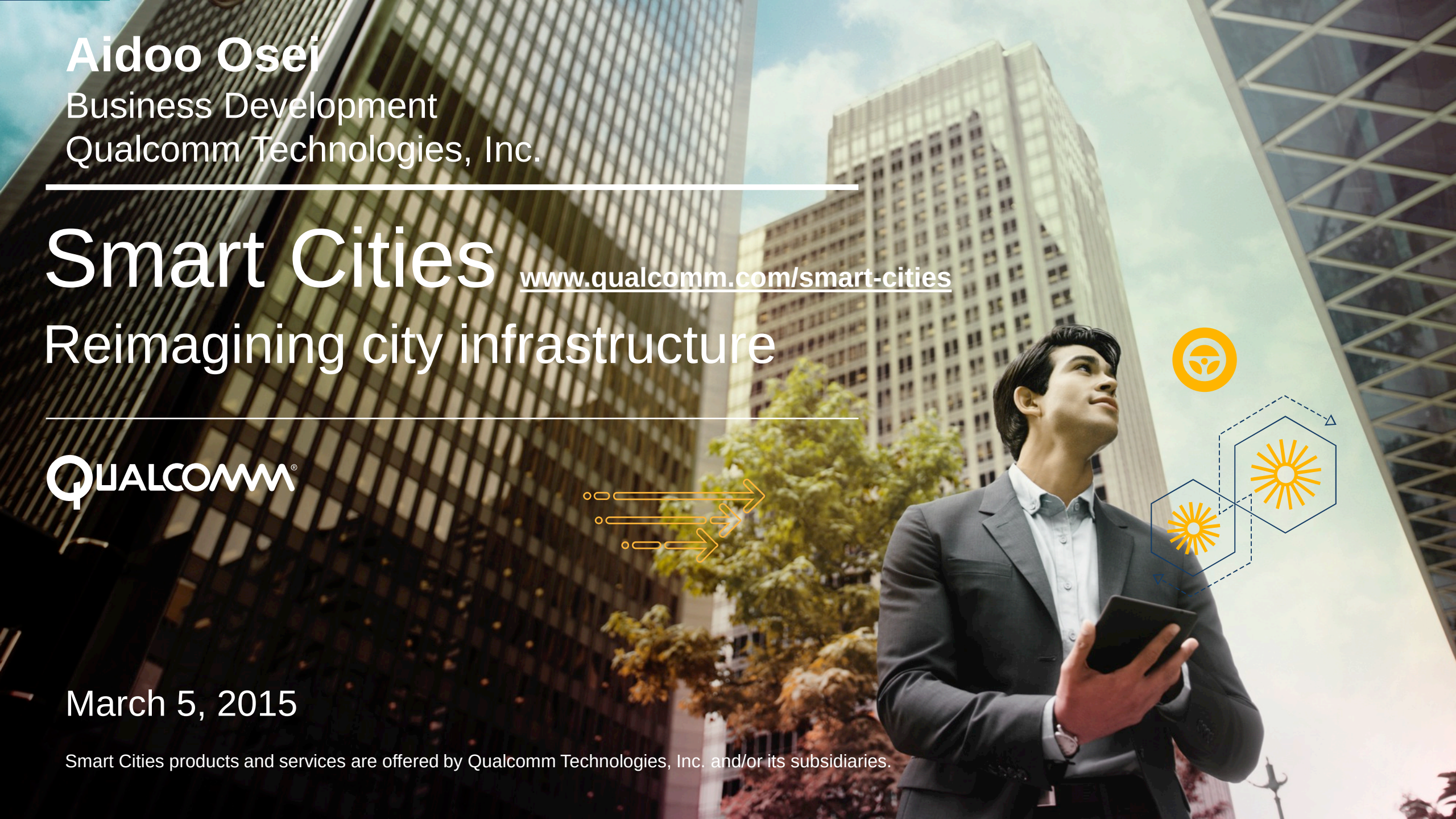
Aidoo Osei
Business Development
Qualcomm Technologies, Inc.

Smart Cities

www.qualcomm.com/smart-cities

Reimagining city infrastructure

QUALCOMM®



March 5, 2015

Surge in connected things has already begun

25B

Lights

Smart Meter

PEV

Security Cameras

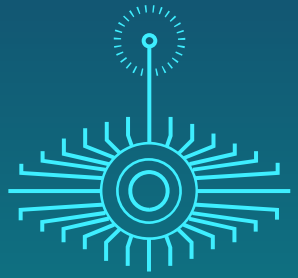
Smart Grid

Driven by powerful technological and generational trends

Smarter

1000x Anticipated data traffic growth driven by more connection and richer content

More connected



~75% US 18-24 year olds reach for smartphone immediately after waking up

~8B Cumulative smartphone shipments 2014-2018[2]

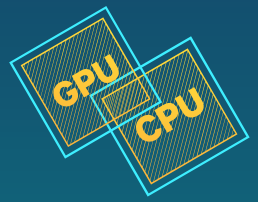
Sources: [1]Machina Research, April '13, IDC Mar '13. 2Gartner June '14

Technologies “Under the Hood”

Key Requirements for IoE Products

Multimedia

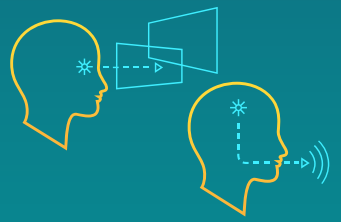
Power Management



GPU & CPU

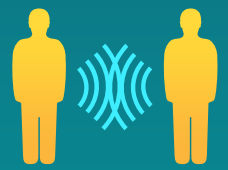
DSP & Sensor Hub

Software/ HLOS



Visual Computing Voice Processing

Wi-Fi/ Bluetooth



Peer to Peer

Position Location

Security

Reimagining City **Infrastructure**

From single-purpose to multi-purpose

Single-purpose: Payphone

- Phone calls
- Emergency services

Multi-purpose: Communication Kiosk

- Free Wi-Fi
- Free Phone Calls
- Emergency Services
- City Services
- Digital Advertising

Single-purpose: Street Lighting

- Lighting

Multi-purpose: "Smart Node"

- Lighting management
- Video feeds
- Wi-Fi hotspot
- Urban intelligence sensors
- Emergency lighting indicators

Reimagining City **Infrastructure**

From single-purpose to multi-purpose

Single-purpose: Trash Can

- Trash collection

Multi-purpose: Connected Waste Station

- Self-compacting trash collections
- Real time status
- Wi-Fi hotspot
- Urban intelligence sensors
- Solar powered

Single-purpose: Parking Meter

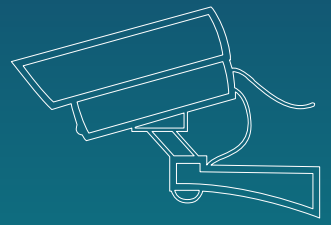
- Revenue generation

Multi-purpose: Smart Meter + Car Detection

- Multiple payment options
- Real-time revenue information
- Vehicle detection
- Solar powered

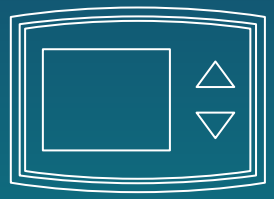
Smart Buildings

Connectivity solutions to increase efficiencies, revenues and cost savings



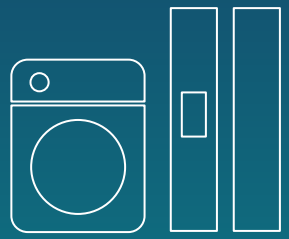
Security

Remote monitoring of building facilities and residents for increased peace of mind.



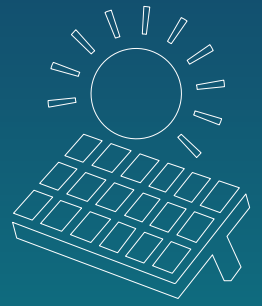
Heating / Cooling

Monitor HVAC usage and optimize usage per current weather conditions and power rates.



Appliances

Enable interoperability between appliances for advanced home automation.



Power / Solar

Monitor and optimize energy production & consumption in real-time.

Commercial Real Estate

Personalization

Technology: Bluetooth Smart Beacons

Benefits: Provides indoor context for app users

Examples: Museums, Sporting Areas, Shopping Malls

Digital Engagement

Technology: Augmented Reality

Benefits: Drives digital + physical engagement

Examples: Gaming/Shopping | Malls, Commercial Mixed Use

Commercial Real Estate

Transportation

Technology: Cellular, Wi-Fi, BLE Telematics

Benefits: Facilitate vehicle / bicycle sharing

Examples: Private campus, residential program

EV Fleet Management

Technology: Halo Wireless EV

Benefits: Hassle-free charging

Examples: Residential, Commercial, Office Park

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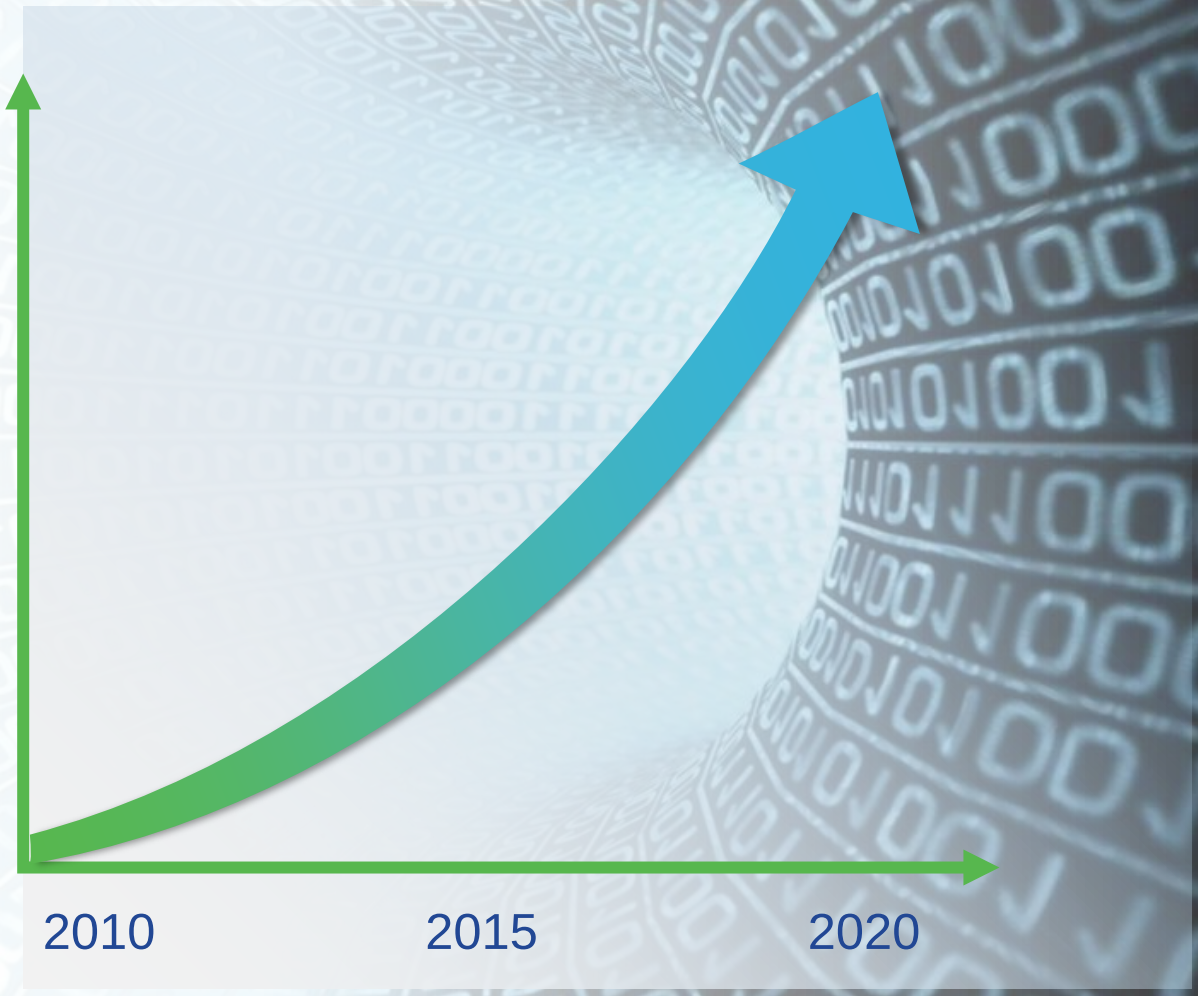
Era of Exponential Digitalization

Explosion of Growth on the Internet		
Connections		
7.3B	18.2B	50B
Data		
3ZB	10ZB	40ZB
Applications		
10.7B	182.7B	???



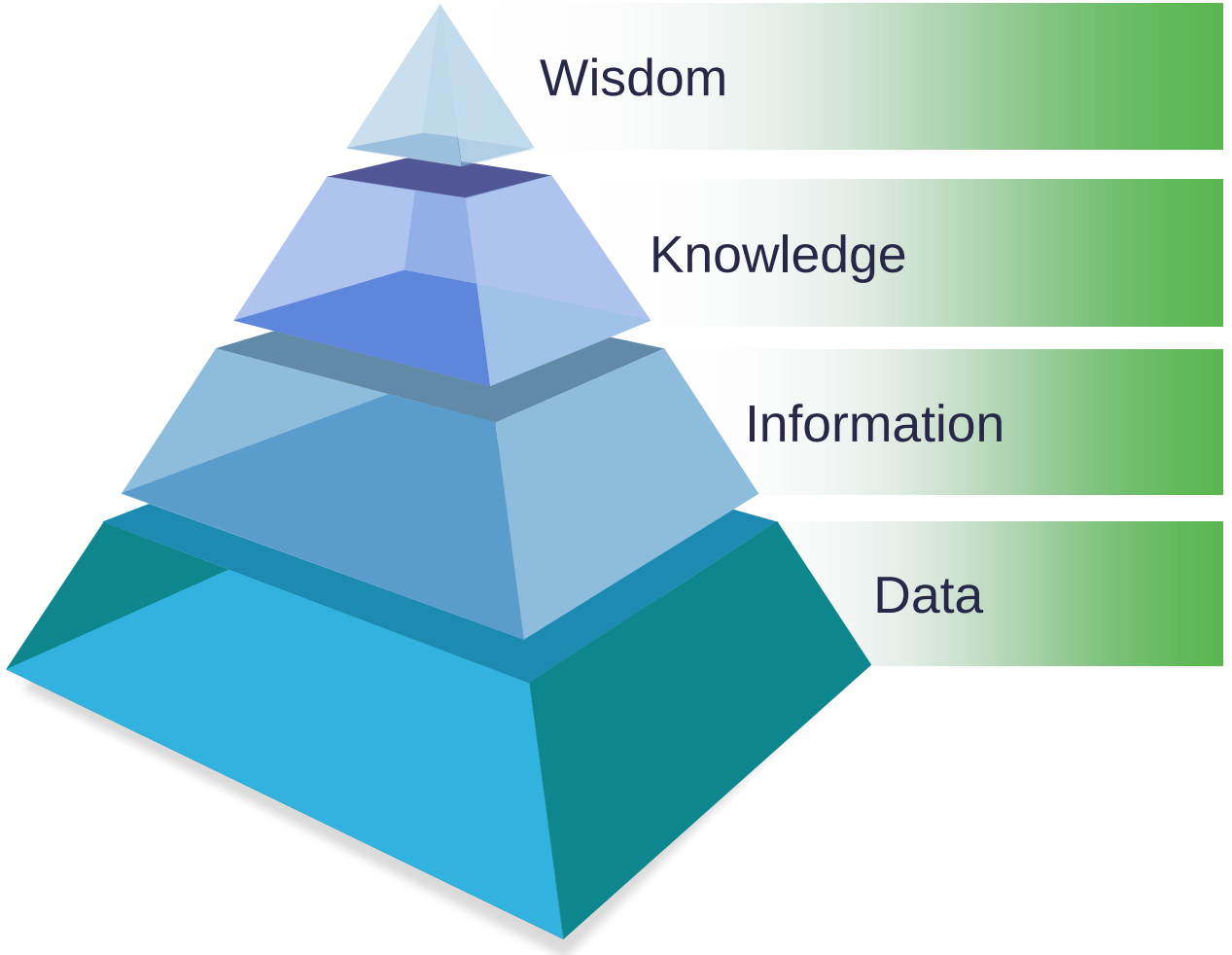
Transforming Data into Actionable Intelligence

End-to-End Analytics

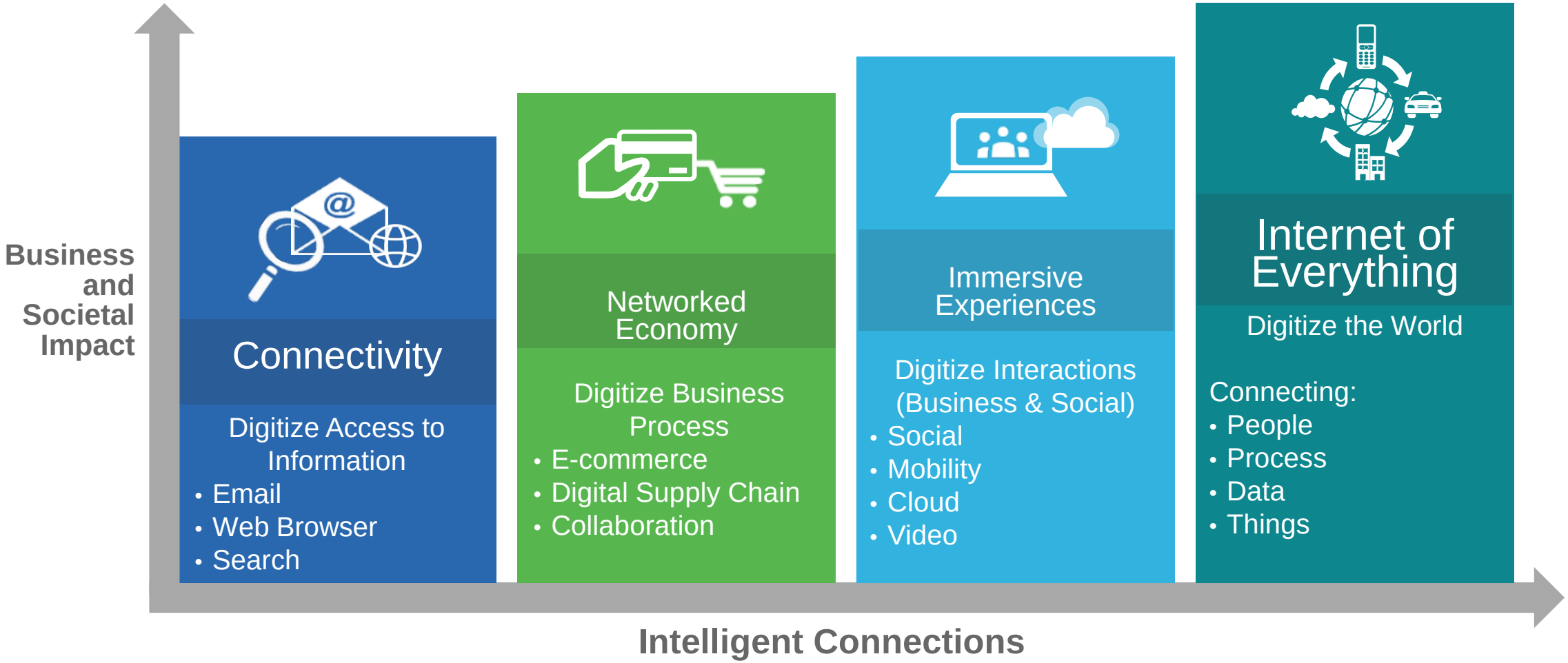
from the Edge to the Data Center

- Scenario Planning
- Decision-Making
- Process Re-Engineering

Creating Bigger and Newer Opp'ys for Cities



Evolution of the Internet



Every Org'n and Every City

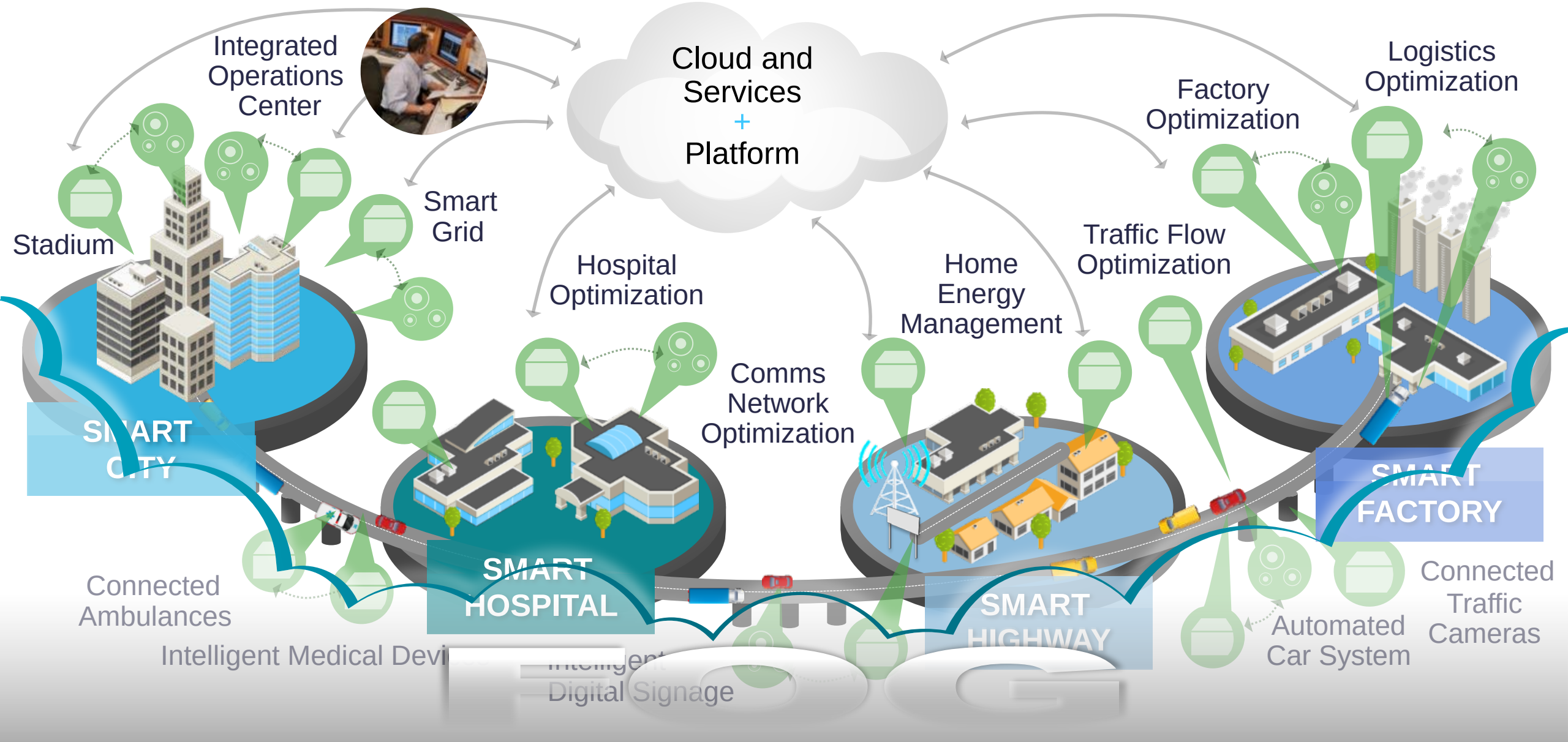
DIGITAL

Pace of **CHANGE**

- Innovation Speed… 2x → X^2
- Disruption of all activities
- Clouds… Private, Hybrid, Public, Fog
- Security Challenges
- Mobility Revolution
- Big Data & Analytics
- Business Models + Technology Models

Internet of Everything… 5X – 10X impact of Internet to date

The Digital Overlay:
Connected Over Industry Standard Platforms



Barcelona – Smart City $3.6B Value Creation

European Commission iCapital Award

Smart Lighting | Smart Buses | Smart Water | Smart Bus Stop | Smart Parking | Smart Waste

Smart Citizens

- 1,500 New Companies
- 44,000 New Jobs
- Mobile Collaboration: $1.6B
- Telework: $199M
- Smart Parking: $67M
- Smart Water: $58M
- Smart Lighting: $47M

Revenue | Citizen Experiences | Jobs | Productivity | Cost Avoidance

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Intel® IoT Solutions for Smart Buildings

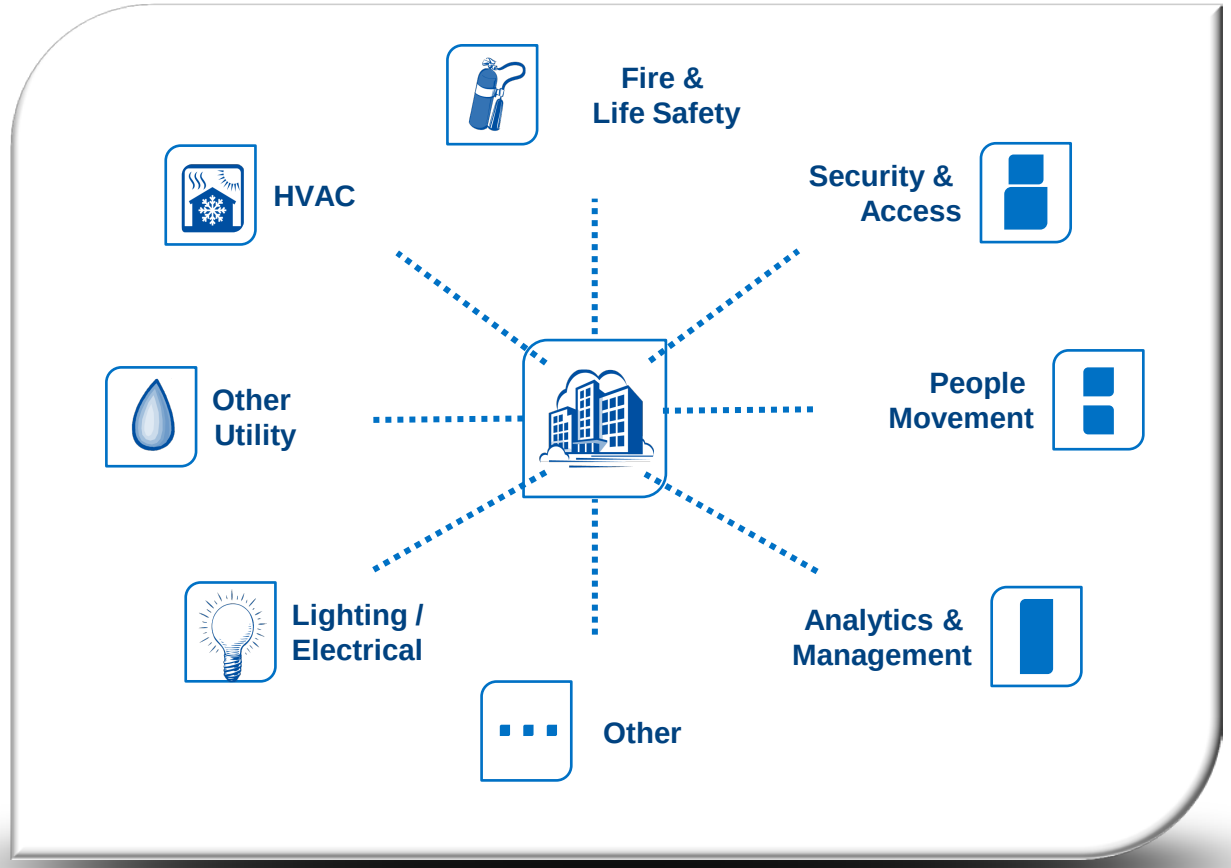
Smart Home and Building Division, Internet of Things Group

Rick Lisa

Smart Buildings

Networked. Intelligent. Adaptable

The Smart Building is an intelligent space that will create the greatest synergies between efficiency, comfort, safety for people and assets



Smart Building Usages

Energy Management

HVAC

Lighting/electrical

e.g:- “manage and optimize peak load based on occupancy, environment..”

Environment /Comfort

Water/Air Quality

e.g:- “control inflow/outflow vents based on dust, pollution, weather…”

Asset Utilization

Equipment, Office/Storage

Space, Parking

e.g:- maintain/ optimize/ show available printers, rooms, parking…”

Security/ Access

People

e.g:- “ get intrusion alerts and information at point of attack”

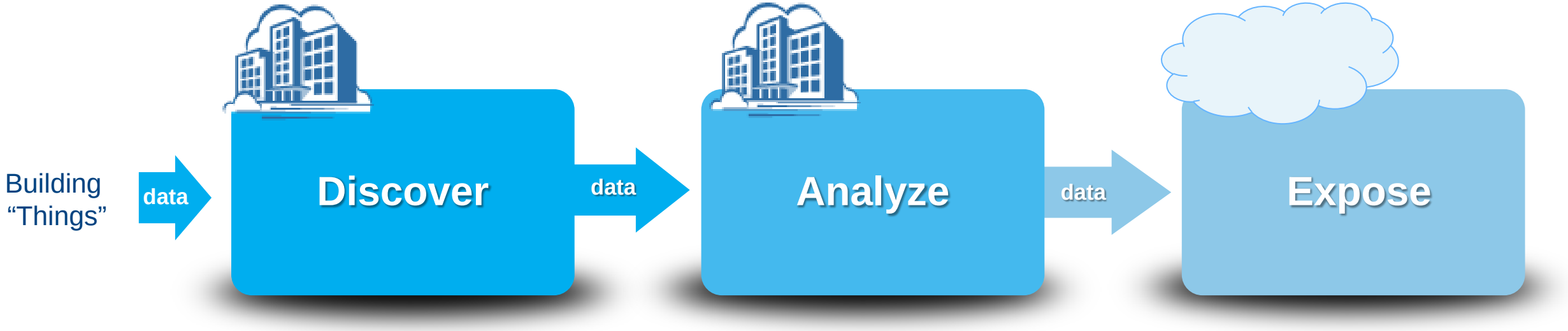
Challenges to Implement Smart Buildings

Larger Goals: Security, Sustainability, Operational Efficiency and Occupant Comfort			
Challenges:			
Operating Costs	**Lack of data visibility into all assets to be managed**	**Un-connected legacy systems with no easy means of data acquisition and finer grain control**	**Lack of compatibility or standards across proprietary systems**

Internet of Things (IoT) will accelerate
IT meeting OT for the Building sector

Intel IOT Products** For Smart Building Solutions

Building Management Systems (BMS) based on Intel® IoT Platform** ***enables*** "Information Technology (**IT**) ***integration*** *with* Operations Technology **(OT**)"



Intel® IOT Gateways
Secure and Scalable
Building IO enabled

Intel® Decision Solutions
Domain specific trend and predictive analytics tools for ***actionable decisions***

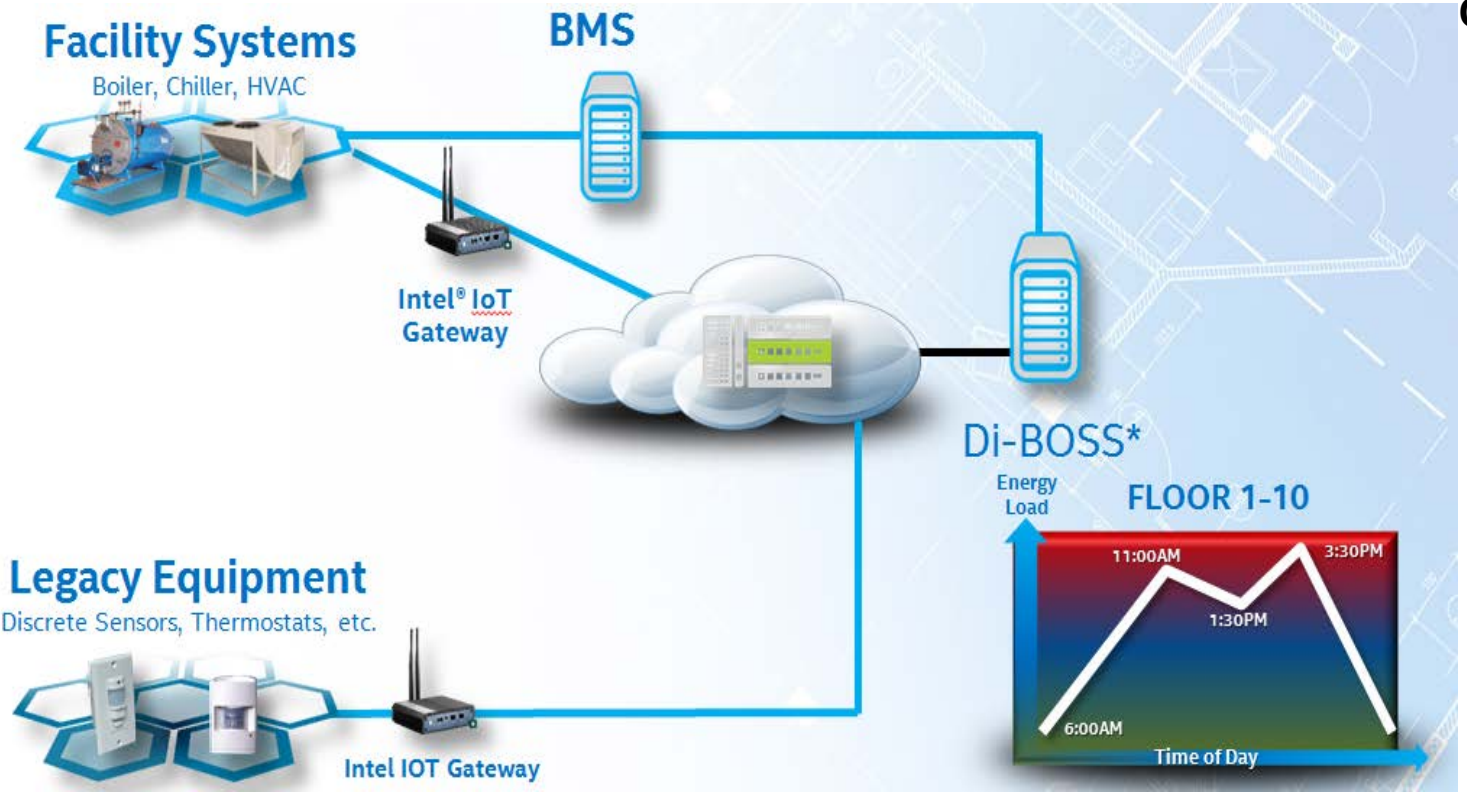
Intel® Mashery™ API Management
Create, Package and Publish
Data to Solutions

** Intel® Security is *built-into all Products*

Rudín

Optimizing energy load based on occupancy levels, saved the company $1M per building, per year at $.50 per sq. ft.

Building Management System



Challenges: Need for finer command and control of building systems for operational efficiency

Proprietary BMS

Lacked detailed data

Unconnected legacy systems

Solution Players:

Rudin*: Building Owner for Commercial and Multi-Family

Intel: Intel® IoT Gateway

Front Street (Evolpa): Facility installation

Selex & Columbia University: Building Analytics/Management System (Di-Boss*)

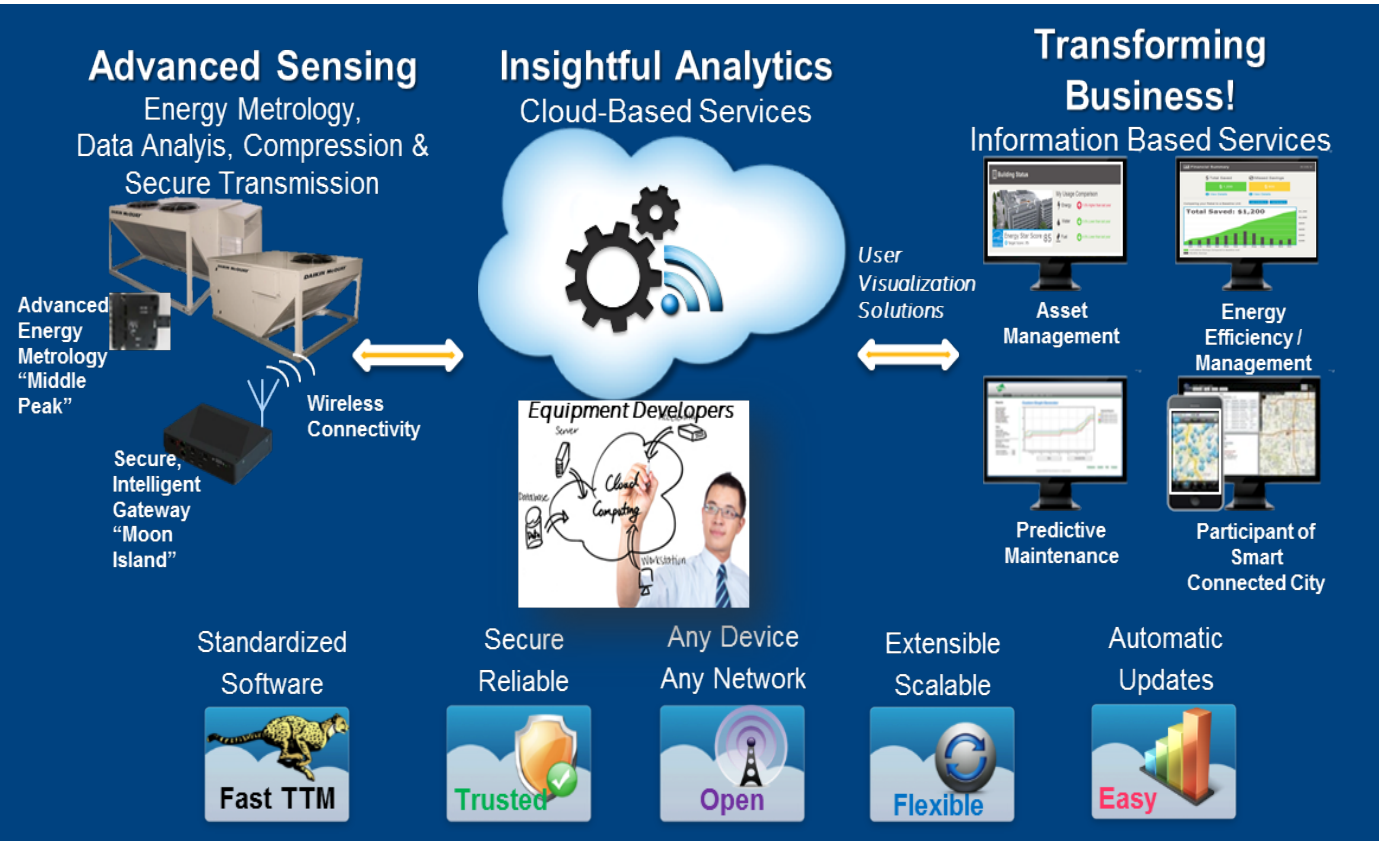
FramTech Solutions Family: Configurator for Gateways

*Other names and brands may be claimed as the property of others.

DAIKIN

HVAC Energy Management System

Demonstrated 15% energy savings year by year in industry studies.



Daikin* envisioned combining accurate energy data with operational state data to enable:

Verification of energy consumed during normal operation and demonstrate 'payback' metrics to existing and prospective customers.

Uncover trending to out of spec operation of subsystem and issue corrective action proposals.

Coordinate multiple connected Rebel HVACs in paid utility demand control programs and corporate peak avoidance programs

Solution Players:

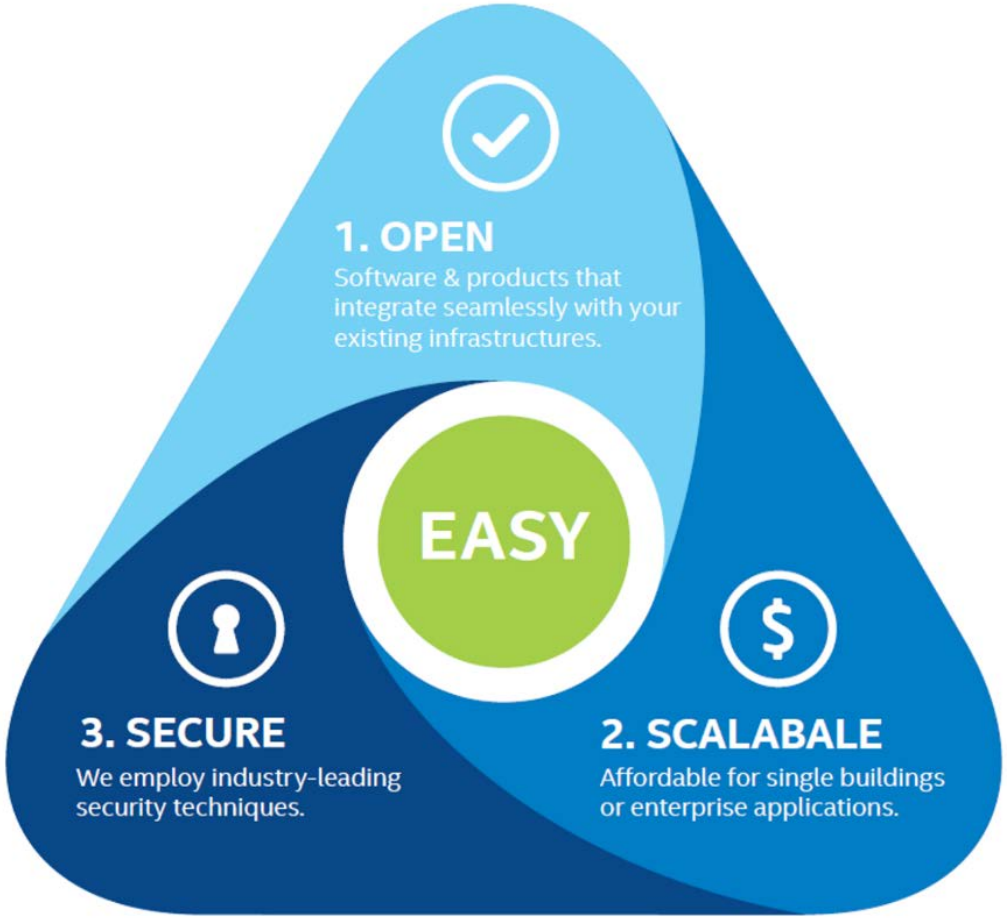
Intel: Intel® IoT Gateway + Intel® Decision Solution: Trend Analytics Software

Daikin

*Other names and brands may be claimed as the property of others.

First IoT school in the province looking to reduce energy consumption and improve student performance

Building Automation System



Challenge:

Giséle-Lalonde School in Orléans, Ontario need a solution to drive energy efficiency and productive environment;

Metering water and natural gas

Benchmarking kilowatt hour (kWh) per student

Actively measuring and managing CO2levels

Tracking occupancy in real time

Solution Players:

BMS: KMC* Controls Comander

Intel/Dell*: Gateway

Sys Integrator: Lar-Mex

www.intel.com/content/dam/www/program/embedded/internet-of-things/blueprints/iot-building-automation-system-blueprint.pdf

Blueprints and Solutions @ http://intel.com/iot/smartbuilding

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Glimpse into the Future

March 2015

Imagination at work.

Future shaped by disruptions

Energy service choices

Technology advances, costs reduced,
Competitive alternative solutions
Disruptive business models

Customers move completely off the grid[1]

[1] www.csiro.au/future-grid-forum

Consumer expectations

Grid resiliency and hardening
New service offerings
Flexibility of cloud based systems

5x Extreme weather events[2]

70% of grid is over 25yrs old[3]

[2] National Oceanic and Atmospheric Administration (NOAA) from Grid Resiliency Report[3]
[3] http://energy.gov/sites/prod/files/2013/08/f2/Grid%20Resiliency%20Report_FINAL.pdf

Growing renewables

Policy: Clean Air Act 111d
Regulatory: CA 33% RPS
Technology: Price and value driven advances

25% destruction

Long term demand

Rising stranded asset risk

Empowering people

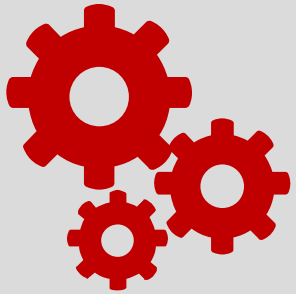
Significant workforce changes
Consumers expect visibility & control
Information to everyone, everywhere

60% Executives and
40% Engineers retiring[4]

[4] www.pwc.com/en_US/us/power-and-utilities/assets/succession-planning-wrapper-in-the-utilities-industry-final.pdf

Energy Future

Energy service choices



Advanced technology platform
Energy domain driven
Advanced analytics
New services and support
New business models

Consumer expectations

Design driven user experience
Asset Performance Mgmt
Systems that optimize reliability, demand, renewables, load and energy efficiency

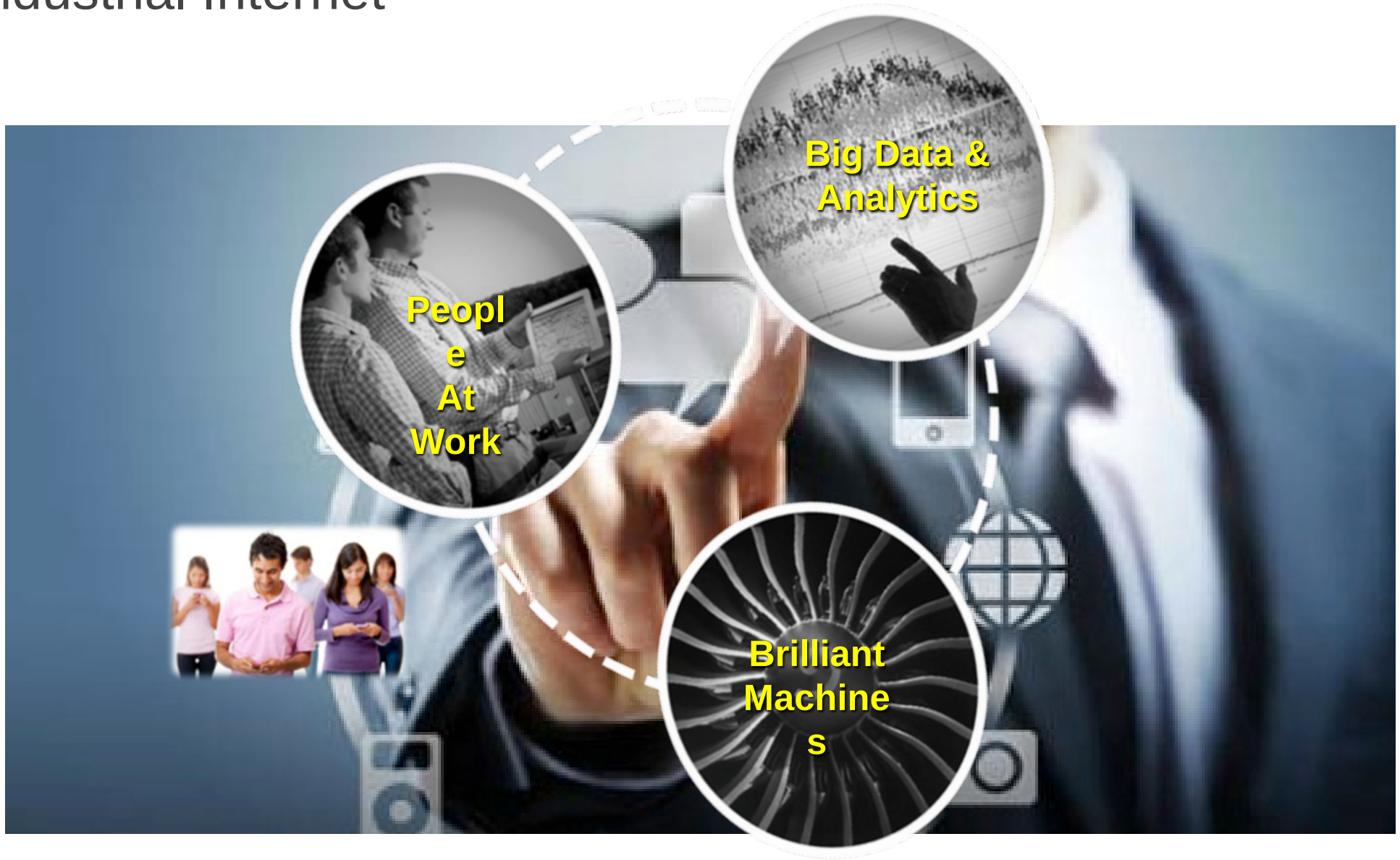
Growing renewables

Enable renewables,
Build balance of plant
Integration optimization, control and protection
Help implement policies & influence policymakers

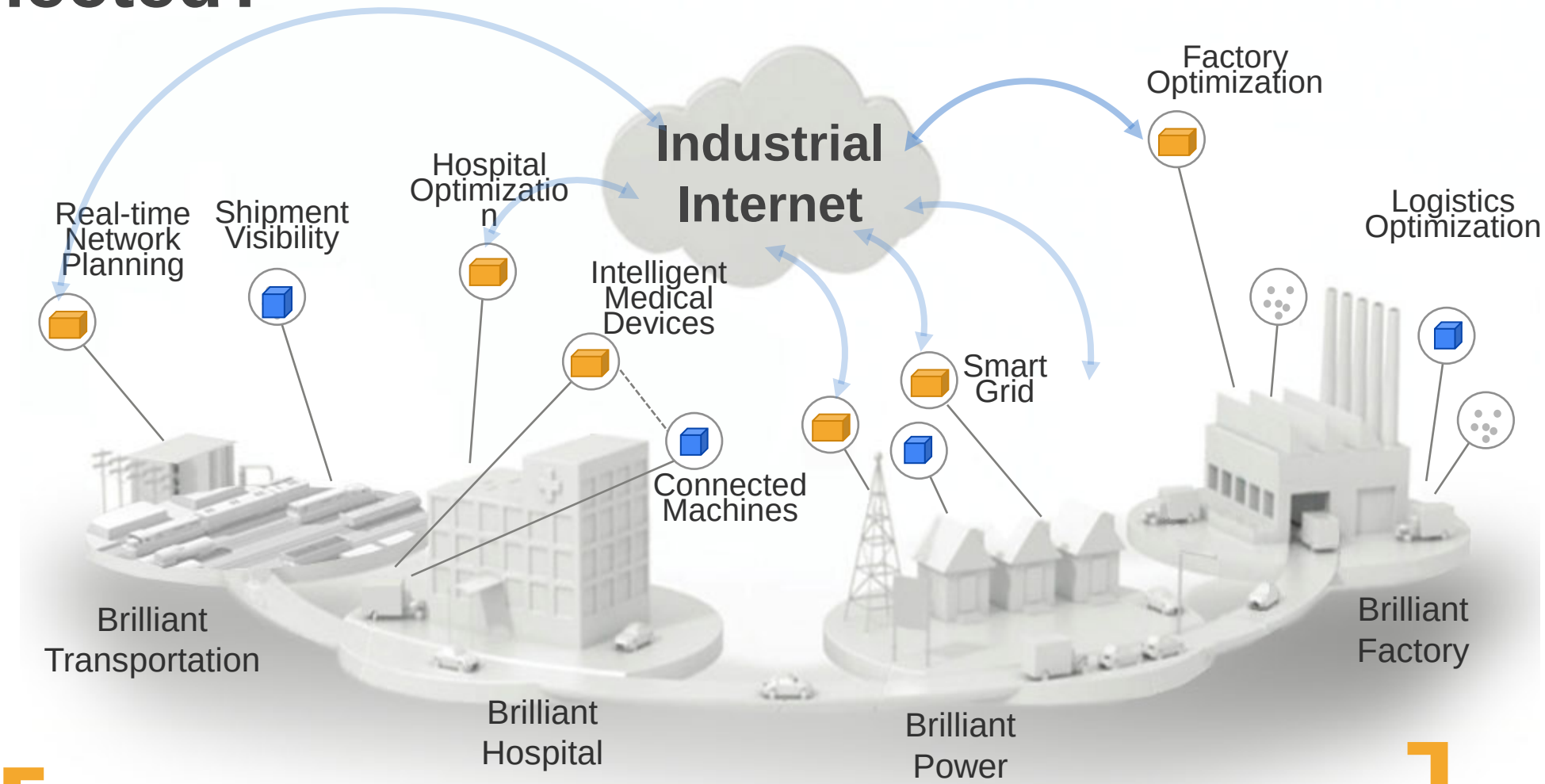
Empowering people

Improve workforce productivity
Enhance user experience
Improve resiliency & hardening
Connect people and information at any place, at any time, on any device

The Industrial Internet



What happens when 50B Machines become connected?



OT is virtualized

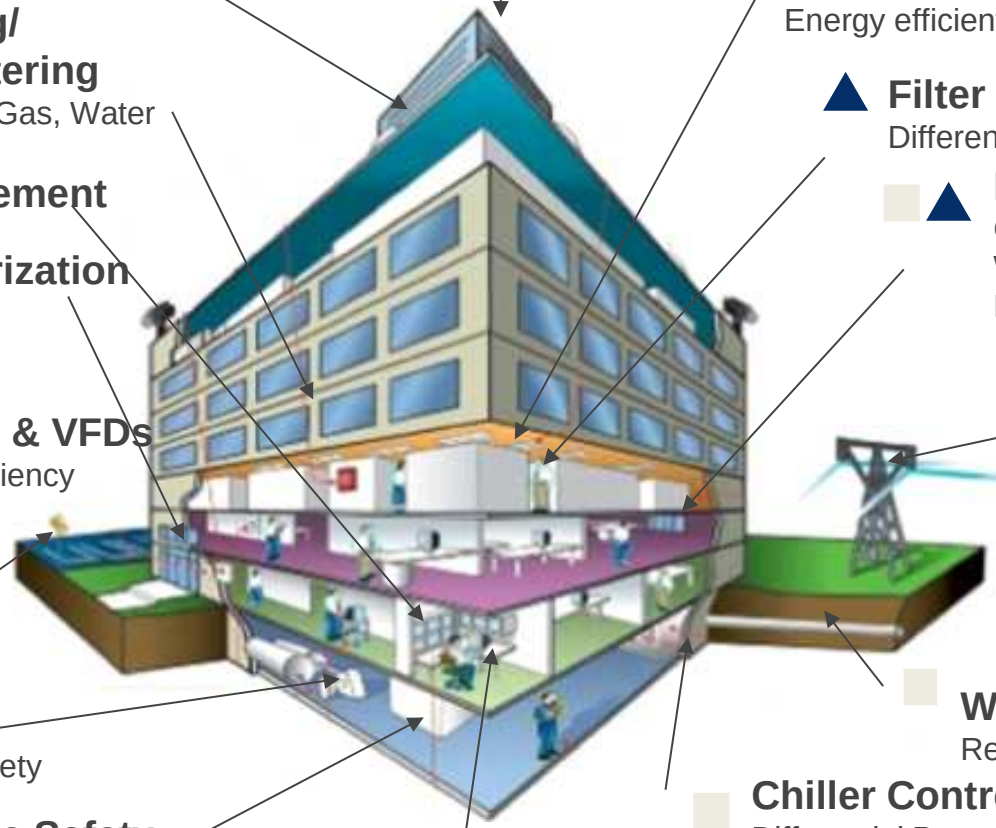
Analytics become predictive

Machines are self healing & automated

Businesses increase productivity

Monitoring and maintenance is mobilized

Smart Buildings



Air Handling Unit
CO_2, Humidity, Temp, Airflow

Power Management
Back-up Power Solutions

Indoor Lighting & Controls
Energy efficient lighting

Metering/ Sub-metering
Electricity, Gas, Water

Filter Monitoring
Differential Pressure

Facility Management

Room Monitoring
CO_2, Humidity, Temp, Wireless Remote Monitoring

Building Pressurization
Differential Pressure

SmartGrid Integration
Microgrid, renewable energy, on-demand response

Motors & VFDs
High efficiency

Outdoor Lighting
Parking, Street

Boiler Control
Process Control, safety

Water Management
Recycle, reuse, treatment

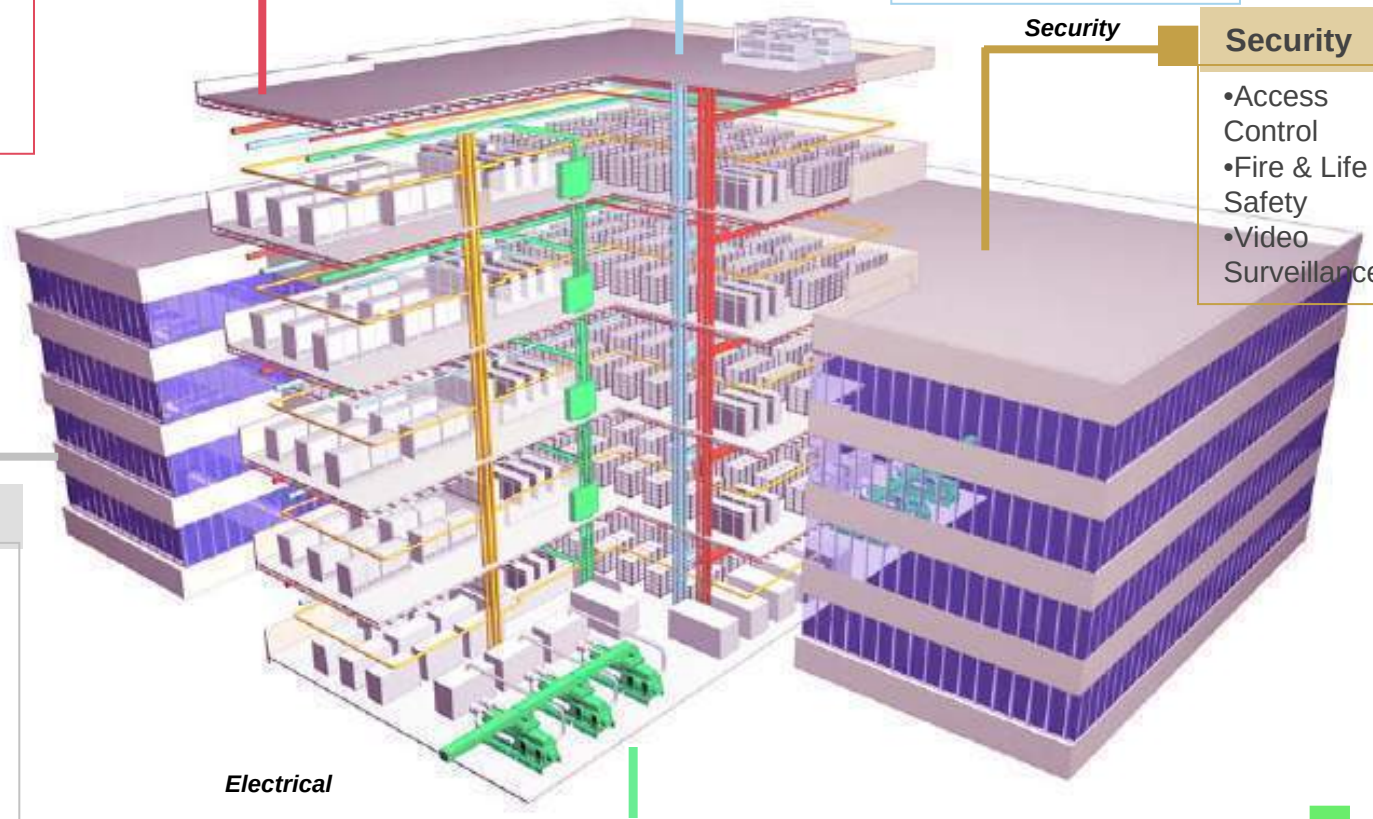
Security & Fire Safety
Access, video, mass notification

Chiller Control
Differential Pressure, Level, Temp

Energy Management System
Connect, measure, and control all systems with software

Energy Efficiency
Emergency & Safety
Air Quality

Smart Data Centers



Power Quality
- UPS
- Battery
- Paralleling Switchgear
- TVSS
- ATS

UPS / Standby

Water
- Make-up Water
- Chemical Treatment

Chilled Water

Automation
- Automation Hardware
- Software Platforms
- Integrated Solutions

Security

Security
- Access Control
- Fire & Life Safety
- Video Surveillance

Lighting
- Lamps & Ballasts
- Lighting Control

Facility/Cost

Commercial Finance
- Equipment (leases & loans)
- Real Estate (leases, loans)
- Construction Finance
- Senior Debt Facilities
- Asset Based
- Cash Flow

Electrical

Electrical Distribution
- MV & LV Switchgear
- Switchboards
- Transformers
- Busway
- Variable Frequency Drives

Energy
- Co-generation
- Solar
- Installation, Start-up & Commissioning
- Training
- After Sales Service

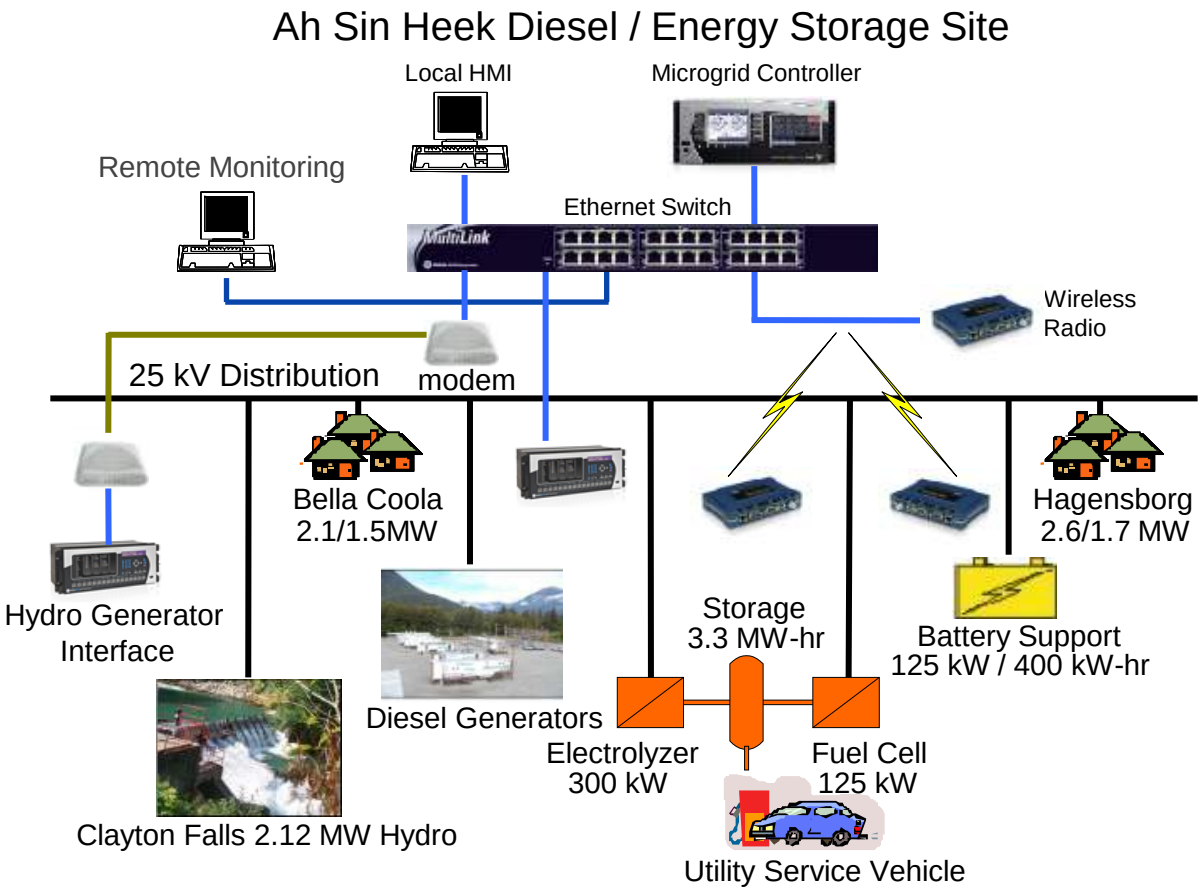
Protection & Metering
- Power Management
- Power Quality
- PMCS
- Protective Relays

Smart Streetlights

Advancing into a new future driven by technology

- Luminaires can offer much more than light
- Stronger infrastructure
- Better safety
- Building a sustainable energy plan with improved communications capacity

Smart Microgrids



- Centralized Supervisory control to optimize the use of renewables and minimize the use of diesel
- Wireless local area network
- Hydrogen based energy storage system
- Capability to connect, monitor and control the system remotely
- Interfaces to all Microgrid elements

Bella Coola, British Columbia will be demonstrating a clean power solution for remote communities. Its Hydrogen Assisted Renewable Power System will:

- Reduce annual diesel consumption by 200,000 liters
- Lower greenhouse gas emissions by 600 tons annually
- Provide storage for run-of-river power, so the electricity can be used when the community needs it most
- GE's Microgrid Controller will find the most economically efficient way to manage the renewable energy for the community.

Contacts

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