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The Digital Port

-

As a base for Big Pictures to Revolutionize your Processes

CHESSCON

Agenda

Introduction

Simulation - Emulation

Digital Twin for Terminals

… based on Industry Standards

Conclusions

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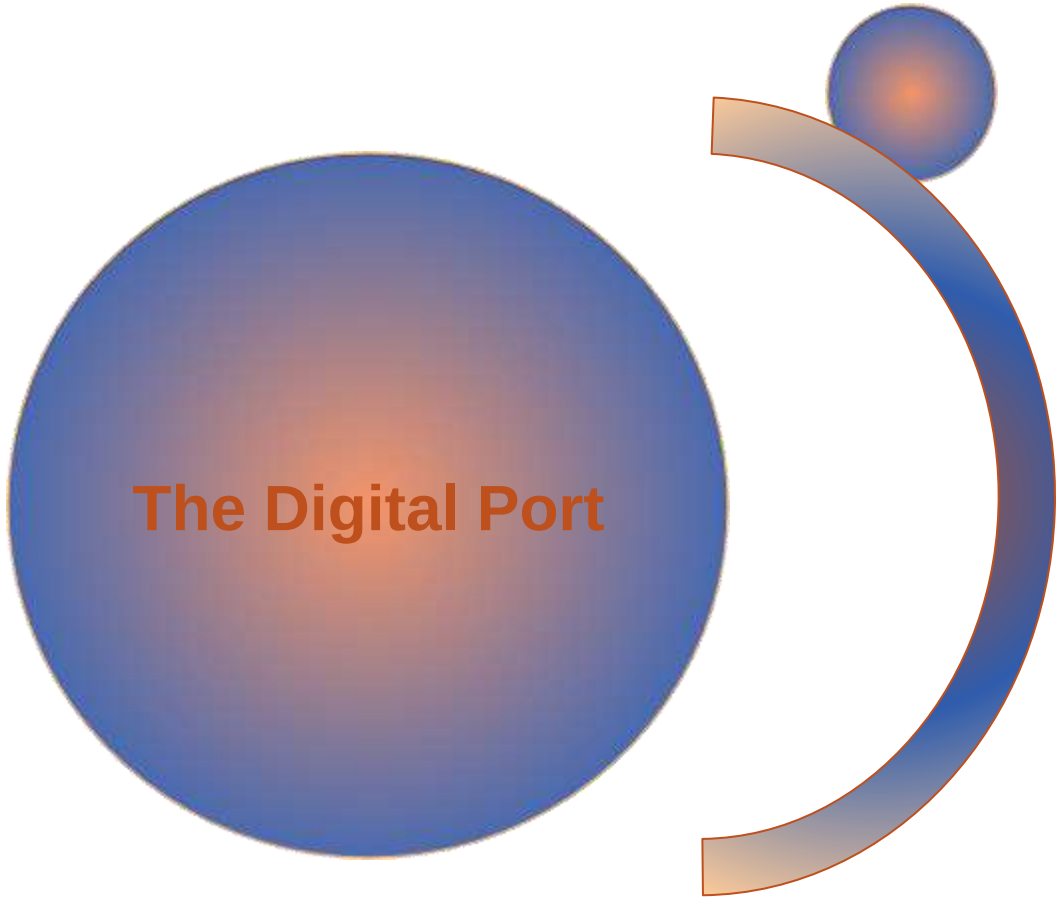


Introduction

AKQUINET port consulting

Prof. Dr. Holger Schütt

30 years of port, terminals and automation experience.

Researcher at Institute of Shipping Economics and Logistics

Professor at University of Applied Sciences Bremerhaven

CHESSCON

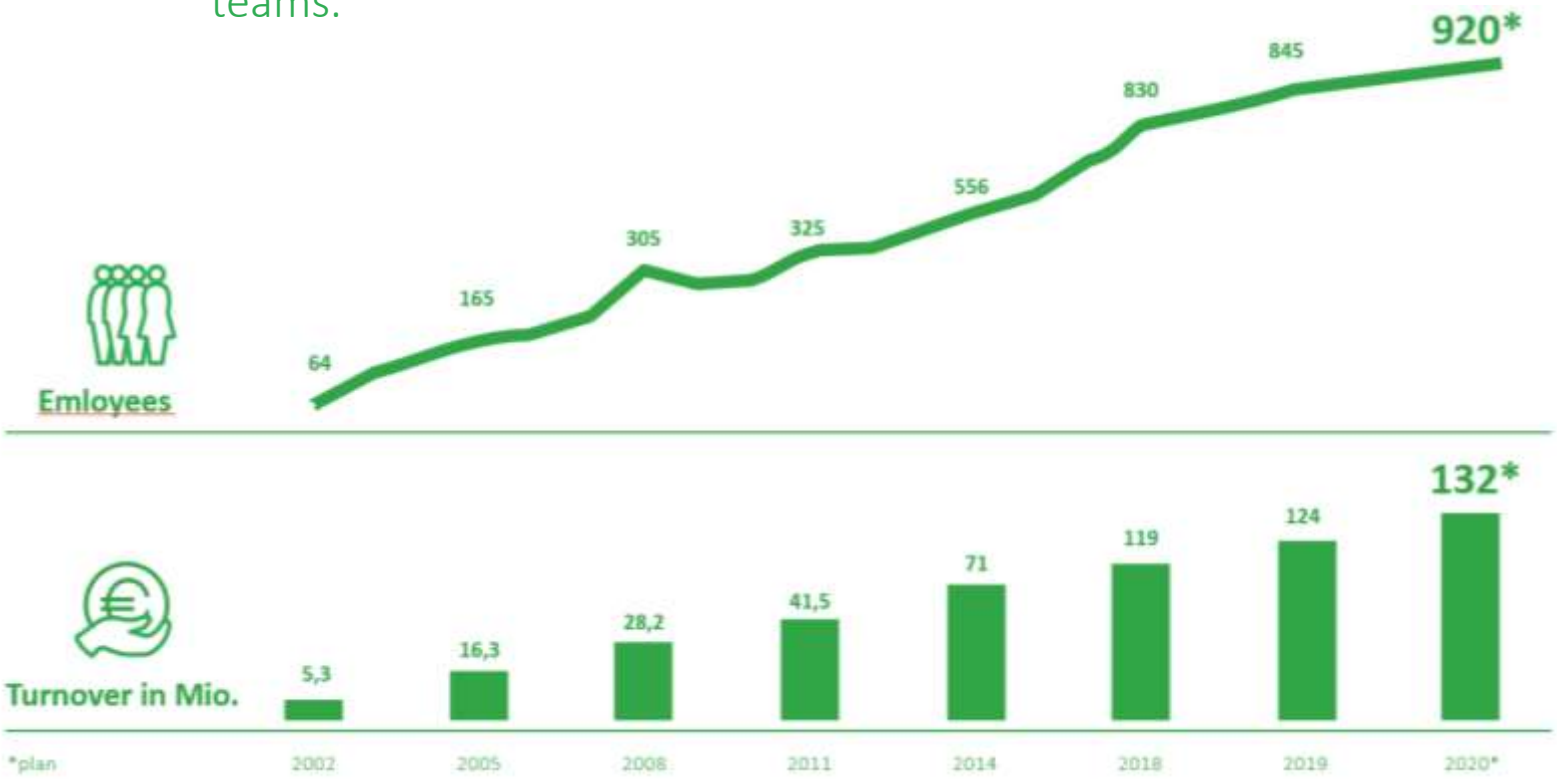
Some 30 years of simulation, emulation and optimization experience.

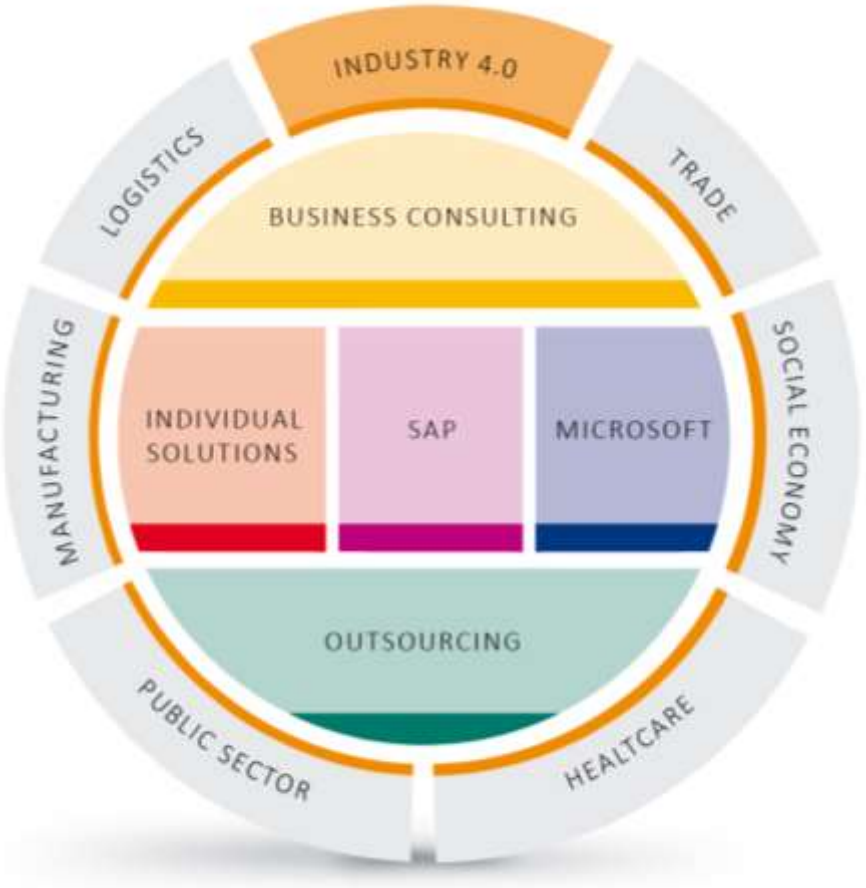
Norbert Klettner

Over 15 years of port, terminals and TOS experience.

AKQUINET Is the largest independent and owner-run IT company in the German-speaking world. Trustworthy In cooperation, flexible in action, human in co-operation, socially responsible.

AKQUINET is focused on different industries such as health care, public and logistics with ports& terminals. These strength are combined into an overall digitization approach with Industry 4.0 teams.





AKQUINET port consulting – taking care of the full lifecycle!

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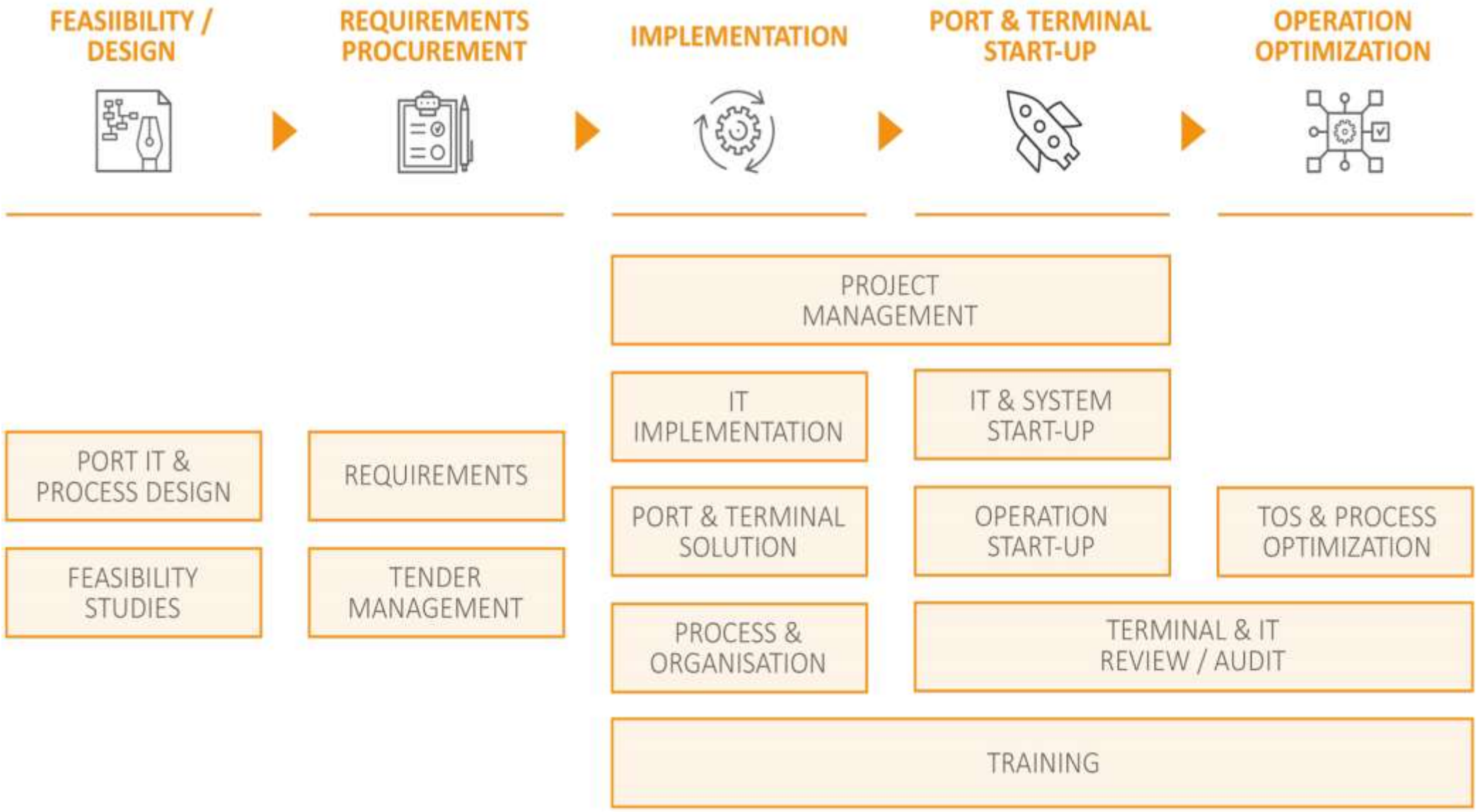
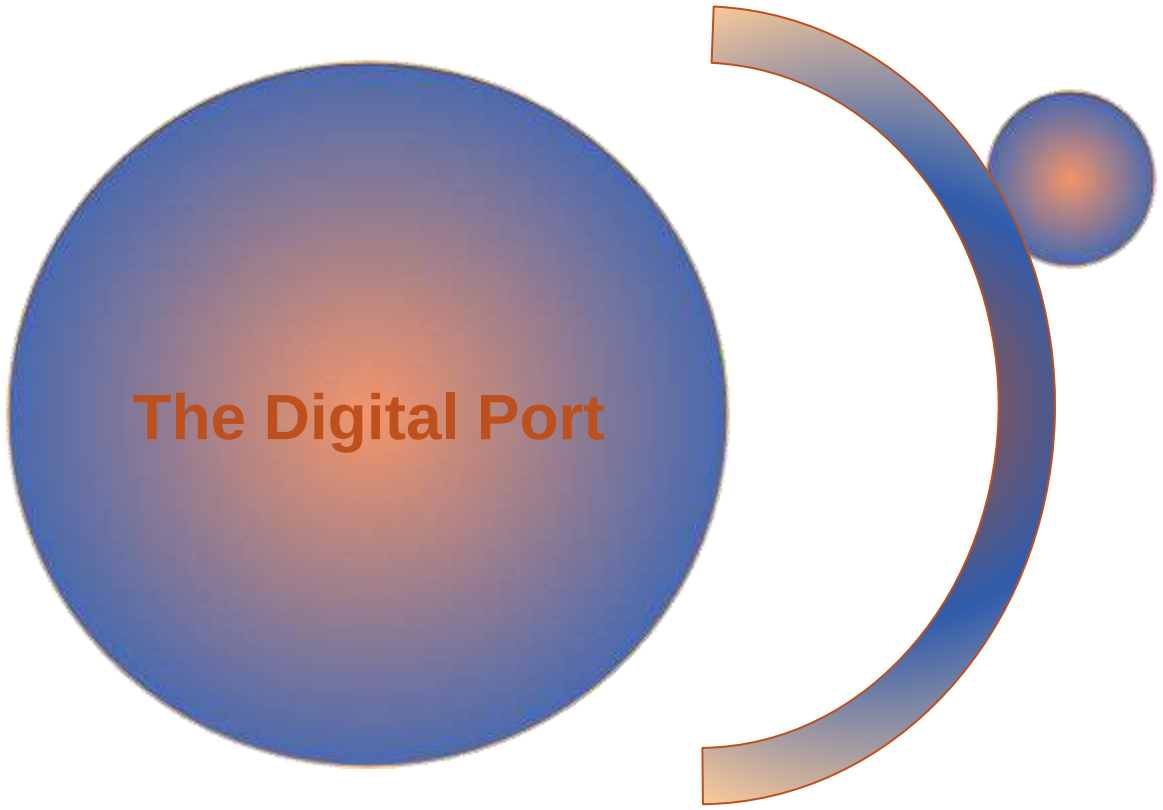


References Worldwide with CHESSCON

APM Terminals; global HQ
ASEAN Terminals, Philippines
Bejaia Mediterranean Terminal, Algeria
Bromma, Singapore
Centerm Terminal, Vancouver, Canada
Contship, La Spezia, Italy
CSX, Jacksonville, USA
DP World Terminal Antwerp, Europe
DP World, Australia
EUROGATE, Germany
HHLA, Hamburg , Germany
HPA Hamburg Port Authority, Germany
HIT, Hong Kong
JadeWeserPort, Germany
Cargotec / Kalmar Industries, Finland
CMSA ICTSI, Manzanillo, Mexico
Marport, Turkey
MCT, Gioia Tauro, Italy
MTL, Hong Kong
Nhava Sheva Terminal, India
Noell Crane Systems, Germany
NTB, Bremerhaven, Germany
P&O Headquarter, London, Europe
Port of Tacoma, USA
PORTEK International Ltd., Singapore
Ports America, North America
PSA International, Singapore
Red Sea Gateway Terminal, Jeddah, KSA
Sandwell Eng. Inc., Vancouver, Canada
SPIA ICTSI, Columbia
Tata Consultancy Services, India
TecPlata ICTSI, Buenos Aires, Argentina
TIL - Terminal Investment Ltd, Netherlands
TotalSoftBank, Korea
TPT, Durban, South Africa
TRP, Buenos Aires, Argentina
VTE, Genoa, Italy
Warsteiner Brewery, Germany

Agenda



Simulation - Emulation

Starting in the 90-ies

→ Terminal planning and design

strategical planning

Optimization software for container terminals

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Development supported by European Union Land Bremen bis

Post - Millenial

→ Terminal Start-Up and Operation

tactical planning

Optimization software for container terminals

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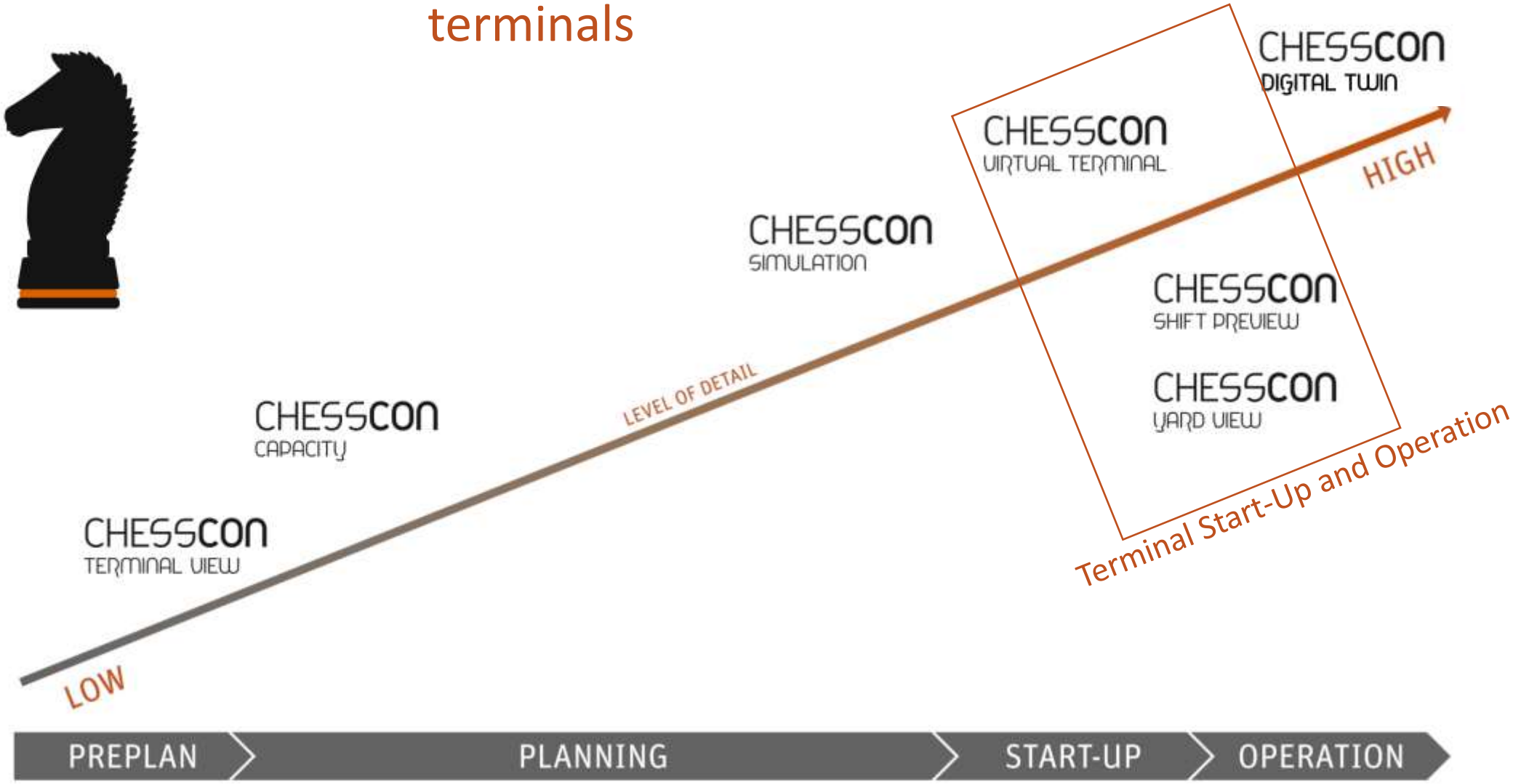

Development supported by European Union Land Bremen bis

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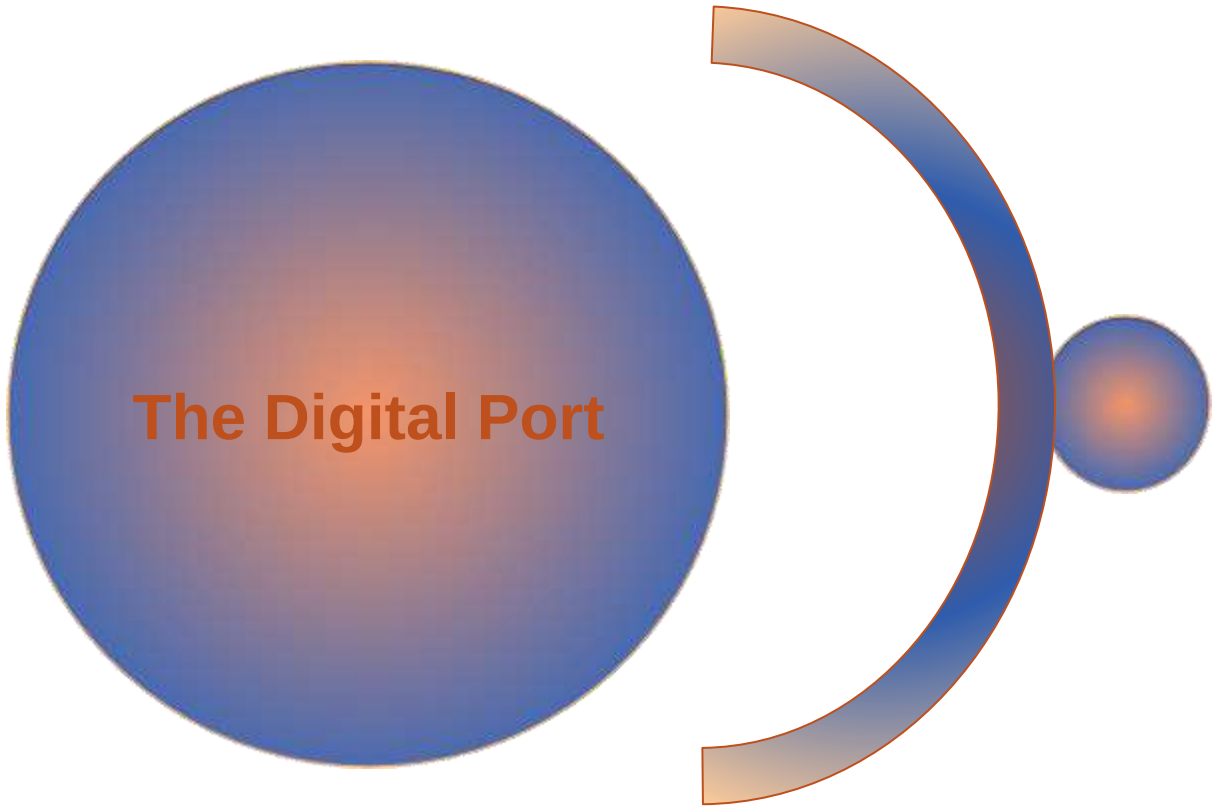


Digital Twin for Terminals

Nowadays

→ Forecasting the coming operation

operational planning

- Definition

Digital Twin

- … is a digital representation of a real-world entity or system. (Gartner IT)[1]

- … is a virtual representation of a physical product or process, used to understand and predict the physical counterpart's performance characteristics. [2]
(Performance Digital Twins: Using digital twins capture, analyze, and act on operational data)

- The concept and model of the Digital Twin was publicly introduced in 2002 by Dr. Michael Grieves, then of the University of Michigan, at a Society of Manufacturing Engineers conference in Troy, Michigan[20]. The concept which had a few different names was subsequently called the Digital Twin by John Vickers of NASA in a 2010 Roadmap Report[21].

The Digital Twin consists of three parts:

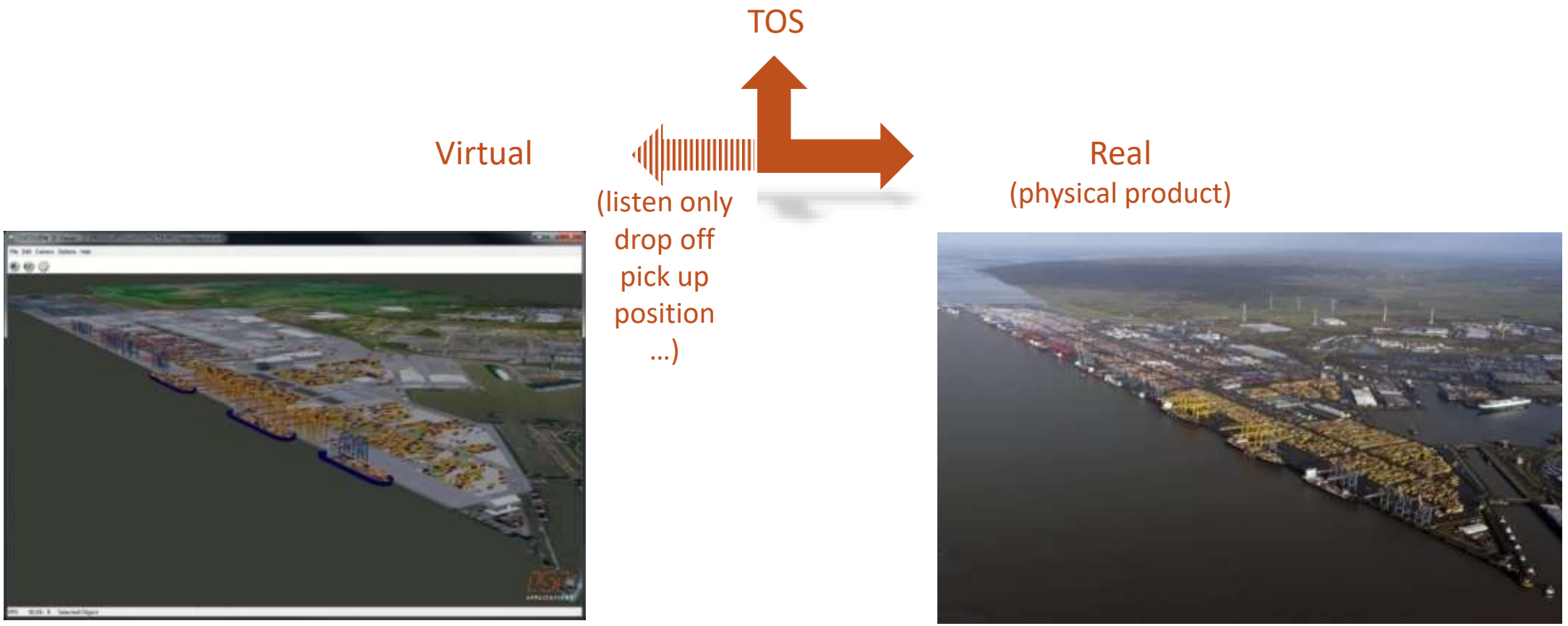
- **The physical product,**
- **the virtual product, and**
- **the connection between the two products**.

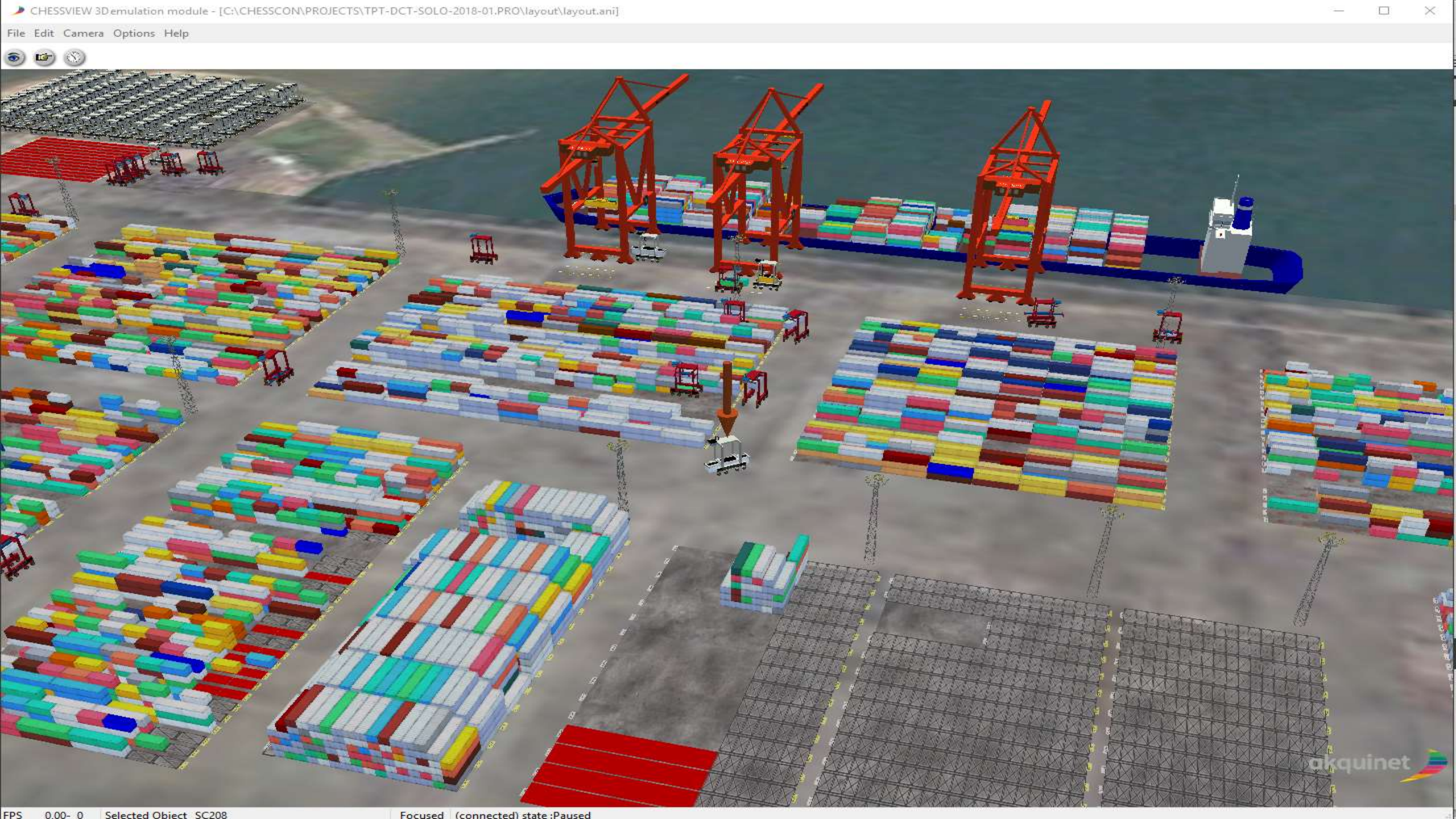
1: https://www.gartner.com/it-glossary/digital-twin/
2: https://www.plm.automation.siemens.com/global/en/our-story/glossary/digital-twin/24465
3: https://en.wikipedia.org/wiki/Digital_twin

Digital Twin

To build the digital Twin

- use the emulation model
- connect it to the TOS (listen only) and the equipment (→ Live View)
- use fast simulation module to forecast operation




CHESSVIEW 3D emulation module - [C:\CHESSCON\PROJECTS\TPT-DCT-SOLO-2018-01.PRO\layout\layout.ani]
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akquinet
FPS 0.00- 0 Selected Object SC208 Focused (connected) state :Paused

CHESSVIEW 3Demulation module - [C:\CHESSCON\PROJECTS\TPT-DCT-SOLO-2018-01.PRO\layout\layout.ani]

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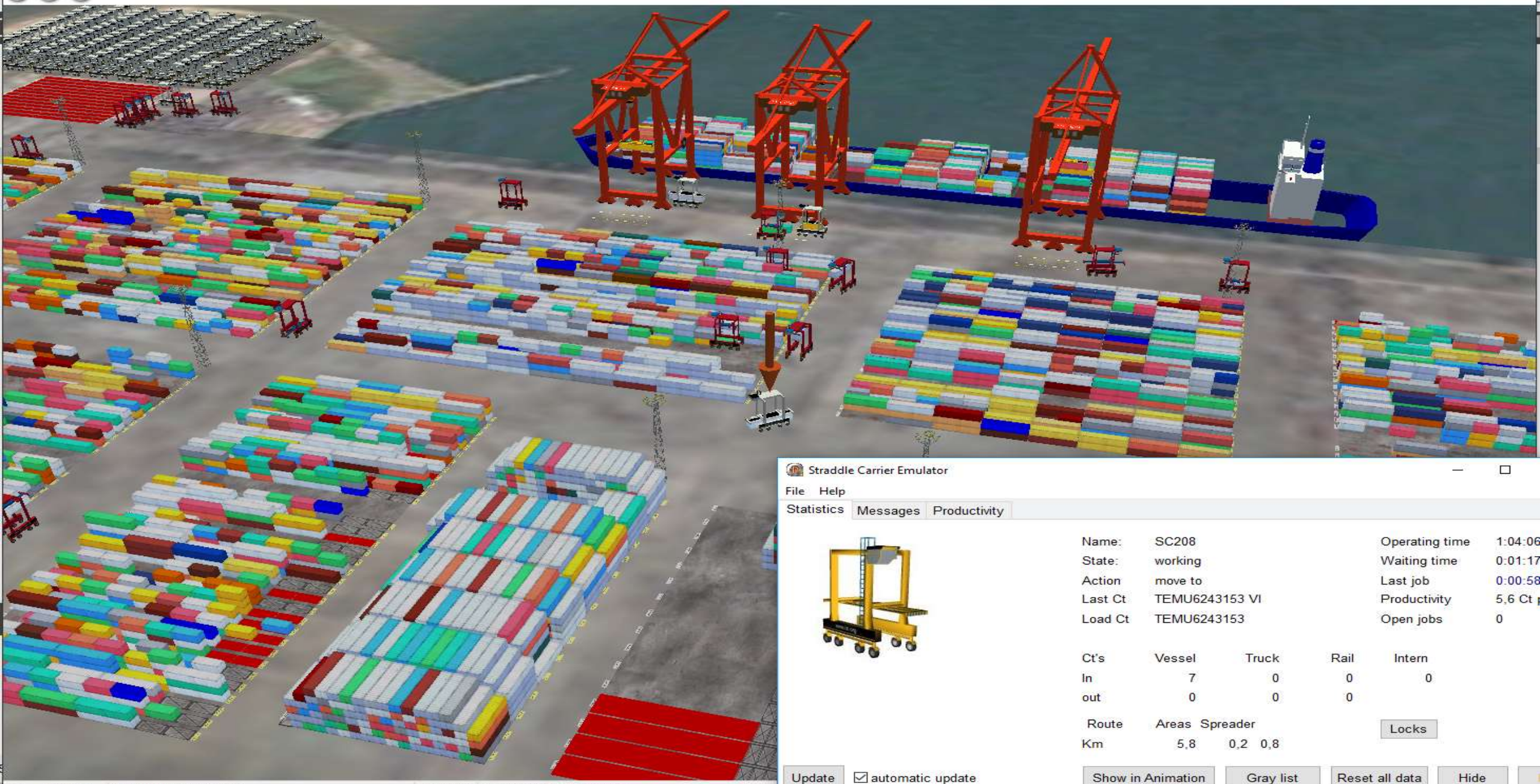


Straddle Carrier Emulator

File Help

Statistics | Messages | Productivity

Name:	SC208			Operating time	1:04:06
State:	working			Waiting time	0:01:17
Action	move to			Last job	0:00:58
Last Ct	TEMU6243153 VI			Productivity	5,6 Ct
Load Ct	TEMU6243153			Open jobs	0

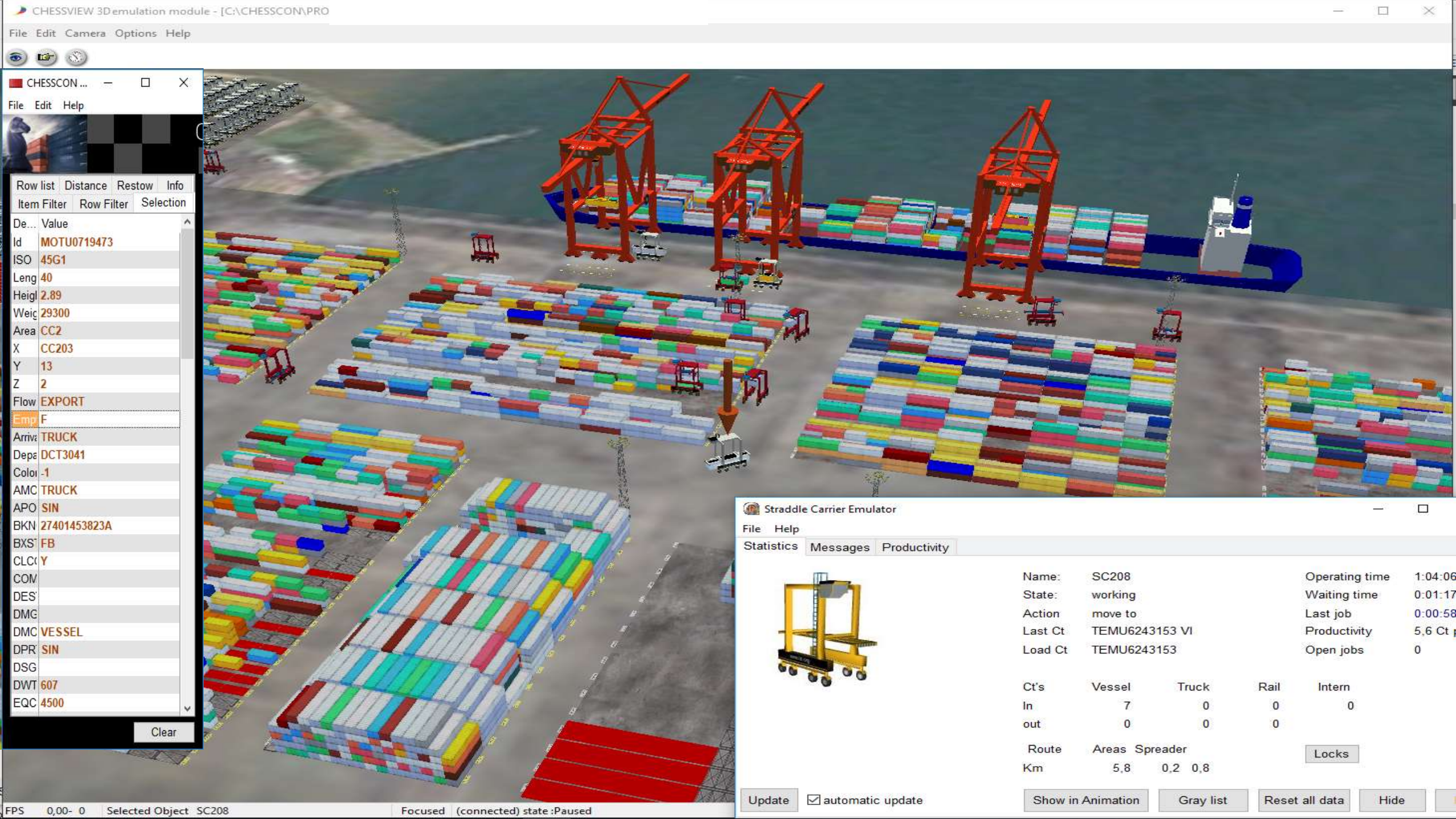
Ct's	Vessel	Truck	Rail	Intern
In	7	0	0	0
out	0	0	0	

Route	Areas	Spreader	
Km	5,8	0,2	0,8

Locks

Update ☑ automatic update | Show in Animation | Gray list | Reset all data | Hide

FPS 0,00- 0 | Selected Object SC208 | Focused | (connected) state :Paused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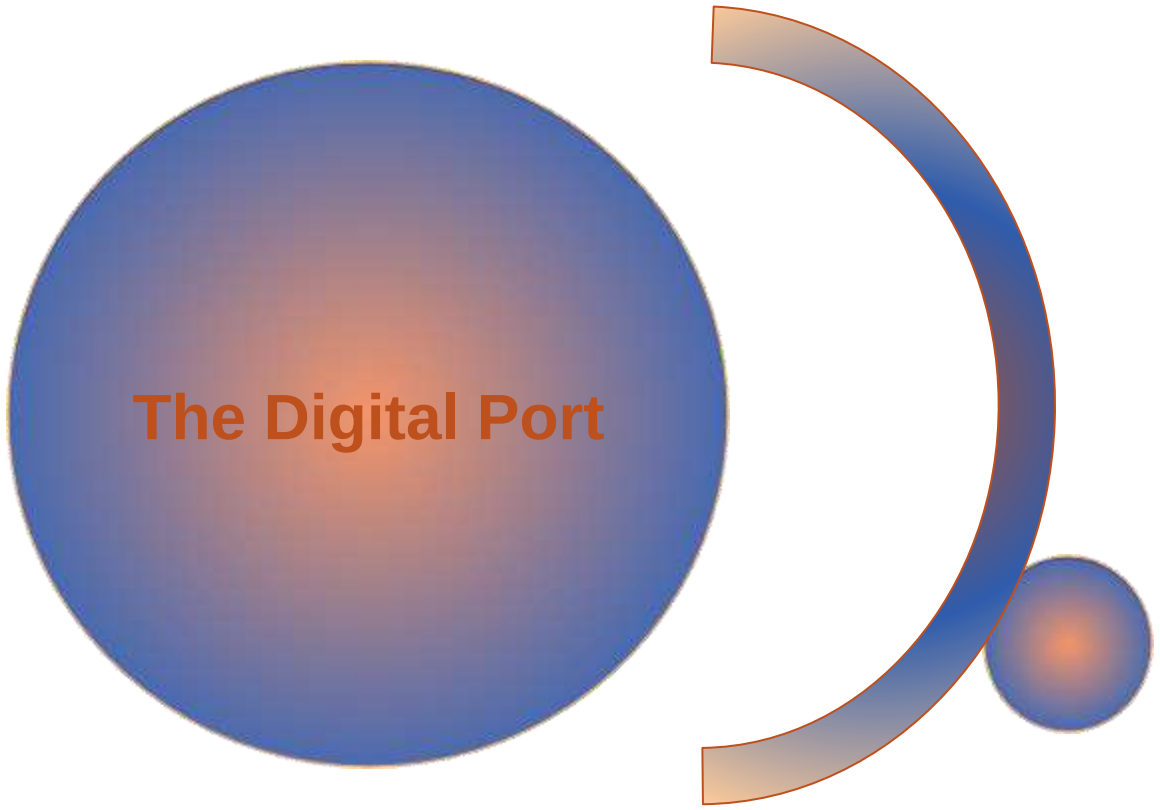
Leng 40
Heigl 2.89
Weig 29300
Area CC2
X CC203
Y 13
Z 2
Flow EXPORT
Emp F
Arriva TRUCK
Depa DCT3041
Colo -1
AMC TRUCK
APO SIN
BKN 27401453823A
BXS FB
CLC Y
COM
DES
DMC
DMC VESSEL
DPR SIN
DSG
DWT 607
EQC 4500
Clear
Straddle Carrier Emulator
File Help
Statistics Messages Productivity
Name: SC208
State: working
Action move to
Last Ct TEMU6243153 VI
Load Ct TEMU6243153
Operating time 1:04:06
Waiting time 0:01:17
Last job 0:00:58
Productivity 5,6 Ct
Open jobs 0
Ct's Vessel Truck Rail Intern
In 7 0 0 0
out 0 0 0
Route Areas Spreader
Km 5,8 0,2 0,8
Locks
Update
automatic update
Show in Animation
Gray list
Reset all data
Hide
FPS 0,00- 0
Selected Object SC208
Focused
(connected) state :Paused

Comparison

	Scenario	Decisions	Level of detail	Speed	Application
Simulation	to be defined	internal light TOS	low - medium	very high	strategic
Emulation	defined in TOS	real TOS	very high	low (due to TOS-coupling)	tactical
Digital Twin	permanently updated by TOS	internal light TOS using real TOS parameters	high	high	operational

Agenda



… based on Industry Standards

(Semi) Automated DIGITAL TWIN Creation

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PortML

www.PortML.io

Layout

Live Data

tic4.0

www.tic40.org

Scenario

Asset Digitization

Applications

Calibrating the simulation model by analysing the behaviour of the real world

- listen to the real world
- analyse the behaviour and find changes
- evaluate parameters of the real objects (e.g. productivity of manned devices → learning curve)
- adapt these changes to the emulators of the objects to be more precise for future simulation analysis

Applications

Re-act on exceptions happening in the real world

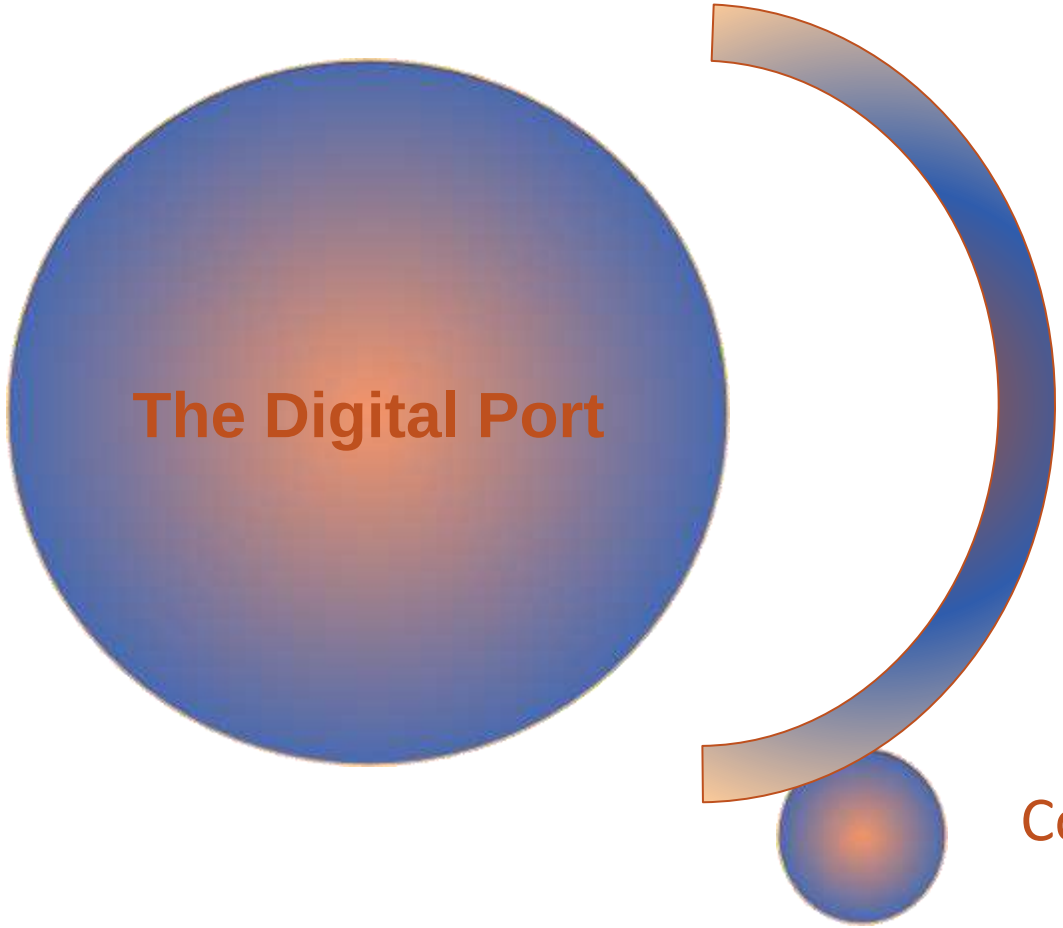
- exception occurs (e.g. crane breakdown)
- planner has to react very fast (e.g. define new crane split)
- test new strategy by fast simulation (Preview)
- potential bottle-necks will be shown
- planner will pro-actively (before they occur) optimise his strategy

Applications

Automated check of the current plan

- preview module is automatically started in predefined intervals
- predefined thresholds are compared to the simulation results
- productivity/efficiency lags may be identified in advance
- check of productivity figures (e.g. planned end of operation at the vessel)
- differences may be automatically sent to the planner/shown on the screen

Agenda



Conclusions

Conclusions

Digital Twins at container terminals should be

- built by using the emulation model of a terminal
- connected to the real terminal by only listening to the TOS‘ and eqiupment‘s messages
- use the preview module (fast simulation) to predict the future behaviour
- Use industry standards for all communication

They combine

- the detailled behaviour of the emulators
- the current state of the terminal (by listening to the messages)
- the fast simulation of the preview module

and thus may be used for improving the operational planning.

What happens next?

Digital Twin prototype for Busan terminal (10/2021)

Digital Twin installation for Hamburg terminal (3 years project)

- Predictive maintenance
- Process optimisation
- AI based evaluations of current and historical data

Come to our booth and grap your horse!

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