

Enhancing Port Operations through TIC4.0 Standards: A Path to Smart Ports

or

Allowing humans & machines to talk to each other and
between themselves: the key to really smart ports



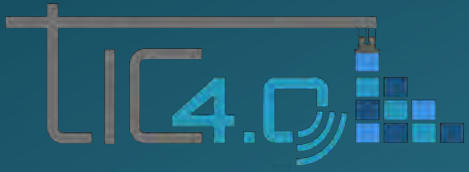
ASEAN Ports & Shipping Conference 2023

BORIS WENZEL – TIC4.0 FOUNDER & PRESIDENT

October – November 2023



- 1. Introduction: why ports need to get smarter... and fast**
- 2. What is, actually, a smart port?**
- 3. What is TIC4.0 & why it will help ports get smarter much faster**
- 4. Examples and Use Cases**
- 5. Future plans: becoming the global industry standard**
- 6. Why you should be part of TIC4.0**
- 7. Conclusions**

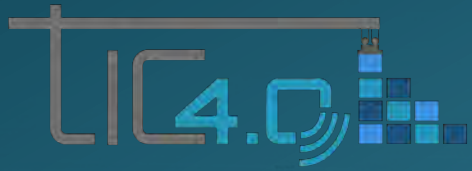


INTRODUCTION: WHY PORTS NEED TO GET SMARTER...AND FAST



Why Ports need to get smarter... and fast

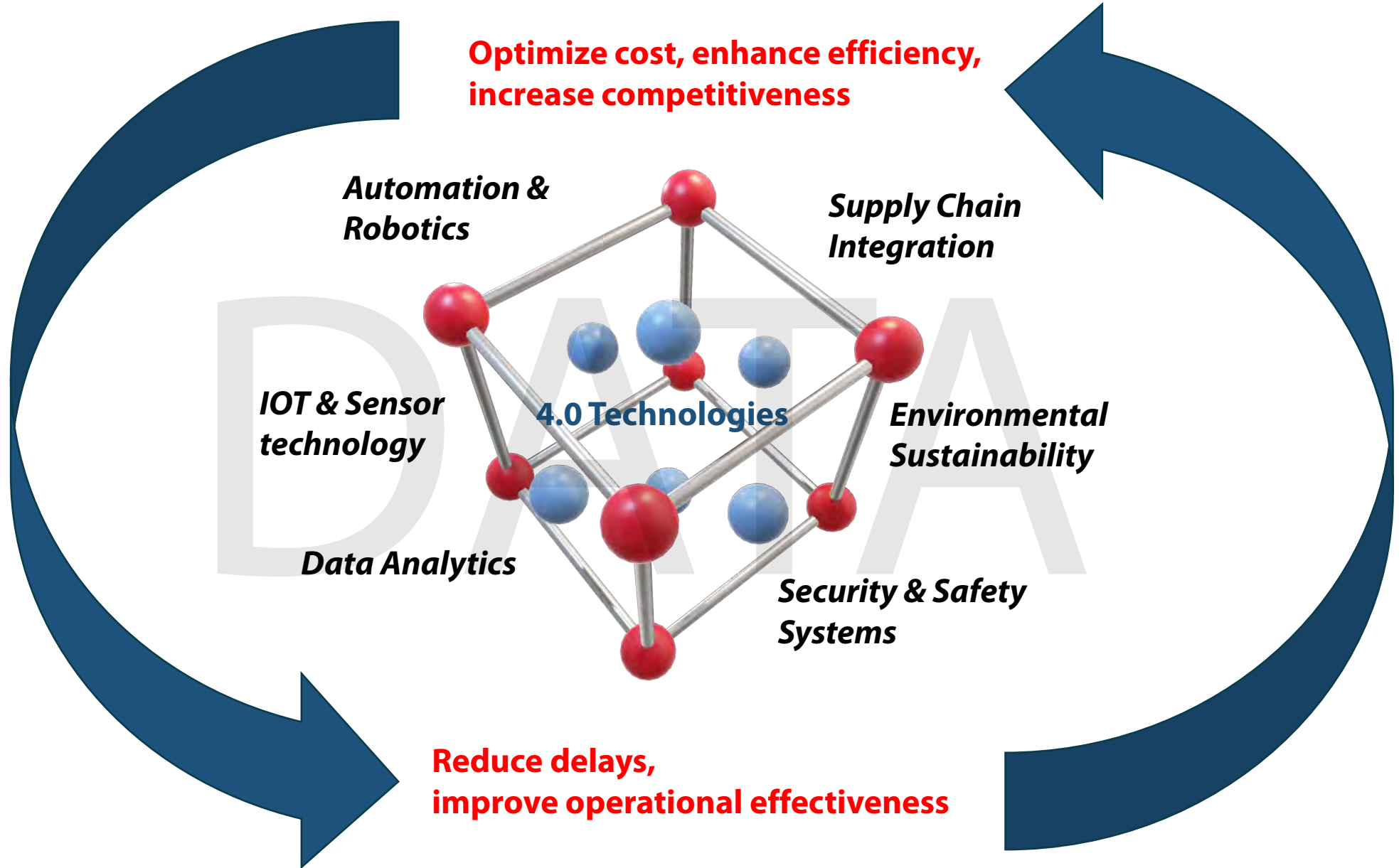
- **Increasing Global Trade Demands Efficiency**
- **Competitive Edge in the Industry**
- **Sustainability Imperative**
- **Customer Expectations**
- **Pressure for Cost Reduction**
- **Technology's Rapid Evolution**
- **Infrastructure Strain and Growth Projections**
- **Regulatory Compliance and Safety**
- **Data-Driven Decision Making**
- **Customer Retention and Attraction**

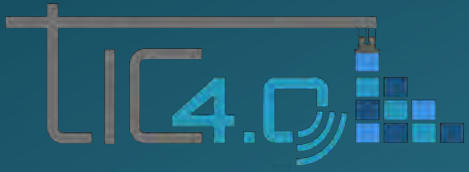


WHAT IS ACTUALLY A SMART PORT?



What is a SMART PORT: Key Features

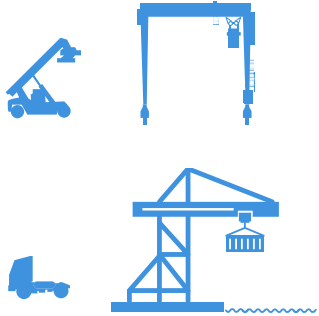




WHAT IS TIC4.0 AND WHY IT WILL HELP PORTS TO GET SMARTER MUCH FASTER

CURRENT STATUS:

- DISCREET PROCESS
- MULTIPLE EXTERNAL STAKEHOLDERS
- INEFFICIENT & COMPLEX CARGO STORAGE STRATEGY
- INEFFICIENT RESSOURCE UTILISATION



$$(20\% \sim 60\%) \times (30\% \sim 70\%) = (6\% \sim 42\%)$$

Low utilization of equipment due to irregular traffic demand

Very high equipment idle time due to discrete process nature (i.e. not continuous) and complexity

Result in a very low profitable utilization of resources

HOW TO TACKLE THE LACK OF EFFICIENCY OF CONTAINER OPERATIONS?

Introduce disruptive new process with full automation

- Entire process redesign
- Increase buffers areas to convert the process as close as possible to a continuous process

→ Very high CAPEX, all new infrastructure and equipment

Improve existing processes & infrastructure by USE OF DATA

OR...



NETFLIX



- Digitalize reality.
- Generates a better decision-making and processes more efficient by connecting all equipment and systems in real time
- Due to complexity, needs standardization and interconnectivity

→ Use the same infrastructure but optimizing the process

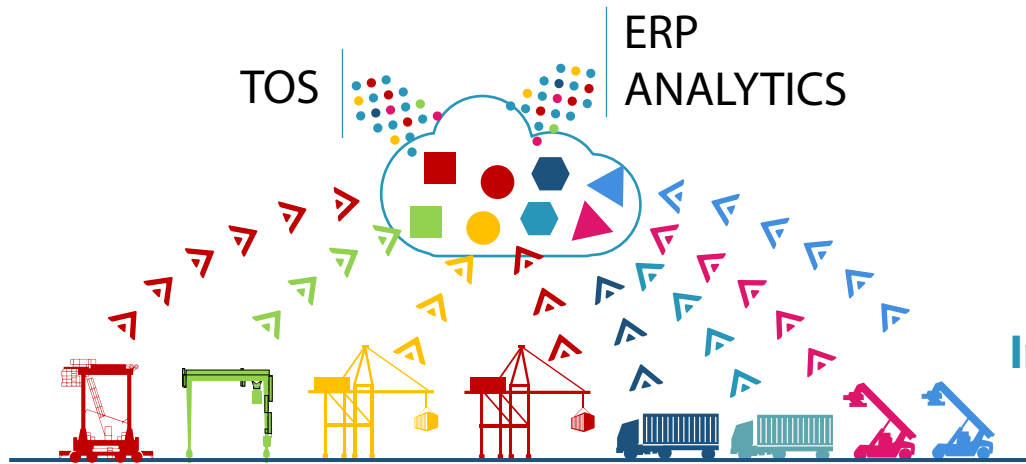


What is TIC4.0, and what is “Talking TIC”?



Embracing the 4th Industrial Revolution in the Port Industry

- TIC4.0 is an international association set up to define industry standards for ports and terminals
- Enabling communication for all stakeholders in Ports & Terminals (and across the supply chain)



Current situation

- Different Standards for every equipment provider, some equipment might not be connected
- Difficult to compare results, since different measurement methods are used



Vision

- All systems and equipment “talk TIC”
- Plug & play environment
- Easy to compare and aggregate results from equipment



Why talk TIC: A Language without Limits



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Excel

BI Tool

TIC4.0

Small Data

Daily – weekly – Monthly

**Aggregated values –
Averages**

Tendencies

10-100 data per table

Once per week

Medium Data

**Per move-Hourly-Daily-weekly-
Monthly-Yearly**

**Aggregated values–Averages-
Correlations**

**Tendencies-Projections-
Histograms-Filters**

1.000-3.000.000 data per table

**Manually Once per year
BI tool every 10 minutes.**

Big Data

**Per second-Per move-Hourly-Daily-
weekly-Monthly-Yearly**

**Aggregated values–Averages-
Correlations-Maps-Parent&Child**

**Tendencies-Projections-
Histograms-Filters
Machine learning-READY FOR AI**

**1M-10.000 Million data
per table**

Real Time (1-10 seconds)



Why Talk TIC: A Language to Represent Any Reality



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TIC4.0 Language can represent any reality in all time instances and from any point of view

Past (Performed) | **Present** (Actual) | **Future** (Scheduled, Planned, Requested, Proposed, Estimated)

Instantaneous
(no time dimension)

Box A is at location C

Events
(change of value)

Box A moved to location B

Aggregations (with time dimension)

- How many boxes between 9AM and 11 AM?
- How long were the boxes in the Terminal?
- How much energy consumed per box?
- How much CO2 was emitted per box?



TIC4.0 language has a specific grammar (semantic):
it allows to create a sentence to express any “reality” in a digital format

Subject

Subjects describe the actors that carry out the action (what is or what does). Can be physical entities or processes

Concept

Concepts describe what the subject is or what the subject does, from a high level view

Observed Property

Observed Properties are the magnitudes that we are measuring:

- status
- duration
- counter
- timer
- distance
- speed
- flow
- ...

Point of Measurement

PoM describes the perspective from which the measure takes place: input/output; past/present/future or started/ended:

- PoM: output-input (result or order)
- PoMt: present-future (actual-schedule/planning/estimated)
- PoMp: started-ended process initiated or completed

Value

Gives the value for the combination of subject, concept, point of measurement and observed property with its correspond unit

<https://tic40.atlassian.net/wiki/spaces/TIC40Definitions/pages/8618041/TIC4.0+Semantic>



TIC Semantic: Describe Any Reality Unequivocally

The combination of a **SUBJECT** with multiple combinations of **CONCEPTs**, **OBSERVED PROPERTies** and **POINT OF MEASUREMENTs** give us a unique meaning of a **VALUE**.

Semantic in “flat format” using different protocols (TXT, email):


Email 2345345 From Jason Martial at 2020-06-04T09:37:08.000Z the subject with id **STS8765745346** and subject name **MFT-STS01** has the **working status (output actual)** on **TRUE** and the **drive speed (output actual)** is **25 km/h**.

```
msg.id: D6wZ6ngBBIsOzhTbxvHy; msg.sender: TOSMFT; msg.timestamp 2020-06-04T20:55:08.000Z;
msg.start_timestamp: 2019-06-04T20:55:08.000Z; terminal.id CLT_ES; terminal.name: “Curro Local Terminal”;
terminal.type: “terminal”; terminal.quay.cycle.move_and_discharging.counter.actual.output.box : 265.568;
terminal.quay.cycle.move_and_loading.counter.actual.output.box : 265.544 ;
terminal.quay.cycle.move.actual.output.box : 531.112 ;
terminal.quay.cycle.move_and_discharging.counter.actual.output.teu : 458.548;
terminal.gate.cycle.move_and_discharging.counter.actual.output.box : 258;
terminal.quay.cycle.move_and_loading.counter.actual.output.teu : 458.548 ;
terminal.gate.cycle.move_and_loading.counter.actual.output.box : 244;
terminal.cycle.move.counter.actual.output.box : 531.614 ; terminal.move.cost.actual.iinput.€ : 50.444.333;
```

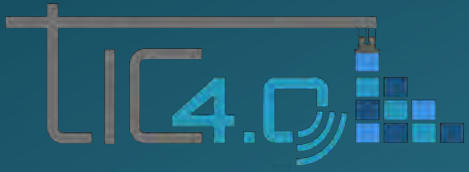


TIC language is Protocol-Agnostic

TIC Semantic is protocol agnostic:

1. MQTT
 2. JSON
 3. OPC-UA
 4. CanBUS
 5. ModBus
 6. Profinet (DB fix)
 7. Plain text (email, handwritten document, etc)
- 

```
{  
  "msg": {  
    "id": "D6wZ6ngBBIsOzhTbxvHG",  
    "sender": "",  
    "timestamp": "2021-04-19T12:24:26.931Z",  
    "topic": "",  
    "destination": "",  
    "creationtimestamp": "2021-04-19T12:24:26.931Z",  
    "starttimestamp": "2021-04-19T12:24:26.931Z",  
    "endtimestamp": "2021-04-19T12:24:26.931Z"  
  },  
  "che": [  
    {  
      "id": "",  
      "name": "",  
      "number": 0,  
      "type": "",  
      "family": "",  
      "brand": "",  
      "model": "",  
      "location": {  
        "logical": [  
          {  
            "pom": "ioutput",  
            "..."  
          }  
        ]  
      }  
    }  
  ]  
}
```

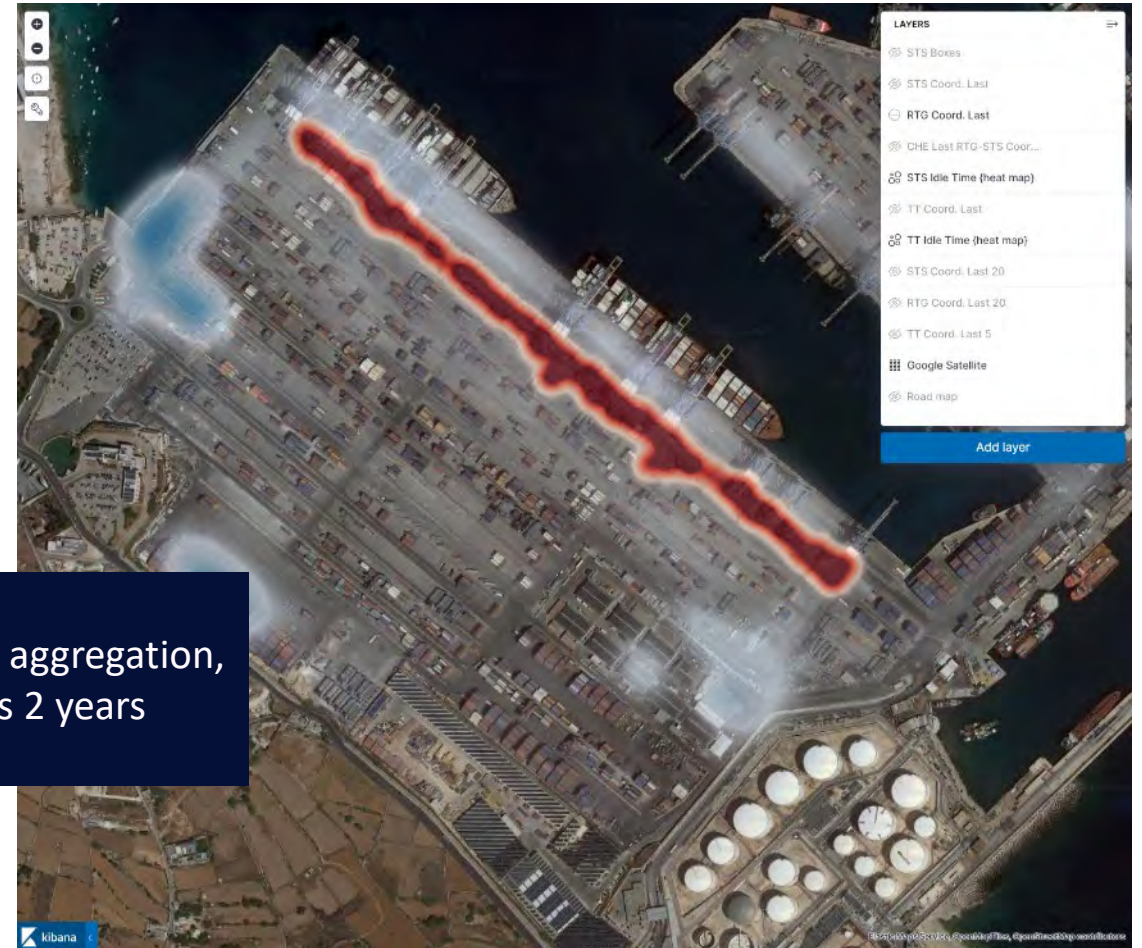
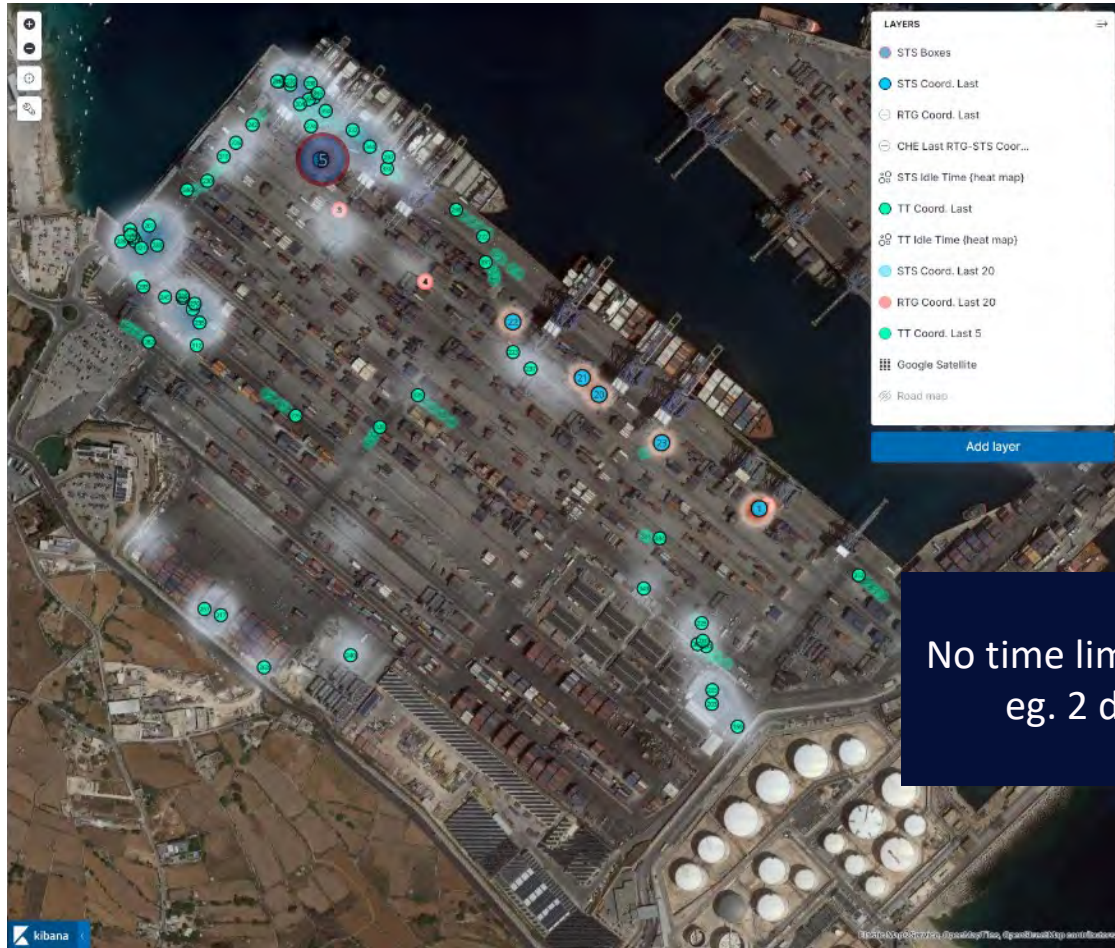
EXAMPLES AND USES CASES



Visualization of BigData: heatmaps



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No time limit on aggregation,
eg. 2 days vs 2 years

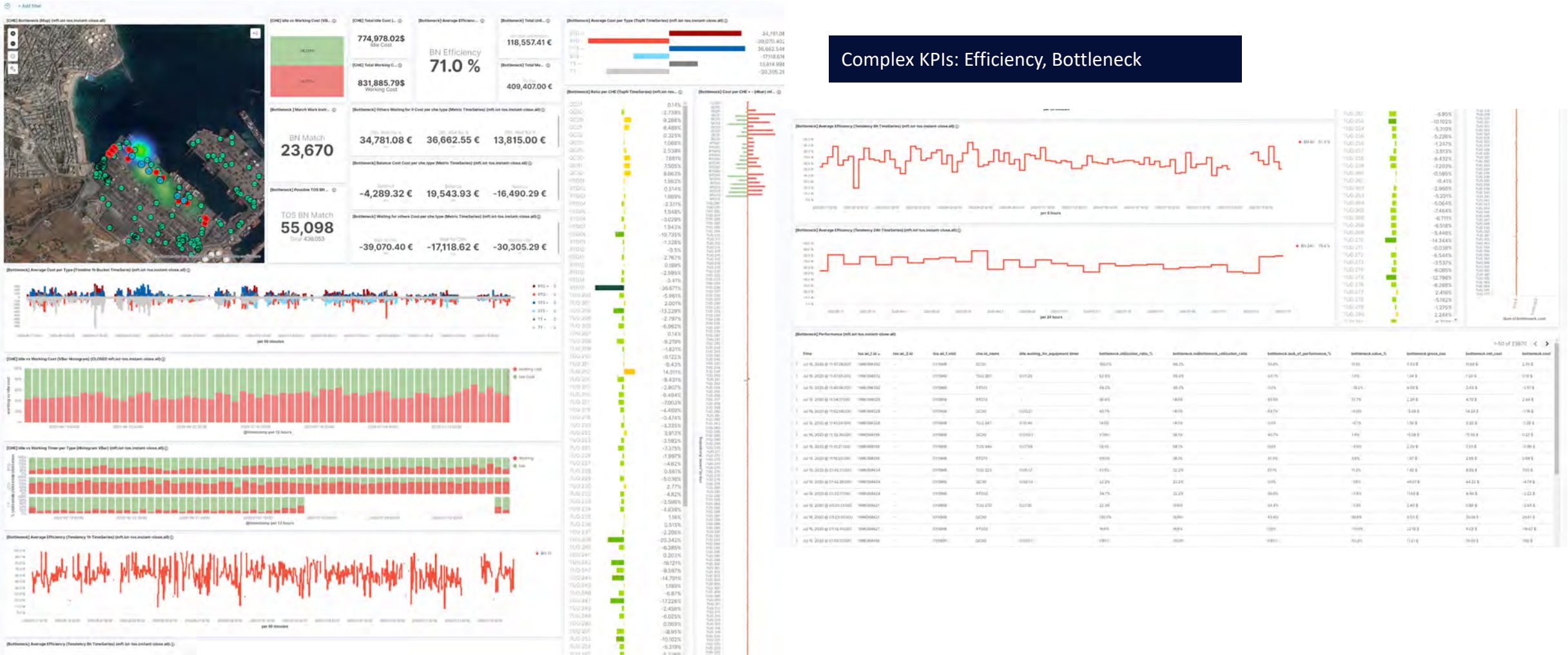


Examples
that can be realized with TIC4.0

Unlimited reporting and analytical capabilities



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Complex KPIs: Efficiency, Bottleneck



Examples that can be realized with TIC4.0

www.tic40.org



Idle time and other metrics analysis

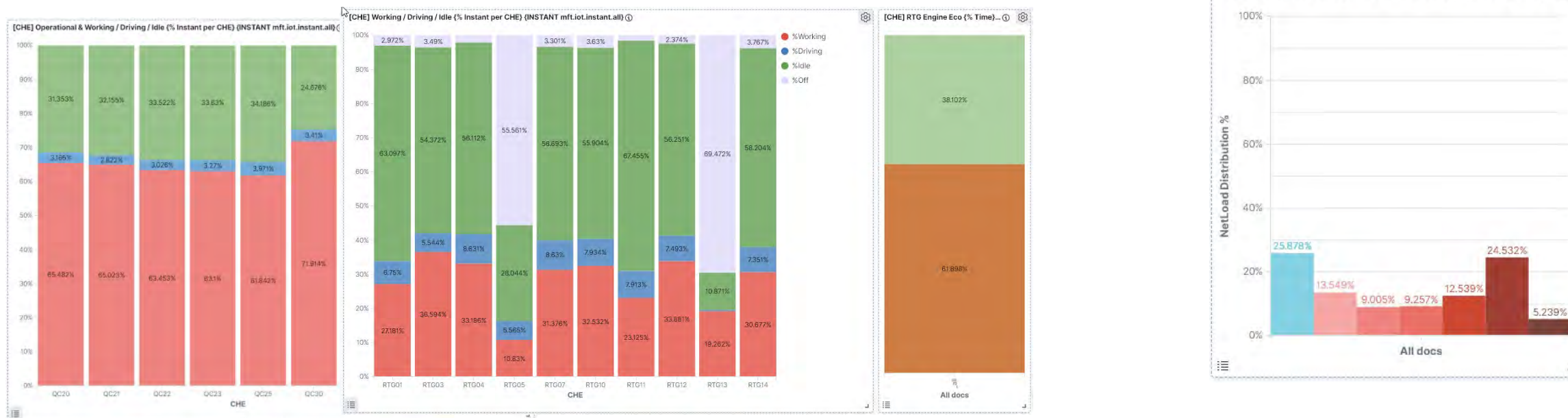


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KPIs based on real (not average) data from specific individual machines, or in any aggregate form:

Engine Eco Mode profitability?
Liters/move?
Liters/move vs Net Load?

Off | Idle | Gantry | Working



Examples
that can be realized with TIC4.0

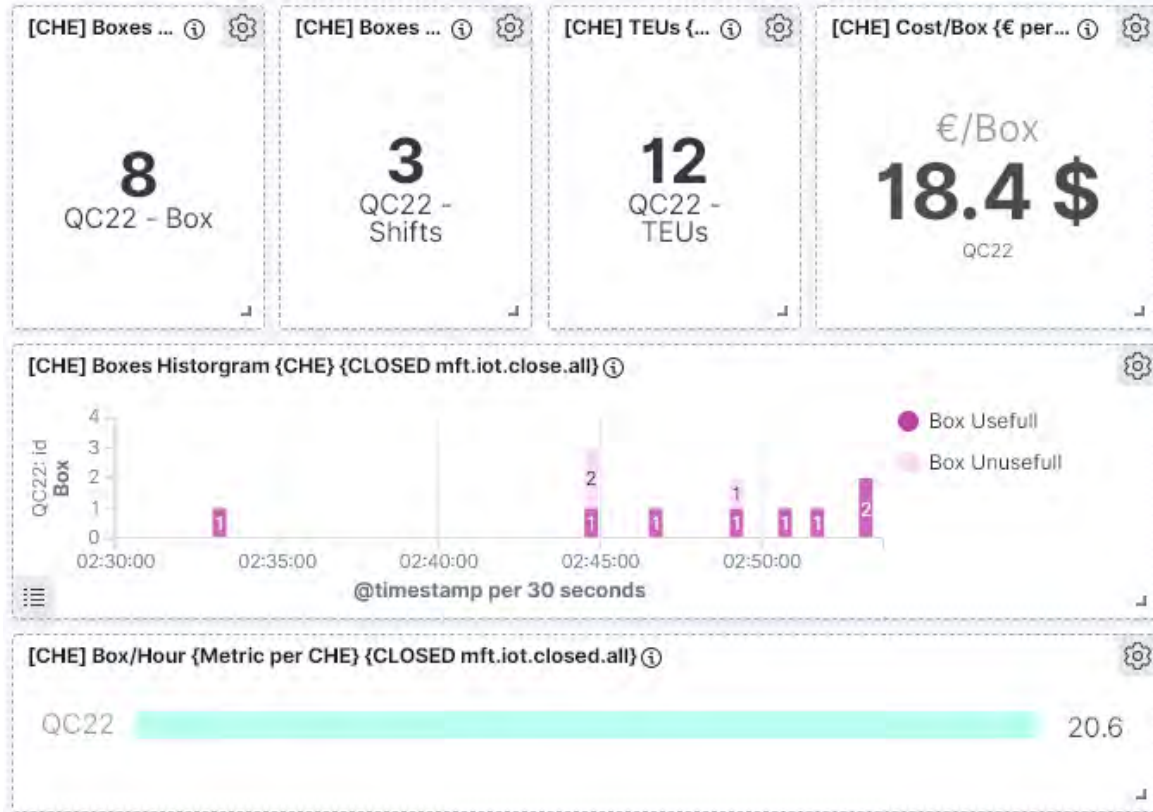
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Move analysis

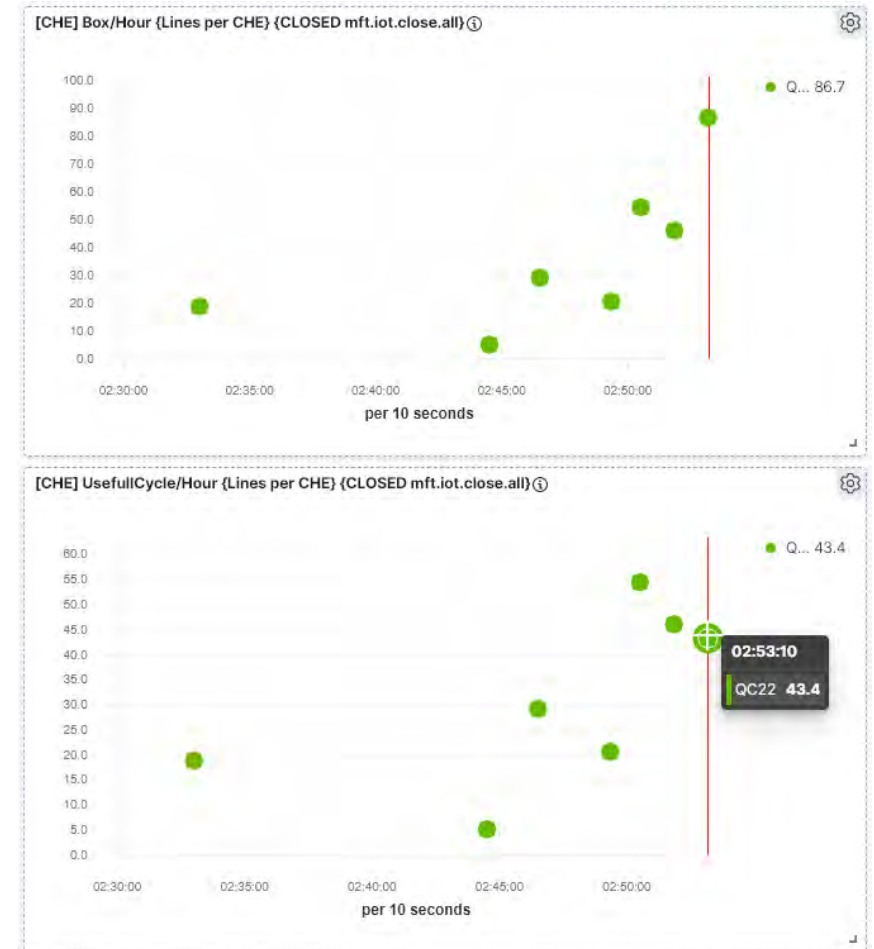


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Determine

- exact cost or co2 emissions for
- a specific equipment or
- a specific box, or
- in any aggregate form



Examples that can be realized with TIC4.0



What should be vs. What reality is



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Instant data enables us to find out equipment with a WO assigned that are IDLE although they should be in WORKING status

TOS process
Job Stepping

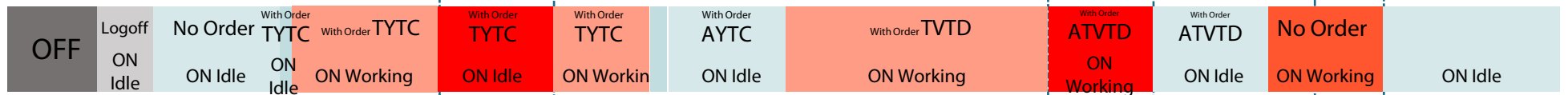


CHE reality

IoT & Big Data platform



Comparing
what **should be**
Vs
what **it is**



Examples
that can be realized with TIC4.0

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Comparing Events



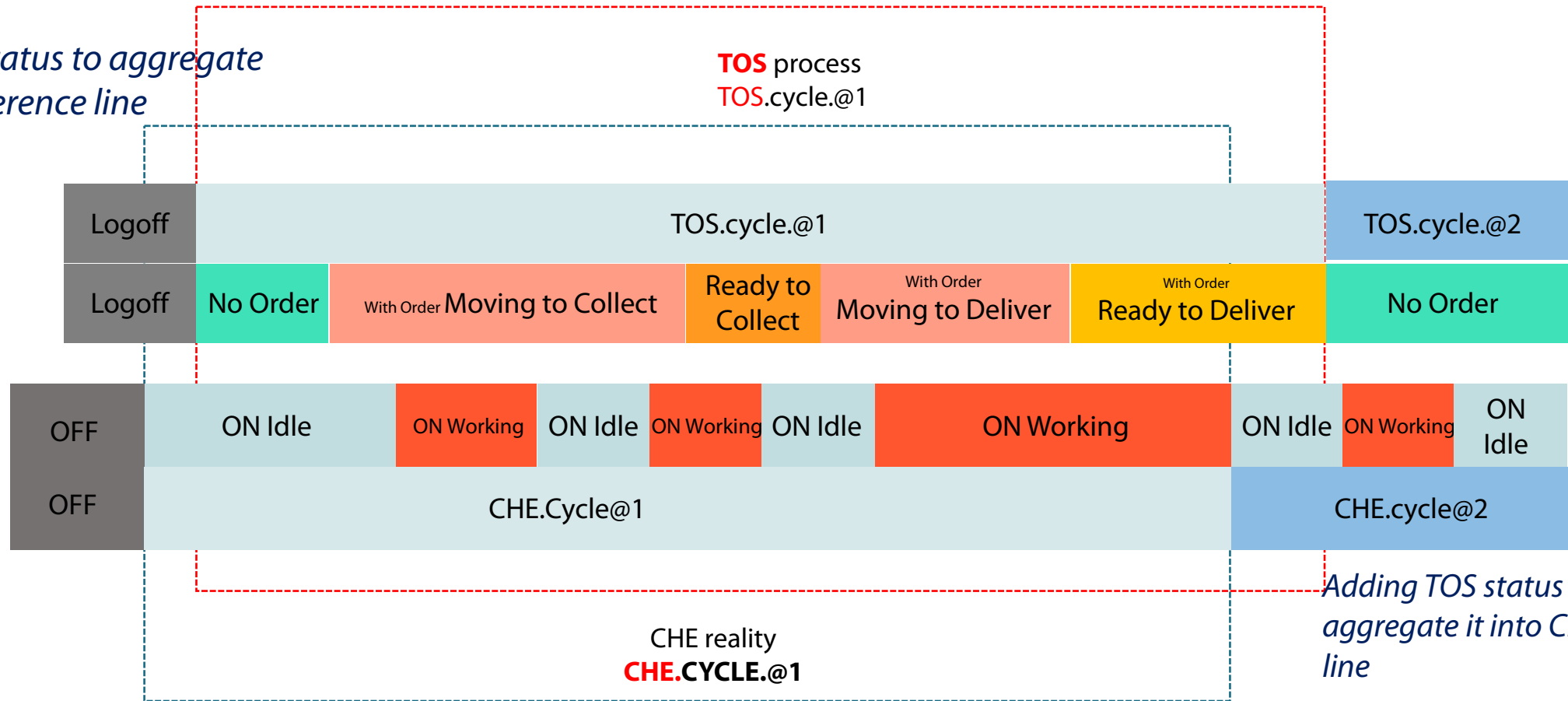
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Aggregated information is always between two timestamps (usually defined by two events).

You cannot compare to aggregated information from two different origins if they are not fully synchronized (usually not).

Adding CHE status to aggregate it into TOS reference line

TOS process
TOS.cycle.@1



Examples

that can be realized with TIC4.0



Live/Real Time View of Terminal Activity



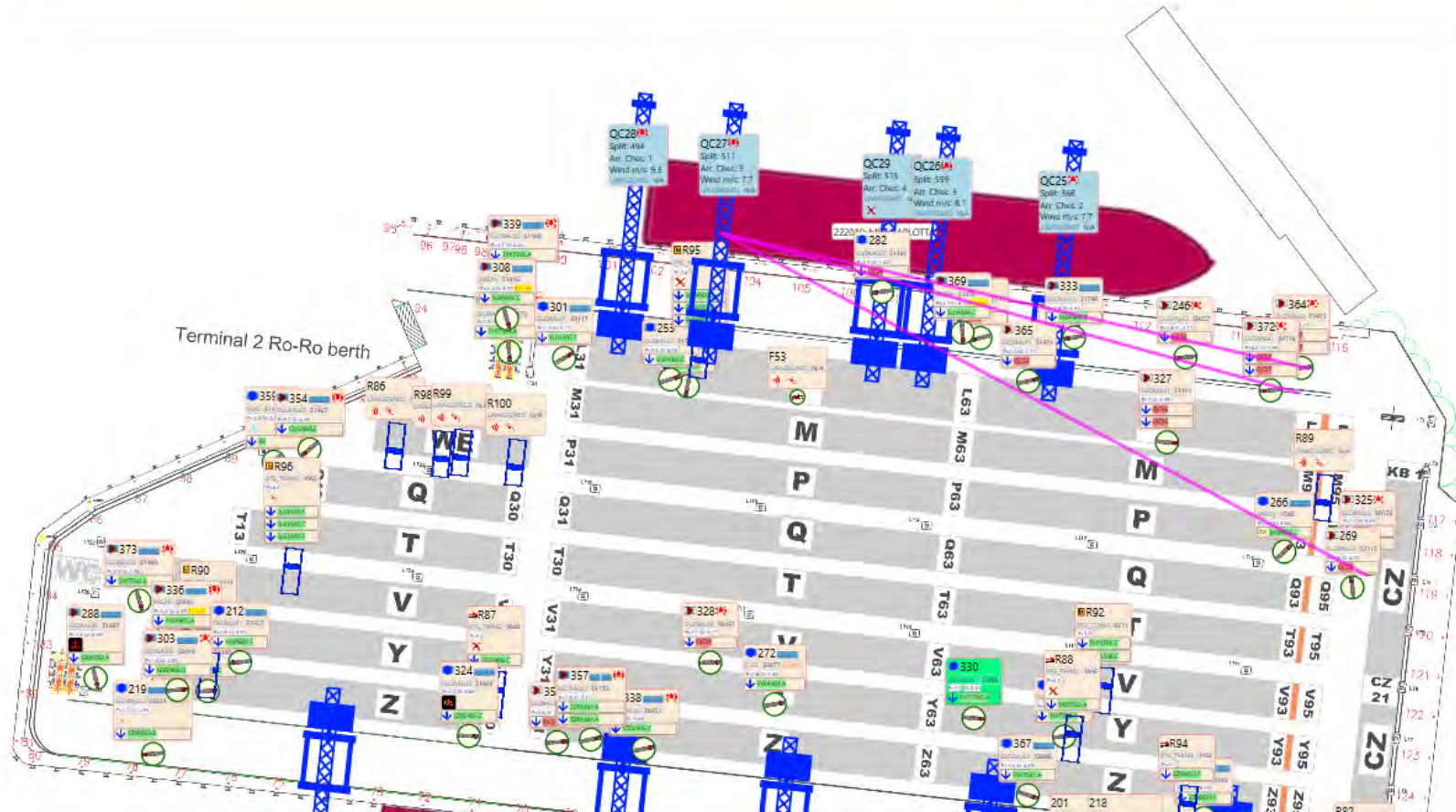
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MftLiveView Ver. 1.1.70.0 (64Bit) [hchet]

Application Administration

Follow: 330 Stop Following Clear Extra Visuals

MTS DRA BIG WIF XRD HDS



Filters	Finder	Info	S.Info
Visuals	Ops. Alerts	Eng. Alerts	ICT Alerts

- Hide/Show Dismissed Items
- Truck Slow
- Truck little or no movement
- Will wait for CHEs
- Truck confirmed on site but is not
- Same Area
- GPS Corrupt
- Long Distance
- Wrong direction

Filter: ITV

ITV 336

Truck Slow: Travelled 2321m in 15 mins 27 secs
i.e. ~9km/h

Last Instruction: 10:36:22



Examples that can be realized with TIC4.0

www.tic40.org



Live/Real Time Digital Twin Visualisation



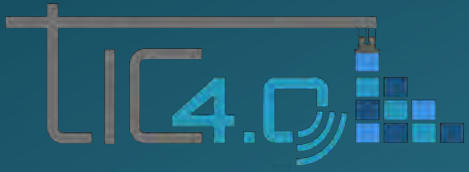
Enabling the 4th Industrial Revolution in the Port Industry

<https://www.chesscon.com/chesscon-products/live-view.html>



Examples
that can be realized with TIC4.0

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FUTURE PLANS: BECOMING THE INDUSTRY STANDARD

TIC4.0 VISION FOR 2025-2028

- Define and formalize different **levels for the *WE TALK TIC* adoption** to reflect the complexity level of TIC language integration in a facility, equipment or solution, and introduce a certification model
- Develop a **Publicly Available Specification (PAS)** with bsi (British Standards Institute) based on TIC4.0 language, as a preliminary step towards forming an international standard with ISO.



bsi.

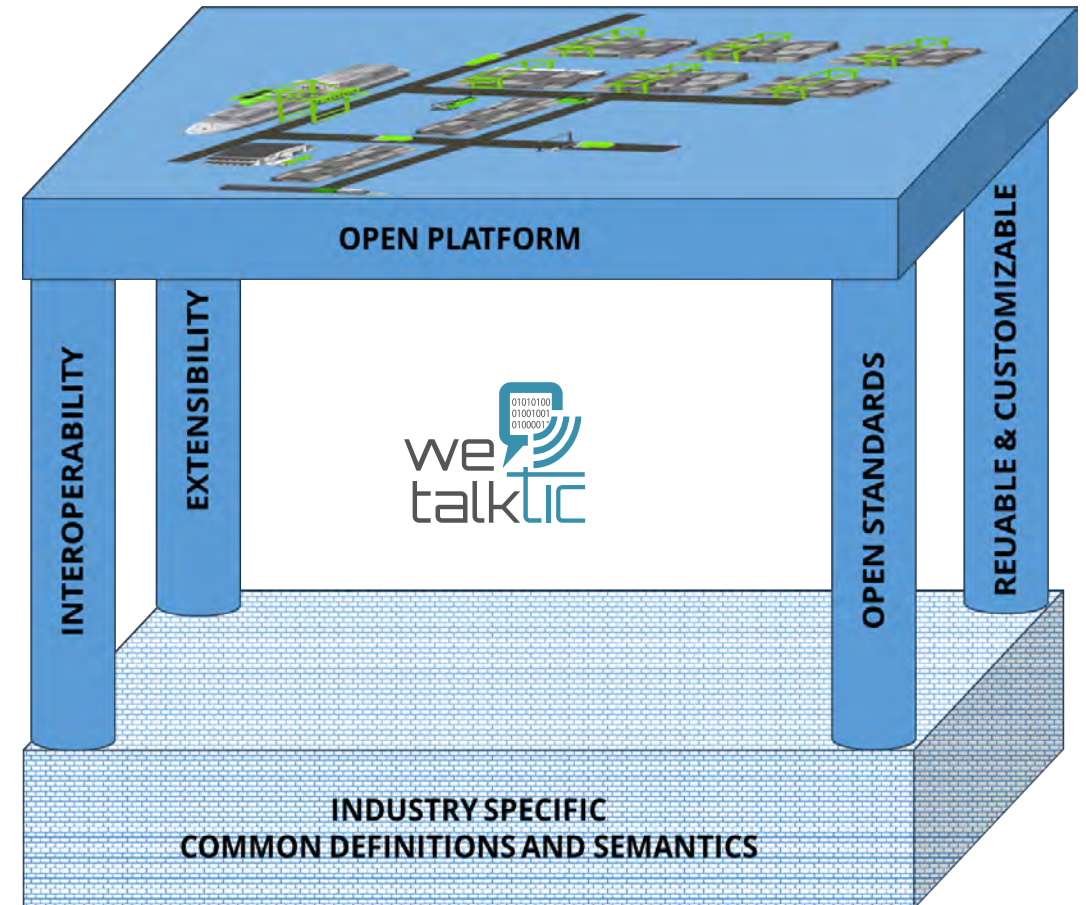
What is a PAS? (Publicly Available Specification)
A PAS is a fast-track standardization document – the result of an expert consulting service from BSI. It defines good practice for a product, service or process. It's a powerful way to establish the integrity of an innovation or approach.

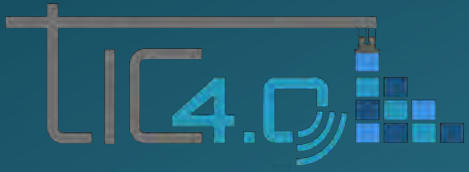


From standards to TIC4.0-powered open platform

TIC4.0 VISION FOR 2025-2028

- **Develop an open platform integrating TIC4.0 language** that will be made **available for free** to the cargo handling industry
- Provide the opportunity for any cargo handling facility **to implement a digital foundation for 4.0 technology adoption at minimal cost**
- Create **an enlarged market for cargo handling equipment and solutions providers to provide plug-and-play equipment and solutions** to a global cargo handling market





WHY YOU SHOULD BE PART OF TIC4.0



We are not selling anything: TIC4.0 outputs are free

TIC4.0: Terminal Industry Committee 4.0

Mission Statement



TIC4.0 is an international association which aims to bring together representative companies from both the Terminal Operators industry and Port Equipment Manufacturers to collectively work on the definitions of technical and operational standards.

The Mission of TIC4.0 is to promote, define and adopt standards that will enable the cargo handling industry to embrace the 4th Industrial Revolution.

Boris Wenzel

TIC4.0 Founder & President

TIC4.0 membership (October 2023) includes many of the most recognizable names in the terminal industry and is growing by 1-3 members per quarter



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Affiliated Members



Our members:



51
MEMBERS

45
FULL MEMBERS

6
AFFILIATED MEMBERS

Endorsed by:



Publications are produced by members joining taskforces managed by the Operations Council according to a roadmap led by the Chair & Vice Chair of the OPS Council and approved by the General Assembly:

All publications freely available for download on TIC4.0 website (www.TIC40.org)

- ✓ 1st publication in Q1 2021 (White Paper)
- ✓ 2nd publication in Q2-2021
- ✓ 3rd publication in Q1-2022
- ✓ 4th publication in Q2-2022
- ✓ 5th publication in Q3-2022
- ✓ 6th publication in Q4-2022
- ✓ 7th publication in Q1-2023
- ✓ 8th publication in Q2-2023
- ✓ 9th publication in Q3-2023



Pov
Defi

Semant

- Cycle
- Carrié
- Cargo
- Healt
- Drive
- Conta
- Termi



Semantics, Dataset, Data Model and Definitions

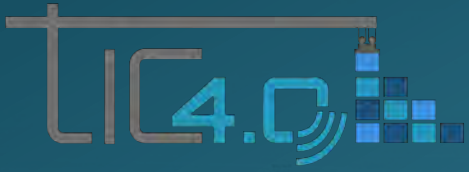
- Cycle (new update)
- Carrier Visit (new update)
- Cargo Visit (new update)
- Schema JSON to FLAT

May 2022
Version: TIC4.0 2022.004



Why Join TIC4.0?

- **Participate** in the development and adoption of the standardized data language, enabling the industry to leverage digitalization, data analytics, and facilitate adoption of 4.0 technologies
- **Collaborate** and exchange with the leading IT and engineering experts in the industry to shape and define standards that will power the future of the terminal industry and supply chain.
- **Contribute your requirements and expertise** to enrich a digital language that can use any protocol, from a simple email and Excel files to Big Data and AI, to power the 4th industrial revolution in the terminal and supply chain industry.
- **Promote and adopt** TIC4.0's human-friendly, decipherable, easy to explore, flexible digital language to facilitate interoperability and data integration of the terminal and supply chain industry, allowing for a deeper comprehension and analytics of processes to improve industry efficiency.



CONCLUSIONS

If you have not done it already? Join us now!





www.TIC40.org

LinkedIn: Terminal Industry Committee 4.0

Or contact me President@TIC40.org or our Vice-President Norbert Klettner: vp@tic40.org