Creating and Automating a Digital 3D Virtual World for Smarter Utilities & Improved Customer Outcomes

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Utilities Becoming Customer Centric

Customer

Energy
- Affordable
- Clean
- Secure & Reliable
- Choice

Service
- Affordable & Efficient
- Customer Experience & Value
- Expanded Range
- Choice

Participant
- Generation
- Storage
- Demand Response
- Trade
What **Knowledge** Do We Need & Why?

- 47GW
- 337 registered generators
- 780,000 km of power lines
- ? Trees
- 9.6m Customers
- ? Streetlights
- Electric Transport
- 1.8m Solar Rooftops
- ?m Appliances

Supply | Storage | Demand
---|---|---
Heating & cooling
Pumping (pool)
Lighting
Appliances
Spatially Connected

The National Electricity Market stretches from Cooktown in the tropical north to Tasmania in the south and across to South Australia
Energy Networks Australia’s “Electricity Networks Transformation Roadmap” is a good example of why greater intelligence on “where” is needed

More intelligence on the network is needed to enable the Distribution System Operator role.
Transforming Big Knowledge to Business Performance

Attributes
- Fast Capture
- Fast Processing
- Full Network
- Spatial Data Frame
- Data Conflation
- 3D Visualisation
- Process Automation
- Machine Learning
- Scalable
- Web base collaboration
- Advanced Analytics
- Business Transformation

Digital 3D Virtual World
- Big Picture – All O/H Network Content in Context
- Spatial Frame connecting all data

Rapid Capture
- UAV & Imagery
- Network & Surrounds
- No Line Work Spots
- Content in Context
- Cost Effective
- Non intrusive

Rapid Processing & Modelling
- Automated/Machine Learning
- Object Recognition
- Web & Cloud based

Report
- Automated Business Rules & Standards based Reporting
- Linked to Visual Navigation

Visualisation & Collaboration
- Enterprise Wide Access & Knowledge
- Spatial Visualisation
- Enterprise & Community Collaboration

Business Outcomes
- Strategy Execution
- Safety
- Customer Service
- Reliability
- Risk Management
- Growth
- Revenue
- Capital Efficiency
- Network Resilience
- Disaster Response
- Operating costs
- Works Management

Transformation
- People, Engagement, Collaboration, Change Management, Solution Development, Business Processes, Service Contracts, Performance Dashboards

Enterprise Data
- Asset
- Energy
- Customer
- Performance

Targeted Capture (Secondary)
- Car
- Drone
- Helicopter
- Fixed Ground

Public & Social Data

Conflate
Disasters: The Moments that Define Us

Dunalley, Tasmania

Black Saturday, Victoria

Yasi, Queensland
Physical Vulnerabilities: Consequence
2017 US Hurricanes – Up to $400B Cost

Hurricane Maria

Disaster

Hurricane Maria is reported as the worst natural disaster on record in Dominica and is potentially the costliest Caribbean hurricane on record as a result of causing catastrophic damage and a major humanitarian crisis in Puerto Rico. Wikipedia

Highest wind speed: 266 kmph
Date: 16 September 2017 – 3 October 2017
Direct fatalities: 86
Category: Category 5 Hurricane (SSHWS)
Lowest pressure: 903 mb (hPa); 26.81 in-Hg
Affected areas: Puerto Rico, Dominican Republic, France MORE
Total fatalities: 97 direct, 32 indirect (as of November 13), 583 reported (unofficial)

Hurricane Irma

Catastrophe

Hurricane Irma was an extremely powerful and catastrophic Cape Verde-type hurricane, the strongest observed in the Atlantic since Wilma in 2005 in terms of maximum sustained winds. Wikipedia

Total fatalities: 134
Highest wind speed: 295 kmph
Date: 30 August 2017 – 16 September 2017
Total fatalities: 134 total (as of October 10)
Affected areas: Florida, Cuba, Puerto Rico, Bahamas MORE
Category: Category 5 Hurricane (SSHWS), Category 4 Hurricane (SSHWS), Category 1 Hurricane (SSHWS)

Hurricane Harvey

2017 tropical cyclone

Hurricane Harvey was the costliest tropical cyclone on record, inflicting nearly $200 billion in damage, primarily from widespread flooding in the Houston metropolitan area, breaching the previous record set by Hurricane Katrina. Wikipedia

Total fatalities: 11
Date: 17 August 2017 – 3 September 2017
Fatalities: 82
Category: Category 3 Hurricane (SSHWS), Tropical Depression (NHC/CPHC)
Affected areas: Texas, Louisiana, Belize, Nicaragua, Honduras MORE
Did you know: Harvey is the costliest Atlantic hurricane ($188.6 billion in damage)
Physical Vulnerabilities: Consequence Australia

- Ash Wednesday Fatalities – 75
- Black Saturday Fatalities – 173
Improving Grid Resilience & Response: Technology & Data Conflation

Data conflation, visualisation and analytics improves resilience planning and disaster response
Improving Grid Resilience: Modelling & Technology

- Adaptation through understanding risk (modelling) & executing good design
- Scenario analysis
- Identify changes for asset renewal
- Reduce disaster impact
- Smart, Embedded & Micro Grids – Intelligent switches
- Distributed Energy Resources – Solar, diesel
Improving Response: Spatial

Visualisation & analytics
• A digital response replaces labour intensive high risk ground based defect identification
• Rapid aerial damage capture & processing (24 hours)
• Automated spatial digital intelligence
• Enables rapid response, logistics and restoration planning
Improving Response: Resource Planning & Field Force Automation

- Visualisation to improve deployment of field crews to priority areas
- Field Force Automation to improve work allocation and closure, workforce productivity and data management Improved

**Note:** Field crews replacing low voltage poles and wires to loads that no longer exist

60,000 response personnel deployed to Irma – were that many needed?

Often the same problem is re-instated – non fire resilient wood poles
Improving Response: Communication & Social Media

Cyclone Marcia (Central Queensland):
1. Target restoration dates for areas published on the web site
2. Website hits peaked when plans were published
3. Social media monitored to improve response. Social media sentiment favourable and overall response results in improved brand and reputation

Observation
Customers further north who had experienced a number of cyclones helped set reasonable expectations for customers in Central Queensland hit by Marcia. The last Cyclone to hit the area was in 1976
Asset Analytics: Safety 1.5M High Voltage Clearance from Building

22KV live 1M off ground
• In Australia Benchmarking is being used by the regulator as a key input in determining performance & revenue
• It is therefore critical to have an accurate stocktake of assets
• The red dots indicate poles that were not in the utilities asset records (some may be private poles).
**Asset Analytics: Conductor Clearance Curves – The Bell & S**

Key Attribute

*Every wire* is measured at 100mm intervals along the line.
Asset Analytics: Conductor Clearance – Data Slicing for Targeted Risk & Strategy

Rural
- Agriculture risk
- Land use overlays
  - Irrigation
  - Spraying

Urban
- Building risk
- Rubbish removal
Asset Analytics: Pole Location

What utilities say:
Locations of poles are accurate
What is usually the truth:
They’re not
This heat map depicts the locations of the poles with potentially inaccurate locations

Errors in location can impact:
- property access information
- Assessment of physical loading of a pole (automated or manual)
- Risks related to pole loadings
- Conductor ground clearances from increased DER
Vegetation Analytics: Vegetation Encroachment
Vegetation Analytics: Bow Wave Peak

Urban

Customer Complaints

Rural

Vegetation Clearance

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Reliability Incentive – Performance & Risk Analytics

- Revenue and service opportunity
- Data conflation
  - Customers
  - Vegetation
  - Asset condition
  - Performance history
- Risk rank entire network
• Work is often done in silos
• By conflating and making visible vegetation, asset attribute, asset condition, clearances, risk, augmentation, customer extension and other data, the best financial and risk decision can be made