Warehouse Execution Systems and the "Smart" Distribution Center

Presented by:

Dinesh Dongre

Dan Gilmore

Softeon

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Presenters

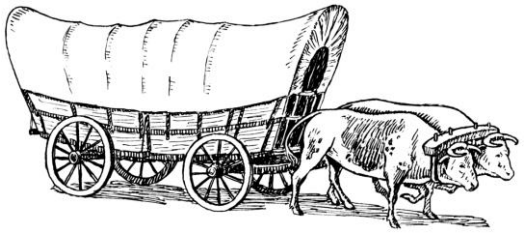
Dinesh Dongre
VP Product Strategy
Softeon, Inc.

Dan Gilmore
CMO
Softeon, Inc.

What is a Warehouse Execution System?

How We Got Here

WMS	WCS



"The WMS should have all the information it needs to make all the decisions. The WCS should just take that decision about where a carton goes, deliver it, and then tell us that it's there."

Mark Fralick, GetUsROI

Some Implementations

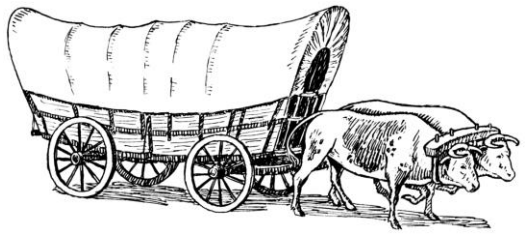
WMS	WCS

Why?

- Lack of WMS Capabilities
- MHA Vendor in Control of Customer
- Agreements between WMS and WCS Vendor

New Dynamic in Some Scenarios

WMS	WES	WCS



Why?

- WES only Developed Due to Perceived Shortcomings in WMS
- Attributes
  - Visibility to Process/Work Area/MHA Status
  - Flow of Work Based on Capacities and Work Load
  - “Waveless” Processing/Leveling of Activity

Gartner's View

System	Definition
Warehouse control system (WCS)	Middleware that sits between the WMS and the PLCs that control material handling automation devices. The WCS translates business-transactional information coming out of a WMS into real-time instructions for the automation. WCSs also help orchestrate product movements within automated warehouses.
Warehouse execution system (WES)	An emerging hybrid that blends capabilities from both a traditional WMS and a WCS. A WES builds on the WCS's near-real-time insight into what's happening in the automated warehouse, but it adds business process logic to this layer.
Warehouse management system (WMS)	The traditional business applications that handle business transactions, such as receiving goods, putting them away, and picking, packing and shipping orders. The focus of a WMS is on inventory and transactional integrity for people-managed processes. On top of process integrity, WMSs have been enhanced to support more and more capabilities that are intended to proactively drive process and productivity improvements.

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This is pretty good –
except WES
Is Not only for Heavily
Automated DCs!

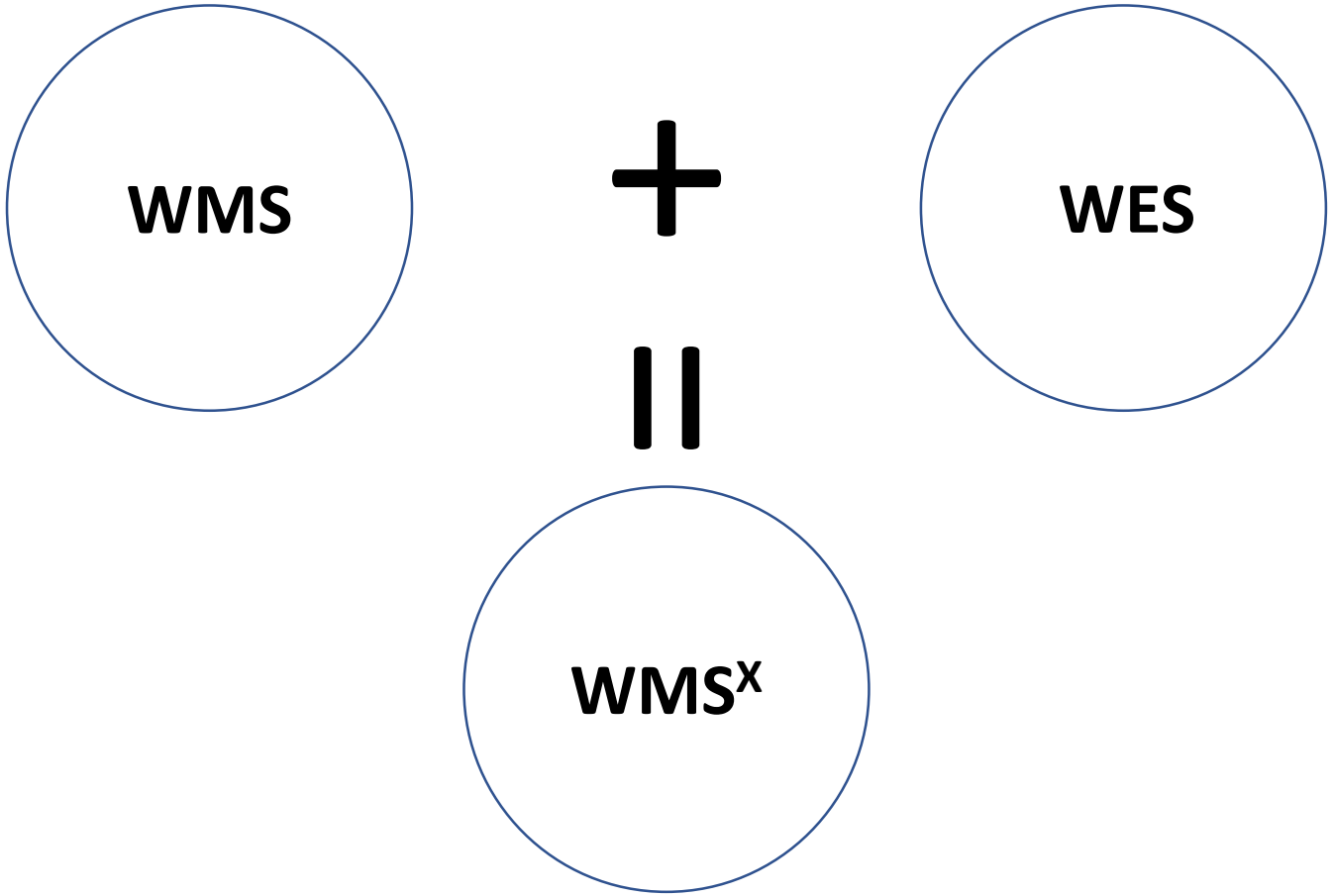
WES Characteristics

- Warehouse Execution System Provides Visibility, Control and Optimization of Order Picking and Related Process, including Optimization of Materials Handling Systems, in a manner far above what is Available Today even in Advanced Warehouse Management Systems
- Can be Integrated WMS of Same Vendor or with Any Existing Warehouse System
- Should Work for Automated, non-Automated and Hybrid DCs
- One System to Manage All Automation in the DC
- Game-changing Breakthrough that Starts Delivery of the “Autonomous WMS”

Represents a Step-Chain in WMS Capabilities

- 20 Years of Only Incremental Improvement in WMS Capabilities
- Softeon Warehouse Management and Execution System Starts Down the Path of New WMS Model

A WMS Market Inflection Point



Warehouse Management & Execution System

WES Addresses Common Distribution Problems/Opportunities

- Lack of Granular Visibility to Throughput and Order Execution
- Labor Planning Challenges
  - Right Resources not in Right Place at Right Time
- Time/Cost/Approach of Adding Technologies (e.g., Picking Sub-Systems)
- Sub-Optimal Picking Execution
- Difficulty Meeting Carrier Cut Off Times/Ensuring SLAs
- High Variability in Materials Handling Equipment Utilization
- WMS Still Highly Reliant on Human Decision-Making

Fundamental Value Proposition

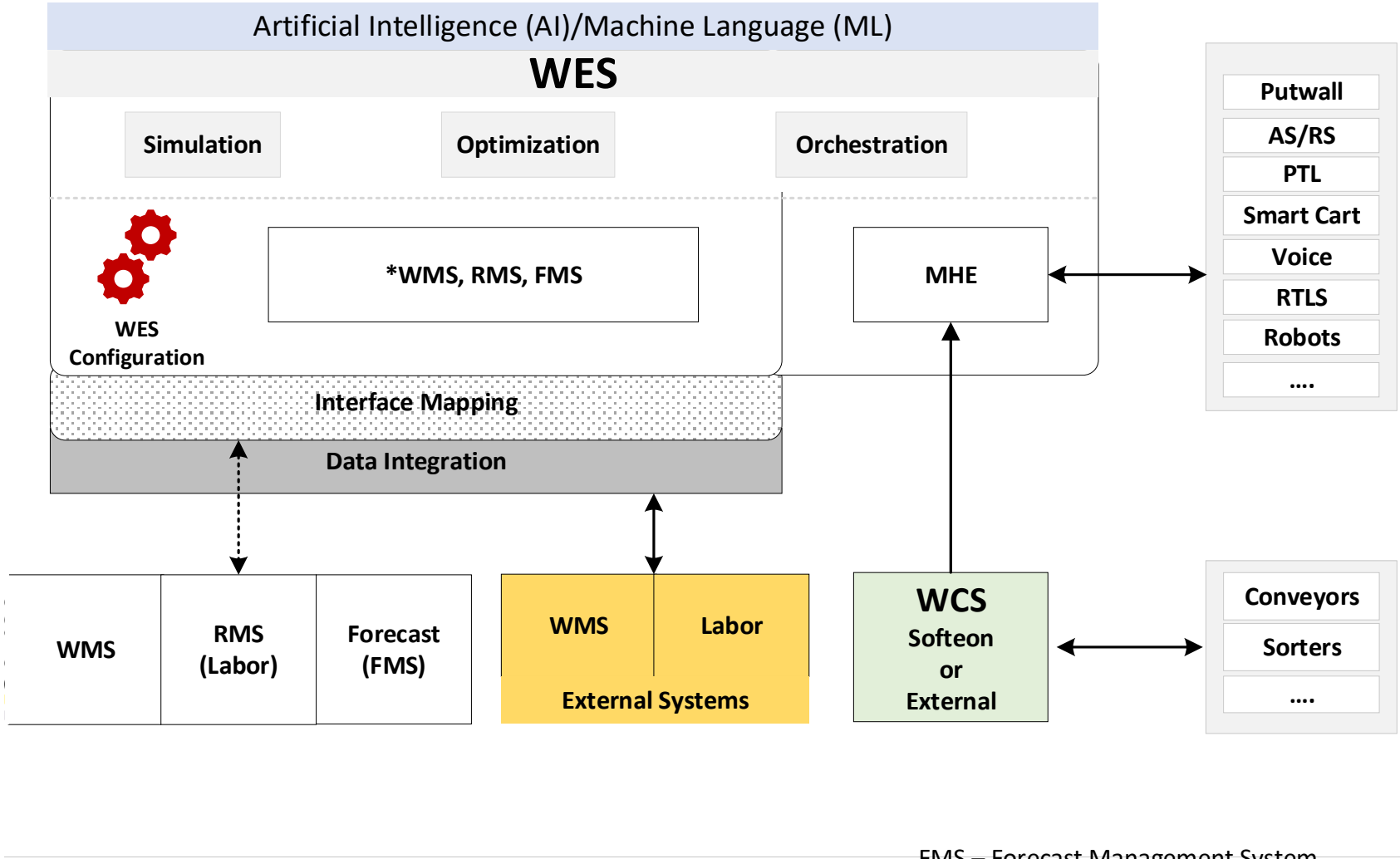
WES Should:

- Enable Companies to Meet Customer Demand and Service Commitments at the Least Possible Cost
- Significantly Shrink the Gap Between Theoretic and Realized DC/System Throughput
- Provide Single System for Management and Control of Fulfillment Across the DC

How WES Delivers Results

- Real-Time Visibility to Throughput, Bottlenecks and Events
- Direct Management and Optimization of Picking Sub-Systems
- Advanced, Configurable Optimization for Order Batching, Release, Picking and Replenishment
- Workload Balancing to Maximize Equipment Utilization and Flow
- Automated Order Release Based on Service Commitment, Shipping Schedules and Real-Time Condition Monitoring
- Use of Simulation to Plan, Re-plan and Allocate Resources

WES Architecture



WES shares same framework with Softeon WMS, RMS, and FMS

*subset of WMS, RMS, FMS components only

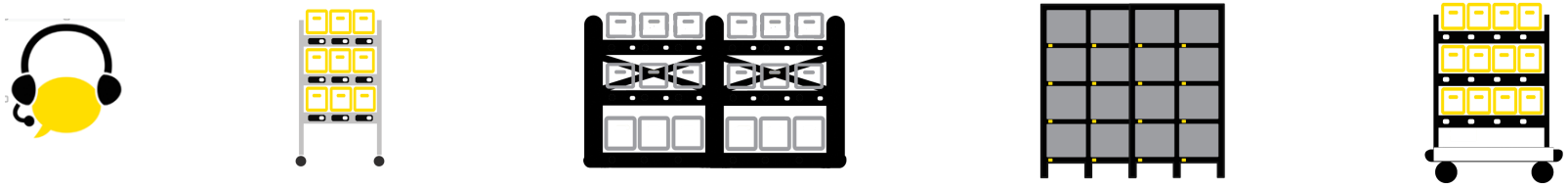
FMS – Forecast Management System
RMS – Resource Management System (Labor)
WMS – Warehouse Management System

Key WES Function Components

Condition and Event Monitor	**Simulation Engine**	**Shared WMS Component Library**
Pick Route Optimizer	**Automated Order Release Engine**	**Advanced Scheduler**
Order Batch Optimizer	**Capacity Manager**	**Dynamic Work Queue Manager**

Dynamic Rules Engine

MHE Integration



Real-time Visibility to Throughput and Bottlenecks

WES Real-Time Dashboards

Shared WMS Component Library

Examples of WMS + WES Capabilities

- Advanced Cartonization
- Optimized Order Planning and Release Based on Many Variables, Including Priority, Travel Path and Distance, Bath and Clustering Opportunities, Replenishment Status, and More
- Waveless, Wave-Based, or Hybrid Picking
- Configurable Order Pool Management
- Dynamic Slotting
- Direct Management and Control of Picking Subsystems Including Voice, Pick-to-Light, Smart Carts, Put Walls, Conveyors and Mobile Robots
- Dynamic Pick Cart and Put Wall Order Assembly
- Hot Order Insertion
- Packing Operations
- Parcel Shipping
- Print-and-Apply
- Distribution Center Resource Planning Based on Simulation of Actual and Forecast Order Volumes
- Real-Time Monitoring of Activity and Throughput by Individual Processing Area in the DC
- Analytics on Available Versus Required Resources (People and Equipment) by Processing Area
- Auto Assignment of Resources to Processing Areas
- Pull-based Order Release Based on Outbound Shipping Schedules, Service Commitment, and Carrier Cut Off Times
- Labor Management and Reporting

Direct Management and Control of Picking Systems

Each Sub-system with its Own Control Software

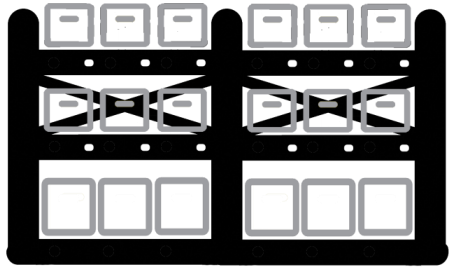
Voice Server
Order Release Logic

Voice terminals

Pick Cart Control System
Order Release Logic

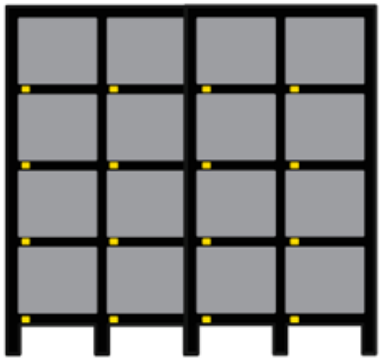
Smart carts

PTL Control System
Order Release Logic



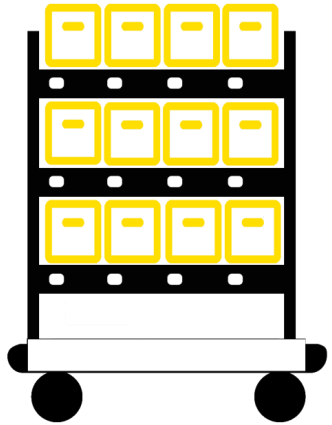
Pick-to-light

Put Wall Control System
Order Release Logic



Put walls

Robot Control System
Order Release Logic



Mobile robots

Each Sub-system with its Own Control Software

Voice Server
Order Release Logic

Voice terminals

Pick Cart Cont… C…

Smart carts

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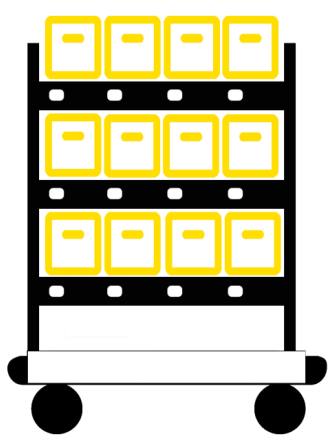
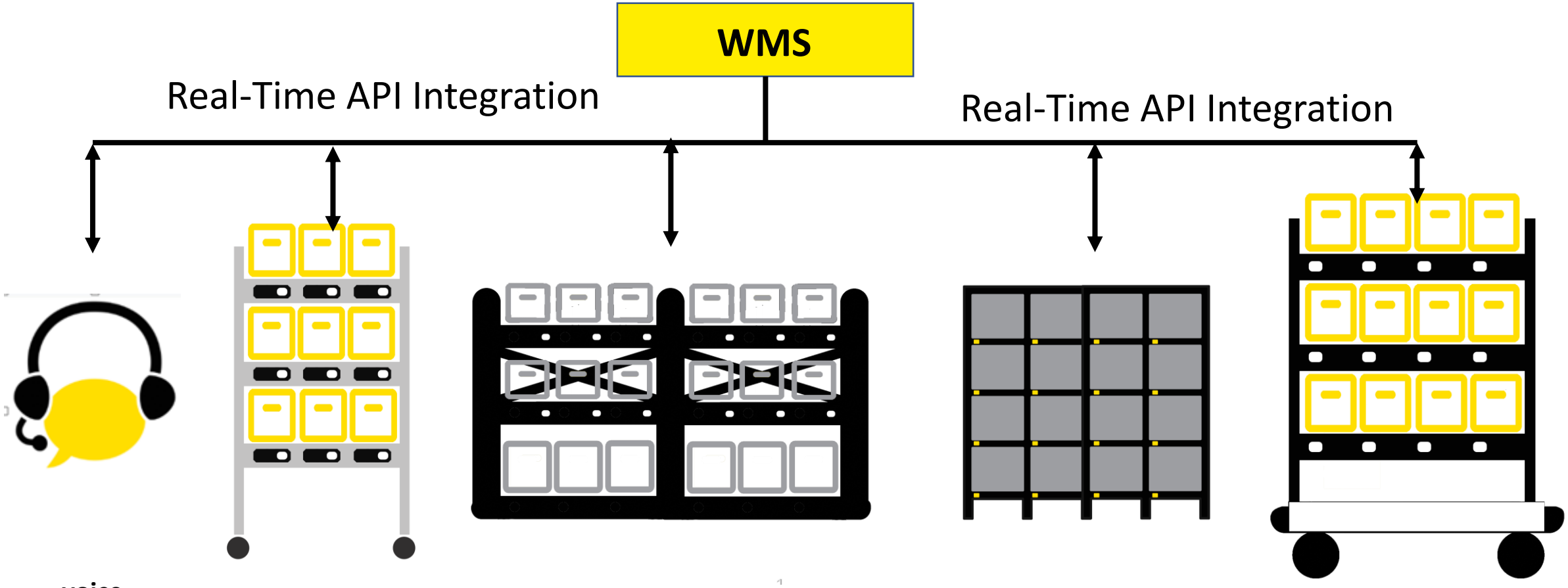


Mobile robots

Issues:

- **High Cost Hardware**
- **Cannot Optimize End-to-End Picking Processes**
- **Subsystems Operate in Silos**

The Better Way



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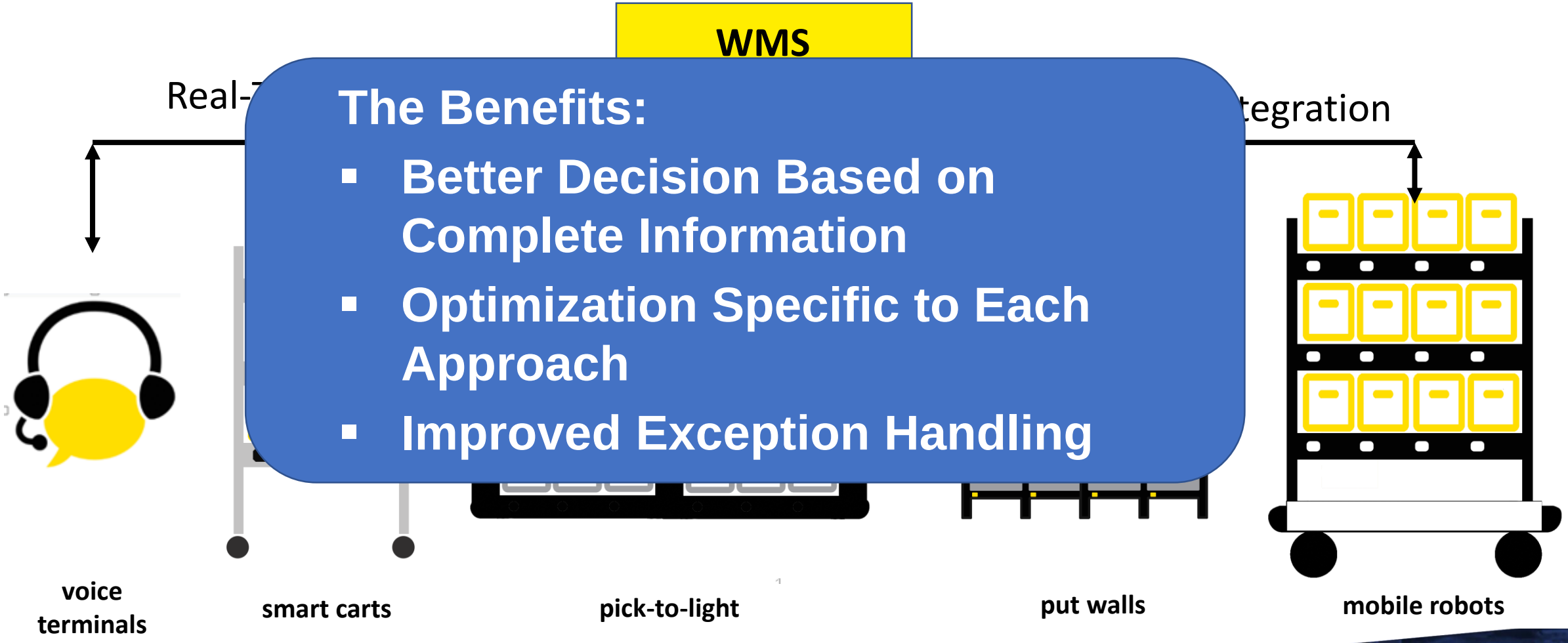
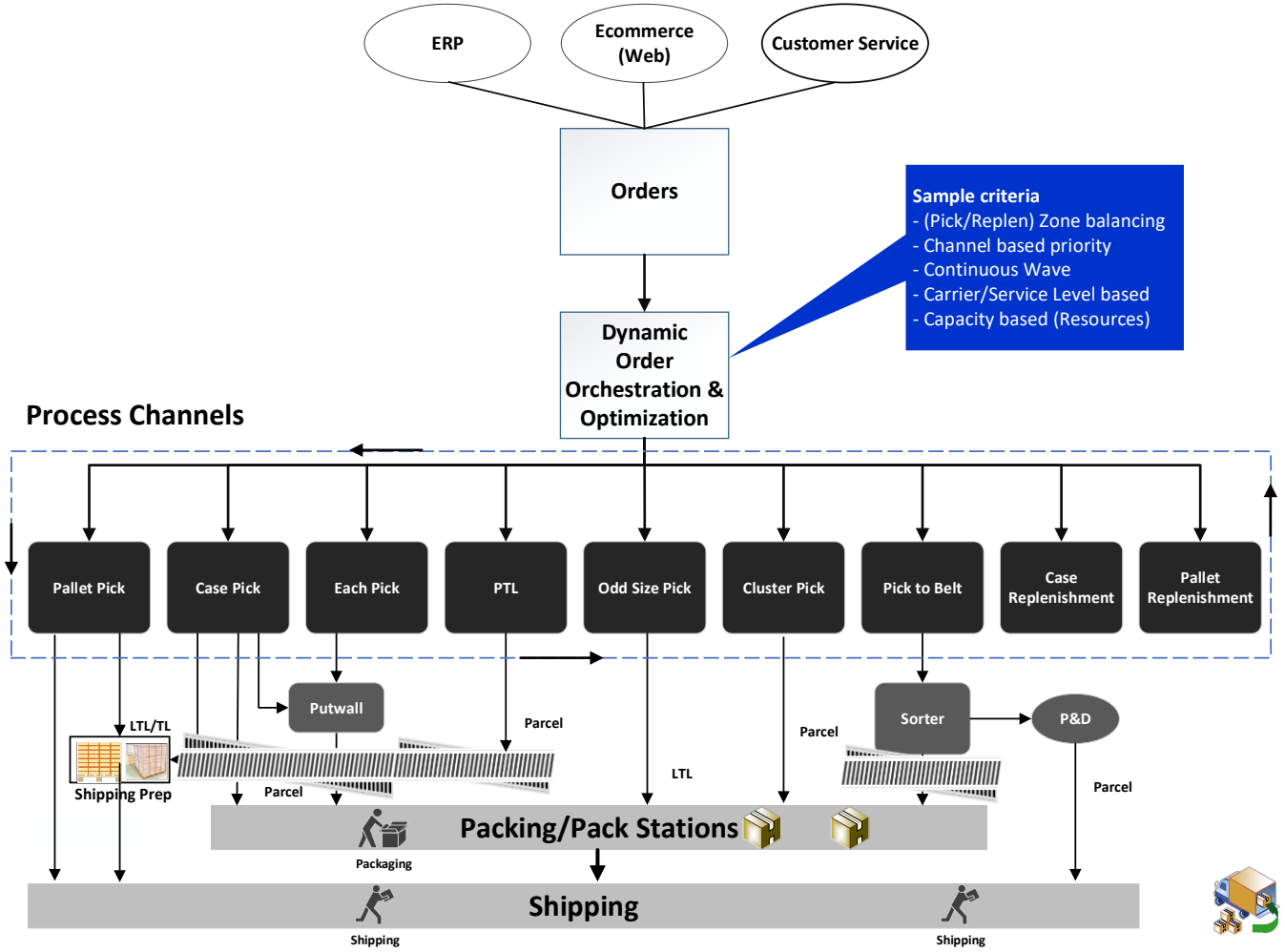


Pick Route Optimization

Dynamic, “Aware” Pick Release Management

Condition and Event Monitor

Advanced Scheduler



Optimization of Order Batching (Example #1)

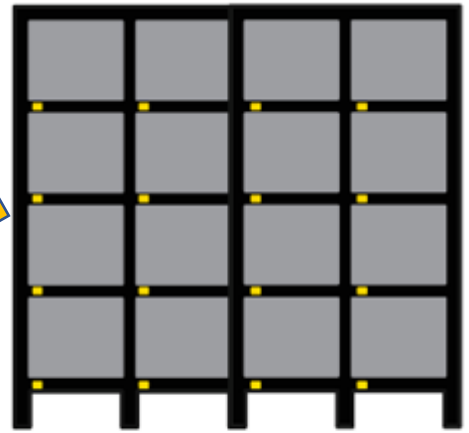
- Cartonization in picking sequence
- Cluster Building based on relative proximity between picking locations of containers
- **Parameter driven batching/cluster-building** based on
  - Cart size
  - Number of free carts
  - Wait times
  - Resource availability
- Strike the right balance between optimization of cart build and on-time task completion (Static Cart Vs Dynamic / Perpetual Cart)
- Intelligent Hot Order Insertion

Optimization of Order Batching (Example #2)

Incoming Order Streams

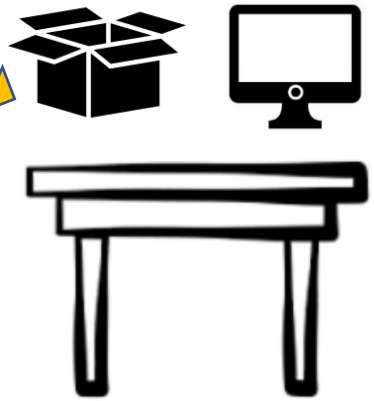
Dynamic Order Pool

Pick Carts



Put Walls

Autobagger



Pack Stations

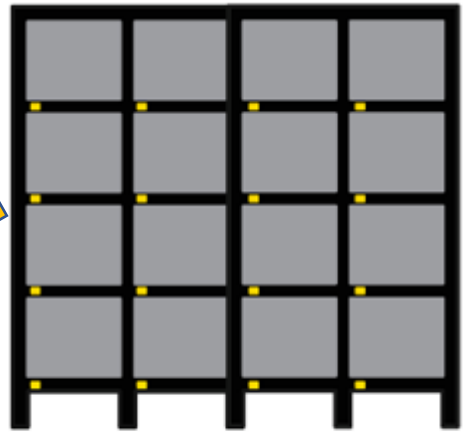
Optimization of Order Batching (Example #2)

Incoming Order Streams

Dynamic Order Pool

Pick Carts

- **Sophisticated Order Planning:**
  - **Picks not Good for Wall**
  - **Best Picks for Wall**
  - **Wall Constraints**
  - **Cluster/Batch Picking Opportunities**
  - **SKUs/Order**
  - **Inventory/Replen Status**
  - **Size of Product/Carton**
  - **SKU Bar Codes Yes/No**
  - **More….**



Put Walls

Autobagger

Pack Stations

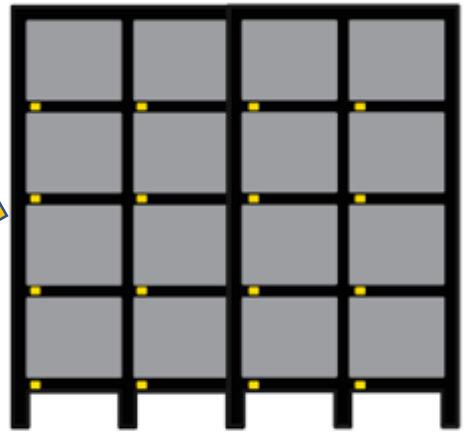
Optimization of Order Batching (Example #2)

Incoming Order Streams

Dynamic Order Pool

- **Advanced Features**
  - **Batch and Cluster Picking on Same Cart**
  - **Pick from Lights/Non-Light Areas Together**
  - **Dynamic and Virtual Wall Assignment**
  - **Multiple Operators per Wall**
  - **Wave Overlap on Wall**
  - **Hot Order Insertion into Best Cart**
  - **Complete Integration with Packing**
  - **Metered Carton Flow into Walls**
  - **More**

Pick Carts

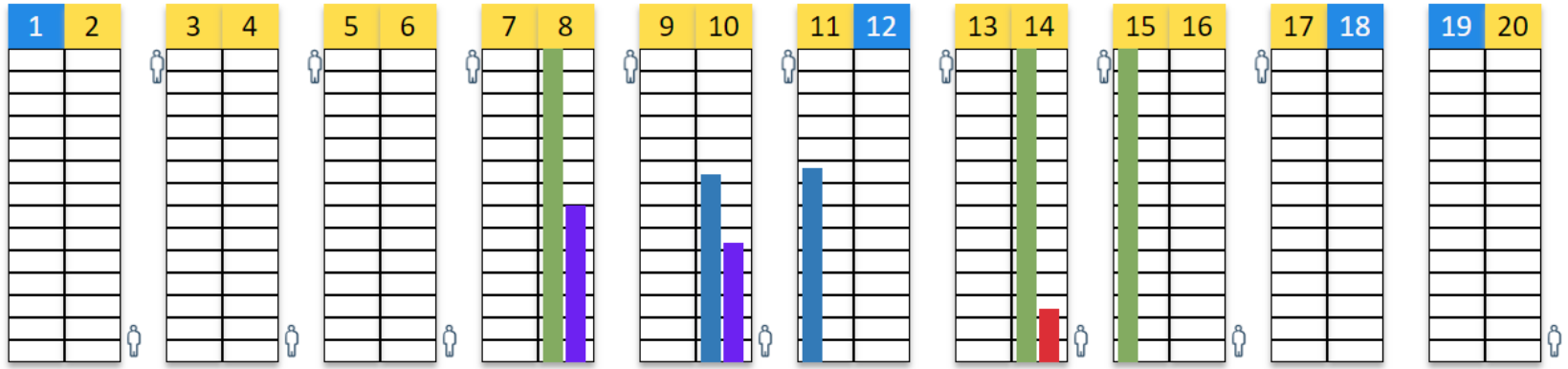


Put Walls

Autobagger

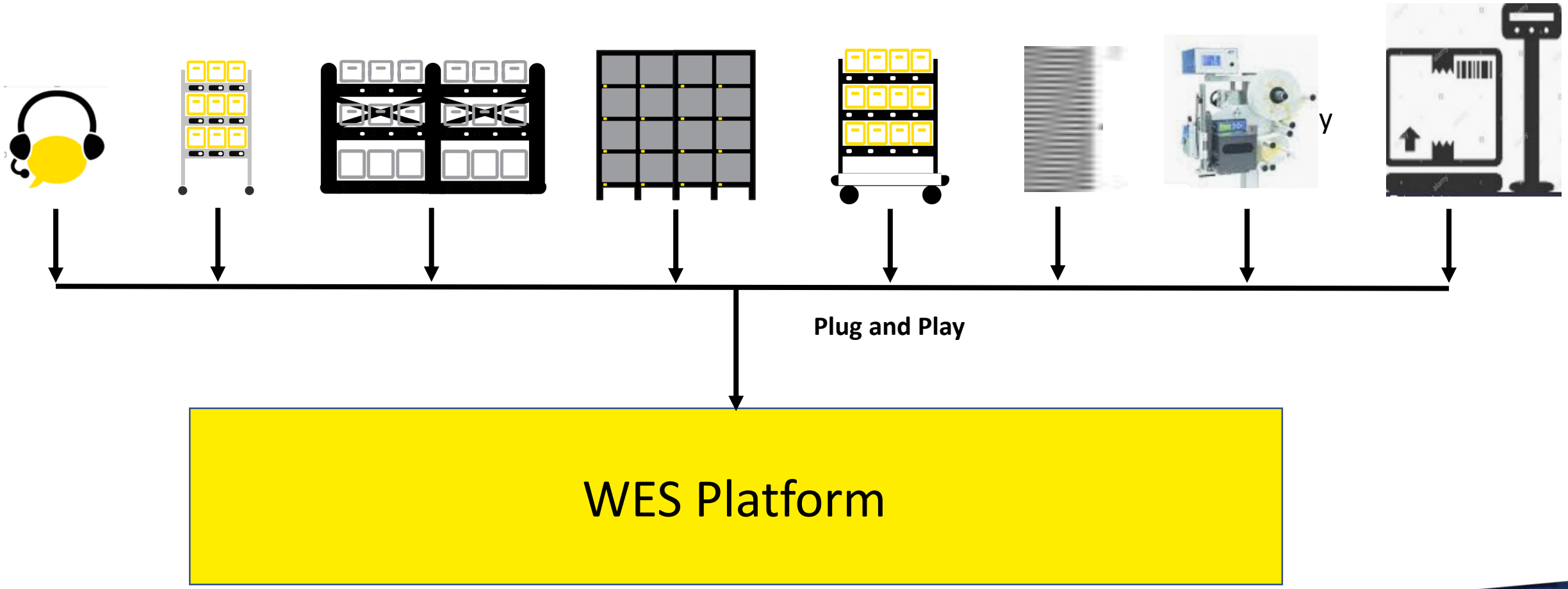
Pack Stations

Putwall Orchestration Dashboard



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Pick %	0	0	0	0	0	0	0	100	0	60	62	0	0	100	100	0	0	0	0	0
Put %	0	0	0	0	0	0	0	50	0	38	0	0	0	17	0	0	0	0	0	0
Est. Totes	0	23	6	6	8	30	22	3	39	11	15	0	22	5	7	7	16	0	0	23
Pick Pending Totes	0	23	6	6	8	30	22	0	39	6	6	0	22	0	0	7	16	0	0	23
Put Pending Totes	0	23	6	6	8	30	22	1	39	6	13	0	22	4	7	7	16	0	0	23
Totes in Put Queue	0	0	0	0	0	0	0	1	0	0	7	0	0	4	7	0	0	0	0	0

New “Plug and Play” Approach to Adding Technology

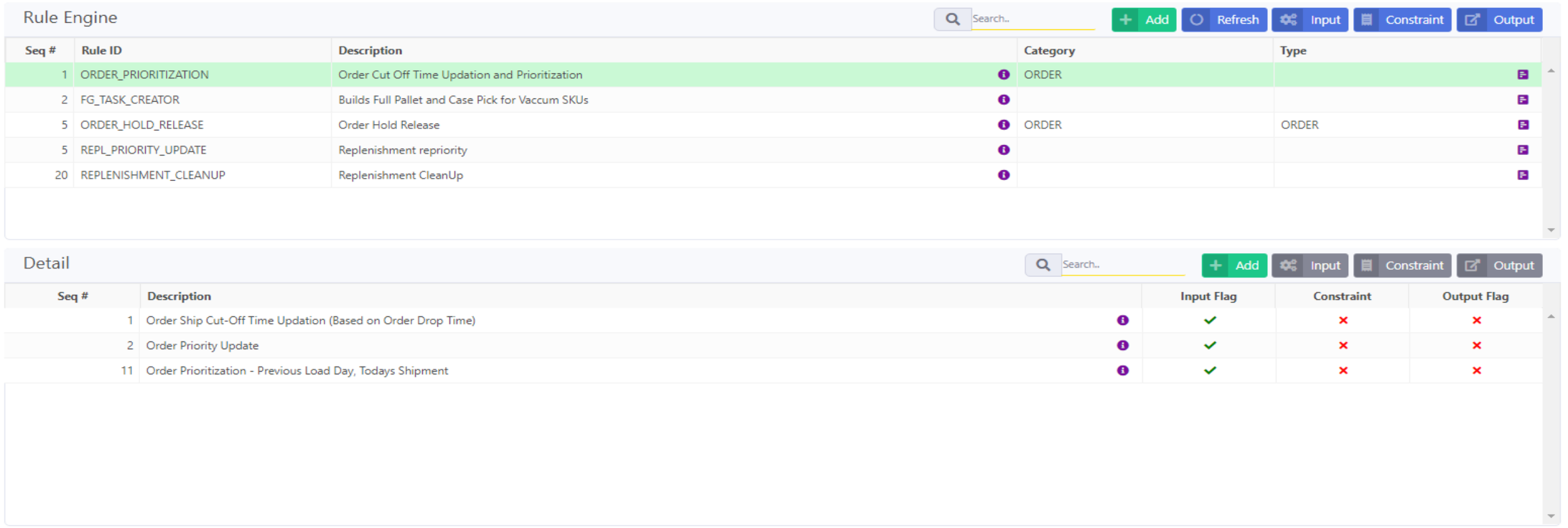


Automated Order Release

Auto Order/Work Release

- **Dynamic Rules-based Auto Release of Order/Tasks**
  - Order Attributes (Priority, Ship Date, Customer, and such)
  - Resource Capacity and Standards
    - Labor & Resource Type (Case Pickers, etc.)
    - Equipment (Cart, Robots, etc.)
    - MHE (Put Wall, Conveyor, Sorter, Diverts, etc.)
  - Reprioritization
  - Workload Balancing needs
  - Real-time feedback (changes in priority and/or ship times, inventory, capacity)
- **Identifying best channels of work (Pallet Pick, Put Wall, Case Pick, etc.)**
  - For example - Ability to accumulate full case picks into pallet picks based on configurable amount of time for newer orders
- **Configurable Rules**

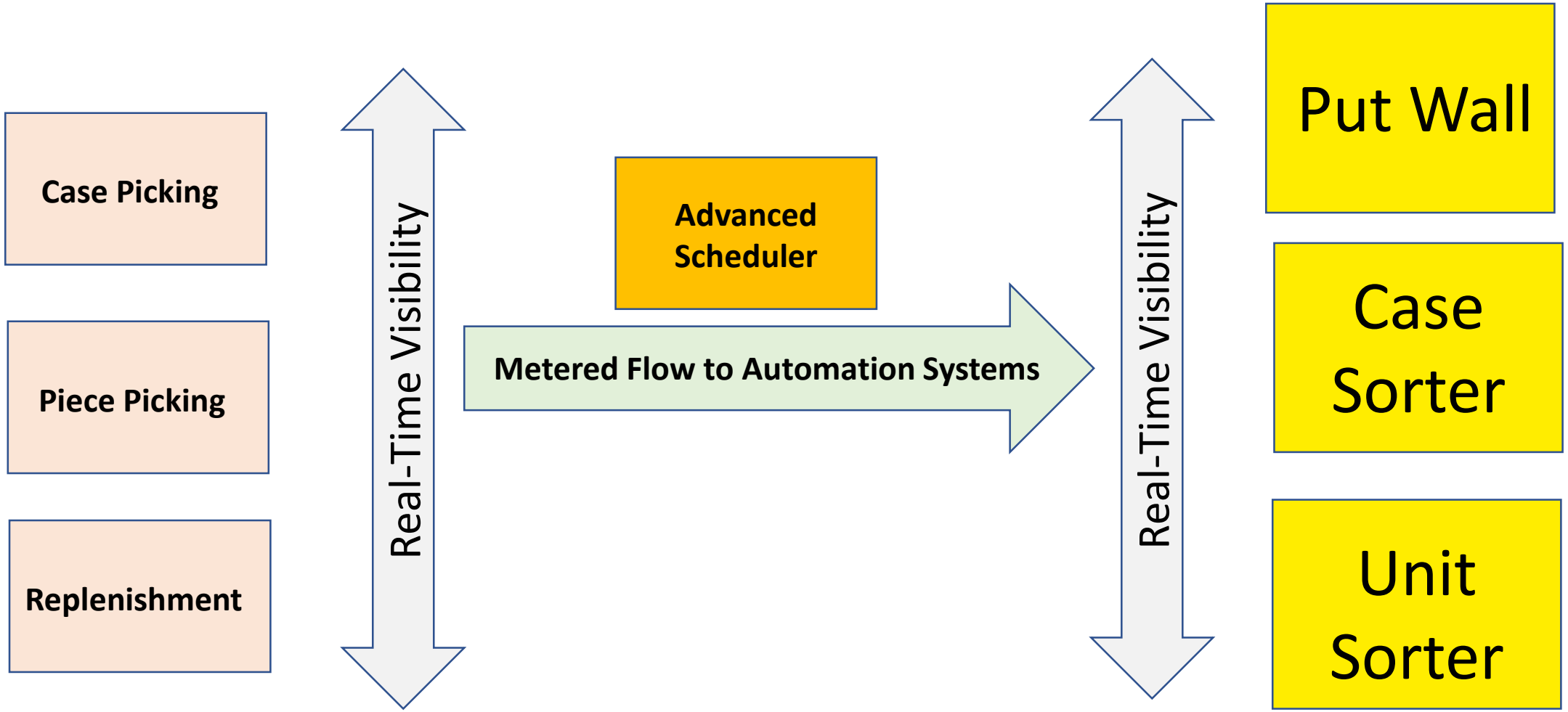
Auto Order Release – Rule Definition/ Configuration



Auto Order Release – Putwall Example

- **Representative Rules for Auto Release of Orders designated for a Put Wall**
  - Put Wall Pairing (One resource per wall or 2 back-to-back walls)
  - Ability to release batches for paired put-wall after 'x' % of Put Wall processing is complete
  - Just in time Cart Build (Creation of Pick task) based on Put Wall completion status
  - Prioritization of batches eligible for cart build based on status of put-wall completion.
  - Maintain balance of workload across Put Walls by feeding the right Put Walls
    - Put Wall level queue (number of totes) configuration
  - Ability to pick for multiple Put Walls in one cart / task
  - Ability to activate / deactivate Put Walls based on resource availability
  - Assign homogeneous orders (units/lines) to a single Put Wall to reduce overall time taken for put-wall release
  - “Elastic” Put Wall (Use a Put Wall of 100 slots to process more than 100 orders by dynamically allocating and releasing Put Wall slots)
  - Ability for priority orders to side-step regular queue and hit the Put Wall at the next possible opportunity

Optimizing Equipment Utilization



Simulation-Based Resource Planning

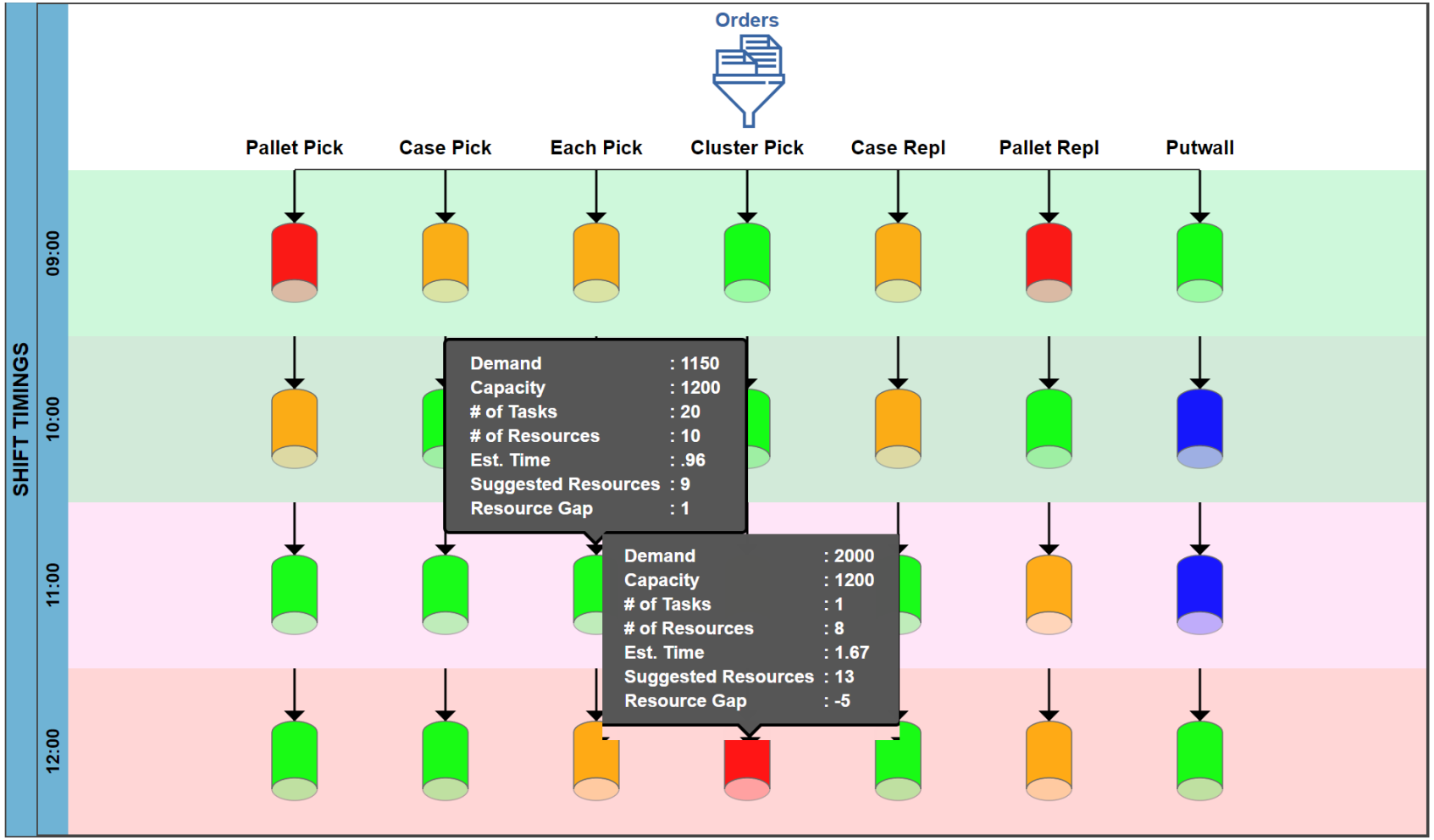
Simulation-Based Resource Planning

How It Works

- Simulation Engine Combines Available Order Pool Forecasts for Additional Work Likely to be Received based on Order History/Patterns
- Understands Current Resource Plan/Allocation across Processing Areas (e.g., Pallet, Case, Piece Pick; Put Walls; Replenishment, etc.)
- WES Simulates Expected Work (Demand) against Current Resources Plan in a Time-Phased Manner
- Identifies by Time Block where there is Demand-Resource Imbalance

Demand vs. Capacity Dashboard from Simulation

Dynamic Capacity Management



Case Studies

- Fast Growing Omnichannel Retailer
- Home Products Manufacturer
- Major Sports/Outdoor Apparel Brand
- Well-Known Home Appliance Maker

Benefits of Next-Generation WES

- Double Digit Improvement in Labor Productivity
- Significant Reduction in Supervisory Overhead
- Reduced/Better Managed Overtime
- Improved Throughput
  - Closing Gap between Theoretic and Actual Throughput of a Facility
- Easily and Quickly Evaluate and Deploy New Sub-Systems/Technologies
- Consistently Meet Service Commitment with Little “Chaos”
- Improve MHE Utilization
  - Additional Throughput or Reduce Required Capacity

Benefits Applicable to Automated, Manual and Hybrid DCs!

Where We Are Headed

- **Beginning of an Era of Autonomous Warehouse Software**
  - Automated Decision-Making
  - Self-tuning (in part through use of AI/ML)
- **Advanced Focus on Product and Process Flow**
  - Reduce/Eliminate Process Bottlenecks and Dwell Times
  - Flow Distribution™

Q + A

For more information:

Speaker #1 email: **DDongre@Softeon.com**
website: **www.Softeon.com**

Speaker #2 email: **DGilmore@Softeon.com**
website: **www.Softeon.com**

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