AUSTRIAN INSTITUTE OF TECHNOLOGY
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Attack Vectors to Metering Data in Smart Grids under Security Constraints

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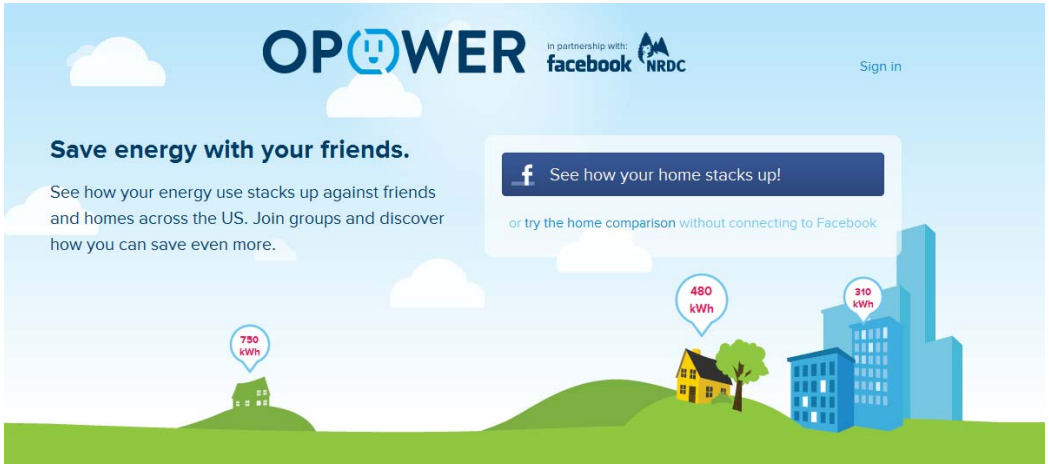
Smart Grid

An electricity network that integrates the behavior and actions of all users connected to it - generators, consumers, or both – to ensure an economically efficient, sustainable power system with low losses and high levels of quality and security of supply and safety [3].

[3] European Regulators Group for Electricity and Gas, *Position paper on Smart grids*, 2010

Smart Energy Community Portal



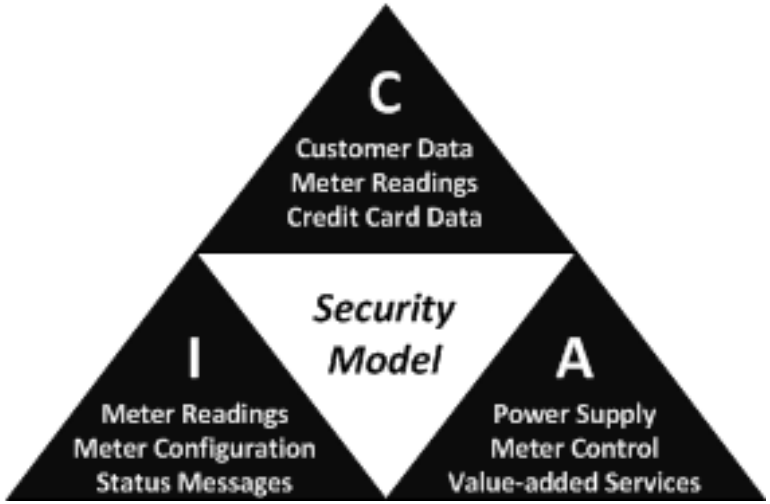
[source] www.opower.com

[source] smartenergygroups.com

Stakeholders

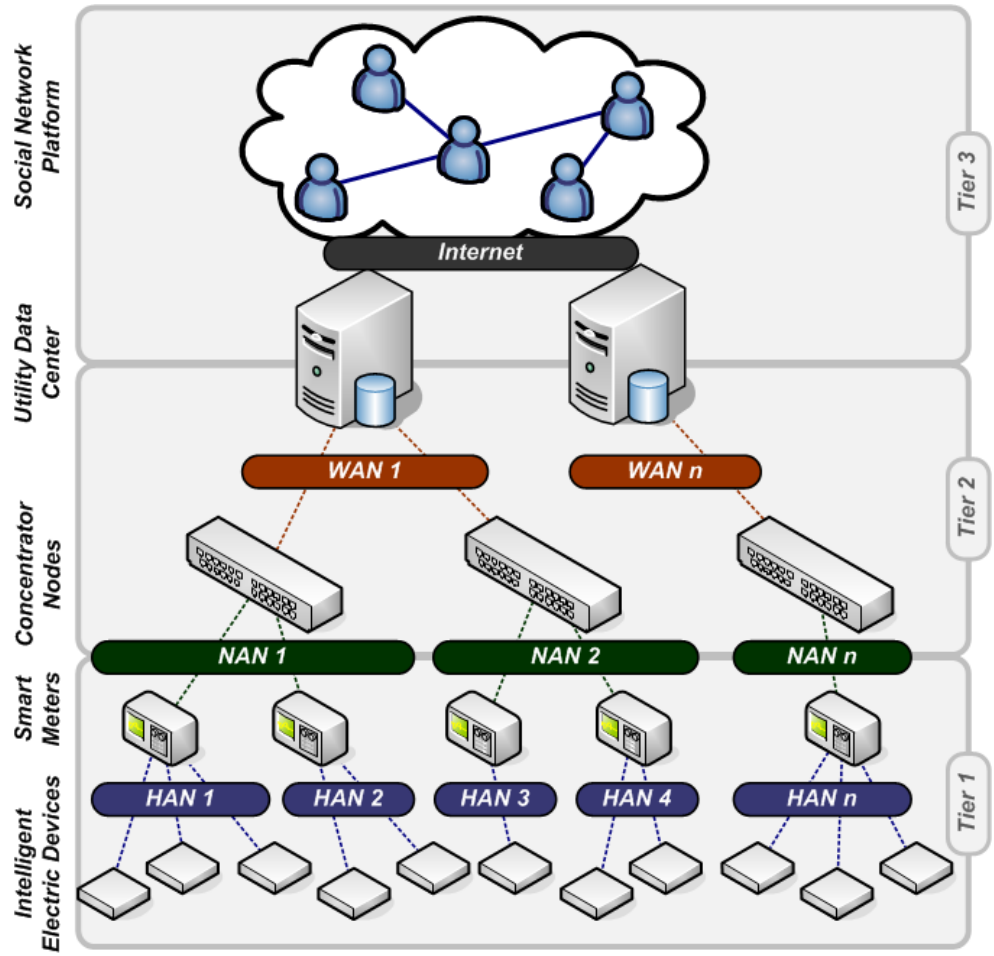
- **Energy Providers** use aggregated data to estimate midterm energy requirements of customers.
- **Grid Operators** real-time metering data to ensure the smooth operation of the network (e.g., detect and compensate local overloads).
- **Billing Companies** demand for accurate consumption data to implement envisioned flexible price models.
- **Third-party Services Provider** are used to generate consumption profiles and potentially compare them within so-called “energy saving communities”
- **Governmental Agencies** might demand access in preparation of lawsuits.

Security Principles and Protectoin Objectives

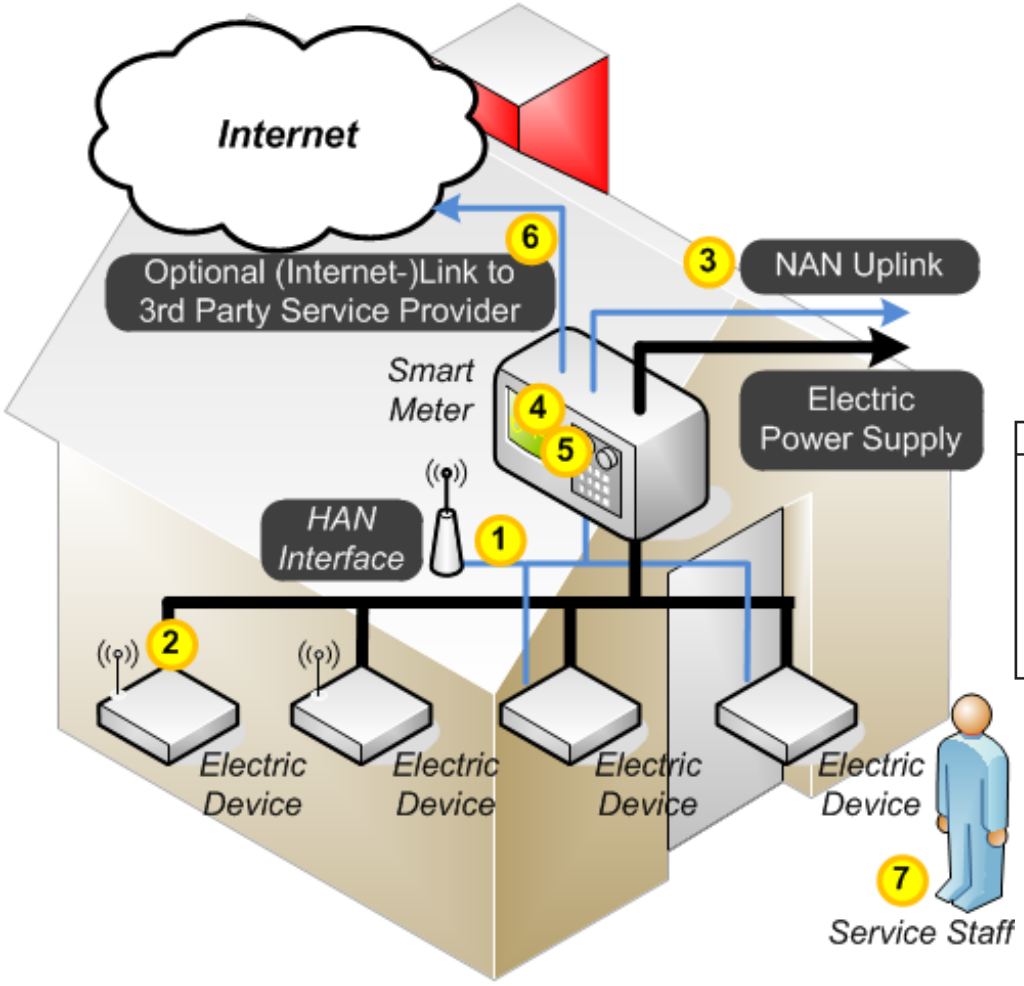


- Availability of the the Power Grid
- Legitimate Power Consumption and Delivery
- Privacy of Consumers

Smart Metering Infrastrucutre: a layered model

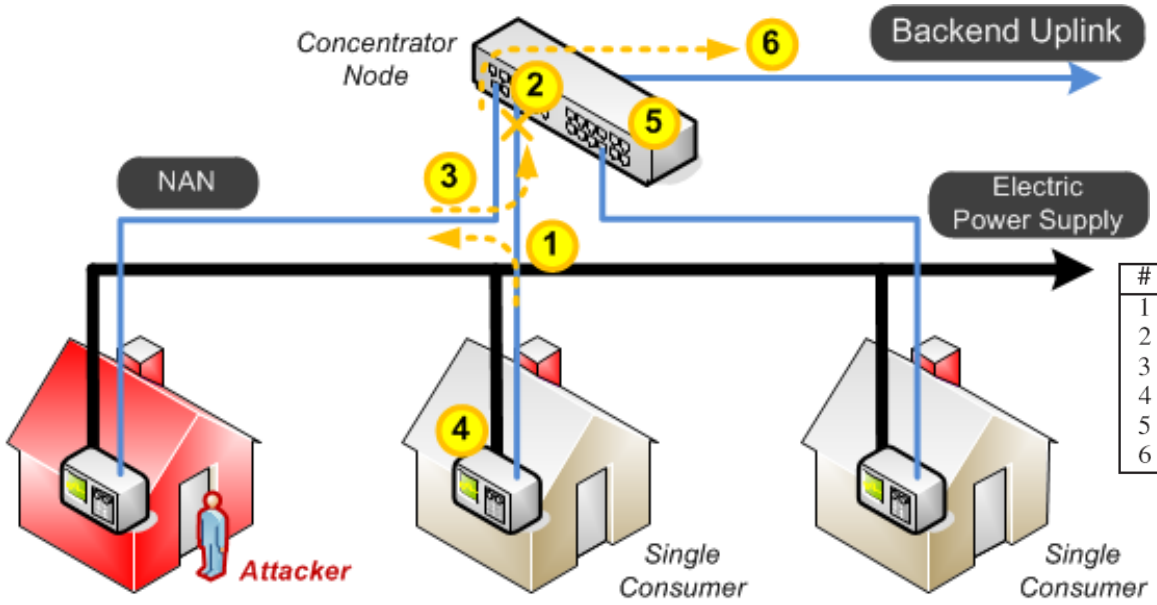


Tier 1 Threats: Smart Meter Attack Vector



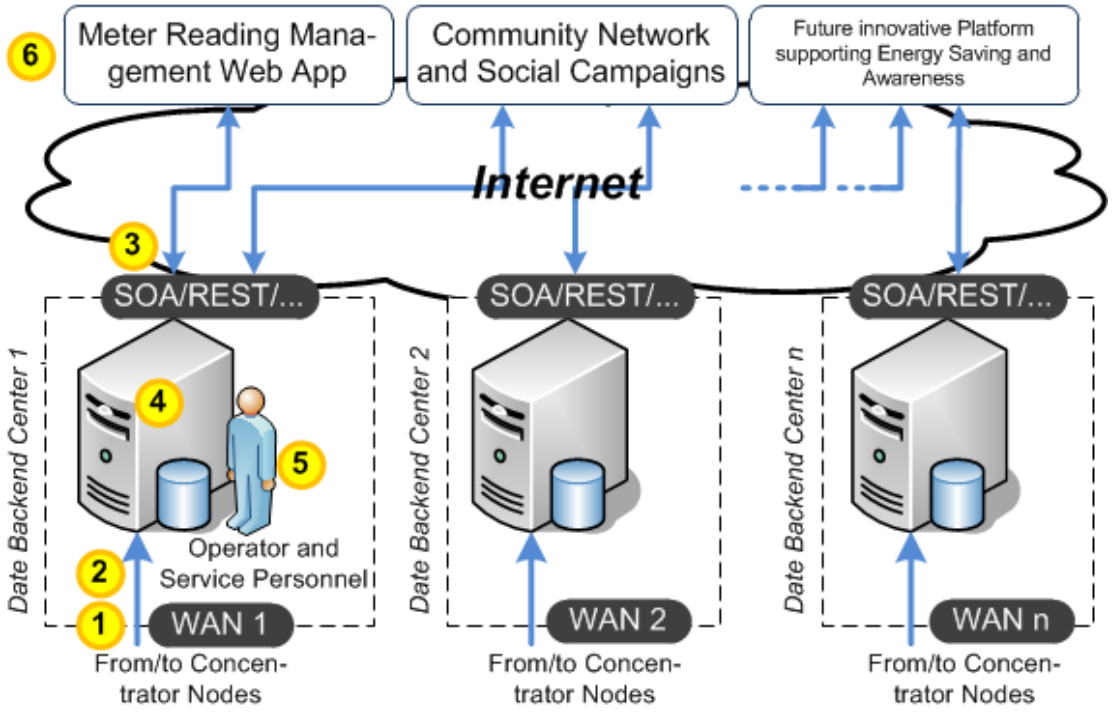
#	attack action	estim. effort	c	i	a
1	HAN sniffing	low – medium	x		
2	HAN message tampering	medium – high		x	x
3	sm. meter NAN shielding	low			x
4	sm. meter false reporting	high		x	
5	sm. meter swapping	low		x	
6	configuration manip.	medium	x		x
7	social engineering	n/a	x	(x)	x

Tier 2 Threats: Electric Utility Attack Vector



#	attack action	estim. effort	c	i	a
1	NAN sniffing	medium – high	x		
2	NAN comm. blocking	medium			x
3	NAN msg. tampering	high		x	x
4	neighbor meter DoS	high			x
5	concentr. node DoS	medium			x
6	utility data center intr.	very high	(x)	(x)	(x)

Tier 3 Threats: Web Services Attack Vector



#	attack action	estim. effort	c	i	a
1	WAN sniffing	n/a	x		
2	data backend DDoS (WAN)	n/a			x
3	data backend DDos (Internet)	n/a			x
4	data backend intrusion	n/a	x	x	x
5	data theft through social eng.	n/a	x		
6	attacks against Web Apps	low-medium	x	x	x

Security Recommendatoins

- Physical robustness and tamper resilience of smart meters and concentrator nodes in order to hinder numerous hardware hacks and attacks.
- Authentication of users and devices using strong passwords, digital certificates and signatures.
- Authorization of users and devices to grant them least privileges to access resources and services.
- Encryption of communication data and user data in the utility data center.
- Integrity and plausibility checks of data, such as meter readings, grid status messages, and network traffic.
- Training of technicians and service staff to prevent social engineering.