



Technical and Operation Considerations in Using Smart Metering for Outage Management

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Focus of presentation

- Outage management functionality associated with AMI technologies
- Use of outage management functionality by an outage management system (OMS)
- Outage management benefits achieved via AMI technologies
- Cautions when considering the outage management functionality of AMI technologies

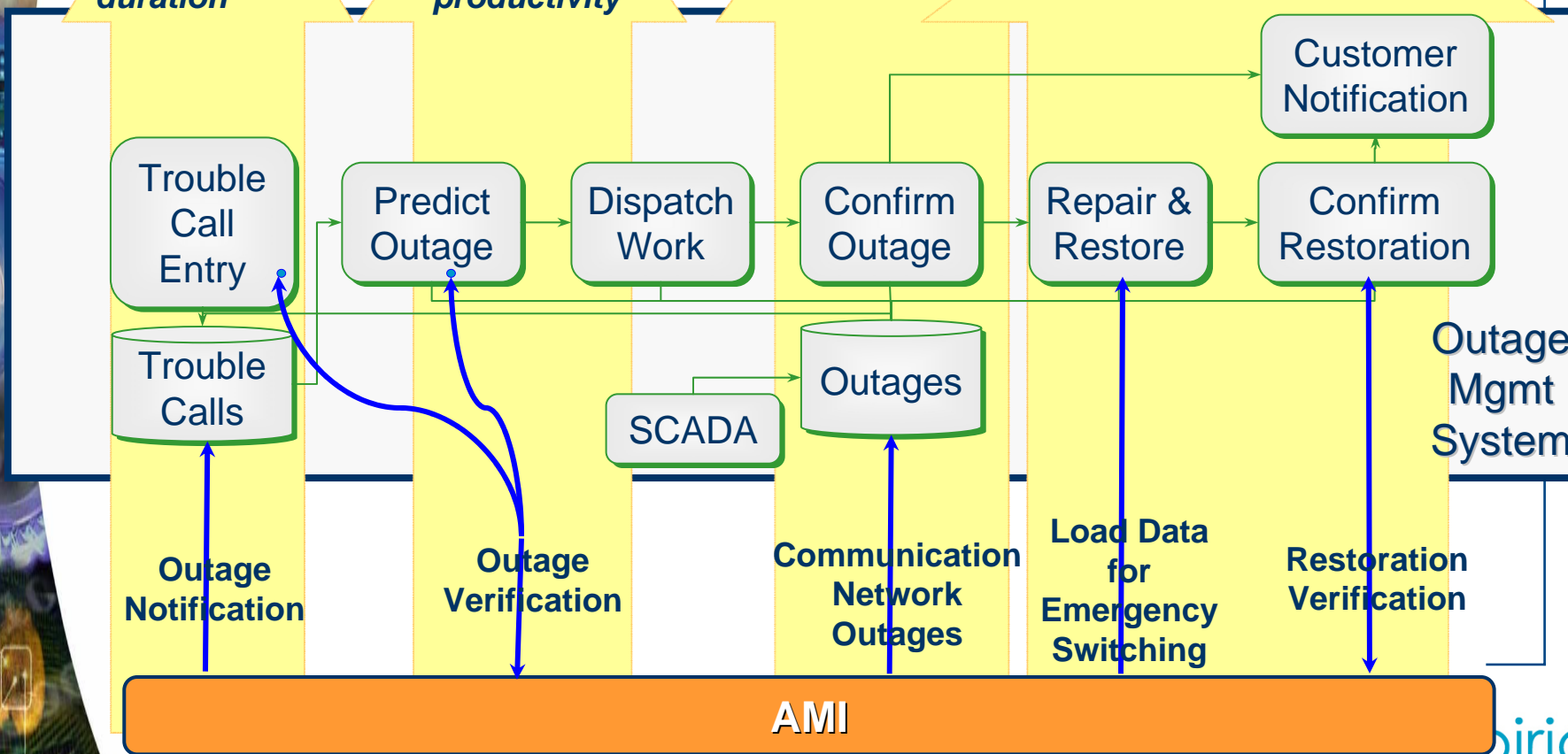
AMI Applications in Outage Management

- Better customer perception
- Reduced outage duration

- Increased crew and dispatch productivity

- Reduced outage duration
- Improved AMI data availability

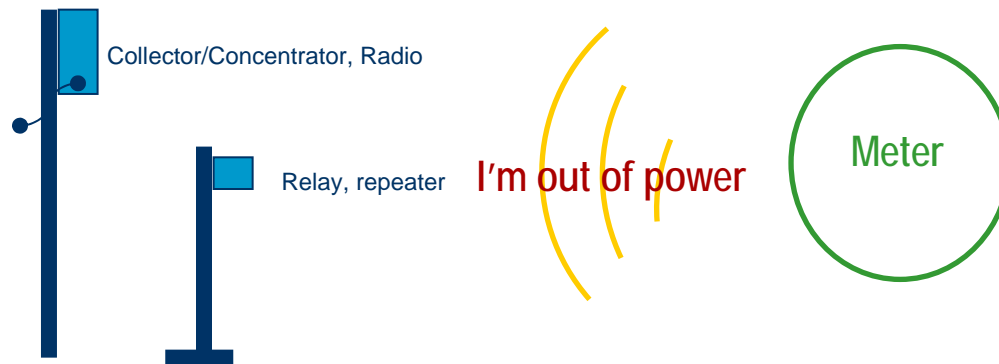
- Reduced outage duration
- Increased crew productivity
- Better customer satisfaction



Outage Management Functionality

Outage Notification or “Last Gasp”

- Most AMI technologies proactively notify the AMI head-end of an outage
- Outage defined as loss of a configurable amount of voltage for a configurable amount of time
- Meters communicate for defined period of time or a defined number of times using capacitor or battery technology



Proprietary



Outage Management Functionality and OMS

OMS use of “last gasp”

- “Last gasp” messages can be used as a data input by an OMS
 - OMS outage determination algorithms will operate more efficiently and effectively with additional data points
- An OMS should consider a “last gasp” message in the same way as a customer phone call



Outage Management Functionality and OMS

Can there be too many “last gasp” messages?

- Some AMI Technologies and some Meter Data Management Systems (MDMS) offer filtering of outage event messages to limit the volume of “last gasps” sent to OMS
 - Avoids overload of OMS and the dispatcher/operator
- Some AMI Technologies utilize OMS-type functionality and can provide diagnoses of outages
 - E.g. determine from multiple “last gasp” messages that a transformer is out of power
- Some utilities opt to receive all messages and filter at the OMS or the OMS interface application



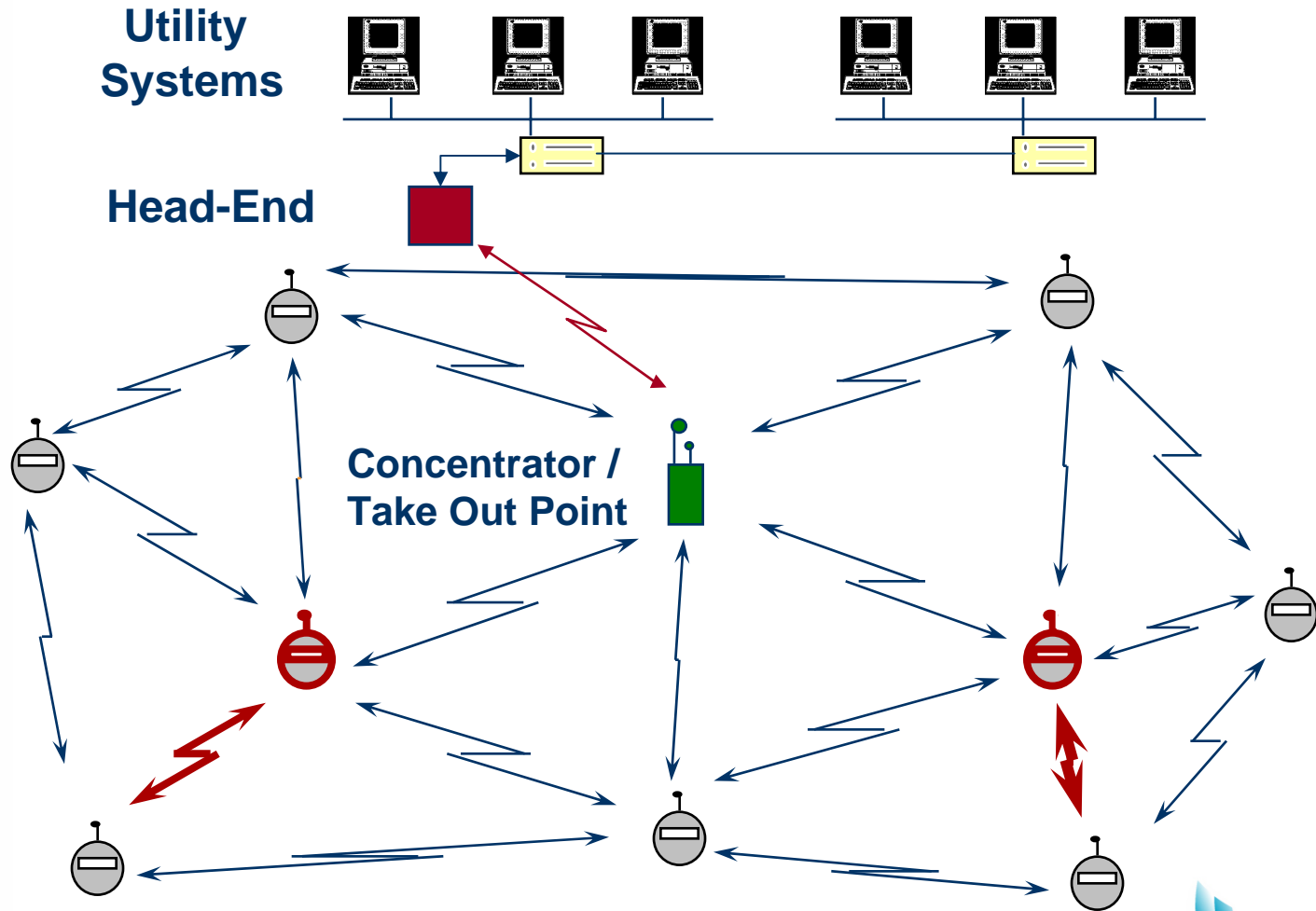
Outage Management Functionality and OMS

Mesh vs Hierarchical AMI Technologies

- “Last gasp” outage notification works differently with different AMI technologies
- For single lights out or outages affecting a small number of meters, performance is similar
- For large scale outages, performance differs
 - Mesh technologies provide information to determine the boundaries of an outage
 - Meters downstream of outage may not be able to communicate regardless of outage status
 - Hierarchical technologies provide information to determine the outage status of each meter
 - High volumes of outage traffic may impede communication of outages

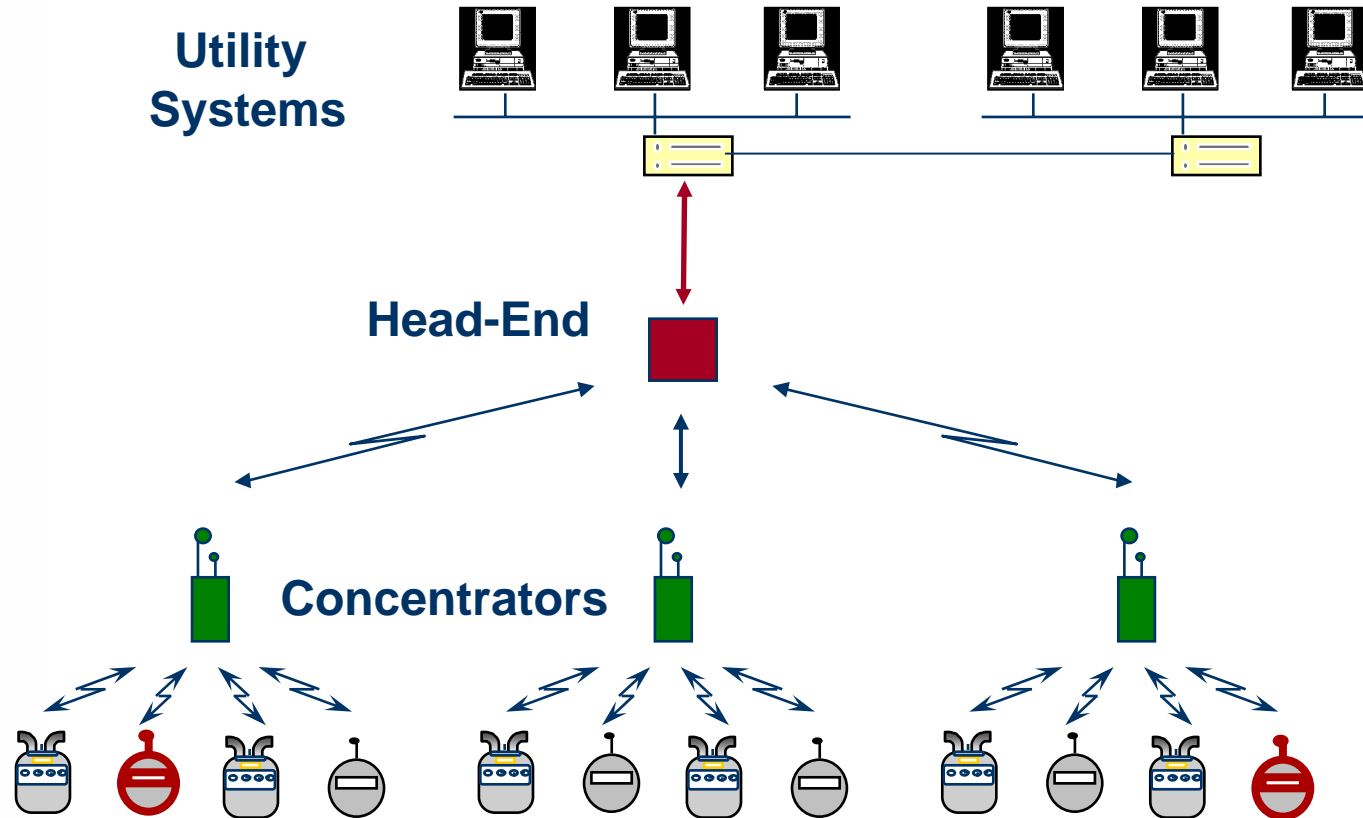
Outage Management Functionality

AMI Network Types: Peer-to-Peer or Mesh



Outage Management Functionality

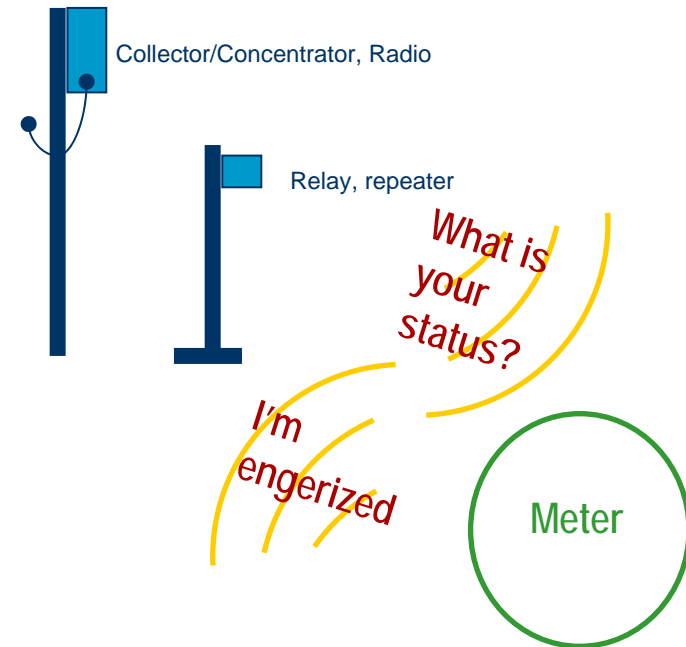
AMI Network Types: Hierarchical



Outage Management Functionality

On-Demand Read or "Ping"

- AMI technologies provide the ability to execute a call to the meter to determine the energized status of the meter
- A "ping" can be used to:
 - Avoid rolling a truck only to determine that the "outage" is actually a customer problem
 - Avoid rolling a truck when the outage has already been resolved but the ticket not closed
 - Avoid leaving an area after a distribution element has been restored but "nested outages" still exist





Outage Management Functionality and OMS

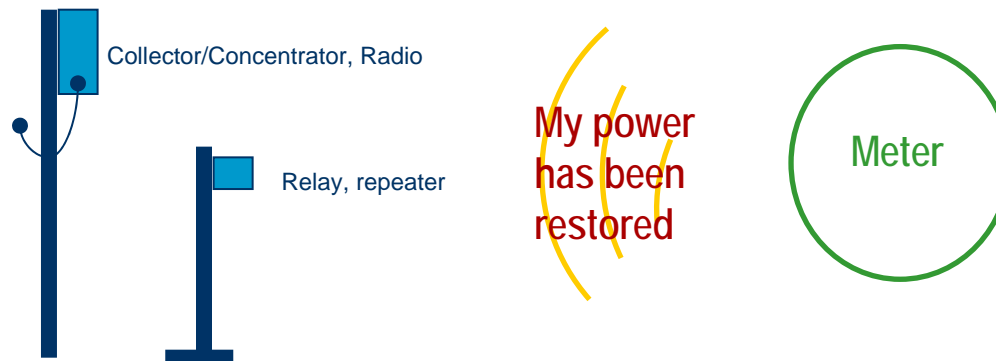
OMS use of “ping”

- “Ping” functionality can be used in an automated manner by the OMS
- OMS can be programmed to “ping” meters served by the same distribution element or nearby distribution elements to validate outage or restoration
- Manual execution of a “ping” by dispatchers can be initiated:
 - Via integration of the OMS with the Meter Data Management System or AMI head-end
 - Or via access to the head-end application directly

Outage Management Functionality

Restoration Notification

- AMI Technologies proactively notify the head-end that voltage has returned to a configurable threshold value for a configurable period of time
- Most AMI Technologies communicate restoration until acknowledged by the head-end
 - Assures near 100% success at restoration notification





Outage Management Functionality and OMS

OMS use of Restoration Notification

- The OMS should accept power restoration notification messages and automatically update the status of distribution elements
 - A big benefit is to use the restoration event timestamp to calculate customer interruption minutes
- Auto restoration of outage tickets improves the effectiveness of the restoration effort



Outage Management Functionality

Outage count or “blink” or momentary indicator

- AMI technologies track the number of times an outage of any amount of time occurs
- Outage count of “blink” indicator does not always trigger a “last gasp”
 - If voltage does not drop below threshold for greater than threshold amount of time, a “blink” or momentary is recorded
- Most AMI technologies time-stamp these occurrences



Outage Management Functionality and OMS

OMS use of “blink” or momentary indicator

- “Blink” indicator used to proactively identify reliability issues
 - E.g. high volume outage count in 24 hour period may be indicative of vegetation in-growth
- “Blink” indicator also used to validate or more clearly identify momentary issues
 - Impact to MAIFI



Outage Management Benefits

Quantifiable Benefits Overview

- Avoid “OK on arrival” trips
 - Utility calls before making trip (savings in call center or dispatcher time)
 - Average cost per trip (labor, trip time)
- Improve outage restoration efficiency
 - Reduce overall storm restoration time and cost by earlier detection of nested outages
 - Eliminate load read trips to support switching planning



Outage Management Benefits

Benefits Quantified

- Utilities can expect to see quantifiable benefits by including AMI functionality in their AMI business case.
- The quantifiable benefit varies by utility:

	Min.	Avg.	Max.
Avoid "okay on arrival" trips	\$0.000	\$0.026	\$0.080
Improve outage restoration efficiency	\$0.000	\$0.064	\$0.131



Outage Management Benefits

Strategic Benefits

In addition to the quantified benefits, utilities can realize strategic benefits:

- Increased customer satisfaction
 - Proactive communication
 - Avoided/minimized customer disturbance
- Improved service reliability
- Improved power quality



Outage Management Functionality and OMS

Cautions

- Current generation AMI Technologies have not been deployed and field-tested in volume
 - Most AMI Technology vendors are proposing their latest technologies for which outage notification and restoration functionality have not been proven in volume
- Reliability indices will go up but reliability will improve
 - Utilities will know about outages sooner
 - But outage management functionality helps utilities operate more efficiently
 - Utilities will more accurately report restoration times



Thank you!

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