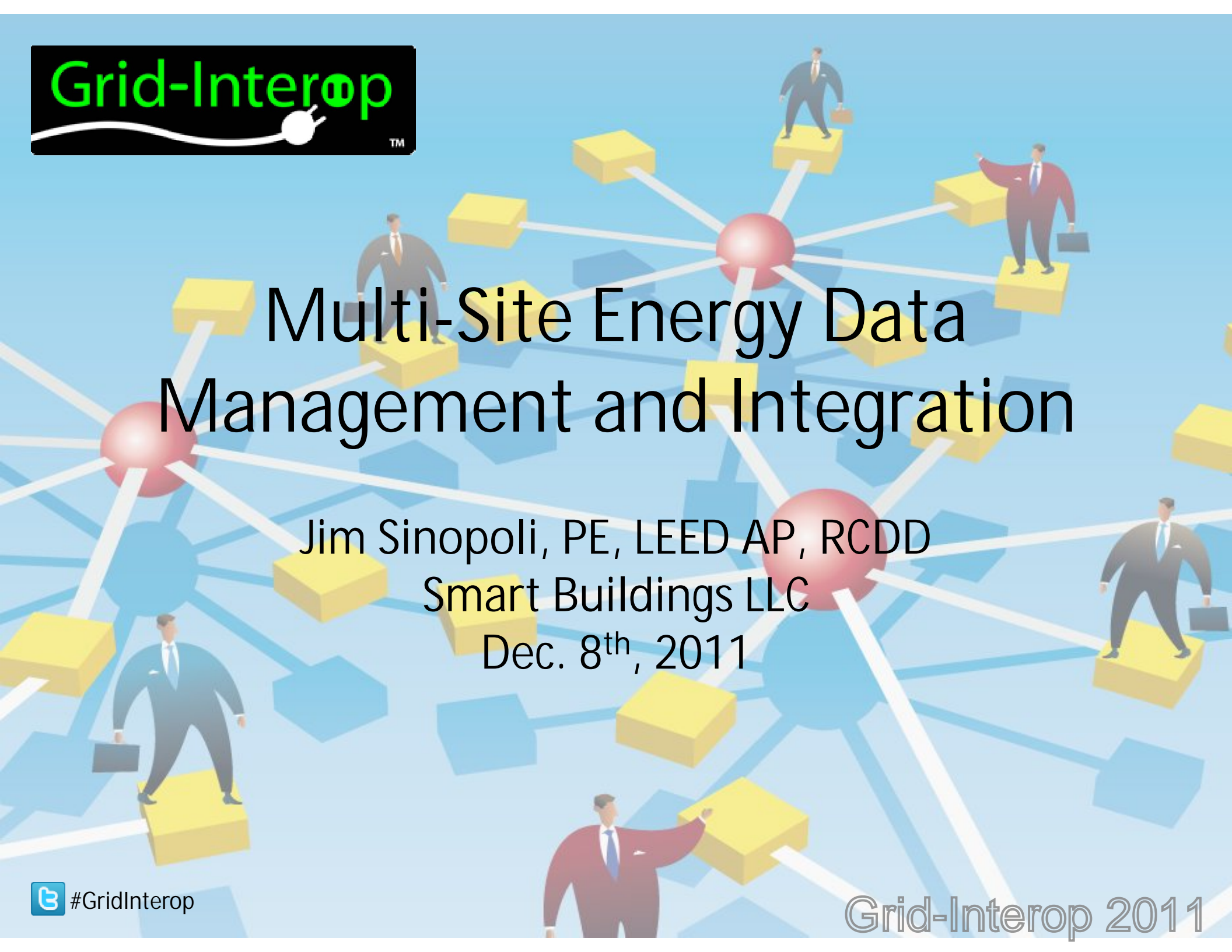


The logo for Grid-Interop, featuring the text "Grid-Interop" in a green, sans-serif font. A white wavy line starts under the 'i' and ends in a white plug icon. A small "TM" trademark symbol is located at the bottom right of the logo.

Grid-Interop™

The background of the slide is a network diagram. It features several red spheres connected by white lines to a central red sphere. These lines also connect to various yellow rectangular blocks. Several 3D-rendered figures of business men in suits are standing on these yellow blocks, some holding briefcases. The overall background is a light blue color with a subtle pattern of blue and yellow shapes.

Multi-Site Energy Data Management and Integration

Jim Sinopoli, PE, LEED AP, RCDD
Smart Buildings LLC
Dec. 8th, 2011

Tip #1

Identify The Level of Integration and SOO

System Integration Levels in Buildings

	Description	Protocols	Applications	Communications Integration	Business Information Management Impact
Level 6	Level 5 & Full Enterprise Application Data Integration	Level 5 & XML, SOAP, WSDL	Oracle, HP, SAP, Microsoft, other Business Systems	Level 5 & Data Integration to Business Level Servers	Executive Level Sophisticated Software Data Exchange
Level 5	Level 4 & Multiple Specialty Systems	Level 4 & OPC, DDE, Server to Server	Specialty Systems for Hospital, Data Center, LAB, etc....	Multiple Network Integration & Multiple Subsystems	Multiple Systems Software, Application Exchange
Level 4	Level 3 & IT Wired/Wireless	Level 3 & SNMP, Wireless	Level 3 & IT Hardware	Integrated IT/IDF, LAN/WAN Wired & Wireless	Multi-Departmental and IS Information
Level 3	Level 2 & Subsystems & IP Network	Bacnet, LON, Modbus	Card Access, CCTV, or Specialty Subsystem	System to System & IP Network LAN	Departmental Information Exchange
Level 2	Level 1 & Electrical Systems	Bacnet, LON, Modbus	High Voltage Power Monitoring & Metering	System to System Dedicated Pathway	Facilities Level Information
Level 1	Stand Alone Web-Based BAS + Equipment	Bacnet or LON	DDC, Chillers, Boilers, DX Equipment	System to Equipment Dedicated Pathway	Little to None

Smart Buildings Principles of Integration©

Systems Integration Matrix

Smart Building Integration Matrix

- Data Network
- Structured Cable
- Grounding System
- VoIP
- UPS Systems
- Video Distribution System
- Audio Visual Systems
- Access Control Systems
- Video Surveillance System
- Intrusion Detections System
- Wireless Systems
- HVAC Management Control Systems
- Electric Power Management Control Systems
- Programmable Lighting Control Systems
- Fire Alarm Systems
- Elevator Systems Controls
- Facility Management System
- Integration of Business Systems

	Data Network	Structured Cable	Grounding System	VoIP	UPS Systems	Video Distribution System	Audio Visual Systems	Access Control Systems	Video Surveillance System	Intrusion Detections System	Wireless Systems	HVAC Man. Control System	Electric Power Man. Control	Lighting Control System	Fire Alarm Systems	Elevator Systems Controls	Facility Management System	Integration of Business
Data Network	•	•	•	•	•	•	•	•	•		•	•	•	•			•	•
Structured Cable	•		•	•	•	•	•	•	•		•	•	•	•	•		•	•
Grounding System	•		•		•	•	•	•	•	•	•	•	•	•	•	•	•	•
VoIP	•	•	•		•	•	•	•				•	•	•	•	•		
UPS Systems	•			•		•	•	•	•	•	•	•	•	•	•	•	•	•
Video Distribution System	•	•	•		•		•								•	•		
Audio Visual Systems	•		•	•	•	•						•		•				
Access Control Systems	•	•	•	•	•				•	•		•		•		•		•
Video Surveillance System	•	•	•		•				•	•					•	•		
Intrusion Detections System			•		•				•	•								
Wireless Systems	•	•	•		•		•			•								
HVAC Management Control Systems	•	•	•		•		•	•			•			•	•		•	•
Electric Power Management Control Systems	•		•		•												•	•
Programmable Lighting Control Systems	•	•	•	•	•		•	•	•	•		•			•		•	
Fire Alarm Systems		•	•	•	•			•	•			•		•		•		
Elevator Systems Controls			•	•	•	•		•	•			•		•				
Facility Management System	•						•	•	•	•	•	•	•	•	•	•		•
Integration of Business Systems	•							•								•		

New Energy Systems And Applications That FM Will Need To Manage

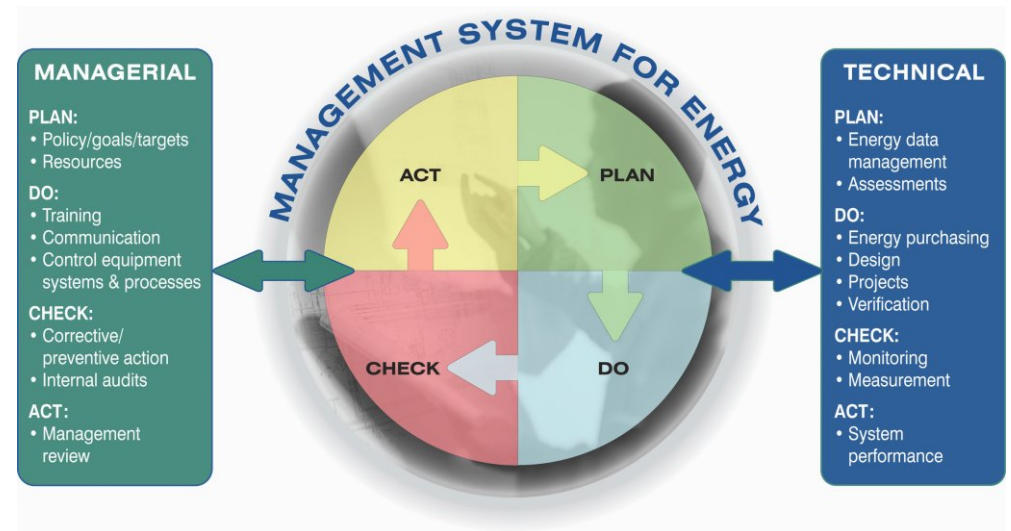
- Solar panels
- Geothermal sources
- Wind turbines
- Vehicle recharge stations
- Electrical switchable glass
- Exterior shading systems
- Wireless building systems
- Demand response planning
- Energy Dashboards
- Sun tracking systems
- Personnel RFID systems
- Structural anti-corrosion monitoring systems
- Oxygen depletion monitoring systems
- Personal rapid transit systems



Tip #2

Develop A Data Plan

- Most building operations have never thought of and do not have a data management plan.
 - BMS
 - Limited to just those systems monitored or managed by BMS
 - Setup of the database, the naming conventions formats and structure is left to the contractor
 - Getting the data out of the BMS database can be difficult
- Comprehensive planning means broader look at all the data and information to manage the building's performance.



Tip #3

Bring IT in Early in the Process

- SaaS
 - Connectivity
 - VPN
- On-site Servers in IT's Data Centers
- Other Relevant Systems
 - Accounting
 - Purchasing
- Corporate IT Security
- IP Addresses





Tip #4

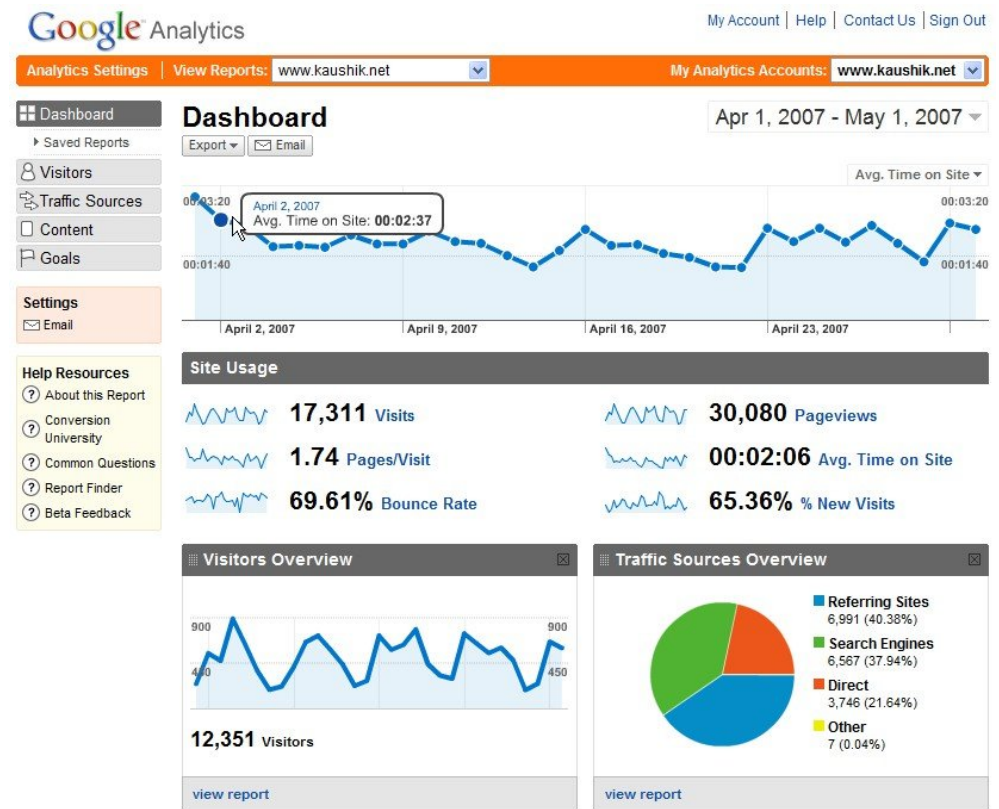
Standardize Naming Conventions

- Standardize what you call things.
- Multiple naming conventions is the largest and most time consuming issue involved with implementing an integrated building management system.
- Coordinate with other corporate systems
 - Asset Management
 - Capital Planning
 - Regulatory Compliance
 - Purchasing
- The format of a naming convention for data and equipment is less important than strict adherence to and enforcement of one standard naming convention.



Tip #5 – Use Analytics and Data Mining

- Opportunities in gaining insight into their building's performance
- Other organizations and businesses “mine” data
- Data mining very mature
- Predictive value means the organization can be proactive rather than reactive.



Tip #6 – Validate Data

- There's no point in collecting inaccurate data.
- Check the calibration of sensors and meters.
- Building spaces or uses may change; the effect is that while you can confirm or validate the design parameters, for example 54° air being delivered by an air handler, the space may have changed and have a different cooling load, and may not need 54° air from the air handler.
- Systems may need to be adjusted in order to reflect current conditions.



Tip #7 - Organize Your Document Management



- A significant portion of relevant FM information is likely to be in other formats; hard-copy drawings, submittals, O&M manuals, photographs, contracts, faxes, forms, etc.,
- Electronic files in Word, PDF, Excel and Autodesk
- A document management system should be implemented to scan the paper documents into an electronic format and store all of the electronic files.

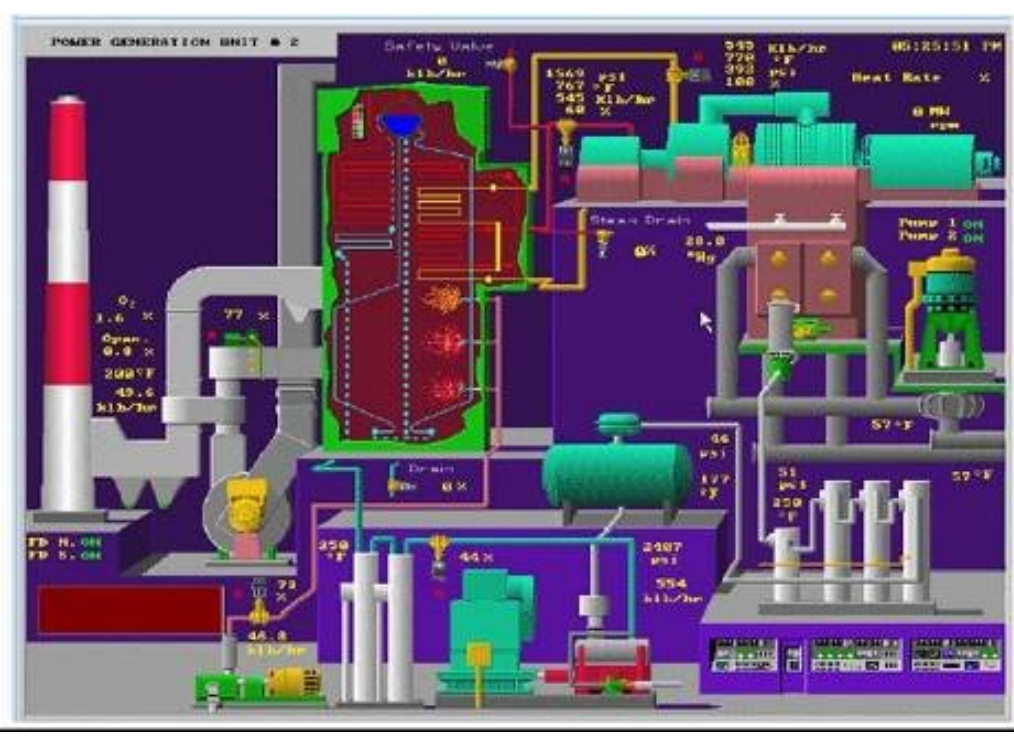
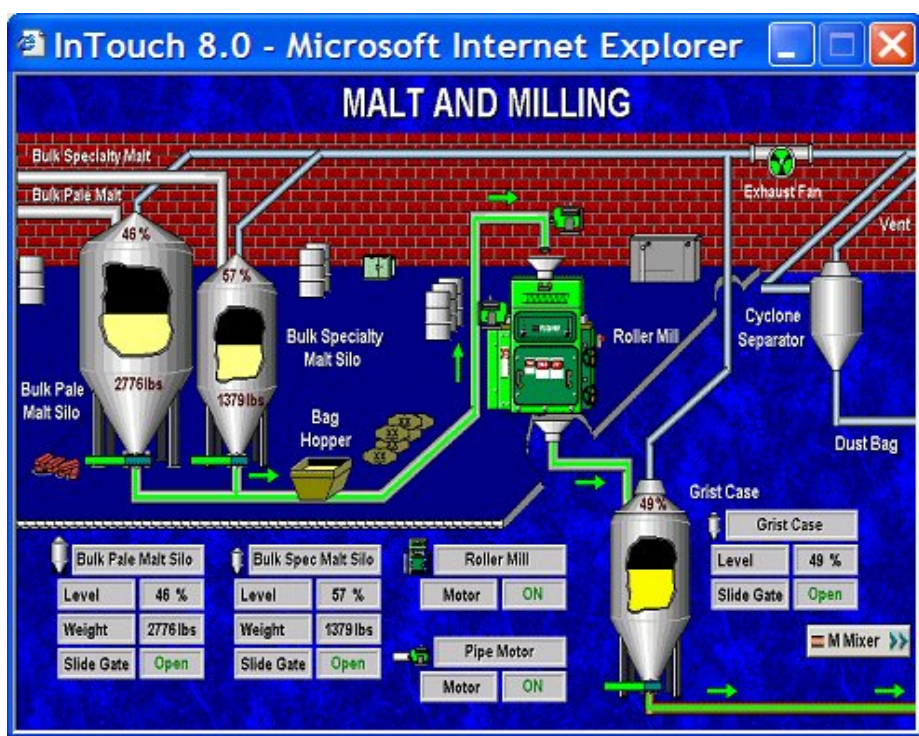
Tip #8 - Understand the Psychology and Purpose of Dashboards

Tidbits

- 50% of the processing in our brain is related to our vision
- We read at the same rate people did 100 years ago.
- No multi-tasking regarding attention - sequential

HMI Examples

More May NOT Be Better



CASE STUDIES

San Francisco Public Utility Commission Headquarters Building Integrated Building System (IBS)



- 277,000 sq. ft.
- LEED Platinum
- 45% daylight harvesting
- 55% percent less energy
- 32% less electricity demand
- 3 roof tops of solar panels
- Water Reclamation system
- Wind turbines
- 13,500 data points
- 460 Dashboards
- Middleware

Building Systems

- Conveying Equipment
- Irrigation System
- Waste Water Treatment System
- Direct Digital Controls
- Digital Network Lighting Controls
- Power Monitoring and Control System
- Communications
- Electronic Access Control & Intrusion
- Digital Video Surveillance System
- Fire Alarm and Detection System
- Solar Energy Collector Metering
- Wind Energy Electrical Power Generator Metering
- Interior and Exterior Sun Control and Window Shade Control System
- Seismic and Weather Station Monitoring System
- Window Washing System
- Water Reclamation
- Domestic Hot Water

Major Applications

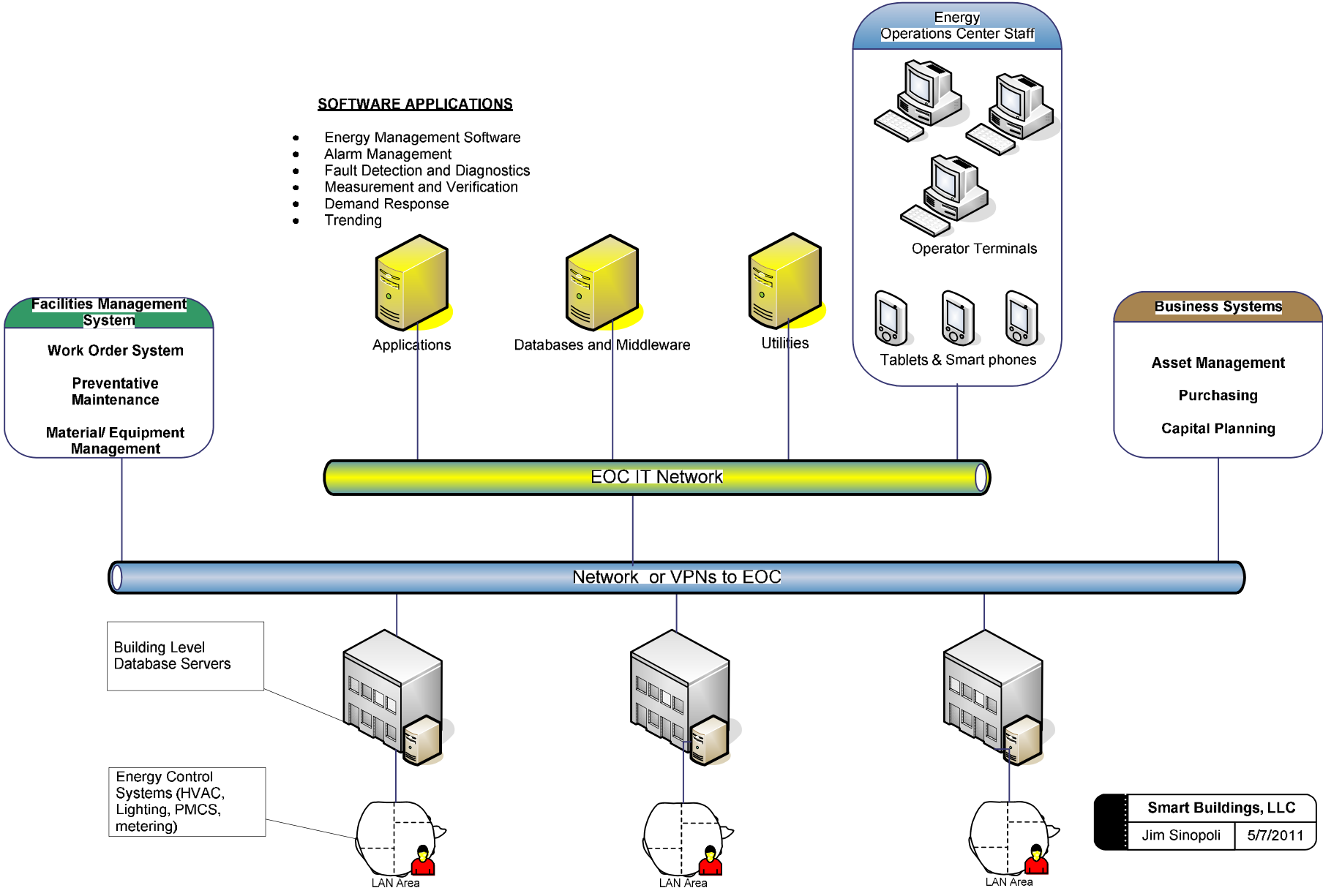
- System Scheduling
- Trend Analysis
- Data Archiving
- Energy Management
- Demand Response
- Building Analytics /Fault Detection And Diagnostics
- Energy Information and Public Information Dashboards

Major Healthcare Company



- 150 Sites, 50M Sq. ft.
- Expenditures of over \$200M annually on electric power and natural gas
- Goals:
 - Reduce Demand
 - Reduce Costs of Supplies
 - Standardize Operations
- Solution: A Energy Operations Center

EOC Conceptual Network Architecture



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Additional Resources
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