

Frame Relay Congestion Control

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These slides are available at

<http://www.cis.ohio-state.edu/~jain/cis777-00/>



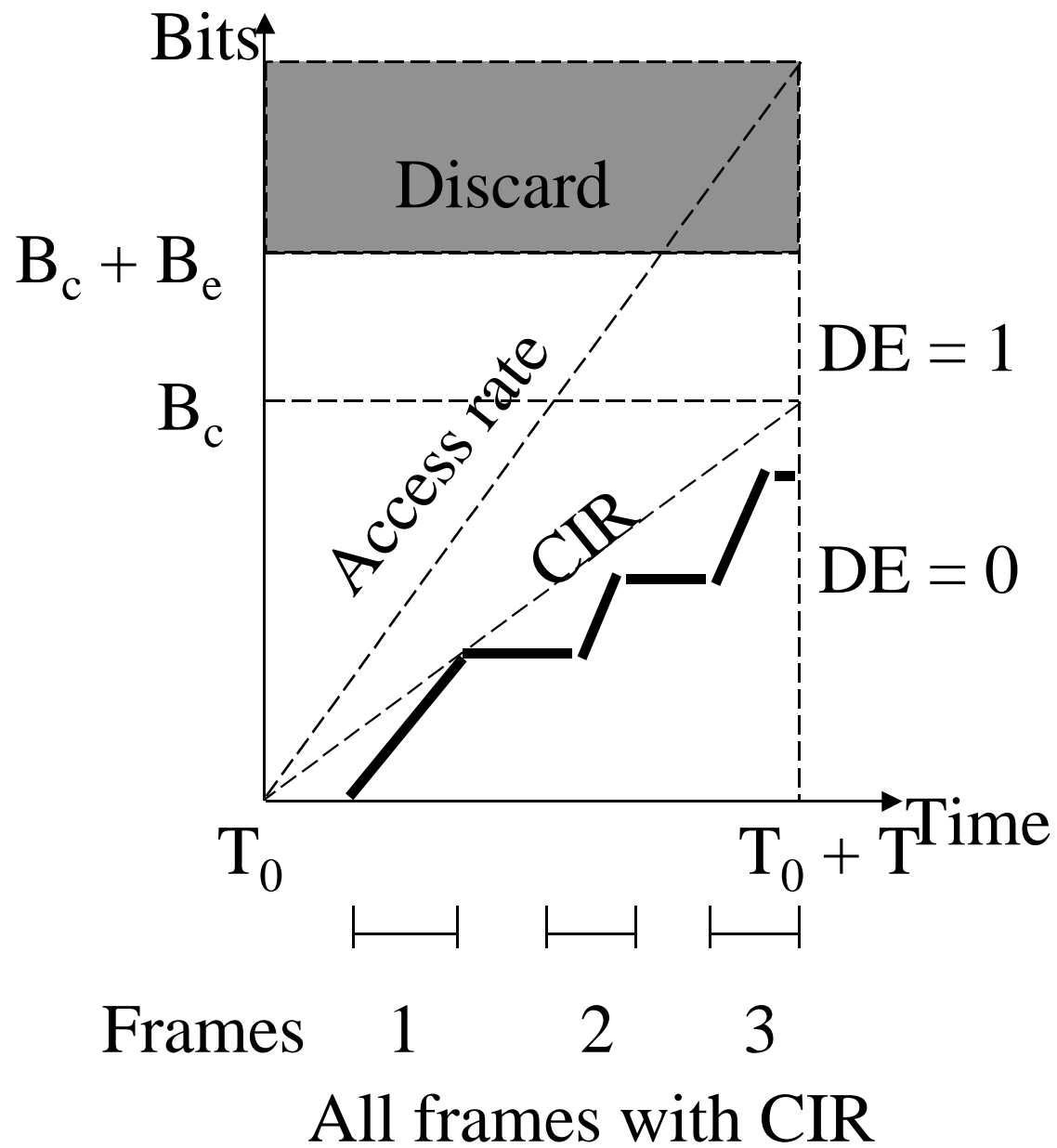
- ❑ Congestion avoidance vs recovery
- ❑ Discard control
- ❑ Explicit forward/backward congestion notification
- ❑ Implicit notification

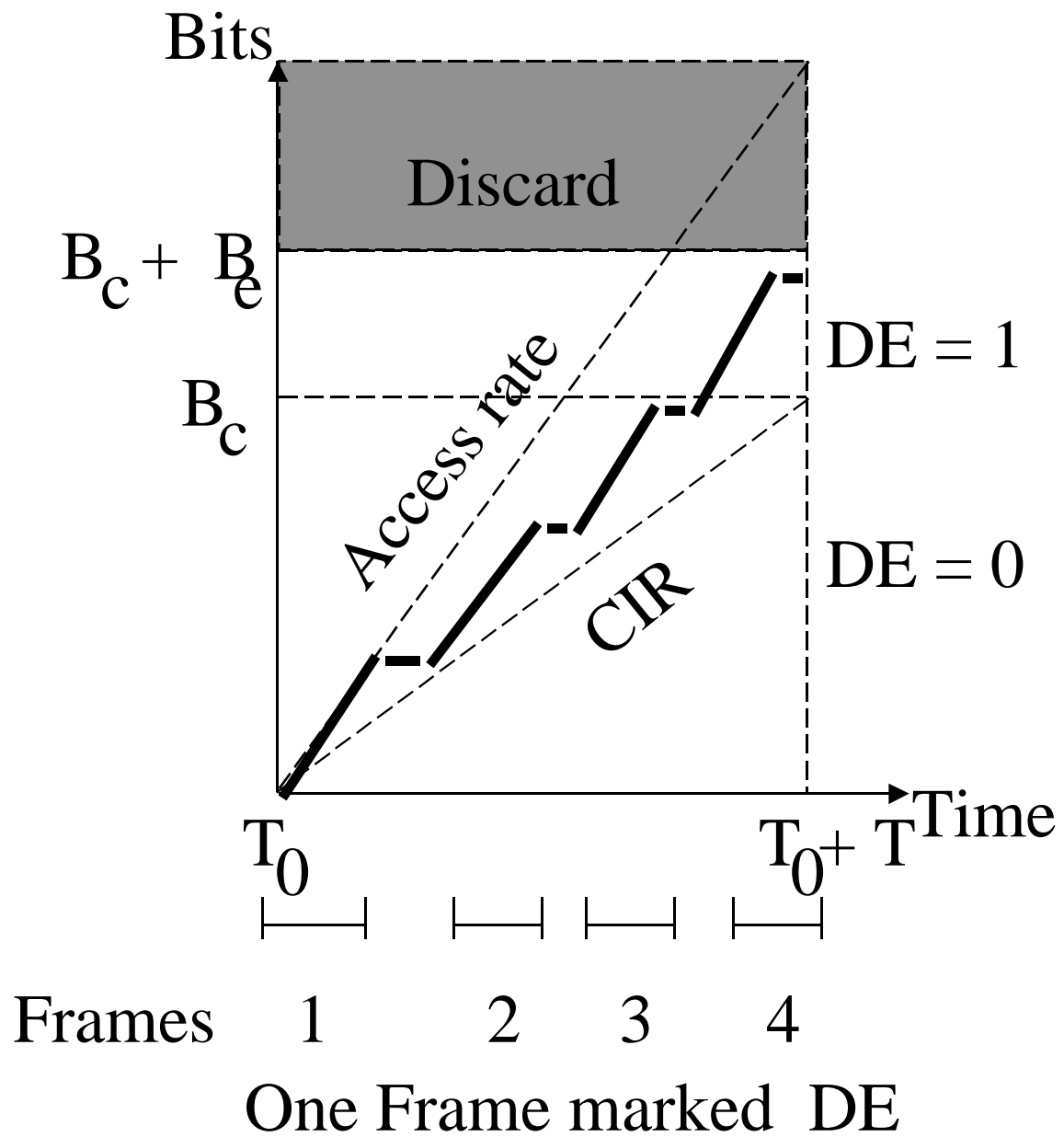
Frame Relay Congestion Techniques

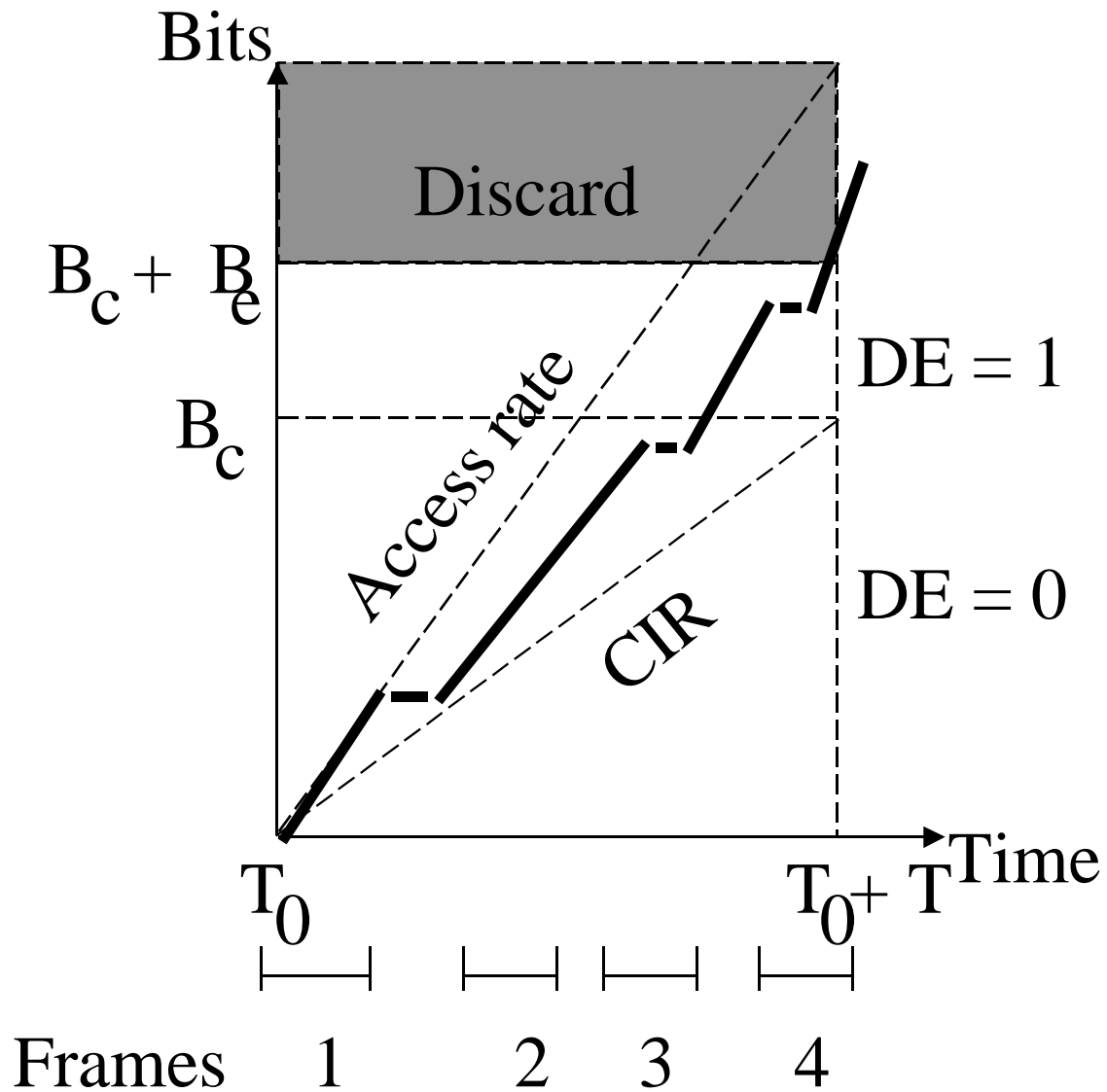
- ❑ Discard Control (DE Bit)
- ❑ Backward Explicit Congestion Notification
- ❑ Forward Explicit Congestion Notification
- ❑ Implicit congestion notification
(sequence numbers in higher layer PDUs)

Discard Control

- ❑ Committed Information Rate (CIR)
- ❑ Committed Burst Size (B_c):
Over measurement interval T
 $T = B_c / \text{CIR}$
- ❑ Excess Burst Size (B_e)
- ❑ Between B_c and $B_c + B_e \Rightarrow$ Mark DE bit
- ❑ Over $B_e \Rightarrow$ Discard

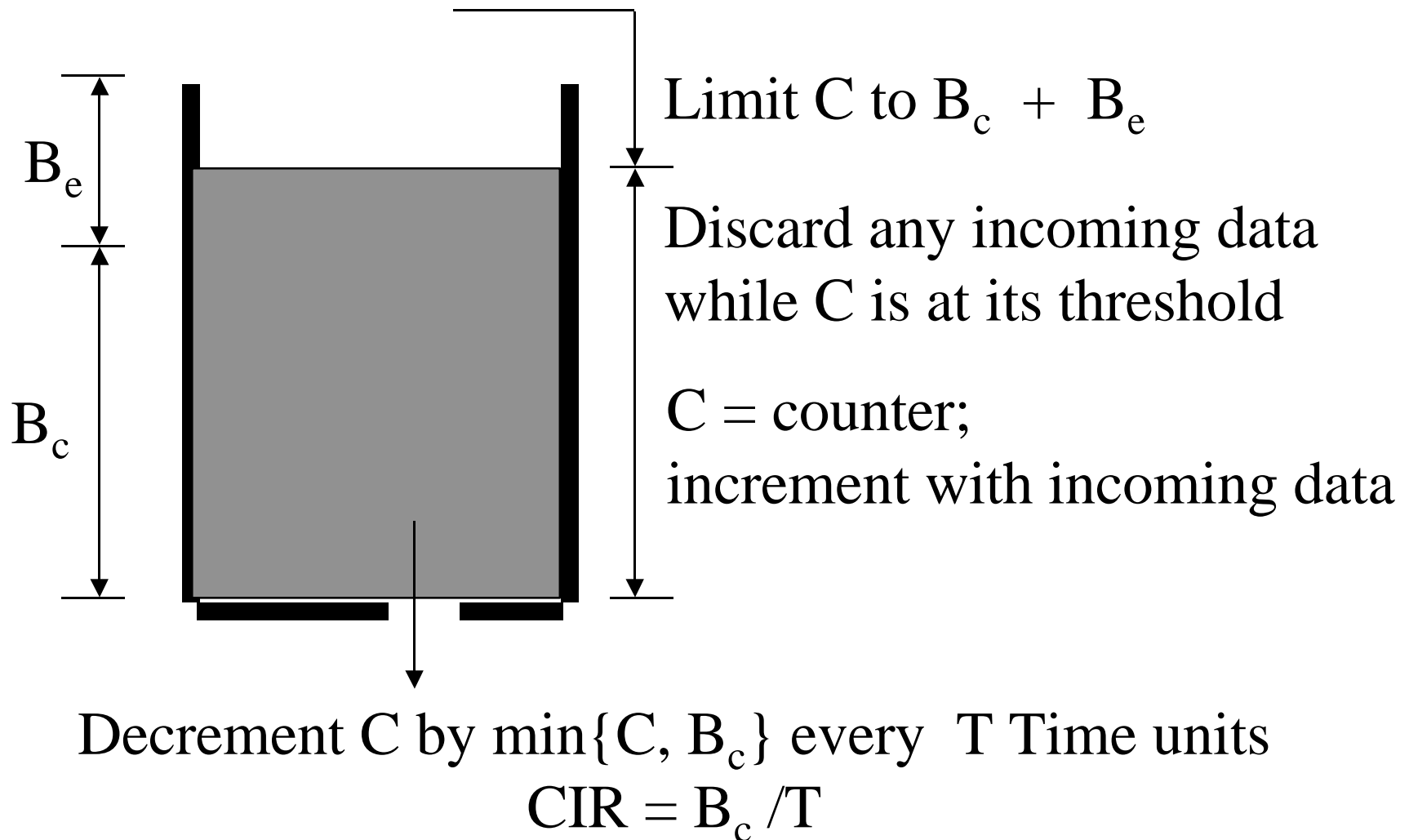




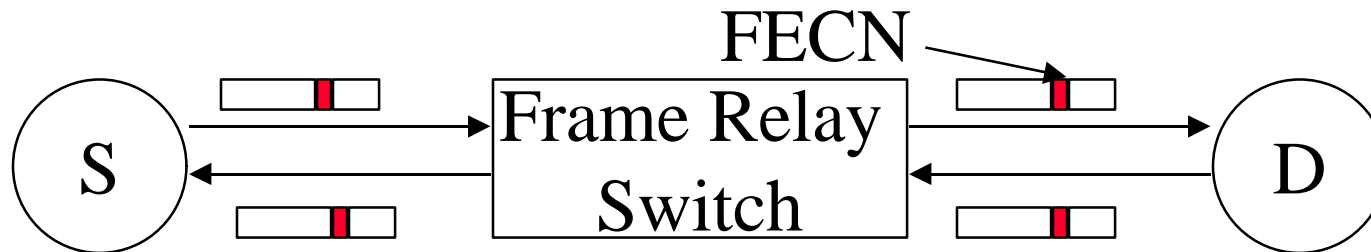


One Frame marked DE; one frame discarded

Leaky Bucket Algorithm



FECN



- ❑ Forward Explicit Congestion Notification
- ❑ Source sets FECN = 0
- ❑ Networks set FECN if avg $Q > 1$
- ❑ Dest tells source to inc/dec the rate (or window)
- ❑ Start with $R = \text{CIR}$ (or $W=1$)
- ❑ If more than 50% bits set
⇒ decrease to $0.875 \times R$ (or $0.875W$)
- ❑ If less than 50% bits set
⇒ increase to $1.0625 \times R$ (or $\min\{W+1, W_{\max}\}$)
- ❑ If idle for a long time, reset $R = \text{CIR}$ (or $W=1$)

BECN



- ❑ Backward Explicit Congestion Notification
- ❑ Set BECN bit in reverse traffic or send Consolidated Link-Layer Management (CLLM) message to source
- ❑ On first BECN bit: Set $R = CIR$
- ❑ On further "S" BECNs: $R=0.675 CIR$, $0.5 CIR$, $0.25 CIR$
- ❑ On S/2 BECNs clear: Slowly increase $R = 1.125 R$
- ❑ If idle for long, $R = CIR$

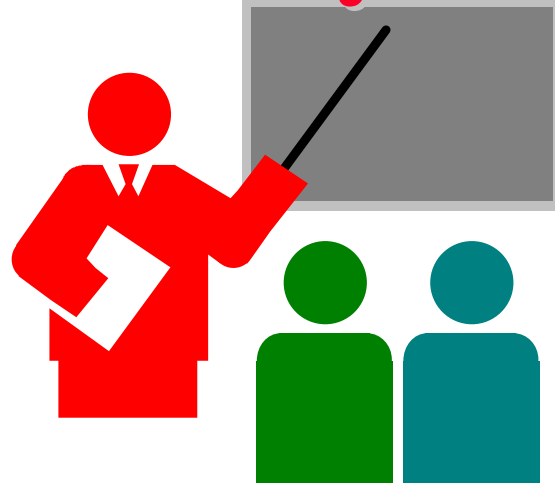
BECN (Cont.)

- ❑ For window based control:
 - $S =$ One frame interval
 - Start with $W=1$
 - First BECN $W = \max(0.625W, 1)$
 - Next S BECNs $W = \max(0.625W, 1)$
 - $S/2$ clear BECNs $\Rightarrow W = \min(W+1, W_{\max})$
- ❑ CLLM used if no reverse traffic
- ❑ CLLM = XID message on maintenance
DLCI = 1007 (decimal)
- ❑ CLLM contains a list of congested DLCIs

Implicit Congestion Control

- ❑ Decrease window on frame loss
- ❑ Increase window slowly
- ❑ Decrease by 1, Decrease to W_{min} , Decrease by a factor α
- ❑ Increase by 1 after N frames
- ❑ Increase by 1 after W frames

Summary



- ❑ Discard strategy: Leaky bucket
- ❑ Forward explicit congestion notification
- ❑ Backward Explicit congestion notification
- ❑ Implicit congestion control