Intelligent Networks

MIT Smart World 2004

December 8, 2004

Christian Clauss
Worldwide Auto-ID Leader
WebSphere Product Center
Networks are both clusters of computers and clusters of people!

- We now use “network” as a verb
  - Cocktail Party
  - Distributed Software Development
  - Collaborative Standard Development

- It is vital to think back and forth between these two styles of networks. There are bi-directional effects.

- The Internet has profoundly changed the way we live, work and play.
Three looks into Intelligent Networks

- Global Data Synchronization
- Electronic Product Code deployment at scale
- Compute Farm Networks for On Demand computing
Keys to building a successful Intelligent Network

- **Start with a layered design – think “big blocks”**
  - Complexity is preserved but can be hidden – try for black box
  - Division of labor – focus skill sets – highly distributed teams
  - Outsourcing opportunities – understanding the skills of partners
  - Flexibility to change components without breaking the framework
  - Re-use of components in other application
  - End points will change over time – be flexible
  - Ready to scale

- **Trust is essential yet its importance is underestimated**
  - Focus on Win-Win use cases first to maintain innovation & commitment
  - Carefully document the use cases and get sign-off from all participants
  - Security must cover both people and devices
Global Data Synchronization Network
Manage Linkages Among Items, Locations, Organization and Trading Partners

Locale specific attributes
- Localized (French/German/Spanish...) description of the item
- Unit of measure (Metric Vs British), net content, net weight
- Currency
- Local government compliance (e.g.: gluten claim, nut/seed content claim etc)

Core item attributes
Relationship with other items
- Packaging (each, pack, case, pallet etc)
- Substitution
- Complementary
- Bundles/prepacks

Category specific attributes
- e.g. Cigar Style, Cigar Ring Gauge
- Item map to internal and external category schema

Time

Product

- Retailer and target market specific trade conditions (pricing, promotion...)
- Retailer specific attributes

Location

- Business unit, brand family the item belongs to
- Brand or category manager responsible for the item
- Manufacturer/Distributor Warehouses that stock and ship item

Organization

- Retailer warehouses that are authorized to receive and stock the item
- Retailer stores that the item is sold through

Trading Partner

Category

Item

© 2004 IBM Corporation
THE GOLDEN SOURCE OF PRODUCT INFORMATION

1) A flexible, scalable repository managing and linking product, location, trading partner, organization, and terms of trade information

2) Tools for modeling, managing, capturing and creating this information with high user productivity and high information quality

3) Integrating and synchronizing this information internally with legacy systems, enterprise applications, repositories and masters

4) Workflow and solutions for supporting multi-department and multi-enterprise business processes

5) Exchanging and synchronizing this information externally with business partners

6) Leveraging this information via many internal and external electronic and human touch points

Integrate – Transform – Harmonize

Product

- ERP & CRM Systems
- Legacy Systems
- Document Management Systems
- Images, Docs, Excel

Website & eCommerce

- Sales Brochures
- Product Specs
- Shelf Tags & Signage
- Kiosks & Info-Stations

RFID

- Content Leverage

UCCnet

- TRANSORA
- WWRE
- Other Data Pools
- Portal
- EDI

Broker & Retail Direct

Global Data Synchronization
Master Data Management View of an Item

1969 orig fit

1969 orig fit

SIZE:

price: $98.00

item: #191458

color:

select one

select one

size:

select one size charts

select one

quantity:

1

Shown in: view larger image

Available colors:
Product Information Management View of an Item (Ecommerce)

Web Hierarchy and Sub Category
- 1969 Denim Collection
  - 1969 Collection for Men
    - 1969 original fit
    - 1969 selvage jean jacket
    - 1969 boot fit (dusted)
    - 1969 range fit (infused)
    - 1969 boot fit (indigo arctic)
    - 1969 boot fit (black crunch)
    - 1969 explorer shirt (tinted black)
    - 1969 western shirt jacket
    - 1969 boot fit (panhandle)
    - 1969 western shirt (dark indigo) sale

Images
- Jeans image

Marketing Benefits
- 1969 original fit
  - The Limited Edition
  - 1969 Collection:
  - Premiere, Authentic GC
  - Made from a premium denim fabric in a dark shade of indigo with very subtle whiskering and grinding.
  - Sits just below waist. Low rise. Slim, straight leg.
  - Five-pocket styling, button fly.
  - 100% cotton. Machine wash.
  - Made in USA.

Sizes
- Select one
- size: 30w x 32l, 32w x 32l, 33w x 32l, 34w x 32l

Colors
- Available colors:
  - Rusted
  - Sagebrush

Promo. Price
- Now $39.99

Cross-Sell & Up-sell
- You'll also like:
  - Hand-knit zip sweater
    - $99.00
    - $59.99

- Hand-knit half zip sweater
  - $99.00
  - $59.99
Impact on New Item Introduction and Promotion Management

What's New?

New Face Cleanser

Reps Talk

Promo/Price Agreement

Item Info

ASN

ASN

Order Filled

Ship

Carton Received

EPC Read & Compared

EPCs

RFID

EPC Information Services

Retailer

Manufacturer

GDS

EDI

EPC

ASN Received

Tell Me More?

OK - Verified

Sends Promo Status

How's Promo Going?

More Info

EPC Information Services

Retailer Sells Product

Feedback Cycle Repeats Until Promo Over

ASN

Purchase Order Sent

Receive

Promo/Price accepted

Item accepted

What's New?

Manufacturer

Item accepted

Promo/Price accepted

GDS

WebSphere Product Center

© 2004 IBM Corporation
Electronic Product Code Network
EPC RFID is a linkage of Physics and IT in order to enable computers to automatically Monitor, Decide, and Take Action.
Sensor Networks

It is essential that:

- Always architect for massive scale
- Never move data unless you have to
- Sensors must be:
  - Plug and work
  - Authenticated
  - Remotely monitored
  - Remotely configured
  - Remotely upgraded
  - Optional data encryption
- Architectural layers must:
  - Hide complexity
  - Provide flexible filtering
  - Provide programmers with a higher level abstraction
RFID links the world of Physics to the world of Information Technology in order to allow computers to sense the real world.

The Physics challenges and IT challenges of building RFID Systems are about equal.

IBM should focus on the IT challenges and partner with others to overcome the physics challenges.
How can I reliably keep my Warehouse Management System up-to-date on the movement of my products?

Simple for small plots but increasingly difficult in global rollouts for big manufacturers and retailers.
The IBM RFID Domain Model breaks the problems of doing EPC deployments at scale into manageable sub-components.
EPC data is captured by both the Manufacturer and Retailer

1. Manufacturer (or its packaging supplier) adds an **EPC enabled RFID tag** to individual products.

2. The items are loaded into EPC tagged cases and pallets.

A reader above the shipping door **reads each pallet, case and item** as it leaves the plant.

3. The pallets of Manufacturer product arrive at a DC and the items are **automatically received and uploaded to the WMS**. The product is picked and shipped with increased accuracy and throughput, and reduced labor expense.

4. The delivery arrives at the retail store and is **automatically received and inventory is updated**. A network of readers in the back room and the storefront ensure that **product movement is tracked** to improve shelf availability, promotion management, reduce theft, etc.

Source: Auto-ID Center, IBM Business Consulting Services analysis
We wrote a whitepaper with the Global Commerce Initiative…

Purpose: Link existing investment in Global Data Synch to emerging investments in EPC.

Similarities, Differences, Practical Advice
Retail / Consumer Products – Business Case Findings

- **Retail**: “It is relatively easy to find ROI if you don’t have to pay for tags”
  - Largest benefits tied to improved store level execution (Out of Stocks, Inventory, Productivity)
  - Largest cost drivers - process change, infrastructure and integration

- **Many Consumer Products manufacturers are still searching for ROI**
  - Largest benefits tied to improved retailer execution and/or data sharing (Out of Stocks, Proof of Delivery, Inventory Reduction, Other)
  - Awaiting the <$0.05 or <$0.02 tag
  - ROI will require increased retailer adoption (scale)

**Overall Value Chain Business Case Is Often Positive!**

... But **CP reluctance is problem #1 for EPC adoption**
Both the manufacturer and the retailer have their own separate RFID infrastructure and talk via EPC Network.
Current Linkage Between GDS & EPC Networks

GDS Network

- Party Data
- Category Specific Data
- Target Market Specific Data
- Relationship Data

Core Product Information
- Description
- Brand name
- Color
- Height
- Weight
- … etc.

Manufacturing Information
- Lot number
- Manufacture date
- Expiry date

Lifecycle History – Distributed
Track & Trace Information
Transaction Information

EPC Network
How Does the EPCglobal Network keep the product info linked?

- **Object Naming Service (ONS)**
  - Root ONS contains pointer to Company ONS (i.e. Manufacturer)
  - Company ONS contains pointers to CPI, MTI, LHI

- **EPC Discovery Service (EPCDS)**
  - Second-level index
  - Contains a list of pointers to each EPCIS that holds info on this EPC

- **EPC Information Service (EPCIS)**
  - The actual data repository for all three types of information

---

![Diagram showing the relationship between Object Naming Service (ONS), EPC Discovery Service (EPCDS), and EPC Information Service (EPCIS) with pointers connecting them.](attachment://diagram.png)
S&A Premises and Business Process Integration servers plus Enterprise Apps can read & write information about EPC tagged products into WPC on demand.

EPCIS Web Services API

EPC Network-enabled WebSphere Product Center

Lower level APIs →
- Read API
- Write API
- Delete API

Current WebSphere Product Center DB (read-only)
- Core Product & Location Information

New Instance Information Repository
- Manufacturing Time & Lifecycle History Information

EPC Network
- Core Product, Manufacturing Time, Lifecycle History & Location Information
Why Is The EPC Network Required?

Brand Manager
“How is my product selling?”

Accurate
Consistent
Timely

Retail Portal New York
Retail Portal Paris
Retail Portal Tokyo
EPC Network Can Simplify Communication

Brand Manager
“How is my product selling?”

Efficient, Consistent, and Timely Reporting
Query Trader Moes and see where the product is out-of-stock.
### EPC Track and Trace History Records

#### EPC Search

| EPC: 85112 3456789120000000123456 | Search | Query Trace |

#### EPC Scans for 85112 3456789120000000123456

<table>
<thead>
<tr>
<th>Time of Scan</th>
<th>GLN</th>
<th>Company Name</th>
<th>Reader Location</th>
<th>Additional Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thu Aug 20, 2004 - 10:34:34.237 am</td>
<td>000000123426</td>
<td>Manufacturer</td>
<td>Reader is located in the Manufacturer's Plant</td>
<td>Temperature: 43 F</td>
</tr>
<tr>
<td>Thu Aug 20, 2004 - 10:34:34.237 am</td>
<td>000000123433</td>
<td>Manufacturer</td>
<td>Reader is located in the Manufacturer's Plant</td>
<td>Temperature: 43 F</td>
</tr>
<tr>
<td>Thu Aug 20, 2004 - 4:39:32.117 pm</td>
<td>000000123440</td>
<td>Manufacturer</td>
<td>Reader is located in the Manufacturer's Warehouse at the inbound loading dock</td>
<td>Humidity: 65%</td>
</tr>
<tr>
<td>Thu Aug 20, 2004 - 7:14:45.019 pm</td>
<td>000000123457</td>
<td>Manufacturer</td>
<td>Reader is located in the Manufacturer's Warehouse at the outbound loading dock</td>
<td></td>
</tr>
<tr>
<td>Fri Aug 21, 2004 - 2:10:12.277 am</td>
<td>0041163123410</td>
<td>Albertsons</td>
<td>DC inbound loading dock at 7550 Oak Grove Road, Fort Worth, Texas 76140</td>
<td></td>
</tr>
<tr>
<td>Fri Aug 21, 2004 - 2:15:45.456 pm</td>
<td>0041163123427</td>
<td>Albertsons</td>
<td>DC outbound loading dock at 7550 Oak Grove Road, Fort Worth, Texas 76140</td>
<td></td>
</tr>
<tr>
<td>Fri Aug 21, 2004 - 4:34:34.237 pm</td>
<td>0041163123434</td>
<td>Albertsons</td>
<td>Back of Store loading dock at 7400 oaktm, fort worth br 76132</td>
<td></td>
</tr>
<tr>
<td>Sat Aug 22, 2004 - 10:34:43.983 am</td>
<td>0041163123441</td>
<td>Albertsons</td>
<td>Reader is located on the door between the back storage area and the sales floor at 7400 oaktm, fort worth br 76132</td>
<td></td>
</tr>
<tr>
<td>Sat Aug 22, 2004 - 2:06:11.721 am</td>
<td>0041163123458</td>
<td>Albertsons</td>
<td>Eco compactor at 7400 oaktm, fort worth br 76132</td>
<td></td>
</tr>
</tbody>
</table>
Compute Farm Network
WebSphere XD Dynamic Operations

**Virtualization**

**Conventional Distributed Environment**

- Environment
  - 30+ applications
  - 100 application servers

- Challenges
  - Underutilized servers
  - Inability to share resources across server pools – especially during peaks
  - Inconsistent quality of service for business critical applications
  - Human Intensive Monitoring and Managing Environment
WebSphere XD Dynamic Operations

Virtualization

WebSphere XD Environment

- **Virtualized**
  - Pool Resources (Node Groups)
  - Virtualized Applications

- **Autonomic**
  - Operational Policies are attached to Application to reflect operational goals and importance of application
  - Autonomic Managers monitor environment for maximum utilization using business goals

- **Results**
  - Reduce total cost of ownership (doing more with less)
  - Increase stability and repeatability of Environment
WebSphere XD Dynamic Operations
Goals Directed Infrastructure

Applying Business Goals to Applications

<table>
<thead>
<tr>
<th>Application Solutions</th>
<th>Service Classes</th>
<th>Goals</th>
<th>Priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock Trading</td>
<td>Gold</td>
<td>RT &lt; 1sec for 80% req</td>
<td>Very High</td>
</tr>
<tr>
<td>Account Management</td>
<td>Bronze</td>
<td>Avg RT &lt; 2sec</td>
<td>Medium</td>
</tr>
<tr>
<td>Portfolio Forecasting</td>
<td>Silver</td>
<td>Avg RT &lt; 5sec</td>
<td>Medium</td>
</tr>
<tr>
<td>Customer Support</td>
<td>Other</td>
<td>Best Effort</td>
<td></td>
</tr>
</tbody>
</table>

Policies Drive Decisions of Autonomic Managers
Keys to building a successful Intelligent Network, continued

- Build on existing standards – avoid Not Invented Here
- Move the smarts out towards the edge of the network
- Trust but verify – network and device outage will occur
- Clearly document interfaces between the big blocks
- Think of device management up front
  - Monitor, Manage, Reconfigure, Device Security

- Always be on the lookout for unintended consequences
- Demo early and often – Great for getting real feedback
- Continue to make computers and complexity disappear
Learn by doing…

Always looking to co-innovate

Christian C. Clauss
Worldwide Auto-ID Leader
WebSphere Product Center
IBM Software Group

ccla@ch.ibm.com