Trust-Aware Self-Organizing Supply Demand Management in Smart Grids
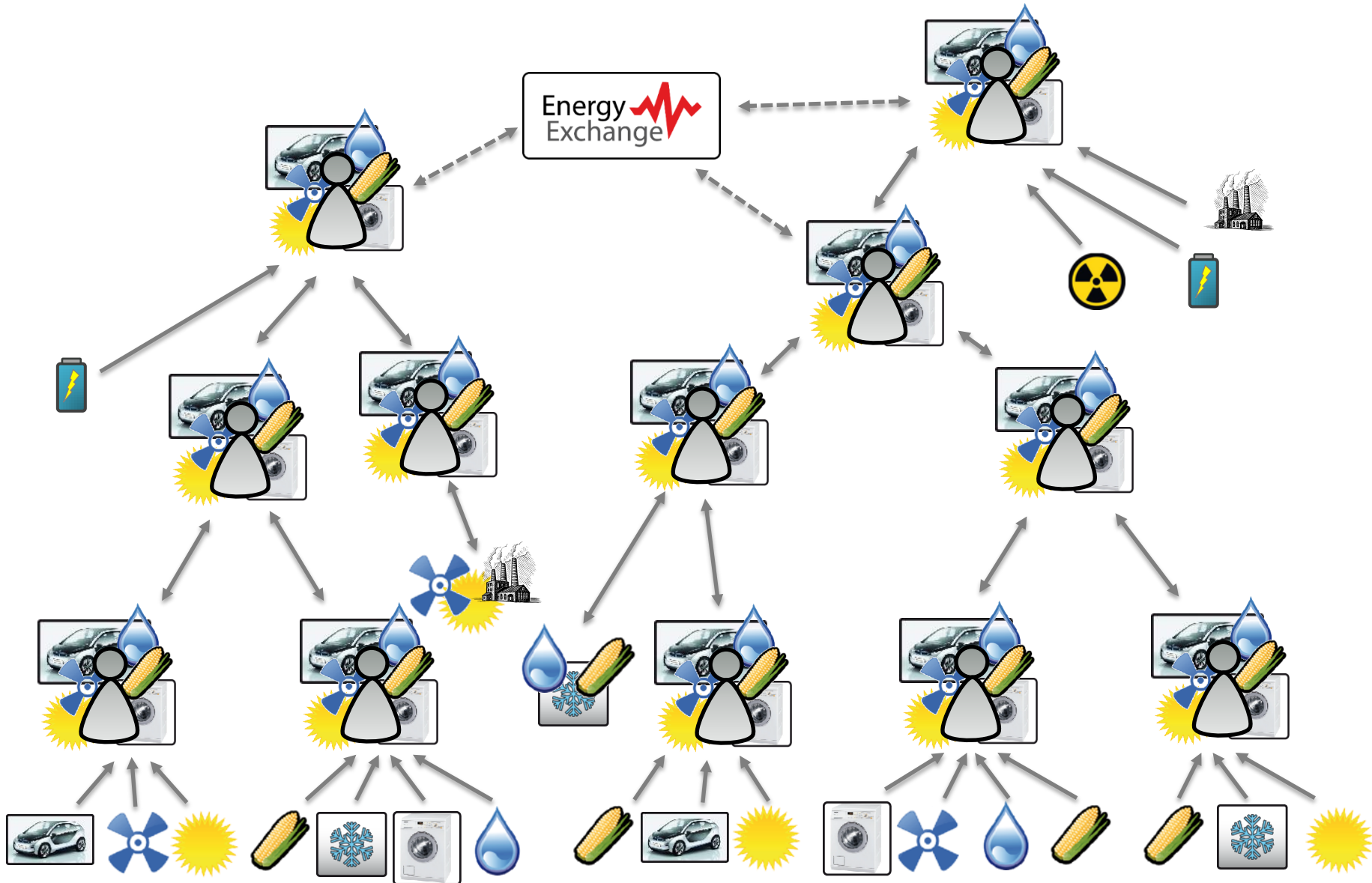
Florian Siefert
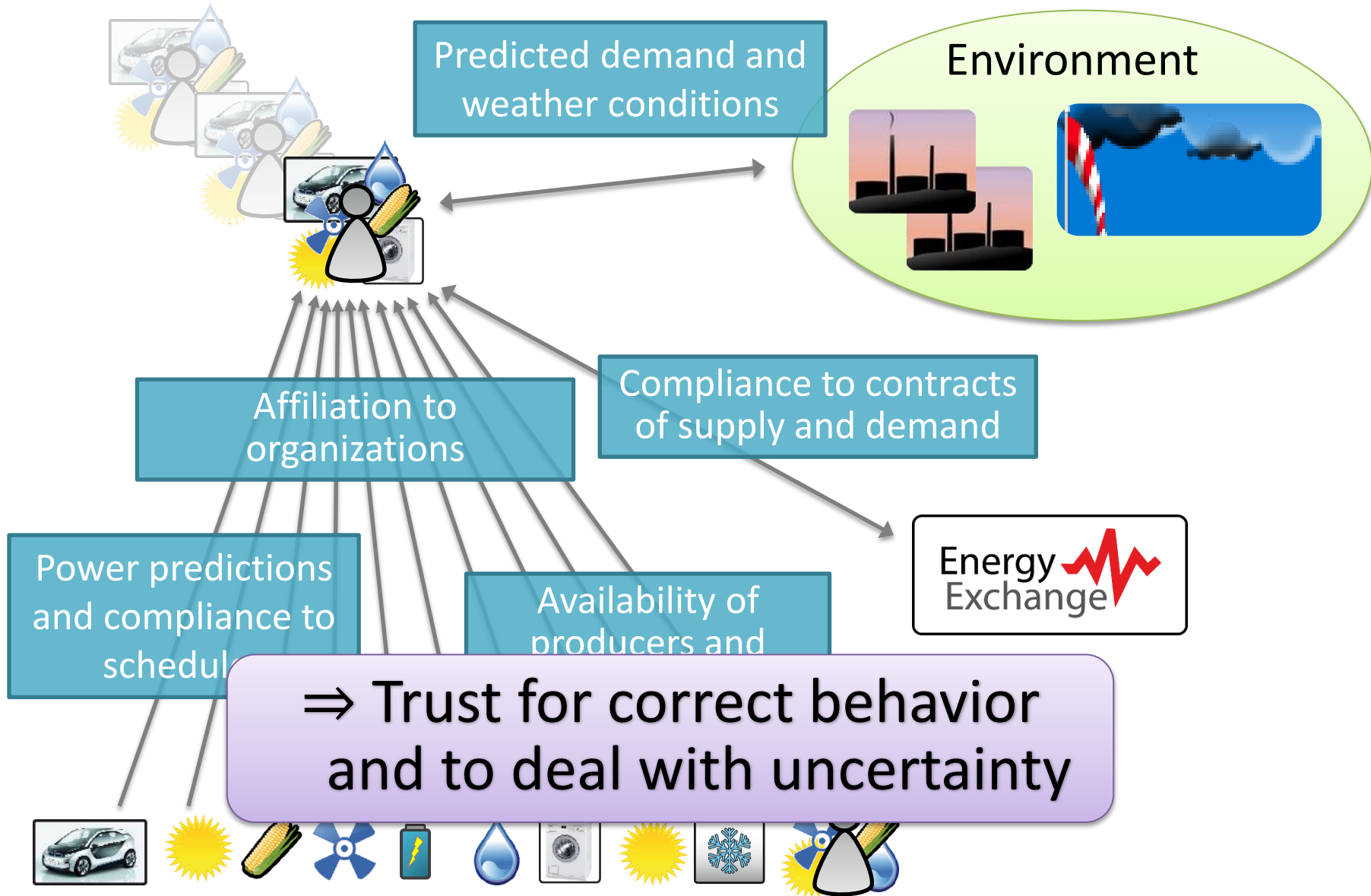
Current Power Management Systems
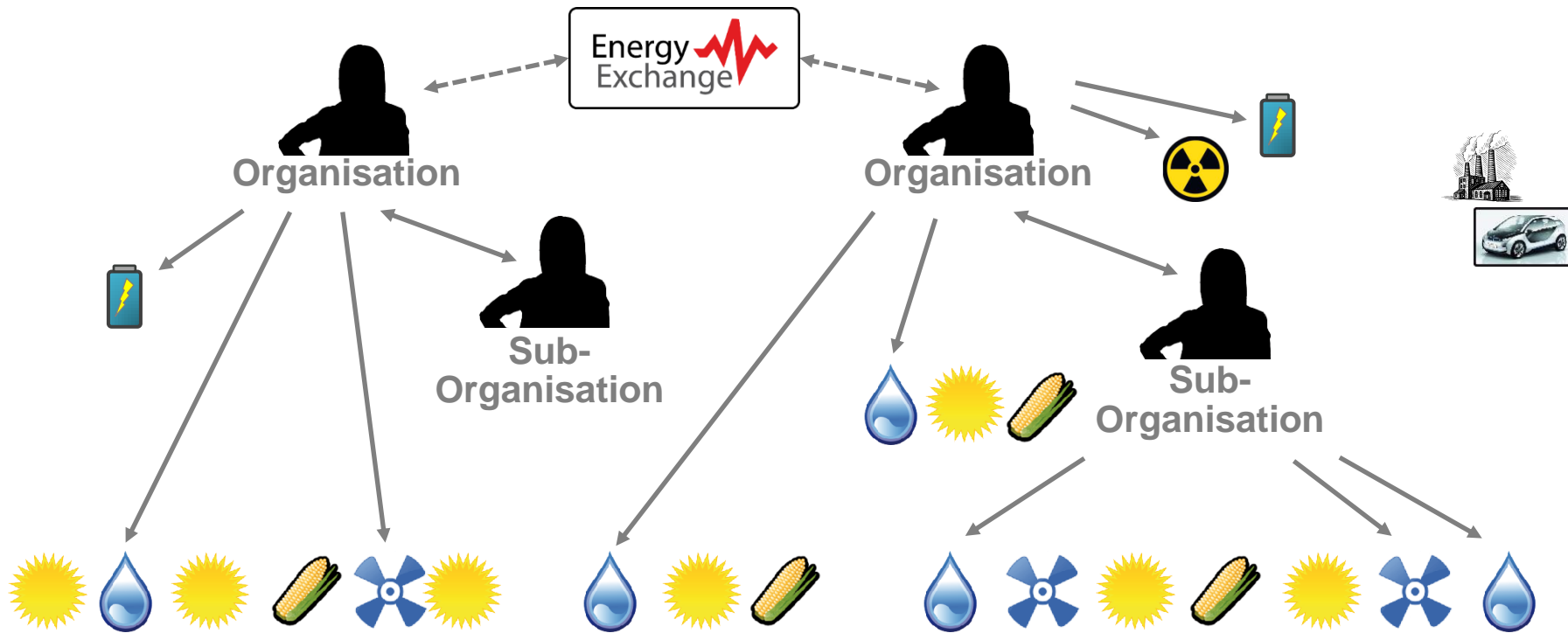
- Flat hierarchy
- Schedules based on crude predictions and created manually

- No control over Distributed Energy Resources (DER)
- Little knowledge of current power grid status
- Little control over demand

Our Vision of Autonomous Power Management

Uncertainties in Autonomous Power Management

Predicted demand and weather conditions

Environment

Compliance to contracts of supply and demand

Affiliation to organizations

Power predictions and compliance to schedule

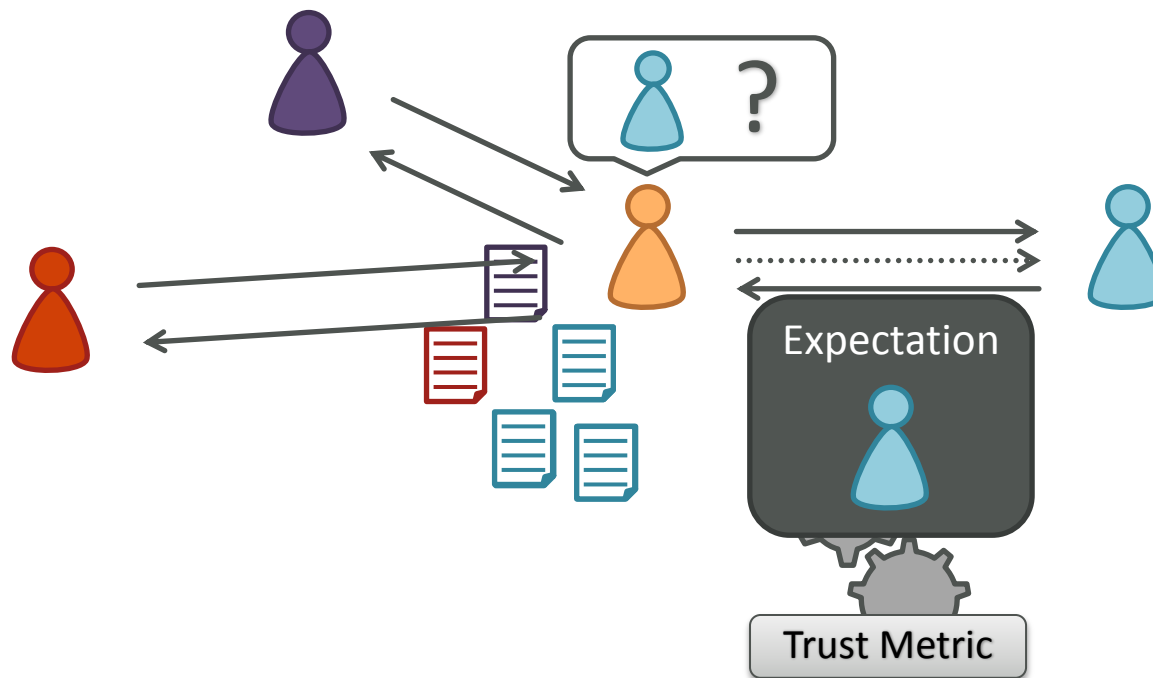Availability of producers and

Energy Exchange

⇒ Trust for correct behavior and to deal with uncertainty

Trust as a Measure of Uncertainty

- Trust values can be used to predict an agent's or the environment's future behavior
- Applicable if prior behavior is indicative for future behavior

Experiences

Trust Metric

Trust Value

Expectation

Trust Metric
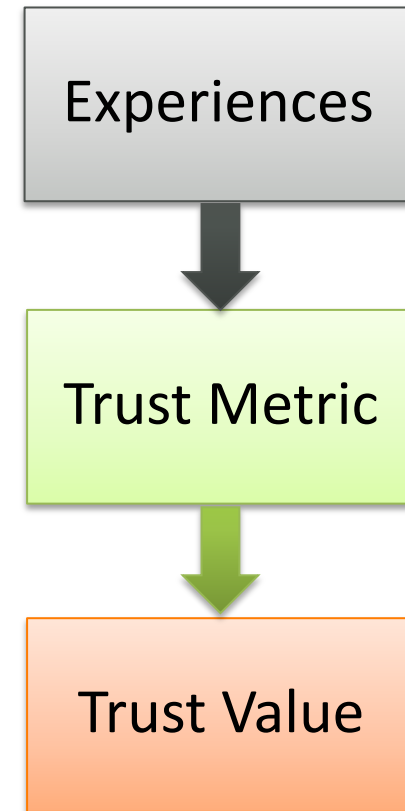
[Ramchurn et al., 2004]

Requirements for Suitable System Structures

- Requirements:
  - Mixture of trustworthy and untrustworthy prosumers and different degrees of freedom
  - Economical considerations
  - Incorporate system topology
  - ➢ Stable structure
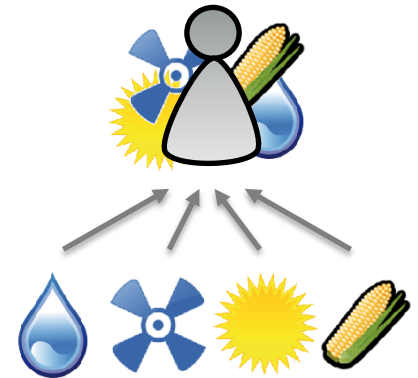
- Advantages of mixtures
  - Trust mix: Establish a balance of uncertainty resulting from unreliable and non-credible prosumers
  - Degrees of freedom mix: Balance the capability to react to production and demand fluctuations locally