

Silicon Valley World Internet Center:

Massive Adoption of RFID?

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Xterprise
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Topics:

- *The Big Picture*
- *RFID Overview*
- *Why The Supply Chain?*
- *\$64,000 Question...when? And With What?*

The Big Picture

Evolving The Real-time Enterprise

- Collins & Porras, Built to Last ...
..... “Genius of the And”:

We Can....	AND we can
Reduce <u>errors</u> to almost none..	Get things done <u>faster</u>
Engage people in understanding and improving their <u>processes</u> and procedures...	Maintain <u>control</u> on how works gets done
<u>Measure</u> and analyze what we do....	Apply <u>creative</u> solutions to “Push the envelope”
Make <u>customers</u> extremely happy ...	Make a lot of <u>money</u>

The Real-time Enterprise

- Pande, Neuman and Cavanah, The Six Sigma Way, “the importance of measurement”:
 - “The long term development of measurement infrastructure... is a key building block for a full organizational Six Sigma system. The huge benefit is an ability to monitor and respond to change in a way that few organizations can lay claim to today.”

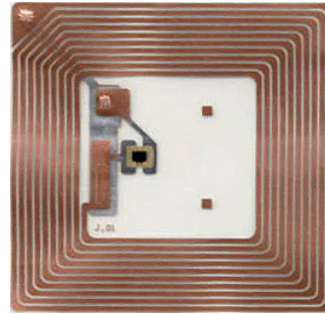
RFID Overview

Some Inductive Tag Anatomies



Traditional 125kHz Inductive RFID

- Antenna typically ~120 turns of copper wire
- Typically use discrete resonant capacitor
- Rigid construction
- Pre-defined form-factor



13.56MHz flexible Inductive RFID

- Planar antenna typically use 7-10 turns
- Wire, etched or stamped coils
- Typically use on-board or laser tuned resonant capacitor
- Resonant tanks sensitive to surroundings - some laser tuned to application
- Requires bridged cross over interconnect
- Limited, pre-defined form-factors



13.56MHz Inductive RFID

- Antenna typically 3-10 turns of copper wire
- Discrete or on-board resonant capacitor
- Rigid construction
- Pre-defined form-factor



915 MHz flexible Inductive RFID

- Planar antenna typically 1 turn
- Etched or printed coils
- Typically use solid state, mask defined resonant capacitor. No tuning required
- Requires advanced assembly processes to adhere very small chips to interconnect
- One Chip, many antenna designs

Tag Memory

- Read Only Memory (ROM):
 - Data is burned into IC at the factory (License Plate)
 - Can never be changed
 - Virtually no control or alignment of data content with respect to enterprise needs
- Write Once, Read Many (WORM)
 - Data generally written into the IC at factory and locked
 - When locked can not be reprogrammed
- Read/Write
 - Some data may be programmed at the factory and locked
 - Other data may be written, erased and rewritten into memory in the field
 - By customer individually
 - During operation

Tag Power

- Beam Powered
 - Generally referred to as “Passive”
 - Converts RF energy into DC power to operate
 - Uses reader RF carrier as source of “Clock” to Synchronize with Tag Signal
 - Very Long Life products
 - Range is dependent on several factors:
 - Reader Transmit Power
 - Reader Receive Sensitivity
 - Tag Modulation Depth
 - Integrated circuit efficiency/power consumption
 - Environmental/ambient tag/reader conditions
- Battery Powered
 - Generally referred to as “active”
 - Generally operate asynchronously (Tags have their own tag source)
 - Battery boosts range and tag sensitivity
 - Battery powers onboard functions when away from reader

Anti-Collision & Read Rate

Anti-collision

- Ability to address a number of tags simultaneously in a given read zone

Read rate

- The speed at which the reader can process tag data
 - Readers multiplex amongst their antenna ports
 - 1 port ~ 200 reads/sec
 - 2 ports ~ 100 reads/sec per port



Electronic Product Code (EPC)

Acronyms Soup:

- Global Item Trade Number (GITN)
- Uniform Product Code (UPC)
- Japan Article Numbering Code (JAN)
- European Article Numbering (EAN)

- EPC Example (96 bit), 1.1×10^{18} unique item numbers

01 . 0000A89 . 00016F . 000169D C0

Header
0-7 bits

EPC Manager
8-35 bits

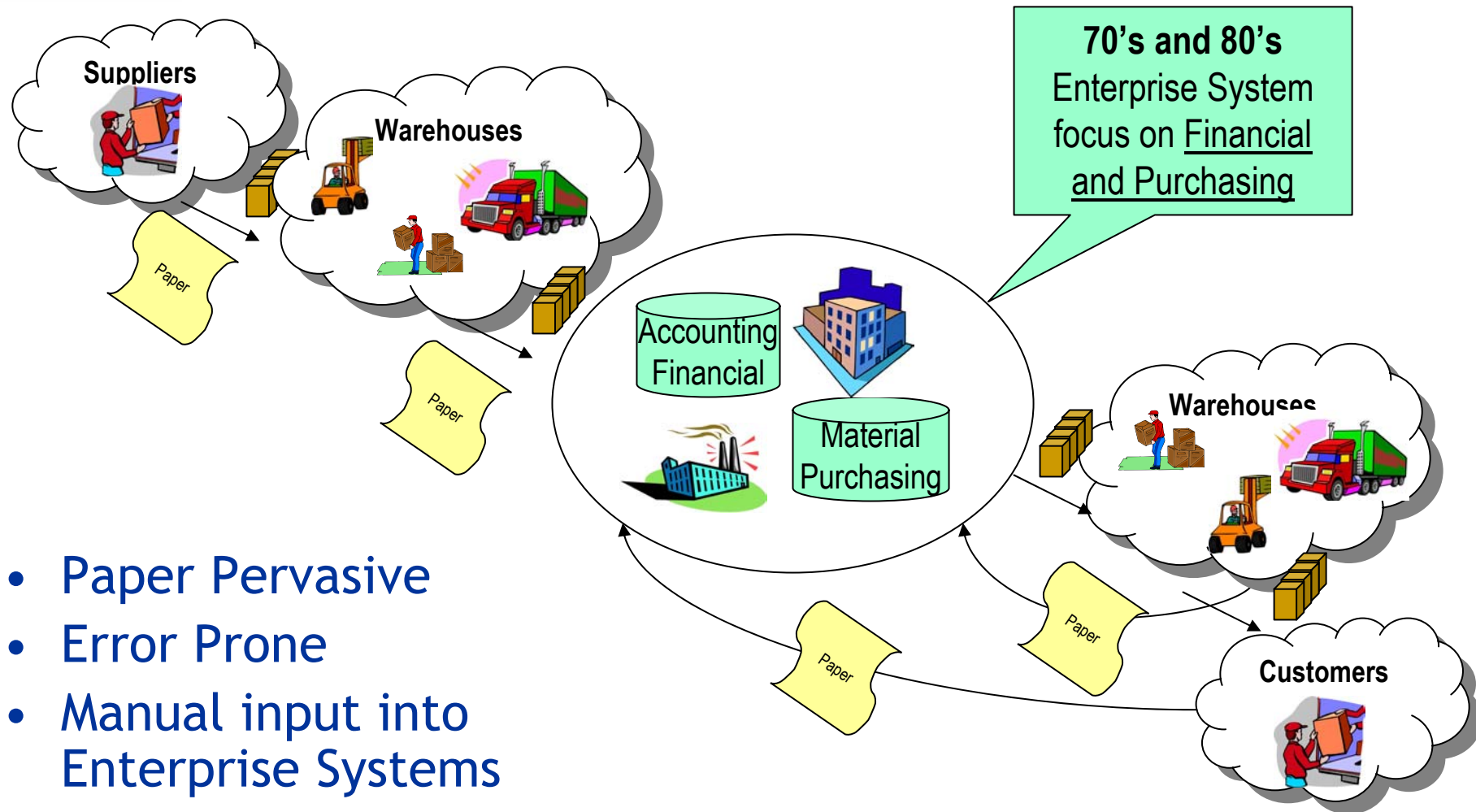
Object Class
36-59 bits

Serial Number
60-95 bits

- EPC is technology independent

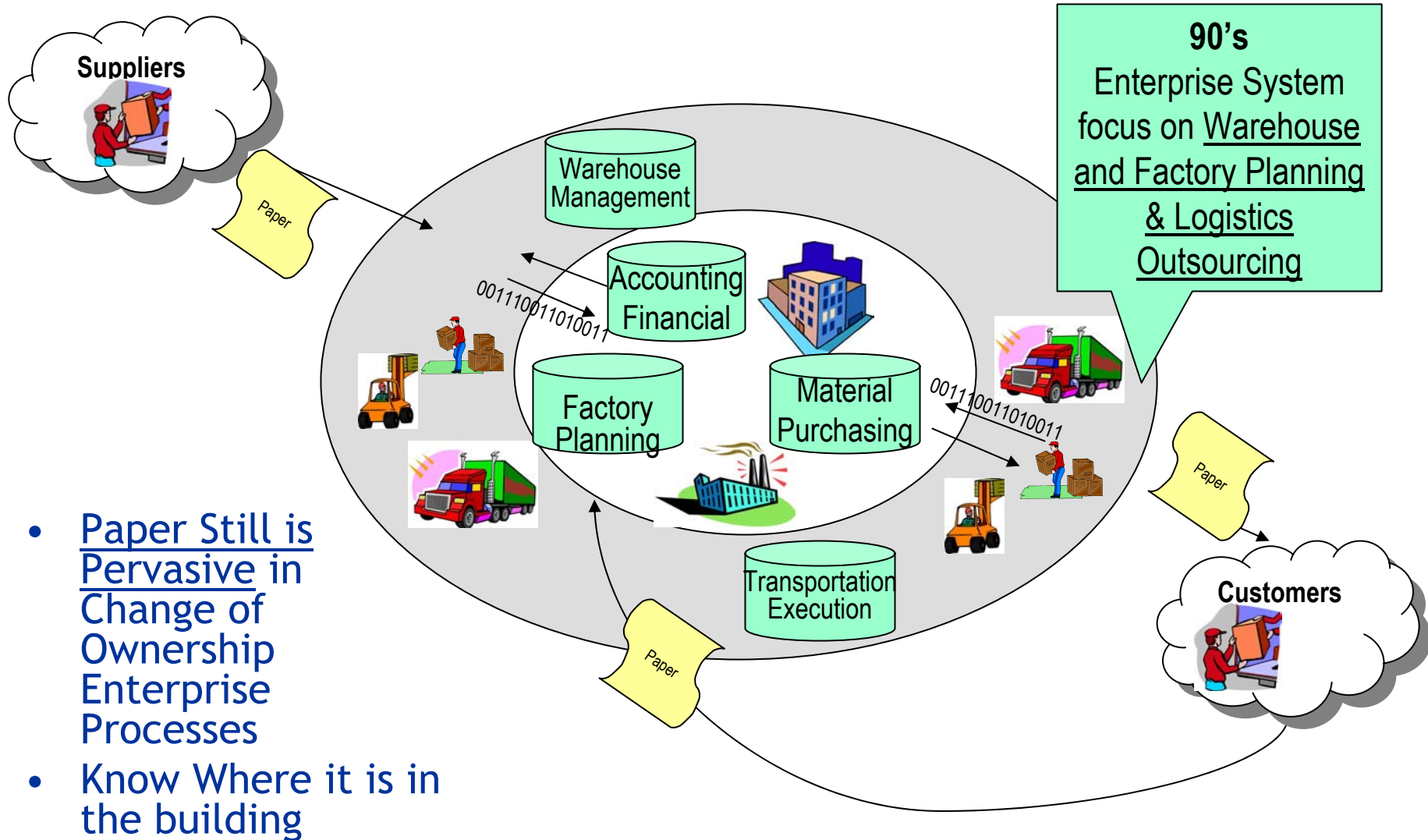
Why Will Supply Chain Applications Drive Massive Adoption?

“Entirely Contained” Enterprise

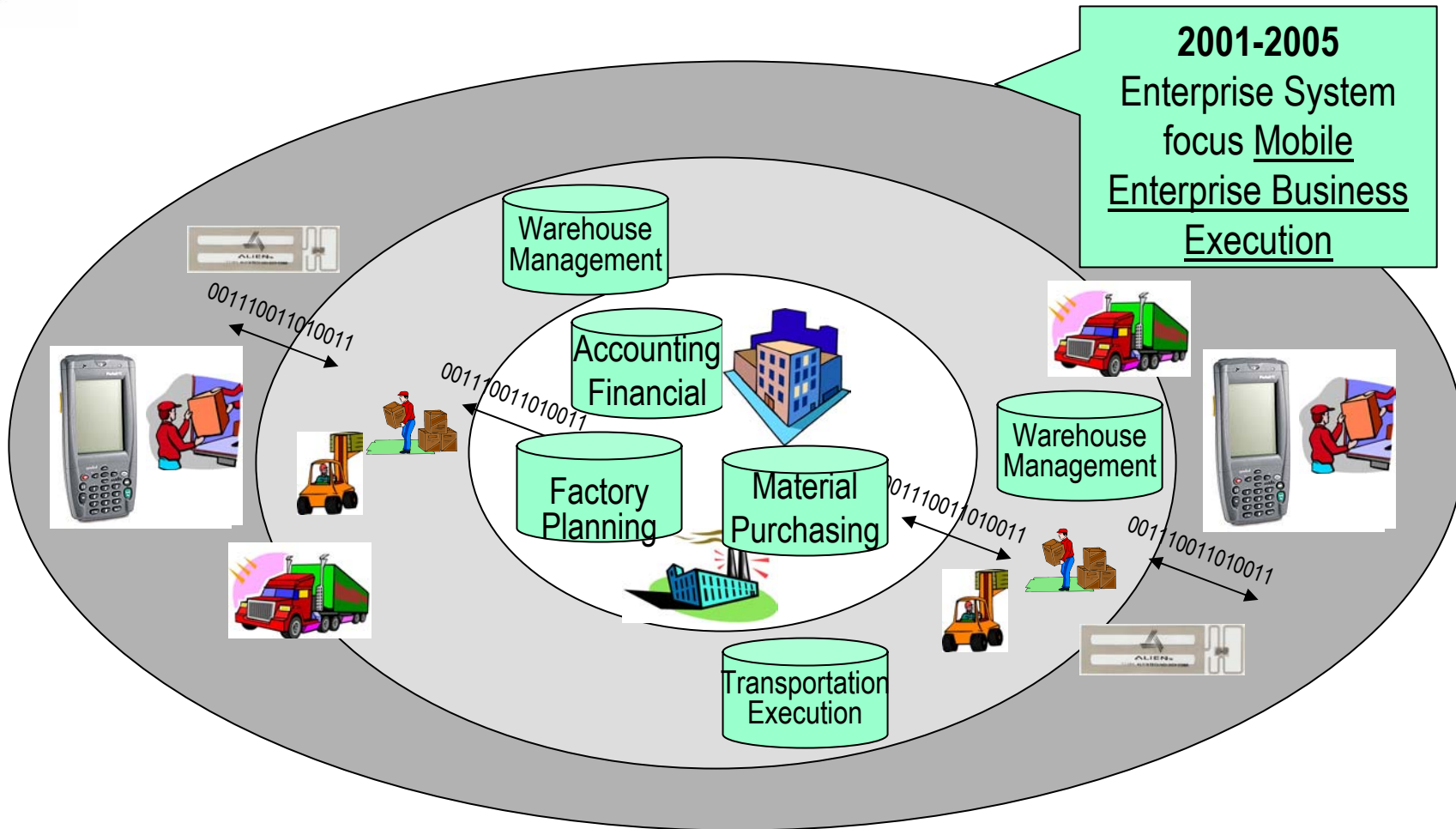


- Paper Pervasive
- Error Prone
- Manual input into Enterprise Systems

“Contained” Enterprise



“Extended/External Enterprise”



- Digital Real-time Enterprise... Extended To Farthest Reaches Of Enterprise

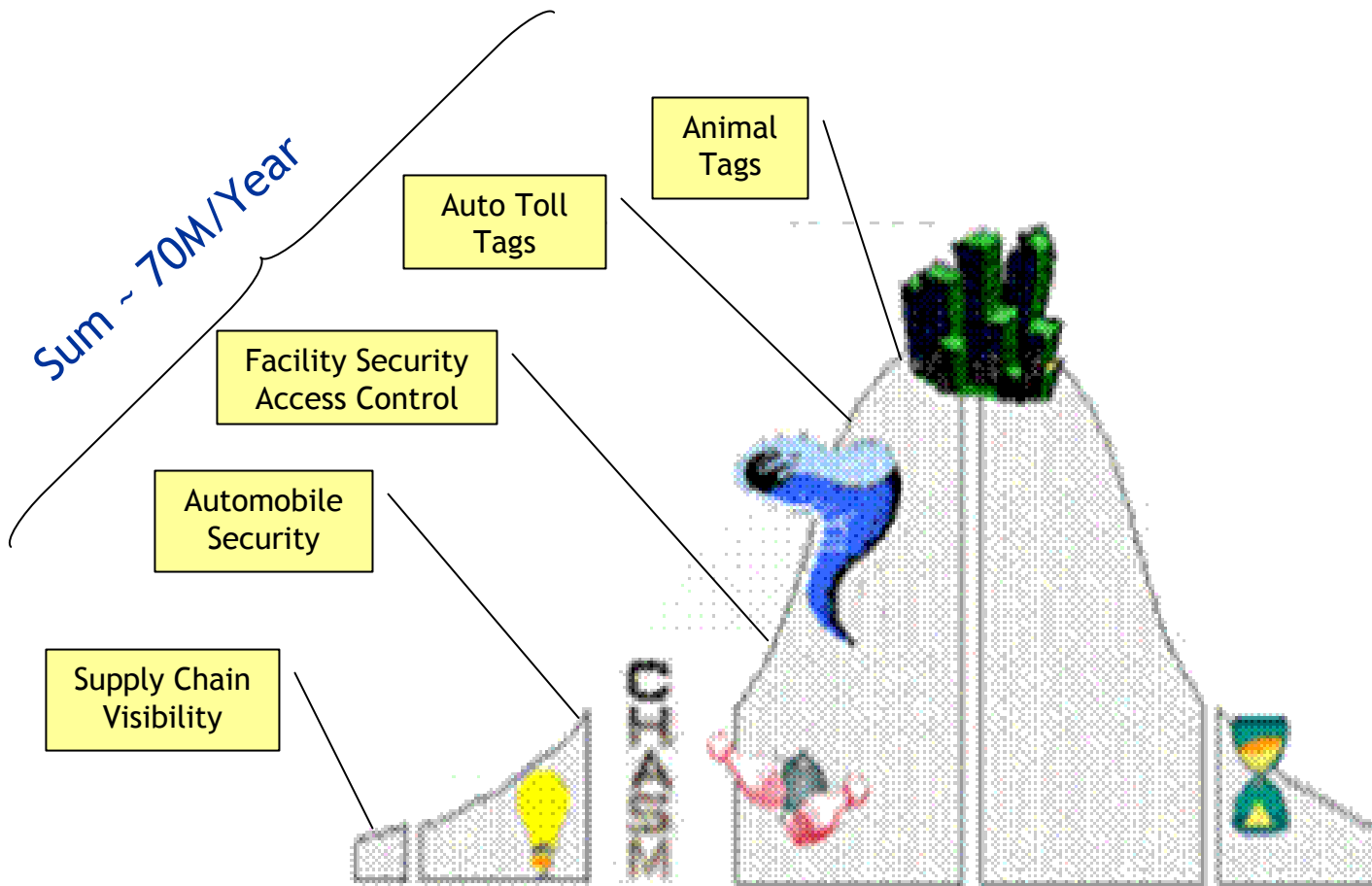
Global Supply Chain Needs

- Increased focus on inventory visibility ⁽¹⁾
 - Importance: 1.63 on a 1 to 7 scale (1 = very important) on shipping giants
 - Current information visibility: 2.39 on a 1 to 7 scale (1= very visible)
- Increased pace of inventory turns
- Increasing need for absolute quality of data down to S/N
- Reduced accounts receivable back log day sales outstanding (DSO)
- Anti-counterfeiting and anti-theft is emerging as high on for visibility solutions

1. (From Giants Of Shipping Study, Logistic Management Magazine, Et. Al, September 2002)

Where is RFID in Adoption?

- It Depends on the Definition of RFID..... & Perspective



Ref: Crossing the Chasm, www.chasmgroup.com

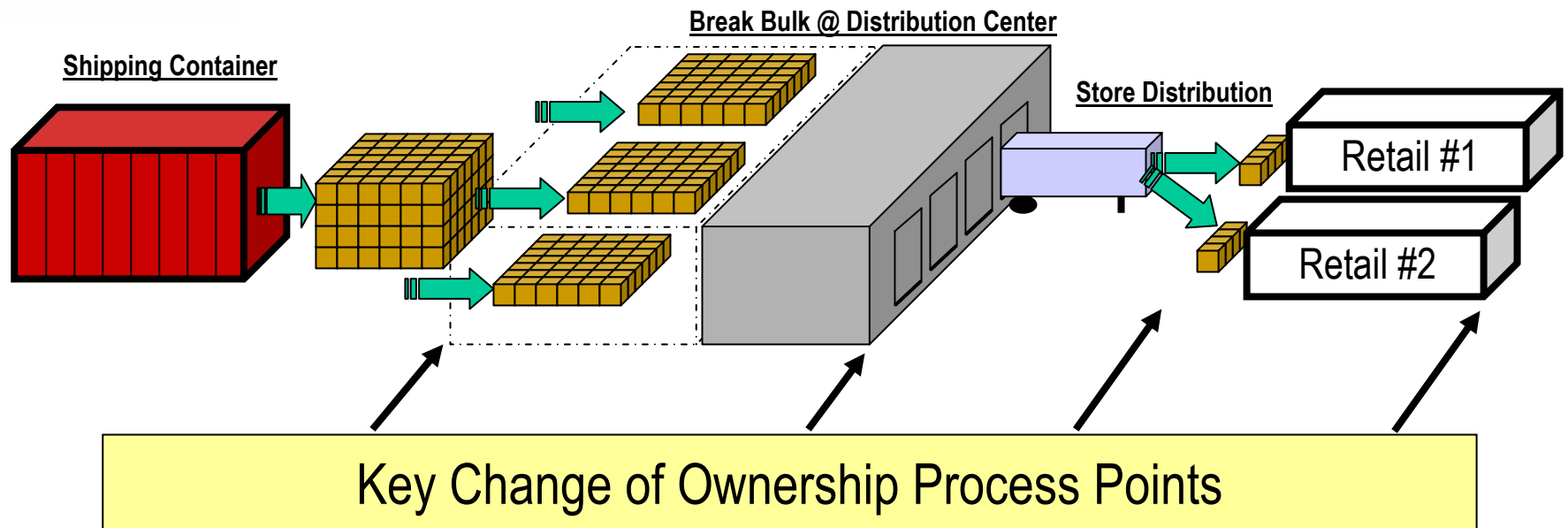
Specific “Pain Points” In Supply Chains Addressable by RFID.....

- It’s the accuracy and accountability of inventory at change of ownership points
- In the Warehouse
 - Automating Receiving and/or Shipping
 - Pick, Pack and Ship visibility
- In the retail location
 - Automating receiving into the store room
 - Shelves... when readers come way down in price
- Sales teams wanting to up sell on serial number traceability
- Pallets now ... Box level soon ... Individual Items after that

System Considerations

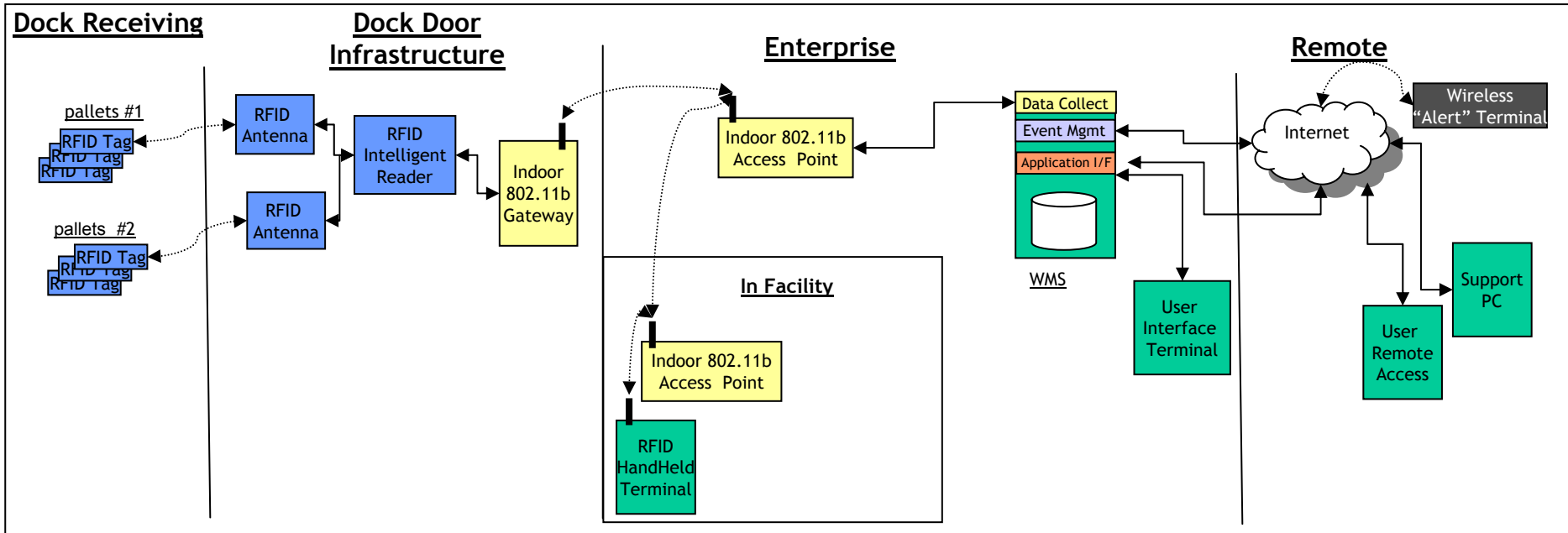
- Read Reliability 99.99%
- Process Margins Wide, can not be restrictive
- Managing Exceptions Murphy's Law
- Data Model What do you want to track?
- Product Distribution models and networks
..... Practicality of outfitting network
- Value Added Applications
..... Decision Support
- Interfaces Use Standards, low volume in
distributed transaction model

Retail Distribution Process



- Highly Manual
- Lack of accurate and complete inventory measurements at each change of ownership “point” Leads to inventory shrink.

RFID Supply Chain Implementation



- *Increased read range enables many processes to now be automated*
- *No middleware required*
- *Most WMS systems have handheld (human interaction element) in place*

Editorial Comments....

Customer's View Of What Flavors Of RFID in The Supply Chain Will Be Successful And Where?

- Pragmatic
 - Solve my “Today” problems without huge enterprise investment and disruptive process changes
 - No “Anti Gravity Machines” ... bought too much “shelfware” last go around
 - Bring solutions that can start small and scale throughout the enterprise

Value Description Matrix

<u>Characteristics</u>	<u>Yesterday</u>	<u>Today</u>	<u>Future</u>
1) Reader : Tag Ratio	1:1	1:100	1:1000
2) Read Range Process Window	1'	6'	12'
3) Value Proposition/ Function	Data Collection	Data Collection + Process Automation+ Event Triggering	Closed Loop Control
4) Host Unit	Pallet	Box & Item	Item

- *Value propositions are directly applicable to items 1) and 2)*

Ranked Supply Chain Market Verticals...

Each Have Unique Opportunities & Challenges

- 1) Consumer Electronics
 - 100's of Millions of units, high value and moderately verticalized supply networks... but many system units are metal and thus might not applicable to RFID
- 2) Pharmaceuticals:
 - 100's of Millions of units, high value, packaging host is largely plastic and security and serial number traceability is important... but supply chains are moderately fragmented
- 3) Consumer Goods
 - Billions of units, moderately valued products, cloth and leather based, moderately verticalized distribution networks, smart labels ... but very fragmented supply base
- 4) Automobile Parts
 - 100's of Millions of units, high value and highly verticalized supply networks... but many are metal and thus not applicable to RFID
- 5) Consumer Packaged Goods
 - Billions of units, smart packages ... but lowest cost products, most fragmented supply chains/distribution networks, many are liquid and foil based

How And When Will We Reach a High Point In Adoption of RFID in Supply Chain Applications?

- When...
 - RFID is not a technology issue any longer
 - RFID Successes are well documented and replicatable across customers
 - Supply Chain Enterprise S/W providers embrace this natural extension of their systems
 - Open Standards for:
 - Air Interface
 - Tag Payload Format
 - Tag payloads are able to be adapted to match existing enterprise system product numbering schemes
- We are getting closer
- *It will be a "Spock's New World" vs. a "Big Bang"*

RFID Value Chain Questions That Still Remain Open?

- How will closed loop systems really work? ⁽¹⁾.
- Is a “middleware” needed?
- Can we get to a \$.05 tag? Does it Matter?
- How will the Smart packaging movement impact RFID?
- How will RFID system elements be distributed into solutions? Where is the money to be made?
- How much data will be required to be transmitted outside the enterprise?

(1). Ref: www.autoidcenter.org

Thank You

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