Interworking in Multi-Protocol based network Environments

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Outline

1. Network Evolution and Situation
2. Interworking Requirements
3. Service and Network Interworking
4. Interworking with MPLS
5. Conclusions

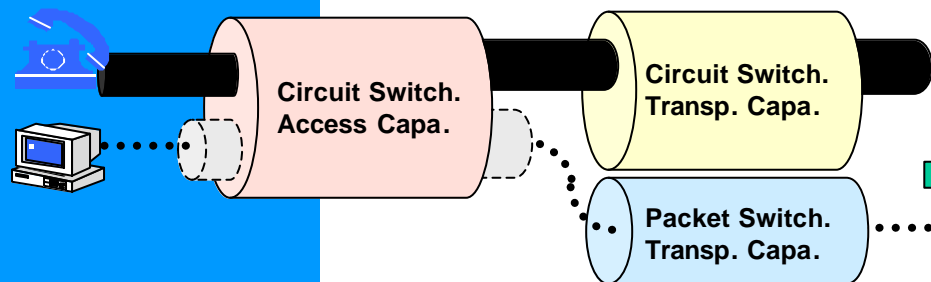# 1. Network Evolution Trends

Network Evolution Trends

- **Optical Infrastructure**
  - **Capacity imperative**

- **Packet Based Transport & Switching**
  - **Multi-service flexibility**

- **Location of Intelligence (Core vs Edge)**
  - **QoS and Bandwidth Granularity/Control**

- **Convergence of Control & Management Aspects**
  - **E.g., Dynamic routing vs protection switching**

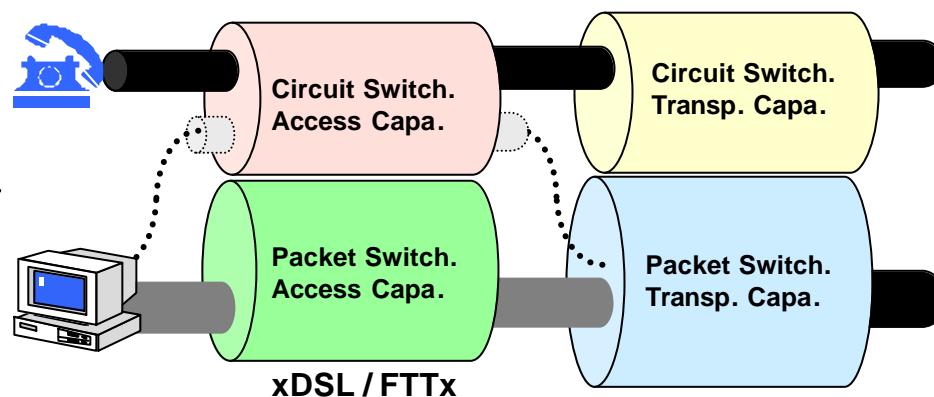- **Interworking with Legacy Systems**

1. Network Evolution Trends
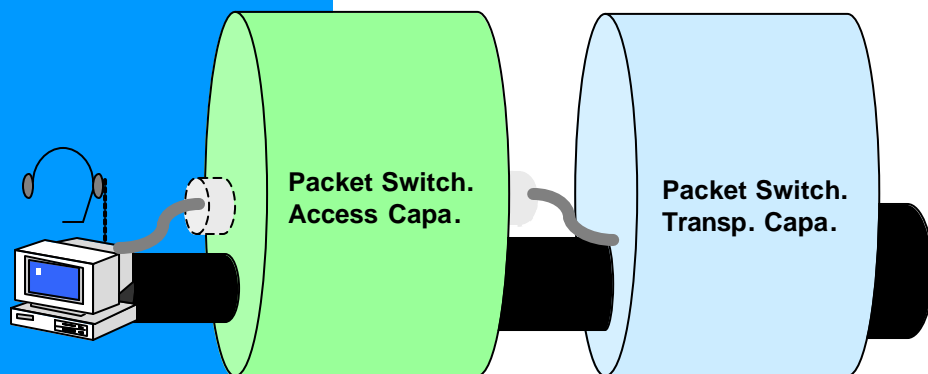
Expected Future Transition Trend
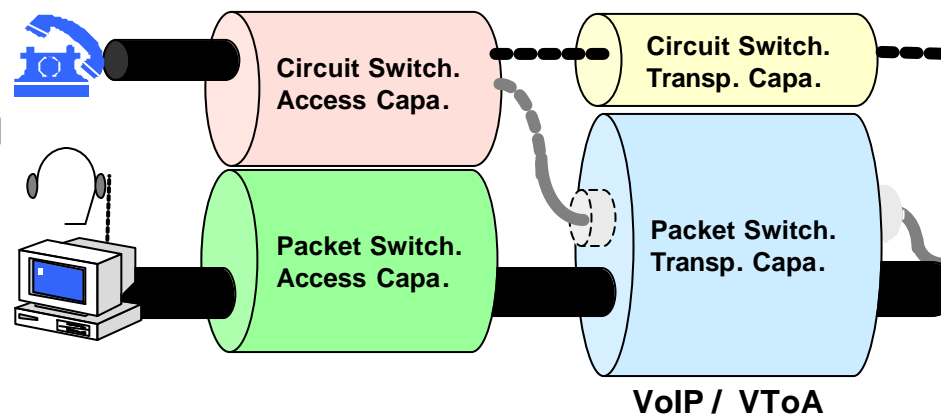
Past : Seper. of Voice & Data Transp.

Circuit Switch. Access Capa.

Circuit Switch. Transp. Capa.

Packet Switch. Transp. Capa.

Present : Sep. of V & D Access

Circuit Switch. Access Capa.

Circuit Switch. Transp. Capa.

Packet Switch. Access Capa.

Packet Switch. Transp. Capa.

xDSL / FTTx

Future : Integration of V & D Access and Transp.

Packet Switch. Access Capa.

Packet Switch. Transp. Capa.

Near Future : Integration of V & D Transport

Circuit Switch. Access Capa.

Circuit Switch. Transp. Capa.

Packet Switch. Access Capa.

Packet Switch. Transp. Capa.

VoIP / VToA

25.11.2002

4

1. Network Evolution Trends

Diversity of Technologies

Network Management

Management Platform
- CMIP
- SNMP
- JAVA
- CORBA
- DCOM

Policing Adaptation

Switching & Routing
- IP
- MPLS
- ATM

Routing

Backbone Switching Network

Addressing
- IPv4, v6
- E.164
- NSAP

Accessing
- ISDN
- ADSL
- Cable Modem
- FLC
- FTTH

Multiplexing
- IP
- ATM
- F/R
- SDH/PDH
- WDM

Access Network

Switching

Access Switching Network

Transmission
- ATM
- SDH
- WDM

Backbone Transmission Network

Policing Adaptation

1. Network Evolution Trends

Separation of Services from Network

Single point
Or
Distributed
Application

Application Server ◄········► Application Server

Users ◄►

Switched Access Network(s)

Switched Core Packet Network(s)

Switched Access Network(s)

Users ◄►

Transport Protocol Interworking

Transport Protocol Interworking
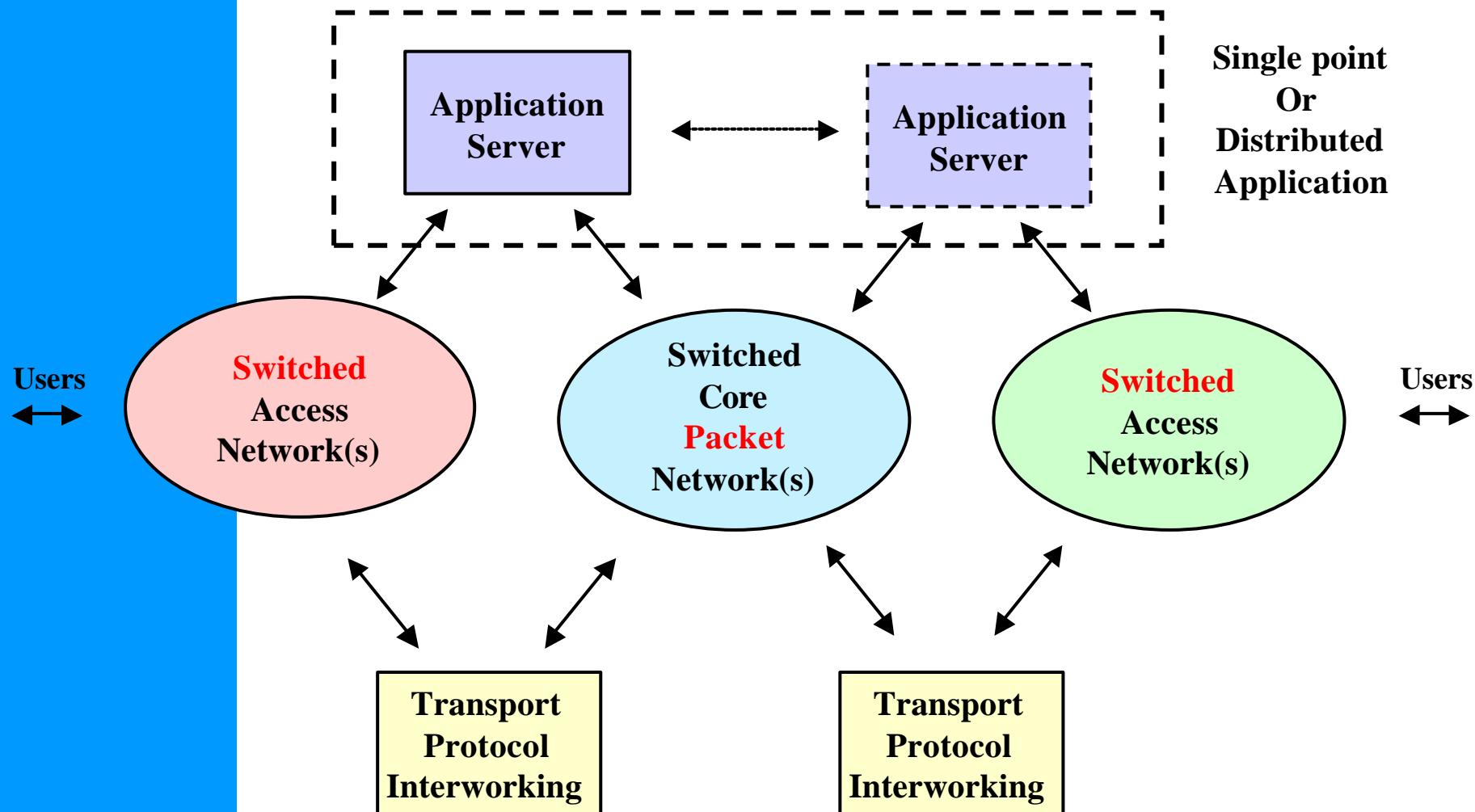
Protocol Layering considerations

Service Mapping
&
Protocol Translation

Protocol X

Protocol Z

Service Mapping
&
Adaptation

Peering Relationship

Layering Relationship
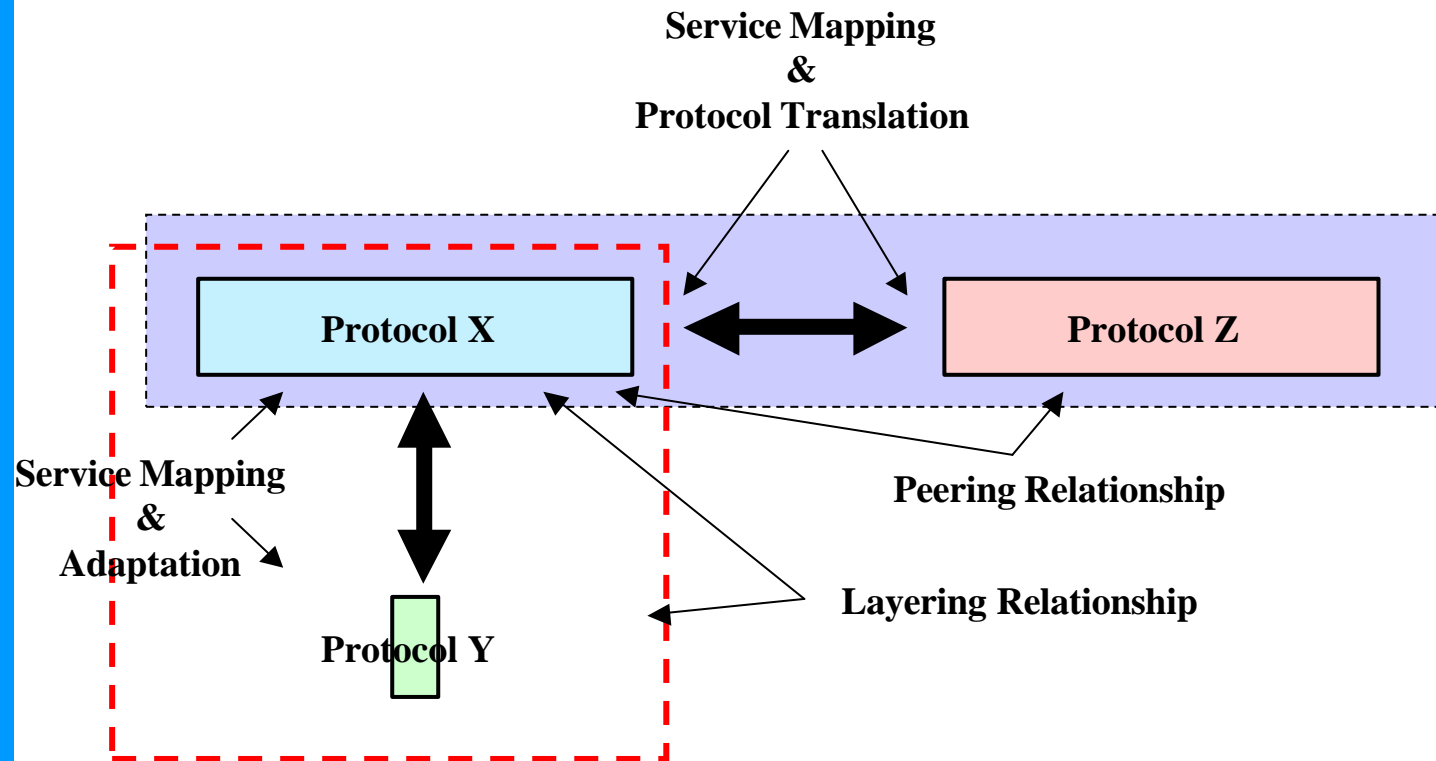
Protocol Y

No particular prescribed protocol hierarchy:
Any X over any Y

2. Interworking Requirements

Interworking need when the protocol stacks in Network 1 (N1) are different from those in Network 2 (N2) thus where one, or more protocol discontinuity will occur in an interworking path created to span both N1 and N2.
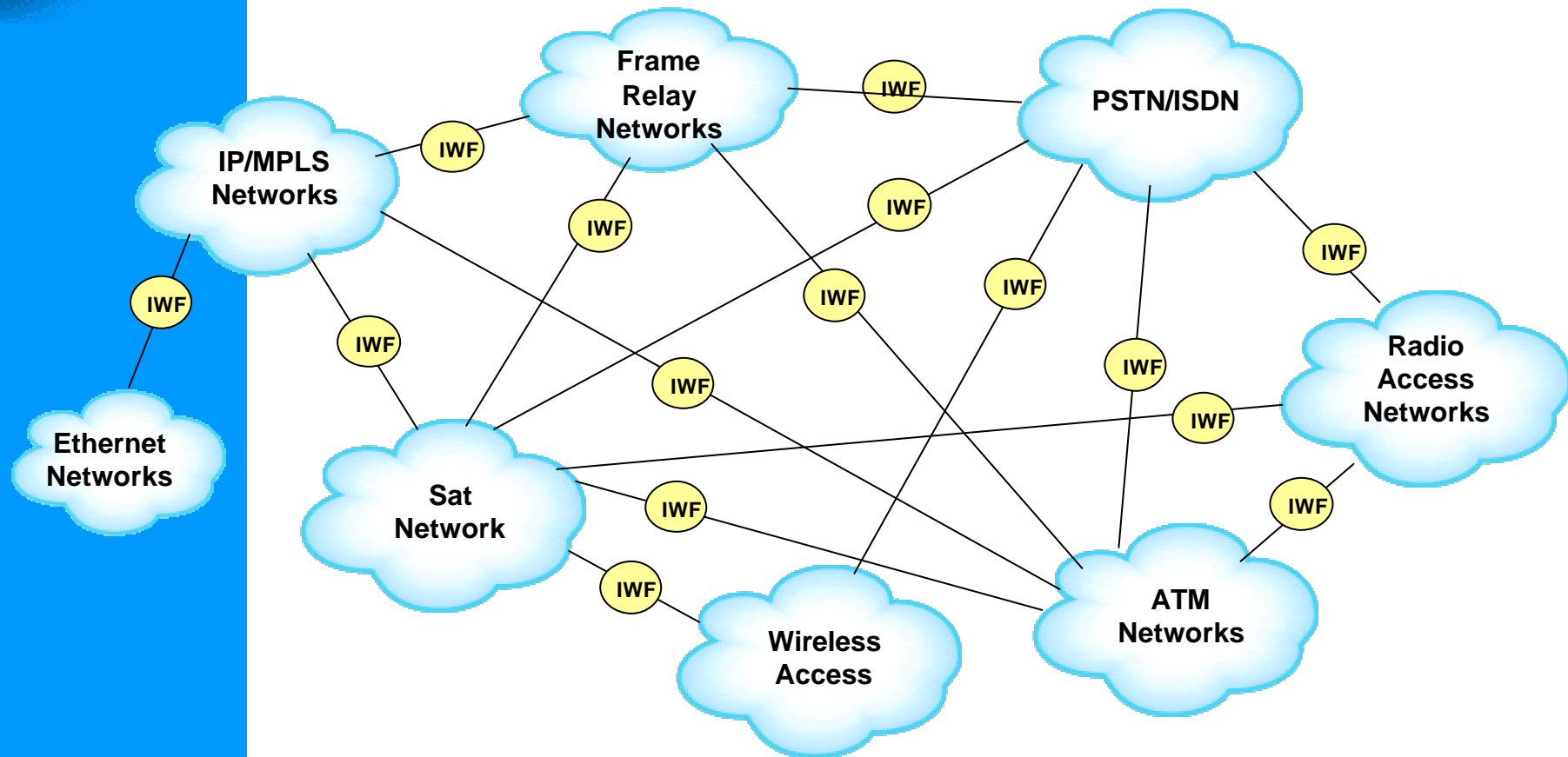
Mapping of Service characteristics ➔ Network 1 ⟷ Network 2
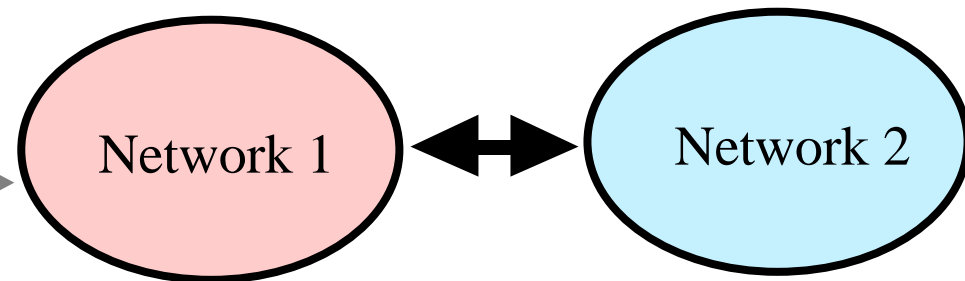
Interworking by Superimposition ➔ Network 1 | Network 2
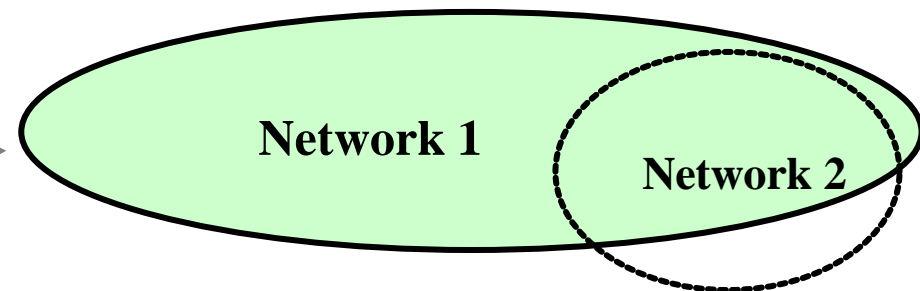
2. Interworking Requirements
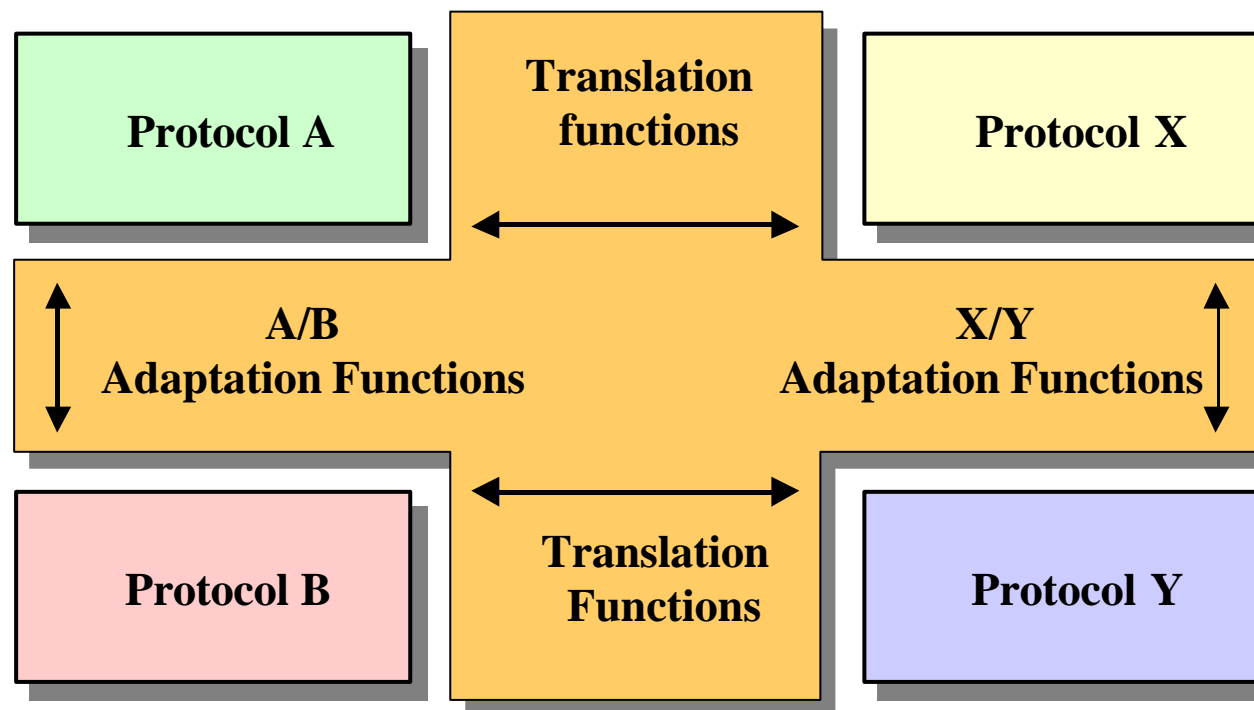
Today's Network Situation

- Multiple, interworked, interdependent networks
- Diversity of control and management architectures
- Capacity and performance bottlenecks
- Each network has its own control plane and management plane

2. Interworking Requirements

Generic Interworking Model

Protocol A	Translation functions	Protocol X

A/B Adaptation Functions   X/Y Adaptation Functions

| Protocol B	Translation Functions	Protocol Y

Translation Function :This applies horizontal aspects between functional entities, enabling peering relationship between entities to provide requested services.
Adaptation Function : This applies vertical aspects inside a functional entity, enabling layering relationship between adjacent layers to transport service requirement of each layers.

2. Interworking Requirements

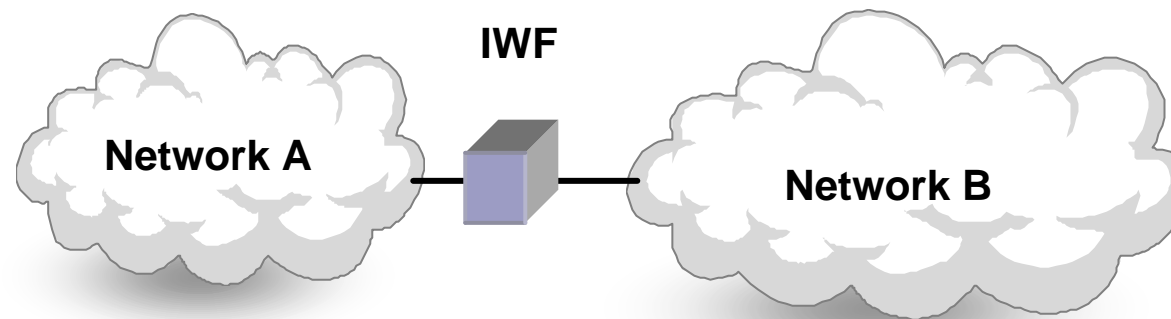**Interworking Function**
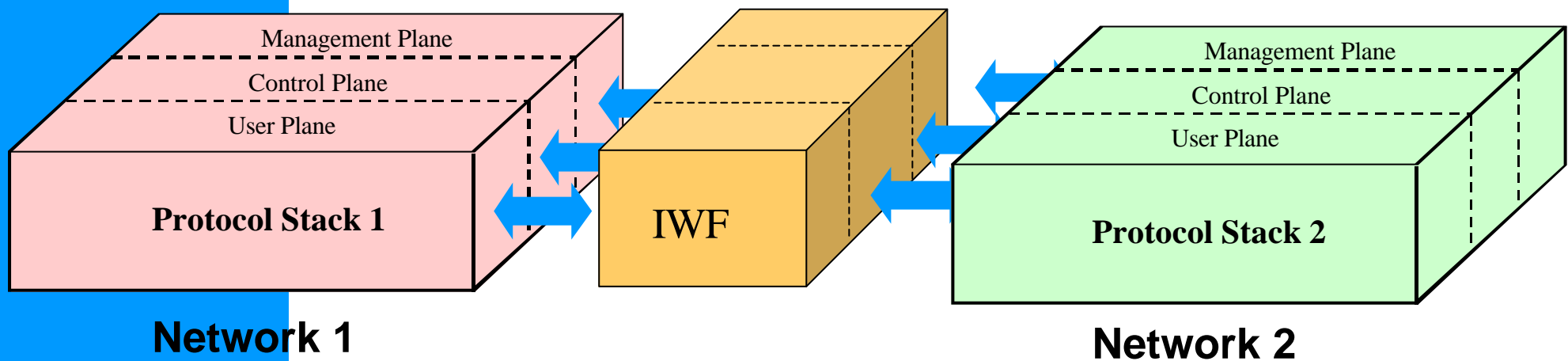
Network 1

Network 2

IWF : provide the functions (translation and/or adaptation) for interworking between N1 and N2, for either service interworking or network interworking, considered to notionally exist between the Network 1 and Network 2

3. Service and Network Interworking

General Service Interworking

- In Service Interworking, the IWF between two dissimilar protocols (e.g., ATM & MPLS) terminates the protocol used in one network and translates (i.e. maps) its Protocol Control Information (PCI) to the PCI of the protocol used in other network for User, Control and Management Plane functions to the extent possible.

IWF

Network A   **Network B**

IWF=Interworking Function

- Networks A and B are **NOT** similar networks, e.g. one may be ATM and the other Frame Relay or MPLS

3. Service and Network Interworking

Service Interworking Model

Protocol A	Interworking Translation functions ← →	Protocol X
	A not equal X	

A/B Adaptation Functions   **X/Y Adaptation Functions**

B equal Y, or B not equal Y

Protocol B	Interworking Translation Functions ← →	Protocol Y
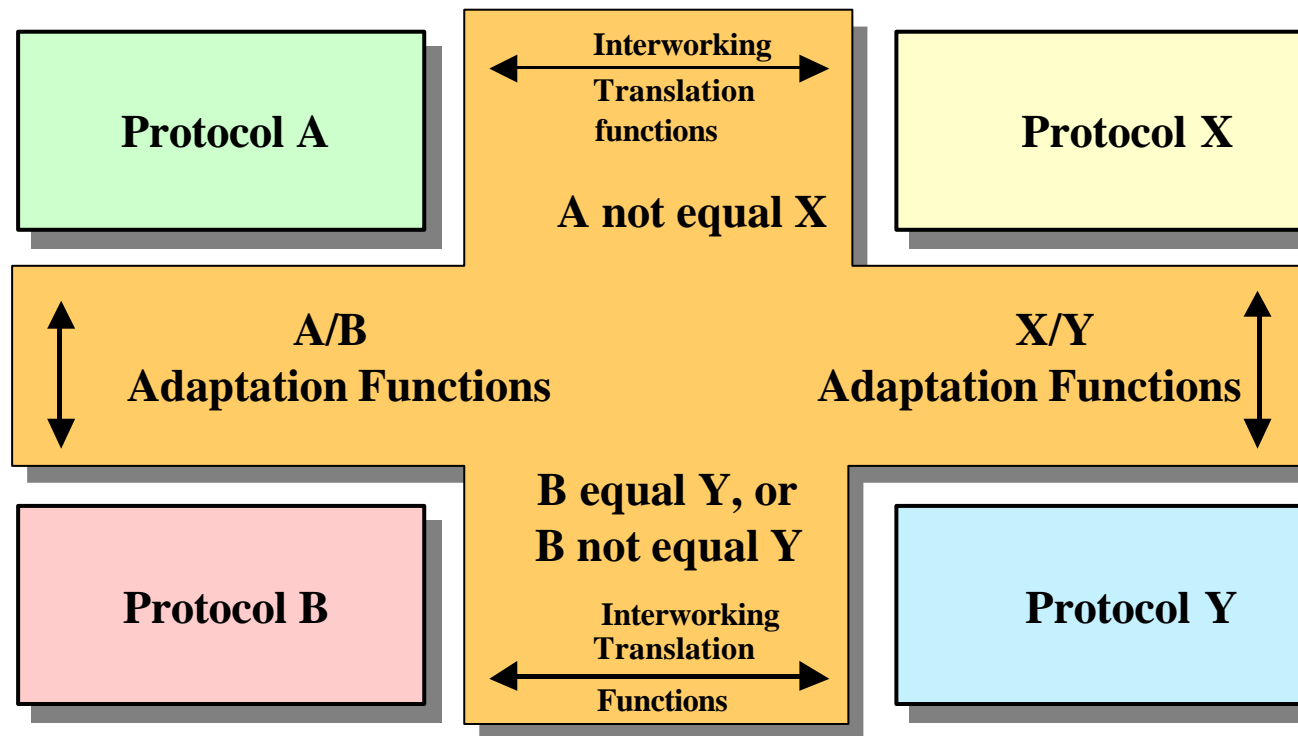
3. Service and Network Interworking

General Network interworking

- **In Network Interworking, the PCI (Protocol Control Information) of the protocol and the payload information used in two similar networks are transferred transparently by an IWF (Interworking Function) . Typically the IWF encapsulates the information which is transmitted by means of an adaptation function and transfers it transparently to the other network.**

IWF   IWF

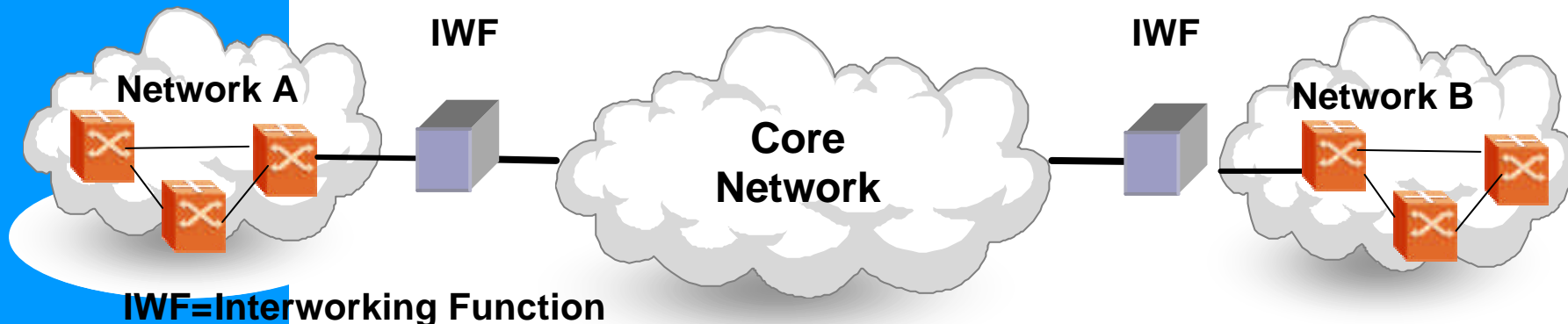**Network A**   **Network B**
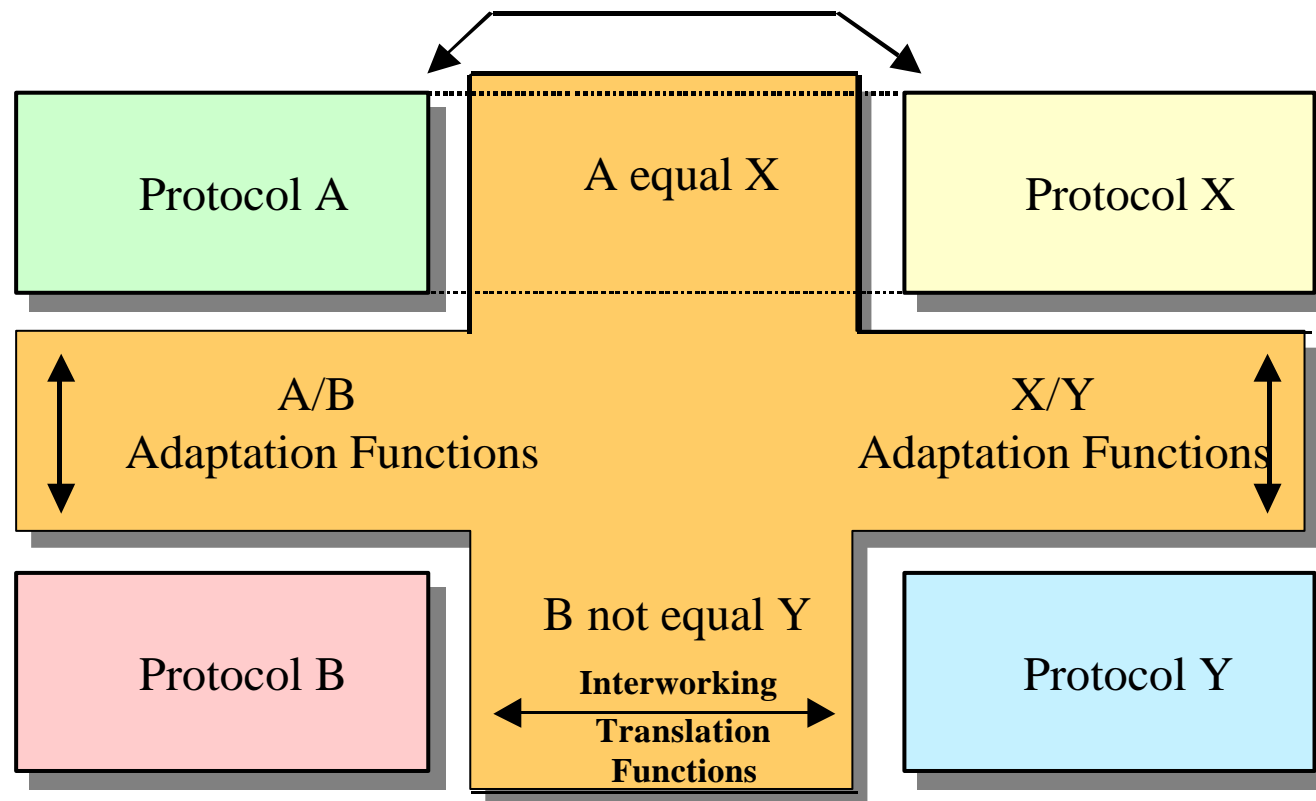
Core Network

IWF=Interworking Function

- **Networks A and B are similar networks, e.g. both are ATM or Frame Relay, etc.**
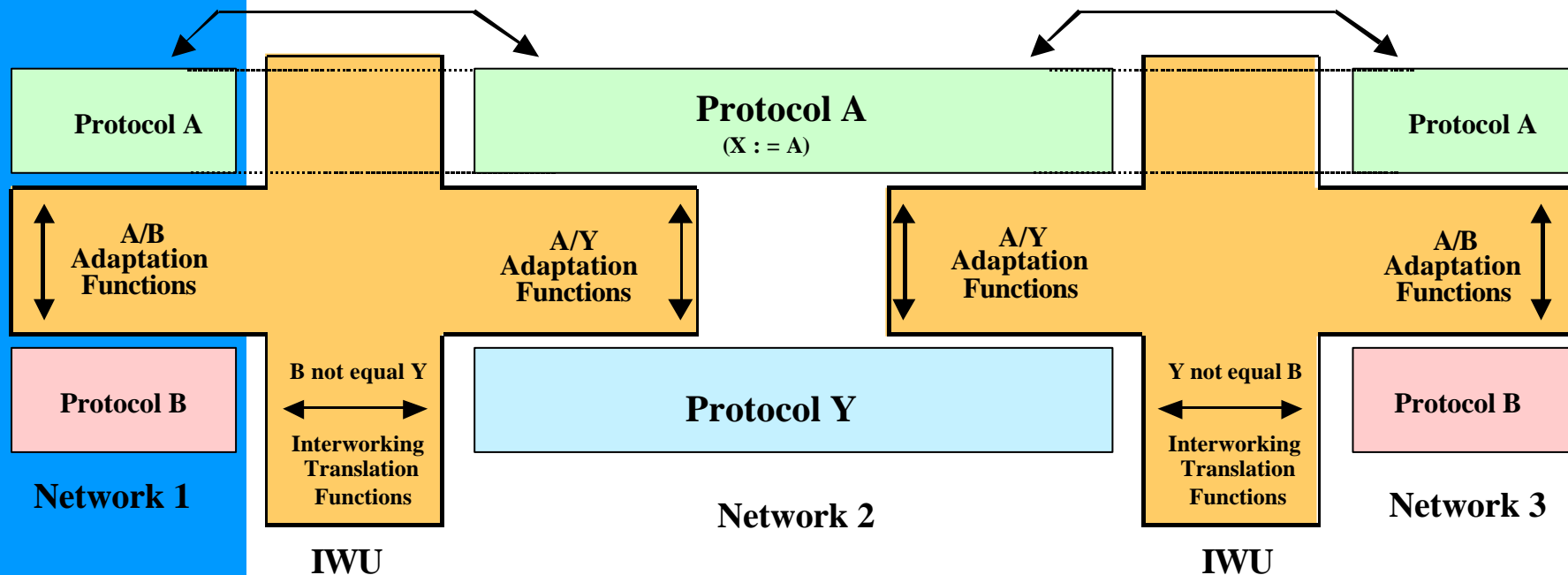
3. Service and Network Interworking

Network Interworking Model

Protocol A

A equal X

Protocol X

A/B
Adaptation Functions

X/Y
Adaptation Functions

Protocol B

B not equal Y

Interworking
Translation
Functions

Protocol Y

3. Service and Network Interworking

Example of Network Interworking

Protocol A		Protocol A (X : = A)		Protocol A
A/B Adaptation Functions	A/Y Adaptation Functions		A/Y Adaptation Functions	A/B Adaptation Functions
Protocol B	B not equal Y Interworking Translation Functions	Protocol Y	Y not equal B Interworking Translation Functions	Protocol B
Network 1	IWU	Network 2	IWU	Network 3

4. Interworking with MPLS

Near Term Evolution of Networks

Rec. Q.931

SS7 Network

Rec. Q.700 series

PSTN/ISDN

Q & X series Rec.

PSTN/ISDN

IWF **Rec. I.580**

Frame Relay Networks

Rec. Q.2931, PNNI

FR OSF & NM

IWF

PSTN/ISDN OSF & NM, M series Rec.

IWF

Rec. I.580

ATM Networks

IWF **Rec. I.555**

IETF RFCs

IWF

Wireless access

IWF

ATM OSF & NM, M series Rec.

Rec. Y.1310

IP-based Networks

SNMP based
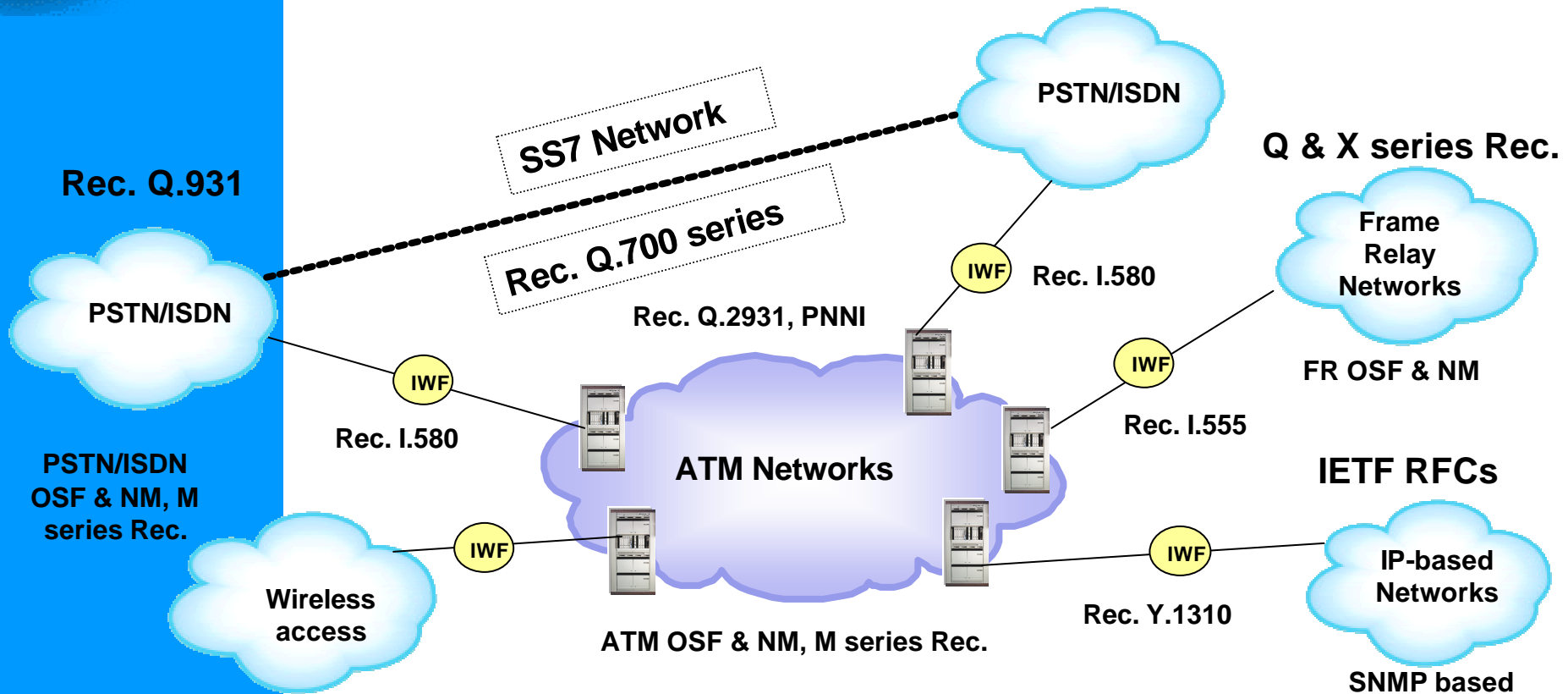
Prose
- **Convergence on ATM core networking enables initial stage of unified management and control**
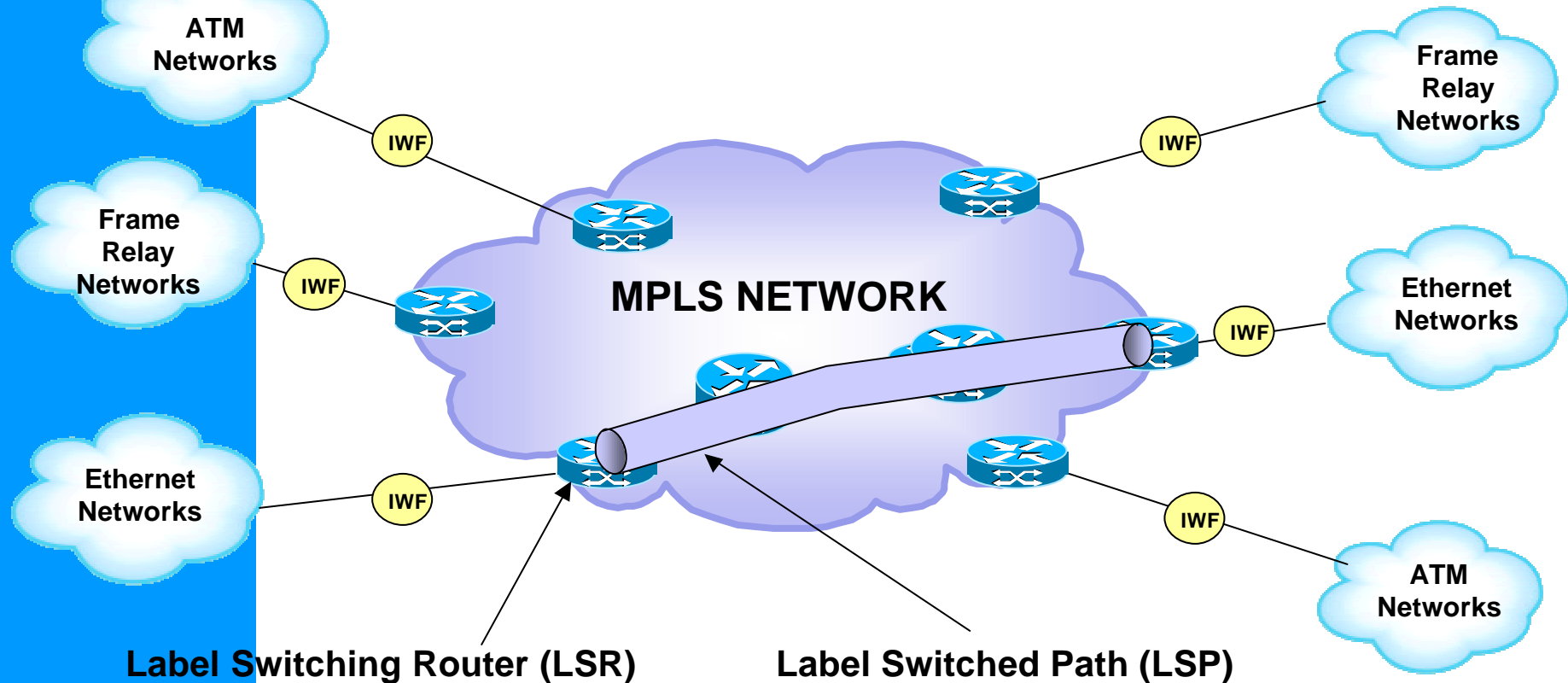- **Enhanced performance and QoS capabilities for multi-services over common platform**

Cons
- **Lack of service transparency between IP based services and ATM/PSTN services**

OSF = Operating Support Function

4. Interworking with MPLS

Mid Term Evolution Network Architecture-Convergence on MPLS Core

ATM Networks

Frame Relay Networks

Frame Relay Networks

Ethernet Networks

MPLS NETWORK

IWF

IWF

IWF

IWF

IWF

IWF

Ethernet Networks

ATM Networks

Label Switching Router (LSR)

Label Switched Path (LSP)

- Requires well defined interworking mechanism for all services
  - Transfer plane functions
  - Control plane functions
  - Management plane functions

4. Interworking with MPLS

Why Multi-Services over MPLS?

- **Operational Expenditure Reduction**
  - Leveraging existing IP/MPLS packet core
  - Scaling all networks across a common transport and control core

- **Preservation of Existing Layer Two Operational Models**
  - Existing Layer Two features and functionality (including SLAs) can be maintained by providing OAM interworking

- **Core Network Scalability**
  - High speed links in routed core (e.g., potential OC192 forwarding capability)
  - QoS/Traffic engineering based on explicit routing
  - Aggregation capabilities based on label stacking

4. Interworking with MPLS
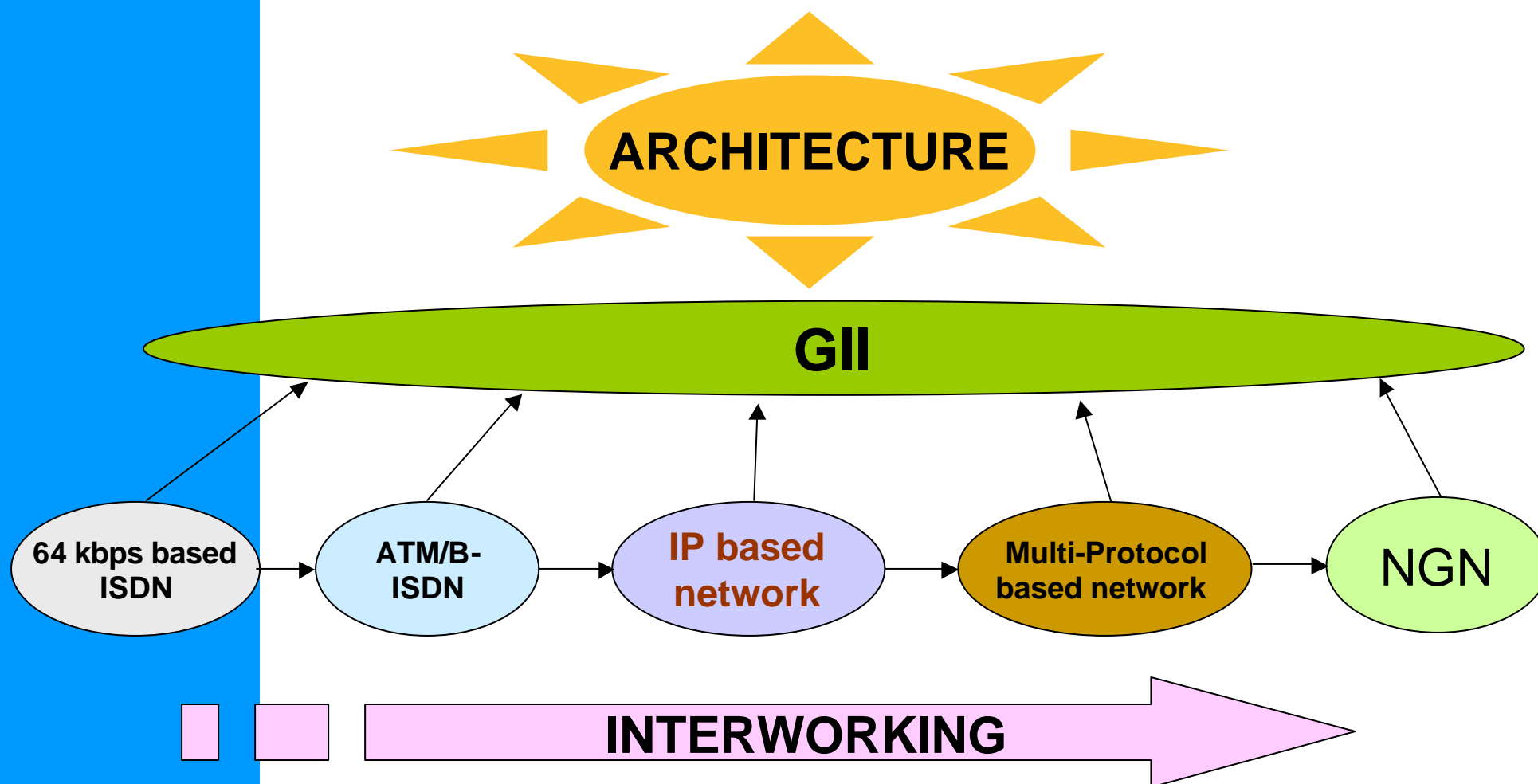
Example ATM-MPLS Network Interworking

IWF

LSP "tunnel"

ATM Network A

IWF

LSR

ATM Network B

IWF=Interworking Function
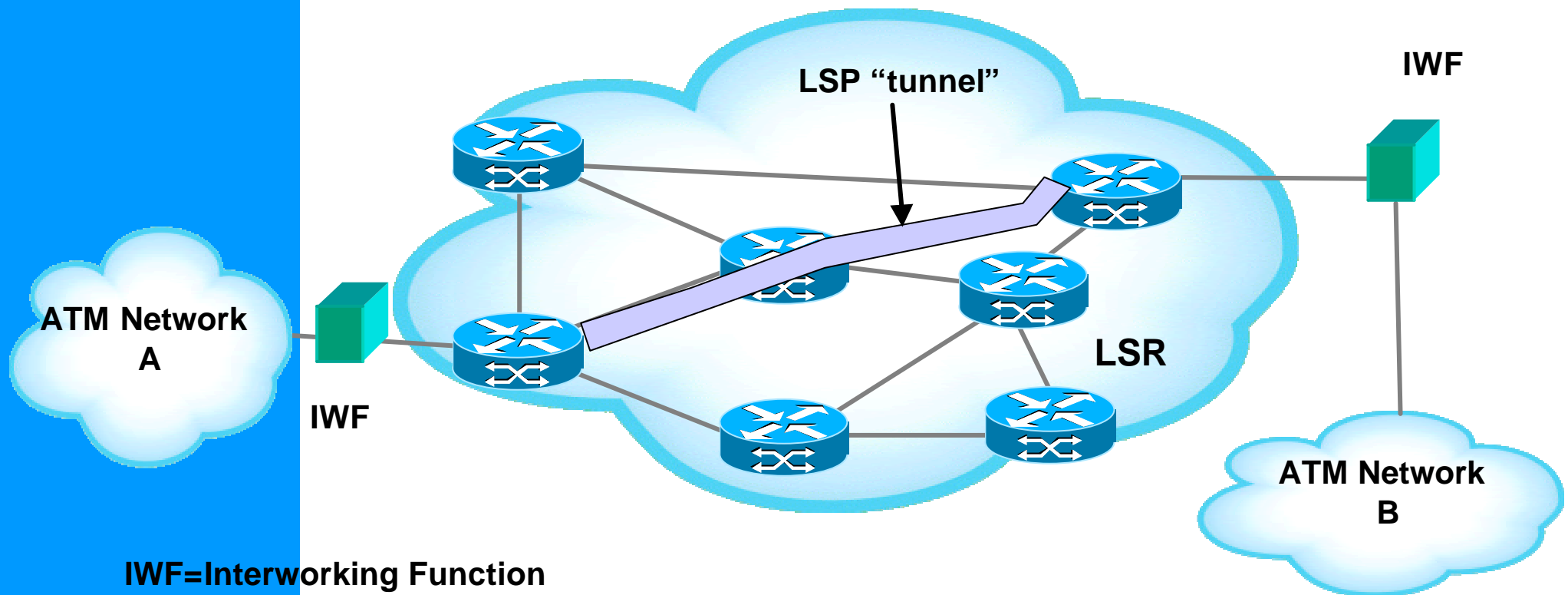
In MPLS, network interworking and tunnelling concepts are used interchangeably

5. Conclusion

Scope of WP 2/13

ARCHITECTURE

GII

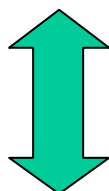| 64 kbps based ISDN	ATM/B-ISDN	IP based network	Multi-Protocol based network	NGN

INTERWORKING

5. Conclusion

Role and Activities of WP 2/13 Study

Interconnection

- Develop Framework Architecture for RPOI
- Identify Reference Point of Interconnection
- Specify Attributes and Requirements of RPOI

Architecture

- Framework Architecture of GII and Principle
- Develop Telecom. Archit. For Evolv. Environ.
- Study of New Reference Model
- Develop Framework of IP based Network include Satellite communication
- Specify Network Capabilities for IP and others

Interworking

- Develop Framework for Interworking
- Specify Interworking Functions btw. Different Networks and Services