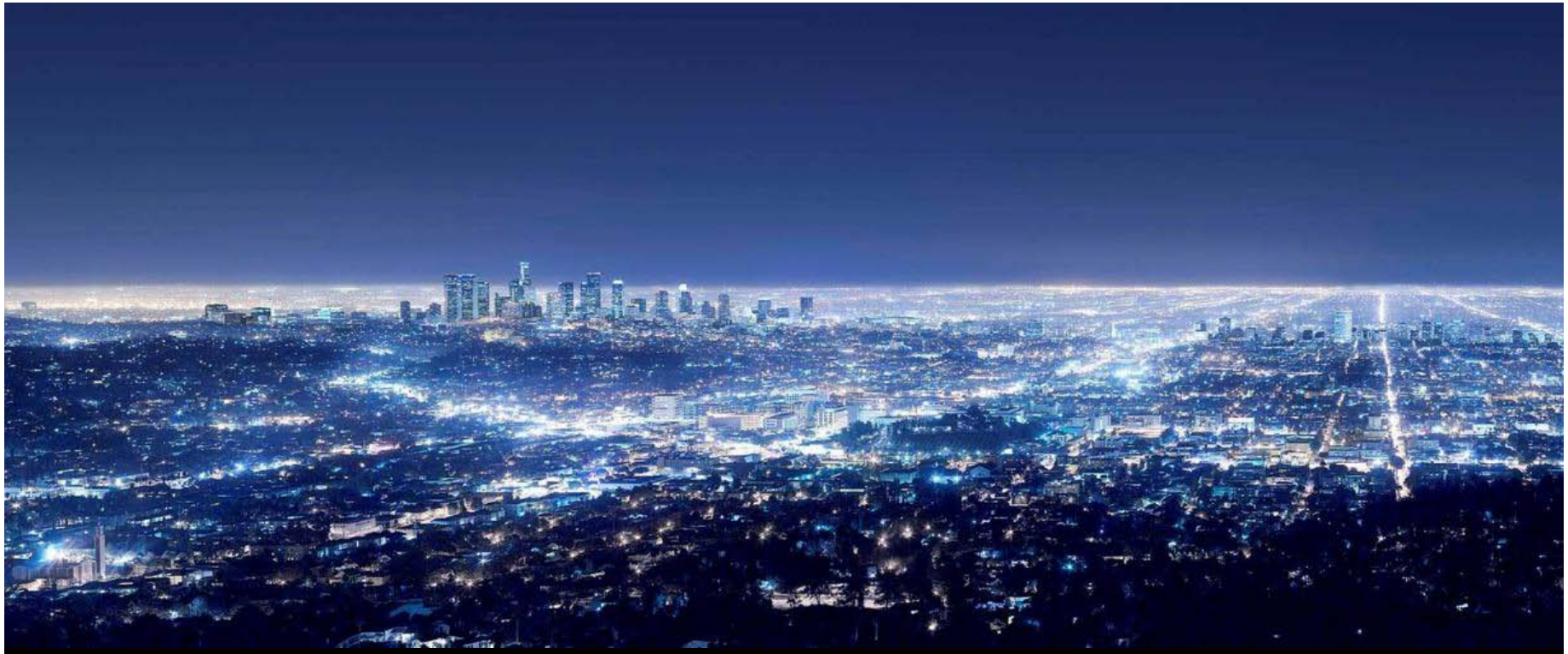

April 8 – 11, 2013

Protections to Consider with ABTS

Implementation for Sterling Power Plant – Yale

2013 Texas A&M Relay Conference

Co-authors and Speakers

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A Unique Application at Yale University

Automatic Bus Transfer Scheme

Introduction & System Description at Yale

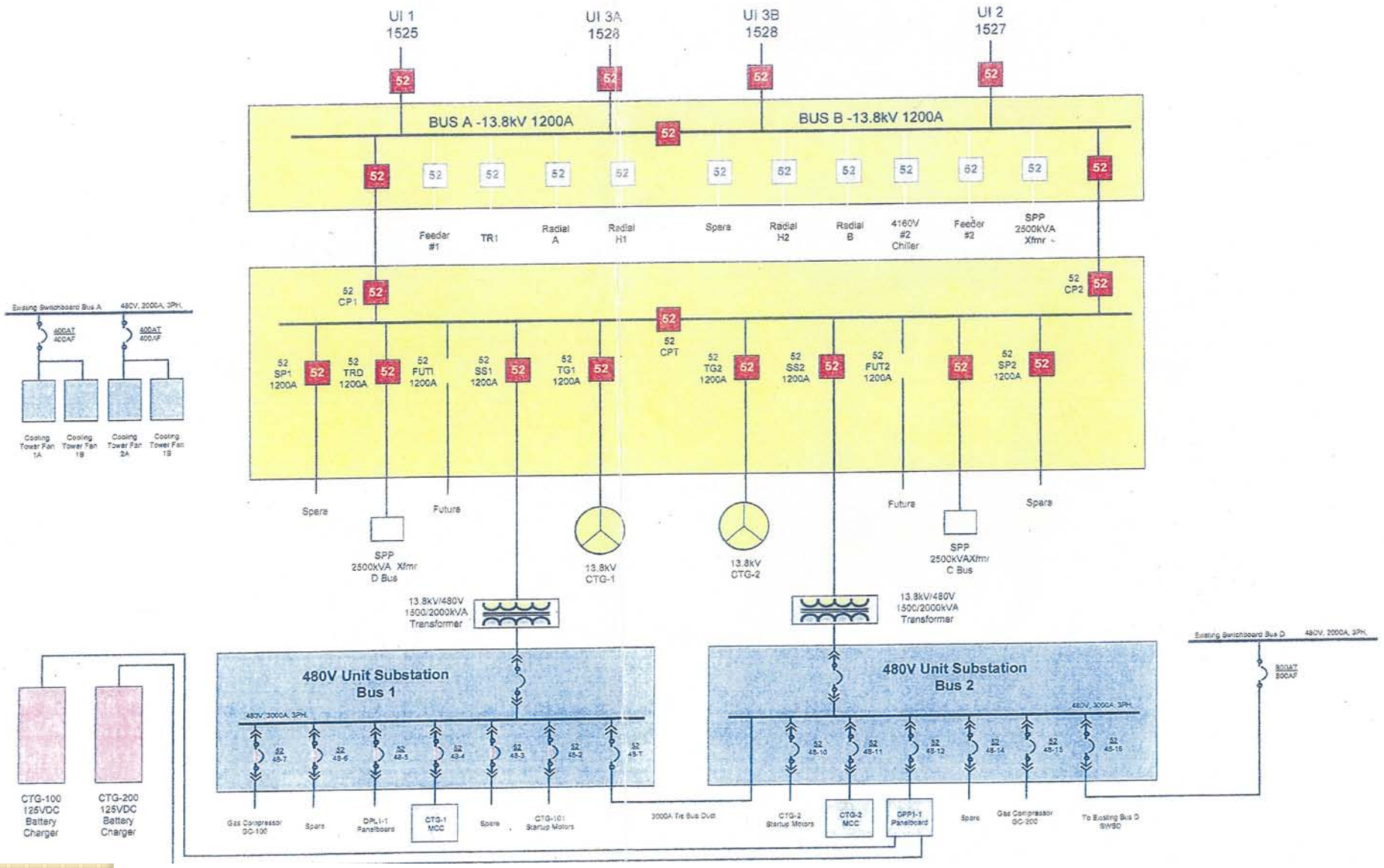
Operation philosophy at Yale University:

- Safety and reliability

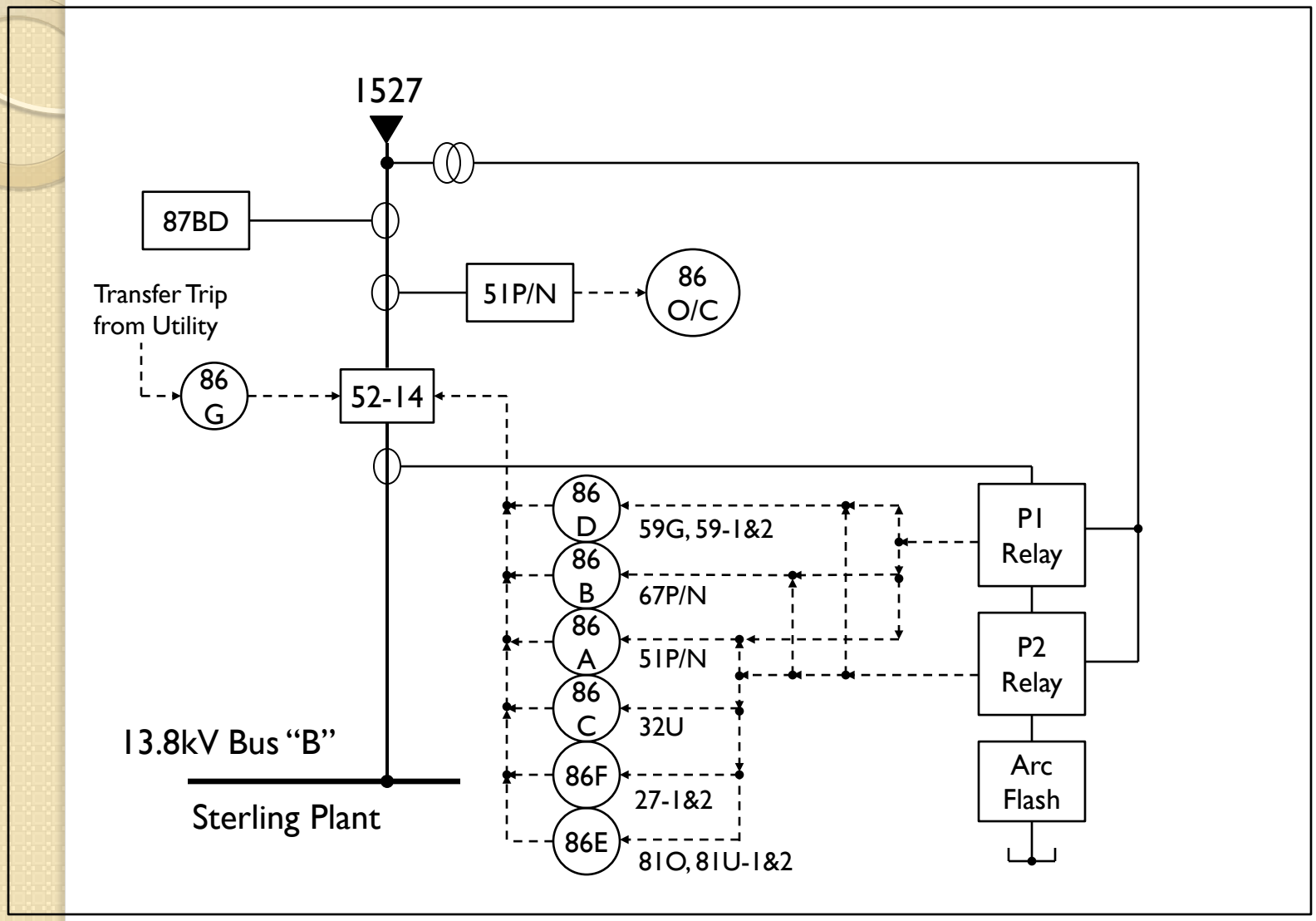
Two power Plants:

- Central Power Plant, 18MW at 13.8kV
- Sterling Power Plant, 18MW at 13.8kV
  - Four 13.8kV, 1,200A Switchgears
  - Two gas turbine generators
  - Interconnected with The United Illuminating, 4 incoming feeders
  - Serves the Medical Campus

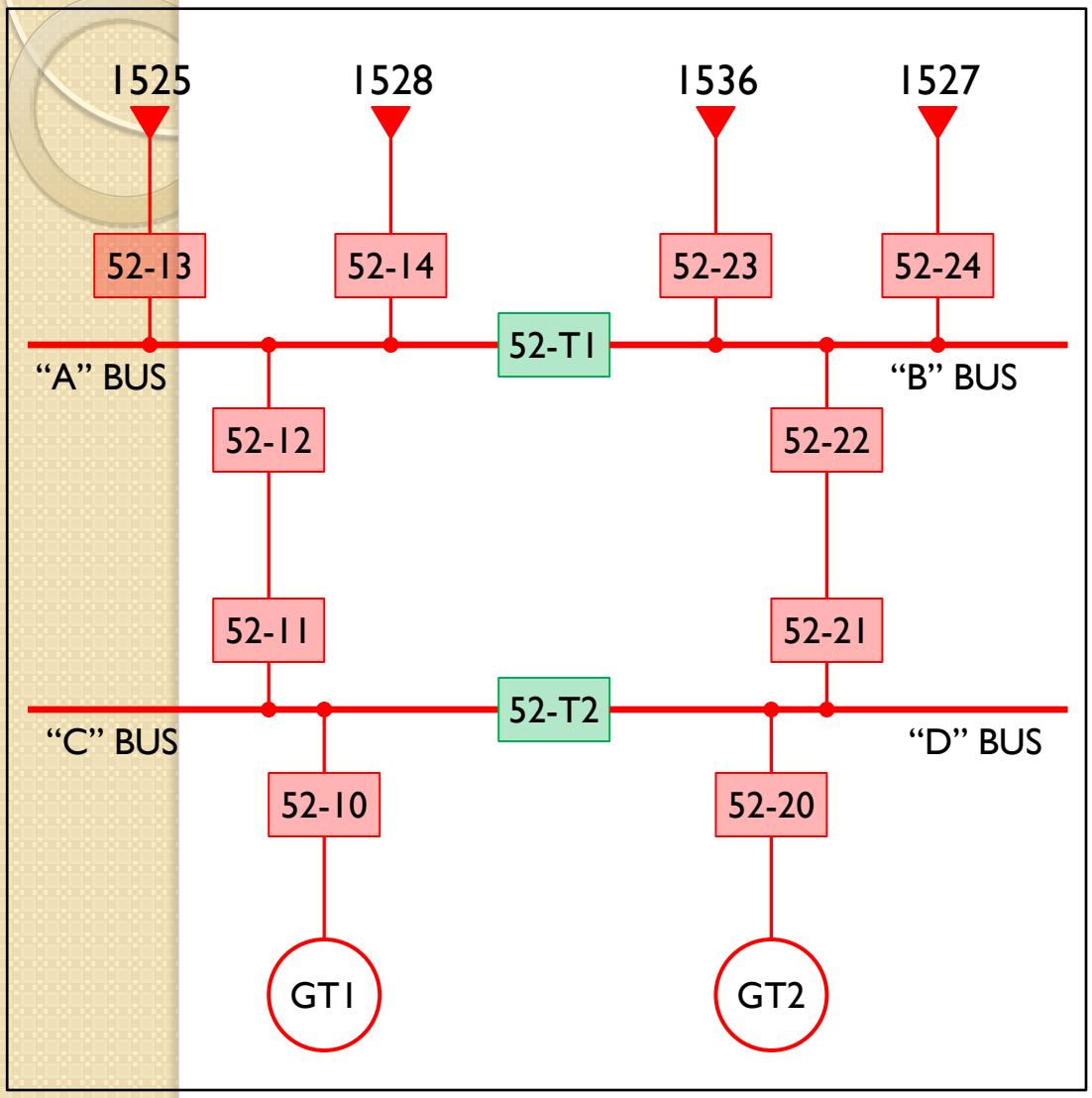
Sterling Plant 13.8kV One Line Diagram



Typical Protection Package for a Feeder Terminal

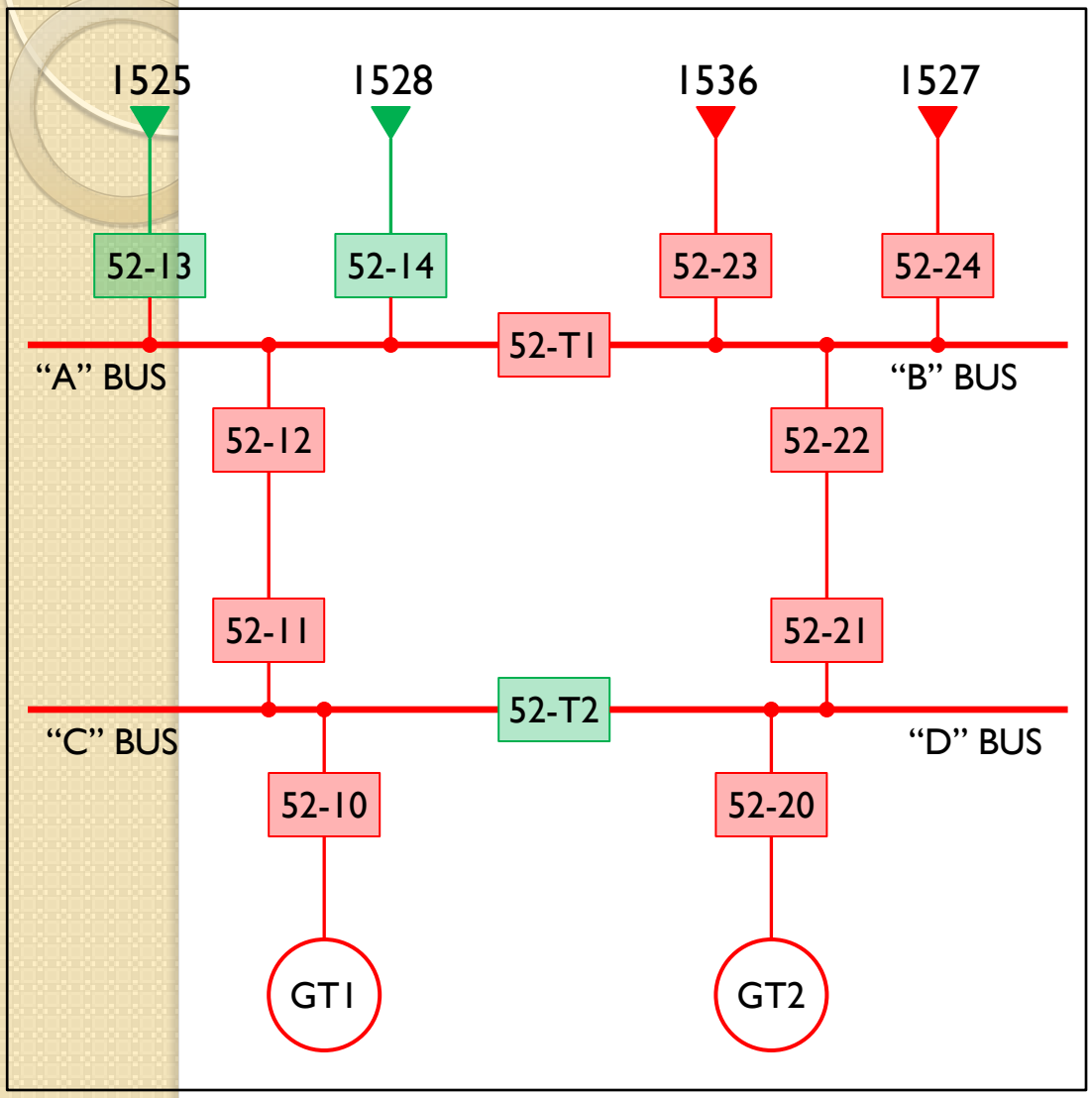


Sterling Plant Operation Mode at "HIGH LOAD"



- All 4 incoming feeders are connected
- Both gas turbines are in service
- Both tie breakers are open

Sterling Plant Operation Mode at "LOW LOAD"



- Only two incoming feeders are connected either on A or B Bus
- Both gas turbines are in service
- Tie breaker between C and D Bus is open
- Tie Breaker between A and B Bus is close

Why ABTS is Needed

Sequence of Events:

- A fault occurred at the utility side
- The "old" protection package was slow
- Breakers at the Sterling Plant did not trip fast enough
- The Sterling Plant generators were feeding the fault
- Generators removed from service by protection relays
- The Medical Campus experienced a black-out

Six (6) incidents in two months!!

Implementing the Scheme

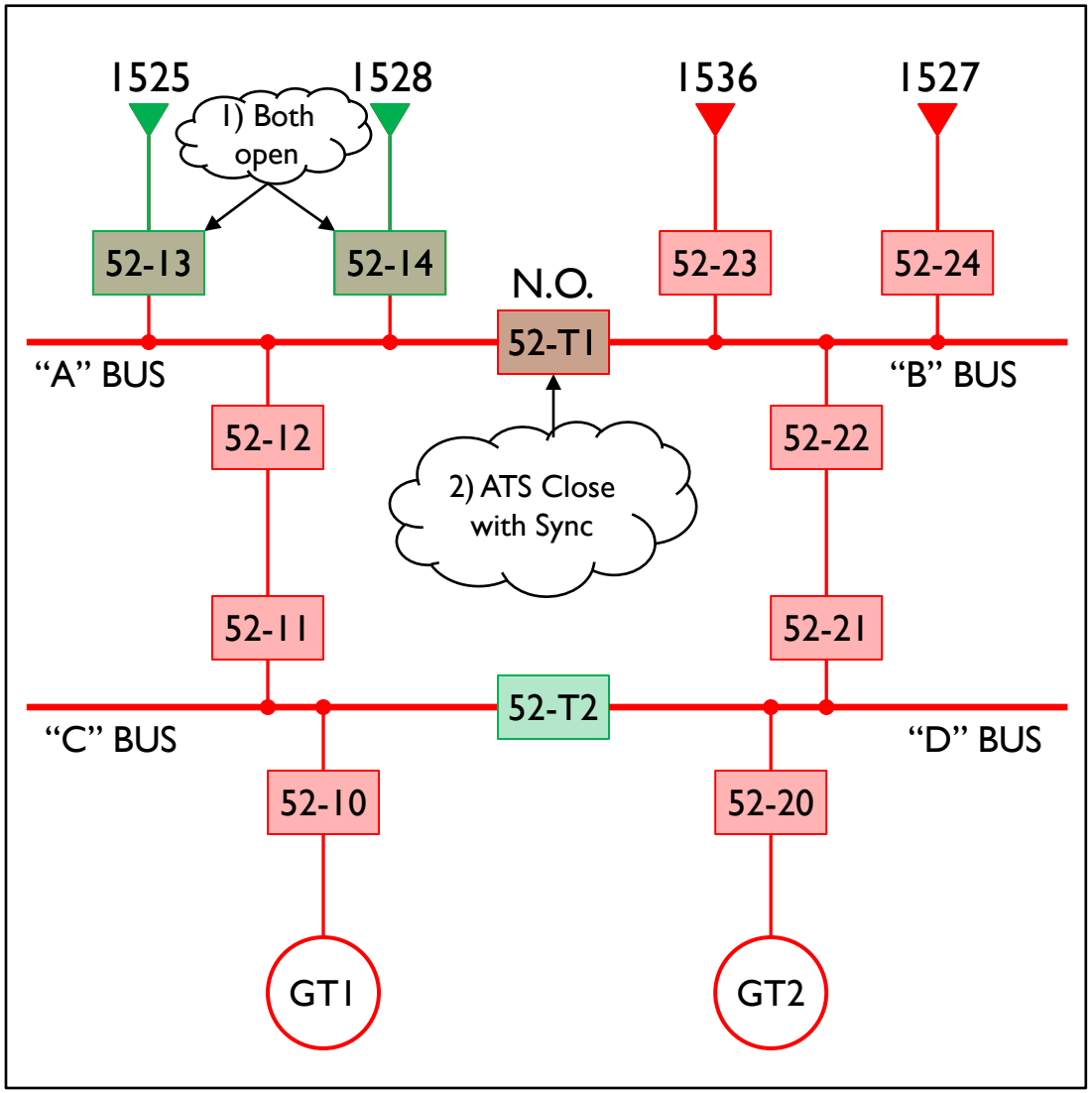
Enhancement of incoming feeder protection:

- Trips for faults on utility side before the Sterling Plant generators become unstable

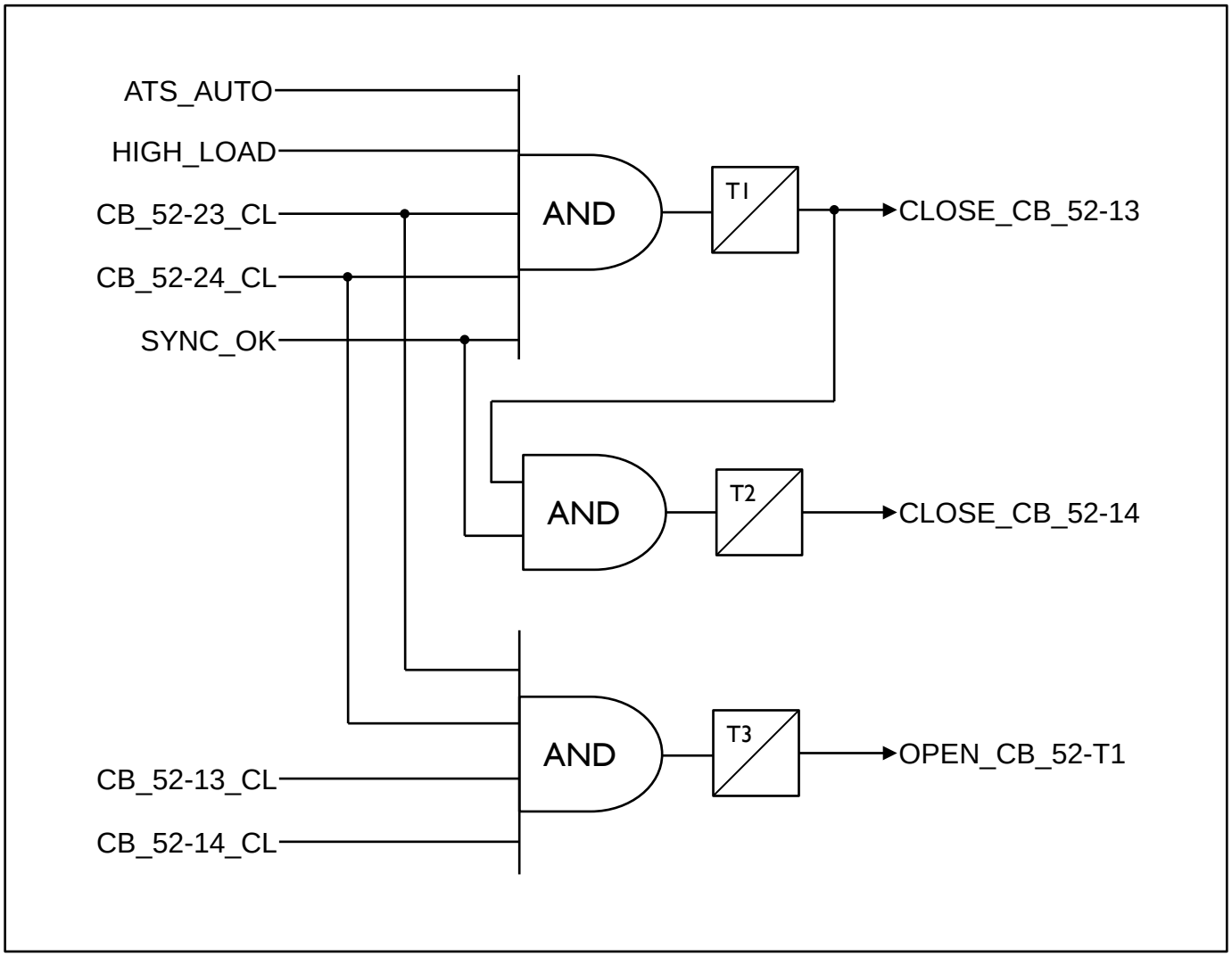
Automatic Bus Transfer Scheme (aka Auto Throw-over Scheme):

- At "HIGH LOAD" mode
  - Ensure both utility incoming feeders on either bus off line
  - Close tie breaker connecting A and B Buses with synch check
- At "LOW LOAD" mode
  - Ensure both utility incoming feeders off line on the energized bus
  - Close the incoming feeder breakers on the opposite bus with synch check
- Automatic restoration when the incoming feeders are back to normal

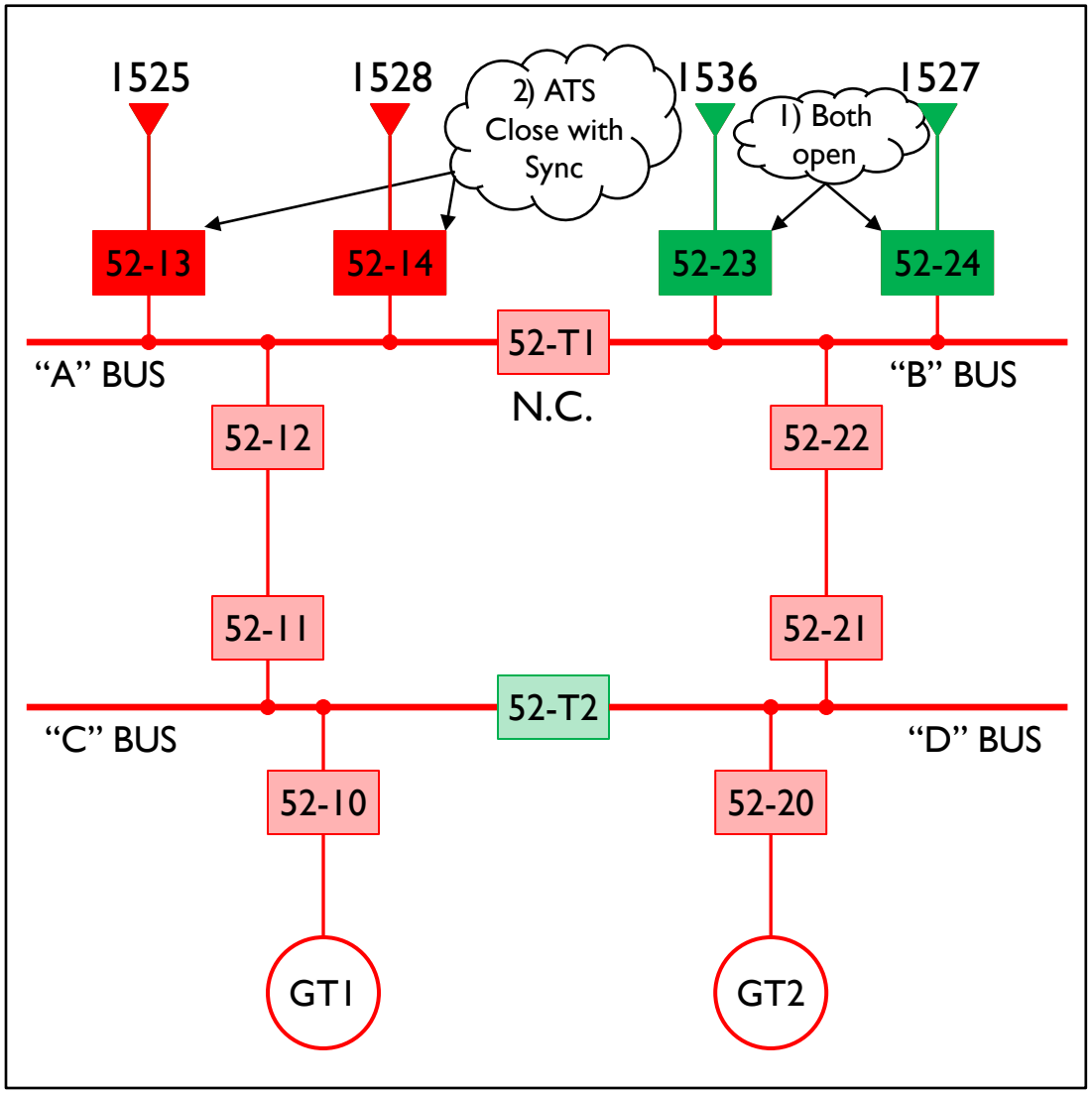
"HIGH LOAD" ATS with Impacted "A" Bus



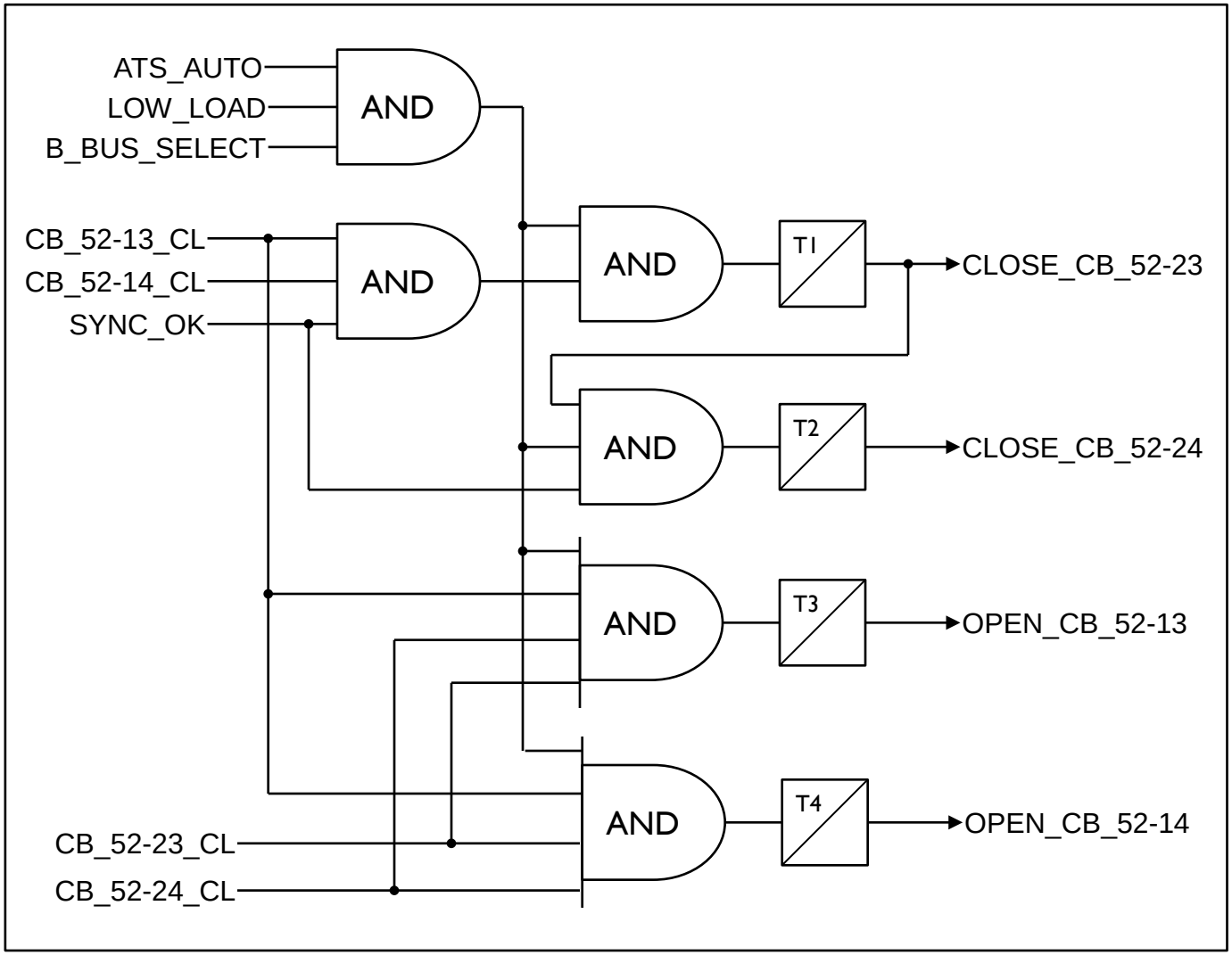
"HIGH LOAD" ATS Auto Restoration Logic of "A" Bus



"LOW LOAD" ATS with Impacted "B" Bus



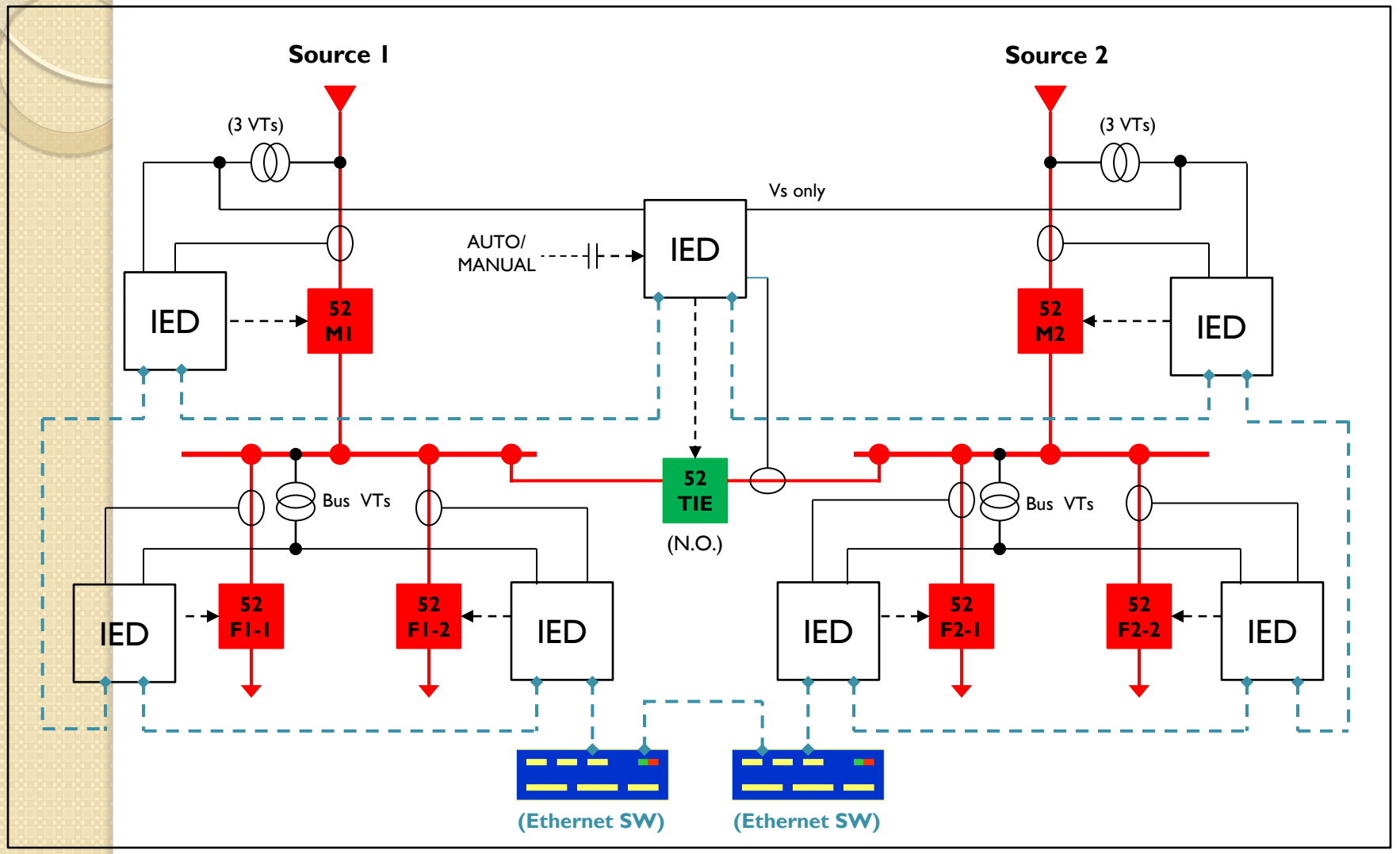
"LOW LOAD" ATS Auto Restoration Logic of "B" Bus



Protection Considerations

Automatic Bus Transfer Scheme

Typical M-T-M ABTS with IEC61850 GOOSE

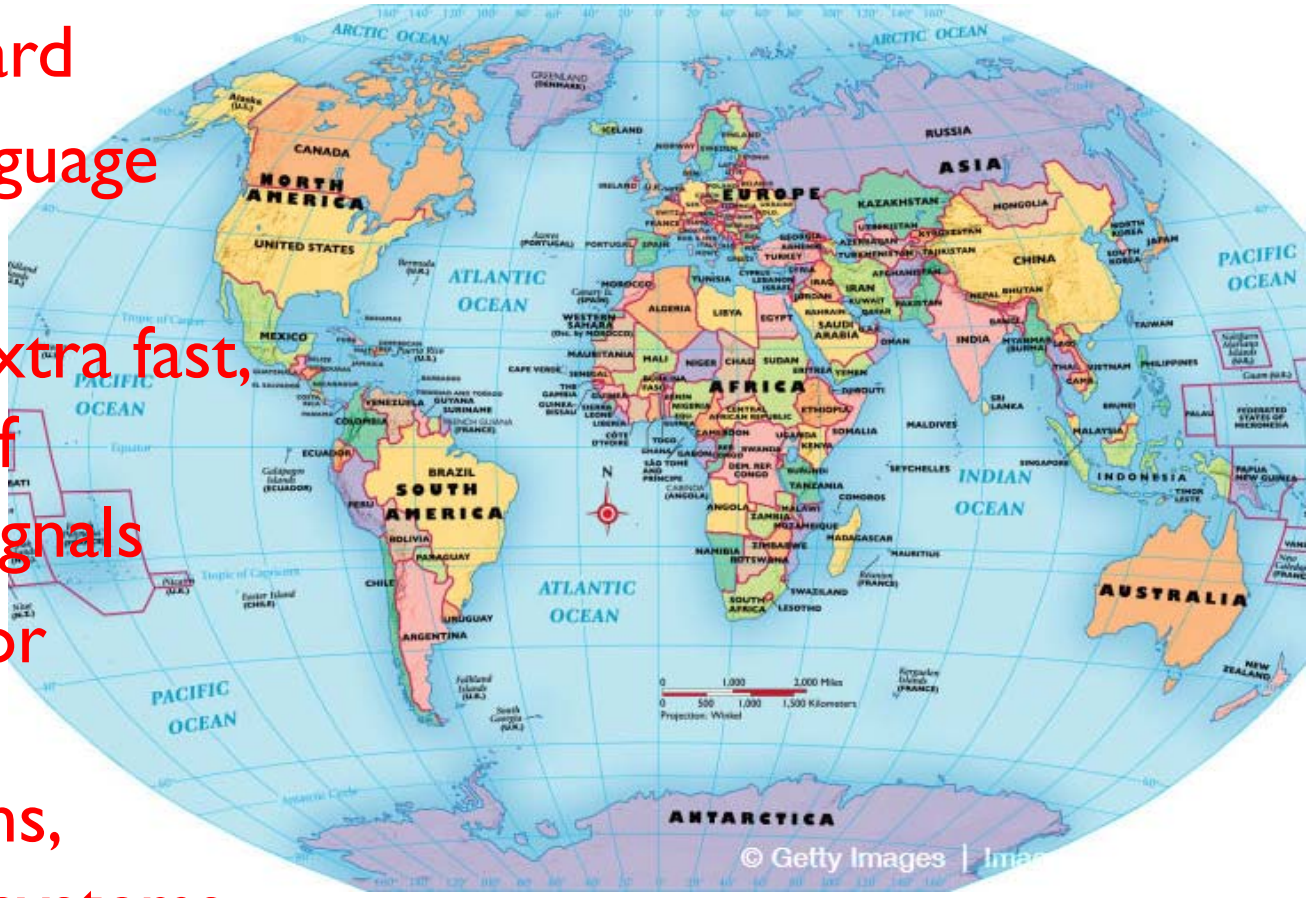


IEC61850 GOOSE Communication Charateristic

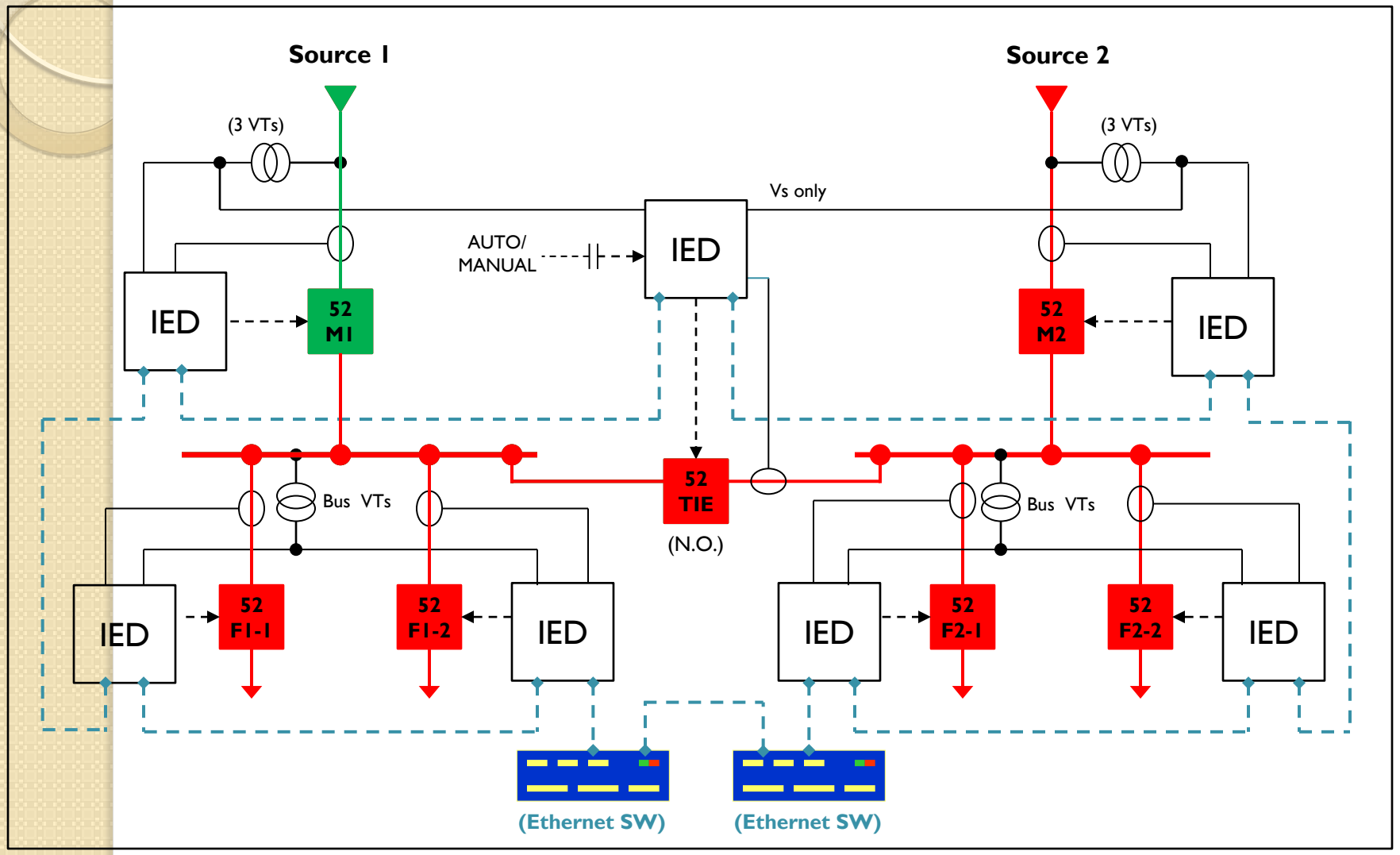
- All IED's are IEC61850 compliant/capable
- GOOSE (Generic Object Oriented Substation Event) means peer-to-peer (horizontal) communication among IED's over ethernet
- Signal communicating among IEDs is event based and when a change in GOOSE data occurs
- GOOSE signals are based on broadcaster/ subscriber relation
- Isolation and restoration processes are automated

IEC61850 Benefits

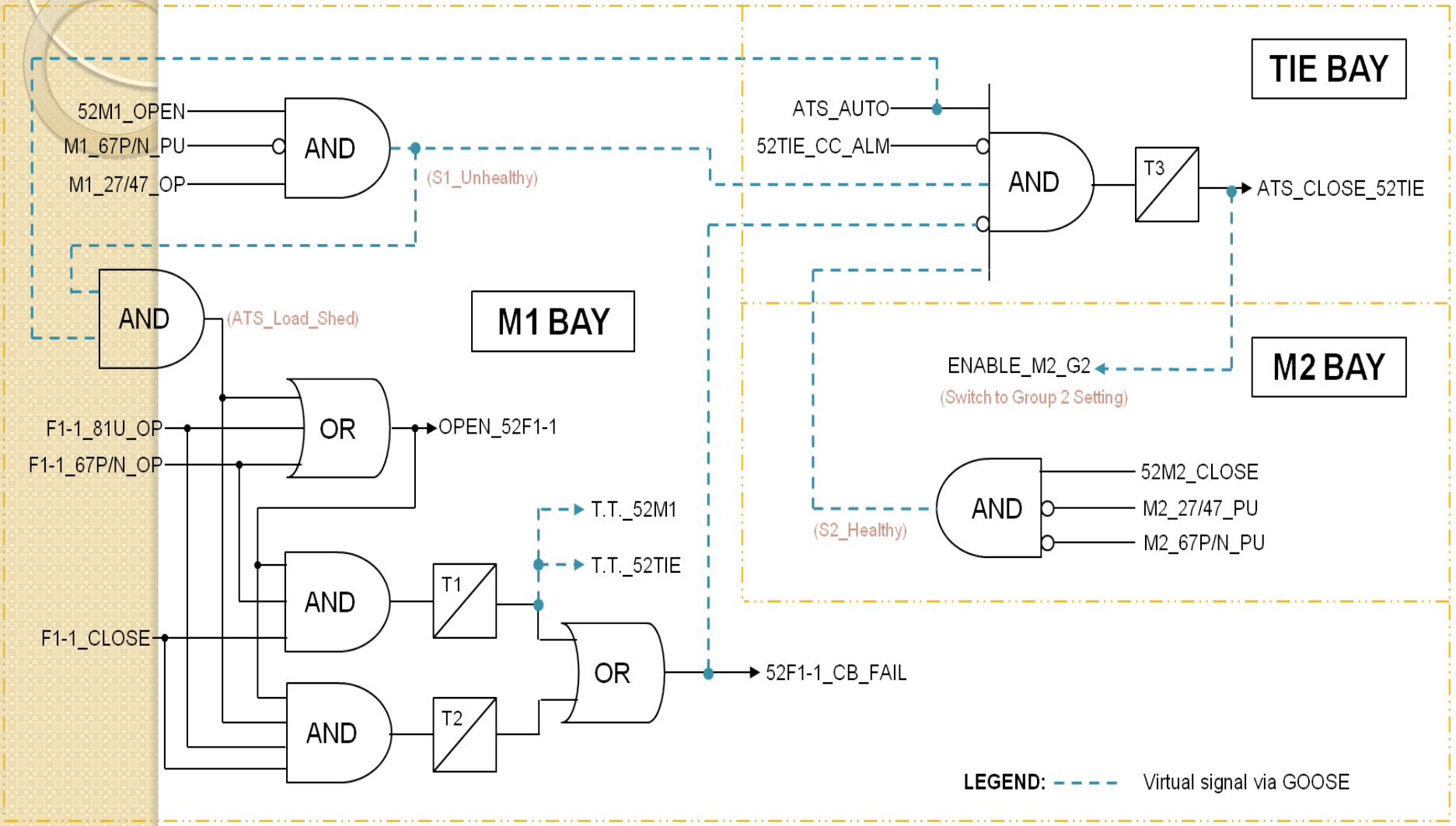
- IEC 61850 standard
  - One global language for all IEDs
  - Widespread, Extra fast, Reliable Way of transmission signals
  - Architecture for substation communications, networks and systems



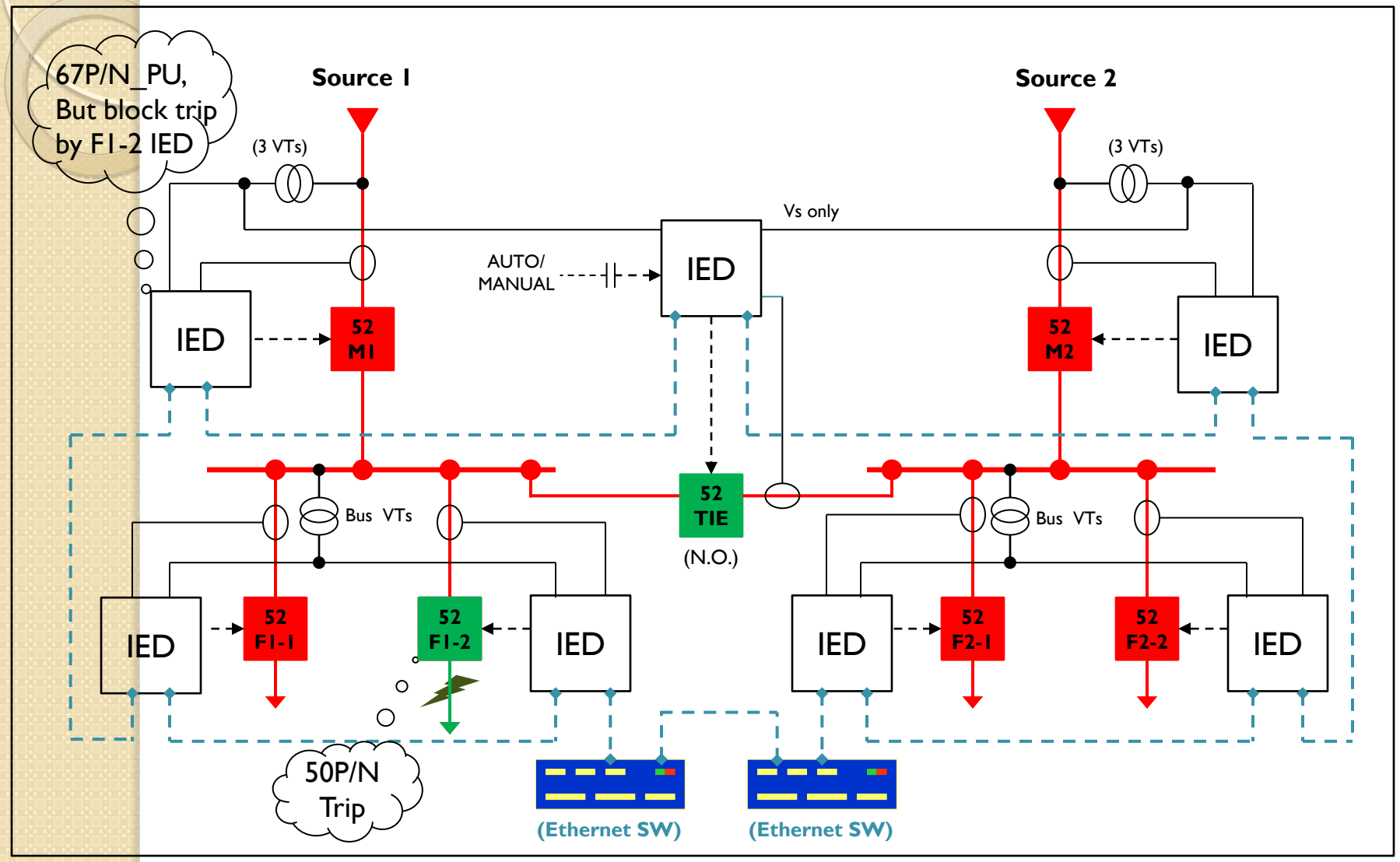
GOOSE Base Automatic Bus Transfer – Loss of Source 1



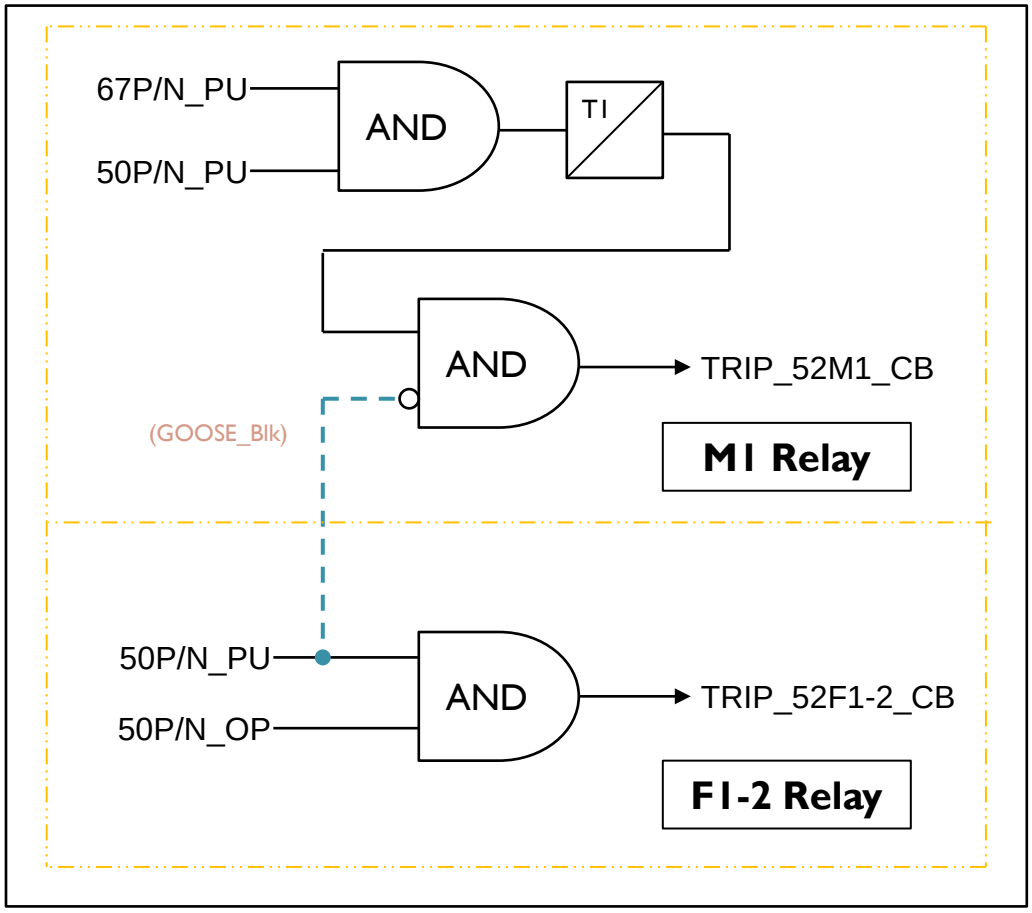
Logic for ABTS Incorporating Load Shedding, BF, & Close Coil Monitor



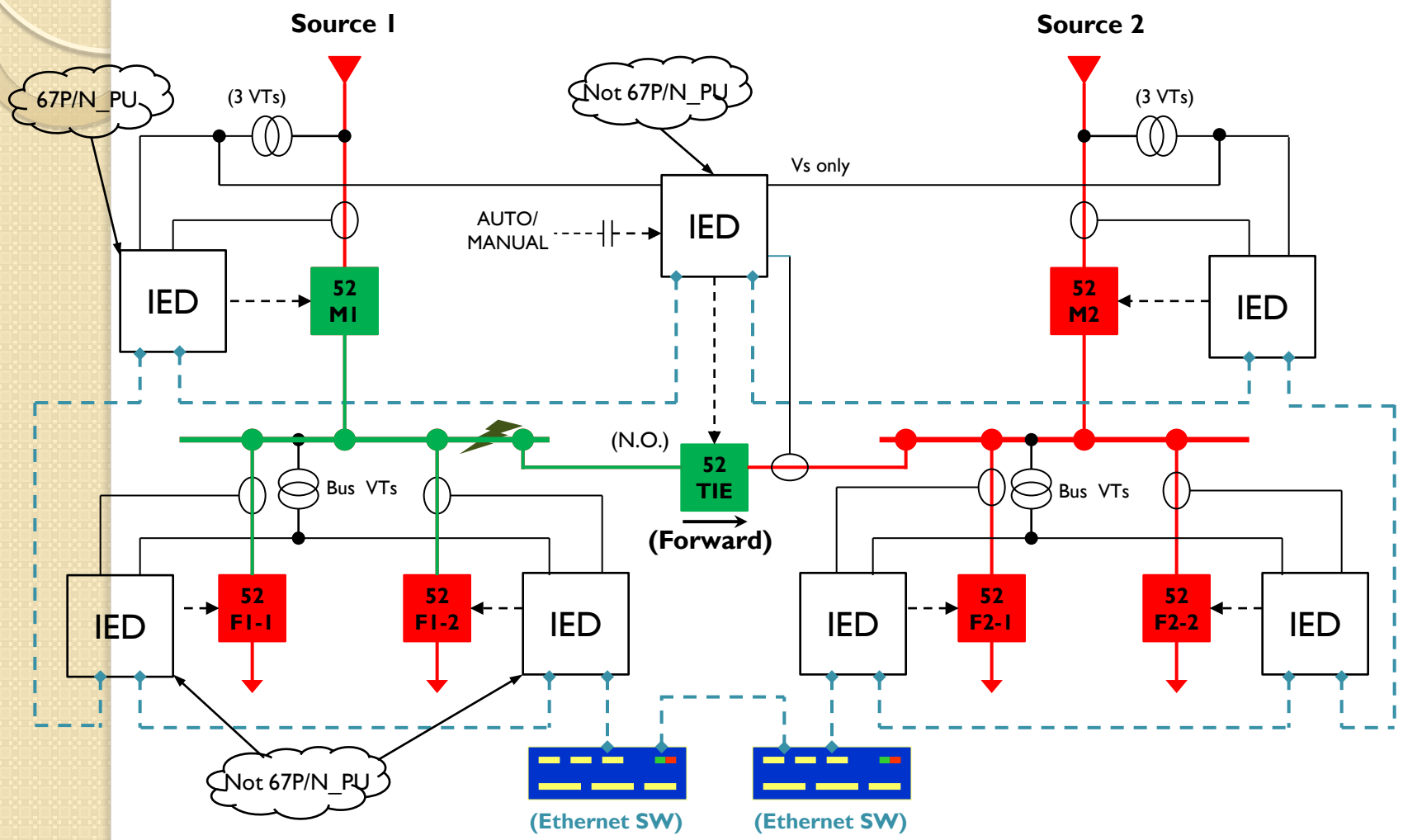
Protection Coordination with GOOSE Blocking



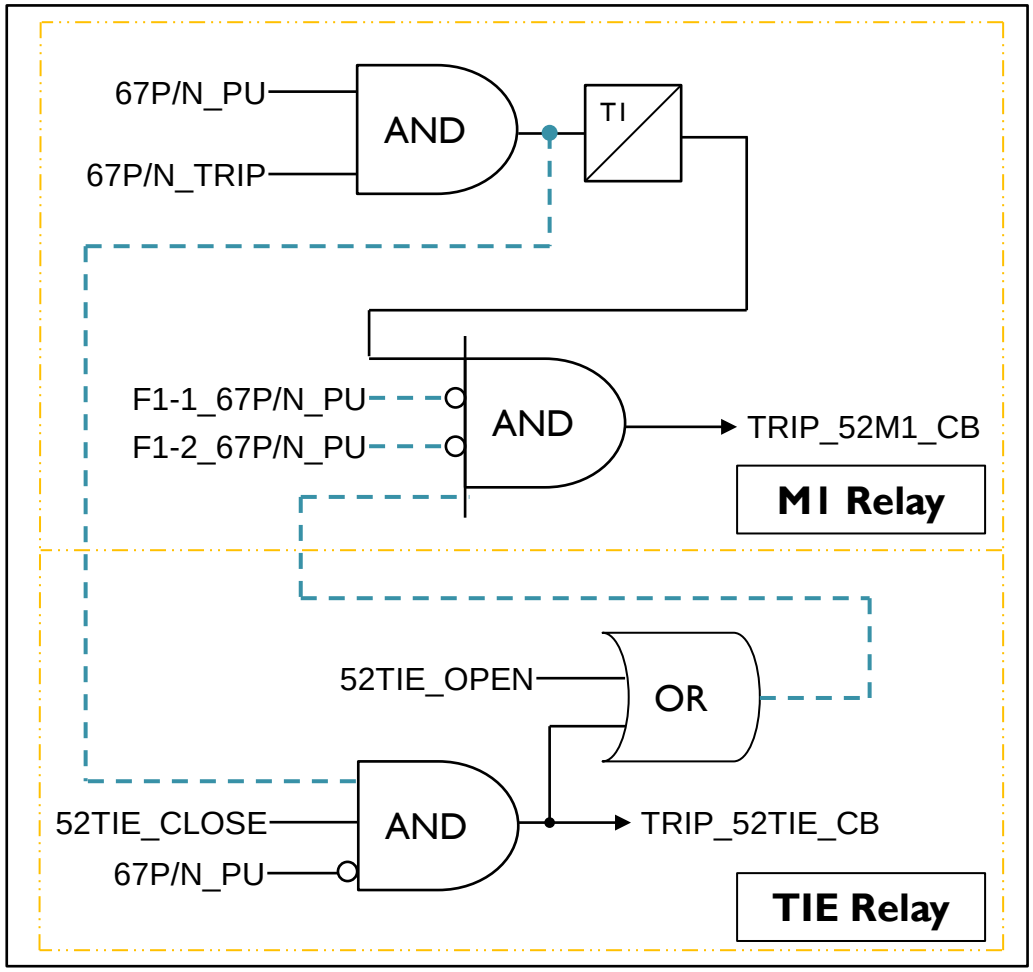
GOOSE Blocking Logic



Main Bus Protection with GOOSE



Main Bus Protection Logic



Conclusion

Unique ATS application at Sterling Plant:

- Functionally tested several times off-line and on-line
- No Mis-operation
- The Medical Campus has not been in the dark

M-T-M ABTS with IEC61850 GOOSE Communication:

- Many Benefits
- Achieves better coordination between Main breaker and feeder breaker
- Can incorporate load shedding, breaker failure protection, and bus protection equivalent to bus diff.
- Non-interrupted running motor possible

QUESTION?

Thank You…