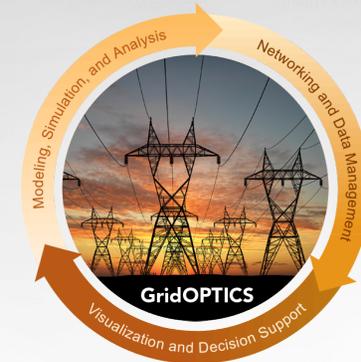


The 2nd SC12 International Workshop on High Performance Computing, Networking and Analytics for the Power Grid ( )  
Salt Lake City, UT, USA, November 11, 2012

In part sponsored by Future Power Grid Initiative



# Data to Knowledge to Actions *by Way of High Performance Computing*

**Henry Huang**

Pacific Northwest National Laboratory

Richland, WA

## HiPCNA-PG Workshop Program Committee

- ▶ **Daniel Chavarría**, Pacific Northwest National Laboratory, Workshop Chair
- ▶ Bora Akyol, Pacific Northwest National Laboratory
- ▶ Mihai Anitescu, Argonne National Laboratory
- ▶ Gilbert Bindewald, US Department of Energy
- ▶ Jeffrey Dagle, Pacific Northwest National Laboratory
- ▶ Zhenyu (Henry) Huang, Pacific Northwest National Laboratory
- ▶ Patrick Panciatici, Réseau de transport d'électricité
- ▶ Boming Zhang, Tsinghua University

# Why HiPCNA-PG workshop?

- ▶ Raise awareness of power grid challenges in the computing society
  - Power grid problems can leverage vast amounts of work done in other domains.
  - Power grid problems do have unique challenges that require new research by multi-disciplinary teams.
- ▶ Exchange research ideas and results
- ▶ Foster a multi-disciplinary community to tackle power grid computational challenges
- ▶ *Computing is a core element of our Future Power Grid Initiative*

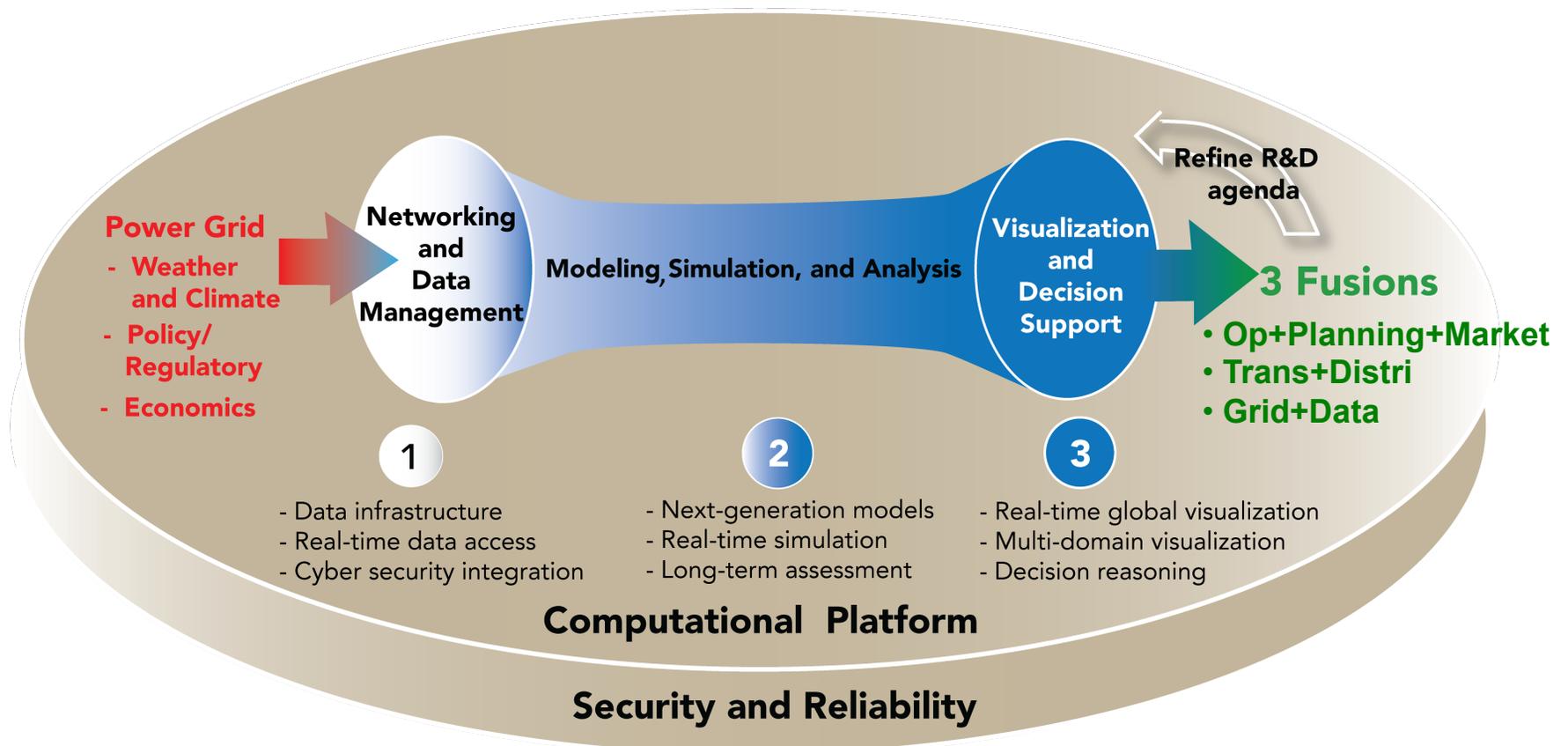
# Future Power Grid Initiative (FPGI)

Henry Huang, Jeff Dagle



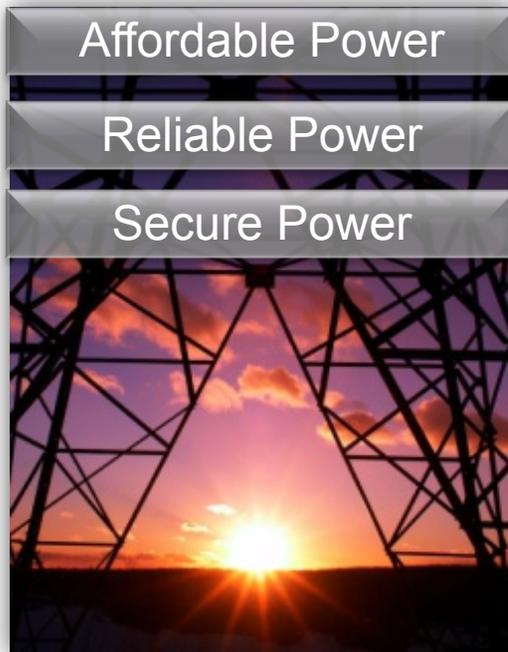
Pacific Northwest  
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# The future power grid must transform to meet new expectations and technical challenges

## *Historical Expectations*



## *Emerging Expectations*



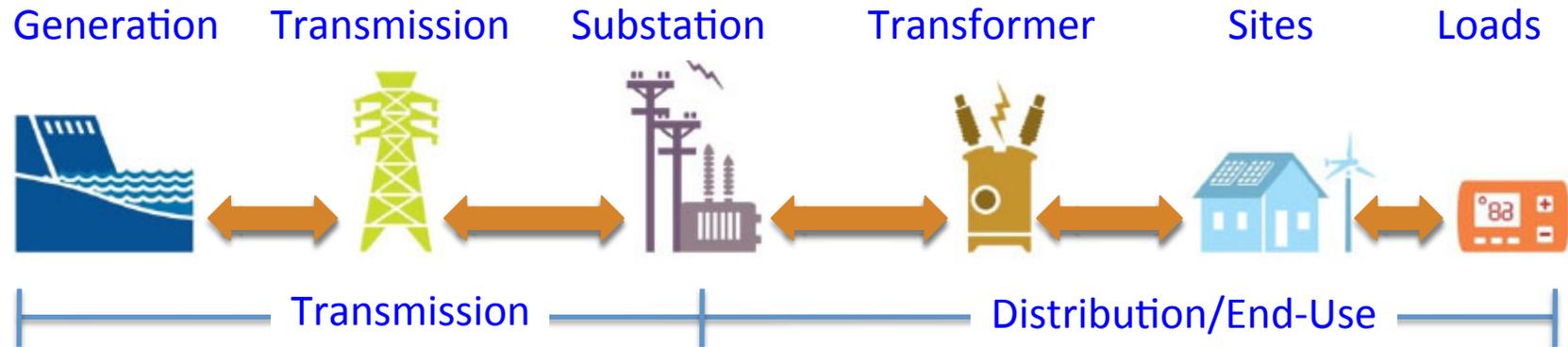
Integrate renewable generation

Maximize benefits of end-use efficiency and storage

Electrify transportation to reduce dependence on imported oil

Accommodate changing and responsive loads

# The future power grid will be an even more complex system within a decade



- ▶ 10-100M measurement & communication devices
- ▶ 100X more data (petabytes/year) with sub-second speed from two-way communication across interconnections (distribution to transmission)
- ▶ >15% penetration of renewable generation (centralized & distributed)
- ▶ >15% demand response + energy efficient loads, PHEV, distributed gen



# High performance computing supports power grid's transition in three fusions

- ▶ Interdependency between power **grid** and **data** network
  - Bring data to applications efficiently and reliably
  - Enable “all-hazard” analysis
- ▶ Fusion of **operation** and **planning** to enable more seamless grid management and control
  - Remove overhead in communication between operation and planning
  - Improve response when facing emergency situations
- ▶ Integration of **transmission** and **distribution** in managing two-way power flows
  - Understand the emerging behaviors in the power grid due to smarter loads, mobile consumption, and intermittent generation

# Transition from serial to parallel computing requires significant foundational work

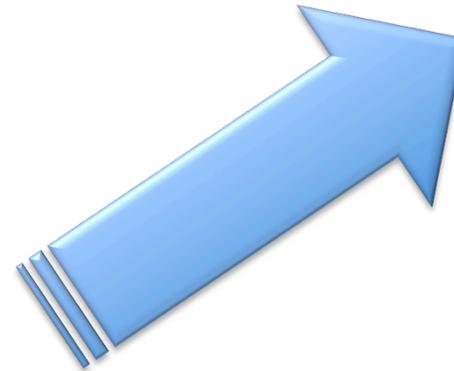
- ▶ Ubiquitous HPC (*anything beyond one core*) available for the power industry.
- ▶ Software tools need to be fundamentally redesigned to take advantage of HPC.
- ▶ Research can accelerate this transition
  - Match computing to power grid problems.



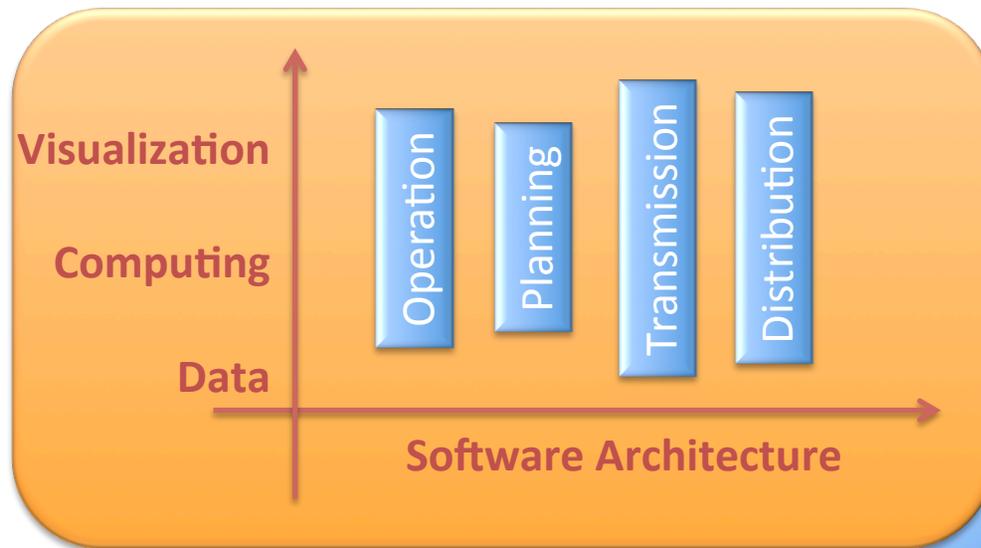
**Parallel Computing**



**Serial Computing**



# GridOPTICS™: foundational framework for vertical and horizontal interoperability



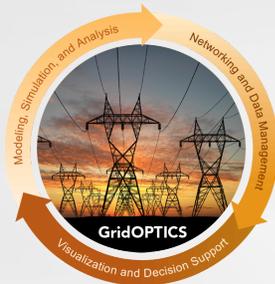
**Parallel Computing**



**Serial Computing**

**Needs a community!**

# Questions?



@GridOPTICS

<http://gridoptics.pnnl.gov/>

Monthly Newsletter

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