SHARP MAPPING

SuperMap

Machine Guidance:

An implementation of Machine Guidance to improve unit productivity and office monitoring

Survey Equipment and IoT Solution Provider

December 2021

Justin Lim
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Justin Lim

- Founder at Sharpmapping
- Computer engineering & Management from McMaster University, Canada
- 5 years as a Lead software engineer at Reuters working on realtime financial data application development
- 4 years in Coal Exploration & development
- About 10 years in Indonesia
- Now supplying survey and sensor equipment to project companies

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AGENDA

- Indonesia Overview (2 min)
- Mining Industry (5 min)
- Customer Requirements (5 min)
- Our solution (15 min)
- Questions (3 min)

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SHARPMAPPING

- SHARPMAPPING started in 2011
  - 10 – 20 Team members
  - Systems integrator and authorized distributor of CHC Nav (Huace Navigation from Shanghai)
  - Supermap distributor in Indonesia

Product sales (RTK GPS since 2012)
IoT Sensor Projects (10+ Projects since 2018)
Drilling guidance (3 projects since 2020)
Excavator guidance (1 projects since 2019)
Bathymetry (multiple projects since 2018)
Road watering (1 project in 2019)

IN PROGRESS/FUTURE:
Environmental monitoring (2021)
Asset tracking (2022)

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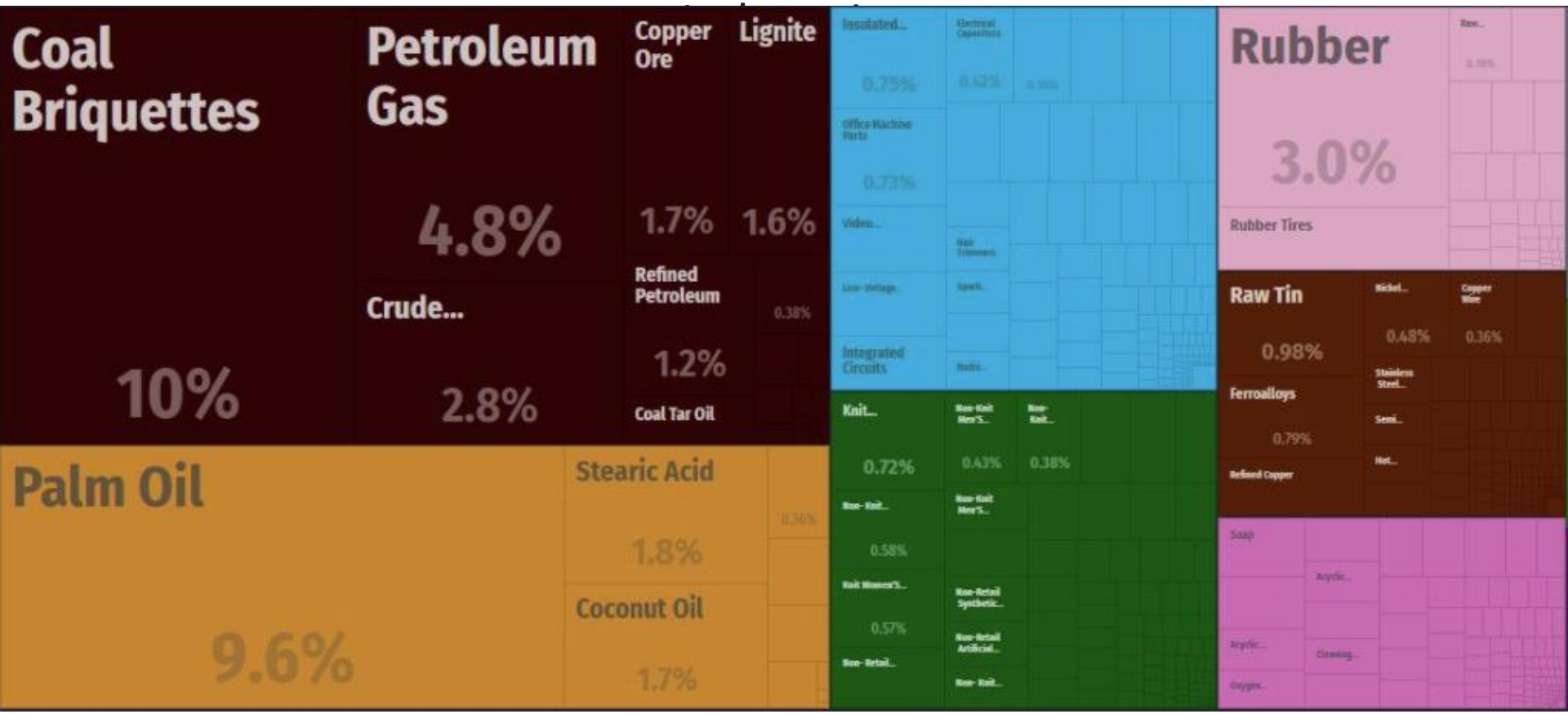
Indonesia's main exports



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Picture of an Open Pit Coal mine

- Over burden = $2.5 USD per Cubic
- Coal getting = $1.3 USD per ton

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Picture of an Open Pit Coal mine

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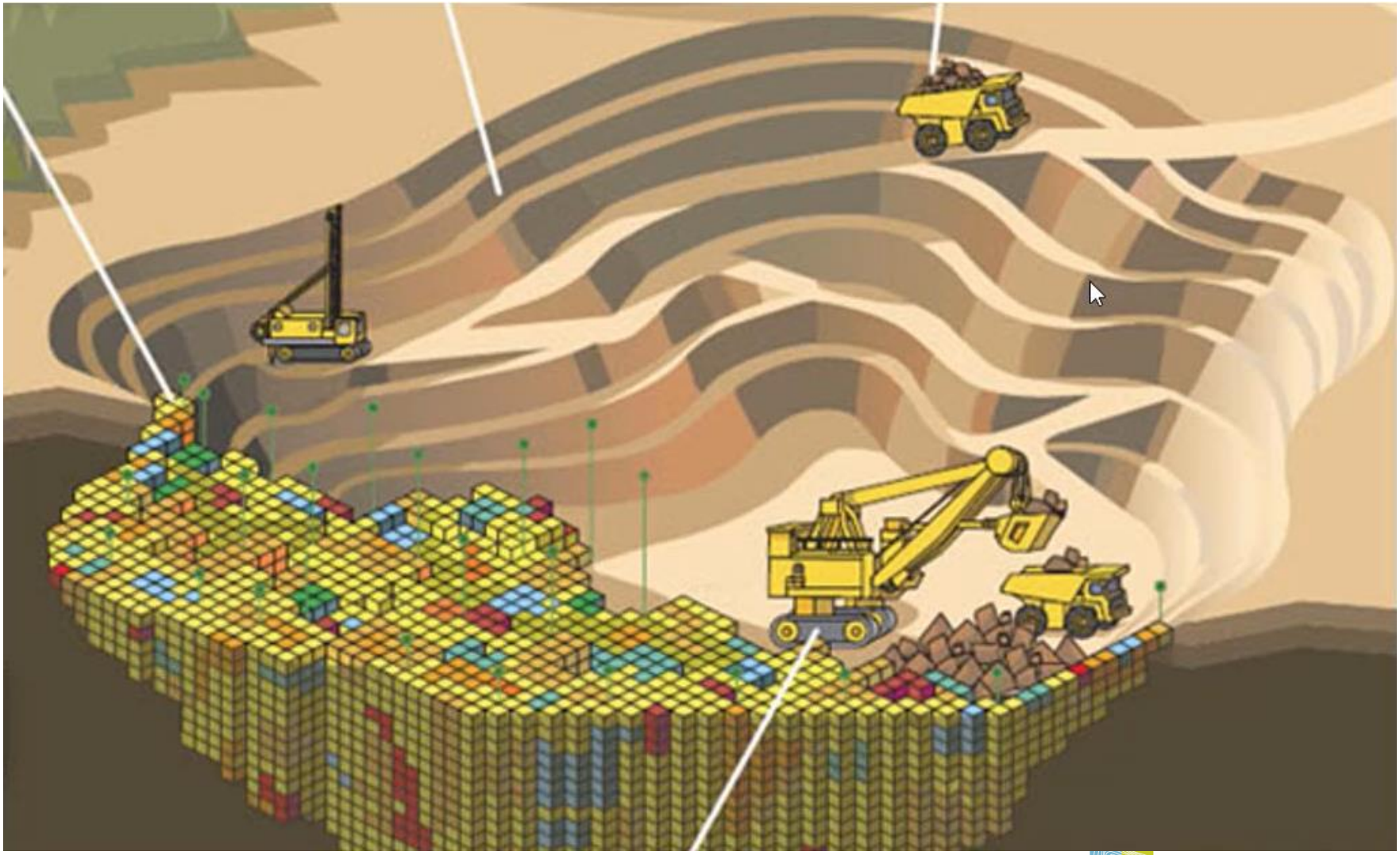
Digitizing the mine area



Note: graphic above is borrowed from a Dassault Systems Presentation

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Traditional tools and process

Staking out mining XY boundaries

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Customer requirements – Excavator guidance

- GPS Based
- Overlay with Design
- Overlay with design/work area
- Accuracy +/- 20 cm
- Monitoring by Supermap control center software

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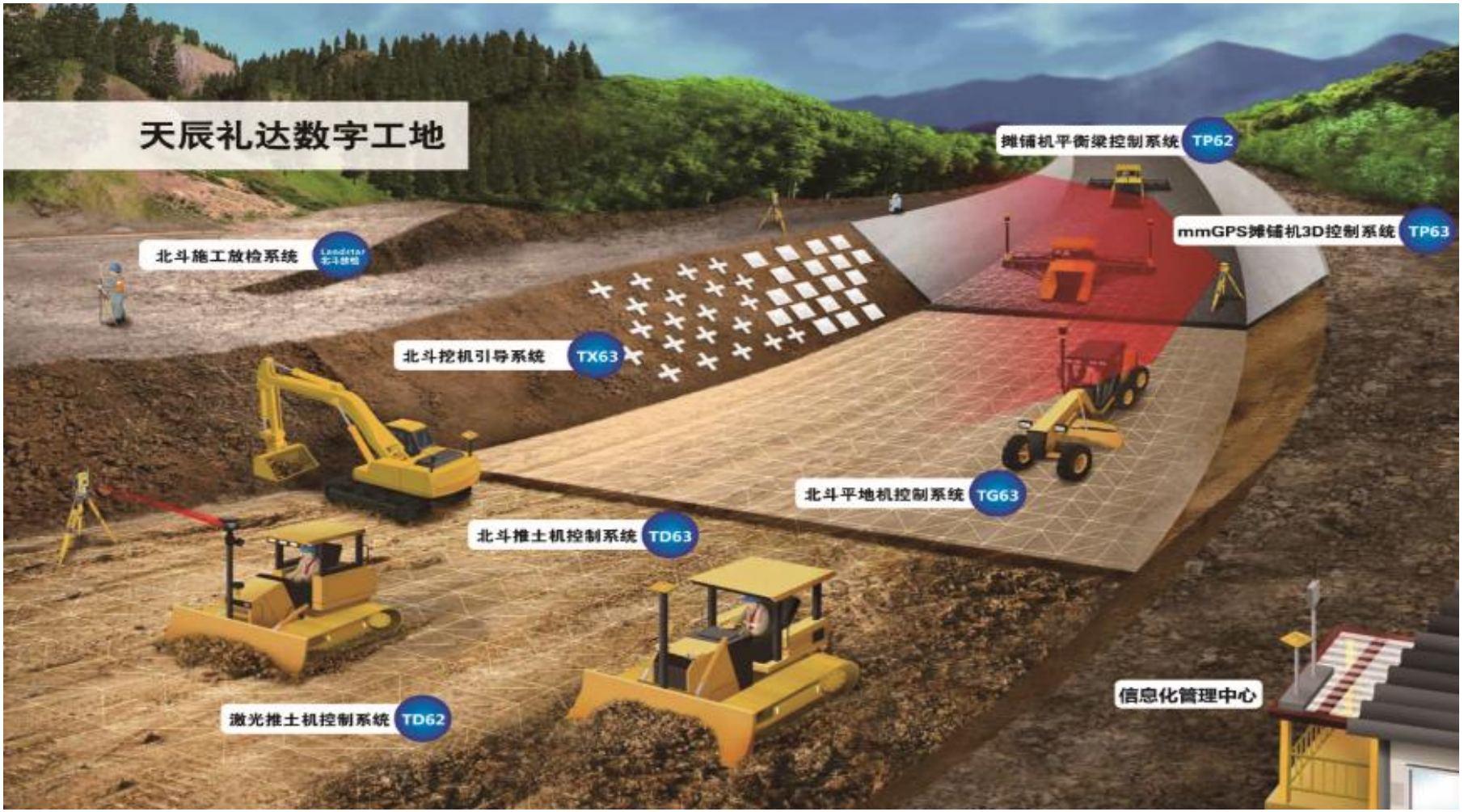
Machine Guidance



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Unit Monitoring Process

SENSORS	TRANSMISSION MEDIUM	OFFICE	USERS

Excavator

Wifi Access Point
or
Mobile Tower

SuperMap
Supermap
Server &
Infrastructure

USERS

Management

Note : Positional data of the bucket is streamed via TCP stream to the server

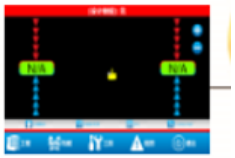
TX63 Machine Guidance Excavator

AS101-AS 102
Single and Dual Axis Angle Sensor

CHC AT311
GNSS Antenna industrial and anti vibratio

10 inch Industrial Tablet PC w/ ethernet port

Display



CHC MC100 - GNSS w/ Trimble Board BD982
CHC PM103 Power Module
CHC AB103 Junction Box

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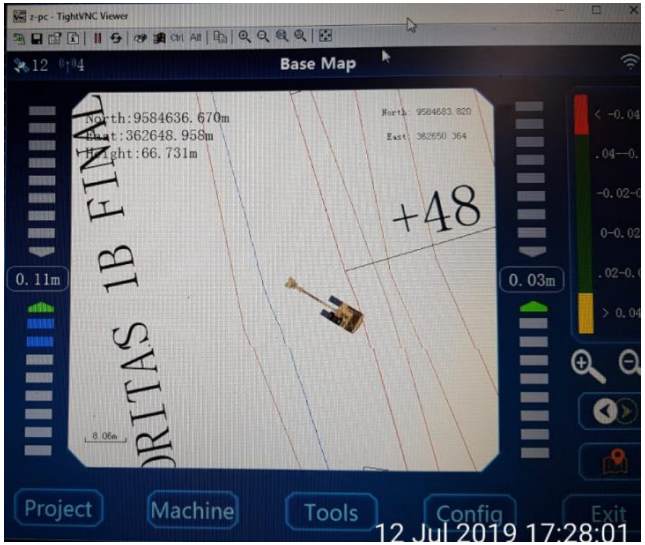
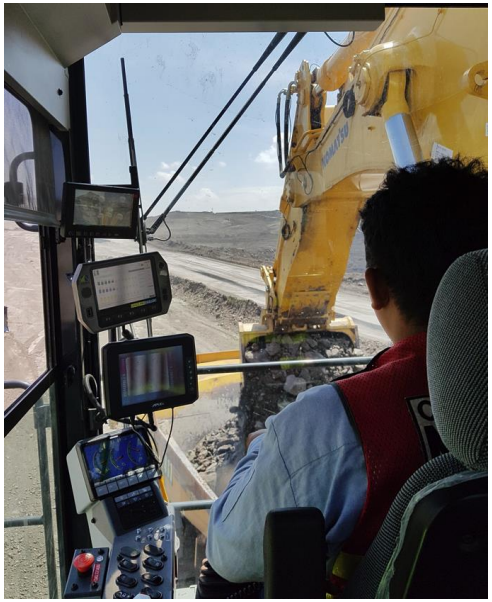
Cabin View

Design View

Mixed View



Basemap View



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Key Features of TX63

- Boundary Area Alarm
- Basemap
- Ability to use local coordinate systems/Coordinate transformation
- Streaming positional data via TCP Steam

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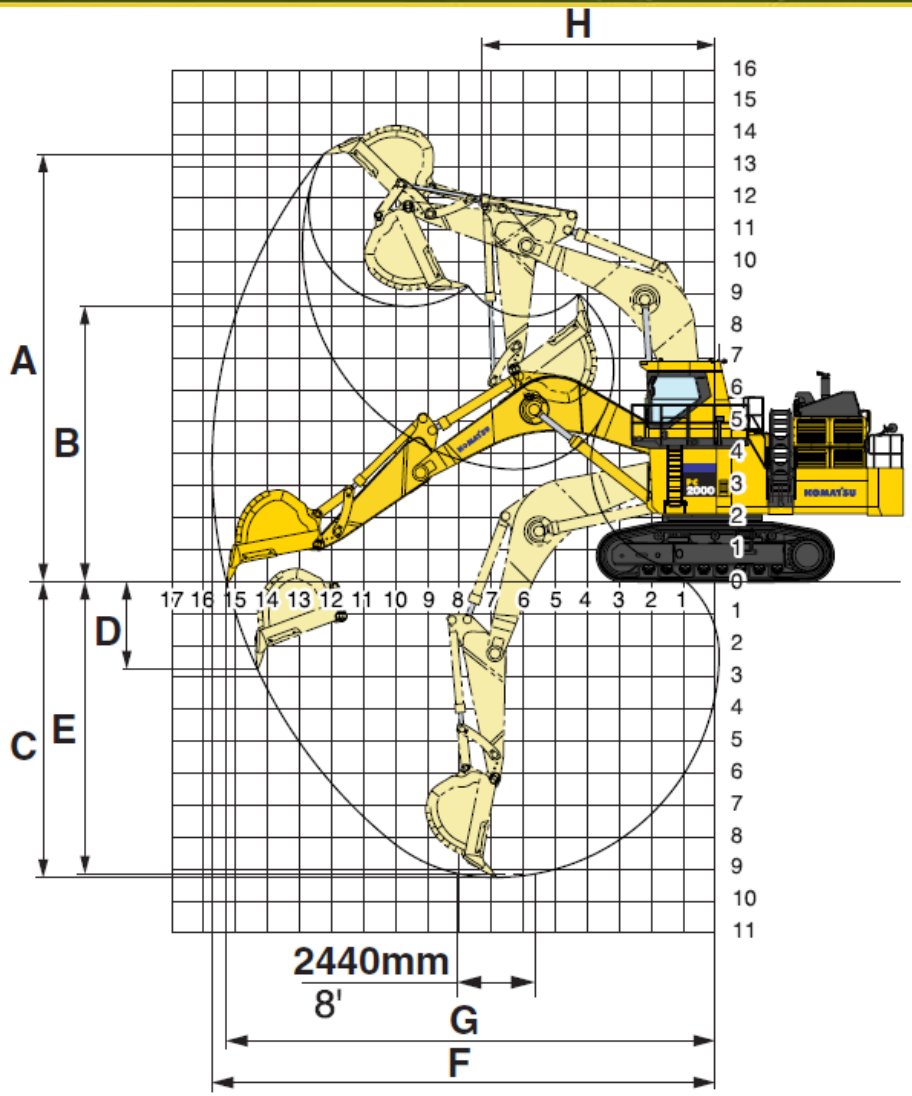
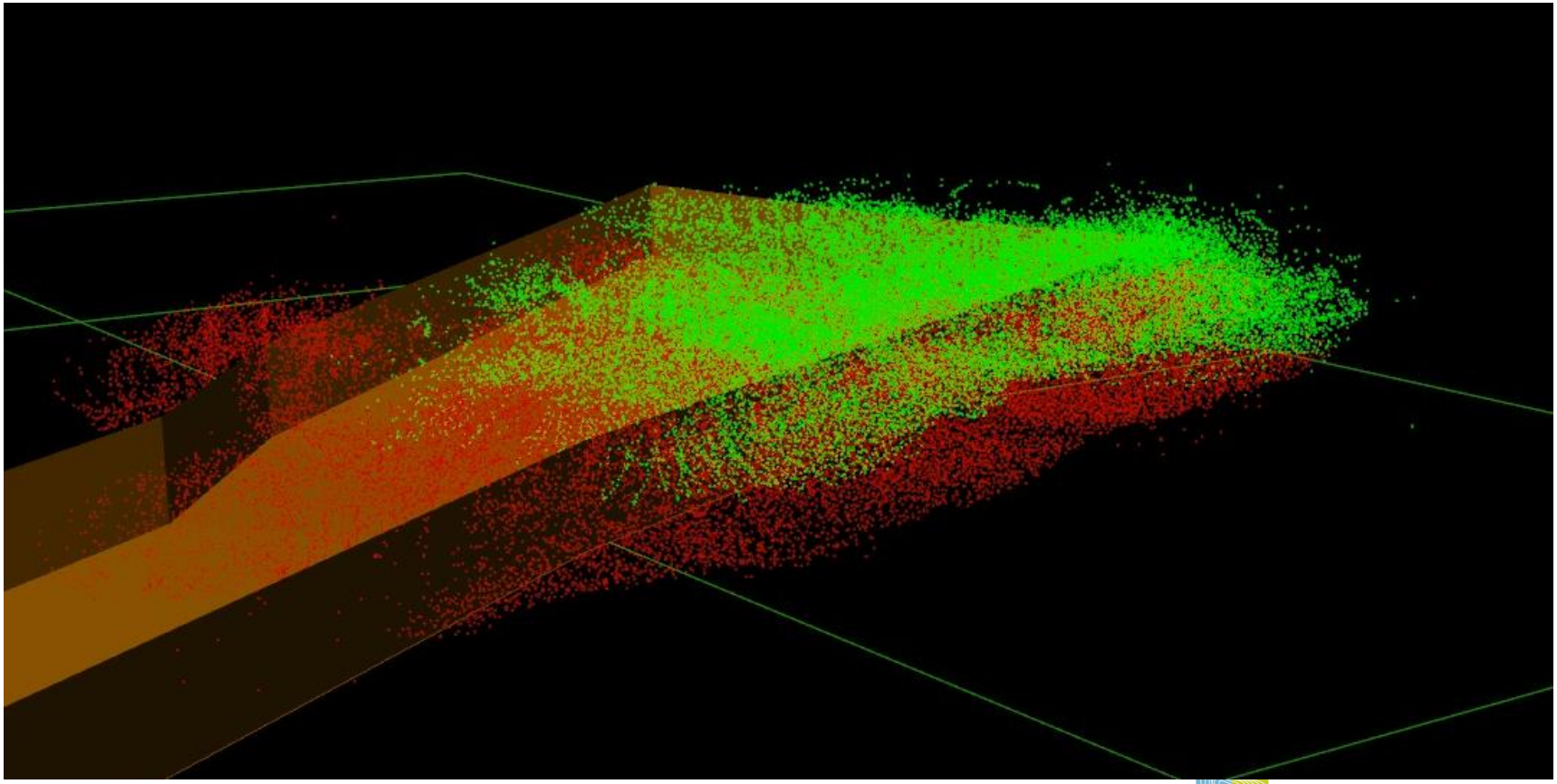
Excavator dimensions

- “C” (Max Digging Depth) = 9.2m
- Drilling depth = 9m
- Hence blasting material to be loaded in two layers



Scatter Point map

- Bucket Scatter Point Map over time



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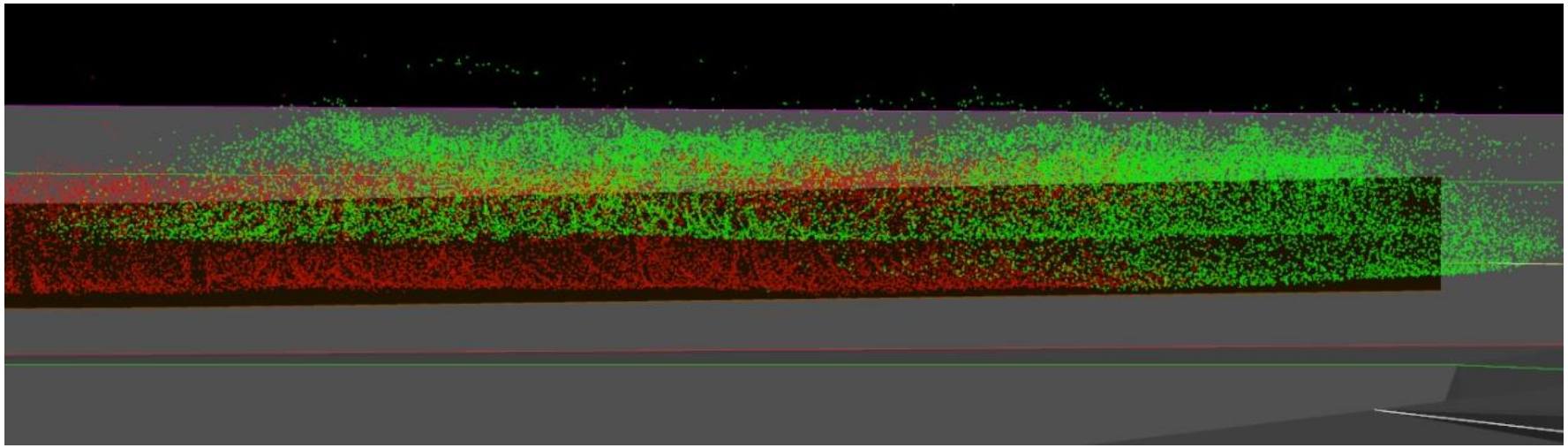
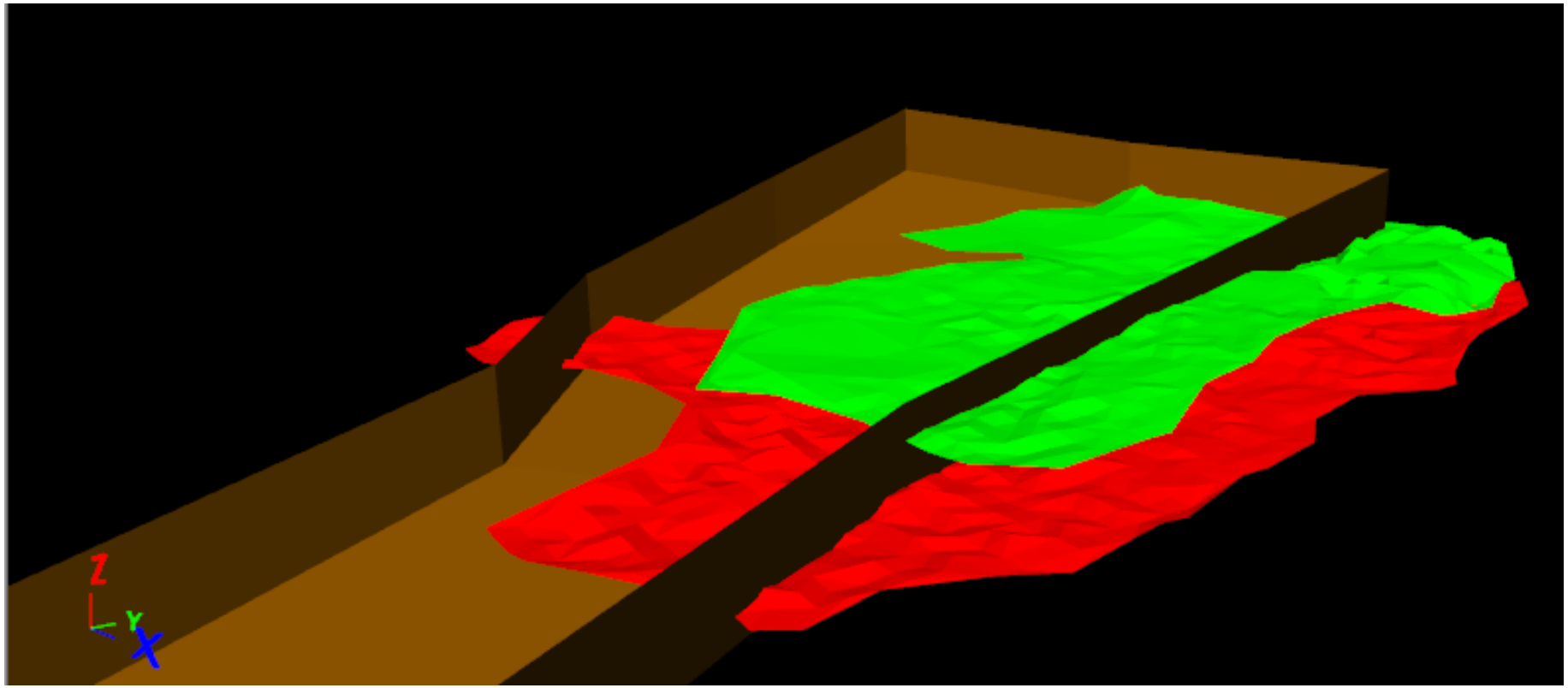


Bottom surface

- Using the bottom surface, we can calculate the volume of mined material



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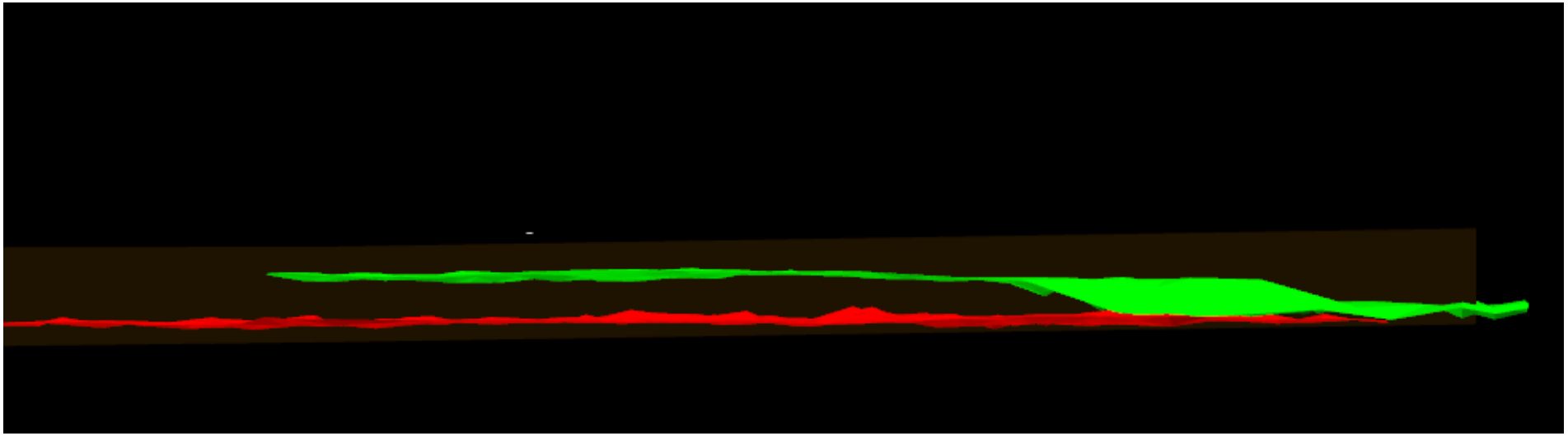

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Accuracy at the bucket

TCP Streamed Data sent to Supermap

- JSON data
- TCP stream with the following format:

{"AVRData":"$PTNL,AVR,080028.90,+274.4228,Yaw,-0.0262,Tilt,,,4.618,3,1.5,28*37","GGAData":"$GNGGA,080028.90,0343.44705124,S,10342.85312745,E,4,14,0.7,-32.932,M,10.364,M,2.9,0001*5D","HDTData":"$GNHDT,274.423,T*2F","ZDAData":"$GNZDA,080028.93,12,06,2020,00,00*75","east":"357214.8639731771","gpsTime":"1591948935222","height":"-28.0042525790","id":"1814","north":"9588275.7663439810"}

Analysis and Value-add of the data

- This is the data sent to Supermap for further processing:
  1. Auto-Topography, volume of materials mined
  2. Calculating productivity of the excavator operator
  3. Calculating Physical Availability, UA
  4. Office GIS and Front End Dashboard for unit positional monitoring
  5. Dispatch

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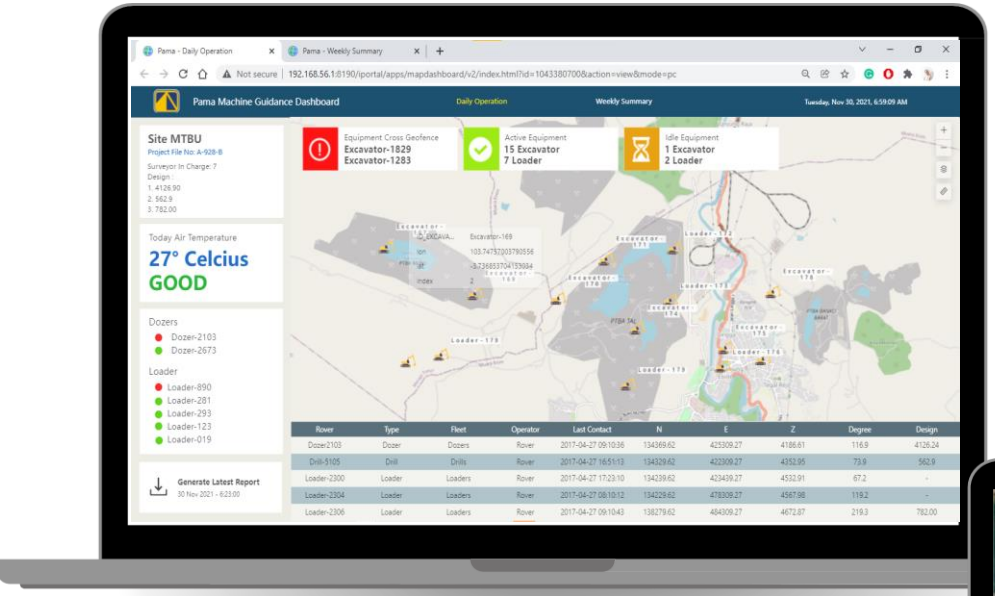
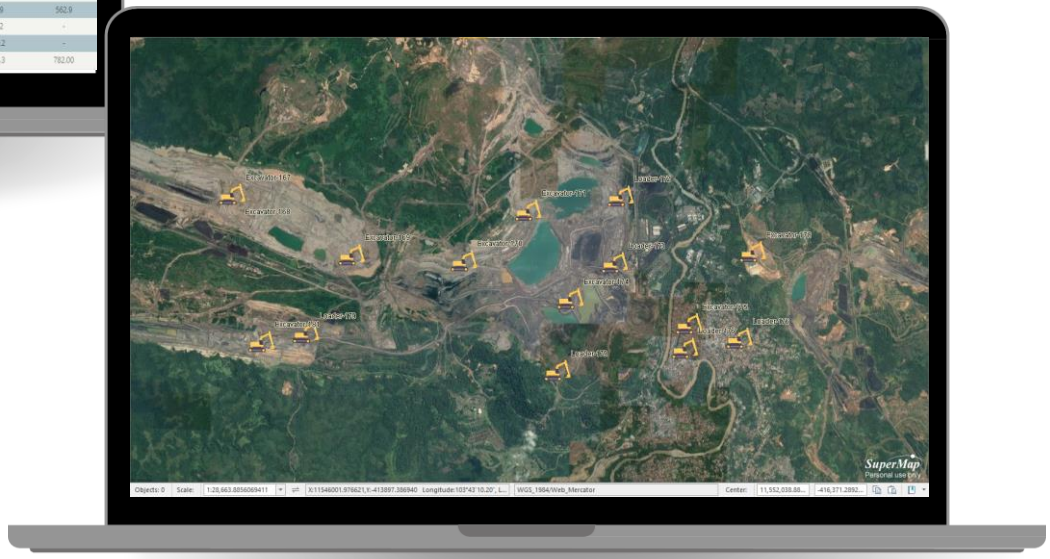
Supermap – Datacenter management



Daily Operation
Monitoring Dashboard



- Access real time equipment sensor
- Display cut and fill (and other that matters) information from sensor
- Generate playback route from each equipment
- Produce surface points from each sensor elevation
- Generate daily report

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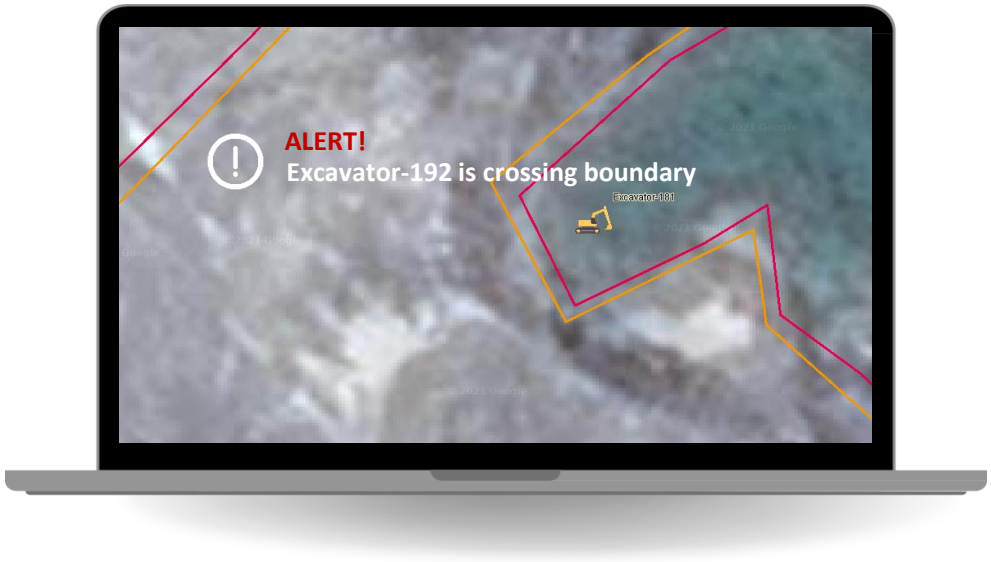

Geofence for Equipment
Boundary Monitoring

Generate a virtual perimeter from design file as a geofence so that every time the equipment crossing the boundary, an alert will appear.

This is good to ensure each equipment work inside where they should be.

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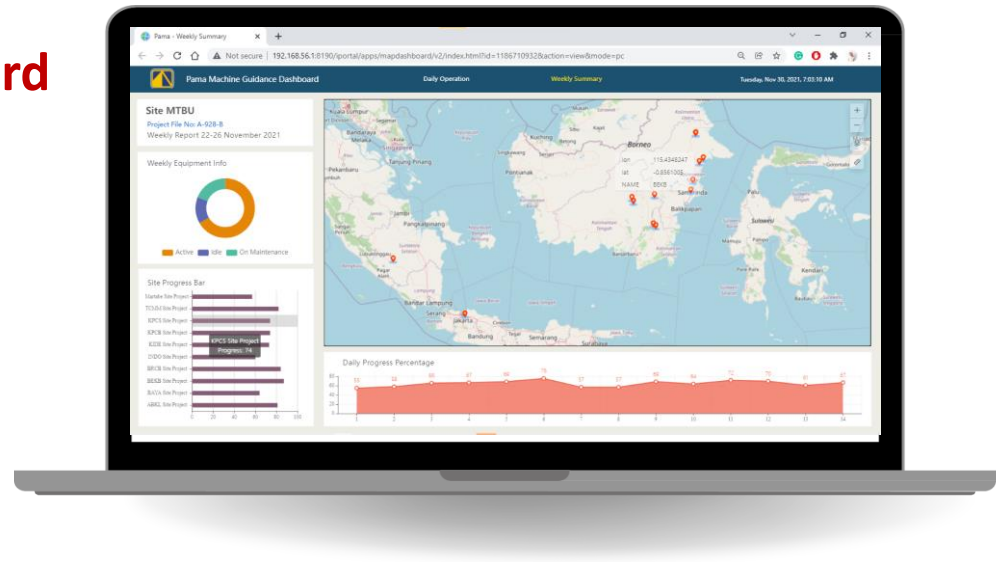
Supermap – Datacenter management

Weekly Operation Dashboard

- Display distribution of site on map
- Report of equipment activity each week (the number of active, idle, and on maintenance)
- Calculate the progress of each equipment by comparing the surface from design and equipment elevation.



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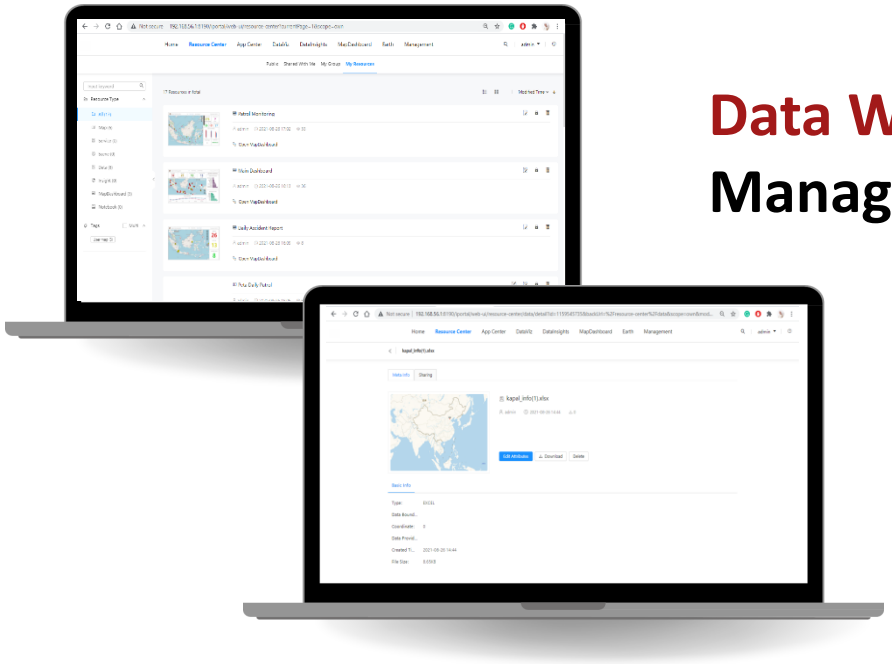
Supermap – Datacenter management



Data Warehouse and Management

- Old data tracking
- Spatial and non spatial data management
- Data access authorization
- Report management
- User Level Management

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Summary Results and Benefits

- Save costs by mining to design limits and reduce over cutting
- Reduce survey team (ie, increased safety)
- Reduce errors
- Increase loading effectiveness poor lighting
- Better tracking of equipment

- After implementation, it took approx. 2 months for the operators to adjust but eventually increased efficiency in mining by about 11%

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