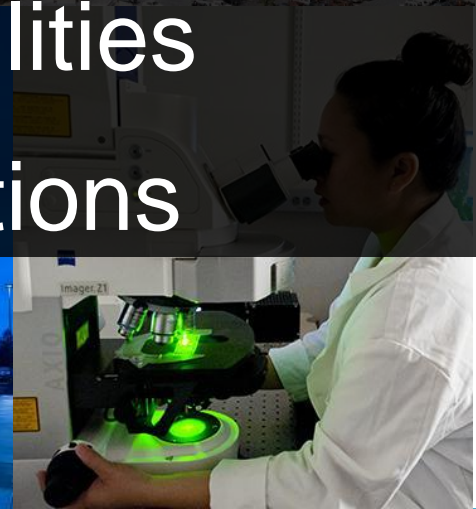




Mission Critical Facilities and Data Center Operations



What is a Facility?

fa-cil-i-ty /fə'silədē/

- (1) a place, that provides particular purpose such as an office, store or school
- (2) **Mission Critical Infrastructure, where the availability has a direct impact on the mission.**
The mission may vary from a hospital who has a life saving mission, a corporate campus who has a mission to support the core business operations to a government installation that provides either financial, security or social services.

Requirements of a Facility



A Real-Time Data Infrastructure: The Agent for Federal Enterprise Transformation

Asset
Health

Energy

Process
Efficiency

Holistic Cyber
Security &
Safety

Quality

Federal
Standards



PI System Software
Infrastructure



Lawrence Berkeley
National Laboratory

NIST
National Institute of
Standards and Technology
U.S. Department of Commerce



Argonne
NATIONAL LABORATORY

**OAK
RIDGE**
National Laboratory



2018 Intelligence and National Security Forum

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- Water/Waste Water Processing

- Building Management
- Sustainability/Efficiency
- Critical Environmental Facilities

- Data Centers
- Capacity Planning
- Performance Monitoring

- Condition Based Maintenance

- Energy Management
- Outage Management
- Fault/Issue Detection

- Central Plant Operations
- Asset Management
- Power Generation
- Outsource Contract Management

- Renewable Energy
- Microgrid
- Energy Storage



Mission Critical Systems

SINGLE BUILDINGS

To

CAMPUS

TO

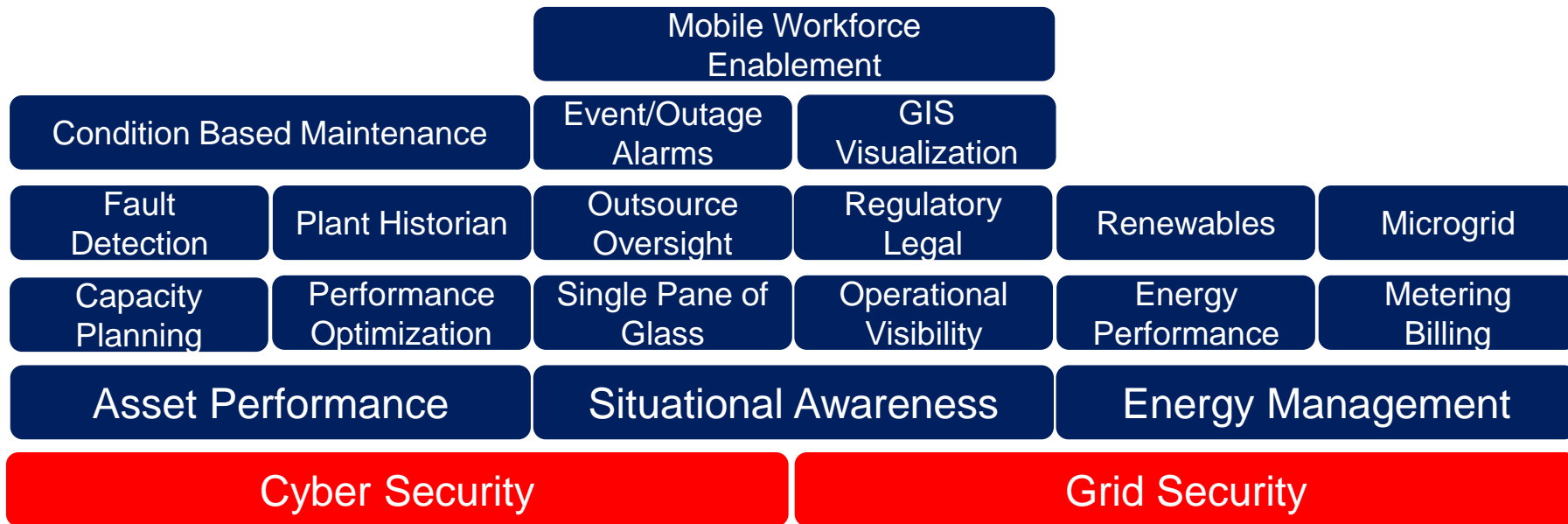
GLOBAL ASSETS

- Building Management Systems
- Lighting
- HVAC/Chilled Water
- Hot Water
- Electric Distribution
- Metering
- Security
- Fire
- Backup Generators
- Elevators
- Light Harvesting
- Window Tinting
- Demand Response

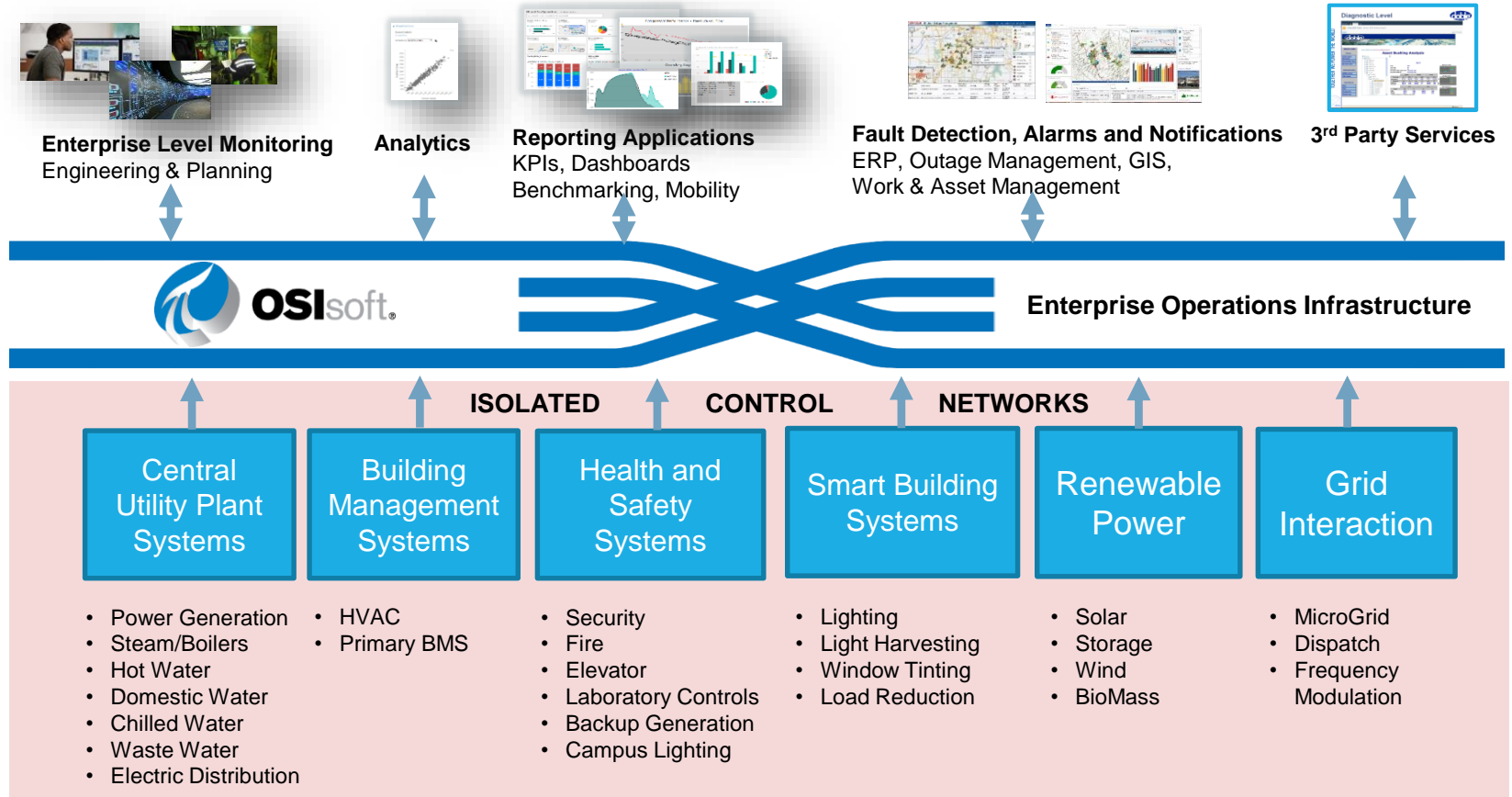
- CHP/Gas Turbines
- SCADA
- Diesel Generators
- Water/Waste Water
- Steam/Boilers
- Campus Lighting
- Campus Chilled Water
- Electric Substations
- Steam Distribution
- Hot Water Distribution
- Campus Metering
- Demand Response
- BMS X # of Buildings

- Battery/Energy Storage
- Solar
- Wind
- Biomass
- Diesel
- Microgrid Controller
- Demand Response/Curtailment
- Frequency Modulation
- EV Chargers

Use Cases



Cyber Security



Cyber Security

Internet Risk

Shodan.io - Shodan is the world's first search engine for Internet-connected devices



In less than 5 minutes had log in screens for multiple building management systems

The Washington Post

“How a fish tank helped hack a casino”

Remote Access

Industry Trends



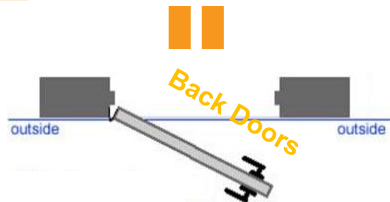
Outsourcing



Remote Commissioning



Lack of Security Experience



“HVAC vendor eyed as entry point for Target breach”

Best Practice

“The only time most people even think about the building systems are when they are not comfortable”

More times than not your own security team may have no knowledge or awareness of these control systems.

Situational Awareness



How do you know if you have been hacked if you do not have your foundational information and if you do not have ongoing measurement, validation and notifications.

Grid Security – Grid Reliability/Microgrid

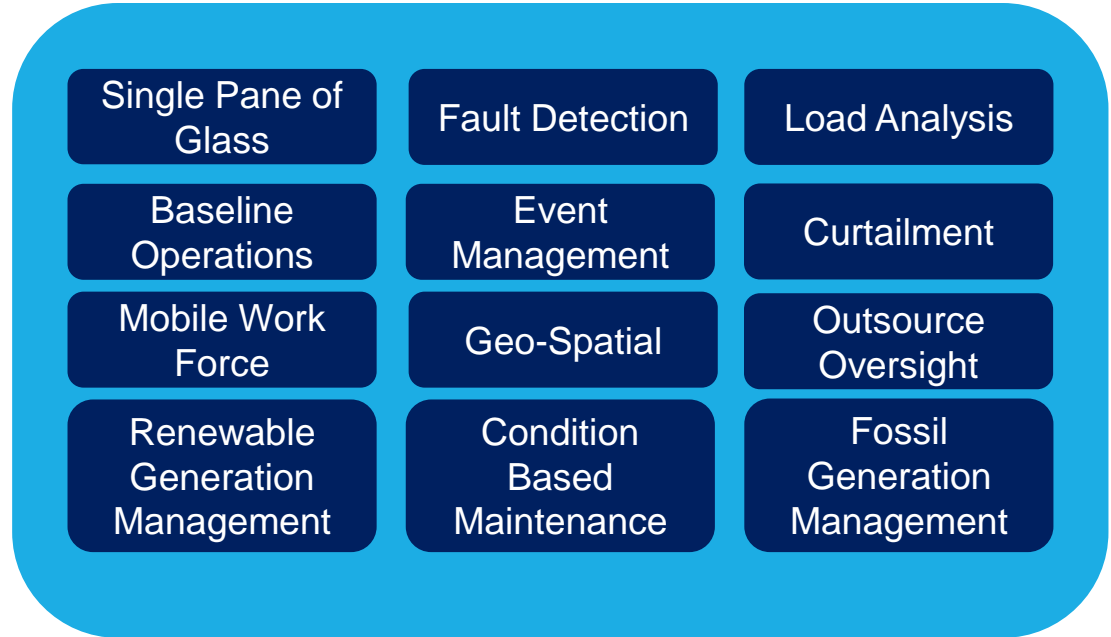
Baseline Operations



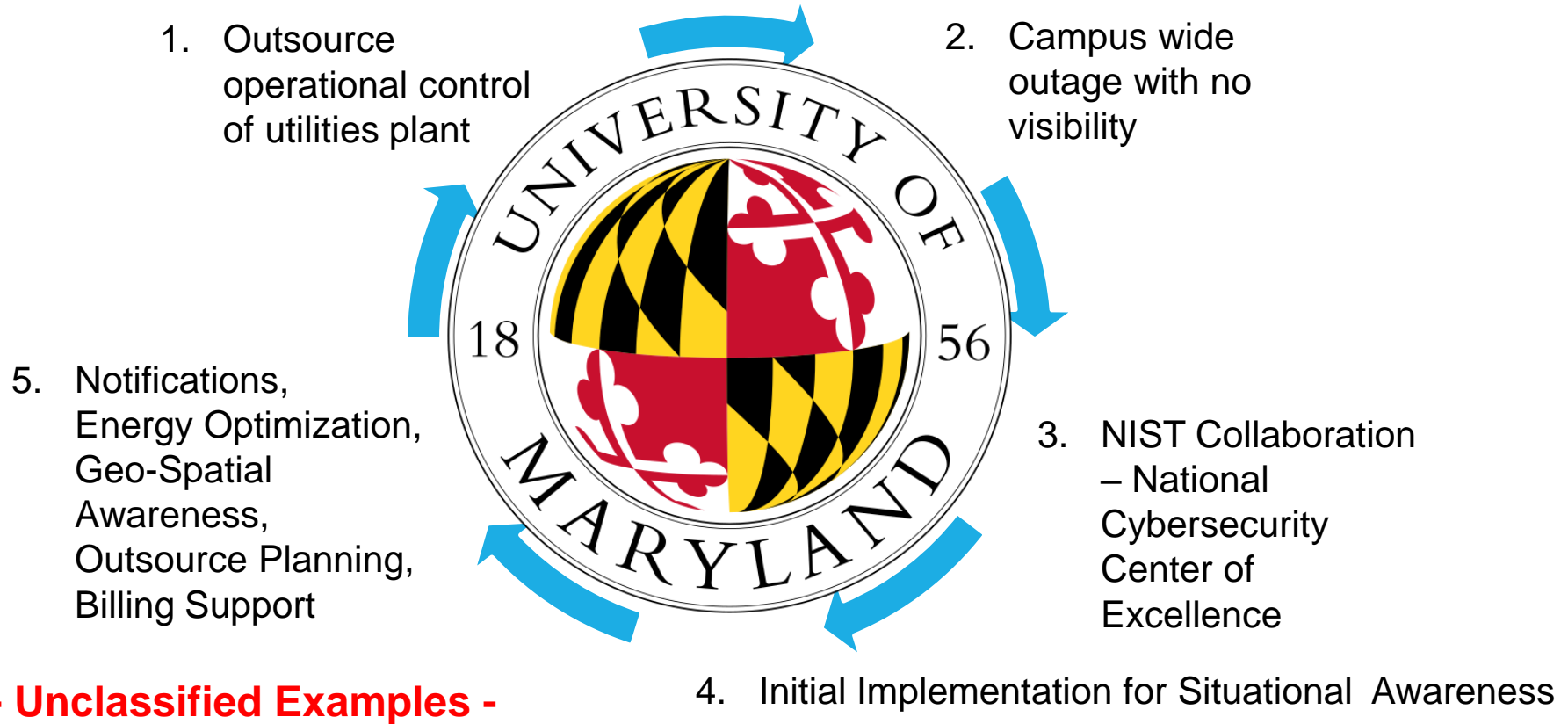
Build

Outsource

Operations



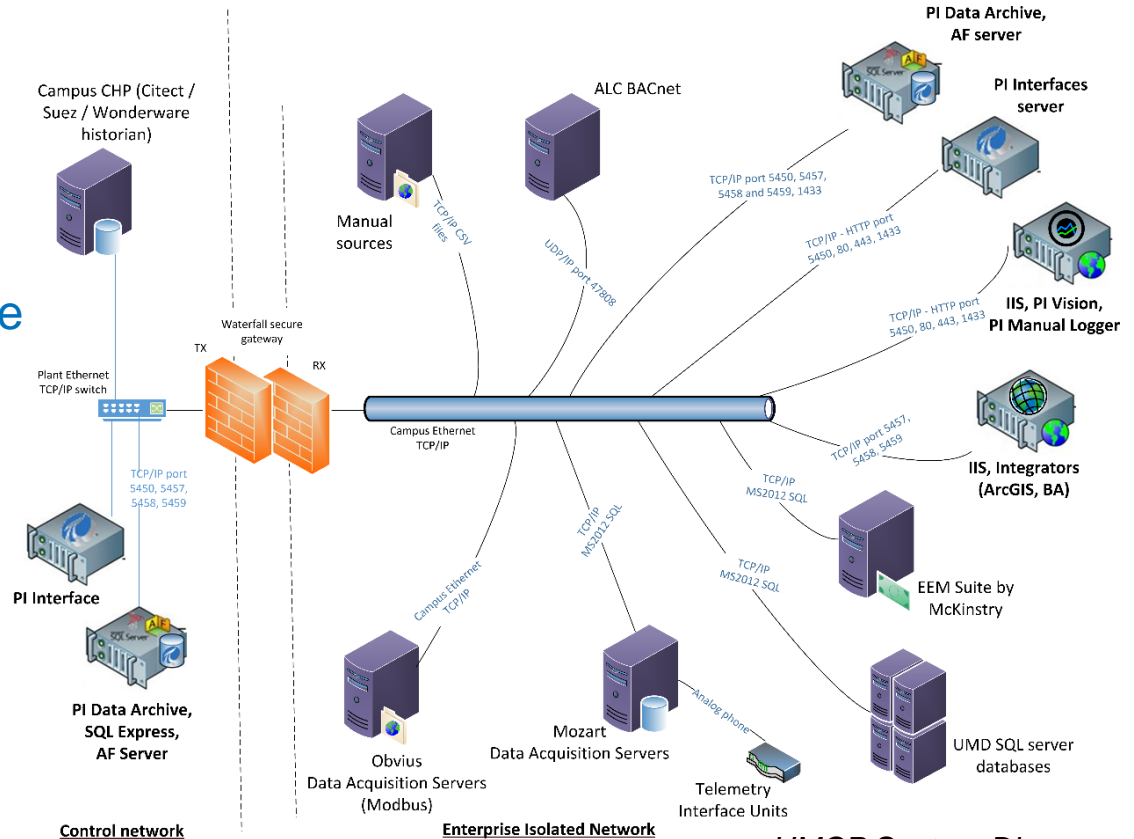
Situational Awareness @ UMCP



- Unclassified Examples -

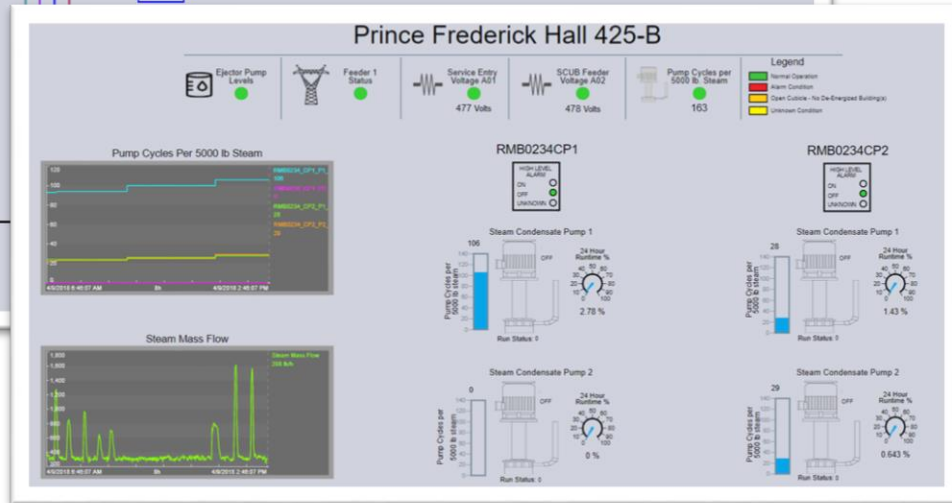
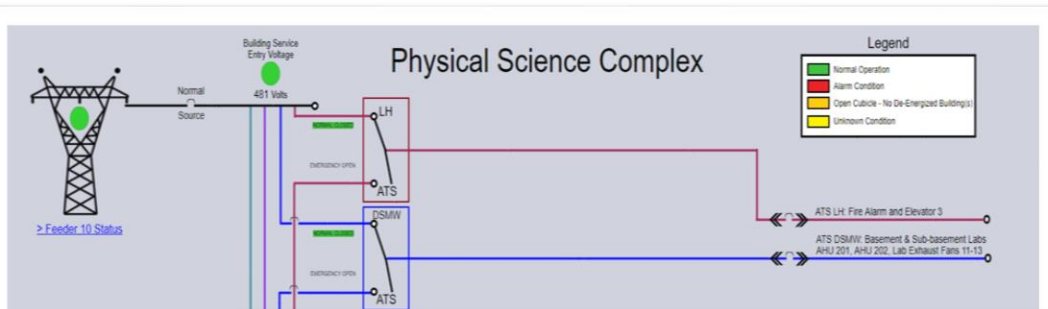
UMCP: Secure, Centralized Data

- Waterfall Secure Gateway
 - One-Way Data Appliance
- 5 different interfaces
 - Disparate Data Sources
- PI Manual Logger
 - Manual Entry
- Daily tag reports
 - Health of Interfaces



UMCP System Diagram

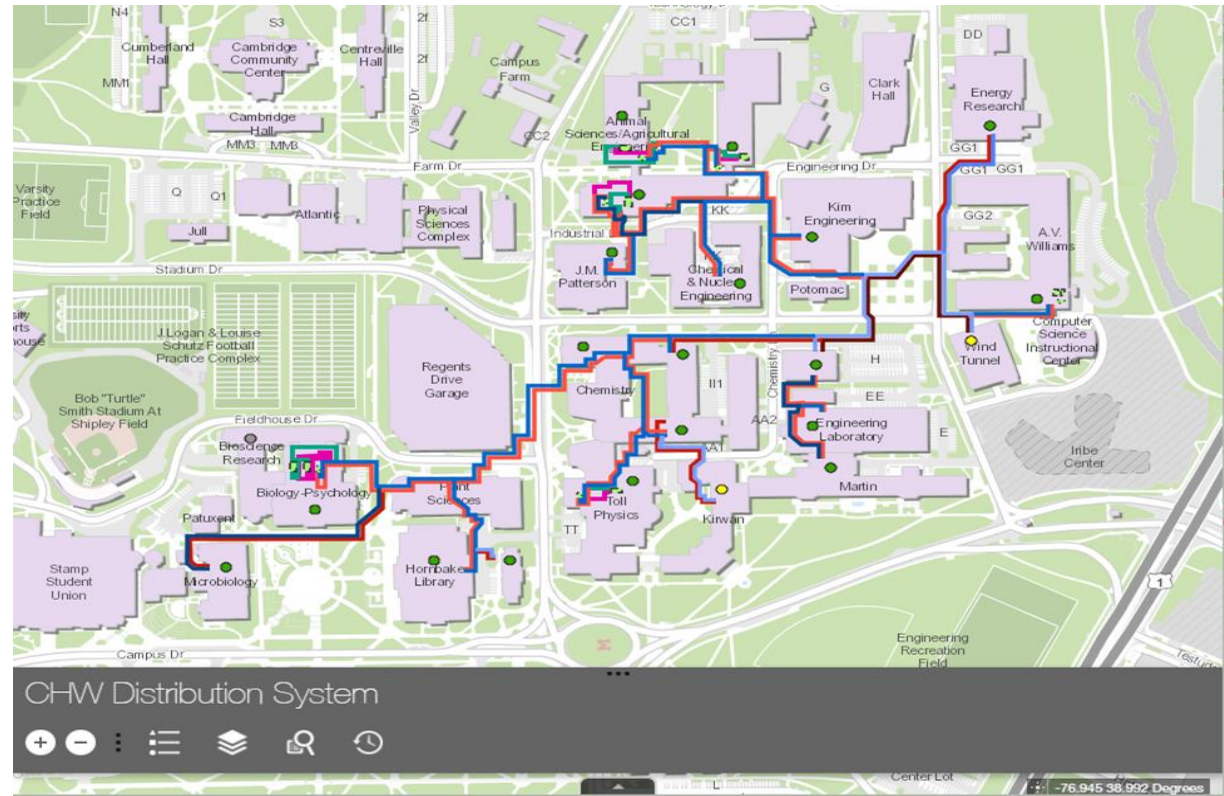
UMCP: Situational Awareness



- Identified regulatory requirement for diesel generation runtime reporting
- Identified cost avoidance of \$500,000 for sump pump monitoring
- Identified feeder potential arcing
- Identified 2M lbs. of lost steam condensate due to failed underground network

UMCP: Geo-Spatial Awareness

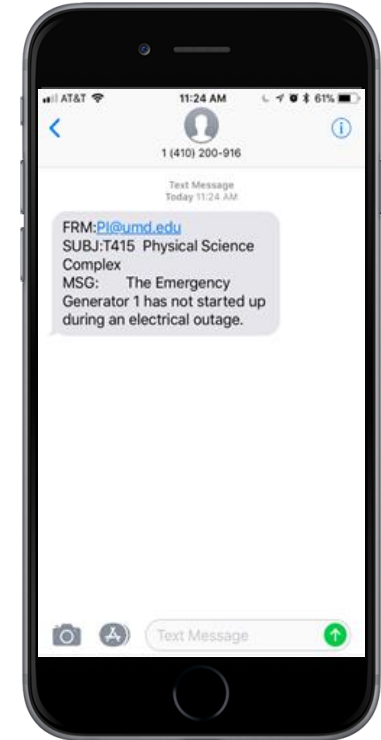
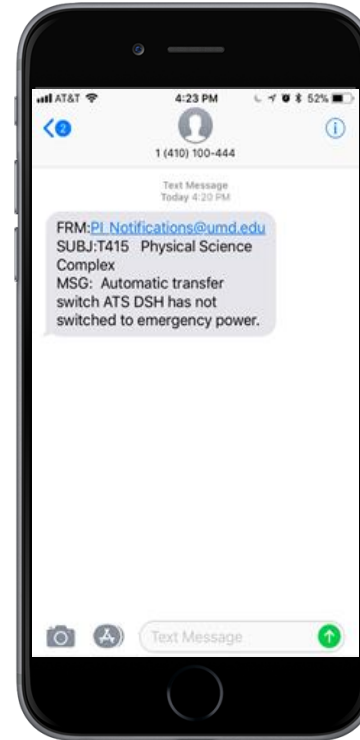
- Integrated real time data
- Provide outage awareness
- Initial
 - Chilled Water
- Next
 - Electric
 - Steam
 - Hot Water
 - Domestic Water
- Mobile workforce support



Chilled Water Distribution ArcGIS® WebApp

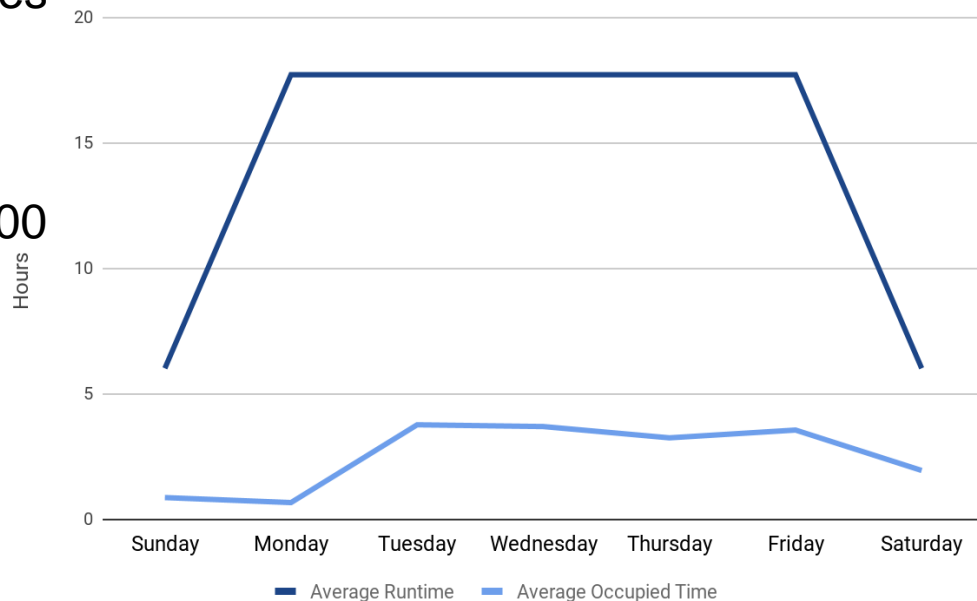
UMCP: Notifications

- 60-90 minute head start
- Timely and accurate information
- Optimized resource deployment
- Next Predictive
 - Feeder Arcing
 - Dew Point Analysis



UMCP: Challenge Reduce Energy Load

- Target: Switch from manual overrides and single occupancy model to automated scheduling
- ~1/3 of the buildings offers ~\$730,000 potential annual energy savings
- Issues:
 - 40% Occupancy
 - Overuse of equipment
 - Unnecessary energy use



Average Occupied vs. Run Times

UMCP | Key Features and Business Value

- OSIssoft is a critical aspect of the Energy Management Facility Operations program which allows University of Maryland to have automate notifications of events and visualize mission critical information

Key Features

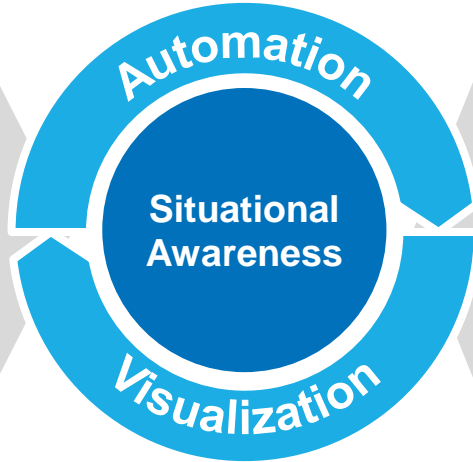
Interface for Legacy Systems

Real-time Environment Information

Event Notifications

Real-time Geo-Spatial Visualization

Visualizations that provide wider access to situational awareness



Business Value

- ✓ Reduced electrical outage response times to near 0
- ✓ Identified 2M Lbs of Steam Condensate Loss
- ✓ \$500,000 cost avoidance from flood prevention
- ✓ Identified failed instrumentations
- ✓ Identified significant capital risk from Outsource contract
- ✓ Real Time Data Access with highly secure architecture
- ✓ Identified ~\$730,000 energy savings potential
- ✓ Proactive management of demand, constraints and costs
- ✓ Increased availability + faster incident remediation
- ✓ Ability to assess impact changes and outages

PayPal | Data Center Landscape

- PayPal has grown rapidly over the last decade and our data center landscape has become increasingly complex. A key challenge was to maximize data center efficiency to ensure available capacity and optimize operational stability

Salt Lake City, UT

- Colocation Provider
- Tier III Design



Las Vegas, NV

- Colocation Provider
- Tier IV Design



Phoenix, AZ

- PayPal Owned
- Tier IV & Tier II Design



Key Facts and Figures

- 16 Countries
- 33 Data Centers; 3 primaries
- ~2,500 Racks
- 27 Megawatts
- 3,000+ DC Infrastructure Assets
- 1M+ Monitoring Endpoints
- 3 primary DC partners
- 13 Tools & Platforms
- ~130 People
- 900+ DC Procedures

PayPal | Challenges and Goals

- The program addresses specific challenges that data center operations face, namely consolidating facilities and knowledge management, and introducing real-time visualization of data center space and power

Challenges



Delayed **mission critical reporting** as a result of manual tracking of critical information on space, power, and cooling



Inability to **make reliable capacity planning decisions** due to a lack of real-time data



Limited visibility into **vendor performance and validation** resulting from data center components, work orders, and procedure documentation tracked outside of PayPal tool sets



Lack of detail in **capacity planning and forecasting** processes



Disconnected **view of operations** resulting from historically fragmented ticketing, monitoring, alarming, and data across multiple platforms



Goals and Outcomes



1. Enable Data-Driven Decision Making

- Real-time Environment Information and Alerting
- Real-time Space and Power Visualization



2. Plan for Growth

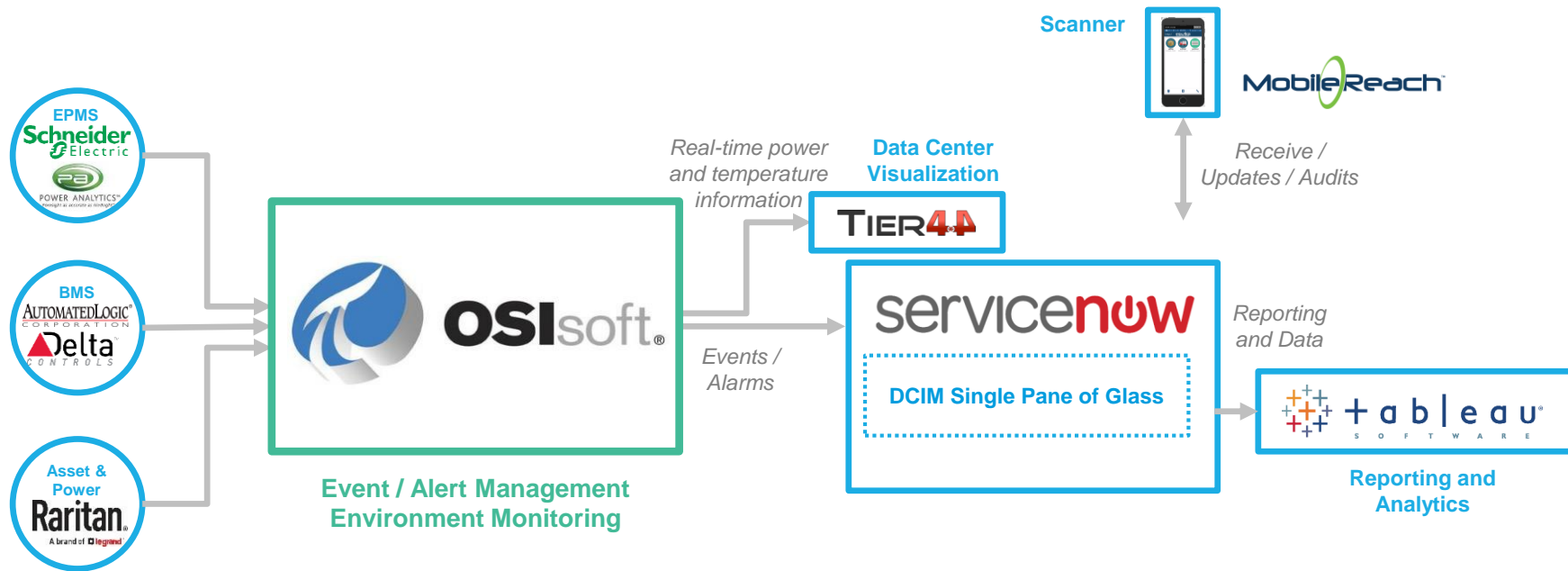
- Shared, accurate, real-time forecast of capacity / demand
- Integrate planned installation and decommission activities from ServiceNow



3. Capture Value through efficiency

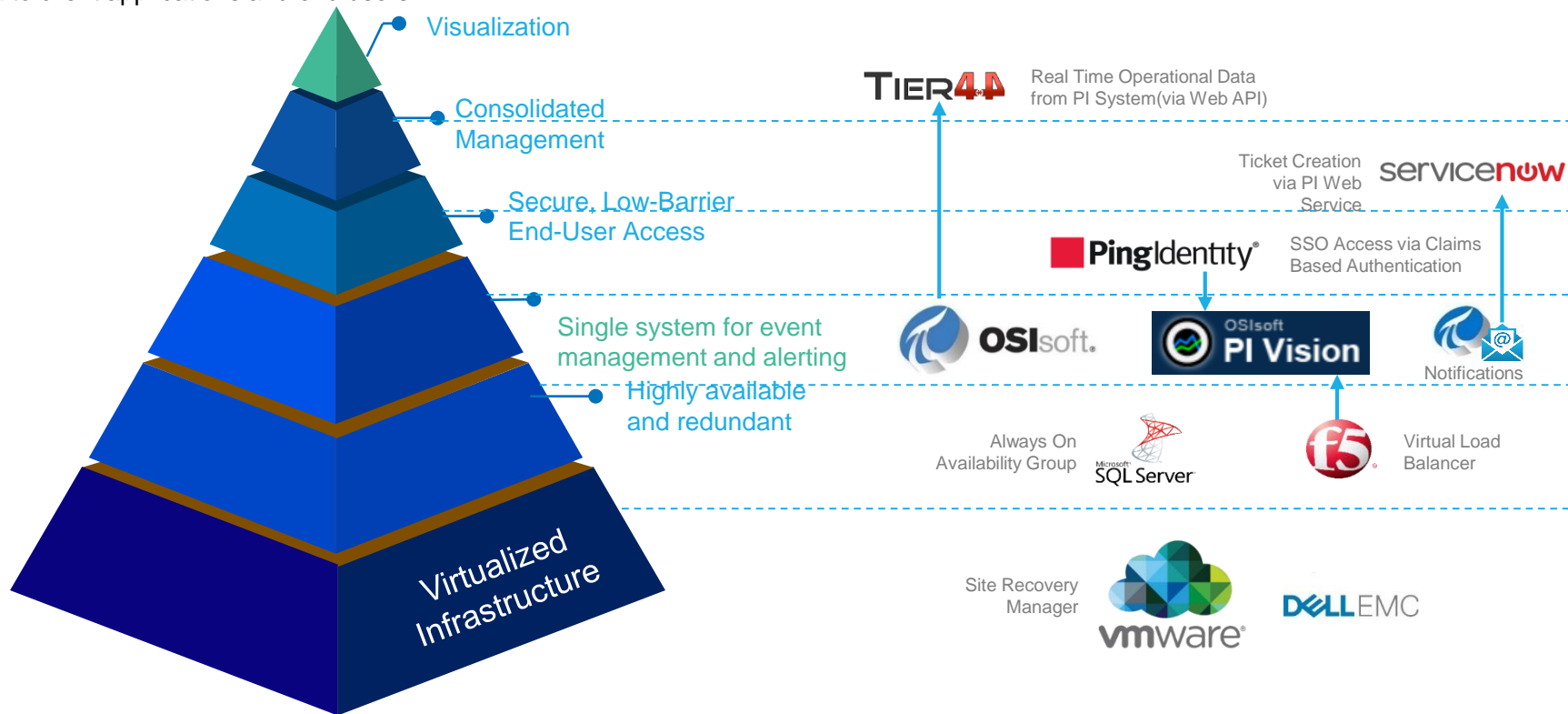
- Increase capital asset efficiency by identifying reallocation opportunities
- Automated and orchestrated work order and doc. mgmt.

PayPal | High-Level Architecture



OSIsoft Solution | Building Blocks

The OSIsoft PI System is installed on a redundant, highly available virtualized infrastructure, providing reliable, easy-to-access real-time operational data to client applications and end users



PayPal | Key Features and Business Value

- OSIssoft is a critical aspect of the Data Center Infrastructure Management program which allows PayPal to automate key activities and visualize mission critical information

Key Features

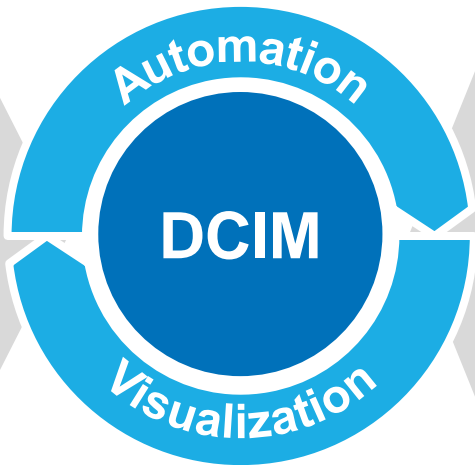
ServiceNow Orchestrated Data Center Management and Maintenance

Real-time Environment Information and Alerting

Relationship driven physical infrastructure CMDB

Real-time Space and Power Visualization

Shared, accurate, and real-time forecast of capacity and demand



Business Value

- ✓ Reduced probability of manual errors
- ✓ Efficiencies that drive cost reduction
- ✓ Optimized procedures through continuous improvement
- ✓ Improved speed of delivery of infrastructure
- ✓ Minimized risk and business impact
- ✓ Model and validate changes in real-time
- ✓ Data driven decision making
- ✓ Proactive management of demand, constraints and costs
- ✓ Increased availability + faster incident remediation
- ✓ Ability to assess impact changes and outages

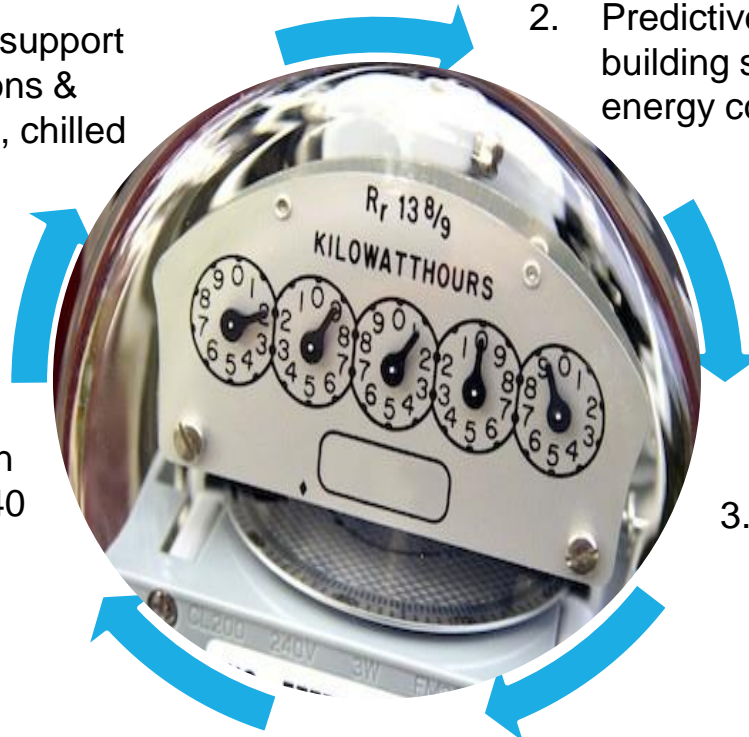
Metering @ MIT

1. PI Installed to support meter operations & billing (electric, chilled water, steam)

2. Predictive analytics for new building start ups for reduced energy consumption



5. PI Data supporting a replacement of Co-Gen center from 25mW to 40 mW



3. Trend Data – Simultaneous Heating and Cooling – 3 Way Valve Broken

4. Events - Chilled Water management return temp 0.5 Degrees – valve not functioning - \$80K/annually

NEXT STEP

1. PMU Data to support Microgrid

In The Words of our Customers

University of Maryland	https://osisoft.com/Presentations/Technology-Assisted-Maintenance-at-the-University-of-Maryland--College-Park/
PayPal	https://osisoft.com/Presentations/Modernizing-DCIM-through-Visualization-and-Real-Time-Monitoring/
MIT	https://www.thecube.net/guest/YnrY3PESoYA6MF9JX
eBay	https://osisoft.com/Presentations/How-eBay-is-implementing-a--Cockpit--view-of-its-Data-Centers-1x/
Roche	https://osisoft.com/Presentations/Handling-Dynamic-Infrastructures-and-Visual-Analytics/
Harvard Medical School	https://osisoft.com/Presentations/Harvard-Medical-School-Transformed-Using-PI-System-Data/
NASA Langley Research Center	https://osisoft.com/Presentations/Using-the-PI-System-For-Real-Time-Energy-Management-at-NASA-Langley-Research-Center/
MLB	https://www.youtube.com/watch?v=7CcWIKC-n-o

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Industry Principal Facilities and Data Centers

OSIsoft



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Thank You

