

FAT/SAT Procedure for Substation switches and Substation Rouse cum firewall (RcF) for communication with Control Centre

Corporate Asset Management
Power Grid Corporation of India Ltd.

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Revision History

Sl.No.	Pages	Revision	Remarks
01	All Pages	Rev_00	Initial Release

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1. Introduction

Router cum Firewall is used in substations for interconnecting the substation data, video, and voice through MPLS Cloud. The WAN side of router shall have three separate VPN for Voice, Video and Data.

Substation switches are used for connection with redundant gateway ports for communication with control centre, NVR server, VOIP phone, RAS-AFAS client PC, Read only SCADA client PC, VMS client PC, camera etc. There shall be 8 to 12 no. VLANs at LAN side for traffic segregation.

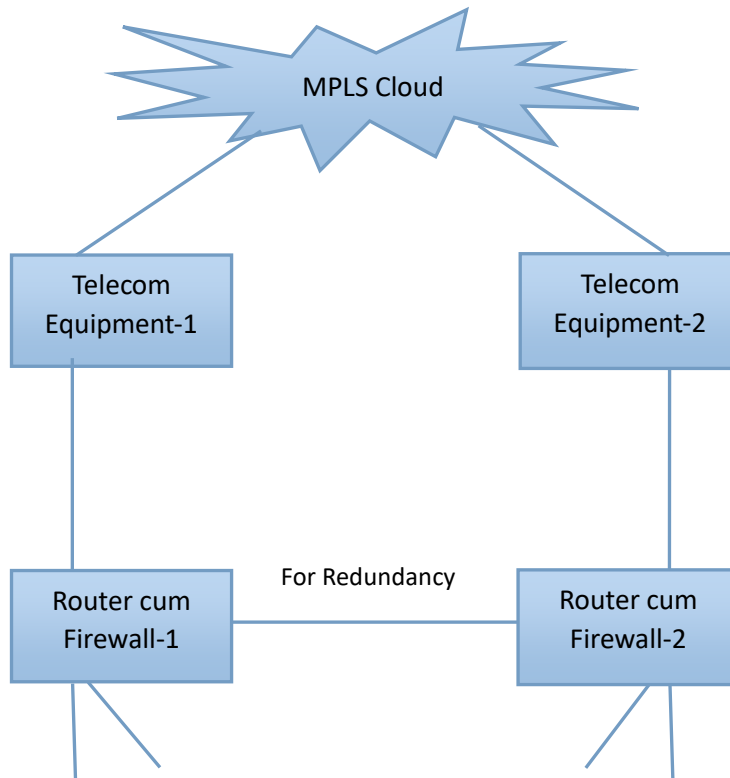
This document describes a required minimal security configuration for all routers and switches connecting to the control centre network.

2. Reference documents:

During detailed engineering, following documents shall be approved by CC-Engg in coordination with CC-NTAMC

- i. Approved Substation architecture
- ii. Approved Substation IP plan: It includes port connections details also
- iii. Approved baseline configuration of Substation switches and Substation Router cum firewall

3. Generic architecture



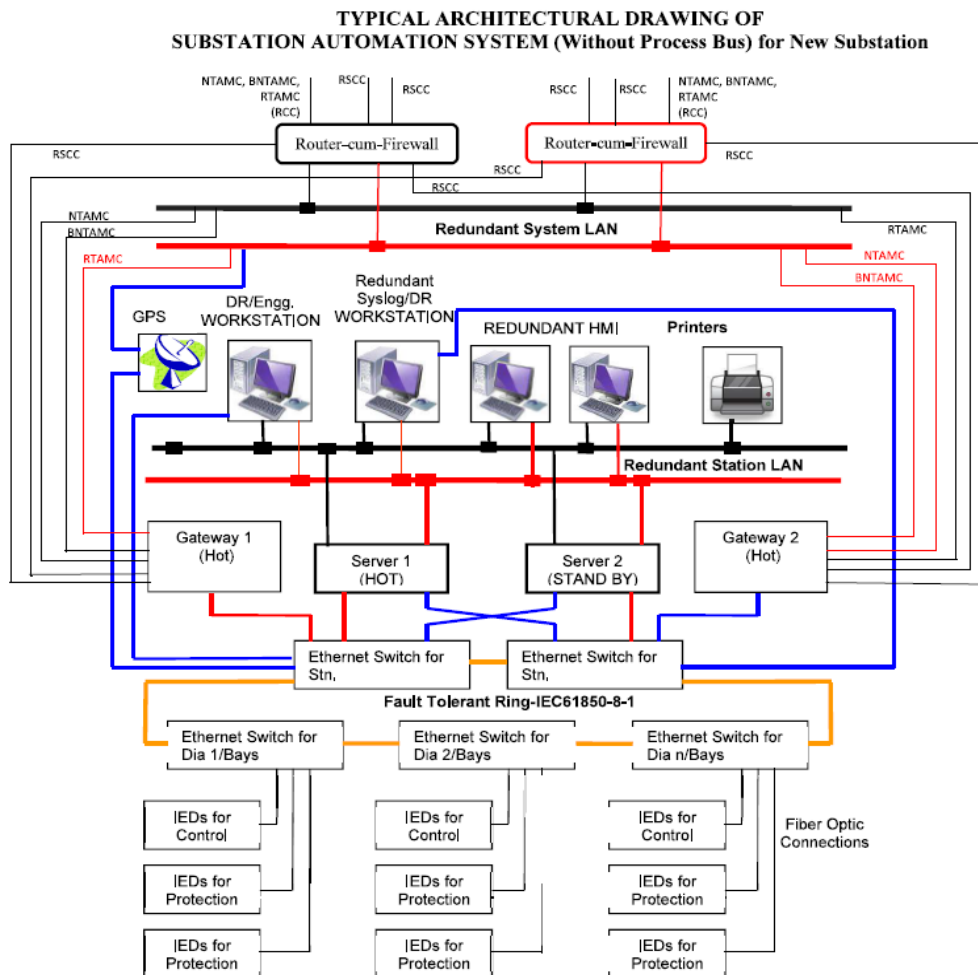
Criss-cross connection with substation switches /gateway for redundancy

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Typical architecture as per model technical specification, specific requirement's (Section- Project) C/ENGG/SPEC/SEC PROJECT/ SPECIFIC REQUIREMENT REV NO 08 is as follows:



Key points to note from above typical are as follows:

1. NTAMC and RTAMC ports are connected on different switches of redundant system LAN
2. One set of redundant system LAN may have single or multiple switches, generally total 16 ports
3. Load dispatch centre data (eg RLDC) port of gateway is directly to router cum firewall.

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4. Common checks for Substation Switches and Substation Router cum firewall (RcF)

- i. LED indications shall be visibly blinking on connected LAN ports.
- ii. Username and Password shall be changed from default username and password. New users must be created with proper privileges.
- iii. Configured with all defined VLANs.
- iv. Configured for time synchronization and correct time zone.
- v. Configured in redundancy: fail-over shall be tested with smooth link fail-over transition.
- vi. Logging must be enabled.
- vii. Telnet shall be disabled. SSH v2 or higher shall be used for accessing the devices.
- viii. Accessible with management IP over SSH for configuration changes and access control eg Substation switches must be assigned a private internal IP address in a management VLAN
- ix. Router & switches firmware shall be up to date to the latest stable release provided by respective OEM.
- x. Backup of Routers and Switches configurations shall be taken and stored in a separate storage.
- xi. “auto” setting is to be preferred instead of hard coding of speed and duplex setting on router and switch interface.
- xii. Adequate timeout after login shall be defined.
- xiii. SNMP v3 configuration with Target Address. Also, a separate user must be defined for SNMP with operator privileges.
- xiv. Ports without any need to trunk, shall have trunk settings set to off, instead of auto.
- xv. Rapid Spanning Tree Protocol (RSTP) on LAN side shall be enabled.
- xvi. Disable Spanning Tree Portfast on any port that is attached to a router, firewall or load balancing switch.
- xvii. Disable any port that is not needed/used.

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5. Specific checks for Substation Router cum firewall

- i. OSPF functionality for sharing routes with MPLS Routers at WAN side for VPN-10, VPN-20 and VPN-30
 - ✓ Hello-Interval shall be 10.
 - ✓ Dead Interval shall be four times hello interval.
 - ✓ Area must be defined in OSPF for each substation router to avoid flooding of network.

- ii. IPSec (Internet Protocol Security) Tunnel shall be established between Substation and each Control Centres (NTAMC, RTAMC, BNTAMC)
 - ✓ Substation to NTAMC/BNTAMC: tunnel for RTU gateway, BCU gateway, MSH and RAS
 - ✓ Substation to RTAMC: tunnel for RTU gateway, BCU gateway
 - ✓ In routers IPSec Dead Peer detection shall be enable and its parameters shall be set as: Interval=10; Timeout=30; Action=restart

- iii. Firewall settings for controlling inbound and outbound traffic- shall be configured zone wise.
 - a) Clean up rule (Any-Any-> Deny) shall be set.
 - b) Only required protocol/ port / service shall be allowed.

- iv. VRRP services shall be configured such that at least one router is master in all cases. For normal cases, One Router shall be a Master and the Second router shall be Backup.
 - ✓ In routers a VRRP tracker shall be provided for each interface which tracks main NTAMC external network.
 - ✓ Router-1 Priority =100 and Router-2 Priority =50
 - ✓ Router-1 Weight=-70 and Router-2 Weight=-30
 - ✓ no Preempt shall be disabled in all instances in both Main & Backup Router.

- v. QoS setting shall be configured for priority to SCADA data.

- vi. Routers shall be crisscross connected with two cables from Switches. Redundancy checks are:
 - a) "Link fail" i.e. WAN side port of router:
 - ✓ Router LAN side fail-over shall be tested with smooth transition.
 - ✓ Router WAN side fail-over shall be tested with smooth transition.

 - b) "Port fail" i.e. LAN side port of router:
 - ✓ Router LAN side fail-over shall be tested with smooth transition.
 - ✓ Router WAN side fail-over shall be tested with smooth transition.

- vii. Router shall not be accessible from Management port using default IP address.

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- viii. System Name and Location in Routers shall be named distinctively, and it should be informative.
- ix. Greeting Note should be changed to “Warning Message”, to alert the user while login in remotely over SSH.
- x. Log level of Firewall shall be categorized as per recommended norms of cyber security.
- xi. Following shall be configured as per approved baseline configuration document:
 - ✓ Substation IP Plan
 - ✓ WAN IP addresses
 - ✓ Syslog server IP
 - ✓ NTP server IP
 - ✓ Local and Remote address for pre-shared key for IPSec tunneling.
 - ✓ List of Firewall Policies

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