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Smart Grid initiatives are focusing on rebuilding utility infrastructure and the business processes we have come to be comfortable with during the past century. Advanced metering infrastructure (AMI) and meter data management systems (MDMS) are ripping up the foundations of utility meter reading and billing processes and replacing them with a new foundation akin to the transformation from Ma Bell-era telephone service to the modern wireless.

A PHASED APPROACH TO INTEGRATION

Let's get the basics in first. The initial focus must be on the customer information system (CIS). This is not a baby step. Careful planning ensures a smooth upgrade and successful integration between your new AMI head end or MDMS and the CIS.

If you are upgrading your existing IS—already fraught with risk—you might consider completing that before adding AMI complexities. Why is it complex? The additional data being tracked will be substantial. Your old monthly read provides one meter read per customer each month. The new AMI will capture 720 reads (based on one channel of data read at hourly intervals for 30 days).

Many utilities will opt for more data based on the use of additional channels or shorter intervals. The new requirements associated with data validation, estimation and editing (VEE) will add complexity to this initial deployment.

Utilities should consider phased deployment. There are probably some ancillary integrations you must address, depending on the business

needs and specific systems you are buying. The AMI deployment might require geographic positioning system (GPS) locations for meters.

If so, you might need to address asset management or geographic information system (GIS) integrations in this first phase to properly support build out of the AMI communications network and deployment of meters. Key account information must be shared between the system of record (typically CIS) and AMI head end or MDMS. Identifying the data that must be synchronized is lengthy and critical in the initial integration.

If an installation contractor will support the meter deployment, you will have additional integrations to that vendor's logistical systems. You can add more integrations to phase 1, but there are benefits in keeping phase 1 as simple as possible.

Subsequent phases of your AMI integration could focus on capturing key business benefits, then multiplying benefits based on widespread deployment of AMI meters.

Some systems will require a critical mass of meters before you see any substantial benefits from integration. The outage management system (OMS) is an example. The meter deployment strategy might be based on meter read routes or geographic areas (zip codes). Neither guarantees that you will get complete feeders upgraded with AMI meters early in the deployment.

The ability to resolve down to a localized outage depends on having comprehensive data relating to the connectivity model in the OMS. Many experts say that the benefit of AMI to an

OMS is your knowing when customer power has been restored, opposed to knowing that power has been lost via the meter's last-gasp message. Knowing that power has been restored to all affected customers will preclude the need for additional truck rolls. You'll need full deployment of new meters over feeders to accurately gauge power restorations.

Table 1 lists systems you might want to integrate with your AMI or MDMS. The schedule of efforts has been broken into a fictitious, three-phase project to spread risks and capture benefits of a deployment over two to three years. Figure 1 illustrates a sample of integration architecture.

OTHER CONSIDERATIONS

The pace at which AMI technology is evolving is exciting. Most leading providers of this technology have developed their products to meet the custom needs of their first few customers. These customers got custom solutions to their requirements.

As the next generation of AMI adopters surveys the technology landscape, they are specifying requirements that draw on best-of-breed capabilities from all AMI technology providers. The requirements being put in front of suppliers are forcing a convergence of features between suppliers that originally built those custom systems for their first clients. This is great for users and integrators because the feature set of AMI and MDMS systems is exploding. It poses some logistical hurdles that must be overcome, however.

The features you might want to implement in your integration might not be available in the current release of AMI head end or MDMS software. Plan for and coordinate a certain amount of vaporware that is in each vendor's development roadmap. Allow for delivery slips

if you expect to take advantage of features being added to the systems you are implementing.

Many utilities are expecting to receive negawatt benefits from AMI deployments as a result of conservation from time-of-use rates, critical peak pricing and demand response programs (rebates or active control of customer loads through usage limiting or device control). This requires that the utility has a critical mass of deployed meters to reap the benefits of widespread conservation. This critical mass might not exist in the early integration phases and might be delayed until meter deployments reach a substantial percentage of your customer counts.

For a utility planning to implement time-of-use rates, it is safe to wait on these particular integrations. If you are implementing meters with remote disconnect capability, you might want to wait to control those disconnects until phase 2 to minimize the step change customer service representatives will encounter.

Measures of success are as varied as the utilities that undertake AMI projects. They will include some financial measures that are generally accepted as objective. Careful planning of deployment schedule will ensure financial benefits are realized early. Coordinate your integrations with this deployment schedule to ensure the systems from which you expect to receive benefits are in place at the right time.

Utilities can't get too much information to plan deployment and integration effectively. Talk to trusted partners, vendors, other utilities and consultants regarding work they have implemented. Participate in symposia, conventions, webinars and internal workshops to glean knowledge about the complex interfaces utilities will face.



Table 1. Systems to Integrate with AMI or MDMS / Associated Integration Phases

| SYSTEM | INTEGRATION PHASE | NOTES |
|--|-------------------|--|
| Customer Information System | 1 | Don't break the cash register. If you are not using TOU rates, you might want to implement this type of rate expansion into phase 2. |
| Asset Management System | 1 or 2 | Select an appropriate integration phase depending on the utility's asset management strategy and the specific needs or recommendations of the AMI technology vendor. |
| Geographic Information System | 1 or 2 | Select an appropriate integration phase depending on the utility's GIS strategy and the specific needs or recommendations of the AMI technology vendor. |
| Work Management System | 1 or 2 | Do this in phase 1 if you are doing your own meter replacements. If you are hiring a contractor for meter replacements, you might be able to hold off until phase 2. |
| Mobile Work Management System | 1 or 2 | Do this in phase 1 if you are doing your own meter replacements. If you are hiring a contractor for meter replacements, you might be able to hold off until phase 2. |
| Outage Management System | 2 or 3 | Outage restoration information depends on having a critical mass of meters covering complete distribution lines. |
| Transformer Load Management | 3 | You'll want to develop a year or more of profile information before you can glean the benefits. This integration can be delayed for that reason. |
| System Planning | 3 | You'll want to develop a year or more of profile information before you can glean the benefits of a system planning program. This integration can be delayed for that reason. |
| Load Research | 3 | You'll want to develop a year or more of profile information before you can glean the benefits. This integration can be delayed for that reason. |
| Existing Meter Reading Technologies | 1 or 2 | You might want to incorporate existing meters (non-AMI) into your MDMS to provide as much history as practical regarding historical usage. This could drive when or if you implement this integration. Be aware that tying in all meters in phase 1 will require your MDMS to accommodate all of your meters within approximately one month (duration of your billing cycles) rather than an easy ramp up associated with only your AMI meter deployments. |
| Corporate Data Warehouse/Business Intelligence Systems | 2 or 3 | Chances are that you will want to mine the new information after it becomes available to you. This could be associated with benefits such as conservation or production avoidance. Integration to existing or new systems could be handled as independent projects in parallel to the phased mainstream integrations. |
| Corporate Web Portal/Customer Self Service | 1, 2 or 3 | Decisions on where to implement additional customer information access will depend on your systems' current capabilities and customer expectations. |
| Demand Response/Load Curtailment | 2 or 3 | Home area networks and how customers want to communicate with utilities are still evolving. Use of the utility's meter communication network may or may not be the right solution. Waiting might be attractive to conservative utilities while early adopters might want to test the waters as soon as possible. |

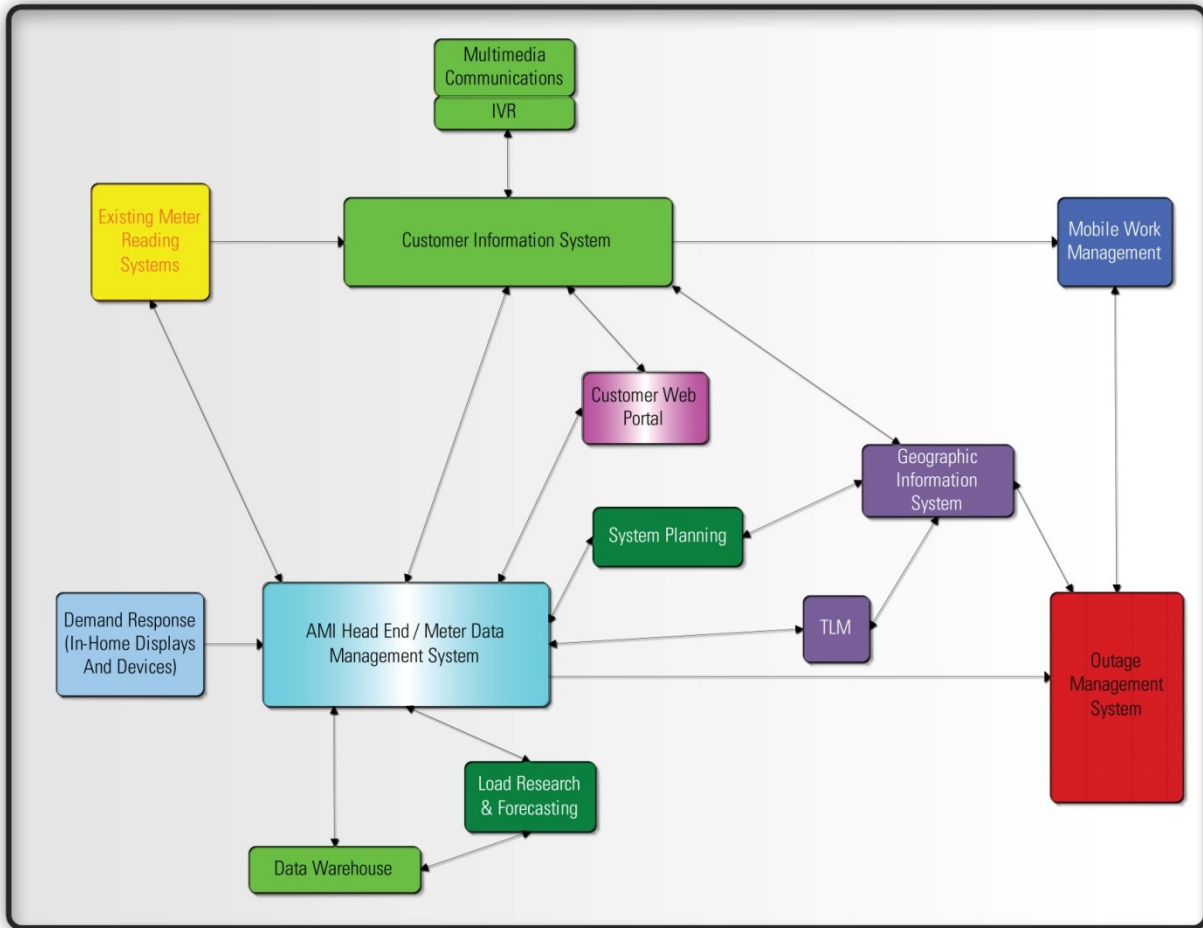


Figure 1. Sample Integration Architecture



ABOUT THE AUTHOR

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