



International Civil Aviation Organization

Fourth ATN Transition Task Force Meeting

Mumbai, India, 8 - 12 April 2002

Agenda Item 10: Any Other Business

**INFORMATION FOR THE INCORPORATION OF THE IP
(INTERNET PROTOCOL) IN THE ATN**

(Presented by Japan)

Summary

This paper presents information for the incorporation of the Internet Protocol (IP) into the ATN environment.

1. Introduction

1.1 Internet Protocol (IP) is recently used worldwide. As the ATN is based on the ISO OSI Standards, there is no direct interoperability between IP and ATN.

2. Discussion

2.1 Considering the worldwide use of the IP (Internet Protocol) technology, ATNP WG had started investigation how to incorporate the IP into the ATN environment. At the ATNP WG Meetings in Phuket, Thailand, 12-20 March 2002, there were considerable discussions made. Though many issues have to be discussed at the next meeting, this paper presents a Draft Position Statement of WG B as in the Attachment-1, as well as some related information on this matter in Attachment-2.

3. Action by the Meeting

3.1 The meeting is invited to note the information provided in this paper.

Attachment-1: “Draft Position Statement of ATNP WG B on the use of IP Subnetworks as part of the ATN”; Appendix E to the ICAO ATNP Draft Report of the Third Joint Working Group Meeting (JWG/3) dated 20 March 2002

Attachment-2: “Information for the incorporation of the IP (Internet Protocol) in the ATN”; hardcopies of slides in Microsoft Power Point format

**DRAFT POSITION STATEMENT OF ATNP WG B ON THE USE OF IP
SUBNETWORKS AS PART OF THE ATN**

Considerations

1. The ATN was designed to embrace all air-ground and ground-ground communications technologies. IP subnetworks can and should be available for use by the ATN.
2. Non-ICAO Air-Ground networks are being developed that use IP for non-safety airborne applications. Where the Quality of Service provided is acceptable for ATC Applications, such networks could be useable as part of the ATN.
3. The ICAO specification for the ATN uses OSI protocols, specifically CLNP and TP4, to support internetworking and reliable end-to-end connection mode communications. ICAO Applications and Upper Layers Communications Services including Security Services depend upon the availability of TP4. There has been considerable industry investment, of both resources and time, in these protocols, including the development and validation of the ICAO specification and the development and certification of ATN compliant products to ensure that they meet the safety, mobility and QoS requirements of the ATN applications.
4. TCP/IP communications protocols although functionally similar cannot replace the OSI protocols specified by ICAO without a similar level of investment in time and effort to produce certified products. Off the shelf implementations are not acceptable as they neither include additional features deemed necessary for ATC use nor have they been developed using the lifecycles and methodologies appropriate for certifiable software.
5. The ATN Mobile Routing strategy permits mobile platforms to :
 - act as a subnetwork and receive incoming connections on well known and statically assigned network addresses, and to make outgoing connections to ground systems;
 - seamlessly move between different mobile networks without disrupting end-to-end communications;
 - simultaneously use more than one mobile network; and
 - support Policy Based Routing Decisions in order to choose between alternative routes to the same destination.

Mobile IP strategies are directed to the support of single systems and support only the first two of the above functionalities. Mobile IP also introduces a special point into the network (the Home Agent) and has issues associated with a potential single point of failure, inefficient routing due to the necessity of routing through a Home Agent, and security due to apparent “spoofing” by a mobile system.

Conclusions:

It is appropriate, on both economic and technical grounds, to continue the use of CLNP and TP4 as the ATN core protocols whilst developing specifications to enable the use of IP subnetworks as ATN subnetworks for both ground-ground and air-ground use, where there is industry demand.

1. ATNP WGB SG1 will develop SARPs to permit the use of ground-ground IP subnetworks as ATN subnetworks for both BIS to BIS and within local domains.
2. Should demand ever develop, ATNP WGB SG1 could develop SARPs to enable the use of Air-Ground IP subnetworks for Airborne Router to Air-Ground Router interconnections.

In order to achieve the above, ATNP WGB SG-1 will develop SARPs and Guidance Material for an IP SNDCEF to support the encapsulation of CLNP packets for their transit across an IP subnetwork. An IP subnetwork will have to meet the existing performance requirements that the ATN Technical Provisions already define. There is no intention that the public "Internet" should be used as an ATN subnetwork; the SARPs will apply to private IP subnetworks only.

***Agenda Item 10: Any Other Business
Information for the incorporation of the
IP (Internet Protocol) in the ATN***

Attachment 2 to IP/5

***Fourth ATN Transition Task Force Meeting
Mumbai, India, 8-12 April 2002***

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- Detailed Explanation
 - Fully ATN Based Communication
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- Further Issues
- Conclusions

Summary

- ICAO ATN SARPs
 - Communication based on the ISO OSI
 - Demand for the IP based protocol
 - IP (Internet Protocol)
 - RFC (Request for Comments) 791/950/919/922, etc.
 - IP is the Internet Protocol used worldwide
 - It is not included in Doc 9705 SV-5 (Internet Communication Service)
 - There is no direct interoperability between ATN and IP
 - ATN : CLNP in the Network Layer / TP4 in the Transport Layer
 - IP : IP in the Network Layer / TCP in the Transport Layer
- *OSI : Open systems interconnection*
 - *CLNP : Connection-Less Network Protocol*
 - *TP4 : (Connection Oriented) Transport Protocol (Class 4)*

Summary

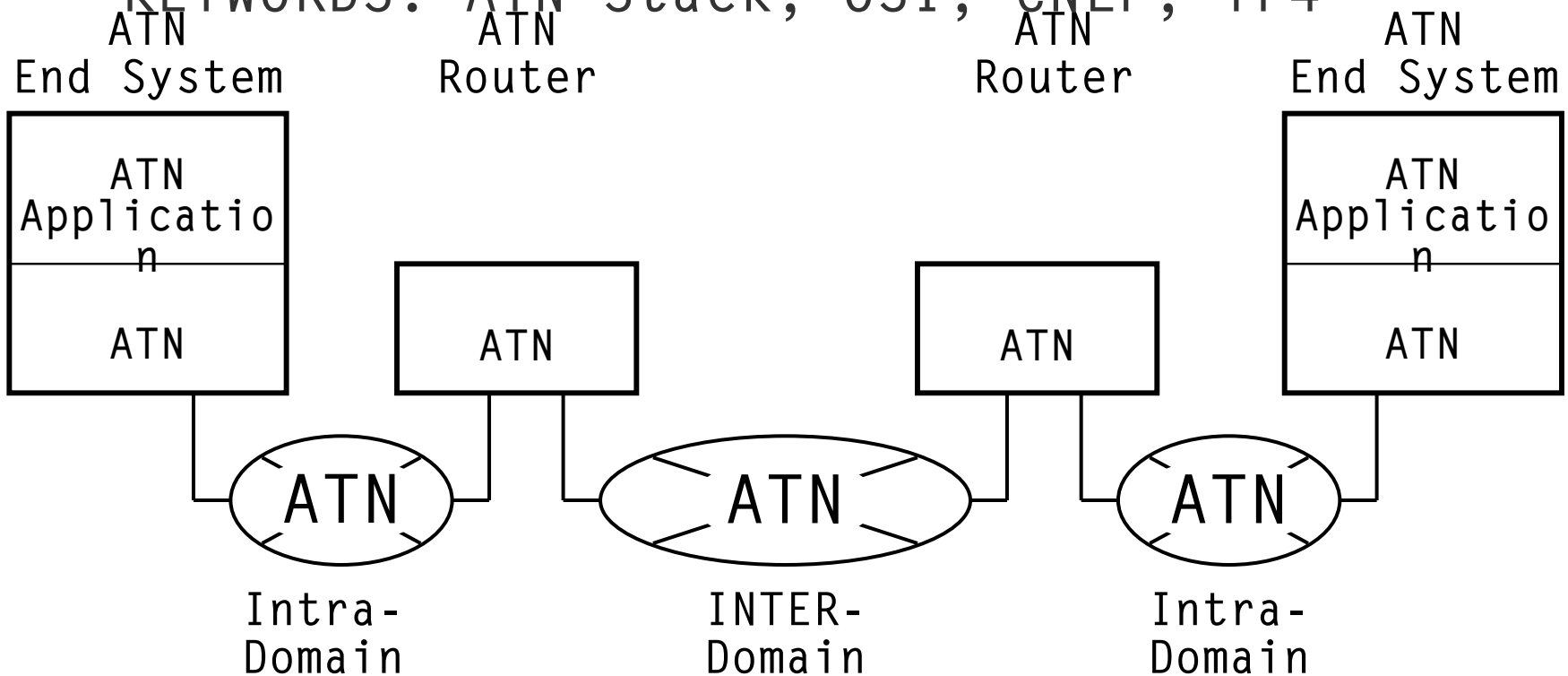
- Three possibilities
 - Fully ATN Based Communication
 - ATN Compliant
 - KEYWORDS: ATN Stack, OSI, CNLP, TP4
 - Fully IP Based Communication
 - IP in lieu of ATN (NOT ATN Compliant)
 - KEYWORDS: IP Stack, TCP/IP
 - IP as an ATN Subnetwork
 - ATN Compliant
 - KEYWORDS: Tunneling, Capsulation (Encapsulation/Decapsulation)
-
- *TCP* : *Transmission Control Protocol*
 - *IP* : *Internet Protocol*

Summary

- 1st case: Fully ATN Based Communication

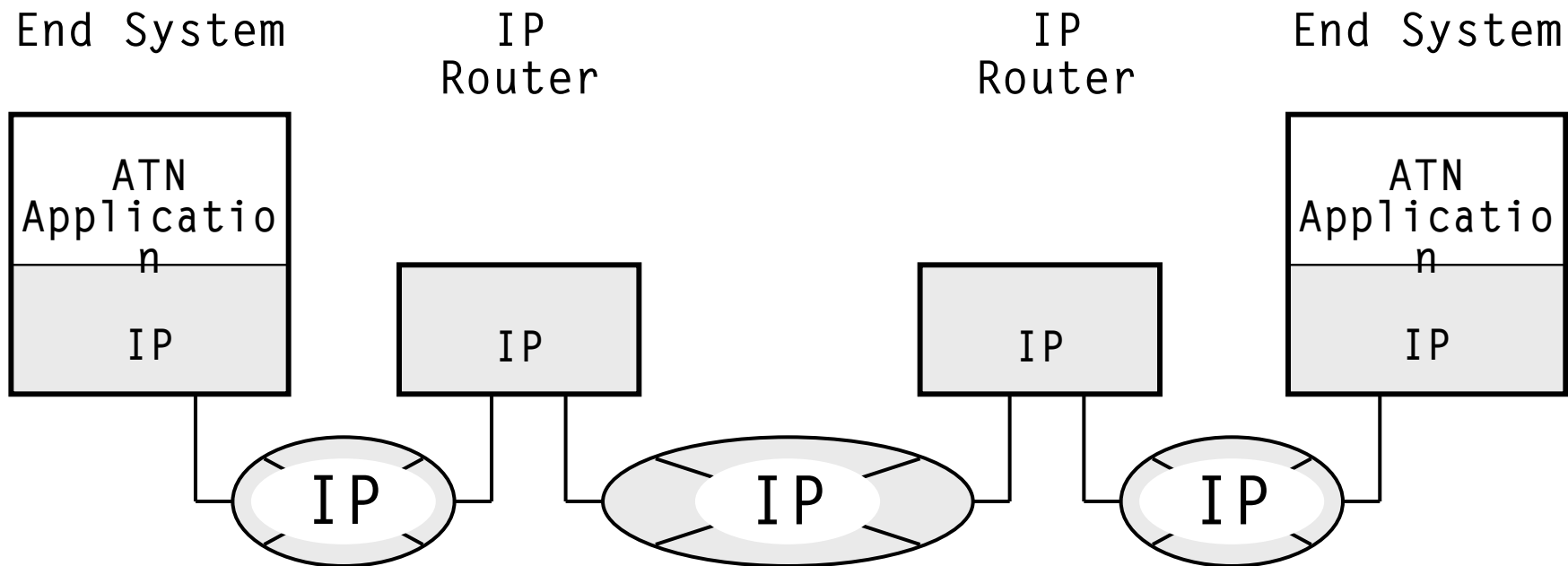
- ATN Compliant

- KEYWORDS: ATN Stack, OSI, CNLP, TP4



Summary

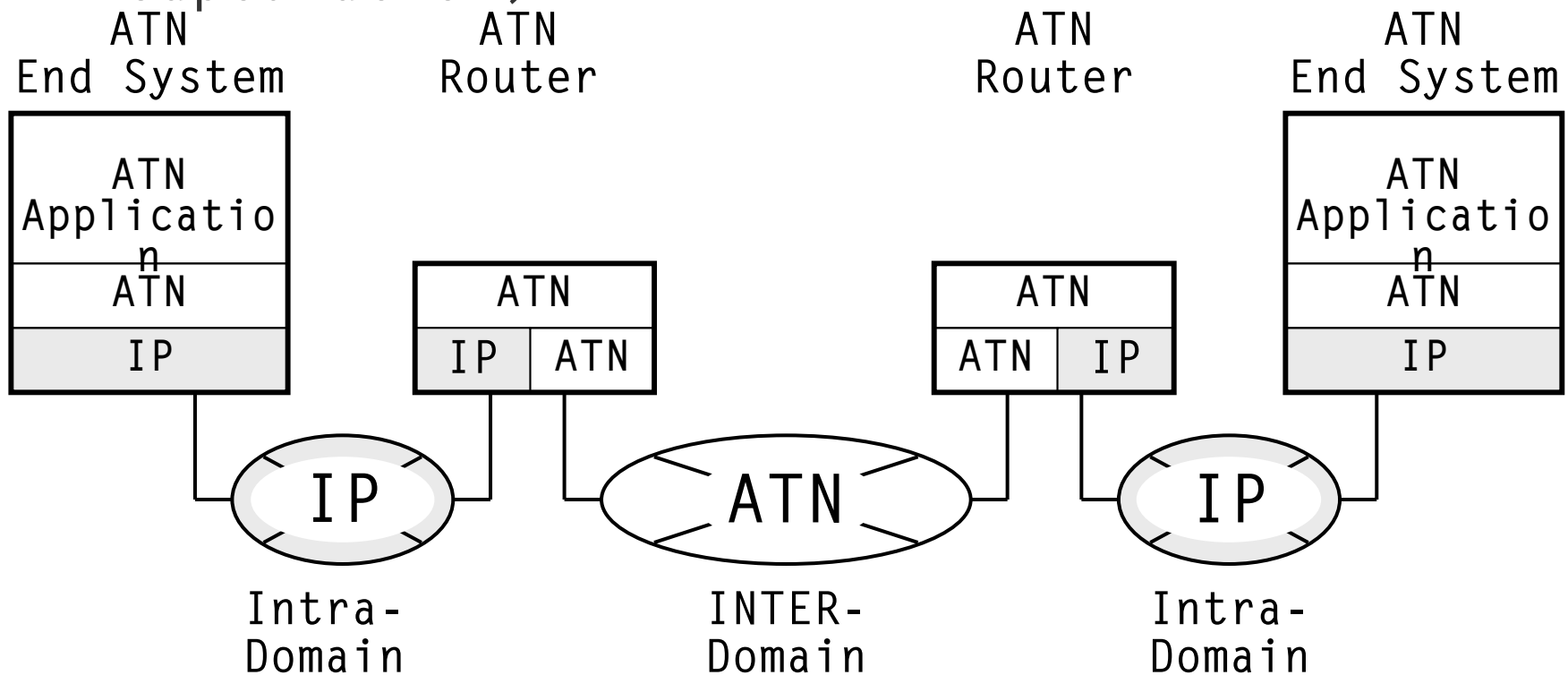
- 2nd case: Fully IP Based Communication
 - IP in lieu of ATN (NOT ATN Compliant)
 - KEYWORDS: IP Stack, TCP/IP



NOTE: There is no ATN Domain Concept in this case.

Summary

- 3rd case: IP as an ATN Subnetwork
 - ATN Compliant
 - KEYWORDS: Tunneling, Capsulation(En/De-capsulation)



Summary

- Recent ATNP WG Meeting (March 2002, Phuket)
 - Fully ATN Based Communication
 - All Air/Ground and Ground/Ground Applications
 - Context Management, System Management, Security, Directory
 - AMHS planning in the Asia/Pacific region (including FAA)
 - Fully IP Based Communication
 - No requirement for the A/G and AIDC Application
 - Some requirement by Eurocontrol and SITA for the investigation of the AMHS fully based on the IP instead of ATN
 - There are many issues and WG continues investigation
 - IP as an ATN Subnetwork

Summary

- Draft Position Statement of ATNP WG B (March 2002)
 - Considerations
 - ATN uses OSI protocol (CNLP and TP4)
 - There has been considerable industry investment on ATN
 - TCP/IP protocols cannot replace the OSI protocol easily
 - ATN Mobile Routing cannot be satisfied by Mobile IP strategies
 - Conclusions
 - To continue the use of CNLP and TP4 as the ATN core protocols
 - To use IP subnetworks as ATN subnetworks for A/G and G/G use
 - To use G/G IP subnetworks as ATN subnetworks for both BIS to BIS and within local domains
 - To use A/G IP subnetworks between Airborne Router

Detailed explanation

- Fully ATN Based Communication
- Fully IP Based Communication
- IP as an ATN Subnetwork
- AMHS fully based on the IP

Fully ATN Based Communication

• ATN Full Stack in End System

7.	Application Layer
6.	Presentation Layer
5.	Session Layer
4.	Transport Layer
3.	Network Layer
2.	Datalink Layer
1.	Physical Layer

ATN Application ULCS
COTP (TP4)
CLNP/ES-IS
SNDCF
Datalink
Physical

A/G
Application
or AIDC
End System

AMHS
ACSE RTSE
Presentation
Session
COTP (TP4)
CLNP/ES-IS
SNDCF
Datalink
Physical

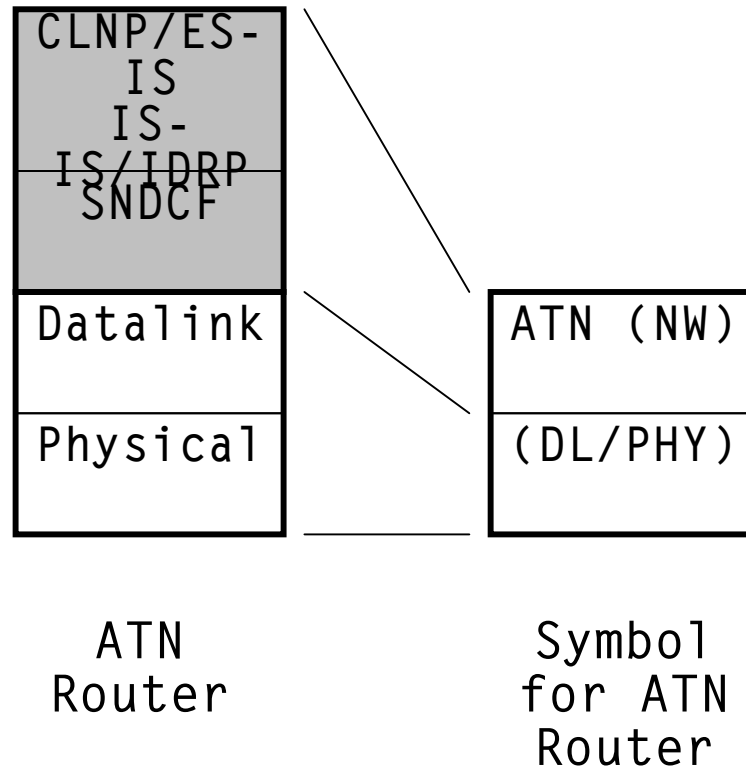
AMHS
End System

ATN Application
ATN (TR)
ATN (NW)
(DL/PHY)

Symbol
for ATN
End System

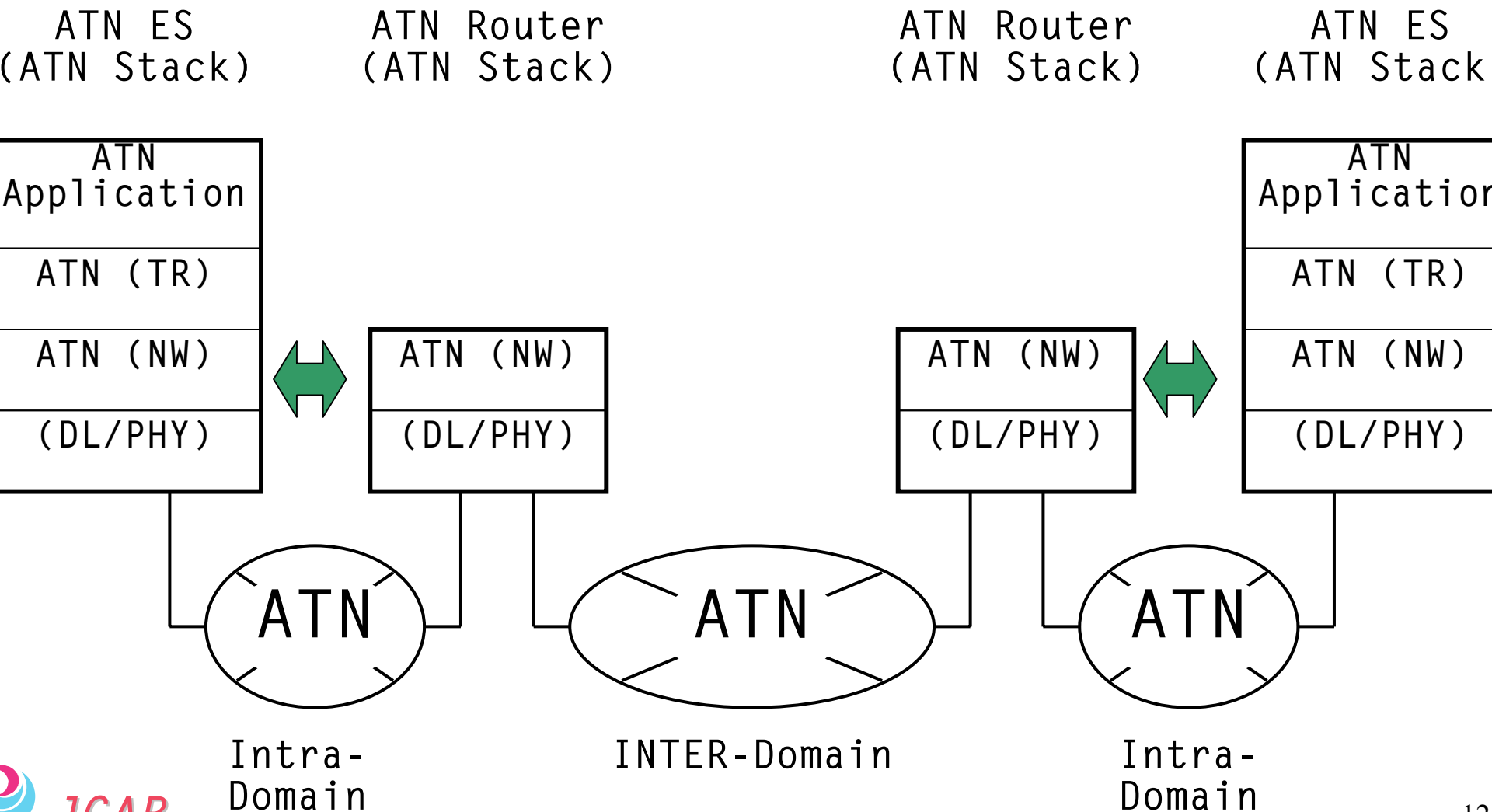
Fully ATN Based Communication

- ATN Router in ATN Full Stack



Fully ATN Based Communication

- ES-ES Connection in ATN Full Stack (ICAO ATN)



Fully IP Based Communication

- Comparison between OSI Full Stack and IP (TCP/IP) Full Stack

7.	Application Layer
6.	Presentation Layer
5.	Session Layer
4.	Transport Layer
3.	Network Layer
2.	Datalink Layer
1.	Physical Layer

AMHS	
ACSE	RTSE
Presentation	
Session	
COTP (TP4)	
CLNP/ES-IS	
SNDCF	
Datalink	
Physical	

ATN (AMHS)
End System
(OSI Full Stack)

AMHS	
ACSE	RTSE
Presentation	
Session	
TCP (UDP)	
IP	
Datalink	
Physical	

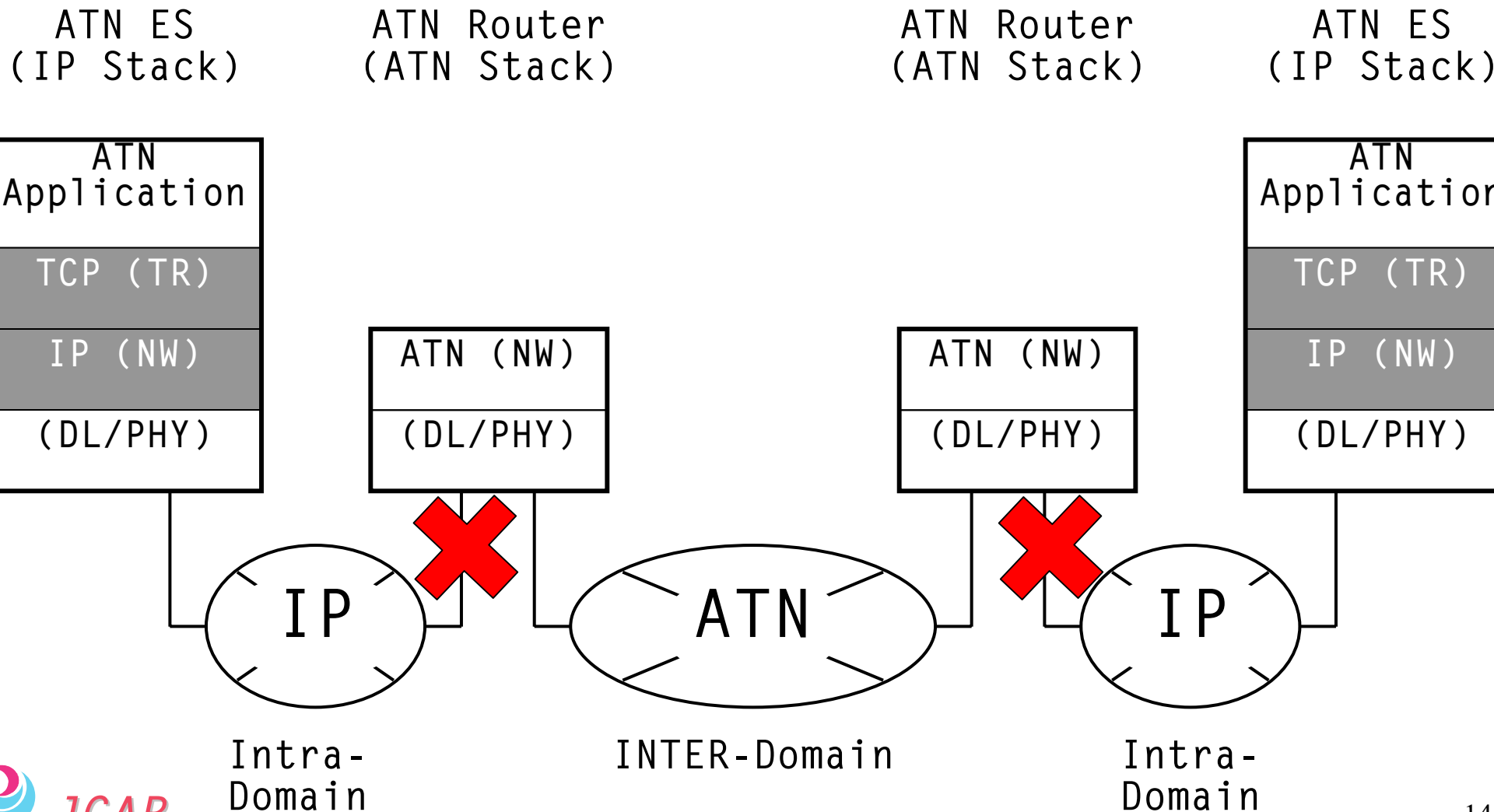
IP
End System
(IP Full Stack)

ATN
Application
TCP (TR)
IP (NW)
(DL/PHY)

Symbol
for IP
End System

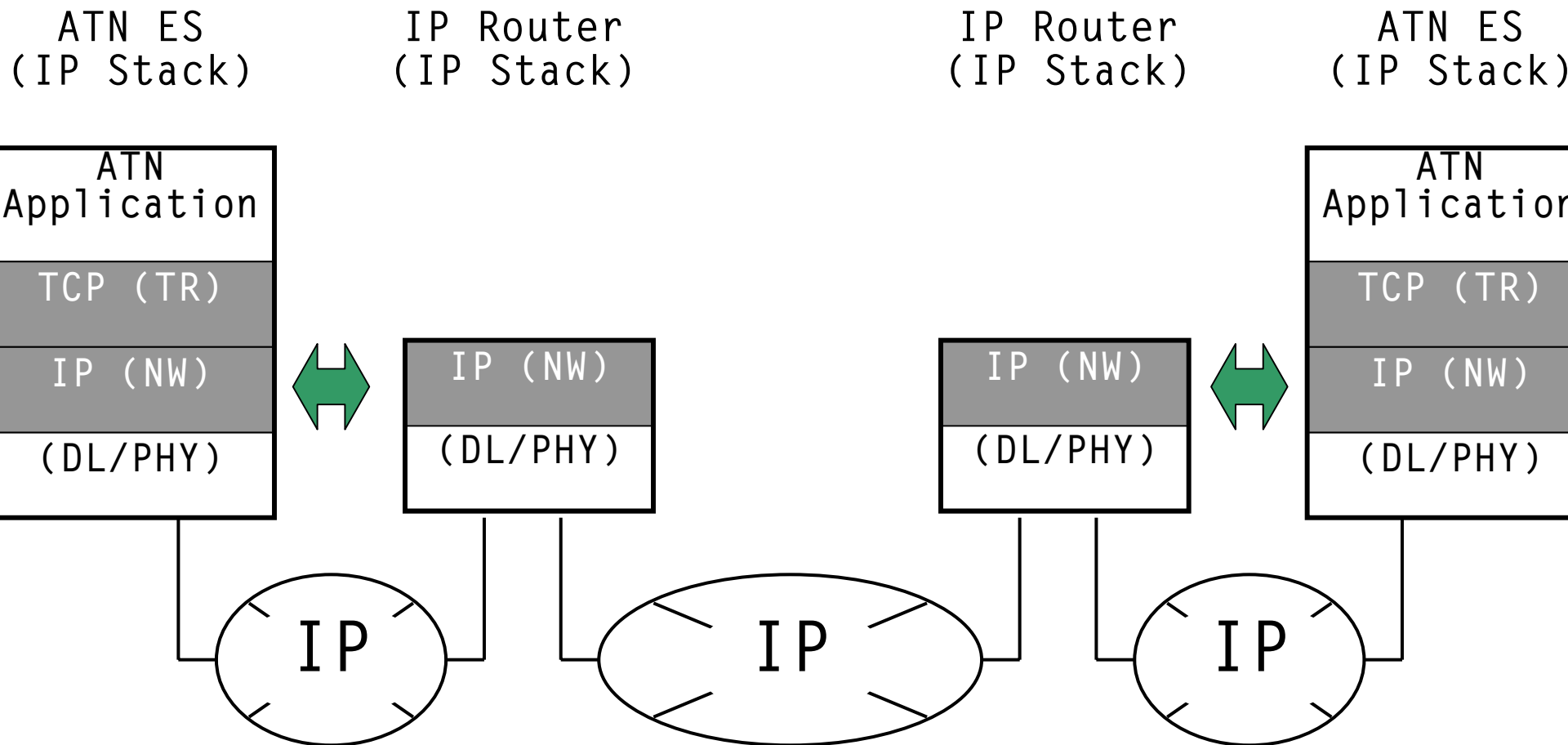
Fully IP Based Communication

- ES in IP Full Stack (NOT connect with ATN)



Fully IP Based Communication

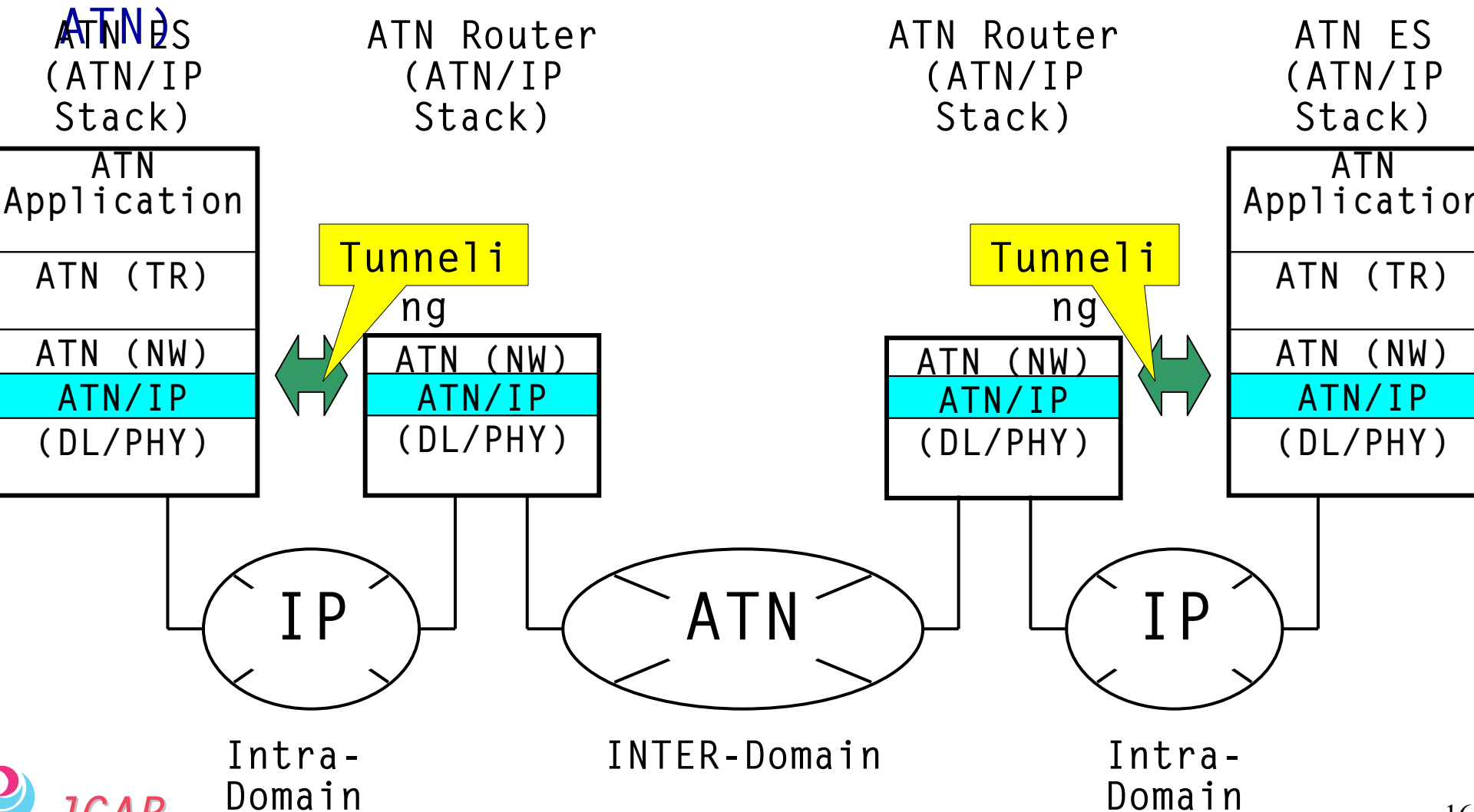
- IP only World (NOT compliant with ICAO ATN)



NOTE: There is no ATN Domain Concept in this case.

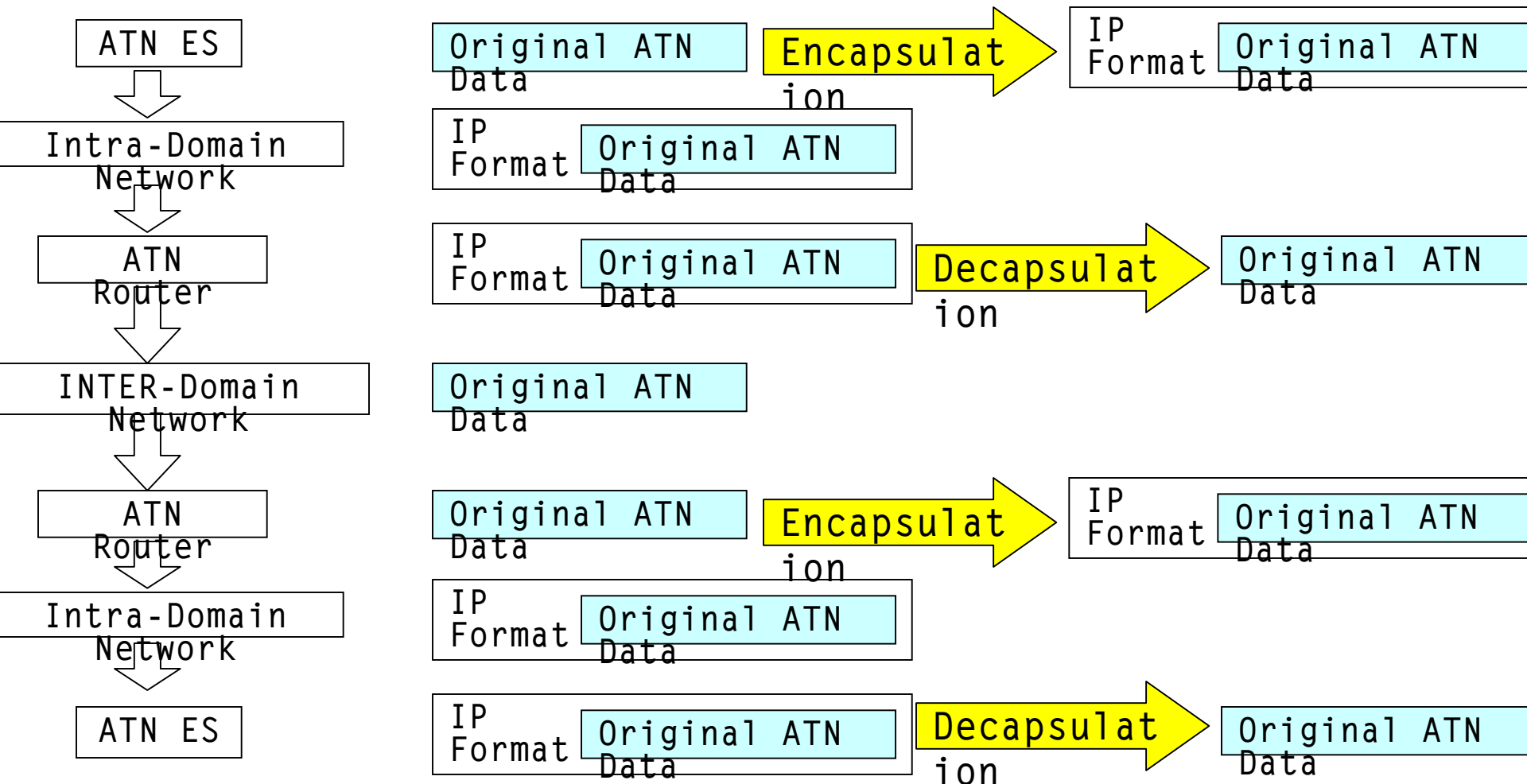
IP as an ATN Subnetwork

- IP as Subnetwork (under investigation in ICAO)



IP as an ATN Subnetwork

- Tunneling of ATN Data through IP by Capsulation



IP as an ATN Subnetwork

- Comparison between IP Full Stack and ATNP/IP

7. Application Layer
6. Presentation Layer
5. Session Layer
4. Transport Layer
3. Network Layer
2. Datalink Layer
1. Physical Layer

AMHS	
ACSE	RTSE
Presentation	
Session	
TCP (UDP)	
IP	
Datalink	
Physical	

IP
End System
(IP Full
Stack)

AMHS	
ACSE	RTSE
Presentation	
Session	
COTP (TP4)	
CLNP/ES-IS	
IP SNDCF	
Datalink	
Physical	

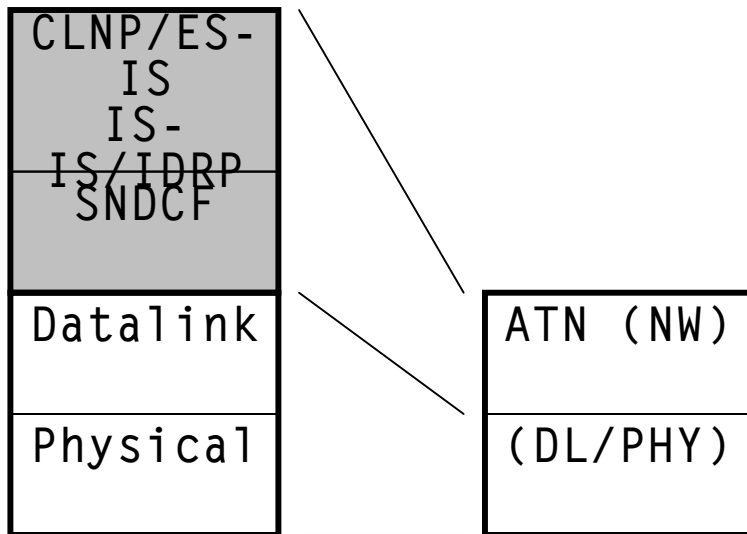
ATN/IP
End System
(ATN/IP
Stack)

ATN	
Application	
ATN (TR)	
ATN (NW)	
ATN/IP	
(DL/PHY)	

Symbol for
ATN/IP
End System

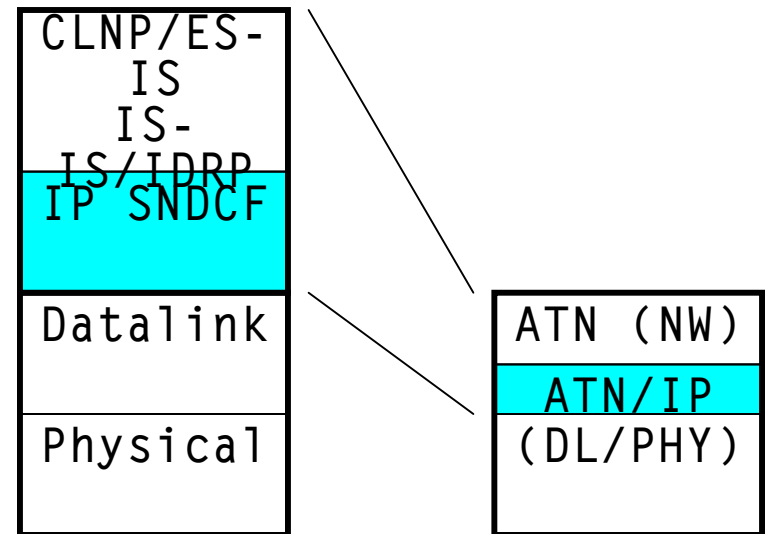
IP as an ATN Subnetwork

- ATN Router in ATN Full Stack and ATN/IP Stack



ATN
Router

Symbol
for ATN
Router

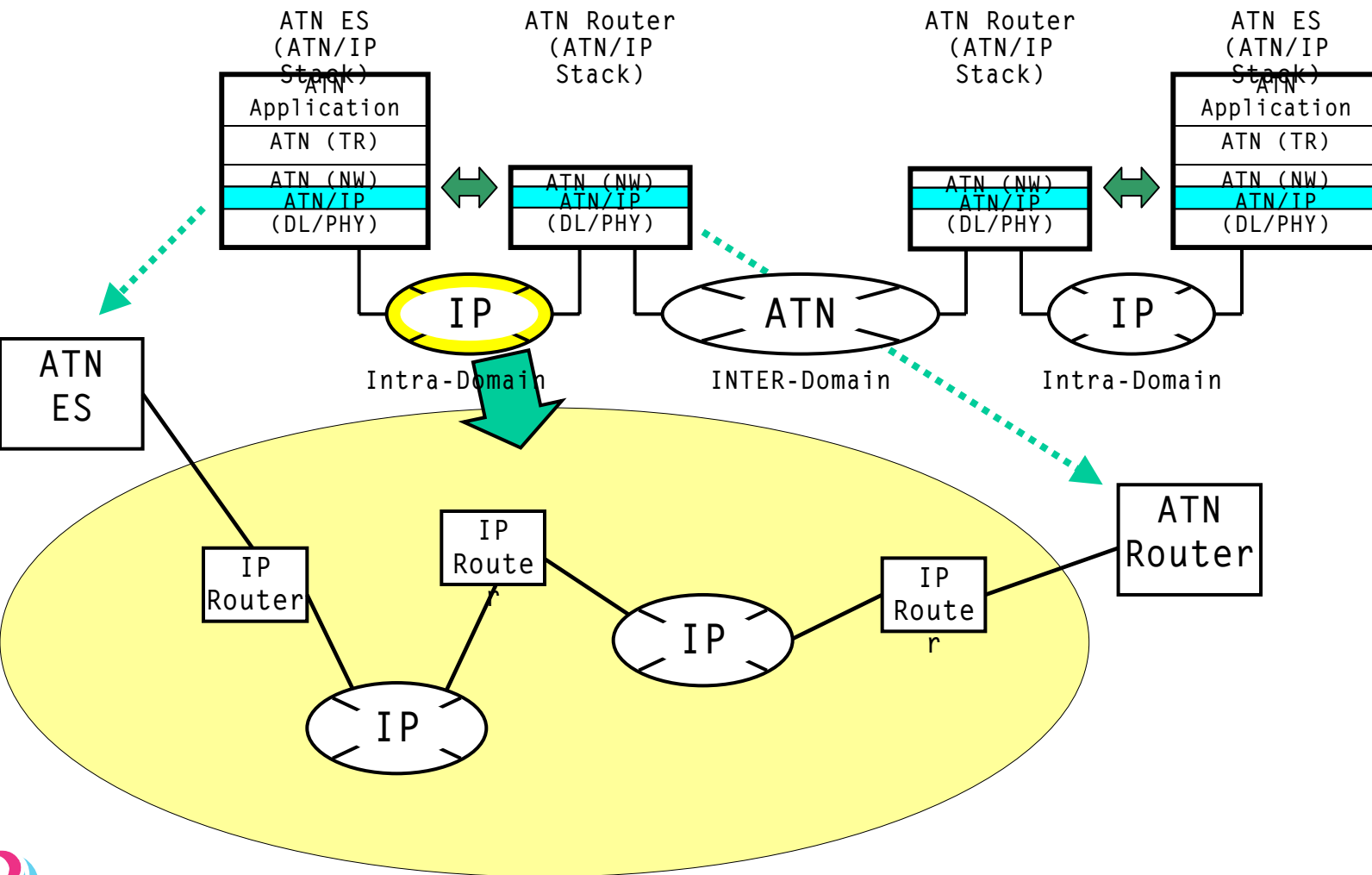


ATN/IP
Router
(ATN/IP
Stack)

Symbol for
ATN/IP
Router

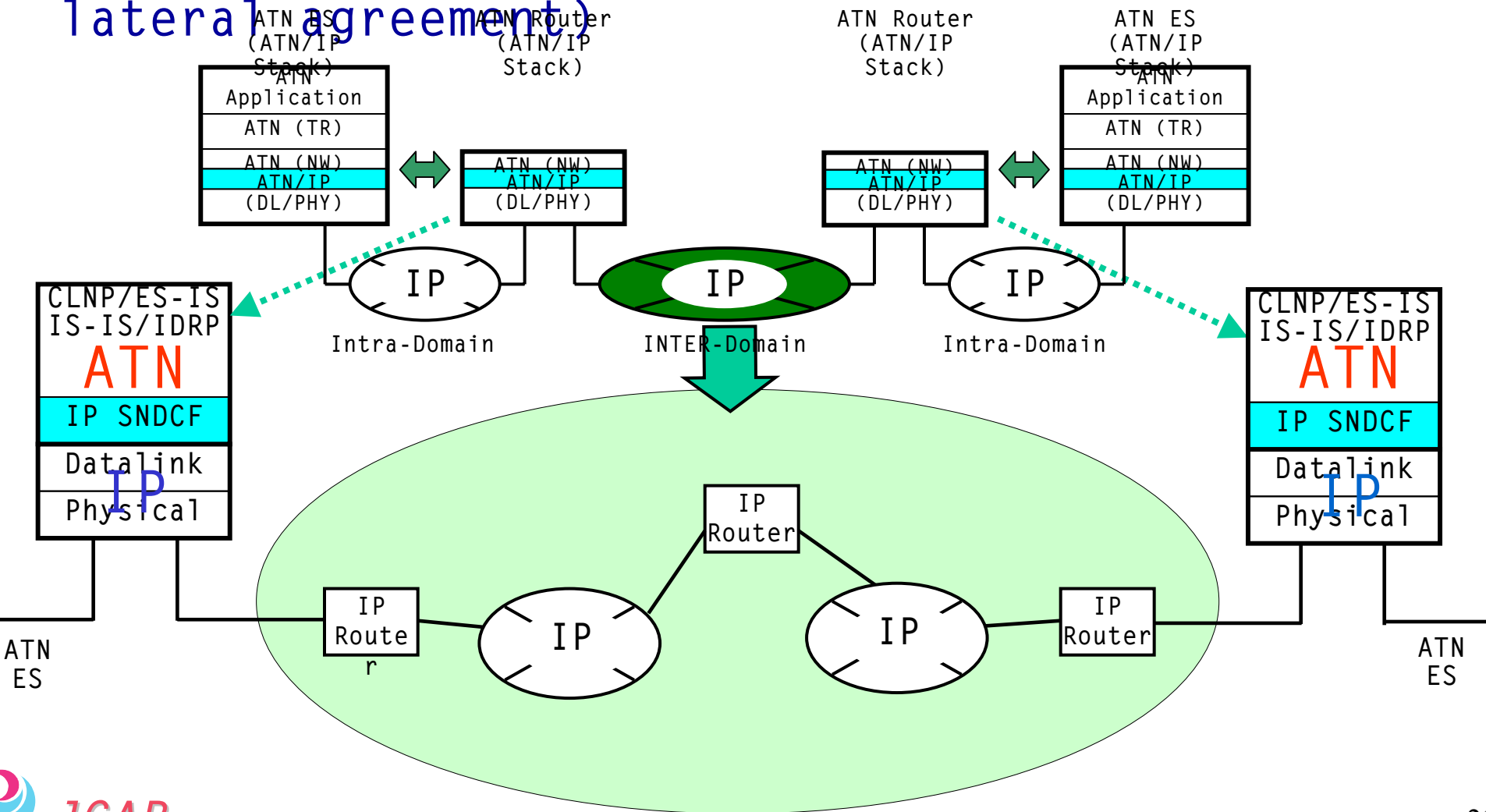
IP as an ATN Subnetwork

- Intra-Domain IP Network



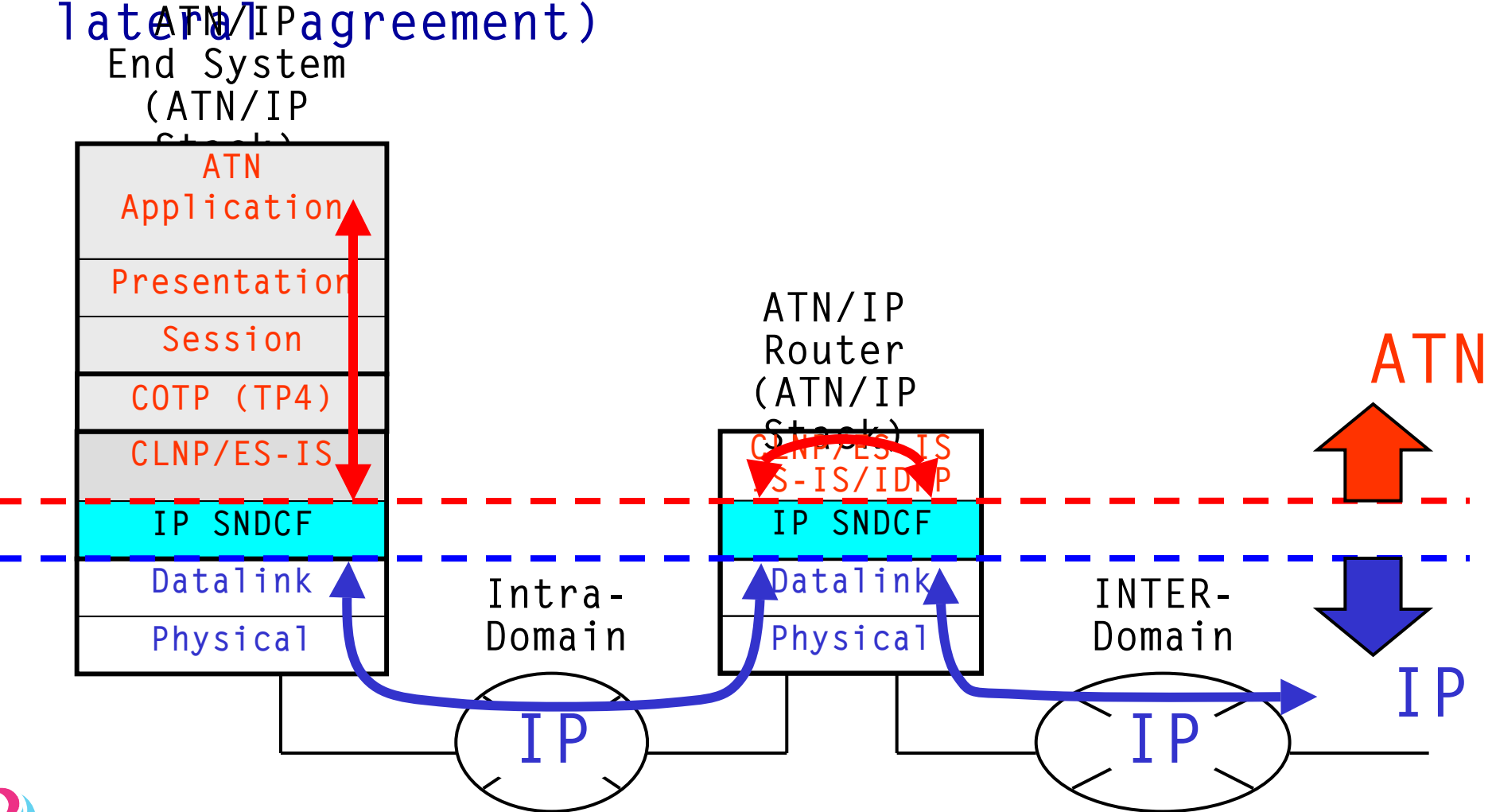
IP as an ATN Subnetwork

- INTER-Domain (and Intra-Domain) IP Network (Bilateral agreement)



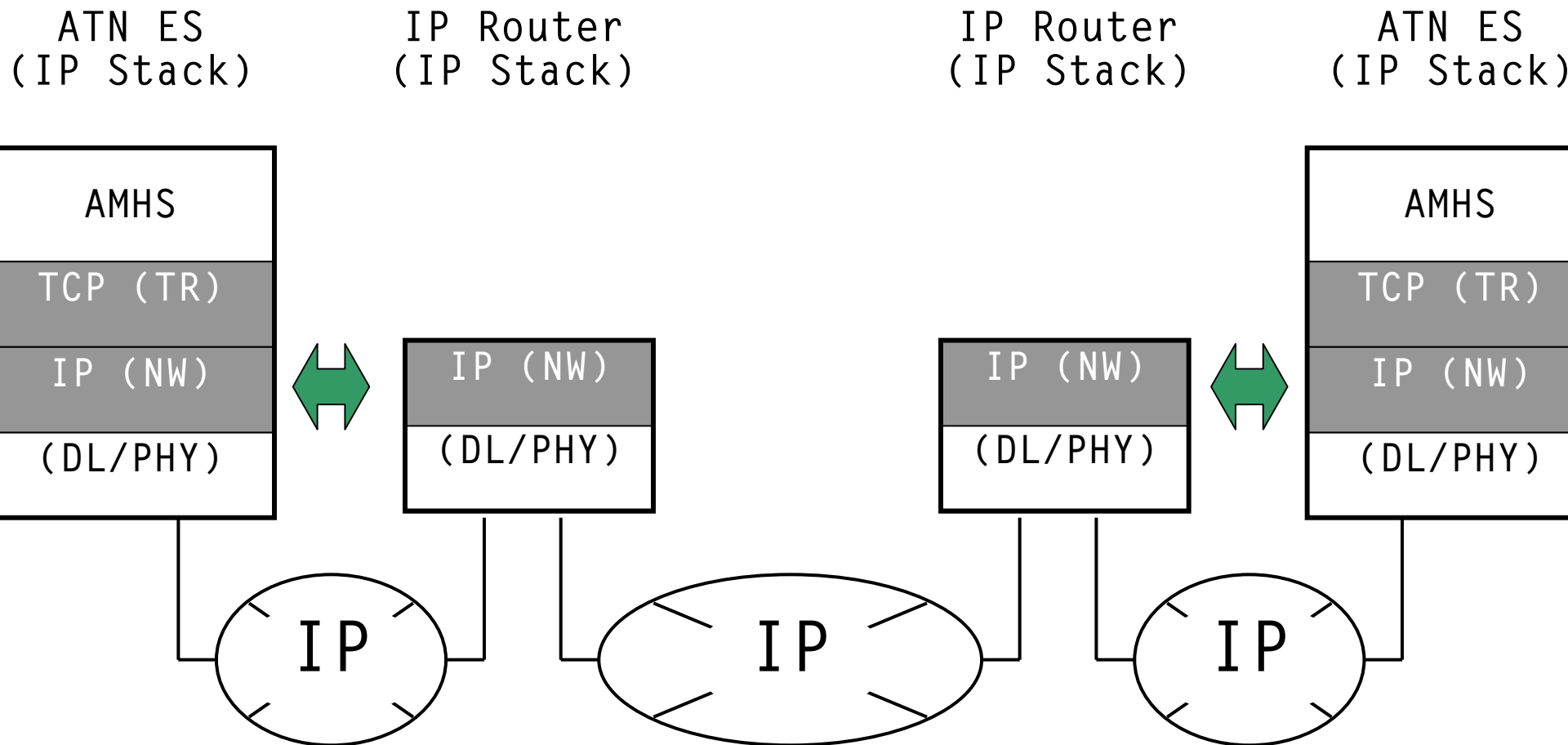
IP as an ATN Subnetwork

- INTER-Domain (and Intra-Domain) IP Network (Bilateral agreement)



AMHS fully based on the IP

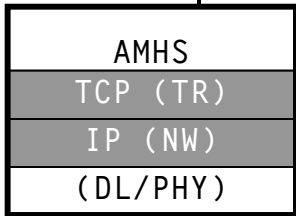
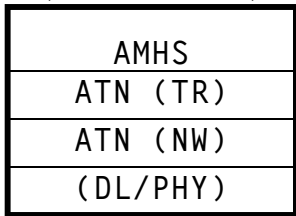
- IP only World (NOT compliant with ICAO ATN)



NOTE: There is no ATN Domain Concept in this case.

IP

- operable) ATN ES)

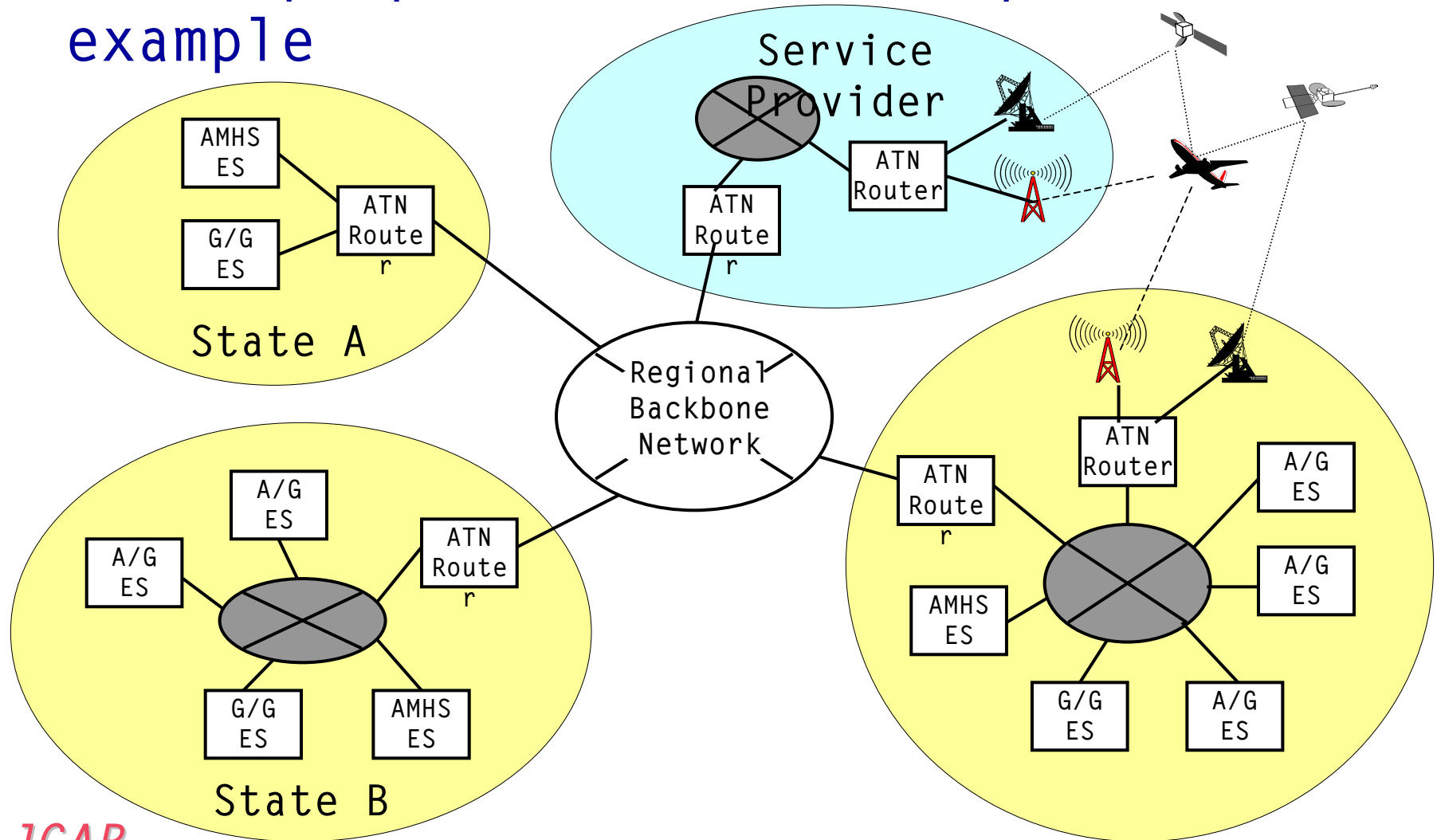


Some Considerations

- Whose property?
 - AMHS (ATN ES)
 - AMHS Terminal (User Agent)
 - ATN Router (BIS)
 - ATN Network (domestic)
 - ATN Network (international)
 - ATN ES for Air/Ground Application
 - Air/Ground Subnetwork
- Regional ATN Backbone
 - AMHS
 - AIDC
 - Air/Ground

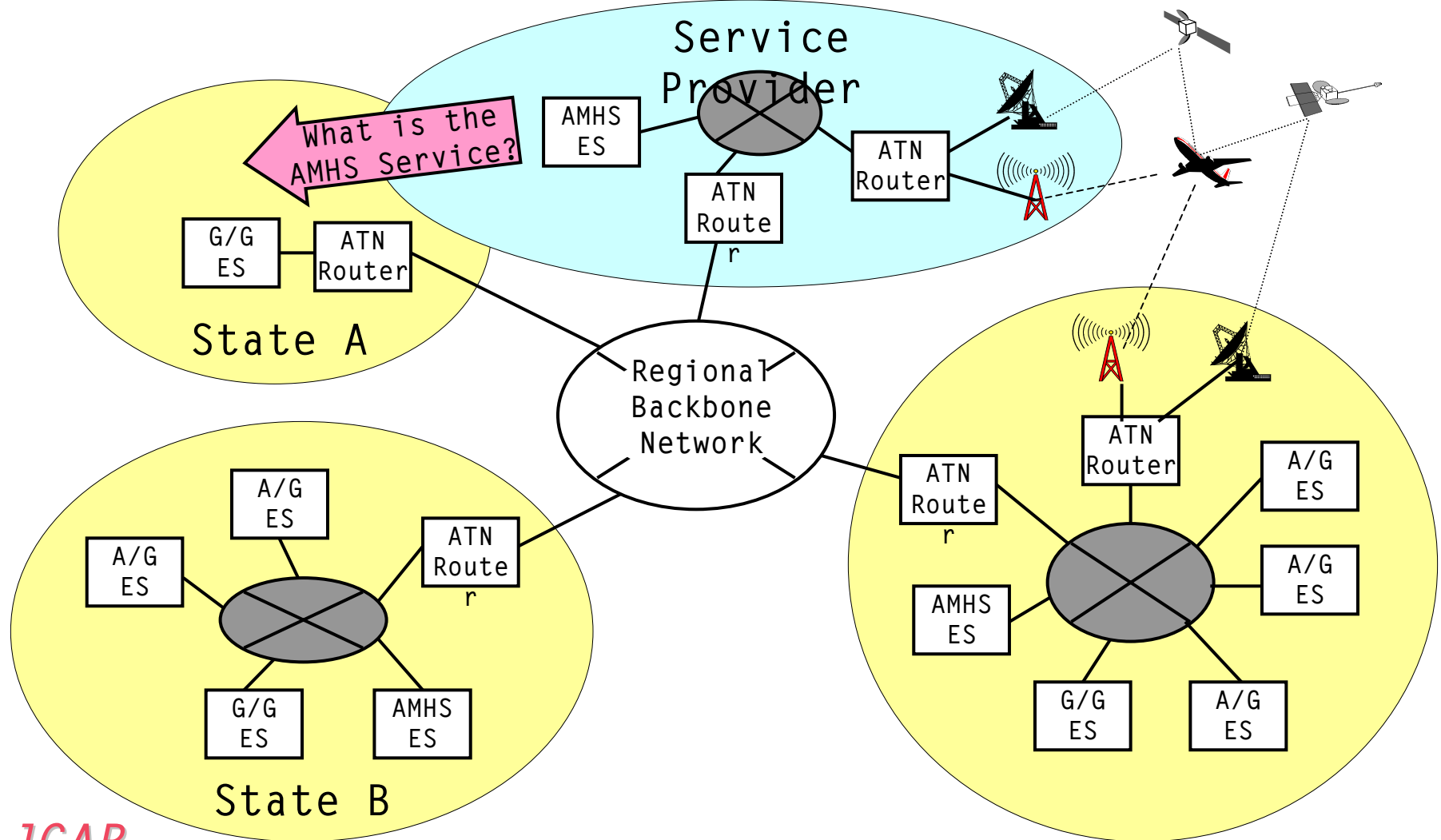
Some Considerations

- Whose property? (ATN Concept) : one example



Some Considerations

- Whose property? : one example



Further Issues

- IP as an ATN Subnetwork
 - IPv4 or IPv6
 - Security Issues
- AMHS fully based on the IP
 - Who will agree the Non ICAO ATN specification
 - More investigation, even if Non ICAO ATN
 - Interoperability between ATN/AMHS and IP/AMHS
 - Migration from AFTN to IP/AMHS (Gateway?)
 - When the SARPs will be completed?
 - Cost Benefit Analysis
- Next ATNP WG



Conclusions

- Make sure which he is speaking
 - Fully ATN Based Communication : ATN Compliant
 - KEYWORDS: ATN Stack, OSI, CNLP, TP4
 - Fully IP Based Communication : NOT ATN Compliant
 - KEYWORDS: IP in lieu of ATN, IP Stack, TCP/IP
 - IP as an ATN Subnetwork : ATN Compliant
 - KEYWORDS: Tunneling, Capsulation
(Encapsulation/Decapsulation)
- Watch the further activities by ATNP WG on the IP
- Remember the ATN policy
 - Common infrastructure for all the ATN application
 - Regional ATN Backbone is the common network for ATN
 - End to End Connection
 - Between one ATN End System and another ATN End System