


# VIRTUWIND



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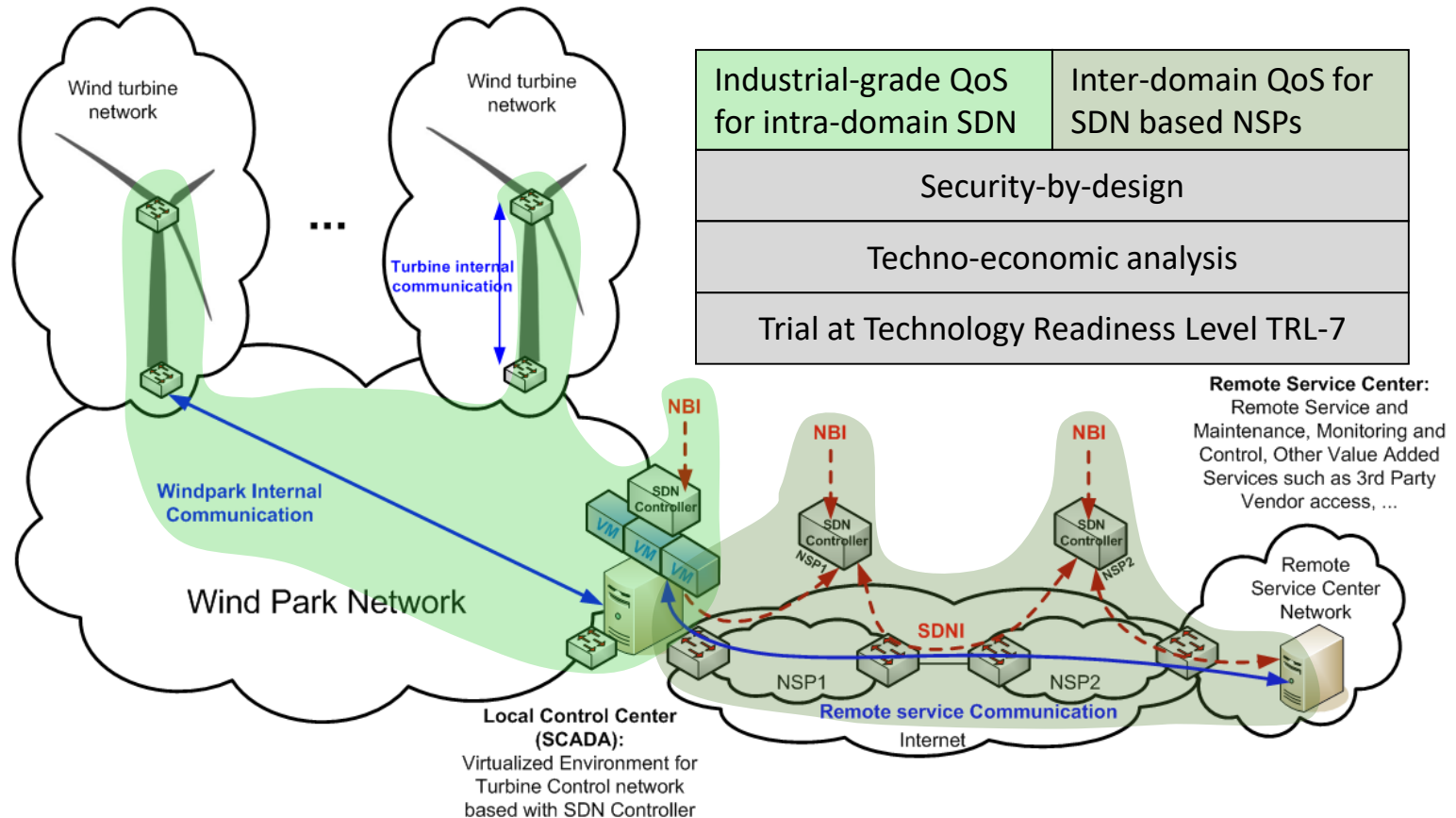
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# Project name: VirtuWind

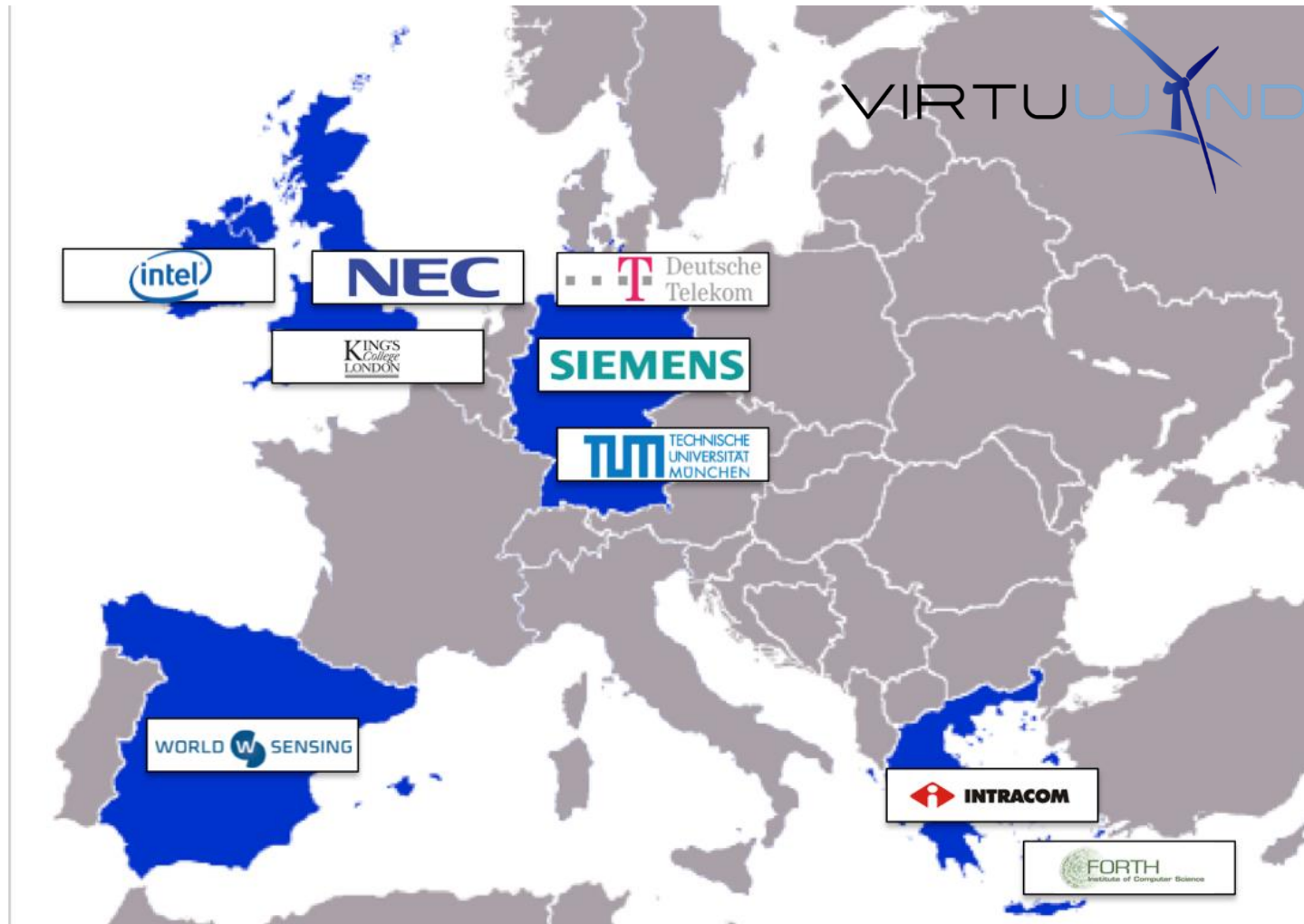
(Project title: Virtual and programmable industrial network prototype deployed in operational Wind park)



# VIRTUWIND Project

- Consortium
  - 9 members from 5 countries
  - 5 large industry partners
  - 3 research institutions
  - 1 SME
- Budget
  - 4,874,902€
- Duration
  - 3 years
  - Project kicked off on July 2015

# VirtuWind Consortium Map



# VirtuWind Aim

- To develop a SDN & NFV ecosystem for industrial domains, based on open, modular, and secure communication framework
- To develop a prototype demonstration for intra-domain and inter-domain scenarios in real wind parks as a representative use case of industrial networks
- To quantify the economic benefits of such a solution.

# VirtuWind Objectives

1. Realize industrial-grade QoS for intra-domain SDN solution
2. Guarantee inter-domain QoS for SDN based multi-operator ecosystem
3. Reduce time and cost for service provisioning and network maintenance
4. Assure security-by-design for the SDN and NFV ecosystem
5. Field trial of intra- and inter-domain SDN and NFV prototype
6. Collaborate with related 5G-PPP projects and contribute to relevant standards

# VirtuWind Overall Concept

- adapt SDN as per requirements in industrial networks by developing novel SDN-based mechanisms to reduce CAPEX and OPEX
  - Reduction of CAPEX in turbine control components utilizing new SDN & NFV based network architecture and providing a centralized, secure, highly available environment for virtualizing industrial control components;
  - reduction of OPEX by increasing the efficiency of industrial network management. SDN enables centralized industrial network configuration reducing costs for operation and maintenance.

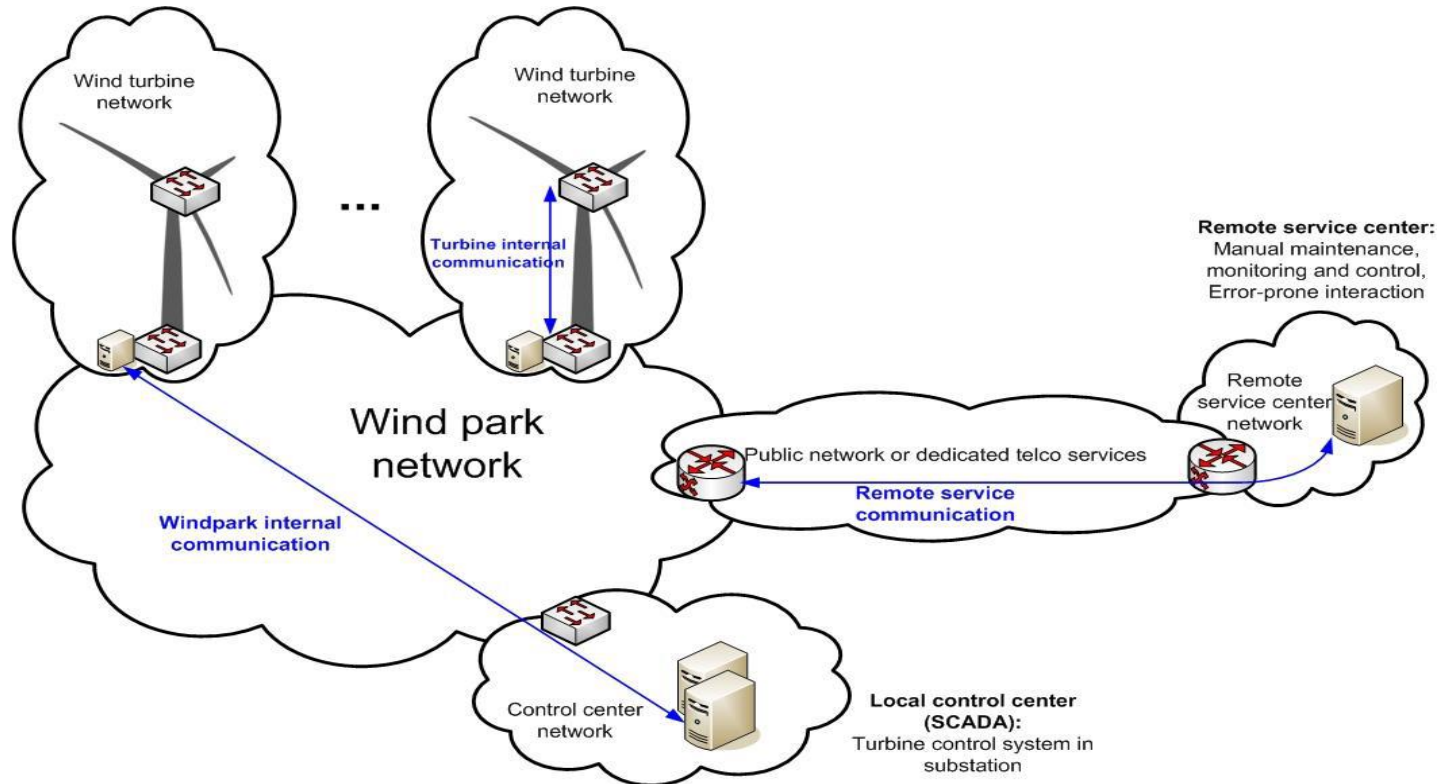
# VirtuWind challenges and impact

- Areas to be addressed
  - Programmable industrial networks via SDN
  - Multi-tenancy support via NFV
  - Techno-economic analysis for foreseen OPEX and CAPEX reduction
  - Increase in service provisioning velocity
  - Assess industry-readiness at TRL-7
- Main impact
  - Boosting European competitiveness in wind business
  - Positioning Europe as the Centre of Competence for “QoS-enabled SDN/NFV”

# Network requirements

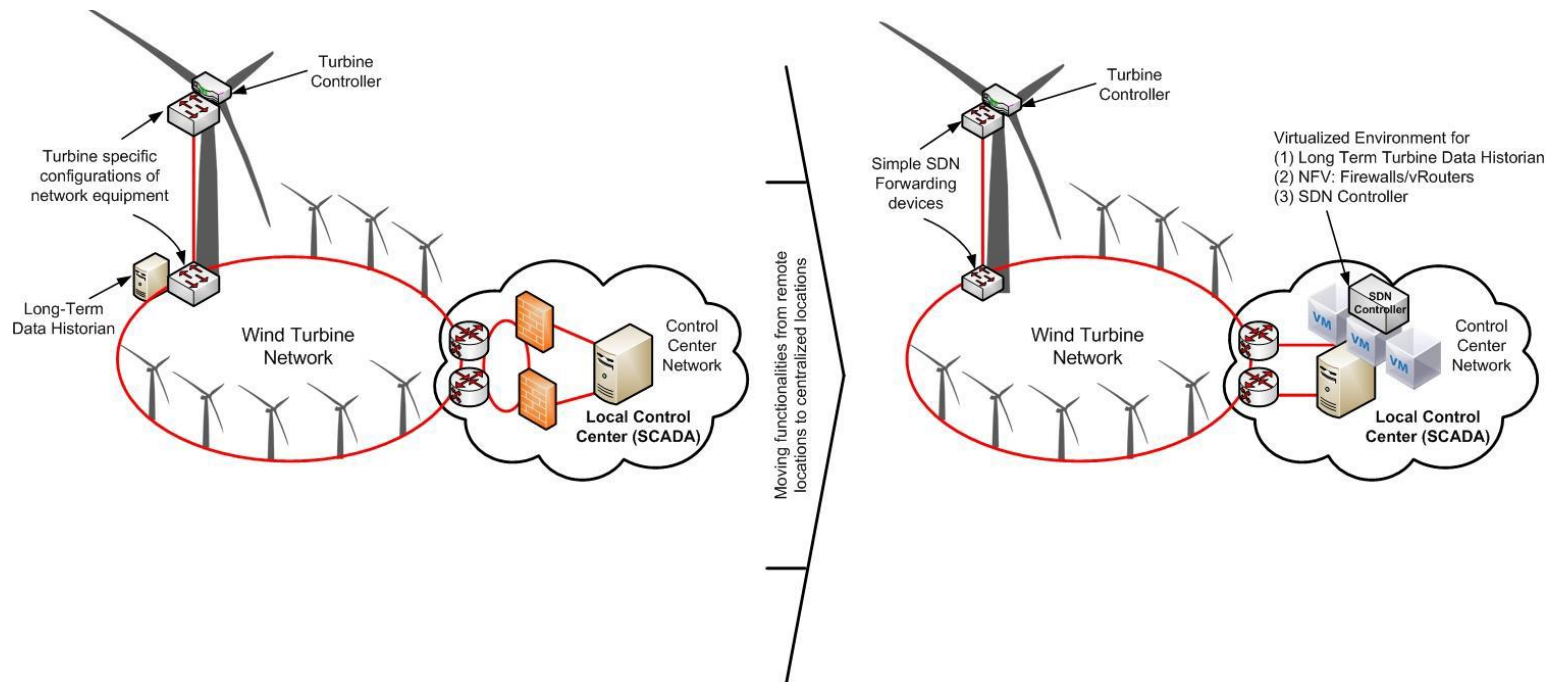
- Industrial-grade QoS (e.g. bandwidth, delay, jitter, packet loss, redundancy, etc.)
- Industrial-grade security (e.g. least privilege principle, firewalls, mandatory policing, root of trust for BIOS, OS, hypervisor and similarly for guest VMs etc.)
- Multi-site (e.g. remote control centres and distributed installations)
- Multi-tenancy (e.g. different stakeholders needing different access profile like plant owners, operators and maintenance engineers etc.)
- SCADA virtualisation (e.g. server virtualisation and SCADA application virtualisation)

# Existing wind park control network



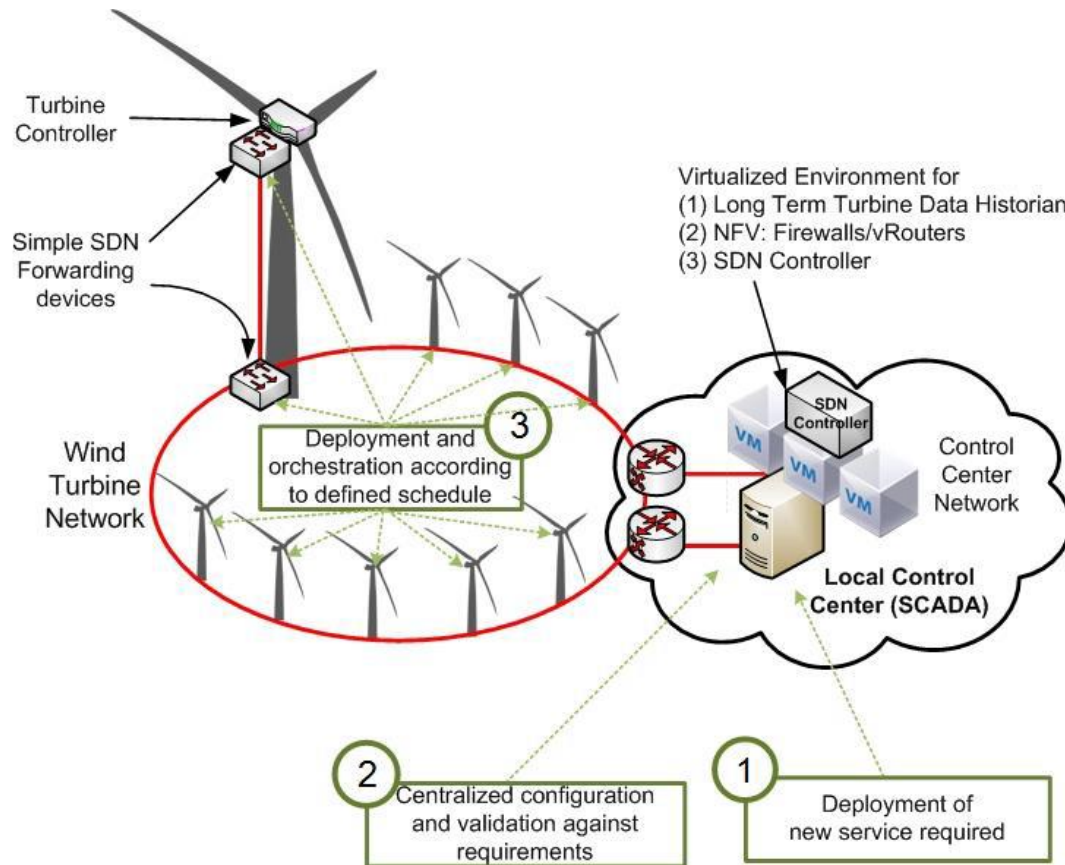
# Trial Scenario 1

## Moving functionalities from remote to central location



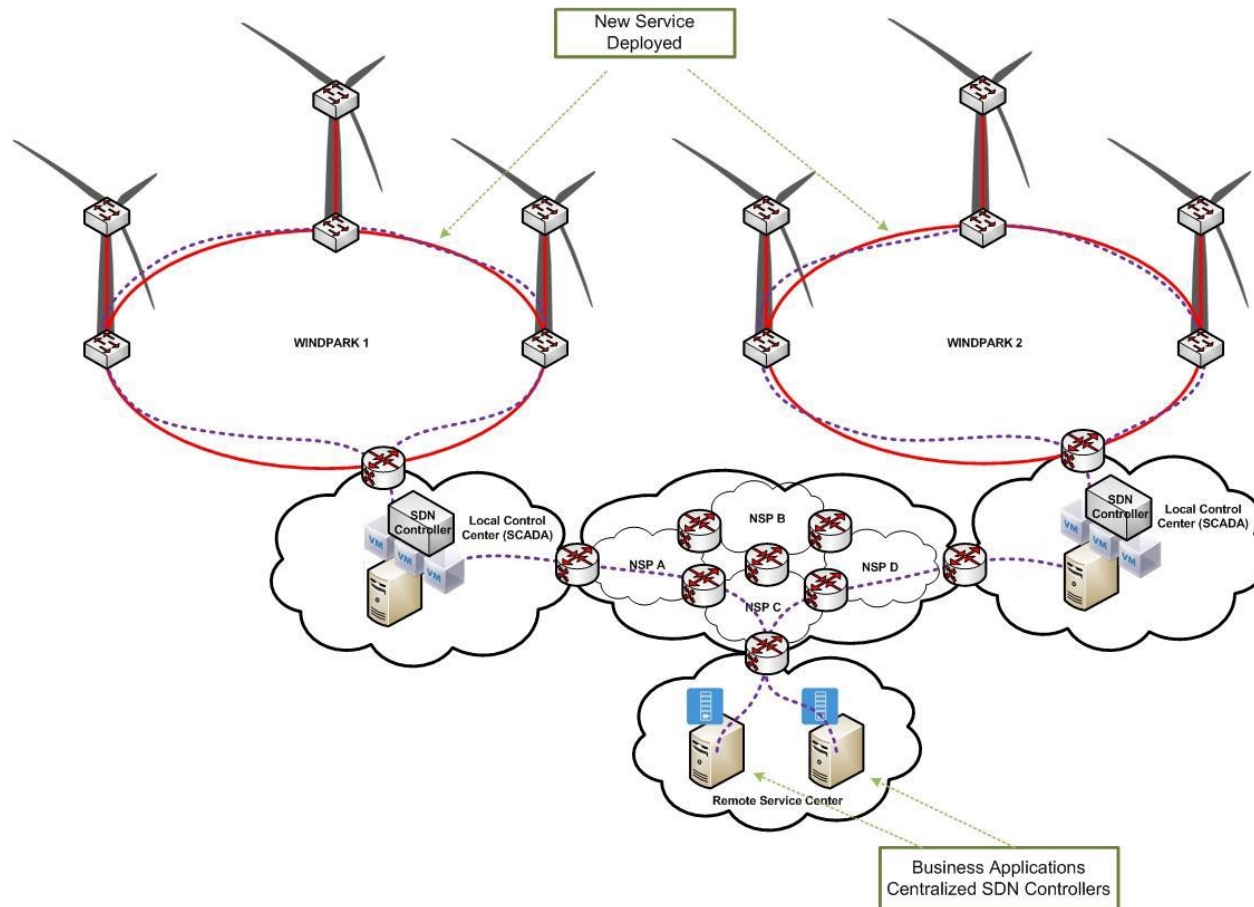
# Trial Scenario 2

Upgrade of a system and installation of a new service



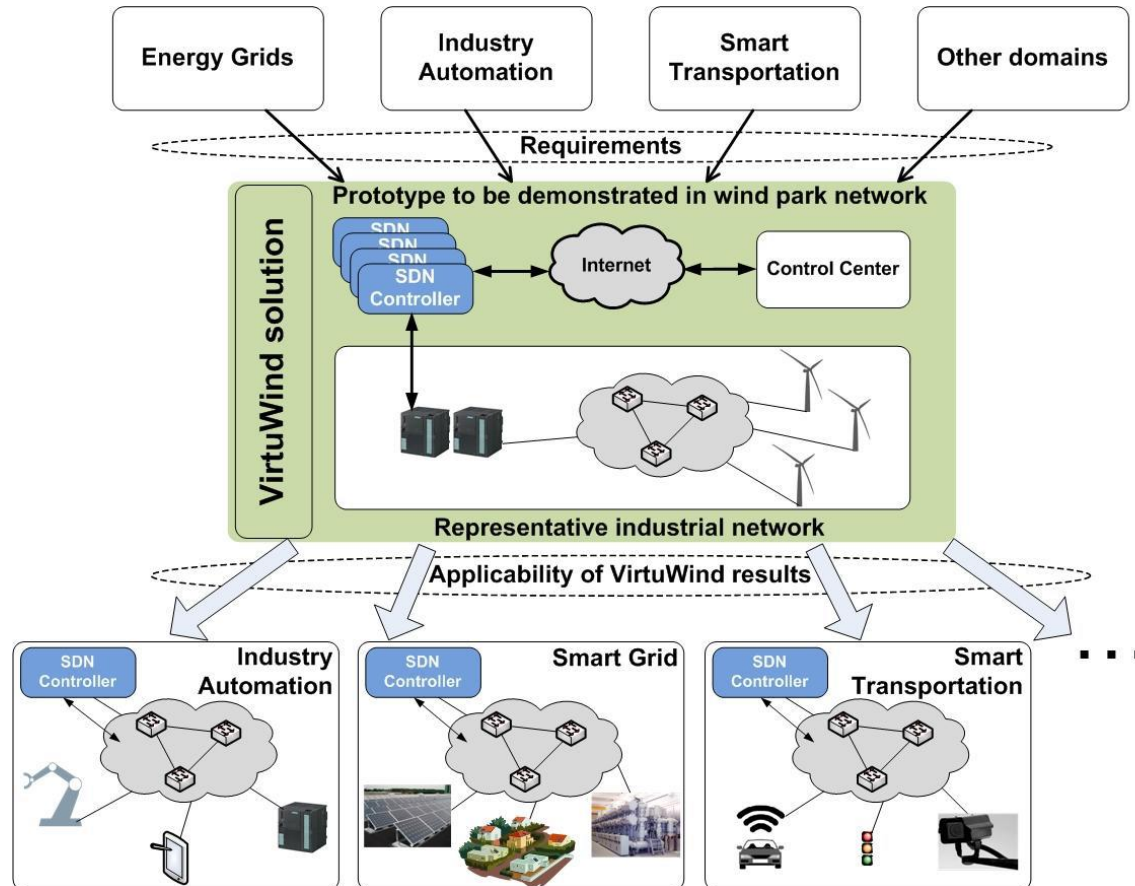
# Trial Scenario 3

## Multi-site service deployment and update



# VirtuWind Solution

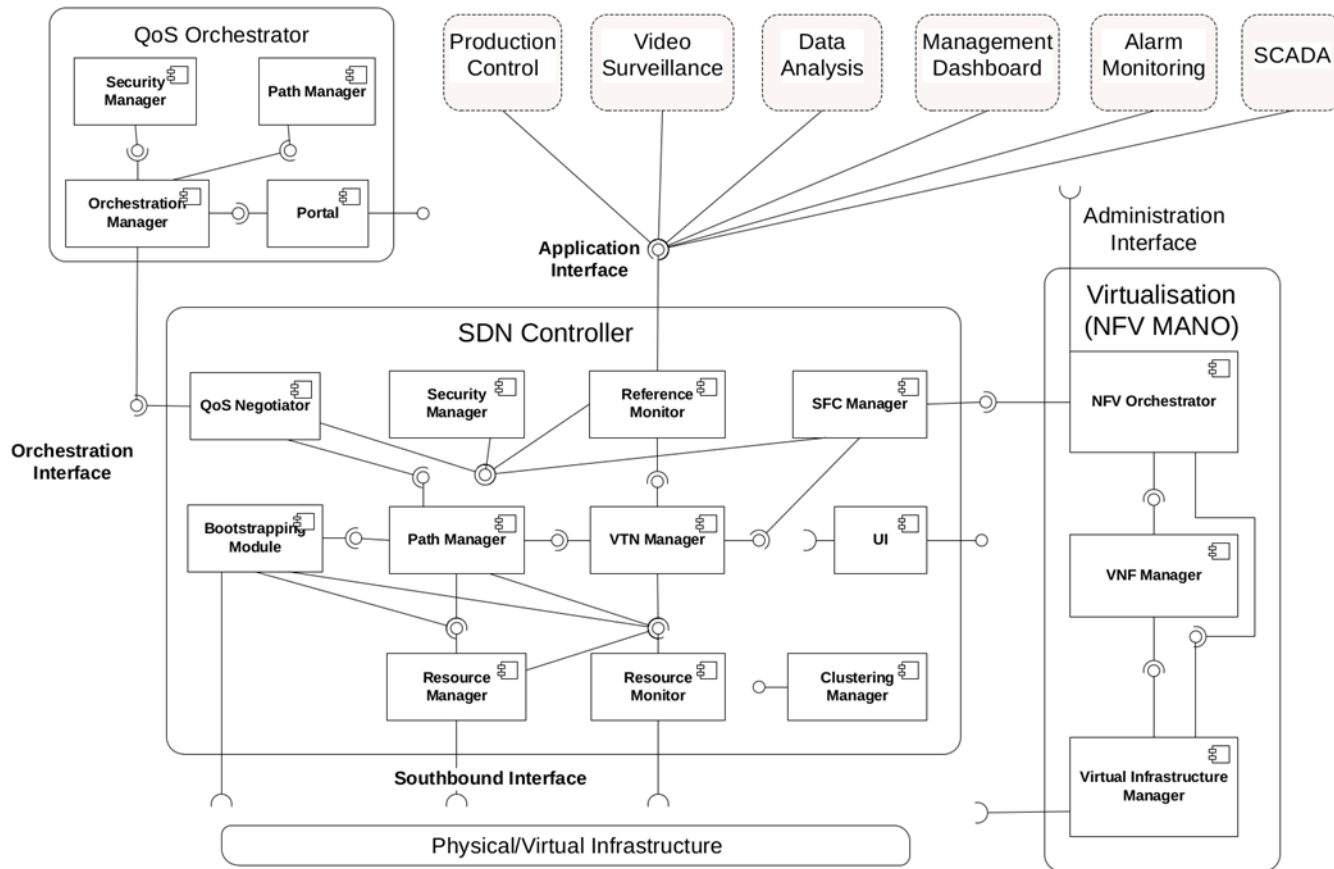
Wind-park solution as a representative industrial network



# VirtuWind achievements

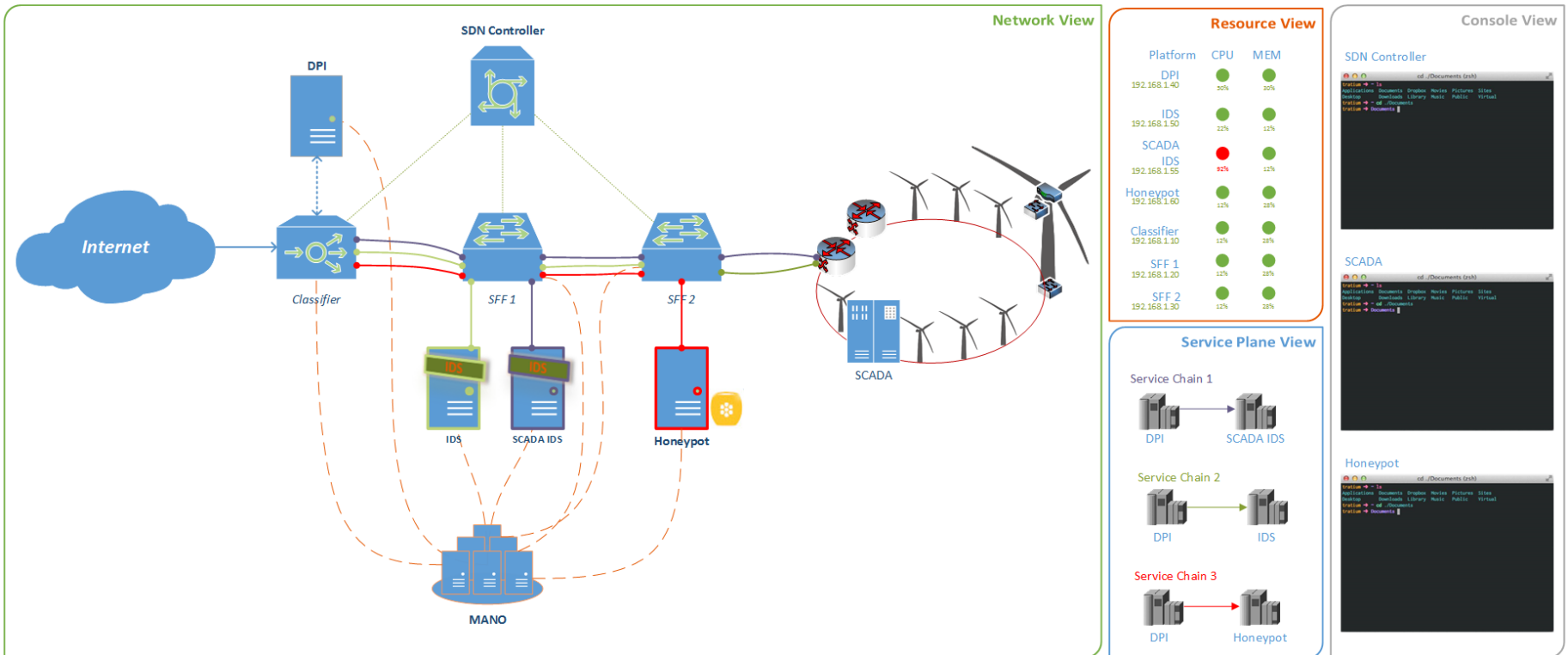
- NFV Mano
- OpenDaylight
- Implementation of various controller modules
- SFC chaining
- 1<sup>st</sup> trial @Brande wind park in a few days
- 24 papers published
- 9 Keynotes/Presentations in several events
- Standardization Activities
  - IETF, ONF, IRTF

# VirtuWind achievements



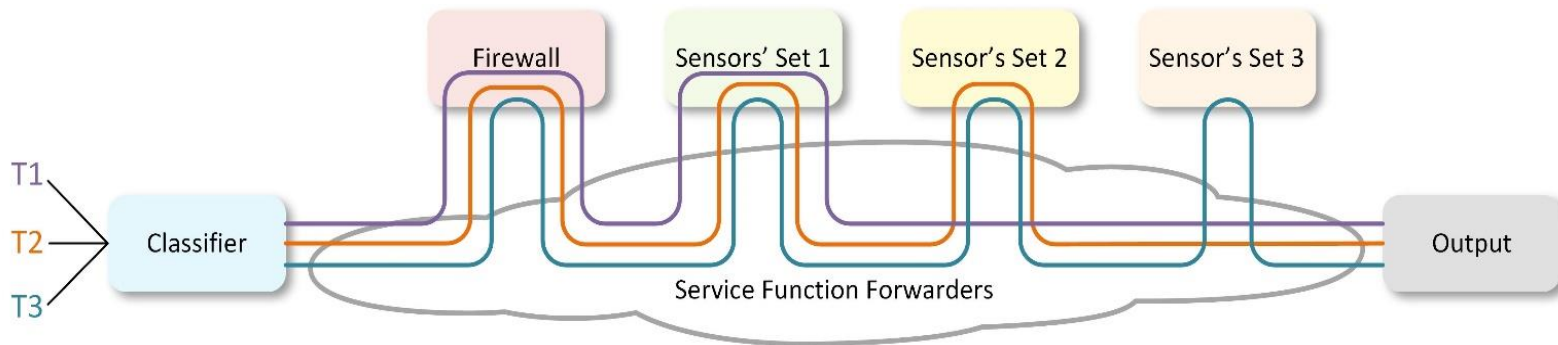
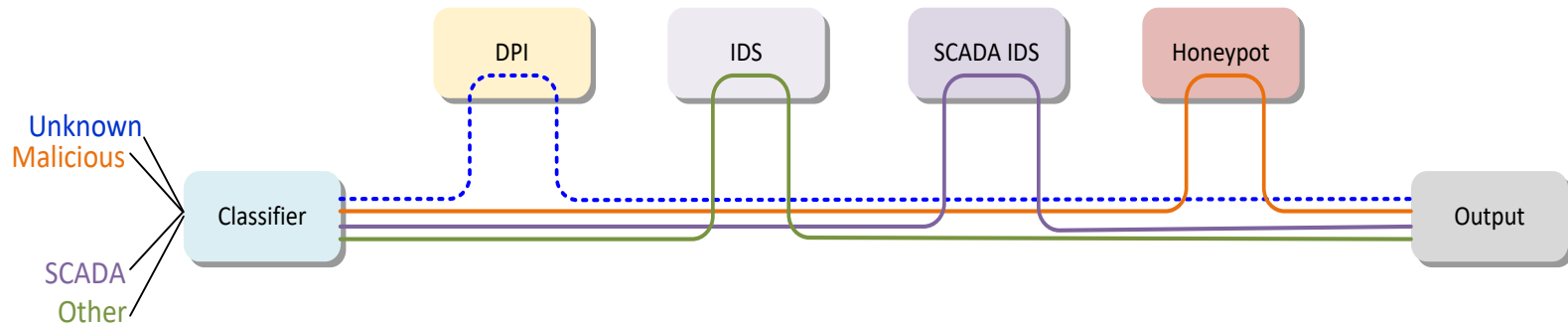
## VirtuWind architecture

# VirtuWind achievements



GUI

# VirtuWind achievements

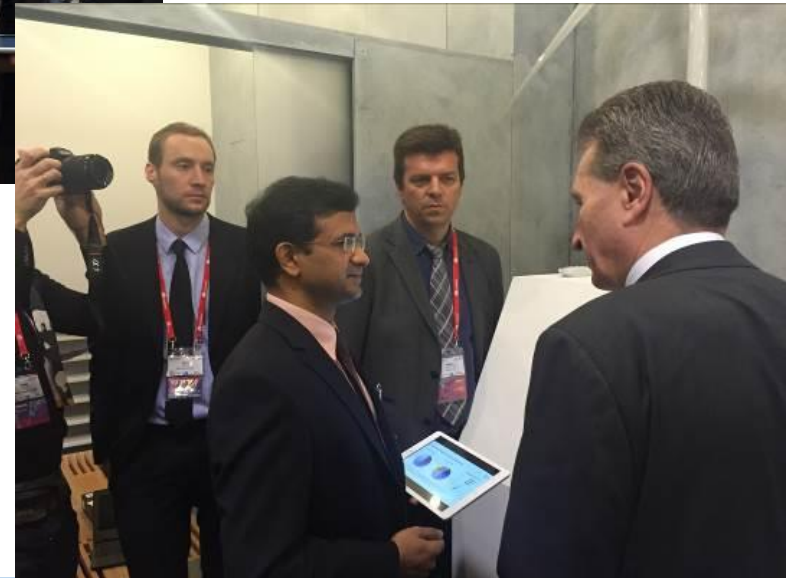
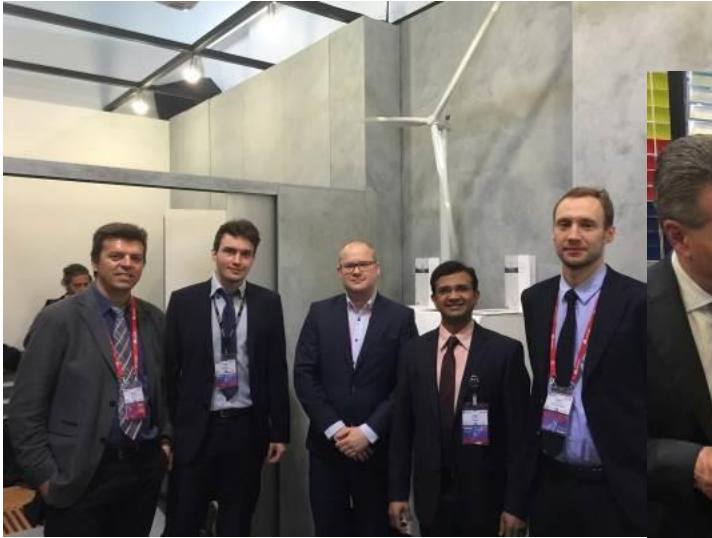


## Service Function Chaining

# VirtuWind achievements

- Demonstrations
  - MWC 2016 VirtuWind Demo, Barcelona, Spain
  - CoC COM Industry day, Munich, Germany
  - Second Global 5G Event, Rome, Italy
  - ISCC 2017 SFC Demo

# VirtuWind achievements



**@ MWC 2016 (Barcelona, February 2016)**

# VirtuWind achievements



**2<sup>nd</sup> Global 5G Event  
(Rome, November 2016)**

**Mr. Viola  
Director-General of DG  
CONNECT**




# VirtuWind achievements



@IoT solutions world congress 2016

# VIRTUWIND



Thank you for your attention.

More info at <http://www.virtuwind.eu/>

Any questions?



**FORTH**  
INSTITUTE OF COMPUTER SCIENCE

