



# Fibre Channel over Ethernet: An Additional Mapping for FC-BB-5

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# Overview

- **FC-BB-2 (and following) define the FCIP model**

A way to transmit FC frames over IP networks

- **IP networks may lose packets**

TCP is then needed to recover from possible losses

FCIP is layered on top of TCP, not IP

- **TCP is not hardware friendly**

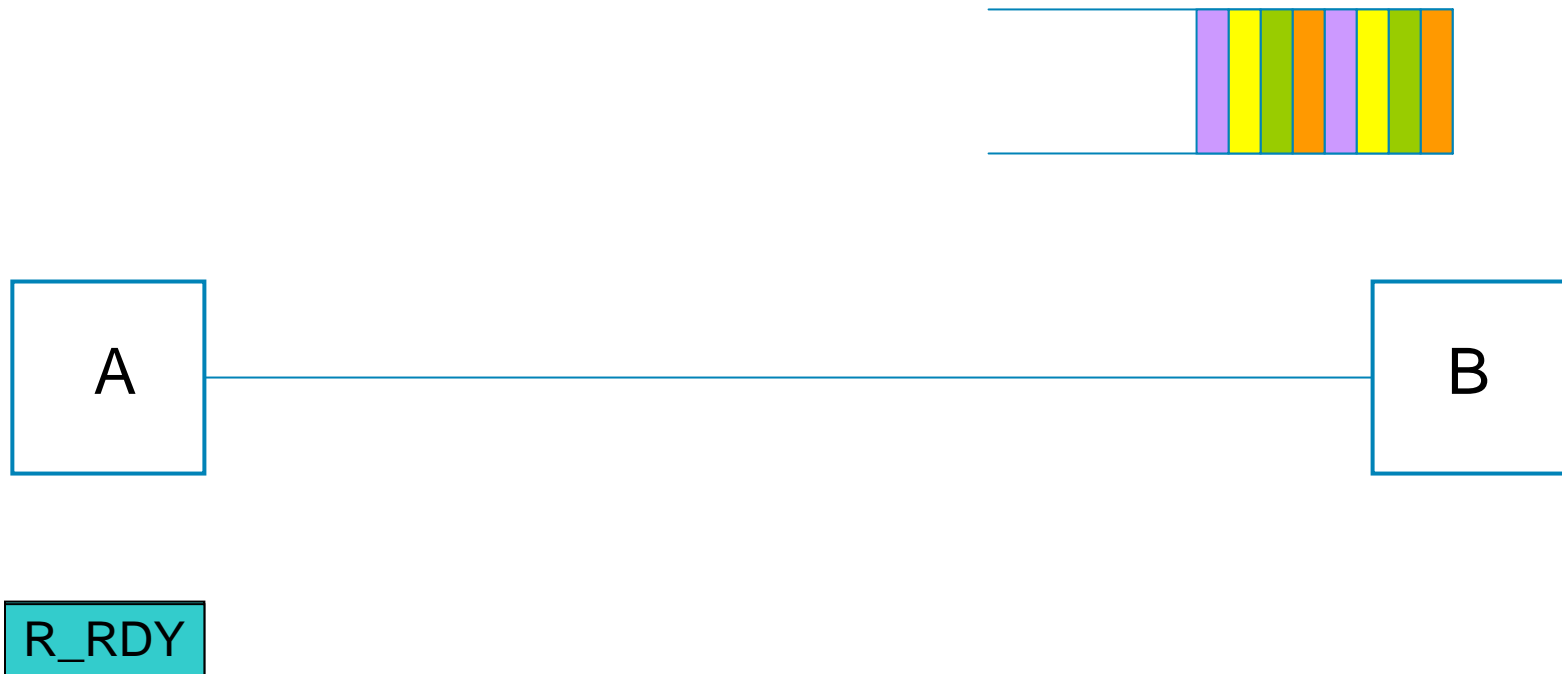
This leads to complex and not scalable implementations

- **Can we improve the situation?**

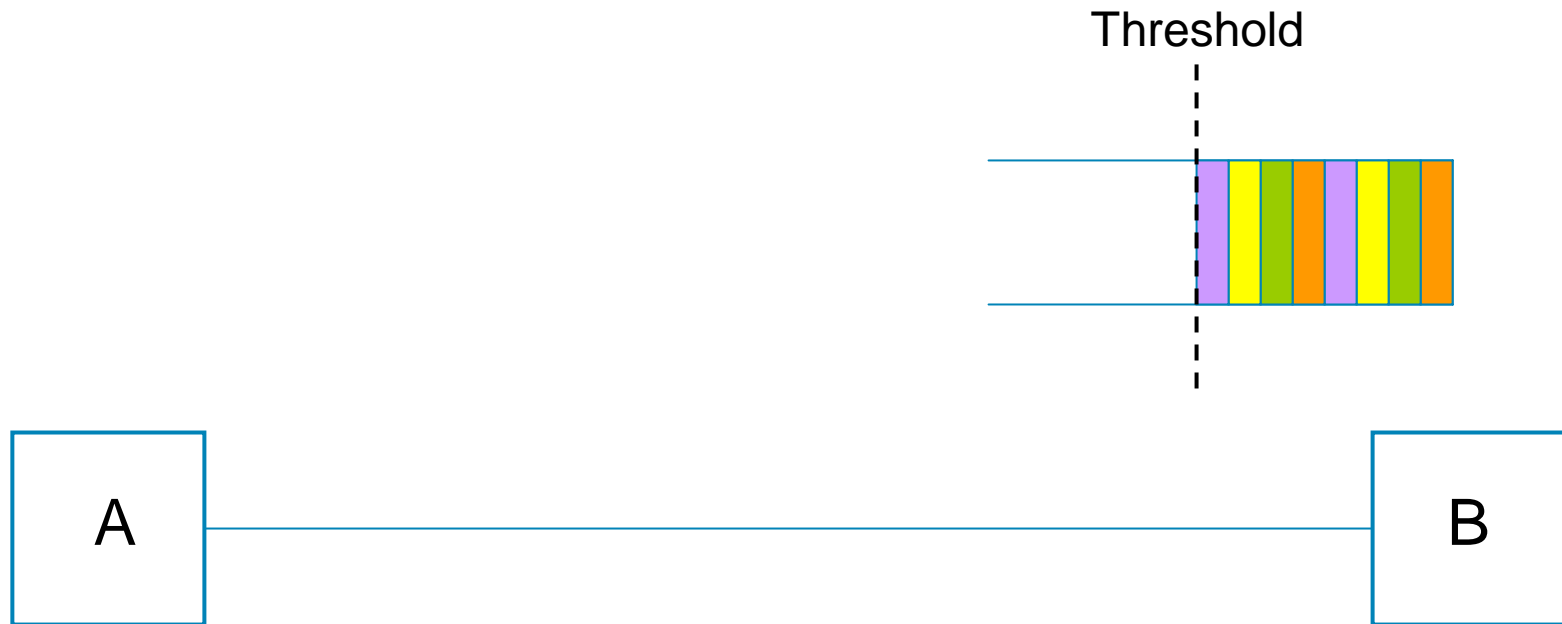
# Fibre Channel over Ethernet

- **IP networks are often built with Ethernet**
- **Usually Ethernet switches discard frames, while Fibre Channel switches do not**
  - Thanks to the **Buffer to Buffer credit mechanism**
- **Some optional Ethernet extensions allow Ethernet switches to not discard frames**
  - The **Pause mechanism defined in IEEE 802.3 Annex 31B**
  - A mechanism different than the **Buffer to Buffer credit**, but able to achieve the same result
- **If these extensions are implemented, Fibre Channel frames can be mapped directly on top of Ethernet**
  - FCoE: Fibre Channel over Ethernet**

# FC Buffer to Buffer Credit Mechanism



# IEEE 802.3 Annex 31B Pause Mechanism



**PAUSE  
Frame**

Stop sending  
frames for this  
interval of time

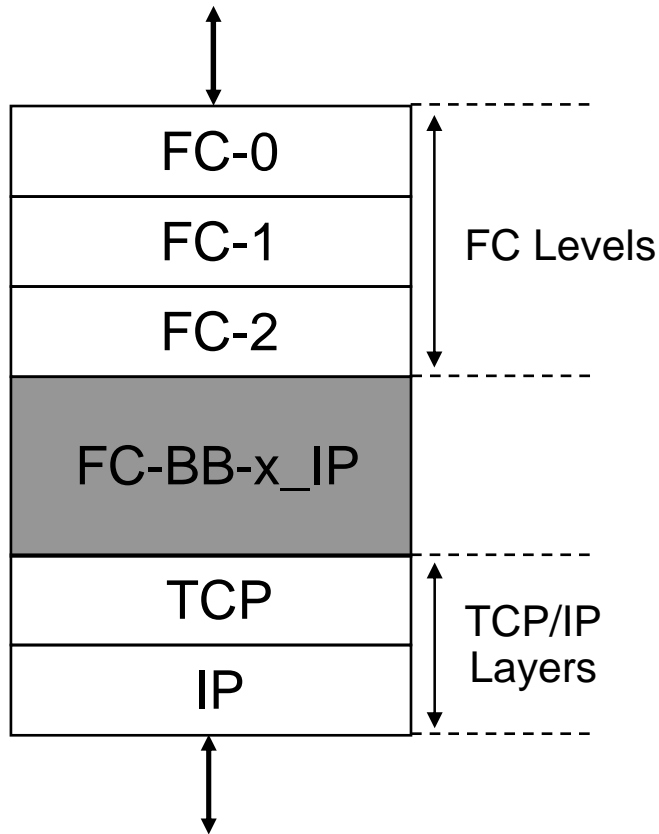
# Pause vs. BB\_Credit

- **Both mechanisms allow to avoid dropping frames**
  - With different trade-offs**
- **The Pause mechanism requires at least the bandwidth x delay product on a link as buffer space**
  - But allows to handle the buffer in an arbitrary way**
  - Well suited for networks with limited bandwidth x delay product**
- **The Pause frame is handled by the MAC layer**
  - Similar to the R\_RDY handling by the FC-1 level**
- **The BB\_Credit mechanism allows to not lose frames over any link**
  - Under-utilizing a link if the credits are not enough**
  - Requiring to handle the buffer in maximum frame size units**

# Protocol Layers

## FCIP

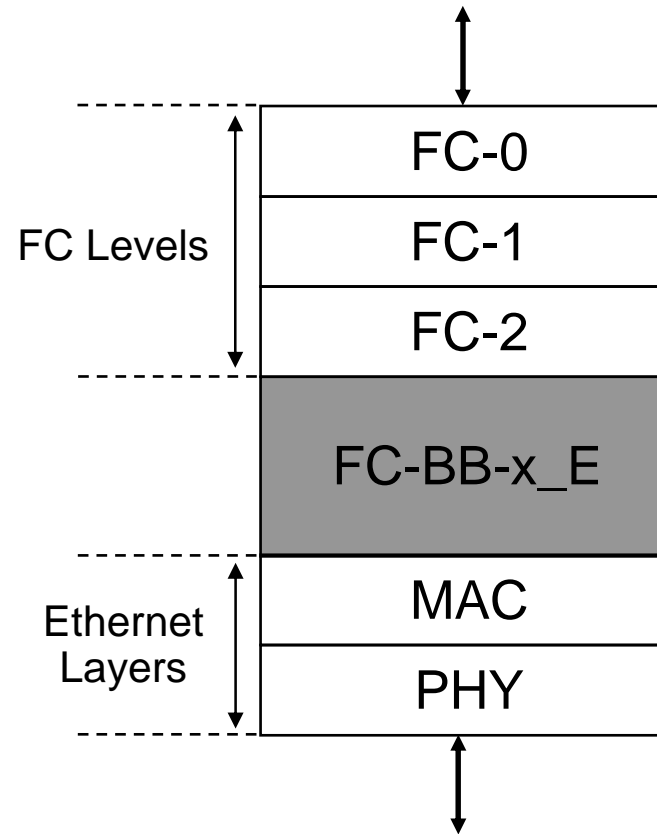
To/From FC Switches



To/From IP Network

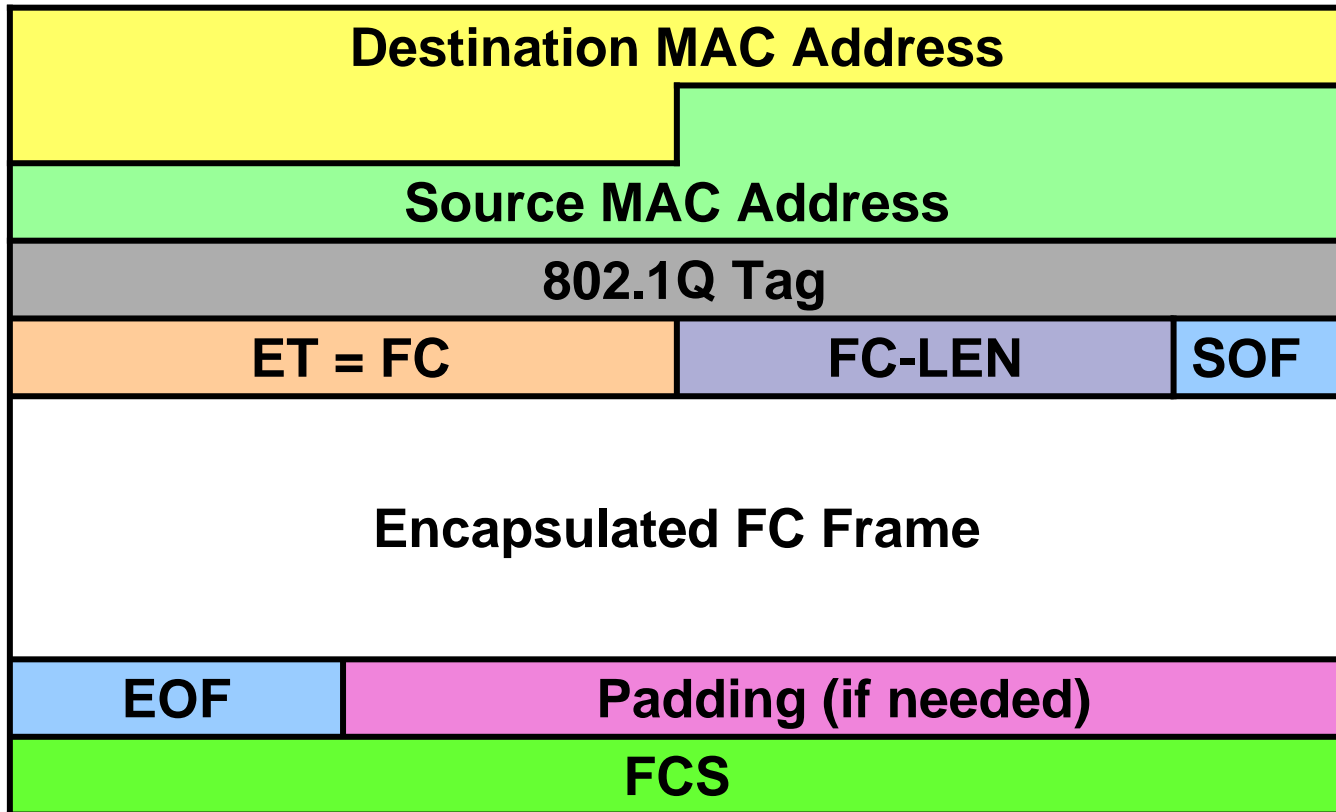
## FCoE

To/From FC\_Ports

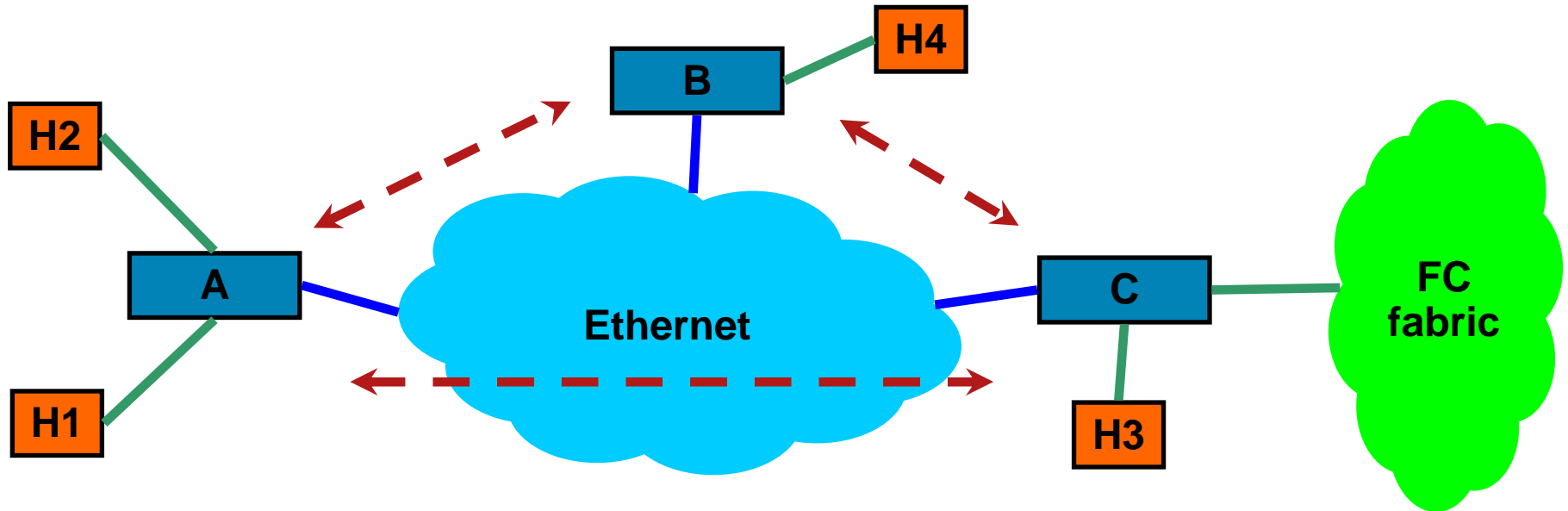


To/From Ethernet Network

# A Simple Encapsulation

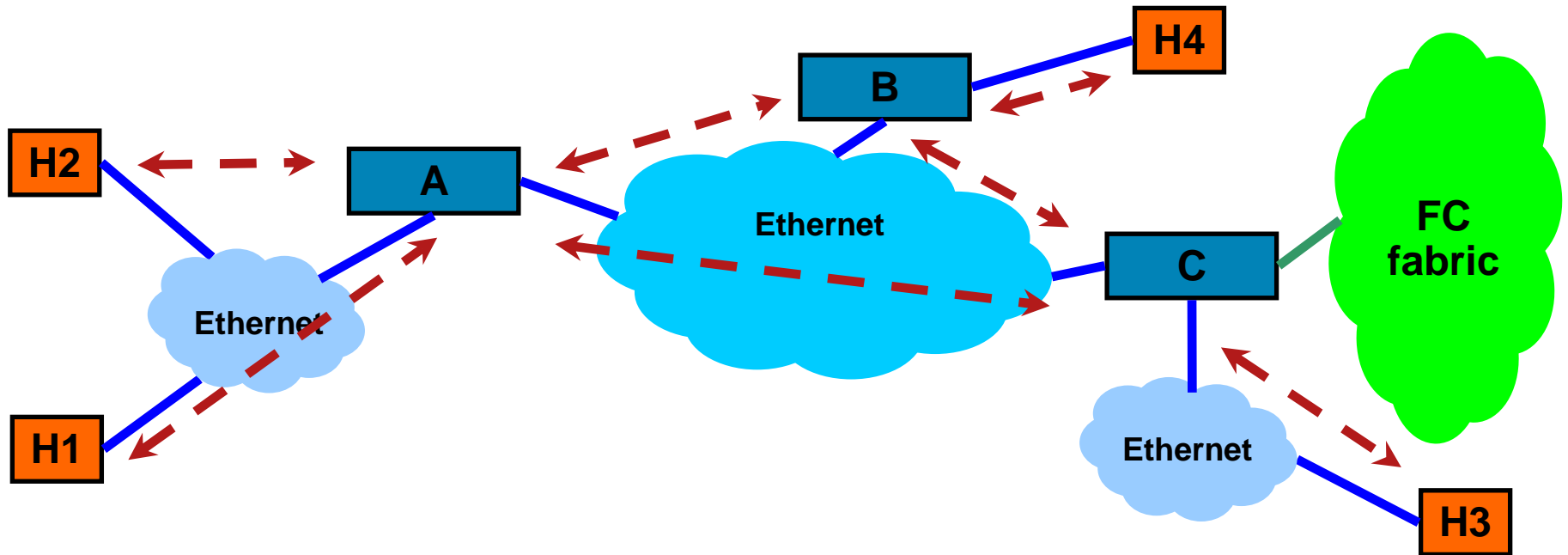


# Basic Model



- **Switch Port to Switch Port**  
Same as FC-BB-x\_IP
- **Extensible for N\_Port to F\_Port**

# Extended Model



- **Extended to include N\_Port to F\_Port**  
As FC-BB-4\_GFPT does

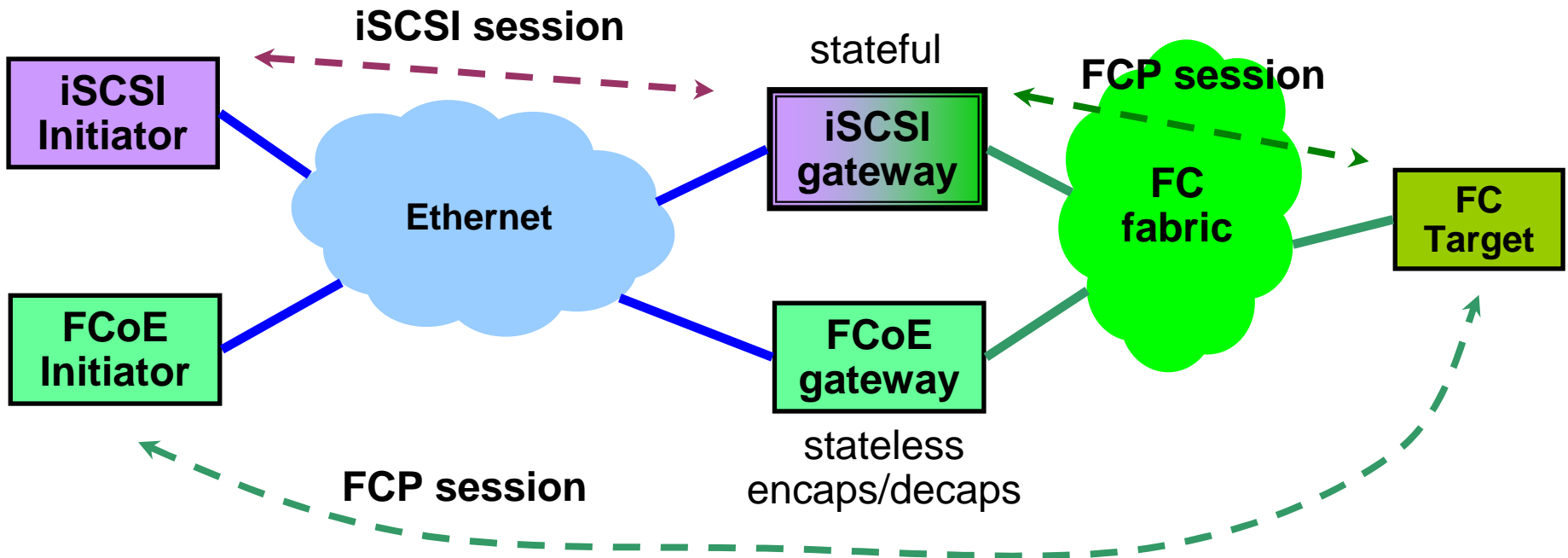
# N\_Port to F\_Port Extension

- **Allows I/O consolidation**

iSCSI is proposed today as an I/O consolidation option

At the price of a management nightmare

**FCoE allows I/O consolidation without the management issues**



# FCoE vs. FC-BaseT

- **FC-BaseT allows to leverage a single copper cabling infrastructure**

**Keeping two different networks**

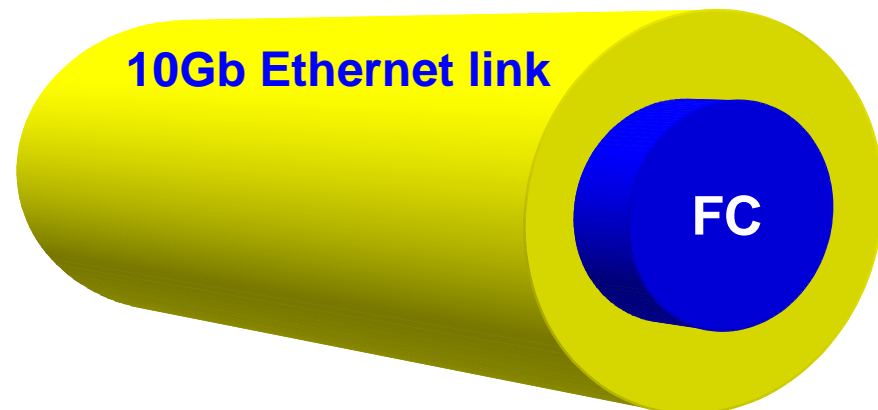
The Fibre Channel Fabric

The Ethernet LAN

- **FCoE allows to consolidate networks and switches**

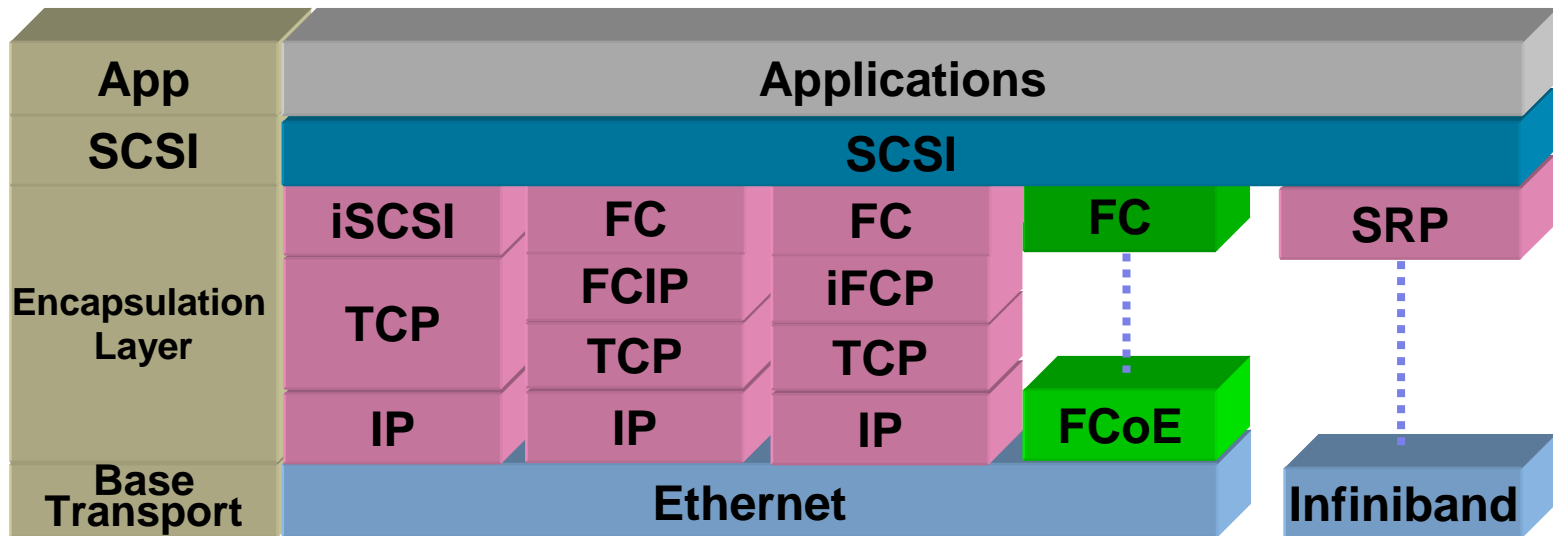
**Over a single network**

Ethernet based



# Encapsulation Technologies

- To transport SCSI
- Other than native Fibre Channel



# I/O Consolidation Options

	iSCSI	FCIP	iFCP	FCoE	IB-SRP
TCP Required	Yes	Yes	Yes	No	No
Performance	Low	Low	Low	High	High
CPU Overhead	High	High	High	Low	Low
Gateway Overhead	High	High	High	Low	High
FC Security Model	No	Yes	Yes	Yes	No
FC Software on Host	No	No	Yes	Yes	No
FC Management Model	No	No	Yes	Yes	No
IP Routable	Yes	Yes	Yes	No	No

# Conclusion

- **iSCSI is being positioned today as THE solution for I/O consolidation**

**It requires new drivers and management tools**

**It solves a local problem with a global solution**

TCP

- **FCoE leverages a local solution to the local problem**

**The Pause mechanism**

- **Let Fibre Channel be a player in I/O consolidation!**

**FCoE provides seamless compatibility with existing storage, drivers, and management tools**

**The congestion management work being done in IEEE 802.1 (to simplify iSCSI) further enables FCoE!**

- **Define an FCoE model and encapsulation in FC-BB-5**