Intelligent Direct Transfer (DTT) Trip Over Cellular Communications

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New Intelligent Direct Transfer Trip
Using Cellular Communications

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DTT Application
Background
Direct Transfer Trip (DTT)
Typical Distribution Feeder Architecture
Direct Transfer Trip
Why the need for Direct Transfer Tripping?

Substation
Feeder Breaker

Feeder
Recloser
Recloser
Recloser

Utility Point of Circuit Connection
Distributed Generation Site

Primary Switchgear Closed
Primary Switchgear Open
Direct Transfer Trip
Background
Direct Transfer Trip
Background

Is this a desirable action?

- Substation Breaker
- Feeder Reclosers
- DTT Equipment
- Utility Point of Circuit Connection
- Distributed Generation Site
- Patch Panels
- Leased Telephone Line Provider Network

Primary Switchgear Closed
Primary Switchgear Open
Drivers for new DTT approach

1. Leased land line telephone wire networks supporting existing DTT systems unreliable causing many unwanted disconnections of DG sites.

2. Investigate and prove possible alternatives leveraging modern digital communication technologies and Substation Protection Standards.
Direct Transfer Trip
Cellular Communication

Performed Penetration Testing

Public Cellular Mobile Network

AMI Private Cellular Network

DTT Private Cellular Network

Peer to Peer links through IPsec Tunnels

DTT Controller

LTE Modem

DTT Controller

LTE Modem

DTT Controller

LTE Modem

DTT Controller

LTE Modem
Direct Transfer Trip Security

Cellular Network

DTT Device Private Network

Peer to Peer Encrypted VPN Tunnel
“Digital Wires”

Antenna

RX1400 Cellular Modem/Router

7SC80 DTT Controller

DTT Cabinet

Hard Wire Or GOOSE

Control

Recloser
DTT Project Considerations and Requirements

- Communication Systems Considered
  - Fiber – Deployment time frame
  - Cellular – Reliable, fast and easy to deploy

- Communication Protocols
  - DTT – Peer to Peer
  - IEC61850”GOOSE”
  - Control - Substation RTU – DNP3
Pilot Project
Direct Transfer Trip Pilot Project

DTT system objectives:

1. **Maintain Utility Connection to Distributed Energy Site.**
   - Temporary loss of communication
   - Provide Anomaly Detection Protection
   - Provide true redundant communication capability

2. **Provide Event and Fault Reports to operators**
   1. All DTT devices aware of all feeder circuit primary switch statuses

3. **Ensure system is interoperable and future proof**
   - IEC61850 Standard
Direct Transfer Trip
Redundant Communication

- 7SC80 DTT Controller
  - Redundant Logic
  - DTT Permissive
  - Simulation Test

- RX1400 Cellular Modem / Router

- Substation
- Line Recloser
- DG PCC

Cellular
Fiber
Drivers for new DTT approach

- DTT Project
  - Two new Solar Sites connected into CVEC grid
  - Dominion Energy Required DTT from delivery point to CVEC
  - Cost and speed of deployment (Large Geographical area)
DTT Project Considerations and Requirements

- **Communication Systems Considered**
  - Fiber – Installed cost prohibitive (27 miles)
  - Leased phone lines - Cost high, unreliable
  - Cellular – Installed Cost Low, Reliable

- **Communication Protocol**
  - DTT – Peer to Peer
  - IEC61850 “GOOSE”
  - SCADA – DNP3
Direct Transfer Trip Project

Transmission Delivery Point Substation

Distribution Substation

Circuit Breaker

Transmission Feeders

Distribution Feeder

Recloser

Solar Site
Direct Transfer Trip Project

Transmission Delivery Point Substation

Circuit Breaker

Transmission Feeders

Distribution Substation

Circuit Breaker

Distribution Feeder

Recloser

Solar Site

Distribution Feeder

Recloser

Solar Site
Direct Transfer Trip Project

Perform Direct Transfer Close (DTC)

Is this a desirable state?

Transmission Delivery Point Substation

Transmission Feeders

Distribution Substation

Distribution Substation

Distribution Substation

Distribution Feeder

Distribution Feeder

Distribution Feeder

Recloser

Recloser

Solar Site

Solar Site

Solar Site
DTT Implementation at DG and Reclosers

- Cellular Antenna
- Recloser Control
- GPS Antenna
- DTT Cabinet
- Interconnect Wiring
Questions

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