

The Smart Grid Maturity Model & The Smart Grid Interoperability Maturity Model





Maturity Models – Dueling or Complementary?



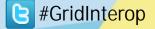


- Technology has been evolving ever since the industry was born
- Technology today is moving faster than our ability to respond to it
- To achieve Smart Grid will require interoperability across a wide spectrum of participants and systems
- In systems of systems this large, we need to focus on:
 - Human
 - Organizational
 - Policy
 - Hardware and
 - Software components
- So where do SGMM and SGIMM fit into this?



SGMM and SG IMM

- The SGMM and SG IMM have different but potentially complementary purposes and uses
 - SGMM
 - Is a management tool to support utility smart grid planning and implementation;
 - It references interoperability as a key element of smart grid maturity
 - It does not focus on how to achieve it
 - SG IMM
 - Is specifically designed to assist stakeholders in achieving interoperability between devices and systems that support smart grid capabilities
- The SGMM and SG IMM teams are exploring ways to collaborate for the benefit of users of the two tools





BUSNESS PROCESS & OPERATIONS

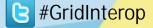
DATA, INFORMATION, & SYSTEMS INTEGRATION

Grid-Interop

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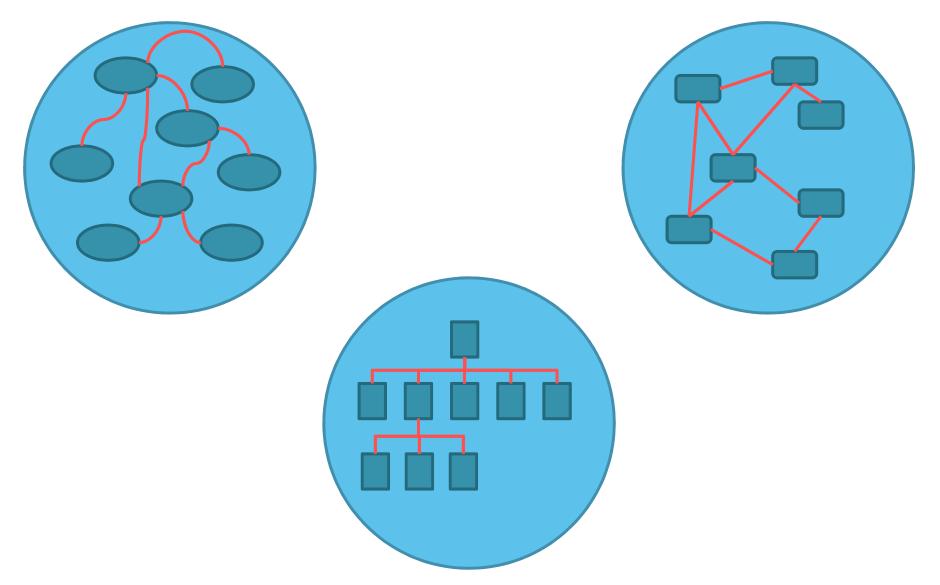
ORGANIZATION, STRUCTURE, & REGULATION

Several key elements referenced in SGMM and SGIMM





Grid-Interop 201%

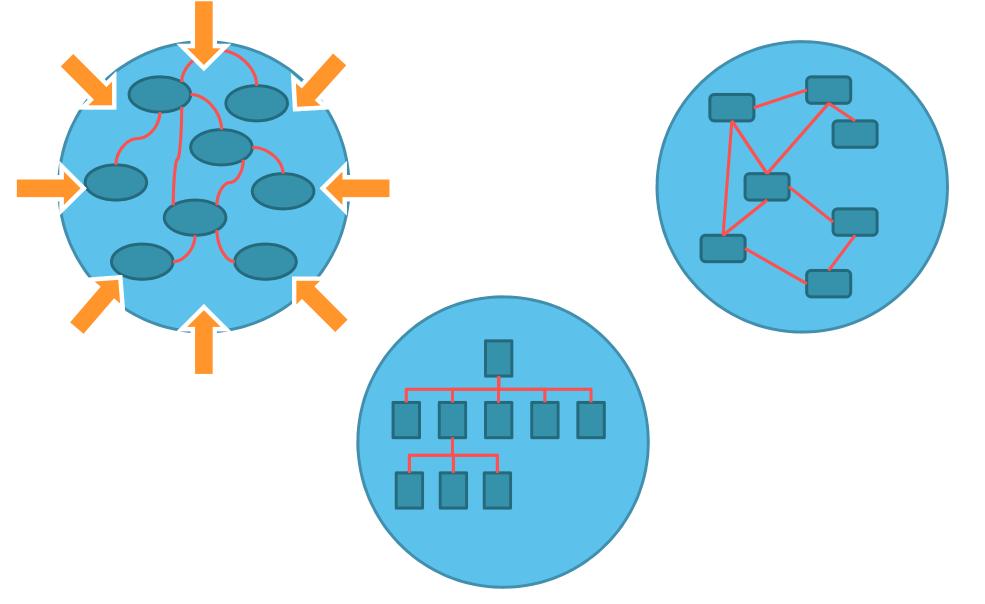


Several key elements referenced in SGMM and SGIMM



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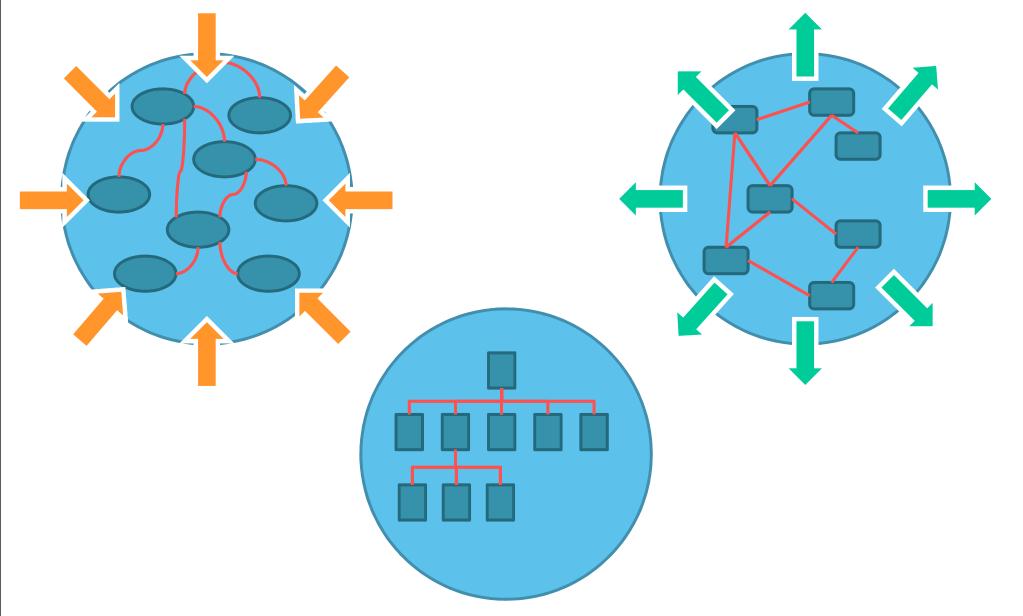


SGMM can be viewed largely as an internal focus

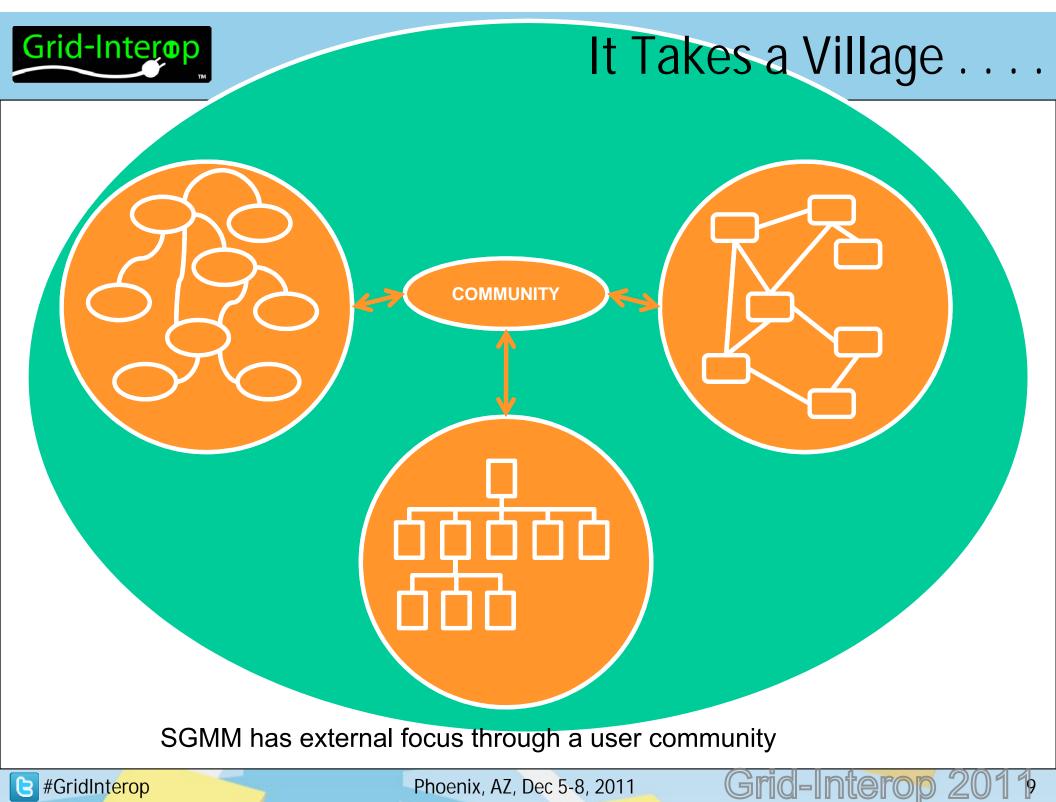


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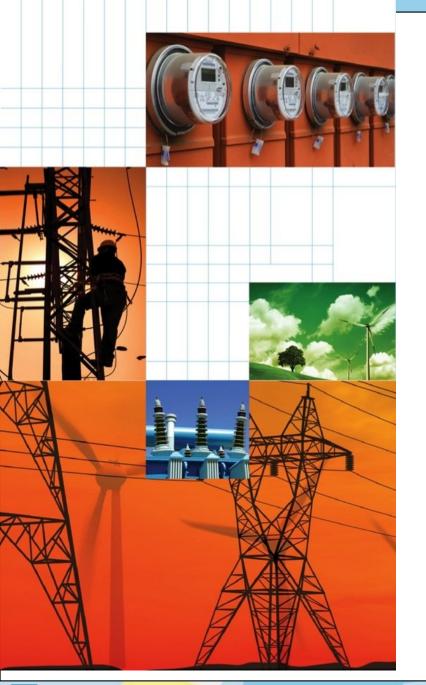


SGIMM can be viewed largely as an external focus



#GridInterop B

Smart Grid Maturity Model



How can utilities

- Develop effective roadmaps?
- Track progress?
- Understand their posture in comparison to peers?

The Smart Grid Maturity Model was developed by utilities to address these concerns



A management tool that provides a

common language and framework for defining key elements of smart grid transformation and helping utilities develop a programmatic approach and track their progress





SGMM timeline

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2007 20	08 2	2009 2		2011	2012
Global Intelligent Utility Network Coalition (GIUNC) develops SGMM GIUNC: CenterPoint Energy Progress Energy Progress Energy DONG Energy North Delhi Power Ltd Country Energy Sempra Energy Pepco Holdings IBM APQC	SG	oftware Engi SE MM v1.1 pro	neering Institu I releases oduct suite fication progra avigation begin		

Developed by utilities for utilities



Software Engineering Institute

SEI is a federally-funded research and development center at Carnegie Mellon University, a global university recognized worldwide for its energy and environmental research initiatives.

A trusted, objective source of best practices, methods and tools to organizations worldwide, SEI is a global leader in software and systems engineering, process improvement and security best practices – all critical elements of smart grid success.

SEI collaborates in public-private partnership with government and industry on important cyber security, architecture, and interoperability challenges of the smart grid.







SEI's Role as Steward of the SGMM





- Provide **governance** working with multiple stakeholders
- Enable widespread availability, adoption, and use of the model for the benefit of the community
- Evolve the model based on stakeholder needs, market developments, user feedback, and interactions with domain experts
- Develop transition mechanisms education, training, awareness, research collaboration to support the model
- Grow the SGMM community of users
 worldwide



SGMM at a glance

6 Maturity Levels: Defined sets of characteristics and outcomes

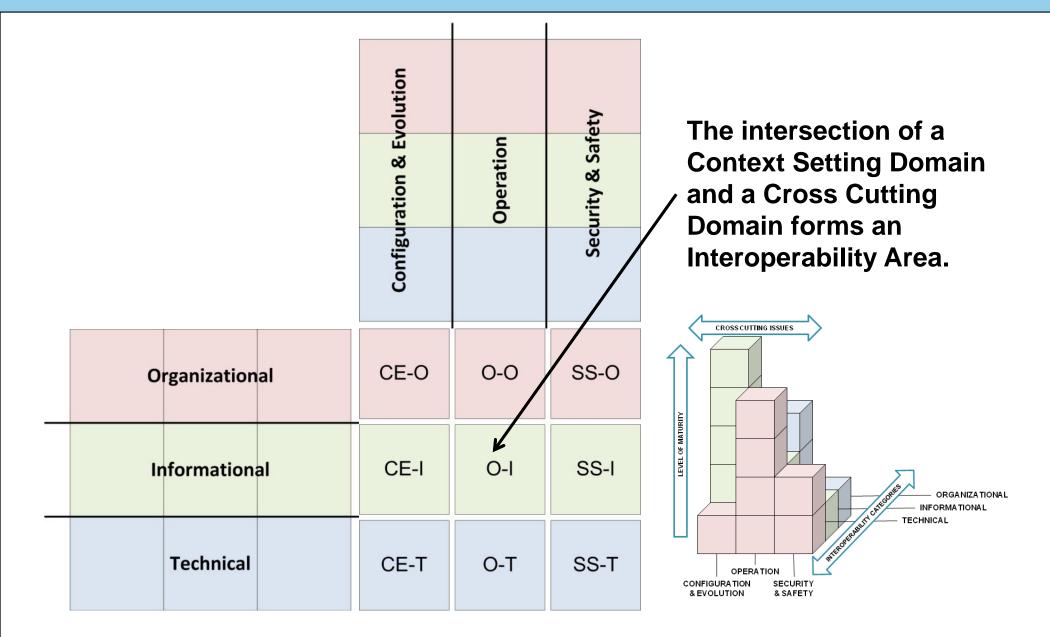
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SGIMM at a glance

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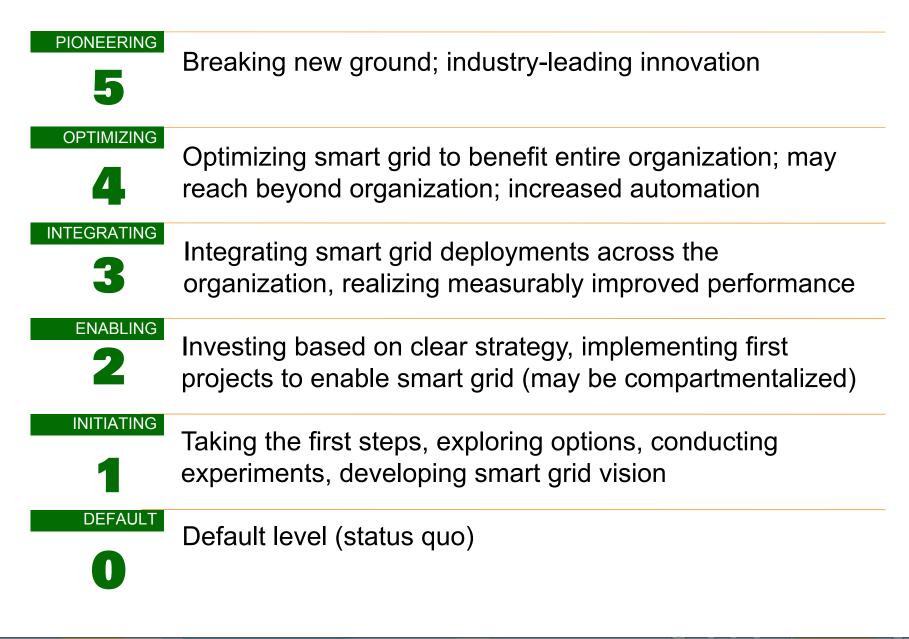


SGIMM at a glance

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Smart Grid Maturity Model – levels





Maturity Level	Community/ Governance	Documentation	Integration	Test/ Certification
Level 1: Initial	management is ad hoc	documentation is ad hoc	integration is a unique experience	testing is ad hoc
Level 2: Managed	managed by project agreement	documented in a project specification	integration is repeatable, with customization expected	tested to plan with results captured
Level 3: Defined	managed by community agreement	references community standard with some customization	integration repeatable with predictable effort	tests exist for community with certification Members claim compliance to standard
Level 4: Quantitatively Managed	processes ensure currency and interoperation	references a community standard w/o customization	integration metrics are defined and measurements collected reference implementations exist	community test processes demonstrate interoperability members claim interoperable conformance
Level 5: Optimizing	managed by a community quality improvement process	adopts an open, community standard	integration metrics used for improvement of the standard	test processes are regularly reviewed and improved

Grid-Interop Smart Grid Maturity Model – domains

Strategy, Mgmt & Regulatory	Technology
Vision, planning, governance, stakeholder collaboration	<i>IT architecture, standards, infrastructure, integration, tools</i>
Organization and Structure	Customer
Culture, structure, training, communications, knowledge mgmt	Pricing, customer participation & experience, advanced services
Grid Operations	Value Chain Integration
Reliability, efficiency, security, safety, observability, control	Demand & supply management, leveraging market opportunities
Work & Asset Management	Societal & Environmental
Asset monitoring, tracking & maintenance, mobile workforce	Responsibility, sustainability, critical infrastructure, efficiency

Phoenix, AZ, Dec 5-8, 2011

Grid²⁰¹ Panteero pyersiz

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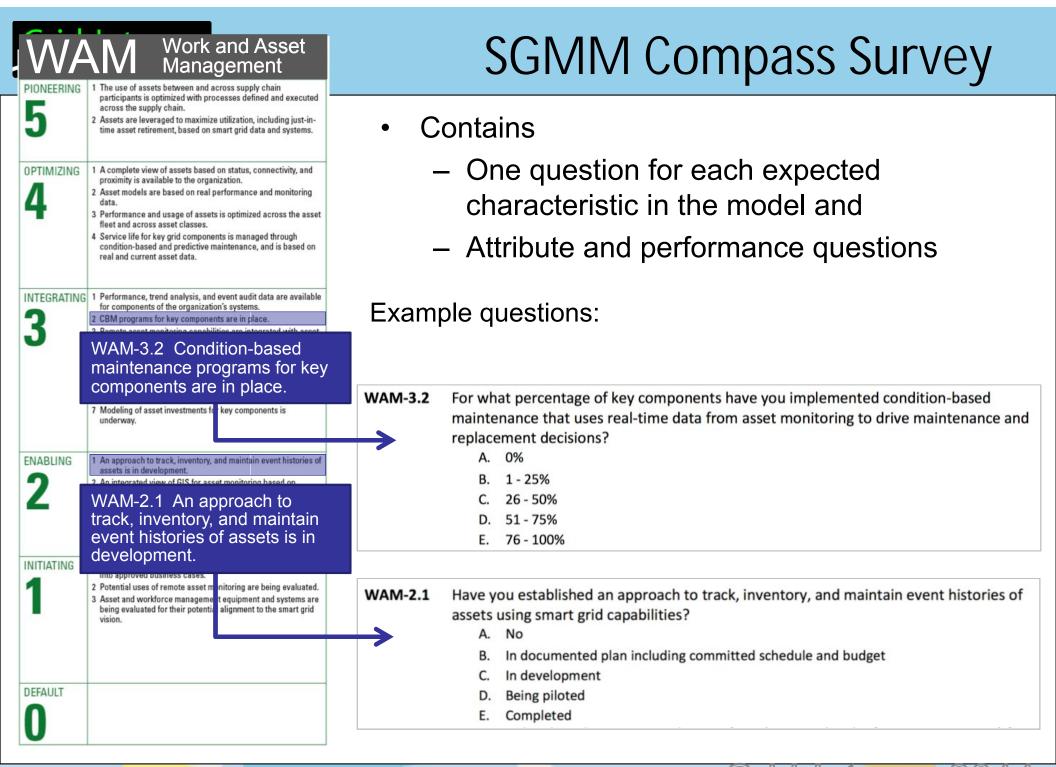


т	Model	Fully described in the Model Definition document				
ссклкл	Compass Survey	Questionnaire-based assessment yields maturity ratings and comparisons				
SGRAN Smart Grid Maturity Model V 1.2 Product Suite	Navigation Process	Expert-led workshops to complete Compass and use results to develop consensus aspirations				
	Training	Overview Seminar and SGMM Navigator Course				
	Partner Program	License organizations and certify individuals to deliver Navigation process				

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www.sei.cmu.edu/smartgrid

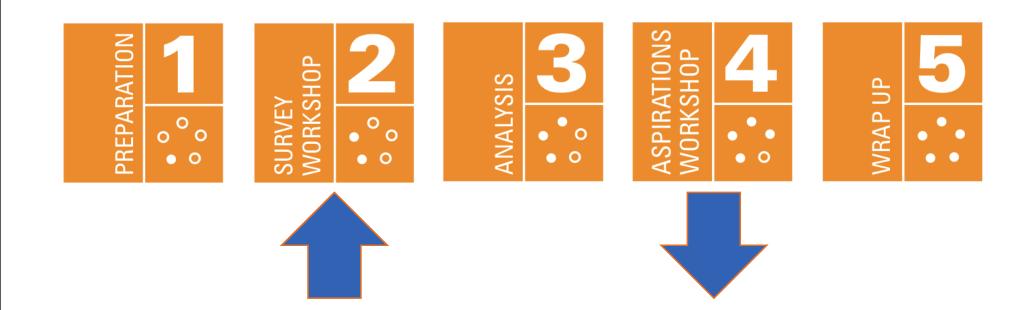


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Phoenix, AZ, Dec 5-8, 2011

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Grid-Interop SGMM Navigation: five-step, expert-led process



Stakeholders complete SGMM Compass survey Discussion and consensus answers lead to internal alignment on current state Stakeholders review survey findings & set aspirational profile Consensus on aspirational state and identification of <u>motivations</u>, <u>actions</u>, and <u>obstacles</u> to achieve it

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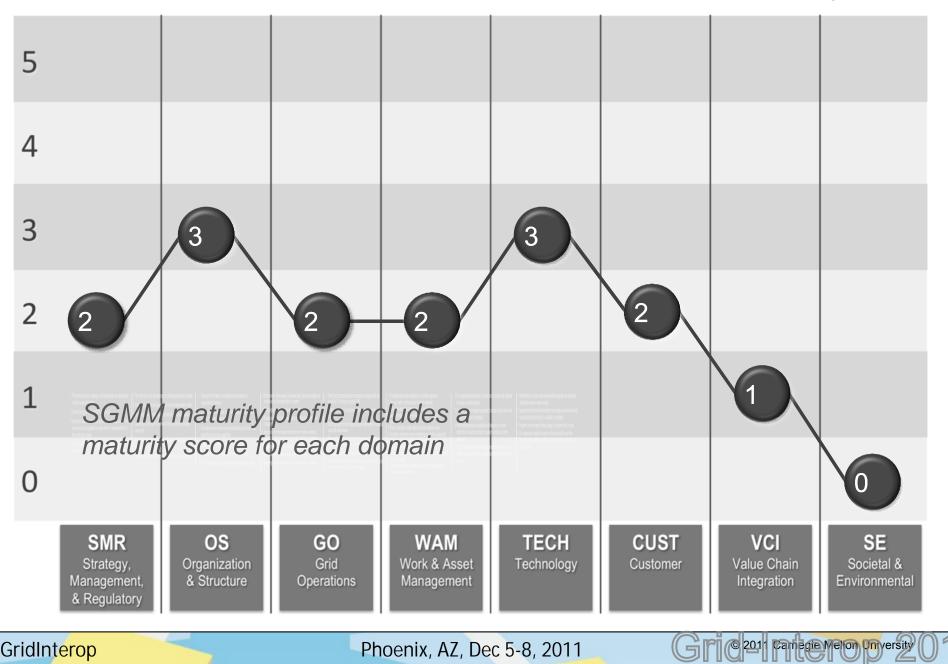
23



Compass results: maturity profile

example results

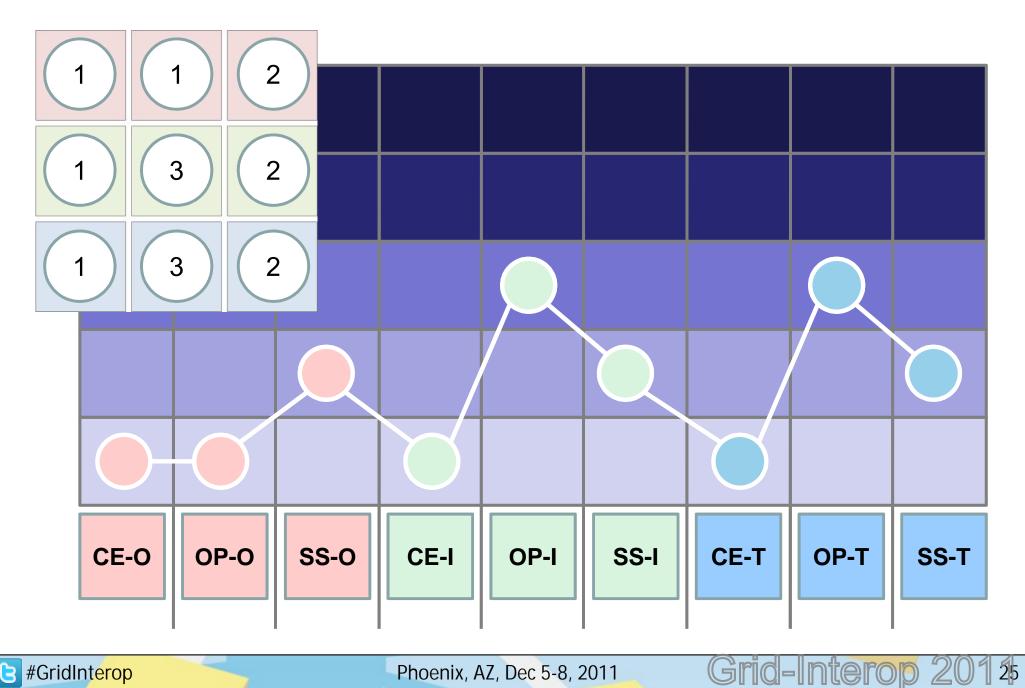
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What Does SGIMM Maturity look like?





Compass results: dashboard

example results

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Sampl	Sample Results								
Level	Strategy, Management & Regulatory	Organization & Structure	Grid Operations	Work & Asset Management	Technology	Customer	Value Chain Integration	Societal & Environmental	
5	0.53	0.50	0.25	0.00	0.00	0.20	0.30	0.30	
4	0.57	0.17	0.28	0.30	0.40	0.36	0.25	0.40	
3	0.65	0.75	0.57	0.47	0.73	0.59	0.58	0.35	
2	1.00	0.82	0.93	1.00	1.00	0.92	0.58	0.76	
1	0.90	1.00	1.00	1.00	0.84	0.85	0.78	0.68	
0	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

	Point Range	Meaning	
	≥ 0.70	Green reflects level compliance within th	ne domain
	≥ 0.40 and < 0.70	Yellow reflects significant progress	
	< 0.40	Red reflects initial progress	
	= 0	Grey reflects has not started	
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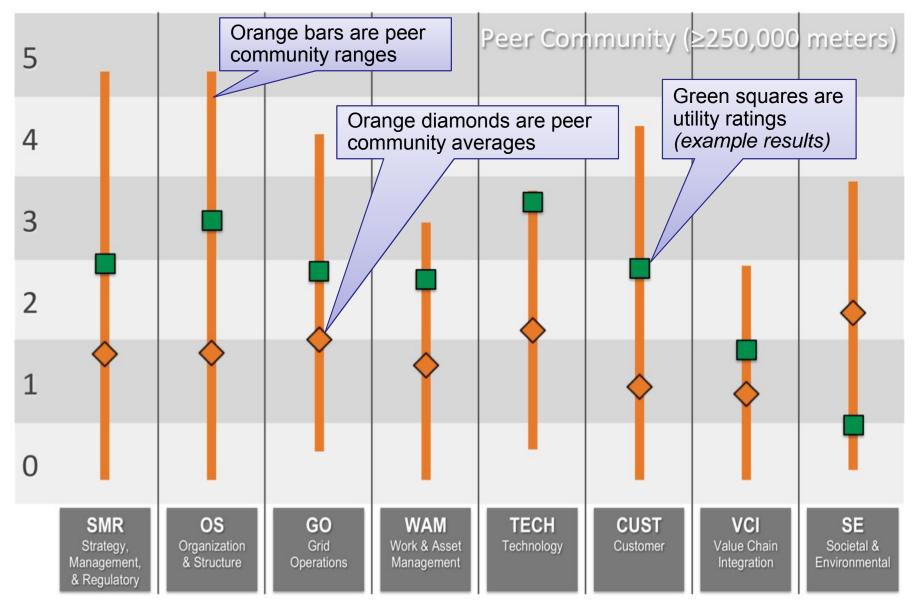
Grid-Interop Compass results: peer community comparison

example results

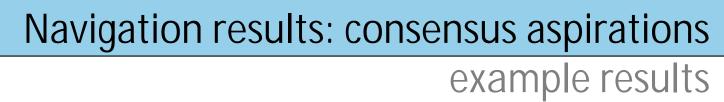
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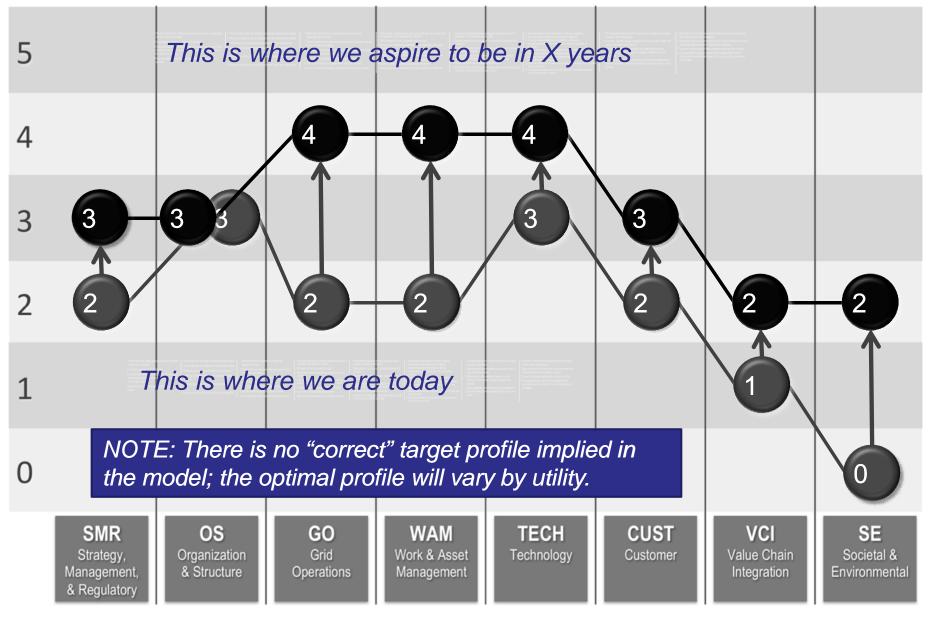
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Community data as of September 2011





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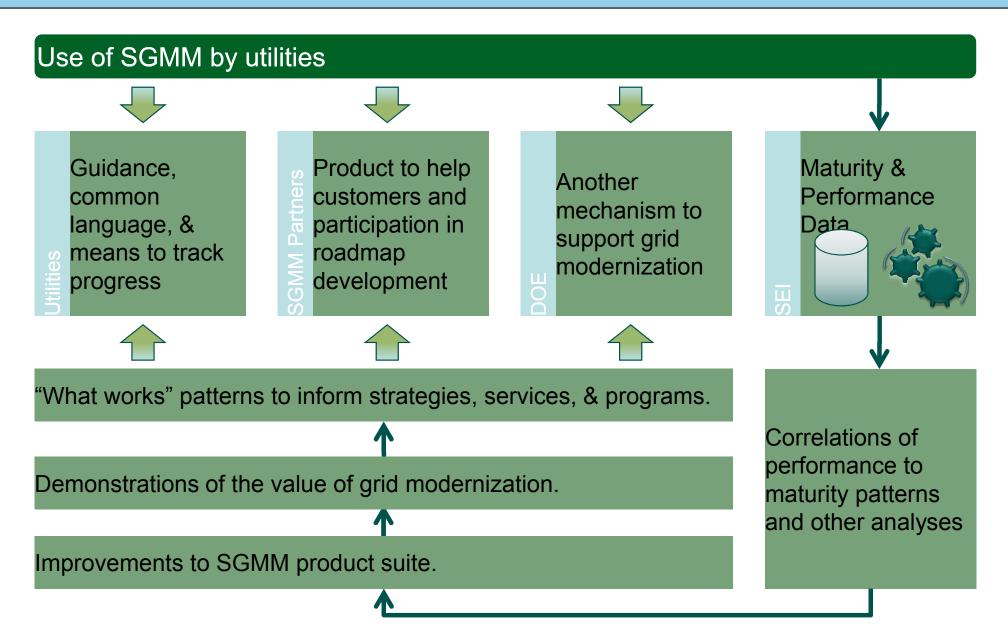
Grid-Interop

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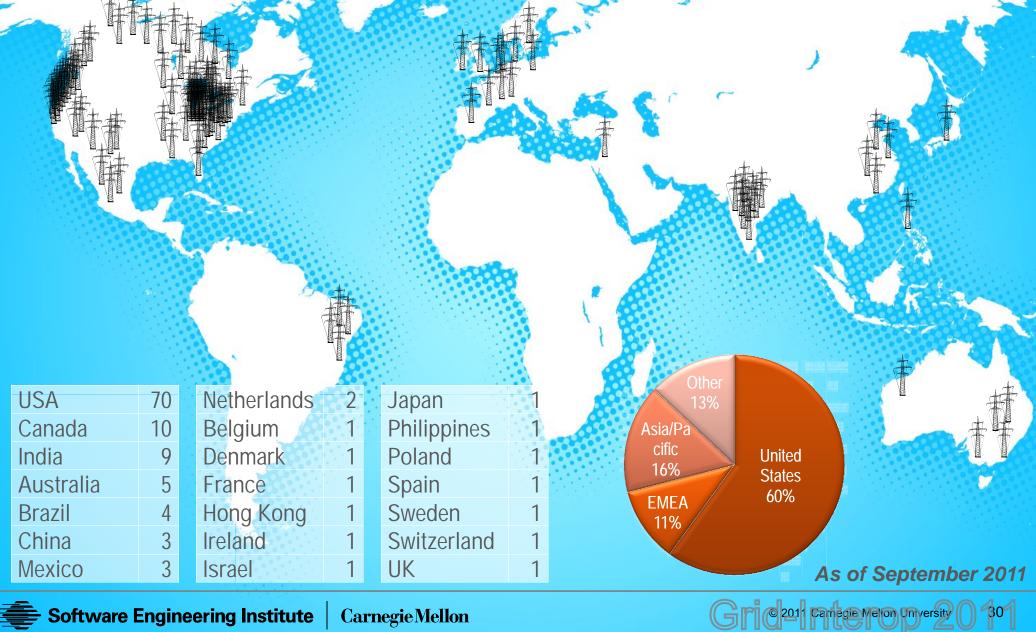
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Grid-Interop SGMM benefits – a community view



SGMM community: 119 utilities in 21 countries



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SGMM Partners

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 SGMM Partners are licensed by the SEI to provide official SGMM services, which are delivered by SEI-Certified SGMM Navigators

For the current list of SGMM Partners, visit: www.sei.cmu.edu/partners/sgmm

SGMM Navigator population

SGMM Navigator Certification Statistics

- 41 Navigator trainees (completed course)
- 34 Candidate Navigators (passed exam)
 - Certified Navigators (completed all requirements)

As of September 2011

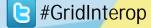


Why use the SG IMM

Grid-Interop

- 1. Assess how best to leverage the context-setting framework.
- 2. Group cross-cutting issues into groups.
- 3. Develop high-level goals for each framework level.
- 4. Develop high-level goals for each cross-cutting issue.
- 5. Develop detailed goals for each intersection of (3) and (4).
- 6. Construct metric statements for the goals.
- 7. Create a matrix of maturity characteristics and maturity-level statements to provide guidance in assessing maturity for each metric.
- 8. Construct an evaluation sheet to apply the SG IMM and capture interoperability maturity for an interoperability area.
- 9. Assess scoring models.

Participation and feedback are essential





Example Use Cases

Grid-Interop

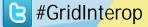
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- Energy Market Operations
- Retail Service Provider/Vendor Technology Community
- A Multi-Player, Smart Grid Research Project
- An Enterprise Smart Grid Application





- Focus on the transactions associated with buying and selling energy
- Trading of energy generation resources in real-time, day-ahead or longer term timeframes
- Bringing demand-response and ancillary service resources into the markets
- Bilateral agreements between various parties
- Interface between these players includes the exchange of information about price, schedule, quantity, and other attributes of the energy being traded
- As a sample use case, a power exchange market uses the SG IMM as an assessment tool for understanding and developing an evolutionary roadmap for their trading platform. The outcome provides a more automated, efficient, and reliable mechanism for a new participant to join the market.





- The community around a smart meter interface
- Vendors of smart meters, retail service providers, retail customers, and integration partners
- Improve the standardization of the meter data interface and information exchange
- A stakeholder alliance working group uses the SG IMM to evaluate impediments to achieving interoperability goals
- Business goals of service providers, regulators, and vendors are not aligned for interoperability
- Set requirements that there be an independent test and certification authority. Develops technology procurement guidelines to assist in evaluating interoperability of specific vendor proposals



- Testing new business models and new technologies within an institutional structure such as an electric power market
- While intended to be applied to communities, SGIMM use with an experimental project can be useful
- Develop a significantly more sophisticated business and technical model for energy market operations
- Determine whether a scalable communication signal about the price of energy can be used to modify overall system behavior
- Develop signaling technology to test if new distributed, price-based, control system can provide efficiently scalable system for managing complex power flows and transactions
- Identify regulatory and business issues to be addressed for the most efficient scaling of the technology



- Smart grid capabilities require the integration of applications and systems that have typically operated in separate parts of an enterprise in the past
- Interoperability between myriad applications both within a utility enterprise and with its partners becomes the foundation or a prerequisite to deploying the next generation of services
- Applications may have been developed independently (to different standards) without long-range design for integration with other systems
- The enterprise is a community of systems
- Conduct an assessment of the interfaces between a bidirectional metering application, the smart meter, the advanced metering system, and the billing system in order to better understand the architecture and design issues that cause integration challenges to occur
- Better understanding of interoperability issues at the senior management level and with the regulator



- A lot of similarities
 - Processes
 - Documentation
 - Systems
 - Regulation
 - Interoperability
 - Maturity levels
 - Based on measuring current situation and defining goals through questions
- Trying to harmonize the approaches
 - Areas of focus
 - Terminology
 - Maturity levels
 - Characteristics
 - Provide a roadmap to higher maturity levels
 - Scoring?



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