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"Grids" and Connecting the dots on Climate Action A Question of Architecture

Bruce Beihoff

Technical Director Systems and Industrial Research Grainger Institute for Engineering |University of Wisconsin-Madison Director of Technology Innovation Midwest Energy Research Consortium 11-8-2019





Outlining the Discussion

Objective: Inspire questions and discussion about the convergence of our Big Systems, "Grids" and our Climate

- ARCHITECTURE DEFINED
- ARCHITECTURAL APPROACH TO BIG THINGS
- EXAMPLES
- BIG GRIDS | BIG SYSTEMS | CLIMATE
- ARCHITECTURE ; NOT JUST FOR THE BIG
- ARCHITECT OUR GRIDS FOR WIN-WIN CLIMATE ACTION





ARCHITECTURE DEFINED

- A logical description of present and future interactions between structure and function (Natures View)
- A logical description of interactions between structure and function to meet present and future objectives.. (Designers View)
- A set of principles that enable interactions between structure and function to meet present and future objectives.. (*Policy Framework View*)



WHY AN ARCHITECTURAL APPROACH

- Architectural Approaches are not new Over 6000 years old
- <u>Growing Systems Complexity</u> have made architectural approaches critical to success of Large Systems ...Our Climate, Environment and Human Systems







Architecture You All Know ...

Functions



COMFORT, SECURITY, LIGHTING AND ACCESS TECHNOLOGIES





Electrical Grid Architecture Example



Functions	Structures	New Functions	New Structures
-Generators -Loads - Grid Converter - Controllers -Protectors - Storage -Filters	 Power Plants Dist. Gen Solar PV Farm Battery Syst Sub Stations 	 -Dist. Routers -Data/Control Aggregators - Dist. Optimizer - Mode adaptive control - SS Xfmr 	 Modular Power Plants Combined Physics Power Processor Std Cell Conversion Sub Stations Hybrid Battery System

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- Coupling is increasing between these grids
- The Largest Man-Made Systems interacting with the Largest Terrestrial Systems
- Could we hope to improve our grids (our Climate) without Architecture ...?



ARCHITECTURE AND THE GRIDS

The Journey

Conceptual

Functions and Structures

Primary Dynamic Network



S1 S2 S3 S4 S5 S6 F1 0

Nicrogrids Distribution Grid Understand Distribution Grid

Multi Doman Networks



Domain Relations (Who owns and operates)

Policy & Standards

Document No.	Title of the document	
RFC 5548	Routing Requirements for Urban Low Power and Louis Networks	
dealt address prof-transferres gualelines	Condelinese for Using IP/6 Transition Michamorae during IP/6 Deployment	
draft baker setf-core	Internet Protocols for the Smart Grid	
draft-c1222-manapott-over-sp	ANSI C12.22, IEEE 1703 and MC12.22 Transport Over IP	
draft commence matter	A Cryptzgraphe: Suite for Exchedded Systems (StateE)	
duil dass every controlog mb	Power and Energy Monitoring MB	
daf-dan-peve-naugeneer-ach	Power Mangement Architecture	
draft setf-Slevypax concares	Design and Application Spaces for 6LoWPANa	
draft-inf-many-mergy-aware-gab	Energy-aware Networks and Descore MIB	
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draft or froit terminology	Tremanology in Low power And Lener, Networks	
draft fee gg problem-manuent	The Internet of Thargs - Concept and Problem Statement	
draff-earty-ration	IPv640-IPv6 Network Prefix Taaslation	
dist-offme-cas-beeningping	Security Boostrapping of Resource-Countrained Detainer	
dust-mindan mody-bet-oriunfastion	Recommendations for the Remediation of Bots in 13P Networks	
out techno man applicability statement	Energy Maragement (EMAN) Applicability Stamport	

Source: NIST Smart Grid Framework v1.02010





You don't have to start big



You can begin the Architectural Evolution at key gating application cases





An ongoing architecture for "a" Future Grid



Utilities , Third Parties

"How does our economics and operational architecture change in a new grid...?"

- How do we unify and federate these different points of view.... ??
- How do we organize the team to plan and implement a new architecture.... ??
- What is the best path of grid evolution ...?



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Architecture for "Grid Wise" Wisconsin



Planning our grids to fast forward Wisconsin on Climate Action

- Model Systems, Architect, and evolve grids as policy practice
- Make data as transparent as needed through policy
- Evolve Wisconsin to be "Grid Wise" to support win-win Climate Action





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Bruce Beihoff Technical Director Industry Relations University of Wisconsin-Madison Director of Technology Innovation Midwest Energy Research Consortium Beihoff@wisc.edu, 1-608-262-2707 11-8-2019



