

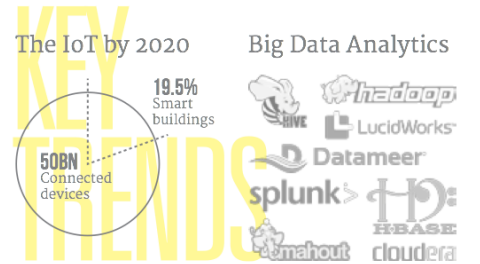
Big Data – Analytics – IoT – BloT – Smart, Connected Buildings – Smart Energy Analytics



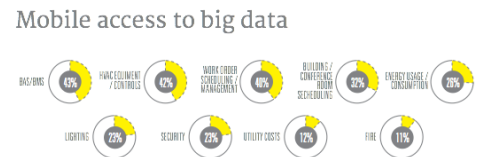
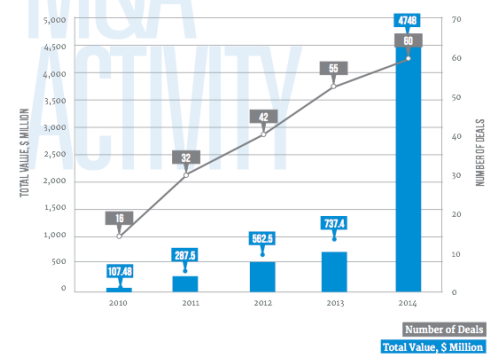
BIG DATA FOR SMART BUILDINGS

Emerging Solutions

- DASHBOARDS & DATA VISUALISATION
- FAULT MONITORING & DETECTION
- PREDICTIVE ANALYTICS
- BUILDING OPTIMIZATION



BIOT and Building related Big Data Deals Completed from 2010 to 2014

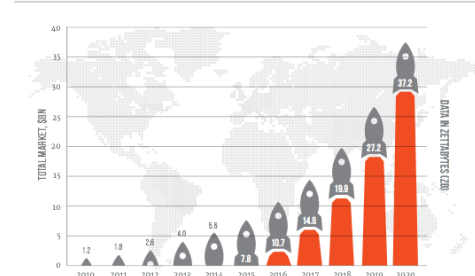


The Protocol Soup

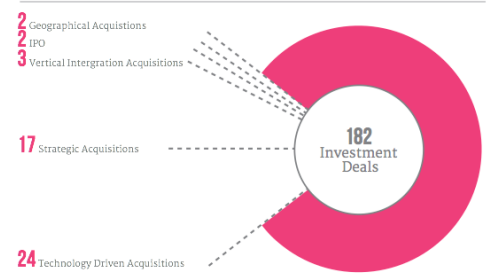
- LEGACY BUILDING PROTOCOLS**: BACnet / LonWorks / ModBus / KNX / DALI / C-Bus
- COMMUNICATIONS PROTOCOLS**: 6LowPan / Wifi / Zigbee / Bluetooth / ZWave / RFID / Wired
- IOT MESSAGING PROTOCOLS**: MQTT / CoAP / DDS / AMPQ / XMPP
- ALLIANCES & CONSORTIA**: AllSeen / Open Interconnect Consortium / Industrial Internet Consortium / Wi-Sun Alliance / Thread Group

Exploding Data Volumes

80% GROWTH IN DATA VOLUMES DATA VOLUMES DOUBLING EVERY 2 YEARS



Deals by Primary Driver 2010 - 2014



Lots of buildings, lots of applications, lots of potential.

- What's needed to extract this POTENTIAL??
- A connecting middleware or platform - Volttron??

Partial and growing list of applications that need BAS & energy data from buildings

Skyfoundry	http://skyfoundry.com/
Clockworks	http://www.kgsbuildings.com/clockworks.aspx
Infometrics	http://www.cimetrics.com/
Iconics	http://www.iconics.com/Home/Products/AnalytiX/Facility-AnalytiX.aspx
Coppertree Analytics	http://coppertreeanalytics.com/
Panoptix (JCI)	http://whatspossible.johnsoncontrols.com/community/panoptix
BuildingIQ	http://www.buildingiq.com
entic	http://www.enticusa.com
LOBOS	http://www.enerliance.com
BuildingOS	http://luciddesigngroup.com
Splunk	http://www.splunk.com/view/SP-CAAHV
bdoc	http://www.biforbuildings.com/
Ezenics	http://ezenics.com/
Accenture	http://www.accenture.com/us-en/Pages/service-smart-building-solutions.aspx
IBM	http://www-142.ibm.com/software/products/us/en/tririga-energy-optimization
Di-BOSS	http://www.di-boss.com/di-boss.aspx
Attune	https://hbsmicrosites.honeywell.com/HBSCDMS/Attune/
Phoenix Energy Tech	http://www.phoenixet.com
Pacific Controls	http://www.pacificcontrols.net
FacilityConnex	http://facilityconnex.com/
PI Coresight	http://www.osisoft.com/software-support/what-is-pi/Analyze.aspx
PACRAT	http://www.facilitydynamics.com/
Interval Data Systems	http://www.intdatsys.com
NIST - APAR & VPACC	http://www.nist.gov/el/building_environment/mechsys/fddchac.cfm
DABO	http://adms-tech.com/
FlywheelBI	http://flywheelbi.com/

Our work with Energy Dev.



Sustainability and

- Portfolio - 400 buildings, 150 with BAS. Schools, office buildings, recreation centers, libraries, police stations, etc.
- Started in 2014 connecting two buildings and doing data-driven RCx
- Today -50 of the largest buildings connected. 170,000 physical data points: inputs – temp, hum, CO2, equipment status, etc; outputs – fan, pump, valve, damper, boiler, chiller commands.
- Web-enabled facility and energy dashboards, reporting, alarming, trending.
- BAS, EIS, AFDD, DR, & Optimizations

Early Challenge – data trending, tagging, & archiving.

- No universal, open, standard, trending hardware or platform.
- No tagging standards (some positive develops here)
- No database, historian, or archiving standard.

- We tested and experimented with a few options, finally choosing Building Robotics Trendr. Worked OK, but alas was not to be. Lack of support, further development, discontinued product.
- Volttron?

Volttron

- DOE / BTO / PNNL developed
- Open source
- Platform to connect buildings to 3rd party applications
- Modern software architecture

Current deployment

- 8 physical boxes installed – 7 Intel NUC's & 1 Kangaroo PC
- Trending set-up on 6 Volttron instances in 6 buildings
- Largest site has 7500 points trended on \$100 Kangaroo PC
- Volttron Central & Mongoddb

What's next

- Set-up trending on 4 more sites
- Improve on the “ease of deployment” – web based interface for device and points scanning, and trending.
- Add meta-tagging capabilities.
- Add ad hoc charting, graphing, visualizations of the data
- Add 35 more buildings by converting existing Trendr boxes to Volttron instances.
- Data to multiple different databases
- Work with 3rd party application providers (vendors) to retrieve data from Volttron platform - API