Trends and Innovations in RF Identification

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Agenda

- What's changing?
- When customers meet RF Tags
- When data and bandwidth explode
- Device management written big
- Edge data in the big picture
- Access and security
RFID – What's changing?

• RFID is a 50 year old technology so why the excitement today?

• What's new is - “Networked RFID”
  – RFID + The Internet
  – Cheap tags with only ID
  – Detailed data resides across a network

• Networked RFID is essentially the harbinger for sensor-driven networks
  – Drive new applications and achieve levels of business efficiencies through the use of real-time data
RFID and the Enterprise

Using real-time data to achieve new levels of business efficiencies for enterprises

Sensors
Temperature, Pressure, Speed, Vibration etc.

RFID Tags
Active, Passive, Semi-Passive etc.

Devices
Mobile Devices, GPS, Other devices

Business Applications
Warehouse Management, ERP, Legacy

Business Partners
Suppliers, Distributors, Customers etc.

Business Efficiencies
ROI, Customer Satisfaction, Brand Integrity
The RFID Integration Chain
Components to consider for Mission Critical RFID

Key Requirements
Availability, Scalability, Manageability, Security, Integration
When Customers Meet RF Tags

Learning from “Gen 1” Tags

- Privacy
  - Passwords
  - “Killable” tags can be erased
  - Improved security encryption

- Speed and reliability
  - High read rates and accuracy (→ 100%)

- Size
  - 2 to 3 times smaller
“Gen 2” Tags to the Rescue

• Cross vendor compatibility
  – Tags and readers interoperable across vendors

• Greater memory
  – 96 bits plus password
  – 8 bits assignable memory in non-EPC modes

• Improved RF
  – Spread spectrum, frequency hopping UHF with frequency-modulation capabilities
  – Minimize interference with other devices
When Data & Bandwidth Explode

What are the expected network and storage requirements?

How do we manage those expected data volumes effectively?
How much data will we see?

or
## Network Bandwidth Requirements

Network Bandwidth in a sample Warehouse

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td># of Readers</td>
<td>200</td>
</tr>
<tr>
<td>25% Reading at any given instant</td>
<td>50</td>
</tr>
<tr>
<td># of reads/second</td>
<td>500</td>
</tr>
<tr>
<td>Bytes/Read</td>
<td>72</td>
</tr>
<tr>
<td>Data generated per second in Mbytes</td>
<td>1.7</td>
</tr>
</tbody>
</table>
## Data Storage Requirements

### Incremental EPC Data generated by a sample manufacturer

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production/packaging Line Speed (items/second)</td>
<td>1</td>
</tr>
<tr>
<td># of Production/Packaging Lines</td>
<td>10</td>
</tr>
<tr>
<td># of Reads per Item</td>
<td>2</td>
</tr>
<tr>
<td>EPC Bytes</td>
<td>12</td>
</tr>
<tr>
<td>Timestamp (Date, Time, Year + TZ Offset)</td>
<td>12</td>
</tr>
<tr>
<td>Location (GLN - 13 Digits/Chars + extra)</td>
<td>16</td>
</tr>
<tr>
<td>Other Sensor Data</td>
<td>32</td>
</tr>
<tr>
<td>Total Data generated in Bytes/Read</td>
<td>72</td>
</tr>
<tr>
<td>Total bytes of raw data generated per second</td>
<td>1,440</td>
</tr>
<tr>
<td>Total KB of Data generated / second</td>
<td>1</td>
</tr>
<tr>
<td>Data generated in a day (Mbytes)</td>
<td>119</td>
</tr>
<tr>
<td>Data Generated in a Month (Gbytes)</td>
<td>4</td>
</tr>
<tr>
<td><strong>Data Generated in a Year (Gbytes)</strong></td>
<td><strong>43</strong></td>
</tr>
</tbody>
</table>
Infrastructure Issues

What if my Network is limited, intermittent or fails regularly?

How do I recognize and fix problems at remote sites with no IT Support?
Recommendations for the edge

1. Use Self-assembling networks
2. Do most of the data processing at the edge
3. Keep Data Locally; Sync when required
4. Avoid Single Point of failure

Things (Sub-IP)
Tag, sensor, dust, ...

Devices (IP)

The Network

Reader/Gateway
The RFID Value Chain
Components to consider for Mission Critical RFID

Key Requirements
Availability, Scalability, Manageability, Security, Integration
Device Management Written Big
Or Filtering ≠ Middleware!

- RFID Middleware is narrowly viewed as being limited to filtering
- What about:
  - Centralized Reader Config and Management
  - Reader/Device Provisioning
  - Reader/Device Coordination (e.g. Interference)
  - Business Event Filtering
What is a “Dumb” Reader?

- No intelligence besides reading and forwarding data
- Little or no filtering of data
- Floods the network with data
- Cheap, Single protocol/frequency

Applications

- Rely on middleware to do bulk of filtering
- RFID Middleware could become point of failure; need robust middleware
What is a “Smart” Reader?

Applications

- Smart Reader Management and Provisioning
- Firmware/Business logic upgrades
- Reader Coordination
- High-Level Filtering/Aggregation

An event you are interested in has occurred

- Built-in low-level filtering
- Dynamic config and updates
- Reduces network traffic by sending only relevant data
- Multiple protocol/Frequency

Tagged Assets

Smart Readers

Central Management Server
## Dumb vs. Smart Readers

### Dumb Readers

**Pros**
- Simple and Cheap
- Potentially disposable

**Cons**
- Generates a lot of network traffic
- Relies on RFID middleware to do bulk of filtering; RFID Middleware could become point of failure
- Management of Readers

### Smart Readers

**Pros**
- Reduces Network Traffic
- Enables better/centralized management e.g. Firmware & software provisioning

**Cons**
- Still needs middleware for event aggregation and inter-reader coordination
**Data Filtering - What is ALE?**

- ALE stands for Application Level Events

- ALE is a SW specification for the filtering and collection of RFID data being defined and ratified by EPCGlobal

- ALE enables the aggregation and translation of individual reader events into events meaningful to applications
Why ALE is important to Scaling

An Application-centric approach on incorporate RFID data is not scalable

What if you need a new application to access data from your existing readers?

ALE-based middleware enables a more scalable approach to integrating RFID

In this example, with the same set of readers

- Application 1 can request RFID reads only when an object enters or leaves a door
- Application 2 can request RFID reads every 10 seconds for inventory tracking
- Application 3 can request all RFID reads whenever they happen
RFID Middleware Requirements

**Scalability**
- Management of large # of services
- Implementation and protocol independent

**Reliability**
- Keeps Services Simple
- Helps Handle partial failure
- Replaces broken services

**Flexibility & Integration**
- Supports implementation in HW, SW, Java & non-Java
- Surrogate Architecture

**Availability**
- Enables Upgrades while system is running
- Redundant Services

**Administration**
- Discovery and Leasing automated addition and removal of services
- Self-Healing and Self Managing Services
Device Management

Jini Network Technology provides...

- A simple infrastructure for delivering network services
- An proven distributed framework

and Enables...

- The spontaneous interaction between programs or devices that provide or consume services
- How Services are added or removed from the network
- How new clients can find existing services without administration

Project Rio builds on Jini's distributed architecture concepts to enable dynamic adaptive network capabilities using Policy-based and Quality of Service mechanisms

jini.org

rio.jini.org
The RFID Integration Chain

Components to consider for Mission Critical RFID

Key Requirements
Availability, Scalability, Manageability, Security, Integration
Edge Data in the Big Picture

Integration Issues

- Business Processes
- Legacy Systems
- Applications
- RFID Data
- Internal to the Enterprise
- External to the Enterprise
- Services
- Business Partners
Recommendations for Integration

1. Avoid direct integration with readers
2. Implement EAI Strategies for Incremental Integration to accommodate any existing systems
3. Think distributed; Avoid single point of failure
4. Consider security implications while designing

Avoid This!
Sun RFID and SOA

ALE Event Aggregation

1. Incoming ALE Events
   From RFID Readers & Middleware
2. Admin
3. Enterprise Systems
   WMS, ERP, Legacy Systems etc.
4. Business Partners
Access and Security Issues

Someone is asking me for my status... How should I respond?

A manufacturing system is requesting access to some data... should we allow it?

What did we agree to share with Supplier XYZ?

Manufacturing

Truck in Transit

Partner
Access and Identity Control

1. Hello!!
   I am a RFID reader and I want to be part of your RFID network...

2. Hi there...
   What is your ID?
   What type of reader are you?
   Where are you located?
   Let me check if you are allowed on our network...

3. OK. Welcome...
   You are authenticated now.
   Let me send you the latest firmware and business logic that I want you to use...

RFID Reader

RFID Server with Access Manager Support
Thank You!
Questions?

Email: jim.wright@sun.com

RFID Info: www.epcglobalinc.org