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A laboratory research platform for validating WAMPACS solutions

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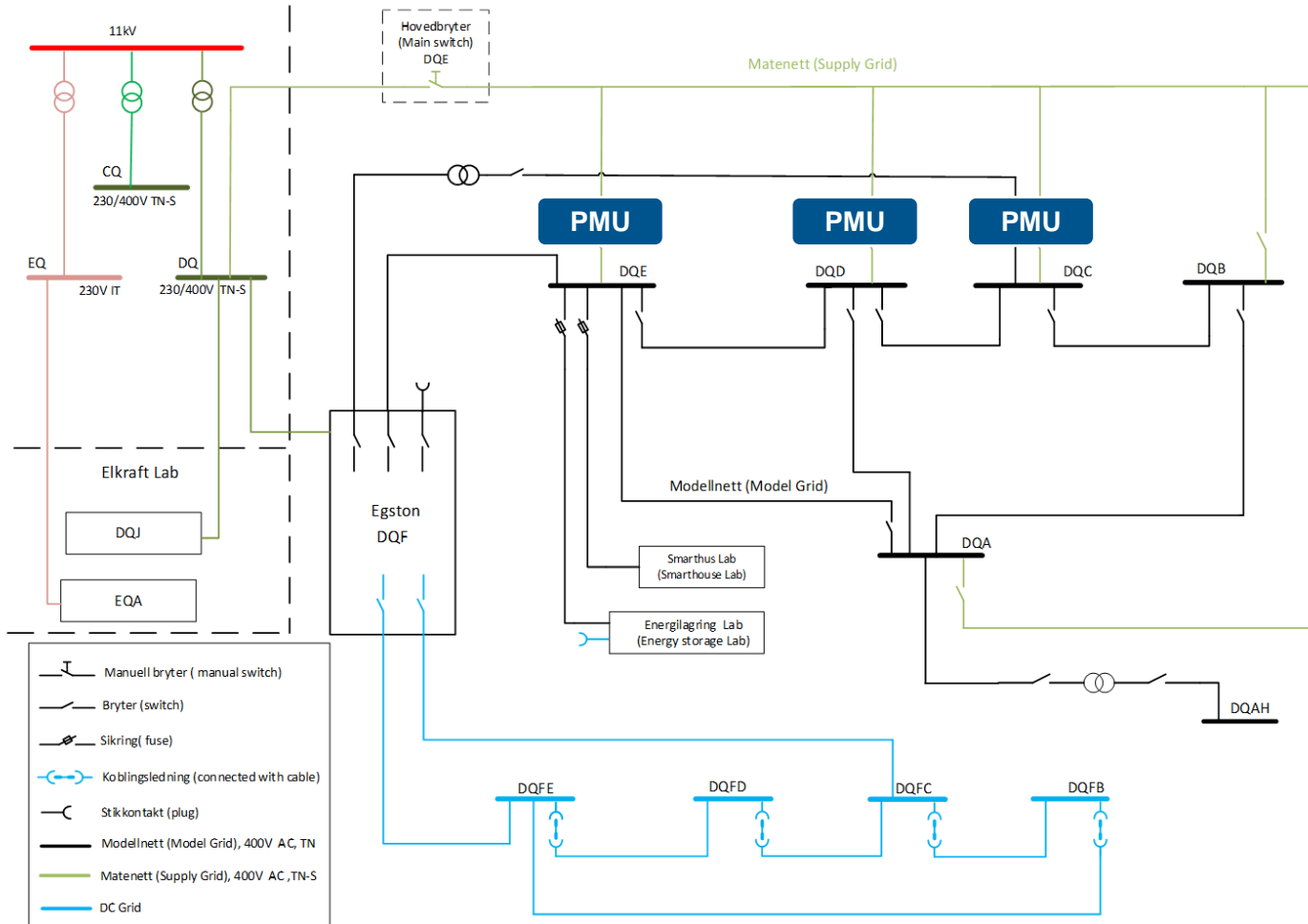
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Norwegian National Smartgrid Laboratory

- Reconfigurable layout with ac and dc bus
- Power electronics converters (2 level VSC 60 kVA, MMC 60 kVA, Grid emulator 200 kVA)
- Electrical machines (Synchronous generators, Induction machines)
- Real time simulator platform (OPAL-RT eMEGASIM 7 parallel cores, 2 FPGAs, Fiber optic communication)



Electrical layout and IEDs

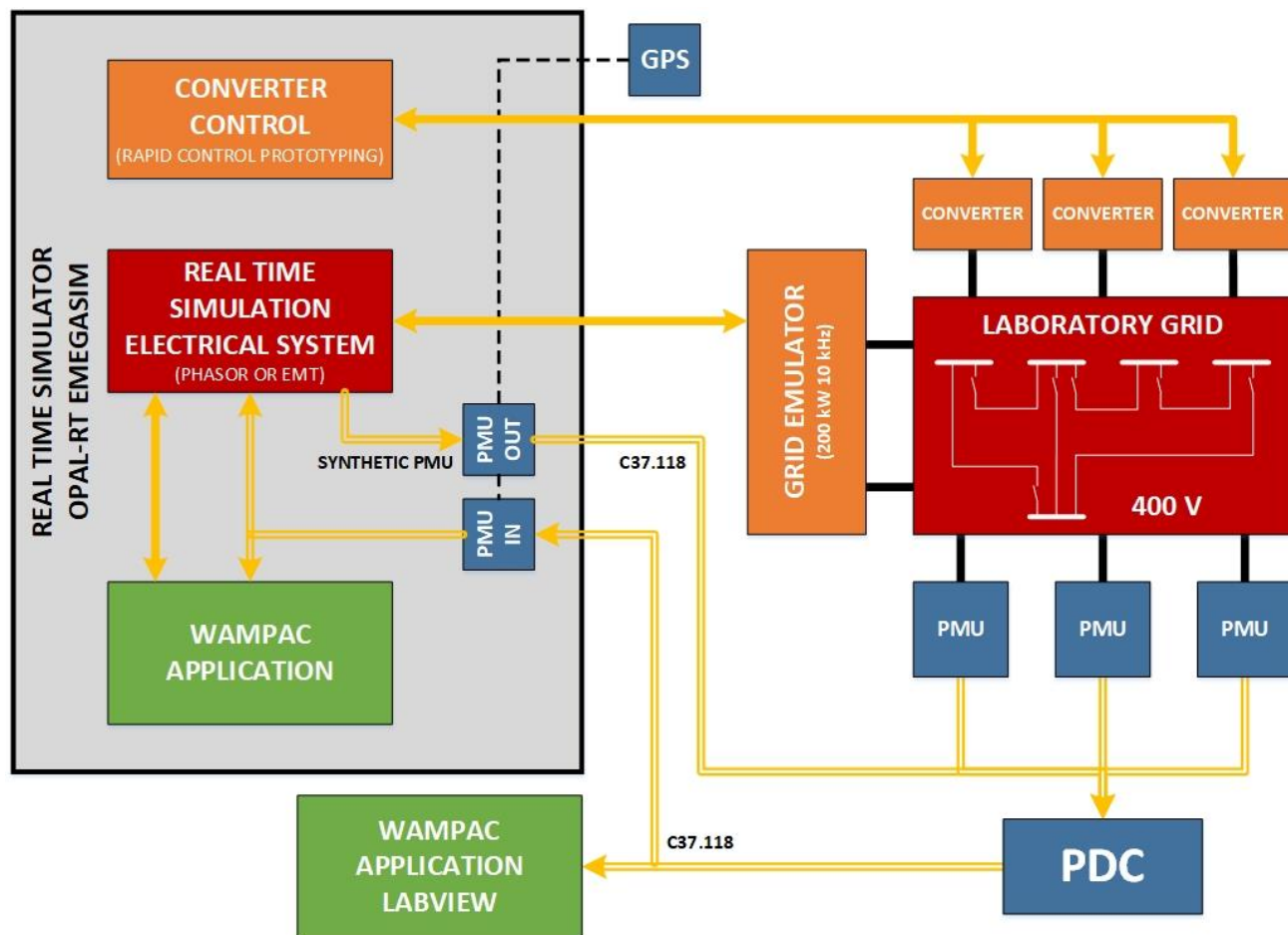


	<p>Siemens 6MU85: Merging unit</p>
	<p>SEL 401: Merging unit</p>
	<p>Siemens 7SJ85 (IED) Feeder and line protection</p>
	<p>ABB Ret 670 (IED) Transformer protection</p>



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HIL and PHIL testing capabilities



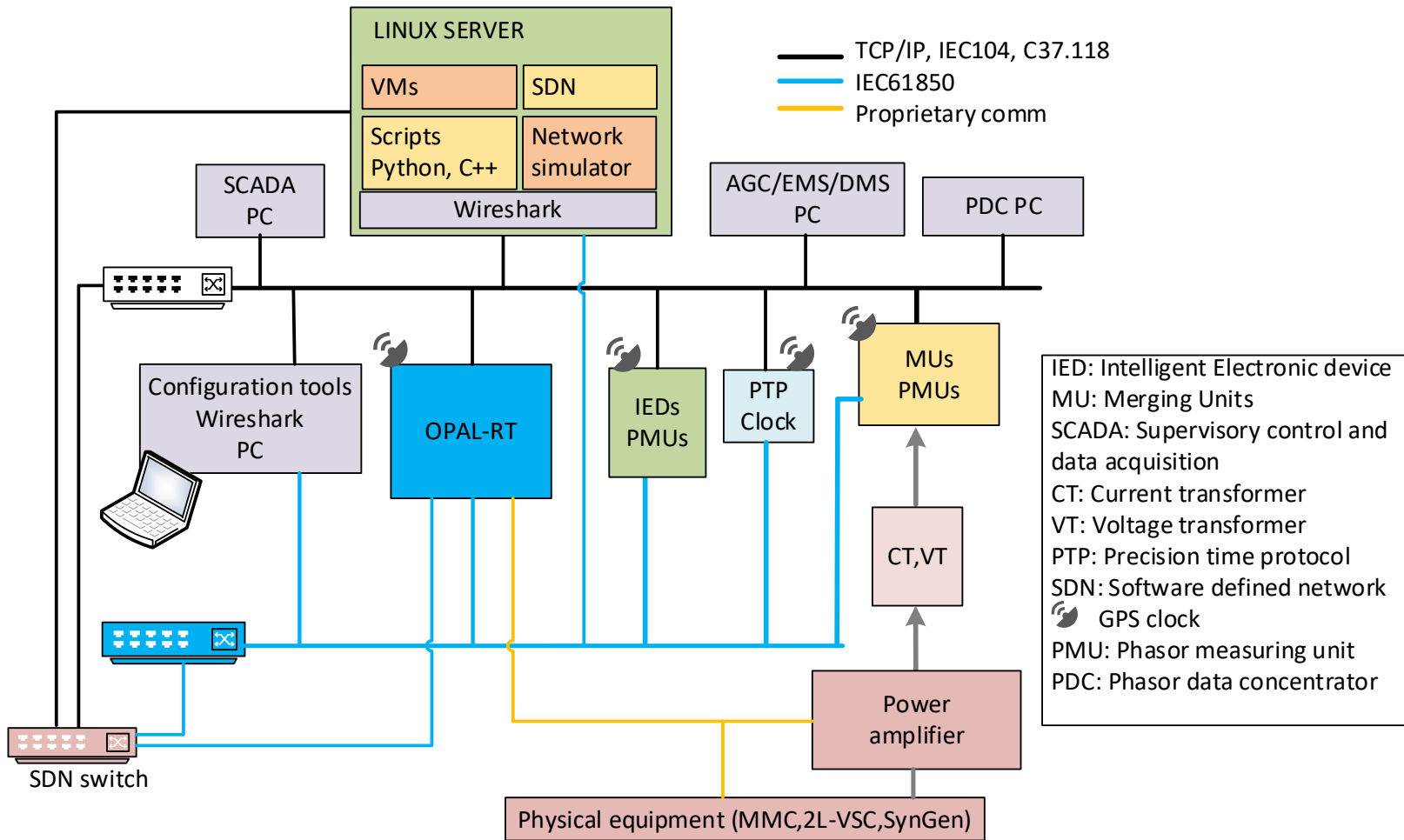
200 kVA controlled power amplifier with 5 kHz bandwidth



Real time simulator



Towards a Cyber-Physical Power System



IED: Intelligent Electronic device
 MU: Merging Units
 SCADA: Supervisory control and data acquisition
 CT: Current transformer
 VT: Voltage transformer
 PTP: Precision time protocol
 SDN: Software defined network
 GPS clock
 PMU: Phasor measuring unit
 PDC: Phasor data concentrator



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Technology for a
better society