AWS re:Invent

NOV. 29 – DEC. 3, 2021 | LAS VEGAS, NV

PNU305

How volt-VAR optimization (VVO) on AWS can cut utility emissions

Abhineet Parchure (he, him, his)
Senior Power and Utilities Solutions Architect

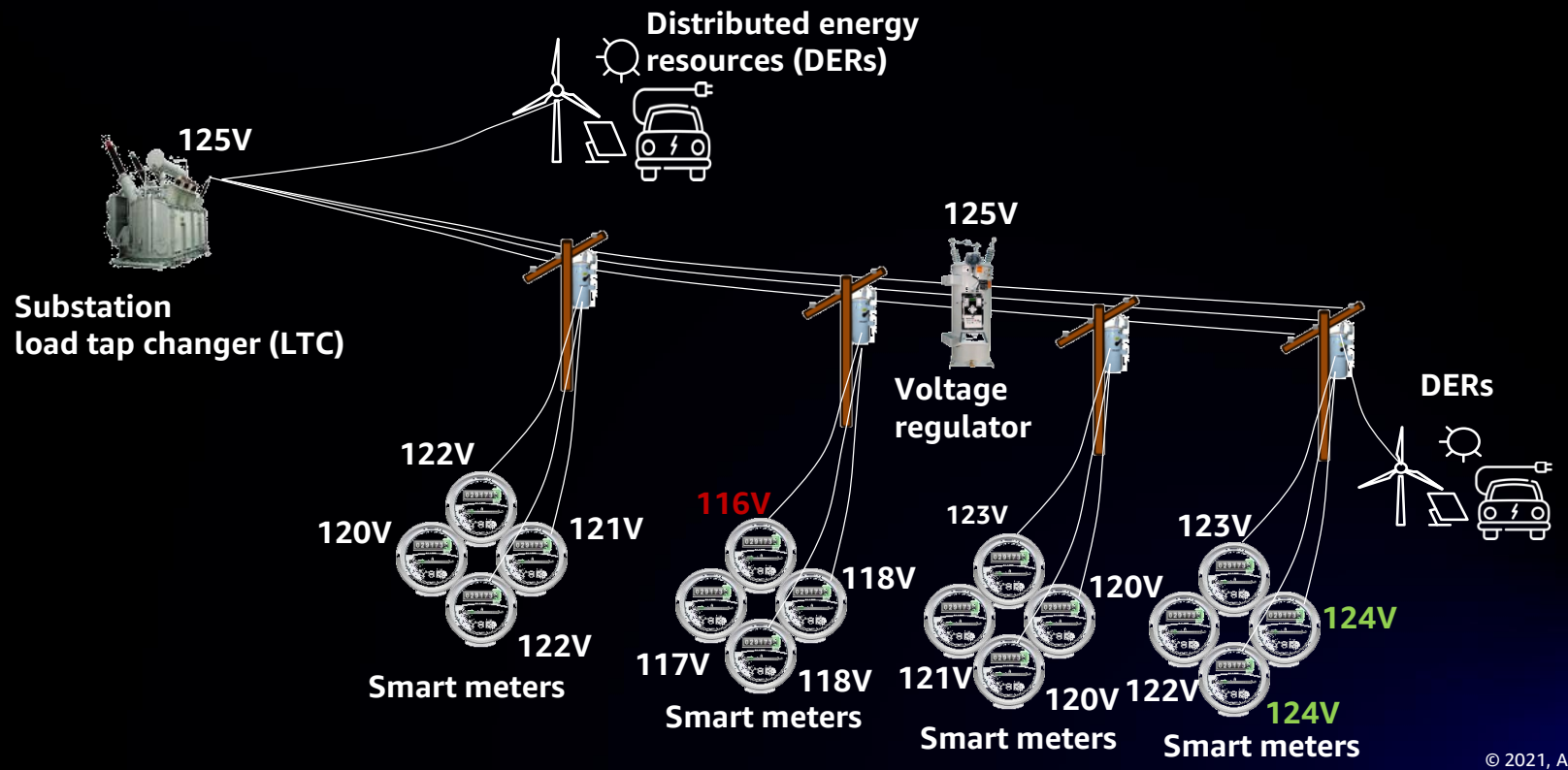
aws power and utilities

aws

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

What is VVO?

- VVO = distribution voltage and reactive power management
- Traditionally aimed at lowering losses and energy consumption with no impact to end consumer's usage



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

VVO and conservation voltage reduction (CVR)

- Leverages the principle of “conservation voltage reduction (CVR)”: lower voltage = lower energy consumption



“Constant impedance” loads

Power consumed = $VI = V^2/Z$
where *V* is the voltage across the load, *I* is the current drawn by the load, and *Z* is its impedance

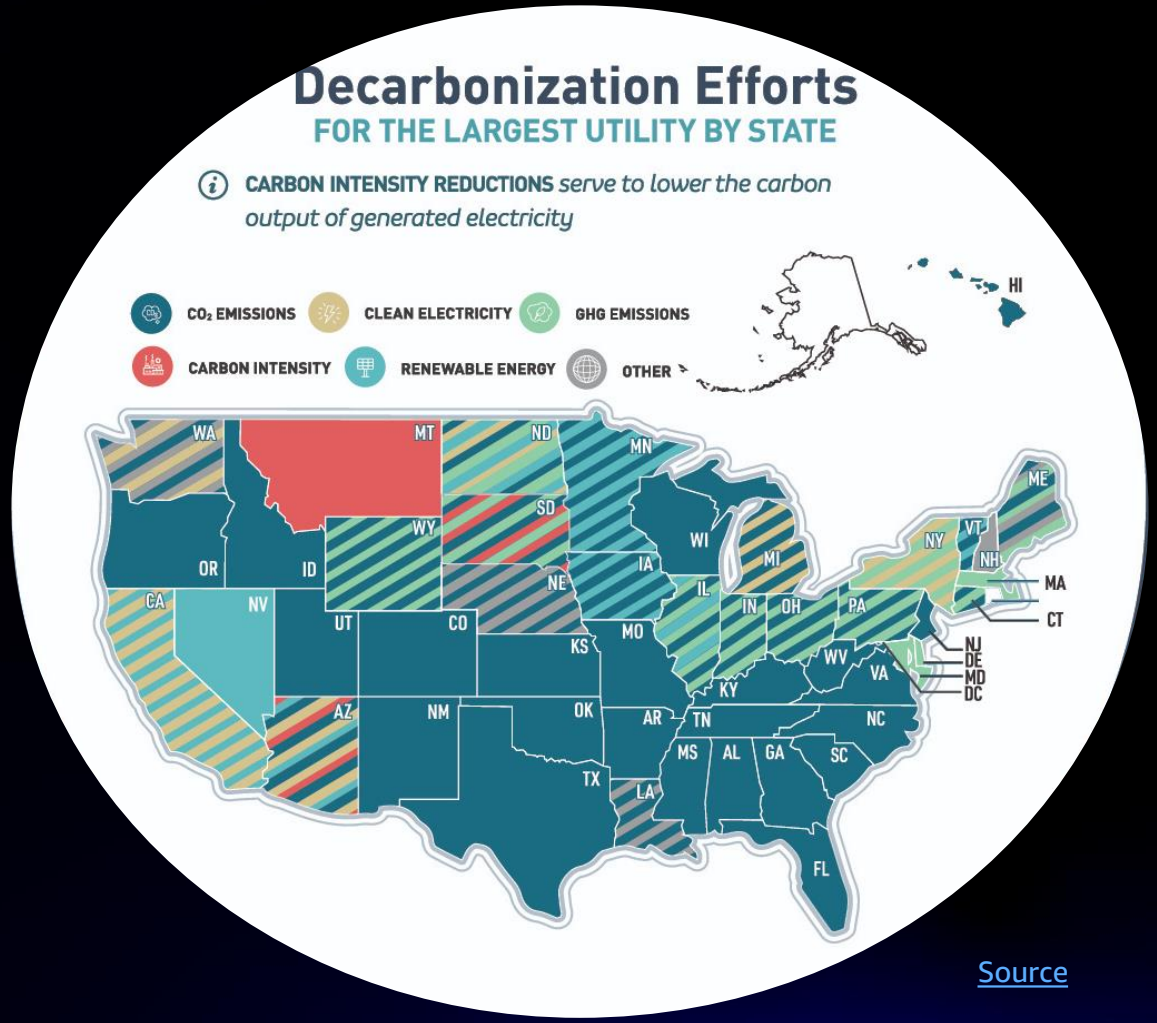
*Not all loads have constant impedance

- CVR applicable for most circuits, not all, but VVO still useful for all

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Why is VVO important?

- VVO supports decarbonization goals by lowering energy consumption
- Helps lower end customer's energy bills, and, in turn, improve CSAT
- VVO is a tool to justify investments in advanced metering infrastructure
- Helps utilities lower expenditure in the form of peak demand charges
- Helps manage the grid in the presence of intermittent DERs



Source

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

What is being proposed?

A microservices-oriented ***architectural framework*** for distribution voltage management. Example use cases:

- VVO
- Energy and carbon savings calculator
- Abnormality detector
- And more…

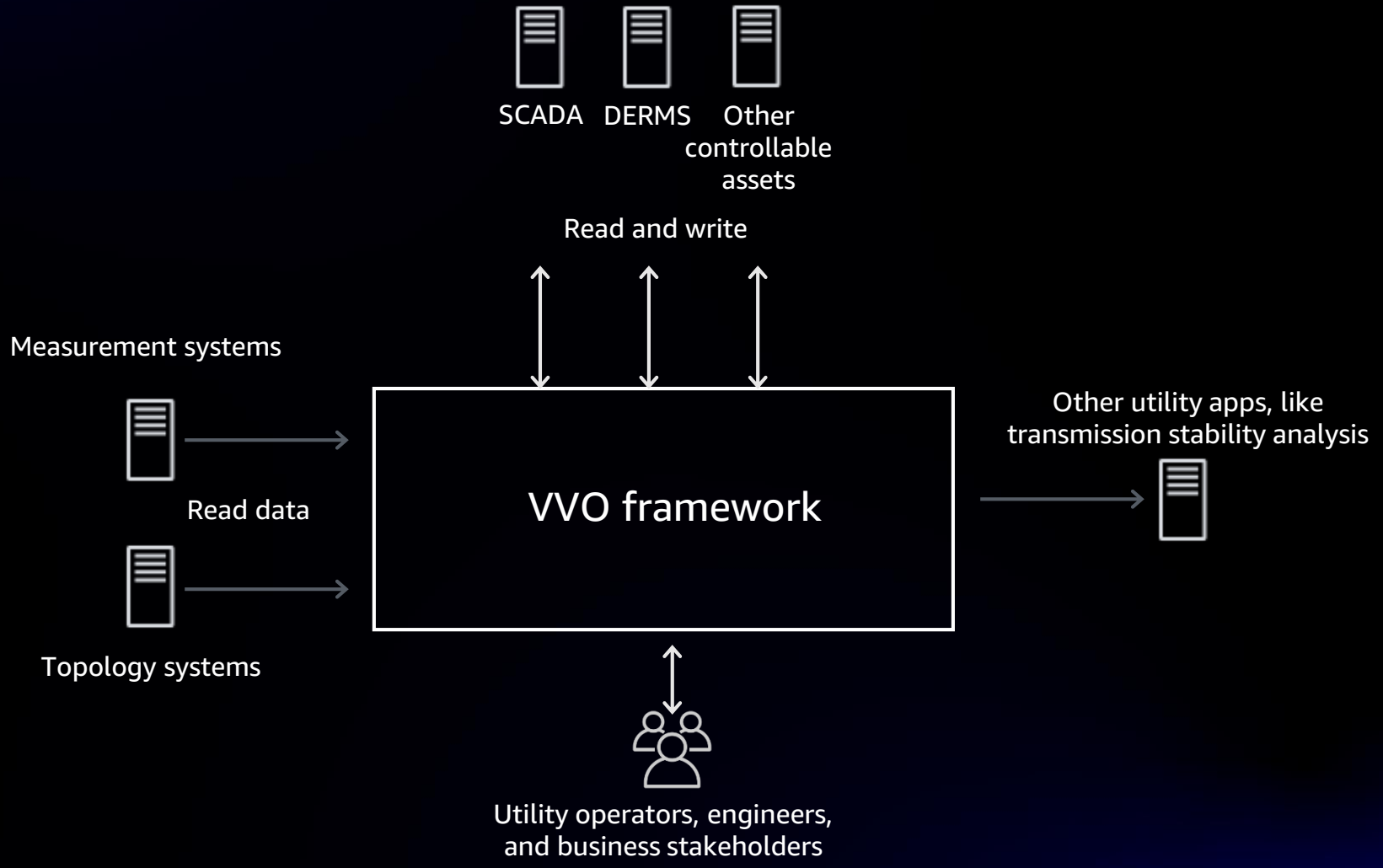
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Who is this framework valuable for?

- Utilities wanting to implement distribution volt-VAR optimization or conservation voltage reduction with a vendor/DIY
- Utilities already running VVO/CVR and looking for a near-real-time monitoring framework to track energy savings, carbon reduction, end customer savings, control failures, and more
- Utilities looking to build near-real-time system integration and performance-monitoring applications using their SCADA/AMI/other data (e.g., solar/smart inverter)
- AWS partners developing VVO/ADMS products
- Utility regulators and **people**

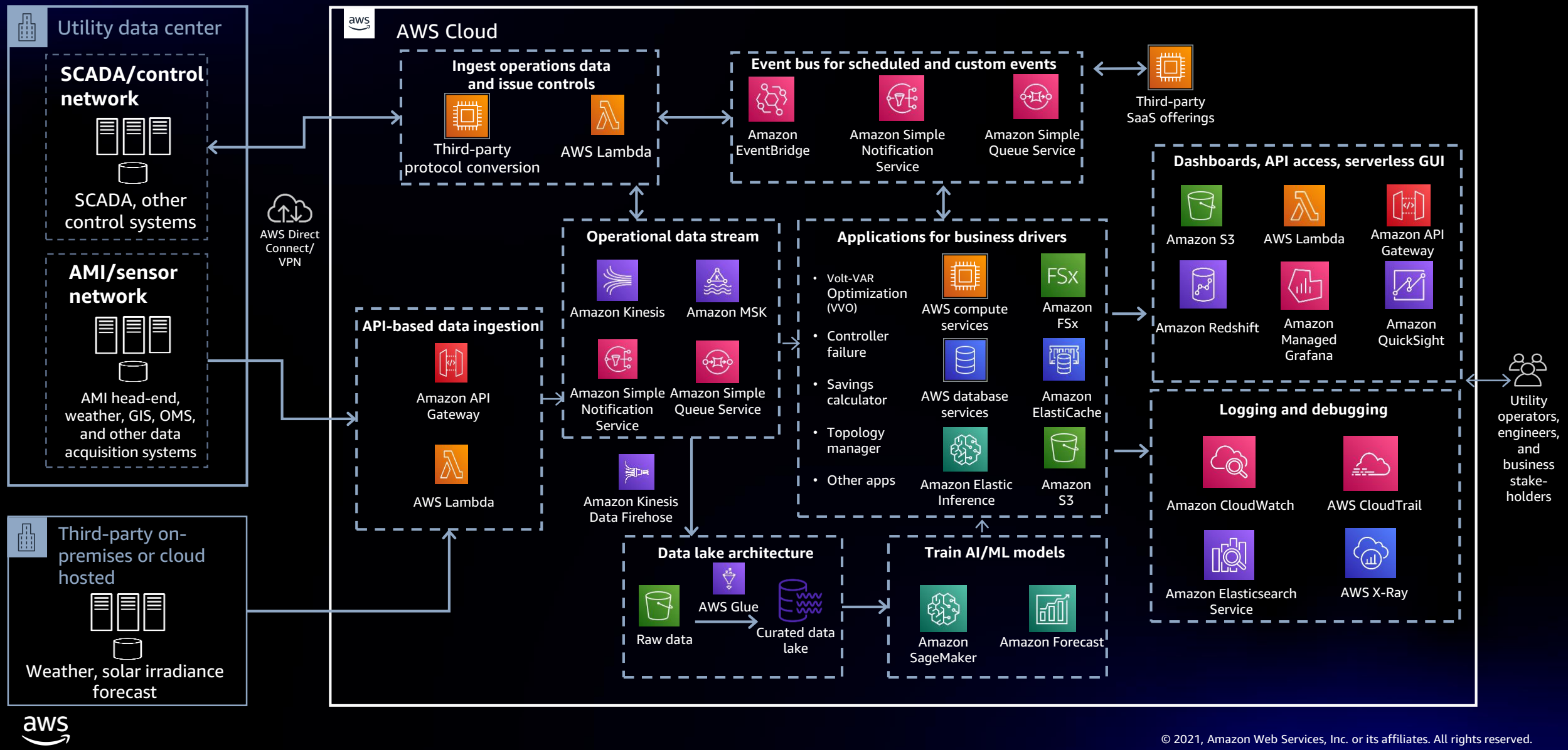
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Interaction diagram



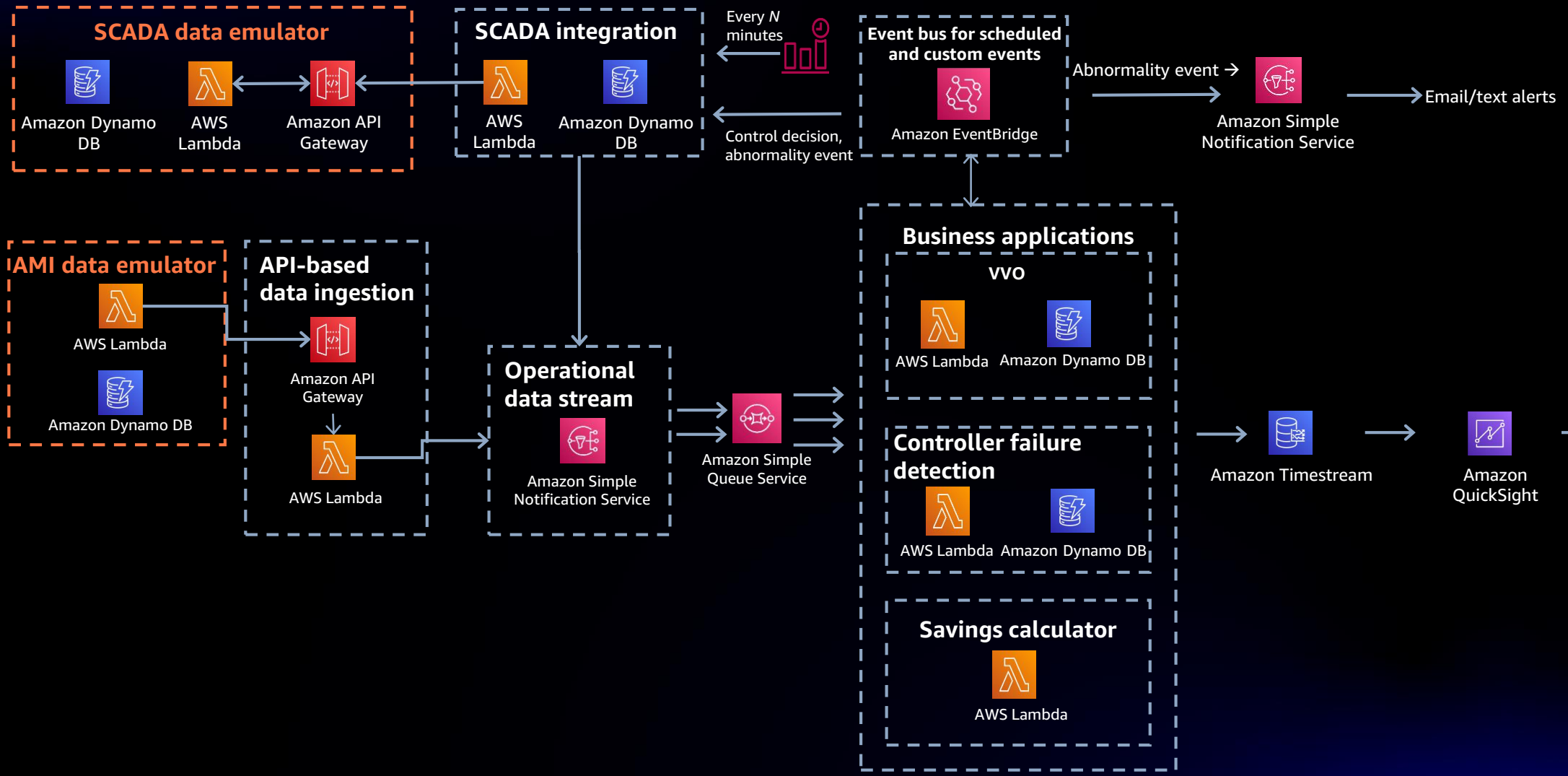
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Distribution volt-VAR management framework



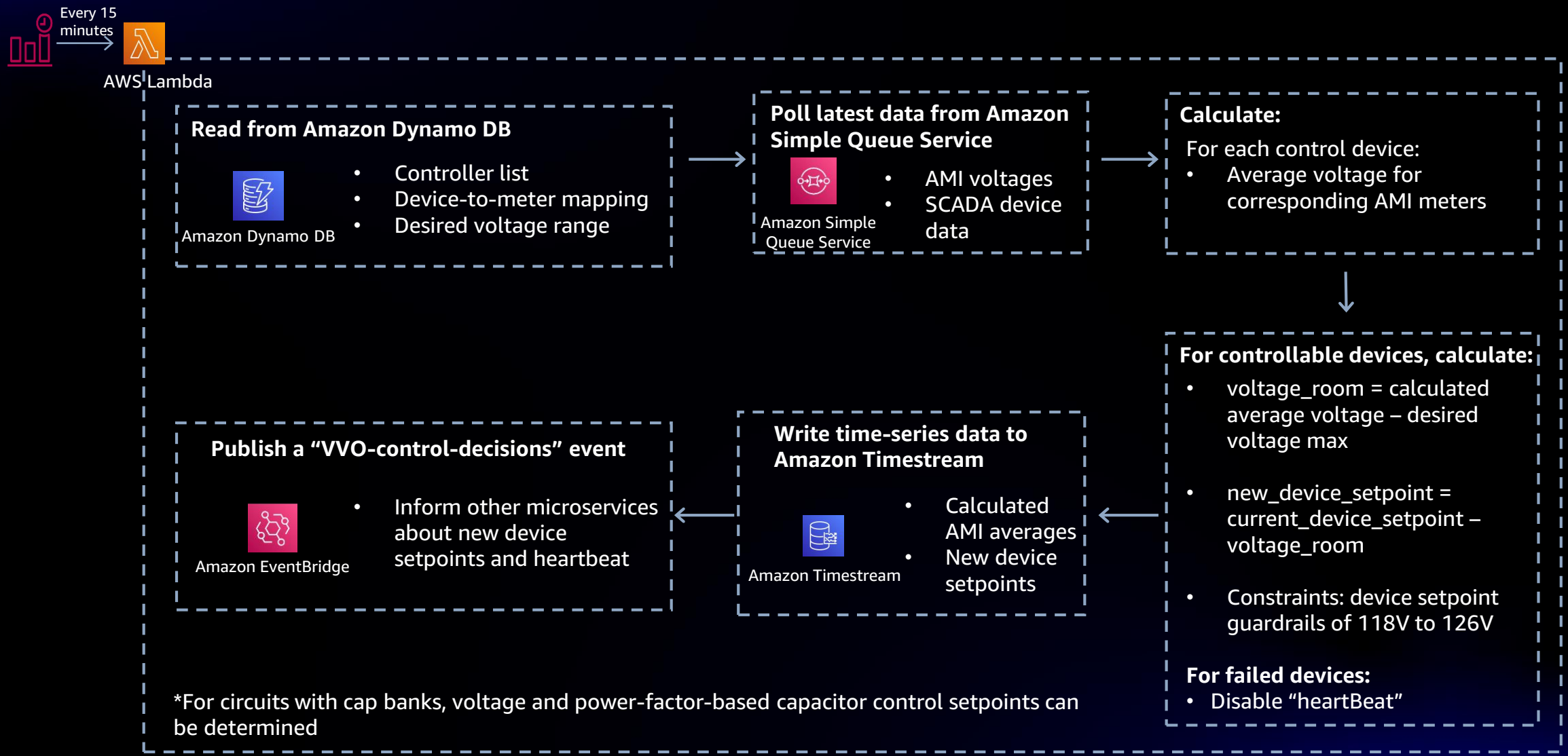
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Demo implementation architecture



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

VVO implementation



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Assumptions used for the demo

- 1000 total customers and 1 control device for demo circuit
  - 10% AMI meters read near real time
  - AMI data available at the top of each hour
  - Device data available every 5 minutes (5 minute DNP3 integrity poll)
  - Control decisions made hourly
  - Control failure detection run every 5 minutes
  - Savings calculations run every 5 minutes

- Savings calculations:
  - CVR_{factor} = 0.8
  - Cost of energy purchase/generation = 1.1 cents/kWh
  - Electricity rate for end customer = 11 cents/kWh
  - Carbon emission = 1111 lbs/MWh

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Thank you!

Abhineet Parchure

parchua@amazon.com

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.