TerraSwarm

Smart Grid as the Swarm

Presenter: Alper Sinan Akyurek

Advisor: Tajana Simunic Rosing

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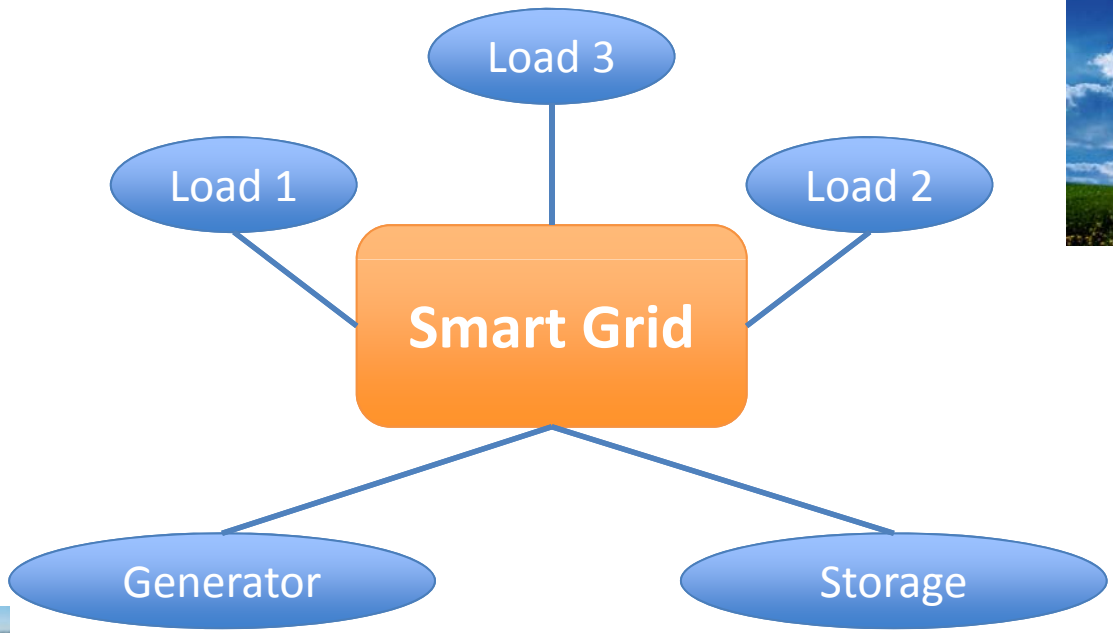
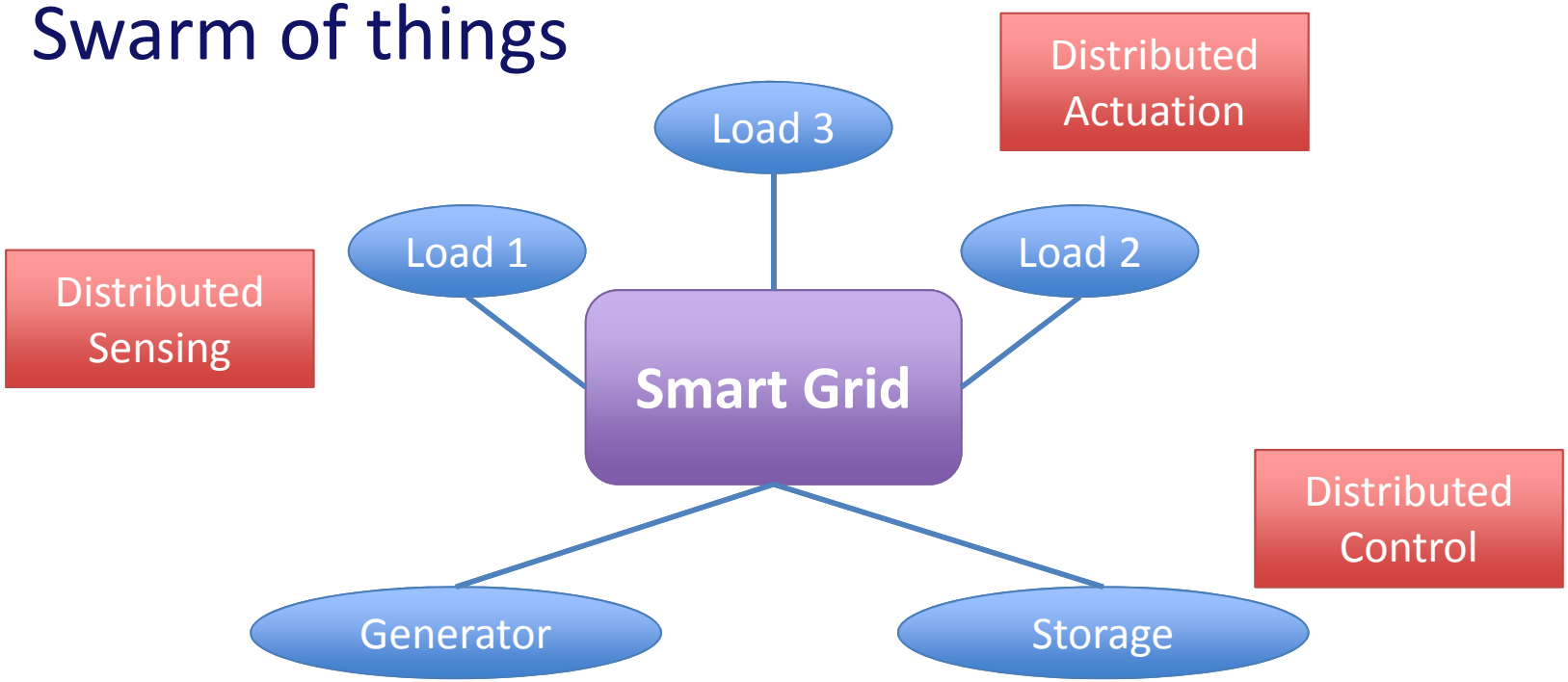
The Smart Grid

- Cyber Physical System



The Smart Grid as the Swarm

- Cyber Physical System
- Swarm of things



New Challenges

- Distributed generation & renewable resources
  - Uncertainty in input
  - Rapid variations
  - **Inefficiency in control output**
- Distributed control
  - Heterogeneous control strategies
  - Unaware from each other
  - **Instability**

TESLA: Taylor Expanded Solar Analog Forecasting

- Good prediction is required for a good control output
- Analog based solar forecast engine
- **High accuracy** predictions
  - 50% improvement over state-of-the-art solution
- **High speed** predictions
  - 24-hours in a few seconds
- **Variable range** of forecast horizons
  - Horizon > 48 hours ahead possible

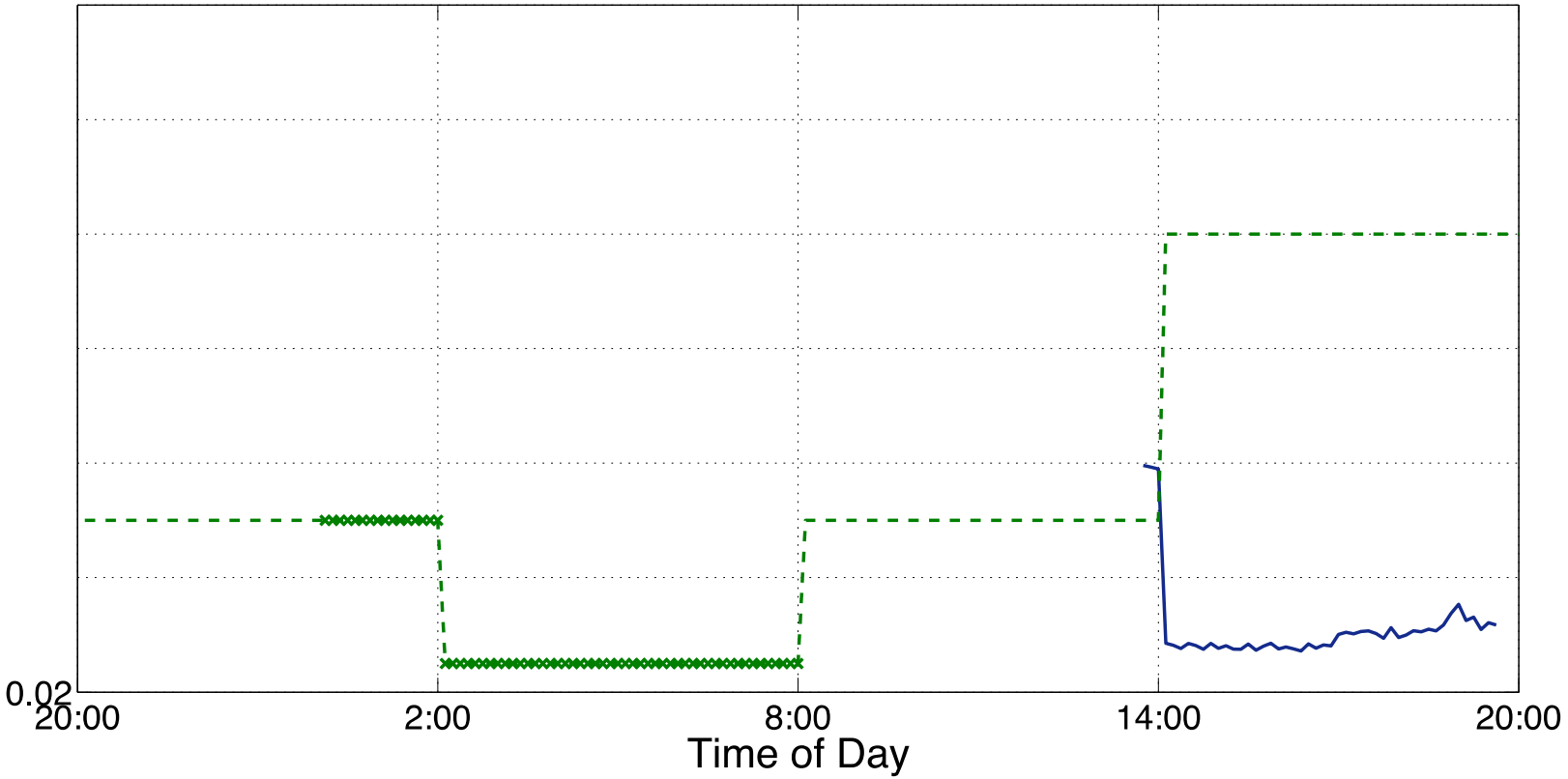
TESLA – Root Mean Square Error Performance

p (y)

S^2Sim: Smart Grid Swarm Simulator

- Smart Grid simulator in C++
- Co-simulation of distributed, heterogeneous control algorithms
- Real-time price/regulation signal feedback
- Power flow solution based on OpenDSS
- Ability to use sensor and database data
- Time synchronization between clients

S²Sim: Instability Example



S²Sim: Instability Example