Course: Computer Network for Communication
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→ Project 2: Frame Relay in Power Utility Network

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Assignment Unit-2

Project: Frame Relay in Power Utility Network

Scenario:
A power utility company uses frame Relay, a wide area network (WAN) technology, to connect control centers and power substations. These connections help transmit commands, telemetry and monitoring data reliably.

1. How do virtual circuits in frame Relay support consistent data flow?

Explanation:

- Virtual Circuits (VCs):
  Frame Relay uses logical path called virtual circuits (either permanent - PVC, or Switched - or Switched - SVC) to establish a consistent communication route between devices.
- Support for Consistent Data Flow:

1. Pre-defined path: VCs ~~are made~~ ensure data always travels the same route, reducing delay and packet loss.

2. Efficient Bandwidth Use: Multiple VCs can share a single physical line (multiplexing), make it cost-effective.

3. Dedicated links (PVCs): Power utilities usually use permanent Virtual Circuit to maintain Continuous and stable communication between control centers and substations.

4. Reduced Congestion: By prioritizing Critical Control centres and Substations.

5. fixed logical paths (VCs):

- Frame Relay uses permanent virtual circuits (PVCs) for always on-connections.
- This ensures that control commands and monitoring data follow a consistent, pre-established route - minimzing delay and confusion in routing.

6. Reduced Packet Recording:

- Since all data packets follow the same virtual circuit, the risk of out-of-order delivery is minimized.
- This is especially important for time-sensitive control in utility network.

5. Think of VCs as dedicated "lanes" on a highway - each one keeps traffic moving in an orderly way between specific destinations.

02. Explain the Significance of DLCIs in this System.

Explanation:

- DLCI = Data Link Connection Identifier
- What it Does:

1. Identifies Each Virtual Circuit: Each DLCI is a unique number assigned to a Virtual Circuit.
2. Acts like an Address: Helps Frame Relay Switches know where to send the data - like a delivery address for each power Station / control Center.
3. Efficient Routing: DLCI ensures data reaches the correct Substation without needing Ip-level routing.
4. Supports Multiple Connections: A single Control center can talk to multiple Substations using different DLCIs on the Same physical line.

- Imagine DLCI as a "Label" on each data packet - telling it which substation to go to.

- Summary Table

Concept	Purpose	Role in Power utility
Virtual Circuits	Predefined comm-unication paths	Stable control and data links
PVCs	Always-on connections	Real time monitoring
DLCIs	Unique circuit IDs	Route data to right substation
Data Consistency	Same path, less delay	Smooth data flow
Bandwidth Sharing	Multiple circuits on one line	Save cost
Error Control	Detects basic errors	Accurate data
Congestion Control	Manages heavy traffic	Avoids delay in Signals
CIR	Guaranteed bandwidth	Ensures command delivery

- Conclusion

Frame Relay ensures reliable and consistent communication between control centers and substations. it uses of virtual circuits and DLCIs make it efficient and suitable for real time Power utility operations.