



## Value Proposition for Getting Buy-in for Synchronphasor Technology



# What is the issue?

Historically, utilities have resisted the development of new operations technology particularly in the space of identifying hidden system issues.

The operations question could well be:

**“We have no problems operating the system now, why do we need this new technology?”**

A synchrophasor-driven response could be:

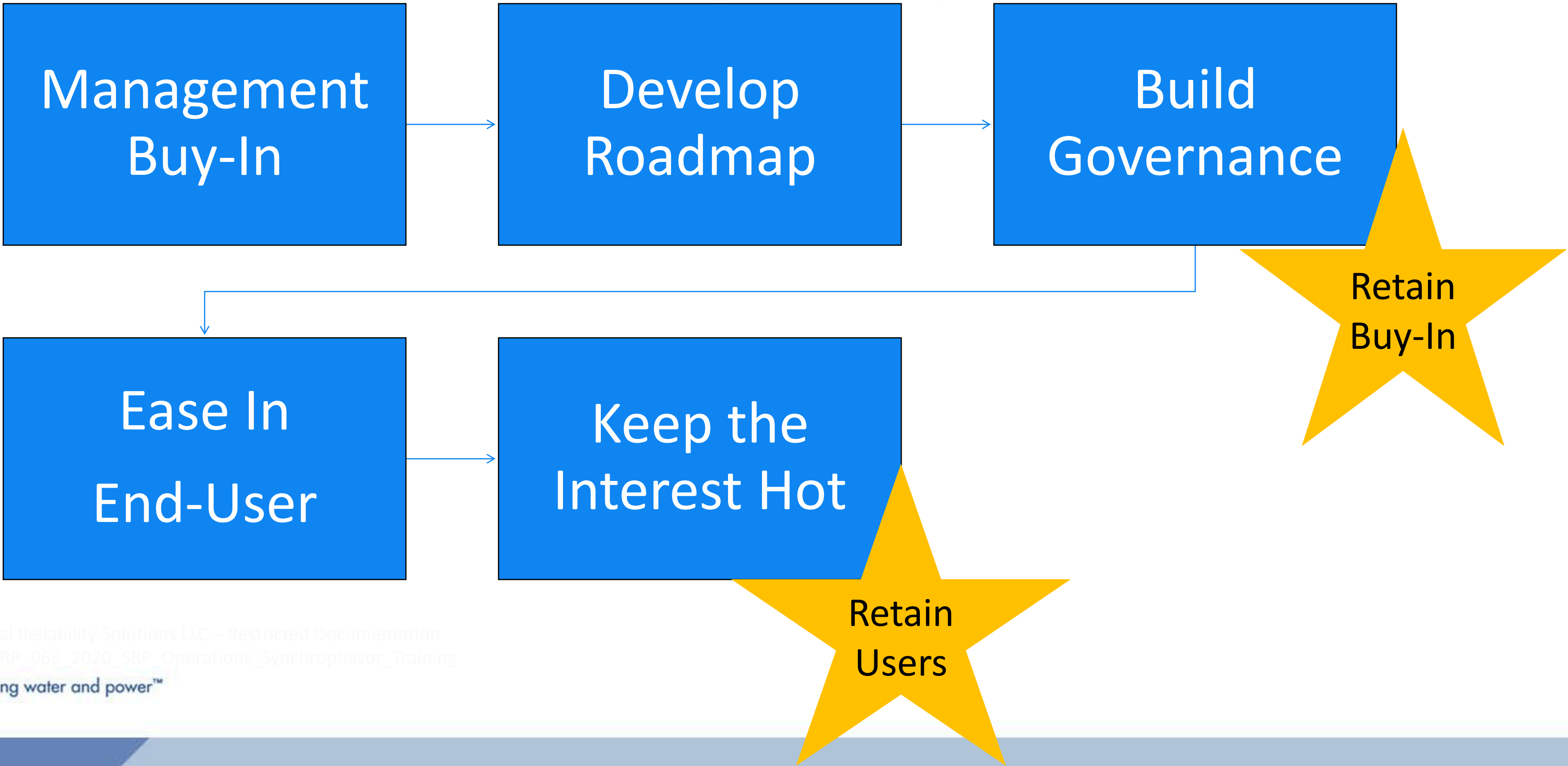
**“If you don’t start monitoring dynamic system behavior such as oscillation or asset performance, problems may go unrecognized!”**

The transition of utilities from historically static system awareness to one requiring dynamic system awareness, particularly with the shift **of Inverter Based Resource from system supportive to system critical resources**, has allowed for more open dialogue for new technology experimentation and acceptance. We have seen maturing synchrophasor applications such as oscillation monitoring, power plant model validation and dynamic system visualization to meet this shift.

# What is the path to greater dynamic awareness?

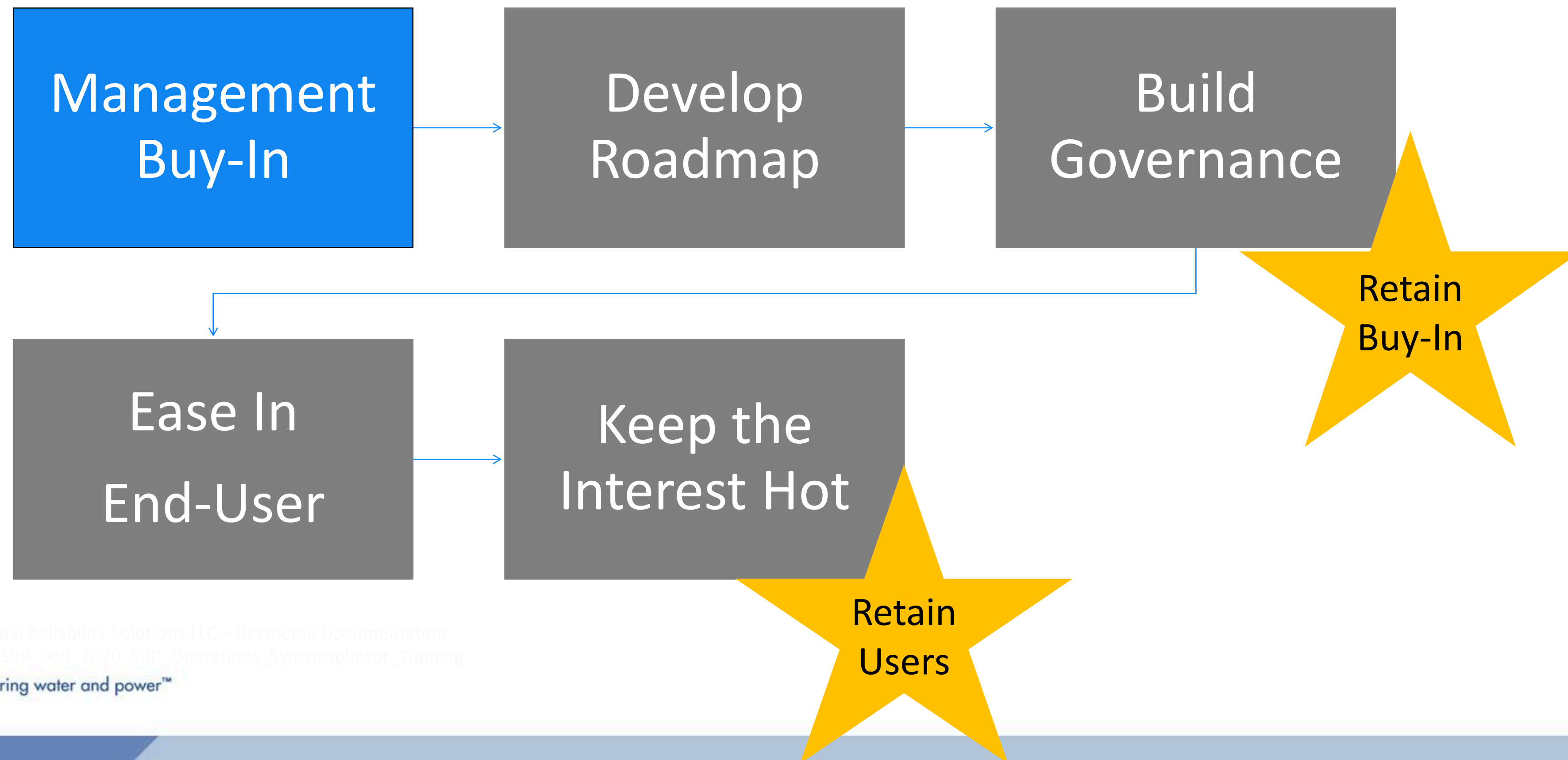
But there still needs to be an organized approach to selling synchrophasor technology to utility management and engineers to successfully integrate synchrophasor applications.

This talk will focus on the approach SRP has taken to successfully move this synchrophasor sales pitch from that of a research novelty to a critical system tool.



# Management Buy-In

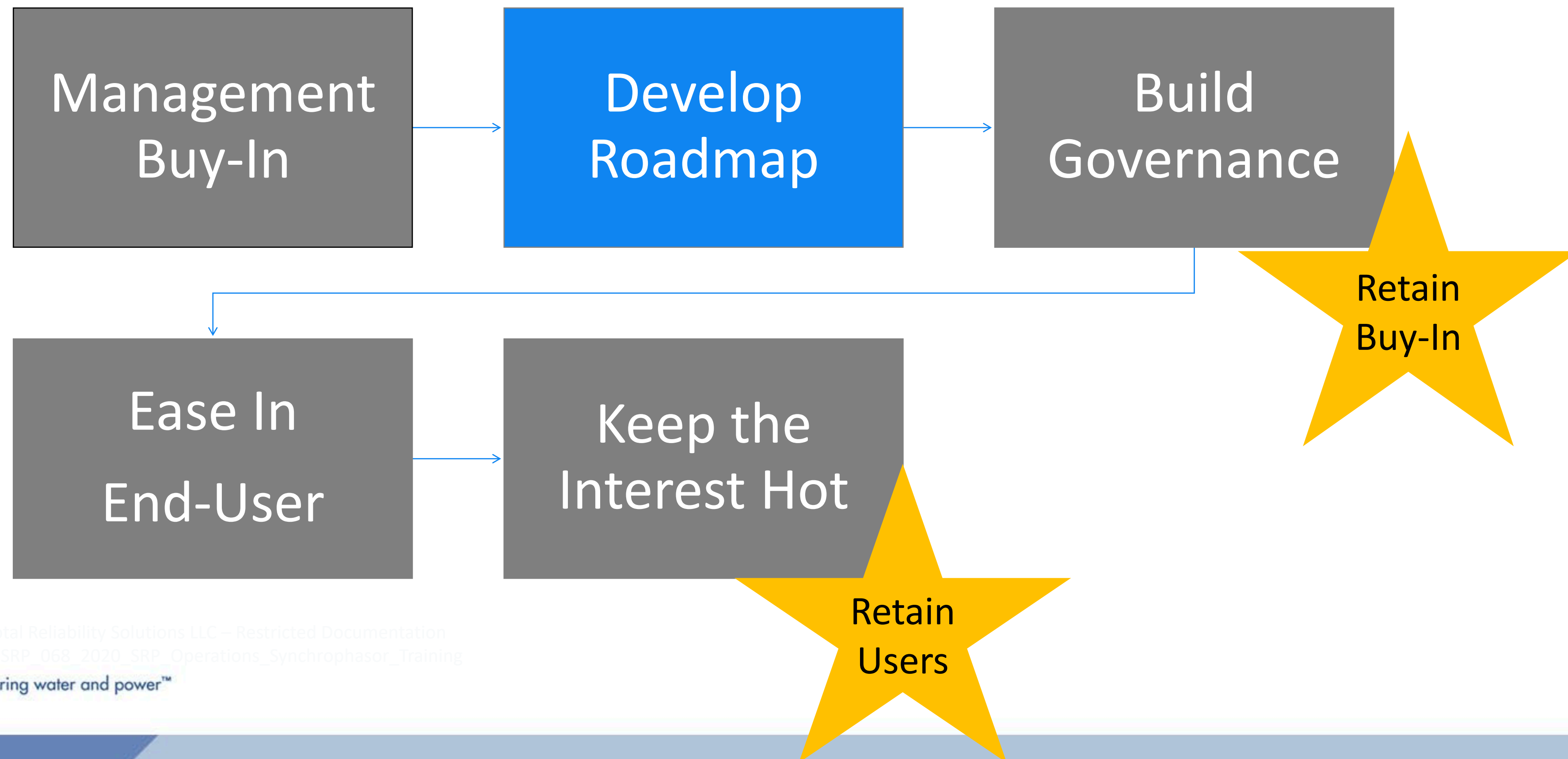
Initial management interests develop through a high-level company benefits.  
The sales pitch for synchrophasor applications depends on managements inset perspective.





# Develop a Roadmap

Bring together a cross-departmental team of engineer level synchrophasor enthusiasts.  
Hold gap analysis meetings with departments who can potentially benefit – AND LET THEM REVEAL THE GAPS.  
Build a list of potential applications, build a roadmap and vet that roadmap back with those departments.

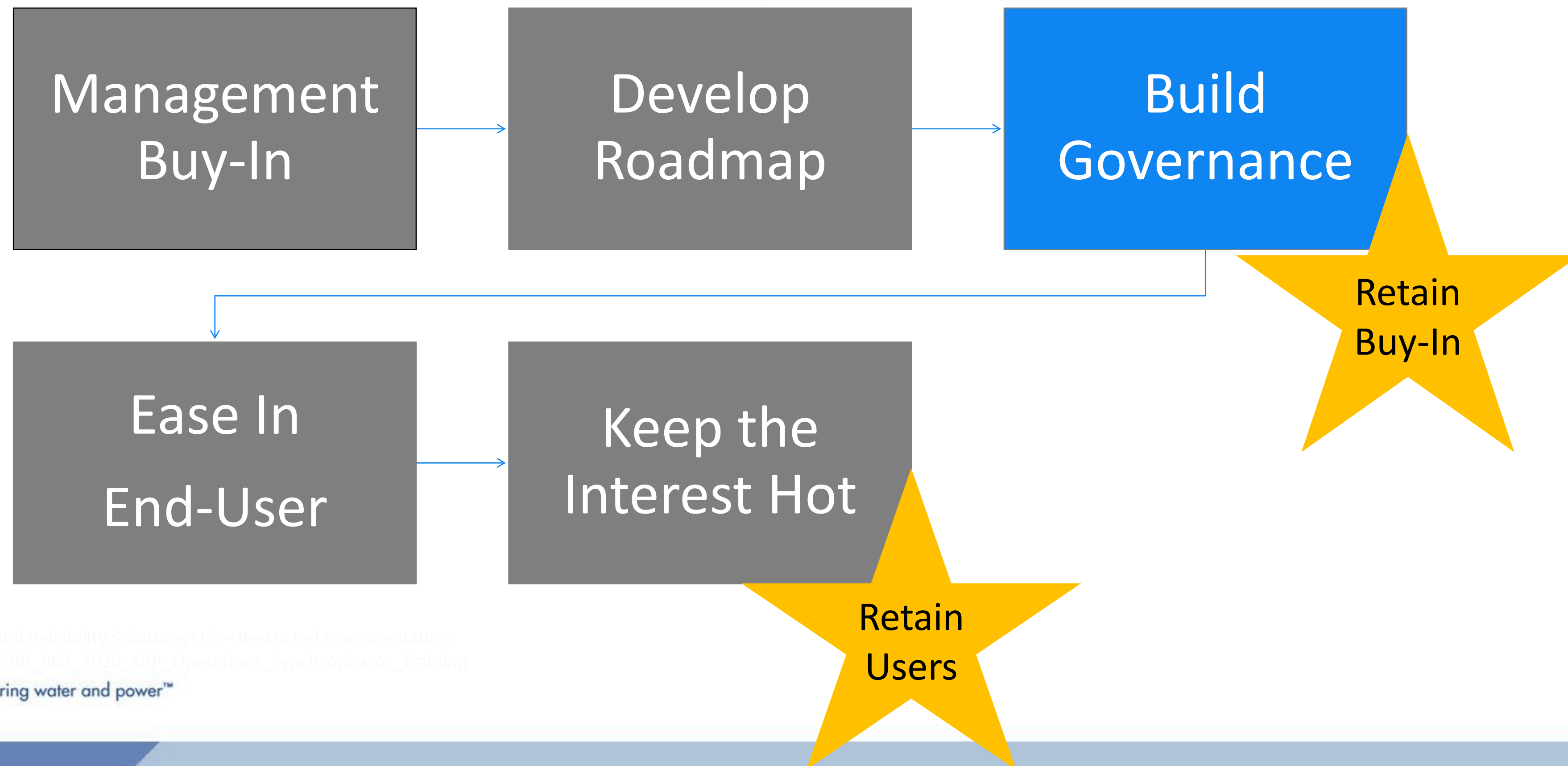




# Build Governance

Bring together a Governance team made up of those same management approached initially. This includes them in the synchrophasor application decision process.

Bring together a Business team from those same “synchrophasor enthusiasts” to recommend and work on implementation of applications.



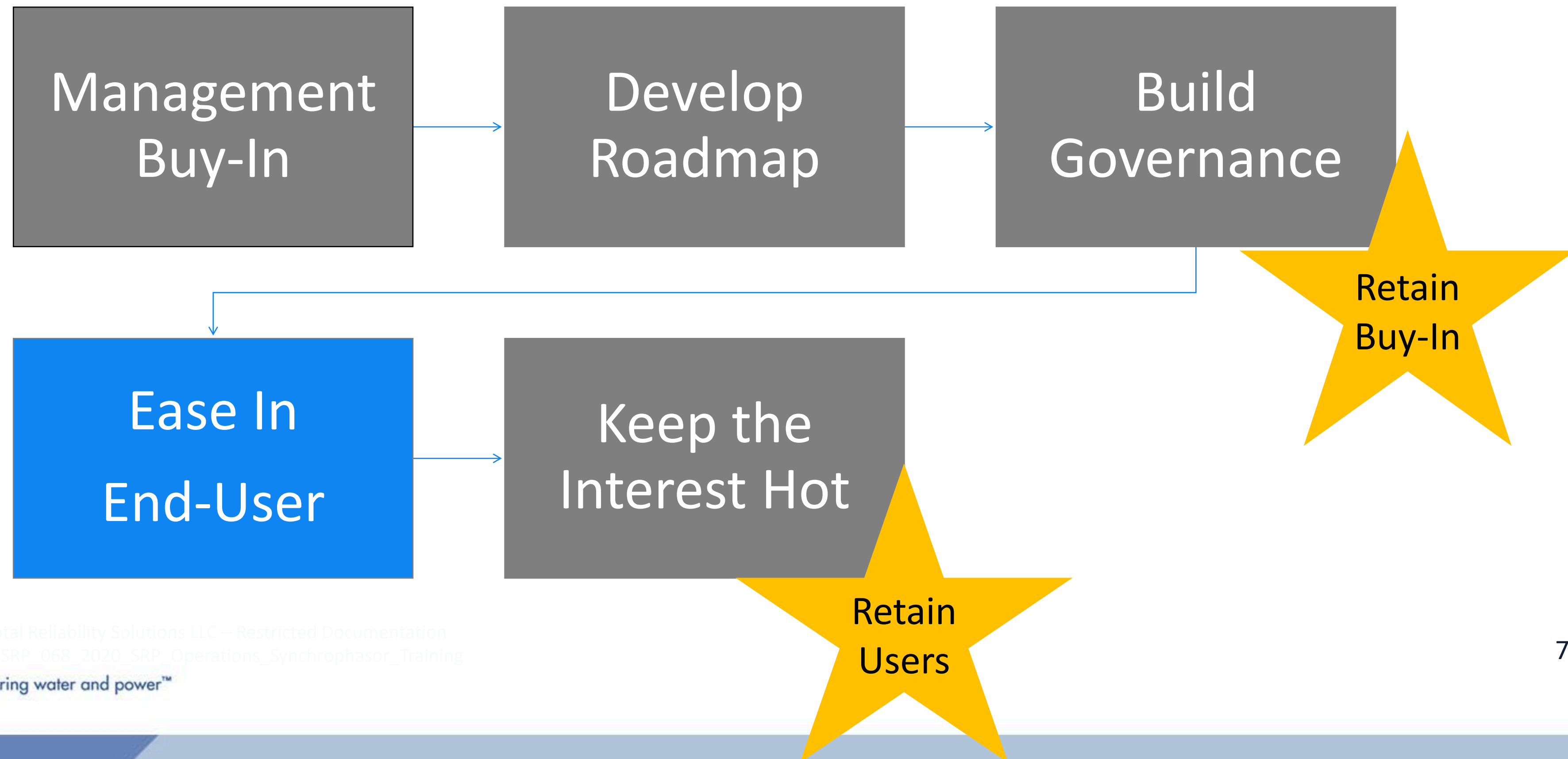


# Ease In End-Users

FIRST - Provide training courses on applications.

THEN – Bring applications to the user’s desk.

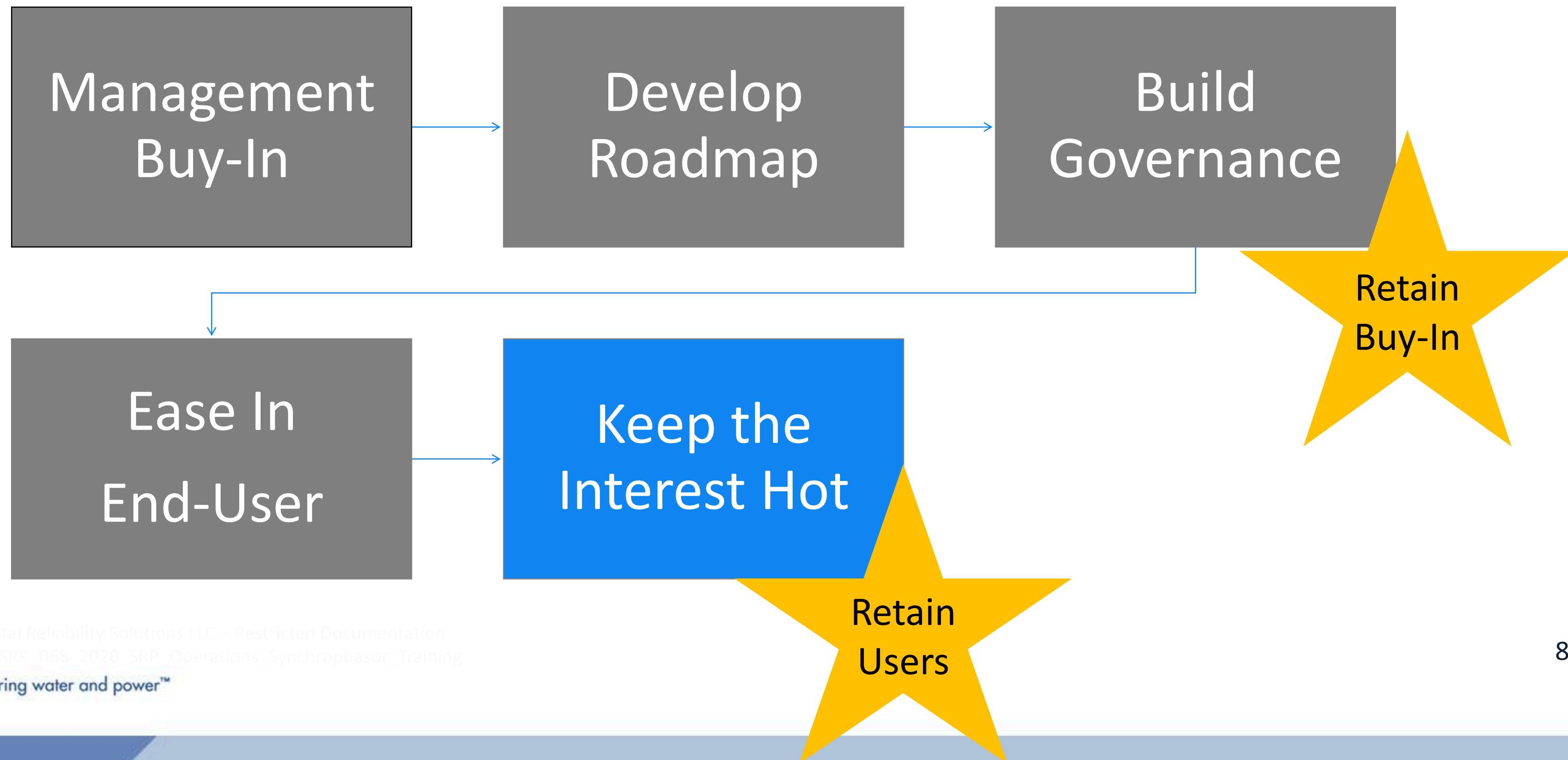
**MOST IMPORTANT** – Train on synchrophasor technology to build user awareness and industry applications before bringing them into end-user’s workflow.





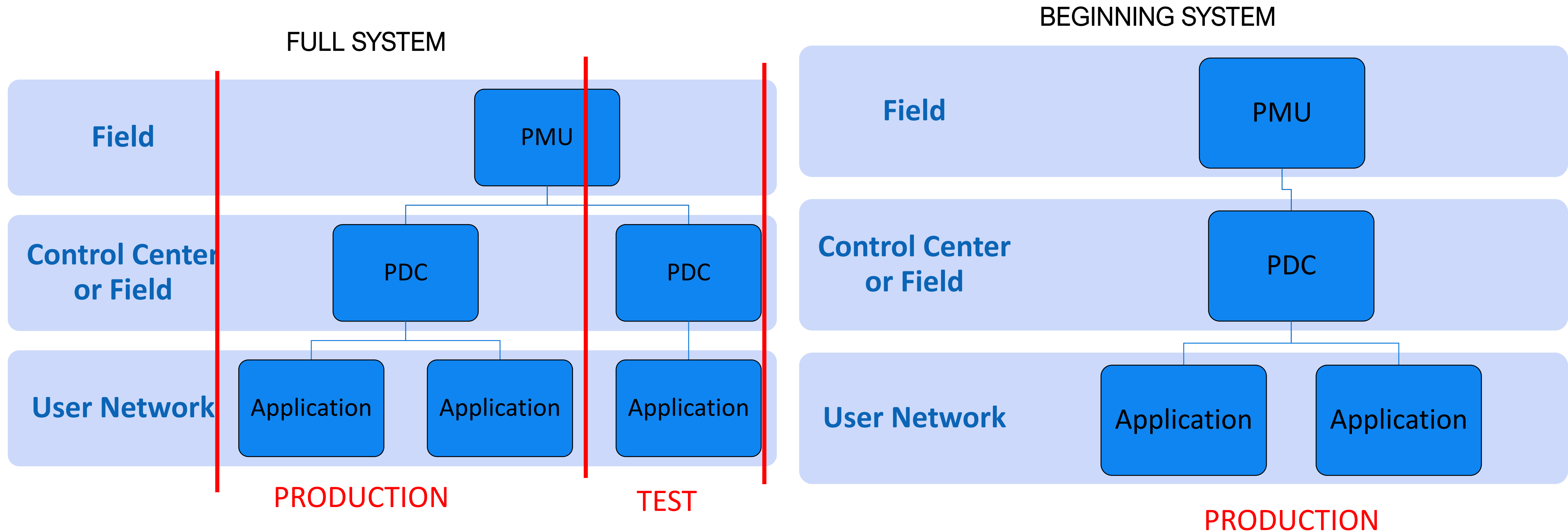
# Keep the Interest Hot

Keep management aware of recent synchrophasor application development.  
Meet with users frequently to collect feedback to update the value.





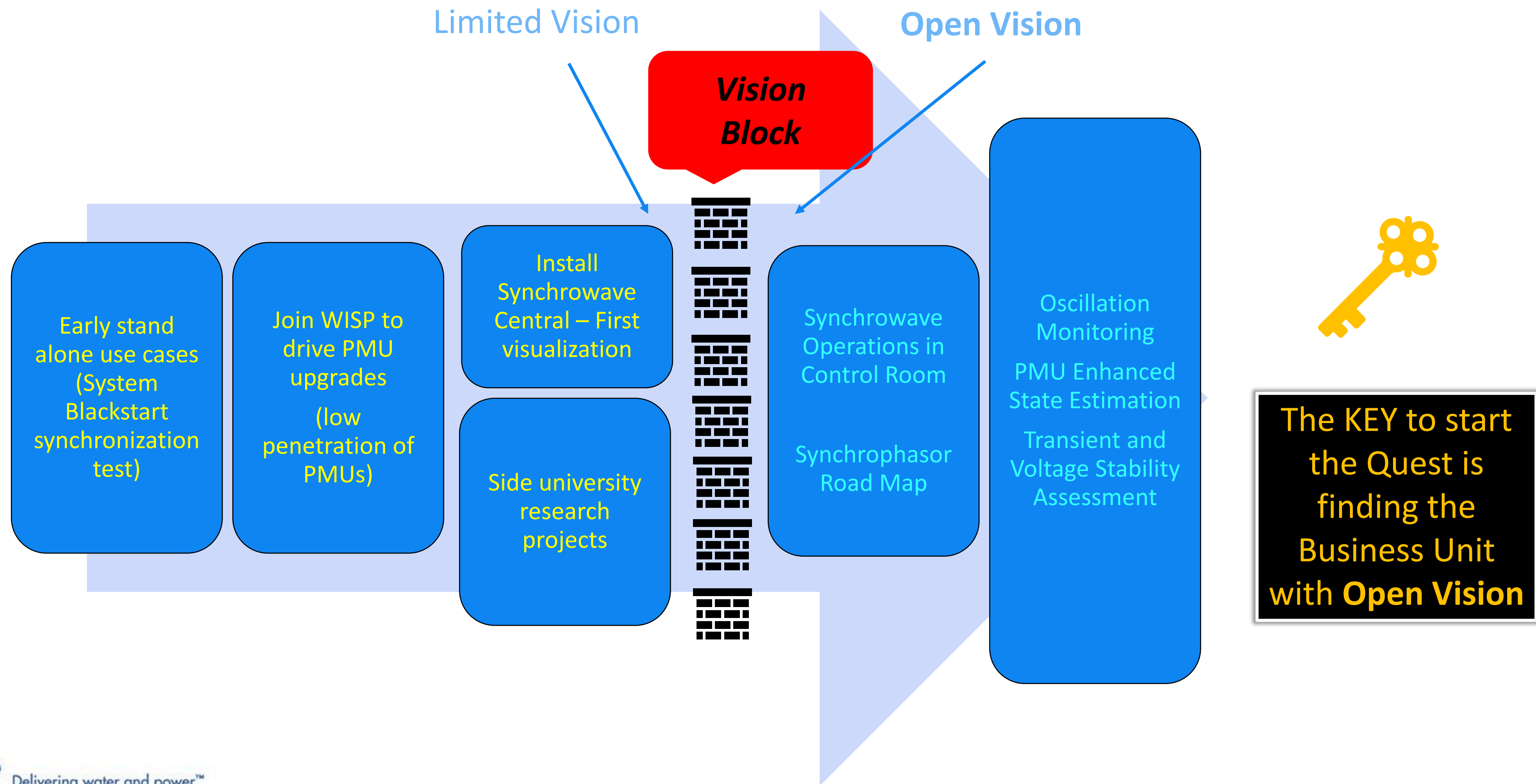
# Don't Forget the Network!



High bandwidth system network required for large data transfer – Network enhancement may be needed in your system  
 If it is not feasible to build or upgrade the network to the full system, sell it a research project with a small test system of  
**SYNCHROPHASOR-BASED, DYNAMIC BEHAVIOR SENSING, VALUED RESEARCH.**

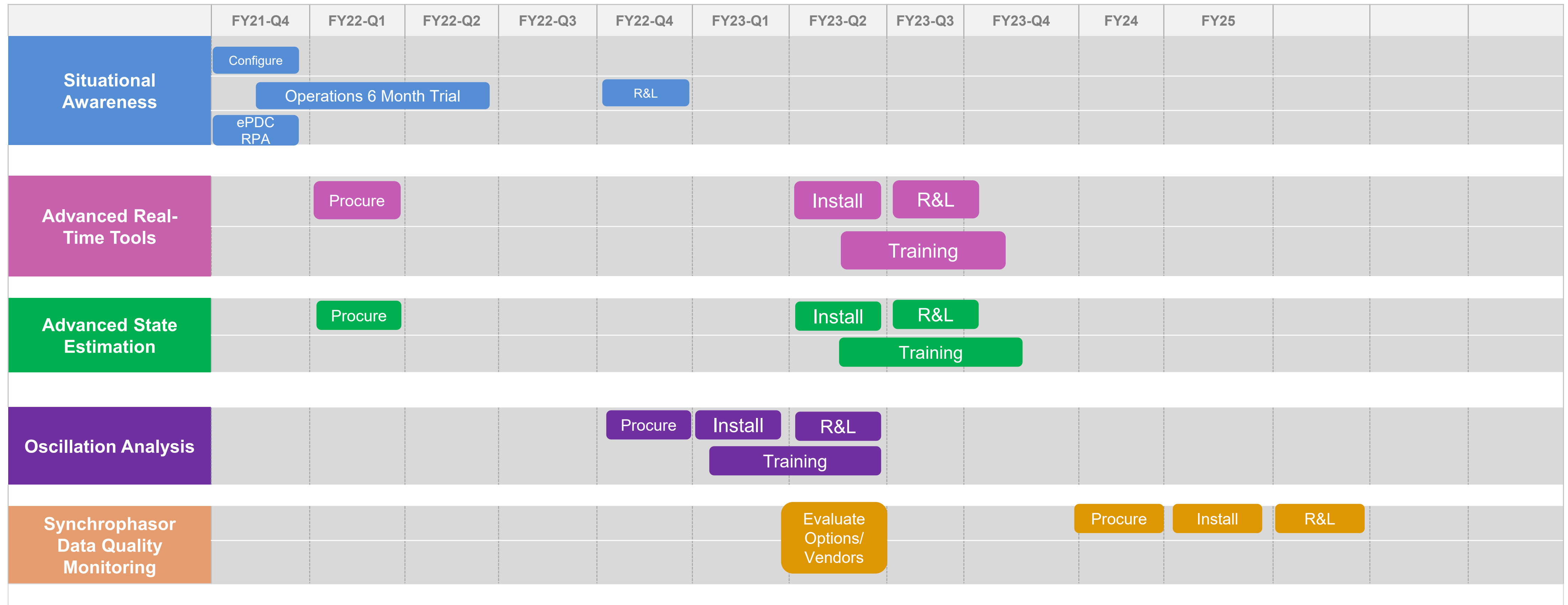


# SRPs Vision Quest





# Sample – Synchrophasor Roadmap





# Sample Synchrophasor Training – Developer Attribution

The following training course material was developed by Total Reliability Solutions (TRS) in collaboration with the Pacific Northwest National Laboratory (PNNL).

Thanks goes to Mike Cassiadoro (TRS) and Eric Andersen (PNNL) for this training material and a special thanks to the following individuals who contributed to the development of the materials:

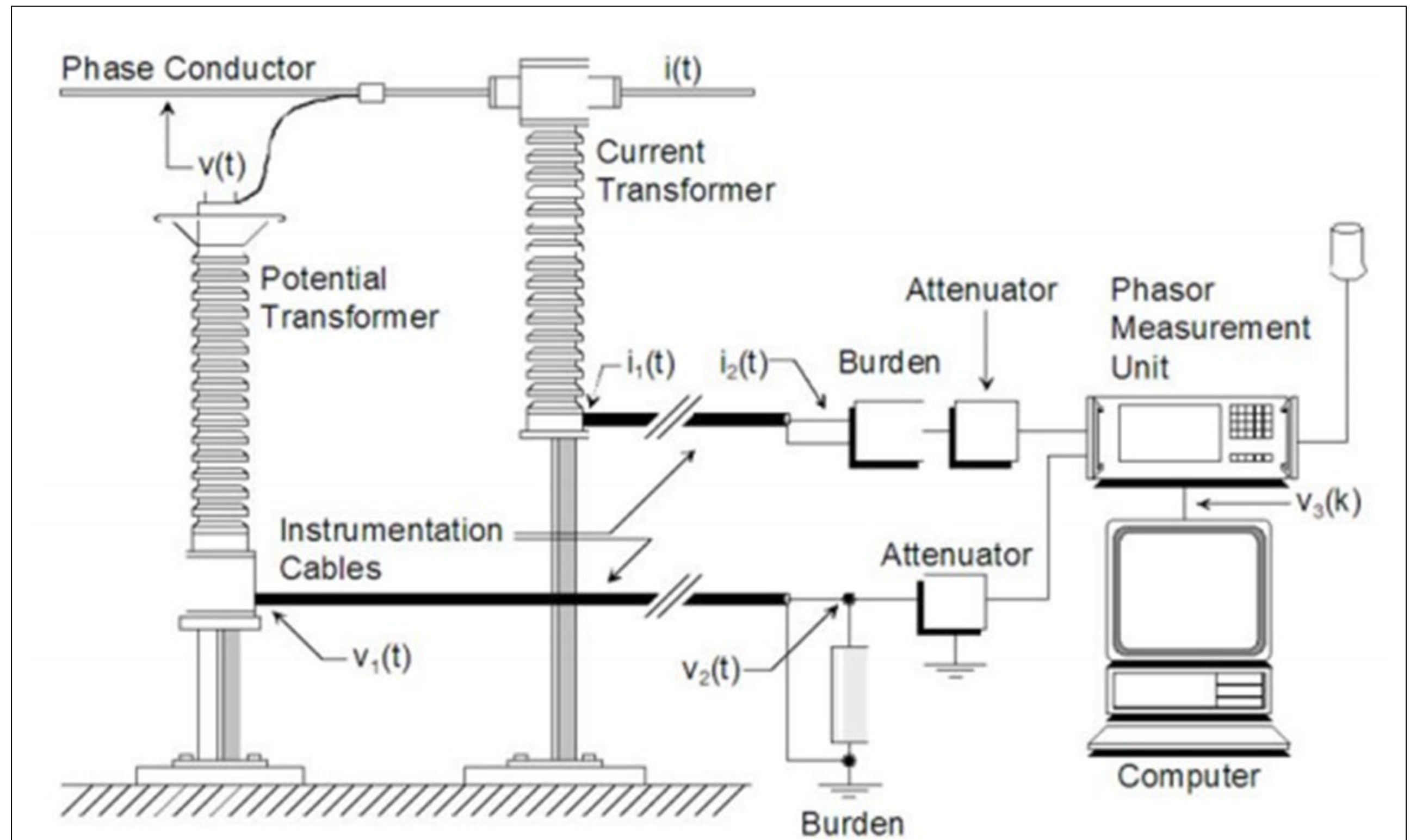
- Urmila Agrawal
- Eric Andersen
- Tamara Becejac
- Crystal Eppinger
- James Follum
- James O'Brien

# Sample Synchrophasor Training

## What are Synchrophasors?

Synchrophasors are time-synchronized measurements of current and voltage phasors taken from Phasor Measurement Units (PMU).

PMU current and voltage measurements can be used to derive parameters such as frequency and phase angle.



Source: NERC's "Real-Time Application of Synchrophasors for Improving Reliability" paper published in Oct. 2010.

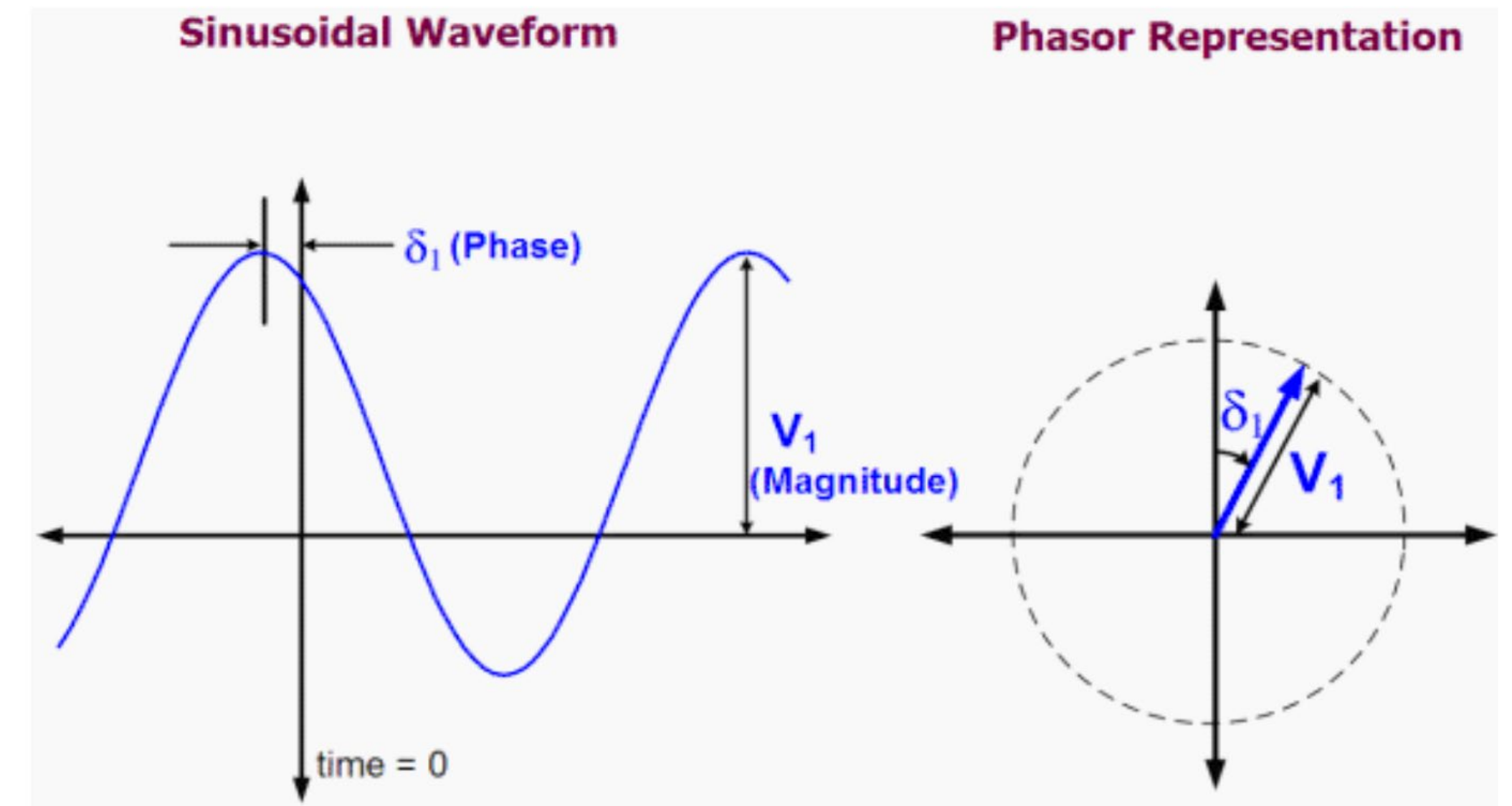
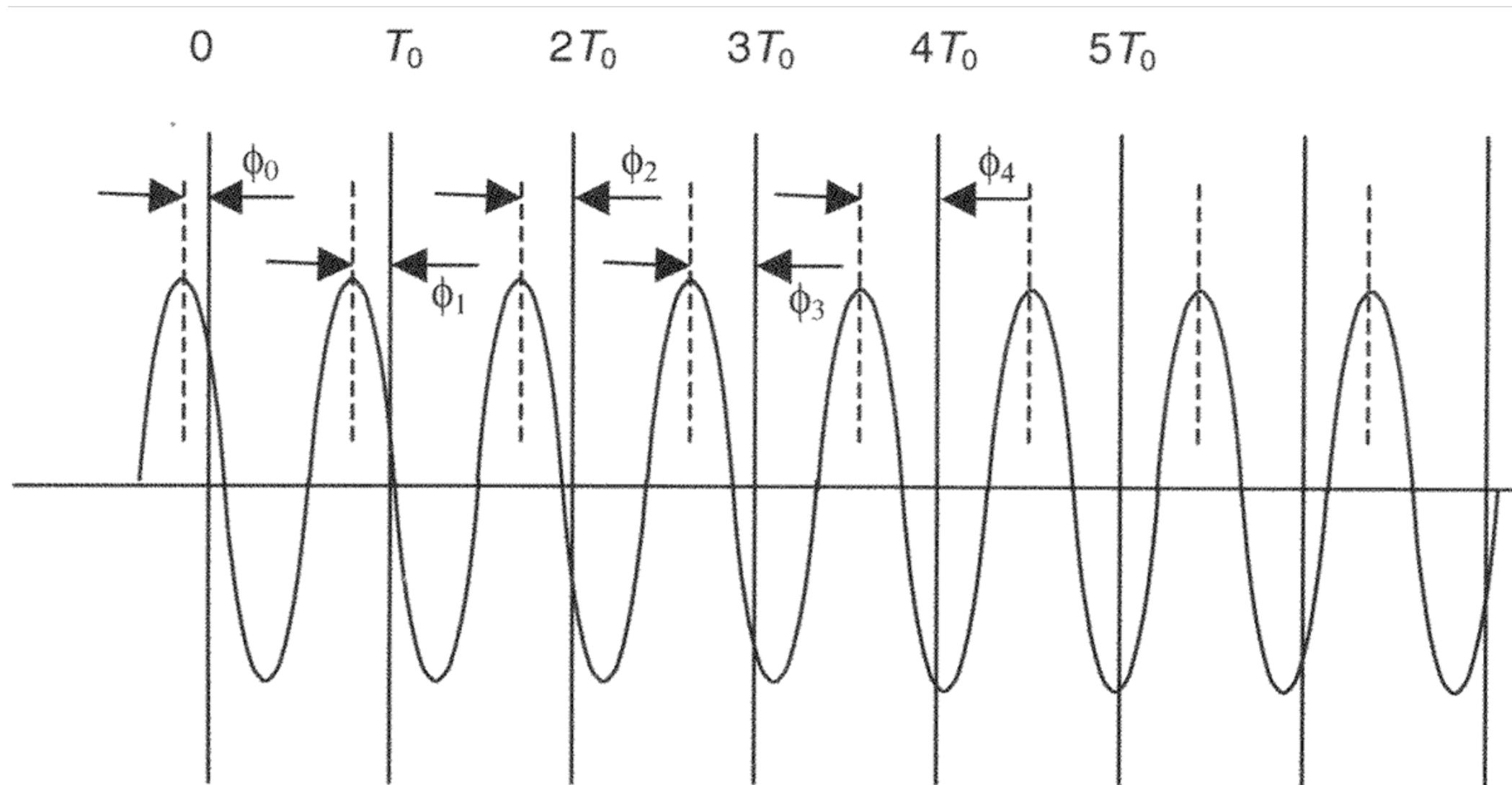


# Sample Synchrophasor Training

## “Synchro” Vs. “Phasor”

“Synchro” represents the time component of the measurement.

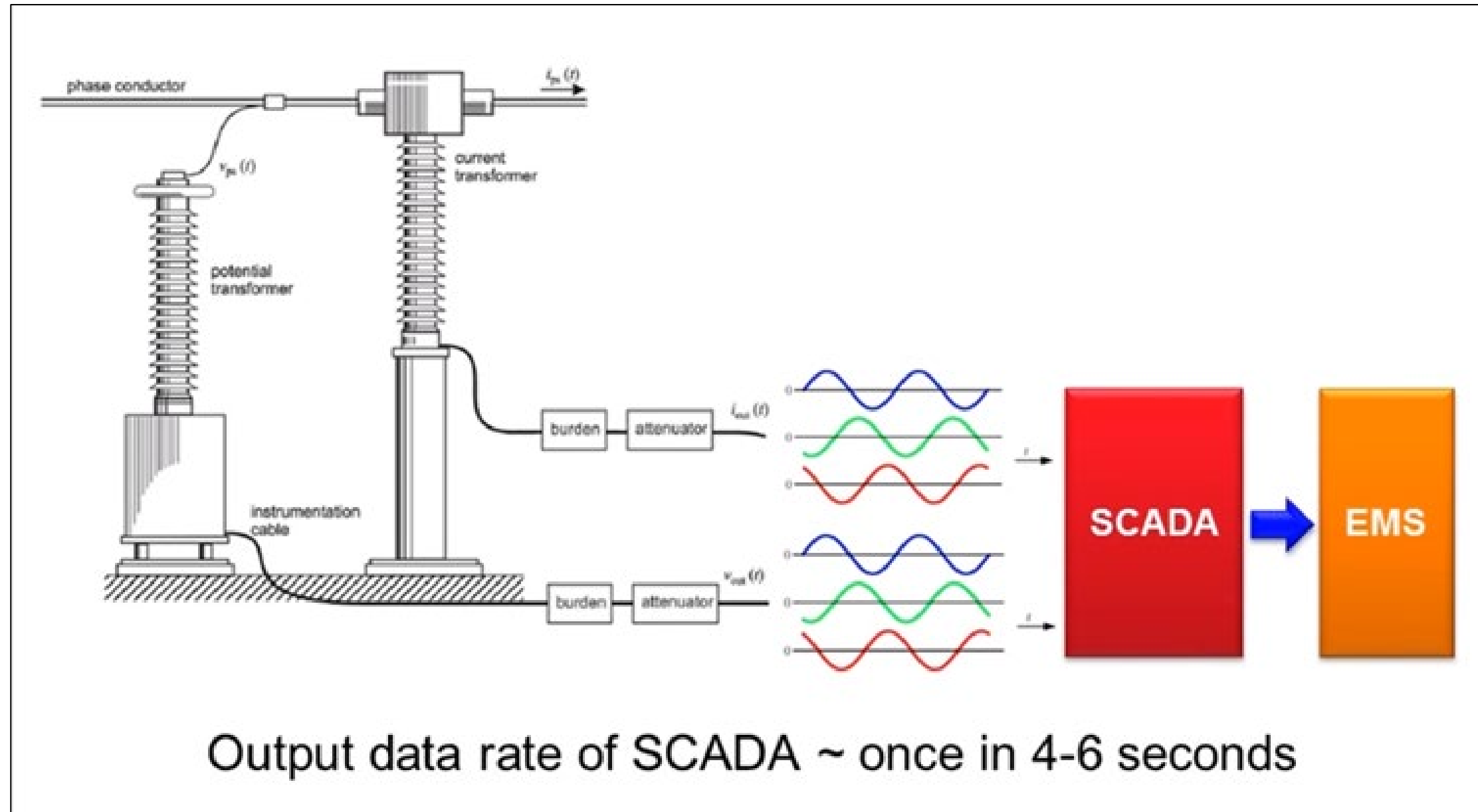
“Phasor” is the angle and RMS magnitude of the current or voltage sine wave.



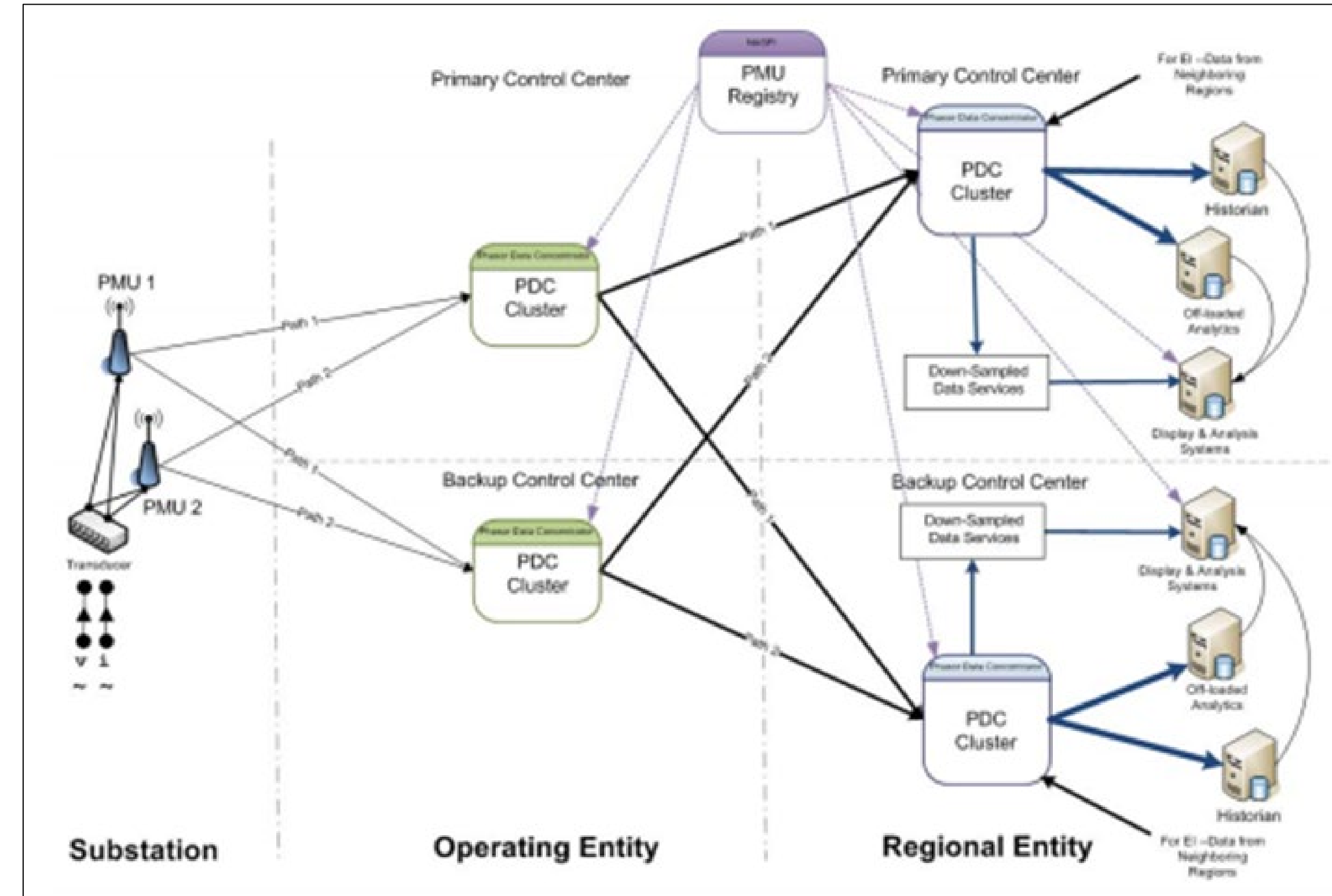
Source: CERTS, Phasor Technology Review

# Sample Synchrophasor Training

## Comparing SCADA & PMU Networks



Source: Washington State University Smart Grid Demonstration & Research Investment Lab's *Fundamentals of Synchrophasor Technology and its Applications* training course.



Source: NERC's "Real-Time Application of Synchrophasors for Improving Reliability" paper published in Oct. 2010.



# Sample Synchrophasor Training PMU Vs. SCADA Measurements



Comparison of full stream sub-second PMU measurements and SCADA data taken during testing of new generator control settings that caused unit output to swing rapidly and result in voltage oscillations on the 138 kV system.

# Sample – Synchrophasor Training

## Time-Synched Measurements in the Control Room

Synchrophasor-based applications can be used for:

- Frequency monitoring
- Voltage monitoring
- Real and Reactive Power monitoring
- Phase angle monitoring
- Oscillation detection & mode meter
- Voltage stability monitoring
- Enhanced state estimation
- System islanding detection & blackstart restoration



# Sample Synchrophasor Training

## Recognizing the Value Added

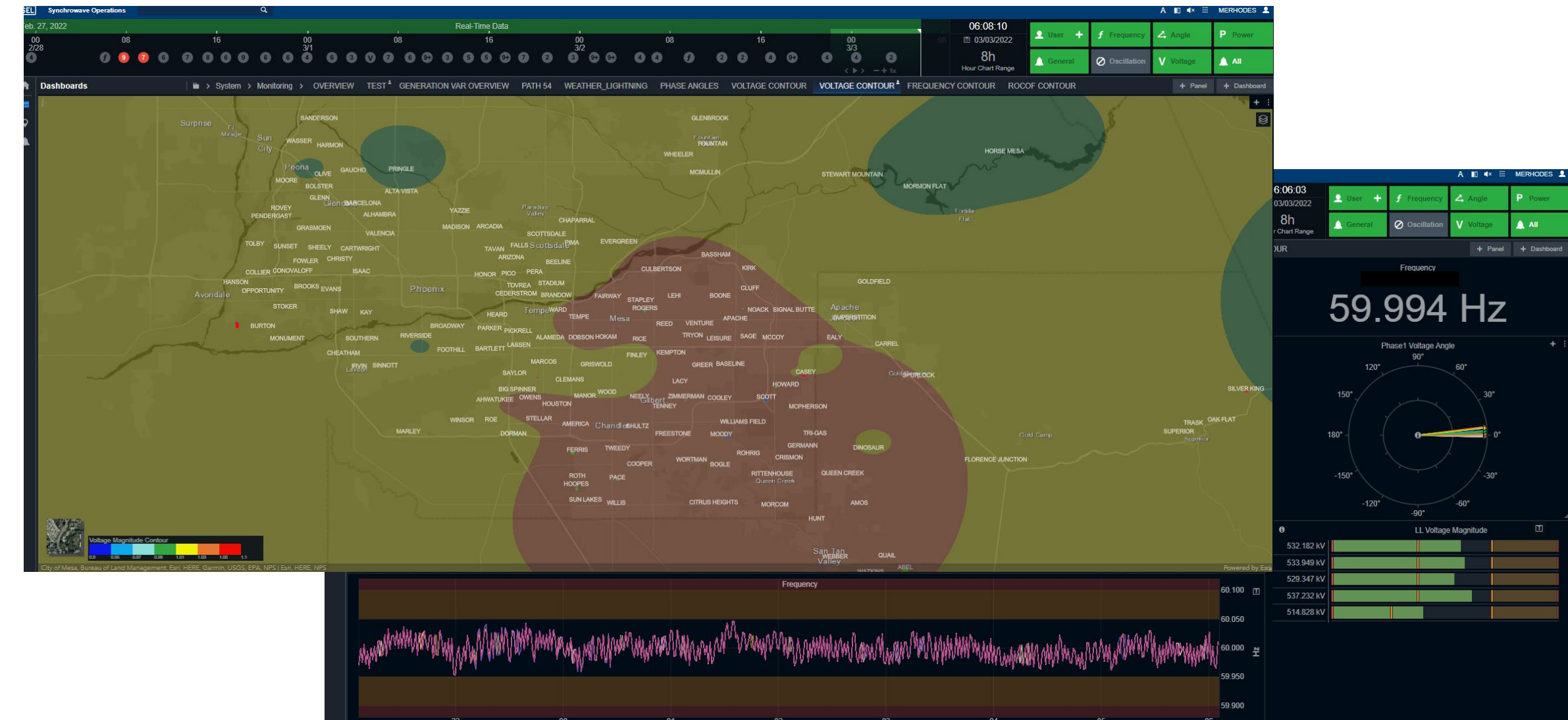
- Increased Wide-Area situational awareness through improved monitoring, visualization and trending capabilities.
- Clearer view of how the electric grid responds to changes in system conditions.
- Ability to identify unacceptable system performance that may go undetected with traditional data sources.



# What has this Quest lead for SRP?

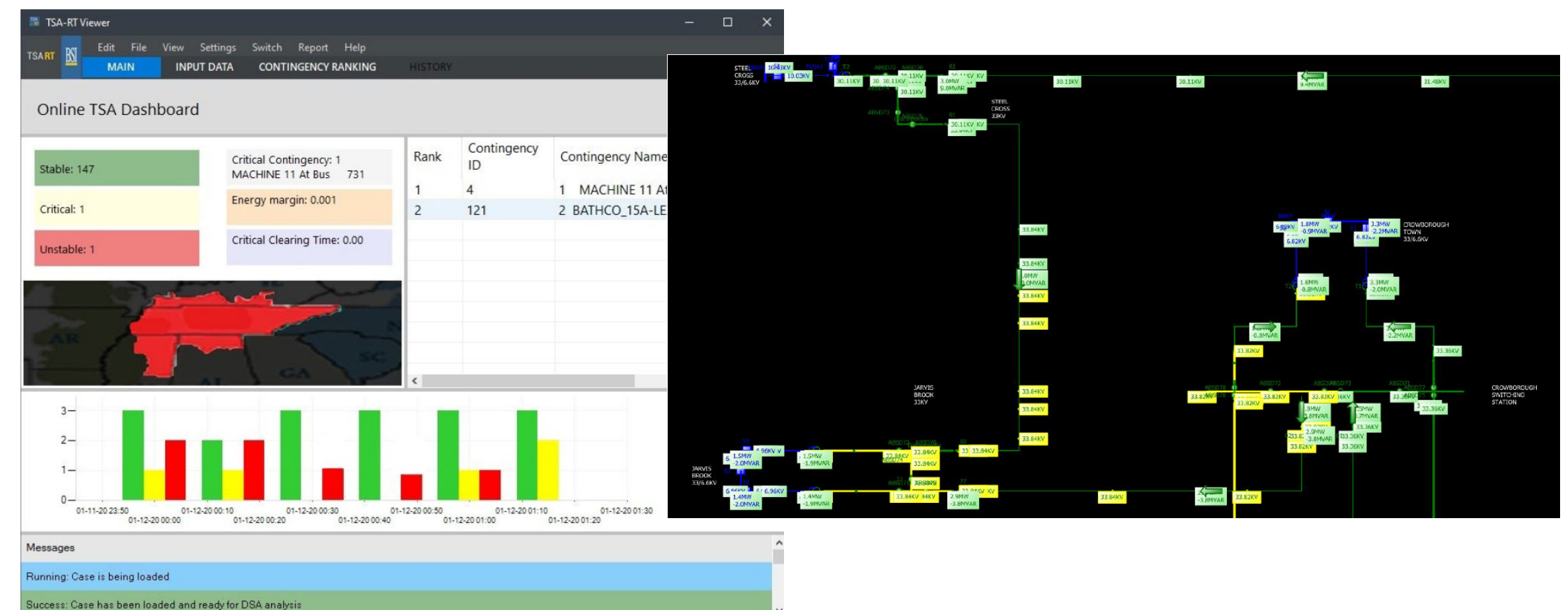
## SYNCHROWAVE OPERATIONS (NO REAL-TIME DECISIONS ALLOWED) – In Service

- Transmission Operator system awareness
- Transmission Engineer offline analysis and data extraction
- Distribution pilot to realize initial value of substation distribution PMUs
- **Driver: Gap of real-time control room system dynamics situational awareness**
- *Part of SRP Synchrophasor Roadmap*



## BIGWOOD TSA/VSA AND NON-LINEAR STATE ESTIMATOR – In Implementation

- Real-time Operator transient and voltage stability assessments
- RTCA backup/validation
- PMU-based state estimator for backup/validation
- **Driver: Gap of real-time voltage and transient stability assessment**

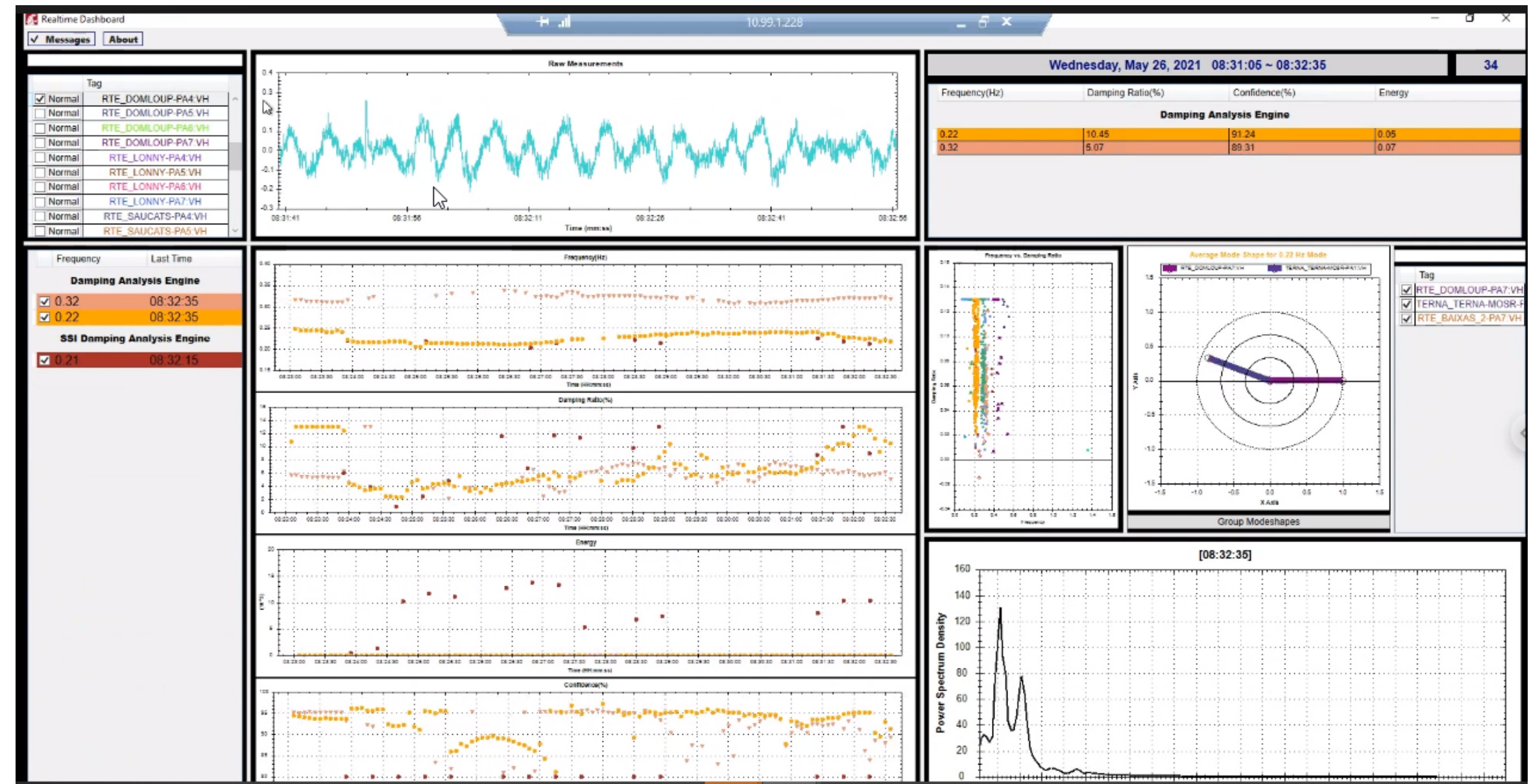




# What has this Quest lead for SRP?

## MANTRA OSCILLATION ANALYSIS TOOL – In Implementation

- Transmission Engineer online oscillation monitoring
- Transmission Engineer offline oscillation analysis
- **Driver: Gap of system dynamic oscillatory mode monitoring**
- *Part of SRP Synchrophasor Roadmap*





# QUESTIONS

For further questions, feel free to contact me:

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