SOLVE FOR X.

TURNING BIG DATA INTO USEFUL ANALYTICS

Presented by:

Mike Maris

Sr. Director,
Transportation & Logistics

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ZEBRA

WAREHOUSE & LOGISTICS

WAREHOUSE TECH

SHIPPING TECH

DELIVERY TECH

Systems get smarter, intelligently collaborate

- Trends & Distributed Interfaces
- Simplicity Via Augmented Reality
- Trailer Load Analytics

SOME KEY TECH TRENDS

Influencing New Thinking Around Business & Product Form Factors

New Energy Technologies

New Camera Capabilities / Analytics

New Device Constructions

Distributed Wearables / Personal Area Networks / New User interactions

OEM Automotive In-Cab Tech Growing

Real Time Business Intelligence / Analytics

VEHICLE MACRO TRENDS

Distributed Interfaces, Smartphone – Vehicle Coordination

Buick Intellilink
System syncs smartphone with vehicle system

Chevy Spark - MyLink
Seamless integration between Smartphone and vehicle. Gets all infotainment from the smartphone, including leveraging the voice-activation button on the steering wheel.

MirrorLink

MirrorLink™ is based on a set of well established, non-proprietary technologies. It uses standard Internet technologies (such as Internet Protocol) for compatibility with a wide range of devices. It also uses technologies such as Wi-Fi, as well.

Universal Plug and Play (UPnP™) is used for controlled access to applications. Virtual Network Computing (VNC™) is used to replicate the phone's display on the navigation screen and communicate user inputs back to the phone. Beside Bluetooth™, audio can also be streamed using the Real-Time Protocol (RTP).

MirrorLink™ also provides a mechanism that ensures only approved applications are accessible while driving. Applications will be approved using a standardize testing process that will be introduced later this year.

DISTRIBUTED INTERFACES

Vehicle Area Network

Small notifications displayed via windshield accessory without obstructing field of vision.

Information Snacking via T-OLED Display

Head – Up, Eyes on the Road – Transparent Windshield accessory display connected via BT to MSI Mobile Computer – presents notifications, re-route information without the driver having to reference the primary mobile computer, which remains holstered or cradled while driving.

PERSONAL TECH MACRO TRENDS

Distributed Interfaces, Smartphone – Smartphone Coordination

Sony SmartWatch
Small Android, multi-touch companion device – provides notifications, call answering, widget display

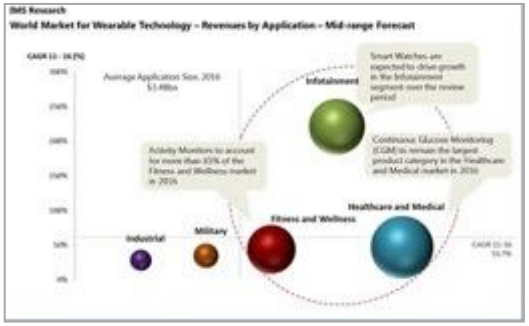
Moto Actv
Android GPS fitness Tracker and Music Player

Google Glass
Prototype, advanced development. Legitimizing head-worn computer. Most likely, companion to smartphone. Size, weight, cognitive limitations

Pebble SmartWatch
E-ink companion device – connects to i-Phone and Android devices. Most successful Kickstarter project ever

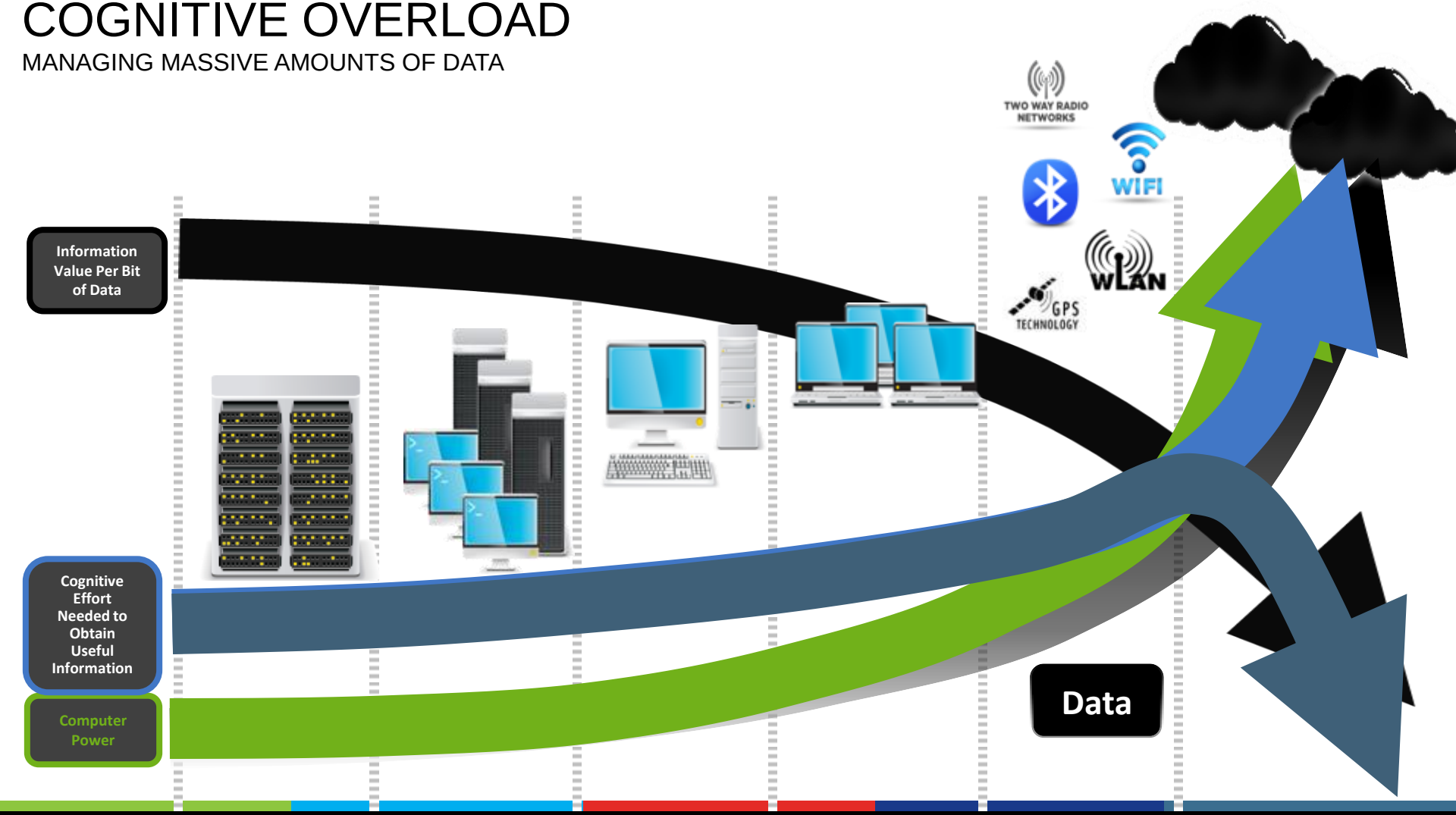
Vuzix Smart Glasses M100
Android, iOS – compatible. Mid-2013 launch. companion to smartphone via BT or wlan.. Ergonomics, Size, weight, cognitive limitations

Worldwide market for wearable wireless technology



COGNITIVE OVERLOAD

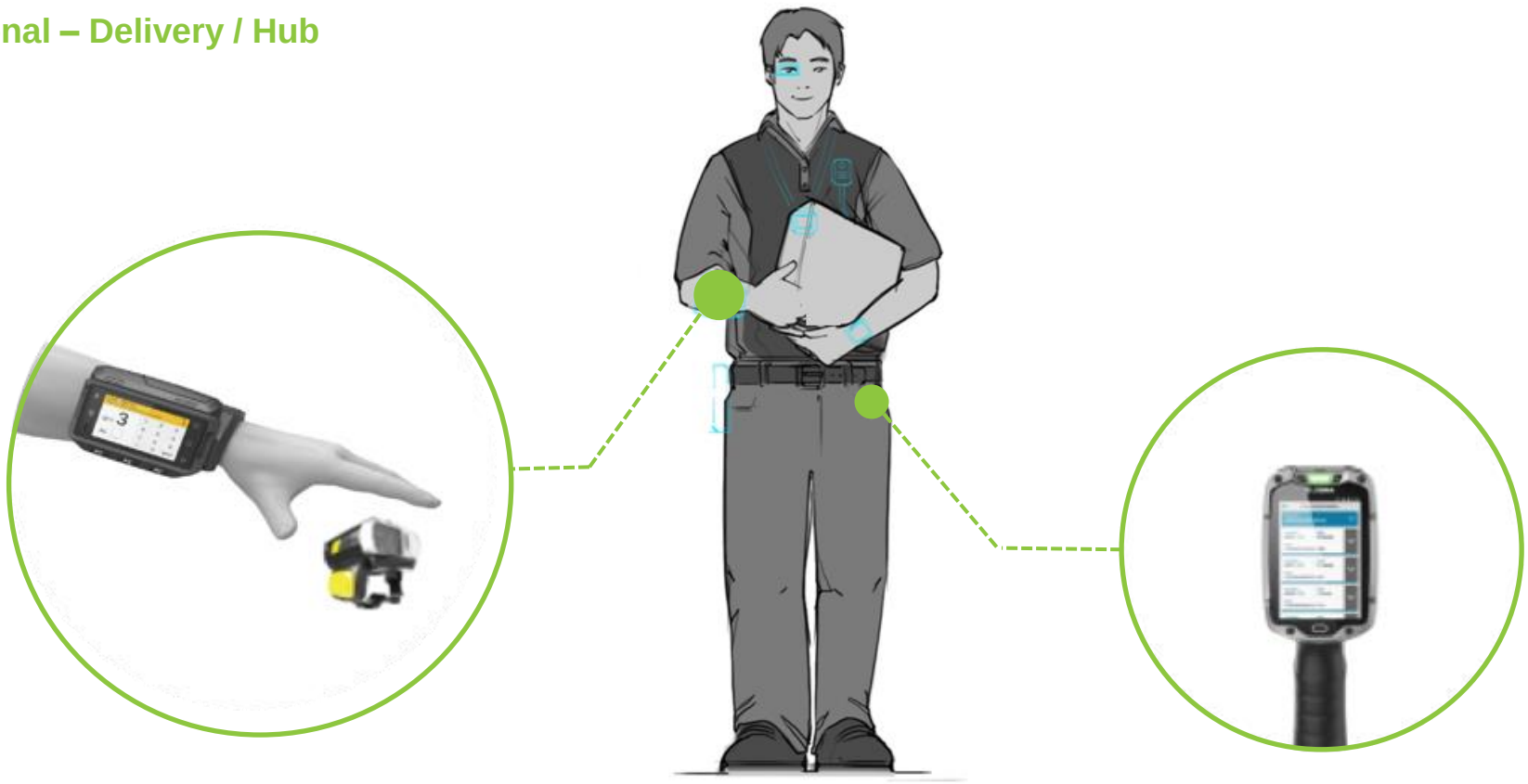
MANAGING MASSIVE AMOUNTS OF DATA



WAREHOUSE WORKER OF TODAY AND TOMORROW

TODAY'S INTERFACES

Personal – Delivery / Hub



NEXT – DISTRIBUTED INTERFACES

Personal Area Networks – Delivery / Hub Potentials

Eyewear Display
Interface Accessory

Lanyard
Display / Imager Accessory

Arm Wearable -
Low Profile, Multi-touch Display, power-efficient

STT, TTS, Voice Concierge
Facilitates form-filling, order completion and status. Limits physical keyboard inputs

Wearable Wrist
Display / Multi-touch Accessory

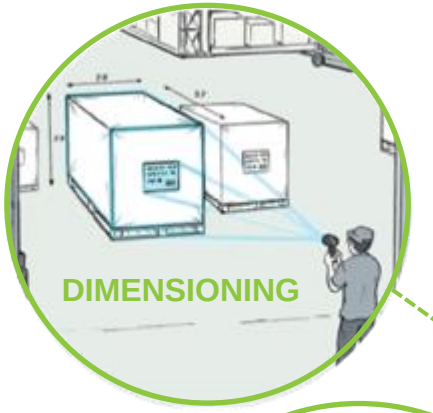
Mobile Computer.
Primary Hub for PAN systems

* Image Simulated

ANALYTICS PROBLEMS / SOLUTIONS

SMART T&L VISION

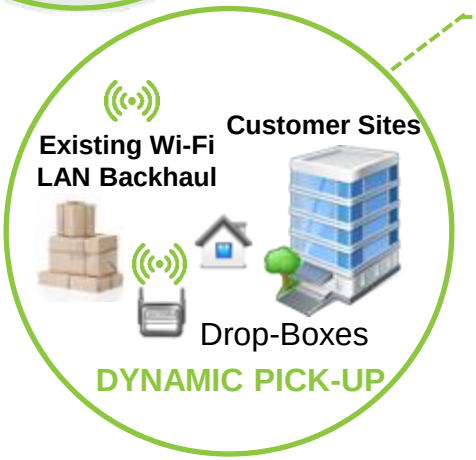
Converging Solutions That Transform Experiences Ties Hardware Together



SMART HUB

Existing Wi-Fi LAN Backhaul

Smart T&L Management



EMPOWERED WORKER

MHI
THE INDUSTRY THAT MAKES SUPPLY CHAINS WORK®

- Ties components to generate data
- Drives informed decision making
- Contextual information for user level

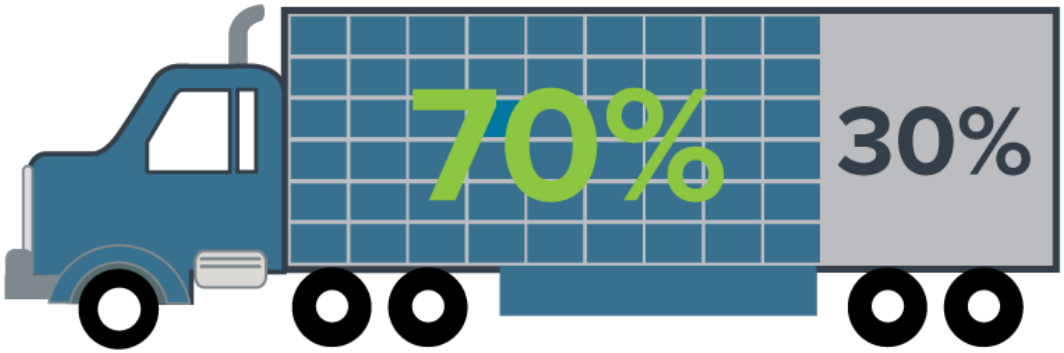
TRUCK LOAD OPTIMIZATION

Optimizing The Outbound Process

- Trailer loading refers to the process of loading the packages in the trailer.
- Currently, the process is operated completely by manual labor.
- Recent studies shows that a trailer's space is only about 70% occupied when it is considered fully-loaded.
- Another problem is the possible package damage due to improper stacking configurations.
- How to improve space utilization of the trailer to reduce costs?

CUSTOMER PROBLEM STATEMENT

Problem: How to improve efficiency of trailer loading operations?

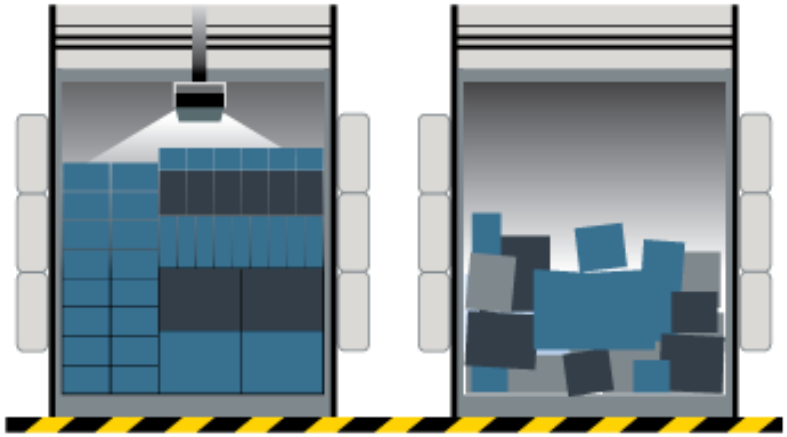


Space Utilization

Load Speed

ADVANCED LOAD ANALYTICS

Solution: Optimize loading operations in real-time and reduce costs



Load Speed, Efficiency and Utilization

Trailer Load Analytics

TLA VIDEO

TRAILER LOAD CHALLENGES

Efficiency: Trailer space is not efficiently utilized

- Typical utilization around 70% full
- Even a slight increase leads to significant savings
- System relies mostly on experience of loaders

Quality: Boxes are not stacked properly

- Usually, the “T-formation” rule is not observed
- Exacerbate the previous problem
- Packages may be damaged due to improper stacking

Feedback: Limited visibility to performance & safety issues

- No objective evaluation of loader performance
- Service managers have limited real-time visibility
- Loader feedback is provided mostly after the fact

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ANALYTICS

Safety
- Proper Lifting
- Hazardous Material
- Package Wall Construction

Theft, Loss, Damage
- Package Wall Construction
- Theft Watch

Employee Performance Improvements
- Performance Metrics
- Performance Incentive
- Teaming (local, regional)

Communication
- Gesture Language
- Scheduling, Notification & Feedback

Financial
- Cost Correlation

BUSINESS IMPACT

- OSHA Performance
- Workmen's Comp Ins/Claims
- HMTA & Related Mitigation
- Workmen's Comp Ins/Claims
- Behavior Deterrent
- Damage Claim Mitigation
- Loss Claim Mitigation
- Operations Efficiency & Labor negotiation (Empirical Data)
- Labor Goodwill, Profile, & Retraining
- Competition-based Results & Minimize Employee Turnover
- Operations Efficiency
- Operations Management
- Enhanced Decision Support
- “Everyone is an Owner” Reinforcement

LOADER MONITORING ANALYTICS

- Detect & track loaders to improve trailer fullness accuracy
- Safety: Detect improper lifting
- Communication: Recognize gestures

COMMUNICATE BY GESTURE

IMPROPER LIFTING

Analytics, Solving Another Problem

Problem: CONVEYOR BELT JAM MANAGEMENT

USE CASE

PROBLEM DESCRIPTION

- Automation is finding itself into more and more warehouse operations
- Existing distribution centers with conveyors have frequent belt jams: 60-70 jams/night or more in many high-speed operations
- Jam cost: Labor, damaged goods, operation disruption
- Jam causes:
  - Large packages get stuck at choking points
  - Multiple packages combine to bind together and get stuck
  - Packages get caught on the apparatus (e.g. cardboard corner or flap, mesh bag catches on sheet metal, etc.)
- It’s cost prohibitive to upgrade to newer facilities that have fewer jams

CURRENT SOLUTION

Operations control center

- Typically analog cameras have been installed over the years
- Operations centers use a set of monitors to look for jams (reactive)
- One worker monitors all cameras, controls belts stop/go, and dispatches jam breakers. Requires manning during entire production run

SOLUTIONS

Jam Detection:

- Detect jams sooner and more reliably
- Send jam signal to control center
- Control center stop belts and dispatch workers

Jam Prediction:

- Predict jams before they actually occur
- Send jam probability signal to control center
- Control center may stop belts and dispatch workers

Jam Prevention:

- Predict jams before they occur
- Send signal to belt control switch to slow down related belts and notify workers

Proactive use of real-time analytics!

BIG DATA OPPORTUNITIES

OFFERING	DESCRIPTION
Trailer Load Analytics	• Extensible Dock Door platform (for adding other sensing applications), Near Real-time Cubes Scores, Load Speed, Load Quality, Safety, drives corrective actions to optimize trailer utilization
RFID RTLS	• Cross-Dock RFID reader infrastructure for pallet level location and tracking
Smart Trailer	• Extensible platform for adding M2M applications (location, tire pressure, weight, door open/close, trailer contents etc.), 3G/4G radio, alternative power, improved diagnostics and troubleshooting
Handheld Dimensioning	• Hand-held box and pallet 3D dimensioning solution, robust measurement in a challenging environment (e.g. low-light, clutter), new technology to dimension non-cuboid shaped boxes & pallets
Smart Package	• WiFi ID Tag for location and tracking (e.g. “put a pin on a map”), extensible sensing technologies (shock detection, temperature, vibration, gases, etc.)
Dynamic Dimensioning	• Exploring fixed dimensioning of moving cargo through the dock door for freight operations

SMART CAB

Important Adjacencies

Peripheral Sensors (IoT)
- Tire Pressure
- Weight
- Seat belt detection
- Open door sensor (trailer)
- Refrigerated goods sensors
- Driver drowsiness sensors

Data from Mobile Computer
- GPS location
- Delivery/Pick-up locations (Business Data)
- Traffic/accident/construction reports

Local analytics
- Real-time information for the driver
- Fuel efficiency
- Time/distance to refuel
- Suggested changes to driving
- Gamification
- Routes to avoid

Via J1979/ J1939/ J1708 adapter

Display to driver without distracting
- Window projection
- In-dash display
- Audible (high priority alerts)

Data from ECU
- Speed
- Fuel Efficiency
- Distance travelled over time
- Acceleration and Braking intensity/frequency
- RPM over time
- Idle time

Transmit over WAN connection to company server
- Average efficiency (idle time, fuel/pkg, time between maintenance)
- Identify outliers (low performers should emulate high performers)
- Monitor CO_2 creation (could be mandated in future)
- Other KPIs

SMART FLEET

Combining Telematics, The Device, And Iot

Mobile Analytics Platform (MAP) – gives mobile visibility/control

- Applies to: Smart Trailer, Delivery Truck, Airplane, Drop Boxes, Containers
- 802.11 AP (multi-purpose mobile hotspot, main initial use case Smart Package)
- Backhaul
  - Long Backhaul & Mobility: WAN – LTE gateway (2-5km range)
  - Short Backhaul & Mobility: Wi-Fi
- Unique ID for equipment/asset Tag Tracking
- GPS locationing
- Data storage (1GB), Processing (1GHz class CPU), and Mechanically Rugged
  - Geo-fence storage
  - Future applications
- USB2.0, RS-232, micro SD, TBD peripherals
- Easy to deploy/provision
- Modular Power Sources (Solar, rechargeable, in-vehicle, power line, wireless)
- Multiple modalities
  - Independent/Stand Alone (spot trailer, delivery truck, drop box)
  - Paired (trailer to cab/tractor, delivery truck or cab/tractor to personnel device(s))
  - Docked (vehicle to DC/Hub; spot trailer to customer site)
- Automation (alerts/notifications based on frictionless workflows, e.g. customer site arrival events and Smart Package verification)
- Sensing aggregation (vehicle and variable environments)
- Design for adjacent technologies (Pair with TLA Platform at dock door)

Smart Container

- Security

Platform:

- GPS | WAN | WiFi
- Optional BTLE | Dash 7 | LoRa
- Solar Power | Battery | 7 Way
- Computing | Scripting | Storage
- Geo-Fencing

Sensing:

- Tire Pressure (fuel efficiency, lifespan)
- Miles (tire replacement | scheduled maintenance)
- Weight
- Trailer systems (brake light, 7-way power status)

Smart Cab

- Researching

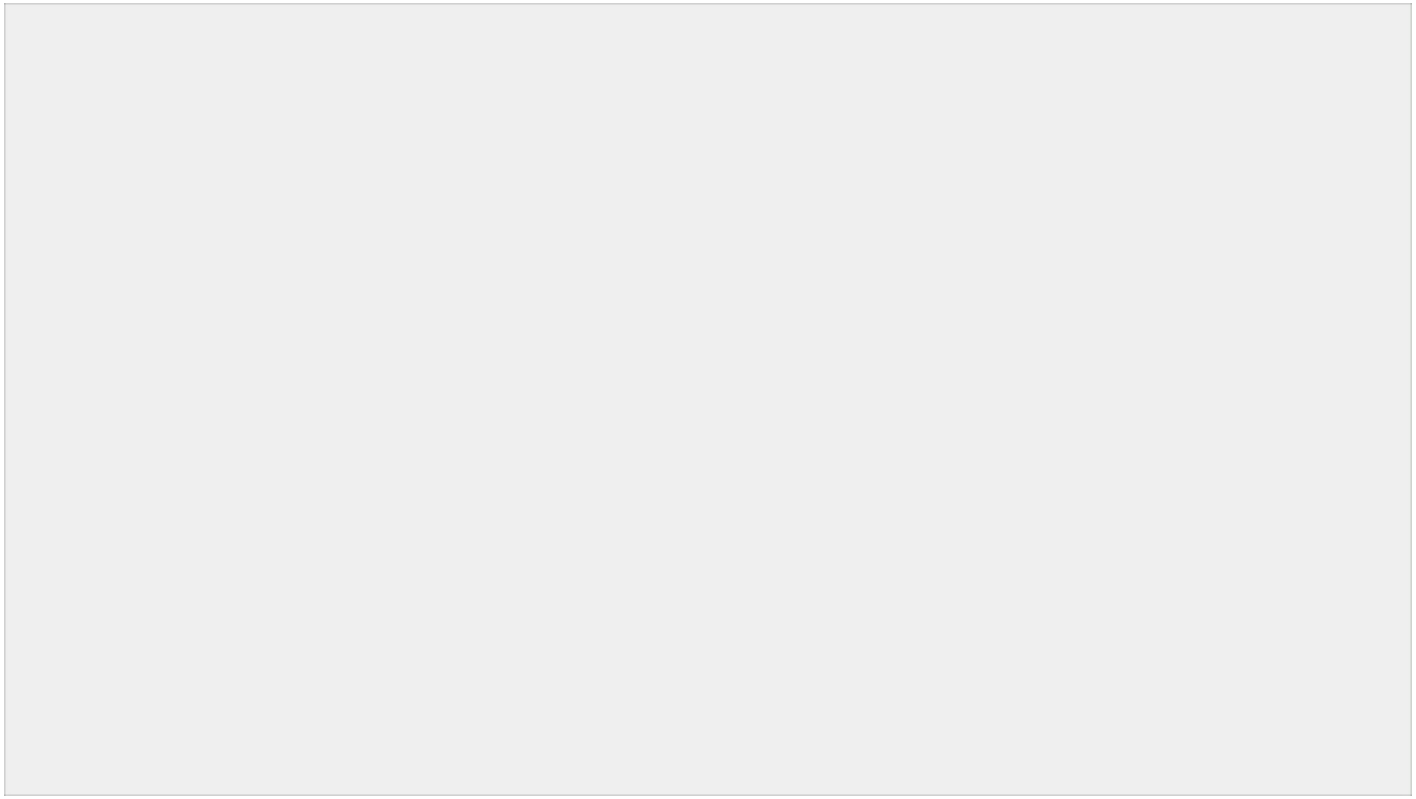
Sensing:

- Dock Door Unique ID
- Loader | Unloader ID
- Packages | Equipment

Smart Delivery

- Telematics

REAL-TIME LOCATIONING



SMART PACKAGE

Solution Overview

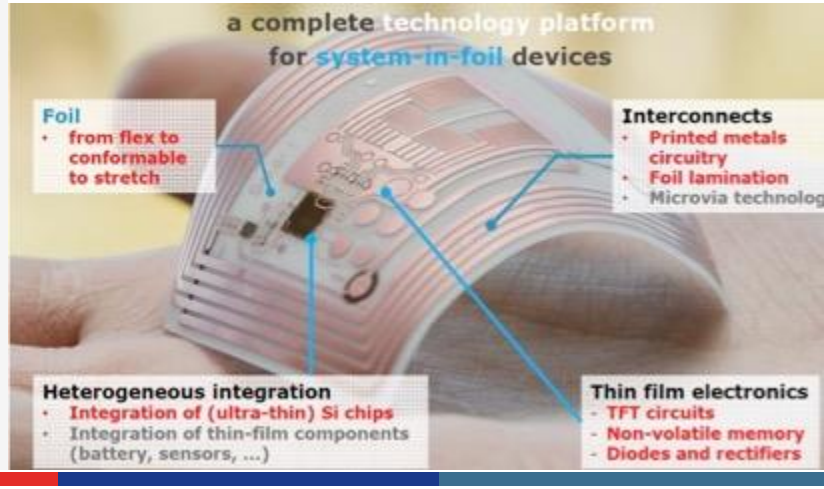
Sensing Objects of Interest

- Packages
- Pallets
- Trailers
- Equipment

Electronic Label (& other form factors)

- 802.11 Std based
- Ultra Low Power & Disposable, Eco-friendly
- Read/Writeable for dynamic labeling

- Flexible, very low profile tag using:
  - Printed battery & electronics | System-in-Foil technology
  - Printed barcode and serial number for provisioning
- Ability to sense:
  - Movement, vibration (accelerometer), presence
  - Temperature, Humidity
  - Toxic gases, Explosives
- Extremely easy to provision & use - Like postage stamps
  - Activation of Tag: Removing the tag from the roll or booklet, activates it for provisioning (IP Pending)
  - Provisioning of Tag: Via WiFi from any mobile computer, smartphone app, or desktop



DIMENSIONING

Solution Overview

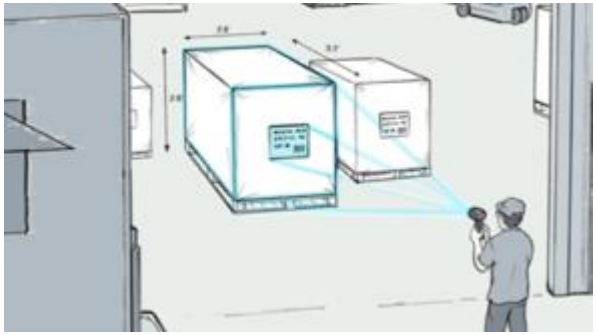
Mobile Dimensioning:

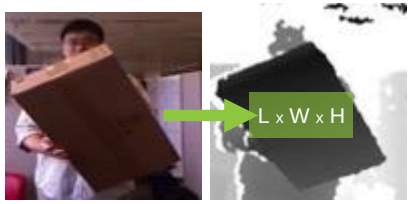
- Hand-held box and pallet 3-D dimensioning solution
- Using newly emerging 3-D low-cost sensors and 3-D processing technology
- Robust measurement in a challenging environment (e.g. low-light, clutter)
- Exceeds the performance of RGB camera and label based solutions
- Creating new technology to dimension cuboid shaped boxes & pallets
- Extending technology to dimension irregular shaped boxes and pallets
- Applies to field workers (LTL, Delivery/Pickup etc.)

Dynamic Dimensioning (Fixed)

- Wall or ceiling mounted 3-D dimensioning solution
- Dimensioning mobile pallets (80% of freight) (i.e. a type of scan tunnel)
- Extending technology to dimension irregular shaped items (20%)
- Robust measurement in a challenging environment
- Applies to freight & parcel (x-Docking etc.)

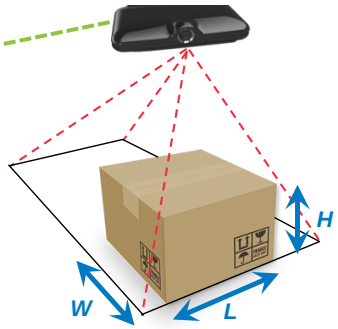
PACKAGE DIMENSIONING





Pallet Dimensioning
…can be inputs to volumetric weight measurement
…can move towards vwm profiles

RFID RTLS



RFID RTLS CONCEPT

Objective

- Track each pallet in real-time
- Identify the door where pallets enter or leave from
- Locate pallets sitting in staging areas to better than 4’ accuracy

Low-cost Reader Hardware

- Advanced Access Points
- Omni-directional phased array antenna structure

Reader-based Core Location Technology

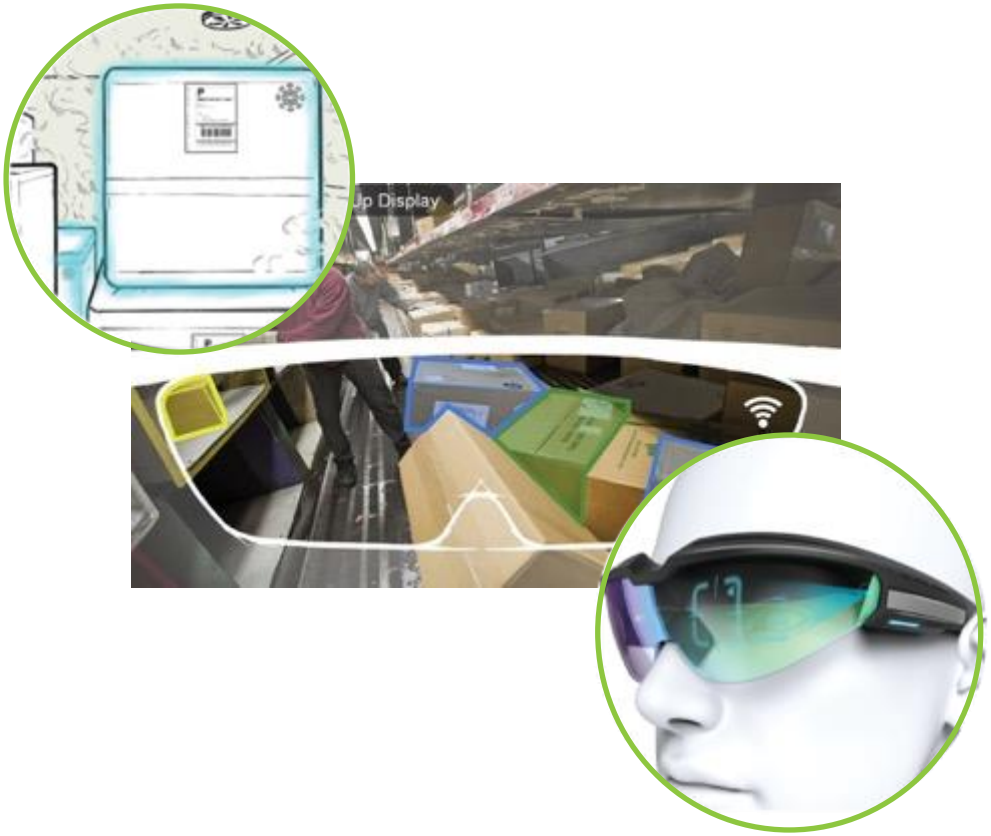
- Uses adaptive monopulse method for Angle of Arrival (AOA) estimations

Server-based Analytics Software

- Tracking each pallet on a dock within a 3-4 feet range
- Know precisely where each pallet resides on
- Tie in with loading systems that optimize trailer loading

HANDS-FREE COMPUTING

Future Concept



- Information when you need it - in appropriate task sequence
- Information displayed as real-time overlay – augmented reality
- Accessing information does not interrupt workflow – no stopping to check display

FOR MORE INFORMATION:

Speaker email: mike.maris@zebra.com

Website: www.zebra.com/TL

Or visit ProMat Booth #S2459