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AGENDA ITEM II: SMART PORTS AND SUPPLY CHAINS: INTERNET OF THINGS (IOT) AND BLOCKCHAIN

ASSOCIATION OF CARIBBEAN STATES (ACS)

2ND COURSE ON MARITIME PORT UPGRADE FOR EXECUTIVES OF THE GREATER CARIBBEAN

(VIRTUAL MEETING)

ACS Secretariat, Port of Spain, Republic of Trinidad and Tobago

March 23rd, 2021

DP WORLD

ZODIAC

DP WORLD TIoT Platform

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Creating the Future, **Now.**

Agenda 1

TIoT Platform overview

1. TIoT Platform Overview: Why do we need Terminal IoT for DPWorld?

Terminal automation will be new trend after Covid-19

"The majority of global container terminals are still manual, and the industry is yet to take full advantage of what automation can offer short and long-term."

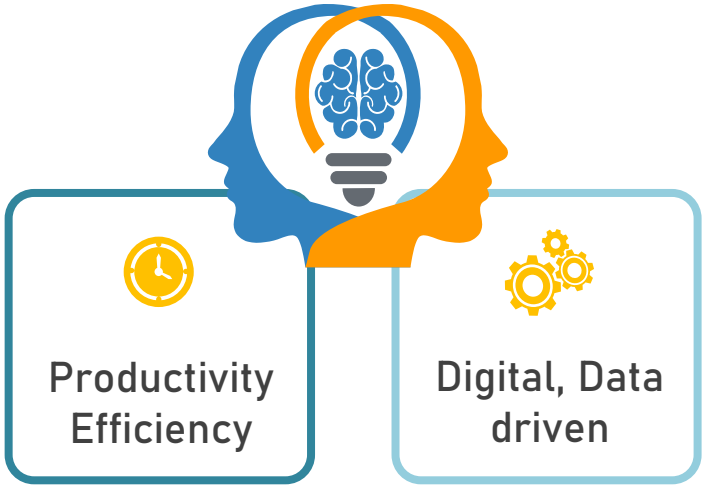
"Big data analytics will be one of the top transformational technologies used by ports and other segments of commercial shipping."

– Port technology (CTAC ,2020)

Future growth will be harvested from technical innovation not from huge capital investment

Via

Digital transformation of P&T



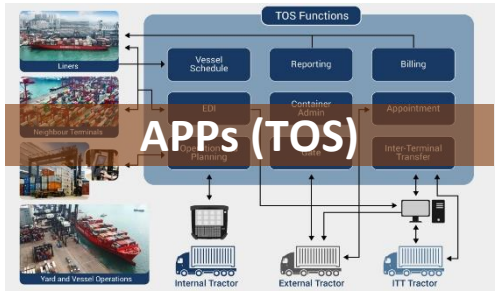
TIoT Platform Overview: Foundational framework for sustainable digital journey and process automation

STS
RS/ECH
RTG
ITV/OTR
RMG
Facility
CCTV
AP/Switch
Wearable
AP/Switch
Sensor
Reefer Monitor

Data
Control

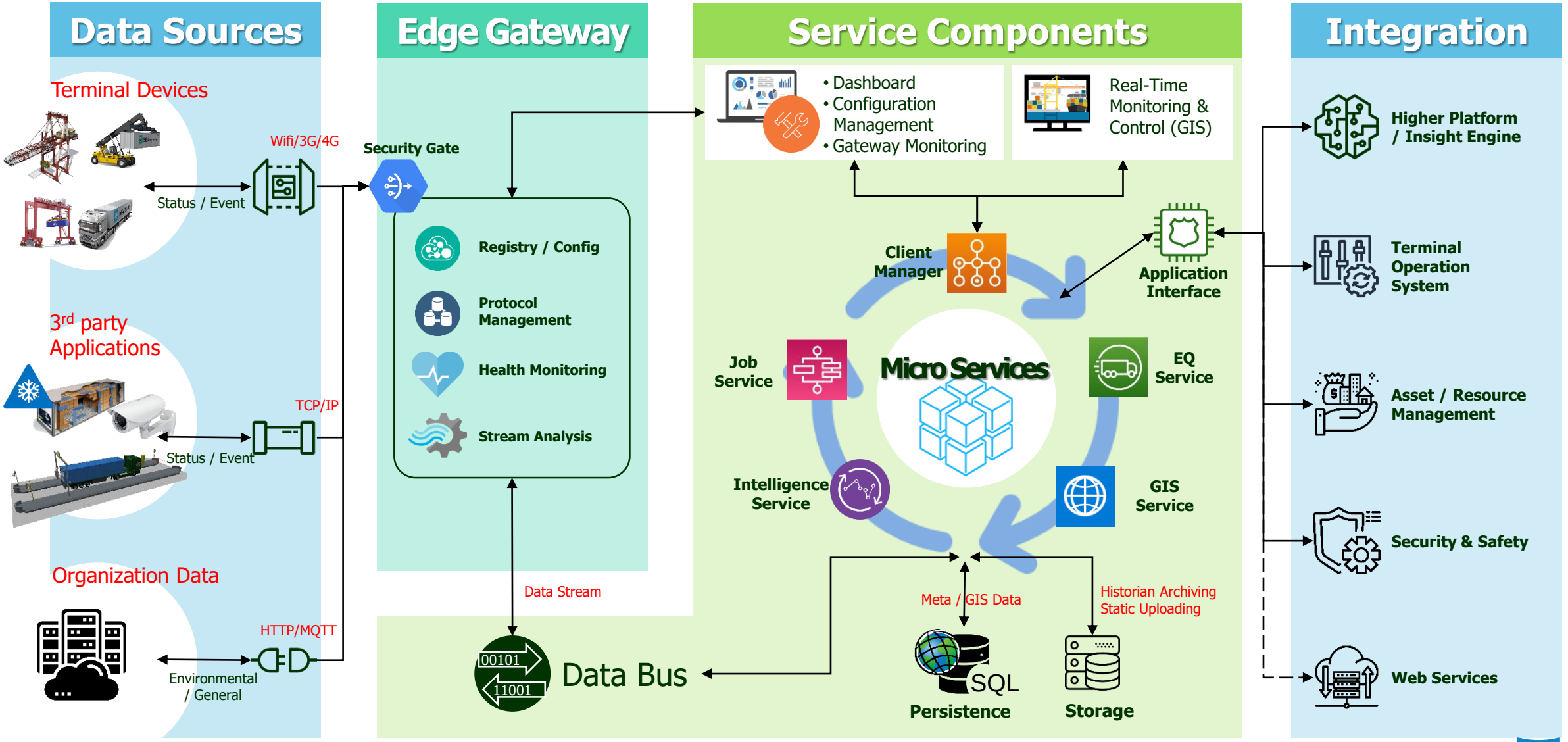
Augmented Real-Time
BI / Report Engine
Security/Safety Monitoring
EQ Status Manager
Mission Manager
Real-time Events Capture
Dynamic Rules
GIS Framework

Events
Missions
Data



"Things"
"Integrate"
"Intelligence"

ZODIAC TIOT Solution Architecture



Agenda 2

Targeted Benefits

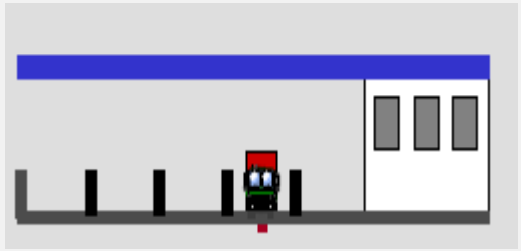
2. business value #1: *Dynamic Job Sequence control & prioritizing using RTLS signals (with OPS 7)*

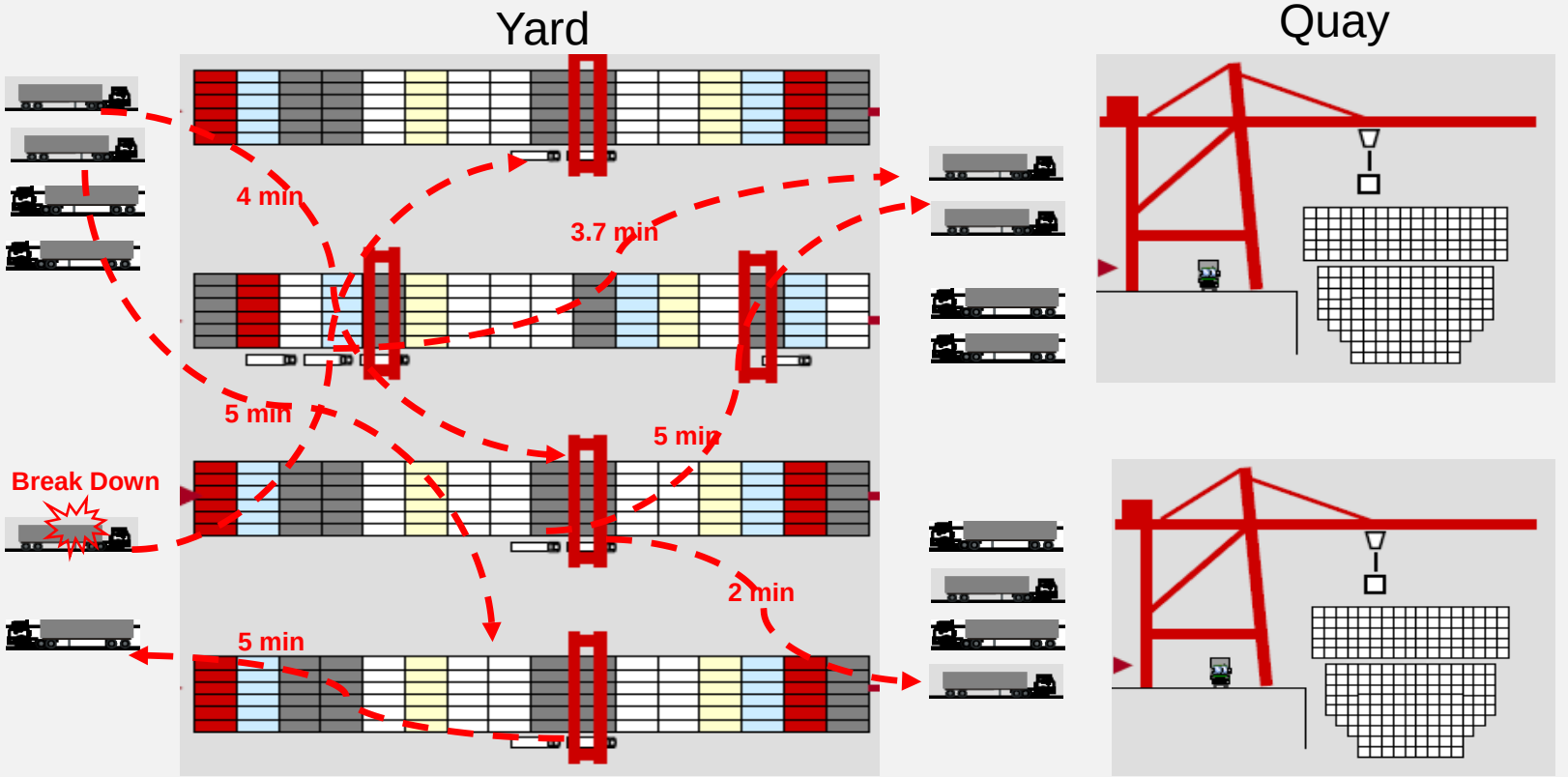
- **Intelligent YC scheduling**
  - -. Intelligent ETA estimation
  - -. YC scheduling as per ETA

- ***Prioritized JIT Job Control***
  - -. Enable Dynamic zoning / swap
  - -. JIT crane assignment with precise ETA
  - -. Intelligent sequencing / Pre-shuffling
  - -. Minimize waiting / unproductive travel of YCs

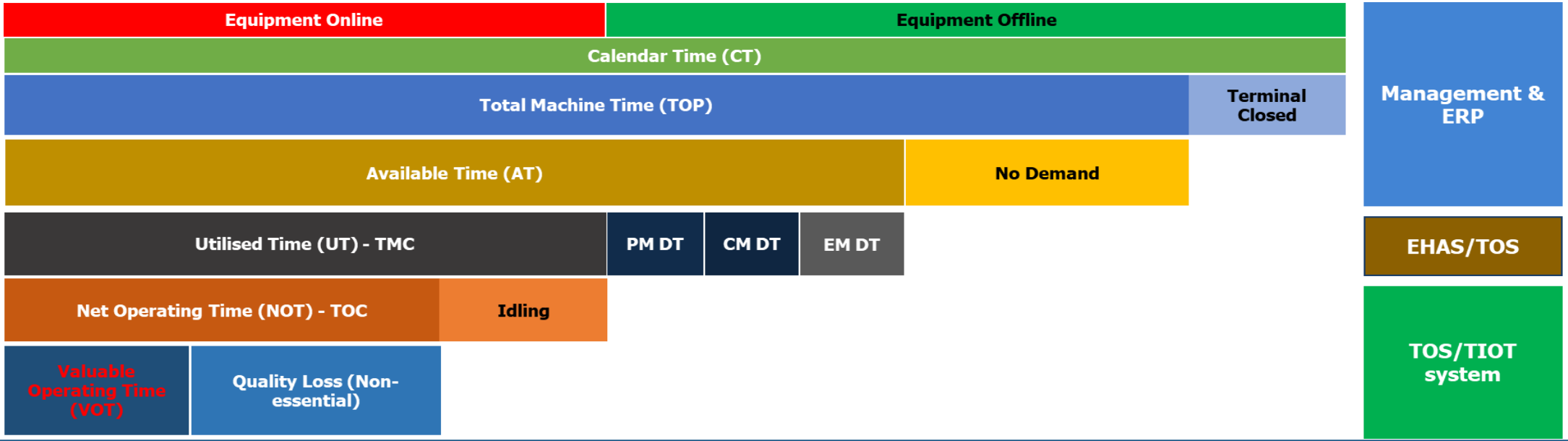
- **Sequence control / Optimize**
  - -. Arrival sequence control for loading (Follow ITV function in OPS 7)
  - -. Dual cycle / ITV Pooling
  - -. Optimum ITV assignment

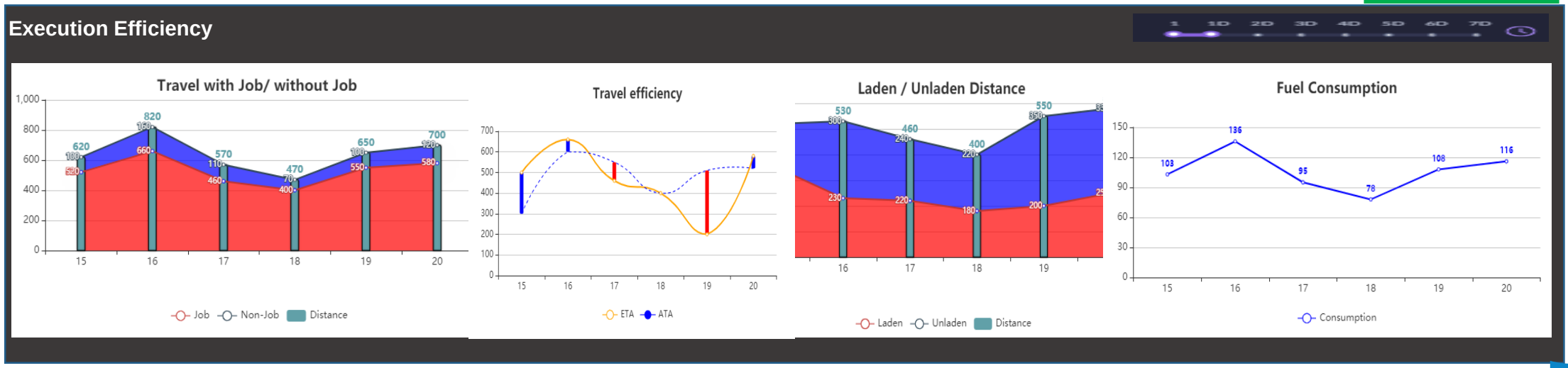
Gate





2. business value #2: *In-depth insight on operational details & advanced data analytics*





2. business value #3 : *Equipment status monitoring and maintenance support, Activity based costing, safety rule violation (FMS)*

Horizontal movers

- Speed / travel path
- Log-in driver info
- Responsiveness
- Weight carried
- Laden/unladen
- Engine Temp
- Fuel consumption
- Engine Idling
- Safety belt on/off
- Other sensor input (Vibration, mechanical metrics)

CHEs

- Gantry travel
- Log-in driver info
- # of re-handling
- # of Pick/drop during stacking
- Stacking location check
- Fuel/Electricity consumption
- Other sensor input (Vibration, mechanical metrics)

Safety/Operational compliance Awareness

- ✓ Operational rule violation detection
- ✓ Safety rule violation detection
- ✓ Visualization of violation events in real-time

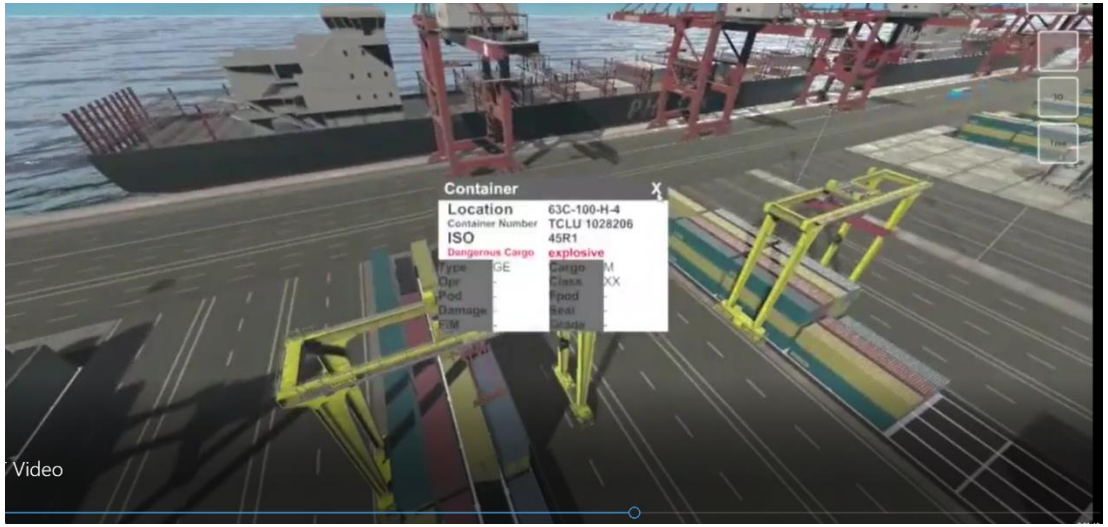
Operational efficiency / Activity based costing

- ✓ Execution efficiency calculation
- ✓ Resource consumption efficiency calculation based on the execution record
- ✓ Identify key waste and visualize

Preventive / Predictive maintenance

- ✓ Equipment usage metric in details
- ✓ Activity based, not schedule based preventive maintenance
- ✓ Predictive maintenance utilized accumulated machine's mechanical metric.

2. business value #4: *Augmented, rich UI for real-time operation monitoring (Digital Twin)*



Agenda 3

Major Activities Expected

Geodesic Survey and GIS DB construction (M+1 ~ M+2)

	Field Survey	Data Processing	Database Integration
Description	Collecting points within 0.05m tolerance using Total Station and GPS	Interpolating the entire terminal map based on the collected points	Loading GIS data to DBMS and building Routing dataset for ETA
Activities	✓ Verify national reference points nearby terminal ✓ Temporary marking ✓ Setup the equipment ✓ Measuring coordinates	✓ Digitization ✓ Attribution ✓ Data integrity check ✓ Topology check	✓ Populating Database ✓ Building Routing Dataset ✓ Testing
Support Request	✓ Terminal accessibility and guidance for survey engineers	✓ Respond to inquiries about attribute data	

Target Layer

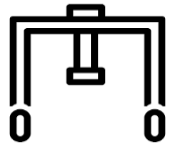
- Terminal Boundary
- Road Polygon
- Apron
- Yard
- Hinterland
- Block
- Bay
- Gate Zone
- Restricted Area
- Parking Area
- Building
- RFID Pole Reader
- Light Pole
- BITT
- Berth
- Rail
- Fence
- Road Centerline
- Lane Node
- Lane Edge

Device Installation & Integration with Equipment (M+4 ~M+5)

Interface

RTLS devices and IOT gateway devices provide location information through GNSS/INS, and collect signals and information from the device through vehicle and crane interfaces to transmit data to the Edge gate server in the HTTP Restful in Json format, using wireless network in terminal. *Equipment type-wise interface specification document will be shared as per ZODIAC standard, with which Equipment vendor will comply or adjust.*

ITV (Terberg)



RTG (ZPMC/FIJI)

STS (ZPMC/FUJI)

RS/ECH(Kalmar)

DGPS Base station

Position Info(GNSS)
Latitude, Longitude, GNSS Status, Speed, Heading

Correction Data(GNSS)
DGPS/RTK correction data

Telemetric info(CAN)
Speed, Fuel level, Engine temperature, Fuel level, Engine Coolant Temperature, Engine status info, fuel consumption Seat belt

PLC Info (Modbus)
Trolley Position, Hoist position, Twist status, Spreader size, Torque, Weight of Container, Fuel level, Engine Coolant Temperature, Engine status info, fuel consumption

PLC Info (Modbus)
Trolley Position, Hoist position, Twist status, Spreader size, Torque, Weight of Container, Boom Status

PLC Info (CAN,Serial)
Trolley Position, Hoist position, Twist status, Spreader size, Torque, Weight of Container, Boom angle, Boom height , Fuel level, Engine Coolant Temperature, Engine status info, fuel consumption

Message List
Device on, Message Type Periodic, Device Error, Upgrade, History

Message List
Crane on, Periodic Msg, Event(Pick up/drop), Break down, Device Error, Upgrade, History

Message List
RTCM version 3.3 Message

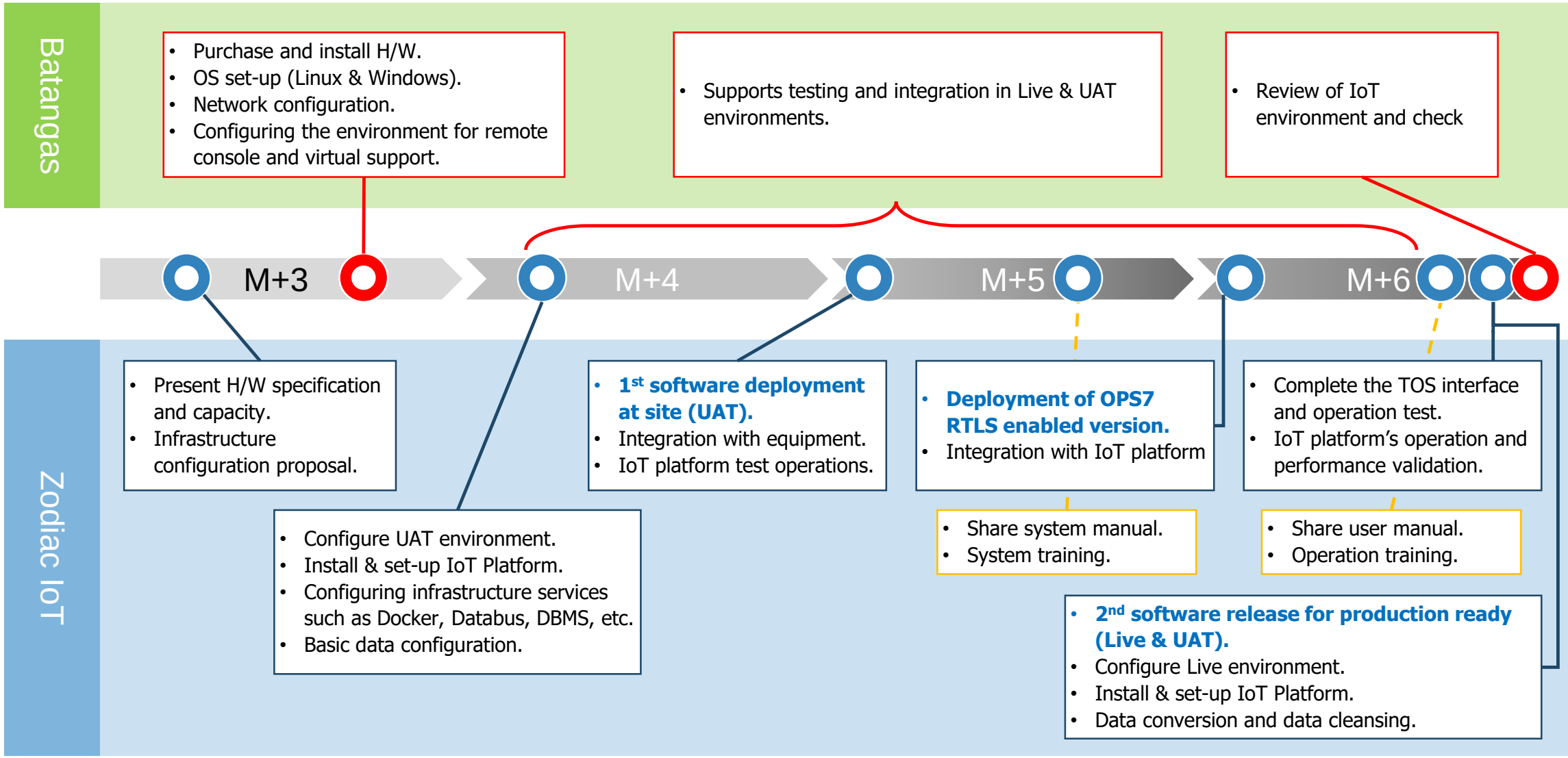
Terminal support
CAN Interface specification (J1939), Integration test, Driver, Device installation

Terminal support
PLC Interface specification (Interface type), Integration test, Driver, Crane PLC engineer support, Device installation, WIFI network

Terminal support
Can or Serial Interface specification(Protocol), Integration test, Driver

Terminal support
Install Position(Open sky), Base station Pole, network connection,

TIOT Platform installation / Integration with field Signal (M+4 ~ M+6)



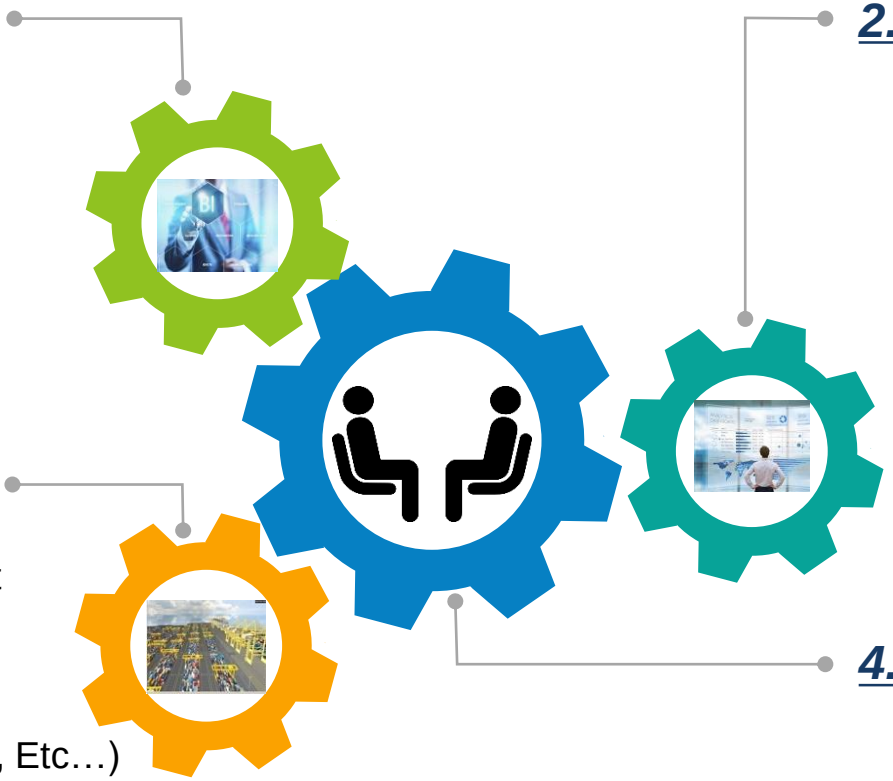
BI / Data analytics Enrichment / Virtual Terminal implementation / Further use cases (M+5 ~)

1. Business Intelligence

- ✓ Development Requirements
- ✓ BI Data Verification

2. Data analytics

- ✓ Data Key-Point Requirements
- ✓ DATA Mart Configuration
- ✓ Reports that the customer needs
- ✓ Build APIs with other systems



3. Virtual Terminal implementation

- ✓ Server Configure Live / UAT Environment
- ✓ Visualizer Client Program Installation
- ✓ Development Requirements
- ✓ Real-Time Monitoring Verification
  - -. Terminal Map (Apron, Block-Bay, Road, Etc…)
  - -. Type and number of equipment
  - -. Equipment movement path

4. Further User Cases

- ✓ Safety Monitoring
- ✓ Equipment Status Monitoring
  - -. Signal Status
  - -. Equipment Maintenance Status
- ✓ Generating Report