SG-CAT: Communications Analysis that Turns Up Your Smart Grid Benefits
SCADA Comms Failure Detected
Could You Benefit from an SG-CAT Assessment?

Are you...

1. Experiencing difficulty with your communications infrastructure?
2. Planning to expand your communications infrastructure?
3. Modernizing your grid with solutions such as AMI, Feeder Automation, Distribution SCADA, etc.?

If so, you could benefit from an SG-CAT analysis

- Siemens has the tools to turn up your smart grid benefits through superior telecom simulation and analysis
- SG-CAT is powerful co-simulation software that:
  1. Models your utility’s telecom situation
  2. Evaluates how well different telecom strategies would support your operational interests
  3. Diagnoses problems with your existing infrastructure
Informed decisions require good information

SG-CAT: Communications Analysis that Turns Up Your Smart Grid Benefits

What We Do:
We use our SG-CAT tool to help utilities:
- Diagnose problems with their telecom infrastructure
- Assess which communication technologies they should use to support their future smart grid needs

What Is SG-CAT?
Our telecom simulation software that models utility applications like SCADA, Feeder Automation, AMI, and Volt/VAr Optimization.
SG-CAT assesses: RF Propagation, Operational Performance, and Cost

Benefits:
- Insights of a pilot; fraction of the cost and time
- Take the guesswork out of telecom planning
- Extend the useful life of your infrastructure
- 100% vendor-neutral / unbiased
The Path Towards a Modernized Grid is Paved with Solid Communications Infrastructure

Utilities understand power systems

Vendors understand communications

SG-CAT understands both

SG-CAT bridges the gap between utility operations and the communications systems that support them
To Make Informed Decisions, You Need Good Information

Good information is the fuel of success

- SG-CAT is revolutionizing communications diagnostics and planning for utilities
- SG-CAT provides you with the insights of a pilot, at a fraction of the cost and time
When it Comes to Your Power Network, Siemens Believes in Science, Not Speculation

SG-CAT uses simulation and modeling to provide scientific analysis of grid-specific communications
SG-CAT: It’s More than a Propagation Study…

SG-CAT uses advanced simulation and modeling to provide balanced analysis of Coverage, Cost, and Operational Performance.
## SG-CAT Operational Performance Analysis

### Reliability by Application and Technology

<table>
<thead>
<tr>
<th>Packet Reception Rate / Reliability</th>
<th>Comm Technology 1</th>
<th>Comm Technology 2</th>
<th>Comm Technology 3</th>
<th>Comm Technology 4</th>
<th>Comm Technology 5</th>
<th>Comm Technology 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volt/VAR Optimization</td>
<td>82.70</td>
<td>89.70</td>
<td>99.96</td>
<td>99.80</td>
<td>97.40</td>
<td>72.10</td>
</tr>
<tr>
<td>FCI Telemetry</td>
<td>76.60</td>
<td>83.45</td>
<td>100.00</td>
<td>98.00</td>
<td>97.10</td>
<td>60.65</td>
</tr>
<tr>
<td>SCADA</td>
<td>86.90</td>
<td>94.26</td>
<td>99.80</td>
<td>99.20</td>
<td>91.25</td>
<td>73.50</td>
</tr>
<tr>
<td>AMI</td>
<td>92.70</td>
<td>97.80</td>
<td>100.00</td>
<td>94.33</td>
<td>99.67</td>
<td>92.30</td>
</tr>
<tr>
<td>FLISR</td>
<td>21.61</td>
<td>23.61</td>
<td>99.91</td>
<td>99.70</td>
<td>100.00</td>
<td>5.00</td>
</tr>
<tr>
<td>Backhaul</td>
<td>N/A</td>
<td>N/A</td>
<td>99.51</td>
<td>97.68</td>
<td>100.00</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Delay by Application and Technology

<table>
<thead>
<tr>
<th>Delay/Latency (ms)</th>
<th>Comm Technology 1</th>
<th>Comm Technology 2</th>
<th>Comm Technology 3</th>
<th>Comm Technology 4</th>
<th>Comm Technology 5</th>
<th>Comm Technology 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volt/VAR Optimization</td>
<td>5.23</td>
<td>62.50</td>
<td>43.97</td>
<td>48.00</td>
<td>0.51</td>
<td>200.00</td>
</tr>
<tr>
<td>FCI Telemetry</td>
<td>33.30</td>
<td>36.80</td>
<td>44.48</td>
<td>21.20</td>
<td>20.47</td>
<td>150.00</td>
</tr>
<tr>
<td>SCADA</td>
<td>7.69</td>
<td>78.50</td>
<td>47.20</td>
<td>19.70</td>
<td>16.73</td>
<td>187.00</td>
</tr>
<tr>
<td>DER</td>
<td>2.45</td>
<td>20.50</td>
<td>51.71</td>
<td>18.57</td>
<td>15.12</td>
<td>65.00</td>
</tr>
<tr>
<td>FLISR</td>
<td>8750</td>
<td>6000.00</td>
<td>50.85</td>
<td>47.76</td>
<td>7.71</td>
<td>53.00</td>
</tr>
<tr>
<td>AMI Backhaul</td>
<td>N/A</td>
<td>N/A</td>
<td>66.62</td>
<td>50.02</td>
<td>7.65</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Backhaul Demand At Each Substation

### Breakdown of Traffic by Application

- **FCI**: 85.34, **FLISR**: 1.29, **VVO**: 0.24
- **FR**: 11.03, **FR**: 3.01, **VVO**: 0.56
- **FCI**: 65.77, **FLISR**: 3.13, **VVO**: 38.65
- **FR**: 11.43, **FR**: 11.43, **VVO**: 100.00

© Siemens AG 2013. All rights reserved.
### SG-CAT Operational Performance Analysis

#### SG-CAT Scoring Index

<table>
<thead>
<tr>
<th></th>
<th>Telecom Strategy 1</th>
<th>Telecom Strategy 2</th>
<th>Telecom Strategy 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Telecom Strategy 1</strong></td>
<td>PASS</td>
<td>FAIL</td>
<td>FAIL</td>
</tr>
<tr>
<td><strong>Telecom Strategy 2</strong></td>
<td>FAIL</td>
<td>FAIL</td>
<td>PASS</td>
</tr>
<tr>
<td><strong>Telecom Strategy 3</strong></td>
<td>PASS</td>
<td>PASS</td>
<td>PASS</td>
</tr>
</tbody>
</table>

#### Volt/VAr Control
- Volt/VAr Optimization
- Conservation Voltage Reduction
- Capacitor Bank Telemetry / Control
- Voltage Regulator Telemetry / Control
- Load Tap Changer Telemetry / Control

#### Substation Automation
- Bus Load Transfer
- Overload Load Shedding
- Under-Frequency Load Shedding
- Digital Fault Recording Retrieval
- Power Quality Monitoring/Metering

#### General Protection, Control, SCADA
- Distance Protection
- Differential Protection
- Load Flow Calculation
- Transfer Trip
- Transformer Monitoring
- General SCADA Telemetry and Control

#### Distribution Feeder Automation
- High-Speed Distributed FDLR
- Fault Detection and Localization
- Fault Isolation
- Feeder Reconfiguration
- Auto Sectionalizing & Reclosing
- Fault Current Indicator Monitoring

#### Microgrid / Power Islanding / DER
- Telemetry
- Control

#### Smart Metering / Customer Engagement
- Interval Reads
- Remote Connect / Disconnect
- Outage Management
- Last-Gasp
- Time-of-Use Billing
- Voltage Reads
- Residential Load Control

---

**How do different applications stack-up on my network?**

1. **Telecom Strategy 1**
   - Application 1: Scenarios Studied
     - PASS
   - Application 2: Scenarios Studied
     - PASS
   - Application 3: Scenarios Studied
     - PASS
   - Application 4: Scenarios Studied
     - PASS

2. **Telecom Strategy 2**
   - Application 1: Scenarios Studied
     - PASS
   - Application 2: Scenarios Studied
     - PASS
   - Application 3: Scenarios Studied
     - PASS
   - Application 4: Scenarios Studied
     - PASS

3. **Telecom Strategy 3**
   - Application 1: Scenarios Studied
     - PASS
   - Application 2: Scenarios Studied
     - PASS
   - Application 3: Scenarios Studied
     - PASS
   - Application 4: Scenarios Studied
     - PASS
SG-CAT Cost Analysis

SG-CAT compares the fully-loaded cost of different telecom strategies

<table>
<thead>
<tr>
<th>CAPEX</th>
<th>Auxiliary infrastructure and sundries</th>
<th>Professional and managed services (network provisioning, project management, configuration, software installation, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Towers and poles</td>
<td>Software fees</td>
</tr>
<tr>
<td></td>
<td>Construction costs</td>
<td>Spectrum license costs</td>
</tr>
<tr>
<td>OPEX</td>
<td>Operations FTEs</td>
<td>Monthly data charges (if using public/leased systems)</td>
</tr>
<tr>
<td></td>
<td>Replacement/spare parts</td>
<td>Maintenance fees</td>
</tr>
<tr>
<td></td>
<td>Priority support from the vendor</td>
<td>Recurring spectrum license costs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5 Year Capex + OPEX</th>
<th>Technology A</th>
<th>Technology B</th>
<th>Technology C</th>
<th>Technology D</th>
<th>Technology E</th>
<th>Technology F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$598,973.61</td>
<td>$2,123,181.70</td>
<td>$4,024,764.59</td>
<td>$1,582,471.34</td>
<td>$2,568,677.23</td>
<td>$798,632.53</td>
</tr>
</tbody>
</table>
SG-CAT Coverage Analysis

Assess interference, signal strength, antenna heights, TX power, link budgets, and more.

800 MHz

2.4 GHz

<table>
<thead>
<tr>
<th>Connectivity</th>
<th>% of devices</th>
<th>% of devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy Connected</td>
<td>20</td>
<td>16.12</td>
</tr>
<tr>
<td>Mostly Connected</td>
<td>32</td>
<td>25.81</td>
</tr>
<tr>
<td>Nearly Connected</td>
<td>26</td>
<td>20.16</td>
</tr>
<tr>
<td>Non-connected</td>
<td>47</td>
<td>37.90</td>
</tr>
</tbody>
</table>

© Siemens AG 2013. All rights reserved.
SG-CAT Gives You a Global View of Your Telecom Situation

How does my telecom situation compare to other utilities?

Overall Telecom Score

- Your Future Projection
- Industry Average
- Your Current Situation

- Reliability
- Robustness of Coverage
- Cost
- Future Readiness
- Operational Performance
A Trusted Advisor Shouldn’t Be Biased

SG-CAT: 100% Vendor-Neutral Telecom Analysis for Utilities

SG-CAT doesn’t care what the answer is, as long as it’s the right one
“There are potential cost savings associated with grid modernization.

We can’t afford to piece the network together over several years.

Taking advantage of the benefits of the applications sooner works to our benefit.”

-- Don Bowman
Manager of Engineering, Wake Electric
Hawaiian Electric Company

“The communications assessment conducted by Siemens and their SG-CAT tool gave HECO unbiased recommendations for which communications technologies we should use to support our future smart grid needs.

We feel Siemens is a true partner going forward.”

-- Richard Freitas
Manager, Communications
Thank you for your attention!