

IED Relay Testing Lab

University of Regina

RTDS Technologies
ATC 2019,
Doug Wagner



Outline

- Introduction
- Systems Engineering & Power program at U of R
- Protection & Control Lab
 - Examples...
- RTDS Applications



University of Regina

- Power Systems “Focus area” or stream (1 of 4)
- “Systems Engineering”
- 3 Stream courses (Undergrad)
- 3 course (Grad)



[1]<https://www.google.com/maps/@50.4203726,-104.5240247,5z>



U of R Power Lab

- Established in 2014, University & targeted Provincial funds
- Very high vendor support (discounts, permanent loans)
- Various IED's - IEC 61850 Station Bus, replicating utility partner installation



U of R Power Lab - Protection Components

Feeder/Arc Flash Synchronization	SEL 751A (4) SEL 751 (2) Siemens 7SJ85 Siprotec 5
Differential	SEL 387E SEL 487V Siemens 7UT6135
Distance	SEL 321 (2) - Early series
Motor Protection	SEL 849 (2)
Programmable Controllers	SEL 2411 (4) SEL 2241 RTAC (1)



U of R Power Lab - Communications

Managed Switch	SEL 2730M (4) 2 RSTP Non PRP 2 PRP
PRP-Non PRP Interface	Siemens Scalance X204RN EEC
Inter-Station	SEL ICON Communications terminal (2)
Un-managed Switch	various - 6
Time Reference	SEL 2488 Network clock

U of R Power Lab Testing & Software

Injection Test Set	Omicron CMC 256 - Test Universe Software
Digital Simulator	RTDS Cubicle - New addition 2019
Support Software Tools	PSCAD ETAP AutoCad Electrical MatLab/Simulink



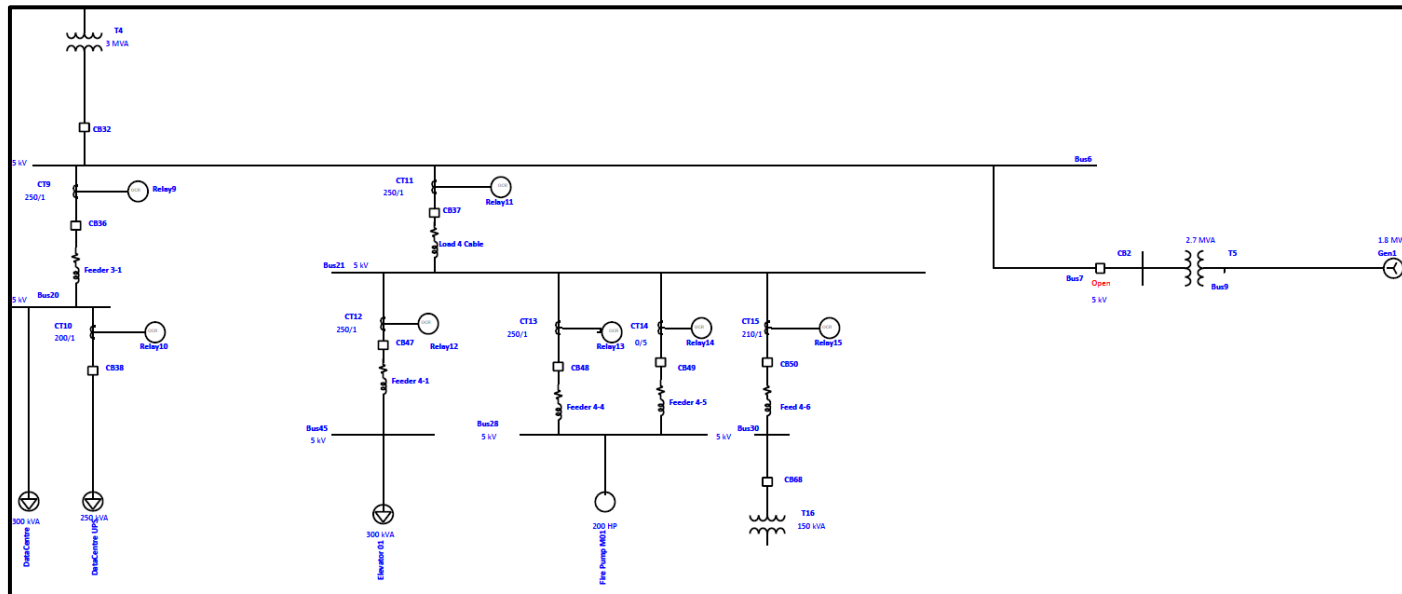
Application to Undergraduate Program

- Basics:
 - IED programming environment(s)
 - GOOSE device communications
 - ANSI 50, 51 87 device characteristics
 - Motor protection (ANSI 49)



Application to Undergraduate Program -Design & Testing

- **Project Driven** - Device coordination using software tools
- **Design Validation** - Testing device programming
- Student specified Breaker failure programming and testing
- Generator transfer controller programming



src: ENEL 482 Project Bikram Saini p.28



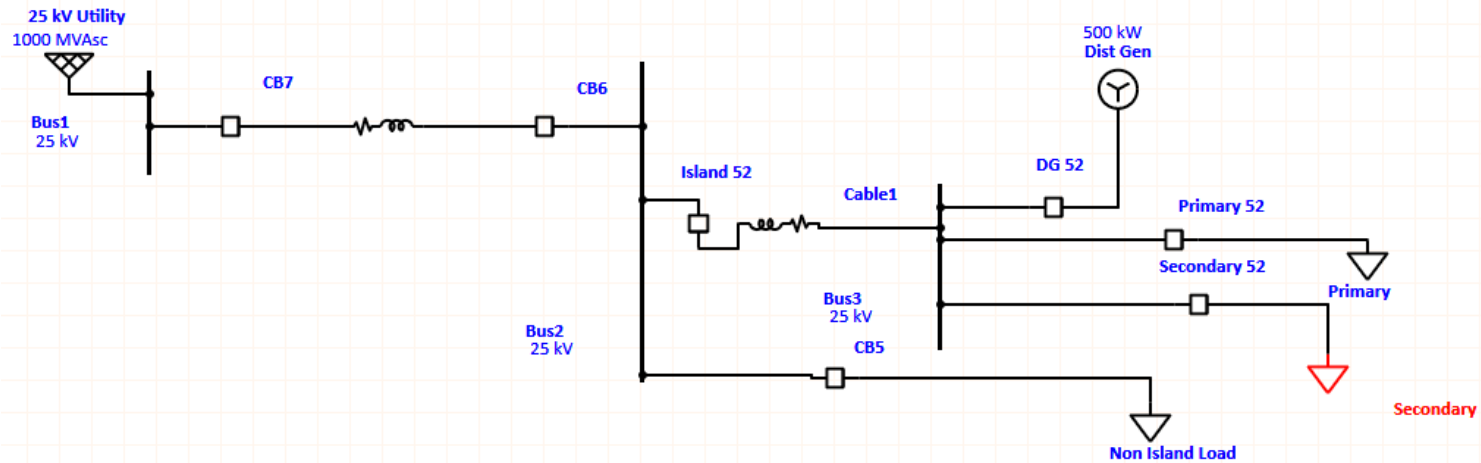
Application to Graduate Courses & Projects

- In class components: familiarization
- Masters students Project Platform:

- Examples:

Projects: Islanding

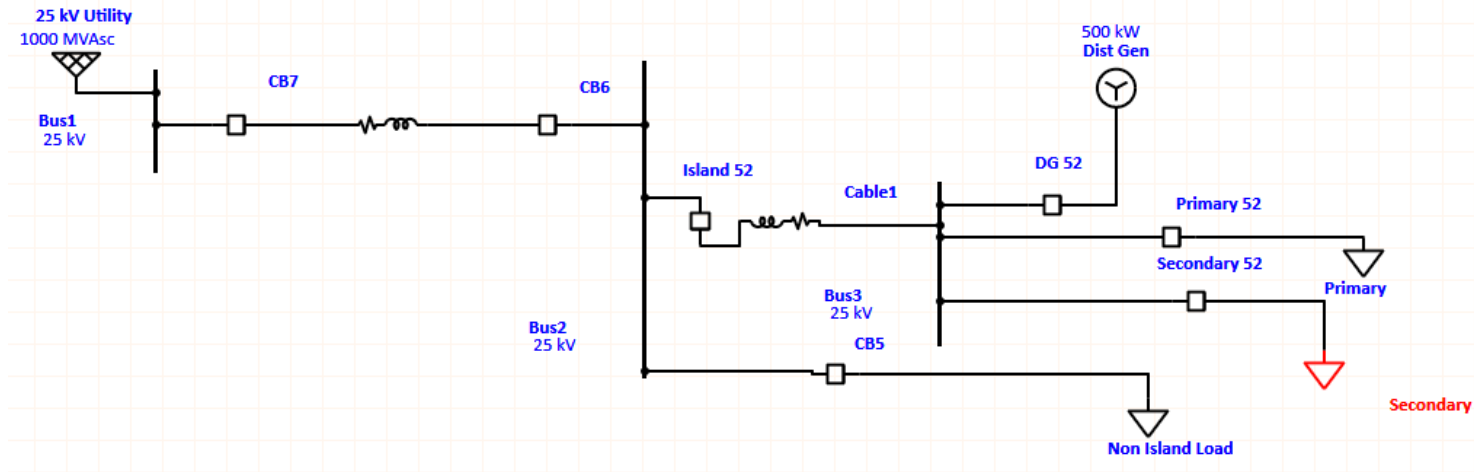
- Several iterations with different students:
 - Frequency limits,
 - Selective load dispatch based on metered values messaged between relays (binary status also used in earlier iterations)
 - SEL 751A & SEL 2411 controller



Projects: Islanding(2)

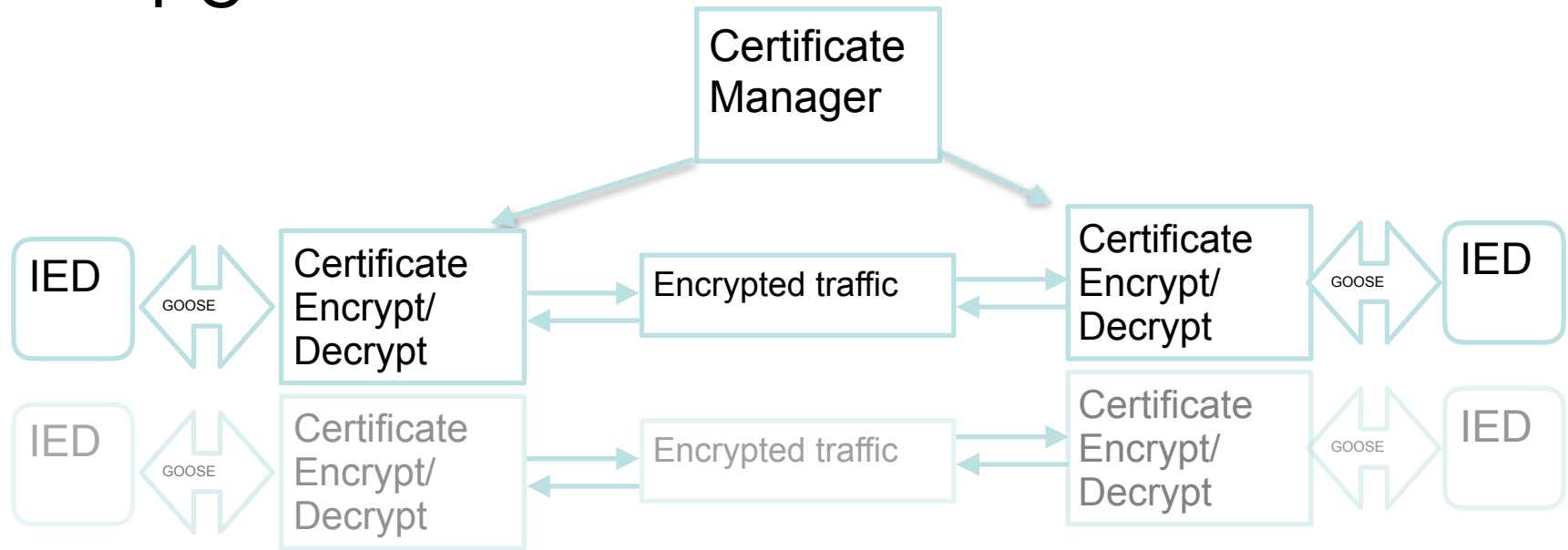
- Challenges

- Existing inputs limited to output capabilities of CMC 256
- Metering value latency (~100 ms)
- Non Dynamic model



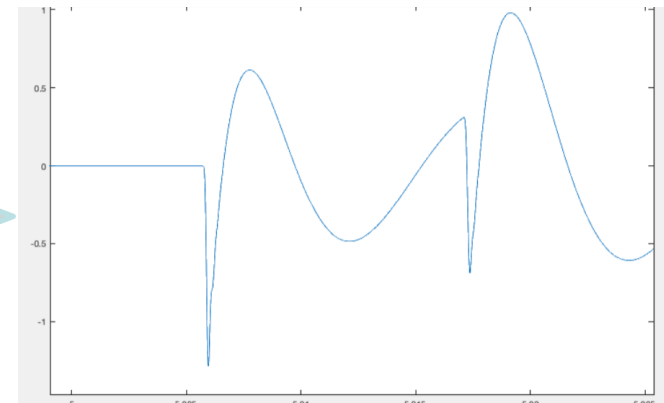
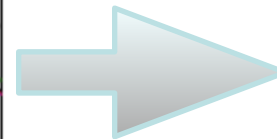
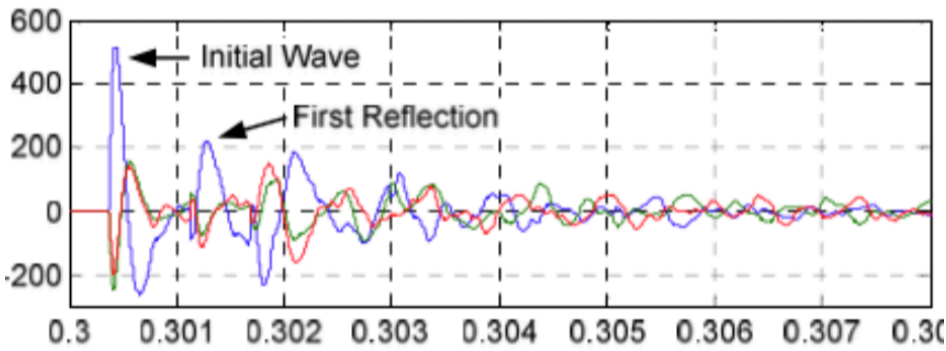
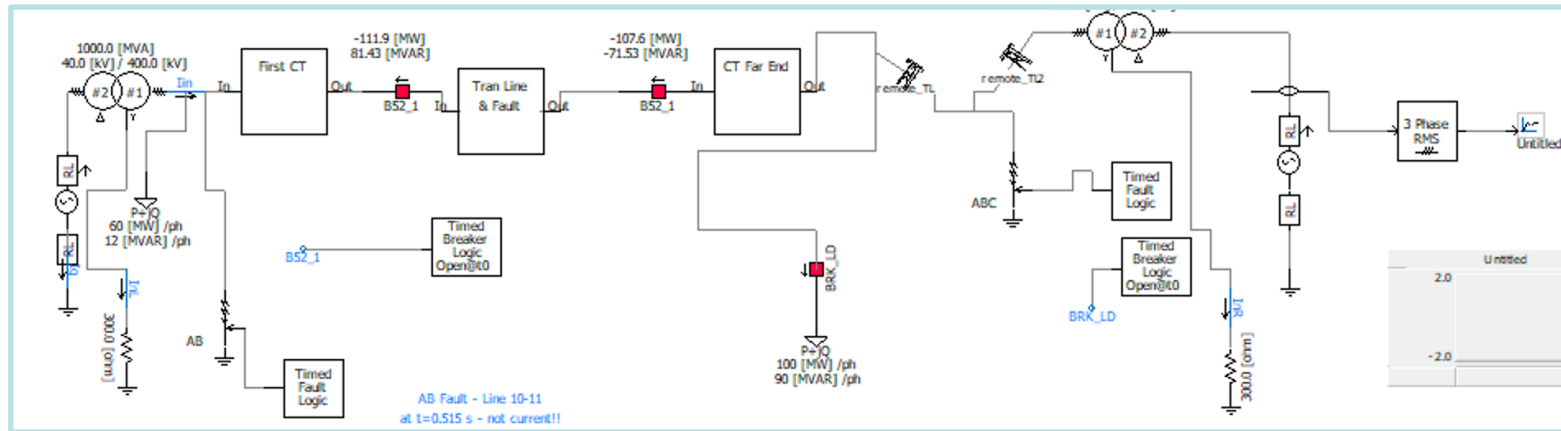
Projects: Automated Security update

- Application of ICON terminals and 3 virtual linux machines hosted on SEL 3355 station PC



Research areas

- Travelling wave protection/augmentation



U of R Power Program

- Targeted approach - Industrial/plant focus
- Protection at expense of other topics
- Future & Applied Research?



Testing and Simulation

- Recent Provision of RTDS Cubicle
- - Supports Development of SV/ Process Bus and Power electronics initiative
- Class->Lab->Research

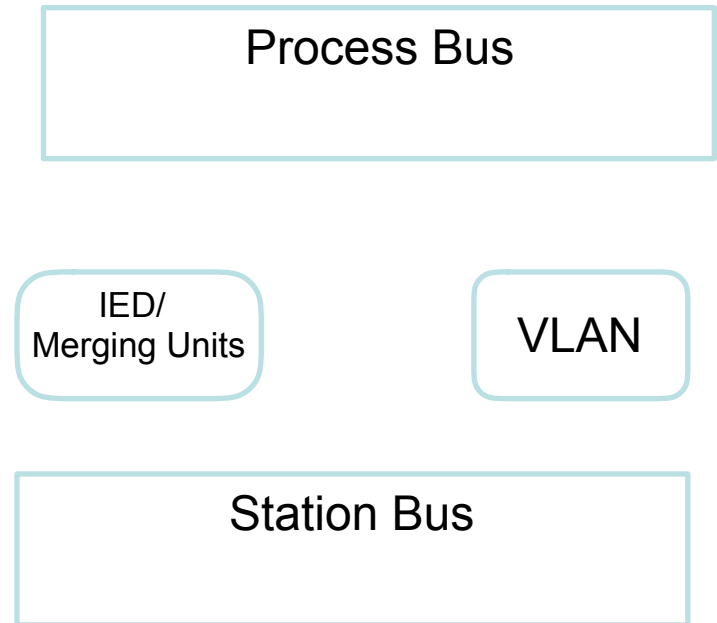


Future Work

- Develop a platform to explore Process Bus/Sample Value applications
- Distributed Generation/Renewable Generation -& stability
- Power Electronics (*Electronics Systems Engineering*)

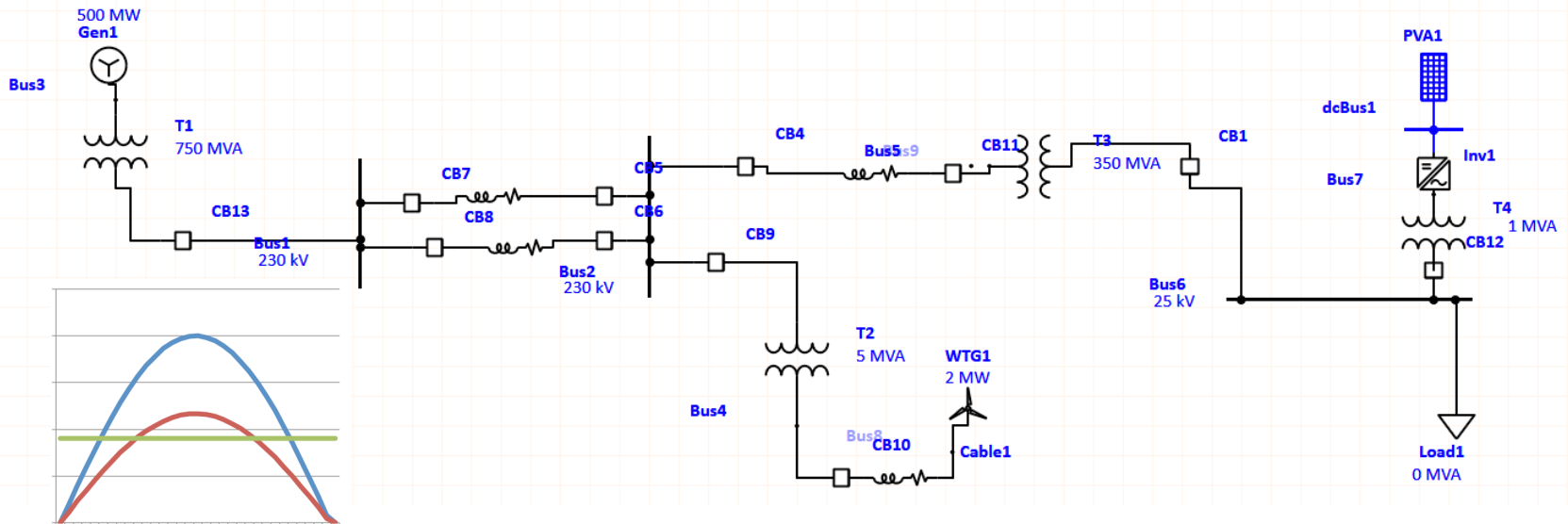
Process Bus/ SV

- Connection of existing IEC 61850 environment to new process bus capable equipment
- R.T. test & explore configuration



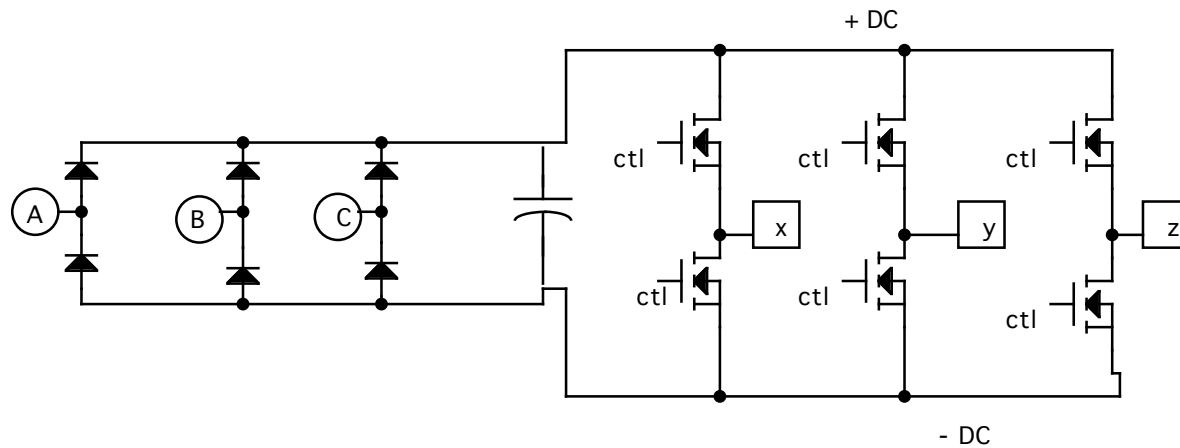
Renewable-Distributed Generation

- Platform to explore intermittent generation & its impact on availability
- Class-Lab experience → public awareness



Power Electronics

- Application of:
 - VFD
 - Active Harmonic Filter
 - Grid Applicable systems



Control Signal Source (Digital Simulator)

Thanks!

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