

# Integration Center of Excellence— the Competitive Advantage to an Agile Smart Grid

**E**volving smart grid systems provide unprecedented capabilities for cutting-edge features like forecasting demand, understanding customer usage patterns, preventing outages and optimizing unit commitment. These advances also generate unprecedented data volumes along with systems that are highly complex and require time-sensitive communications. Information technology (IT) and operational technology (OT) systems must

exchange more information and it is not uncommon for a utility to have 500 information flows within its core systems.

These advanced capabilities lead to a more and more challenging integration environment. As the utility integrates many systems, the integration environment becomes costly and difficult to maintain. To remain competitive, a utility should establish an integration center of excellence (COE) and incorporate smart grid enabling standards.

## EVOLVING SMART GRID SYSTEMS

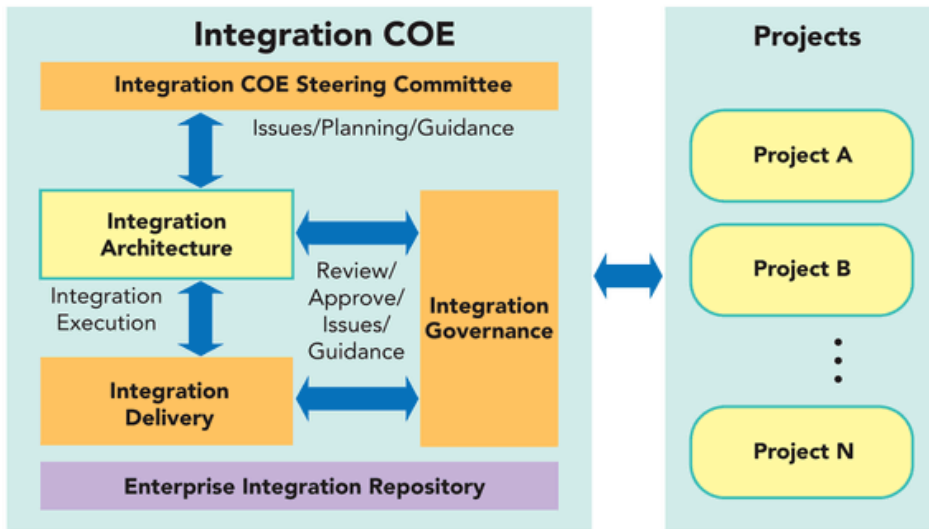
Utilities continue to add advanced smart grid system capabilities such as advanced metering infrastructure (AMI), distribution management systems (DMS), demand response (DR) and distributed energy resources (DER). Growth in grid modernization is driving an important conceptual change in the way utilities deploy smarter, more automated equipment and use advanced control with two-way mobile capabilities for crews and customers alike. Many utilities are providing advanced applications to help their customers understand their usage and societal impacts.

Historically, distribution  
SCADA (DSCADA)  
and DMS



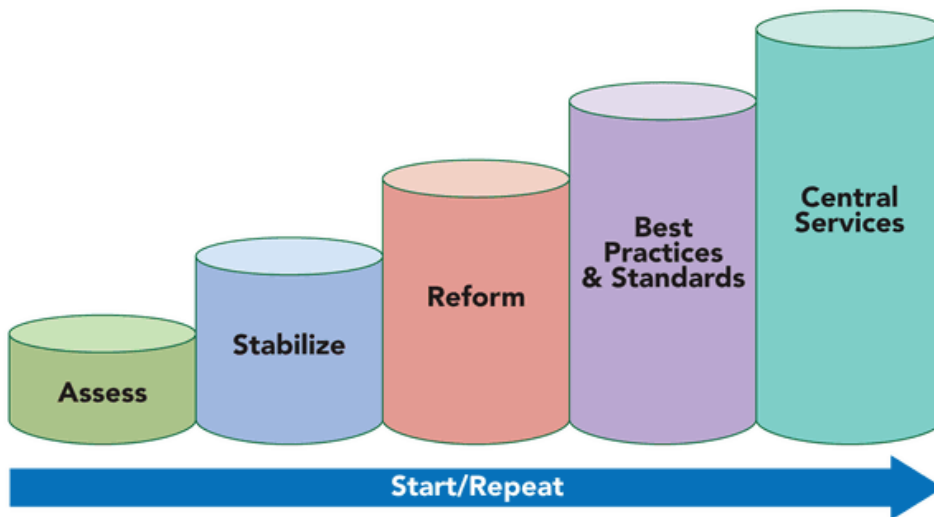
## INTEGRATION COE MODEL

1



## EVOLUTION OF THE INTEGRATION COE

2



applications were developed and maintained in isolation from IT, which focused on controlling a limited number of operating assets. Today DSCADA and DMS applications are characterized by much broader application and integration requirements and the DMS provides OMS capabilities. Once considered to be an extension of a call center application, modern OMS deployments now embed

network intelligence to support restoration and switching operations.

### INTEGRATION CHALLENGES

Utilities must be able to integrate and deploy field-based and customer-facing applications at a faster rate to remain competitive. As more applications are added to the enterprise portfolio, the natural tendency is for developers to quickly create a “hard” connection among the systems,

ultimately fusing together both business processes and data definitions. This establishes a pattern of behavior that continuously pushes the utility into a fragile IT/OT situation. The integration environment is characterized by the following:

Each application has its own internal data schema/model. This means, for example, that definitions cannot be easily changed globally when the business adapts to changing markets. In addition, the chance for process mismatches among systems becomes increasingly more problematic leading to data errors and process breakdowns. Technologies used may include Java, .Net, scripting language, object DB, hierarchical DB, relational DB, monitoring and APIs. This means that IT departments must have much bigger staffs than is optimal to cover both real-time support and capital improvements. It means also that the IT members operate in “silos” with little cross-training and the potential for low moral within the teams.

Each new integration brings the potential for a new method of integration. This leads to fragile interfaces

Carl Ozkaynak is a senior integration architect at UISOL, an Alstom company. He specializes in data architecture, system integration, cloud computing and DevOps solutions, specifically as related to SOA, ESB, CIM, and cloud computing. Carl is a working member of IEC TC57 Working Group 14 and is TOGAF Certified. Reach him at [COzkaynak@uisol.com](mailto:COzkaynak@uisol.com)

Scott Coe is a vice president at UISOL, an Alstom company. He is a working member of IEC TC57 Working Group 16 and Chair of the IEC CIM-OpenADR Harmonization initiative. Scott is an instructor with the Peak Load Management Association and previously served as a board member at NAESB and co-chair for NIST Priority Action Plan 19. Reach him at [SCoe@uisol.com](mailto:SCoe@uisol.com)

and impedes common solutions for monitoring, performance improvements and potentially even resiliency against cybersecurity attacks.

### INTEGRATION COE SERVICE OFFERINGS AND FOUNDATIONAL COMPONENTS

An integration COE has never been more important, and is critical for promoting pragmatic enterprise integration, API enablement and standards. The COE provides the structure to absorb

new technologies, standards and processes into the organization and build capabilities around them. This structure helps distribute best practices and standards across the organization and avoid “reinventing of the wheel.”

A well-functioning integration COE provides the following service offerings:

- Reference architecture (roadmap)
- Opportunistic interface/service identification
- Relevant training
- Guidance on applicable standards,

reusable services

- Patterns, standards and templates
- Registry/repository services
- Project support
- Integration design, build and test expertise
- Stakeholder involvement and communications
- Governance
- Retrospectives and continuous improvement

Delivering these services is non-trivial. The integration COE needs to be a dedicated group within a utility that provides integration leadership, guiding current, transitory and future integrations. It uses a shared services model to ensure optimum resource use. The integration COE must involve staff members who understand the business, applications, data models and underlying technologies. One crucial, and often-overlooked, skill is the technical resource with a solid understanding of the business.

The right team can establish and maintain the core principles of the integration COE:

#### Flexibility

- Ability to deploy rapid changes for new or changed business requirements and/or functionality.
- Each deployment should be measured and evaluated to help create continuous improvement.

#### Efficiency

- Reasonable cost to the business that results in continuous improvement through the elimination of wasteful practices and reusability.
- Each deployment should be measured and the costs should be analyzed, including those related to hardware, software, design, development, testing, administration and

## SMART GRID ENABLING INTEGRATION STANDARDS

INTEGRATION STANDARD	CHARACTERISTICS
IEC 61968 and IEC 61970 (Common Information Model or CIM)	<ul style="list-style-type: none"> <li>• Defines the information exchanged among control center systems using a common information model</li> <li>• Defines application-level EMS interfaces and messaging for distribution grid management</li> </ul>
IEC 61850	<ul style="list-style-type: none"> <li>• Defines communications within the distribution grid, focused on substations for automation and protection</li> <li>• Efforts to extend include communications beyond the substation to integration of distributed resources and between substations</li> </ul>
MultiSpeak (an initiative of the NRECA)	<ul style="list-style-type: none"> <li>• Specifies XML and web services for information exchanges at munis and coops</li> <li>• Certified MultiSpeak vendors must demonstrate interoperability with other vendors with a MultiSpeak ‘Assertions’ document identifying specific interfaces that have been successfully validated.</li> </ul>
IEC 60870 -6/TASE.2	<ul style="list-style-type: none"> <li>• Binary protocol for Intra-Control Center Protocols (ICCP)</li> <li>• Well supported and widely deployed by all major SCADA vendors</li> <li>• Once properly configured, the interface is effectively ‘plug and play’</li> <li>• Development of an ICCP adapter is very complex and typically requires third party products</li> <li>• ICCP was defined before the advent of OMS and implementations often do not provide some of the features that are desirable for filtering of updates to the OMS, such as momentaries</li> </ul>
Web Services	<ul style="list-style-type: none"> <li>• includes a number of protocols, most common today being REST, SOAP, JMS, XML, and JSON</li> </ul>

deployment. Total cost of ownership (TCO) analysis also means that ongoing support and maintenance (both fees and internal support) must be factored into these analyses.

#### Stability

- Enforcing controls and processes to maintain the integrity of systems and underlying information.
- Having an integration COE provides a culturally inclusive approach to the systems' environment and focuses on discipline, agility and simplification. It is easy to demonstrate that a utility with an integration COE will experience a much lower TCO.

#### ENTERPRISE SERVICE BUS INTEGRATION

An enterprise service bus (ESB) is vital to the integration of smart grid systems and is used to facilitate the exchange of information across various applications. The principle benefits of an ESB solution are economies of scale by using a common integration platform for application integration and overall service count reduction through consolidation and re-use.

Once a utility acquires an ESB, it should use the ESB as the default point of integration. Rigid, point-to-point interfaces and direct-to-database connections also can be valid implementation choices if integration standards are employed and decision criteria are properly established. This is a key area where the integration COE can provide clear and pragmatic architectural governance. If integration through the ESB does not meet certain integration

requirements, the value of using the ESB must be assessed (the earlier-the-better) to determine if the technology decision must be changed.

An ESB supports many integration patterns. Organizations must define the necessary criteria or requirements in order to choose the right integration standard or pattern. In the past, vendor solutions did not support or, at best, did not fully implement integration and interoperable standards like REST, SOAP and JMS. Commercial ESB tools, therefore, were heavily used for this function and in some cases overused to integrate systems using a desired service oriented architecture (SOA) approach. More and more vendor systems are supporting these standards through APIs that can be reused.

Proprietary and open-source ESB tools have matured tremendously and are now capable of providing utilities and vendors with cost-effective, reliable, high-performance, simplified integration solutions.

#### SMART GRID ENABLING STANDARDS

Standards are urgently needed to further advance smart grid technologies and create a more reliable and efficient grid. Standards are critical for the rapid integration of wind, solar and other renewable resources, and to ensure that utilities achieve greater reliability and immunity to grid instabilities resulting from wide-scale deployment.

Key smart grid enabling integration

standards include MultiSpeak, which is designed to meet the needs of distribution utilities in the U.S., and IEC 61968/CIM, which is focused toward utilities in the international marketplace (see Table).

Many of the widely adopted messaging standards have been ratified by a standards development organization (SDO) like the IEC or NAESB. There are, however, varying degrees of longevity and standards are still evolving. The approach to standards adoption is to focus primarily on established interoperability protocols, and then adopt other advanced, emerging protocols.

#### INTEGRATION COE EVOLUTION

It is important to build an integration COE based on models of successfully implemented COEs. Figure 1 represents the basic model that has been most widely adopted.

##### Figure 1. Integration COE Model Continuous Improvement

The integration COE continuously improves integration throughout the enterprise and as it matures it fosters an environment that encourages everyone throughout the enterprise to continuously improve integration efforts.

##### Progress Over Time

Implementation progress must be made over time, as the COE team learns and customizes its processes for its host utility. A good high-level model for this evolution is presented in Figure 2.

This evolution is not easy. It takes patience, money and executive sponsorship. In the early phases, many will question the approach—quoting longer project times and higher budgets. Once the later stages are attained, the returns should be many times the investment, most notably increased reliability for the utility customer with faster implementation times for new services. ●

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