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Performance and energy models In SDN-enabled Fog systems

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Outline

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- Architectures for Fog computing
  - Motivations
  - Optimization models
  - Load balancing algorithms

- Energy models for SDN networks
  - Motivations
  - Data collection infrastructure

Architectures for Fog computing

Motivations

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- Cyber-physical environments with geographically distributed sensors
  - Huge amount of information → Scalability
  - Delay-sensitive applications → Latency

- Some examples:
  - Pipeline monitoring, environmental monitoring
  - Traffic control / autonomous driving

Fog computing vision

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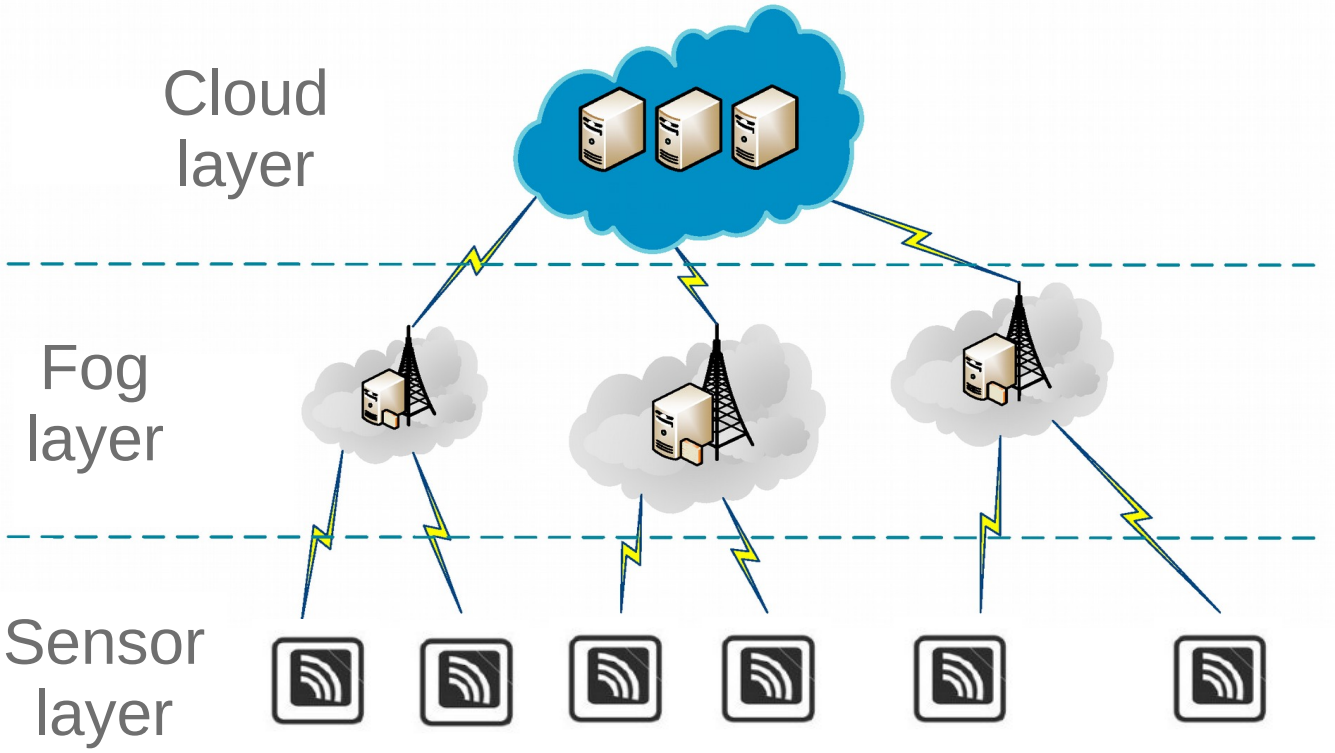
- Intermediate layer of Fog nodes
- Services on the edge: filtering, aggregation, …
- Lower latency
- Higher scalability



What we are doing

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- Smart city scenario
  → Modena, environmental monitoring
- Optimization models:
  - Mapping sensors over Fog nodes
    → placement
  - Optimal set of Fog nodes
    → selection + placement
  - Approach: solvers (AMPL + Knitro) + heuristics (GA, ...)
- Load balancing among Fog nodes
  - Management of traffic surges
  - Simulation of a Fog infrastructure (Omnet++)

Optimization model results

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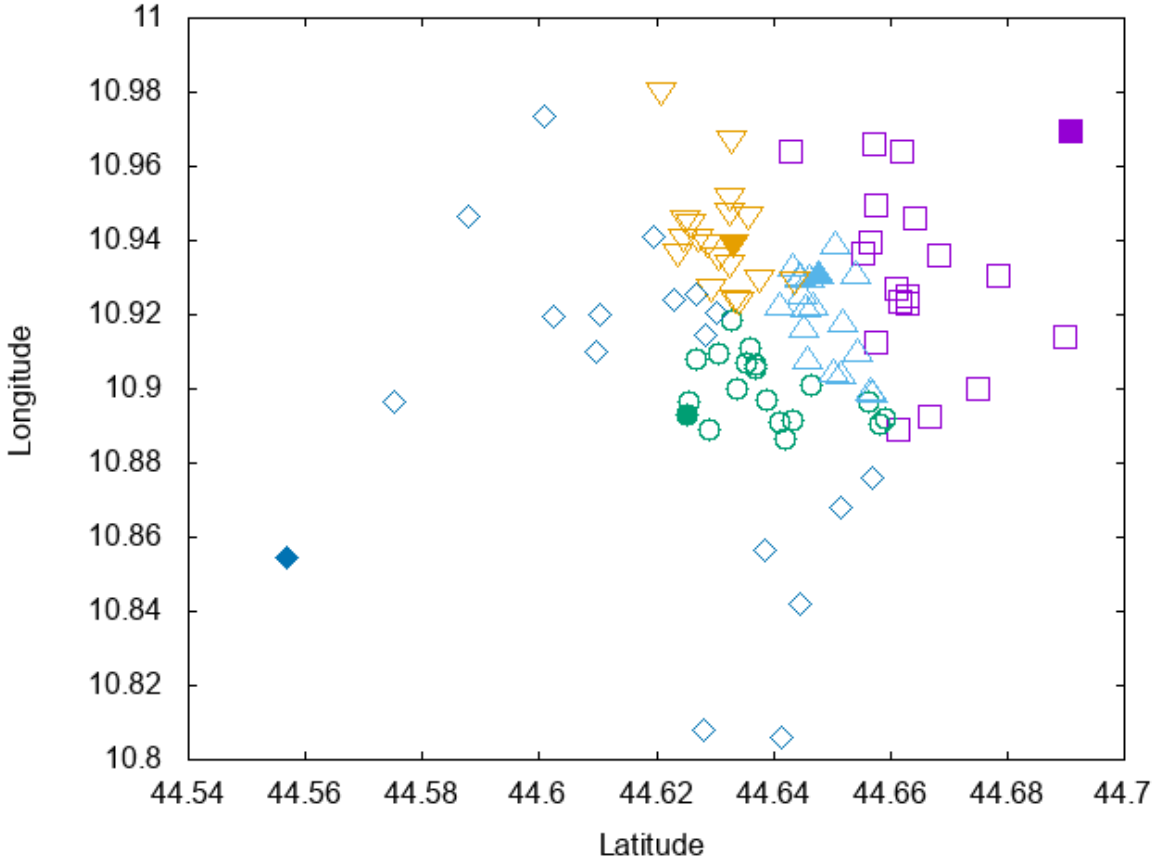

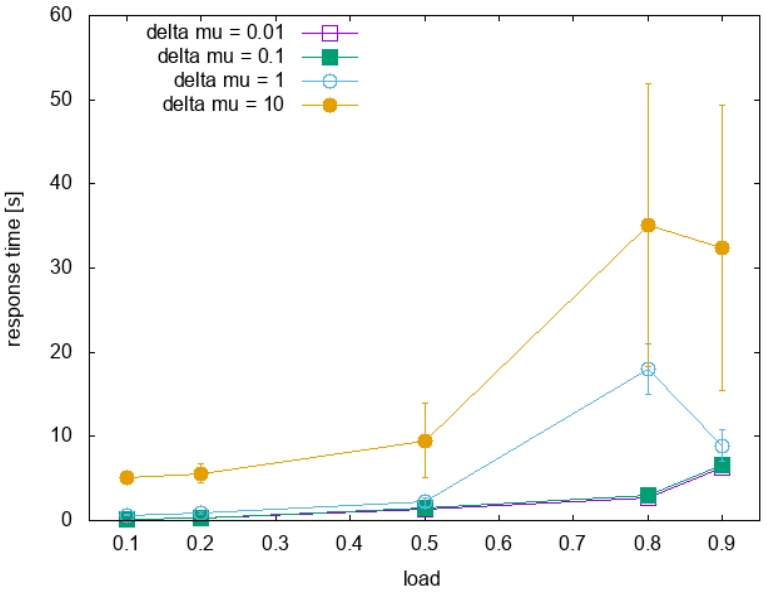

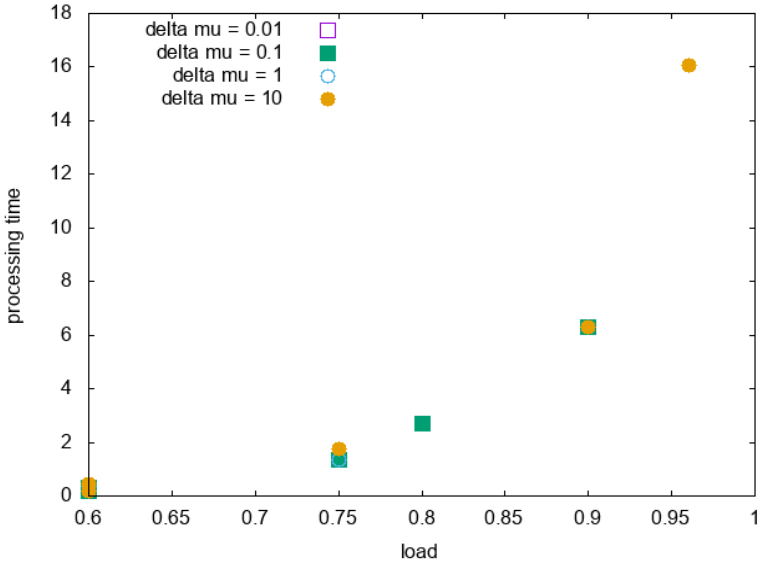

Who is working on this

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- Optimization problem
- Joint work with OR group in Reggio Emilia (REGOR):
  - Manuel Iori (UniMoRE)
  - Thiago Alves de Queiroz (Univ. Fed. Goiàs, BR)




Who is working on this

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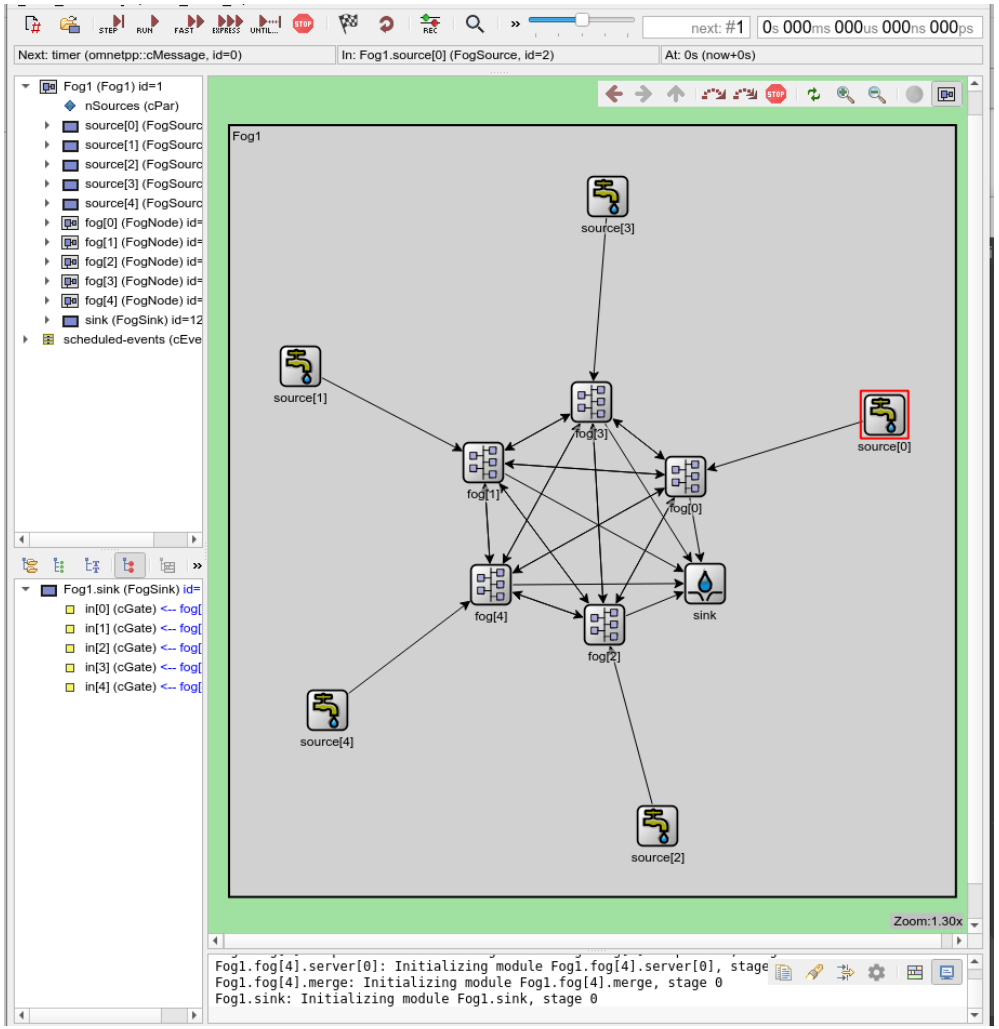
- Load balancing models
- Prof. Roberto Beraldi, University of Rome ”La Sapienza”





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Energy models for SDN networks

Motivations

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- Increasing popularity of SDN technologies
- Scenarios:
  - Agile re-configuration of Cloud data centers
  - Geographically distributed systems (e.g., B4, Fog)
- Challenges:
  - Energy models for SDN devices not available
  - Coordination strategies in distributed control plane (multi-controller systems)

What we are doing

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- SDNLab: testbed for SDN-based systems
  - Multiple workstations as traffic generators (synthetic and realistic traffic traces)
  - One or more SDN switches
  - One or more workstations as controllers
  - Data collection support (SNMP monitoring, IP-capable power meters)
  - Multiple controller software considered

Faucet

OPEN DAYLIGHT

ONOS
Open Network Operating System

SDNLab overview

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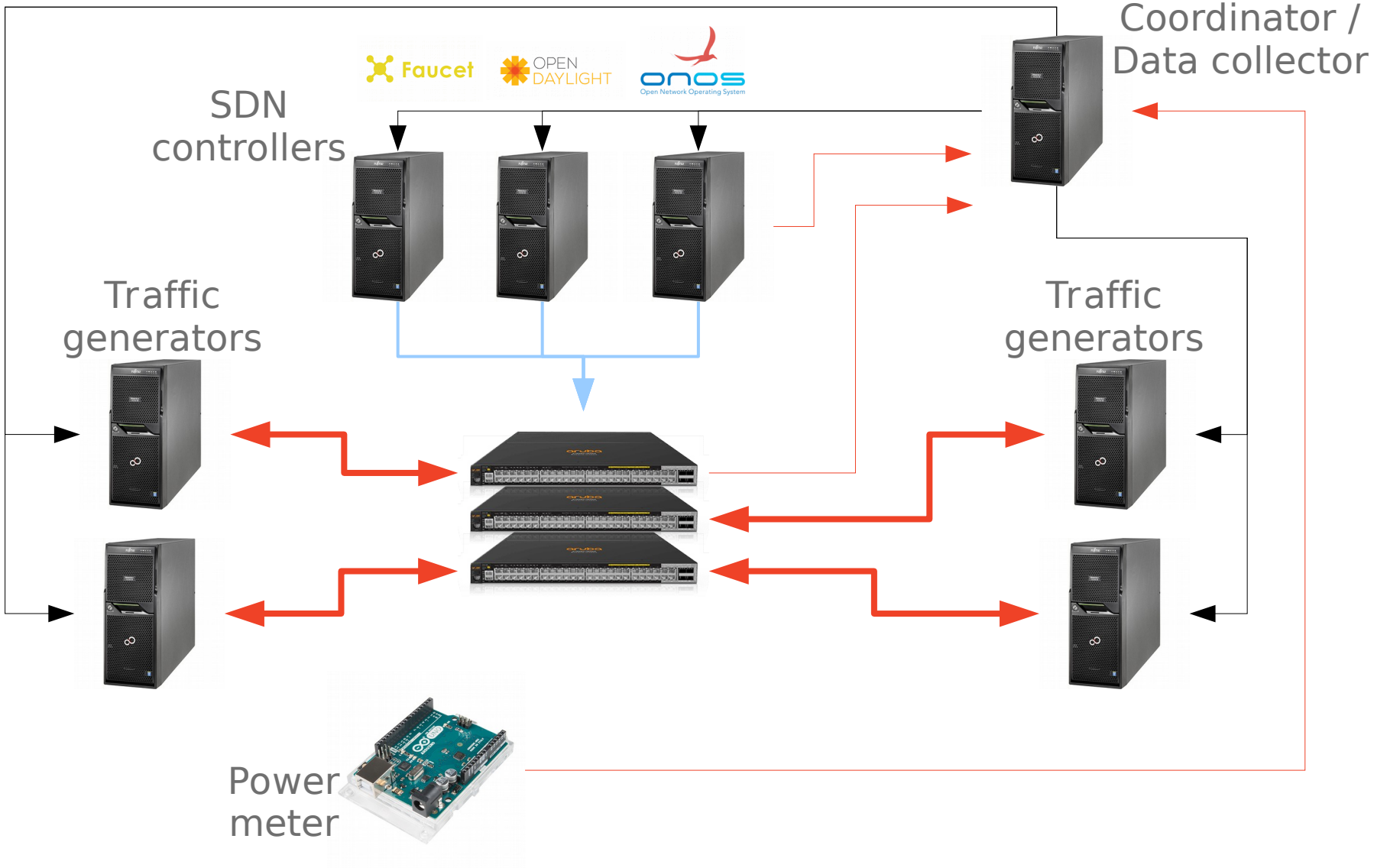

What we are doing

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- Energy model:
  - Power consumption vs. network traffic
  - Power consumption vs. number and type of rules
- Multi-controller analysis:
  - Controller scalability (comparison of multiple platforms)
  - Static and dynamic load balancing in controllers (controller/switch mapping)

Who is working on this

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- Joint work with Computer Networks Research group:
  - M. Casoni, C. A. Grazia, M. Klapez,
- And CESIA:
  - M. Barbieri, D. Neri

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