

# Imagining the future of DER C&C

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Amzur Technologies







Think different

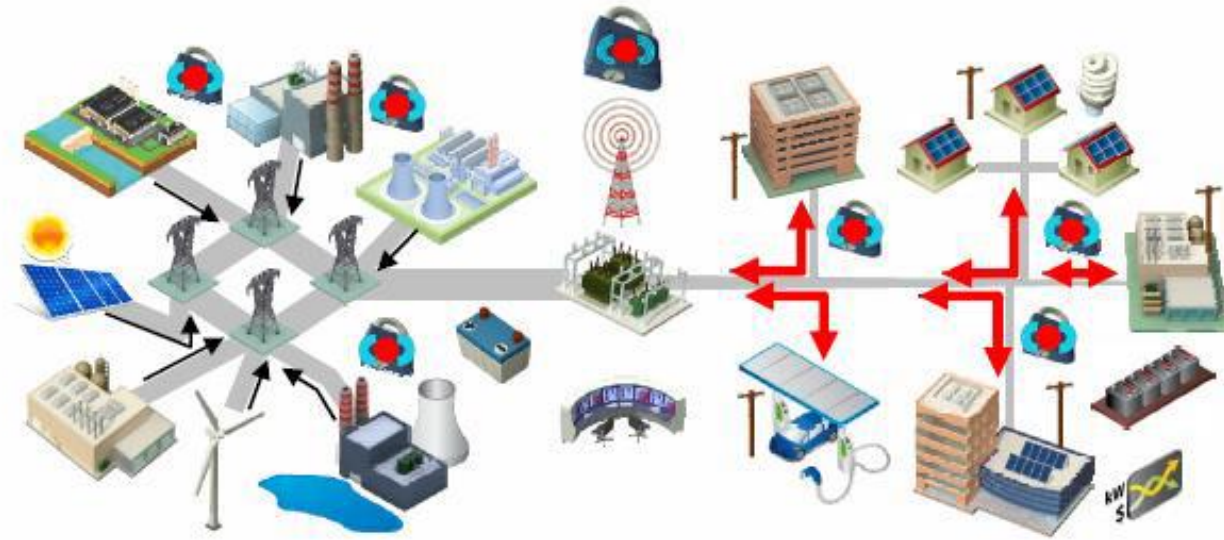


The ability to perceive  
or think differently  
is more important than  
the knowledge gained.

David Bohm

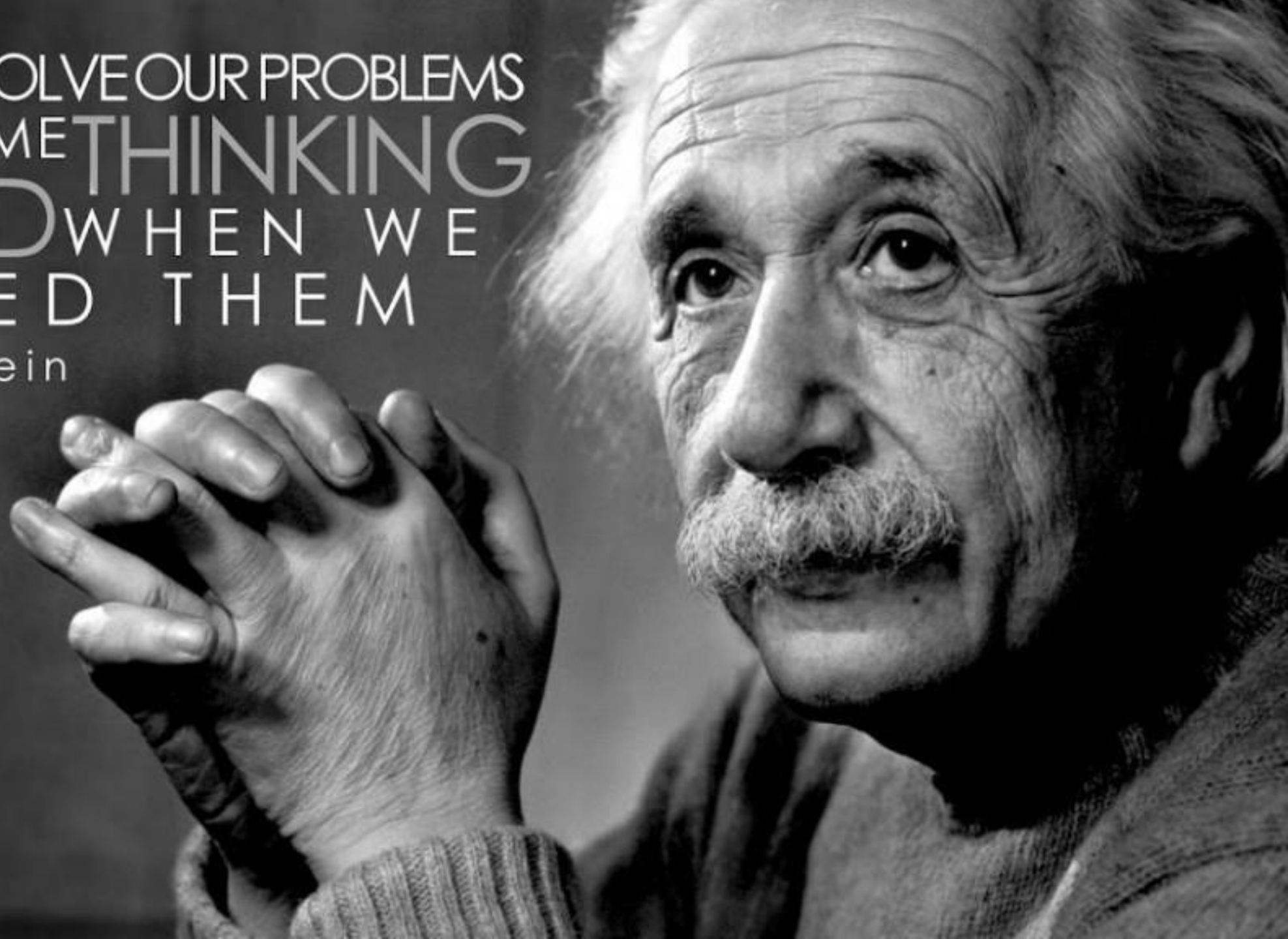
Will the current discussion on OpenADR DER support a fundamental transition from a **baseload-to-peak system** to **inherently uncertain supply and dynamic, flexible demand** model?

Small questions don't yield Big Answers.

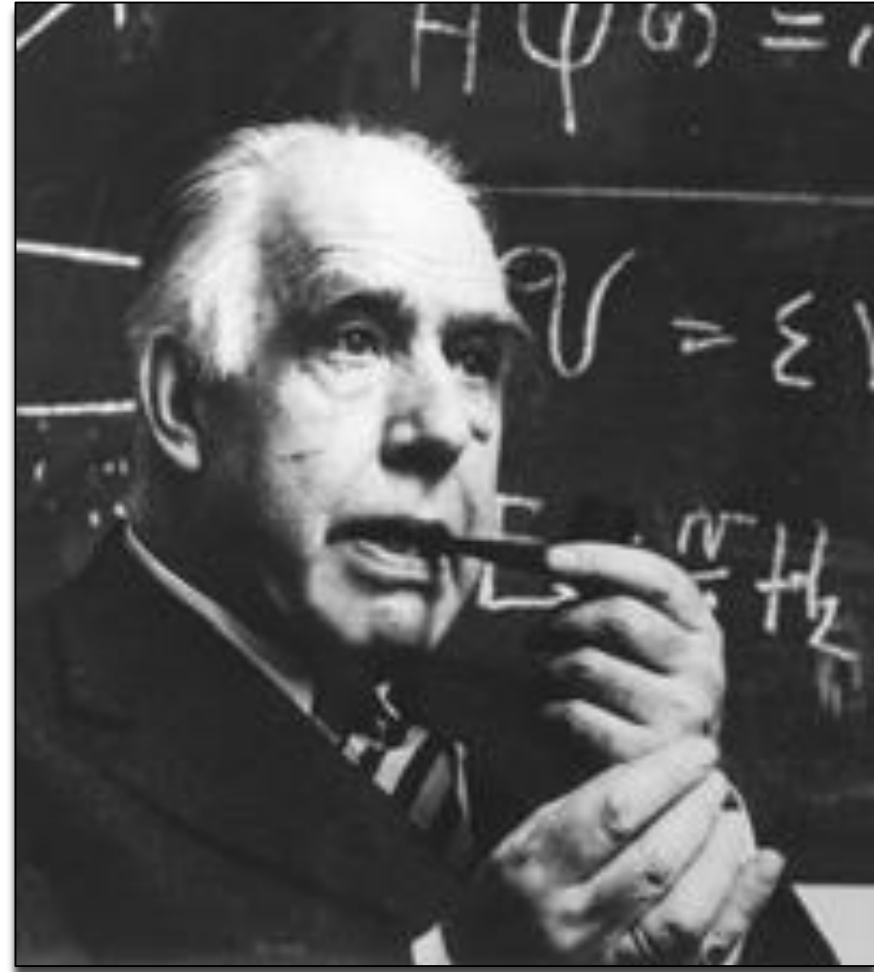


WE CANNOT SOLVE OUR PROBLEMS  
WITH THE SAME THINKING  
WE USED WHEN WE  
CREATED THEM

-Albert Einstein



If you think you  
understand reality,  
that shows  
you don't know  
the first thing  
about it.



Niels Bohr

## Power sector is 20 years behind IT revolution

[illegible]

# A very short list...

- ✓ The data collection process for the Coordinating and Balancing Authorities and the Transmission Operators is labor intensive and error-prone.
- ✓ The data is not readily normalized or shared across the regional service area among market participants (recognizing that some data does need to be anonymized).
- ✓ The planning horizon datasets do not seem to be designed to incorporate real-time data; incorporating time-series data at different intervals (60-second; 15 minute; one-hour) simplifies integrating higher penetration of variable energy resources.
- ✓ LSE and TSO forecast methodologies are narrative rather than quantitative. No simple way to test/simulate the impact of certain forecast assumptions across the entire planning area or within subareas.
- ✓ Data accessibility can readily be applied to market forecasting.
- ✓ Planning models are not integrated within and across transmission service areas.

# 3 Big Challenges

- Re-think architecture
- Re-think autonomy
- Better accommodate uncertainty by Integrating DER into Integrated Resource Plans and next-day/same day operational planning horizons

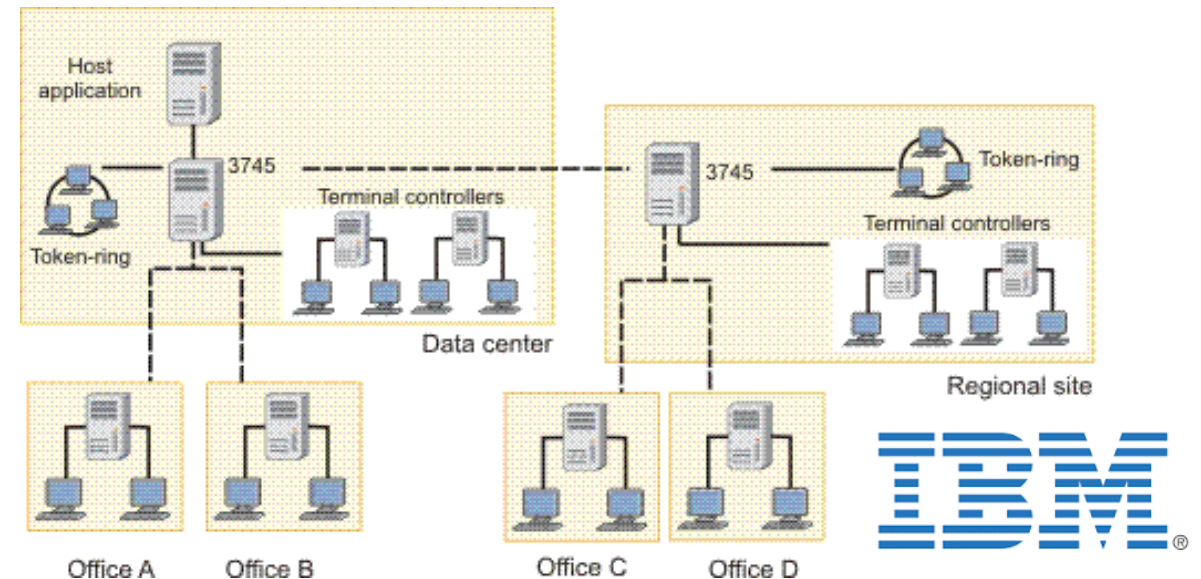
# Lesson from the Past

IBM's System Network Architecture (SNA) **dominated computer networking for over 20 years,**

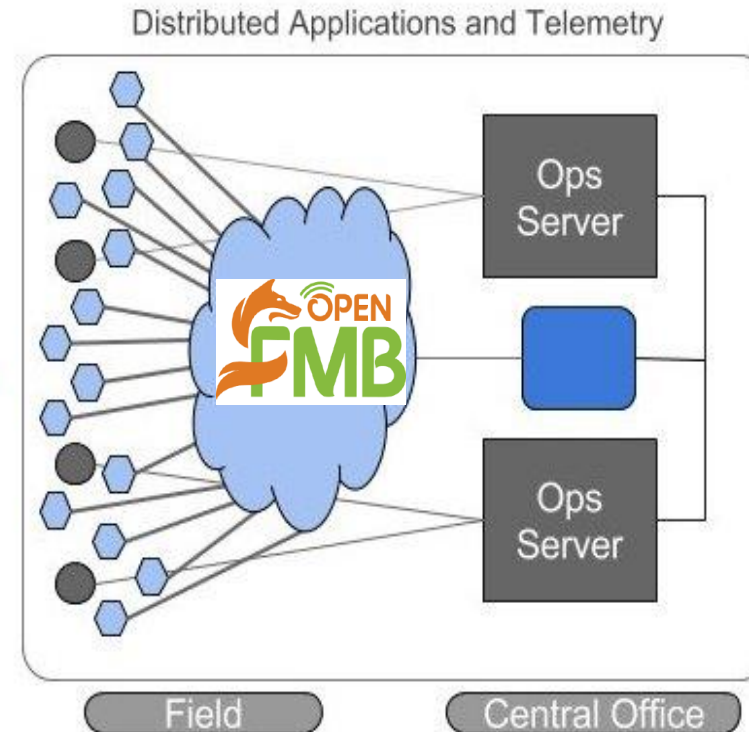
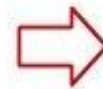
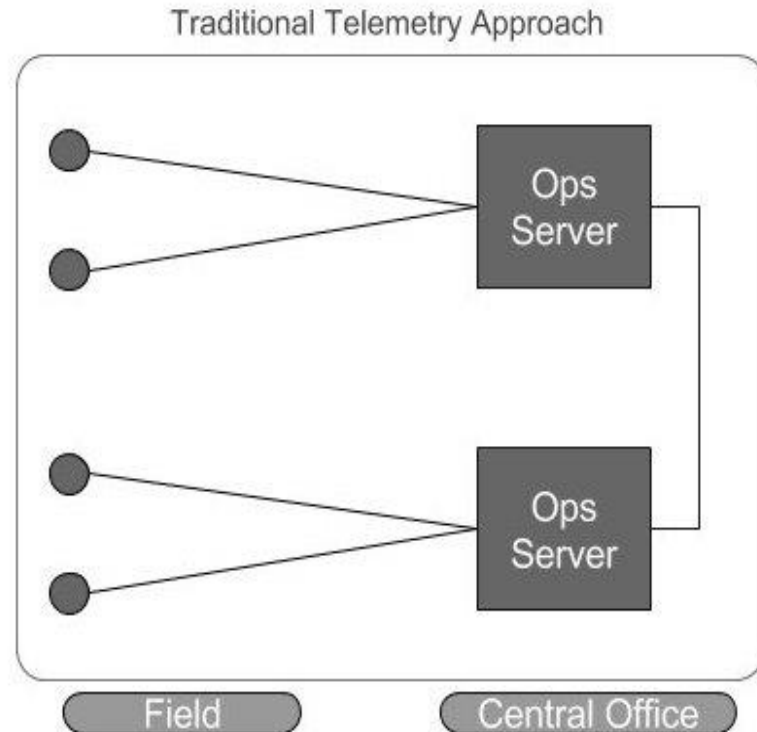
IBM estimates that their clients have invested \$20 trillion in SNA applications.

SNA design – **centrally managed, distributed architecture.**

TCP/IP – **decentralized, semi-autonomous architecture.**



# SCADA is master-slave, distributed architecture



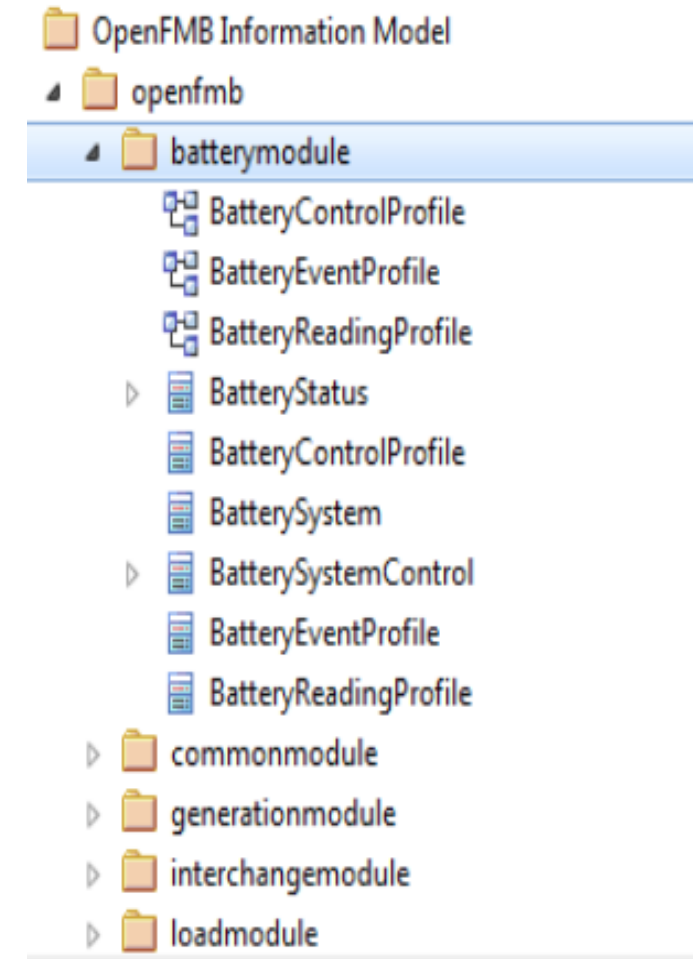
**Open FMB is a federated architecture**

decentralized, semi-autonomous



OpenFMB is based on a **common message bus** using well-proven IoT technologies.

- ✓ Not a client-server or master-slave architecture
- ✓ *Any* common data model with and *any* IoT Pub/Sub protocol
- ✓ No reinventing the wheel / no duplication of existing standards
- ✓ Security and configuration built-in
- ✓ Microgrid & DER management





Industry standard message protocols

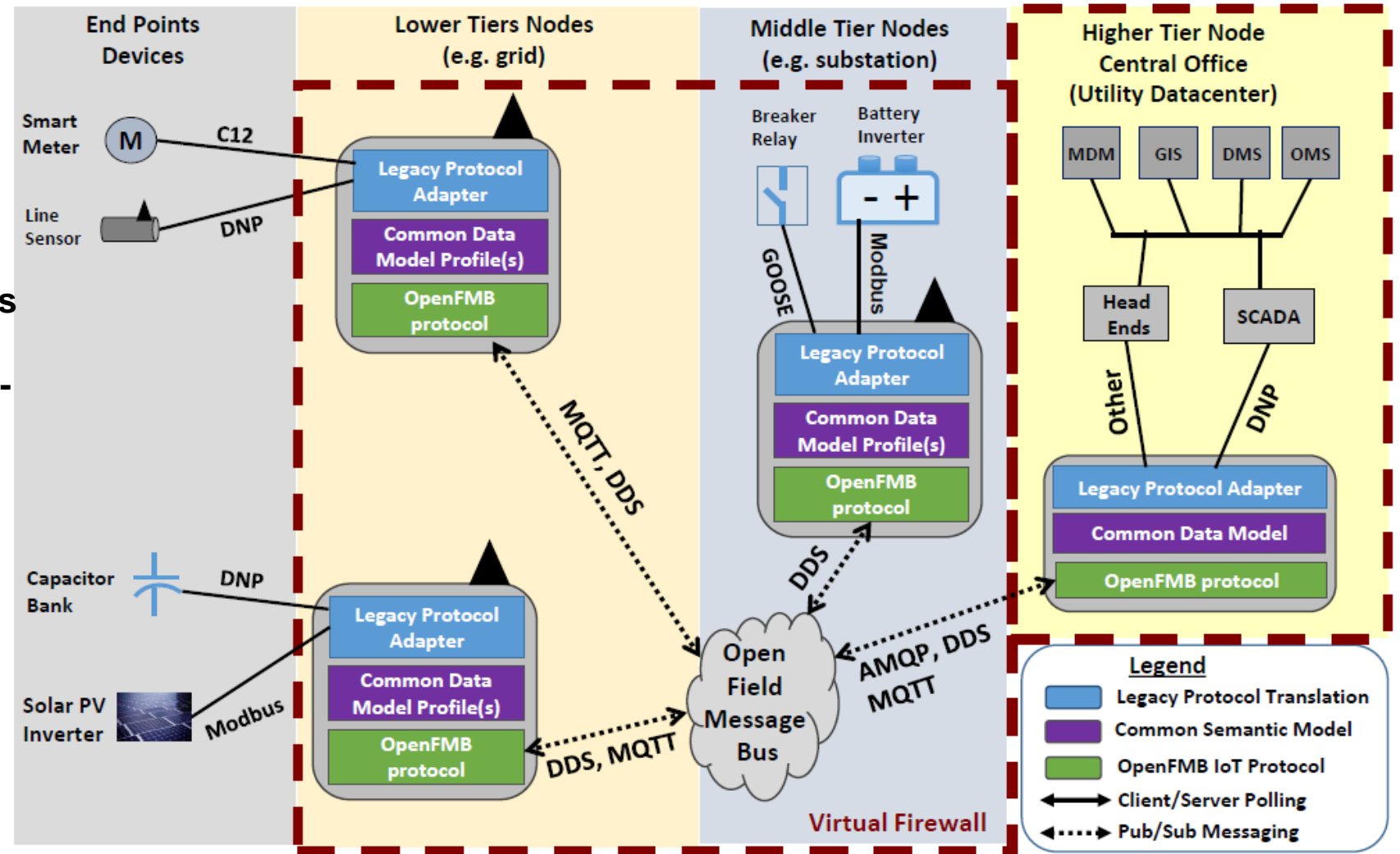
End-to-end situational awareness

Flexible, scalable, and backward-compatible

True **field interoperability**

Greater resiliency

Easy to integrate new technologies



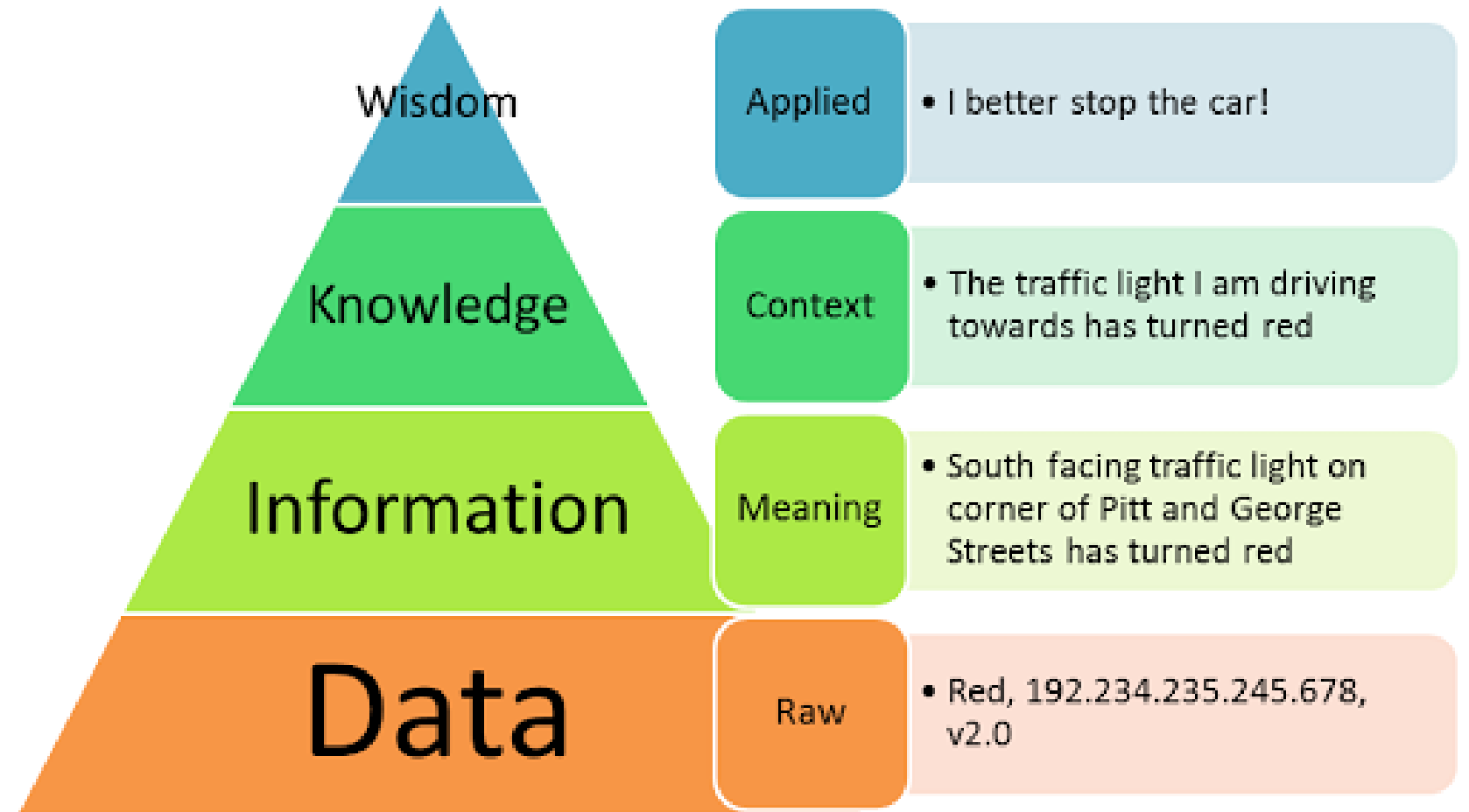
# Autonomy

Where is the control logic?

Tesla – centrally managed? no...

Too computation intensive.

But AI systems are watching and learning.



# Planning for Uncertainty

Short-term DER forecasting capability is key!

## Performance Characteristics Requirements for Grid-enabled Services

Service		Response time	Commit duration	Ramp Rate	Frequency
Regulation	Random unscheduled deviations in scheduled peak load	30 seconds	15 minutes	5 minutes	Continuous during specific bid period
Flexibility	Additional load following reserve for large, unforecasted wind/solar ramps	5 minutes	1 hour	20 minutes	Continuous during specific bid period
Contingency	Rapid and immediate response to a loss of supply	1 minutes	≤ 30 minutes	10 minutes	≤ 1 per day
Energy	Shed or shift energy demand over time	5 minutes	≥ 1 hour	10 minutes	1-2 times per day. 4-8 hour notification
Capacity	Generation alternative	Top 20 hours coincident with balancing authority area system peak			

Data from Table ES-1. Olsen, Sohn. Dudley, Goli, Kilicote (LBNL); Hummon, Palchak, Jorgenson, Denholm (NREL); Ma (DOE). 2013. *Grid Integration of Aggregated Demand Response, Part 1: Load Availability Profiles and Constraints*. LBNL-6417E.

# Planning for Source Uncertainty

## Short-term DER supply forecasting



ORANGE BUTTON

### forecastConditions

startTime  
endTime  
interval  
geographicBoundingBox -WGS84  
or googleMercator  
**forecastRadiation**  
**forecastPowerGeneration**  
dataQuality  
weatherDataSource  
timeReference - period of data

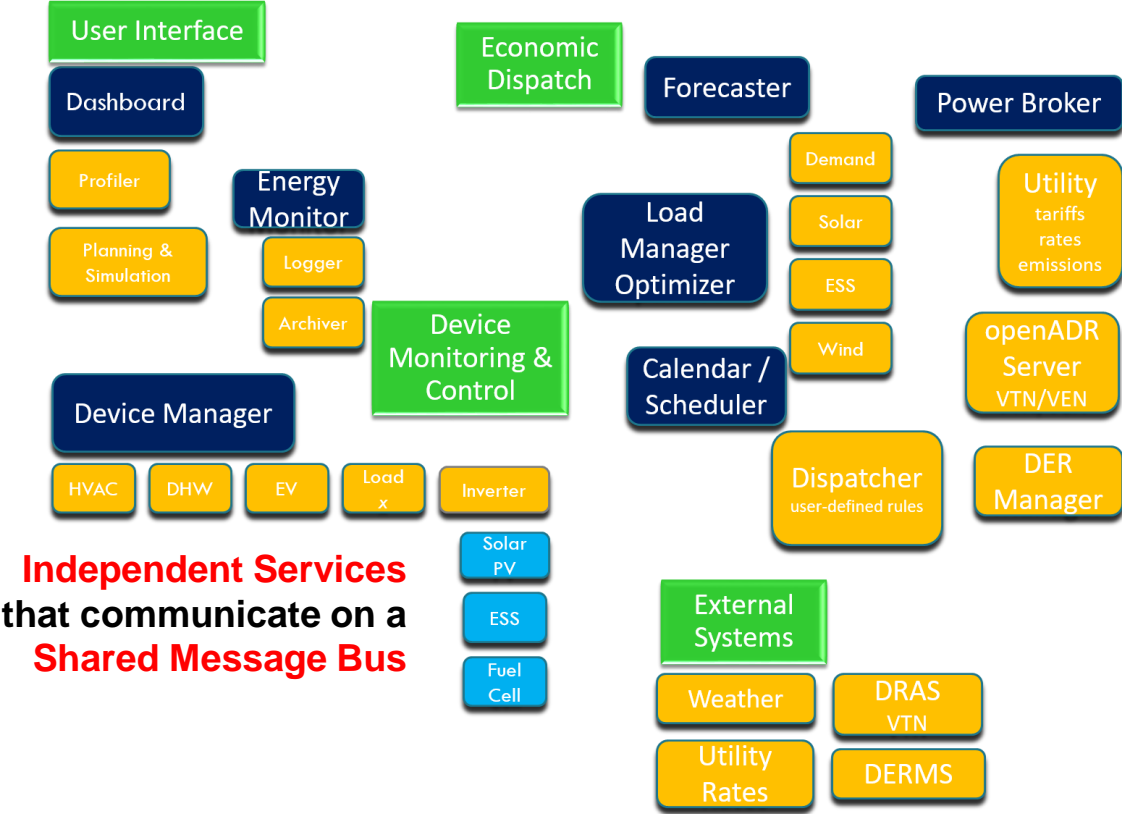
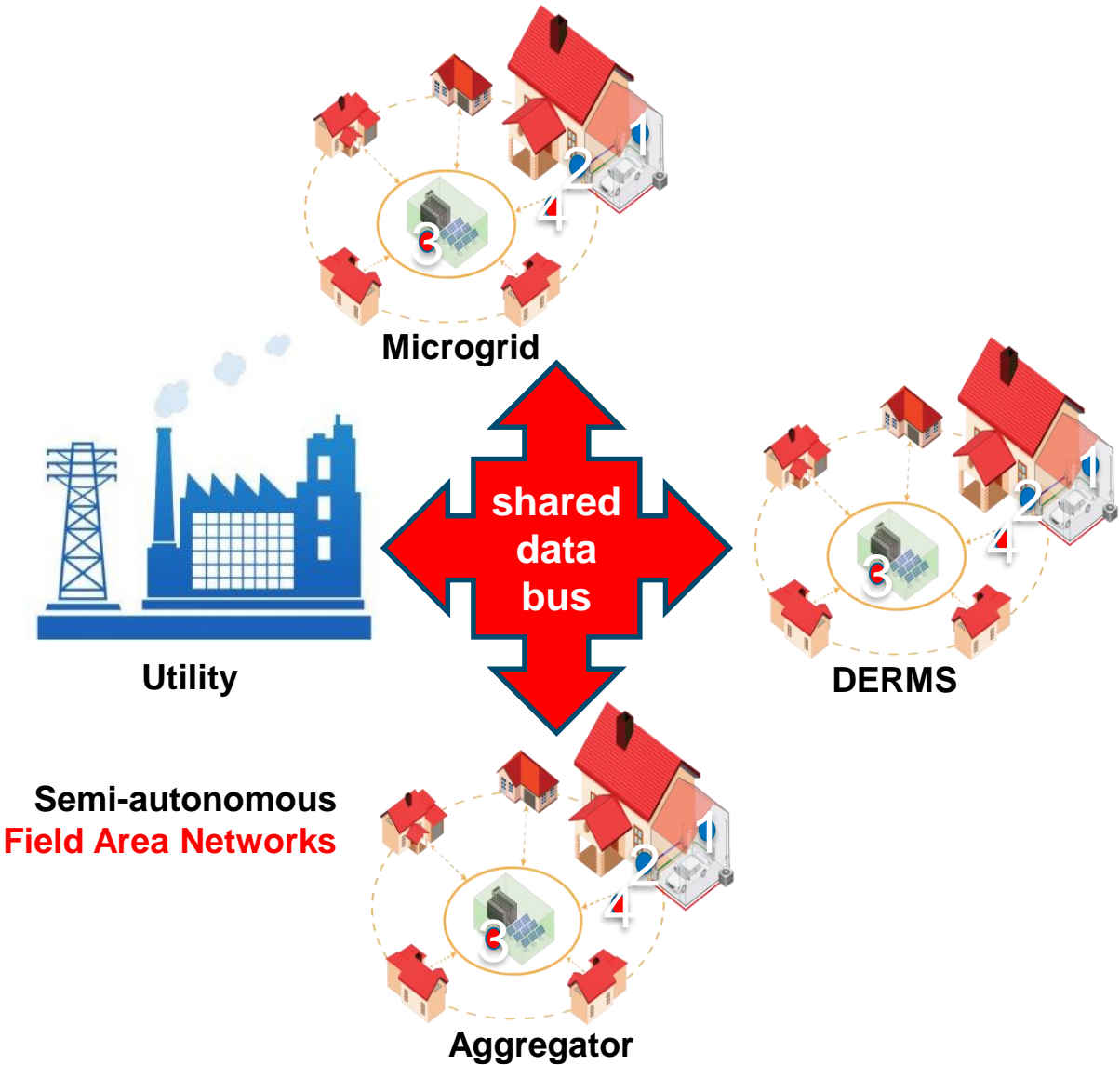
### forecastParameters

confidence (%)  
confidenceRange (% range)  
forecastAnalysisTime  
probability (%)  
validTime

### forecastRadiation

ghi  
ghi10  
ghi90  
dni  
dni10  
dni90  
ambientTemp  
zenith  
azimuth  
cloudOpacity

# A Decentralized Services Model



Who's next



Who's Next?