EMIX 1.0 and the OASIS Smart Grid Suite of Standards

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- Energy Market Information Exchange (EMIX) 1.0 Committee Specification Draft 04 (http://docs.oasis-open.org/emix/emix/v1.0/csd04/emix-v1.0-csd04.html)

Abstract:
We describe how EMIX relates to other OASIS Standards, including WS-Calendar, Energy Interoperation, Emergency Management, SOA Reference Model, and Security standards.

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This document was last revised or approved by the OASIS Energy Market Information Exchange (eMIX) TC on the above date. The level of approval is also listed above.

Technical Committee members should send comments on this document to the Technical Committee's email list. Others should send comments to the Technical Committee by using the "Send A Comment" button on the Technical Committee's web page at http://www.oasis-open.org/committees/emix/.

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1 Introduction

We describe how EMIX **[EMIX]** relates to the OASIS suite of Smart Grid Standards, *WS-Calendar* **[WS-Calendar]**, *Energy Interoperation* **[EnergyInteroperation]**, as well as other OASIS Standards including Emergency Management **[REF NEEDED]**, SOA Reference Model **[SOA-RM]**, and Security standards.

EMIX is an information model for energy and market information, which is in turn used by Energy Interoperation services for communicating price and product information. Understanding the relationship of the three standards helps in understanding the OASIS Smart Grid suite of standards.

To more effectively understand and use EMIX, one must start with a broad understanding of OASIS WS-Calendar **[WS-Calendar]** schedules to which price and product information is attached. We then describe how OASIS Energy Interoperation **[EnergyInteroperation]** and its OpenADR 2 profile uses both EMIX and WS-Calendar.

Composing relatively simple standards has significant advantages over building large unitary standards. The OASIS suite of Smart Grid Standards is designed for composition and re-use, and in fact composes with each other and with other specifications and technologies as we describe in Section 2.

1.1 References

1.1.1 OASIS Committee Specifications and Drafts

[EMIX]
OASIS Energy Market Information Exchange [EMIX] Version 1.0, 08 September 2011. OASIS Committee Specification Draft and Public Review 04. http://docs.oasis-open.org/emix/emix/v1.0/csprd04/emix-v1.0-csprd04.pdf

[EnergyInteroperation]
OASIS Energy Interoperation Version 1.0, 15 July 2011. OASIS Committee Specification Draft and Public Review 02. http://docs.oasis-open.org/energyinterop/ei/v1.0/csprd02/energyinterop-v1.0-csprd02.pdf

[SOA-RM]
OASIS Reference Model for Service Oriented Architecture Version 1.0, 12 October 2006. OASIS Standard. http://docs.oasis-open.org/soa-rm/v1.0/soa-rm.html

[WS-Calendar]
OASIS WS-Calendar Version 1.0, 30 July 2011. OASIS Committee Specification. http://docs.oasis-open.org/ws-calendar/ws-calendar-spec/v1.0/cs01/ws-calendar-spec-v1.0-cs01.pdf

34 1.1.2 Other References

35 **[Collaborative]**

36 *Collaborative Energy Status Page*, Various Dates, http://collaborate.nist.gov/twiki-
37 sggrid/bin/view/SmartGrid/CollaborativeEnergyStatus

38 **[Emergency]**

39 *OASIS Emergency Management Technical Committee*, http://www.oasis-
40 open.org/committees/emergency/

41 **[EMIX Issues]**

42 *EMIX Issues Page*, http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/EMIXissuesPage

43 **[PAP09}**

44 *Slides for Priority Action Plan 09*, July 2011. http://collaborate.nist.gov/twiki-
45 sggrid/pub/SmartGrid/PAP09DRDER/PAP09_OpenSG_20110719.pptx

2 EMIX and the OASIS Smart Grid Standards

2.1 Overview

We focus on the suite of OASIS Smart Grid standards. The three standards respond to three of the National Institute of Science and Technology [NIST] Priority Action Plans [PAPs], and have been implemented so as to address interoperation requirements across and within domains of the Smart Grid.[1]

The OASIS Smart Grid suite consists of three standards. The first two are pure information models, expressed as an XML vocabulary for describing information in their scope; the third is an information model, architecture, and set of Web services definitions for communicating among participants in the Smart Grid.

- OASIS Energy Market Information Exchange **[EMIX]** corresponding to NIST/SGIP Priority Action Plan 03[2]
- OASIS WS-Calendar **[WS-Calendar]** corresponding to NIST/SGIP Priority Action Plan 04[3]
- OASIS Energy Interoperation **[EnergyInteroperation]** corresponding to NIST/SGIP Priority Action Plan 09[4]

The relationships of these three standards and a family of seed standards for energy usage information[5] can be seen in **Figure 1**.

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[1] See the NIST Smart Grid Framework and Roadmap at
http://nist.gov/smartgrid/upload/FinalSGDoc2010019-corr010411-2.pdf and the Smart Grid Interoperability Panel Priority Action Plans at http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PriorityActionPlans

[2] http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PAP03PriceProduct

[3] http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PAP04Schedules

[4] http://collaborate.nist.gov/twiki-sggrid/bin/view/SmartGrid/PAP09DRDER

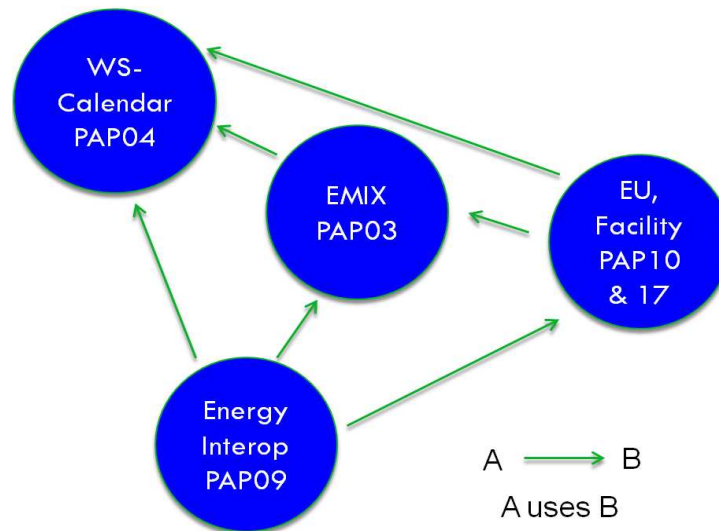[5] Addressed in NIST/SGIP Priority Action Plan 10 and Plan 17

Figure 1 Dependency graph for EMIX, Energy Interoperation, and WS-Calendar

As shown, EMIX uses WS-Calendar and is in turn used by Energy Interoperation. Energy Interoperation and EMIX use the minimal subset of the NAESB Energy Usage information. The arrows indicate that Energy Interoperation uses both EMIX and WS-Calendar, while EMIX uses only WS-Calendar.

The following sections describe how the specifications are used and use other specifications.

2.2 EMIX and WS-Calendar

The WS-Calendar and Energy Market Information Exchange (EMIX) specifications are both information models, expressed as *XML vocabularies*. WS-Calendar uses and extends the IETF iCalendar standards, which are the common information model and vocabulary for calendaring and scheduling. The **[WS-Calendar]** specification was joint work between the North American Energy Standards Board [NAESB][6] and the Calendaring and Scheduling Consortium.[7]

WS-Calendar uses Sequences of time Intervals to communicate schedules. Information elements that are unique to an Interval are communicated in the Interval, while information elements common to the entire Sequence are factored out and communicated once with the Sequence.

For example, the start time of the Sequence, and a common duration of each Interval might be communicated once with the Sequence (in a WS-Calendar artifact called a *Gluon*), while price information might vary across the Intervals and be contained within each Interval.

In WS-Calendar, a Gluon relates to a Sequence by relating to a specific Designated Interval within that Sequence. All other Intervals have defined temporal relationships, directly or indirectly, to the Designated Interval. If a Gluon contains a start date and time, that start date and time is inherited only by a single Designated Interval; the start dates and times for all other

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[6] http://naesb.org/
[7] http://calconnect.org/

86 Intervals in the Sequence can be computed from that single date and time. This allows
87 scheduling of an entire set of time-related intervals, a Sequence, with one operation rather than
88 changing each interval's start, end, and/or duration.

89 EMIX uses the common terminology of markets. EMIX expresses schedules for energy use,
90 delivery, curtailment, and demand with the WS-Calendar vocabulary for schedules, and provides
91 the EMIX vocabulary for expressing information on price and product definition. These
92 definitions are used by implementers and by other standards.

93 EMIX extends WS-Calendar Intervals and Gluons, attaching price, quantity, product definitions,
94 and more. In the EMIX information model, Interval Duration and the Product Description, Price,
95 and Quantity for each Interval in a Sequence can each be inherited from a Gluon.[8] This follows
96 and extends the rules of inheritance defined in WS-Calendar.

97 **Figure 2** below provides a model demonstrating a sequence of three Intervals, and the
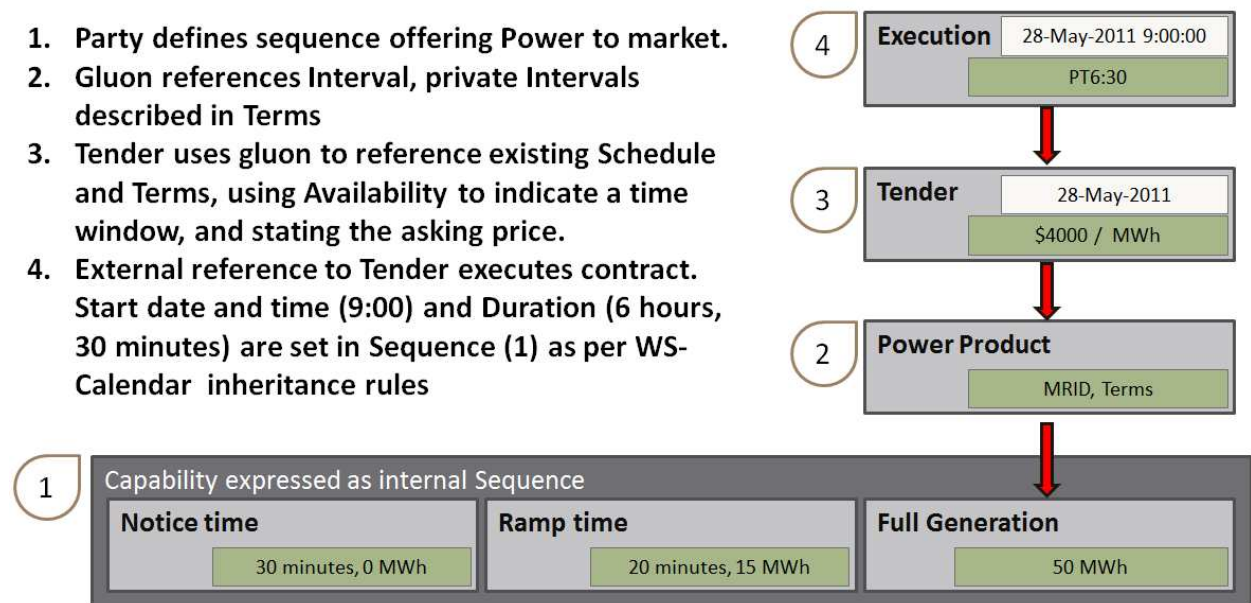98 successive application of Gluons to bring them to market.

99

1. **Party defines sequence offering Power to market.**
2. **Gluon references Interval, private Intervals described in Terms**
3. **Tender uses gluon to reference existing Schedule and Terms, using Availability to indicate a time window, and stating the asking price.**
4. **External reference to Tender executes contract. Start date and time (9:00) and Duration (6 hours, 30 minutes) are set in Sequence (1) as per WS-Calendar inheritance rules**

4 **Execution** 28-May-2011 9:00:00 PT6:30

3 **Tender** 28-May-2011 $4000 / MWh

2 **Power Product** MRID, Terms

1 Capability expressed as internal Sequence

Notice time 30 minutes, 0 MWh

Ramp time 20 minutes, 15 MWh

Full Generation 50 MWh

100 **Figure 2 EMIX Schedule and Building a Product (from [EMIX] Section 6.4)**

2.3 EMIX and Energy Interoperation

101

102 OASIS Energy Interoperation **[EnergyInteroperation] uses the** WS-Calendar and Energy Market
103 Information Exchange (EMIX) information models to implement demand-response, distributed
104 energy resource interactions, and transactive energy interactions.

105 For Events, information may consist of curtailment or generation or regulation levels, quantities,
106 or prices. The price expression is simplified from EMIX.

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[8] Only the Designated Interval inherits the Start Date and Time.

107 Energy Interoperation defines interactions for conveying price quotes (such as clearing prices in
108 a market) and tenders (such as offers to buy or sell) by conveying EMIX schedules with energy
109 product information.

110 In addition several information items in Energy Interoperation build on EMIX definitions. These
111 include

- The EMIX Market Context—a reference to the program, contract, tariff, or market related to the interaction
- The EMIX Resource Description—a description of capabilities for curtailment and generation and for ancillary services
- The EMIX Product Description—a description of details of time, place(s), and more
- Market (or program or tariff or...) Standard Terms—a description of notice, frequency, units, and other requirements

3   EMIX and Other Specifications

3.1 Composition for Consistency

122 The OASIS Smart Grid Suite of Standards are defined to be composed as part of palette of
123 standards used in an application environment, and also to have other standards composed with
124 them.

125 For example, price and product information may be commercially sensitive. Following the
126 compositional approach for electronic commerce and eBusiness standards, a deployment using
127 EMIX will define and compose the necessary security standards to achieve the deployment
128 business and security goals.

129 Likewise, the messages containing EMIX price and product information may travel on a variety
130 of transports and with a variety of reliability, privacy, assured delivery, and non-repudiation
131 standards and technologies that depend on the business and security goals of the deployment.

132 By defining information models that can be exchanged with any security and reliability, uses of
133 EMIX in any environment can share code, information model, XML schema, and the
134 understanding of energy products achieved through broad public discussion and review.

3.2 Other OASIS Standards

136 In this section we list several OASIS Standards used by or coordinated with by EMIX.

137 OASIS Emergency Management Standards—EMIX uses the same profile of the Open Geospatial
138 Consortium's GML. This allows, for example, an area affected by a power outage to be
139 communicated in the same way to emergency management service.

140 OASIS Energy Interoperation—Useful capabilities are enabled by the GML geospatial definitions
141 that are possible in EMIX. Prices may be described for an area of coverage of a particular feeder

142   or substation, and with OASIS Energy Interoperation a curtailment event could be called on that
143   area, or Distributed Energy Resources may be called on.

144   OASIS Security Standards—The industry-standard OASIS security standards[9] can be composed
145   with EMIX, WS-Calendar, and Energy Interoperation, tailoring security to the requirements for
146   an interaction or a piece of information.

147   OASIS Message Reliability Standards—The industry-standard OASIS message reliability
148   standards[10] can be used to send and receive EMIX price and product information in Energy
149   Interoperation messages or whatever messaging standards one selects.

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[9] For example, Web Services Security, XACML, SAML, WS-SecureConversation, and more
at http://www.oasis-open.org/standards
[10] For example, WS-Reliability, Web Services Reliable Messaging, and more at
http://www.oasis-open.org/standards

150 4 Conclusion

151   EMIX is part of a suite of Smart Grid Standards under development by OASIS. By standardizing
152   the description of energy schedules and product attributes, EMIX provides a means for
153   exchanging information among different domains of the Smart Grid and among participants
154   with different business and information models.

155 # Appendix A. Acknowledgments

156 The following individuals have participated in the creation of this specification and are gratefully
157 acknowledged:

158 Participants:

159 Edward Cazalet, Individual
160 Toby Considine, University of North Carolina
161 William Cox, Individual
162 David Holmberg, National Institute of Standards and Technology

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Appendix B. Revision History

Revision	Date	Editor	Changes Made
01	[Rev Date]	David Holmberg	Based on contributed notes by TC members
02	13 October 2011	William Cox	Rewrite based on review and comments

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