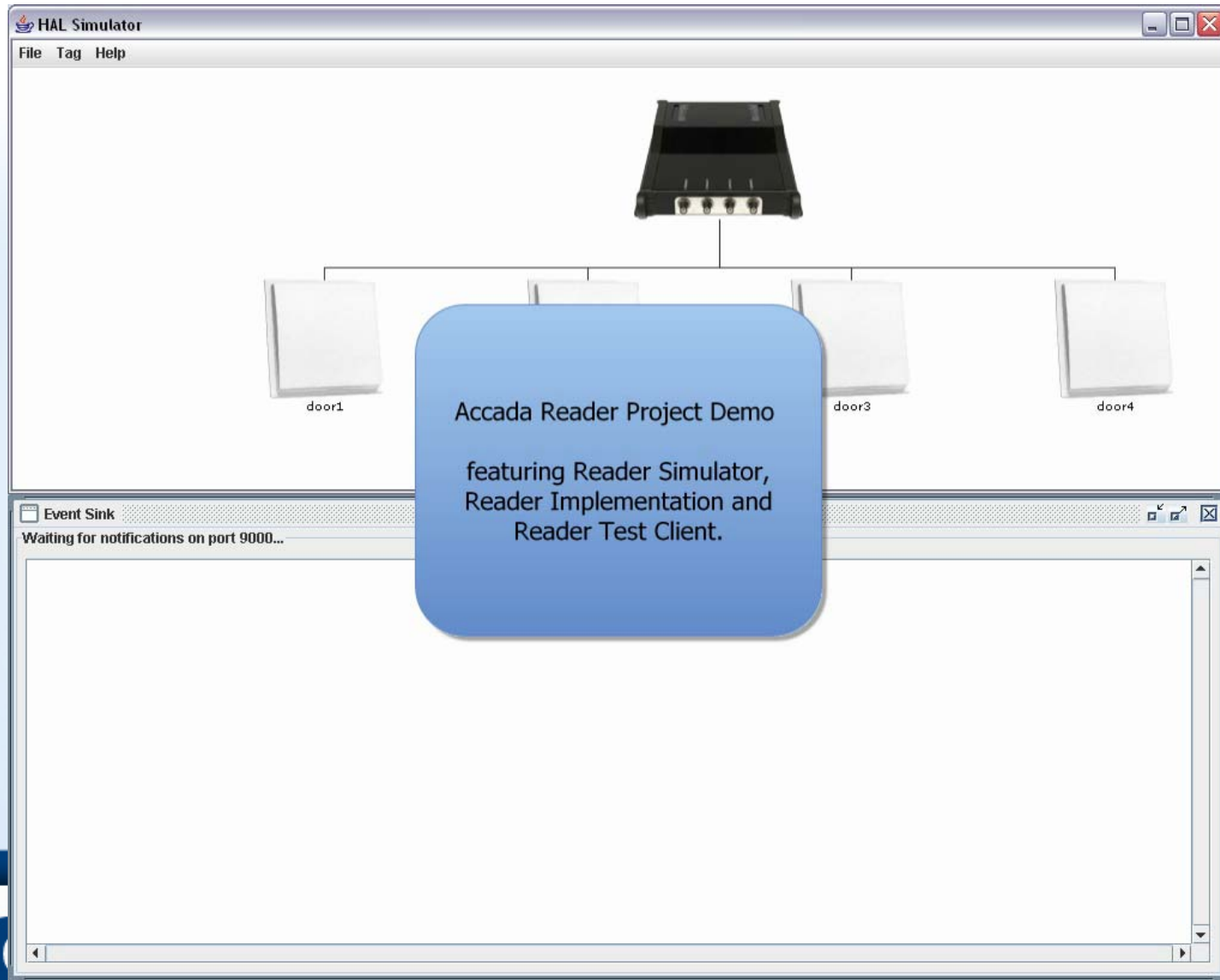
## Reader Proxy – Java Interface to facilitate communication

```
// init handshake
Handshake handshake = new Handshake();
handshake.setTransportProtocol(Handshake.HTTP);
handshake.setMessageFormat(Handshake.FORMAT_XML);

// get reader device
readerDevice =
ReaderDeviceFactory.getReaderDevice(HOST,
PORT, handshake);
```

## Test Client With Graphical User Interface





# Benefits

- Easy way to explore EPCglobal Reader Protocol/Reader Management Features
  - Use simulation engine
- Accelerated application development
  - No need to deal with low-level message transport bindings because of Java Reader Proxy
  - Use simulation framework without RFID hardware
- ....

# Overview

- Showed how you can use the Accada Prototyping Platform to **prepare** for EPC deployments
- Presented 3 **case studies**:
  - Accada Tag Data Translation
  - Accada EPC Information Service
  - Accada Virtual Reader

# Competition to corporate products?

- All of our software is of **academic** quality
- There is **no professional support** available
- Cannot and do not want to compete with corporate implementations, but intend to
  - **Educate** EPC users
  - **Facilitate** prototyping
  - **Promote** use of EPCglobal standards in education and research

# Other RFID Open Source Projects

- **Mentor** by John Williams Group at MIT
  - Complimentary .NET implementation of EPCglobal standards – Accada is developed in Java
- **ALEServer** by LogicAlloy
- **Rifidi** Software by Pramari
- **LLRP Toolkit Project** @ [www.llrp.org](http://www.llrp.org)



# Success Stories So Far

- Used for **Beta-Testing** in EPCglobal Certification Process (RM)
- **Reported Errata** to EPCglobal Working Groups
- Used for Discovery Service Evaluation in EU-Research Program **BRIDGE**
- In Use by a Number of **Commercial R&D** Departments
- In Use by various RFID research groups in academia

# Conclusion

- Illustrated with 3 Case Studies the Objectives of the Accada Prototyping Platform
  - Educate
  - Drive Adoption
  - Foster Research
- Target Audience:
  - EPC Users
  - System Integrators
  - University Researchers and Commercial R&D

More information at:  
[www.accada.org](http://www.accada.org)



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**Thank You!**