Empower your Smart Grid Transformation

David White
SGMM Project Manager

10 March 2011
Empower your Smart Grid Transformation

Carnegie Mellon University, Software Engineering Institute, Pittsburgh, PA, 15213

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Number of Pages: 38

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The SEI Architecture Technology User Network (SATURN) Conference brings together experts to exchange best architecture-centric practices in developing, acquiring, and maintaining software-reliant systems.

www.sei.cmu.edu/saturn/2011
SEI Launches New Technology Blog

With posts written by staff members, the blog will provide the SEI audience with insights into the broad spectrum of work at the SEI via a two-way, read-write medium.

http://blog.sei.cmu.edu/
How to Participate Today

Open and close your Panel
View, Select, and Test your audio
Submit text questions
Q&A addressed at the end of today’s session
About the Speaker

David White is a member of the Resilient Enterprise Management (REM) team in the CERT Program at the Carnegie Mellon’s Software Engineering Institute (SEI). The REM team performs research and development in the areas of operational resilience, critical infrastructure protection, and smart grid deployment.

David is the project manager and a core development team member for the SEI Smart Grid Maturity Model (SGMM), a business tool to assist utilities with planning and tracking progress of their grid modernization efforts.

David is also a core development team member for the CERT® Resilience Management Model (CERT-RMM), a process improvement model for managing security, business continuity, and IT operations.

David works from his home in New York City.
Polling Question #1

How did you hear about today’s webinar?

a) DistribuTECH 2011 (conference or email)
b) Social Media (Twitter, LinkedIn)
c) Email Invitation from the SEI
d) SEI Website or Press Release
e) Online Webinar Calendar (i.e. webinarlistings.com/)
A major power grid transformation is underway.

How can utilities

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

SGMM was developed to address these concerns
**SGMM History**

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Global Intelligent Utility Network Coalition (GIUNC) develops SGMM</td>
</tr>
<tr>
<td>2008</td>
<td>Utilities use SGMM v1.0</td>
</tr>
<tr>
<td>2009</td>
<td>Utilities use SGMM v1.1</td>
</tr>
<tr>
<td>2010</td>
<td>Software Engineering Institute serves as model steward</td>
</tr>
<tr>
<td>2011</td>
<td>SEI releases SGMM v1.1 product suite</td>
</tr>
<tr>
<td></td>
<td>Certification program for SGMM Navigators begins</td>
</tr>
</tbody>
</table>

**GIUNC:**
- CenterPoint Energy
- Progress Energy
- DONG Energy
- North Delhi Power Ltd
- Country Energy
- Sempra Energy
- Pepco Holdings
- IBM
- APQC

*Developed by utilities for utilities*
Polling Question #2

How did you learn about SGMM?

a) From using the model
b) Website
c) Conference or event
d) This webinar announcement
e) Other
What Is the Smart Grid Maturity Model?

SGMM is a MANAGEMENT TOOL that provides a COMMON FRAMEWORK for defining key elements of SMART GRID TRANSFORMATION and helps utilities develop a PROGRAMMATIC APPROACH and track their progress.
How Is the SGMM Used?

SGMM is used to help organizations:

- Identify where they are on the smart grid landscape
- Develop a shared smart grid vision and roadmap
- Communicate using a common language
- Prioritize options and support decision making
- Compare to themselves and the community
- Measure their progress
- Prepare for and facilitate change
SGMM at a Glance

8 Domains: Logical groupings of smart grid related capabilities and characteristics

175 Characteristics: Features you would expect to see at each stage of the smart grid journey

6 Maturity Levels: Defined sets of characteristics and outcomes
The Smart Grid Maturity Model – Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIONEERING 5</td>
<td>Breaking new ground; industry-leading innovation</td>
</tr>
<tr>
<td>OPTIMIZING 4</td>
<td>Optimizing smart grid to benefit entire organization; may reach beyond organization; increased automation</td>
</tr>
<tr>
<td>INTEGRATING 3</td>
<td>Integrating smart grid deployments across the organization, realizing measurably improved performance</td>
</tr>
<tr>
<td>ENABLING 2</td>
<td>Investing based on clear strategy, implementing first projects to enable smart grid (may be compartmentalized)</td>
</tr>
<tr>
<td>INITIATING 1</td>
<td>Taking the first steps, exploring options, conducting experiments, developing smart grid vision</td>
</tr>
<tr>
<td>DEFAULT 0</td>
<td>Default level (status quo)</td>
</tr>
</tbody>
</table>
## Eight SGMM Domains

<table>
<thead>
<tr>
<th>SMR</th>
<th>Strategy, Mgmt &amp; Regulatory</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vision, planning, governance, stakeholder collaboration</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OS</th>
<th>Organization and Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Culture, structure, training, communications, knowledge mgmt</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GO</th>
<th>Grid Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reliability, efficiency, security, safety, observability, control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WAM</th>
<th>Work &amp; Asset Management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asset monitoring, tracking &amp; maintenance, mobile workforce</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TECH</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IT architecture, standards, infrastructure, integration, tools</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CUST</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pricing, customer participation &amp; experience, advanced services</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VCI</th>
<th>Value Chain Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Demand &amp; supply management, leveraging market opportunities</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SE</th>
<th>Societal &amp; Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Responsibility, sustainability, critical infrastructure, efficiency</td>
</tr>
</tbody>
</table>
| **Model** | • Model Definition document  
| | • Matrix  
| **Compass Survey** | • Compass survey yields maturity ratings and performance comparisons  
| **Navigation Process** | • Facilitated completion and interpretation of Compass, led by a certified “SGMM Navigator”  
| **Training** | • Overview Seminar  
| | • SGMM Navigator Course  
| **Licensing** | • License organizations and certify individuals to deliver Navigation process  

**SGMM**
Smart Grid Maturity Model
V 1.1 Product Suite

www.sei.cmu.edu/smartgrid
Compass Survey

Contains

- One question for each expected characteristic in the model and
- Demographic and performance questions

Example questions

WAM-3.2 Condition-based maintenance programs for key components are in place.

WAM-2.1 An approach for using smart grid capabilities to create inventories, maintain event histories, and track assets is in development.

WAM-3.2 For what percentage of key components have you implemented condition-based maintenance?

- A. 0%
- B. 1 - 25%
- C. 26 - 50%
- D. 51 - 75%
- E. 76 - 100%

WAM-2.1 Have you established an approach to track, inventory, and maintain event histories of assets using smart grid capabilities?

- A. No
- B. In documented plan including committed schedule and budget
- C. In development
- D. Being piloted
- E. Completed
Two ways to Complete SGMM Compass

1. SGMM Navigation

SGMM Navigator

- Leads utility stakeholders through defined process including two consensus-building workshops
- Helps utility stakeholders interpret and answer survey questions
- Analyzes and presents findings to help utility stakeholders reach consensus on SGMM aspirations
- Documents results and provides follow-on support

2. Self Assessment

Utility

- Completes survey
- Submits survey for scoring
- Receives scoring report containing
  - Maturity rating by domain
  - Community statistics for comparison

Expert-led

Self-service
Compass Results: Maturity Profile

Both Navigation and self-assessment yield current rating by domain

<table>
<thead>
<tr>
<th>SMR</th>
<th>OS</th>
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<th>SE</th>
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<tr>
<td>Strategy, Management &amp; Regulatory</td>
<td>Organization &amp; Structure</td>
<td>Grid Operations</td>
<td>Work &amp; Asset Management</td>
<td>Technology</td>
<td>Customer</td>
<td>Value Chain Integration</td>
<td>Societal &amp; Environmental</td>
</tr>
</tbody>
</table>

This is where we are today

Example results
Fictitious organization
# Compass Results: Detailed Scores

## Sample Results

<table>
<thead>
<tr>
<th>Level</th>
<th>Strategy, Management &amp; Regulatory</th>
<th>Organization &amp; Structure</th>
<th>Grid Operations</th>
<th>Work &amp; Asset Management</th>
<th>Technology</th>
<th>Customer</th>
<th>Value Chain Integration</th>
<th>Societal &amp; Environmental</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.53</td>
<td>0.50</td>
<td>0.25</td>
<td>0.00</td>
<td>0.00</td>
<td>0.20</td>
<td>0.30</td>
<td>0.30</td>
</tr>
<tr>
<td>4</td>
<td>0.57</td>
<td>0.17</td>
<td>0.28</td>
<td>0.30</td>
<td>0.40</td>
<td>0.36</td>
<td>0.25</td>
<td>0.40</td>
</tr>
<tr>
<td>3</td>
<td>0.65</td>
<td>0.75</td>
<td>0.57</td>
<td>0.47</td>
<td>0.73</td>
<td>0.59</td>
<td>0.58</td>
<td>0.35</td>
</tr>
<tr>
<td>2</td>
<td>1.00</td>
<td>0.82</td>
<td>0.93</td>
<td>1.00</td>
<td>1.00</td>
<td>0.92</td>
<td>0.58</td>
<td>0.76</td>
</tr>
<tr>
<td>1</td>
<td>0.90</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.84</td>
<td>0.85</td>
<td>0.78</td>
<td>0.68</td>
</tr>
<tr>
<td>0</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### Point Range

- **≥ 0.70**: Green reflects level compliance within the domain
- **≥ 0.40 and < 0.70**: Yellow reflects significant progress
- **< 0.40**: Red reflects initial progress
- **= 0**: Grey reflects has not started
Compass Results: Community Data

Community (≥250,000 Meters) Comparison - Average and Range

- Green bars are community ranges
- Orange diamonds are community averages
- Purple squares are utility ratings

Maturity Level

SMR | OS | GO | WAM | TECH | CUST | VCI | SE

- Community average
- Sample Organization

Example results
Fictitious organization
SGMM User Community as of October 2010

Exelon/PECO
Manitoba Hydro
BC Hydro
Bonneville Pwr.
Portland Gen.
Salt River Proj.
Sempra
Austin Energy
CoServ
Centerpoint
Entergy
Glendale W & P
Detroit Edison
Burbank Water & Power
Integrys
PG&E
Toronto Hydro
Tucson Electric Power
Xcel Energy

EPCOR
Hydro Ottawa
Exelon/ComEd
VELCO
Allegheny Power
Dominion Power
First Energy
AEP
PHI
Exelon
Duke Energy
SCANA Corp.
East Miss EPA
Ameren Illinois
Ameren Missouri
NB Power
PGN Carolina
PGN Florida
AMP (22 municipal power utilities)

Tokyo Electric
Shanghai Municipal Electric Power Co.
Alliander
EDF (UK)
DONG Energy
EDF
Union Fenosa
NDPL
Zhejiang Energy
CLP
Energy Australia
Country Energy
CPF
EDP
AusNet
CELPE
Enexis
Integral Energy
Tata
CFE (3 divisions)
Polling Question #3

How important is grid modernization in your region?

a) Extremely
b) Somewhat
c) Not very
d) Not at all
SGMM Community Data – Utility Type

**SINGLE FUNCTION**
- 25.8% Distribution Only
- 2.2% Transmission Only

**FULLY INTEGRATED**
- 27% Generation, Transmission, Distribution, Retail

**PARTIALLY INTEGRATED**
- 2.2% Generation, Distribution
- 2.2% Generation, Transmission
- 9% Transmission, Distribution
- 10.1% Distribution, Retail
- 4.5% Generation, Distribution, Retail
- 4.5% Generation, Transmission, Distribution
- 12.4% Transmission, Distribution, Retail

**2 Functions**
- 2 Functions

**3 Functions**
- 3 Functions

**4 Functions**
- 4 Functions
SGMM Community Data – Size and Location

**Meter Count**

**Distribution by region**

- United States: 60%
- EMEA: 13%
- Asia/Pacific: 13%
- Other: 14%
Polling Question #4

Where are you located?

a) North America
b) South or Central America
c) Europe
d) Middle East/Africa
e) Asia/Pacific
SGMM Community Data – Average and Range

Community Composite (≥250,000 Meters)

Maturity Level

5
4
3
2
1
0

SMR  OS  GO  WAM  TECH  CUST  VCI  SE
SGMM Community Data – Average and Range

Community Composite (<250,000 Meters)

Maturity Level

5
4
3
2
1
0

SMR  OS  GO  WAM  TECH  CUST  VCI  SE
Navigation Process

A five-step process lead by a certified SGMM Navigator

1. Preparations are completed, first four Compass survey sections are completed

2. Survey Workshop: stakeholders from utility complete the Compass survey as a team, discussions occur to develop consensus on responses

3. Navigator analyzes results and prepares findings

4. Aspirations Workshop: Compass results and findings are presented and discussed; aspirations for planning horizon are agreed through consensus discussions

5. Actions are planned and documentation is completed to conclude the process
<table>
<thead>
<tr>
<th></th>
<th>1.1 Smart grid vision is developed with a goal of operational improvement.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.2 Experimental implementations of smart grid concepts are supported.</td>
</tr>
<tr>
<td>1</td>
<td>1.3 Discussions have been held with regulators about the organization’s smart grid vision.</td>
</tr>
<tr>
<td>2</td>
<td>2.1 An initial smart grid strategy and a business plan are approved by management.</td>
</tr>
<tr>
<td>2</td>
<td>2.2 A common smart grid vision is accepted across the organization.</td>
</tr>
<tr>
<td>2</td>
<td>2.3 Operational investment is explicitly aligned to the smart grid strategy.</td>
</tr>
<tr>
<td>2</td>
<td>2.4 Budgets are established specifically for funding the implementation of the smart grid vision.</td>
</tr>
<tr>
<td>2</td>
<td>2.5 There is collaboration with regulators and other stakeholders regarding implementation of the smart grid vision and strategy.</td>
</tr>
<tr>
<td>2</td>
<td>2.6 There is support and funding for conducting proof-of-concept projects to evaluate feasibility and alignment.</td>
</tr>
<tr>
<td>3</td>
<td>3.1 The smart grid vision, strategy, and business case are incorporated into the vision and strategy.</td>
</tr>
<tr>
<td>3</td>
<td>3.2 A smart grid governance model is established.</td>
</tr>
<tr>
<td>3</td>
<td>3.3 Smart grid leaders with explicit authority across functions and lines of business are designated to ensure effective implementation of the smart grid strategy.</td>
</tr>
<tr>
<td>3</td>
<td>3.4 Required authorizations for smart grid investments have been secured.</td>
</tr>
<tr>
<td>4</td>
<td>4.1 Smart grid vision and strategy drive the organization’s strategy and direction.</td>
</tr>
<tr>
<td>4</td>
<td>4.2 Smart grid is a core competency throughout the organization.</td>
</tr>
<tr>
<td>4</td>
<td>4.3 Smart grid strategy is shared and revised collaboratively with external stakeholders.</td>
</tr>
<tr>
<td>5</td>
<td>5.1 Smart grid strategy capitalizes on smart grid as a foundation for the introduction of new services and product offerings.</td>
</tr>
<tr>
<td>5</td>
<td>5.2 Smart grid business activities provide sufficient financial resources to enable continued investment in smart grid sustainment and expansion.</td>
</tr>
<tr>
<td>5</td>
<td>5.3 New business model opportunities emerge as a result of smart grid capabilities and are implemented.</td>
</tr>
</tbody>
</table>

**Aspiration setting:**

1. Model characteristics are sequentially reviewed, discussed, and considered for levels that have not yet been achieved.
2. Consensus on relevance and importance to organization for achieving characteristics is used to set aspiration.
What motivates this aspiration?
- 
- 
- 
- 

What actions must happen to achieve this aspiration?
- 
- 
- 

What are the obstacles that must be overcome to achieve this aspiration?
- 
- 
-
Setting Aspirations

Workshop 2 sets *strategic aspirations* by domain, for example:

<table>
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<td>Societal &amp; Environmental</td>
</tr>
</tbody>
</table>

This is where we aspire to be in X years

This is where we are today

NOTE: There is no “correct” target profile implied in the model; the optimal profile will vary by utility.
Licensing and Certification

**Licensed organizations** are able to

- Offer SGMM Navigation as a service, which must be delivered by Certified SGMM Navigators
- Sponsor individuals to become Certified SGMM Navigators
- Participate in the ongoing evolution of the model

**Certified SGMM Navigators** are

- Trained and certified by SEI: 3-day course, exam, and reviewed first delivery
- Recognized as SGMM and industry experts
- Equipped with turn-key materials to lead SGMM Navigation process including detailed process scripts, checklists, and templates
- Provided with regular updates from and special access to model team

SGMM licensing and certification program is currently in pilot phase
SGMM Benefits – A Community View

Use of SGMM by utilities yields:

- **Utilities**: Guidance on strategic objectives & means to track progress
- **Service Providers**: Product to offer their customers and ability to participate in strategy dev.
- **DOE**: Another mechanism to help with grid modernization
- **SEI**: Assessment & Performance Data

- Correlations of grid performance to modernization patterns
- Demonstrations of the value of grid modernization.
- “What works” patterns to inform strategies, services, & programs.
- Improvements to SGMM product suite.
Polling Question #5

I work for:

a) An electric utility
b) A service provider or vendor to electric utilities
c) A government organization
d) Other
Next Steps to Consider

Complete the post webinar survey
This will automatically present when you exit the webinar.

Learn more about the model
Follow links on the post webinar resource web page.

Find a licensed organization to lead a SGMM Navigation
www.sei.cmu.edu/partners/directory/organization/
Select “Smart Grid Maturity Model” in the “Service” pull-down.

Complete a self-assessment
Email info@sei.cmu.edu and request instructions for SGMM self-assessment.

Learn more about the SGMM Navigator certification process
Complete the inquiry form on the post webinar resource web page.

Learn about the SGMM licensing program
Email info@sei.cmu.edu and request information about the SGMM licensing program.

For all other inquiries, please email info@sei.cmu.edu
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The Software Engineering Institute

SEI is a federally funded research and development center based at Carnegie Mellon University, a global research 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