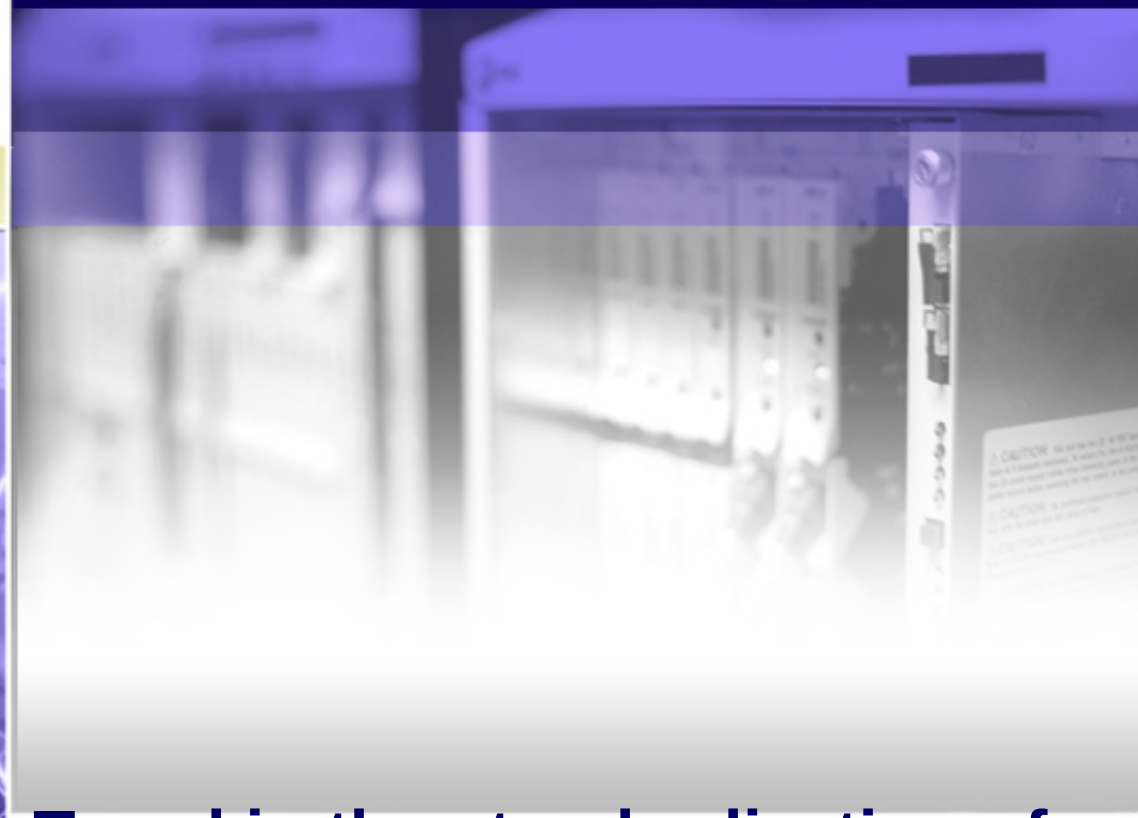


# Trend in the standardization of FCoPW and FC over MPLS implementation

October 2006

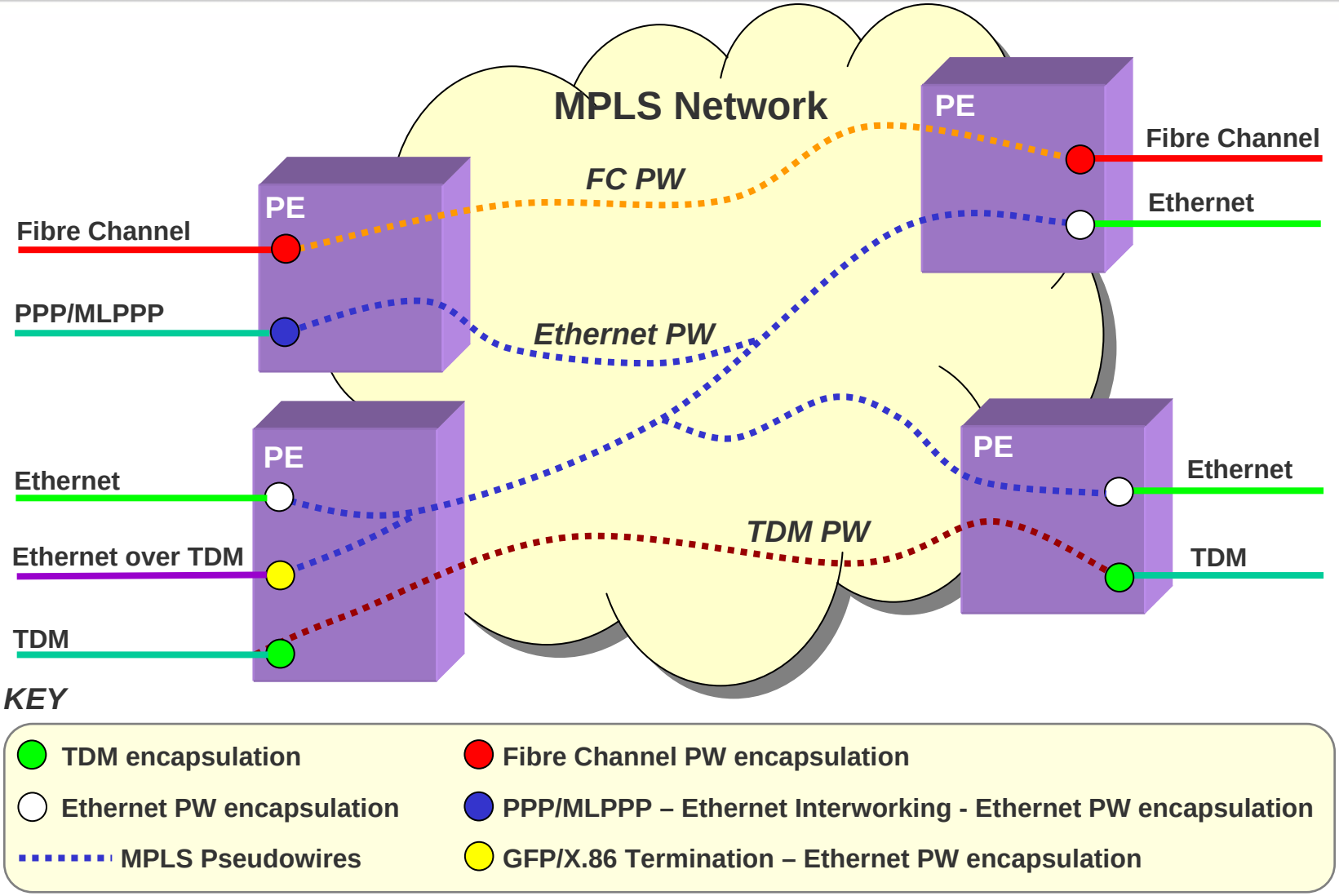
# Outline

- FCoPW Overview
- Standardization Status
- Encapsulation
- Congestion Control
- Summary

# FC PW Overview

- FC PW allows the transport of point-to-point Fibre Channel to support SAN extension and disaster recovery
- A new service for the Multi-Service transport network
- Key attributes
  - Transparency for separation of carrier and enterprise domains
  - Large distances
  - Reliable transport
  - Efficient transport by PSN statistical multiplexing

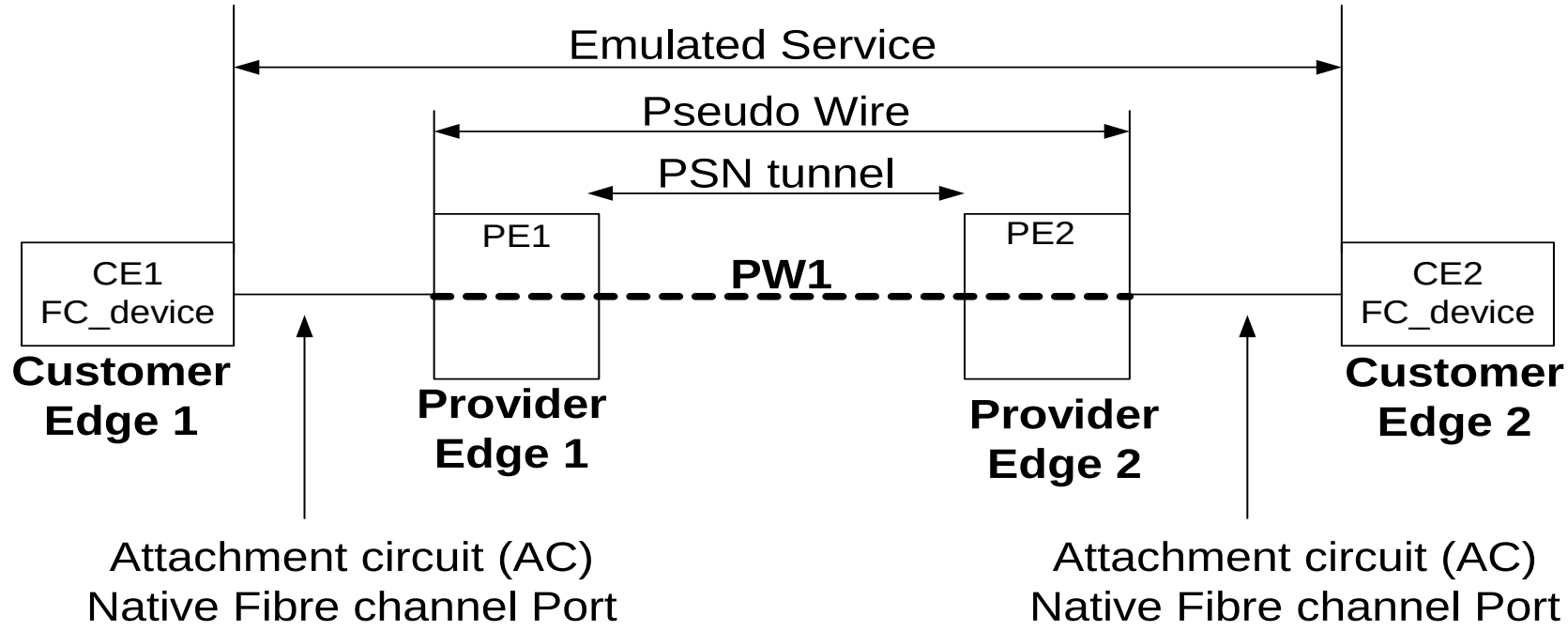
# Motivation

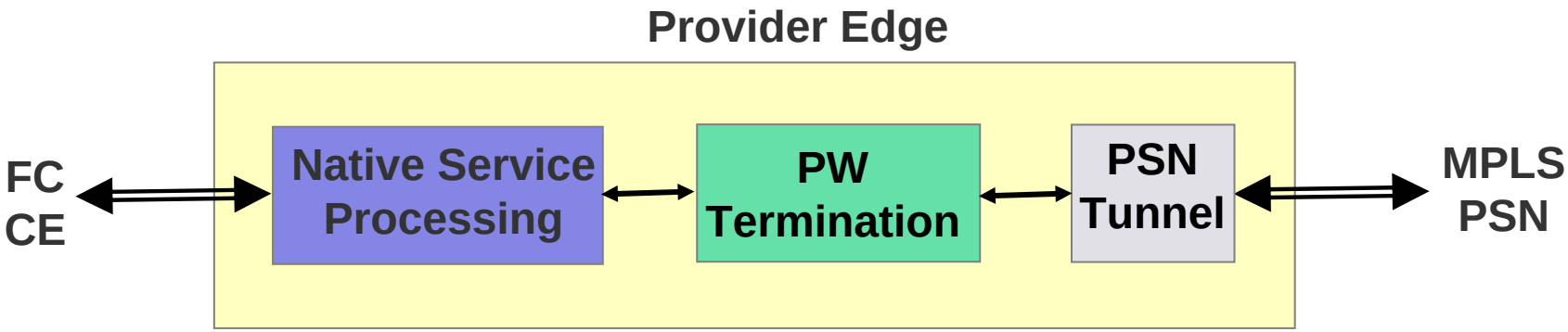

MPLS Network
PE
PE
PE
PE
Fibre Channel
PPP/MLPPP
Ethernet
Ethernet over TDM
TDM
Fibre Channel
Ethernet
Ethernet
TDM
FC PW
Ethernet PW
TDM PW
KEY
TDM encapsulation
Ethernet PW encapsulation
MPLS Pseudowires
Fibre Channel PW encapsulation
PPP/MLPPP – Ethernet Interworking - Ethernet PW encapsulation
GFP/X.86 Termination – Ethernet PW encapsulation

# FC Transport Methods

- FC over WDM
  - Limited distance
  - Not BW efficient
- FC over SONET/GFPT
  - Based on SONET/SDH transport network
  - No statistical multiplexing
- FC over IP
  - SAN-centric model
  - Necessitates TCP/IP network layers

# FC over PW Reference Model



# Standardization Status

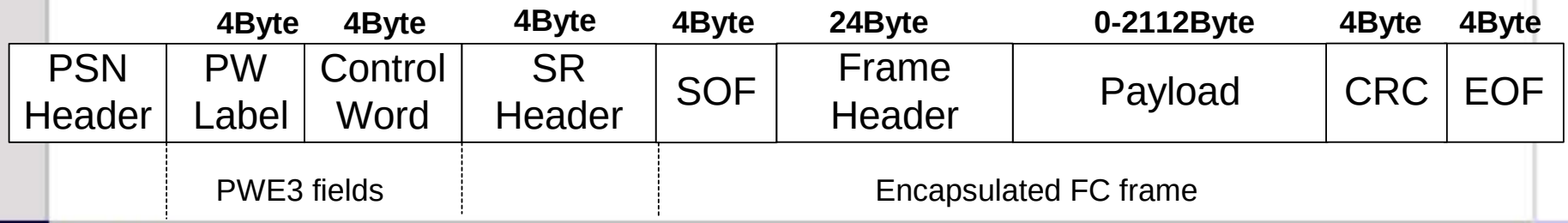
- IETF PWE3 WG – PW termination
  - draft-ietf-pwe3-fc-encap-01.txt (June 2006)
  - Encapsulation methods
  - FC PW signaling
  - Congestion control
  - draft-ietf-pwe3-fc-encap-02.txt – in work to include mainly congestion control details

# Standardization Status

- T11 FC-BB WG – NSP functionality
  - FC-BB_PW is a work item in FC-BB-4
  - Credit management
  - Link Initialization
  - Login monitoring
  - Primitive Signals handling
  - Adaptation of FC information for PW transport

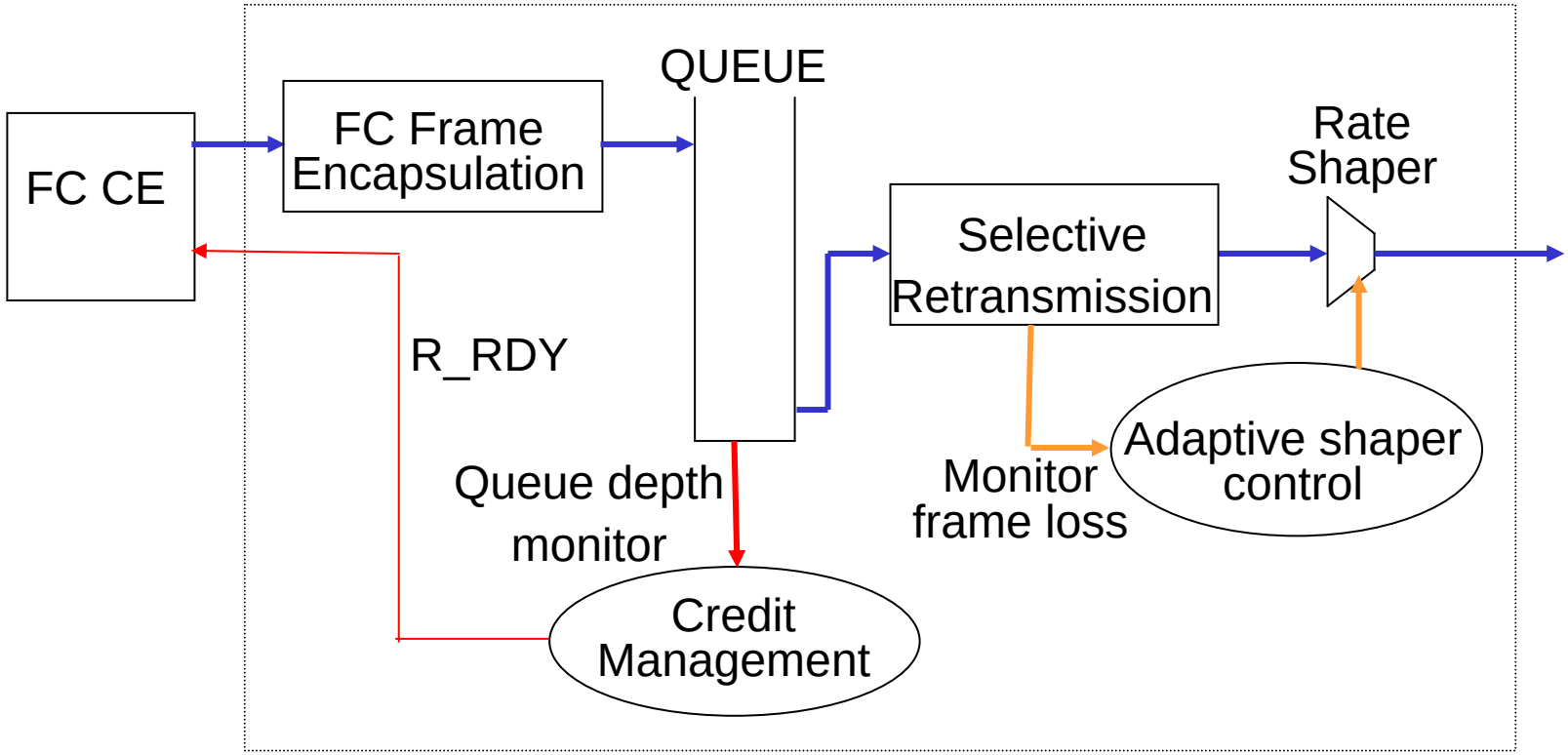
# Encapsulation

- FC port traffic is carried transparently over **a single PW**
- FC information encapsulation
  - FC **data frame** is carried in one PW PDU
  - FC-BB_PW generated **control frame** (WAN flow control, Ping) is carried in one PW PDU
  - FC **Primitive Sequences** are terminated at the local FC-BB_PW and sent as single control frame
  - FC **Primitive Signals** (Idle, R_RDY) are terminated and handled at the local FC-BB_PW



# Congestion Control

- Avoid frame loss as experienced by the CE
- Enable statistical multiplexing



# Congestion Control

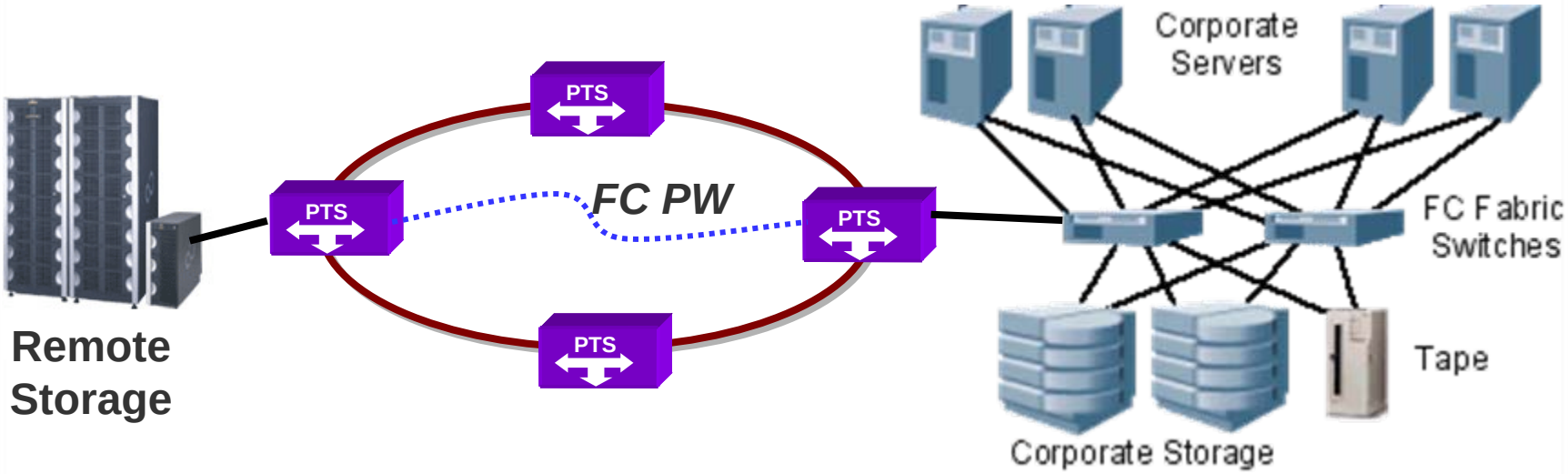
- Adaptive Rate Control
  - Guarantee minimum bandwidth (CIR)
  - Reduce loss probability by limiting bursts
  - Enhance efficiency by adapting to network conditions
  - Provide fairness between flows (TCP-friendly based on RFC3448)
- Selective Retransmission of lost frames
  - Enable in-order, no-loss transport
  - Allow efficient retransmission of lost frames
  - Provide congestion indications to the rate control mechanism
  - Standardized for FC transport in T11 FC-BB WG

# Congestion Control

- Ingress queue management
  - Avoid received frame loss due to buffer overflow
  - Control credit management
- Credit management
  - Buffer-to-buffer credit handling with the CE
  - Performed as part of the NSP as standardized in T11 FC-FS WG

# Implementation Example

- FC PW over Resilient Packet Ring
- Protected service over the ring
- Service is not degraded upon protection events
- Statistical multiplexing with Ethernet services



# Summary

- FC PW benefits for a carrier:
  - Separation of SAN and Transport network domains
  - Very large distance (~1000 Km) to support disaster recovery
  - Reliable transport by packet retransmission
  - Efficient BW utilization by statistical multiplexing and repetitive signal suppression
  - Low latency by MPLS-TE

# Questions?