



# Smart Digital Twin for Electrical Networks

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Hexagon Safety, Infrastructure & Geospatial

**VIII INTERNATIONAL CONGRESS  
OF POWER ENGINEERS**

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# Today's needs



Single, reliable source for all physical assets



Versatile workflows from the office to the field via cloud, mobile and desktop



Topology-centric network models



Accurate, geospatial depiction of networks, assets and surrounding environments



Integration with other core systems



# The resiliency challenge

- ✓ The underlying events are unpredictable
- ✓ Priority vs. resources?
- ✓ Speed vs. completeness
- ✓ Proactive vs. reactive measures



## Tomorrow's evolving requirements



Integrating distributed energy resource management systems (DERMS)



Microgeneration



Electric vehicles (EVs)



IoT devices and sensors



Government regulations

# Introducing HxGN NetWorks

*Perform today. Transform tomorrow.*

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A flexible, integration-ready **geospatial asset management solution** that helps utilities and communications providers build **digital twins** of their networks, topology and assets.

# Addressing each phase of the asset management lifecycle

## Construction

Use **HxGN NetWorks Core**, **HxGN NetWorks Web**, **HxGN InService** tools to provide designs electronically to construction crews to track materials used and note as built changes that differ from the design.

## Operation

Use **HxGN InService Advanced Distribution Management System** for responding to outages and providing advanced applications for proactive measures to address potential problems before they arise along with dispatch capabilities.

## Design

Use **HxGN NetWorks** design leveraging configurable business rules to ensure connectivity is maintained and QA/QC is performed during the design phase and Hexagon ortho imagery for accurate aerial mapping streaming with integration into design tools

## Planning

Use the power of **HxGN NetWorks** to provide a robust network modeling of both proposed and as-built network along with NetWorks to share that data with 3rd party tools to perform planning and analysis

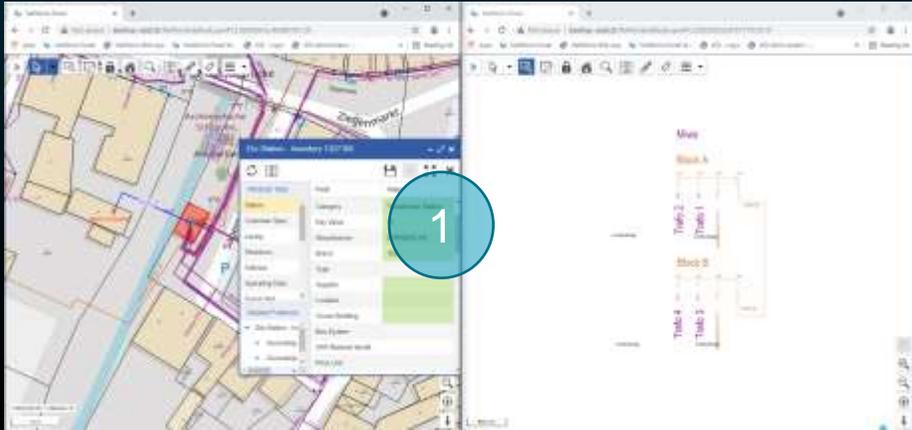
## Maintain

Harness the power of **HxGN NetWorks** and mobile capabilities of **NetWorks Mobile** to perform network analysis and inspections of the network

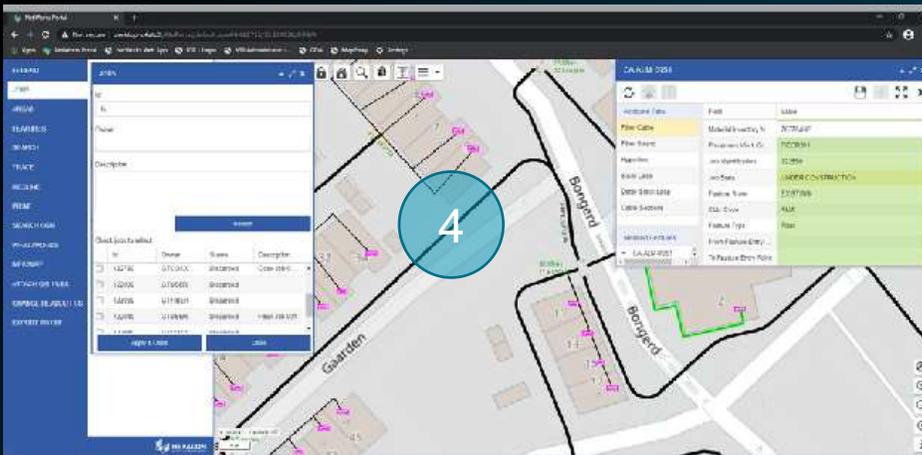
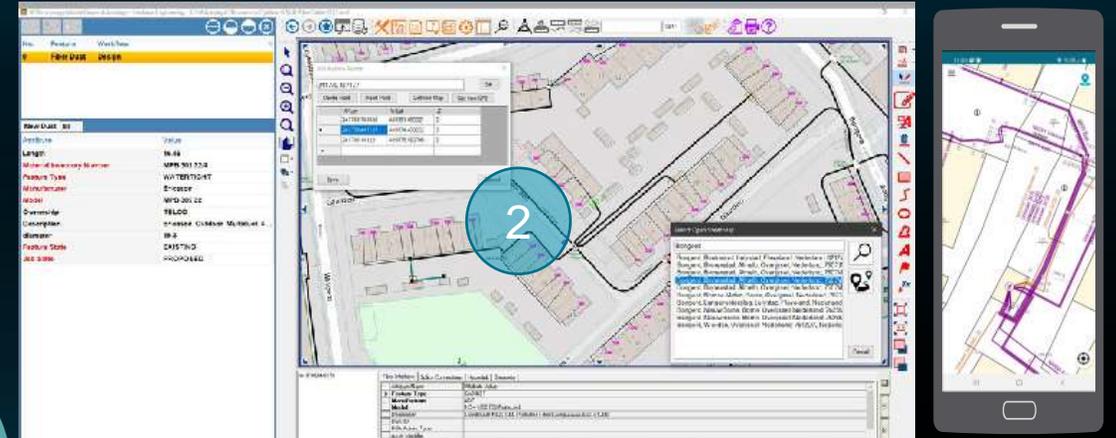


# Business workflows

## Prepare your work - Web



## Perform surveys - Mobile

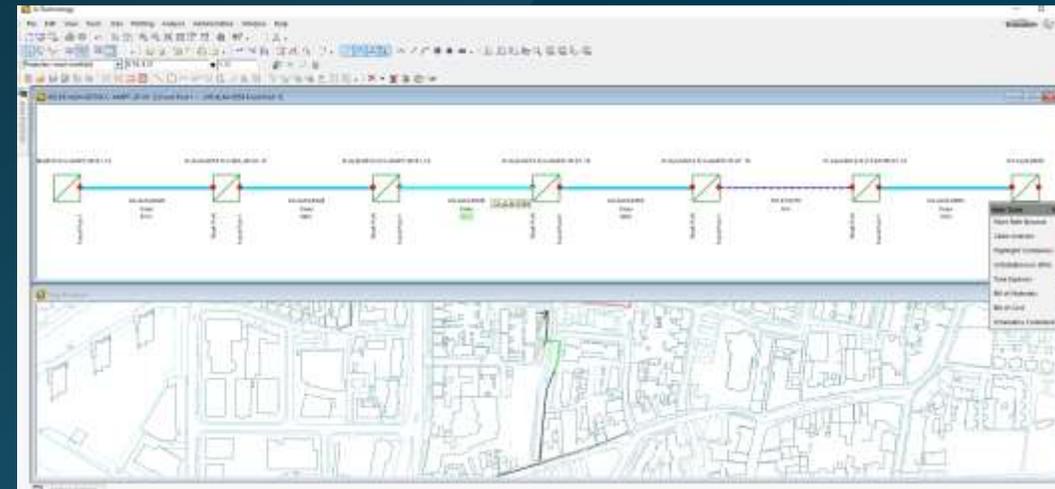


## Build, Maintain, Modify

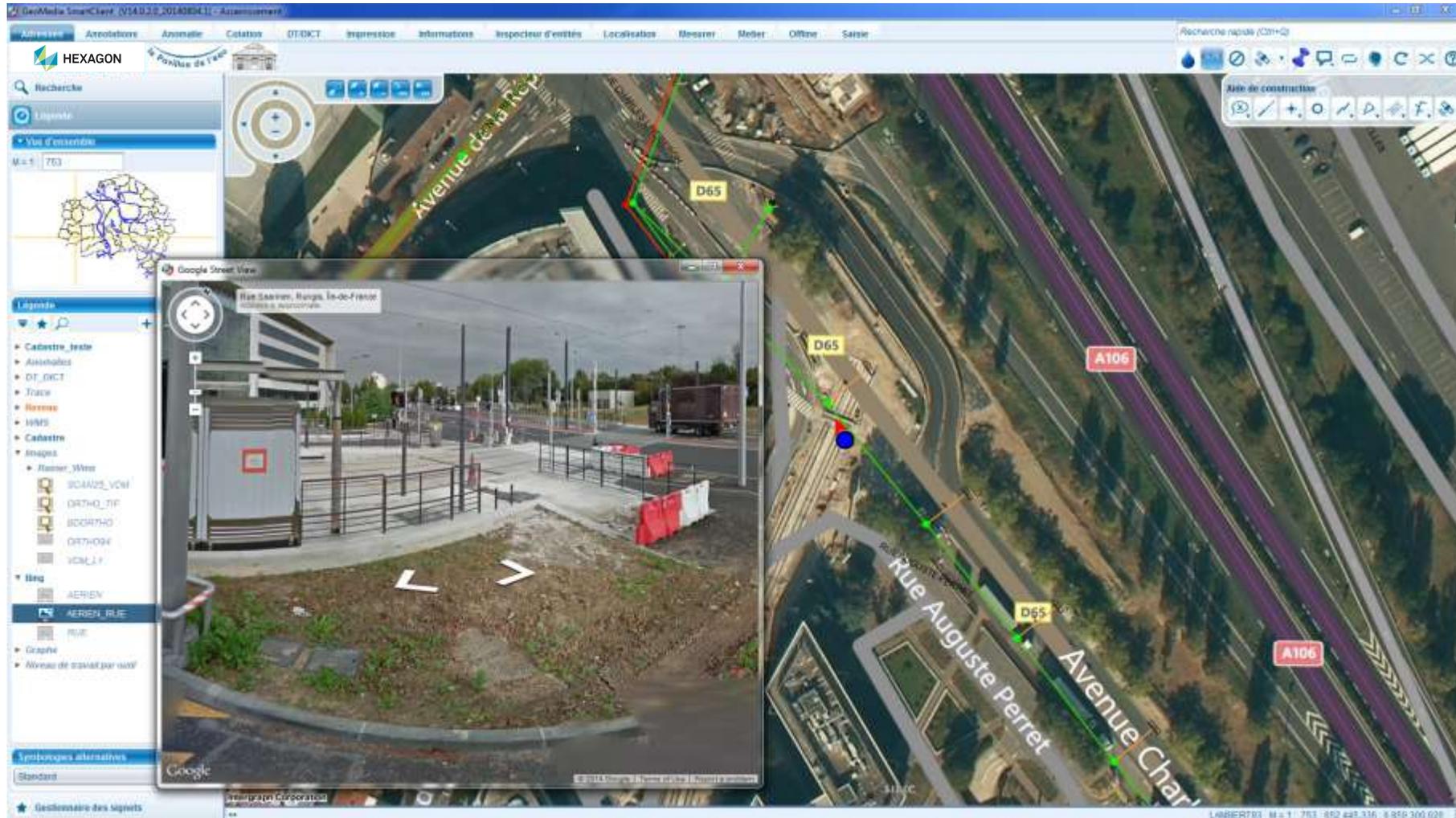
## Create Detailed Designs

# Geospatial electrical infrastructure management: Solution coverage

- Single source of truth
- Paperless administration
- Asset characteristics
- Asset lifecycle management
- Version management (multiple scenarios)
- Inside and outside plant management
- Business rules
- Network validation
- Relationships between assets
- Multiple presentations of the same asset
- Network analysis
- Thematics
- Online and offline viewing

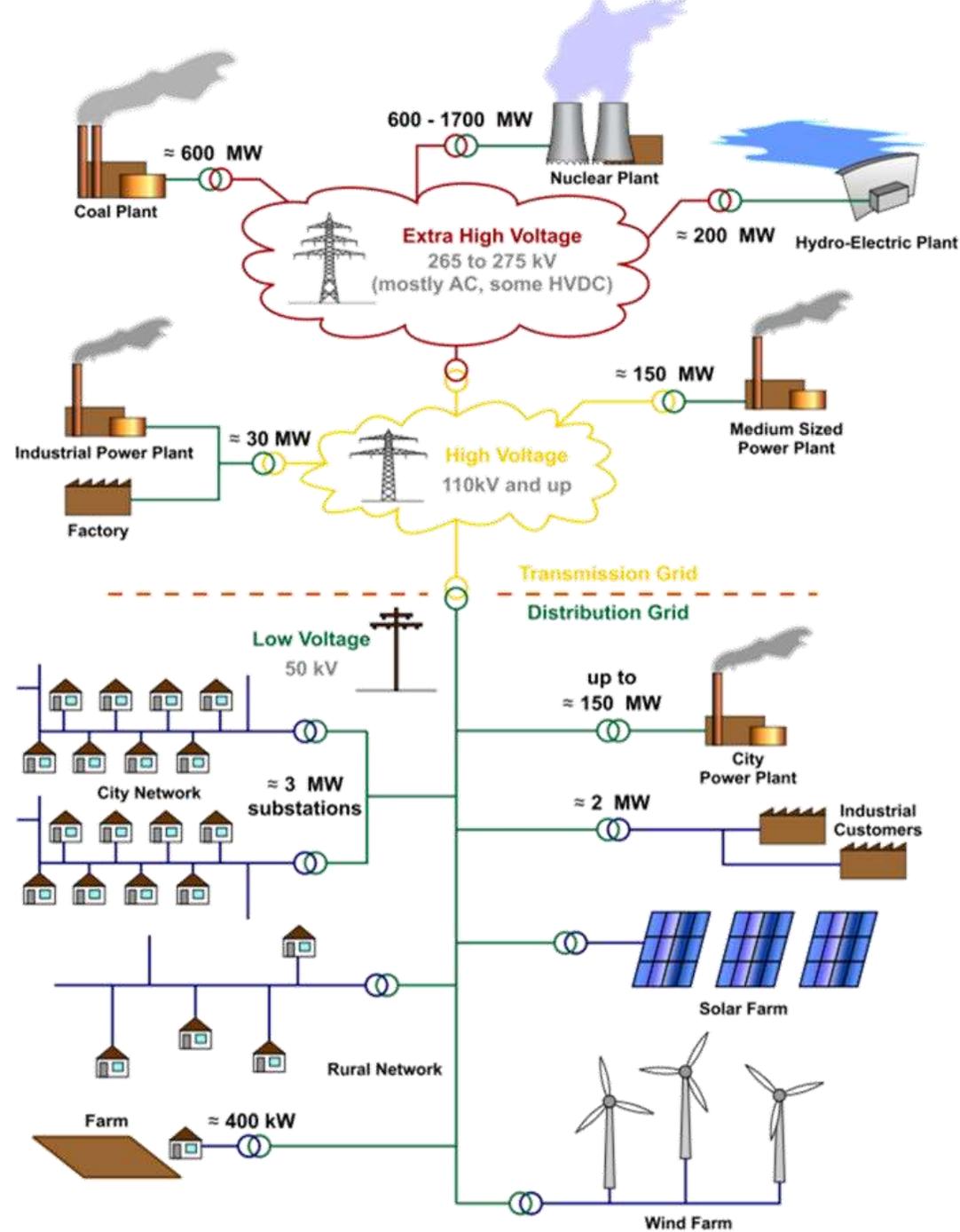


# Online viewing



# Mobile viewing: Field inspection





Solution coverage

# Benefits



**Industry specific:** Built specifically for utilities and telecommunications providers



**Market tailored:** Features pre-packaged modules for electric, gas, water/wastewater, multi-utility and fiber networks



**Fully digital:** Provides a paperless solution



**Unified inventories:** Delivers a single source of truth for a physical network, topology and assets



**Integrated workflows:** Integrates easily with other systems via its composable, API-first architecture



## Benefits



**Accurate digital twins:** Ensures robust modeling for network planning and data quality for network design



**Cross-functionality:** Supports inside plant (ISP) and outside plant (OSP) functions



**Versatile delivery methods:** Supports field-to-office work via desktop, web and mobile support



**Backed by experience:** Leverages Hexagon's more than 45 years of relevant industry experience

# Outage Management

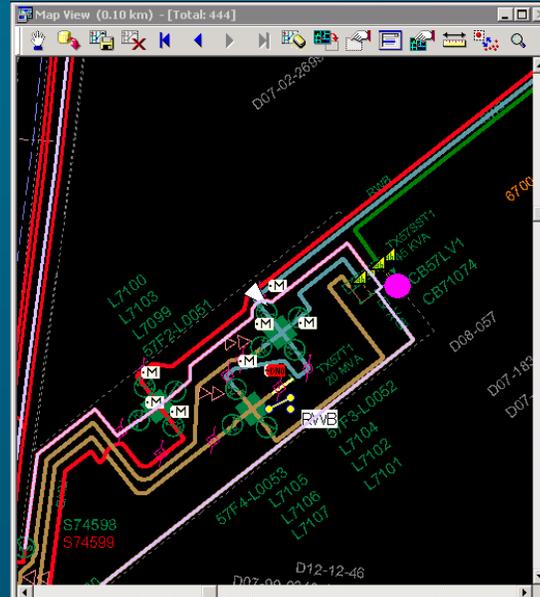
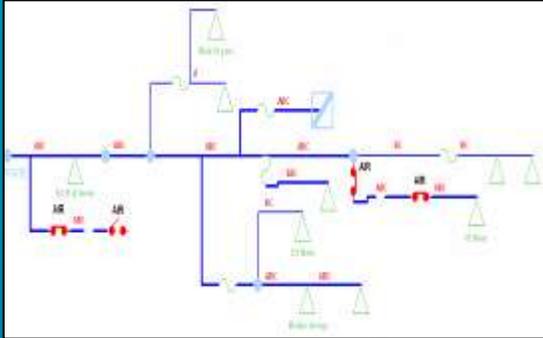


Integrated with the Digital Twin.



# InService

## Outage Management System

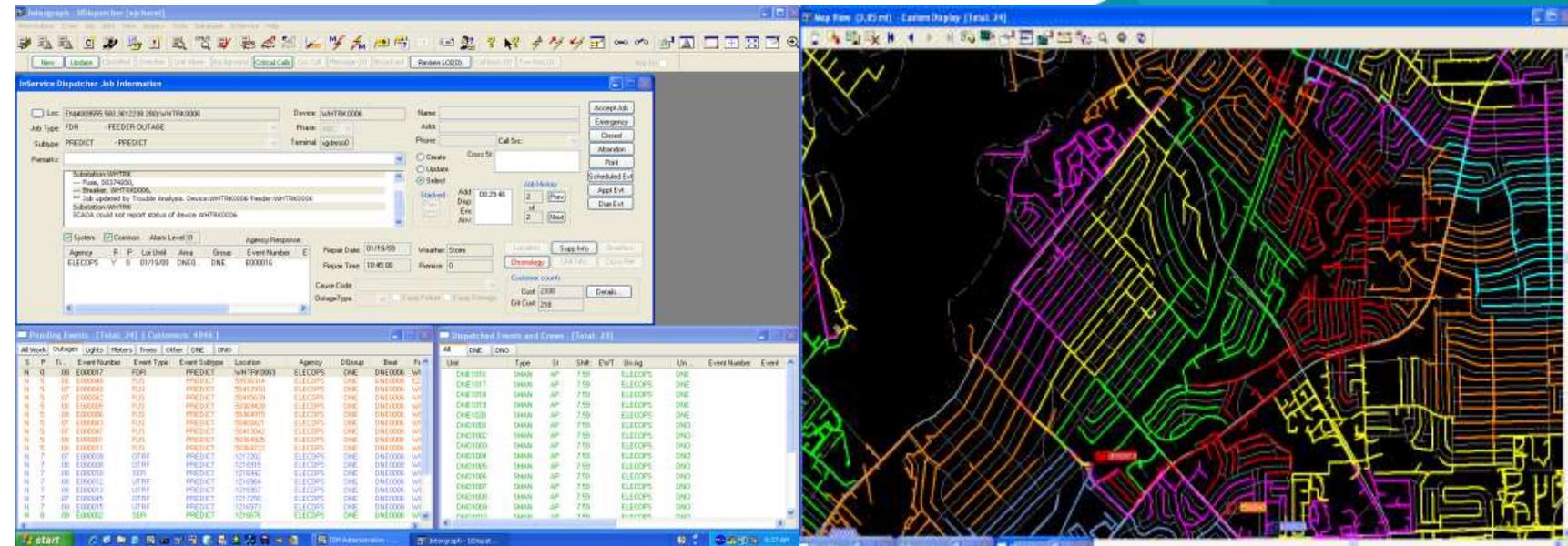


S	A	F	Dir	# Cals	Event Number	Event Type	Location	First Address Location
P	2	1106		0	01965	SW_OUT	L10054	
P	3	506.21		0	01974	FUSE_OUT	C2821	
P	3	2210		0	01961	FUSE_OUT	C3300	
P	3	2213		2	01959	TX_OUT	TX509	1700 MAZO CRES
P	4	62017		1	01952	SW_OUT	L04333	
P	5	911.33		1	01972	SW_OUT	011982	1056 OSBORN AVE



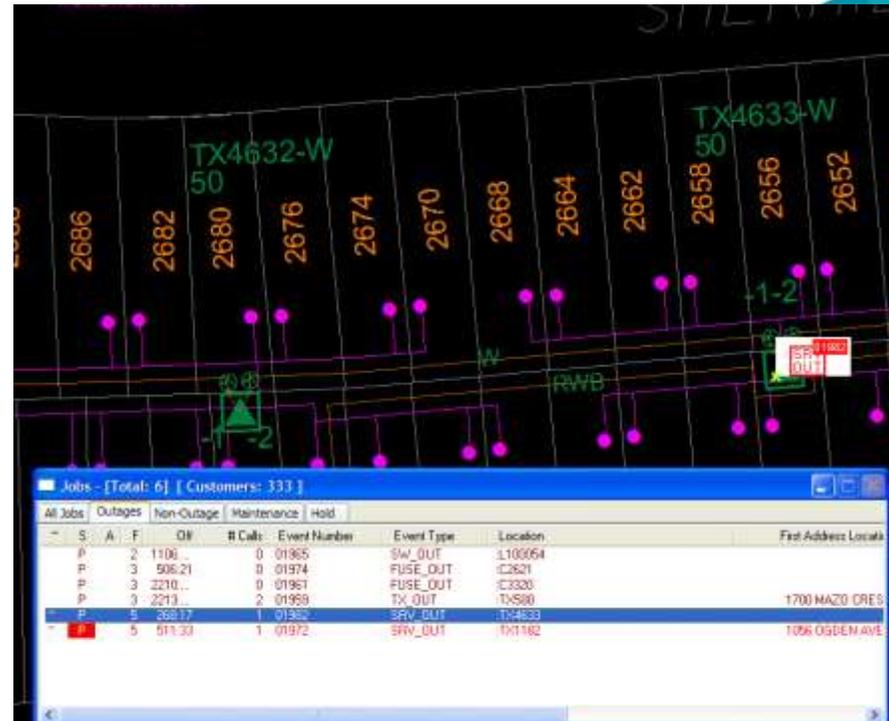
# InService

- Outage Analysis
- Computer-Aided Dispatch
- Automatic Dispatch
- Switching
- Street Routing
- Crew Monitoring
- Mobile Computing
- GPS Tracking
- Web Access
- Reporting
- Interfaces
- Configurable
- Commercial Off the Shelf



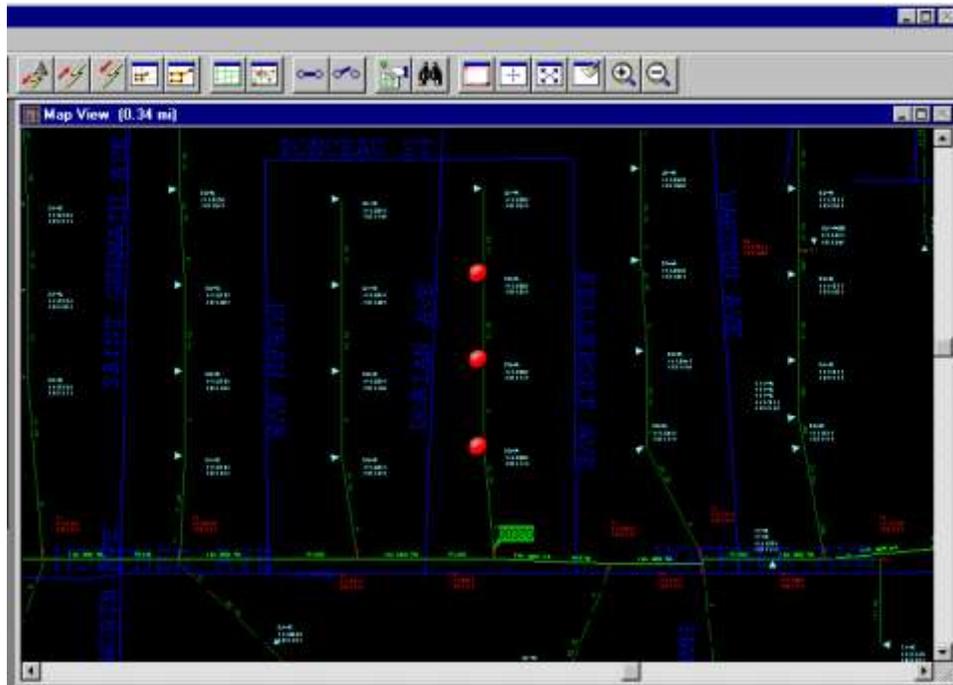
# InService Outage Management Capabilities

- Outage Analysis and Restoration
- Call Taking
- Planned and Adhoc Switching
- Device Tagging
- AMI Integration
- SCADA integration
- Reporting
- COTS Interface to G/Technology
- Interface support for external systems
  - IVR
  - CIS Call Taking



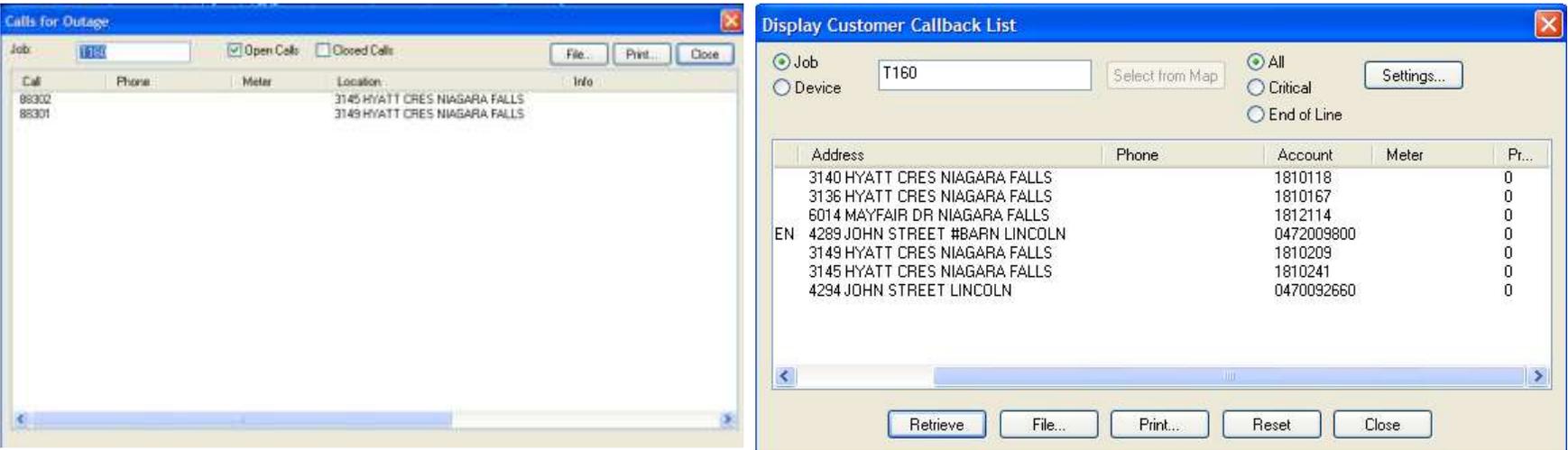
# Outage Analysis

- Trouble Analysis Engine predicts probable device of failure.
- Revises automatically based upon latest information.
- Accumulates calls to single event, avoiding duplication



# Outage Restoration

- Automatically identify affected customers
- Effective monitoring of outage conditions
- Up-to-the-minute customer outage statistics
- Reduction in overhead – no paper forms



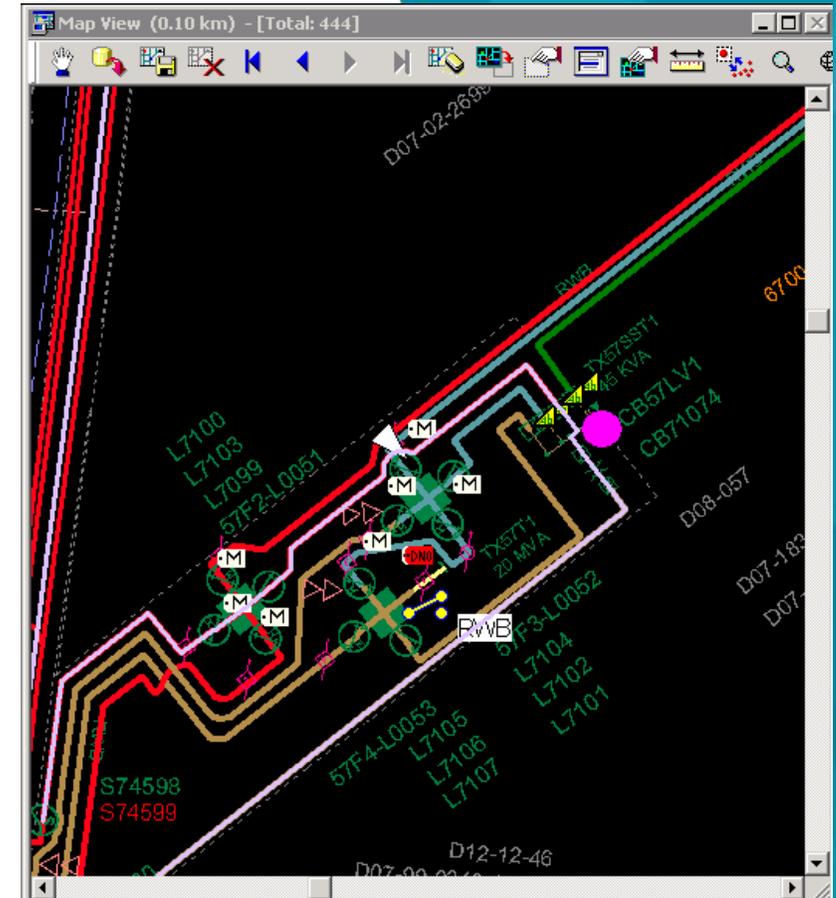
# Complex Analysis & Restoration

## Capabilities

- 🚗 Supports Large Volume of Calls
- 🚗 Partial Restoration Modeling
- 🚗 Customer tracking
- 🚗 Restoration switching
- 🚗 Network Tracing based upon real time status

## Benefits

- 🚗 Performance during peak call volume
- 🚗 Automatic determination of affected customers
- 🚗 Effective monitoring of outage conditions
- 🚗 Up-to-the-minute customer outage statistics



# Trouble Call Processing



- 🛒 Multiple methods of call entry
  - Within core product
  - Web call taking
  - Interface to external system
    - CIS/IVR or AMR

🛒 Eliminates manual paper processes

🛒 Automatic outage prediction

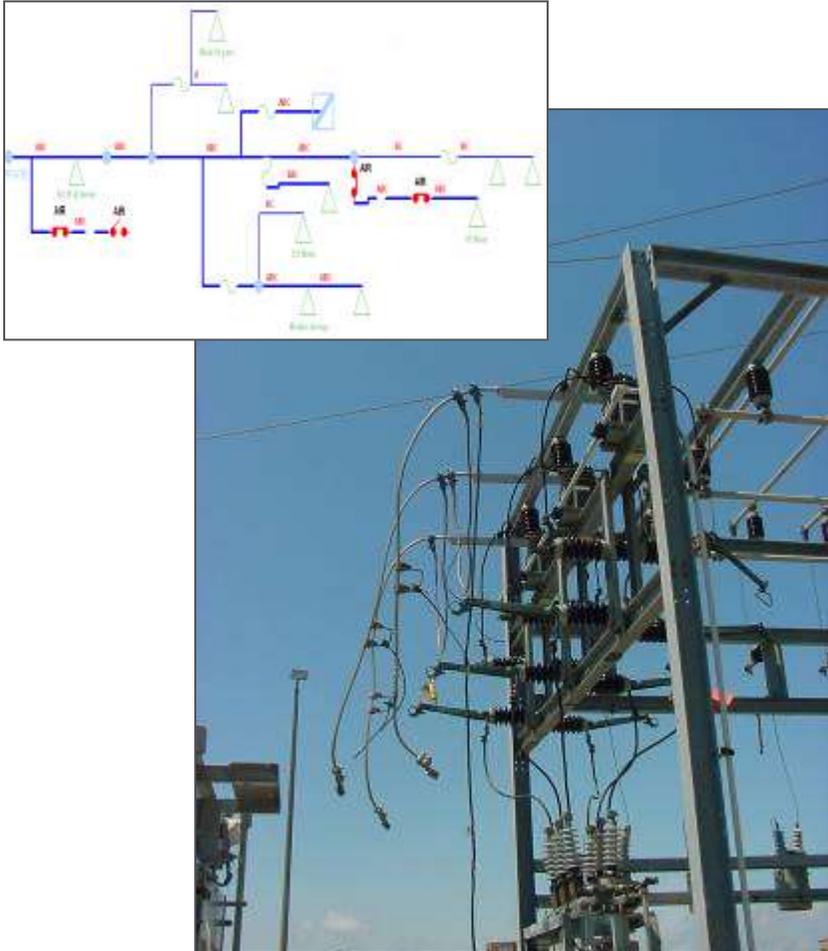
🛒 Outage status updates

🛒 Accurate outage status to customers

🛒 Off-the-shelf interfaces



# Network Management



- 🔌 Ability to use model as real time dynamic reflection of operational network
- 🔌 Restoration switching
- 🔌 Schematics
- 🔌 Open/close switching tie points
- 🔌 Place Cuts, Jumper and Temporary Devices
- 🔌 Graphically display tie points to other feeders
- 🔌 SCADA interface

# InService Mobile

## Capabilities

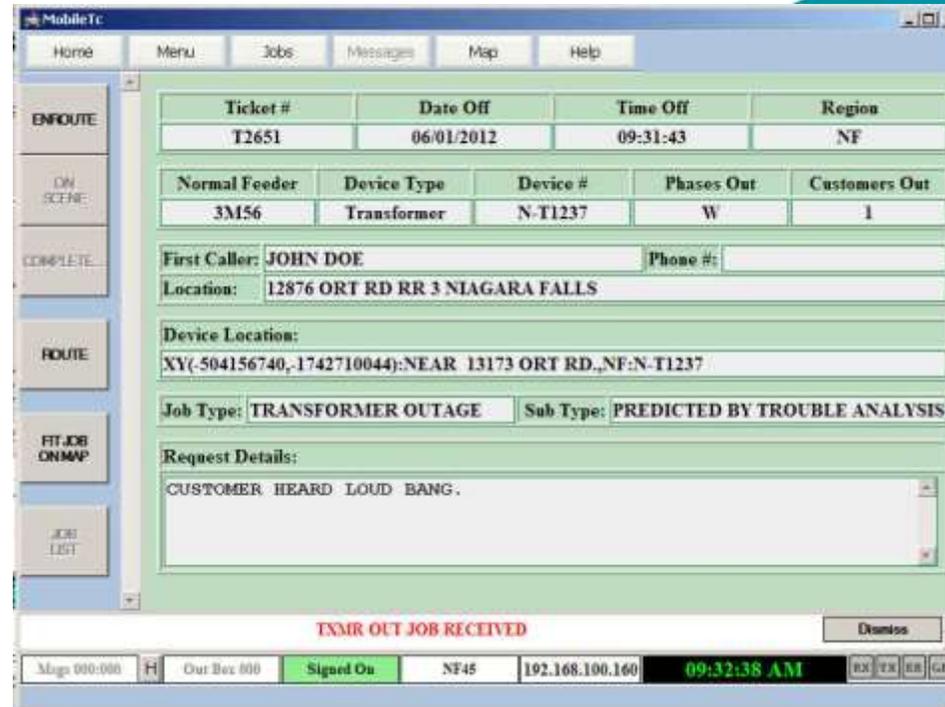
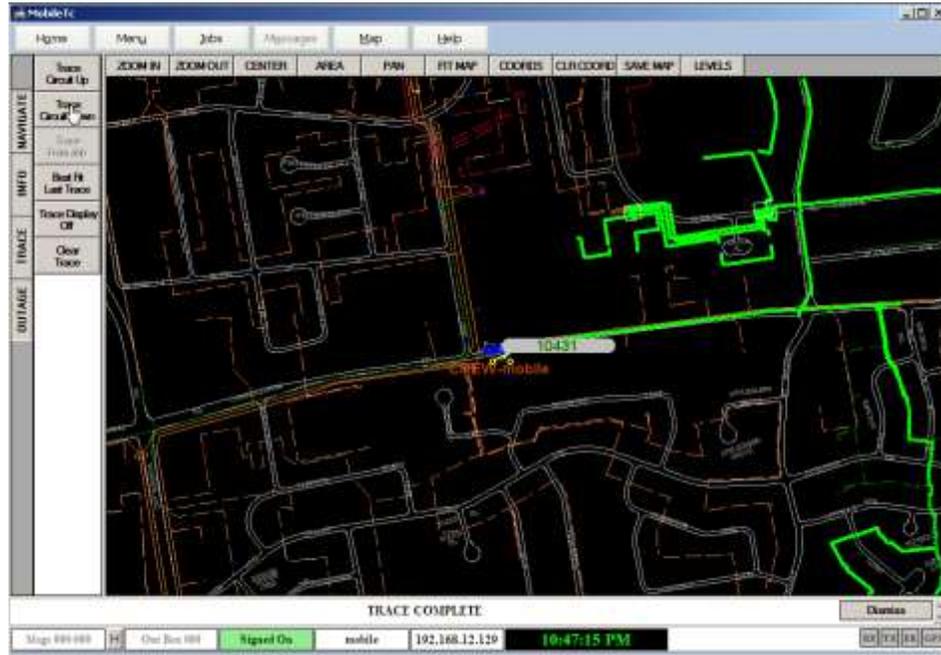
- 🚚 Enterprise platform for all work types
- 🚚 GPS tracking
- 🚚 Job assignments with geographic information
- 🚚 Job update & closure
- 🚚 Messaging
- 🚚 Seamlessly integrated with OMS
- 🚚 Electric Network Tracing

## Benefits

- 🚚 Eliminates paper tickets
- 🚚 More information relayed to field
- 🚚 Real-time feedback for customers
- 🚚 Decreased radio traffic
- 🚚 Better tracking for crew safety



# Mobile TC



# InService Outage Management

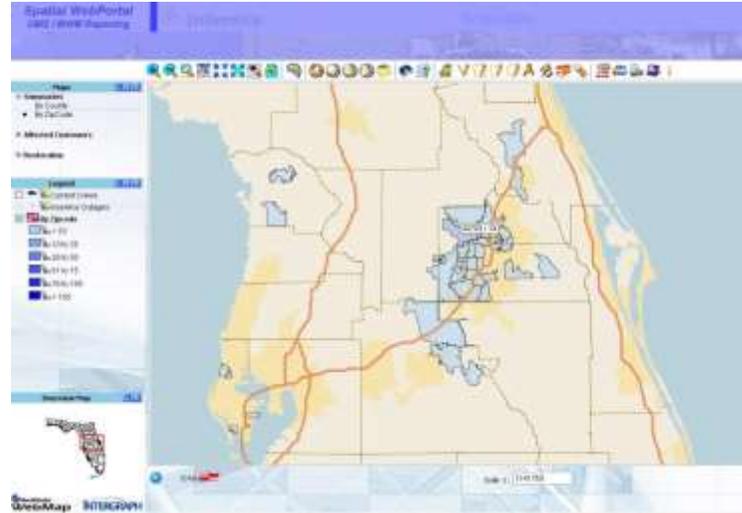
## Reporting

### Sample Reports

- Reliability index reports
- Trends
- Spatial Analysis
- Decision Support
- Executive Dashboards
- Crew & dispatcher performance
- Connectivity errors

### Benefits

- Productivity analysis of dispatchers and crews
- Flexible search criteria for reliability index reports
- Geospatial reliability analysis
- Ability to identify areas of potential improvement
- Proactive restoration increases revenue



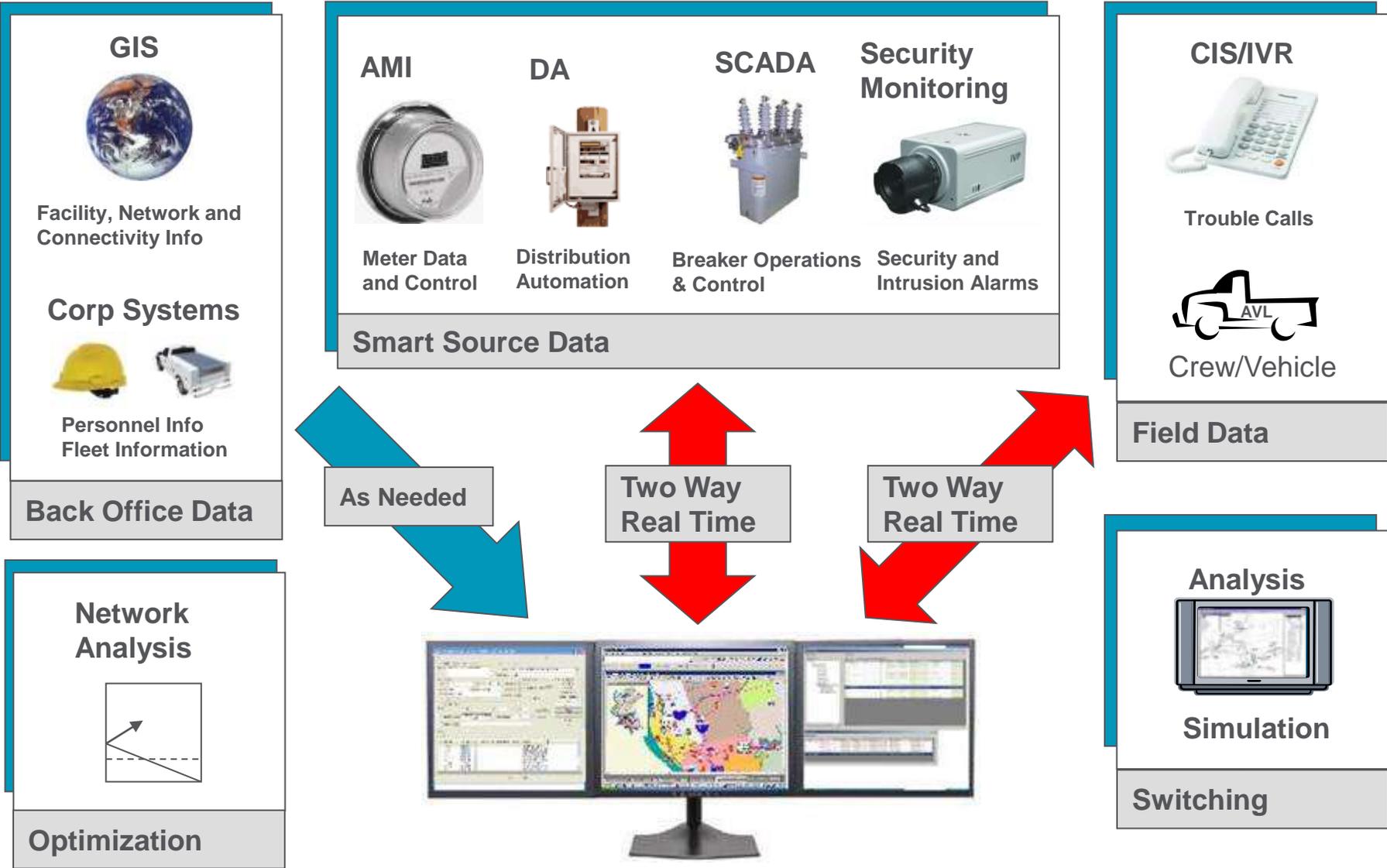
**System Reliability Stats by Month** **InService**  
Report Run Date: 7-Apr-09 11:30

Month	Customer Count	# Outage Events	Customer's Affected	Cust Outage Hours	SAIDI	SAIFI	CAIDI
March 2009	110,500	14	524	293.25	0.00265	0.00474	0.56
April 2009	110,750	1	108	525.90	0.00475	0.00098	4.85
<b>Reporting Period Totals:</b>		<b>15</b>	<b>632</b>	<b>819.15</b>	<b>0.00370</b>	<b>0.00286</b>	<b>1.29</b>

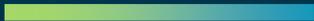
**Notes:**  
-Outage events of less than 1 minute are *not* included in this report

SAIDI: System Average Interruption Duration Index  
SAIFI: System Average Interruption Frequency Index  
CAIDI: Customer Average Interruption Duration Index

# Consolidated User Environment



# Further applications



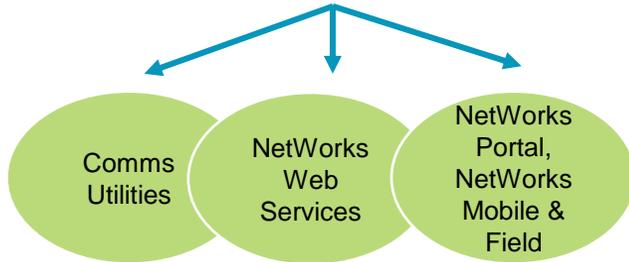
Integrated with the Digital Twin.



## Inventory management

HxGN NetWorks

Geospatial Asset Management



Business models

Services

Mobile



## Security

HxGN Safety Manager

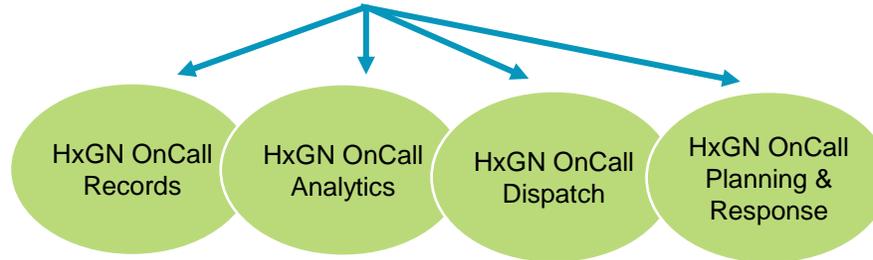
Physical Security Information Management



## Safety

HxGN OnCall Portfolio

Call-taking, dispatching, analytics & field mobility



Record management system

Business intelligence

Mobile



## Enterprise operation management

HxGN OnCall Planning & Response

Management of major incidents and events

Assets

Alarms

Events

Operations

# Smart Grid management with Hexagon

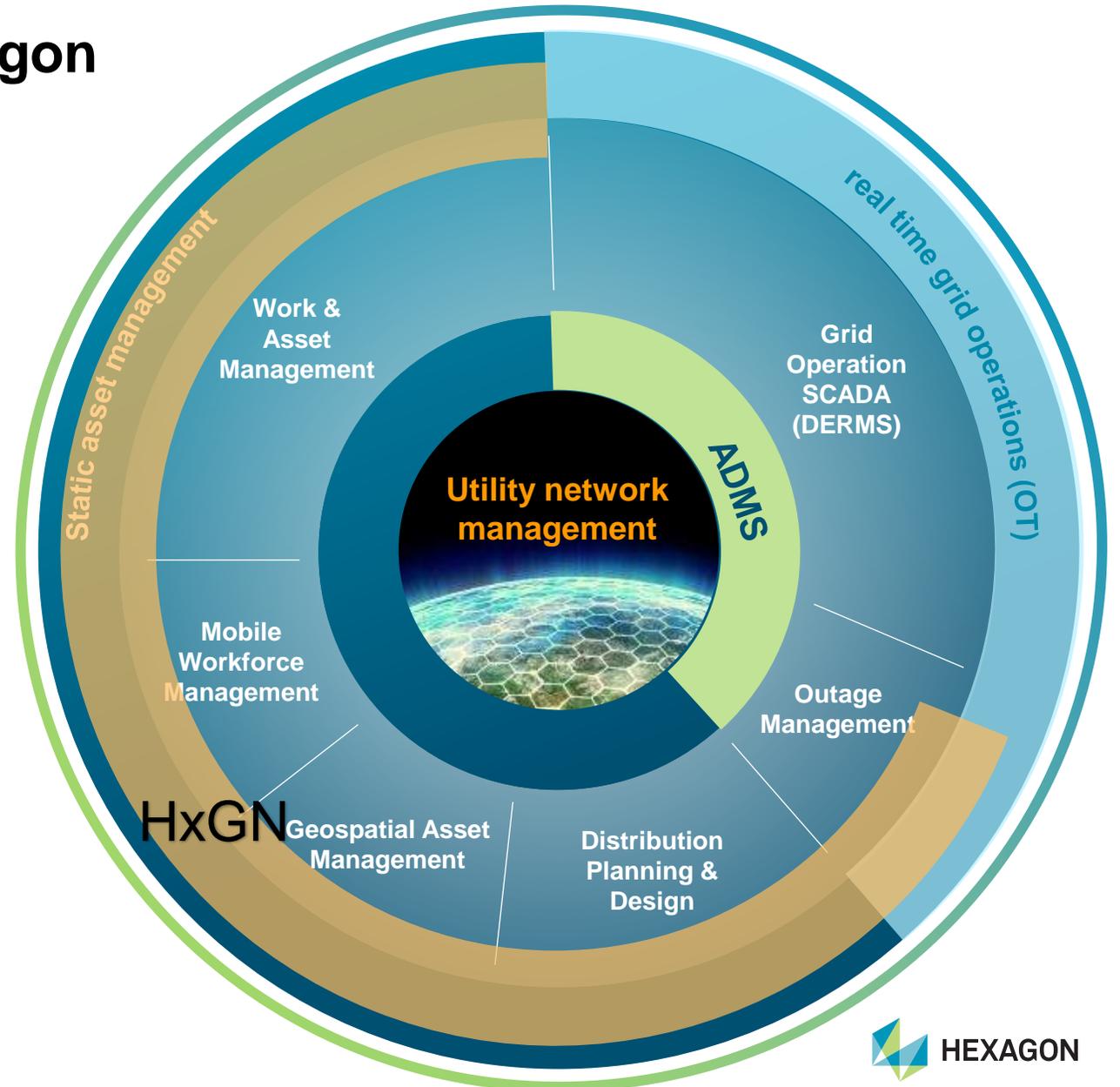
Planning, design, maintenance & repair of infrastructure assets.

Manage infrastructure work and **outage management** under **real-time grid operations**.

## Outcome:

- improve **efficiencies and customer services**,
- **adapt** to the market and technological changes
- reduce their **overall costs**.

ADMS – Advanced Distribution Management system  
DERMS - Distributed Energy Resources Management System



# Future applications

AR, VR, LiDAR, Underground, Satellite  
etc.

(contact us)

# Key Customers

# Iberdrola (Spain)

## Company information:

- Activities: funding, design, development, construction and maintenance of Electricity network (distribution) in Spain.
- Key numbers:
  - Number of clients: 11.03 million
  - High-voltage power lines: 24,059 km
  - Medium and low voltage power lines: 245,579 km
  - Transformer substations: 1,137
  - Transformer centers: 95,829

## Hexagon related information:

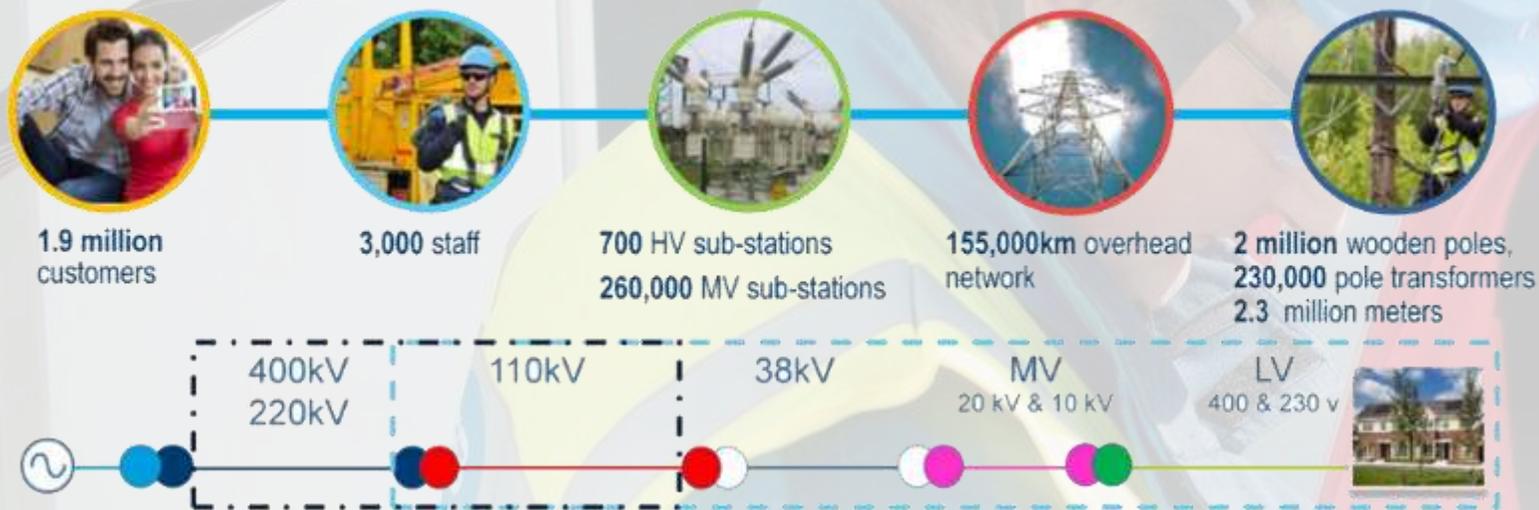
- 468 Designers licenses
- 8 NetWorks Professional (web) licenses
- The solution is integrated with:
  - SCADA (SPECTRUM)
  - SAP (work management, asset management)
  - CIS (customer information system)
  - Network calculation (Exadata, smart meters)
  - Mobility
  - Environmental system



# ESB (Ireland)



NETWORKS



- 150 Designers
- 1000+ Web users
- Integration with
  - SAP (ISU)
  - OMS
  - Calculation (Synergiee)



e.on

bayernwerk

# Bayernwerk GmbH (Germany)

## Company information:

- Activities: funding, design, development, construction and maintenance of Electricity and Gas networks (distribution and transmission) in the Bavarian region.
- Key numbers:
  - Medium and low voltage Power lines: 150.000 km
  - High voltage Power lines: 30 km
  - Transformer stations: 44.000
  - Gas lines: 5,000 km

## Hexagon related information:

- 500+ Designers licenses
- 10+ NetWorks Professional (web) licenses
- 1000+ Mobile users
- The solution is integrated with:
  - SCADA for Electricity and OMS for Sas
  - SAP (work management, asset management)
  - Calculation
  - Mobile Work force mgt (Klick Software)
  - Environmental system

# E.ON (Czech Republic)



## Company information:

- Activities: funding, design, development, construction and maintenance of Electricity, Gas and Telecommunication networks (distribution) in the south Bohemian and South Moravian region.
- Key numbers:
  - Number of clients: 1.5M for electricity + 115K for gas
  - Medium and low voltage Power lines: 80.000 km
  - Gas lines: 5,000 km
  - Telecom lines: 5,000 km

## Hexagon related information:

- 60 Designers licenses
- 2 NetWorks Professional (web) licenses
- 600 Mobile users
- The solution is integrated with:
  - SCADA for Electricity and OMS for Gas
  - SAP (work management, asset management)
  - Network Calculation
    - Gascor for gas
    - Daisy and Simone for Electricity
  - Czech Cadaster
  - Mobility
  - Environmental system

# SMUD (United States)



- Company information: Located in Sacramento, California, 6<sup>th</sup> largest community-owned electric utility, committed to being zero carbon by 2030
- Company highlights:
  - Number of clients: 644,723
  - Service area: 900 square miles
  - Miles of power lines: 10,912
  - Smart meters: 600,000

## Hexagon related information:

- 60 designers licenses
- 80 NetWorks NetViewer licenses
- InService Suite
- The solution is integrated with:
  - SCADA/ADMS (OSI)
  - SAP (work management, asset management)
  - CIS (customer information system)
  - Network calculation (Exadata, smart meters)
  - HxGN InService



# EPB of Chattanooga (United States)

- Company information: Most resilient smart grid power distribution in the US, community-wide 100% fiber optic infrastructure
- Company highlights:
  - EPB Smart Network clients: 48,635
  - EPB Fiber Optics Customers: 121,259
  - EPB customers licensed 2,997 solar share panels
  - Miles of fiber: 9,000 in a 600-mile radius
  - Gig city: First to offer 1 Gig-speed internet  
First in the world to offer 10 Gigs-speed internet
  - Smart switches and sensors: 200,000

## Hexagon related information:

- 35 Networks Designers licenses
- 30 NetWorks Comms licenses
- Community benefits: In 2021, an independent study of EPB's smart grid documented \$2.7 billion in community benefit in the grid's first ten years of life.



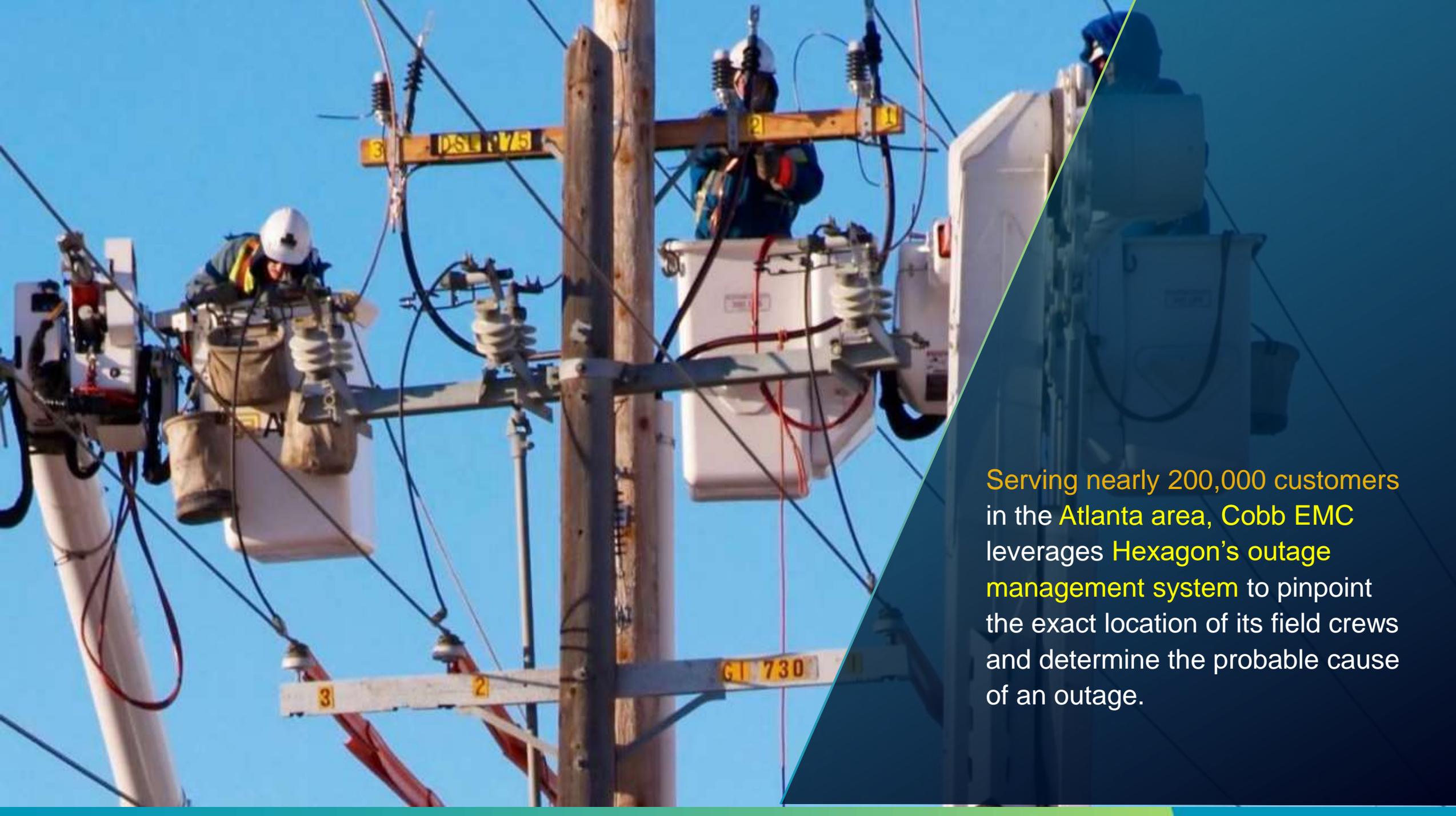
# Alectra (Canada)

- Company information: Formed by the merger of 5 utilities, Alectra Utilities is now the largest municipally-owned electric utility in Canada.
- Company highlights:
  - Number of clients: 1M+
  - Square-KM service territory: 1,924
  - Overhead and underground lines: 21,581
  - Transformer substations: 14
  - Municipal substations: 149

## Hexagon related information:

- 70 Designers licenses
- NetWorks Framework and Web Services for Viewing
- 18 GeoMedia Licenses for Analytics
- 100 Networks Field Review/Update for Inspections
- The solution is integrated with:
  - OMS using a Common Operating Model
  - SmartPlant Foundation for document management and nomenclature
- Competitive process to select the Geographic Engineering Records system after merger. Hexagon selected due to our electrical modeling, data integrity, scalability, and ability to most accurately create and maintain a digital twin.





Serving nearly 200,000 customers in the Atlanta area, Cobb EMC leverages Hexagon's outage management system to pinpoint the exact location of its field crews and determine the probable cause of an outage.



Hexagon helped **Oncor Electric Delivery** detect and correct **20 percent** of outages before customers knew they occurred.



Global leader in **smart digital reality solutions**  
that are empowering an autonomous, sustainable future by putting data to work

(Source: NASA)

# The Smart Digital Reality

Two worlds, ONE reality  
Workflow-driven  
Real time and autonomous

## Reality Capture



Data  
Collection

Real World

Digital Twin

capture & transfer

visualise & analyse

The Smart Digital Reality

Data  
Leverage

## Intelligence engine

- Reality capture data sets
- 3D models
- Connection to persistent data sets
- Enrichment with real-time data sets
- Two-way integration & interaction
- Autonomous decision-making & actions

physical activities

define actions

- Plan
- Build
- Operate & Maintain
- Secure

# The Smart Digital Reality

Two worlds, ONE reality  
Workflow-driven  
Real time and autonomous

## Reality Capture



Data  
Collection

Real World

Digital Twin

capture & transfer

visualise & analyse

The Smart Digital Reality

physical activities

define actions

## Business Outcomes



Leverage  
Data

- Plan
- Build
- Operate & Maintain
- Secure

# Hexagon in brief



## INNOVATION at scale

10-12% of revenues for R&D

~5,000 R&D employees

Thousands of active patents

Complementary emerging tech  
through acquisitions (170+ in 21 yrs)



## RELEVANCY that is vital

Serving manufacturing,  
infrastructure, construction, city  
services and more

Solutions that drive fewer inputs,  
less waste and less pollution from  
**efficiency, productivity, quality  
and safety** gains



## STABILITY that is proven

€500mn (2000) to €3.8bn (2020)

**More than 21,000 employees  
across 50 countries**

Increasing role in customers'  
businesses



## SUSTAINABILITY integral to our strategy

Committed to driving profitable  
business value that ensures  
economic growth, but **not at the  
expense of the planet or people**

# The contributors to our vision and mission

We rely on the unique contributions that each of our businesses add to the whole.

## Manufacturing Intelligence

Converging design and engineering, production and metrology solutions to enable smart factories for digital transformation.



## Asset Lifecycle Intelligence

Enterprise engineering solutions that empower customers to design, construct, and operate more profitable, safe, and sustainable industrial facilities.



## Mining

Solving the toughest surface and underground challenges with proven technologies for planning, operations and safety.



## Safety, Infrastructure & Geospatial

Improving the resilience of critical services and infrastructure by transforming complex data into meaningful information for better decision-making.



## Geosystems

A comprehensive portfolio of digital solutions that capture, measure and visualise the physical world and enable data-driven transformation across countless ecosystems.



## Agriculture

Enabling better planning, efficient execution, precise machine controls and automated workflows to improve agricultural efficiency and productivity.



## Autonomy & Positioning

Pioneering end-to-end solutions for assured positioning and correction for land, sea and air.



## Xalt Solutions

Accelerating digital transformation by solving workplace challenges with the industry's most agile framework.



# Safety, Infrastructure & Geospatial division

Making the world's critical services and infrastructure more resilient and sustainable

Public safety



Utilities & communications



Smart  
digital reality

Government

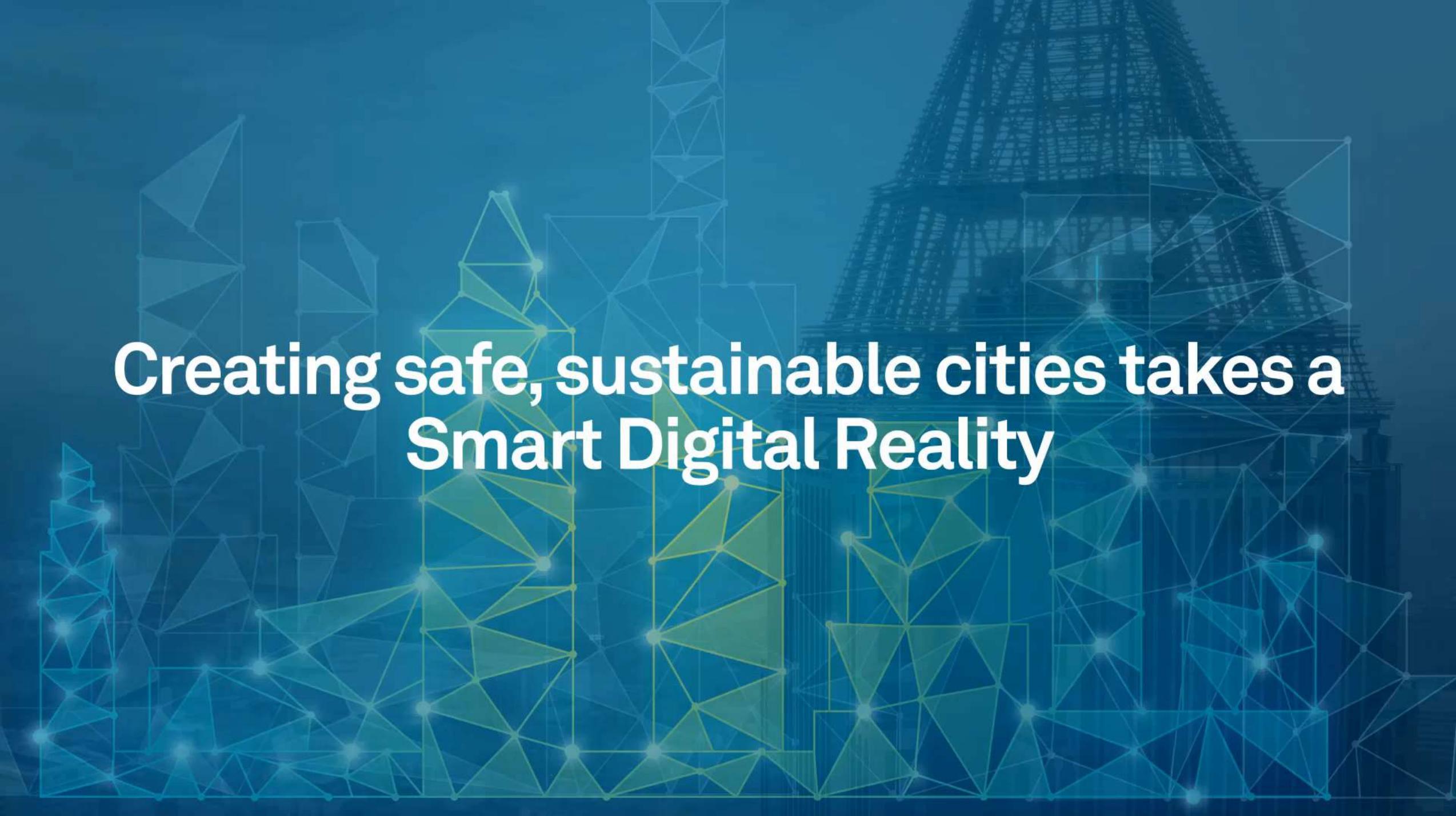


Defense



Transportation





**Creating safe, sustainable cities takes a  
Smart Digital Reality**

# THANK YOU

Learn more about Hexagon network digital twins

<https://hxgnutilities.com>

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