



NARUC Energy, Resources, and Environment Committee Meetings

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Silver Spring Networks



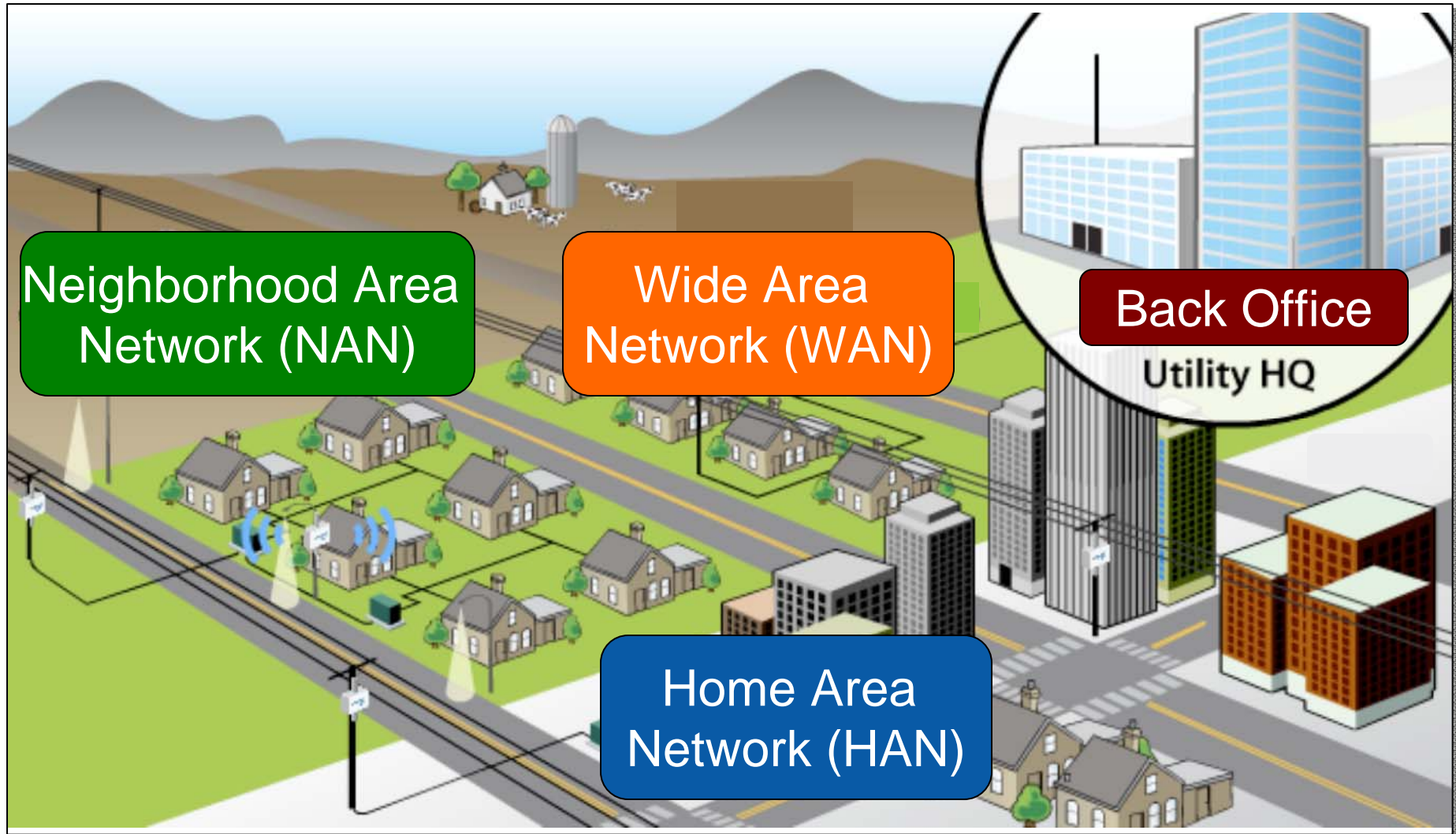
Networking '101'

- » The Smart Grid is a network
 - Think about modern IT systems
 - Lots of devices [meters, sensors, switches vs. computers, printers]
 - Lots of software / applications [metering, distribution management, outage vs. email, web browsers]
 - **Common Network**
- » Understand requirements
 - Networking is the glue for lots of Smart Grid devices
 - Performance optimized for Smart Grid needs

Smart Grid Questions

- » Where do we need **coverage**?
- » Why & Where does **interoperability** matter?
- » How do we **secure** the Smart Grid?
- » How much **performance** do we really need?
- » Can we “**future-proof**” our investments?

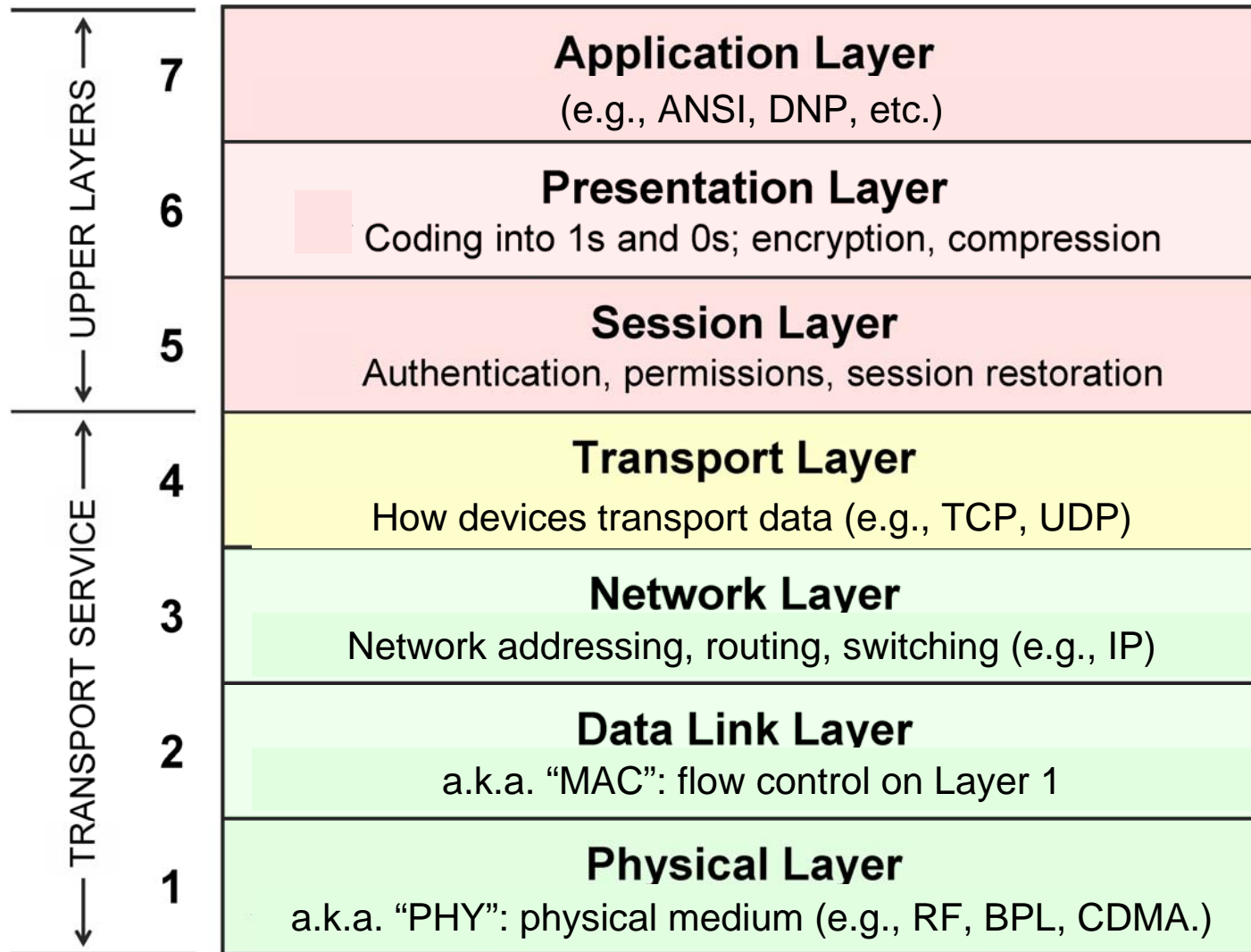
Topology and Coverage



Glossary of Terms

- » Bandwidth
 - How much data the system moves over a period of time
- » Latency
 - How long it takes a message to move from point-A to point-B
- » RF (Radio Frequency)
 - Use of 'air' as the carrier
- » PLC (Power Line Communications)
 - Use of the power line as the carrier, either 'broadband' or 'narrow band'
- » Frequency
 - Primarily of interest in RF systems – generally:
 - lower frequency = longer range and less interference
 - higher frequency = more bandwidth, shorter range, more interference
- » Packet
 - Single transaction of data. Large amounts of data use multiple packets.

The OSI “Stack” and Interoperability



Glossary (yes, there's more!)

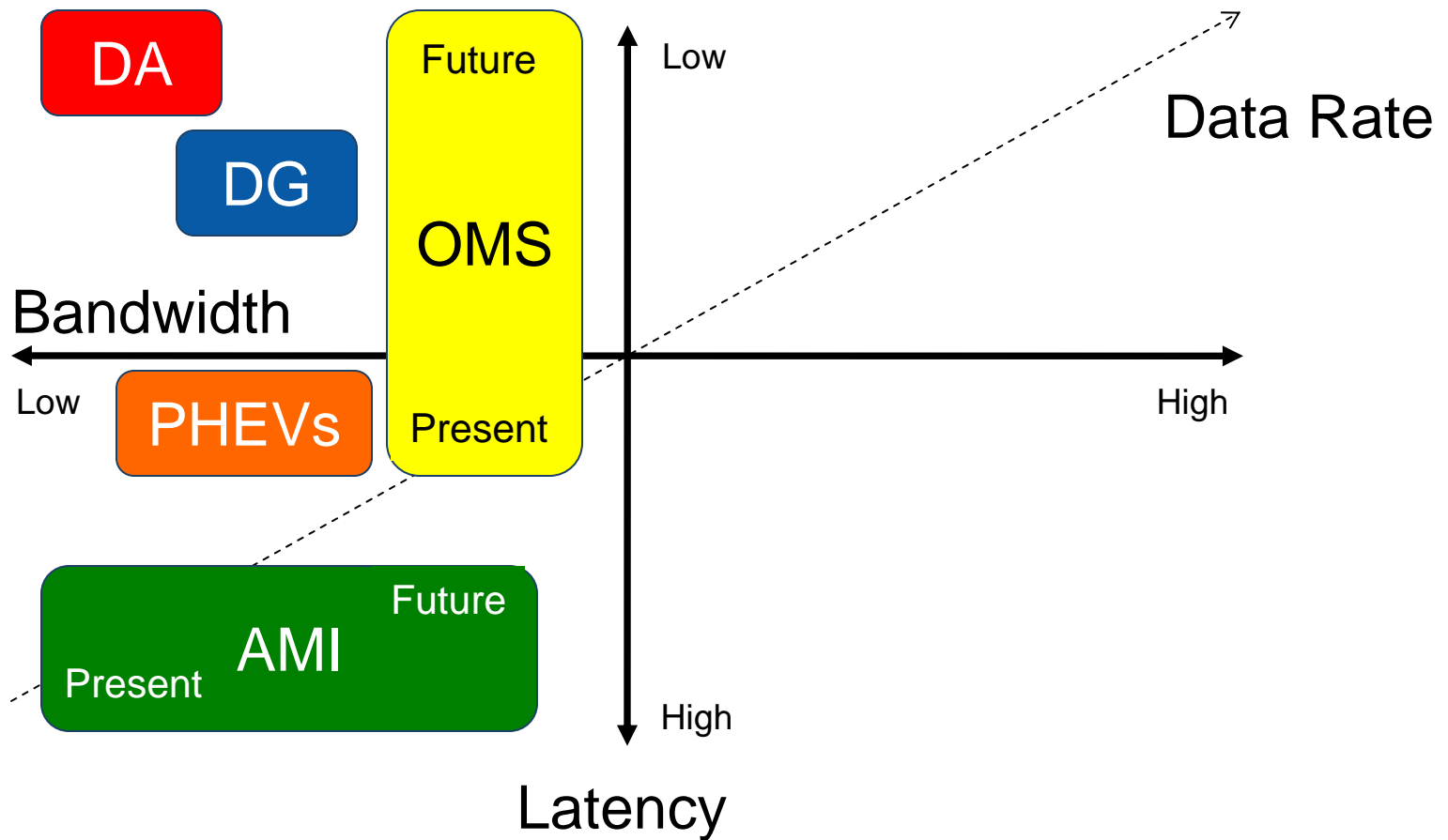
- » Mesh
 - Devices on the network can 'talk' to other peer devices and 'hop' messages around the network
- » Point-to-point
 - Direct communications between two devices, often known as "Star" topology
- » Virtual Private Network (VPN)
 - Creating a virtual 'Closed' or private network over an otherwise 'Open' network for security reasons (think banking or logging on to your work network from home)
- » Encryption
 - Process of turning information into an algorithm (code) to make it unreadable to anyone who does not have special knowledge, generally known as a 'key'
- » Firmware
 - Operational software that is loaded into a hardware device

Future-Proofing



Seamlessly connect all people and devices that generate, distribute or use energy

Latency + Bandwidth = Data Rate



Utility / Regulator Challenges

- » If money were no object.....
- » Define the problem
 - Applications: Metering? Distributed Automation? Distributed Generation?
 - Requirements today vs. 10-15+ years out?
- » Recognize things change
 - How does the system incorporate new technologies?
 - What can't I do with the system I am considering?
 - How easily can I change parts of the system?
- » Balance known needs and foreseeable opportunities to deliver a reasonable Smart Grid business case

Conclusions and Recommendations

Category	Metrics	Recommended Target
Coverage	% homes / devices covered	100% - no customer left behind
Interoperability	At which level/layer?	Everywhere possible Back office = Webservices/SOA Application = ANSI, DNP, etc Network = IP Transports = many
Performance	kpbs point/point latency	AMI ~ 15-20kpbs / SG ~ 40kpbs++ AMI ~ 3-5 second on-demand, full SG ~ <100ms point / point
Security	20 year threat assessment	AMI-SEC, others have prescribed Strong Encryption – 256 AES Public/Private rotating key management No 'security through obscurity'
Future Proof	Doesn't likely exist, so use a reasoned approach to what we can affect / predict	-Flash upgradeable firmware -Extra bandwidth (2-3X known need) -Extra memory (4-5X known need) -Open Standards everywhere

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