
A photograph of a power substation control room. The room is filled with rows of electrical control panels and equipment. The panels are primarily grey and yellow, with some black sections. The equipment is arranged in a long aisle, with a green metal grating floor. The ceiling is white with various pipes and conduits. The lighting is bright and even.

Central Electricity Authority
(Technical Standards for
Communication System in Power
System Operations) Regulations,
2020

What are these about?

- Set of specifications to ensure reliable, secure, and efficient exchange of data
- Covers the 
 - Requirements
 - Design and Planning aspects
 - Cyber Security Aspects
 - Centralised monitoring
 - Detailed functional requirements of wideband communication network (fiber optic based media), PLCC, cellular communication, VSAT & RF communication

Objective

Smooth, stable, reliable and secured operation, monitoring, control, and protection of the power grid

Who prepared it

Prepared by Power System Communication Development Division and published by CEA on 02.03.2020

Requirements to be fulfilled by Communication System for Power System Operation

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graph TD; A[Requirements to be fulfilled by Communication System for Power System Operation] --> B[Functional Requirements]; A --> C[Performance Requirements]; A --> D[Interface Requirements]; A --> E[Reliability Requirements];
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Functional Requirements

Performance Requirements

Interface Requirements

Reliability Requirements

Functional Requirements

- Reliable data and voice communication
- Reliable Teleprotection
- Integration with SCADA, WAMS (PMU), Video Conferencing, AMR , VoIP and Teleprotection

Performance Requirements

- Capability to relay control command from control centre to equipment
For SCADA – within 2 sec
For WAMS - within 1 sec
- Required bandwidth to conform the specified data interval time

Data Interval time

Category	Data Type	Time Interval (Sec)			Time Interval (Sec) via Data Concentrator		
		765 or 400 kV	220* or 132** kV	Below 132** kV	765 or 400 kV	220* or 132** kV	Below 132** kV
Automatic Generation Control (AGC)	Analog Value	2		3	2		3
Dispatch	Status	2	3	4	2	3	5
	Analog Value	4	5	6	4	5	7
Phasor	Analog/Status	0.04 to 0.01			0.04 to 0.01		
Forecast/ Weather	Value	60			60		

Interface Requirements

- Requisite interfaces at both ends
- Audio-visual status indication to indicate normal operation
- Adhere to specified Standards for interfacing to communication system

Reliability Requirements

- Total outage period shall be less than 16 hours on monthly basis and less than 48 hours in a rolling 12 months assessment period.
- Adequate redundancy to be ensured

Standards for interfacing to communication system

Interfaces	Type	Standards
Electrical Interface	Ethernet	IEEE 802.3 / IEEE 802.3u
	Ethernet VLAN	IEEE 802.1 P/Q
	Serial	RS232 / RS422 / RS485 / X.21 / X.25 / G.703 / V.35 / RJ45
Optical Interface		ITU-T G.957, G.958
Tele-protection /Control	Relay	IEEE C37.94, ITU-T G.703
Voice		2-wire FXO/2-wire FXS/ 4- wire E&M, VoIP
SDH		ITU-T G.821/G.826
IP - Packet Switched Networks	Layer 2.5 OSI	RFC 2702, RFC 4379, RFC 4090 & RFC 4553 – Circuit Emulation
RF		IEEE 802.11s, , IEEE 802.15.4, ETSI EN 300 220-1, ETSI EN 300 440.
Cyber Security		MD5 Authentication, 3.SNMPv3, Radius/TACS+
Video		H.323
Cellular	GPRS/3G/4G/ NBIoT/MPLS	ETSI, 3GPP Compliant
MPLS-TP:		G.8110,8112,8113.1,8113.2,8121,8121.1,8121.2,8131,8151,8152.
MPLS-IP:		As per standard Industry practice.

Design & Planning Aspects

- CTU & STU are designated as planners for ISTS and Intra-state communication system as per CERC (Communication System for ISTS) Regulations, 2017
- System shall be planned up to the interface points of the user and the respective control center including the interfacing communication equipment. CTU/STU shall consider design of the intervening communication system for seamless integration to have wideband network
- System shall be planned in accordance with Communication Planning Criteria issued by CEA

Design & Planning Aspects

- User shall
 - Ensure **centralized monitoring**/management of its communication network and shall provide necessary facilities for configuration, identification of faults and generation of various reports on availability of communication system --- **NMS**
 - Be responsible for planning, design, implementation, secured operation and maintenance of its own communication infrastructure
- Communication equipment shall be interoperable (with other OEM's equipment), synchronized with GPS clock and shall be provided with at least 10 hours battery backup and extended backup (as required).
- Minimum guaranteed life for all wideband communication equipment shall be 10 years

Site Responsibility Schedule

To be prepared by the owner of the communication equipment. Shall include :-

- schedule of telecommunication interface equipment, their responsibility for access, maintenance and operation;
- schedule of auxiliary power supply catering communication equipment;
- schedule of patching details (like Synchronous Transport Module (STM) level, E-1 level, Transmission Control Protocol/Internet Protocol (TCP/IP level) for channel routing, and numbers of fiber connectivity;
- type of connectors required for making the connection through;
- specific information provided by the original equipment manufacturer;
- site or node common drawings for each interface point; and
- responsible person for the site.



Centralised Monitoring

- Users to provide necessary support to interface their NMS or N/w element with Centralised N/w Management System
- Users to undertake O&M of their interfaces
- Features of NMS:
 - Store necessary information
 - Facilitate monitoring of performance of communication system
 - Generate Availability Reports of equipments and data channel
 - Logging facility to facilitate operator for quick fault detection
 - Displays for audio visual alarm generation
 - Facilitate access to equipment for configuration and fault restoration

Centralised Monitoring

- Architecture : Main and Backup Control Center with centralised database and 24 hours maintenance
- Specialised training to the personnel manning the center

CTUIL is implementing Unified Network Management System (UNMS) pursuant to above regulations. UNMS in Northern Region and Northeastern Region have been commissioned and is under implementation for Eastern Region. UNMS for Southern and Western Regions are under bidding stage.

Other Aspects

Outage Planning:

Owner of communication equipment to plan monthly outage and get respective RPC's approval

Connection with earth:

As per IEEE-1100, IEEE-80, BIS-3043

Cyber Security:

In accordance with CEA (Cyber Security) Regulations/Guidelines

Access to connection site:

for installation, maintenance, survey, configuration, testing etc. of the equipment

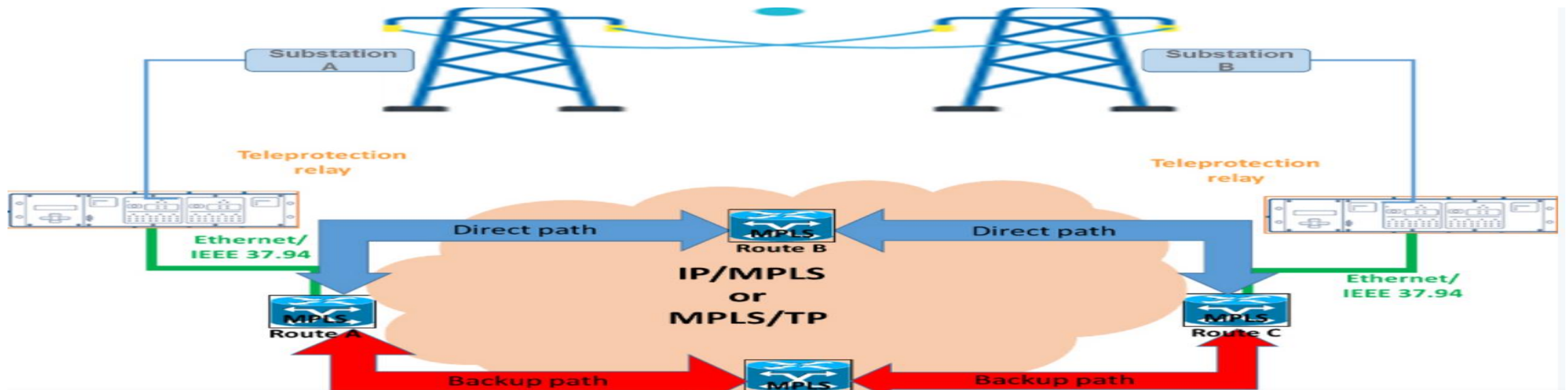
Data retention and confidentiality:

Availability data for previous 2 calendar year plus current year

Adoption of new technologies

New technologies can be adopted with the approval of appropriate Commission or as per the regulations or pursuant to the reforms programme of the appropriate Government

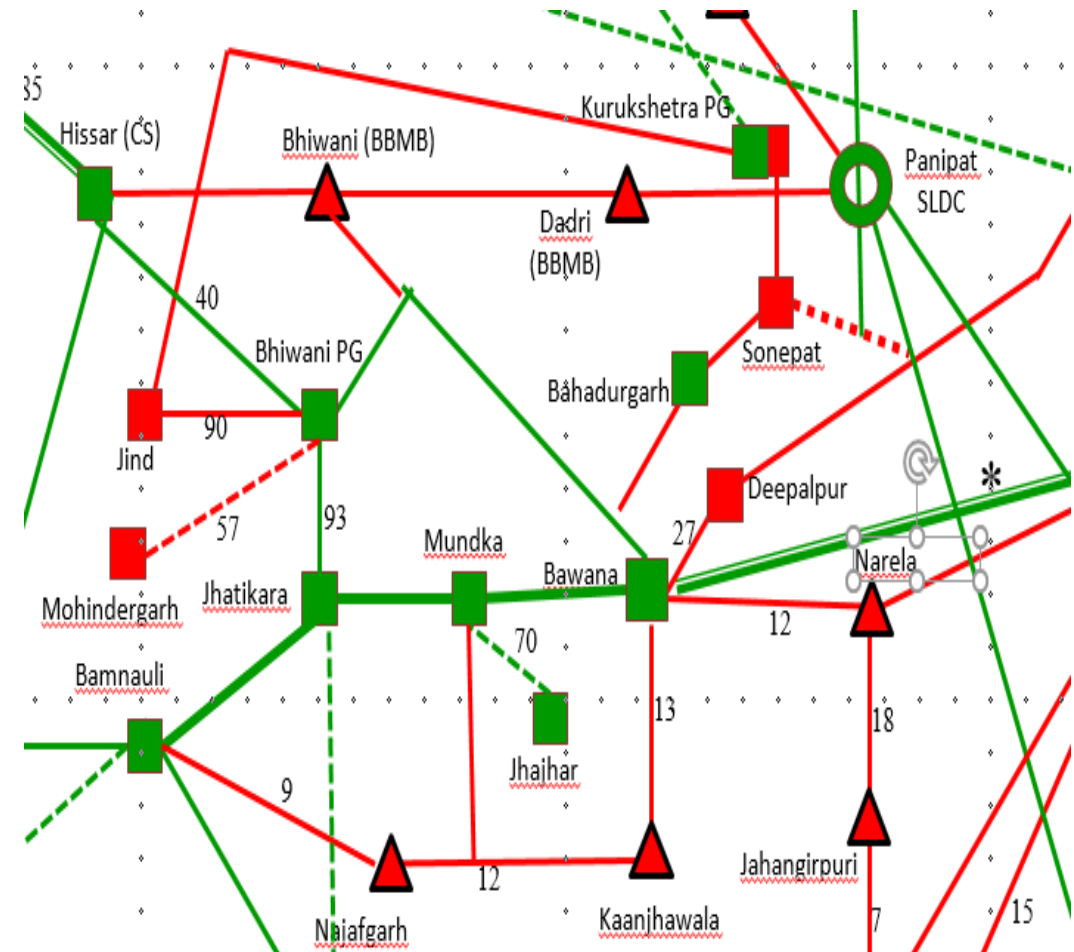
Many State Transmission Utilities (viz. KSEBL., TANTRANSCO, CSPTCL etc.) are planning for migration from existing SDH technology to MPLS technology



Requirements stipulated

Wideband Network:

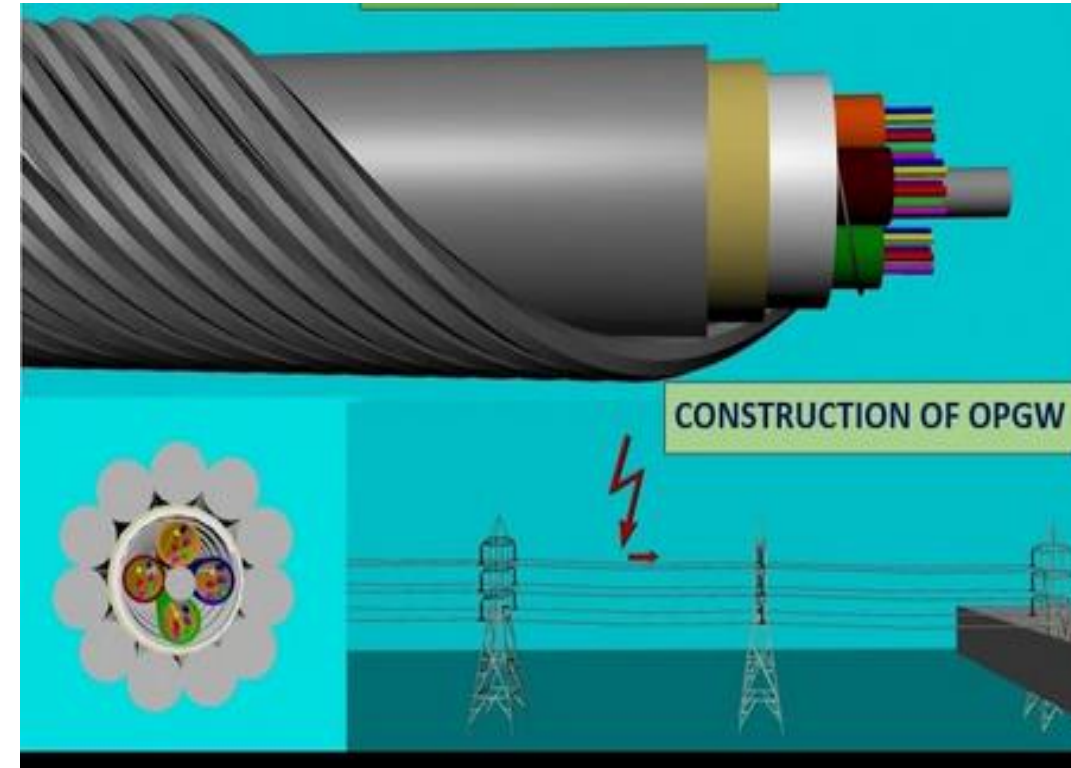
- Absolute channel delay: less than 25 msec
- Channel delay asymmetry : less than 0.1 msec for protection applications
- Automatic switchover to the alternate path or route in case of failure of one path
- switching time delay : less than 50 msec
- Terminal equipment to be designed with required number of directions considering the route redundancy and future expansion.



Requirements stipulated

Fiber Optic Communication:

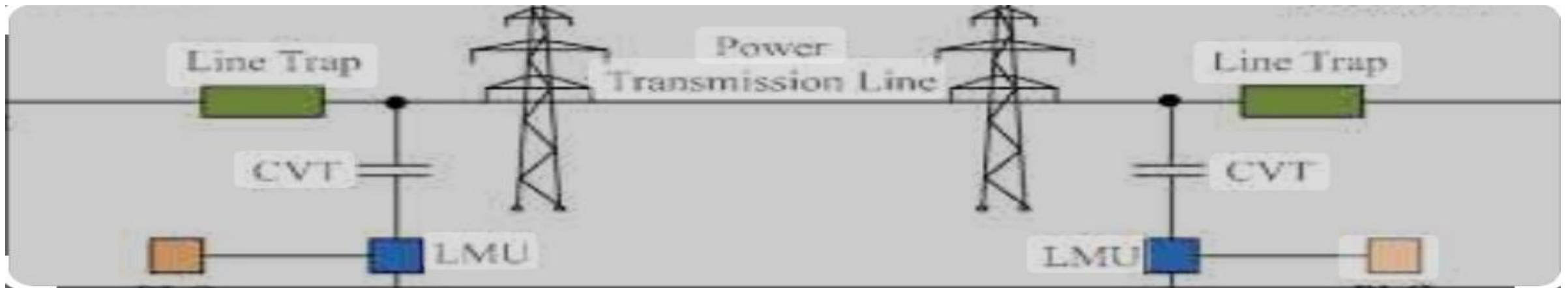
- All wideband communications shall be established using fibre optic communication consisting of underground fibre optic cable, optical ground wire (OPGW) or underground fiber optic cable (UGFO) and all dielectric self supporting (ADSS)
- The cable shall contain 12 or 24 or 48 numbers dual window single mode (DWSSM) or dual window multi mode (DWMM) fibre depending on the local network design and requirement envisaged.



Requirements stipulated

Power Line Carrier Communication:

- shall be used in the grid network between two consecutive substations and shall provide speech, data and tele-protection requirements of the power system.
- shall be duplex, independent transmission (Tx) and receiving (Rx) channels, operating in the carrier frequency spectrum 40 to 500 kHz.



Requirements stipulated

Cellular Communication:

- may be used for data acquisition system, where feasibility of access to wideband network is not possible.
- shall be adopted after ensuring the available signal level up to the required strength and dual or more Subscriber Identification Module (SIM) with different service provider
- automatic changeover to ensure 99.5 per cent link availability for interruption free operation of the communication system.

R F Communication:

- shall be used below 132 kilovolt / 110 kilovolt system for low speed data acquisition system and shall not be used for protection of power system equipment

Thanks