# RTLS and Yard Management: Increasing Visibility

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### **Overview**

- Problem definition in the Distribution Center Yard
- What is RTLS: Benefits, applications, technologies
  - Technical evaluation criteria
  - Implementations w/ Active-RFID and Passive RFID
  - Technology Comparisons
- RTLS vs. Yard Management
  - How to choose a starting point
- Quantifying benefits
- Conclusions





## **The Problem in The Yard**

### The Problem at a Distribution Center Yard

### Predominantly Manual Operation

Trailers Checked-in manually and directed to a parking spot.

Drivers do not necessarily follow instructions

Multiple "yard-truck" moves needed to process trailers

Check-in to checkout visibility is lacking







#### Turn around time: up to 6 hours

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(Aberdeen 3/07)

### The RTLS Way: Yard Visibility

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Parking Lanos		Matrix	Shipment #:
Readers		YARD	
Reference Tags		Manual	Location:

Know where your assets are in real time! • Turn around time: 50% faster (Aberdeen 3/07)



## What is **RTLS**

## **Definition and Benefits**

### What is RTLS?

- Real-time Location System
- Key qualitative descriptors that need to be quantified
  - Real-Time per second vs per day
  - Location by inch, by foot, by acre?
- Quantification is application dependent
- For effective yard visibility:
  - RTLS means "track trailers with a few second delay and within a few feet, or +/-1 parking spot of accuracy."

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### **Active vs Passive RTLS**

- Active systems use an active (battery operated, with a processor and local intelligence) tag that has to communicate with multiple receivers concurrently
- Passive systems use standard C1G2 (no battery no intelligent processing) RFID Tags that are read by RFID readers

### Yard Operation – w/ RTLS



### **RTLS Benefits in The Yard**

- Labor Savings
  - Reduce/eliminate the need for yard checks
  - Reduced search time for yard truck drivers
- Improved yard truck staffing
  - Productivity monitoring and comparison
  - Proper training
- Reduced demurrage/detention
  - Electronic documentation of all movement, Alerts and reminders
  - Reverse demurrage
- Reduced Shrinkage through visibility
  - Spoilage, theft, delays

### **Additional Benefits**

- Reduced number of empty equipment on site
- Improved yard utilization from better partitioning
- Less equipment needs by activity leveling
- Lower insurance claim deductibles
- Improved communication among departments
- Improved communication with partners and carriers
- 24/7 visibility via internet

### **RTLS Applications Beyond Yards**

- Containers, Chassis in Shipyards
- Equipment, people in Healthcare/Enterprise
- Pallets/Cases, forklifts in Warehouses
- Cargo at Airports
- Cars in Manufacturing Plants, Parking Lots
- Books in the library

### **RTLS Players by Market**

10.3-3

- Distribution Center Yards
- Shipyards
- Automotive
- Enterprise/healthcare

PINC, Wherenet Wherenet, **ContainerTrac** Wherenet, **Identech** Aeroscout, Ekahau, Pengo

### **RTLS Growth projections**

- The market reached \$200 million in 2004.
- The market is expected to grow to \$1.26 billion by 2011
- Frost & Sullivan (877-463-7678) Sathya Durga, research analyst



## **Understanding RTLS**

## **Technical Evaluation Criteria**

### **Clarifying Terminology**

- Location versus Presence
  - Knowing the LOCATION means you can directly go to the item
  - PRESENCE information lets you know if you have the item (somewhere)
- Choke Points
  - Keep track of items as the enter and exit
  - No idea where they end up

### Not all Active Tags have RTLS

- A number of companies sell "Active" Tags, i.e. tags that are battery powered, and have longer read ranges:
  - Identech, RF-Code, Savi
  - Inetelleflex
- While these tags are great for presence management in larger areas, they do not come with RTLS

## **Clarifying Terminology**

- The "real-time" in RTLS
  - Interrogation Frequency
  - Battery life

- Management vs. Visibility
  - Management = Brain
  - RTLS = Eyes and Ears





# Implementations

### **RTLS** Technologies

### Active RTLS - Proprietary

- Wherenet
- Time difference of arrival for triangulation
- Tag cost \$40+, each tag needs to see 4 antennas (\$5K+installation)

### Active RTLS – Standard Wi-Fi

- Aeroscout, Pengo, Ekahau
- Signal strength
- Tag cost \$40+, each tag needs to see 4 antennas (\$5K+installation) Asset may already have WiFi, facility may already have some antennas!

### Passive RTLS - Standard C1G2 RFID

- PINC
- Track location of a few mobile assets with an RFID Reader, place passive tags of the large number of tracked assets, perform RTLS in software!
- Tag cost ~\$3, Tracker cost ~\$8,000 installed!

# **Active RFID-Based RTLS**

- Major Player: WhereNet (now Zebra)
- Location determined by measuring the relative time-of-arrival of signals to the access points
- Pros:
  - Accurate, efficient, and proven
- Cons:
  - Requires extensive infrastructure installation and calibration (esp. costly in outdoor settings)
  - Proprietary hardware
  - High initial hardware investment
  - May need recalibration
  - Battery life, maintenance

### **Gate Process**



### **RTLS Architecture**



# WiFi-Based RTLS

- Major Players: AeroScout, Ekahau, PanGo
- Location determined by relative signal strength received by the access points
- Pros:
  - Can utilize existing Wi-Fi infrastructure
  - No tags needed to track Wi-Fi enabled equipment
- Cons:
  - Can require extensive infrastructure, even if Wi-Fi infrastructure already exists (need minimum four access points)
  - High initial hardware investment
  - May need recalibration
  - Battery life, maintenance

### **Installation Architecture**



### Installation Steps for Active or Wi-Fi based RTLS

10.3-3

- Antennas
- Tags
- Exciters
- Reference Tags

### **Typical Active RTLS Challenges**

- Installation Cost
  - Digging ditches
- Coverage area and uniformity
- Asset tagging
  - Permanent vs. transient assets
- Power
  - For the antennas and for the active tags

### Passive RFID-Based RTLS

- Major Player: PINC
- Methodology: Place RFID Reader on assets, making readers mobile. Track the vehicles which "see" and locate the assets.
- Pros:
  - Small infrastructure requirement
  - No change to workflow
  - Significantly lower cost than active RFID or Wi-Fi based solutions
  - Uses Standard Wi-Fi/RFID equipment
  - Can place trailers to +/-1 spot accuracy
- Cons:
  - Need a vehicle for the mobile RFID reader that can drive by assets in ~40' proximity

### **Installation Steps: Tags**



### **Installation Steps: Tracking Unit**



### **Gate Check-in Process**



### **Product Operation – Passive RTLS**

SERVER

**Event** 





# **Technology Comparisons**

## **Comparing RTLS Technologies**

	ACCURACY		INFRAS C	TRUCTURE OST	TIME TO IMPLEMENT
ACTIVE-RFID	Good -	10 ft High		Months	
PASSIVE-RFID	Good -	10 ft Low		Days	
	FREQUENCY	MAIN ADVANTAGE		MAIN DISADVANTAGE	
ACTIVE-RFID	2.4Ghz	Proven technology		High cost	
PASSIVE-RFID	900 Mhz	Proven, Simple, inexp		inexpensive	Requires "movers"
	RANGE			В	ATTERY LIFE
ACTIVE-RFID	1000 ft			A few months to years	
PASSIVE-RFID	40 ft*			No battery needed	

### **How To Select**

- Passive RTLS is cheaper and easier to implement and maintain and is the better solution if:
  - The application has a "tracking" vehicle (like yard truck) that can drive by assets within ~40'
  - If moves performed by "unmonitored" vehicles can be identified by the "tracker" in time
  - If several feet of accuracy is sufficient
- By spending more \$\$ you can ultimately address wider range of problems with active RTLS
  - Place an active tag on all tracked assets
  - Blanket your facility with antennas/readers
  - Replace batteries as necessary



# **RTLS and Yard Management**

### **RTLS and Yard Management**

- RTLS is the beginning of proper yard management
- It provides actionable information for proper decision making
- The decision making can be performed by a human operator
- The decision making can be assisted by/made by other IT systems
  - If there are 2+ Yard Trucks in the yard, IT system assistance may be warranted!
- Traditional Yard or Warehouse Management Systems rely on manual information about transactions and provide planning support



### **Application Integrations**



### Yard Management Analytics

- Constructs
  - Trailers, Yard Trucks, Tractors
  - Gates, Dock Doors, Parking Spots
- Input:
  - A number of trailer arrivals at a Yard
  - A sequence of moves that need to be performed for appropriate processing of the trailer
- Output
  - Directives to Yard Truck drivers to perform trailer moves
- Interfaces
  - Trailer readiness at the Warehouse Dock doors
  - Arrivals/departures at the Gate
  - Every move by Yard Trucks or Tractors

### YMS or WMS without RTLS

- Tractor drivers are expected to drop off trailers at designated locations
- As Yard Truck drivers carry out move instructions, they are expected to
  - Complete moves as instructed
  - Provide reliable feedback on start and end of maneuvers
- Fact
  - Trailers are not always dropped of at the correct locations
  - Driver feedback is not always accurate
  - Subsequent drop off or pick-up instructions cannot be carried out
  - Exceptions require manual problem resolution
  - Ongoing Yard Checks remain a requirement

### YMS or WMS without RTLS

- The performance of the overall solution is limited by the accuracy of the human feedback
- There is no independent verification of actual system
   performance
- Lack or RTLS requires additional manual intervention (labor overhead) for proper operation



## Do you start with Yard Visibility or Management?

### If You Already Have a YMS

#### Add RTLS To

- Validate all task assignments and completions for full trailer location accuracy
  - Eliminate need for yard checks
  - Reduced search/driving time for yard trucks
- Automatic trailer identification across sites
  - Faster check-in/out
  - Monitor smaller satellite yards
- Refrigerated unit monitoring
  - Eliminate manual fuel/temperature checks
  - Avoid spoilage
- Independent productivity monitoring
  - Improved staffing
  - Better equipment utilization
- Faster incident resolution
- Improved security

Reduced labor & equipment + Increased visibility and accuracy

### Visibility vs. Management

- If you have a smaller yard with a few yard trucks, visibility may be all you need
- If you have 5-7 yard trucks you can start with visibility and expand your operation with additional features
- If you have 10+ yard trucks, you do need both Visibility and Management



# **Quantifying Benefits**

### Yard Truck Performance Tracking

#### (Sample Web Server Screenshot)



### **Real Time Yard Truck Visibility**

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ve Switcher Display	201	
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eate New Asset	203	
ate New Tag	7.204	
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22	4 204	
	3 201	
	2 272	

### Notifications

- Set notifications for each trailer or all trailers
- Based on
  - Arrival/Departure,
  - Movement,
  - Location,
  - Status,
  - Customizable criteria
- Optimize operations

Home	Delew	
Facility Map Asset Inventory Find Asset	Asset Moved Asset Did Not Move Asset Entered Facility Asset Exited Facility	
Create New Asset Import Assets Create New Tag	Asset Did Not Exit Facility Asset Located Description	_
Reports Event Log Gate Scan Log Goat Path History	CreateCancel	

Status	Asset ID	Туре	Created On	Description	
Closed	SAFEWAY-4097F	Asset Did Not Move (60 minutes)	11/09/06 13:23	System-generated notification renewal	Delete
Closed	SAFEWAY-4097F	Asset Moved	11/09/06 13:21		Delete
Closed	SAFEWAY-4097F	Asset Did Not Move (5 minutes)	11/09/06 13:17		Delete

#### Yard Hound : Create Notification (Asset FRONT-5379)

### **Quantifying Benefits**

 PINC's customers reduce costs while increasing throughput

<ul> <li>Time searching for trailers reduced by</li> </ul>	67%
<ul> <li>Yard checks reduced by</li> </ul>	70%
<ul> <li>Yard check reconciliation reduced by</li> </ul>	70%
<ul> <li>Demurrage/Detention charges down by</li> </ul>	80%
<ul> <li>Opportunity losses</li> </ul>	85%

PINC's customers see ROI in less than one year

### Sample Savings Model



Skilled Maneuvers, 10% Search Time, 5%	Non Driving Time, 15%
AFTER	(loaded & unloaded), 70%

Cost Assumptions	
Number of yard checks currently performed per day	3
Avg. time spent performing yard check (in minutes)	360
Wage rate of person performing yard check (\$/hr.)	\$ 12.00
Avg. time spent reconciling yard check (in minutes)	60
Wage rate of person performing reconciliation (\$/hr.)	\$ 12.00
Avg. number of hours per day per yard tractor	11
Wage rate of hostler	\$ 17.00

#### **Quantifiable Monthly Savings**

Yard Checks	\$ 3,696
Hostler Productivity	\$ 313
Hostler Staffing	\$ 823
Demurrage	\$ 1,333
Reverse Demurrage	\$ 300
Shrink/Opportunity Loss	\$ 708
Total	\$ 7,173

#### Annual Savings

#### <u>86,078</u>

\$



# **PINC YMS Extensions**

### **Yard Hound Director**

- Yard personnel interact with Yard Director to
  - Designate source and destination
  - Select sequence of moves
  - Assign yard truck
  - Cancel/re-order moves
- Yard Director automatically
  - Prevents conflicting orders
  - Sends orders to the yard truck
- Lock/release authority by doc



### Yard Hound Director – Cont'd

- Touch sensitive display in the cab
  - Ruggedized for industrial use
  - Infra-red touch screen display
  - WiFi connectivity
- Driver receives
  - Multiple move assignments
  - Automatic verification of the attached trailer and the current parking location
  - Warning upon incorrect moves
- Driver sends
  - End of move (also verified automatically)
  - Exceptions (blocked, missing, etc.)
  - Trailer load status (empty, partial, full)





### **Reefer Monitoring**

- Reefer monitoring sensor + PINC Tag
  - Permanent or temporary
  - Compatible with Thermo King
- Monitor temperature and fuel levels
- Customized alarms based on
  - Actual vs. set temperature
  - Percent of remaining fuel
  - Multiple alarm levels possible
- Temperature history while in yard
- Preventative maintenance information



### **Carrier View**

- Carriers view own trailers on customers' site
- Real-time equipment status, inventory, and history via the web
- Set and receive notification alerts
  - Ready trailers, arrivals, departures
- Make dock appointments
  - Faster processing upon arrival at the gate



trailers

## **Customer Calligraphy Skills**



## **Customer Calligraphy Skills**



### Conclusions

- RTLS is a reality
- Both active and passive tag approaches represent mature solutions
- Passive is the cost-efficient approach for Distribution Center Yards
- Immediate benefits in Distribution Center yards from RTLS and Visibility
- In smaller facilities RTLS is sufficient for operational efficiency
- Extended benefits as integrated with other IT systems





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