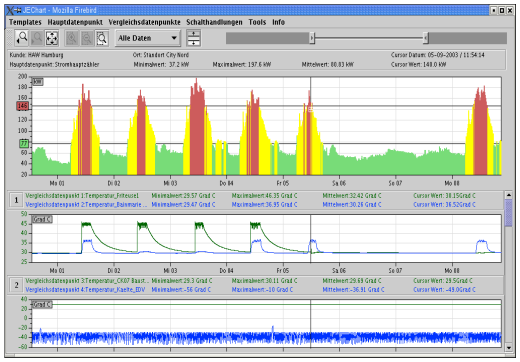
Communication Requirements for Demand Side Management and Microgrids

Communication helps coordination helps...

Peter Palensky

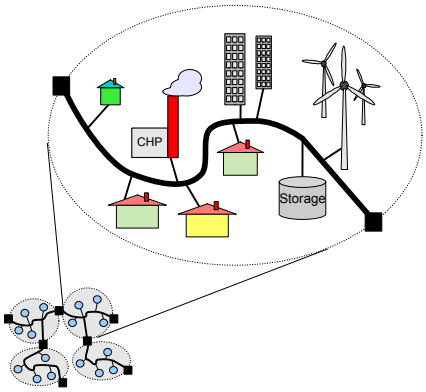
IT for Microgrids and DSM

- Graphical Information System GIS
- Electronic Contracts (EDIFACT, etc.)
- Remote Diagnosis
- **„Global" Control**
- Data Acquisition
- Protection
- Metering
- Billing, etc.



Transport of Energy and Information

- Combine Microgrids and fine grained DSM
- What coordination is needed?
  - Market driven
  - Grid operation
- To solve:
  - Common model of DR potential and microgrid opimization
  - Suitable global/local communication infrastructure

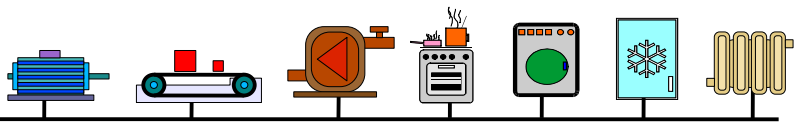


„Global" remote instrumentation/operation

- Reliable, robust
- Geogr. available
- Affordable
- Secure

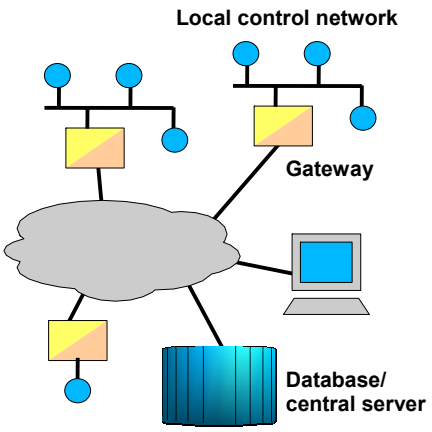
} only existing Internet/Telephone

- Categories: Meter reading <-> Alarm message?
- Multiple vendors: Standards, Interoperability



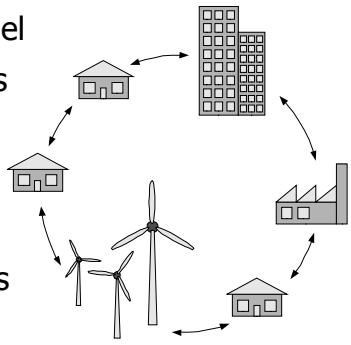
Properties of „the cloud"

- Internet
  - Abstract view of many network technologies
- Unknown
  - Topology
  - Transport
    - ATM, Dial up lines
    - Satellite, FDDI, etc.
  - Reliability

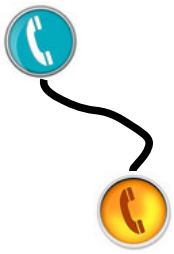


Gobal network based control

- (real) NBC needs **real time transport**
- General purpose global communication
  - Unreliable communication channel
  - Packets/line dropped, sometimes offline, etc.
- -> distributed design
  - ahead-schedules
  - anticipated local offline-scenarios
  - robust algorithms
  - accurate time sync & common strategy



Comparison of communication channels



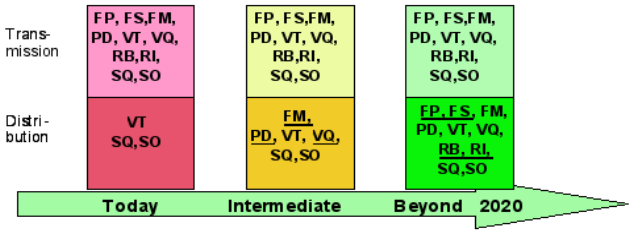
- Quality of service (QoS)
  - Bandwidth, latency, jitter, delays, reliability, dial-in-time, etc.
  - E.g.: Satellite link 250ms latency
- Availability
  - Dial up, static, dial-up probability, local availability, etc.
- Costs
  - Per packet, time, session, MB, monthly costs, etc.
  - Hardware, software license, etc.

Example: Costs for GPRS

- General Packet Radio Switching
  - A GSM service, hundreds of tariffs...
- Austria
  - No fixed monthly costs but for **real** traffic
    - GPRS 1 EUR/MB
    - GPRS/WAP 0,03 EUR/kB
    - GPRS 0,20 EUR/32kB
    - SMS: 0,15 EUR (0,01 EUR with 5 EUR monthly)
- Germany
  - More expensive + one dummy-block per hour...

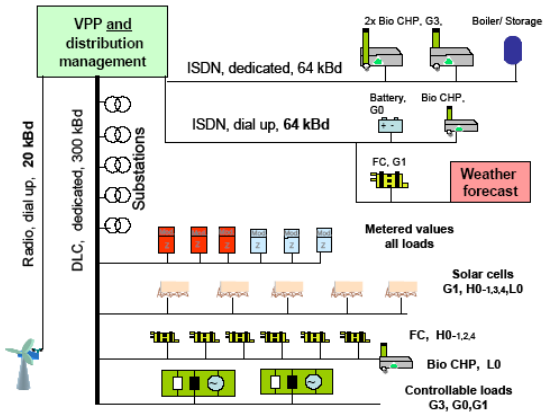
Anciliary Services via DERs?

Frequency stability:	FP – Primary control power (<30s)
	FS – Secondary control power (< 5 Min.)
	FM – Minute reserve power (7–15 Min.)
Power Balancing:	PD – Scheduling and Dispatch
Voltage Stability:	VT – Tap changer control
	VQ – Reactive power control
Restoration of supply:	RB – Black start capability
	RI – Island operation
Further system management:	SQ – Power quality assurance
	SO – operational and asset management



DER Virtual Power Plant (VPP) and IT

- Simulation
- Usage of IEC 61850
- IT Optimization
  - Topology
  - Transport
    - DLC, ISDN, Radio
- Interoperability
  - Price = network overhead



Message types and requirements

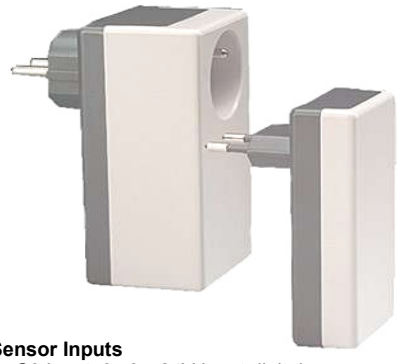
Information class	Abbreviation	Latency time, s	Real time requirement
Error messages, high priority	SMH	1	high
Error messages, low priority	SMN	5	medium
Messages, high priority	MH	5	medium
Messages, low priority	MN	10	low
Measured values, single	MWE	2	medium
Measured values, array	MWF	30	medium
Metered Value	ZW	2	high
Command with confirmation	BR	2	high
Command without confirmation	BO	2	medium
Setpoint value, single	SW	1	high
Profile setting (max 96 entries)	PV	20	high

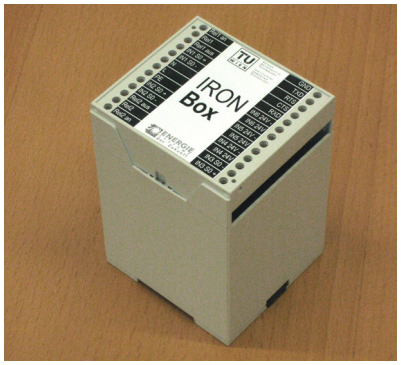
ENERGIE SYSTEME der Zukunft

IRON CONCEPT

- Fine grained control of energy resources
- Wide area automation network
- Distributed Algorithms

IRON Box Models



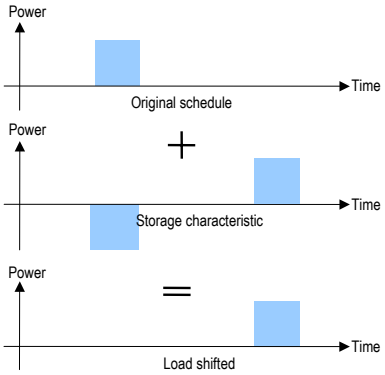


Sensor Inputs
3x S0 Input, 3x 3…24V Input digital
Switch Outputs
2 Relay outputs
IRON Communication Interface
GPRS or WLAN Module

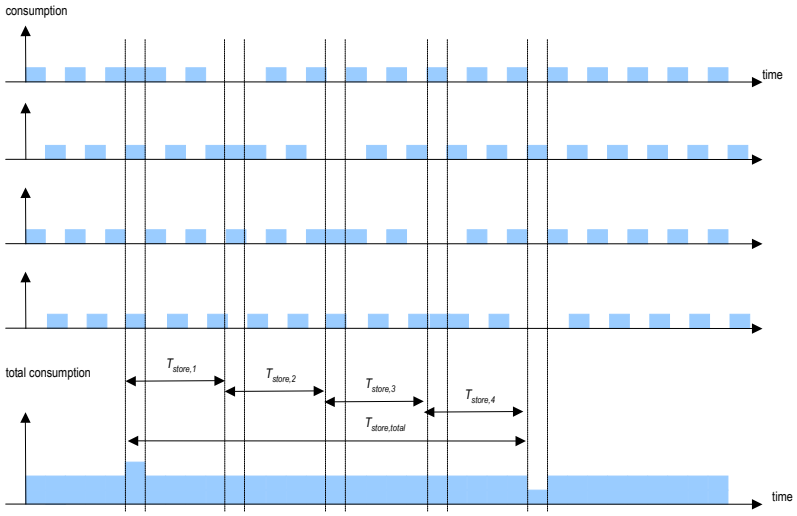
currently 200 EUR,-

IRON Model: Everything is a storage...

- Shiftable loads, load shedding, real storages, etc.
- Kept at 50%
  - de/charge
- How deep can IRON reach?
- Capacity problem
  - How large?
  - How long?

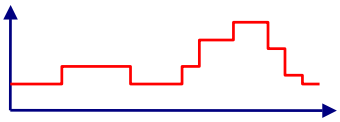


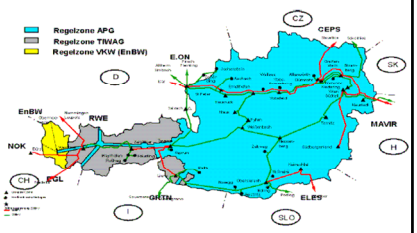
Serial & parallel energy cascades

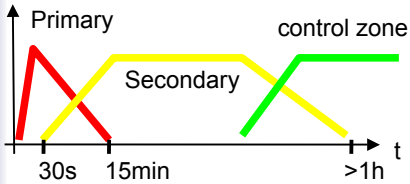


IRON: Two business cases

- Time of use / RTP tariff
  - 5 EUR /a
- Regulation Energy
  - primary: 40 – 400 EUR /kWa
  - 2 – 20 MW minimum

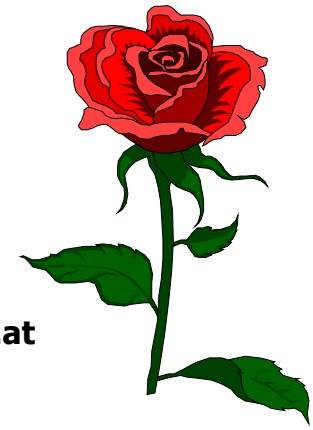






IRON Field Trial 2008

Thank you!



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