Paris Session 2022

cigre
For power system expertise

Wide Area Protection against Islanding in South Australia

B5 PS1 Q1.05

Are there any changes to power swing characteristics in lower inertia grid which would prompt changes to power swing blocking or out of step tripping protection settings or schemes?

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Paper B5 PS1 10120_2022

WAPS Motivation

Why PMU-based islanding prevention

Problem

- Islanding is complex sequences of multiple events
  e.g. 2016 SA blackout was ~ N-6 event
- Vast number of low probability / high impact events
- Conventional approach

WAPS Solution

- Angle & frequency differences are general measures of stress
- Triggers independent of event sequence
- Event impact is measurable, response in proportional

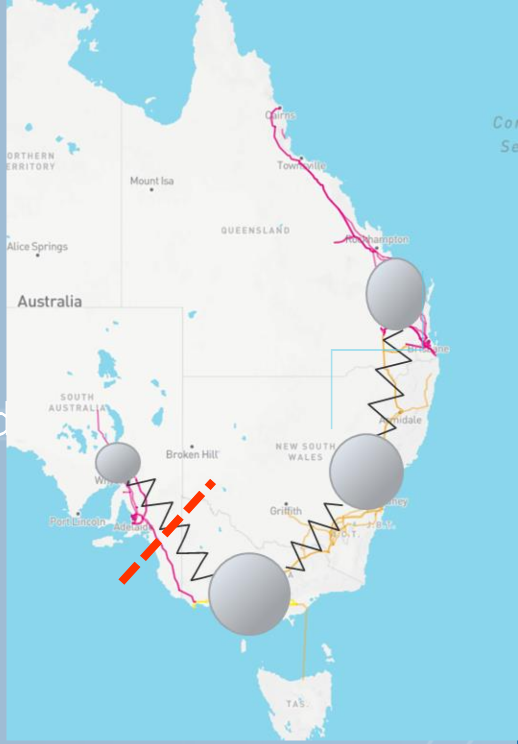
Generalised System Defense

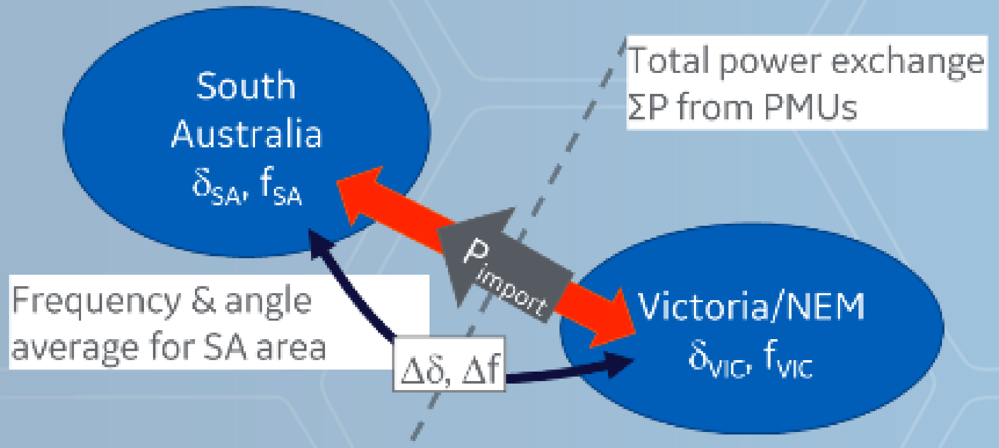
Triggers

- Angle based:
  $\Delta\delta$, Δf, $(\Delta\delta + k\Delta f)$
- Frequency based:
  SA Regional F, df/dt
- Power imbalance:
  P+H.df/dt

Response

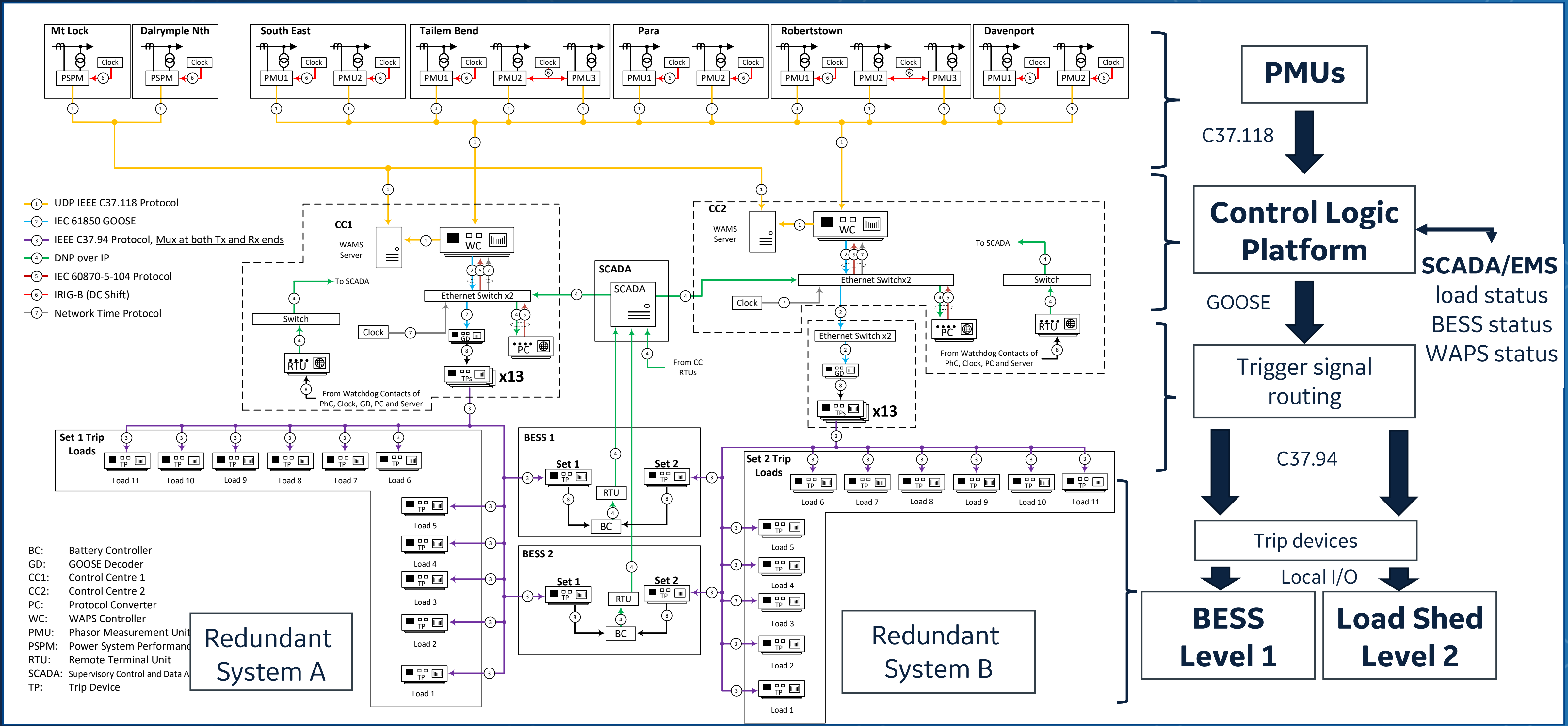
- Power imbalance minus corridor target (strong / weak / v. weak)
- Dispatch BESS & load shed





Implementation

Structure of system



Example:
3 staggered
gen trips

WAPS Test Cases

Test Results

- **279 Complex multi-event** simulations case library to test and tune scheme
- **Trigger accuracy – all tests met expectations**
- Subset of tests run in closed loop (A) manually inserted response (B) Control scheme in PSCAD control loop
- Network Stress (Δδ, Δf) most general for severe events
  1st L2 trigger in 66 cases; Only L2 trigger in 57 cases.
- System Event (f, df/dt) is early trigger (lowest latency) for 39 L1 cases, all of which were followed by another.
- Power imbalance an early trigger in 84 L1 cases