Realtime forecasting through simulation

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“Best of the Best” Simulation Contest

Register at

www.simulationsoftware.com/contest

Winner will be announced at the IIE conference 2008.

All models will be posted online for live voting.

Simulation

- Simulation is the behavior of a virtual environment through time.

- The success of any simulation project requires
  - Correct representation of the model
  - Correct data input and constraints
  - Clear goal definition

Simulation tools

- Traditional simulation tools
  - Based on a simulation engine that is transparent to the user
  - Most require heavy coding
  - Perform in a “build, run, view” mode
  - Limited interfaces during the simulation run
- Dynamic simulation tools
  - The simulation engine can interact with the user
  - Coding requirements vary
  - Perform “build, analyze” mode
  - Extensive interfaces to external tools during the simulation run

Forecasting vs. Scheduling

- Scheduling is a method to organize the sequencing into the operation in order to attain predictable delivery time.
- Forecasting is a look ahead to predict the behavior of the model through time.

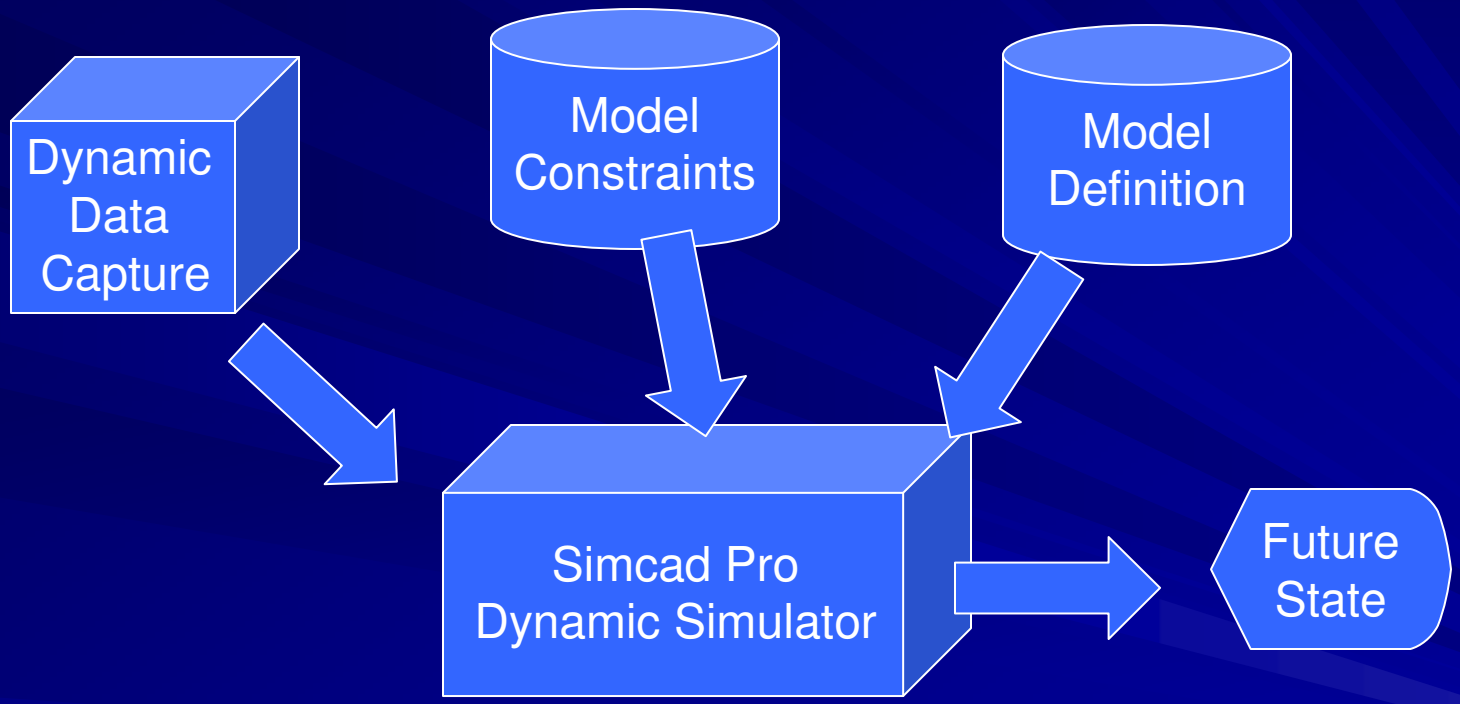
Requirement for proper forecasting

- Model definition
  - Flows, routings, capacity, buffers, material movements, …
- Model variability
  - Scrap rates, downtime, repair schedules, production sequence, …
- Model constraints
  - Resources, required equipment, speed, physical constraints, …

Data capture requirement

- Dynamic data comprises of
  - Current state data
  - Current production sequence
  - Failures, maintenance schedules
- Required additional data
  - Resource availability
  - Variation in speeds, buffers, and process requirements.

How it works



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Material and resource capture

- Bar coding
  - Controlled by human factors
  - Most bar coding sequence do not correctly associate time with location
  - Can not accurately locate resources
  - Does not capture motion
  - Cheap, readily available
  - Can be found in most environments

Material and Resource Capture Static RFID

- Static RFID rely on passing the RFID chip within proximity of a reader.
  - Requires the presence of a reader at every scanning station
  - Is not dependent on the operator
  - Can correlate time and location within reason
  - Cheap tags, requires multiple readers
  - Does not capture motion data

Material and Resource Capture Active RFID

- RFID device emits a signal to a set of receivers which co-locate the position of the tag.
  - Dynamically updates every 10 sec
  - Can be applied to resources, products, and material handlers.
  - Receivers can be located away from processing equipment
  - Is not affected by human factors
  - Can be applied to locate based on floor level (Patent Pending)

Constraints

- Constraints can be acquired through
  - ERP/MRP systems
  - Input from the processing floor, or equipment
  - Include failures, scrap rates, QA rates, rework
- This set can be ignored but will affect the results of the forecasted model

What to expect

- Virtual Camera
  - Live view of the operation (based on the tracking solution)
- Historical replay of events
- Constant forecasting of future events
- Accurate costing analysis
- Improved scheduling capability

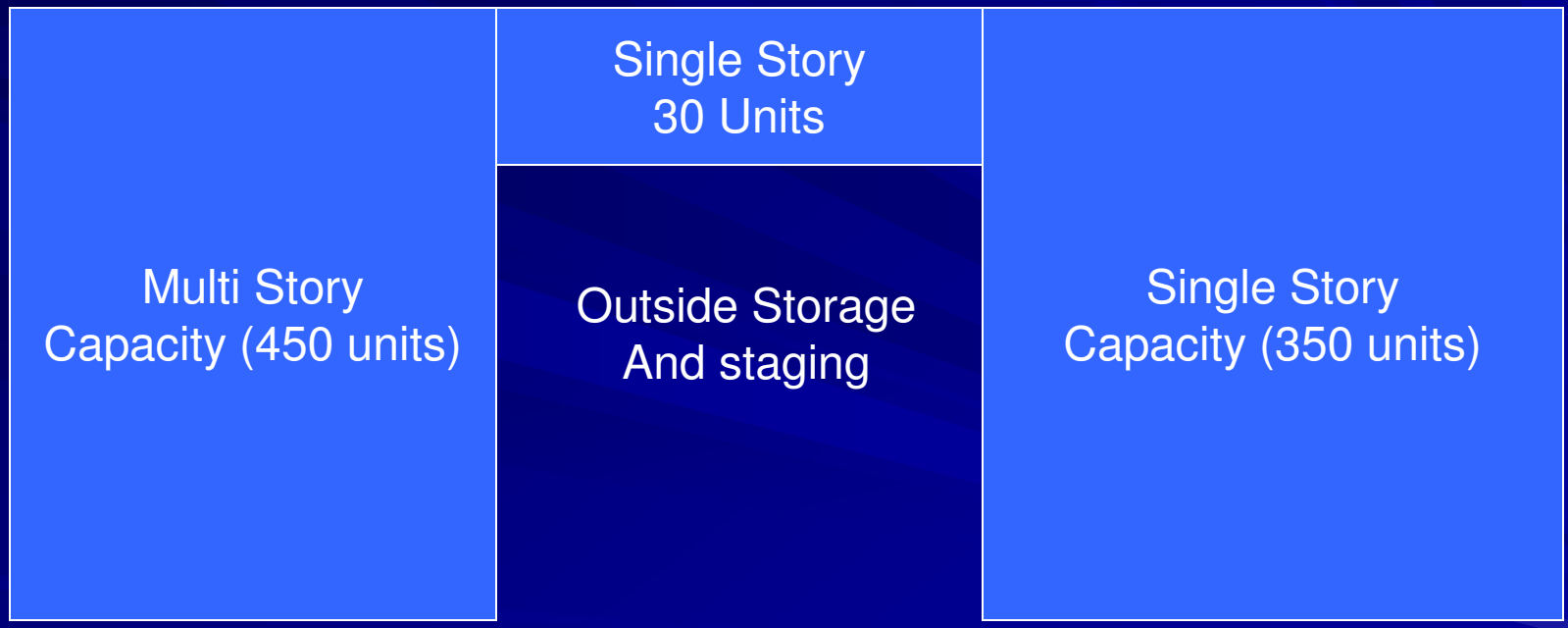
Implementation

- Solution is being implemented and tested at a large warehousing facility
  - Utilizing active RFID tags
  - Using Simcad Pro as the forecasting engine
  - Connects to an ordering system for future pulls.
  - Tracks parts and resources

Making sense of the data

- Tracking is only visual unless
  - Resources, parts, and equipment are mapped based on relationships
    - Resources can be within proximity of a piece of equipment, with the presence of a part indicates that the resource is working on the part (with limitation)
    - Resource moving within proximity of a forklift for the duration of the move indicates that the resource is tagged to the truck.

Model layout



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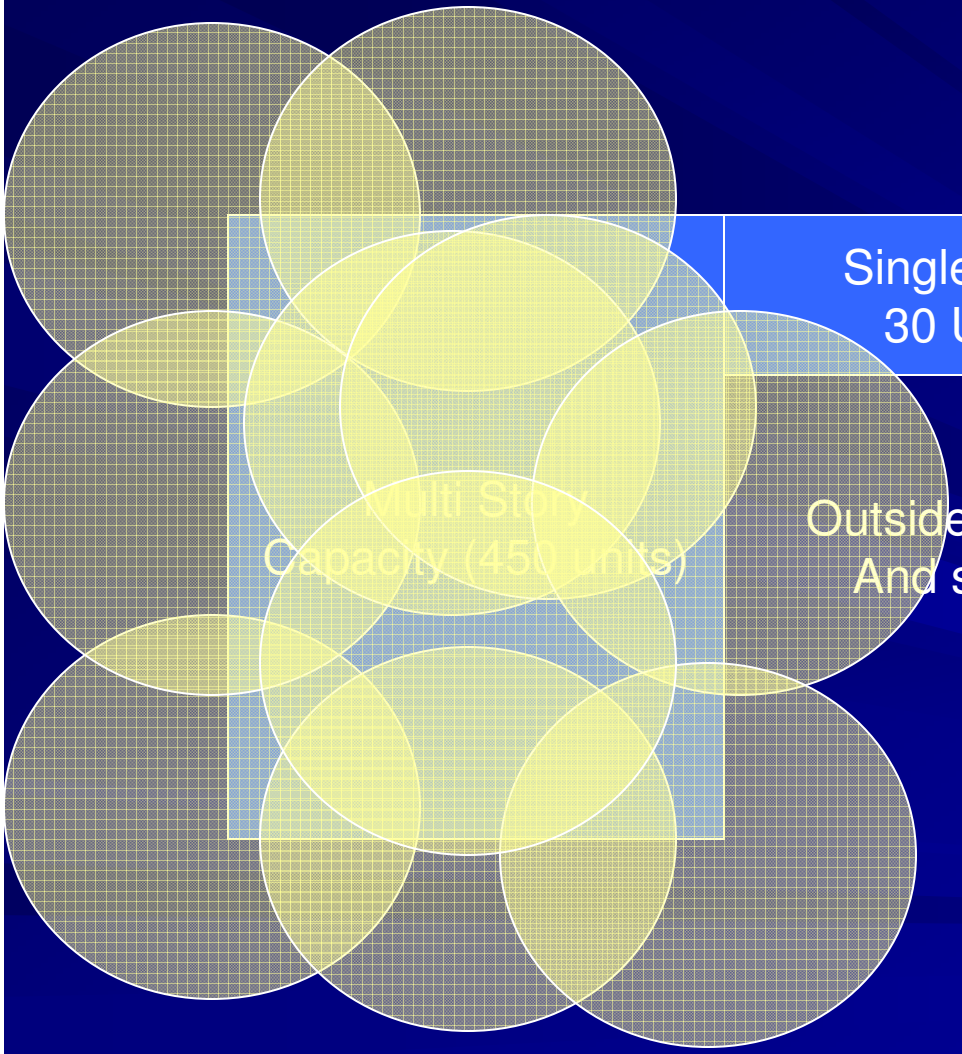
Sample layout



Single Story
30 Units

Outside Storage
And staging

Single Story
Capacity (350 units)

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Problems encountered

- Active RFID tags are accurate within 10 sq ft.
  - Inaccuracy is also generated by the type of building.
  - Signals from other devices may create interference.

Solution – utilize additional receivers with smart positioning to eliminate wrong signals.

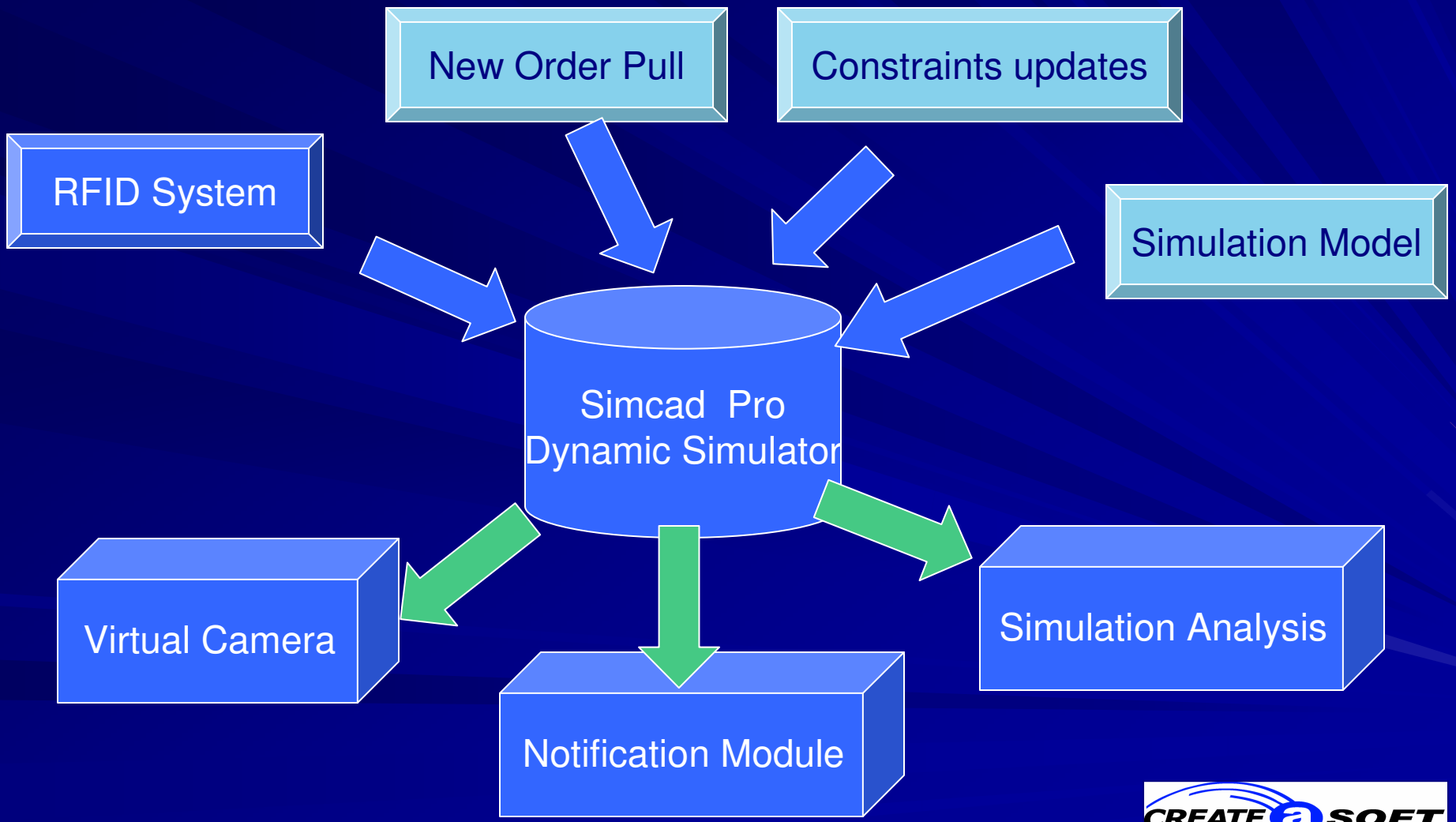
Extended Locator

- Proprietary locator engine that feeds off the main RFID data.
  - Locate using multiple receivers (3 or more)
  - Locate height and planar location
  - Connects to Simcad Pro for dynamic data feed through SQL engine
  - Automatically creates possible relationships.
  - Accurate to 3 Sq Ft

Model Variability

- The simulation model contains variability due to
  - statistical distributions
  - Scrap, rework, and other factors
- To Forecast accurately
  - Monte Carlo simulation is used to make at least 100 runs of the model before a notification event is sent.
  - Monte Carlo results are combined to create the most probable future scenario

Implementation Summary



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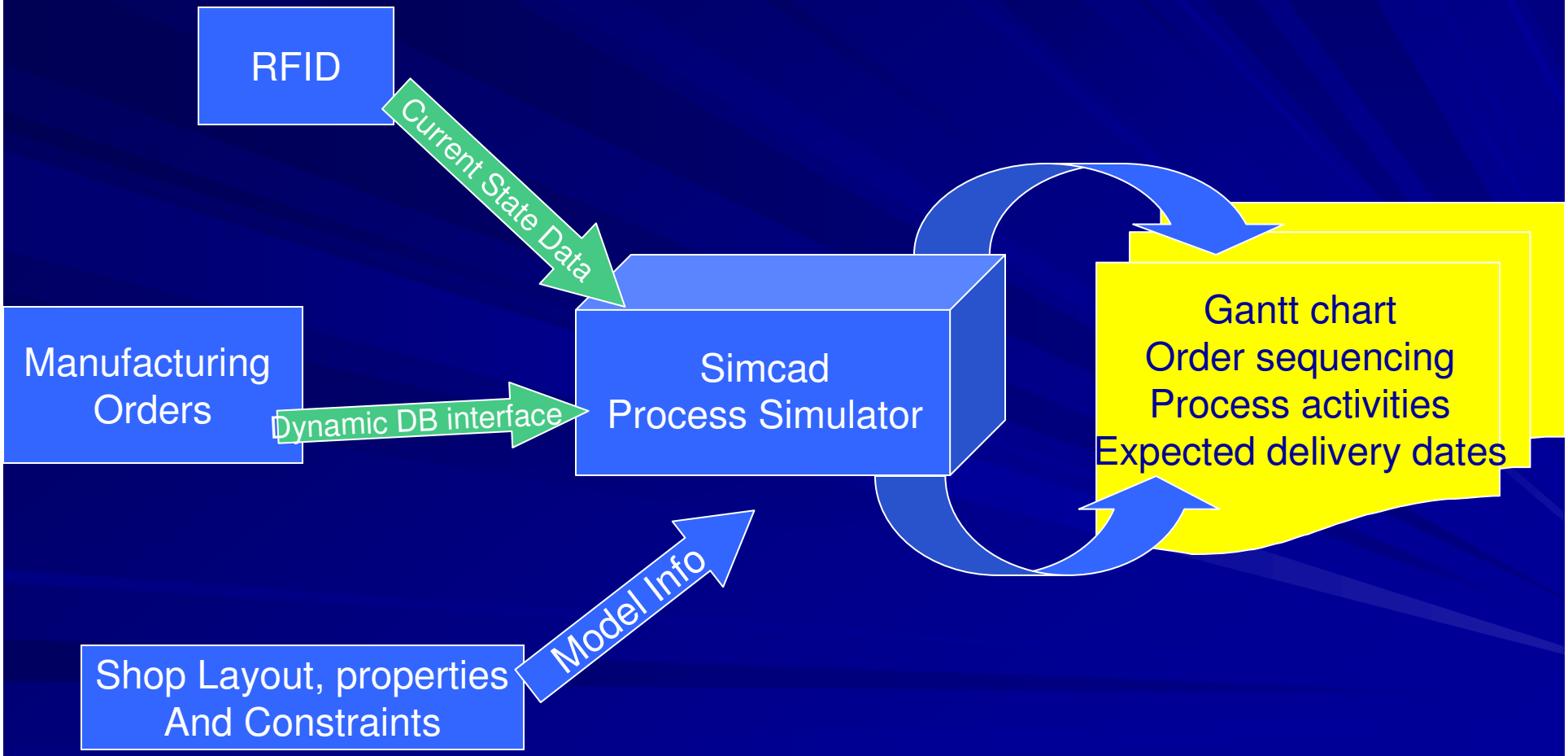
Additional benefits
Dynamic Scheduling



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Applicability

- Can be applied to any process flow.
- A combination of active and static RFID tags can be used to reduce implementation cost.
- Not limited to a specific RFID vendor.
- Requires a dynamic simulation environment to operate properly.

Realtime forecasting through simulation

- Example
- Q&A

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