IMPLEMENTATION EXPERIENCE WITH NRECA'S MULTISPEAK® INTEGRATION SPECIFICATION

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Abstract - The MultiSpeak® Initiative is a collaborative effort of software vendors sponsored by the National Rural Electric Cooperative Association. The Initiative has developed and continues to refine a specification for integration of software applications widely applied at distribution utilities. MultiSpeak Version 3.0 supports real time integration using web services. Implementations of MultiSpeak integration at distribution cooperatives are becoming widespread.

San Bernard Electric Cooperative, Inc. has implemented MultiSpeak-compatible web services interfaces between a SCADA system, an AMR system, an IVR system, and an outage management system. This paper discusses how the web services integration is accomplished and illustrates the business process advantages that can be gained by using standards-based, real time integration.

I. INTRODUCTION

The MultiSpeak® Initiative is a collaboration of the National Rural Electric Cooperative Association (NRECA) and leading software vendors serving the small utility market. The initiative has developed and continues to refine a specification [1] that defines standardized interfaces among software applications commonly used by small electric utilities [2] [3]. Such interfaces can assist to significantly improve utility business processes, thus improving customer service, reducing the duration of customer outages and cutting operations costs.

Multiple software applications have historically operated separately, and hence have presented a fragmented view of utility operations. It was up to the utility employee to gather information from disparate applications, usually using diverse user interfaces, and make decisions based on the total picture thus presented. Often taking the necessary actions required moving between several of the software environments. The drawbacks are particularly evident in time-critical situations, such as outage management. MultiSpeak integration facilitates bringing together information and functionality from multiple software applications, often presenting it to the employee in a single user interface in such a manner as to make the appropriate choice of action clear. Such integration makes it possible for utility employees to efficiently gather the information necessary to make appropriate decisions and take effective action, often while remaining in a single software application.

San Bernard Electric Cooperative, Inc. (SBEC) has implemented (i) supervisory control and data acquisition (SCADA), (ii) an outage management system (OMS), (iii) an interactive voice response (IVR) system, and (iv) an automated meter reading (AMR) application, all of which have been integrated using MultiSpeak Version 3.0 web services interfaces.

This paper will discuss how the integration has been accomplished and the business process improvements that SBEC has gained by applying standards-based, real time integration.

II. MULTISPEAK WEB SERVICES BACKGROUND

The MultiSpeak specification defines what data need to be exchanged between software applications in order to support the business processes commonly applied at small utilities. In order to accomplish this, it makes use of three components:

- ***Definitions of common data semantics.*** Data semantics are an agreement on what information needs to be exchanged about a specific item used in a business process, say a customer or a service outage, which might be exchanged in the context of the outage management business process. Data semantics are documented in the form of an extensible markup language (XML) schema.
- ***Definitions of message structure.*** Once an agreement has been reached on what data need to be exchanged, it is necessary to define message

structures to support the required data interchanges. In MultiSpeak, the XML-formatted data payload is carried as part of a Simple Object Access Protocol (SOAP) message for real time exchanges and as part of a batch file for off-line transfers. SOAP messages are typically transferred using hypertext transfer protocol (HTTP), the transfer protocol most commonly used by the Internet.

- ***Definition of which messages are required to support specific business process steps.*** SOAP messages are linked together to accomplish each potential step in a utility business process. Such steps can then be strung together to support complete utility business processes.

Real time MultiSpeak interfaces use *web services* to define and implement the data transport. Web services are standardized means for one software application to exchange data with or to invoke actions on another application. Each web service consists of one or more *methods*. Methods can be thought of as contracts between the two software applications that describe how the methods are invoked and data are delivered. Typically, one method is used to support a single business process step. Thus, method calls can be strung together to construct complete business processes. MultiSpeak uses Web Services Description Language (WSDL) files to document the methods and define which SOAP messages are required to achieve the goals of each method.

For instance, if the AMR system wants to determine where there are active outages being managed by the OMS, it would call the GetActiveOutages method being hosted on the OMS. The AMR would send a GetActiveOutages request message and the OMS would return a GetActiveOutages response message. Figure 1 illustrates this message flow. In Figure 1, the client would be the AMR and the server would be the OMS. In order to accomplish the data transfer, both the AMR and the OMS would come packaged with a web server component, which would handle all of the data transfers based on the rules documented in the WSDL files.

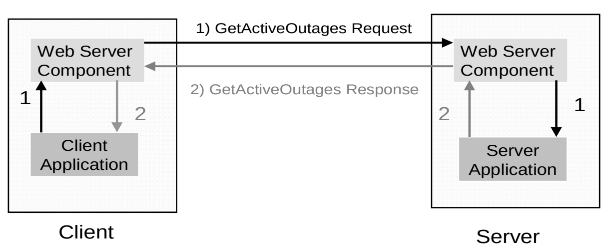

Fig. 1. Message flow to accomplish the GetActiveOutages method call. In this situation, AMR is acting as the client and OMS is acting as the server.

MultiSpeak defines interfaces to support common utility business processes. Interfaces are defined on the basis of software functions, that is to say abstract descriptions of software functionality. To date, 33 interfaces have been defined in the MultiSpeak specification. Figure 2 shows the defined interfaces. The numbers given in ovals on Figure 2 refer to the specific interface descriptions in the specification. Actual software applications may encapsulate one or more MultiSpeak functions. For instance, an AMR system **will** include the capability modeled in MR (meter reading) MultiSpeak function, but may also include capabilities from the OD (outage detection), LP (load profile) and the CD (remote connect/disconnect) functions. For a complete description of MultiSpeak functions and how they relate to actual software products, see the MultiSpeak User's Guide [4]. This document is available from the MultiSpeak web site (www.multispeak.org).

For the purposes of this case study, three different MultiSpeak interfaces were described:

- ***OA-OD.*** This interface is between the outage analysis (OA) function performed by an OMS and the outage detection (OD) function. For this case study two different kinds of software products, the AMR and IVR systems, perform the outage detection service in exactly the same manner.
- ***CH-OA.*** This interface is between the call handling (CH) function of an IVR and the outage analysis (OA) function of the OMS.
- ***SCADA-OA.*** This interface is between the SCADA function of the SCADA application and the outage analysis (OA) function of the OMS.

III. Integrated Operations at SBEC

This section documents how operations at SBEC have changed since the software applications have been integrated. Six different business processes are identified. For each, a brief description is given of the process prior to integration and how the process has been improved using the capabilities provided by the MultiSpeak interfaces.

SBEC uses the following automation systems that have been integrated using MultiSpeak:

- DisSPatch OMS, supplied by Milsoft Utility Solutions
- Porche IVR, supplied by Milsoft Utility Solutions
- Yukon AMR, supplied by Cannon Technologies
- Windows SCADA, supplied by Survalent Technology

To date, the following MultiSpeak interfaces have been implemented at SBEC (see Figure 3):

- OA-OD (DisSPatch OMS and Yukon AMR)
- CH-OA (Porche IVR and DisSPatch OMS)
- OA-OD (DisSPatch OMS and Porche IVR)
- SCADA-OA (Windows SCADA and DisSPatch OMS)

Prior to implementing MultiSpeak integration each of these applications was a stand-alone system. Any exchange of information was done manually; an employee would have to look up information in one program and, if possible, copy and paste the information into the other system; at other times it was necessary to re-type the data into the second application. It was difficult to correlate information about customers, meters and outages in an effective manner.

In order to be effective in his job, a dispatcher needed to be trained in the use of multiple software systems and be able to move fluidly between the diverse user interfaces. The requirement for additional training and the potential for confusion due to conflicting software environments further reduced the dispatcher's efficiency.

Furthermore, a dispatcher had to have a monitor in his work space for each of the systems in order to have access to all of the data necessary to perform his work. This added to the clutter and potential confusion associated with "information overload", as well as potentially adding to the cost for hardware and software licenses.

After integration the following capabilities have been added:

- Outage calls taken by the IVR system automatically show up as outages in the OMS.
- The dispatcher can correlate customers, service locations and meters, directly from the OMS display.
- The dispatcher can request that the AMR system query the status of a meter (also called "ping" the meter) directly from the OMS application. This capability can be used to determine the extent of an outage or to verify that service to specific meters has been restored.
- The AMR system can locate meters electrically on the power system using information supplied by the OMS and thus is able to address and ping groups of meters that could all be potentially affected by a single outage cause.
- The OMS can obtain status of SCADA-controlled devices and thus can more quickly predict outages due to a locked-out substation breaker.

Illustrative examples of inefficient work processes that have now been streamlined include:

A) Entering customer outages into the OMS.

Before Integration: Prior to integrating the Yukon AMR and the DisSPatch OMS it was necessary to copy and paste the affected meter number from the AMR system manually into the OMS. Since this method was inefficient, SBEC typically would minimize this inefficiency by waiting until customers called in to report outages. The dispatcher would then enter the outage manually into the OMS.

After Integration: Now customer outages detected by the IVR automatically show up in the OMS and the dispatcher can begin outage prediction even before a significant number of customer calls have been taken. It is no longer necessary to cut and paste the meter numbers from the AMR system since the AMR and OMS are integrated directly. The SCADA system monitors all breaker status and analog values and reports that information to the OMS. With a little more database building SBEC will have outages reporting automatically from the SCADA to the OMS for the devices the SCADA system monitors.

B) Finding which meter is out of power when a customer has multiple meters.

Before Integration: In the case where a customer had multiple meters and didn't know the meter number of the service that was out of power, the crew would either check all of the possible locations or meet the customer on site to be led to the problem location. Often the outage was eventually found to be part of an existing outage and did not need to be handled individually. In such cases, lack of adequate information from the customer resulted in a wasted crew trip.

After Integration: All of the customer's meters can be located using the OMS, and the AMR system can be instructed to ping all possible meters, directly from the OMS application. The AMR system returns the status of all of the meters and the crew can be dispatched directly to the correct outage location if necessary without delay, saving wasted crew trips and time spent sending the crew to the wrong location. Using the OMS, SBEC can perform group pings on all the meters a customer owns, and have meter status results back within seconds. This was virtually impossible before the integration because it took too much time to hunt down each meter individually and perform a ping within the AMR.

C) Pinging meters so that SBEC does not redispatch crews to outages that have been restored.

Before Integration: In some cases, customers reported an outage from their car or work location and were unaware that service had already been restored. The dispatcher, unaware that the outage being reported was the same one that had been fixed, redispatched a crew to the service location.

After Integration: The dispatcher knows the customer's service location and can have the OMS application request that the AMR system ping the meter to detect outage status prior to disconnecting the customer call. If the outage has already been restored, no crew need be dispatched and the customer can be reassured as to their outage status before the call ends.

D) Pinging meters so that crews can be released to work other outages.

Before Integration: The line crew working an outage would stand by at the outage location while the dispatcher called the affected customers to ensure that all customers had been restored prior to releasing the crew to work another outage.

After Integration: The dispatcher pings all of the affected meters to ensure that all customers have been restored and releases the crew to perform other work. SBEC can then call back affected customers as desired without delaying the line crew.

E) Pinging meters to avoid late-night customer call backs.

Before Integration: The dispatcher would call back every customer affected by an outage to ensure that power was restored to all customers, regardless of time of day.

After Integration: The dispatcher pings all of the meters to ensure that service has been restored; the decision to call customers can be separated from the need to check power restoration. Late night calls can be eliminated, thus reducing customer inconvenience.

F) Not dispatching crews to customer-side outages or recovering trip charges for customer problems.

Before Integration: Any customer call was treated as a potential outage. In some cases, service was intact to the meter and the problem lay on the customer side of the meter.

After Integration: The dispatcher can ping the affected meter to determine whether the meter is receiving service prior to dispatching a crew to the outage. If service has been confirmed to the meter, the customer can be given the option of checking out the problem himself or paying for a trip charge so that a utility serviceman could check out a problem on the customer side of the meter.

IV. A CASE STUDY OF INTEGRATED OUTAGE MANAGEMENT

For each of the six business processes identified in the previous section, cost savings have been calculated where possible and additional unquantifiable or "soft" benefits have been established.

A) Entering customer outages into the OMS.

Savings: Avoiding copy and paste operations
2 minutes each occurrence; 10 occurrences each day; dispatcher wage rate (with overheads) = \$50/hour
Net Savings = \$ 6,083/year

Soft Benefits:

- Faster outage predictions
- More accurate outage predictions
- Better customer service
- Enabling the dispatcher to focus on working the outage rather than managing data

B) Finding which meter is out of power when a customer has multiple meters.

Savings: Avoiding wasted trips and reducing crew "windshield time": 2 hours minimum per trip; 5 occurrences each year; crew costs (with overheads) = \$210/hour
Net Savings = \$ 2,100/year

Soft Benefits:

- Faster outage predictions
- Eliminates wasted crew time
- Better customer service
- Reduces customer inconvenience

C) Pinging meters so that SBEC does not redispatch crews to outages that have been restored.

Savings: Avoiding wasted trips: 2 hours minimum per trip; 150 occurrences each year; crew costs (with overheads) = $210/hour
Net Savings = $ 63,000year

Soft Benefits:
- Eliminates wasted crew time
- Better customer service
- Reduces customer inconvenience

D) Pinging meters so that crews can be released to work other outages.

Savings: Avoiding crew standby time: 15 minutes average per outage; 700 occurrences in 2006; crew costs (with overheads) = $210/hour
Net Savings = $ 36,750 /year
Soft Benefits:
- Eliminates wasted crew time
- Reduces outage durations
- Better customer service

E) Pinging meters to avoid late-night customer call backs.

Savings: Not Applicable

Soft Benefits:
- Better customer service
- Reduces customer inconvenience

F) Not dispatching crews to customer-side outages or recovering trip charges for customer problems.

Savings: Avoiding wasted trips or recovering customer trip charges. Trip charge = $120 per occurrence; 30 trips per year
Net Savings = $ 3,600/year

Soft Benefits:
- Eliminates wasted crew time
- Recovers cost for service provided to customer
- Improved customer choice

The savings from integration of previously installed stand-alone software applications has been calculated for these six illustrative process improvements. The savings are summarized in Table 1.

Table 1
Summary of Outage-Related Quantifiable Benefits of SBEC's Integration

Business Process	Quantifiable Savings
A) Entering customer outages into the OMS.	**$6,083**
B) Finding which meter is out of power when a customer has multiple meters.	**$2,100**
C) Pinging meters so that SBEC does not redispatch crews to outages that have been restored.	**$63,000**
D) Pinging meters so that crews can be released to work other outages.	**$36,750**
E) Pinging meters to avoid late-night customer call backs.	**$0**
F) Not dispatching crews to customer-side outages or recovering trip charges for customer problems.	**$3,600**
Total	**$111,533**

V. Lessons Learned at SBEC

The installation and commissioning of MultiSpeak interfaces at SBEC required little time and effort beyond that necessary to install the application software updates that supported the web service interfaces. For each application it was necessary to input the network location of the software product(s) with which it was to communicate. Once network communication was confirmed, the applications began exchanging information with no further modifications being required. No additional hardware or software was required to implement the interfaces and no upgrade was required to network infrastructure to handle the web service messaging traffic.

It will be necessary for SBEC to make minor changes in the SCADA database before device lockout status information can be exchanged with the OMS, but no other database changes were necessary in any application to accomplish the integration described in this case study.

VI. Conclusions

The MultiSpeak Initiative has developed a specification for real time exchange of information and business process integration of software applications at small utilities. Early adopters have found significant benefits from implementation of MultiSpeak web service interfaces. San Bernard Electric Cooperative, Inc. has seen significant improvements in business processes, improved levels of customer service and enhanced employee efficiency by integrating previously stand-alone software applications. Quantifiable benefits of $111,533/year have been identified in the outage management processes alone. The changes required to existing software, network infrastructure and application databases to achieve these improvements have been minimal.

NRECA, along with a large group of software vendors, continues to enhance and expand the scope of the MultiSpeak specification to better serve the utility market. More information about the MultiSpeak specification, the software products that support the specification, or vendors that participate, is available at the MultiSpeak web site (www.multispeak.org).

VII. References

[1] MultiSpeak Initiative Participants, *MultiSpeak ® Version 3.0 Specification*, Arlington, VA: National Rural Electric Cooperative Association, 2005.

[2] Gary A. McNaughton and Martin E. Gordon, "Common Interfaces for Enterprise Integration – Experience With NRECA's MultiSpeak™ Specification", *Proceedings of the 2001 Rural Electric Power Conference*, New York, NY: Institute of Electrical and Electronics Engineers, Inc., 2001.

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[4] Gary A. McNaughton and Warren P. McNaughton, *MultiSpeak® 3.0 Users Guide*, Arlington, VA: National Rural Electric Cooperative Association, 2006.

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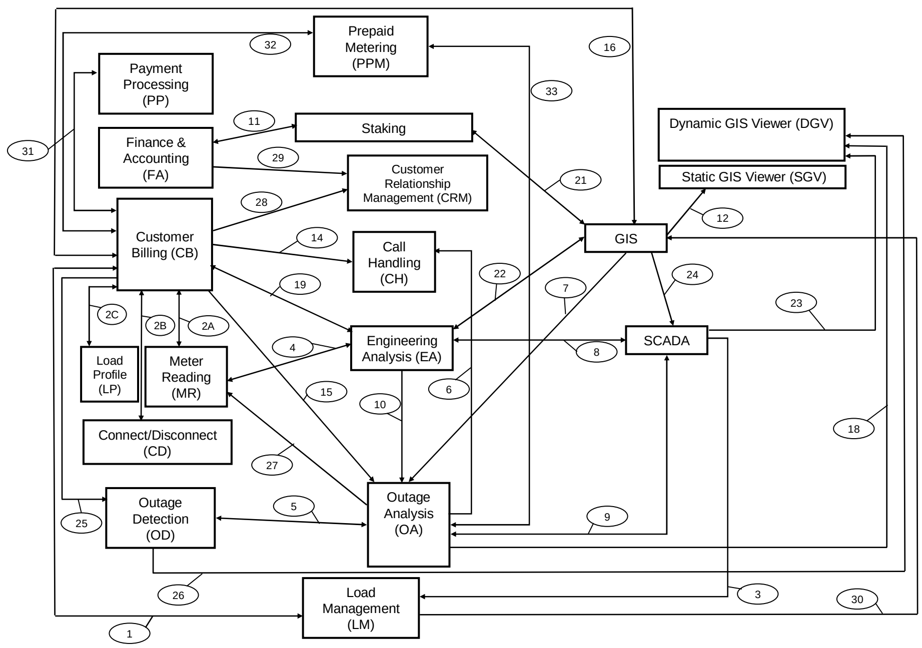

Fig. 2. The MultiSpeak software functions are shown as boxes and the defined interfaces are shown as lines connecting functions.

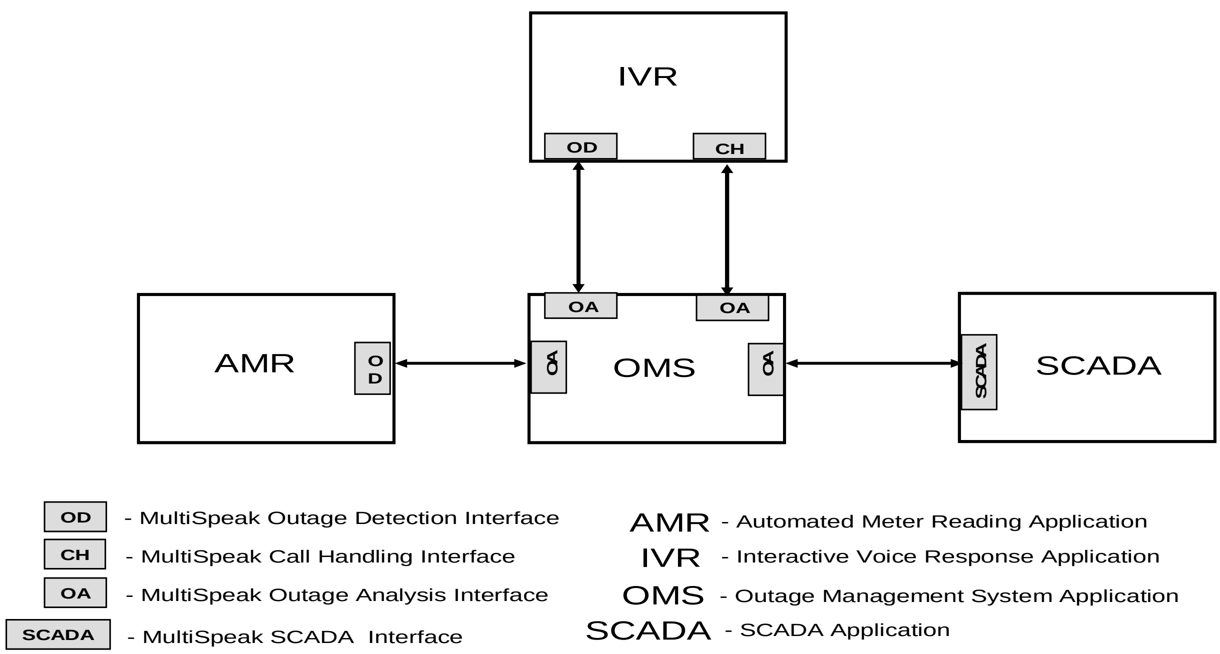

Fig. 3. This figure illustrates the software applications in place at SBEC and the relationship between those software applications and the MultiSpeak defined interfaces.