

SAN integration

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1 SAN integration

- FC SAN primarily is a highly reliable, high-performance, data-centre-centric solution that comes at considerable cost.
- The FCP is non-routable, and is therefore confined spatially.
- Often we want to broaden access to our existing FC SAN by means of integration technologies.

A word of warning:

- Generally, we shouldn't start out building a SAN that needs to use these primarily.
- Like WiFi-extenders, poorly thought-out SAN integration can do more harm than good!

2 Fibre Channel over Ethernet (FCoE)

FCoE is where FCP runs over existing ethernet infrastructure:

- usually on CAT5/6 cabling
- can coexist with LAN traffic

Normally its used to connect ethernet-attached hosts to an existing FC SAN fabric.

- Layers 1 and 2 are the same we are familiar with from IP networking.
- Key difference occurs at Layer 3: FCP is encapsulated in ethernet frames.

2.1 FCoE frame format

- The Ethertype denotes the frame as FCoE (as opposed to IP).
- Figure 1 shows the format of a FCoE frame.

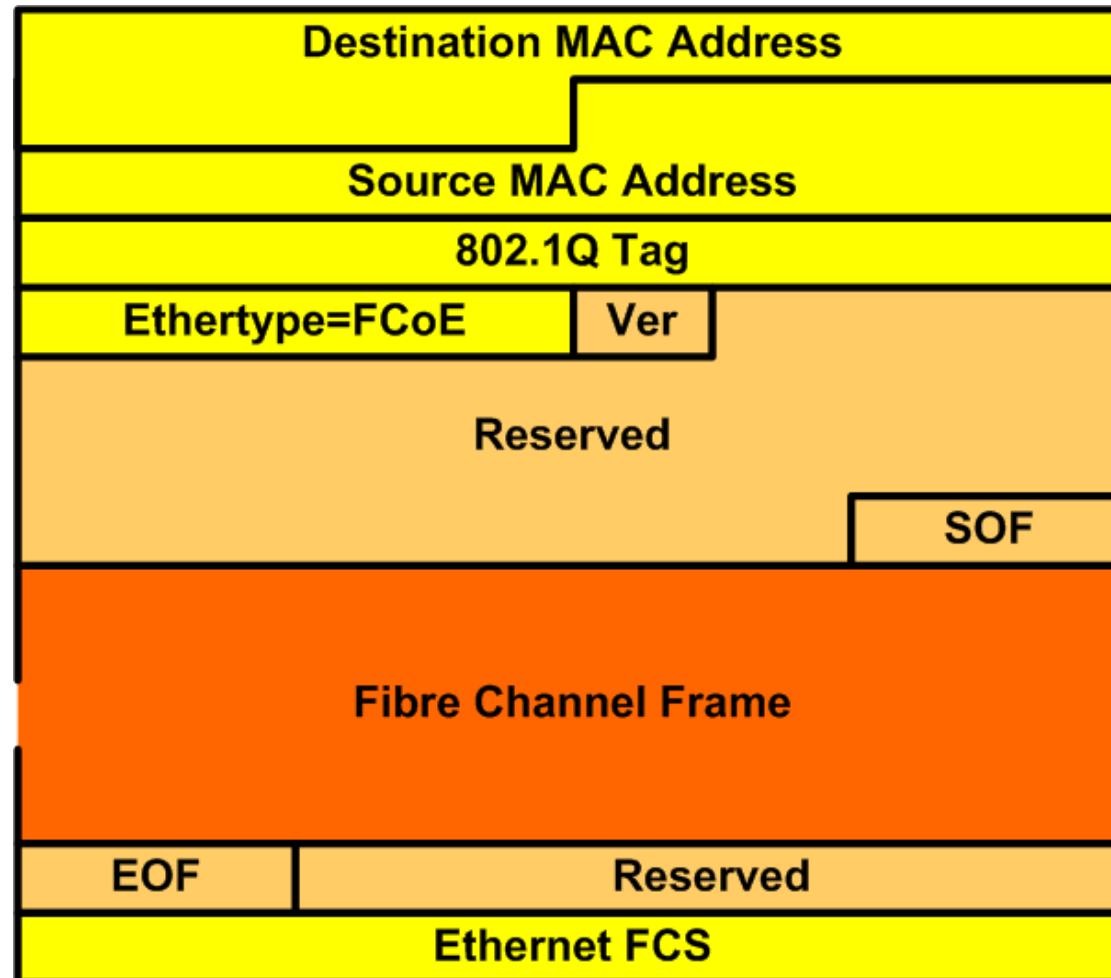


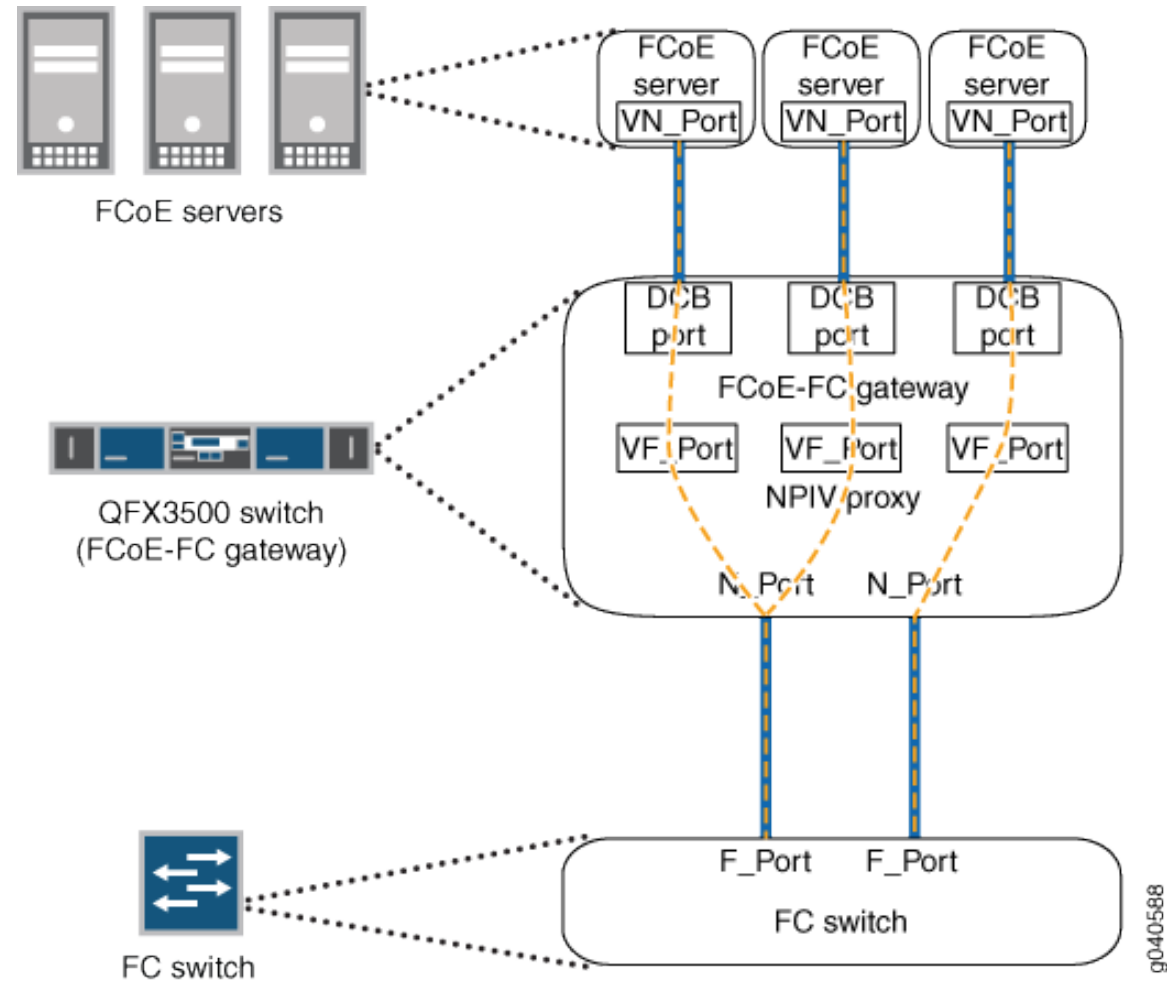
Figure 1: FCoE frame (Wikipedia)

2.2 FCoE fabric

- FC natively has a lossless transport.
- Protocols such as IP running over ethernet normally are tolerant of frames being dropped when congestion is high.
- FCoE requires extensions to the ethernet protocol to guarantee lossless transmission:
 - Called Priority Flow Control.
 - In practice, need FCoE capable switch.

2.3 FCoE-FC gateway

- A FCoE gateway will connect FCoE devices to an existing FC network, ??.
 1. Acts as a so-called fibre channel forwarder to bridge the FCoE to the FC.
 2. Provides the normal fabric services.
- This is actually quite a complex process under the hood:
 - Mapping is required from WWNs to MAC addresses.
 - Gateway device is often a FC switch/director with an FCoE card fitted.

**Figure 2: FCoE gateway**

2.4 FCoE host hardware

Hosts traditionally use a FCoE HBA to connect to the FCoE-provided fabric:

- Software initiators are theoretically possible, like open-fcoe but are unusual to see in use.
- Since FCoE and IP LAN traffic run over ethernet, we can converge the two using a FCoE Converged Networking Adapter.
- Generally recommended that VLANs are used to separate FCoE and IP traffic where they co-exist.

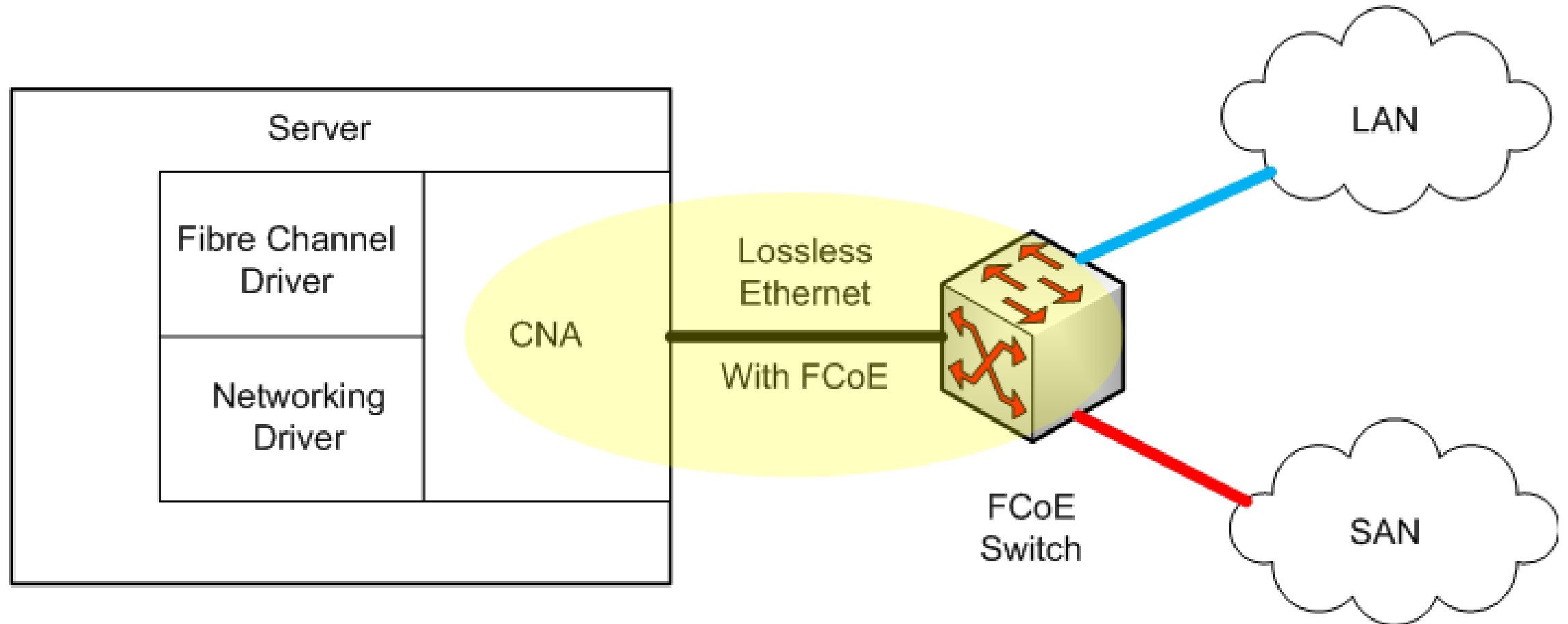


Figure 3: FCoE converged networking (Wikipedia)

2.5 FCoE Application Areas

FCoE's primary purpose is to extend FC SAN by re-using CAT-6 cabling and/or existing ethernet networking. It would be highly unusual to build an entire SAN primarily around FCoE.

Although converged networking is beneficial in many applications, FCoE would not be a primary means of doing so.

FCoE requires gateways, FCoE-aware switches and other expensive hardware. It is normally not cost effective compared to IP SAN.

FCoE is not routable, and can't cross Layer-2 boundaries. Therefore it's primarily seen within a data centre or single-building environment.

In summary, FCoE is best used to connect hosts to an existing FC SAN over CAT5/6-carried ethernet where it is impractical to extend the FC SAN directly to them.

3 Fibre Channel over IP (FCIP)

Fibre Channel over IP (FCIP) encapsulates fibre channel within IP packets on an existing IP network. FCIP is normally used to tunnel directly between two remote FC networks, , and is not used by individual hosts.

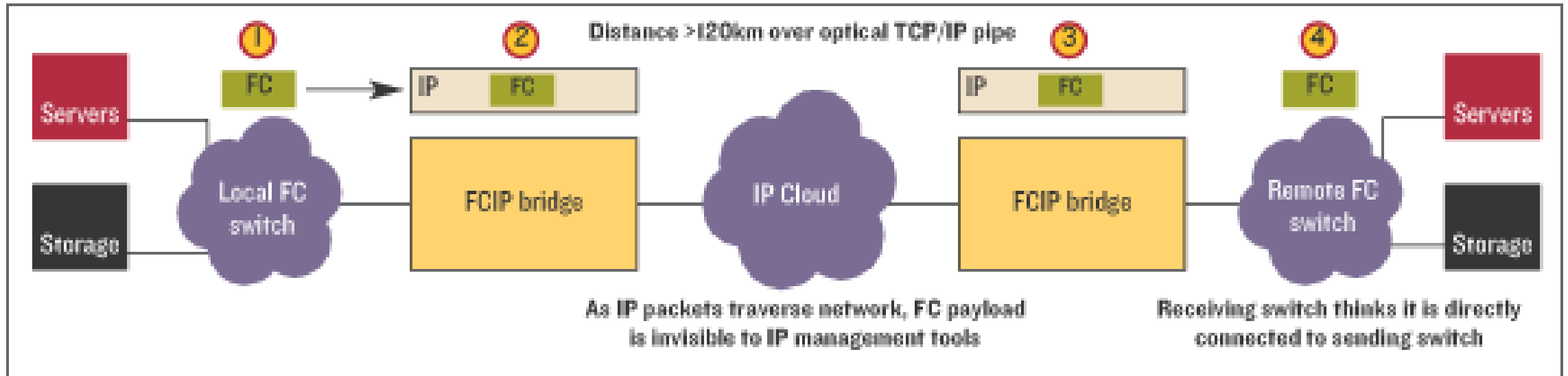


Figure 4: FC can be extended using FCIP (TechTarget)

Configuration is generally needed of the two bridges and the network between them. The encapsulation process does lower performance compared to native FC or FCoE.

3.1 FCIP Application areas

Generally FCIP is appropriate where we need to bridge two physically remote FC networks into one fabric across a routed IP or WAN link. It is our only option when the link involves a WAN or having to cross Layer-2 boundaries.

If the two FC networks can be connected directly CAT5/6 then FCoE may be more suitable than FCIP.

Given that the FCIP link is slower than other links in the FC fabric, it works best where there is comparatively little traffic on the bridged link. FCIP is therefore good for scenarios like offsite backup, replication and accessing archival storage.

4 **FC-iSCSI integration**

FC and iSCSI both encapsulate SCSI commands, so conceptually they can be bridged. This is normally done using a FC to iSCSI gateway, . As iSCSI runs over TCP/IP it is routable across Layer-2 boundaries.

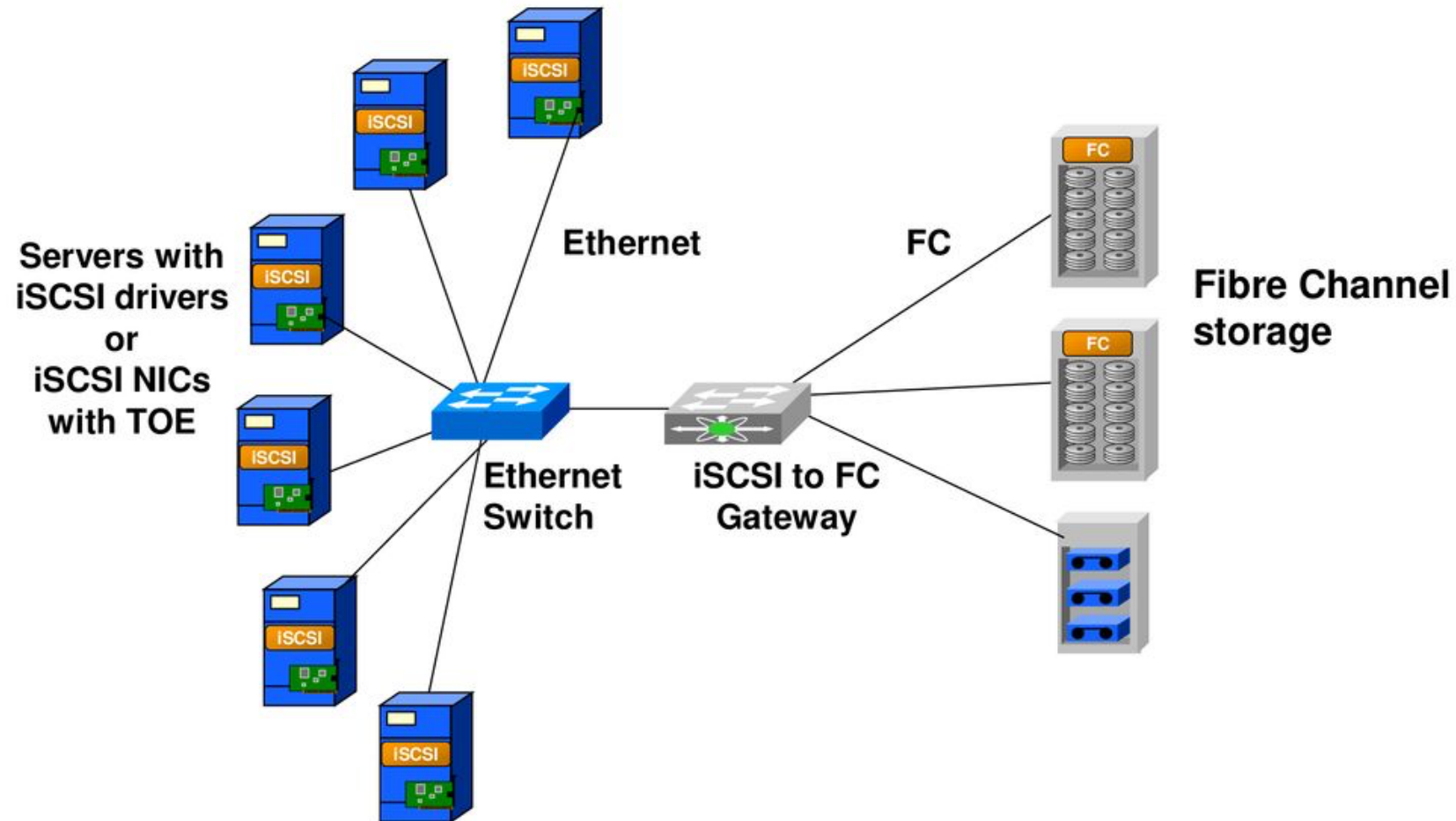


Figure 5: iSCSI hosts accessing FC storage via gateway (Cisco)

4.1 Application areas

- Leveraging existing FC SAN for lower-traffic hosts at minimal cost using software initiators or inbuilt HBAs.
- Allowing iSCSI-capable workstations to directly access FC-SAN storage.
- Giving access to FC SAN for servers that need to be located distant from the FC SAN.