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TRACK AND MANAGE **EVERYTHING**

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RFID Visibility Data for Business Applications

Kenneth R. Traub, PhD

Ken Traub Consulting LLC

3 April 2012

Outline for Today

- 11:30 (now): RFID Visibility Data for Business Applications
 - What's the important data, and how do you use it?
- 12:15: RFID Data Capture Software
 - How do you collect the important data?
- Lunch
- 1:45: Putting It Together: Architecture, Product Selection and IT Governance
 - How do you build a complete system for the enterprise?
- 2:30: RFID Tag-Data Standards
- 3:30: RFID Data-Capture Standards: LLRP and ALE



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About the Speaker

- Independent Consultant
- Specializing in EPC/RFID Standards adoption
 - Software architecture for enterprises and solution providers
 - Educational programs on standards tailored to clients' needs
- Actively involved in GS1/EPC standards development
 - Member, GS1 Architecture Group
 - Editor, GS1 System Architecture
 - Editor, EPCIS and CBV specifications
 - Co-chair, Filtering & Collection (ALE) Working Group
 - Editor, EPC Tag Data Standard
 - Contributor to four other software specifications
- Consulting Instructor for Academia RFID



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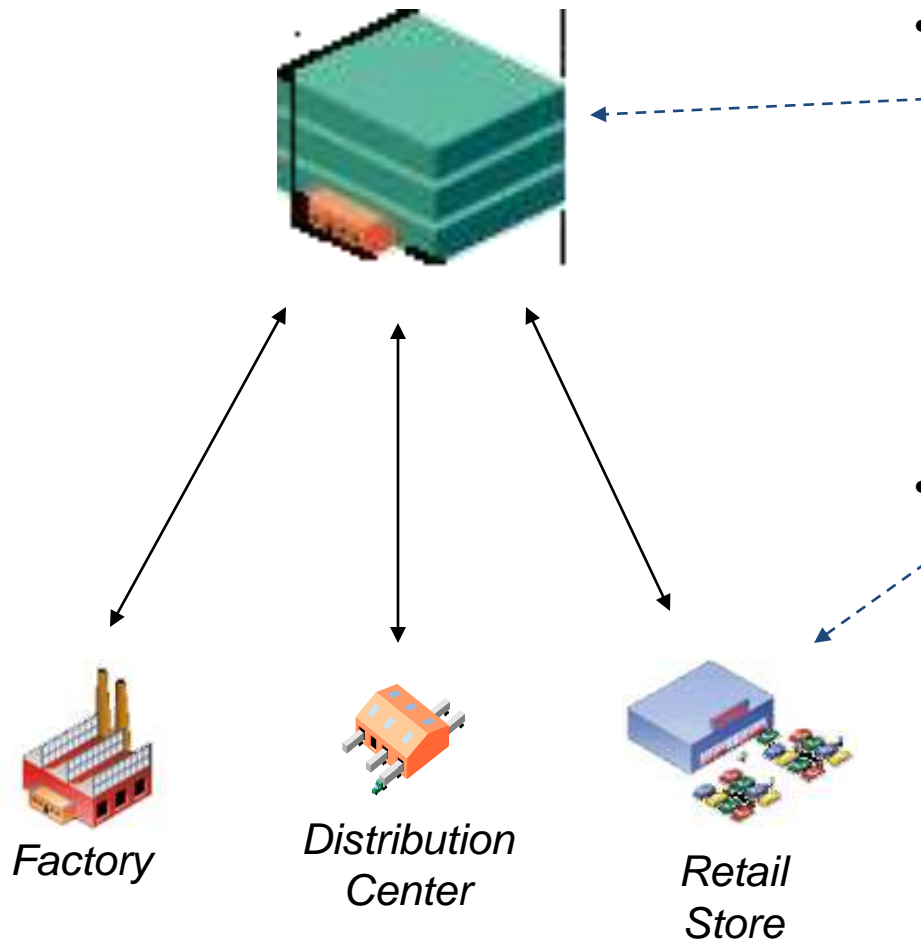
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Visibility into the Physical World



- Business decisions are made here, in the company headquarters data center

- ...but there's an awful lot of important action **here**, in the real world.

➔ Unique identification and RFID technology can bring awareness of the physical world



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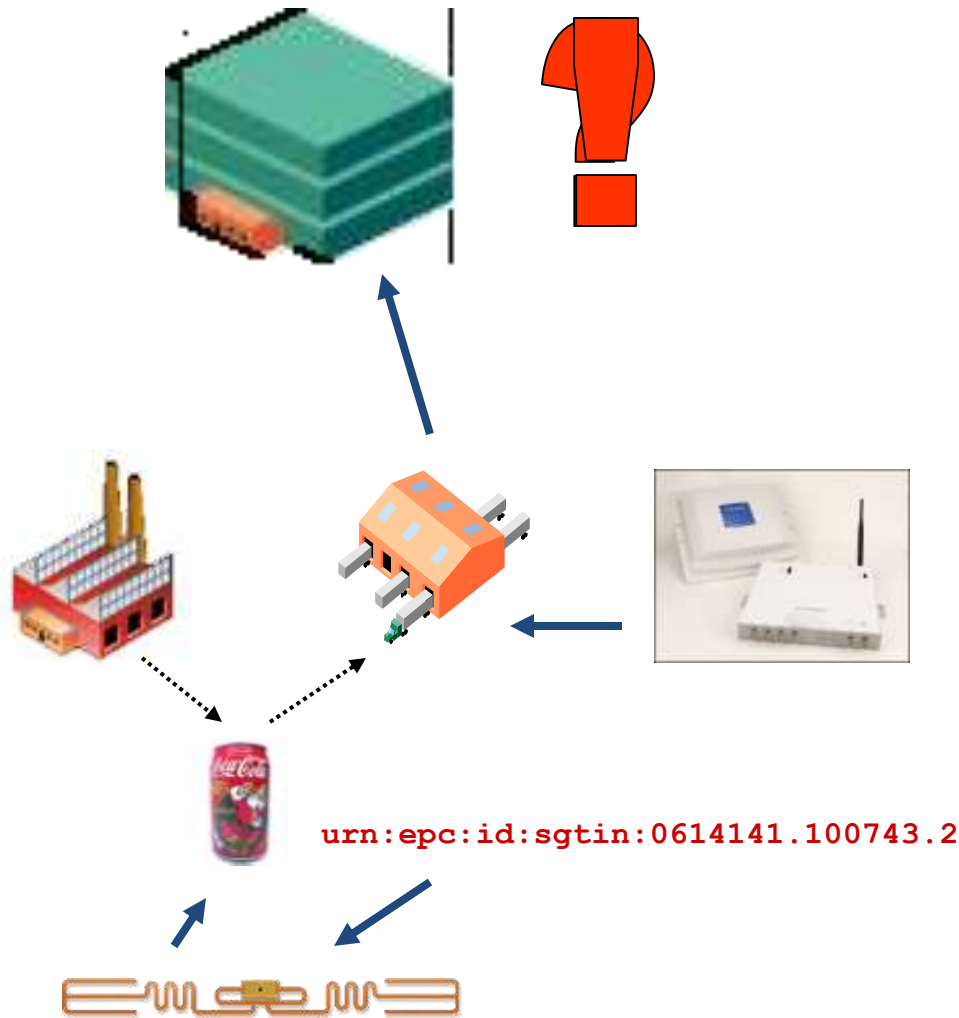
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What do Unique Identification and RFID do?



- No Unique ID/RFID → No Visibility
- An ID (EPC or other) uniquely identifies the asset
- RFID Tag encodes the ID
- RFID Reader senses presence of asset (no human intervention)
- Information systems now have visibility data
- Business can take action



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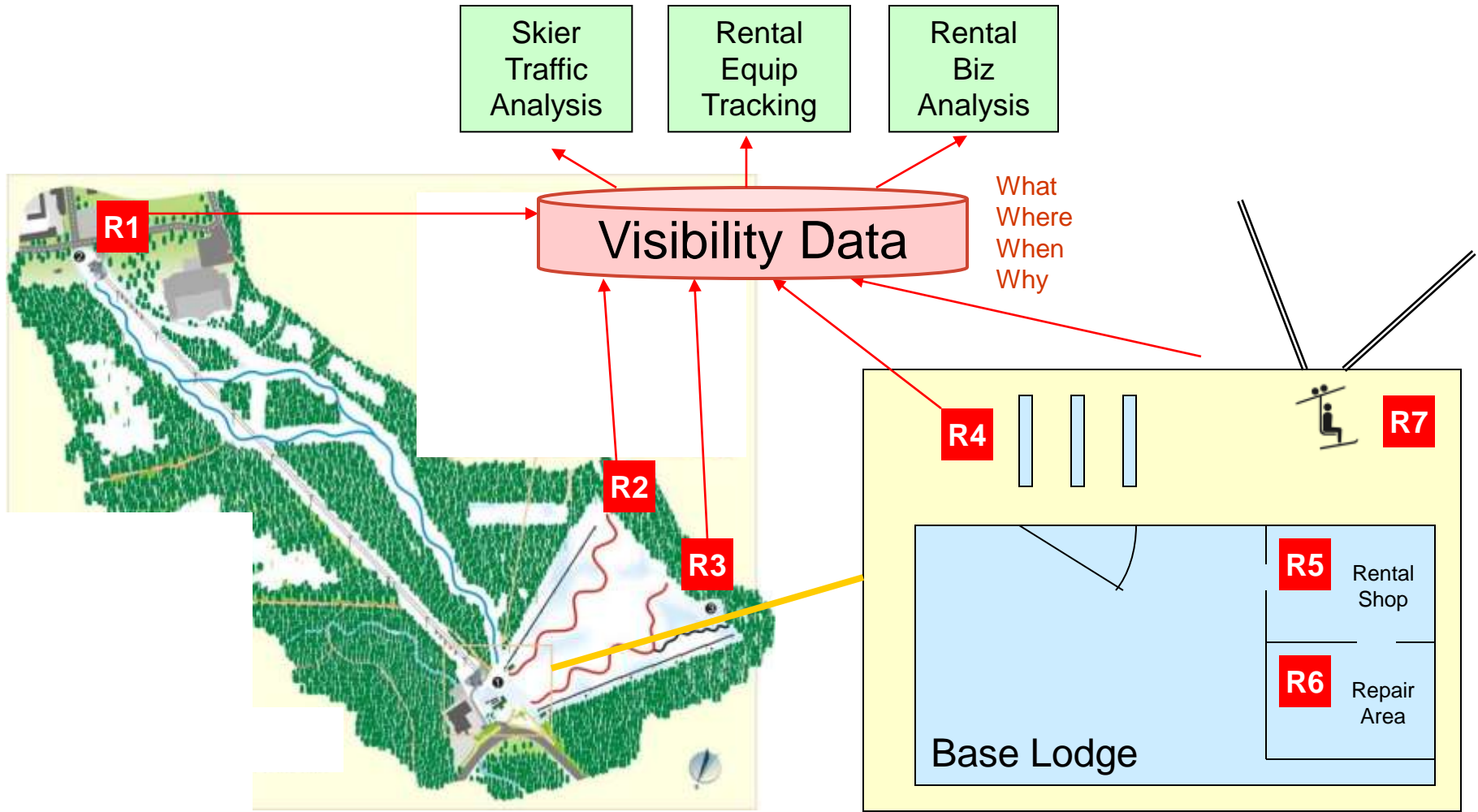
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Visibility Within a Business



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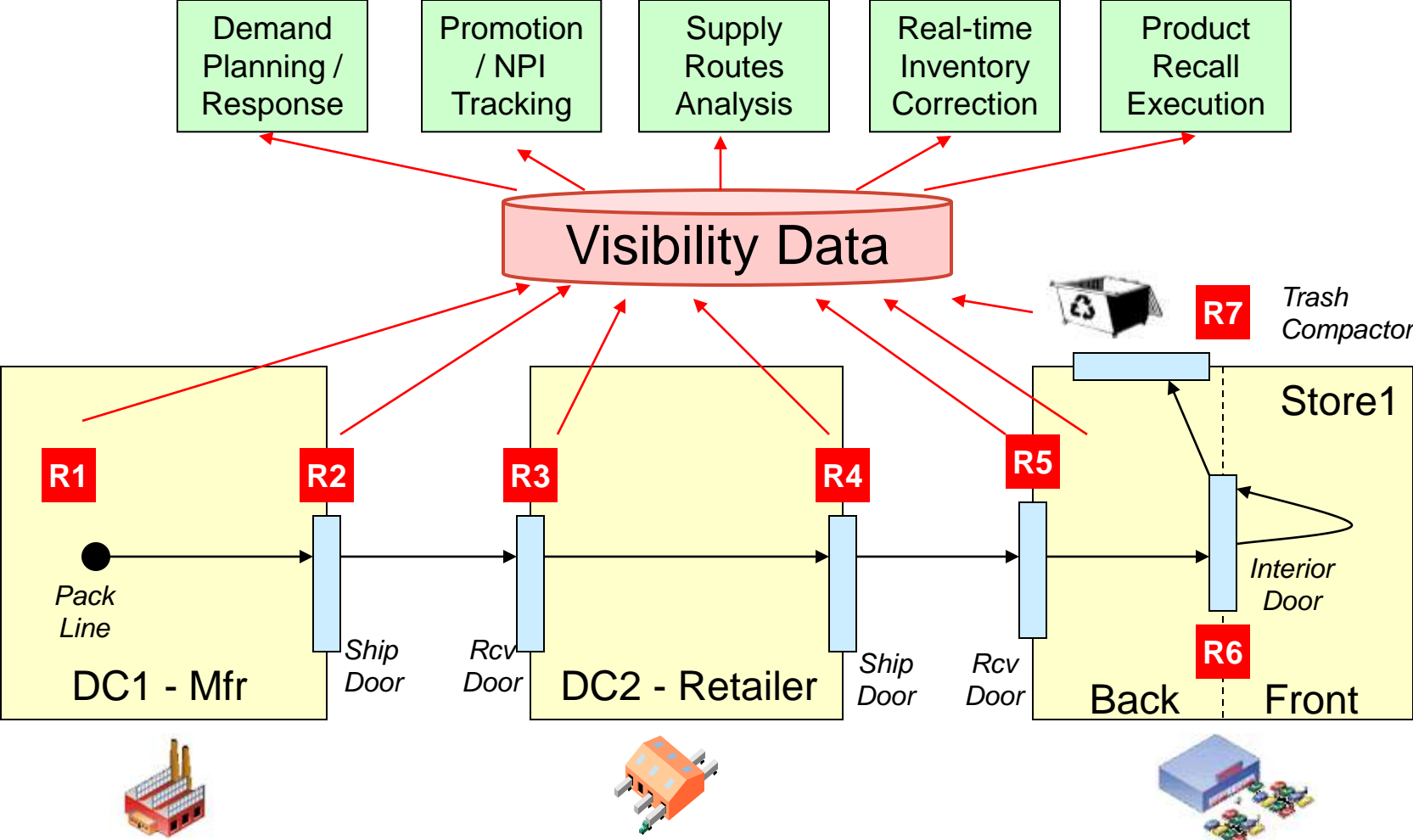
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Visibility in the Supply Chain



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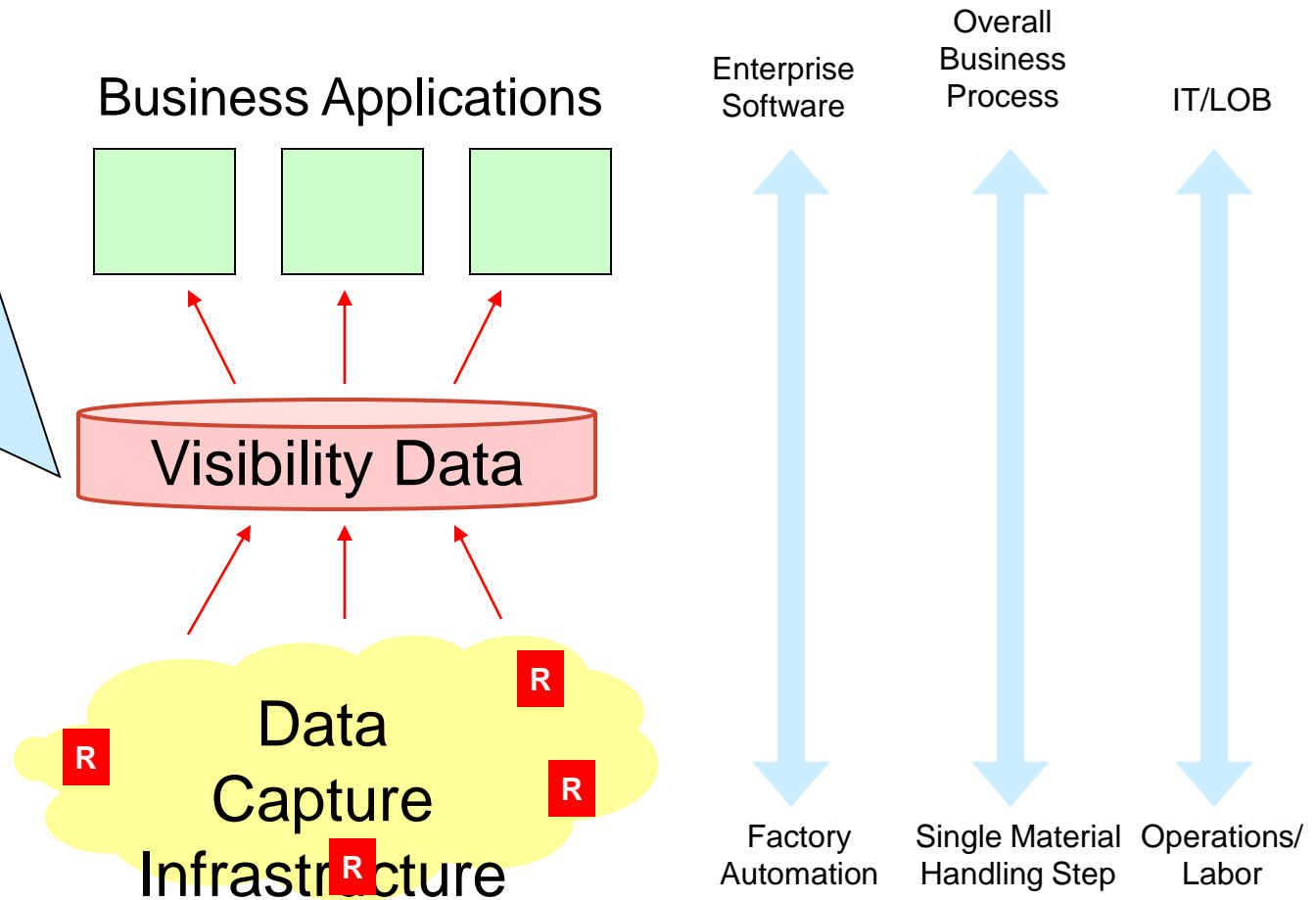
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Visibility Architecture

Single Most Important Design Decision:
This Interface

Key “hinge”
between different
worlds



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Examples of Data Capture

Business Scenario	RFID Data Capture	Visibility Event Data
Monitoring goods in room or shelf	Single fixed reader 	Item arrives Item departs
Assets moving through door	Directional reader pair or reader with motion 	Asset passes through left-to-right Asset passes through right-to-left <i>Calculated from pattern of reads</i>



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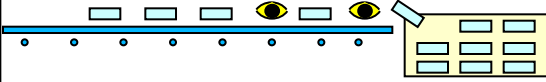
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Examples of Data Capture

Business Scenario	RFID Data Capture	Visibility Event Data
Forklift operations	RFID-enabled forklift Location sensors 	Asset picked up from bin Asset moves zone to zone Asset deposited into bin
Tag Commissioning	RFID Printer 	New tag printed and applied
Palletizer	RFID readers on conveyor; operator interface 	Pallet is built with identified case IDs



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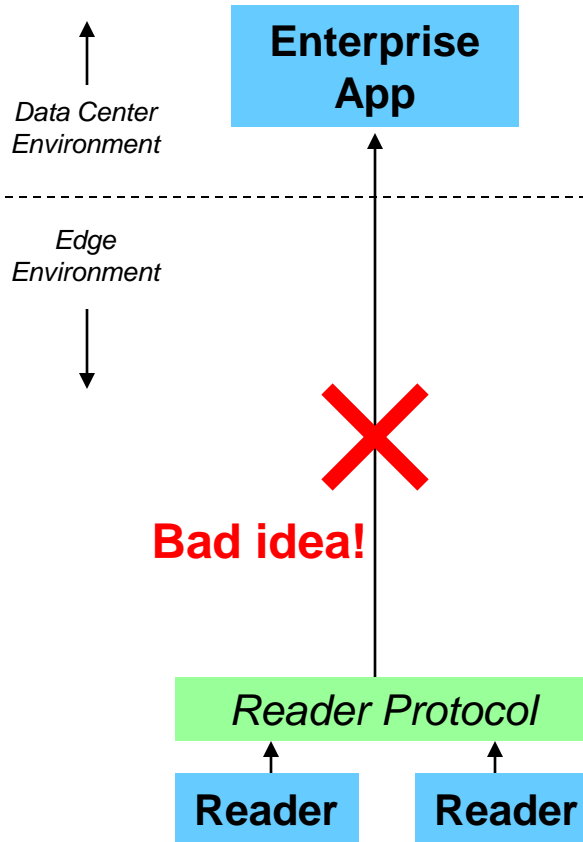
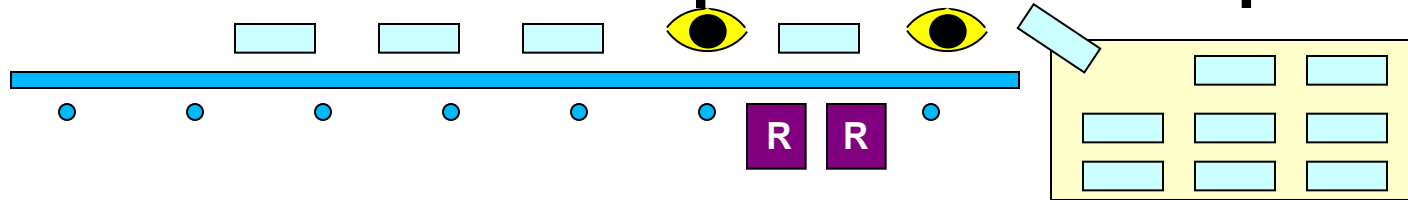
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Data Capture Example



- Too much data
- No local business logic
 - E.g., what if no tag read? Stop? Divert? Continue?
- Physical details not hidden from enterprise application
 - Hard to know what data means
 - Can't change the operational process

dozens of individual tag read events from specific antenna



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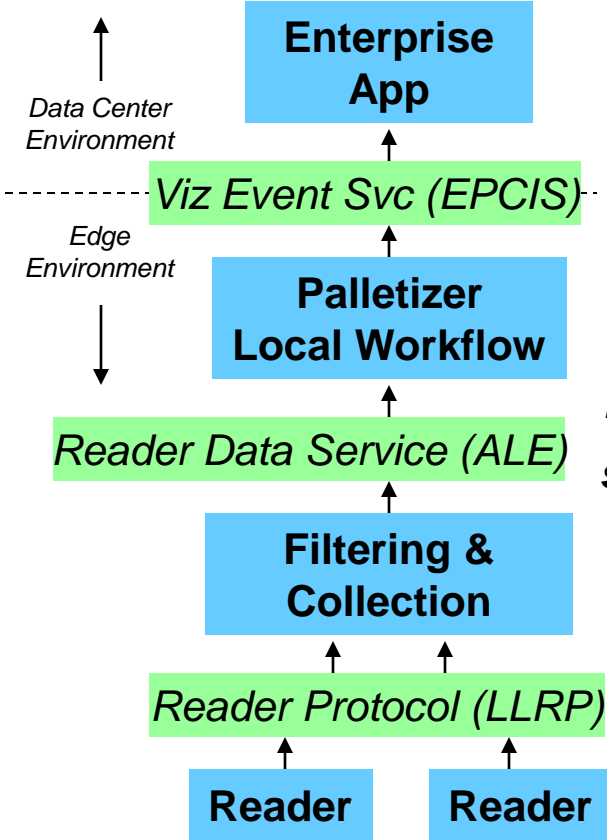
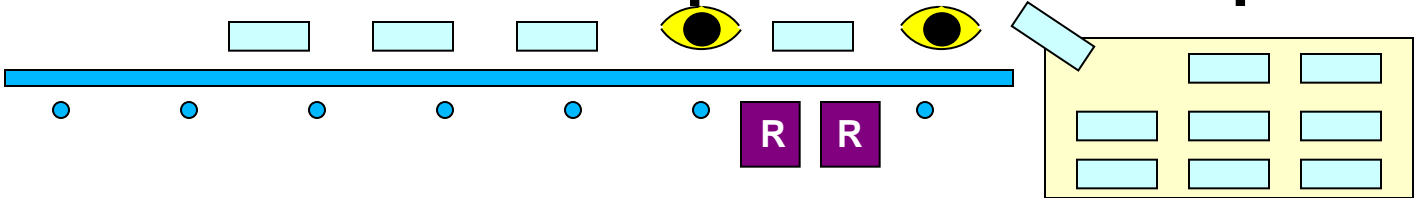
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Data Capture Example



“at time T, the association of the following case tags to the following pallet tag was created at palletizer #3, to fulfill order #1234”

Service consumed by enterprise -- operational details hidden

“between the time the case crossed the first beam and the second beam at location L, the following tag was read”

Service consumed by local business logic -- device details hidden

dozens of individual tag read events from specific antenna



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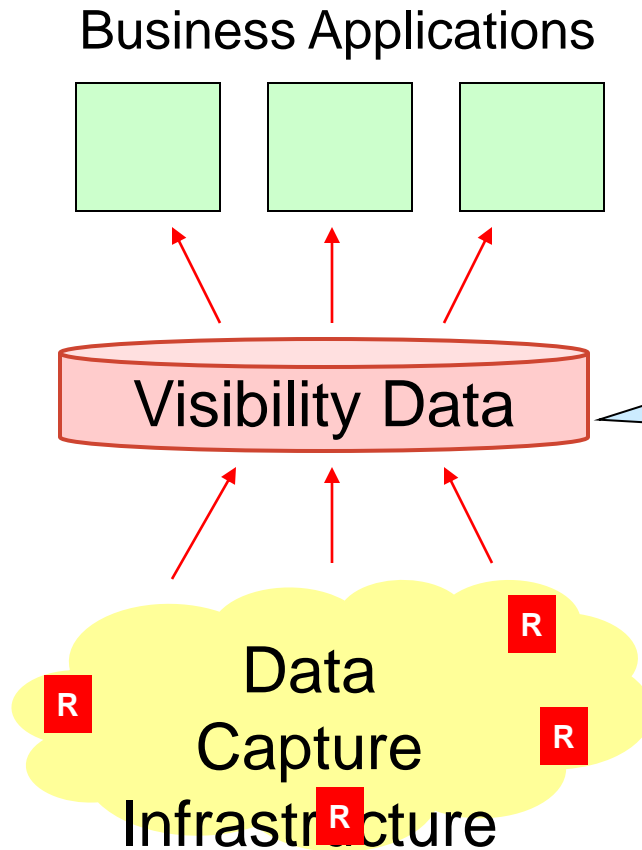
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Key Design Rule



Design the data at this layer to **decouple capture from use**



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Visibility Data Content

- Visibility data consists of **events**, each of which records something that happened in the real world.
- Often, though not necessarily, triggered by reading an RFID tag.
- An event has four dimensions:
 - **What**: what physical objects were involved (EPC or other identifier)
 - **When**: when the event took place (timestamp)
 - **Where**: where the event took place (location identifier)
 - **Why**: what business process step was being carried out

Where and **Why** are what distinguish **visibility data** useful to a business application from raw RFID data

`urn:epcglobal:cbv:bizstep:receiving`



The “Where” Dimension

- A location identifier that says
 - Where the **event took place**; and/or
 - Where things are **following the event**
- Understood by applications
 - **Master data** synchronization → important!

urn:epc:id:sgln:0400001.00300.0

- **Meaningful**
 - E.g., two rooms separated by a door, report which room, not the location of the door
- **Not necessarily the name of the reader**
 - E.g., for an RFID-enabled forklift, indicate into which bin the load was dropped, not which forklift did it
 - Location sensor, location tag, etc – not the reader identity



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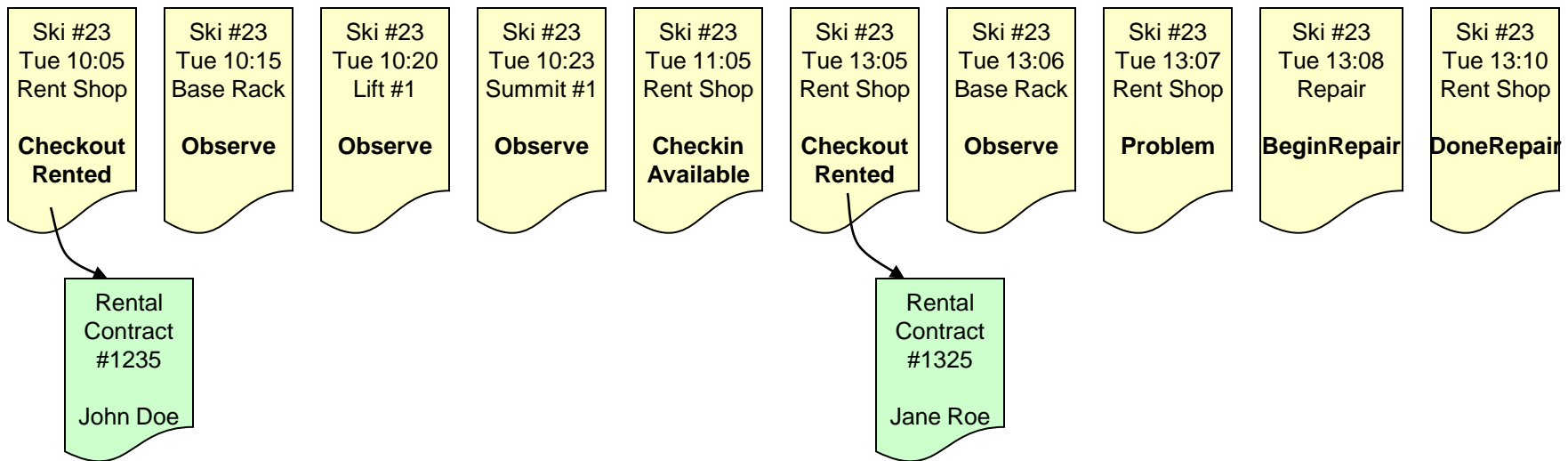
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The “Why” Dimension

- Identify the **business context** of the visibility event:
 - What **business step** was taking place at the time of the event
 - What is true from a business perspective **after the event**
 - Any associated **business transactions**
 - Purchase Order, Invoice, BOL, etc



Relevant EPCglobal Standards

- EPC Information Services (EPCIS)
 - Standard schema and semantics for visibility events
 - Precise definitions of **what**, **when**, **where**, **why**
 - EPCs not required!
- EPC Tag Data Standard (TDS)
 - Identifier structures for **what**
 - Identifier structures for **where**
- EPC Core Business Vocabulary (CBV)
 - Identifier definitions for **why**



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Standard EPCIS Event in XML

<ObjectEvent> ***Event type***

<eventTime>2007-11-06T15:00:02.449Z</eventTime>
<eventTimeZoneOffset>-05:00</eventTimeZoneOffset>

When

<epcList>
 <epc>urn:epc:id:sgtin:0400001.000006.1</epc>
</epcList>

What

<action>OBSERVE</action>
<bizStep>urn:epcglobal:cbv:bizstep:receiving</bizStep>

Why

<readPoint><id>urn:epc:id:sgln:0400001.00300.0</id></readPoint>
<bizLocation><id>urn:epc:id:sgln:0400001.00300.0</id></bizLocation>

Where

</ObjectEvent>



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EPCIS Events in Tabular Form

EPC	Time	Biz Loc	Store	Sub loc	Biz Step	Disposition
urn:epc:id:sgtin:061414.112345.400	2008-10-15 10:12:03Z	urn:epc:id:sgln:0614141.12345.1523	Store 23	Back room	Receiving	Sellable, not accessible
urn:epc:id:sgtin:061414.112345.401	2008-10-15 10:12:04Z	urn:epc:id:sgln:0614141.12345.1523	Store 23	Back room	Receiving	Sellable, not accessible
urn:epc:id:sgtin:061414.098765.24	2008-10-15 11:12:03Z	urn:epc:id:sgln:0614141.12345.153	Store 23	Sale Area	Stocking	Sellable, accessible
urn:epc:id:sgtin:061414.112345.400	2008-10-16 12:12:03Z	urn:epc:id:sgln:0614141.12345.153	Store 23	Sale Area	Stocking	Sellable, accessible
...

What

When

Where

Why



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EPC Core Business Vocabulary

*Actual spelling in
EPCIS data*



urn:epcglobal:cbv:bizstep:arriving

Business Steps
accepting
arriving
assembling
commissioning
decommissioning
departing
destroying
disassembling
holding
inspecting
killing
loading
packing
shipping
receiving
... [plus 16 others]

Dispositions
active
destroyed
inactive
in_progress
in_transit
sellable_not_accessible
sellable_accessible
non_sellable
non_sellable_expired
non_sellable_recalled
non_sellable_damaged
non_sellable_no_pedigree_match
returned
... [plus 6 others]



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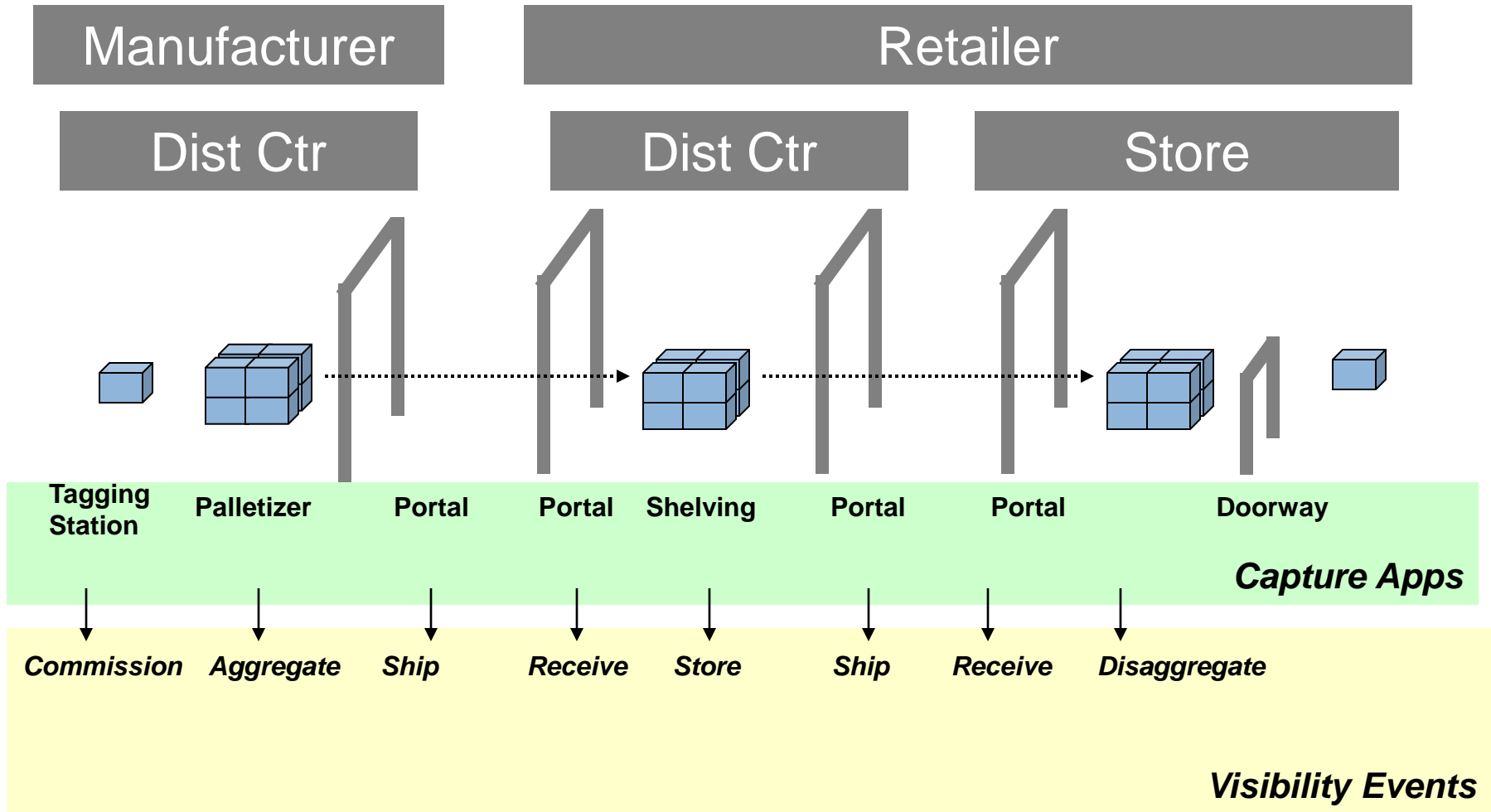
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Visibility Data Across a Business Process



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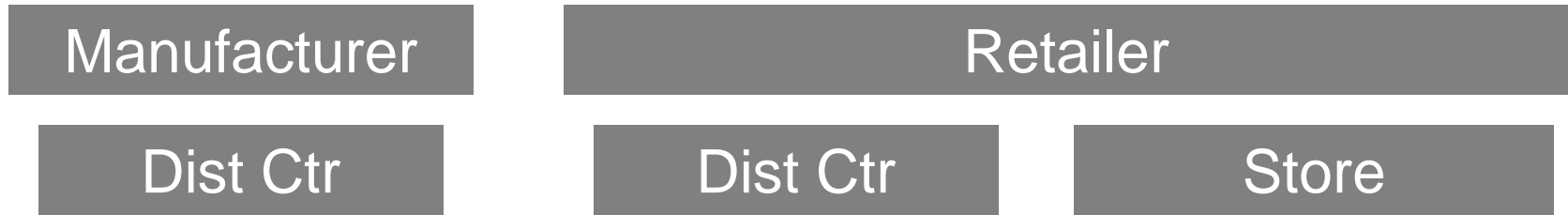
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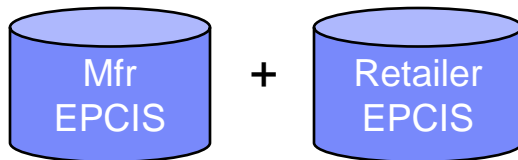
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Visibility Data Across a Business Process



Commission Aggregate Ship Receive Store Ship Receive Disaggregate

EPCIS Events



Case #123 of Cherry Hydro		
2/5 1:23pm	Mfr DC #2	Shipping
2/7 4:28am	Retail Store #5 back room	Receiving
2/8 5:23pm	Retail Store #5 front room	Observe



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Design Process

- Document the business process flows
- Break each process flow into a series of discrete business steps
- Model the completion of each step as a visibility event
 - Understand what information is needed from a business application's perspective
- Decide what data fields are to be included
 - If using EPCIS standard, start with data fields defined there
 - Choose which optional fields to include
 - Define extension fields if necessary
- Define the vocabularies that populate each field
 - A fixed list of identifiers with standardized meanings for things like business step and disposition – e.g., drawn from EPC Core Business Vocabulary
 - Rules of construction for user-created identifiers like read point and business location – e.g., according to EPC Tag Data Standard
 - Borrow from other verticals where semantics coincide exactly



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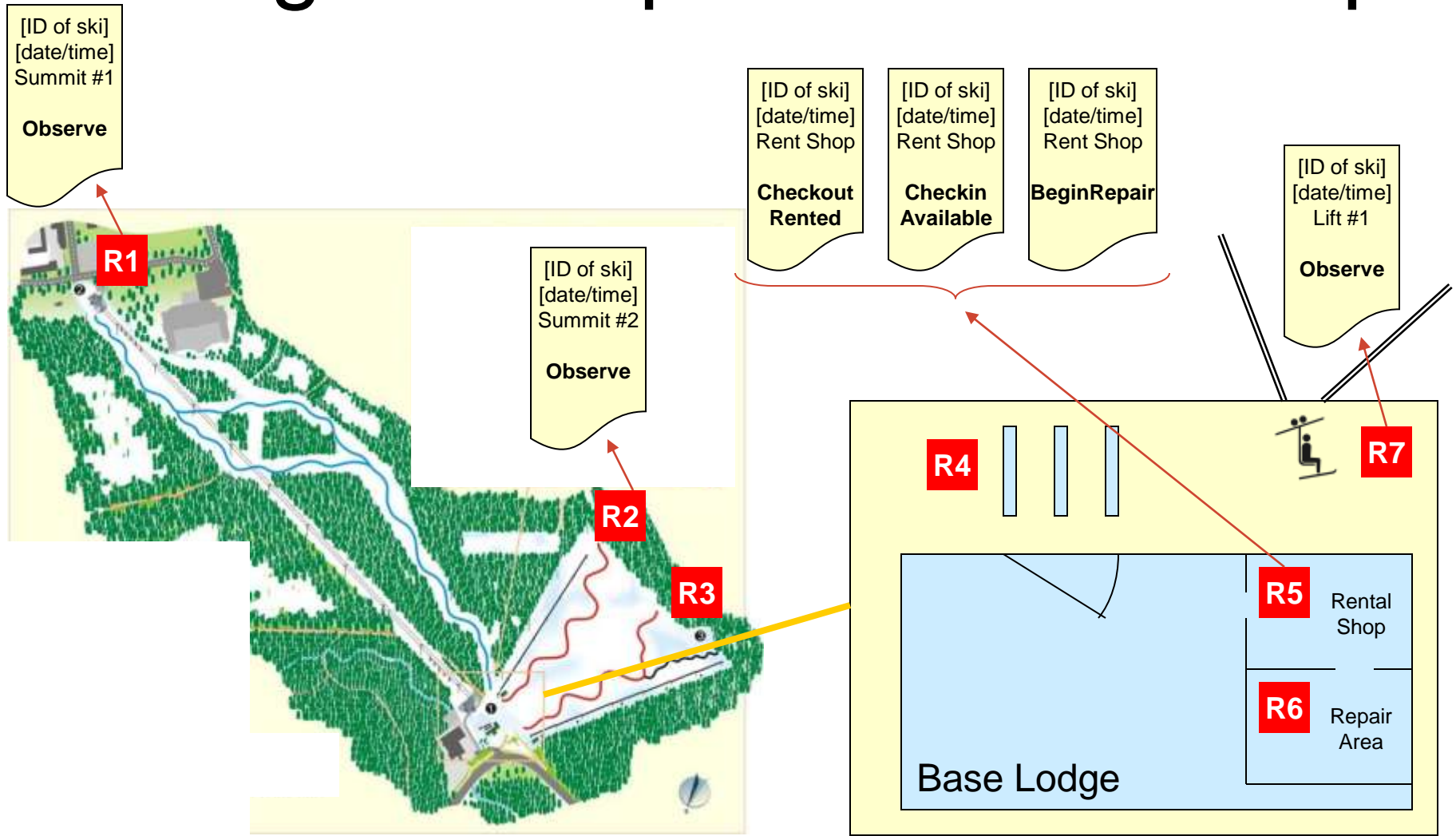
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Design Example – Closed Loop



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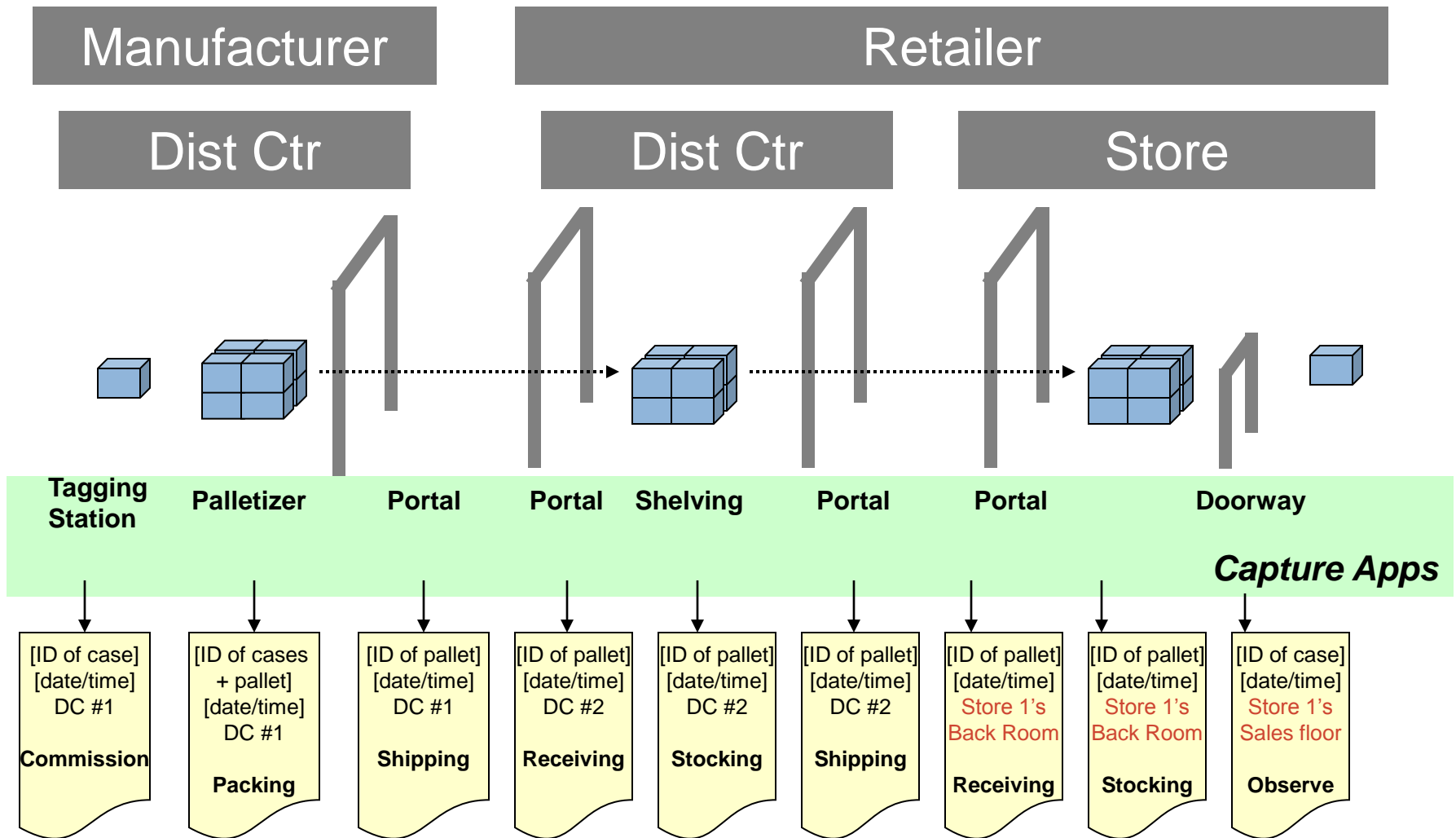
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Design Example – Supply Chain



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Conclusion

- **Visibility of What's Happening** drives the design of RFID hardware/software systems
- Key design area: **Visibility data interface** between
 - Data capture infrastructure; and
 - Data consumption by business applications
- Principle: **decouple data capture** from **data use**
 - **What, When, Where, and Why**
 - **Not** just raw tag reads!
- Relevant **standards**: EPCIS, EPC Tag Data Standard, EPC Core Business Vocabulary



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