Digital Twins

Analytics for Port Optimizations

Presentation by Bart Vermeer

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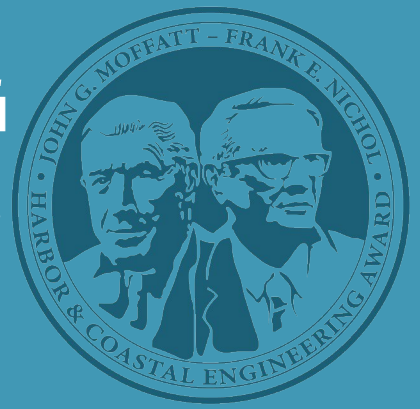
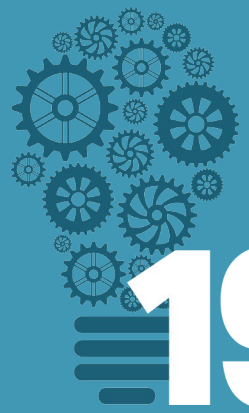
Moffatt & Nichol Today

14,000+
PROJECTS COMPLETED

ENR
Engineering News-Record
TOP 100
DESIGN FIRM

AMERICAN SOCIETY OF CIVIL ENGINEERS JOHN G. MOFFATT–FRANK E. NICHOL HARBOR AND COASTAL ENGINEERING AWARD





FOUNDED IN
1945

50+
OFFICES

80%
REPEAT BUSINESS

1,200+
EMPLOYEES

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FlexTerm

NEXTPORT

The world is changing…

Young children used to learn by playing with real toys first and slowly transitioned into more abstract learning.

The world is changing…

Today is different –
the abstract world is
at their fingertips…

Industrial Digital Twins

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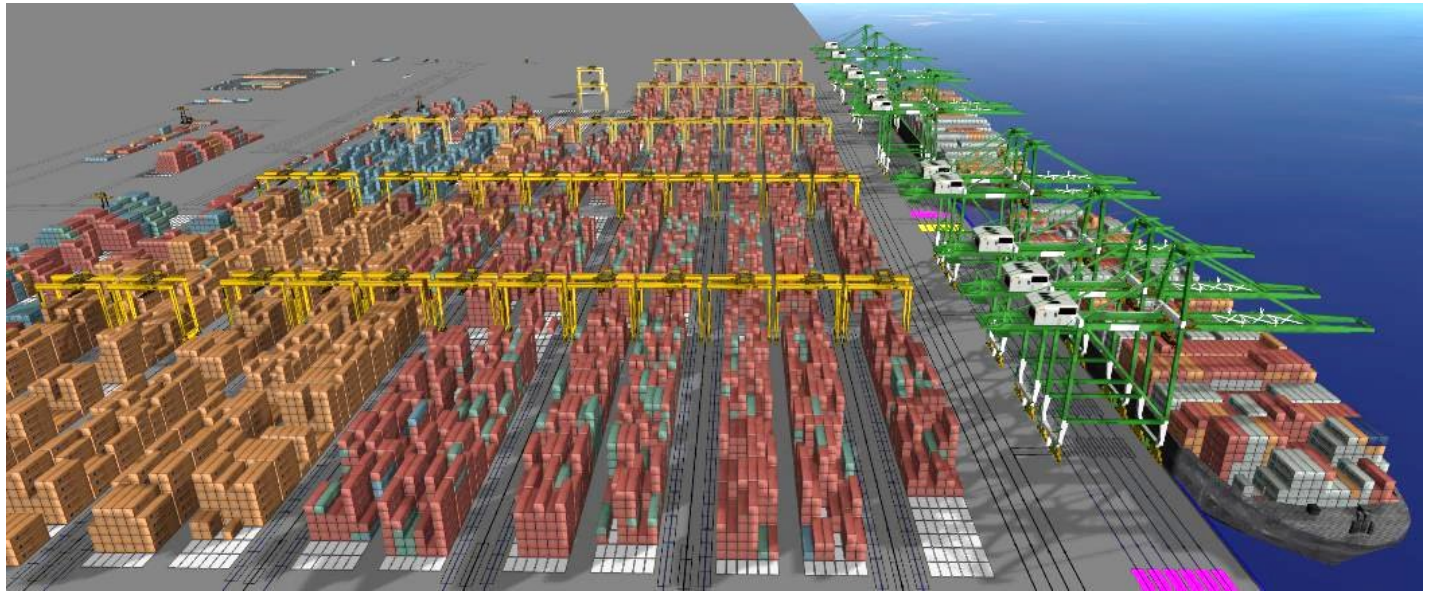
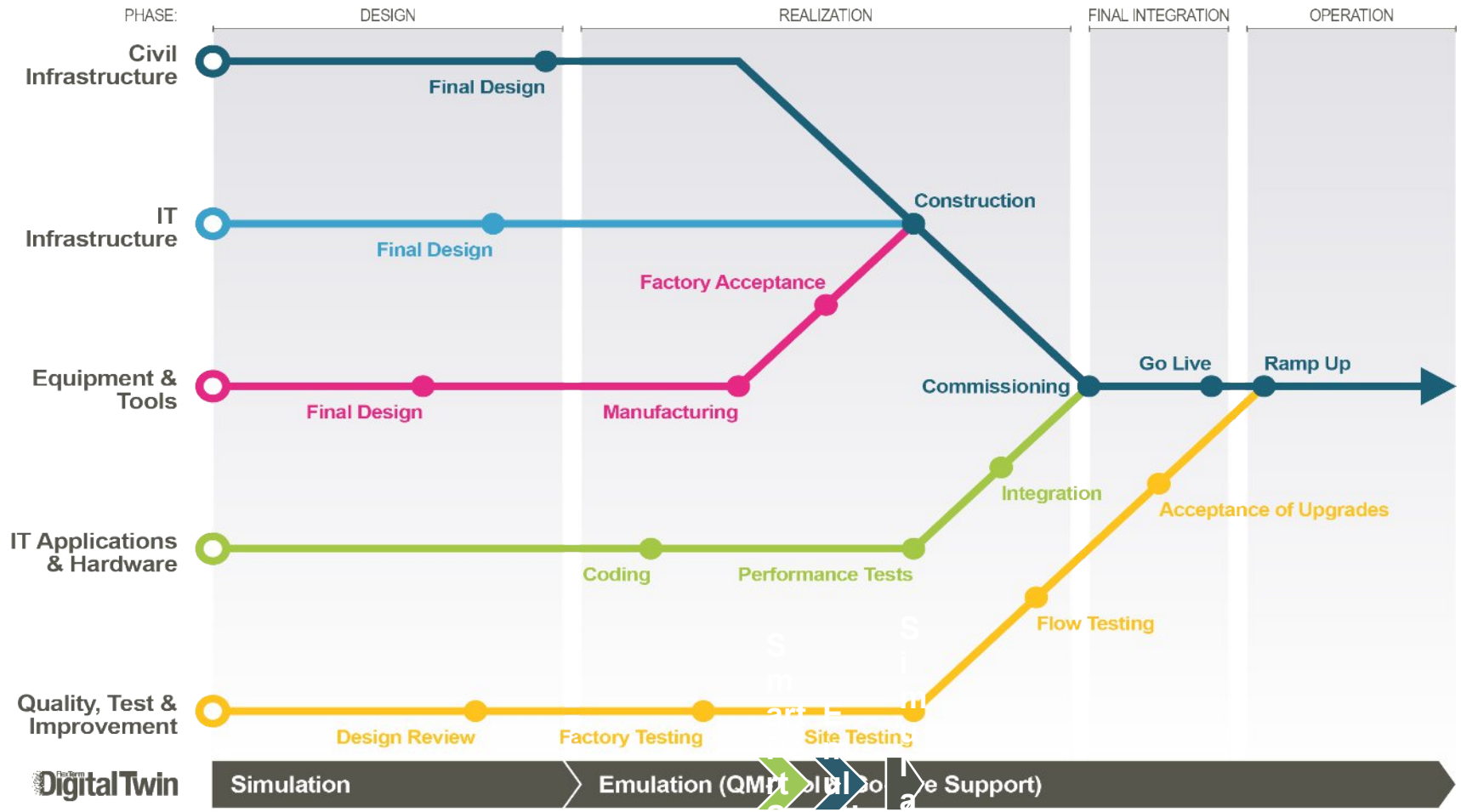
- **Real-Time Mirroring** – A replication of the real word in real time.
- **Simulation** – An abstract model to play out future scenarios.
- **Emulation** – Real software systems and behaviors integrated in a virtual world.
- **Smart Ports Solutions** – Comprehensive Data Platform to optimize operations.



Path to Completion



- The typical work streams and integration challenge.
- Regardless of procurement strategy, this needs to be done.
- Quality Management is key.

Terminal Planning

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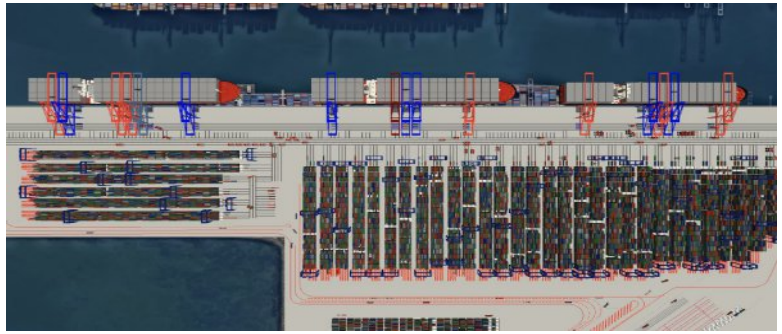
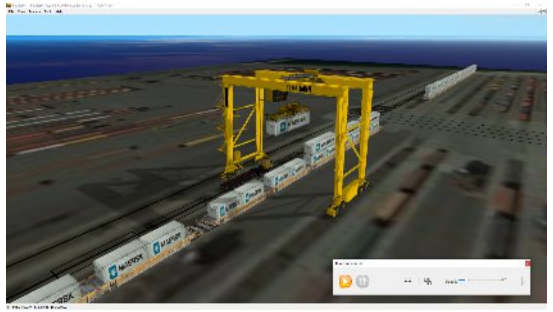




- Define diverse terminal configurations and equipment solutions.
- Try different yard planning techniques and methods.
- Evaluate performance with simulation or emulation.

Simulation

FlexTerm

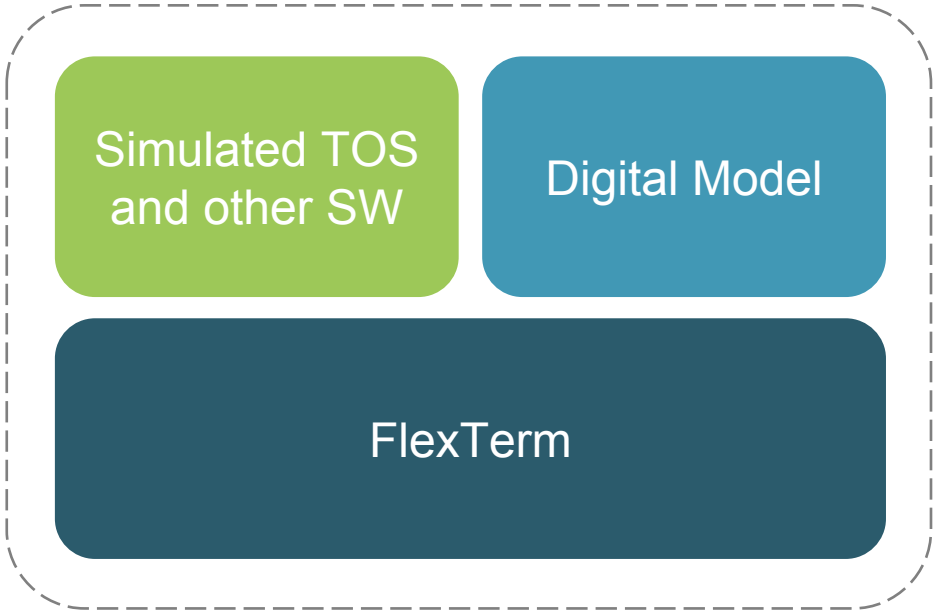
- Optimize container terminal design.
- Test the infrastructure before:
  - Pouring concrete.
  - Ordering equipment.
  - Or even, drafting designs.

Address questions like:

- **What system design? (RTGs vs. automated RMG, terminal tractors vs. AGVs)**
- **For a given concept, what terminal layout is best?**
- **For a concept and layout, how much equipment is necessary to meet operational goals?**
- **What operational capacity can be achieved?**
- **For an existing site, what changes (layout, equipment changes, more equipment) would lead to operational improvement?**

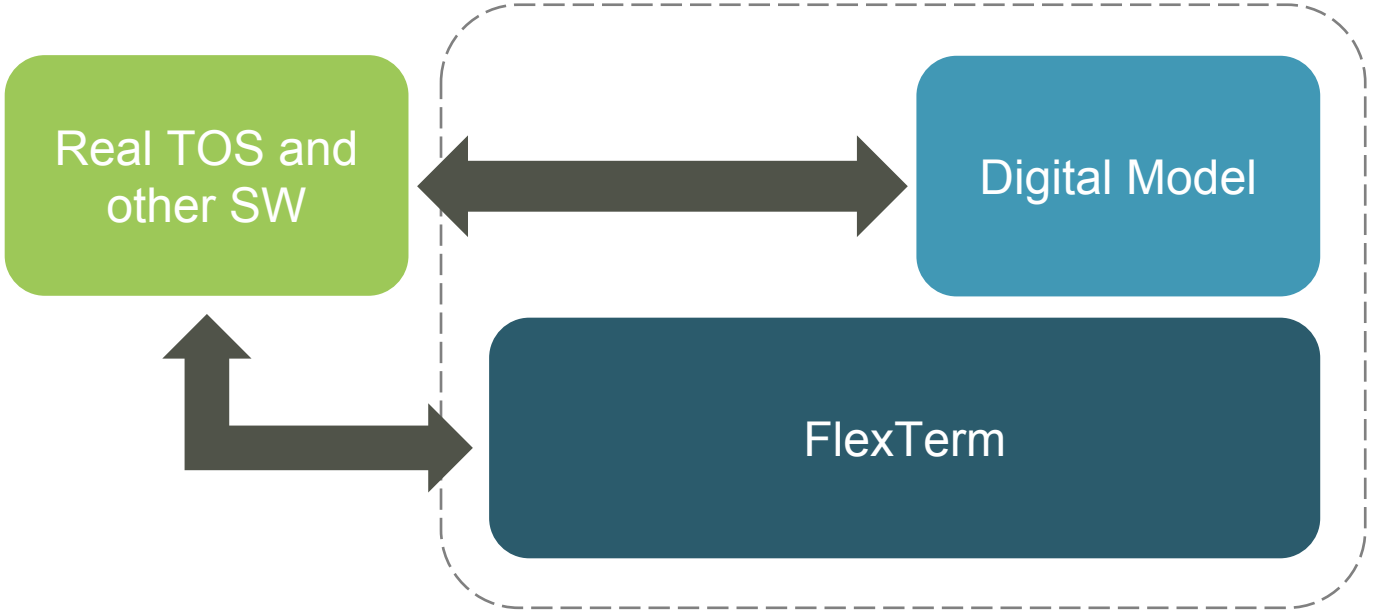
From Simulation to Emulation

Simulation =
FlexTerm + Digital Model + SimTOS



Optimize infrastructure

Emulation =
FlexTerm + Digital Model + TOS



Test systems, Optimize operations,
Train operational staff

Emulation:
The Quality Assurance Solution

FlexTerm

Testing, Training and Optimization

- **Testing**
  - ÒIntegration
  - ÒMissing functionality
  - ÒBugs
- **Training**
  - Happy day scenarios
  - Process variation
  - Exception handling
- **Optimization**
  - ÒScenarios
  - ÒConfigurations
  - ÒVariations

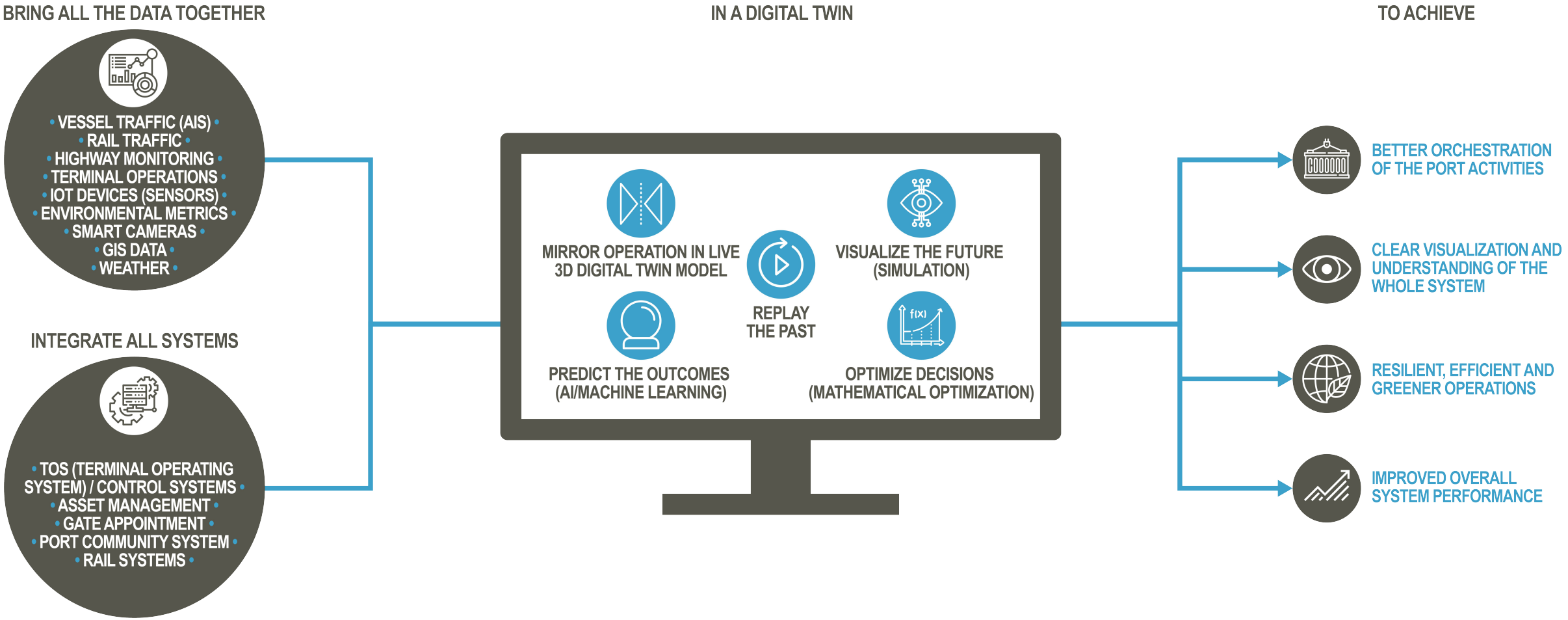
Is the integration complete?

Staff skilled for the job?

Are systems configured the right way?

‘Smart Port’ Concept

NEXTPORT



Digital Twin Opportunities

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Optimize Traffic Flows

Examples:

- Vehicle booking system integration – Planning at port level and no longer at terminal level.
- Vehicle monitoring and feedback – Real time status monitoring to track progress and adapt planning.
- Traffic flow optimization – use combination of real-time data and VBS data to optimize traffic flows.

Digital Twin Opportunities

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Energy Efficiency

Examples:

- Balanced equipment charging – Manage charging of equipment to shave peak demand.
- Vessel speed optimization based on berth availability.

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Examples:

- Improving resource allocations.
- Minimizing idle times and maximizing utilization.
- Proactive Port planning and utilization improvements.

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Sustainability

Examples:

- Smart ports plan to significantly increase throughput in same footprint and same or even reduced emissions.
- Compliance with regulation and transparent energy/ emission KPIs measure.

Optimize Your World

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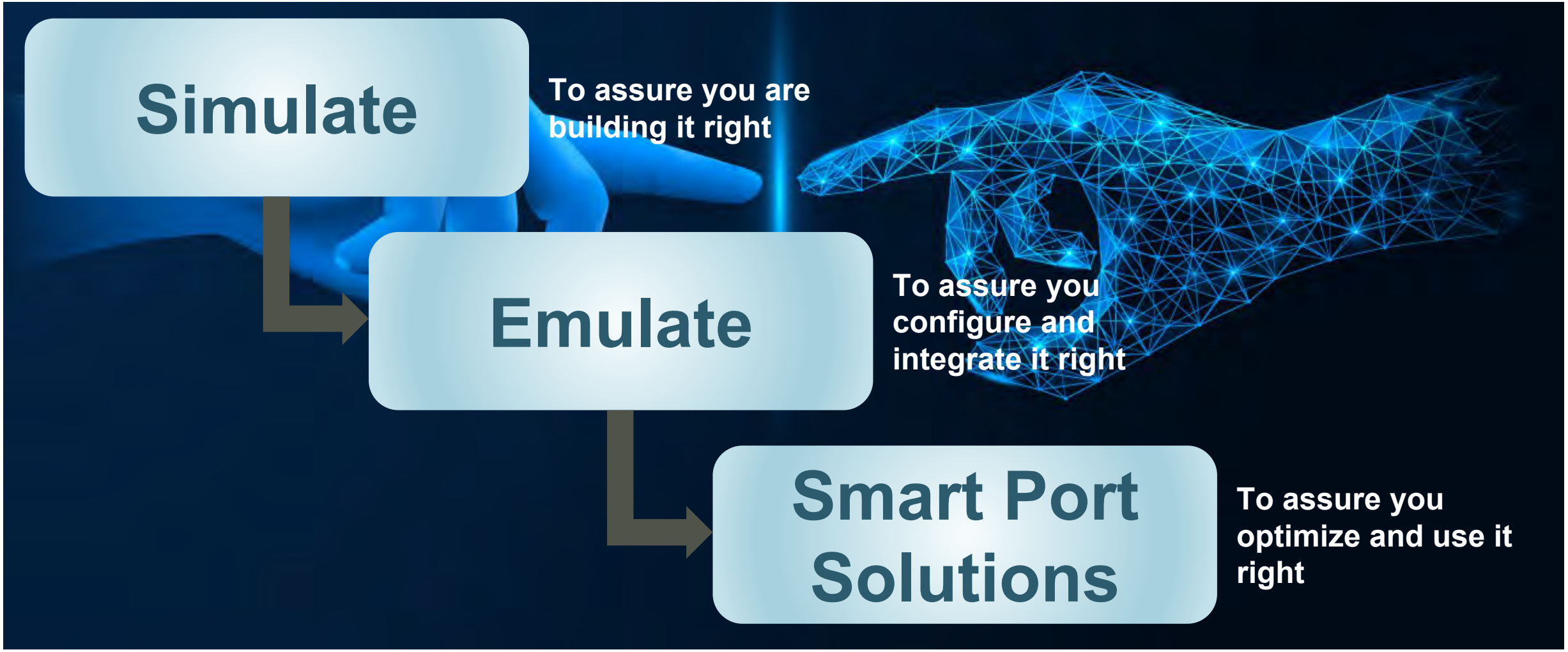

Thank you

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