




# NTNU- Protection and Control

Teaching

Research

New initiatives




**Hans Kristian Høidalen**, Ph. D.  
Professor

Department of Electric Power Engineering  
Faculty of Information Technology,  
Mathematics and Electrical Engineering

Postal address: NO-7491 Trondheim, Norway  
Address: O.S. Bragstadspl. 2F  
Phone: +47 73 59 42 25 • Mobile: +47 911 11 536  
Fax: +47 73 59 42 79

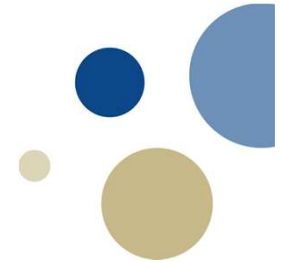
<http://www.elkraft.ntnu.no/~hansh/>

[hans.hoidalen@elkraft.ntnu.no](mailto:hans.hoidalen@elkraft.ntnu.no)  
Norwegian University of Science and Technology

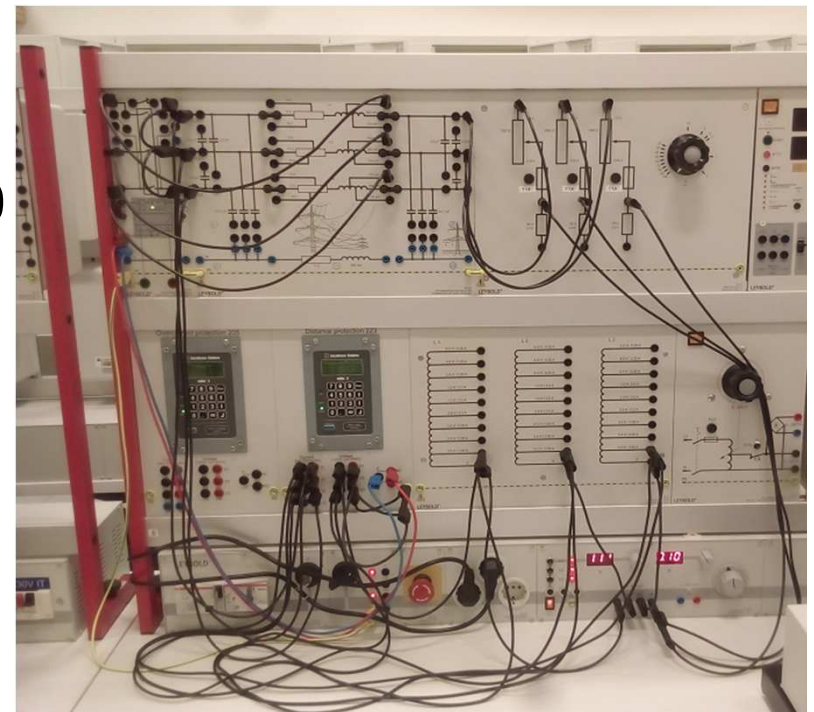


**NTNU**  
Innovation and Creativity

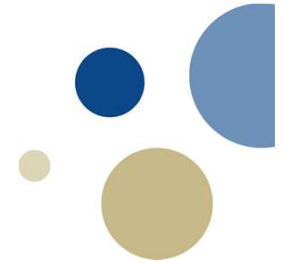
# Teaching







- New course TET4215 Power system protection and control; [Web-page](#)
  - Protection and control overview
  - Instrument transformers
  - Overcurrent, distance, differential, generator protection
  - Ground fault protection
  - Relay planning and testing
  - Syncrophasors/PMUs
  - Substation communication, IEC61850
  - 44 lectures
  - 7 practical labs
  - 3 more exercises
- 20 students attended



# Power system protection and control







- Controls:

	<p><b>Kjetil Uhlen</b> Professor</p> <p>Institutt for elkraftteknikk Avdeling for studieadministrasjon Fakultet for informasjonsteknologi og elektroteknikk ✉ kjetil.uhlen@ntnu.no ☎ 73597204 ☎ +4793008834 Elektro E/F, F-364, Gløshaugen, O. S. Bragstads plass 2e</p> <p>✉ CV in</p>
	<p><b>Jalal Khodaparast Ghadikolaei</b> postdoctoral researcher</p> <p>Department of Electric Power Engineering Faculty of Information Technology and Electrical Engineering ✉ jalal.khodaparast@ntnu.no Choose building, Elektro E/F, Gløshaugen</p> <p>✉ CV in f</p>
	<p><b>Dinh Thuc Duong</b> Postdoctoral Fellow</p> <p>Department of Electric Power Engineering ✉ thuc.duong@ntnu.no ☎ +47 73550401 Elektro E/F, Gløshaugen</p> <p>✉</p>
	<p><b>Hallvar Haugdal</b> PhD Candidate</p> <p>Department of Electric Power Engineering ✉ hallvar.haugdal@ntnu.no Elektro E/F, Gløshaugen</p> <p>✉</p>

- Synchrophasors/PMU
- System protection

- Protection:

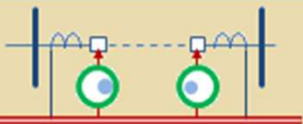
	<p><b>Hans Kristian Høidalen</b> Professor</p> <p>Institutt for elkraftteknikk Fakultet for informasjonsteknologi og elektroteknikk ✉ hans.hoidalen@ntnu.no ☎ 73594225 Elektro E/F, F-411, Gløshaugen, O.S. Bragstads plass 2</p> <p>✉ CV S in f</p>
	<p><b>Konstantin Pandakov</b> Stipendiat</p> <p>Institutt for elkraftteknikk ✉ konstantin.pandakov@ntnu.no ☎ 73595423 Elektro E/F, F-461, Gløshaugen, O.S. Bragstads plass 2</p> <p>✉</p>
	<p><b>Maciej Grebla</b> Stipendiat</p> <p>Institutt for elkraftteknikk Fakultet for informasjonsteknologi og elektroteknikk ✉ maciej.grebla@ntnu.no ☎ 46377522 Elektro E/F, F-414, Gløshaugen, O.S. Bragstads plass 2</p> <p>✉</p>
	<p><b>Charles Mawutor Adrah</b> Stipendiat</p> <p>Institutt for informasjonssikkerhet og kommunikasjonsteknologi ✉ charles.adrah@ntnu.no ☎ 73559054 Elektro E/F, Gløshaugen</p> <p>✉</p>

- IEC61850/RT-HIL
- Relay protection

# About ProSmart- Power system protection in a smartgrid perspective



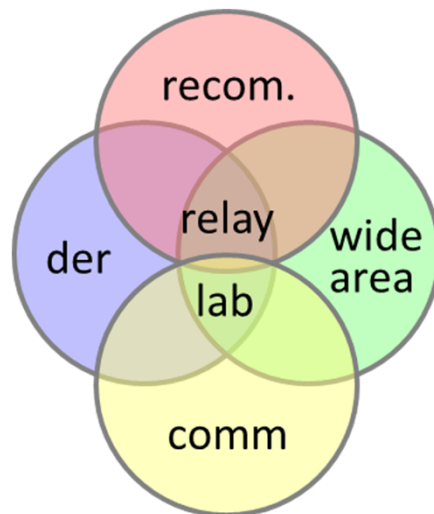
- KPN-project; The Norwegian Research Council
- Partners; Statnett, ABB, Eidsiva, Hafslund, Lyse, Skagerak, Statkraft
- NTNU-Electric Power Engineering, Telematics, Michigan Tech. (MTU), SINTEF
- Associate; The Norwegian Smartgrid Centre
- Budget; 18.4 MNOK, 2015-2019.
- 4 ½ PhD, 3 at NTNU
- One postdoc associated



# Project content



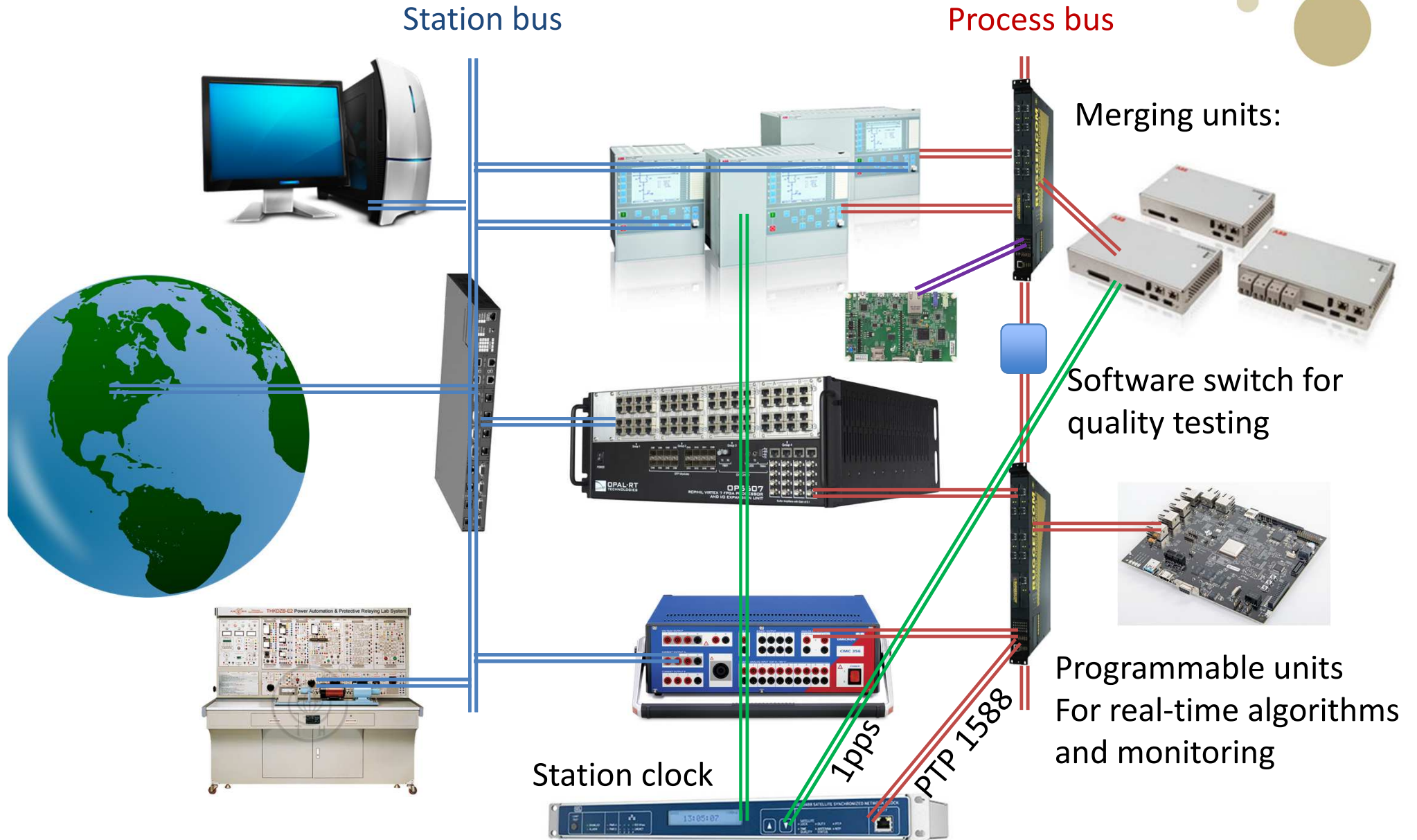
- PhD 1: *Protection of systems with DER – Konstantin Pandakov*
- PhD 2: *Wide-area protection and control – Jaya Yellajosula*
- PhD 3: *Communication for protection purposes – Charles Adrah*
- PhD 4: *Protection of micro-grids – Maciej Grebla*
- *Protection requirements for integration of DER*
- *Power system protection demonstration laboratory*



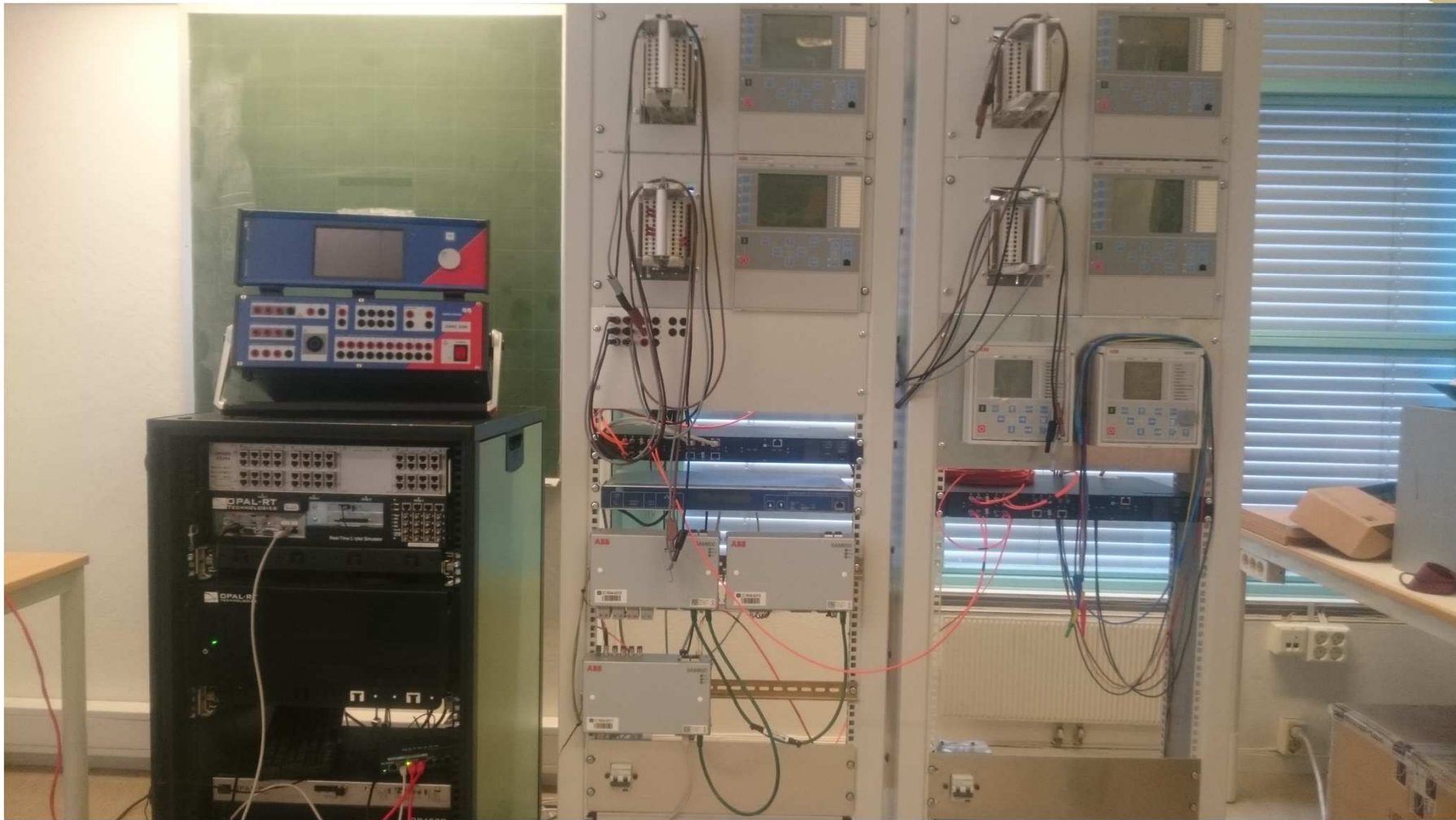
- Recommendations
- Distributed energy resources
- Wide-area protection
- Relay laboratory
- Communication

# Lab organization

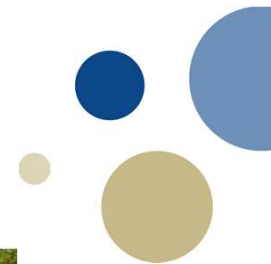
- ==== Station
- ==== Process
- ==== Clock
- ==== UDP



# ProSmart relay lab



# Nordic Workshop May 23. 2017





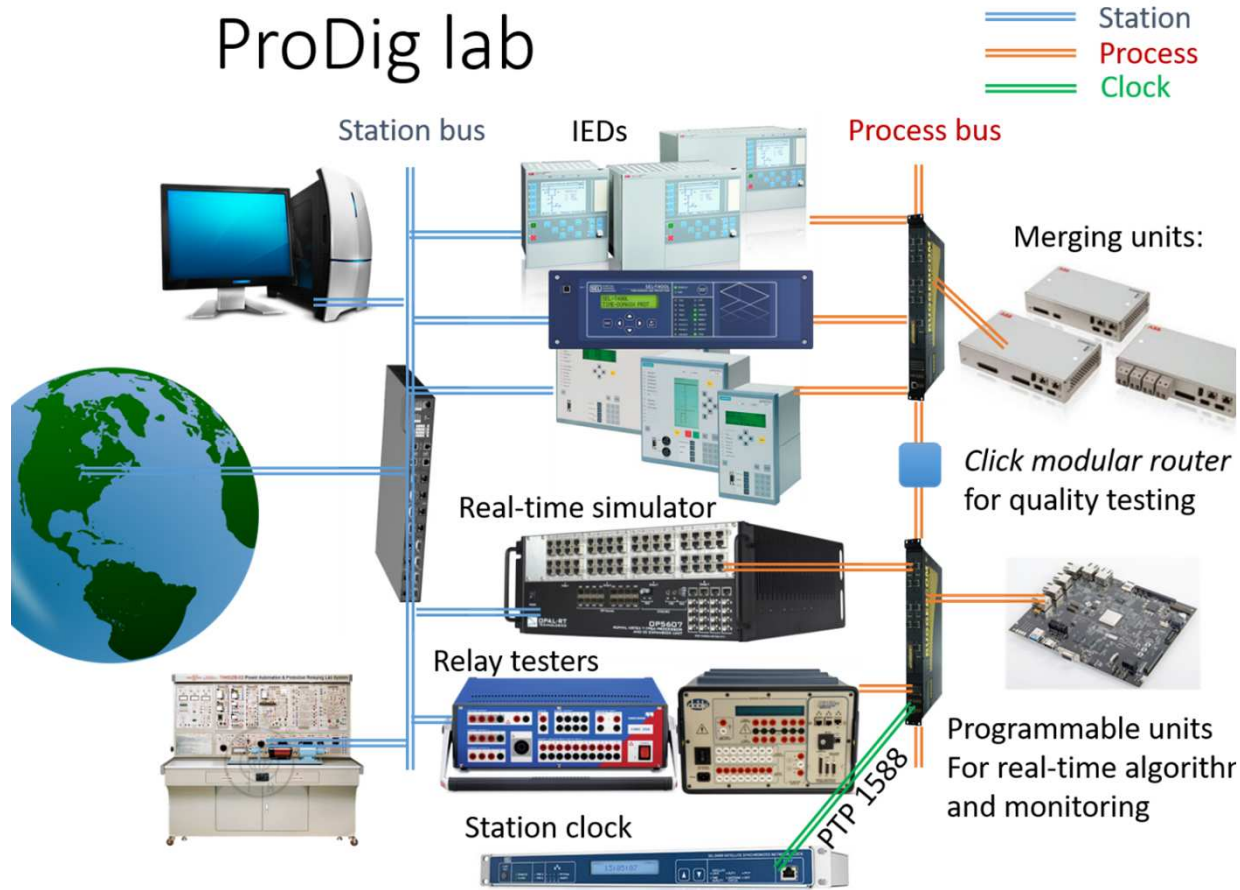
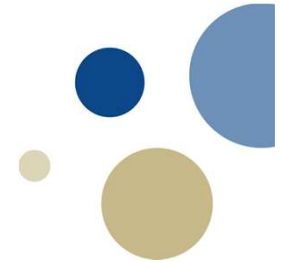
# New initiatives



- New project proposal **ProDig**, 2019-2023
- Continues from ProSmart into digital substations with more partners, multi-vendor
- Co-list other Nordic projects/applications for co-operation

WP	Content
1	Advanced strategies for fault location, restoration, self-healing
2	Communication solutions in digital substations and wide-area
3	Using synchro-phasors and SV in wide-area protection
4	Sensor technology for better fault handling, $\mu$ PMU
5	Test procedures for fast digital substation upgrade
6	Laboratory for remote testing, co-simulation platform
7	Workshops (Internal and Nordic)
8	Specialization course on Digital Substations

# ProDig lab



- Multi-vendor interoperability
- Precision time protocol, PTP
- Co-simulations; power system, communication system
- Remote testing for faster digital substation upgrade

# New professor/associate position



- *Digital Power System Protection and Control*
- Sponsored by Statnett
- 100% permanent position at NTNU-Trondheim
- Will be re-announced for the third time with application deadline Aug. 15.