

OASIS Phase II Structural Design

Task Force Report

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Revision 0.0.3

OASIS Phase II Structural Design

Table Of Contents

Task Force Report

Scope of OASIS II (copied from the ESC System Requirements document).....	3
Scope of the Task Force.....	3
OASIS II Entity Relationship Diagram	4
Process Flows.....	7
Typical OASIS Node.....	9
OASIS Node Interactions	10
Backoffice Integration	11
OASIS Actors and Use Cases.....	11
Comments/Clarifications/Recommendations	11
Conclusion	11
Next Steps	11

Attachments

OASIS II Drawings.doc

OASIS II Drawings.vsd

OASIS II Actors.xls

OASIS Phase II Structural Design

Task Force Report

Scope of OASIS II (copied from the ESC System Requirements document)

For entities that operate in the electric utility industry, OASIS II is envisioned to be a standard interface between market participants and market operators and/or transmission service providers. This standard interface will facilitate the trading and scheduling of energy, transmission, and ancillary services between marketing entities (Purchasing/Selling Entities (PSE's), Load Serving Entities (LSE's), Generation Providing Entities (GPE's), etc...), operating entities (traditional Transmission Service Providers (TSP's), Balancing Authorities (BAs), Regional Transmission Organizations or Independent Transmission Providers (RTO's/ITP's), Independent System Operators (ISO's), Market Operators (MOs), Generator Operators, etc...), and any grouping of the two. Unlike current processes, OASIS II will provide a seamless method for interacting with other entities and for scheduling energy, transmission, and ancillary services, regardless of region, type of entity, or market structure.

OASIS II is envisioned to support both physical and financial markets and to be a standardized interface to be used between market participants and market operators that will:

- Facilitate Procurement of Energy & Ancillary Services
- Facilitate Procurement of Both Physical and Financial Transmission Rights
- Facilitate Electronic Scheduling
- Accommodate Regional Diversity
- Ensure Reliable Electric System Operations
- Accommodate Market Operations
- Support Market Monitoring

Scope of the Task Force

At the December meeting of the NAESB IT / NERC TIWSG a task force was assembled to produce a high level structural design of OASIS II. The members of the task force are: Jim Hudson - Bonneville Power Administration, James Keaton - Southwest Power Pool, Cheryl Mendrala - ISO New England, Aleks Mitreski – Entergy, John Putz – Sungard, and Jagjit Singh - Salt River Project.

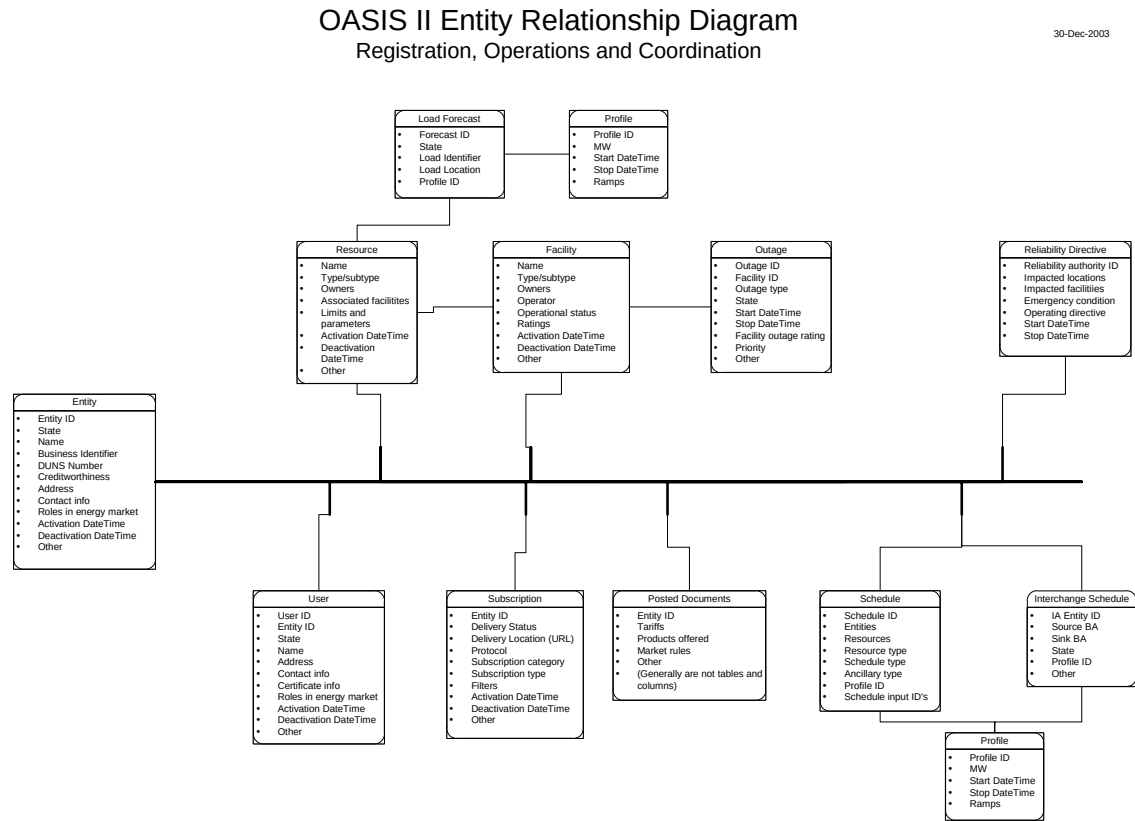
The starting point for the design was the NERC Electronic Scheduling Collaborative System Requirements and Use Case Specification documents.

The work products produced by the task force include a high level block diagram of OASIS II, a narrative describing groups of services, and a list of issues and questions that surface while producing the report. This report is that work product.

OASIS Phase II Structural Design

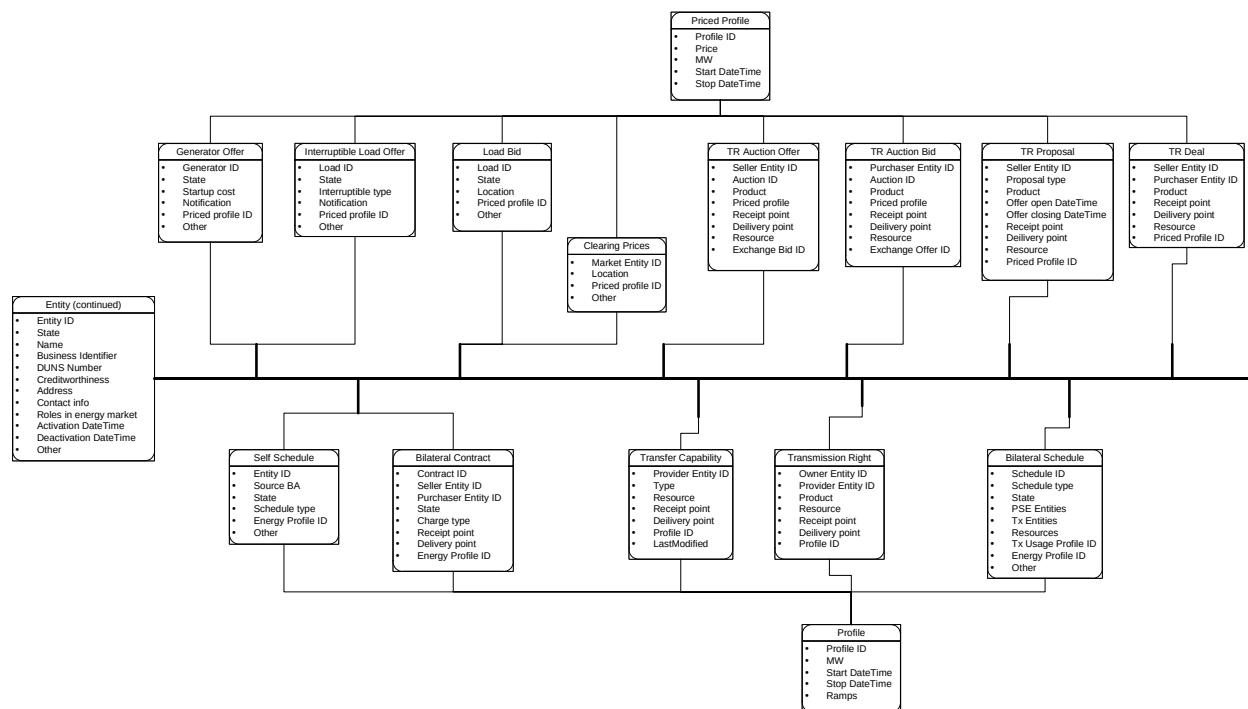
OASIS II Entity Relationship Diagram

(Larger copies of these diagrams are found in the attachments.)



OASIS Phase II Structural Design

OASIS II Entity Relationship Diagram Energy market, Transmission rights, Bilateral and Self schedules



The OASIS II Entity Relationship Diagram identifies the major objects that must be defined as elements of an electronic scheduling system and lists many of the attributes of those objects.

Entity is a company in the wholesale electric market. It contains basic common information such as the name, address, DUNS number, and contact info. It contains the unique ID and code that others use to refer to the entity. An entity may act in several different roles at the same time within the electric market at the same time such as Transmission Owner, Transmission Service Provider, Balancing Authority, Market Operator, Balancing Authority, Interchange Authority, and many more. An entity may also provide services to other entities in which it acts as an agent for the other entities. These roles may change over time so each role has a separate activation and deactivation date time.

User is a human being or automated service that takes actions on behalf of the entity. The user is the object to which authentication certificates are identified. The user also has roles that may limit the range of actions it may take.

Subscription is a computer type object that enables the publish subscribe communication method to operate. It tells the publisher of an event that the subscriber wished to be notified when the event occurs. It contains the type of event subscribed to and the delivery address for the notification.

OASIS Phase II Structural Design

Posted Documents is a place holder for the general information documents that an entity posts such as tariffs, products offered and market rules. These documents provide public awareness to the services offered by an entity but are not actively used in the scheduling process.

Facility is an operating unit of the electricity infrastructure: a generator, transmission line, interruptible load service point, substation, etc. They are owned and operated by entities. Facilities have names, types, owners, operators, operational statuses and ratings. Facilities generally are physical objects as compared to Resource, another one of the objects described below.

Outage is a facility outage or derating where its output is reduced for a time period.

Resource is a marketing unit abstracted from facilities. A resource may be a collection of transmission lines, a path, a flowgate or a point of delivery. It may be a collection of generators within a portfolio or a subdivision of a single generator. It may only be distantly related to facilities such as in the cases of a price point or a hub. Resources have names, types, owners, operators, limits and parameters. Resources are operated by entities.

Load Forecast is a forecast of load for a resource.

Profile is a time series of values. Profiles will reappear as subelements of several different objects.

Schedule is a plan to deliver energy from one resource to another. Schedules have a unique identifier, entities, resources, resource types, schedule types, and a profile. A schedule may be bundled with ancillary services. A schedule is not always energy, but sometimes may be reserves, capacity or the ancillary service itself. If a schedule is derived from other schedules, a link is maintained back to the source schedules.

Interchange Schedule is a particular type of derived schedule that represents interchange between a source and a sink balancing authority.

Generator Offer is an offer to generate electricity from a resource for a price. The offer includes startup costs, notification time, minimum run times and one or more priced profiles.

Priced Profile is a profile that varies over time with prices. The time intervals may overlap with various prices as in a bid curve.

Interruptible Load Offer is an offer to reduce load from a resource for a price. The offer includes costs, notification time, and one or more priced profiles.

Load Bid is a bid to purchase electricity at a delivery point for a price. The bid includes one or more priced profiles.

Clearing Prices is a published summary of the clearing prices set by a market operator for resource locations. This object includes one or more priced profiles.

OASIS Phase II Structural Design

TR Auction Offer is a published notification by a transmission service provider of an offer to sell transmission services.

TR Auction Bid is a bid to purchase transmission services offered at auction.

TR Proposal is an offer by an owner of transmission rights to sell those rights.

TR Deal is a completed transfer of transmission rights from a buyer to a seller.

Self Schedule is a unpriced offer by a resource to inject energy to supply energy or ancillary services.

Bilateral Contract is the documentation of a contract between a seller and purchaser. It is a pure financial transaction in an energy market.

Transfer Capability is the posted information reflecting the total and available transfer capability on a path.

Transmission Right is a right to utilize the transmission grid from a point of receipt to a point of delivery.

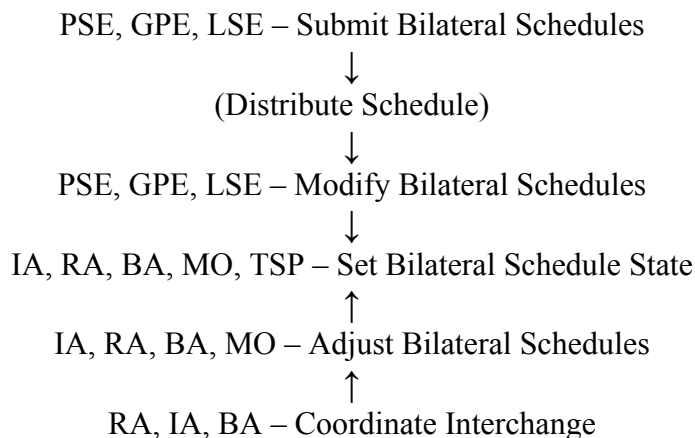
Bilateral Schedule is a schedule for the delivery of energy or ancillary services arranged by the participants. It is similar to today's Etag.

Process Flows

Bilateral and Self Schedules

Bilateral Schedules

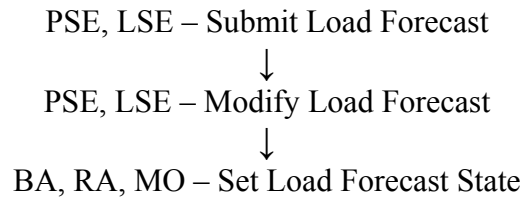
These cases appear to correspond fairly closely to the existing NERC ETag standard.



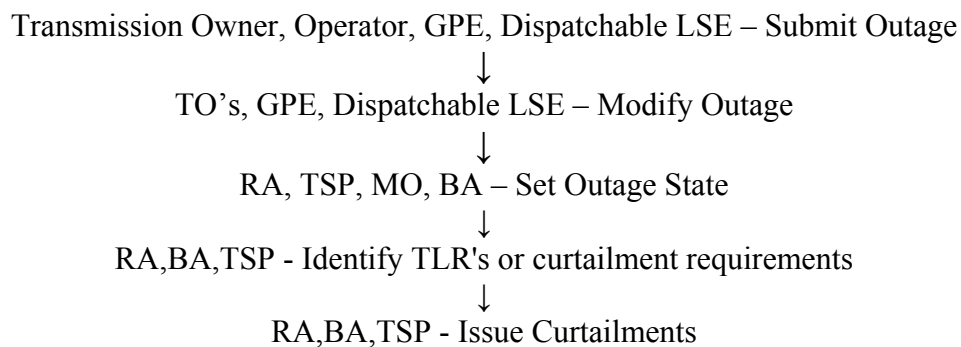
OASIS Phase II Structural Design

Operations

Load Forecasts



Outages



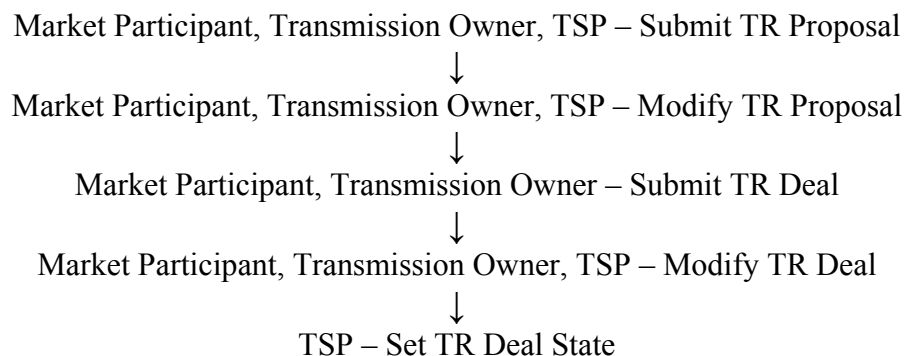
Transmission Rights Market

Bilateral Market – TR Deals

TSP – Post Transmission Rights

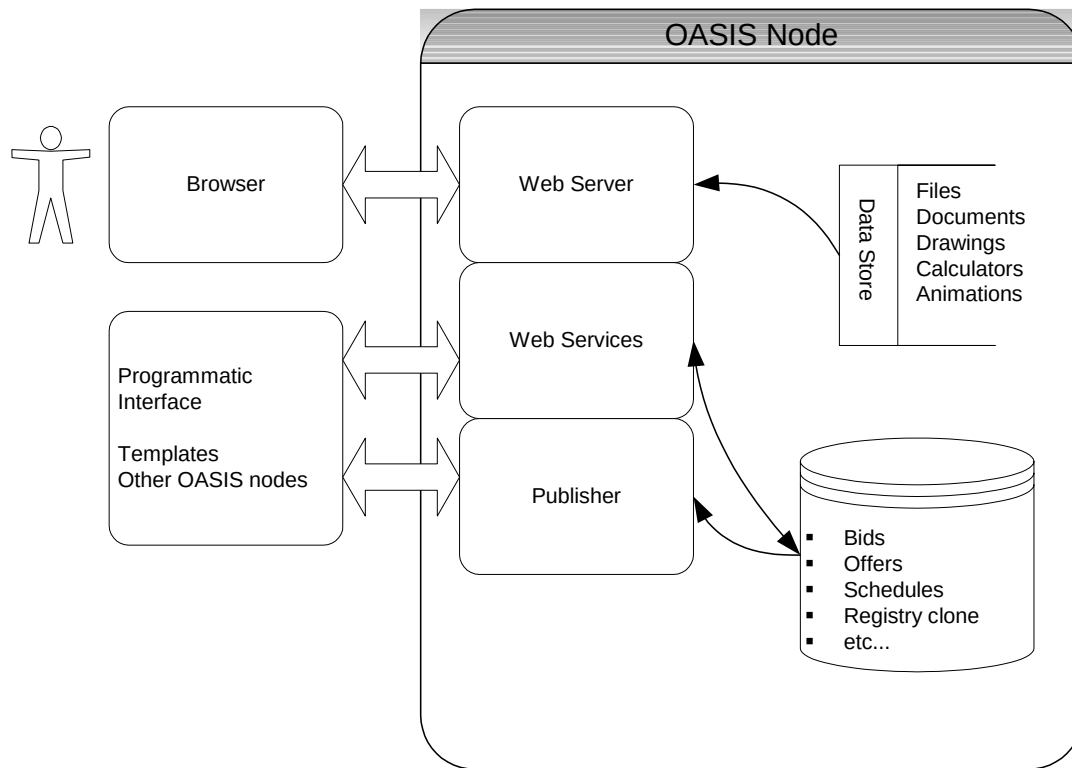
TSP – Post Transfer Capability

Public, Market Participant, Transmission Owner, TSP, Market Monitor – View TR Market



OASIS Phase II Structural Design

Typical OASIS Node



A typical OASIS node will have three web type components, a data store for posted documents and a database for scheduling information.

The web server will be a standard commercial web server that interacts through a standard browser to a human being. The data store will be the posted documents data which consist of files, documents, drawings, tariffs, products and market rules for the OASIS node entity. The web server may include calculators and animations that not available through the other web interfaces. It also may include forms and screens for the browser interaction to the scheduling functions of the OASIS node.

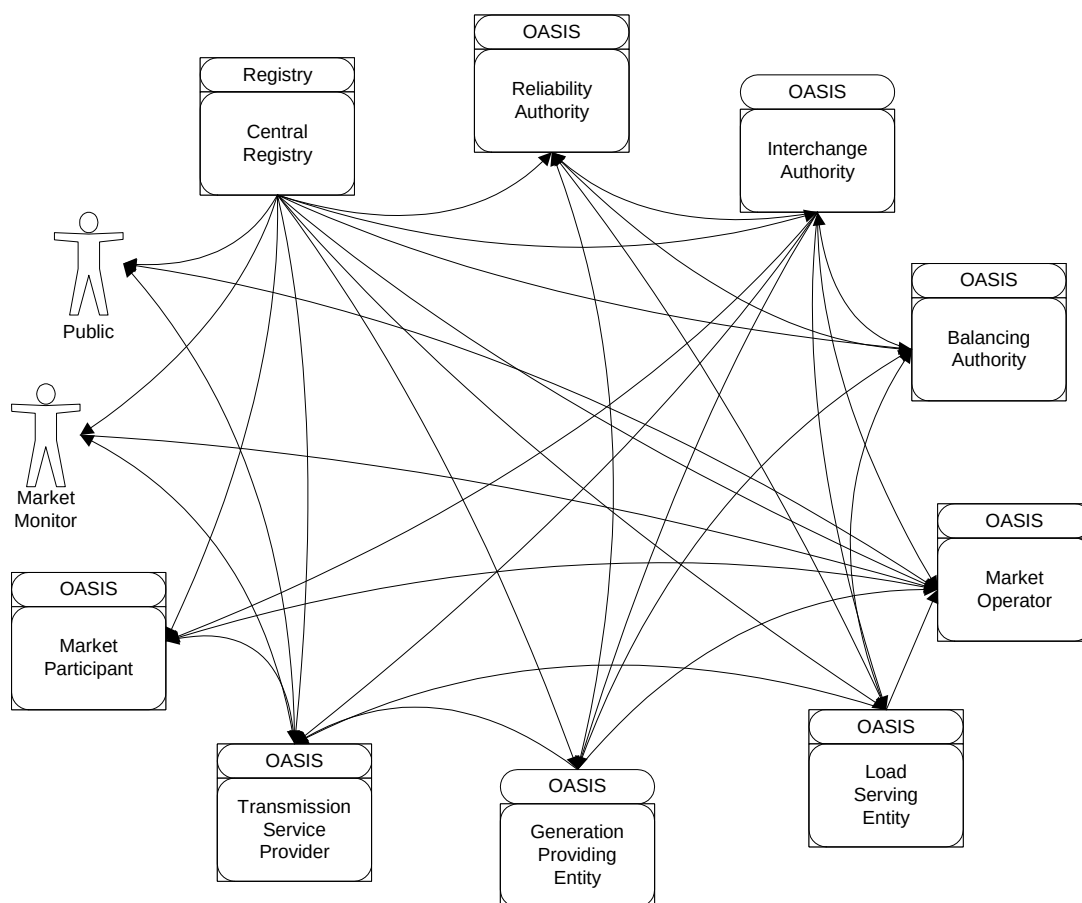
The web services will probably also be provided by the same web server, the difference is that at the other end of the connection there will be a programmatic interface rather than a human being. In most cases the programmatic interface will be another OASIS node and the nodes will communicate by consuming a web service to accommodate scheduling functions. Most, if not all, of the schedule data will be stored in a relational database.

The publisher function will probably be provided by an application different from the standard web server, although it may be in the same physical device. When an event that is to be published occurs, the publisher function will look into the subscription object to find who is to be notified of the event and send a notification to the subscriber.

OASIS Phase II Structural Design

Note that in OASIS II, many more entities will have OASIS nodes than in OASIS phase I. Not only will FERC transmission service providers have nodes, but all marketers and reliability authorities will have nodes.

OASIS Node Interactions



The OASIS Node Interactions drawing depicts the interaction between OASIS nodes. Each node in the circle is an entity that has an OASIS node. Each line in the interior represents one or more use case exchanges of data between the nodes whether the exchange is by a publish or request method.

In OASIS II there will be a great deal of message traffic between nodes. There is even more than the drawing indicates because each type of node is shown once while in a typical energy transaction there is more than one market participant. Additionally, when there is interchange, there are multiple balancing authorities, interchange authorities, and reliability authorities. This contrasts with OASIS I where there is only interaction between a transmission service provider and a market participant.

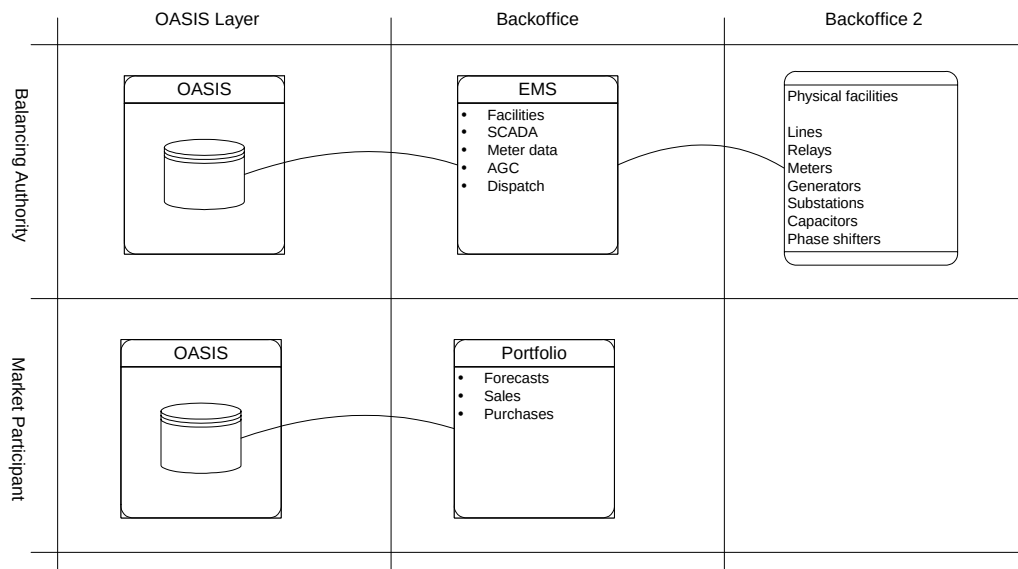
OASIS Phase II Structural Design

A conclusion from this chart is that coordination, verification and checkout will still be time consuming issues in OASIS II.

There are several steps that could be taken to reduce the number of communication lines:

- An entity could choose to fulfill several functions as one entity. For instance, a balancing authority could also choose to be an interchange authority and a reliability authority.
- A region or interconnect could choose to fund and maintain a central scheduling database. That would change the diagram to a star configuration and reduce the number of lines.
- Entities could merge. If a number of entities merge into a single entity that operates a common resource then there will be less intercommunication.
- A single vendor selected for a regional database would also reduce the number of lines.

Backoffice Integration



The backoffice integration chart provides two examples of how an entity's backoffice systems will likely to be integrated with OASIS II. They are included, not to specify how back office systems must be interfaced to OASIS, but only as an example of how they might be interfaced.

For a balancing authority, the OASIS layer will interact with other nodes through the web services and subscriptions that are defined by OASIS. Those services probably will populate a relational database within the node. In the balancing authority's back office almost certainly will be an energy management system (EMS) that collects real time SCADA and meter data and is used to dispatch energy and run AGC. The EMS is clearly outside the scope of OASIS. Its interface to OASIS probably will be through database queries and not through web services.

The physical facilities that make up the electrical grid are even further back in the balancing authority back office. They contain their own layers of meters, relays and controls that are the first lines of defense from abnormal conditions. Their relationship to OASIS is that they should

OASIS Phase II Structural Design

not be dependent on OASIS at all and should continue to function even if there is a complete failure of OASIS. On the other hand, the physical facilities do generate events that should be communicated to OASIS after the fact and incorporated in settlement schedules.

For a market participant, the OASIS layer will probably be very much the same, but the back office layer will be quite different. Its components will probably be a portfolio of purchases and sales associated with forecasts and risk assessments. Many of those sales may never result in physical energy delivery. The interface to OASIS may include bookouts.

Again, this is not an area that should be specified by OASIS. Any entity or vendor can choose to integrate their back office systems in a different manner such as by interfacing the OASIS messages directly into their back office systems.

OASIS Actors and Use Cases

The OASIS II Actors attachment is an Excel spreadsheet that lists the use case actors and the use cases that each actor is involved with.

Some actors that one would expect to be use case participants are not explicitly listed. For instance, the Regional Transmission Operator (RTO) is not specifically listed as a use case participant, but if the RTO is a rollup of the market operator, balancing authority, interchange authority and reliability authority, then the roles are included.

Comments/Clarifications/Recommendations

During the development of the Structural Design document, the Task Force reviewed the ESC Deliverables. During that review, a number of questions/comments/concerns were generated and are included here. This task force has not attempted to resolve or even to prioritize these issues because many of them need much more discussion than this task force has time for. They are presented here simply as a list of issues representative of the types of issues that will need to be resolved:

- **Future Updates to the Use Cases:** How would recommended changes get incorporated into the Use Cases?
- Under **Usability Requirements**, the following statement is made: “Time will be represented in UTC but displayed in a time zone of the user’s choice”. This should be clarified to say that all dates and times in all messages will be in UTC and conversion to other time zones will be handled by the GUI or the receiver of the message.
- Under **Usability Requirements**, a generic statement is made concerning the user interface. Since OASIS II is focused on a messaging format, what does this reference to user interfaces apply to?
- **System Reliability:** Basing the communication architecture on the public Internet does place an upper limit on how reliable it can be because of communication path overload,

OASIS Phase II Structural Design

viruses, etc. The design should incorporate redundant copies of shared data with an ability to operate in isolation when communication is interrupted. When communication is restored, the systems should support recovery and reconciliation of shared data.

- **Data Retrievability:** The Notify Subscribers use case says that participant must provide an online, accessible computer system that is able to respond to the notification. It is always possible for the notification to fail because of a failure on the sender, receiver, or the internet. The electronic scheduling design must include a means to recover from those failures. One method of recovery is to recover past notifications that were missed. Another way to recover is to query the base data elements. A third way is to recover the change record from the base data elements. Probably some combination of all three is necessary.
- If agent functionality is envisioned, that feature should be specifically addressed in the **Registration** Use Cases. Is this a high level registry item or region specific item
- The role of an Administrator in the **User Registration** should be expanded
- **Time standardization:** One of the things that clearly must be standardized is time. The daily scheduling calendar of required submission times, evaluation deadlines, market clearing times (realizing a range of times may be required to accommodate various markets) and coordination of regional flows is the major source of difficulty scheduling. Additionally, sub-hourly timeframes must be considered. (What document will Replacement the Tagging Requirements in NERC policy 3?)
- The lines showing interaction in the **Use Case Diagrams** do not necessarily match the text. It is not clear if the text should be modified to match the diagrams, or if the diagrams should be modified to match the text.
- The **Bilateral Schedule** Use Case does not cover 'transactions' as they exist in markets where they may be against the Spot Market, and may have a price associated with them. We believe additional Use Case(s) will be needed to address this concern.
- The **Post Schedules** use case says "*The Market Operator or Balancing Authority is responsible for posting all Schedules on OASIS by the time established for the market area. The Schedules posted on OASIS will be the source of dispatch instructions for the Market Participants (unless provided by real time telemetry or other automated mechanism). They will be used by the MO or BA for assessing energy imbalance, compliance with instructions, settlements, etc.*" This statement must be modified. Coordination of the schedules with other 'Authorities' is outside this Use Case. As such, any schedules posted to OASIS would be for information only. Currently, this data is not required to be posted until 7-days after-the-fact. Why has it been brought so close to Real-Time? Also, it is not acceptable for OASIS to be the source of dispatch instructions. That is a Real-Time function between Control Rooms and generators and is independent of this Use Case.
- The commercial sensitivity of the **Outage Data** submitted in the OASIS II Use Cases must be considered. Not all submitted outages may be released for public viewing. A means to filter the data available to the public must be included in the requirements.
- **Coordinate Interchange:** The Flow of Events in this section reference OASIS as if it is an application with terms such as "OASIS received", "OASIS validations", "OASIS

OASIS Phase II Structural Design

retrieves". OASIS is merely the message format - applications at either end of the message will have to perform any required functions. This terminology should be modified

- **Coordinate Interchange:** How do the processes and flow of events outlined here correlate to the NERC and NAESB standards being developed?
- **Objects vs. Communication protocols:** The ESC Use Case Specification says that it is a foundation for communication protocols and standards. Yet the things that are communicated (such as Entity, Generator Offer, Profile, etc.) are much like classic IT "objects". Defining those things as objects would allow the abstraction of many of the use case actions to cover more than one type of item. Processes such as validation, modification, withdrawal, recovery, and construction of an audit trail could be specified at a generic object level rather than being separately defined for each item.

Conclusion

The task force has reviewed the NERC Electronic Scheduling Collaborative System (ESC) Requirements and Use Case Specification documents as the basis for a very high level conceptual design of a North American electronic scheduling system. There is a lot of good content in those documents as a result of a lot of effort and careful thought by members of the ESC. The conclusion of the task force is that the ESC documents really do have a significant portion of the design ideas needed to design a wholesale electric quadrant electronic scheduling system.

The documents are not complete enough to implement as a working system. The documents identify many of the actors, many of the interactions between the actors and many of the data elements that need to be exchanged. But they are not detailed enough to fully understand how OASIS II could be implemented by an individual entity or how OASIS II will impact existing systems.

However it is clear that a standard method of exchanging information on the web or private network will be needed for the standard. This standard for communication can be developed based on some basic assumptions about the OASIS nodes being in a distributed or a hub and spoke structure. A task force could start work in parallel with business practices standards to look for the standard technologies for the communication.

The consensus of the task force is that a more detailed design of OASIS II is necessary before the design is transformed into standards and protocols. The level of detail for the further design must be sufficient for participants in the WEQ to know who will operate OASIS nodes, whether those nodes are likely to be central vendor services or distributed nodes, and how those nodes will interface to existing back office systems. Only then will industry participants be able to understand how the standards and protocols should be written.

The ESC has made good start, but there is a long way to go.

OASIS Phase II Structural Design

Next Steps

The next step should be the formation of a new task force with members from the NAESB ESS and NAESB IT subcommittees to proceed with OASIS II design and eventually standards setting.

Hopefully, some of the members of this task force will participate on the next task force and the work of this task force will help the next group to make OASIS II effective.