Trimble

Aggregation of Data from Disparate Geospatial Mining Systems to give more value to the Connected Mine.

INDIA GEOSPATIAL FORUM™

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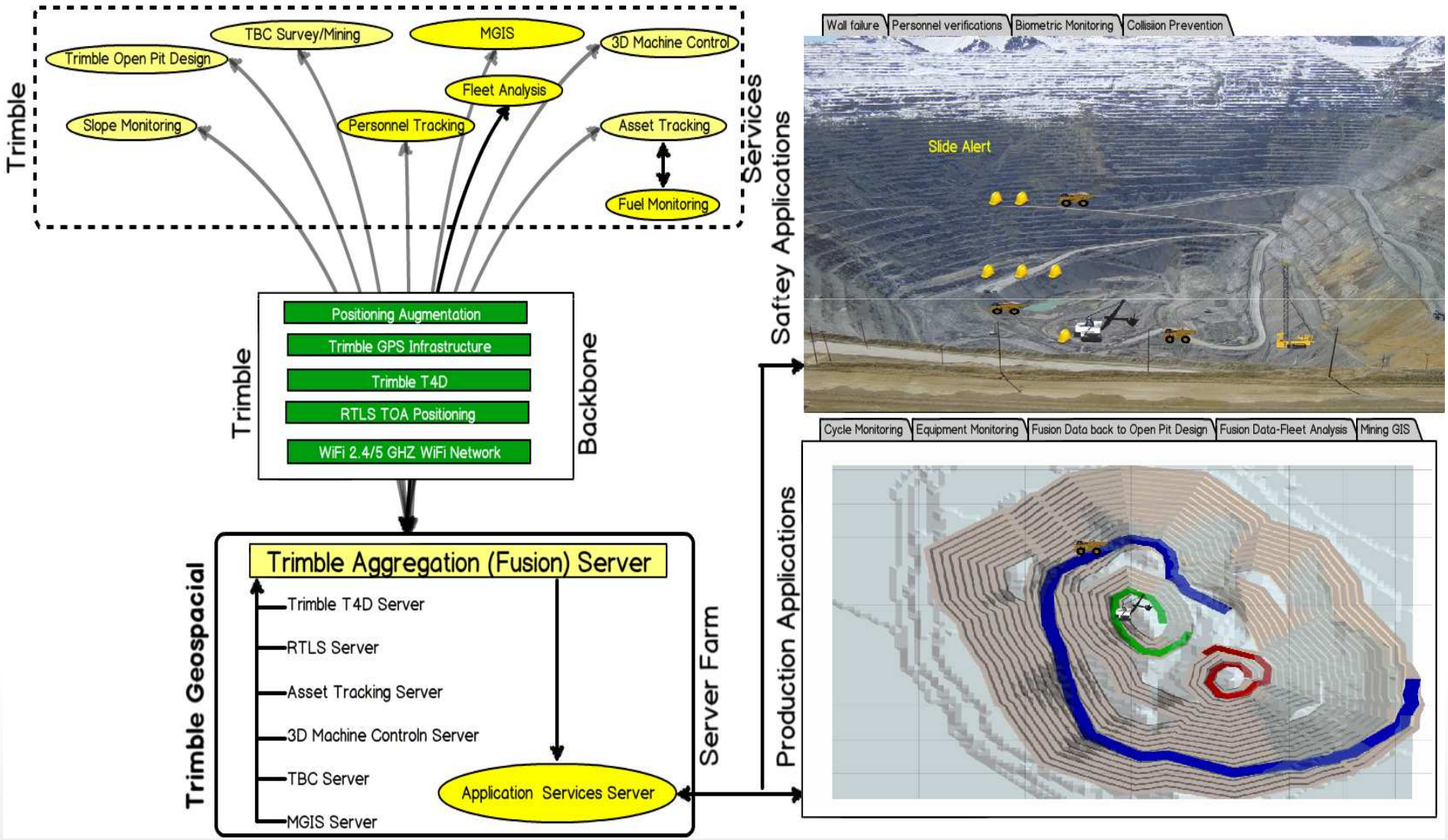
THEME: TOWARDS GEO ENABLED ECONOMY

Connected Mine

Value Statement

Value for the Mine is created by aggregating data from disparate systems – both Trimble and third party – to enable analysis, reporting, display and alerts that improves personnel safety, monitoring of production operations and increases fleet efficiency.

Trimble Connected Mine

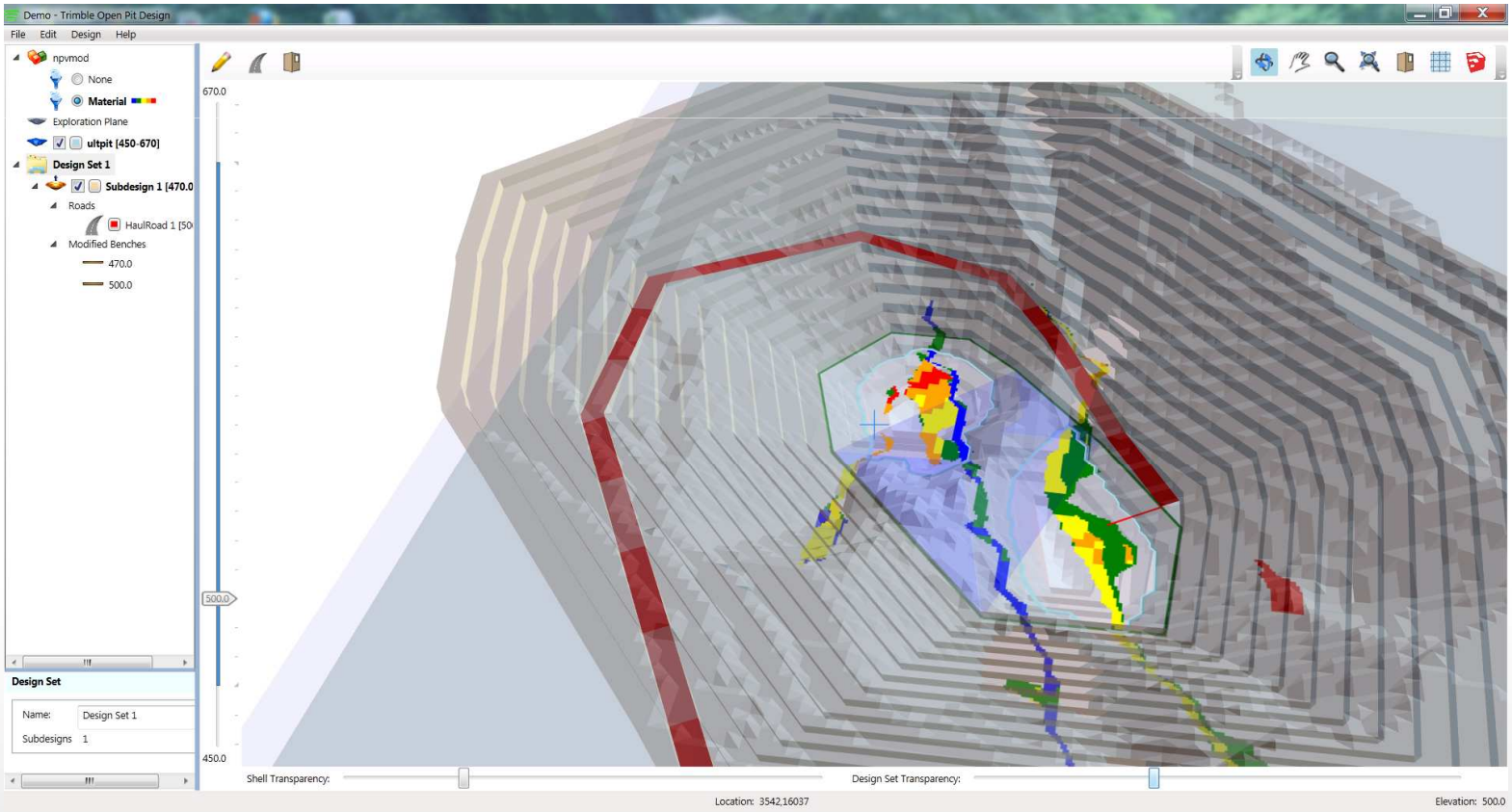


Trimble Services

- **Slope Monitoring**
  - T4D
  - Terrain Radar
- **Personnel Tracking**
  - RTLS
- **3D Machine Control(Road Construction)**
- **Asset Tracking**
  - GPS/WiFi
  - RTLS(Personnel Tracking)
  - Fuel Monitoring

Trimble Services

- **Trimble Open Pit Mine Design**
  - **Artificial Intelligence Engine**
  - **Engineering rules base**
  - **Inputs :Economic shell : Block Model**
  - **70:1 reduction in man months of work**



Trimble Services

- **Fleet Analysis**
  - Analyze individual machine performance based on fuel burn/per cubic yards moved both loading and hauling assets.
  - Ability to compare different manufacturers equipment
- **Application Services**
  - Mining Specific Reporting
- **MGIS**

Trimble Backbone(Hardware Infrastructure)

- Positioning Augmentation
  - Terralites
  - Local Site Positioning Solutions
- Trimble Base Station GPS Infrastructure
- Trimble T4D
- RTLS TOA Infrastructure
- Wi-Fi 2.4/5 GHZ Wi-Fi Networks

Trimble Geospatial Server Farm

- Trimble T4D Server
- RTLS Server
- Asset Tracking Server
- 3D Machine Control Server
- TBC Server
- MGIS Server
- Trimble Aggregation Server
  - Data input from T4D server
  - Data input from RTLS server
  - Data input from Asset Tracking server(Trimble’s and Third party)
  - Data input from Asset Positioning server
  - Data input from TBC server
  - Data input from MGIS server
  - Data input from Open Pit Design server

Use Cases -- Safety

- **Wall failure**
  - T4D alarms and Trimble fusion display shows slide area
  - Assets(both equipment and personnel) that will be affected are identified
  - Immediate warnings are transmitted via RTLS infrastructure and asset structure to each asset that there is danger
- **Personnel verifications of training for zone occupation**
  - Most mines require different levels of training for workers depending on the type of work and area of the mine where they work
  - The personnel tracking system would compare location to training level and alarm if personnel are in areas of the mine that where they are not certified to be
- **Biometric monitoring**
  - Biometric sensors in hard hat uses RTLS backhaul to pass worker condition to Trimble Geospatial server
  - If worker vitals exceed parameters alarm would alert medical personnel
- **Collision Prevention**
  - Trimble Geospatial server monitors and predict collisions between
    - Equipment vs. Equipment
    - Equipment vs. Workers

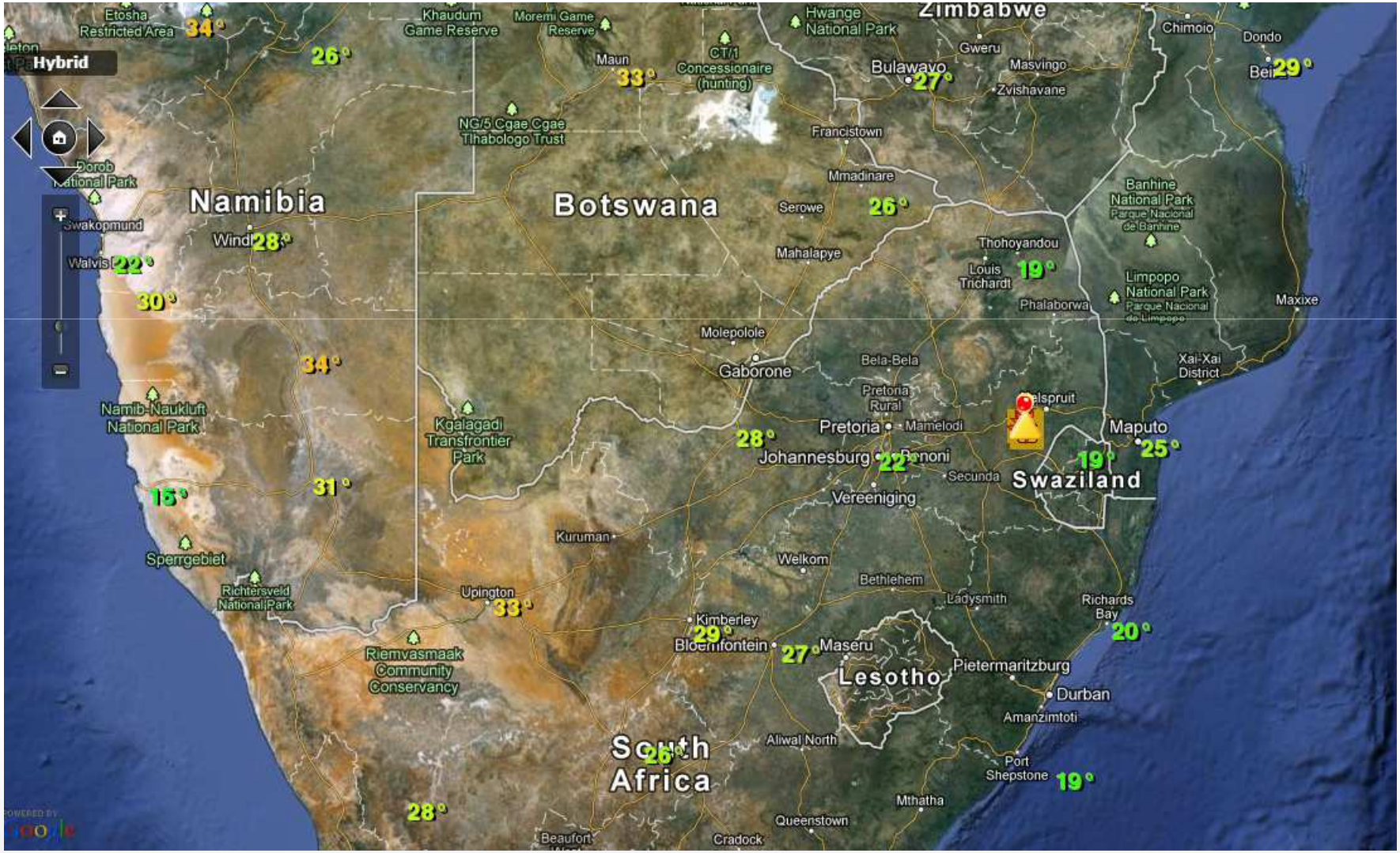
Use Cases -- Production

- Cycle Monitoring
  - Load Count
  - Load time
  - Travel Time between load zone and dump zone
    - Segment travel time versus
      - Grade
      - Turns
  - Dump Time
  - Fuel Monitoring
    - Allows fuel burn per cycle
    - Fuel Theft
- Equipment Monitoring
  - Number of trucks have RTK to map DTM real-time
  - Shovel Monitoring-Buckets per load

Use Cases -- Production (cont.)

- **Feed aggregated data back into *Trimble Open Pit Design***
  - **to have a living design that is updated and optimized based on as-built**
- **Feed aggregated data into fleet analysis engine to rank efficiency of**
  - **Machine performance**
  - **Make**
  - **Combinations of Load/ Haul machines**

TCM-Live Mine in South Africa



TCM –Nikomati Mine