Powering Digital Transformation in Smart Cities: The Role of Smart Buildings

Smart Universities /Health Care

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THE UNIVERSITY of NEW MEXICO

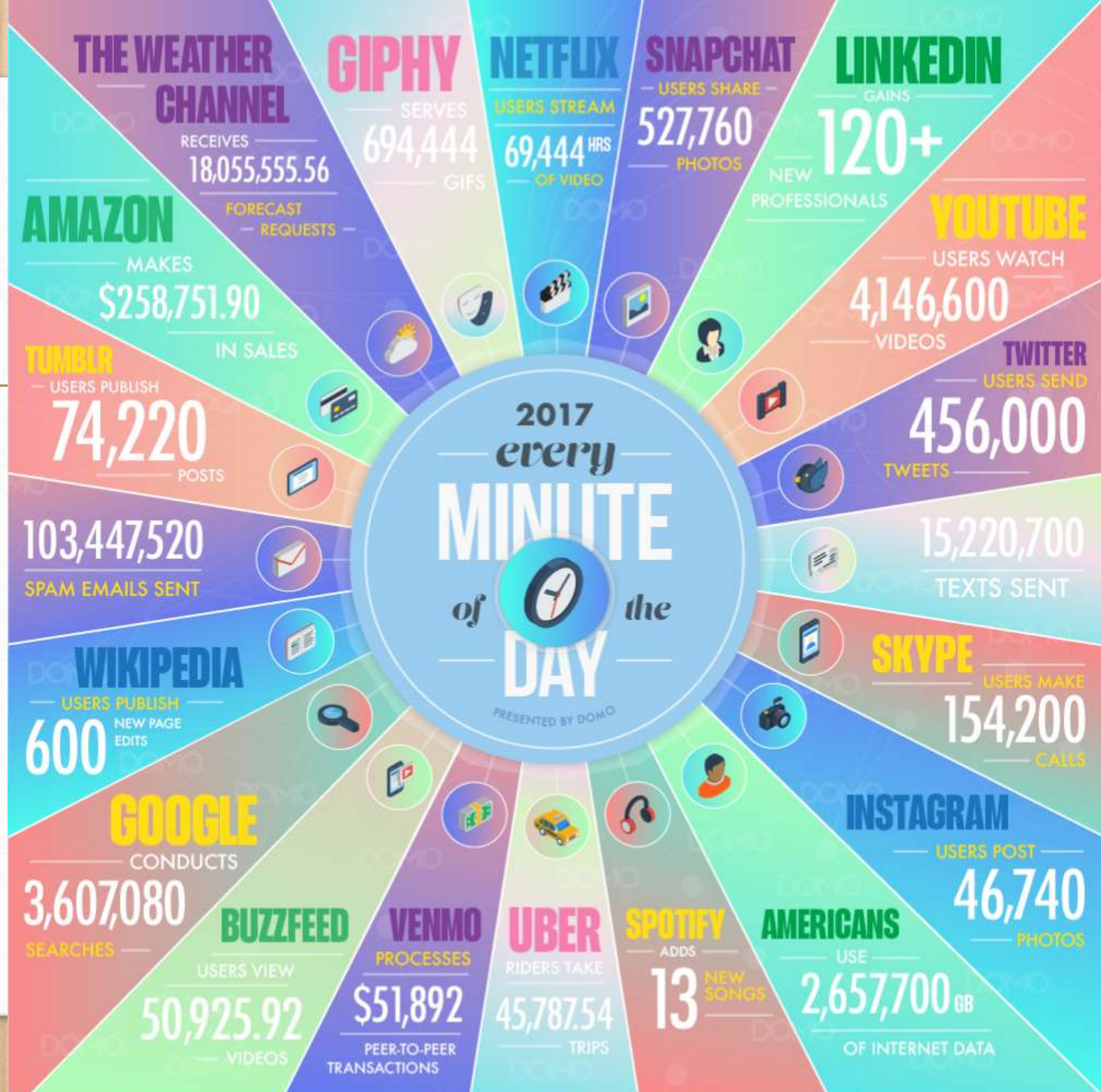
EDUCAUSE

Bicsi

TIA®

Daily Data Dose

- 2.5 Q bytes of data/day
- 90% of all data today was created in the past 2 years
- Depending on what you do daily, contributing 2-13.5 GB/SIM/day
- Consuming 34 GB Data/Day



Smart Building

Smart Campus

Smart City

New Industrial Revolution

- Industry 1.0 – Mechanical production
- Industry 2.0 – Electrical powered assembly line Mass production
- Industry 3.0 – Automation Computers and Electronics
- Industry 4.0 – Cyber Physical System, Internet of Things, Smart Technologies

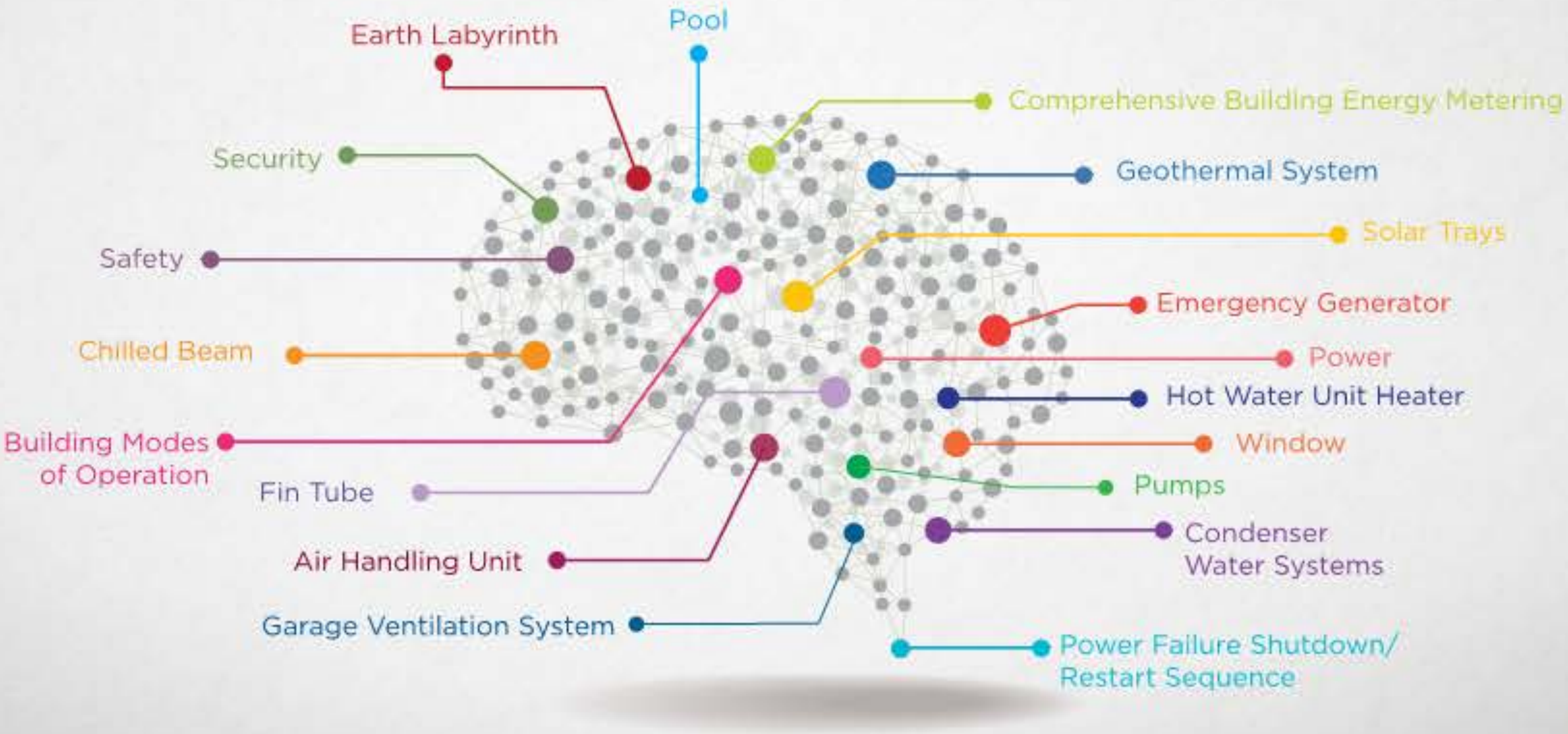
Why Smart Cities

- Lighting
- Parking – sensors – in ground sensor, license plate number, NVR technologies, Applications
- Environment
- Urban Mobility
- Safety and Security – Real time monitoring
- Waste Management
- Harnessing the power of data
- Industrial IoT networking (DC components)
- Water Utilities – acoustic leak detection , conversation,
- Power measurements

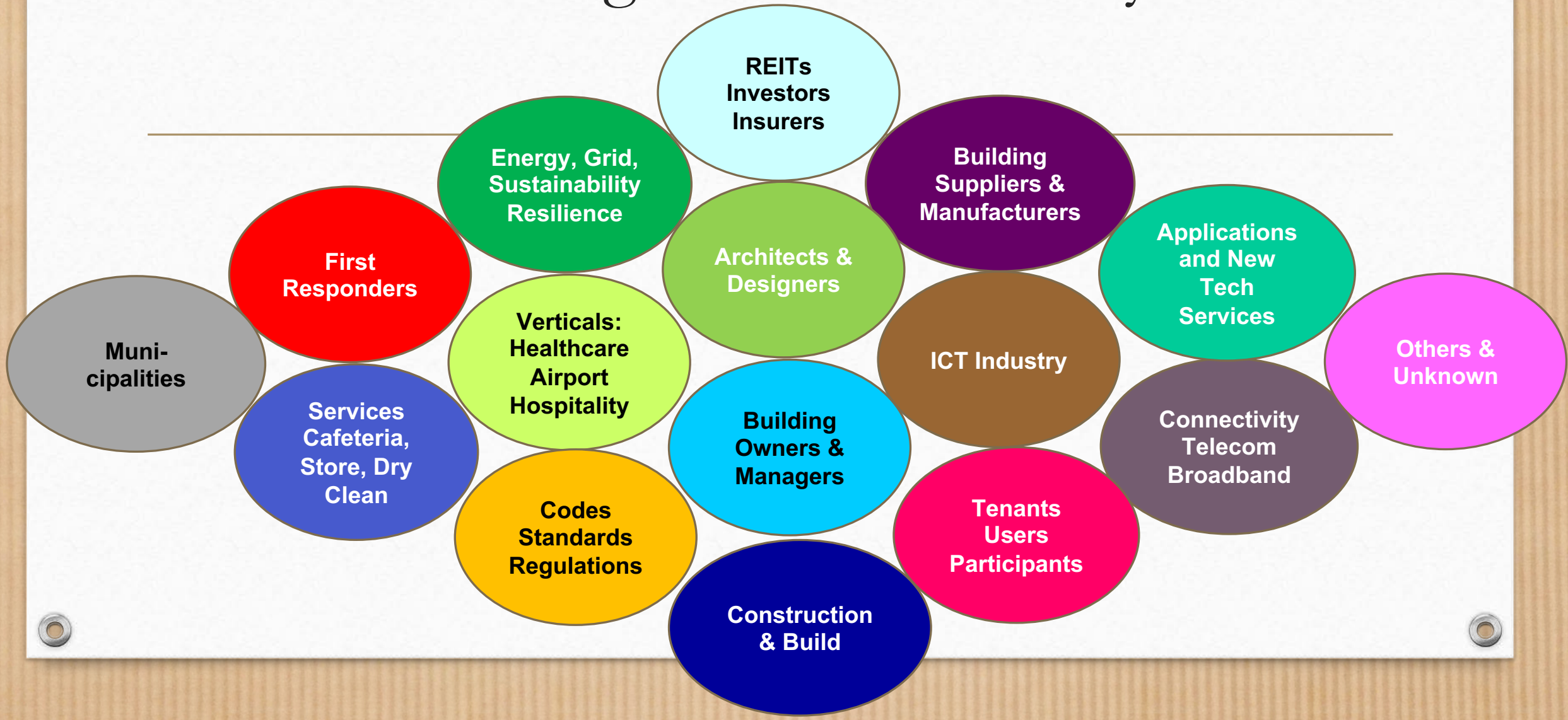
Smart Building Statistics

Can't Optimize What You Cannot Measure

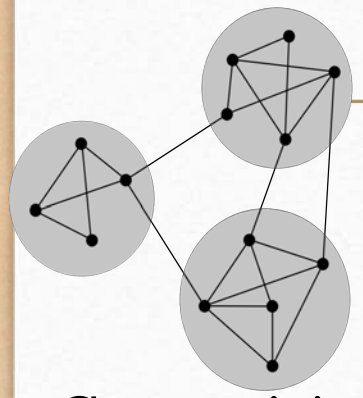
- Edge – Amsterdam uses 70% less energy than the average office building :Youtube
- Ethernet-powered LED lighting system is 80% more efficient than conventional illumination
- HVAC, lighting, and some types of electrical loads, can expect savings 10%-25% savings with a proactive energy-management programs
- Effect a desk to colleague ratio of 1:14 (Hot Desking)
- Personalized control of room temperature can raise productivity by 3%
- Optimized air quality can increase productivity by 11%


Earth Labyrinth
Pool
Comprehensive Building Energy Metering
Security
Geothermal System
Safety
Solar Trays
Emergency Generator
Chilled Beam
Power
Hot Water Unit Heater
Building Modes of Operation
Window
Fin Tube
Pumps
Condenser Water Systems
Air Handling Unit
Garage Ventilation System
Power Failure Shutdown/ Restart Sequence

Smart Buildings Extended Ecosystem



Smart Buildings Levels Assessment



Connectivity

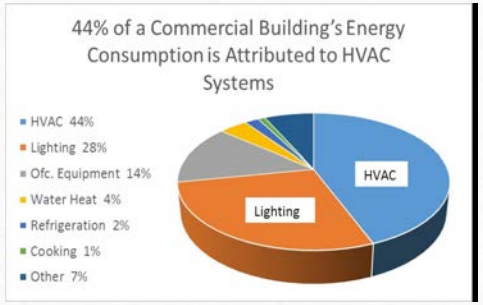
Functionality
Experience

Sensing

Intelligence
And Data

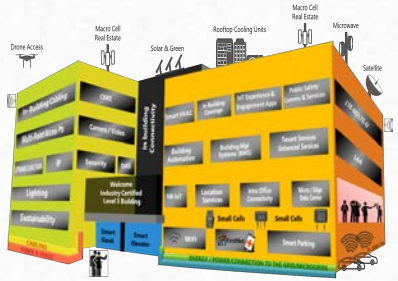
Security - Cyber
& Physical

Safety



Power & Energy

Resilience



Interoperability

Operations

Connected buildings-devices

- IP devices – everything will be connected and addressable
- Management of these systems (Managed services)
- IP security – COST EFFECTIVE WAYS TO PROTECT YOUR ASSESTS
- System security (Common Thread)
- Internet – WAN and LAN (Common Thread)
- Fiber connectivity – ISP, Point to Point (Common Thread)
- Low Latency
- Examples
  - Real Estate – Commercial and no Commercial
  - K-12, Higher Education
  - Health Care
  - Hospitality
  - Entertainment

First Steps Toward a smart city/Building/campus

1. Energy
   - Smart Grid
   - Lighting – multi-sensor LEDs
2. Sustainability
   - Sewage (sensors)
   - Garbage management
3. Operations Services
   - Support
4. Transportation
   - Public transportation tracking
   - Parking
5. Infrastructure
   - Gigabit Cities
   - Small Cells
6. Open Source Data
   - Sharing data

Value potential of the Internet of things

- Interoperability required to capture 40% of total value (building to building, millions of sensors- oil Rig example)
- <1% of data currently used, mostly for alarms and Real-time control more can be used for optimization and prediction
- By 2025 predictions
  - Vehicles – autonomous vehicles – $201B-740B
  - Home – Chore automation and security $200B – 350B
  - Offices – Security and energy $70B – 150B
  - Factories – Operations and equipment optimization - $1.2T – 3.7T
  - Retail environments – automated checkout - $410B – 1.2T
  - Worksites – Operations optimization health and safety -$160B – 930B
  - Human – Health and fitness - $170B – 1.6T
  - Outside – logistics and navigation - $560B – 850B
  - Cities – public health and transportation - $930B-1.7T

Enablers and barriers

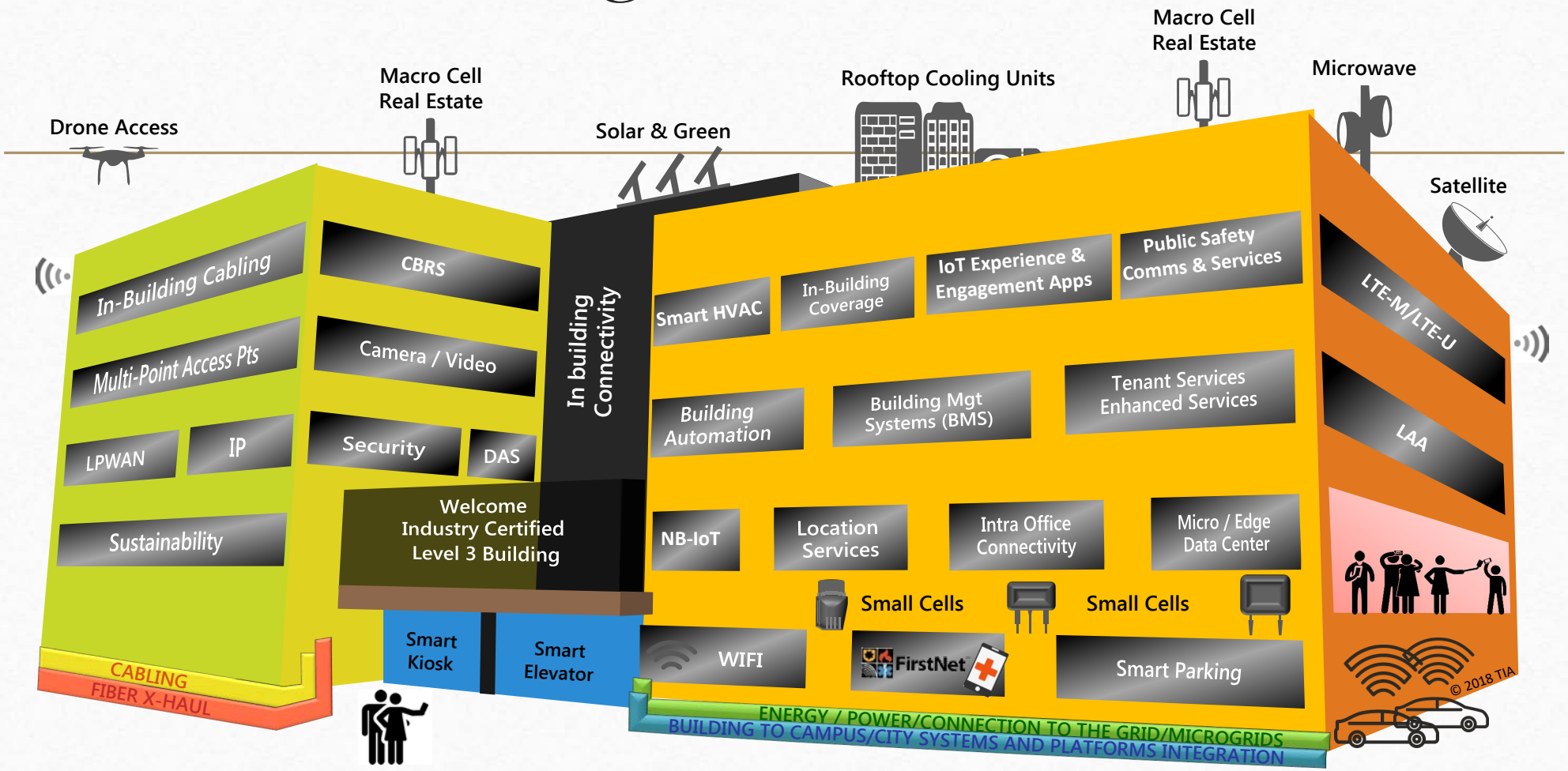
- Technology – smartphones
- Interoperability – open standards
- Privacy and confidentiality – data collected and used
- Security – protecting the data gathered and protect against unauthorized access
- Intelligent property – rights to data – medical example (device implant in patients body – patient, mfg, health-care provider that implanted the device and managing the patients care
- Organization and talent – traditionally IT organization was separate from the operating organization that is charge with managing the physical environment
- Public policy – regulatory approval
- Implications for stakeholders
  - Consumers – new set of risks with iot technologies
  - IOT user companies – investment in the IOT
  - Technology suppliers
  - Policy makers
  - employees



Deloitte's The Edge

https://www.youtube.com/watch?v=F86JI7-6piA

Smart Building As Connected Asset



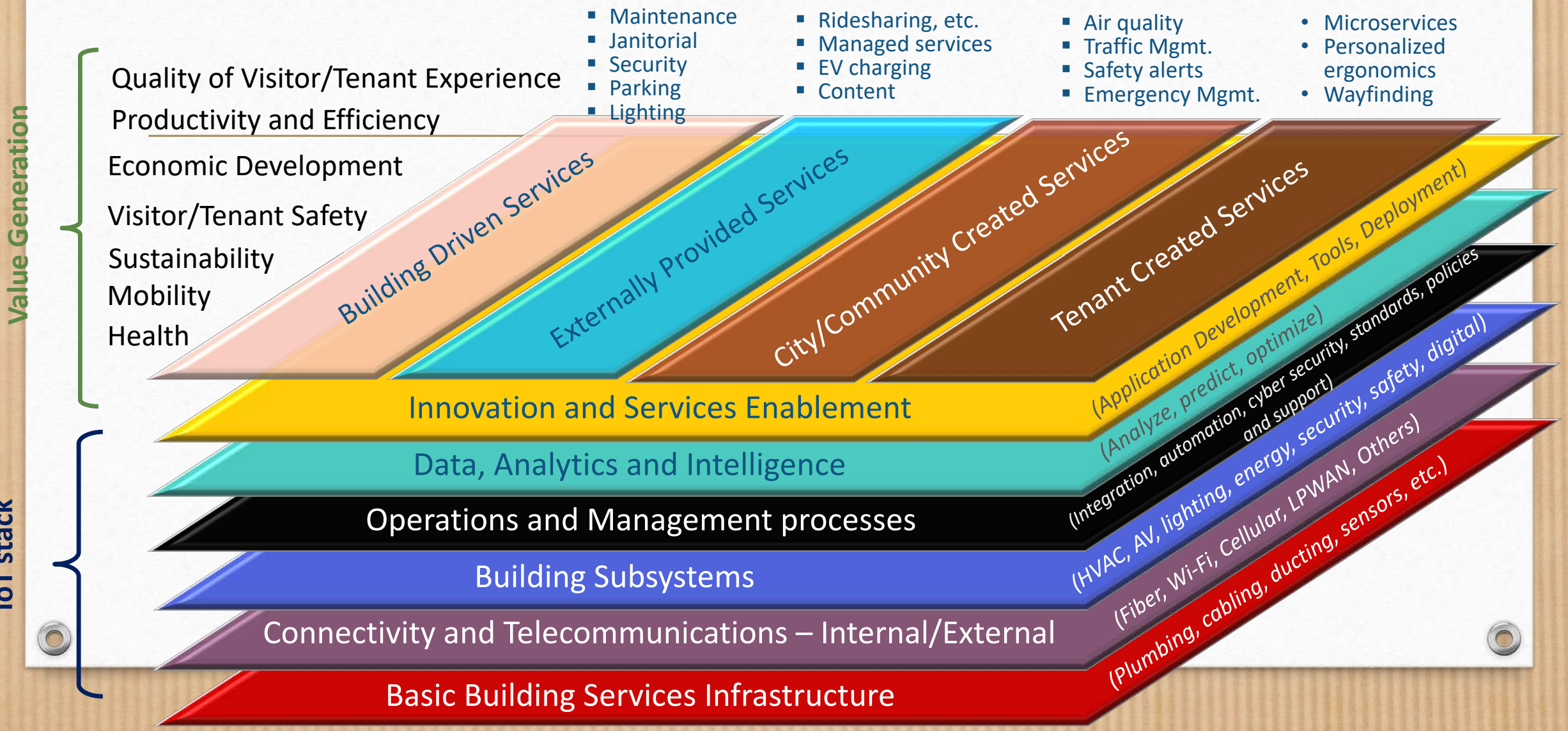
BACNET

https://www.youtube.com/watch?v=oevGXrkxEos

Digital Twin

https://www.youtube.com/watch?v=iVS-AuSjpOQ

Smart Building Layered Ecosystem

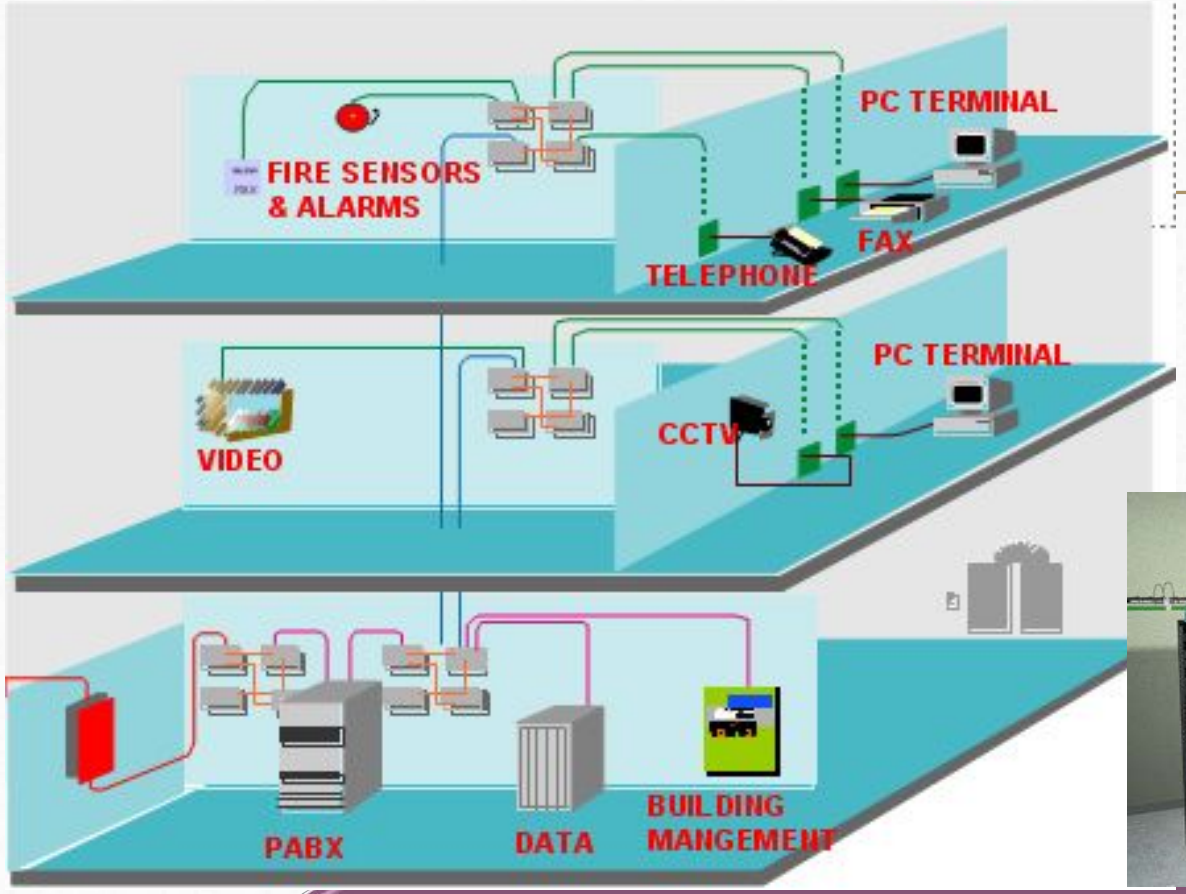


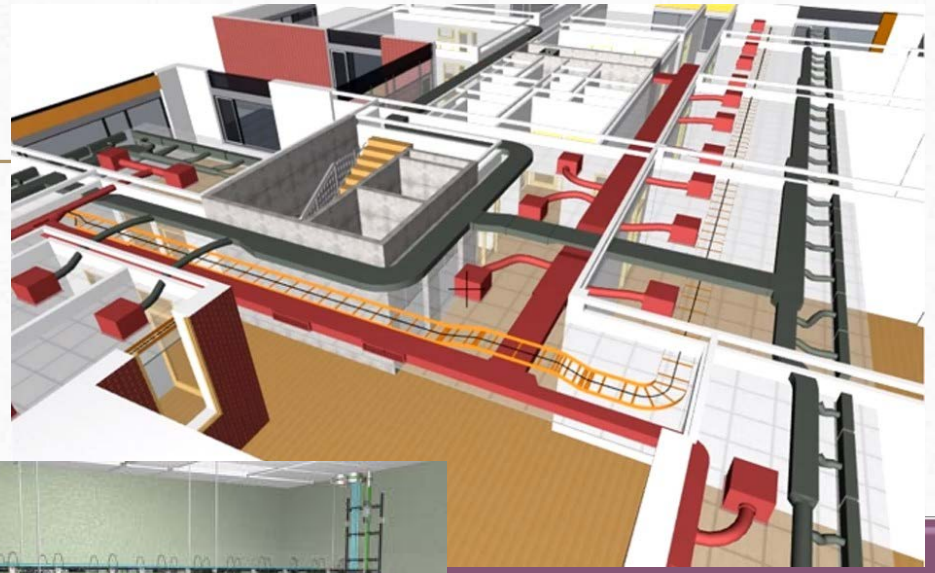
Basic Building Infrastructure

(Plumbing, cabling, ducting, sensors, etc.)

Basic Building Services Infrastructure

Connectivity & Telecommunications





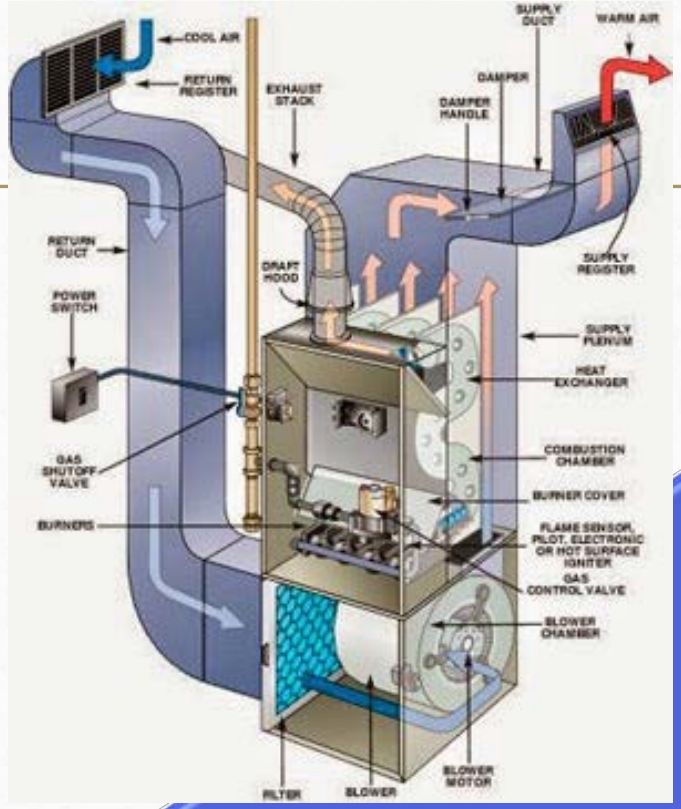
Connectivity and Telecommunications – Internal/External

(Fiber, Wi-Fi, Cellular, LPWAN, Others)

(Plumbing, cabling, ducting, sensors, etc.)

Basic Building Services Infrastructure

Building Subsystems



IoT stack

Building Subsystems (HVAC, AV, lighting, energy, security, safety, digital)

Connectivity and Telecommunications – Internal/External (Fiber, Wi-Fi, Cellular, LPWAN, Others)

Basic Building Services Infrastructure (Plumbing, cabling, ducting, sensors, etc.)

Building Operations and Management

Operations and Management processes (Integration, automation, cyber security, standards, policies and support)

Building Subsystems (HVAC, AV, lighting, energy, security, safety, digital)

Connectivity and Telecommunications – Internal/External (Fiber, Wi-Fi, Cellular, LPWAN, Others)

Basic Building Services Infrastructure (Plumbing, cabling, ducting, sensors, etc.)

Smart Building Layered Ecosystem

Data, Analytics and Intelligence (Analyze, predict, optimize)

Operations and Management processes (Integration, automation, cyber security, standards, policies and support)

Building Subsystems (HVAC, AV, lighting, energy, security, safety, digital)

Connectivity and Telecommunications – Internal/External (Fiber, Wi-Fi, Cellular, LPWAN, Others)

Basic Building Services Infrastructure (Plumbing, cabling, ducting, sensors, etc.)

Innovation and Services

IoT stack

- Innovation and Services Enablement (Application Development, Tools, Deployment)
- Data, Analytics and Intelligence (Analyze, predict, optimize)
- Operations and Management processes (Integration, automation, cyber security, standards, policies and support)
- Building Subsystems (HVAC, AV, lighting, energy, security, safety, digital)
- Connectivity and Telecommunications – Internal/External (Fiber, Wi-Fi, Cellular, LPWAN, Others)
- Basic Building Services Infrastructure (Plumbing, cabling, ducting, sensors, etc.)

IOT FOR HEATH CARE

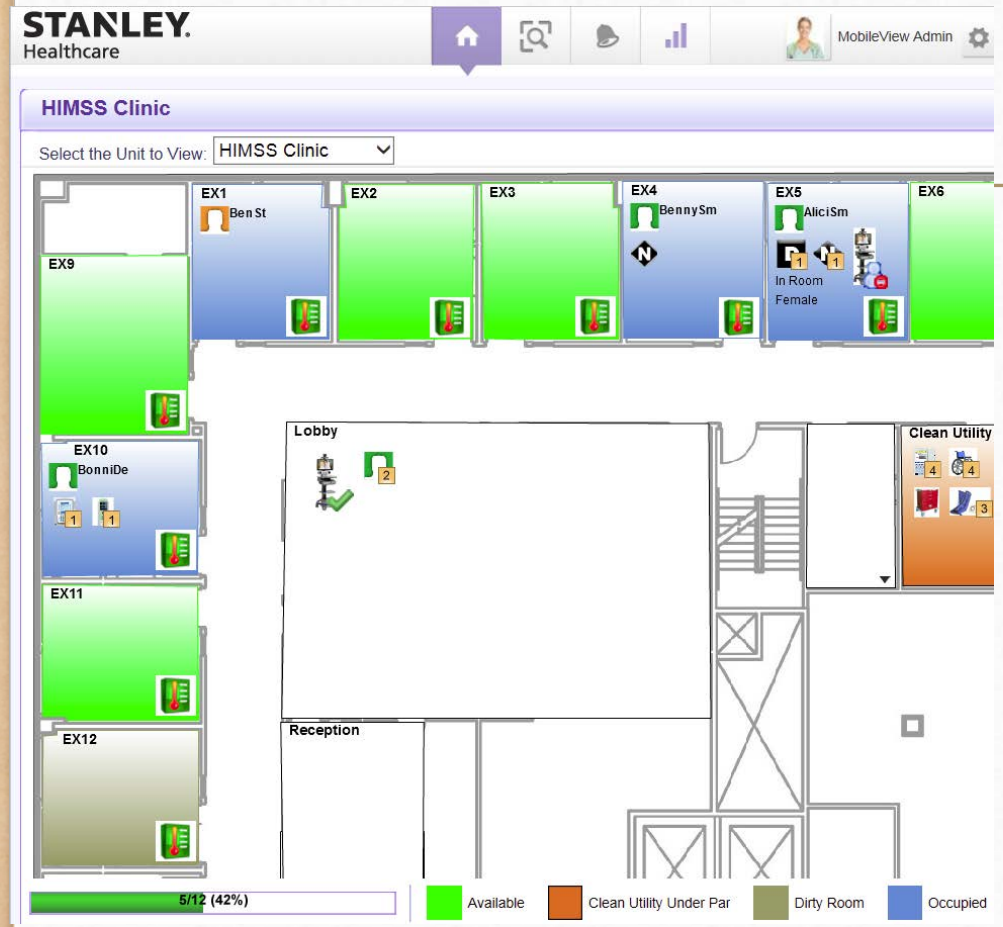
"When we talk about the Internet of Things, it's not just putting RFID tags on some dumb thing so we smart people know where that dumb thing is. It's about embedding intelligence so things become smarter and do more than they were proposed to do."

Nicholas Negroponte

Health Care examples - Real Time Location System (RTLS)

- Locates Doctors, Nurses and other staff
- Tracks Patients and Visitors
- Identifies location of clinical and other valuable equipment
- Custom algorithms to determine specific events, activities and alerts
- Enhances workflow, improves healing environment, increases efficiency

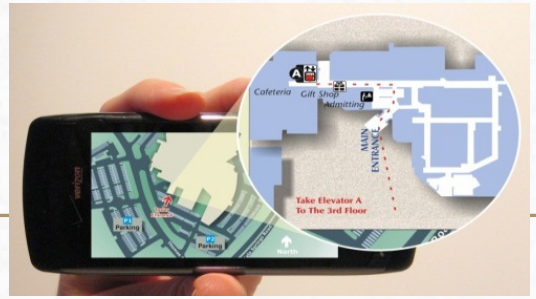
RTLS Sensors and Tags – Vocera -Wearables



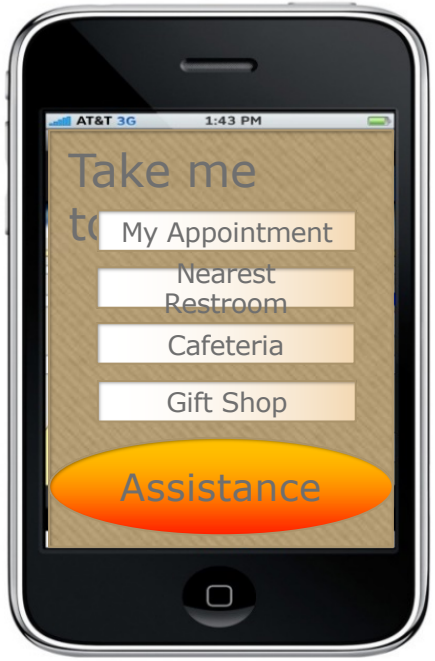
Stanley Healthcare and AiRISTA Flow (Ekahau)

RTLS Use Case – Way-finding

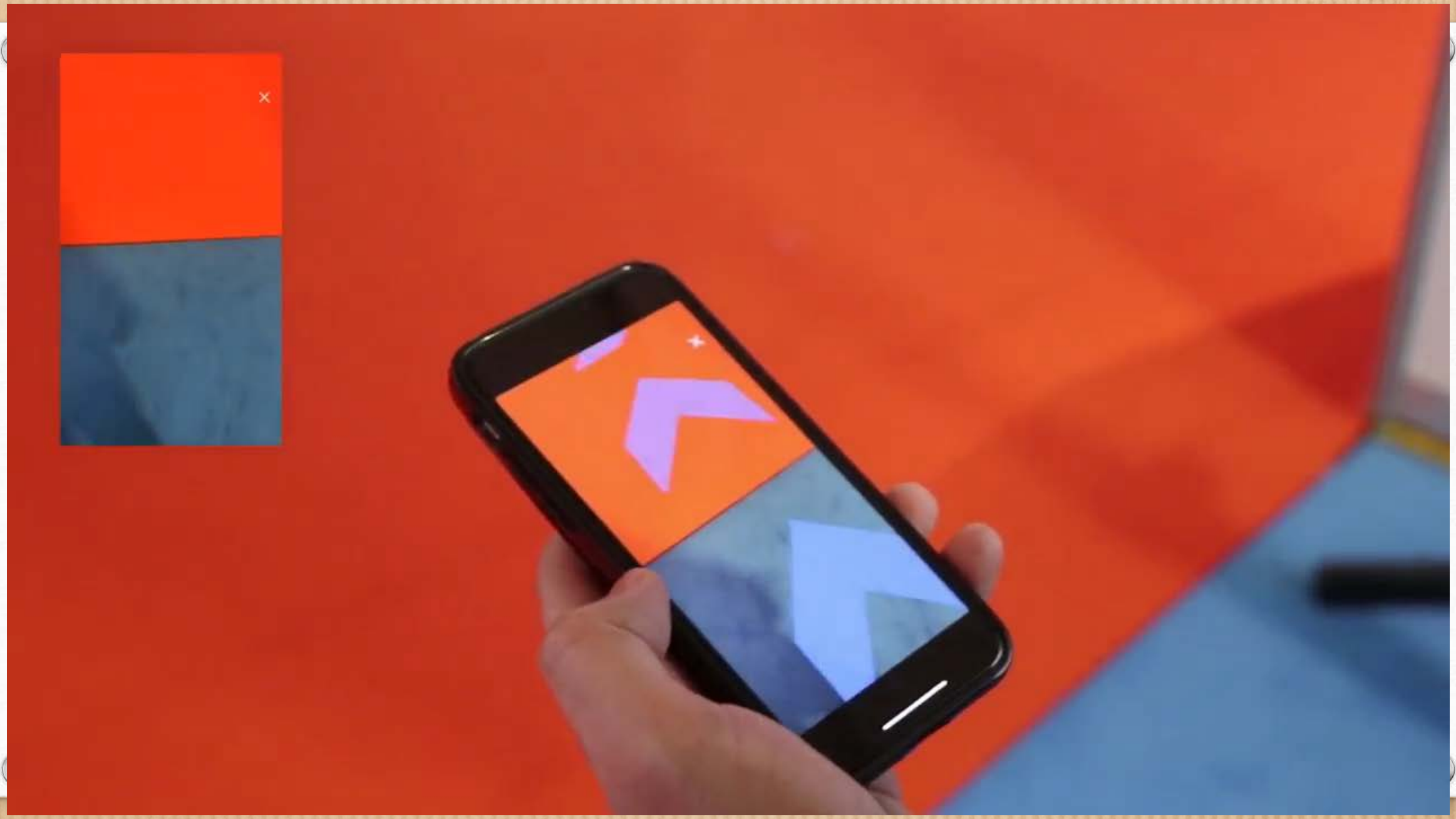
Smartphone App guides Patient to Hospital via GPS and directs to Parking Space / Valet.



App switches to walking directions to guide Patient to Main Entrance. App alerts Department that Patient is en-route and can inform and redirect Patient if appointment is delayed.



App allows Patient to select various destinations at Hospital, and can also provide real-time assistance if needed.



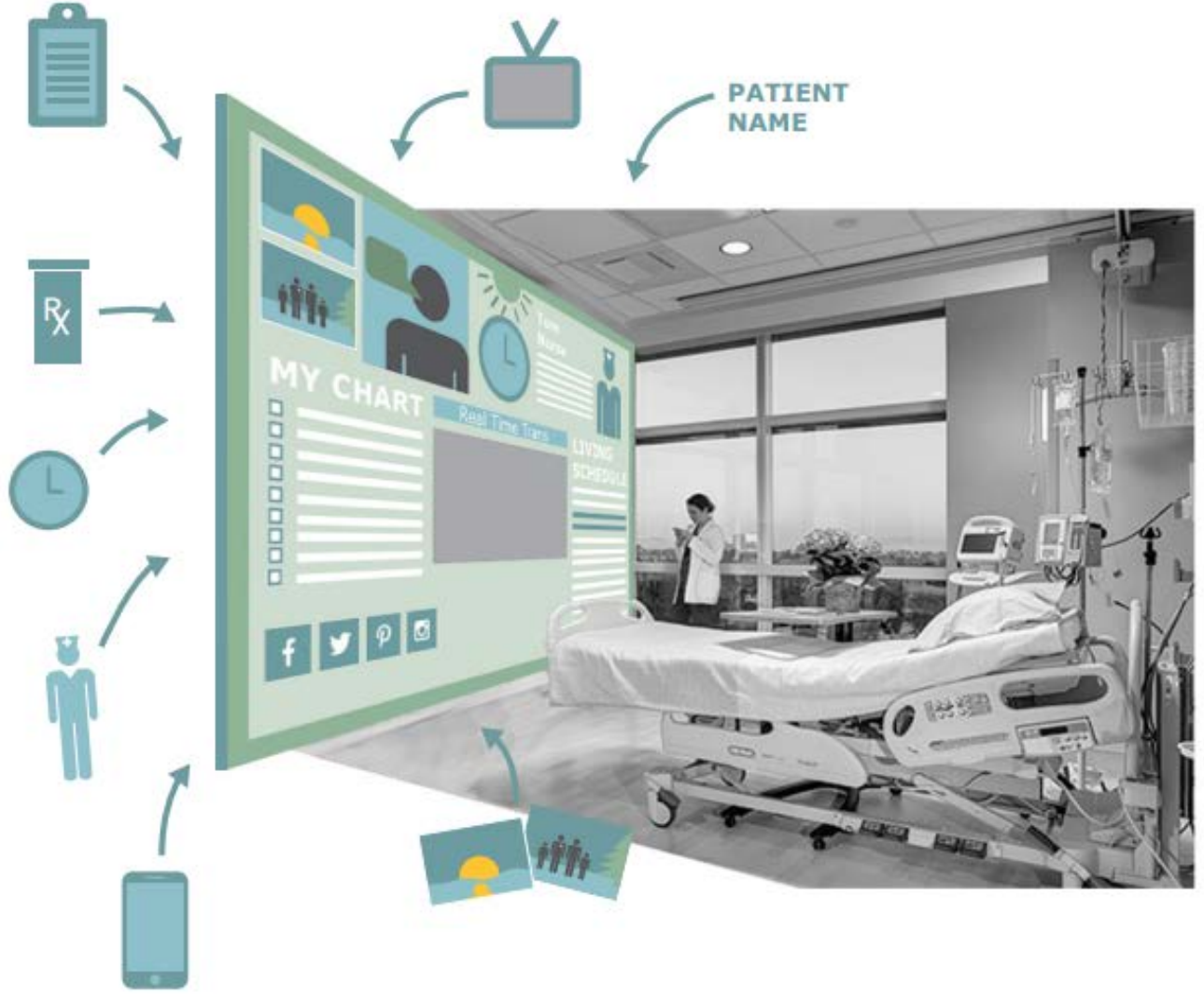
IoT enhances the Patient Experience

- Personalized Room
  - Lighting
  - Temperature
  - Décor
- Enables Positive Distraction Therapy, improves outcomes, and empowers the patient and their family

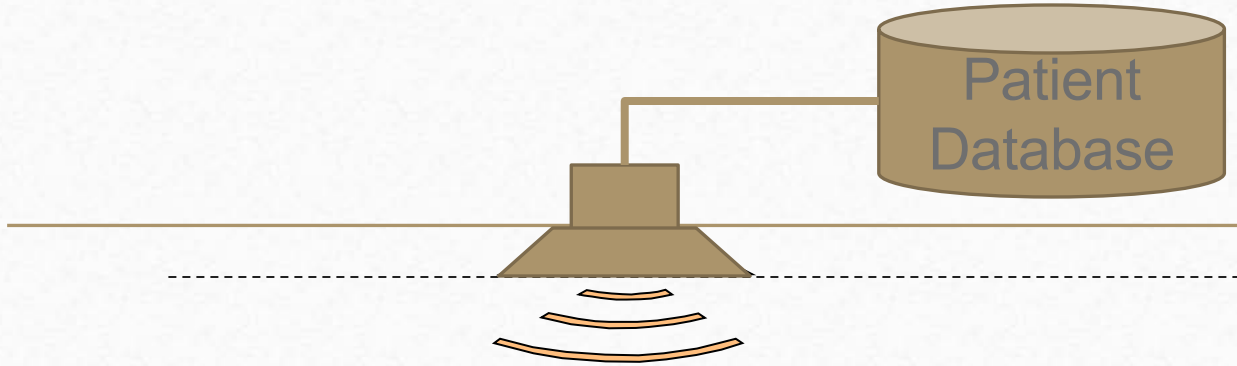
Adopt-a-Room, University of Minnesota, Fairview

Video Footwall

- Education & Entertainment
- Clinical Systems
- Care Team
- Schedule
- Family Window
- Video Visit
- Multi-language / Speech Recognition

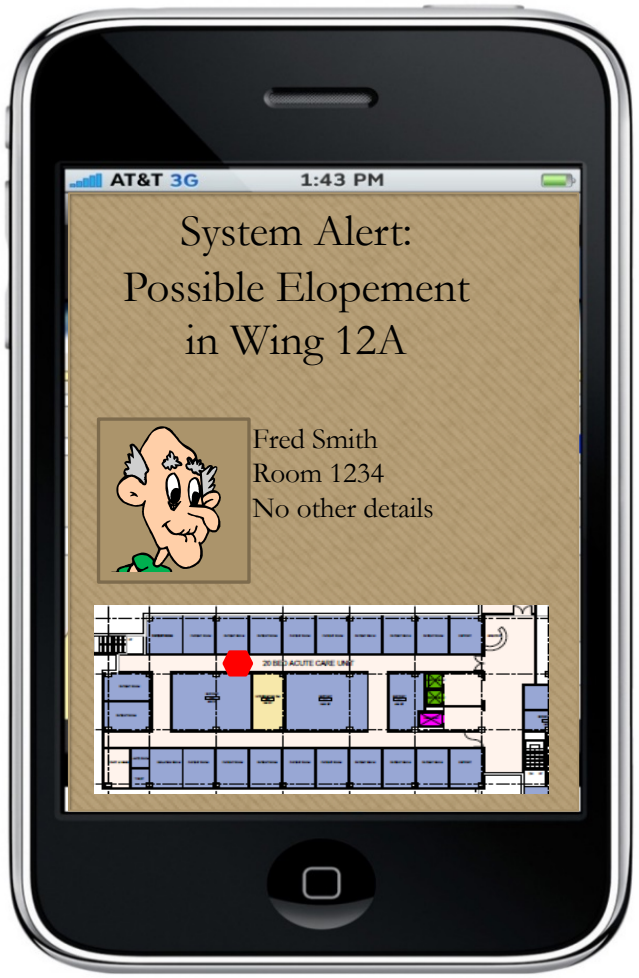


IoT facilitates Building as Caregiver



EXIT

IoT facilitates Building as Caregiver



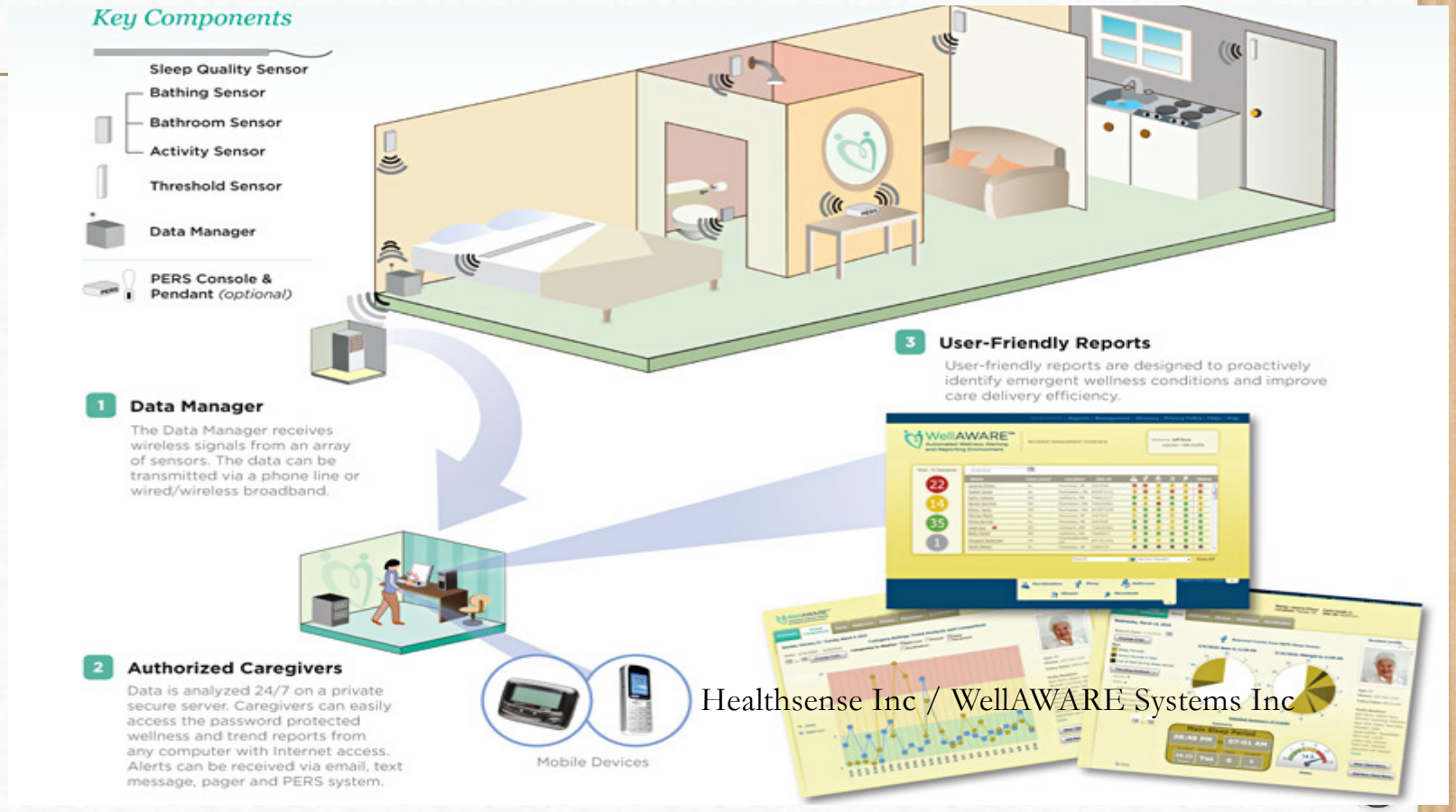
IoT facilitates Building as Caregiver

Benefits

- Allows staff to focus on high-value tasks while system monitors the location patients
- Improves patient safety and provides family members with sense of security
- Enhances environment by reducing opportunities for negative encounters
- Provides valuable clinical data regarding recovery state of each patient
- Handling time with patient – doctor aspect

Extending IoT to the home for healthcare

- Hospital coverage extends to home
- IoT sensors deployed in home monitor health
- Reduces recovery time and improves outcomes



Healthsense Inc / WellAWARE Systems Inc

Extending IoT beyond the home for healthcare

- Connected health via smartphone and / or smartwatch app
- Wearable technologies
- Predictive analytics allow first responders to preempt emergency

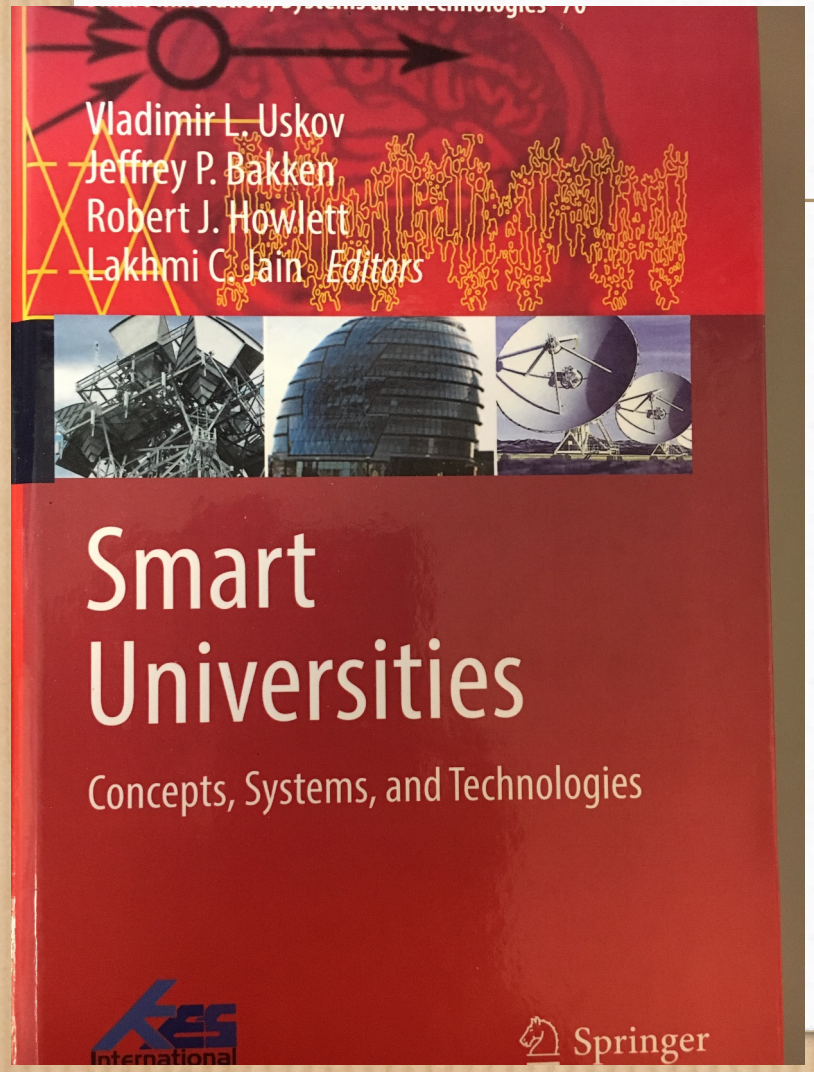
Dario Blood Glucose Management System

Nokia / AMGA / Withings

Digital Twinning Health Care

https://www.youtube.com/watch?v=H6JzPCbyVSM

Smart universities – UNM 101

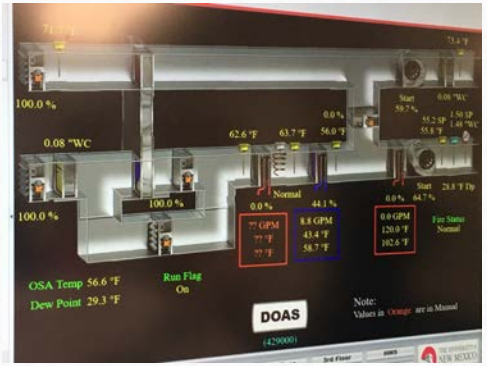


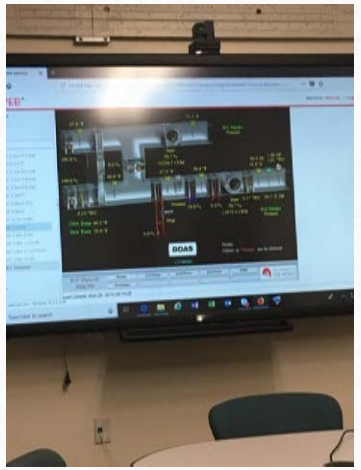
Smart universities

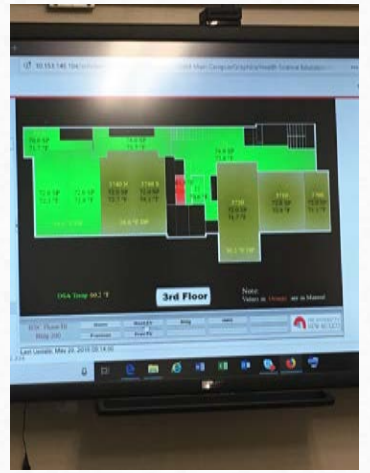
- Same as Smart Building requirements as a baseline service
- Smart Education

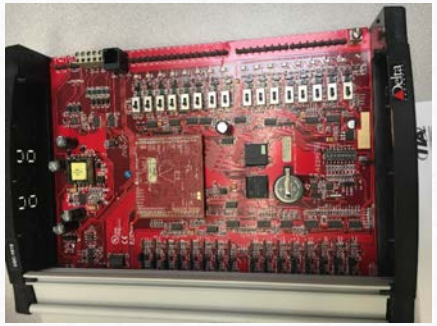
- Smart Learning Environments
- Smart Teachers
- Smart Learning Communities
- Smart Classrooms
- RFID technology
- Taxonomy of smart university
- Attraction for Students
- Ubiquitous Wi-Fi and Cellular
- Safe environment

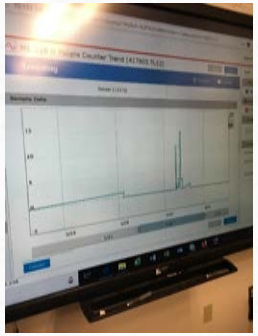
UNM Facilities BACNET











UNM 101

- 14,000 end points monitored by BAS via IP connection with DDC (Distributed digital control) controller systems
- 400 buildings - example is like taking care of 400 cares made by different mfg. but need to be monitored and data bases kept up
- Inputs to DDC are analog or digital
- Protocol is BACNET (local IP, Remote IP , Ethernet MAC based or MSTP hardwired)
- Historical data pulled into system (Historian)
- DDC controllers report back to ALC - web based system or Detla system for controlling of the DDC controllers or retrieving data
- UNM has two programmers for Code
- 200 DDC in 400 buildings
- LED are AC, not DC powered

UNM 101

- People counters
  - UNM student project with Physical plant

  - Occupancy - Ventalization, fresh air, heat, cooling
  - Lights
  - Dampers for Air Flow
  - Per room (usually conference rooms)
  - Savings of 60% on energy
  - Not heating, cooling entire building
- New buildings - Dyson Hand dryer with facet https://www.youtube.com/watch?v=Tw_N71HFxlk
- Skills sets for the future
  - PM that knows all aspects of all systems (basic, intermediate or advanced)

UNM 101

- Experience
  - Temperature - measured and adjusted - DDC systems
  - Zones yes and based on People counters or C02 sensors , bringing this to per room versus building saves energy
  - Automated temp set-back - yes
  - Fresh air - yes
  - Carbon Dioxide - yes measured
  - Background noise - motors, fans, etc. are designed for least amount of noise generated - sound masking in some buildings, but mostly Health Care
  - Smart Parking - not today
  - Smart Elevator - not today
  - Smart Utilization - used to have a committee doing space allocation but has been moved or dissolved at this point
  - Solar control - yes on buildings with Solar
  - Smart windows - yes in some new buildings - chromic glass

UNM 101

- BMS system - 200 out of the 400 buildings completed
- Lighting - exterior - LED story listed above, parking structures are all LED
- Easy building operators controls - yes but to the engineers that have this knowledge
- Remote access to BMS - yes
- Peak shedding and load leveling - used to but not anymore
- Automated work orders - just starting to test - as in bathroom with phone number but no application for the University except log into the Facilities work order system
- AFDD - not yet implemented but interest in doing so
- Monitoring soil/groundwater - Yes but periodically doing
- Moisture detection - under floor systems
- Irrigation water monitoring - not today
- Automated waste collectin – not today

UNM 101

- Sensing
  - Auditory - detection - not today

  - Energy usage - yes with the use of Ford Utilities
  - Environmental - temp, humidity - yes
  - Light: Lumens - some - but not measured for color
  - Occupancy - people sensing - yes discussed above
  - Tracking - asset sensing - not today
  - ASSETS - same
  - Water usage - yes to some extent

Questions – Smart City/building/Higher education

- Where do you see the value of IoT in your environment ?
- What do you see your University or vertical doing today with IoT project or inative ?
- What do you regard as the most interesting use of IoT ?
- What is the biggest risk with IoT ?
- What one factor would most accelerate the benefits of IoT ?
- What's one policy change that would accelerate the benefits of IoT ?
- What shouldn't be connected and why ?
- What happens to big data and privacy ?
- What skill level do you anticipate for an IoT and the associated training

"[T]he Internet will disappear. There will be so many IP addresses, so many devices, sensors, things that you are wearing, things that you are interacting with, that you won't even sense it. It will be part of your presence all the time. Imagine you walk into a room, and the room is dynamic. And with your permission and all of that, you are interacting with the things going on in the room."

Eric Schmidt, Google

Thank you

QUESTIONS ?

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