Bringing Observability to the Built Environment at City Scale

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intro: me
my career started with Industrial IT
600 employee plant, Fortune 100 company
isolated process control network, NT 4.0 Domain
vendor driven, vertically integrated architecture
vendor driven, vertically “integrated” architecture
actually 67 separate vertically integrated architectures
silos...
that’s one way to do it...
67 panes of glass?
So why am I here?
intro: DGS
District of Columbia
Department of General Services
~28M ft² (2.6M m²) building portfolio, valued at ~$40B USD

~$450M USD annual operating budget, ~$100M spent on energy

established an energy, sustainability and environment division in 2012

progressive city government pushing zero carbon goals

responsibility as an equitable provider of civic services
intro: NCE
supporting the DC Department of General Services
energy, sustainability and environment
BUILDSMART DC:
More data.
Less Carbon.
Zero Excuses.
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buildsmartdc.com launched in Summer 2013
provides a unified portal for energy consumption data about the ~400 buildings in the DGS portfolio.
first time a city had achieved near-real-time aggregation of utility data and made it available to public
intro: VOLTTRON™
U.S. Department of Energy sponsored OSS platform for “transactional energy”
framework for distributed sensing and control with sane trust and security defaults
by researchers for researchers, but with lofty goals of commercial adoption
what we’re building now
BUILDSMART DC:
More data.
Less Carbon.
Zero Excuses.
what is retro-commissioning?

process to restore and optimize operating building systems to their design intent
intent ≠ state
buildings are complicated.

conditioning spaces in commercial buildings more closely resembles a complex industrial process than your home AC
an industrial process with a different product in every room, and the product changes multiple times each day
focus on energy efficiency at the design level encourages adoption of complex systems to achieve efficiency goals
if you don’t see the parallels yet...
system designers rarely connect with system operators

facilities staff are operating systems without understanding the design intentions
rather than embracing and tackling the complexity head on, market has looked to vendors to hide it
Our goals

- define the metrics that drive sustained operational excellence
- reduce energy consumption and carbon impact of the built environment
- raise the standard for comfort and reliability
- develop the workforce that can operate and maintain the building of the future
- deliver an aggressive ROI that allows investment in future innovations
the approach
disaggregate energy and operational data, collect critical operational state from every system
invest time at the front end in data quality assurance to enable actionable insights at all organizational levels
support simple operational insights for existing staff while building out infrastructure for advanced analytics
deliver data and insights to the public to ensure accountability and operational excellence is sustained
where we are
application dataflow

building equipment ➔ IoT Gateway (VOLTTRON) ➔ message bus ➔ crate.io cluster ➔ grafana
46 sites
>29,700 topics
>2,700,000 samples per 24h
>972.2M

total sensor records
data-discovery for troubleshooting
ongoing operational status
fault detection and alerting
what have we accomplished?
24 sites with active programs
$4M USD
total savings to date
$1M USD

current recurring annual savings
20% reduction in energy costs at priority sites
$500K USD additional recurring annual savings this fiscal year
what’s next?
**next steps**

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
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<tbody>
<tr>
<td>continue to develop business processes around the available data</td>
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<tr>
<td>implement advanced DERMS applications using our technology infrastructure</td>
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<td>move toward a constant commissioning reality with continuous improvement</td>
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<td>identify new ways to empower our users with data to achieve a sustainable city</td>
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<td>integrate other energy resources to deliver virtual power plant solutions</td>
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what is constant commissioning?

maintain optimal performance through dynamic occupancy, equipment availability, weather, and energy markets
what is DERMS?

Distributed Energy Resource Management Systems (energy buzzword warning)
Virtual Power Plant; mitigating the need for physical infrastructure through intelligent management of existing energy resources
deliver observability to the built environment
build the platform that enables sustainable, responsive management of real estate portfolios
Thank You
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