Transitioning to IP Storage Networks and iSCSI

Using Internet Fibre Channel Protocol (iFCP)

Presentation Topics

- Introduction to iFCP
  - Bridging Fibre Channel to Native IP Storage Networks
- IP Storage Solutions
  - Using iFCP for IP Storage Integration with Fibre Channel and Transition to iSCSI
- IP Storage Protocols
  - Looking at iFCP, iSCSI, FCIP
- Approaches to SAN Extension
  - Single Fabric and Managed Interconnect Options
- Design Decisions and Recommendations
  - Premises and Actions for iFCP Architectures

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Introduction to iFCP

Bridging Fibre Channel to Native IP Storage Networks

A Vision of the Future

- End-users and IP Storage industry players recognize iSCSI as likely end goal of IP Storage Networking configurations
- Most vendors recognize a need to couple iSCSI with a second protocol to accommodate the Fibre Channel installed base
- That protocol can be iFCP, or FCIP, or both

Definitions for iFCP

Internet Fibre Channel Protocol (iFCP):

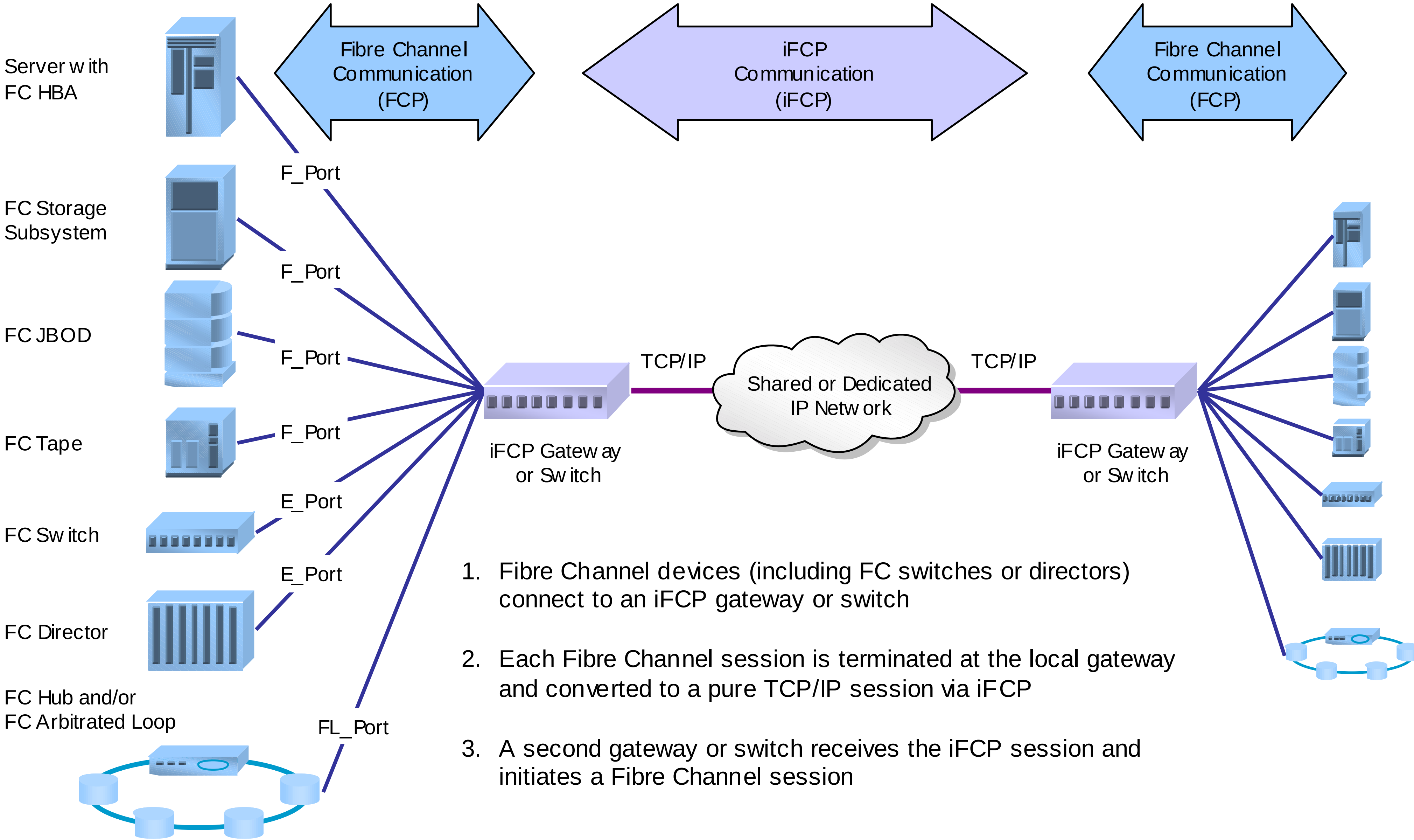
- Acts as a technology catalyst behind networking products that complement and enhance the functionality of Fibre Channel devices and networks
- Allows users to interconnect Fibre Channel devices across TCP/IP networks of any distance
- Enables interconnections to existing Fibre Channel SANs, including Fibre Channel switches, directors, host bus adapters, and storage subsystems
- Offers highly-scalable implementations that provide the flexibility of managed name servers across interconnected FC SAN fabrics
- Provides robust mechanisms for Fibre Channel SANs to be interconnected as autonomous regions
- Focuses on maximizing the use of IP networking and providing a valuable migration path for those transitioning from pure Fibre Channel SANs to those focused on Internet Protocol, including iSCSI

Market Drivers for iFCP

- Installed base of Fibre Channel devices*
  - $2.45 billion FC HBAs in 2005
  - $5.4 billion FC switches in 2005
  - $29.2 billion in external hardware RAID in 2005
- Momentum towards IP Storage Networks
  - Requirement to maintain standards based FC connectivity across IP networks
  - Focus on integration with IP networks and transition to iSCSI end systems
  - $2.48 billion iSCSI market segment in 2005**

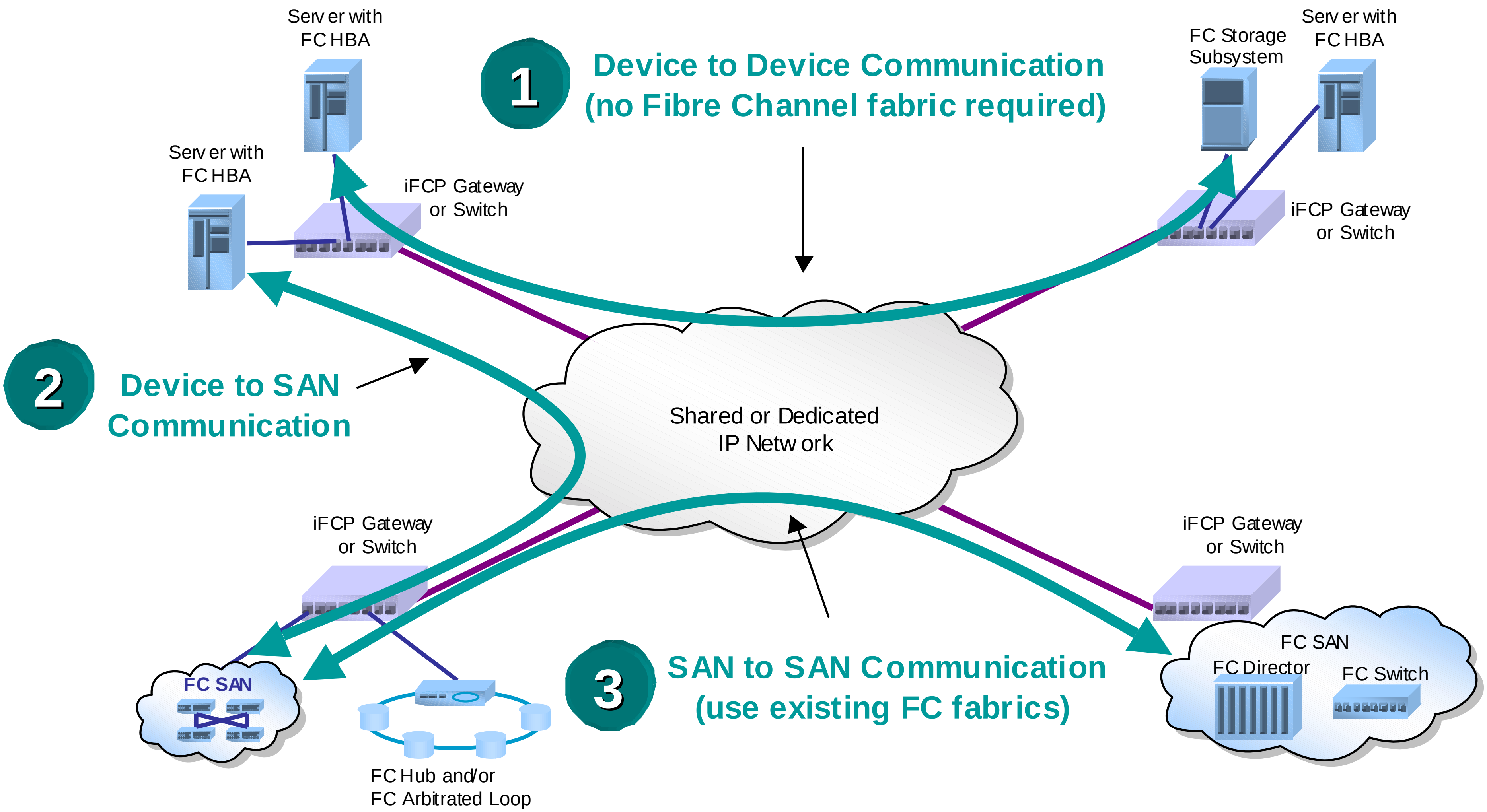
*Source: Gartner, Dec 13, 2001
**Source: IDC, 2001

How Does iFCP Work?



1. Fibre Channel devices (including FC switches or directors) connect to an iFCP gateway or switch
2. Each Fibre Channel session is terminated at the local gateway and converted to a pure TCP/IP session via iFCP
3. A second gateway or switch receives the iFCP session and initiates a Fibre Channel session

Types of iFCP Communication

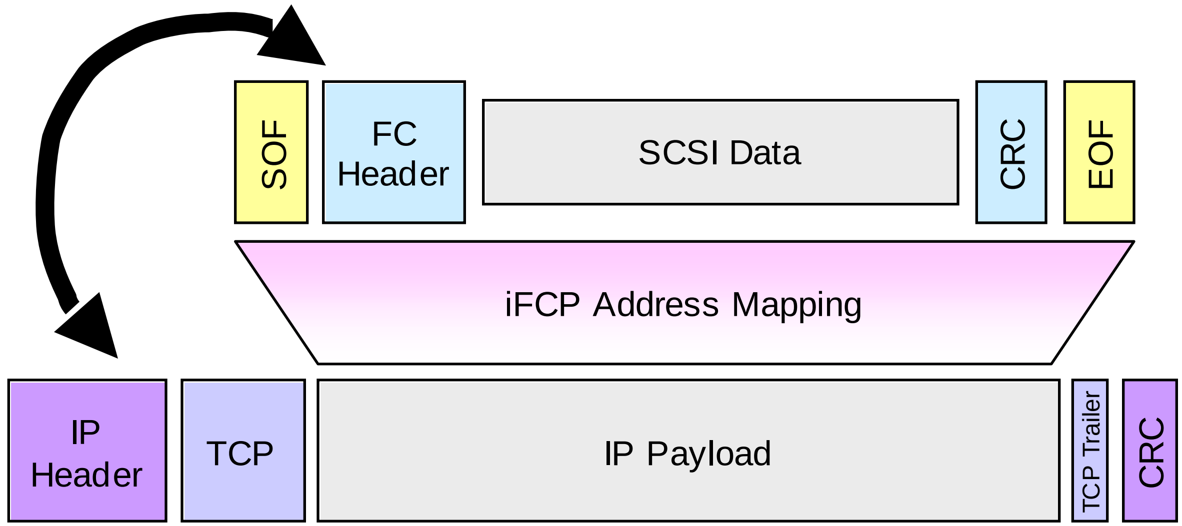


iFCP Addressing

iFCP maps each FC address to an IP address and TCP session

Fibre Channel Frame

IP Datagram



Benefits of iFCP Addressing

- One-to-one mapping between FC and IP
- Complete visibility to individual FC devices
- TCP session control for individual storage transactions

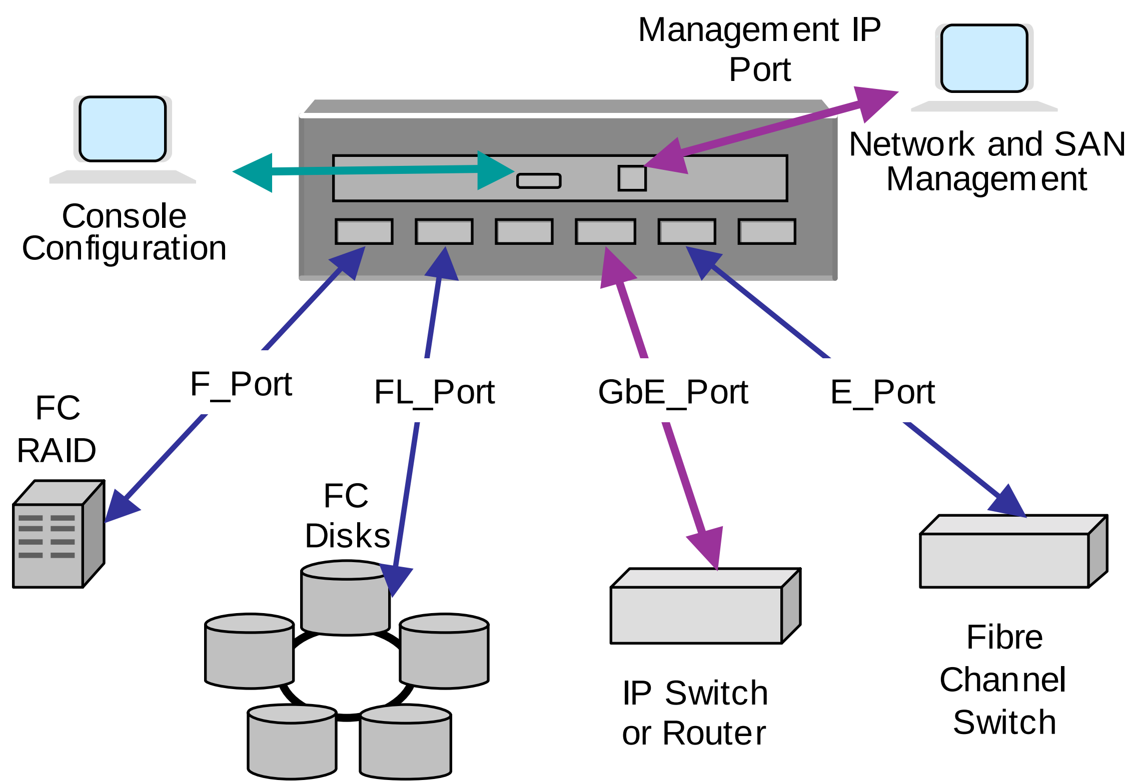
iFCP Gateway Implementation Example

iFCP can be implemented

- In switches or routers
- With layer 3 routing capabilities such as OSPF
- In combination with other IP Storage protocols such as iSCSI and FCIP

Sample Ports

- Fibre Channel
  - F-Port
  - FL-Port
  - FC Auto Port
  - E-port
- Gigabit Ethernet
  - Gigabit Ethernet Port
  - Gigabit Ethernet Trunk Port
- Management
  - IP Java Mgmt Port
  - RS232 Console Port



Benefits of iFCP and iFCP Products

- Extends existing FC infrastructure across IP networks (LANs, MANs, WANs)
  - Protects, complements and expands existing FC investments
  - Leverages IP technology investment and innovation
  - Reduces infrastructure provisioning and support costs
  - Exploits standards-based IP components for full interoperability
  - Provides highly-scalable means to interconnect FC SANs through autonomous regions
- Allows IP based core storage fabrics in conjunction with, or in place of, Fibre Channel fabrics
  - Focuses new networking investments towards IP infrastructure while retaining full FC device, switch, director, and SAN compatibility
  - Supplements Fibre Channel Fabric Services with TCP/IP-based equivalents that scale to large IP Storage fabrics and use full IP routing mechanisms
  - Provides seamless transition to iSCSI by focusing on IP Storage fabrics also required and used by iSCSI end systems

Benefits of IP Storage and iSCSI

On paper, iSCSI has a lot going for it. First may be the comfort factor: the IT world has worked with its two protocols, IP and SCSI, for about 15 years, and knows them well.

There are many other benefits as well. Chief among those are:

- IT staffers can use existing Ethernet network utilities to manage much of their storage as well, and many will view this as a major step towards the convergence of storage-area network, network-attached storage, LAN, and WANs into a single, integrated network.
- It makes use of available infrastructure for data transfer, including remote backups.
- The Ethernet pipe is making significant bandwidth gains.
- In contrast to Fibre Channel, iSCSI shows no performance degradation over long-haul distances.
- iSCSI vendors have been rigorous in their interoperability testing.
- Potentially, iSCSI transfers data at wire speeds, so that the only impact on its performance will come from network-imposed limitations (IP routing problems and network brownouts, for example).

Source: NETWORK WORLD NEWSLETTER:
MIKE KARP on STORAGE IN THE ENTERPRISE, 01/31/02
Today's focus: ISCSI reaches closer to reality

Native IP Goes Everywhere

- iFCP runs over all IP transports
- Full SAN, LAN, MAN and WAN Support

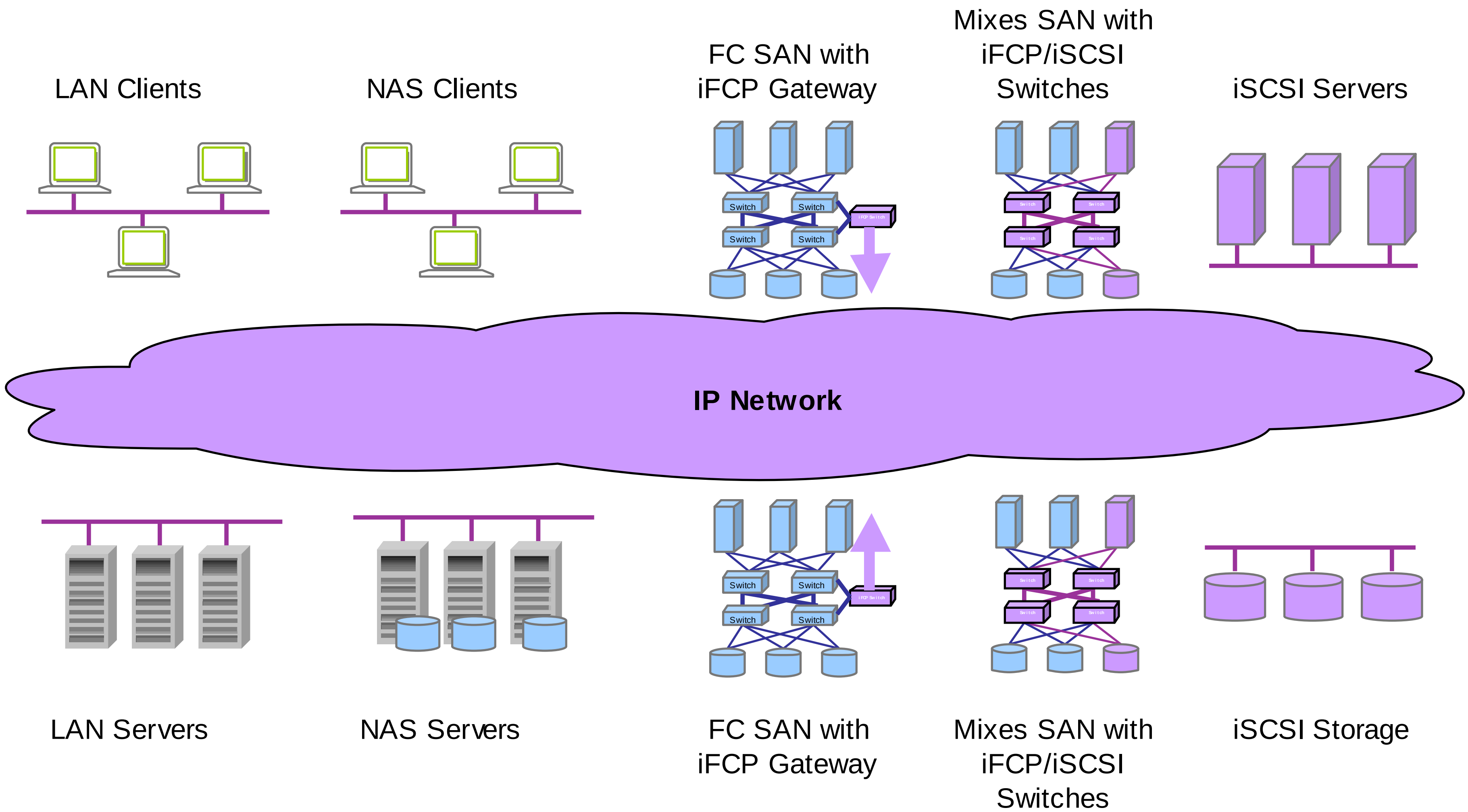
	LAN	Campus	MAN	WAN
Gigabit Ethernet	✓	✓	✓	✓
Dedicated IP	✓	✓	✓	✓
Shared IP	✓	✓	✓	✓
Frame Relay	✓	✓	✓	✓
ATM	✓	✓	✓	✓
Packet over SONET	✓	✓	✓	✓

Applications for iFCP

- FC SAN Extension
  - Link existing FC SANs or FC devices long distance over TCP/IP networks for:
    - Synchronous or asynchronous mirroring
    - Storage consolidation
    - Remote backup and recovery
- FC SAN Interconnect
  - Interconnect FC SANs in local, metro, or wide area topologies for:
    - Highly scalable storage networks with core IP fabrics and FC devices or SANs for integrated IP storage networks
    - Division of FC SANs and IP core fabric into autonomous regions for manageable, scalable, enterprise storage
- iSCSI and Fibre Channel Integration and iSCSI Transition
  - Bridge existing Fibre Channel SANs or Fibre Channel devices towards an integrated IP storage fabric that can also incorporate iSCSI devices
  - Utilize common name service and discovery mechanisms with iSCSI for natural transition to iSCSI end systems without abandoning Fibre Channel infrastructure

Flexibility and Operational Agility

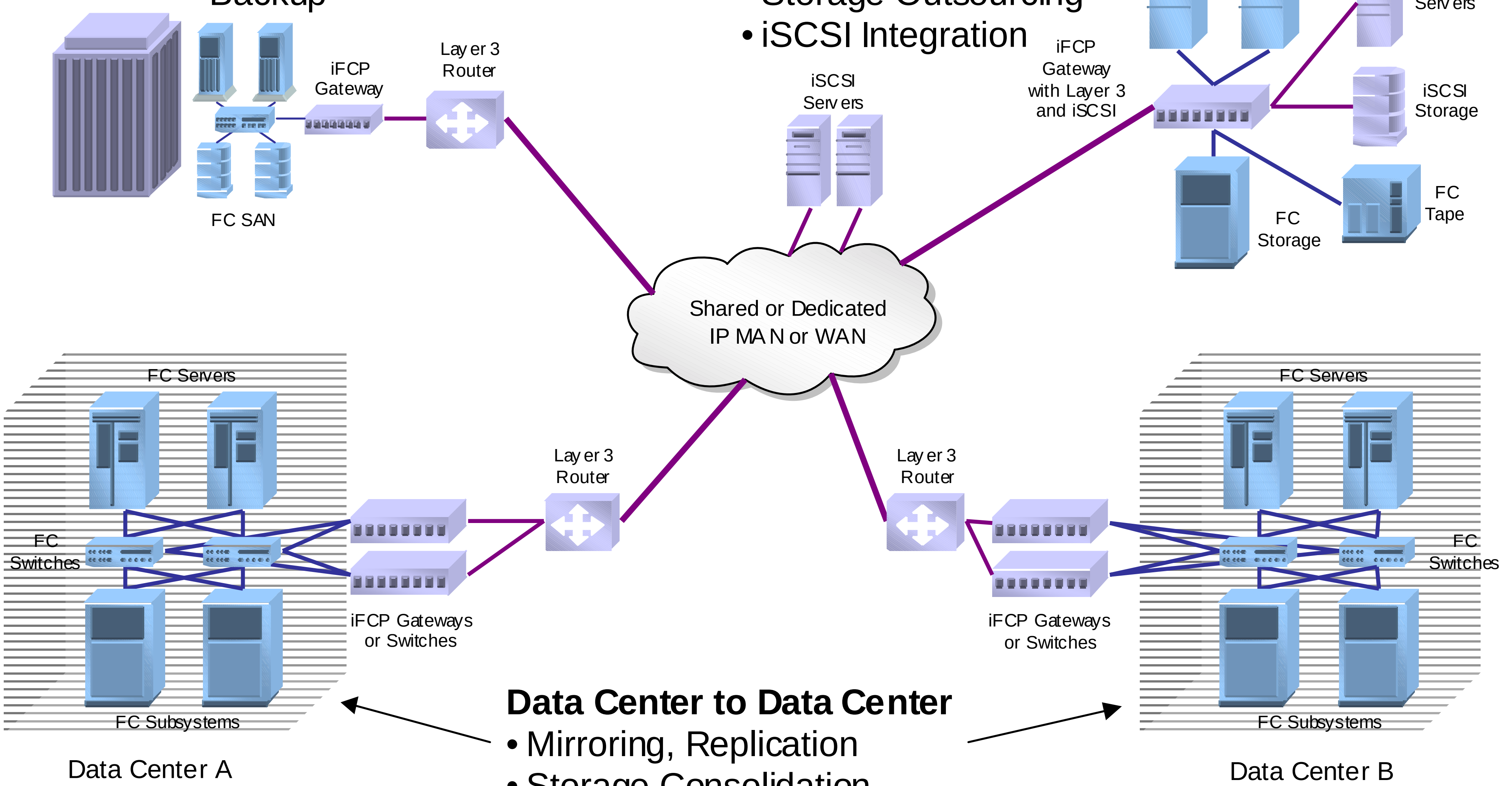
- IP network provides flexibility and operational agility across all installations
- Centralization of network technology reduces management and administration cost



Using Internet Fibre Channel Protocol (iFCP)

Departmental SAN
- Remote Storage Access
- Backup

New Deployments
- Remote Backup
- Storage Outsourcing
- iSCSI Integration



Data Center to Data Center
- Mirroring, Replication
- Storage Consolidation

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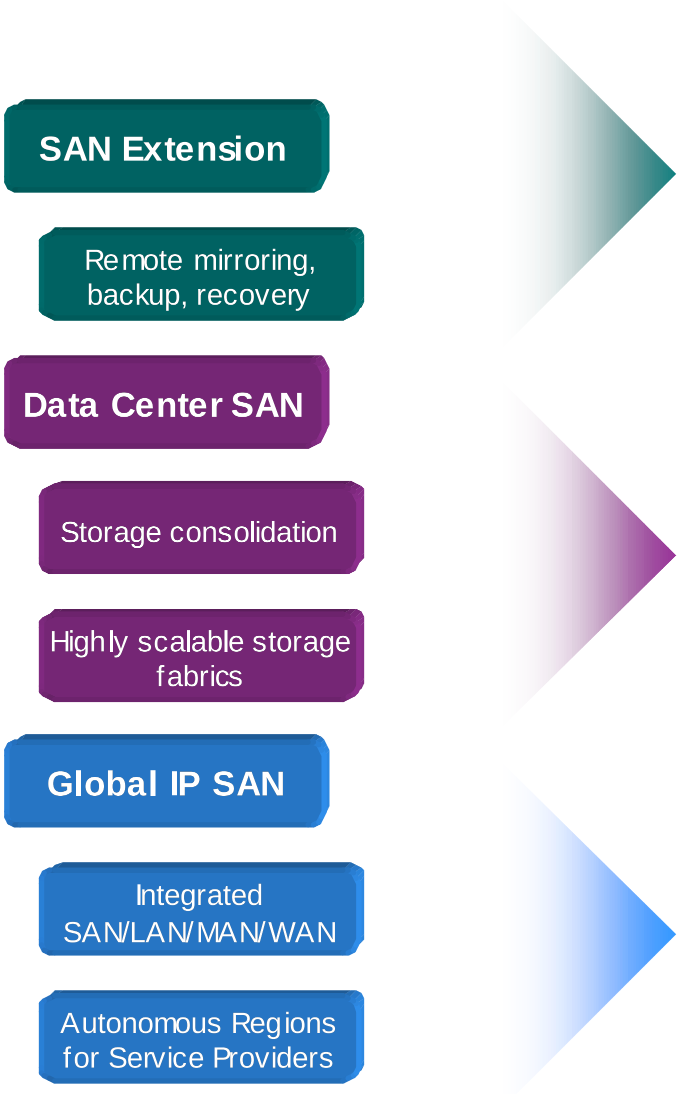
IP Storage Solutions

Using iFCP for IP Storage Integration with Fibre Channel and Transition to iSCSI

Solution Index by Topology



- SAN Extension
  - Remote mirroring, backup, and recovery
- Data Center SANs
  - Storage consolidation
  - Highly scalable storage fabrics
- Global Enterprise IP SANs
  - Integrated SAN/LAN/MAN/WAN infrastructure
  - Autonomous Regions for Service Providers

Remote Mirroring, Backup, Recovery

Situation: Customer wants SAN extension solutions for mirroring, backup, recovery

SAN Extension

Remote mirroring, backup, recovery

Data Center SAN

Storage consolidation

Highly scalable storage fabrics

Global IP SAN

Integrated SAN/LAN/MAN/WAN

Autonomous Regions for Service Providers

Issues:
- DWDM is cost prohibitive - TCO is high
- DWDM is hard to find and may not be available in all areas
- Native Fibre Channel link cannot reach long distance requirements

Remote Mirroring, Backup, Recovery

Solution: Customer deploys iFCP Gateways for SAN extension

SAN Extension

Remote mirroring, backup, recovery

Data Center SAN

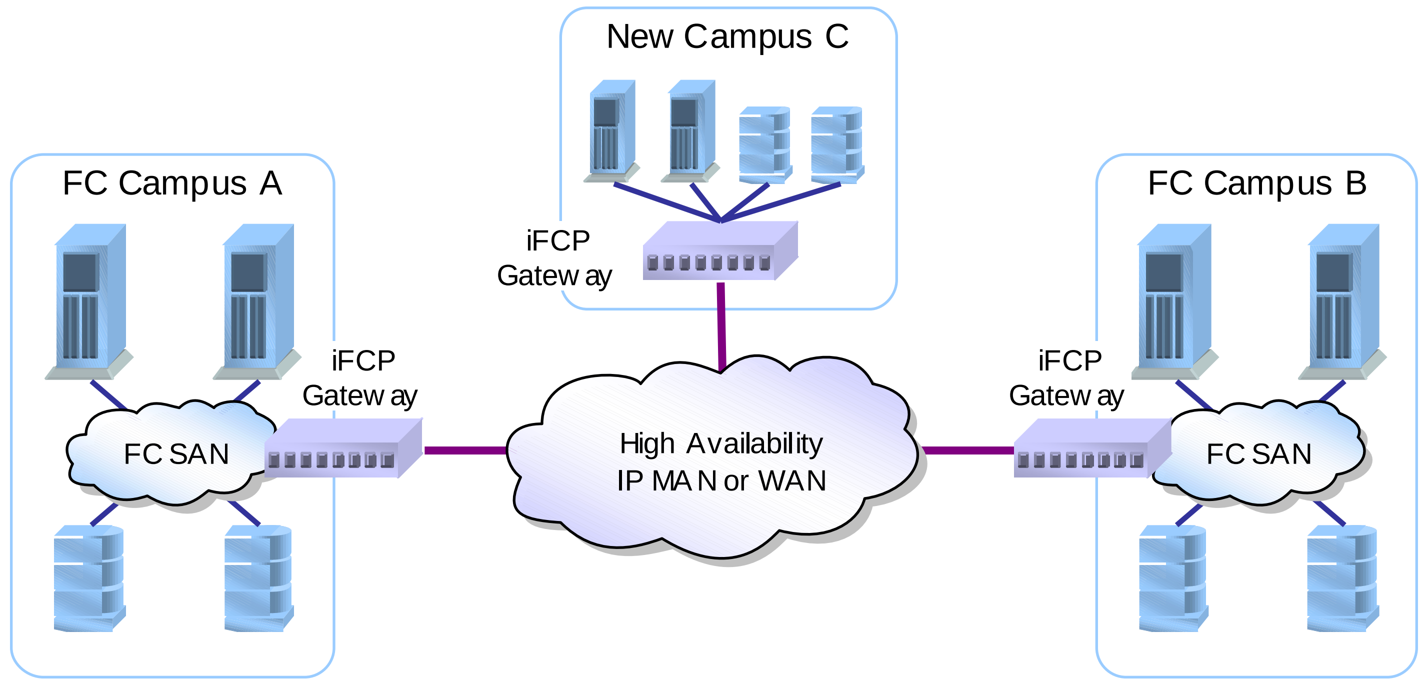
Storage consolidation

Highly scalable storage fabrics

Global IP SAN

Integrated SAN/LAN/MAN/WAN

Autonomous Regions for Service Providers



Benefits:
- Familiar IP and Ethernet management tools for IP network and iFCP gateways
- Lower TCO on hardware components for end users
- Migration path to new IP Storage deployments
- Robust IP security and encryption tools protect mission critical data

Storage Consolidation

SAN Extension

Remote mirroring, backup, recovery

Data Center SAN

Storage consolidation

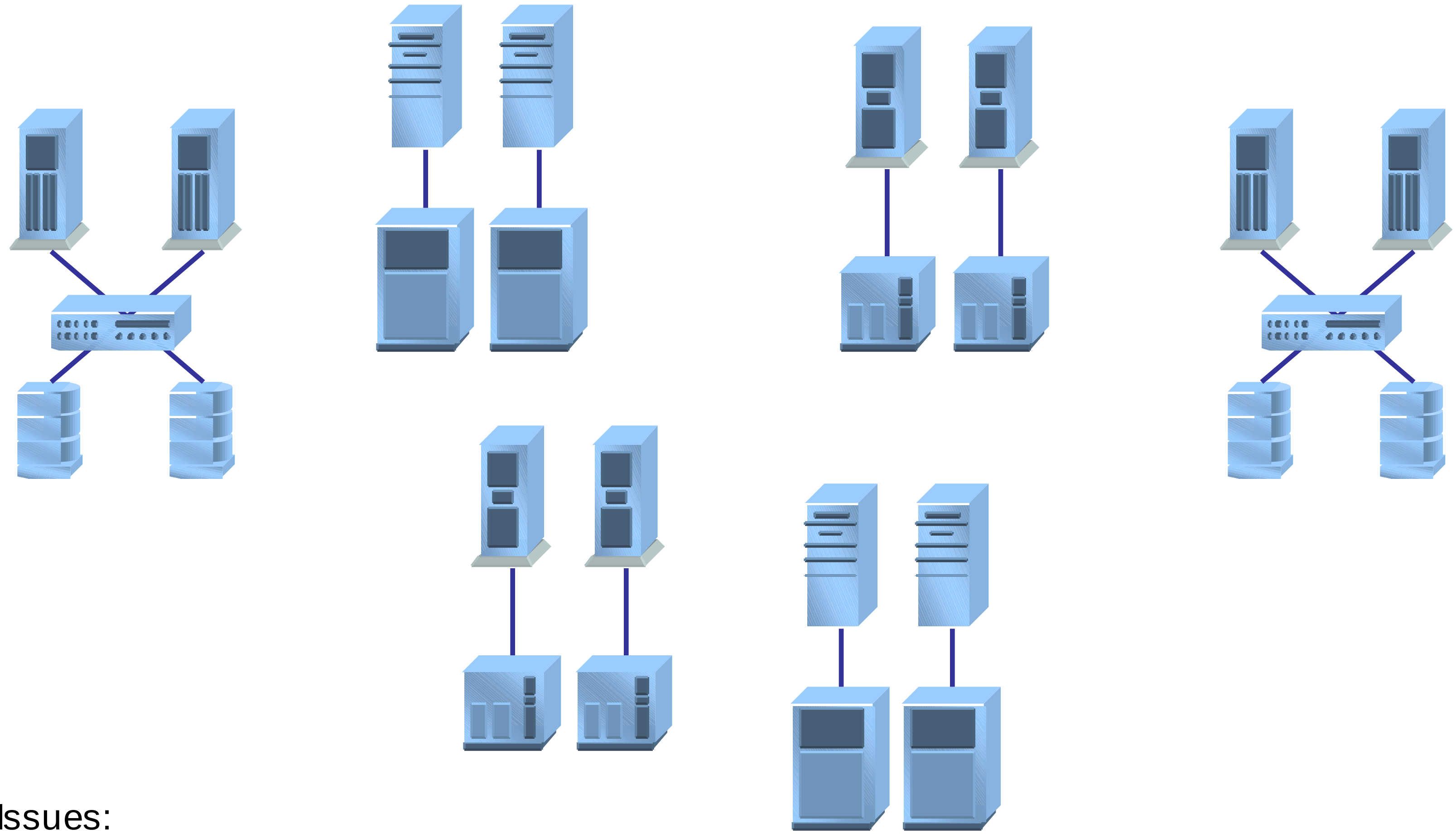
Highly scalable storage fabrics

Global IP SAN

Integrated SAN/LAN/MAN/WAN

Autonomous Regions for Service Providers

Situation: Customer has direct attach storage devices that can't be easily pooled for sharing and resource allocation



Issues:

- Each server group has dedicated storage resources:
  - High management costs, poor scalability and availability of storage and servers
- Server and LAN bottlenecks
- Single points of failure

Storage Consolidation

SAN Extension

Remote mirroring, backup, recovery

Data Center SAN

Storage consolidation

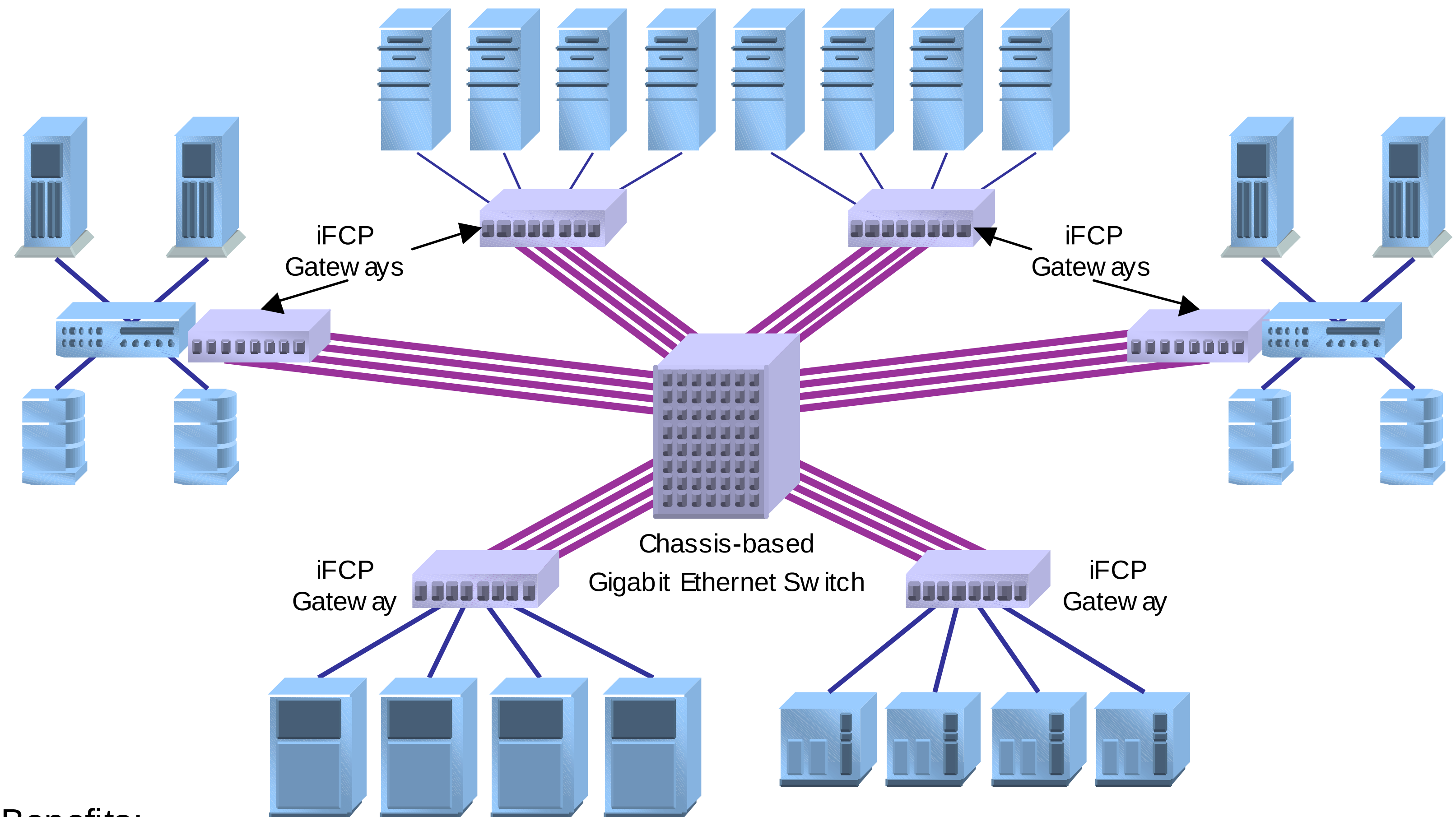
Highly scalable storage fabrics

Global IP SAN

Integrated SAN/LAN/MAN/WAN

Autonomous Regions for Service Providers

Solution: Customer connects all devices to the IP SAN using iFCP for resource allocation and efficient use of storage capacity



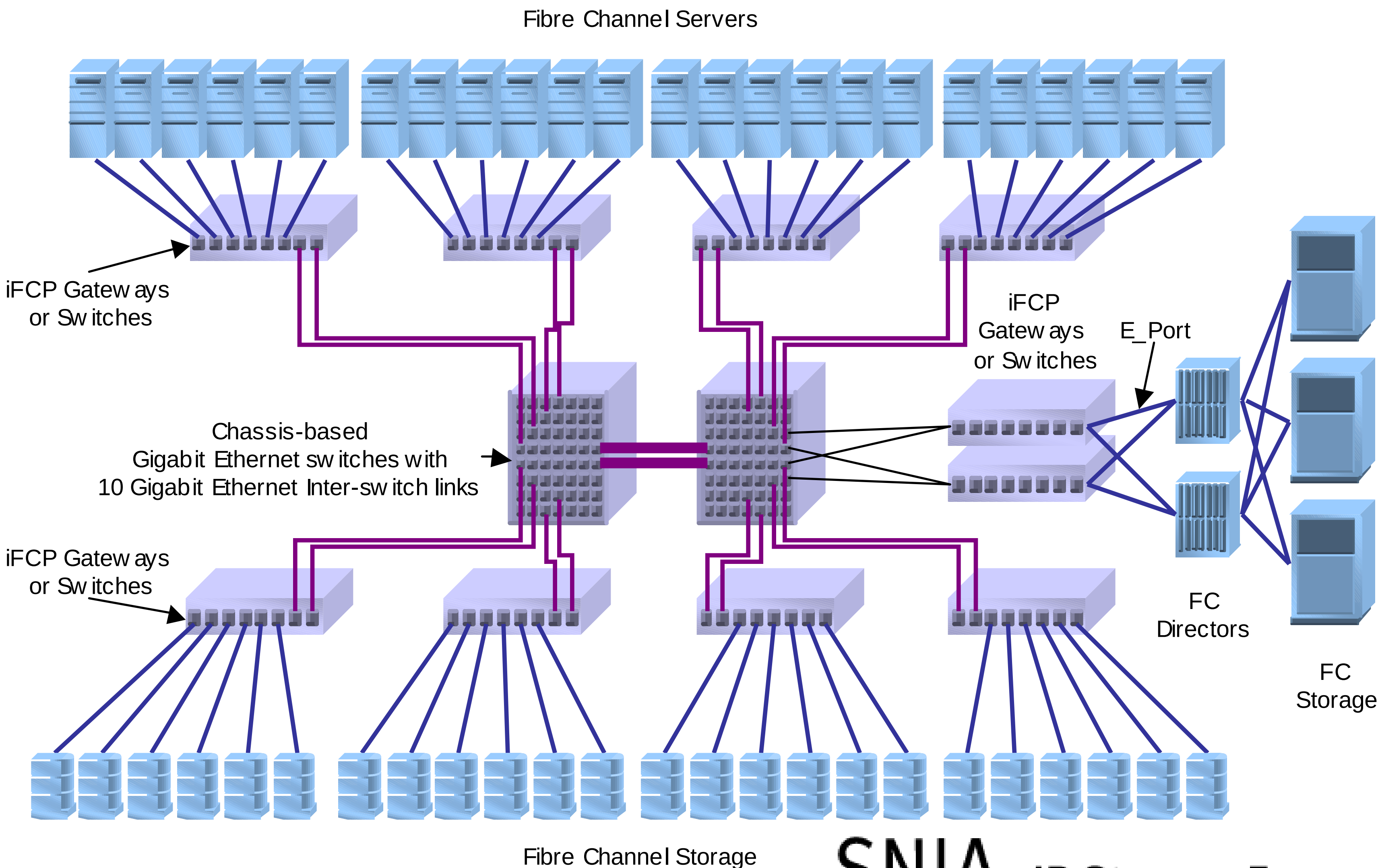
Benefits:

- Enterprise focus: One site becomes the main data center
- Distributed sites have departmental servers
- Reduced amount of overall storage, and perhaps some servers
- Lower TCO in hardware and software

Highly Scalable Storage Networks

- SAN Extension
- Remote mirroring, backup, recovery
- **Data Center SAN**
- Storage consolidation
- **Highly scalable storage fabrics**
- Global IP SAN
- Integrated SAN/LAN/MAN/WAN
- Autonomous Regions for Service Providers

- iFCP Switches or Gateways allow for creation of highly scalable storage networks
- IP core provides sophisticated routing based on OSPF



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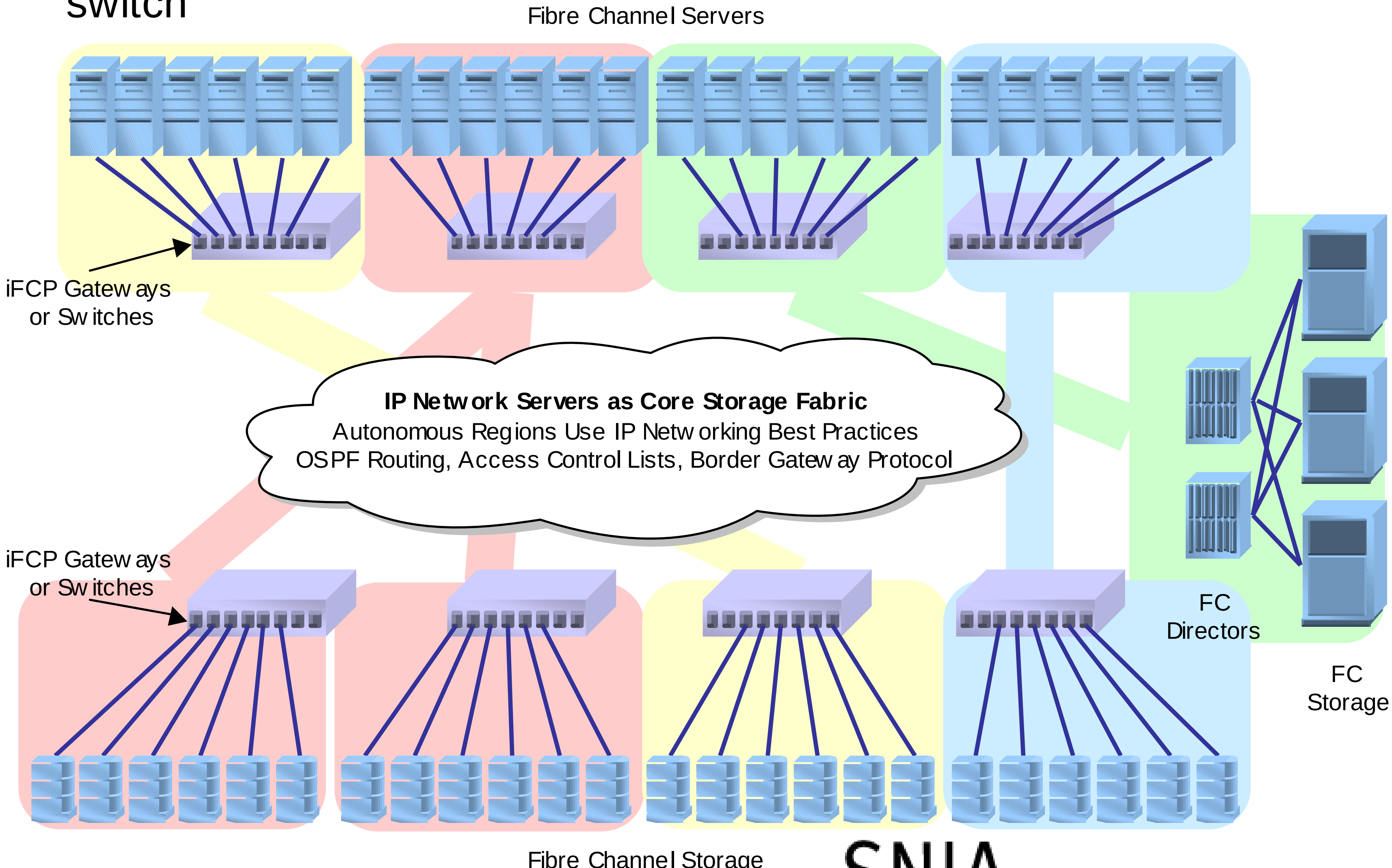
Autonomous Regions for Scalability

- SAN Extension
- Remote mirroring, backup, recovery
- **Data Center SAN**
- Storage consolidation
- Highly scalable storage fabrics
- Global IP SAN
- Integrated SAN/LAN/MAN/WAN
- Autonomous Regions for Service Providers

- iFCP switches or gateways allow for segmentation of highly scalable fabrics into autonomous regions. Each iFCP switch or gateway can maintain an independent name server and principal switch



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Addition of iSCSI Servers

- Migrate server infrastructure to iSCSI end systems
- iSCSI servers connect directly to core Gigabit Ethernet switches
- Existing IP core facilitates easy transition to iSCSI

SAN Extension

Remote mirroring, backup, recovery

Data Center SAN

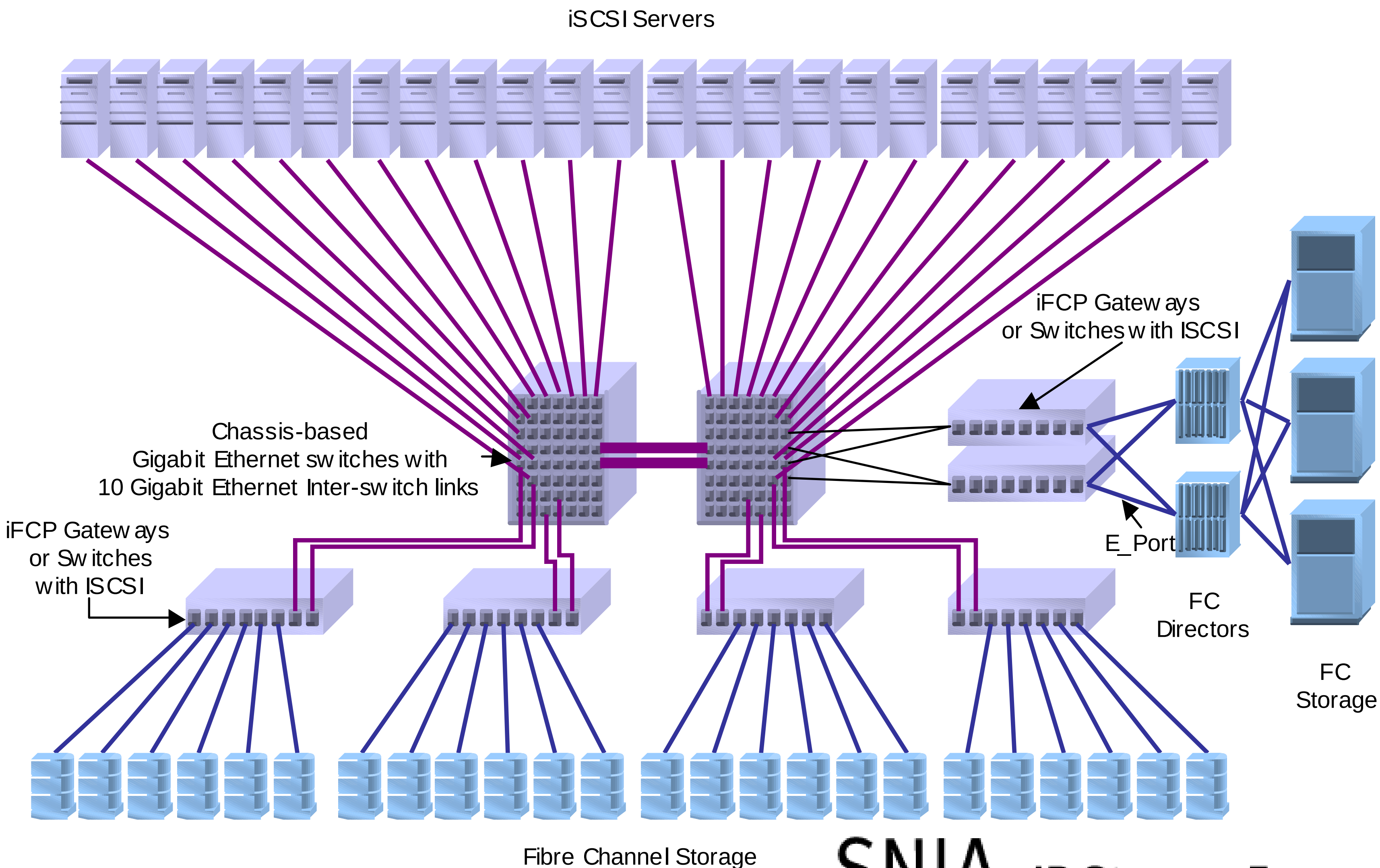
Storage consolidation

Highly scalable storage fabrics

Global IP SAN

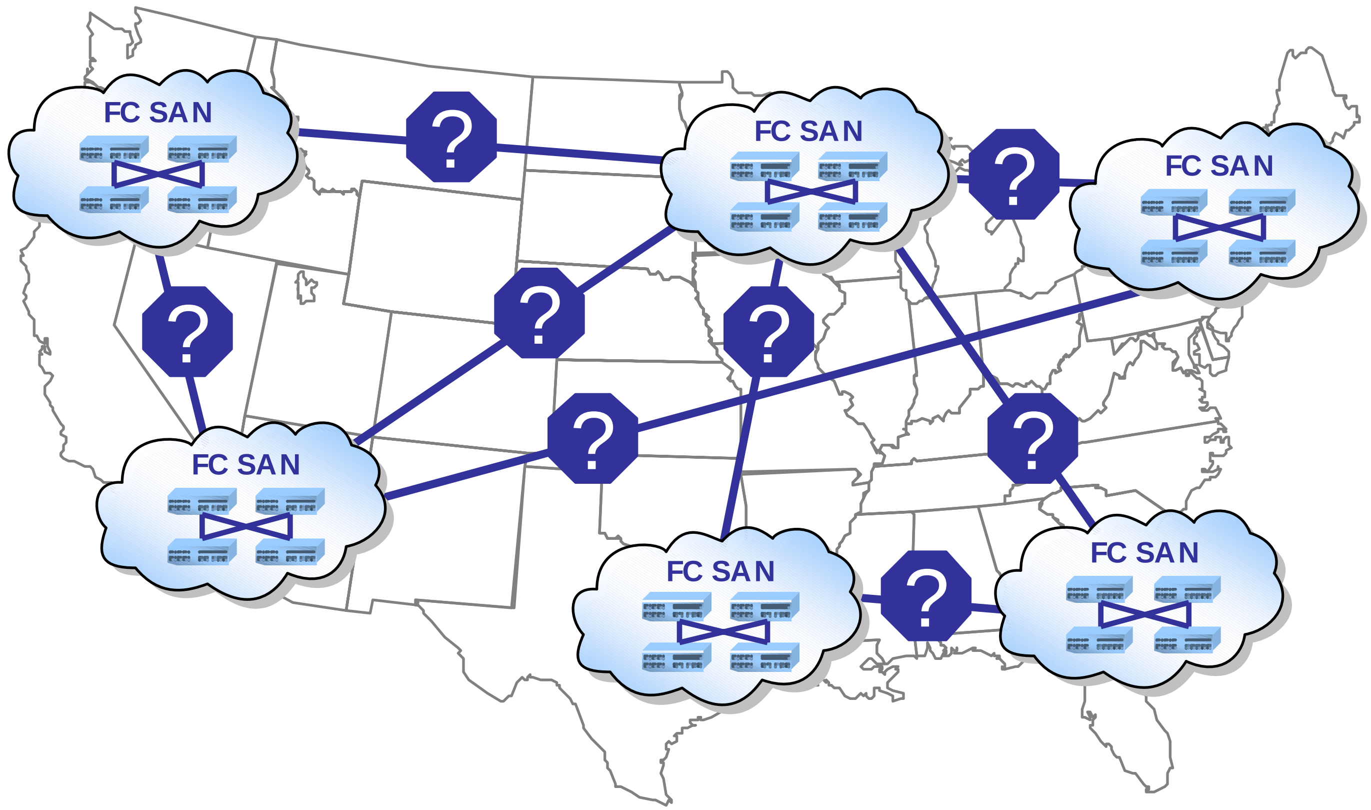
Integrated SAN/LAN/MAN/WAN

Autonomous Regions for Service Providers



Integrated SAN/LAN/MAN/WAN

Situation: Customer wants to scale the SAN infrastructure globally



Issues:

- Linking Fibre Channel SANs directly leads to establishment of one singular unwieldy fabric
- Changes in one SAN (device changes, link states) affect every other site
- Existing DWDM solutions may not economically or technically feasible

Integrated SAN/LAN/MAN/WAN

SAN Extension

Remote mirroring, backup, recovery

Data Center SAN

Storage consolidation

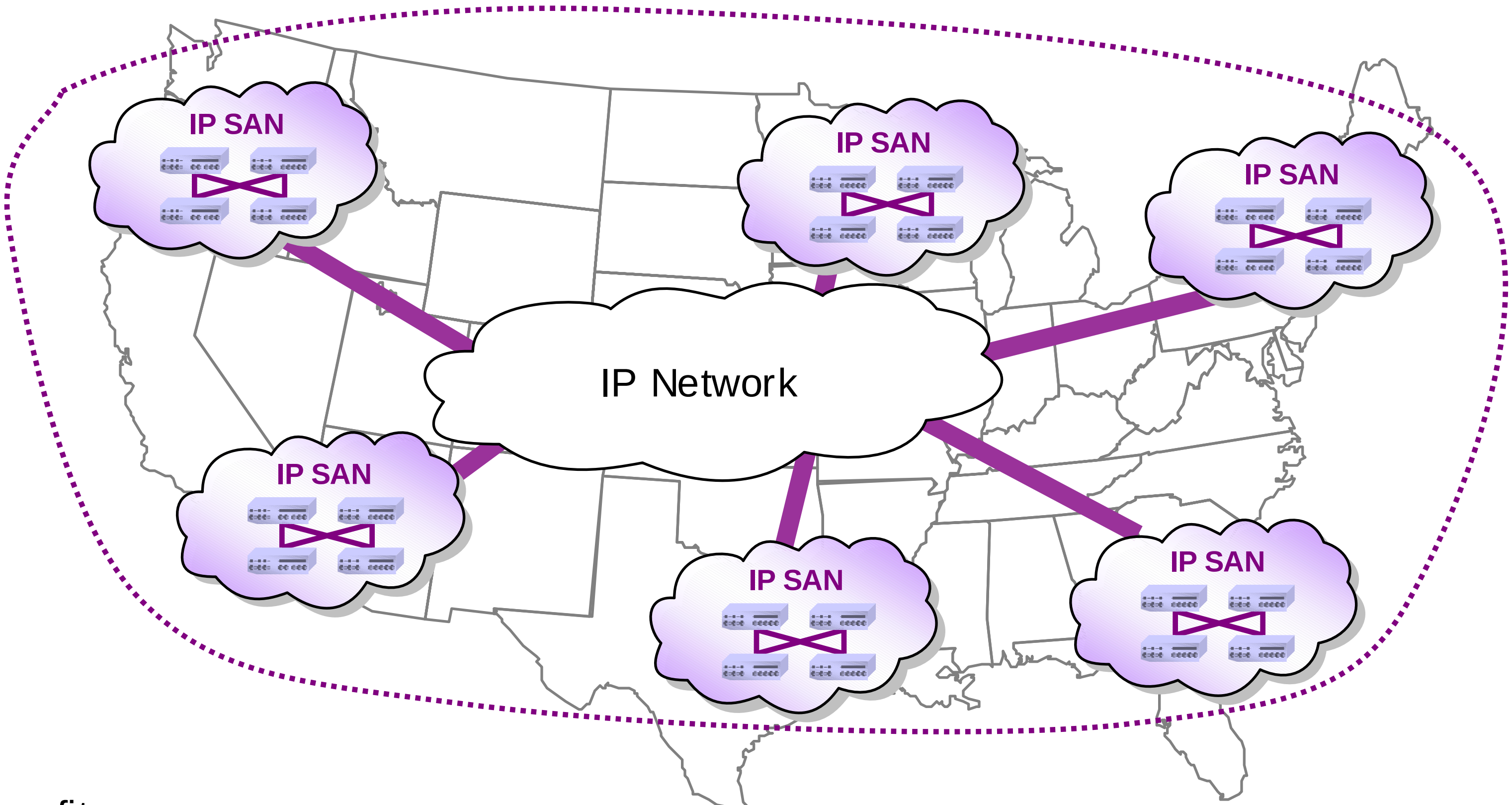
Highly scalable storage fabrics

Global IP SAN

Integrated SAN/LAN/MAN/WAN

Autonomous Regions for Service Providers

Solution: Integrate SANs across topologies with IP and iFCP



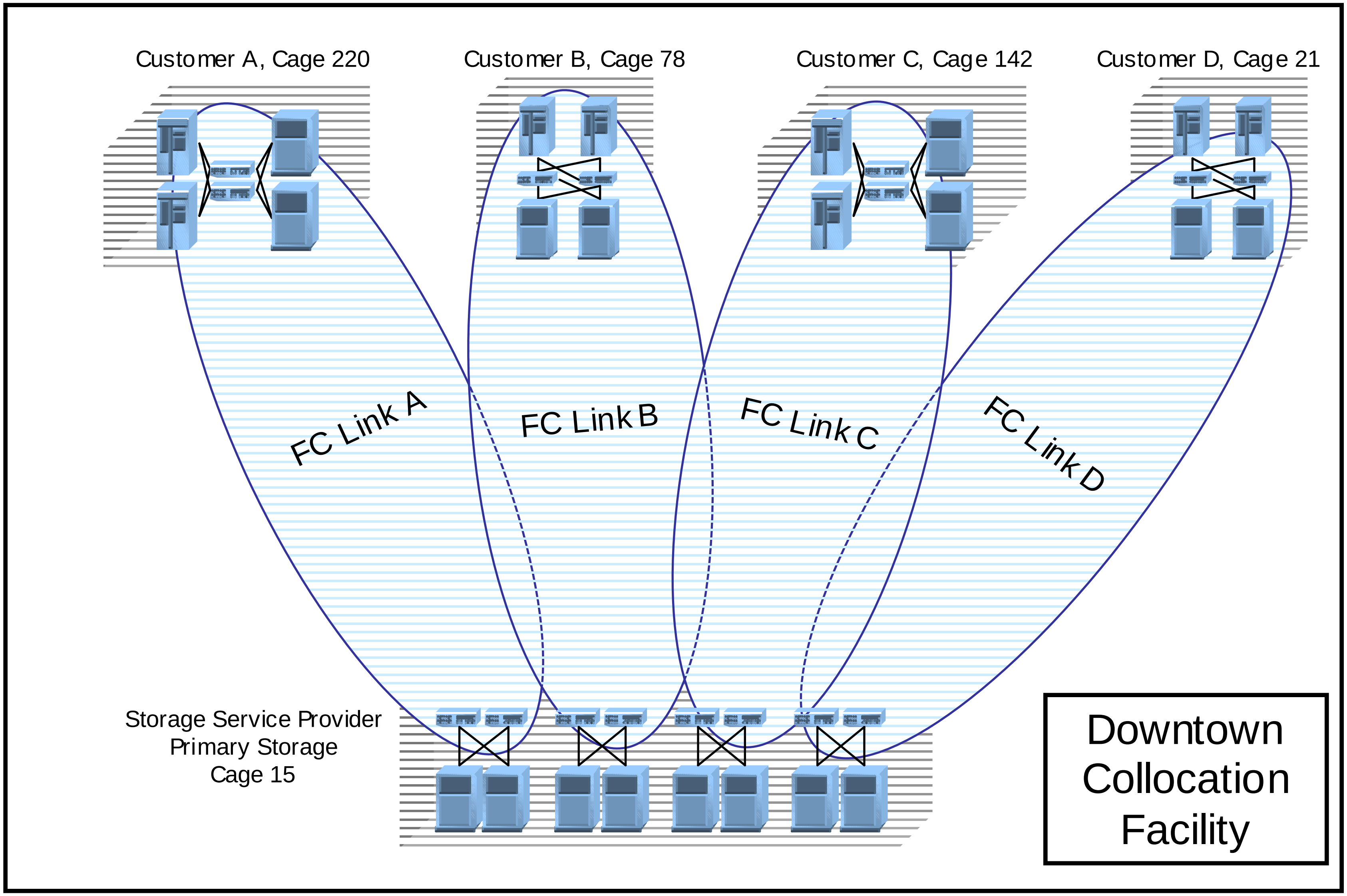
Benefits:

- Enables Internet-class scalability with network services such as QoS and security
- Focus on unified IP technology infrastructure
- Inter-SAN communication managed as independent fabrics, each with their own name server and principal switch
- Unified network management system across SANs, LANs, MANs, and WANs
- Continuous operations protect resources and revenues

Current SSP Configuration

- SAN Extension
  - Remote mirroring, backup, recovery
- Data Center SAN
  - Storage consolidation
  - Highly scalable storage fabrics
- **Global IP SAN**
  - Integrated SAN/LAN/MAN/WAN
  - **Autonomous Regions for Service Providers**

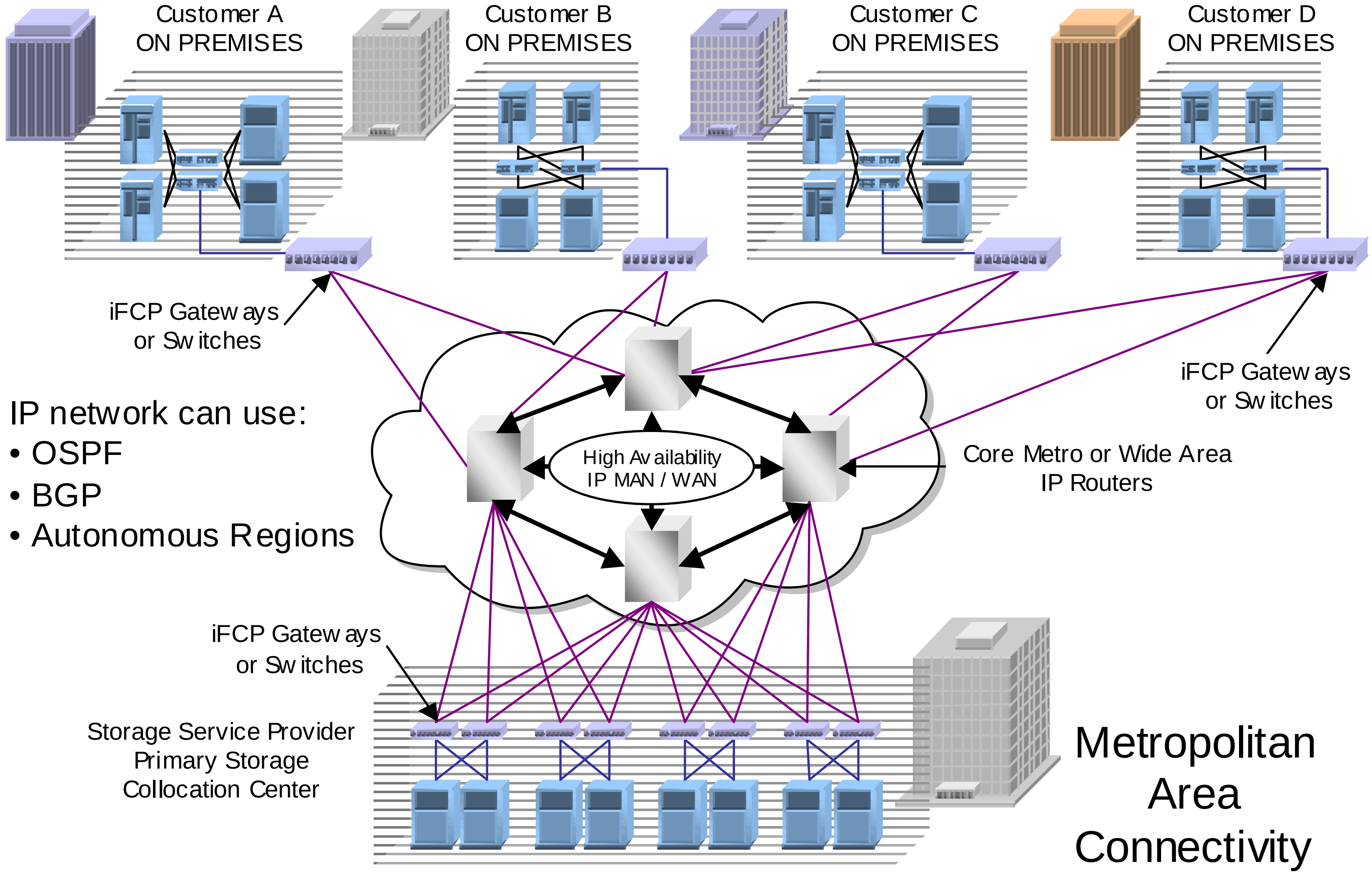
Situation: SSP currently required to maintain separate Fibre Channel fabrics for each customer, and cannot easily make use of IP networks



Autonomous Regions for SSPs

- SAN Extension
  - Remote mirroring, backup, recovery
- Data Center SAN
  - Storage consolidation
  - Highly scalable storage fabrics
- **Global IP SAN**
  - Integrated SAN/LAN/MAN/WAN
  - **Autonomous Regions for Service Providers**

Situation: Use iFCP gateways or switches to interconnect directly to customer site using high availability IP MAN or WAN



IP network can use:
- OSPF
- BGP
- Autonomous Regions

Metropolitan Area Connectivity

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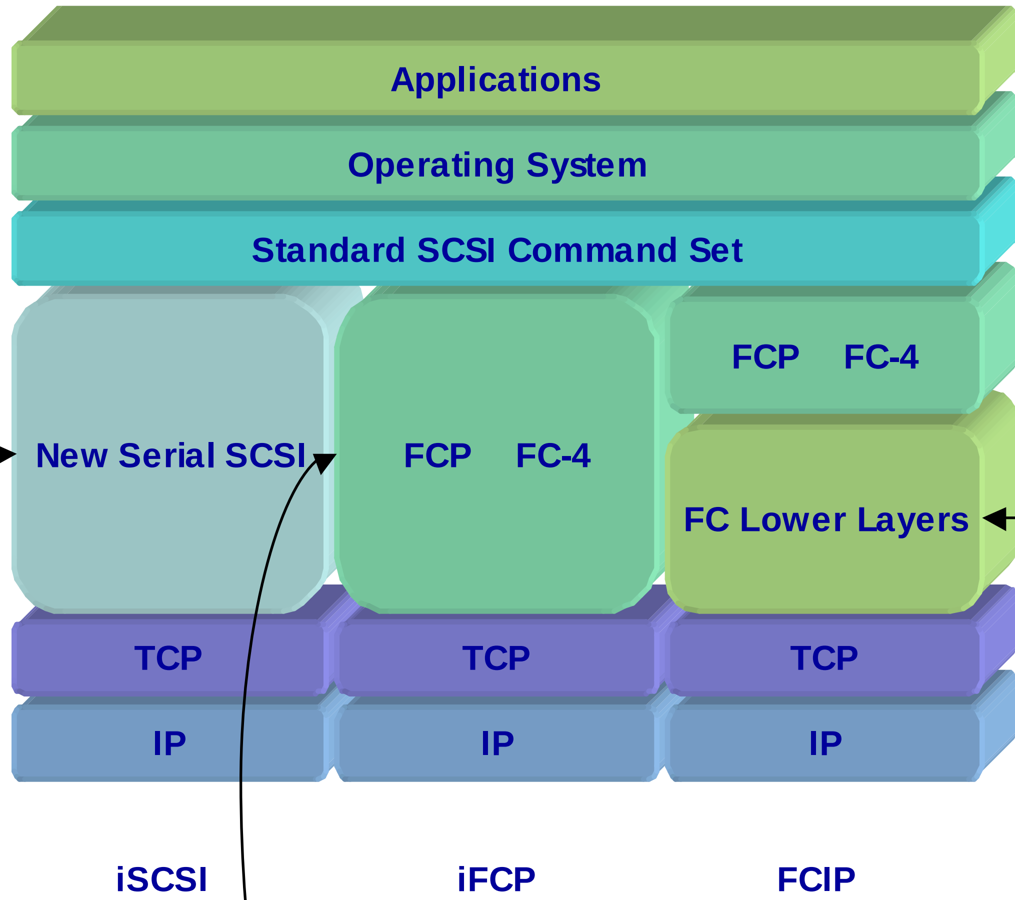
IP Storage Protocols

Looking at iFCP, iSCSI, FCIP

iSCSI, iFCP, and FCIP Protocol Stacks

Understanding New Serial SCSI:

- Focused on new IP end systems with direct mapping of SCSI command set to TCP/IP (i.e. iSCSI)



Understanding FC Lower Layers:

- Based on deployment of Fibre Channel SANs
- Two network management systems, one for IP and one for Fibre Channel
- Potentially costly transition path to native IP Storage networks
- Retains design implications of native Fibre Channel SANs
  - i.e. 239 switches per fabric

Understanding FCP (FC-4):

- Uses existing SCSI Command Set mapping of Fibre Channel Protocol (FCP) to map SCSI command set to TCP/IP (i.e. iFCP)

Key Attributes iFCP, iSCSI, FCIP

Protocol Attributes	iFCP	iSCSI	FCIP
Implementation	Native IP Transport	Native IP Transport	Encapsulation, Tunneling
SCSI encapsulation	FCP	new iSCSI Layer	FCP
Prioritization based on port identification	Yes	Yes	No
Device Integration with iSNS (Internet Storage Name Service, IETF standards track draft)	Yes	Yes	No
End device interface	FC / FCP	IP / iSCSI	FC / FCP
End device routing	RIP, OSPF, BGP other	RIP, OSPF, BGP other	FSPF
Fibre Channel device support	Yes	No	Yes

IP Storage: iSCSI, FCIP, iFCP

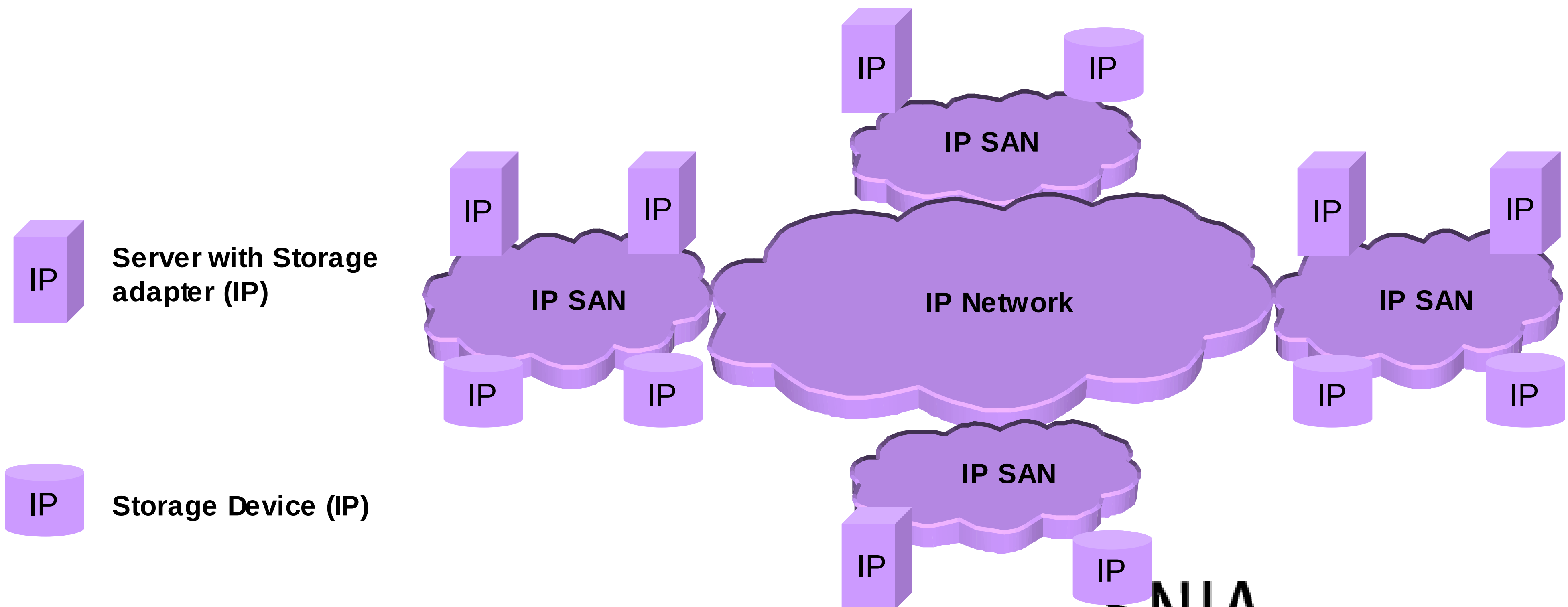
	End Devices	Storage Area Network	Fabric Services*	SAN Interconnect
iSCSI	**iSCSI/IP**	**Internet Protocol**	**Internet Protocol**	**Native Internet Protocol**
iFCP	**Fibre Channel**	**Internet Protocol or FC, if installed**	**Internet Protocol**	**Native Internet Protocol**
FCIP	**Fibre Channel**	**Fibre Channel**	**Fibre Channel**	**FC Tunneling over IP**

* Fabric Services include routing, device discovery, management, authentication, inter-switch communication

IP Storage Technologies: iSCSI

Devices: iSCSI/IP **Fabric Services:** Internet Protocol

- **iSCSI**
  - A transport protocol for SCSI that operates on top of TCP
  - A new mechanism for encapsulating SCSI commands on an IP network
  - A protocol for a new generation of storage end-nodes that natively use TCP/IP



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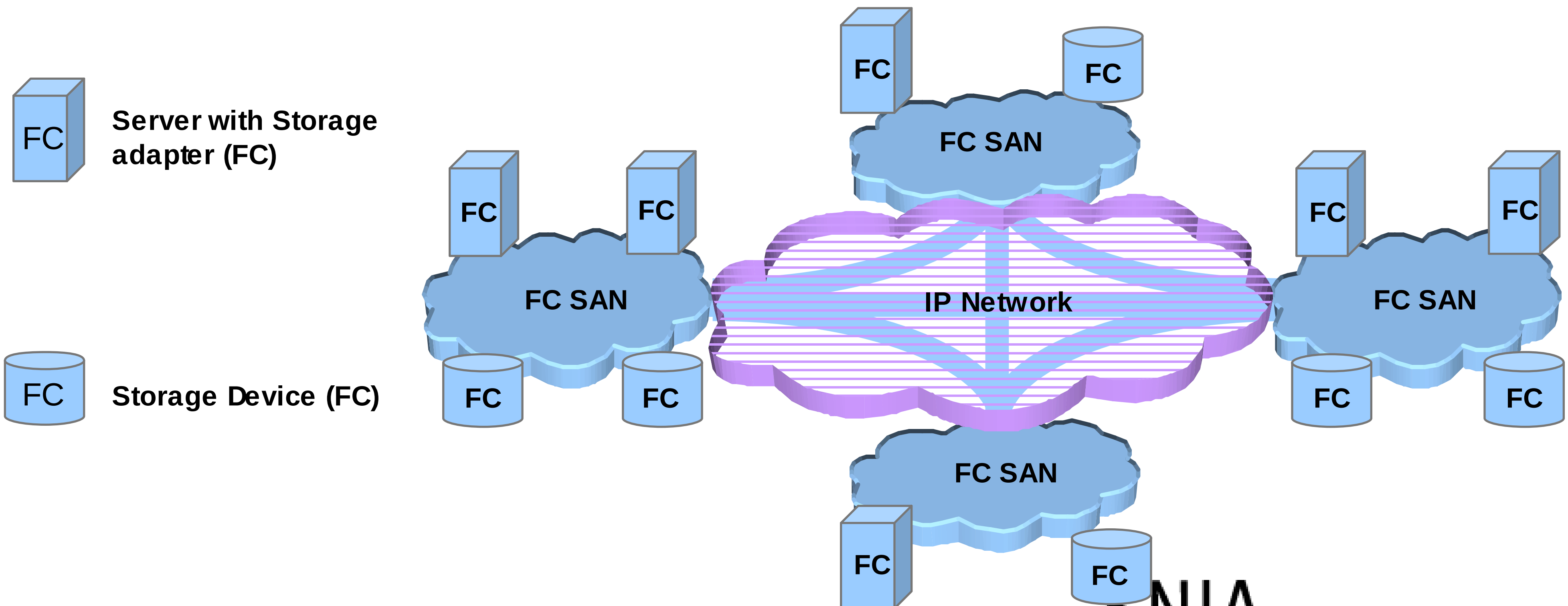
IP Storage Technologies: FCIP

Devices: Fibre Channel **Fabric Services:** Fibre Channel

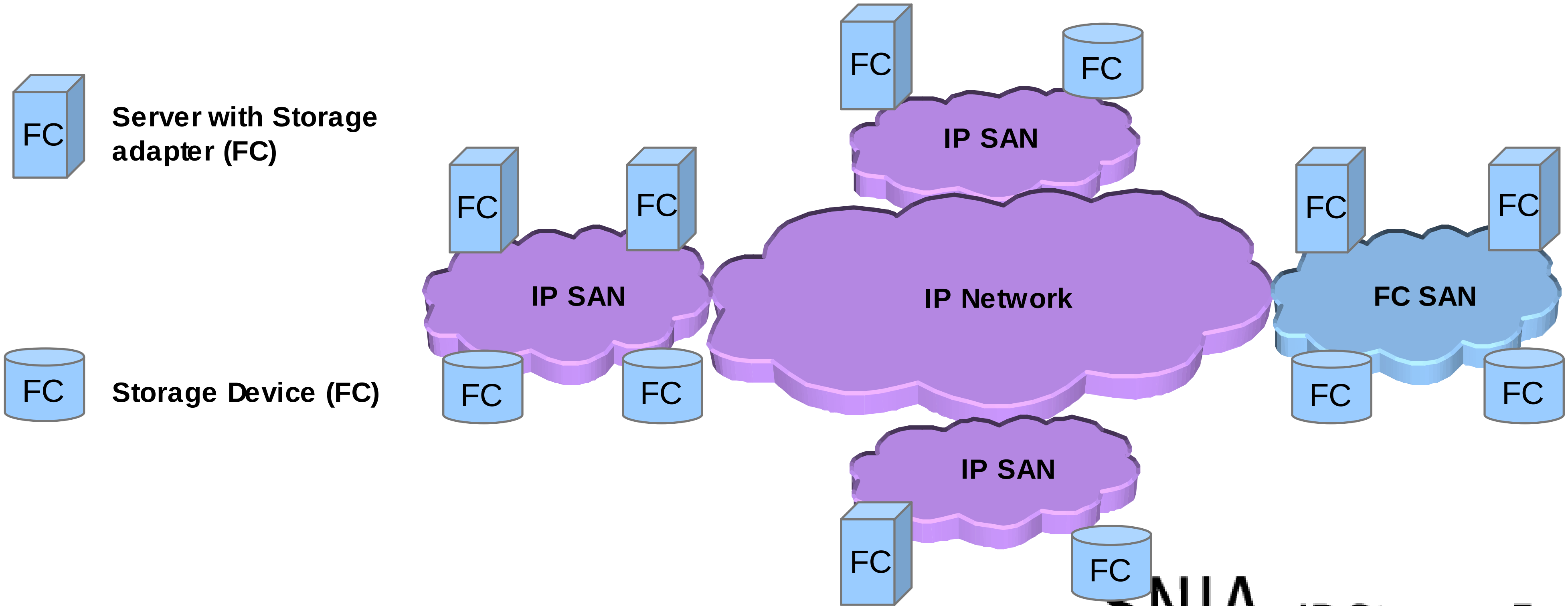
- **FCIP**
  - FCIP is a tunneling protocol for connecting geographically distributed Fibre Channel SANs transparently over LANs, MANs, or WANs
  - Relies upon TCP for congestion control and management and upon both TCP and FC for data error and data loss recovery
  - Uses TCP/IP as the transport while retaining Fibre Channel services intact



IP Storage Technologies: iFCP

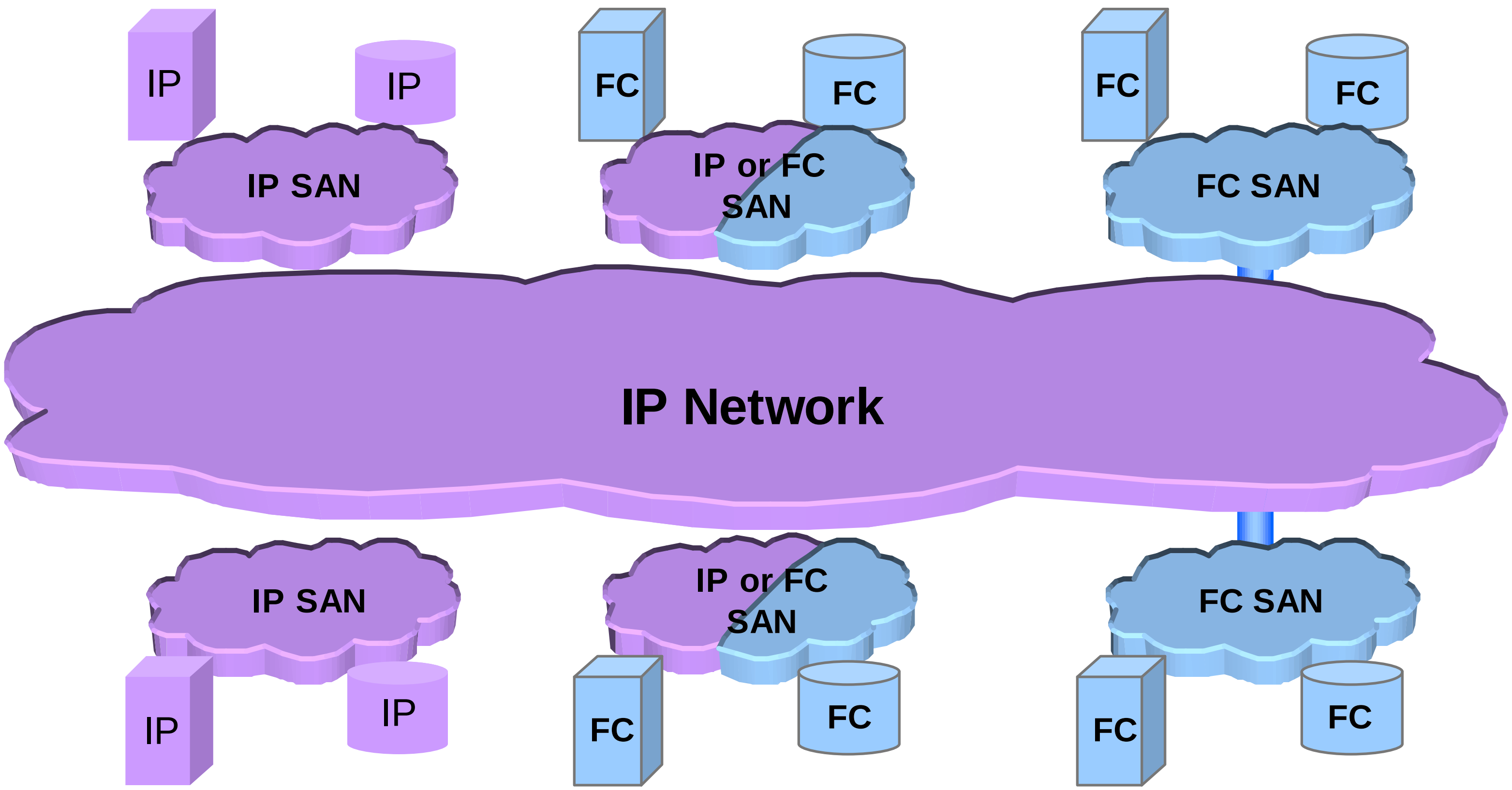
Devices: Fibre Channel **Fabric Services:** Internet Protocol

- **iFCP**
  - A gateway-to-gateway protocol for the implementation of a Fibre Channel fabric in which TCP/IP switching and routing elements supplement or replace Fibre Channel fabric components
  - The protocol enables the attachment of existing Fibre Channel storage devices or Fibre Channel SANs to an IP network

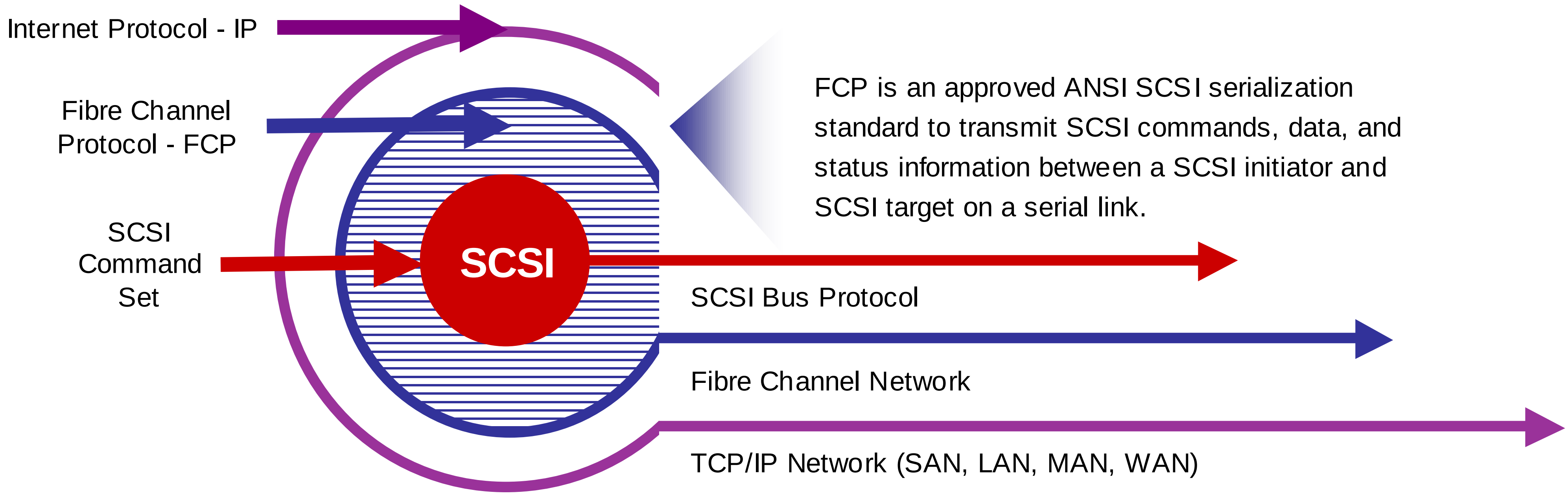


IP Storage Protocols: iSCSI, iFCP and FCIP

	iSCSI	iFCP	FCIP
Devices:	iSCSI/IP	Fibre Channel	Fibre Channel
Fabric Services:	Internet Protocol	Internet Protocol	Fibre Channel

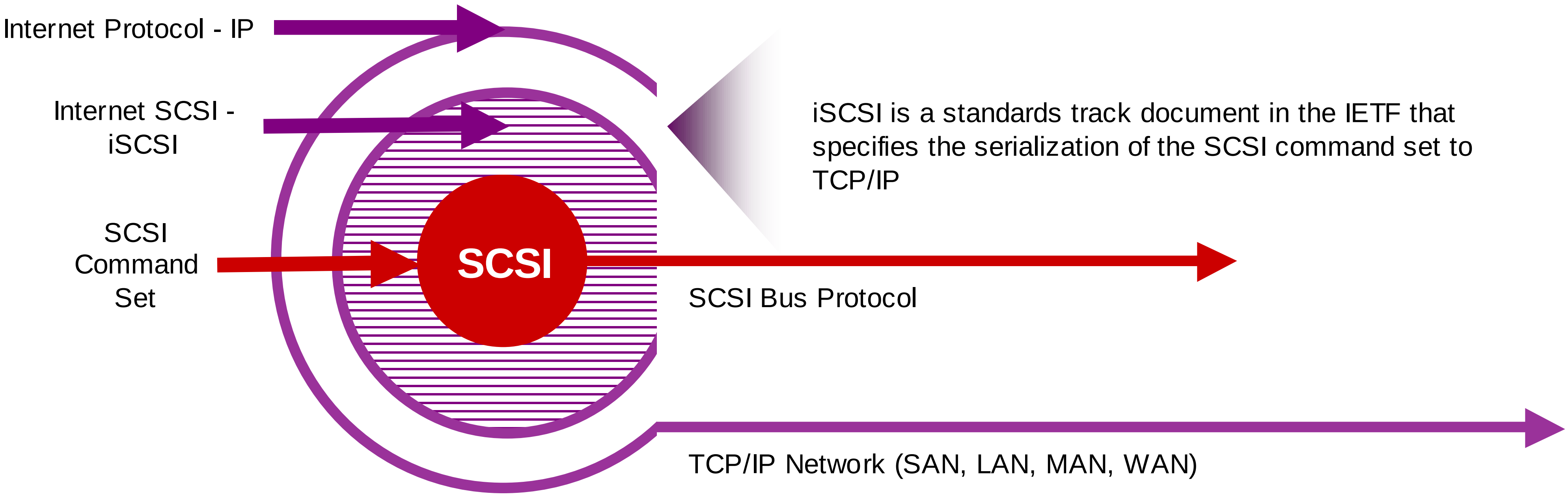


Using iFCP for SCSI Serialization to IP and Ethernet



SCSI	Core command set for hosts and device communication
iFCP Layer	Routable packaging (i.e. SCSI serialization) for network connectivity using FCP
IP Layer	Universal connectivity to global IP infrastructure

Using iSCSI for SCSI Serialization to IP and Ethernet

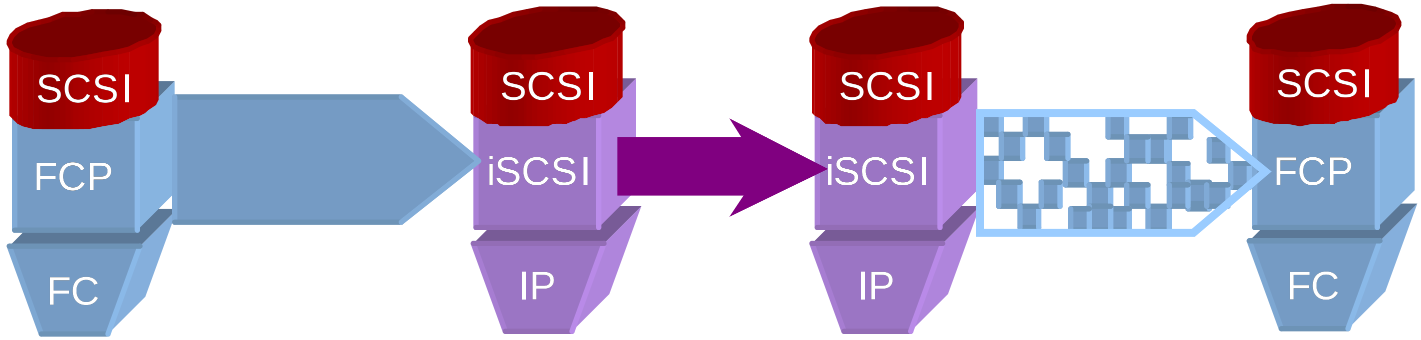


iSCSI is a standards track document in the IETF that specifies the serialization of the SCSI command set to TCP/IP

SCSI	Core command set for hosts and device communication
iSCSI Layer	Routable packaging (i.e. SCSI serialization) for network connectivity
IP Layer	Universal connectivity to global IP infrastructure

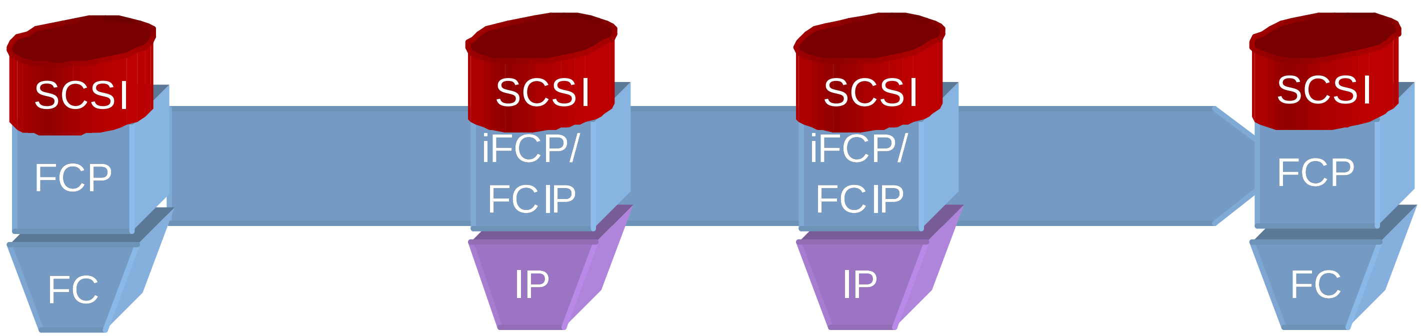
iSCSI and iFCP/FCIP to connect two FC end nodes

iSCSI



- Currently, most FC-2 Control Messages* do not have an iSCSI equivalent, and the original information cannot be reconstructed from iSCSI
- iFCP and FCIP provide full transparency for Control Messages, and may provide more resiliency for Fibre Channel applications heavily reliant on Fibre Channel infrastructure and error recovery mechanisms

iFCP/ FCIP



*e.g. RES (Read Exchange Status Block), RSI (Request Sequence Initiative), TPRLO (Third Party Process Logout), RSS (Read Sequence Status Block)

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Approaches to SAN Extension

Single Fabric and Managed Interconnect Options

IP, Fibre Channel, and SAN Extension

- Fibre Channel Networks are designed for intra-data center environments
  - Not architected with distance in mind
  - Enforce strict reliability and performance requirements
  - Homogeneous FC-2 Transport
- IP Networks designed for global multi-protocol environments
  - Distance and latency do not matter
  - No strong reliability or performance requirements
  - Heterogeneous Transport (Ethernet, PPP, ATM, SONET, etc…)
- FC traffic over IP networks intermixes IP and FC, requiring understanding and management of the following Fibre Channel design assumptions;
  - Single Principal Switch per Fibre Channel fabric
  - "Class F" Inter-switch Signaling Messages
  - Single Name Server per Fibre Channel fabric

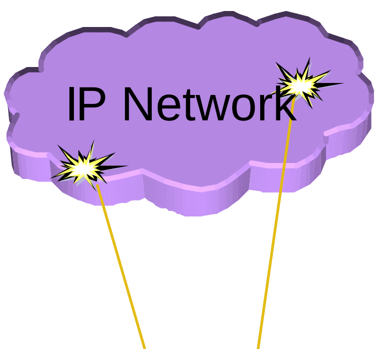
Using IP Networks to Extend SANs

IP Networks

- Global Scale
- Many switching nodes (1000s)
- Heterogeneous link types
- Built-in recovery mechanisms accommodate regular routing adjustments resulting in minor disruptions

FC Networks

- Local Data Center Scale
- Few Switching Nodes
- Homogeneous link types
- Disruptions are rare, but affected links may not automatically recover

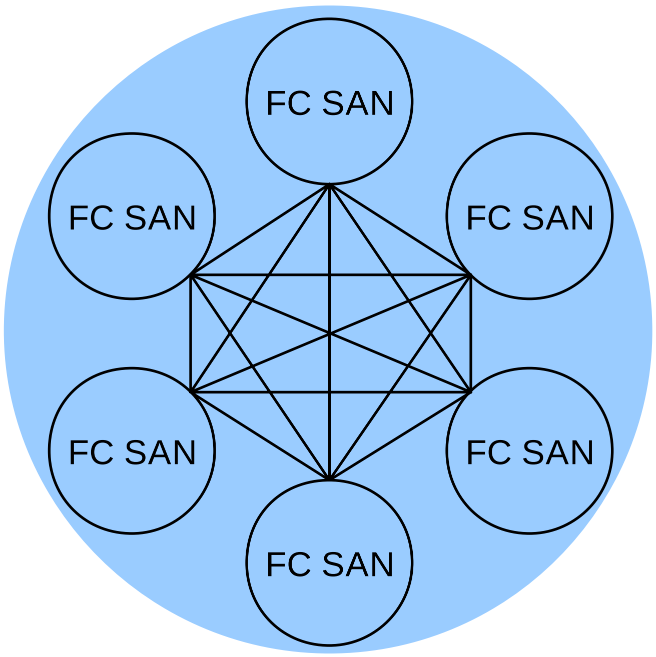


IP Network congestion and routing adjustments

- Automatic recovery from minor disruptions that may occur due to the size and scale of IP networks
- TCP/IP is architected to withstand this network behavior and has robust mechanisms for session integrity

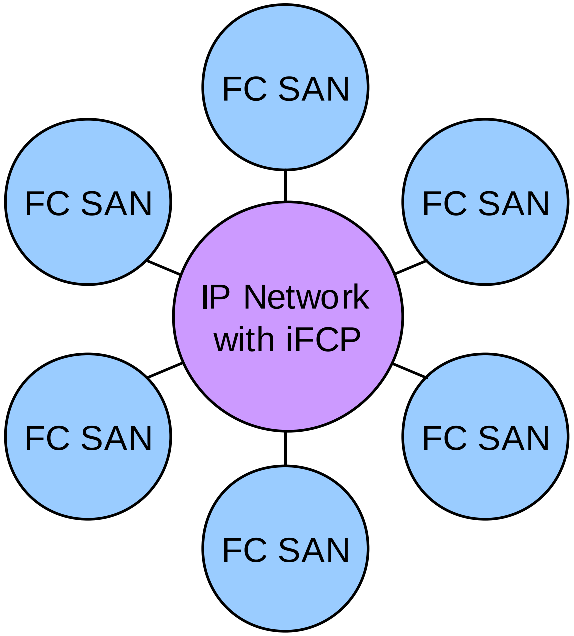
Options for Multi Fabric Configurations

Single Fabric Operation with Fibre Channel



- One Name Server
- One Principal Switch
- Class “F” control traffic between SANs

Managed Inter-fabric Communication with iFCP



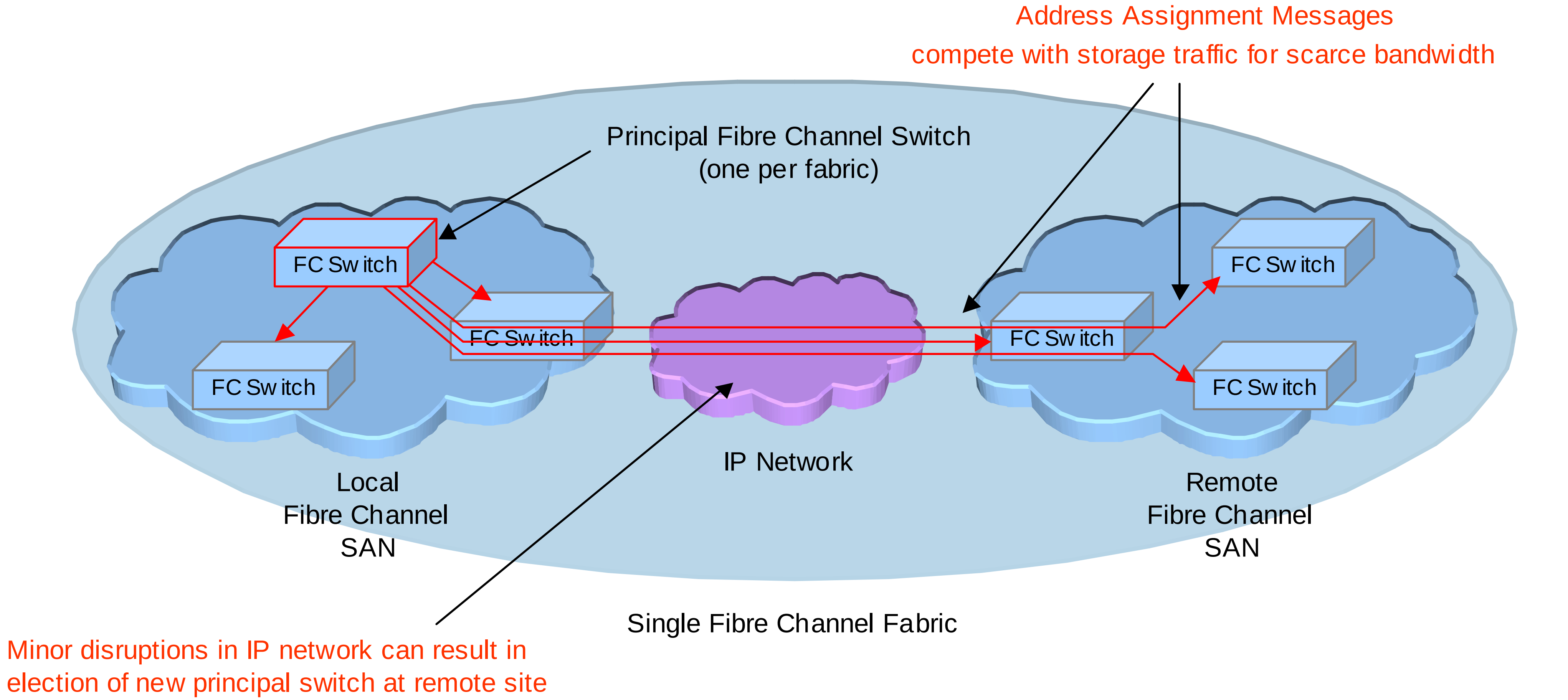
- One Name Server per local SAN
- One Principal Switch per local SAN
- Class “F” control traffic localized at each SAN

Design Intent of SAN Extension

- Fibre Channel over Internet Protocol (FCIP)
  - Simple tunneling of Fibre Channel frames
  - Allows for natural extension of existing Fibre Channel product set
  - Retains existing Fibre Channel assumptions of
    - one name server per fabric
    - one principal switch per fabric
    - class "F" traffic between SANs
- Internet Fibre Channel Protocol (iFCP)
  - Native IP mapping of FC header information to IP addresses for device-to-device TCP/IP sessions
  - Complements Fibre Channel design with flexibility for
    - one name server per local SAN
    - one principal switch per local SAN
    - class "F" traffic localized at each SAN
  - Allows for integration with, or substitution of, Fibre Channel fabric

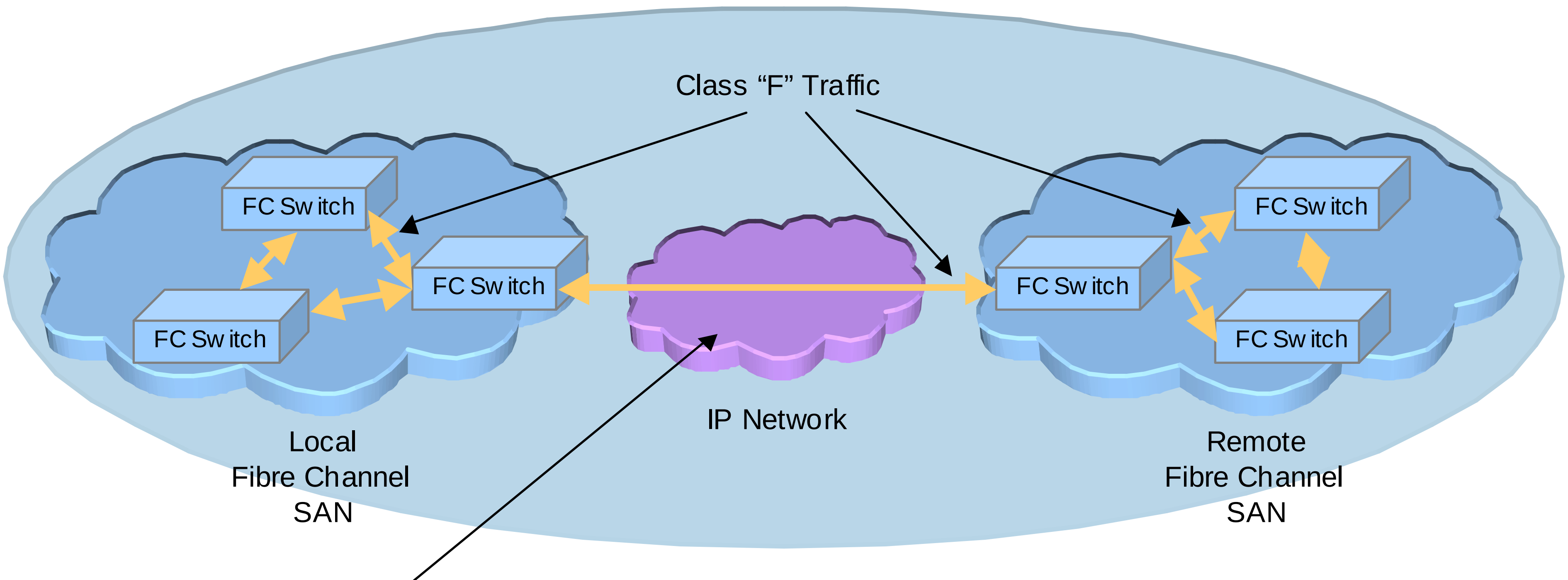
Principal Switch Considerations

- Singe Principal Switch responsible for Address Allocation, including remote FC SANs
- One Principal Switch per FC fabric
- In a multi-site, single FC fabric deployment, the Principal Switch can only be at one site at any moment
- All switches must use valuable WAN links for critical communication with Principal Switch



"Class F" Traffic Considerations

- Class "F" traffic includes special control messages sent between FC switches
- All Class "F" traffic MUST be acknowledged on a hop-by-hop basis
- Non-acknowledgement of "Class F" traffic within a few seconds may result in isolation (shut-down) of the link, splitting the fabric into two
- Even with IP automatic recovery, manual intervention may be required to restore an "isolated" Fibre Channel link across the WAN

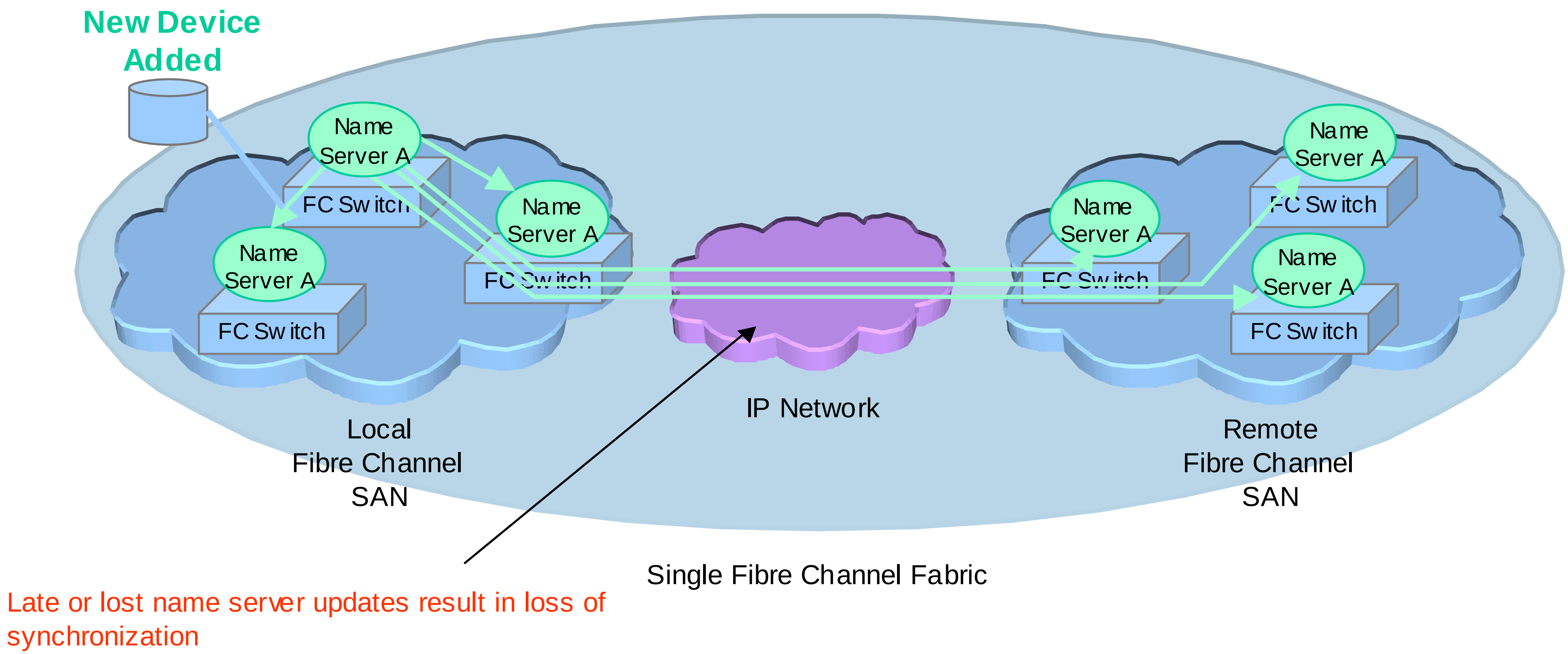


Single Fibre Channel Fabric

Minor disruptions in IP network can result in separation of local and remote SANs to two fabrics

Name Server Scalability Considerations

- Every FC switch has a copy of the same, distributed name server
- Name server updates must be sent to every switch in the fabric
- Name server updates must compete with storage traffic across long distance link
- Delayed or dropped updates result in lost name server synchronization and potentially unstable fabric
- Maximum of about eight name servers per fabric
    - No additional sites can be connected to SAN once limit is reached



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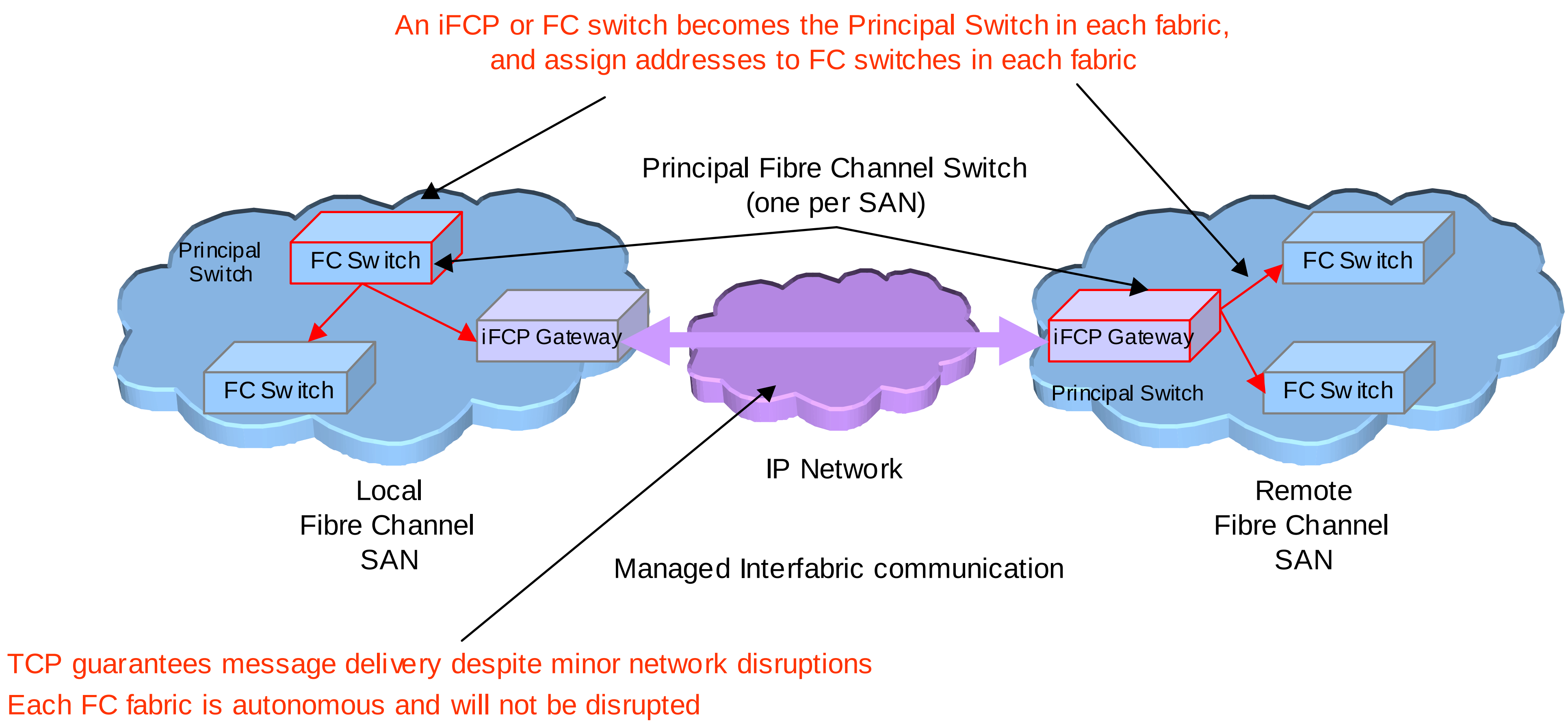
Using iFCP to Address Considerations

- Switches and Gateways Using iFCP Localize Fibre Channel SANs
  - One Principal Switch per local SAN
  - Class “F” Traffic does not propagate across SAN Interconnect
  - One Distributed Name Server per local SAN
  - Automatic recovery from temporary network outages do not impact local FC SAN stability

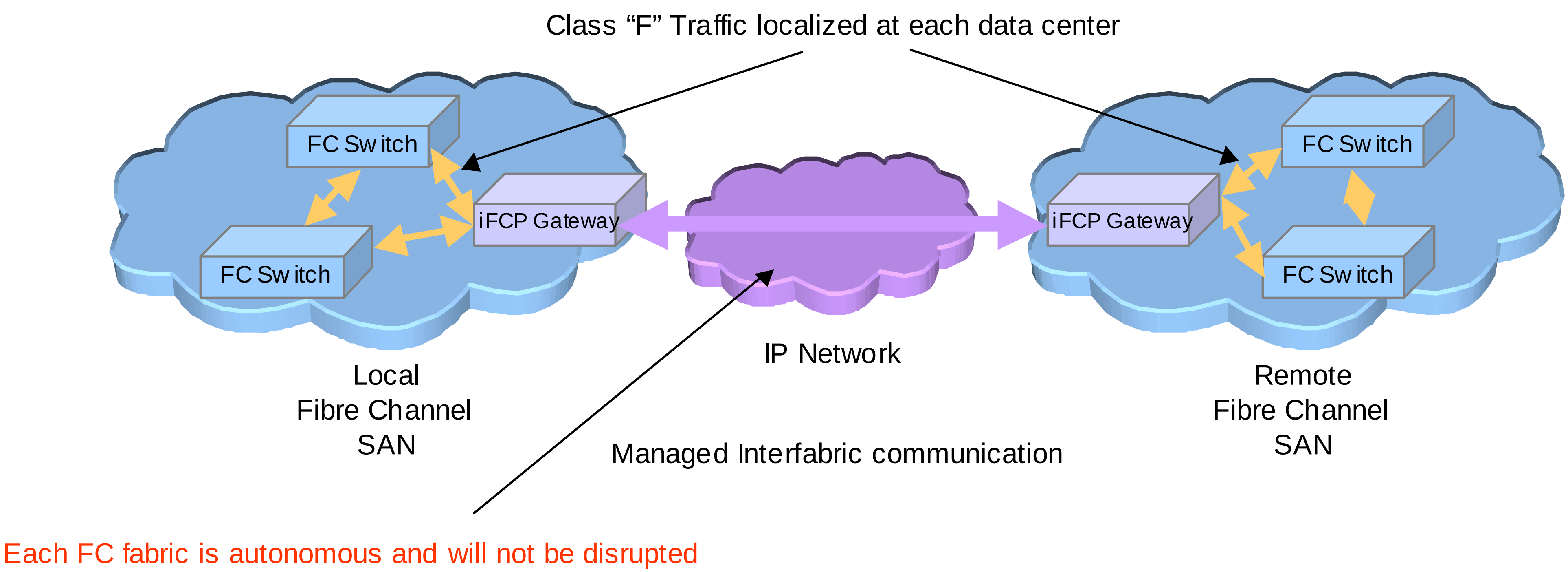
Principal Switch Resolution with Autonomous Fabrics

- One Fibre Channel fabric at each SAN
- One Principal Switch in each SAN, either the iFCP Gateway or an FC Switch
- iFCP gateways or switches and FC SAN within each Data Center collectively is autonomous
- Network disruptions have no effect on each Fibre Channel SAN



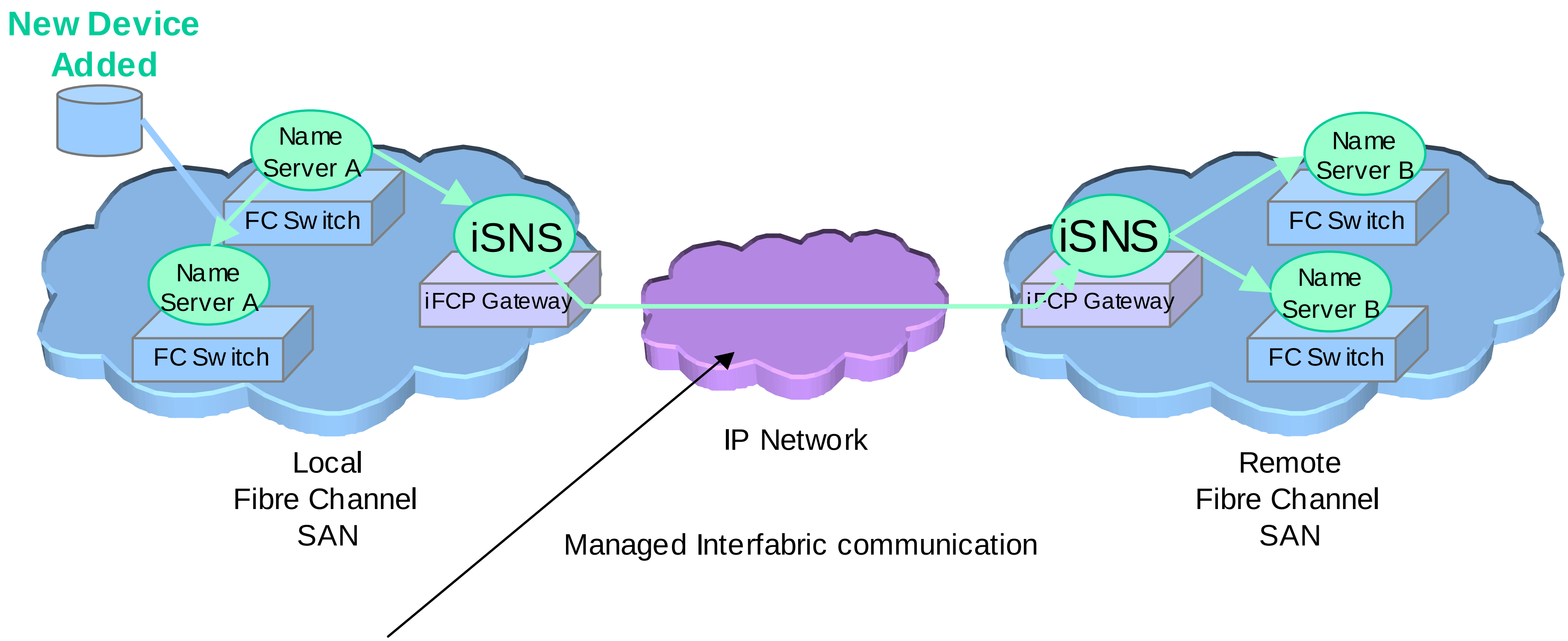
Class "F" Traffic Controlled within Each Data Center

- Class "F" Traffic localized to each local SAN
- iFCP gateways or switches do not propagate Class F traffic across WAN
- Minor IP network disruptions have no effect on each local FC SAN



iSNS Enables Name Server Scalability

- Each iFCP gateway or switch has an iSNS server; iSNS stores all device information in all fabrics, both local and remote
- FC name server updates are sent to the local iFCP gateway or switch
- iFCP gateway or switch propagates name server records to remote switch using TCP transport
- Remote iFCP gateway or switch distributes update to its local SAN
- IP network disruptions do not affect name server update process
- No broadcast of name server updates across WAN link



iSNS records transferred using TCP protocol to remote SAN

Minor network disruptions will not affect name server record propagation

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Design Decisions and Recommendations

Premises and Actions for iFCP Architectures

A Preference for IP

- Premise
  - IP will continue be the preferred networking technology for enterprises and service providers across all applications: voice, video, data, and storage
- iFCP Action
  - Maximize use of IP networking infrastructure
  - Integrate all forms of existing Fibre Channel devices and storage networks (HBAs, subsystems, switches, directors)
  - Minimize NEW investment in FC networking equipment by allowing customers to complement or replace Fibre Channel fabrics with IP networking components
  - Prepare the IP Storage Fabric for entrance of iSCSI devices

Customers Want IP Today

- Premise
  - Customers want to use as much IP networking as possible for their SANs, but may require some time to transition to iSCSI end systems
- iFCP Action
  - Use existing FCP (SCSI serialization) in FC devices, but map natively to IP to incorporate Fibre Channel into IP Storage networks
  - FC to iFCP to FC retains original FCP SCSI encapsulation and handles transparent pass through of FCP information without translation
  - Maximize IP content by reducing or replacing FC fabrics

Emergence of iSCSI End Systems

- Premise
  - iSCSI end systems (adapters, disk, tape) will likely emerge as the preferred block-level, IP Storage devices
- iFCP Action
  - Focus on utilizing IP network and associated IP intelligence immediately, even with Fibre Channel end devices or SANs
  - Use similar device discovery methods for Fibre Channel devices using iFCP as for iSCSI devices – such as iSNS

Fibre Channel Strength

- Premise
  - Fibre Channel will remain a part of SANs for the foreseeable future, with the existing base and continued sales of host bus adapters and storage subsystems
- iFCP Action
  - Integrate all forms of existing Fibre Channel infrastructure including devices and switches (including E_Port)
    - No driver changes required for end systems
    - No equipment changes required for end systems
    - Works with existing applications
    - Ability to integrate and zone with new iSCSI devices using common device models such as iSNS

IP Routing As Much As Possible

- Premise
  - In preparing for iSCSI deployment, utilize familiar pure IP routing methods for existing Fibre Channel devices
- iFCP Action
  - Natively map FCP header information to IP addresses for FC device level TCP/IP session capabilities
  - Integrate Fibre Channel natively to IP and remove the requirement for Fibre Channel routing across IP networks
    - Use OSPF for routing, without requiring FSPF
    - Use iSNS for device discovery. iFCP has the same device model as iSCSI end systems for iSNS integration

Solving Scalability

- Technical Premise
  - A singular fabric (such as the Fibre Channel model) where all switches must register and communicate with every other switch may cause scalability limitations, especially over long distances
- iFCP Action
  - Create connected fabrics (but not a singular fabric) that avoids single fabric scalability issues with Class F traffic, single name servers, and single principal switches

Use TCP/IP for Remote Interswitch Links

- Technical Premise
  - E_Port was designed for the data center. Stretching E_Ports across long distance may invalidate design assumptions
- iFCP Action
  - Terminate E_Port sessions at local SANs and use native TCP/IP connections to link SANs. Create autonomous regions where each SAN can communicate with other SANs, but does not rely on E_Port connectivity assumptions

Overcoming Switch Hops

- Technical Premise
  - Extensive Fibre Channel switch hops may be limited by vendor implementations in Fibre Channel
- iFCP Action
  - Terminate E_Port connectivity and/or FC device communication at each local SAN
  - Initiate TCP/IP iFCP sessions for remote connectivity
  - Reenter the remote SANs with E_Port or Fibre Channel device communication as required
  - Create Autonomous Regions within the IP SAN fabric for maximum scalability

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End of Presentation