Big Data for Big Power

How Smart Is The Grid If The Infrastructure Is Stupid?

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AWAKENING YOUR 6th SENSE

Big Data From a Sensor Manufacturer Perspective

Photoacoustic Gas Monitors


NDIR Infrared Gas Modules & Instruments

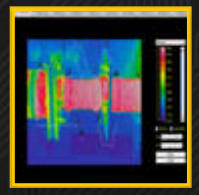
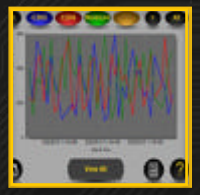



Fiber Optics Temperature Measurement Solutions


Infrared Thermal Imaging

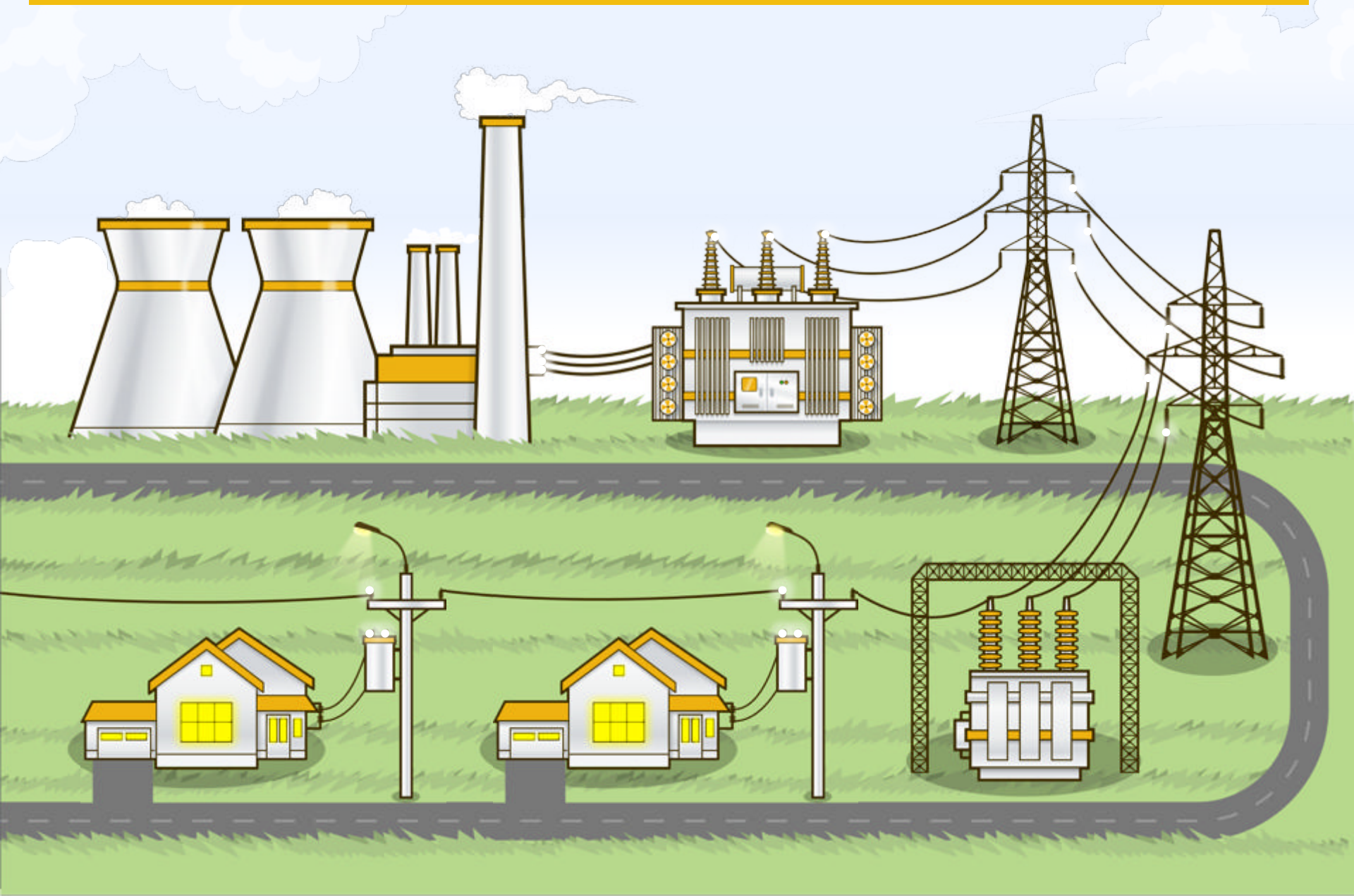


Infrared Thermometry for Non-Contact Temperature Measurement

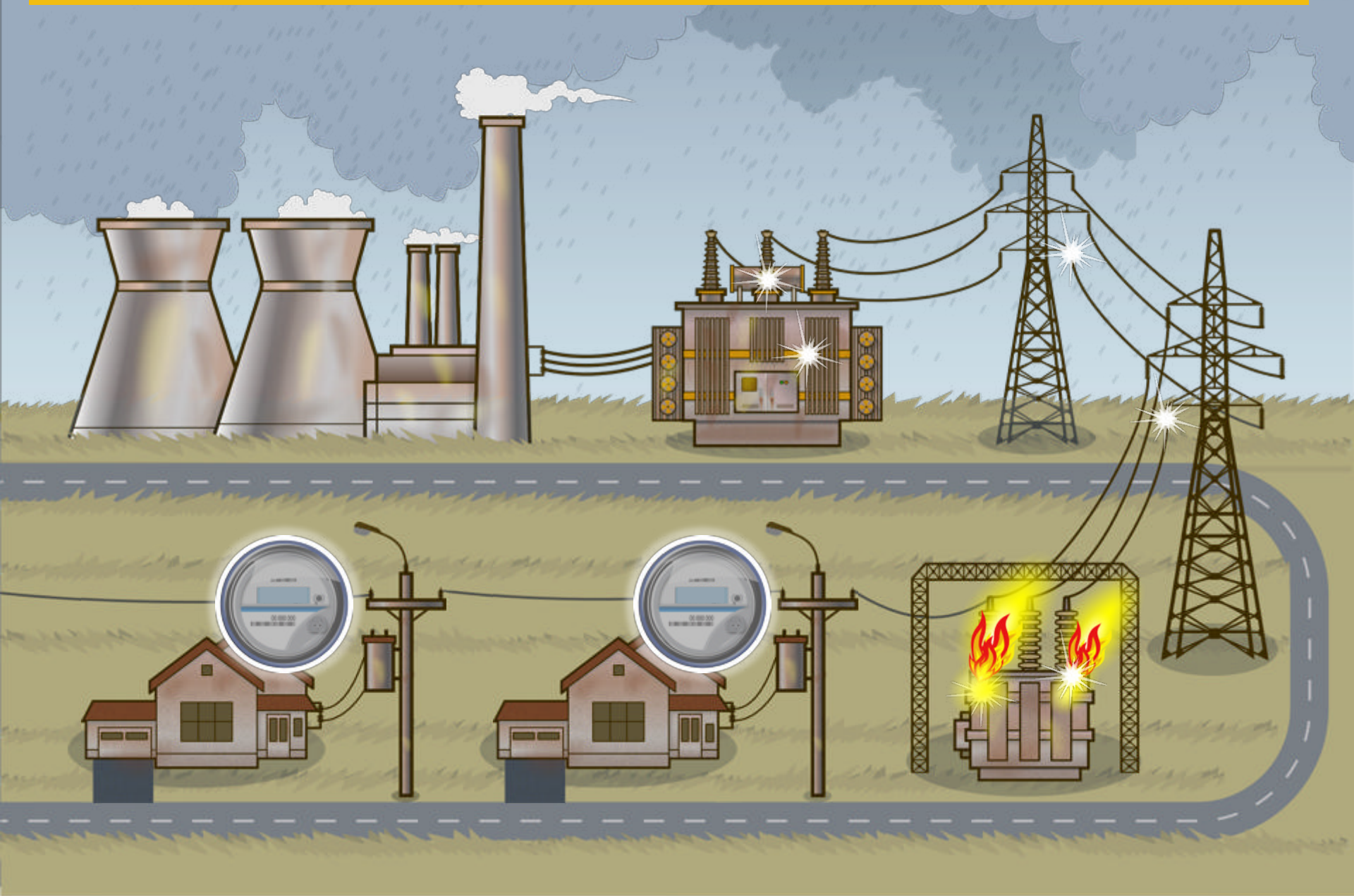



Software & Integrated Solutions

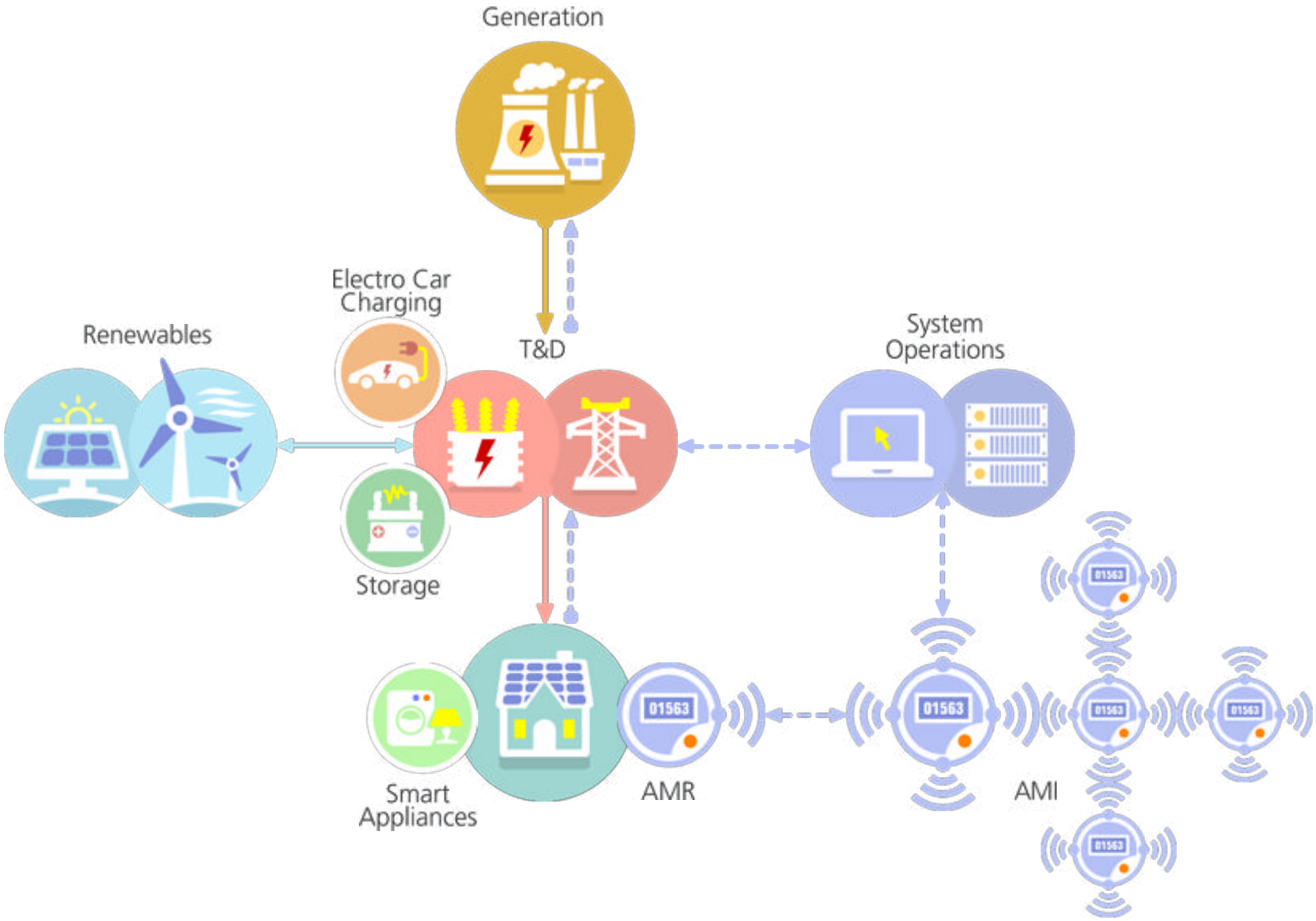
Electric Grid



Electric Grid



Development of the Smart Grid



Obstacles to Building a Smart Grid Infrastructure

01. Budget

02. Time

03. Not In My Back Yard

04. Downtime needed to build new infrastructure

05. Integration of Renewables

06. Qualified Personnel

07. Build Absolutely Nothing Anywhere Near Anyone

08. Cyber Security

Today's "Old" Substations

- 40-50 years in age
- Limited communications in/ out of substation
- Assets running at 75% to 100% of nameplate

- Limited ability to do maintenance (criticality, parts, personnel)
- Knowledgeable people on substations retiring and/or leaving

- Minimal sensors and data
- Cannot afford to replace or update (budget, disruption)
- Huge risk of failure

Doing Nothing

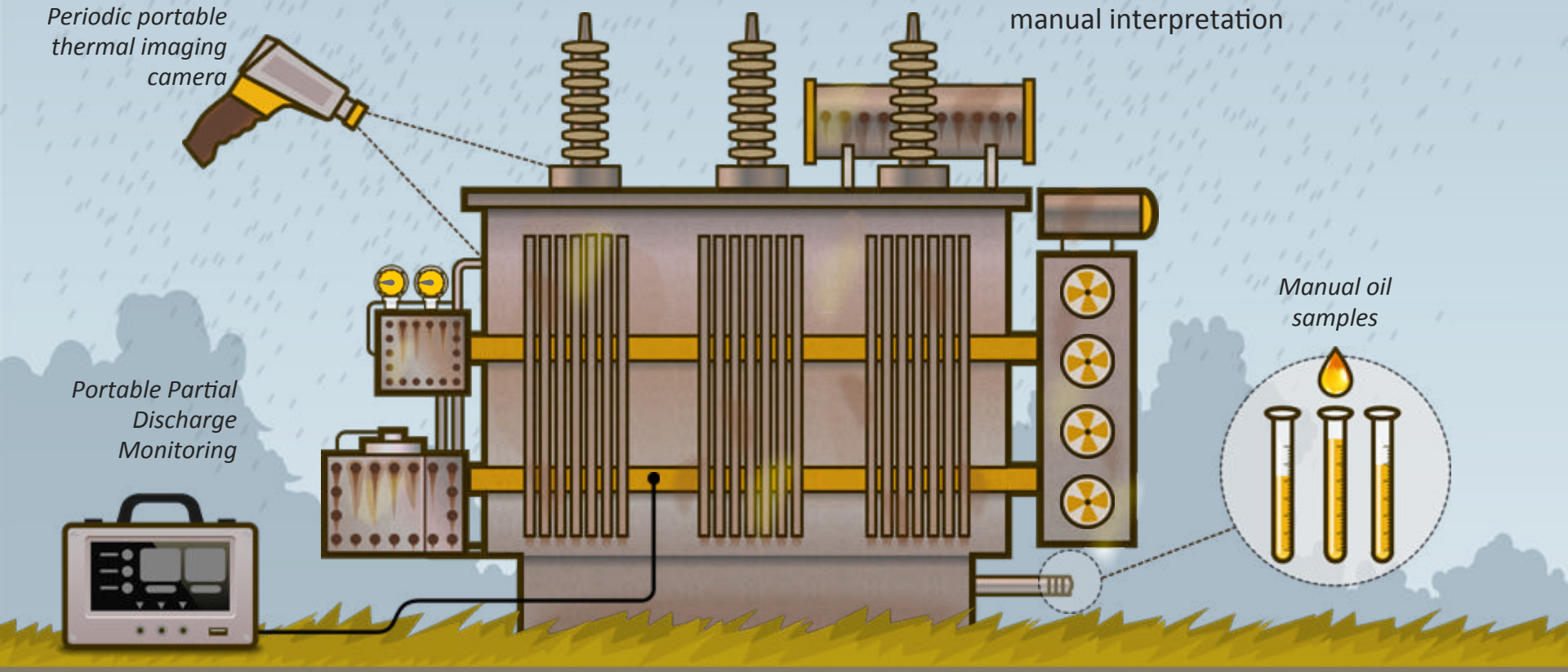
is

Not an Option

Covering Your Substation Assets

OLD SUBSTATION

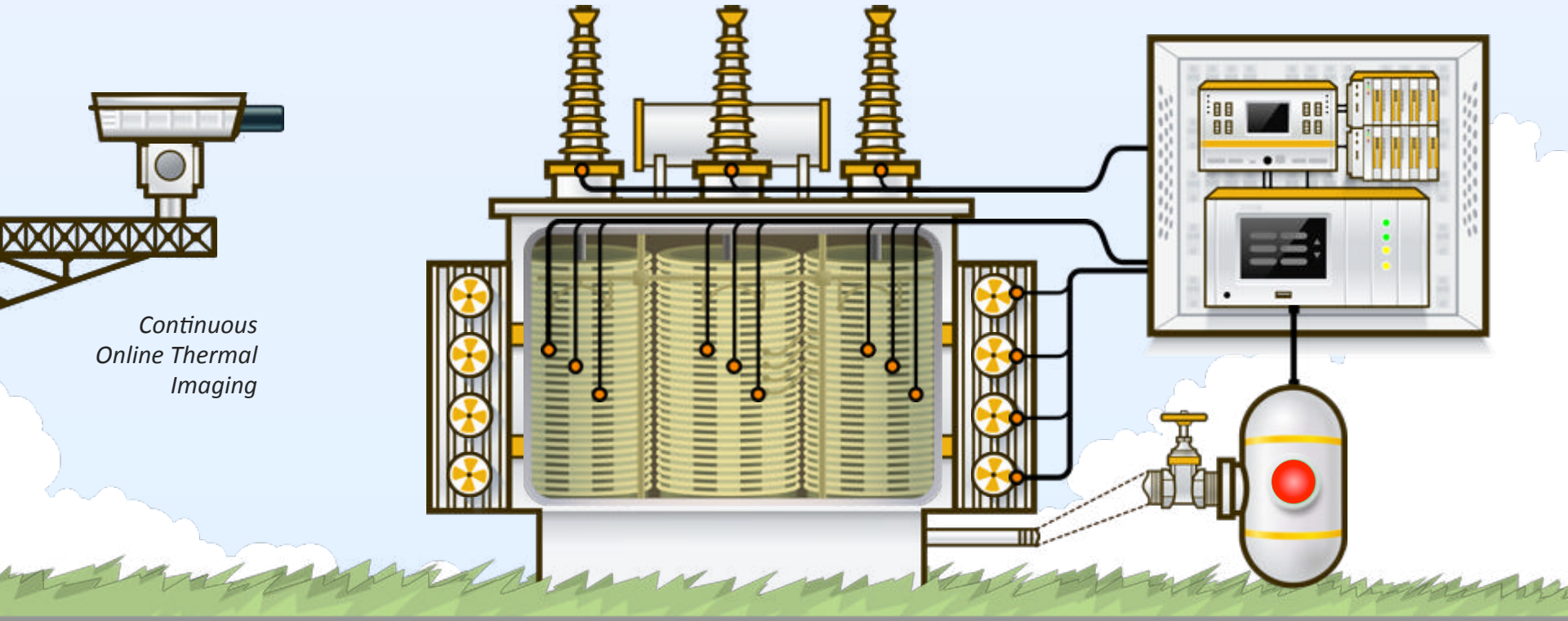
- Analog Gauges: analog outputs, log readings
- Visual indicators and sight glasses
- Shifty log readings looking for physical wear and broken parts
- Assets over 40 years old, overdesigned and heavily loaded to 100% nameplate or higher
- Aged workforce, in general less experienced
- Manual samples, manual analysis, manual interpretation



Covering Your Substation Asset

NEW SUBSTATION

- Solid state sensors with intelligence
- Data concentrator to pull data together from multiple sensors
- More remote, less local
- Most assets under 20 years old
- Aged workforce, in general less experienced
- 10-fold increase in sensors, 1,000-fold increase in data
- Assets designed to nameplate and loaded 75-100%



Continuous Online Thermal Imaging

Sensor Technologies for Transmission and Substations

SLEx™ - Substation Life Extension

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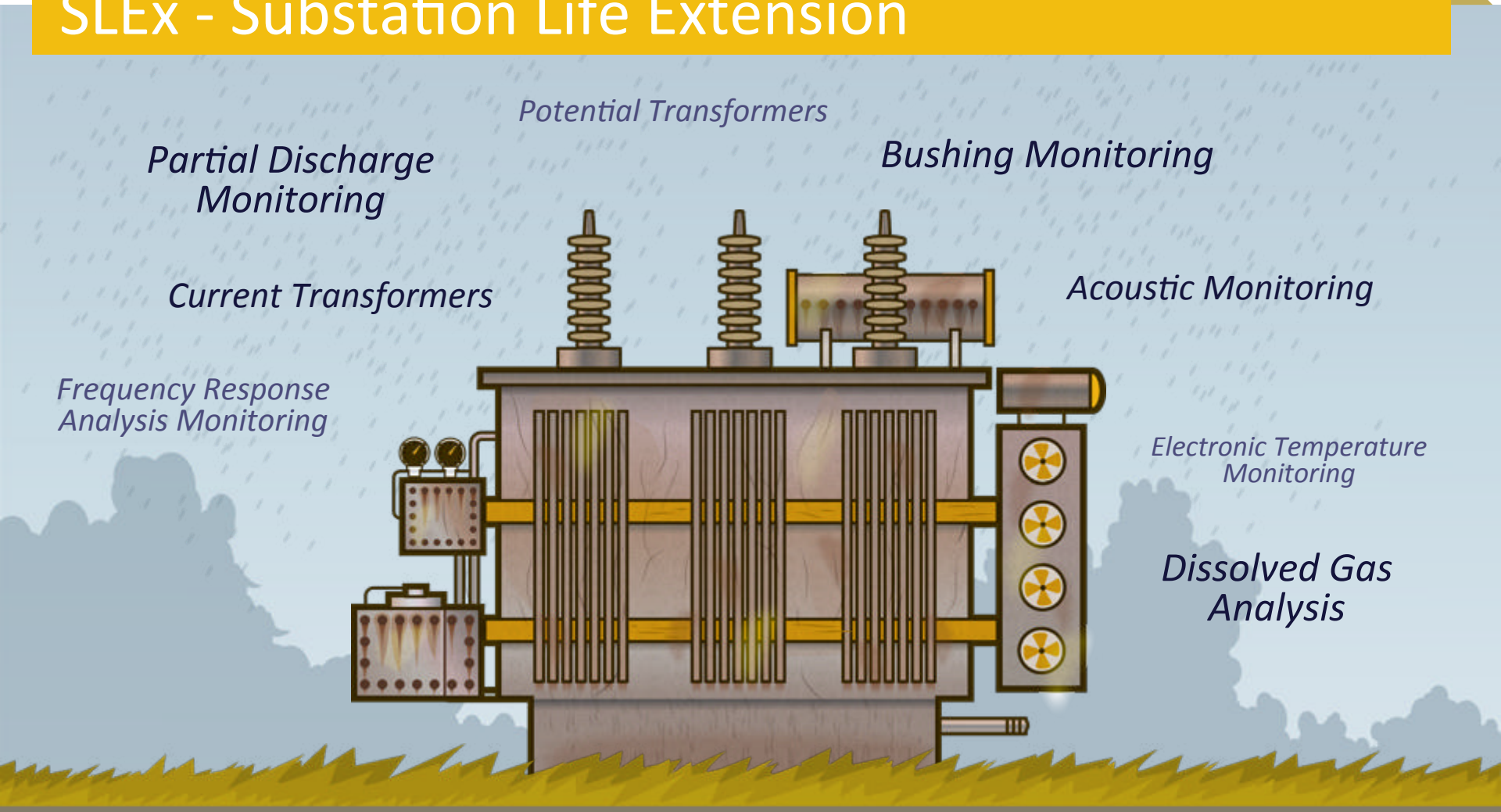
Extending the life of aged assets by "sensoring up" components to provide insight and information on their condition to enable:

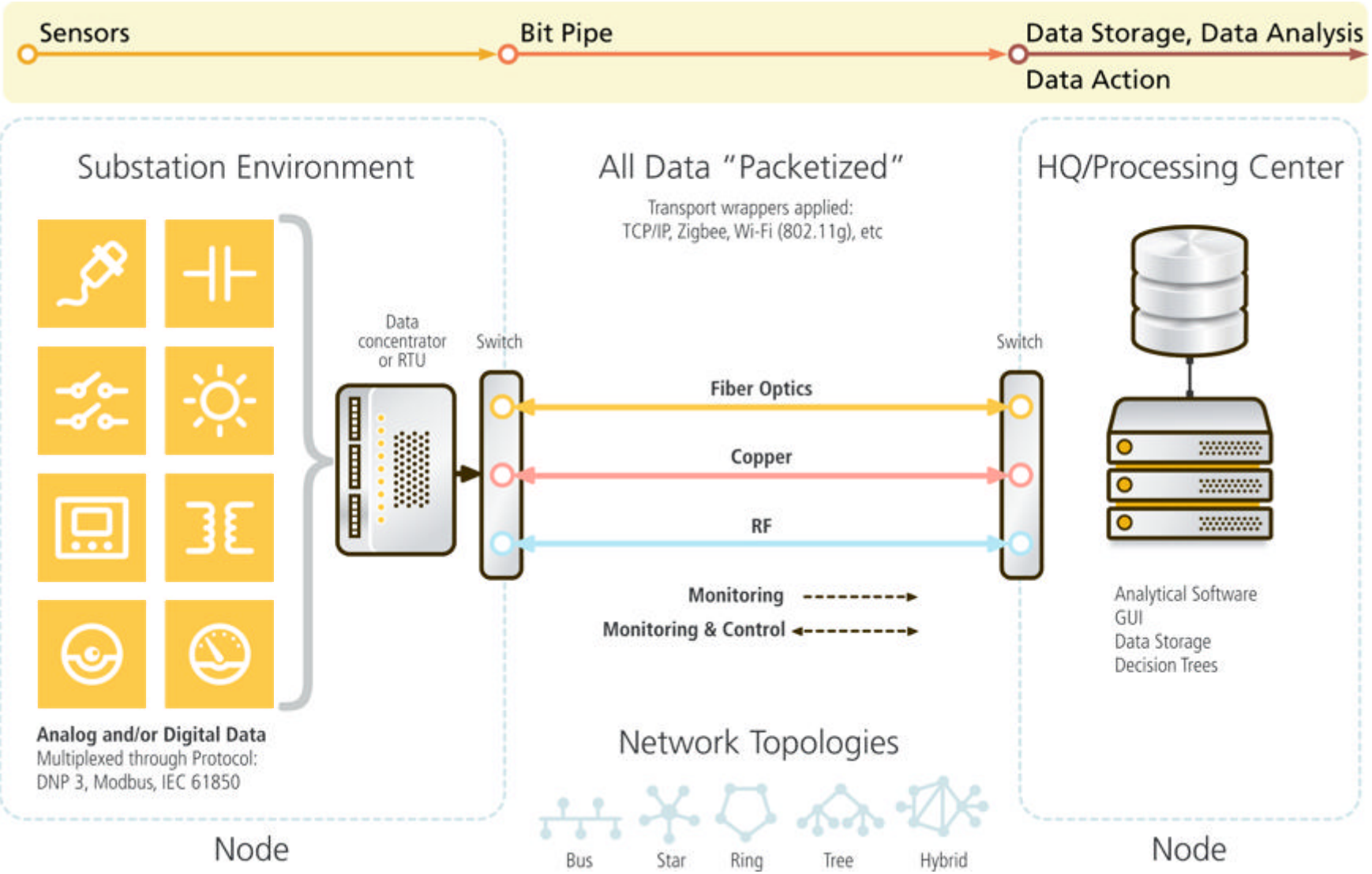
- Condition Based Maintenance
- Safe Dynamic Loading
- ICR – Intelligent Component Replacement
- Maximize Asset Performance
- Safe Life Extension
- Safety
- Workforce Deployment
- Forensic and Diagnostic Analysis
- Probabilistic Risk Assessment

LumaSense Technologies

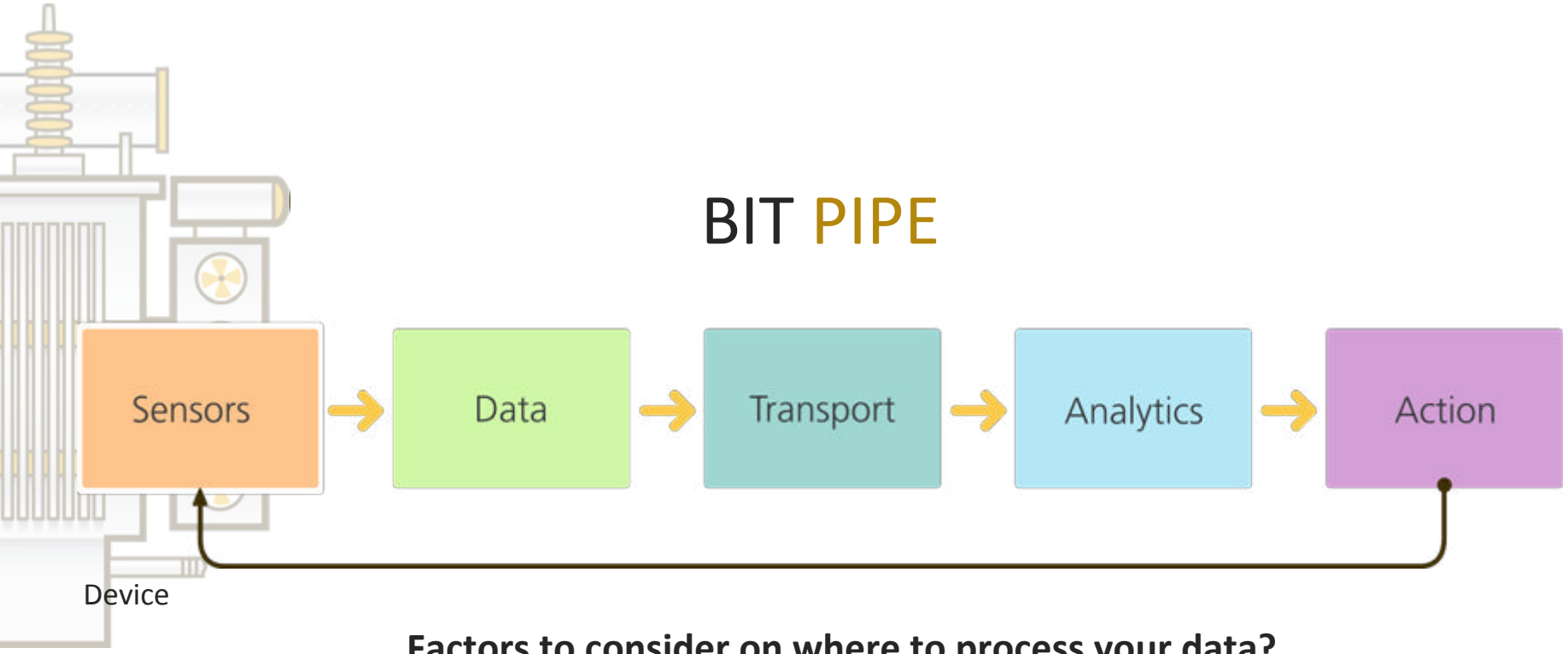
SLEx - Substation Life Extension



Typical Data Flow



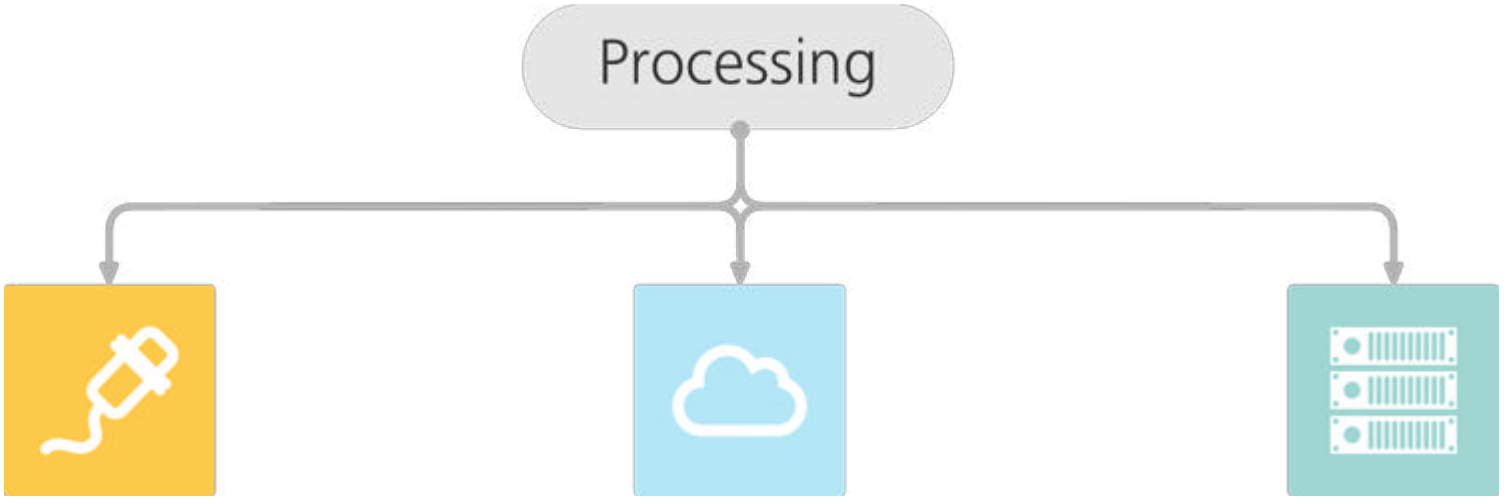
Where Do You Process Your Data?



Factors to consider on where to process your data?

- Cost
- Bandwidth
- Security - NERC CIP
- Stability/Reliability
- Integrity
- Size of Network

Where Do You Process Your Data?



AT THE EDGE

- Moving processing/intelligence to the sensor head
- Will drive the cost of the sensor up - "sensor protection"
- Must be comfortable with data and decisions occurring somewhere else - outside of headquarters
- Allows for fast data action with minimal chance of interruption

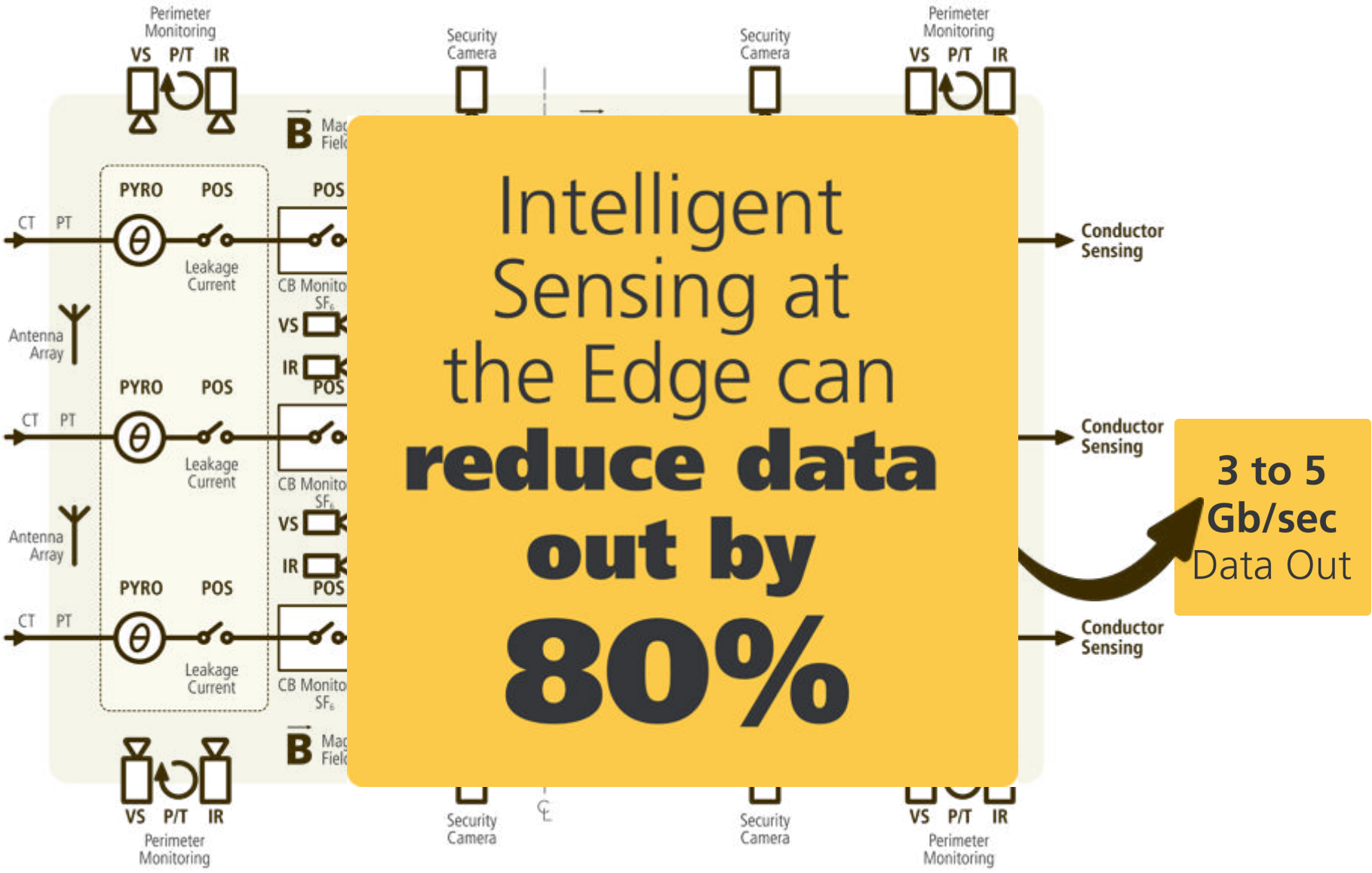
IN THE CLOUD

- Easy to get information into and out of the cloud
- Concerns of virtual and physical attacks, disabling infrastructure and stealing data
- NERC CIP concerns on data security in the “CLOUD”

IN THE SERVER

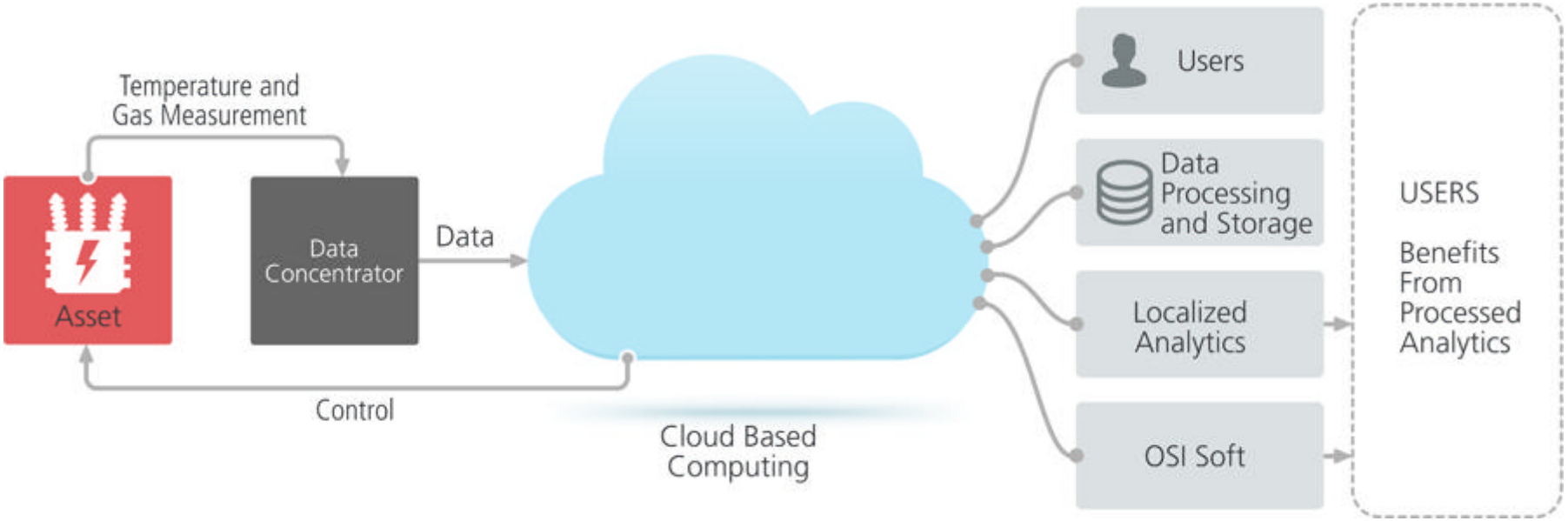
- Processing to occur at one location and can physically secure and control this data storage and analytics
- Provides an infrastructure overload scenario by having to allow for such large bandwidth to accumulate streams of data pouring in
- Will involve "inherent" delays in processing and decisions

Sensors Can Deliver Big Data

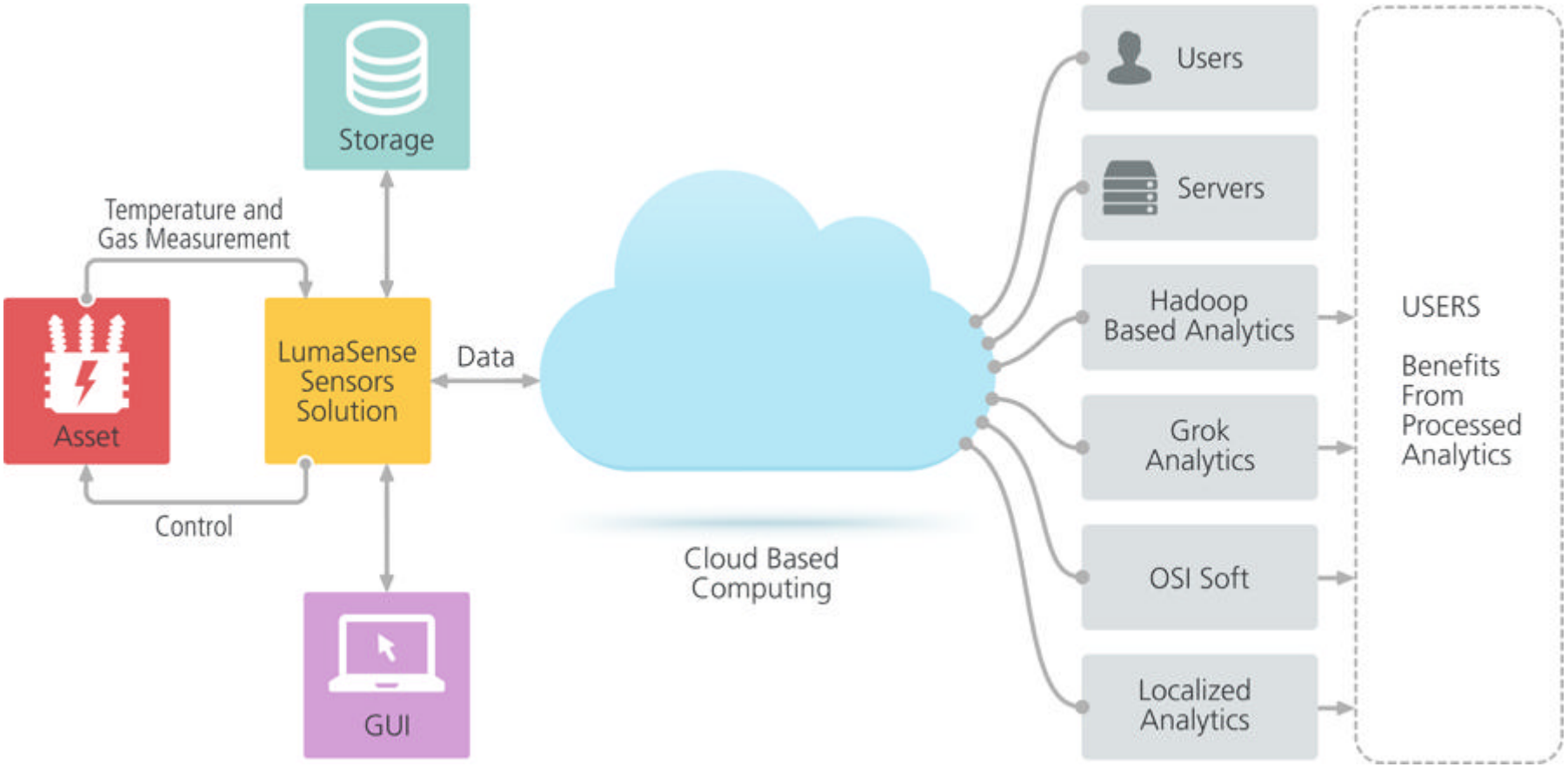


LumaSense Technologies

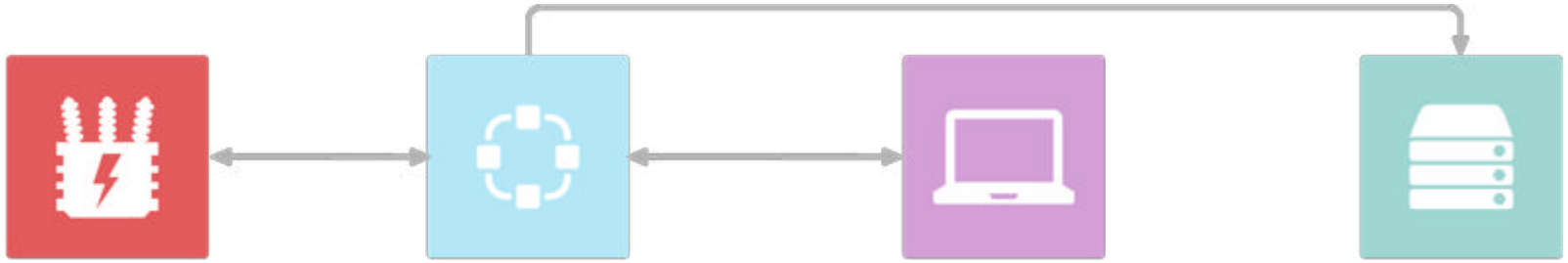
Past Sensing Philosophy



Future Sensing Philosophy



Data Flow Failure Mechanisms



SUBSTATION

- Sensor Failure
- Environmental
- "Cut" Communications
- Power Failures
- Physical Attack
- Interference
- Failed Redundancy
- Data Corruption
- Encoding Issues
- Decoding Issues

TOPOLOGY DEPENDENT FAILURES

- Data Corruption
- Hacking
- Environmental
- Overload/Bandwidth
- Physical Attack
- Virtual Attack
- Wrong Configuration
- Failed Redundancy
- Physical Connection Failure
- Switch Failure
- Power Failure
- Interference

SERVER

- Server Attack
- Server Virus
- Server/Component Failure
- Power Failures
- Decoding Issues
- Encoding Issues

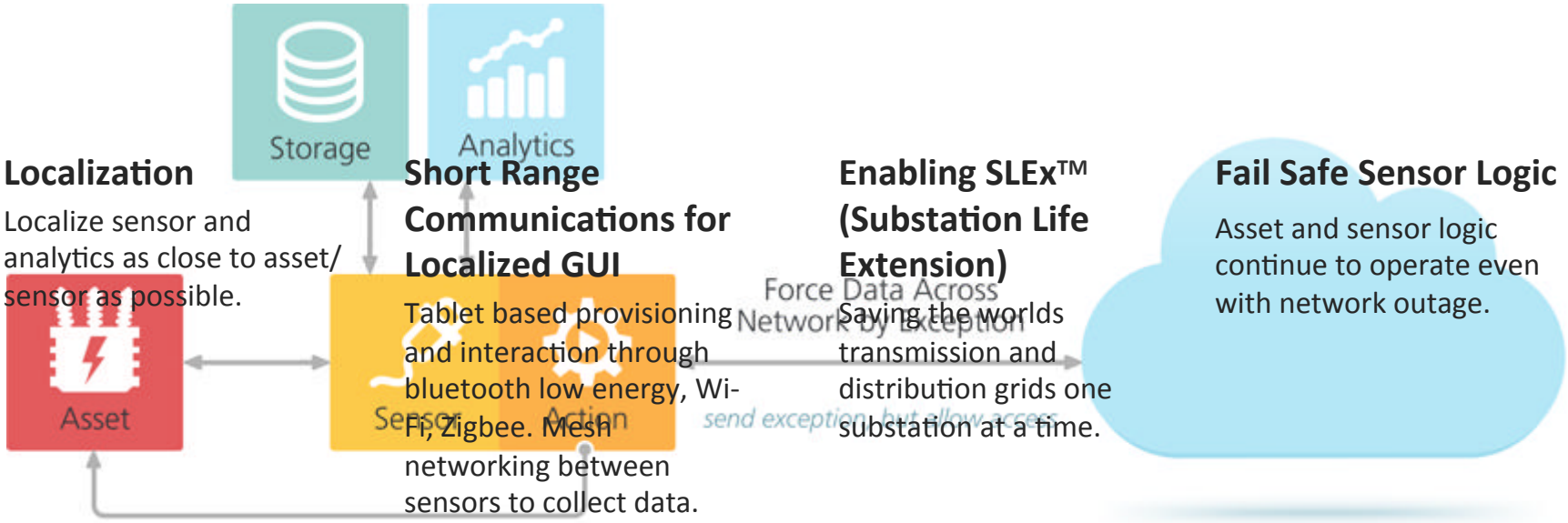
USER STATION

- User Station Virus
- User Hacking
- User Error

What is Intelligent Sensing at the Edge?

Intelligent Sensing at the Edge

- Move decisions/actions/analytics as close to senor head as possible.
- Data Storage
- Report by exception only... not all data



Localization

Localize sensor and analytics as close to asset/ sensor as possible.

Short Range Communications for Localized GUI

Tablet based provisioning and interaction through bluetooth low energy, Wi-Fi, Zigbee. Mesh networking between sensors to collect data.

Enabling SLEx™ (Substation Life Extension)

Saving the worlds transmission and distribution grids one substation at a time.

Fail Safe Sensor Logic

Asset and sensor logic continue to operate even with network outage.

SUMMARY

- Intelligent Sensing Is Needed To Enable The Smart Grid Reality
- Building New Everything Is Not A Reality Given Many Obstacles

BIG SENSORS CREATE BIG DATA

- And It Is Needed And It Is Here To Stay

THE DATA CREATED BY SENSORS IS NEEDED

- Enhance SLEx™
- Enable CBM and Asset Optimization

MOVE TO HAVE MORE ANALYSIS, DATA STORAGE, AND CONTROL TO THE SENSOR HEADS

- Save the Bit Pipe
- Security Concerns
- Minimize the Effects of Communication Failures
- Minimize Time to Decision

REPORT BY EXCEPTION

- Not continuous Streaming Data
- Intelligent Sensing at the Edge
- Data Buffered When Network is Offline


Thank you
Questions?