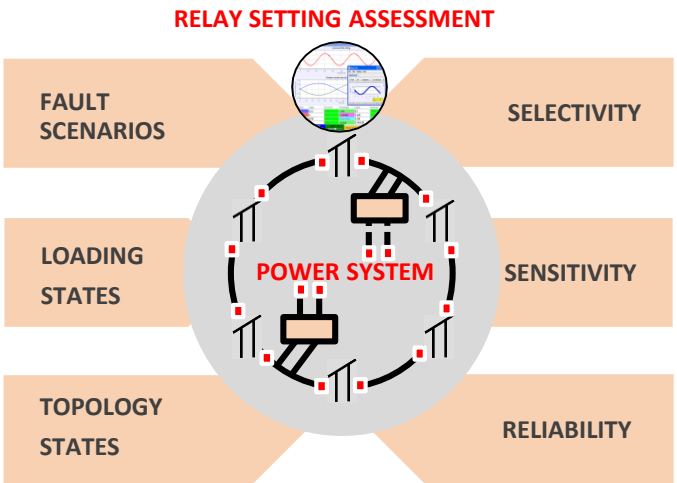
NEPLAN® Protection Assessment

Reliable and improved solution for power system protection

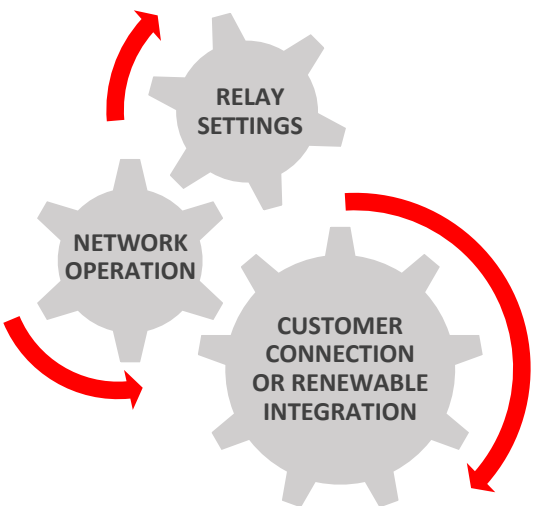
Challenges	Co-ordination of protection devices for all types of faults and different network loading and topology states
Customer	Large transmission and distribution utilities especially with renewable energy integration in LV networks due to their unseen behavior
Advantages	To have a reliable protection system ensuring proper selectivity and sensitivity for all relay settings
Solution	Automatic assessment with clear indication of relays that are not selective and faults that are not cleared

Need for Assessment

- Operation of protection devices ensuring reliability and selectivity
- Dependability: Must operate when required
- Security: Should not operate unnecessarily
- Risk of nuisance relay tripping which may lead to blackout
- Optimal relay settings for:
  - All types of faults
  - Different loading states
  - Different topology states
- Different relay co-ordination philosophies



Why NEPLAN?



Features

- Sequential and simultaneous automatic simulation for all fault scenarios
- Multiple loading and topology states can be simulated simultaneously
- Partial selection of the network bases on voltage level, area, zone, feeder, etc.
- User-defined scanning distance for fault on lines and user-defined minimum co-ordination time Tripping sequence of protection devices
- Report non-selective relays and non-cleared faults
- Fault path visualization on the single line diagram

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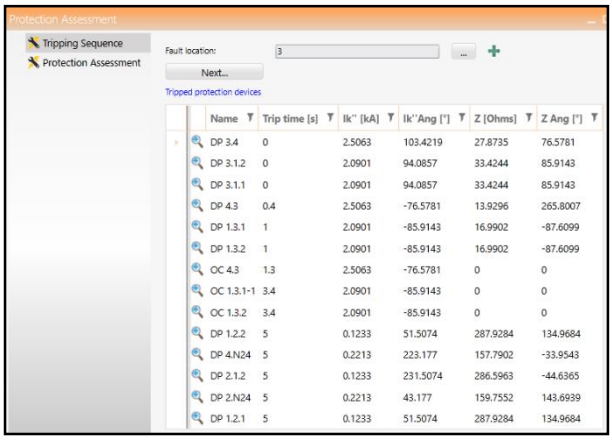
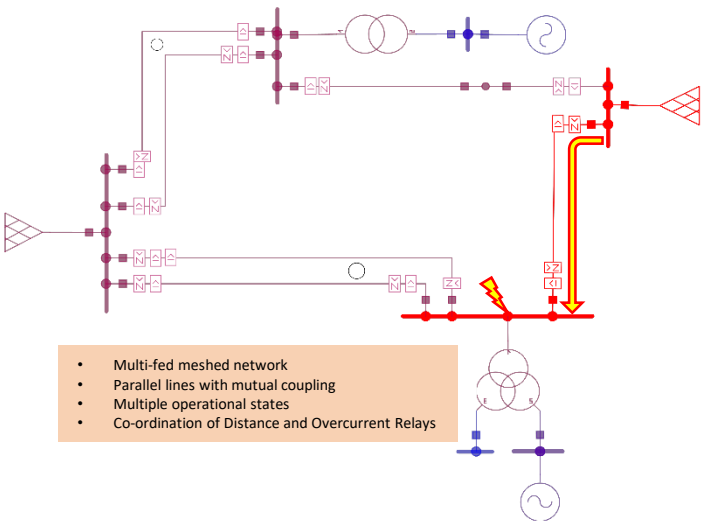
Sequential Assessment

- Simulation of one fault location at a time
- List of all protection devices based on their tripping time
- Sequence of operation of the protection devices
- Along with tripping, all currents and impedances seen by the relay are reported
- As an option, Unfeeded part of the network due to the fastest tripping devices can be visualized in the diagram
- Intuitive user-interface to simulate faults throughout the network



Name	Trip time [s]	Ik'' [kA]	Ik''Ang [°]	Z [Ohms]	Z Ang [°]
DP 3.4	0	2.5063	103.4219	27.8735	76.5781
DP 3.1.2	0	2.0901	94.0857	33.4244	85.9143
DP 3.1.1	0	2.0901	94.0857	33.4244	85.9143
DP 4.3	0.4	2.5063	-76.5781	13.9296	265.8007
DP 1.3.1	1	2.0901	-85.9143	16.9902	-87.6099
DP 1.3.2	1	2.0901	-85.9143	16.9902	-87.6099
OC 4.3	1.3	2.5063	-76.5781	0	0
OC 1.3.1-1	3.4	2.0901	-85.9143	0	0
OC 1.3.2	3.4	2.0901	-85.9143	0	0
DP 1.2.2	5	0.1233	51.5074	287.9284	134.9684
DP 4.N24	5	0.2213	223.177	157.7902	-33.9543
DP 2.1.2	5	0.1233	231.5074	286.5963	-44.6365
DP 2.N24	5	0.2213	43.177	159.7552	143.6939
DP 1.2.1	5	0.1233	51.5074	287.9284	134.9684



- Multi-fed meshed network
- Parallel lines with mutual coupling
- Multiple operational states
- Co-ordination of Distance and Overcurrent Relays

Automatic Assessment

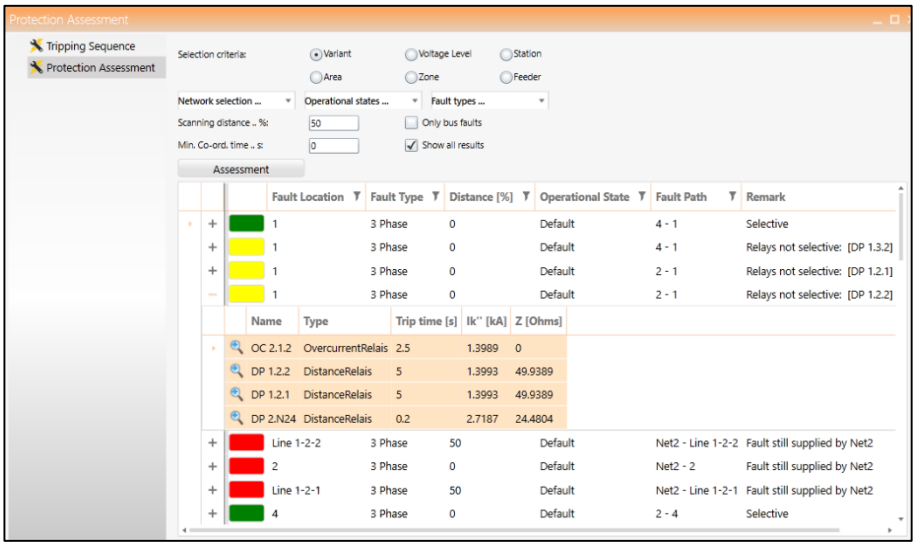
- Simultaneous simulation of all possible fault types at busbars and sliding faults on lines
- User-defined scanning distance for fault on lines
- User-defined minimum co-ordination time between two protection devices
- All fault scenarios with non-selective relays or faults that are not cleared are reported
- Tripping sequence of protection devices for each fault scenario
- Visualization of the fault path on single line diagram
- All results can be exported to MS-EXCEL

Fault is cleared and all relays are selective

Fault is cleared but some relays are not selective

Fault is cleared but some relays did not trip

Fault is not cleared



Fault Location	Fault Type	Distance [%]	Operational State	Fault Path	Remark
1	3 Phase	0	Default	4 - 1	Selective
1	3 Phase	0	Default	4 - 1	Relays not selective: [DP 1.3.2]
1	3 Phase	0	Default	2 - 1	Relays not selective: [DP 1.2.1]
1	3 Phase	0	Default	2 - 1	Relays not selective: [DP 1.2.2]

Name	Type	Trip time [s]	Ik'' [kA]	Z [Ohms]
OC 2.1.2	OvercurrentRelais	2.5	1.3989	0
DP 1.2.2	DistanceRelais	5	1.3993	49.9389
DP 1.2.1	DistanceRelais	5	1.3993	49.9389
DP 2.N24	DistanceRelais	0.2	2.7187	24.4804

Line 1-2-2	3 Phase	50	Default	Net2 - Line 1-2-2	Fault still supplied by Net2
2	3 Phase	0	Default	Net2 - 2	Fault still supplied by Net2
Line 1-2-1	3 Phase	50	Default	Net2 - Line 1-2-1	Fault still supplied by Net2
4	3 Phase	0	Default	2 - 4	Selective