



GridWise™ Architecture Council Interoperability Constitution Whitepaper

What is the Constitution?

The Interoperability Constitution establishes Statements of Principle that represent a consensus view across all stakeholders in the electric system community, and form a foundation from which to derive or revise design requirements. Its goal is to facilitate reliable integration and interoperability of all components in the electric power system.

The Interoperability Constitution is intended to establish a stable guiding framework against which to measure requirements and subsequent architecture designs, in a similar fashion to how the Constitution of the United States (a country made up of federated states) provides a framework and benchmark for the creation of laws that codify the original vision of the country. Further, this framework must be stable, yet not immutable, to allow for judicious evolution over time as business, regulatory, and technology models change.

The GridWise Architecture Council Context

The GridWise Architecture Council's (GWAC) mission is to establish broad industry consensus in support of the technical principles that enable the vast scale interoperability necessary to transform electric power operations into a system that integrates markets and technology to enhance our socio-economic well-being and security. The GWAC is sponsored by the United States Department of Energy. It has several projects in progress; this project's focus is on developing broad-based buy-in and input on the interoperability Statements of Principle required to support the GridWise vision.¹

Framing the Debate and Establishing Consensus

The Constitution is a vehicle to establish consensus surrounding fundamental principles and amass buy-in from a broad base of stakeholders in the application of information exchange to the effective physical and economic operation of the future electric power system. The Constitution consists of a set of fundamental strategic statements that, commonly held, will facilitate the interoperation of electric system components and those parties involved in the production, transport, and use of electricity. To be influential in transforming the management and operation of the power system, the Constitution must strive for longevity (thirty years or more). To do this, the statements must be crafted with the input and agreement of the broadest base of stakeholders. As such, the process of creating the constitution is as important as the resulting statements themselves.

¹ The GWAC Terms of Reference provides a quick overview of the GWAC (http://www.gridwiseac.org/architecture/gw_ab_terms.stm). The GridWise vision web pages can help readers understand the context of the GridWise vision (<http://gridwise.pnl.gov/vision/>).

Constitution Scope

The Constitution's statements are relevant to all operations of the electric system, including end use (load, generation, and storage), distribution, transmission, and generation. Whereas interoperation of processes within an enterprise (operating organization) may benefit from these statements, the organizational priorities and information exchange designs are the responsibility of each enterprise unit. The new frontier in a transformed energy system is the participation of new parties in overall operation of the system. The Constitution therefore emphasizes the collaboration between parties (whether large or small, industrial, commercial, or residential) where lines of responsibility are clear, internal decisions are private, and agreements between parties must be negotiated, respected, secure, and monitored. The Constitution embraces information technology and business connectivity from the concept of a transaction through negotiation, scheduling, operation, settlement, billing, and financial transfers.

An example of new party participation in operation of the electric system is the ability of demand (including individual consumers, equipment, and facility systems) to respond to power system market or operationally threatening conditions. Others include the actions and transactions between bulk generation companies, transmission owners, load serving entities, and the markets in which they interact. The evolution of these interactions over time must be reviewed and monitored by those regulatory bodies whose role is to ensure a viable electric system environment that supports our economy and balances issues of social equity each step of the way. To the extent that the Statements of Principle reflect technical strategic directions that empower interactions by interested parties, they are in the scope of this Constitution.

Attributes of the Statements of Principle

The following attributes apply generally to the concepts behind all Statements of Principle in the Constitution. They are stated here to highlight their importance and remove redundancy in the statements.

Simplicity – elegance in succinctness and clarity.

Choice – enable and encourage innovation through choice (avoid vendor or incumbent service organization favoritism).

Physical realities – acknowledge and respect the laws of physics.

Consistency – principles strive to not conflict with one another; however, where contradictions arise, the priority of principle is clearly stated.

Process Overview

The process of developing the constitution is several cyclical steps – each focusing on getting consensus, increasing clarity of the direction, and achieving wide scale buy-in across stakeholders in the North American electric power system. These steps assume that representative stakeholders have been identified for engagement in the process.

Step 1: Define a series of short statements that describe the key principles that drive a transformation of electric system operations consistent with the architecture vision statements. They are meant to engage stakeholder participation and ownership.

Step 2: Review and socialize the vision and the Statements of Principle with the broad spectrum of stakeholders gathering their concerns, suggestions and modifications to the statements.

Step 3: Analyze feedback from several reviews, consolidate, and discuss results with interviewed stakeholders attempting consensus.

Step 4: Create a new series of short statements that reflect the concerns, suggestions, and modifications from those in Step 2.

As of the date of this document (September 2005), approximately 75 interviews have been conducted with the initial set of statements, the results of those interviews have been analyzed, and revisions have been made to the statements. Additional interviews are now being conducted with the revised statements.

The interviews to date comprise a relatively balanced representation across the sectors below (see Figure 1: Industry Stakeholder Sectors and Figure 2: Balance of Representation in Interviews) and across the spectrum from more technical, to more strategic, to more business-oriented individuals.

Analysis of the interviews has shown a reasonably high degree of consensus, while still evoking good discussion and feedback (see Constitution Feedback and Results below). This would seem to indicate that the current statements represent a shared view of the future without being so general as to lack strong content or direction.



Figure 1: Industry Stakeholder Sectors

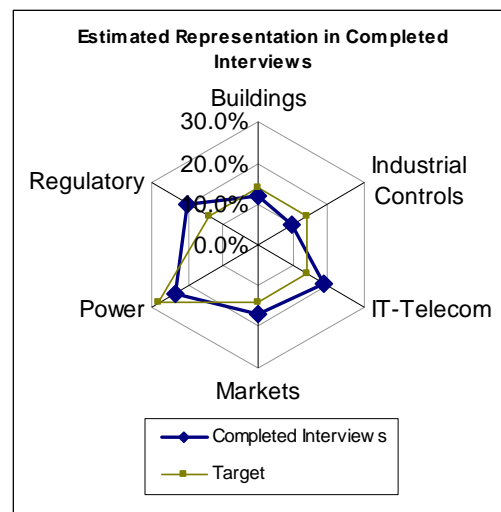


Figure 2: Balance of Representation in Interviews

Constitution Feedback and Results

The colored matrix in Figure 3 below compiles all of the votes on each statement of principle on each horizontal row and orders them from the statements receiving the most agreement (green and dark green) at the top to those receiving the most disagreement (pink or red) or lack of understanding (white) at the bottom. Most statements received a large majority of votes of agreement and strong agreement. A few solicited a notable amount of mixed feeling or disagreement, with statement G03, “The governance of this Constitution is not a standards organization,” drawing the most dissension (though still 2/3 voted in agreement or strong agreement).

Globally speaking, about one third of the interviewees voted in agreement or strong agreement to 90% or more of the statements. About 80% of the interviewees were in agreement or strong agreement with 80% or more of the statements: this would indicate very strong consensus in support of these principles.

Using this feedback, the statements were revised to clarify the statements, remove ambiguity and choose wording more broadly accepted across disciplines. Additional interviews are now being conducted with the revised statements.

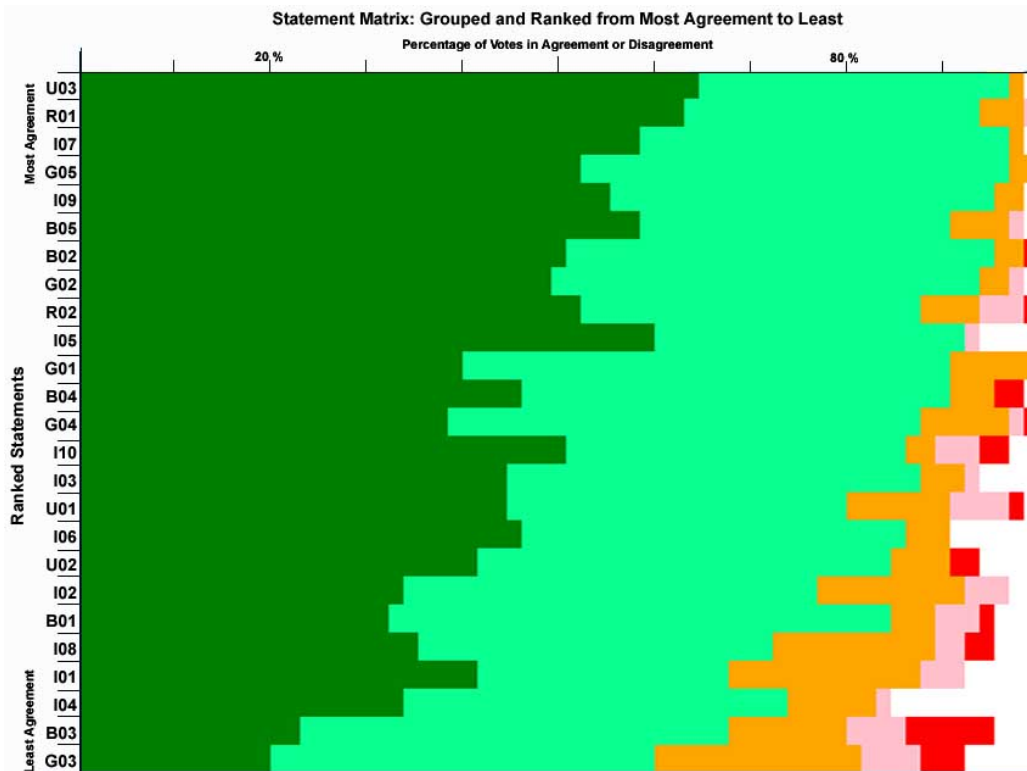


Figure 3: Summary of interview feedback

Constitution Points for Debate and Inquiry

The following topics characterize key issues with respect to the Constitution, and provide a good starting point for discussion.

Business

- the line between privacy of internal operations and transparency for contract/regulatory audits
- style of interaction: centralized command and control versus distributed, collaborative decision making

Consumer

- attraction/acceptance (understanding what's in it for me)
- ease of entry and use
- access and choice of products and services

Technology

- what is an interoperability strategy?
- interoperability issues and gaps (what's missing from the constitution statements)
- paths forward, timeline

Policy

- system reliability responsibility in a multi-party, collaborative environment
- competition as a driver for efficient operation
- policy issues and viable path(s) for marketplace and operational change

Governance

- should the governance body be a standards organization or not (consider neutral affiliation aspects)
- clarification of stakeholders
- structure/composition (size, representation, ...)
- relationships: to standards and trade organizations, companies, government, GridWise Architecture Council
- initiation/start up
- sustainability/support

Additional Insight

Below are selected comments from the interviews conducted to date.

If we had to solve one problem to make the electric power system better, in your view, what would that be?

- “I believe that we’ve made great strides in individual technologies over the last decade or more. Our challenge now is to understand how to integrate and manage these technologies into a clean, affordable, reliable, secure and efficient system.”
- “Enable better demand side responsiveness to power system conditions and prices. The system does not need to only respond to old fashioned price signals, but should be a lot more automatic and organic. Demand Response needs to be empowered to lighten dependence on supply side resources.”
- “The system would have significantly more embedded dispersed intelligence so that anticipation of transients/system problems might be dealt with locally as well as centrally.”
- “An active marketplace that treats demand reduction and generation on an equal footing.”
- “Between entities in the electric power system, we don't know how we positively or negatively impact each other very well. For example, the ISO does not have responsibility to better integrate the overall system and to insure adequacy of energy supply, in fact in California, no one has this authority or governance to ensure that the electric power system will meet requirements.”
- “Address transmission congestion issues.”

Related to the context of this interview, what are your primary concerns?

- “I am afraid that this process will take too long and get too generic in an effort to please everyone. At some point it will need to take a stand on issues. Human tendency to be territorial will lead to conflicts.”
- “With regard to governance, the constituency is very ignorant (not meant to be derogatory). We need re-education of all parties including employees, legislators—all parties. We need to open people’s understanding. People believe things don’t evolve. In fact, our world has changed and continues to.”
- “Keeping critical infrastructure secure and protected are primary so that they are not vulnerable to physical or cyber attack.”
- “Biggest concern: incentives are perverse. Utilities are adversely affected for customer side technologies.”
- “Money is an inhibitor. The business case, as important as this is, it is going to cost...”
- “There is a lack of knowledgeable human resources to design, modify, operate & maintain the grid. Distribution engineers don’t have the tools, training or education to

model the infrastructure they manage. The depth of expertise is just not there. These tools should be taught in schools.”

- “My frustration is the regulatory process for electrical transmission and distribution is based upon who the stakeholders are in the electricity business (utilities and customers) and then entities acting as surrogates for the public (rate payer advocates) in a tug of war with each other over how much the utility will get... Manufacturers basically have no legal voice in these proceedings; they can only use 'remote control' to try to influence these processes. In the rule making context, comments can be made, but there is a lack of standing...”
- “Designing the market structure, interoperability structure, and regulations is, in my opinion, surprisingly analogous to writing tax code, because you have multiple parties with multiple goals, and so there needs to be a structure that I don’t see in this document. That is the regulator needs to be more a party to this process rather than a person who is reported to. The regulator needs to be as integrally involved in what you are doing here as any of the other parties. I can’t emphasize this strongly enough.”
- “An increasing concern is that without an applicable set of standards-based specifications to reference as a minimum set of requirements, or to be used as a functionality checklist, both State and Federal Regulators will authorize the deployment of networks and systems that are bound to become stranded due to obsolescence, lack of interoperability or unforeseen extensibility requirements”
- “Under the status quo, we can't deliver reliability with an old, tired grid. Under the new Energy Bill, if DOE implements the plan and FERC does mandatory reliability, things can improve. We will lose our competitive edge, if we do not follow GridWise like principles.”

A Constitutional Convention

The GridWise Architecture Council thanks all the stakeholders who have contributed their time to participate thoughtfully and insightfully in the GWAC Constitution interview process.

The next step in the process is to meet, discuss, and ratify the initial version of the Interoperability Constitution. The Constitution Statements of Principle, as revised based on the interview process, along with the comments and feedback from the interviews, lay the ground work for this meeting.

We look forward to seeing you at the GWAC Constitutional Convention in Philadelphia, PA on December 6 & 7, 2005.

APPENDIX



Constitution Statements of Principle

B-Business Principles

Context: Subject to the regulatory environment in which they operate, organizations are free to structure themselves in the manner they see fit to best deliver goods and services and compete with other businesses. They interact with other organizations through contracts of their own choosing in as open a marketplace as possible. Enterprises can be categorized into wholesale and retail segments; however, the path from producer to consumer may pass through a variety of businesses each providing their unique value added contribution. There is no standard process of running a business.

B01- (v2.0) Subject to regulatory monitoring requirements, interoperability approaches should focus on the information exchange and the interaction at the boundary between transacting parties while respecting the privacy of the internal aspects of their business (technology choice and processes).

B02- (v2.0) Interoperability approaches must support the ability to roll out changes to contracts or market rules while preserving stable operation of the overall electric system.

B03- (v2.0) Interoperability approaches must address the common types of marketplace transactions among parties along the path between producers and consumers appropriate to the level of service provided.

B04- (v2.0) Interoperability approaches must consider implementation costs/benefits and impacts to the parties involved in the transaction.

B05- (v2.0) Interoperability approaches must support verification and auditability of transaction completion and be able to validate that contract terms have been met.

U-Usability Principles

Context: Electricity users have a wide range of needs and energy management capabilities, as well as varying degrees of willingness to pay for any given energy product. The new frontier in a transformed energy system is the participation of new parties in overall system operations, including end use, distribution, transmission, and generation.

U01- (v2.0): Interoperability approaches should address the technical capabilities needed to support the emergence of markets for consumers to choose the appropriate electricity service program they desire.

U02- (v2.0): In the event of a communications failure between interacting parties, the parties must assume operating positions that best preserve stable operation of the overall electric system.

U03- (v2.0): Interoperability strategies should be communicated in appropriate ways that can be understood and adopted by all stakeholders in the electric system.

1- Information Technology Principles

Context: Advances in information technology empower electronic business and intelligent machine connectivity. Large sectors of the economy rely on information technology to enable greater levels of productivity, efficiency, and reliability of service. This provides a vast marketplace for the application of information technology and reduces the need for industry specific information technology approaches. Information technology is characterized by a high rate of innovation with impacts to large scale systems of systems that must cope with the deployment of new solutions as legacy approaches continue to operate in tandem.

I01- (v2.0) A broadly held interoperability strategy can help organize and advance the large scale integration of automated equipment, business processes, and human interactions.

I02- (v2.0) Strategies for interoperability shall adopt the broadly applicable best practices of information science to improve end to end performance of both business and the electric system's operation and managerial processes.

I03- (v2.0) An interoperability framework shall address a strategy for the identification of system entities beyond organizational boundaries to ensure unambiguous interactions, and shall support the naming of groups or collections of system entities.

I04- (v2.0) An interoperability framework shall incorporate information modeling approaches that define the shared meaning and relationships of entities and concepts applicable to interactions in an area of industry or commerce.

I05- (v2.0) Interoperability strategies shall address time synchronization, sequence of events, time tagging, and other requirements related to time as appropriate to the service provided.

I06- (v2.0) Interoperability strategies shall address the ability to set up (i.e., discover and configure) system components so they can join, modify (e.g., upgrade), and terminate their positions in the system.

I07- (v2.0) An interoperability framework must address information system security and privacy concerns, balance them appropriate to the service provided, and support adaptation to future risks.

I08- (v2.0) As appropriate to each interaction, an interoperability framework should address strategies for e-business transactions that may include creation of a transaction, negotiation, scheduling, operations, settlement, billing and financial transfers.

I09- (v2.0) An interoperability framework must be practical and achievable:

- Meets performance requirements.
- Is reliable.
- Is scalable.
- Has sufficient breadth to meet the range of business needs.

I10- (v2.0) An interoperability strategy must accommodate the coexistence of and evolution through several generations of IT standards and technologies that will reside at any point in time on the Grid.

R-Regulatory Principles

Context: Business is conducted under a formal set of rules or laws meant to follow policy guidelines. The rules are set, maintained, and enforced by various local, state, and federal agencies in accordance with their jurisdictions. Business interactions associated with the electric industry are reviewed and monitored by those regulatory bodies whose role is to ensure a viable electric system environment that supports our economy and balances issues of social equity.

R01- (v2.0) Interoperability strategies and issues must be communicated in a form to be understood by regulators and policy makers.

R02- (v2.0) Interoperability approaches among organizations must allow regulators the ability to verify that business is conducted within established rules and that all relevant transactions are auditable.

G-Governance Principles

Context: This constitution is a living, evolving document that influences the long-term future of the electric power system. Though the Statements of Principle are meant to be long lived, the ability to correct, update, and clarify this constitution is recognized.

G01- (v2.0) An interoperability framework must consider the needs and views of the full range of stakeholders in an integrated view of the electric system.

G02- (v2.0) Governance processes should measure successes and shortcomings of the interoperability framework, and drive improvement.

G03- (v2.0) The governance of this constitution must be independent of any particular standards organization and preserve the technical neutrality of these principles.

G04- (v2.0) With regard to encouraging standards and standards development, the governance of this constitution:

- Will encourage development of standards where appropriate to constitution objectives and work with existing groups to guide standards development toward better achieving interoperability;
- Will endorse and/or recommend standards where appropriate to constitution objectives; and
- Will proactively encourage collaboration, merging, and rationalization of standards where appropriate to constitution objectives.
- Does not develop detailed specifications for standards.

G05- (v2.0) These long lived Statements of Principle and the strategic approaches that derive from them must be able to change through time in a prudent, controlled manner.