RINA
JAK JI CHÁPU JÁ!

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INTRODUCTION

- Motivation
- Step-by-step evolution

PROBLEMS

- DFZ Routing Table growth
  - maximal state vs. minimal state
- Kludged multihoming
  - IP address names interface
- Cumbersome mobility
  - MobileIP is not really easy to deploy
- Congestion control is not done as close to resource
  - TCP treats any message lost as congestion
- Inefficient QoS

- LISP, HIP, ILNP, HAIR, RANGI, hIPv4, NBS only band-aids
- RINA as clean slate architecture

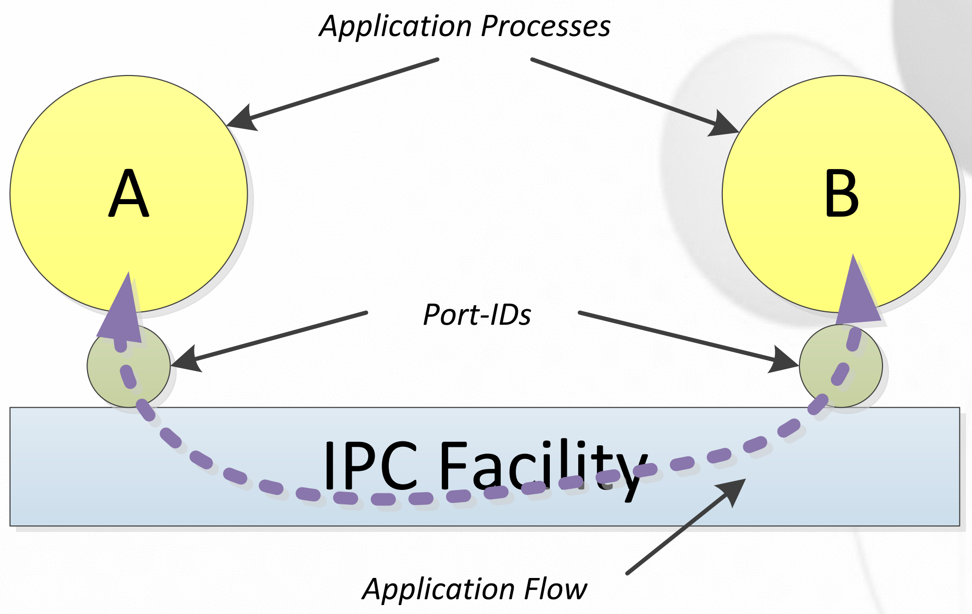
Intro

RINA

Example

PRISTINE

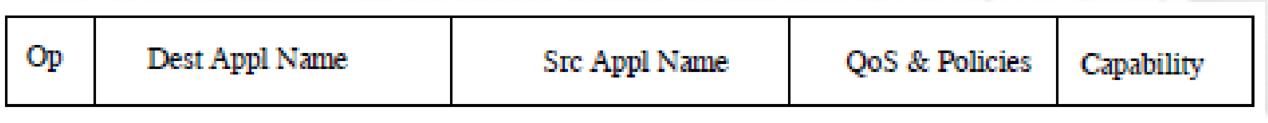
TWO APPS COMMUNICATING IN THE SAME SYSTEM



1) A invokes IPC to create a channel to B; a = Allocate (B, QoS)
2) IPC determines whether it has the resources to honor the request.
3) If so, IPC allocates port-id a and uses “search rules” to find B and determine whether A has access to B.
4) IPC may cause an instance of B to be created. B is notified of the IPC request from A and given a port-id, b.
5) If B responds positively, and IPC notifies A (the API could be blocking in which case the assignment of the port-id, a would be done now).
6) 6) Thru n) Then using system calls A may send PDUs to B by calling Write(a, buf), which B receives by invoking Read(b, read_buffer)
7) When they are done one or both invoke Deallocate with the appropriate parameters

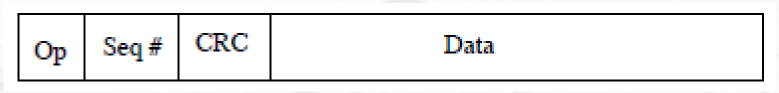
TWO APPS COMMUNICATING IN DISTINCT SYSTEMS

- Management of name space is no longer under the control of a single system
  - Each system no longer knows all available applications
  - Local Access Control can no longer be relied on to provide adequate authorization and authentication
- Need a protocol to carry application names and access control information - IPC Access Protocol (IAP)
  - Simple Request/Response Protocol

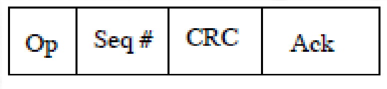


Op	Dest Appl Name	Src Appl Name	QoS & Policies	Capability

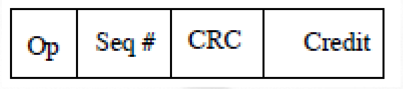
- We need some kind of Protocol for Error and Flow Control (EFCP)
  - Bad things can happen to messages in transit
  - Protection against lost or corrupted messages
  - Receiver must be able to tell sender, it is going too fast



Op	Seq #	CRC	Data

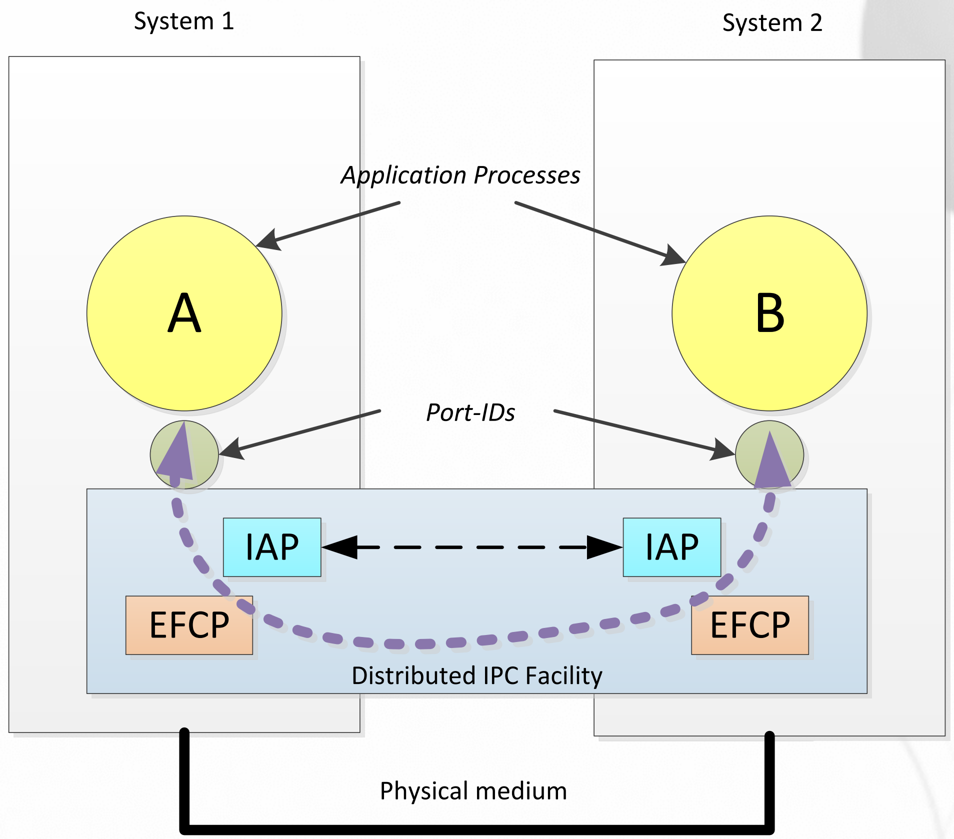


Op	Seq #	CRC	Ack



Op	Seq #	CRC	Credit

Two apps communicating in distinct systems



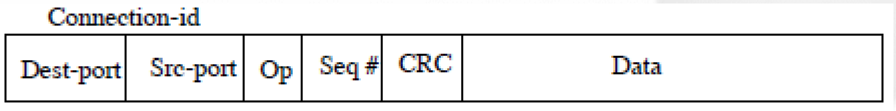
1) A invokes IPC to create a channel to B; a = **Allocate** (B, QoS);
2) IPC determines whether it has the resources to honor the request.
3) Send IAP Request to access B, creating an EFCP connection and determines if A has access to B.
4) IPC may cause B to be instantiated. B is notified of the IPC request from A and given a port-id, b.
5) If B responds positively, and IPC notifies A with a different port-id, a.
6) 6) Thru n) Then using system calls A may send PDUs to B by calling **Write(a, buf)**, which B receives by invoking **Read(b, read_buffer)** over the EFCP connection
7) When they are done one or both invoke Deallocate with the appropriate parameters

TWO APPS COMMUNICATING IN DISTINCT SYSTEMS

- An Application Name Space that spans both systems
  - Should be location-independent in general so that applications can move.
- A Protocol to carry Application Names and access control info
  - Applications need to know with whom they are talking
  - IPC must know what Application is being requested to be able to find it.
    - For now, if the requested Application isn't local, it must in the other system.
- A Protocol that provides the IPC Mechanism and does Error and Flow Control.
  - To maintain shared state about the communication, i.e. synchronization
  - To detect errors and ensure order
  - To provide flow control
- Resource allocation can be handled for now by either end refusing service.

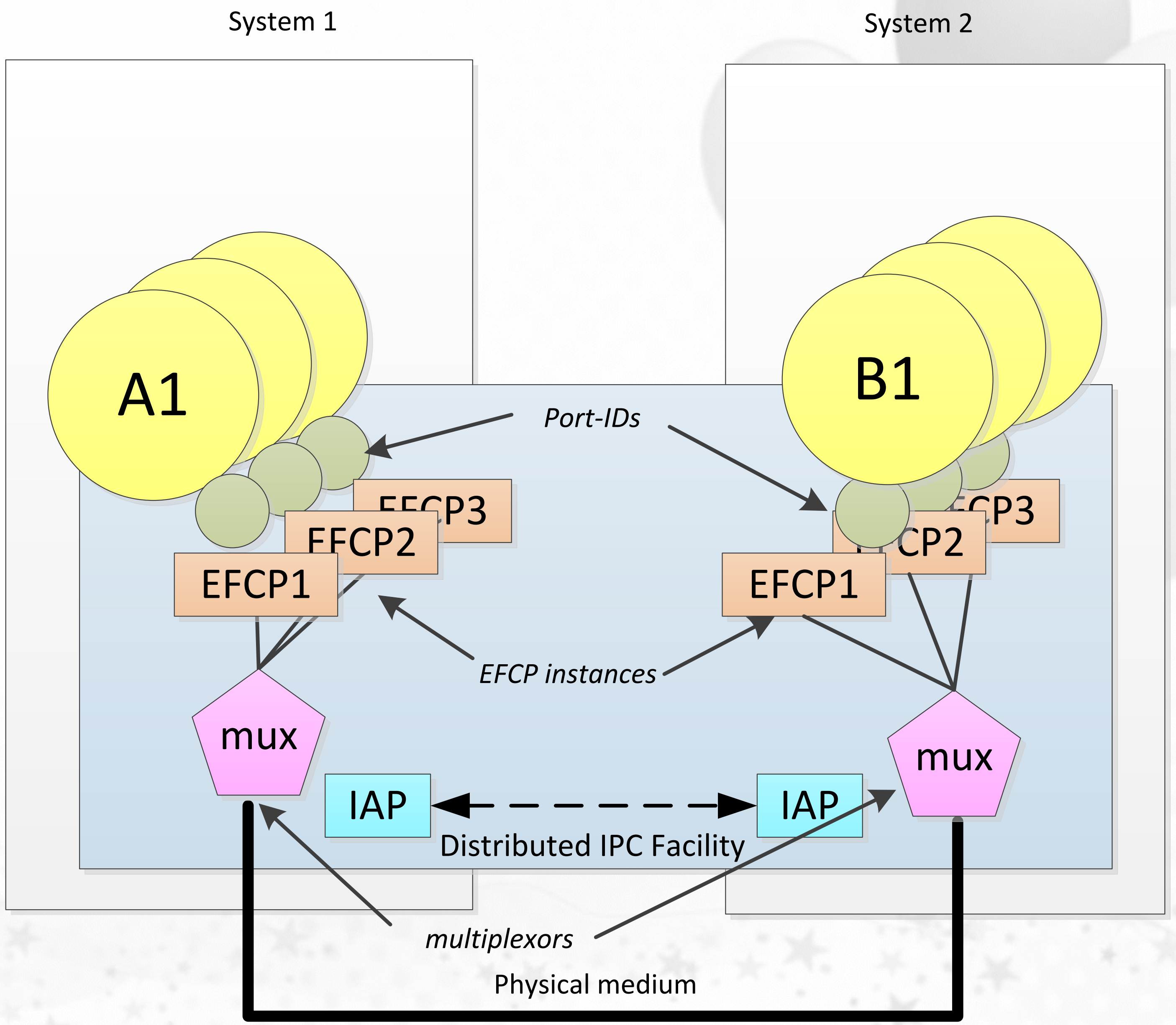
Simultaneous Commun. Between 2 Systems

- Multiple instances of the EFCP
  - Add the ability in EFCP to distinguish one flow from another



  - Include the port-ids in the information sent in IAP to be used in EFCP synchronization (establishment).
- Need for application to manage multiple users of a single resource (mux)
  - The multiplexing application will need to be fast, its functionality should be minimized, i.e. just the scheduling of messages to send.
  - To provide QoS, we use the EFCP and scheduling by the Mux.
- Application naming gets a bit more complicated than just multiple application-names
  - Must allow multiple instances of the same process

Simultaneous Commun. Between 2 Systems

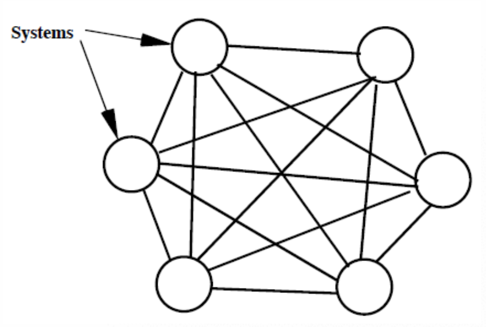


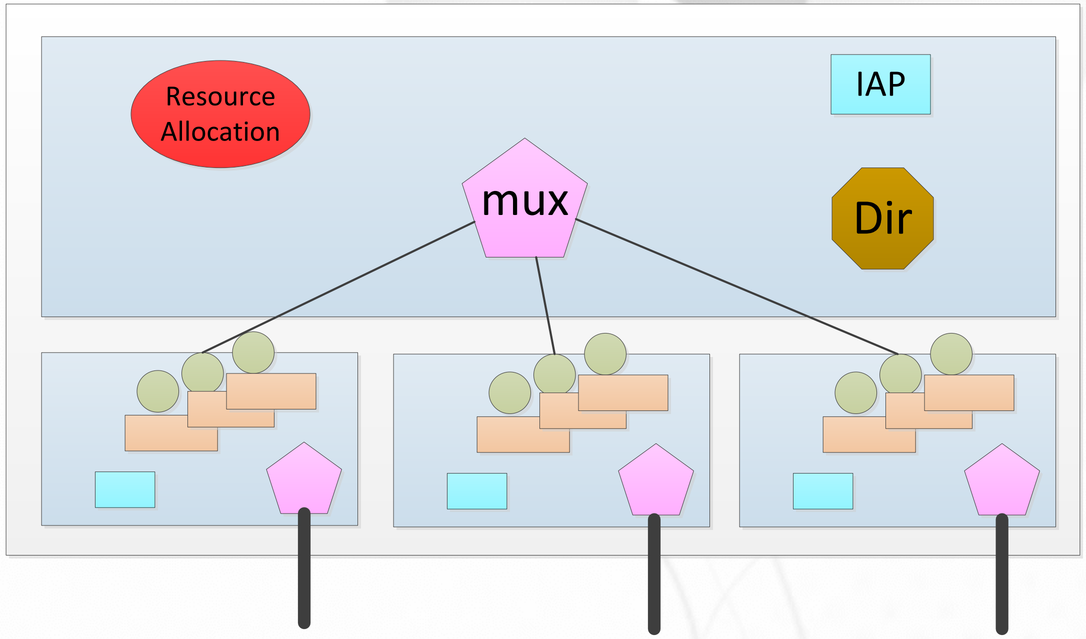
Communication with N Systems

- IPC can find the destination by choosing the appropriate interface.
- If enough applications, create a Directory to remember what is where, i.e. what application names are at the other end of which interfaces.
- We can organize interface IPC into modules of similar elements
- Each one constitutes a Distributed IPC Facility of its own.
  - As required, consists of IAP, EFCP, Multiplexing Application, Directory, Per-Interface Resource Allocation
- Need an application to manage their use and moderate user requests.

Communication with N Systems

- Full-mesh network





- Hence, dedicating systems to IPC, reduce the number of lines required and even out usage by recognizing that not everyone talks to everyone else the same amount

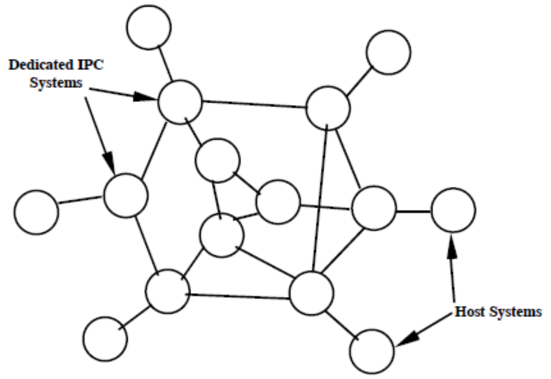
Intro

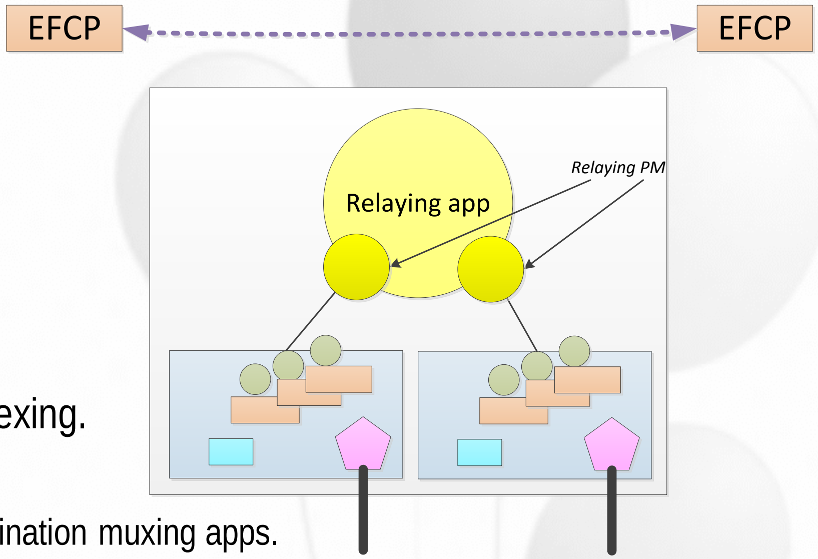
RINA

Example

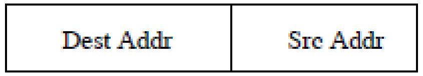
PRISTINE

COMMUNICATION ON THE CHEAP





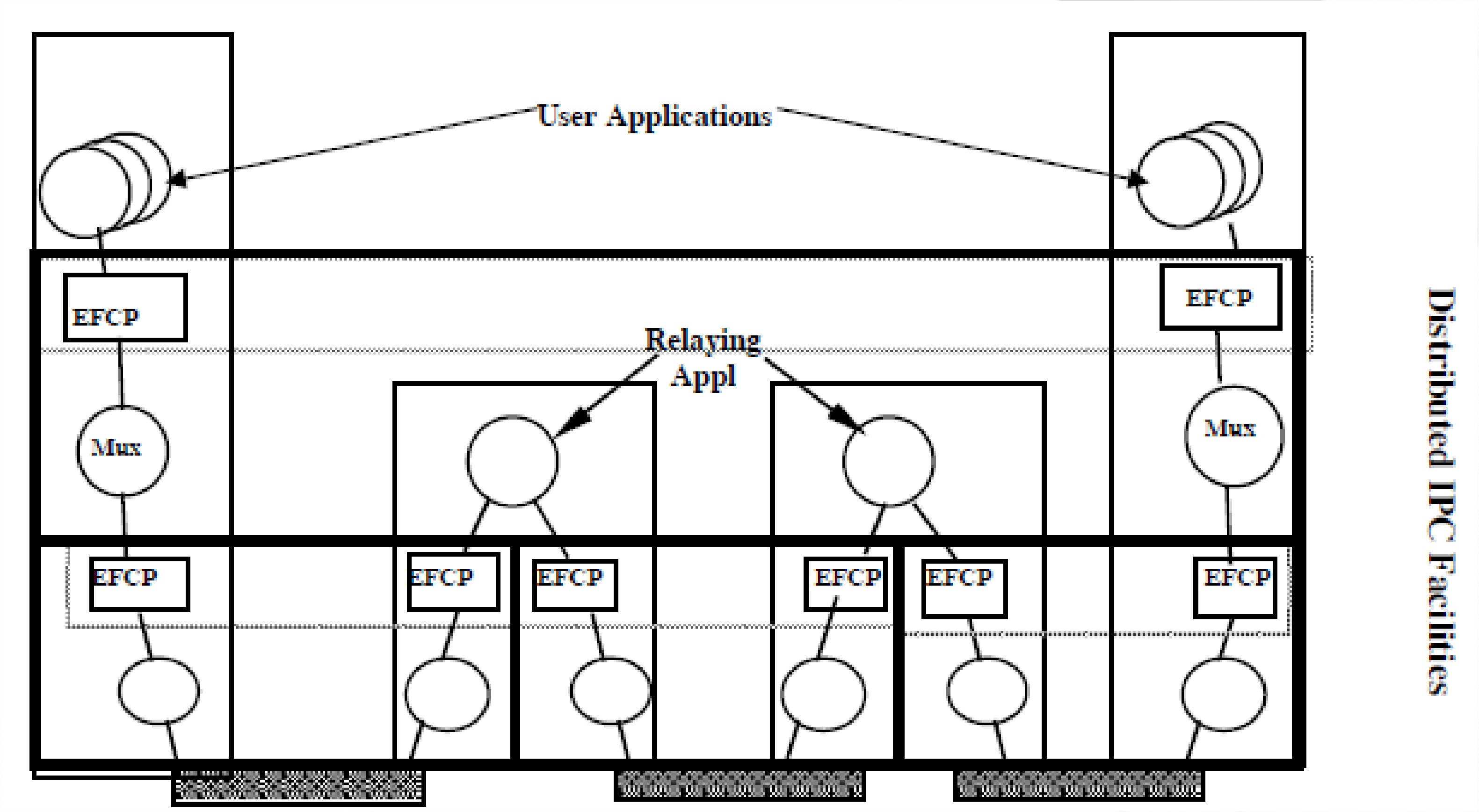
- Need systems dedicated relaying and multiplexing.
- That requires some new elements:
  - Globally accepted names for source and destination muxing apps.
  - And also for the relays. Relays require names for routing. Have to know where you are to determine where to go next.
  - Need routing applications too, which will need to exchange information on connectivity.
- Need a header on all PDUs to carry the names for relaying and multiplexing.
  - Interface IPC Facilities will need one too if they are multiple access.



Dest Addr	Src Addr

- But relaying systems create problems too
  - Can't avoid momentary congestion from time-to-time.
  - Annoying bit errors can occur in their memories.
- Will have to have an EFCP operating over the relays to ensure required QoS reliability parameters

IPC Model



- A layer is a distributed application that manges IPC consisting of a collection of SDU protection, muxing, EFCP, and their associated routing and resource management tasks.

RECURSIVE INTERNETWORK ARCHITECTURE

- Principles
- DIF
- Naming
- DAF
- IDD
- CDAP
- IPC components

RINA PRINCIPLES

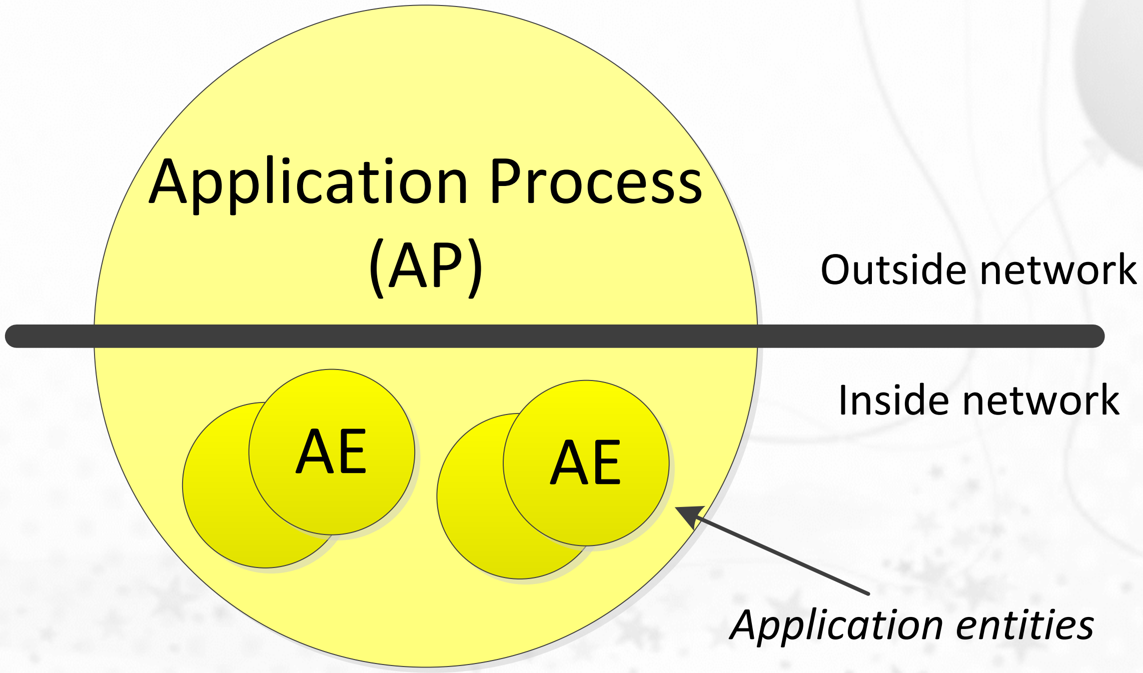
1) Resolving CO/CL
2) Nature of applications and protocols
3) Watson’s Synchronization
4) Separating Mechanism and Policy

1) CO vs. CL

- Connection oriented vs Connection-less is a function of the layer and it should not be visible to applications
  - Connectionless is characterized by the maximal dissemination of state information and dynamic resource allocation.
  - Connection-oriented mechanisms attempt to limit dissemination of state information and tends toward static resource allocation.
- Applications request the allocation of comm resources, the layer determines what mechanisms and policies to use.
  - Tends toward CO when traffic density is high and deterministic.
  - CL when traffic density is low and stochastic.

2) Applications

- The **Application-Entity (AE)** is that part of the application concerned with communication, i.e. shared state with its peer.
  - An Application Process may have multiple AEs, they assumed, for different application protocols.
- The rest of the **Application Process (AP)** is concerned with the reason for the application in the first place.



2) Application Protocol

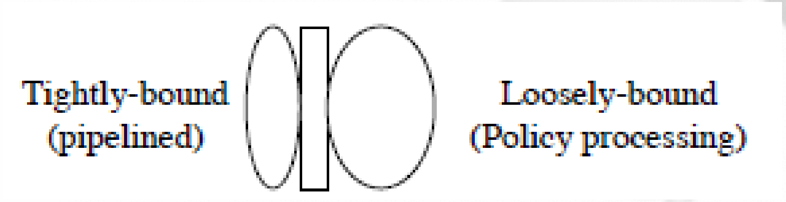
- All application protocols are stateless, the state is in the application
- Application protocols modify state outside the protocol.
- Everything is just an object outside the protocol
- There is only one application protocol – **Common Distributed Application Protocol CDAP**
- CDAP contains six primitive commands:
  - Read/Write
  - Create/Delete
  - Start/Stop
- Each set of objects yields different AE
  - One protocol, potentially shared objects, different state machines

3) Synchronization

- Delta-T assumes
  - all connections exist all the time
  - decoupling of “port allocation” from synchronization
- Watson proves that the conditions for distributed synchronization are met if and only if 3 timers are bounded:
  - Maximum Packet Lifetime
  - Maximum number of Retries
  - Maximum time before Ack
- Thus no explicit state synchronization, i.e. hard state, is necessary (SYNs, FINs are unnecessary)
- All properly designed data transfer protocols are soft-state.

4) Structure of Protocols

- Separation of mechanism and policy

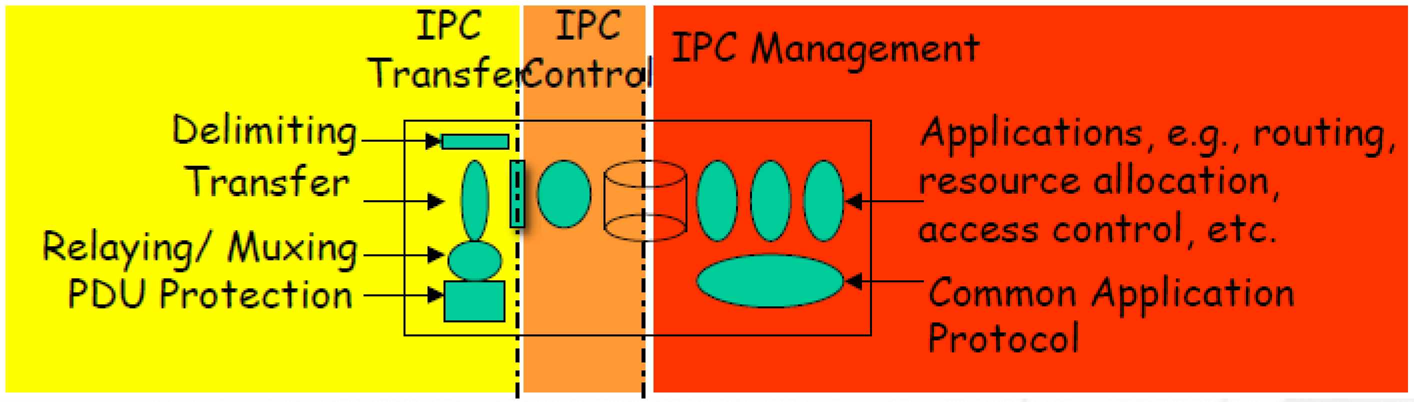


- Two kinds of mechanisms:
  - Tightly-Bound: Those that must be associated with the Transfer PDU; policy is imposed by the sender.
  - Loosely-Bound: Those that don't have to be; policy is imposed by the receiver.
- Furthermore, the two are only loosely coupled through a state vector.
- There is one data transfer protocol with a small number of encodings (called DTP+DTCP that perform EFCP)

RINA Implications

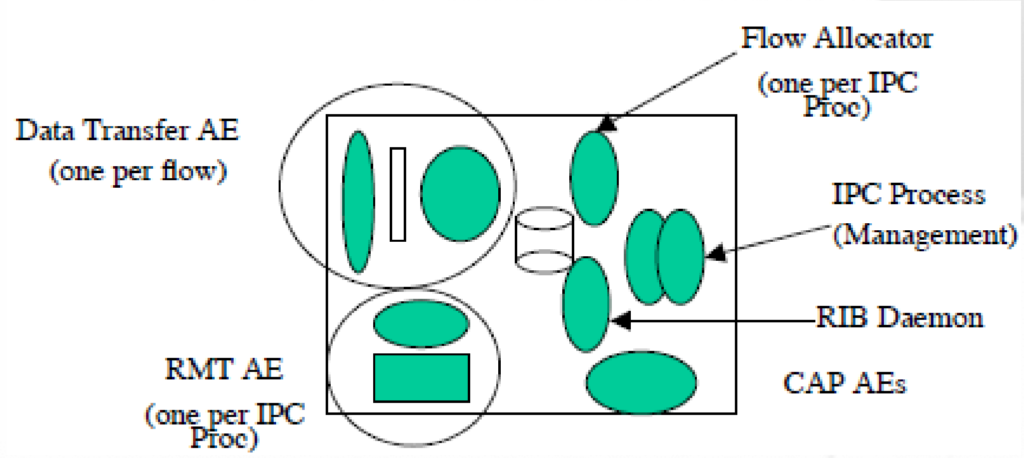
- Data Transfer Protocols modify state *internal* to the Protocol and Application Protocols modify state *external* to the protocol.
- A Layer provides IPC to either another layer or to a Distributed Application using a programming model. The application protocol is the "assembly language" for distributed computing.
- "Hard state" only occurs for some uses of application protocols
  - Storing in a database *may* be hard-state. Everything else is soft-state.
- Separating mechanism and policy in a delta-t like protocol will yield the entire range from UDP-like to TCP-like.

IPC Process


IPC Transfer
IPC Control
IPC Management
Delimiting
Transfer
Relaying/ Muxing
PDU Protection
Applications, e.g., routing, resource allocation, access control, etc.
Common Application Protocol

- Processing at 3 timescales, decoupled by either a **State Vector** or a **Resource Information Base**
- **IPC Transfer** actually moves the data (≈ IP + UDP)
- **IPC Control** (optional) for retransmission (ack) and flow control
- **IPC Layer Management** for routing, resource allocation, locating applications, access control, monitoring lower layer

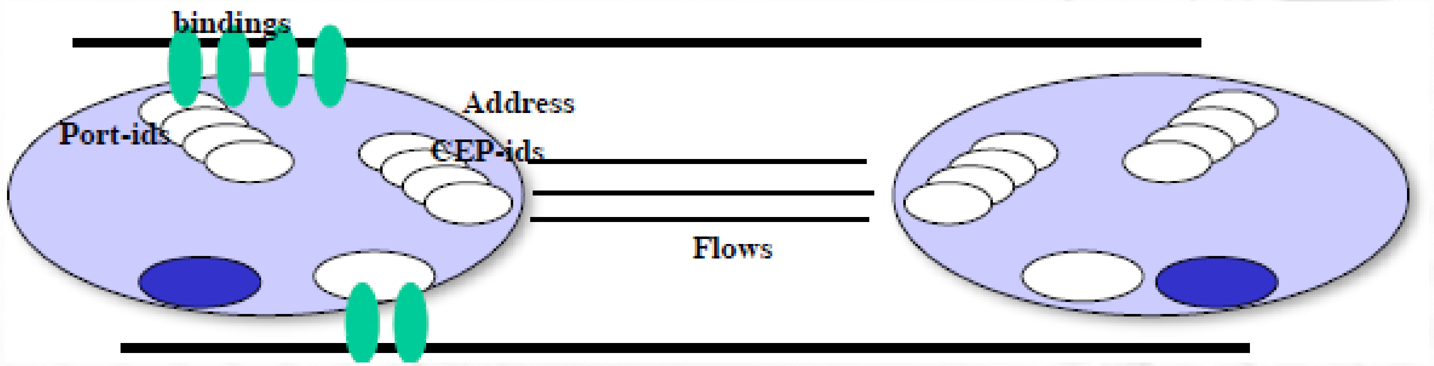
Elements of IPC Process



- Managing IPC means
  - Resource Allocation
  - Maintaining a Resource Information Base
  - Routing
  - Security Management
- **Flow Allocator** manages flows, finds the destination and does access control, manages the binding of connection-endpoint-ids to port-ids.
- **Data Transfer AE** is the error and flow control protocol
- **Relaying/Multiplexing Task (RMT) AE** consists of the relaying and multiplexing task and SDU Protection
- **RIB Daemon** maintains the local RIB information.

IPC Process Naming

- IPC process has an unambiguous **Application Process Name (APN)**, commonly called *address*
- Flow allocator AE instance id (FAI) a.k.a. **port-id**
  - *port-id* is the handle returned to the calling application to refer to this instance of communication, unique within its AE
- Data Transfer AE instance id a.k.a. **CEP-id**
  - *connection-endpoint-id* (CEP-id) identifies the shared state of one end of a flow/connection, unique within its AE
  - *connection-id* identifies flows between the same two IPC Processes, formed by concatenating CEP-ids, unique within the pair



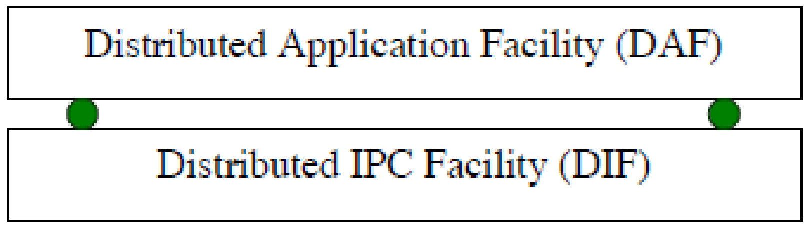
- **Distributed Application Name (DAN)** is globally unambiguous name for the set of all Application Processes in a Distributed Application, e.g. DIF

Naming Summary

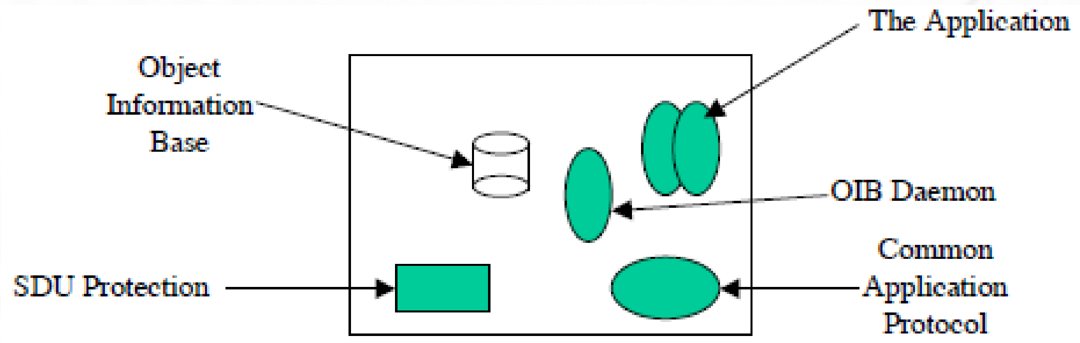
Common Term	Scope	Application Term
Application Process Name (APN)	Global (unambiguos)	Application Process Name
Address	Layer (unambiguous)	Synonym for IPC Process' Application Process Name
Port-id	Allocation AE (unique)	Allocation AE-Instance-Identifier
Connection-endpoint-identifier	Data Transfer AE (unique)	Data Transfer AE Instance-Identifier
Connection-id	Src/Dest Data Transfer AE (unique)	Concatentation of data-transfer-AE-instance-identifiers
DIF Management Updates	IPC Process (unambiguous)	AE-identifier

DIF AND DAF

- DIF a.k.a. Distributed IPC Facility (layer) is a distributed application that does IPC
  - System may be member of 0-n DIFs
  - System has IPC process for every DIF
- DAF a.k.a. Distributed Application Facility
  - DAF uses DIF to obtain IPC services

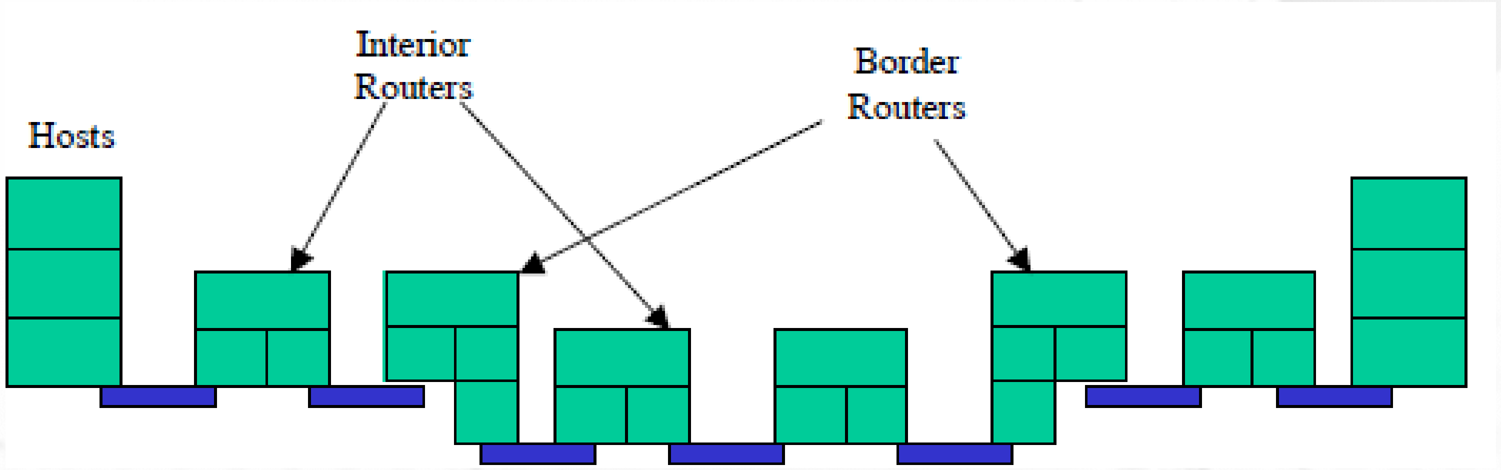

Distributed Application Facility (DAF)
Distributed IPC Facility (DIF)

  - Elements common to DIF and DAF that do not do IPC



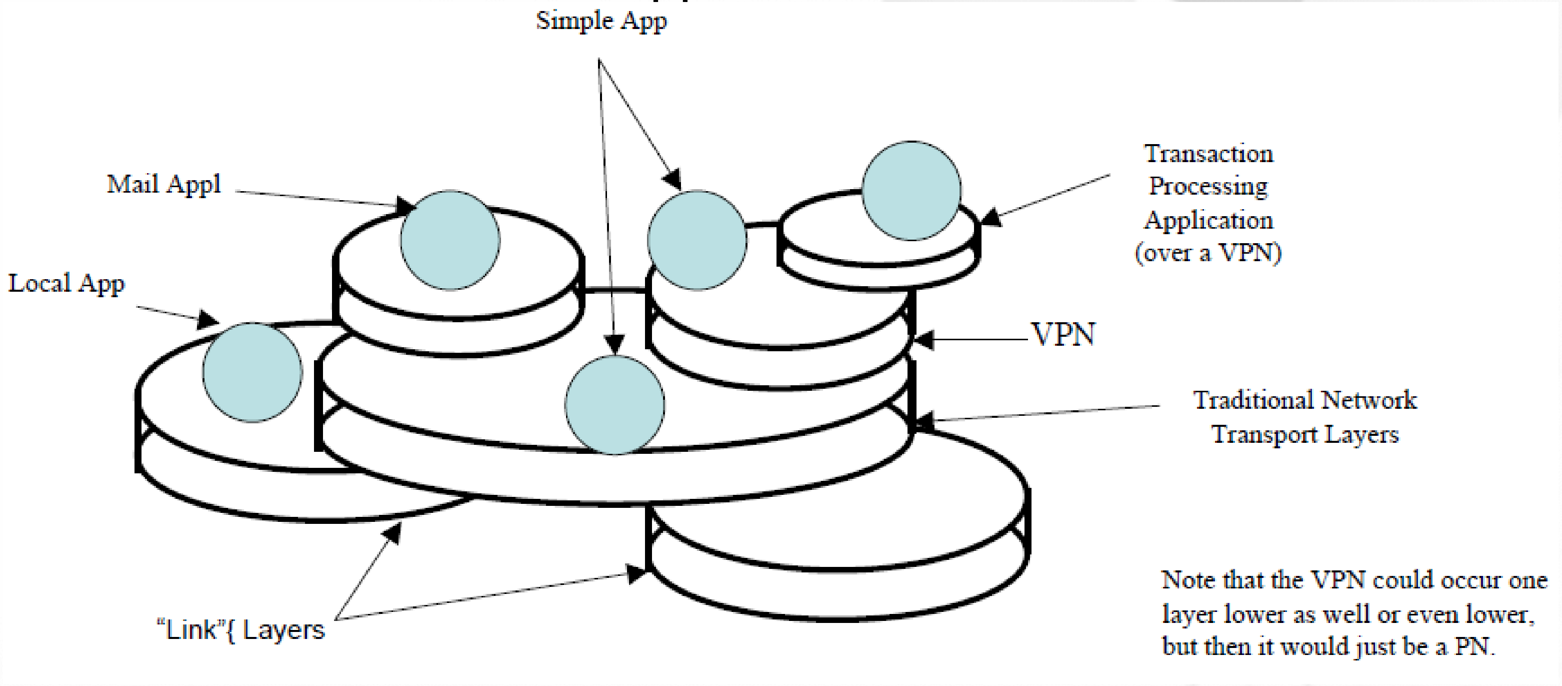
RINA Nodes

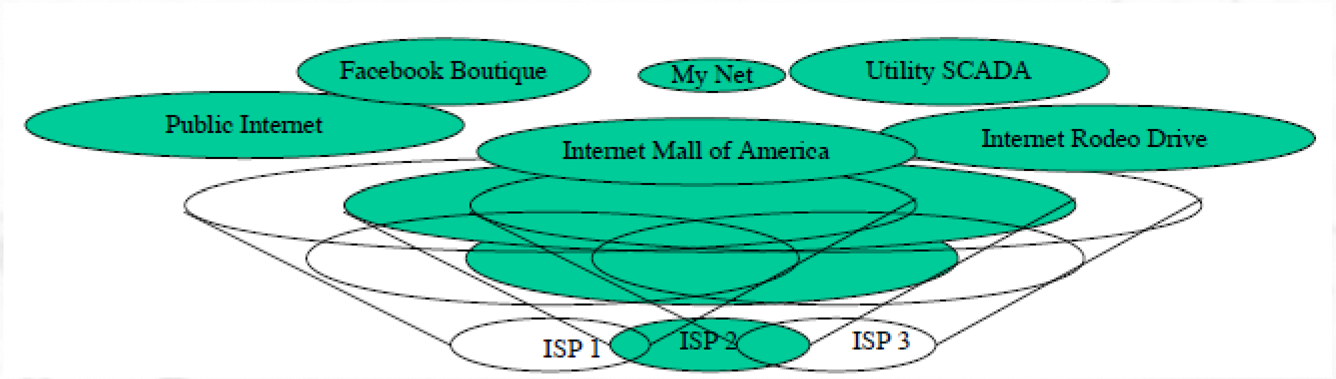
- Hosts running applications
  - members of DAF
- Interior routers
  - dedicated IPC processes providing relaying between DIF members
- Border routers
  - providing relaying between different DIFs



DIF'S INTERNET

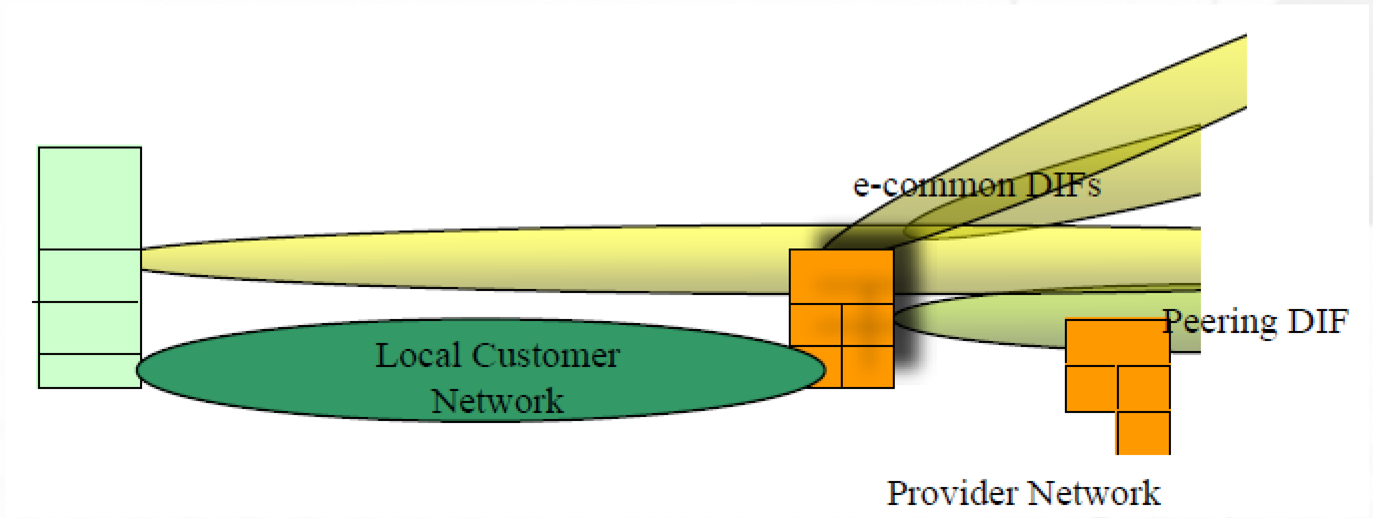
- User Applications use whatever layer has sufficient scope to communicate with their apposite


Simple App
Mail Appl
Transaction Processing Application (over a VPN)
Local App
VPN
Traditional Network Transport Layers
"Link"{ Layers
Note that the VPN could occur one layer lower as well or even lower, but then it would just be a PN.



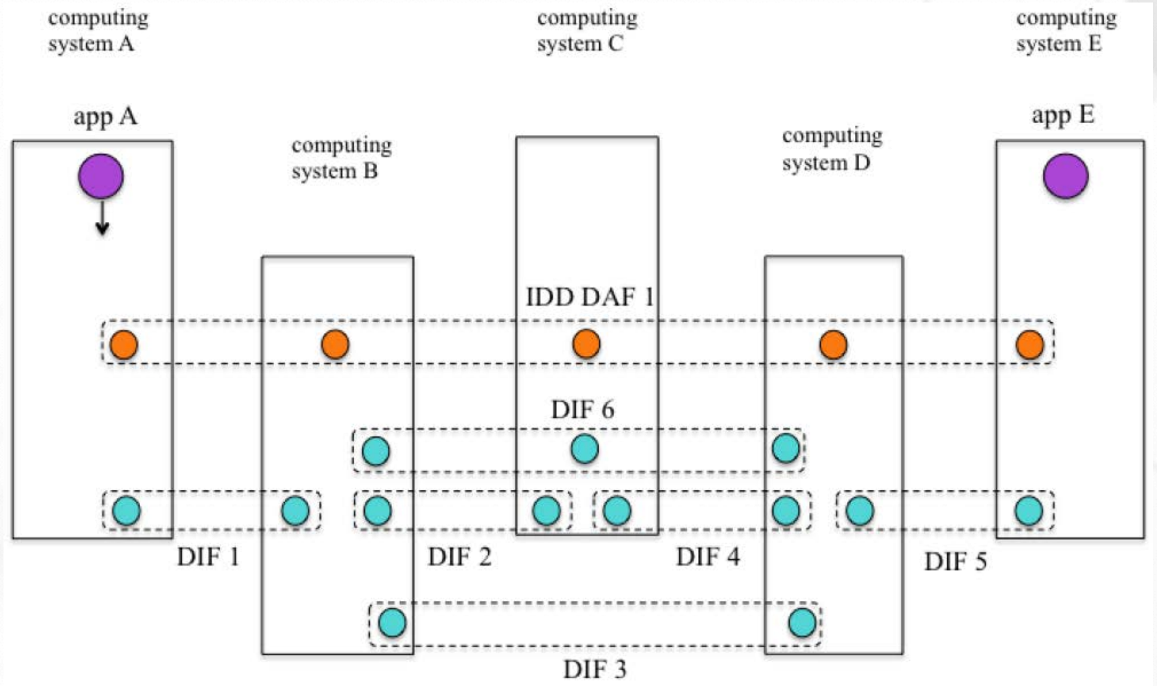
HOST PERSPECTIVE ON DIF'S INTERNET

- A Customer Network has a border router that makes several e-malls available.
- A choice can be made whether the entire local network joins, a single host or a single application.

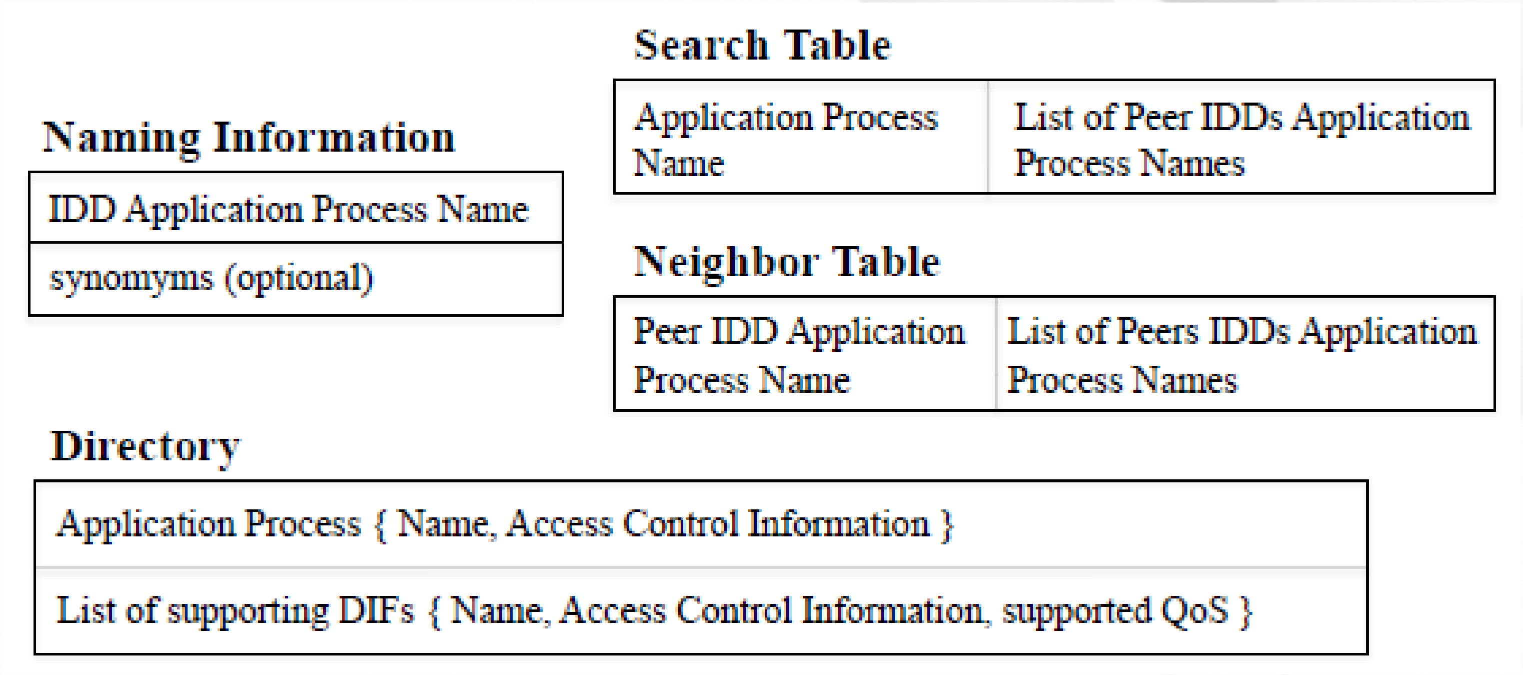


Choosing a Layer

- Hosts do not have to see all of the wires or all the “Nets” either
- Need for directory service
  - database that maintains mappings between two name spaces
  - mappings of application names to list of supporting layers (DIFs)
- InterDIF Directory (IDD)
  - Responsible for two main distinct functions:
  - a) Discovery of the application;
  - b) Creation of the supporting DIF;



IDD Information



Naming Information

IDD Application Process Name
synomyms (optional)

Search Table

Application Process Name	List of Peer IDDs Application Process Names

Neighbor Table

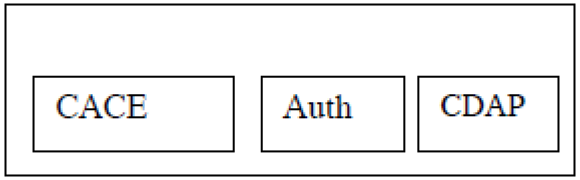
Peer IDD Application Process Name	List of Peers IDDs Application Process Names

Directory

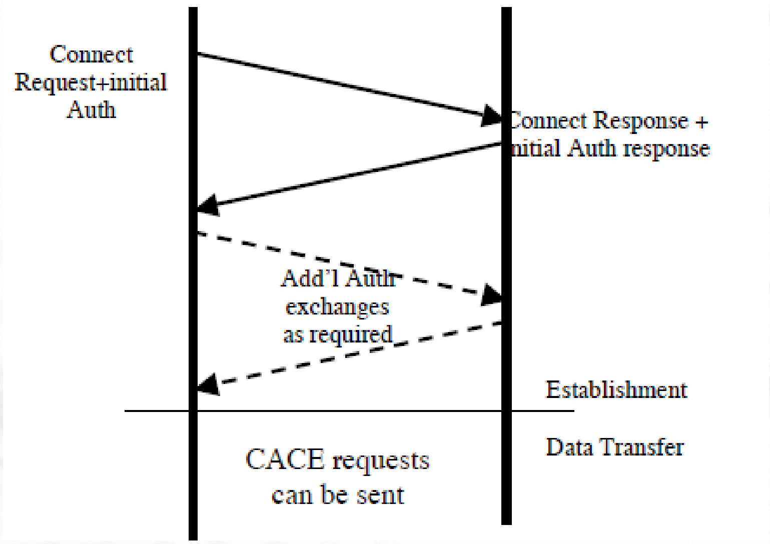
Application Process { Name, Access Control Information }
List of supporting DIFs { Name, Access Control Information, supported QoS }

CDAP

- The Basic Form consists of three components:
  - the common application connection establishment (CACE), based on ACSE
  - the authentication module (Auth)
  - CDAP, based on CMIP



- Three primary objectives
  1) Joining a DIF (Establishing a management connection between an new IPC Process and the members of the DIF, authenticating it, initializing it, and assigning it a forwarding-id)
  2) Maintaining Resource Information Base
  3) Flow Allocation
- DAF asks DIF to allocate flow, then sets up application connection

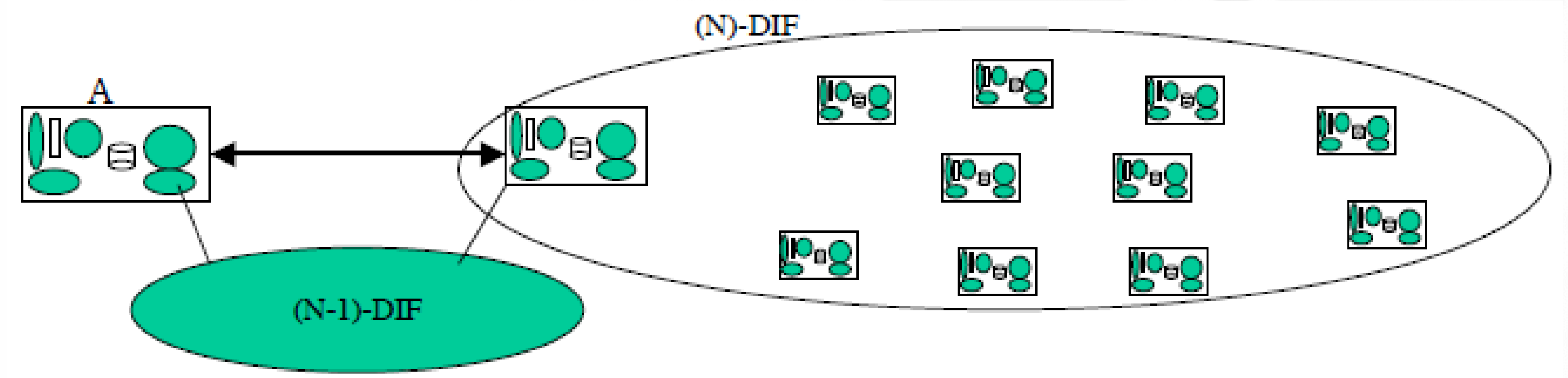

Connect Request+initial Auth
Connect Response + initial Auth response
Add'l Auth exchanges as required
Establishment
Data Transfer
CACE requests can be sent

THREE PHASES OF COMMUNICATION

- Enrollment
  - Operations to create sufficient state within the network to allow an instance of communication to be created.
- Allocation also known as **Establishment**
  - Operations required to allocate an instance of communication creating sufficient shared state among instances to support the functions of the data transfer phase
- Data Transfer
  - Operations to provide the actual transfer of data and functions which support it.

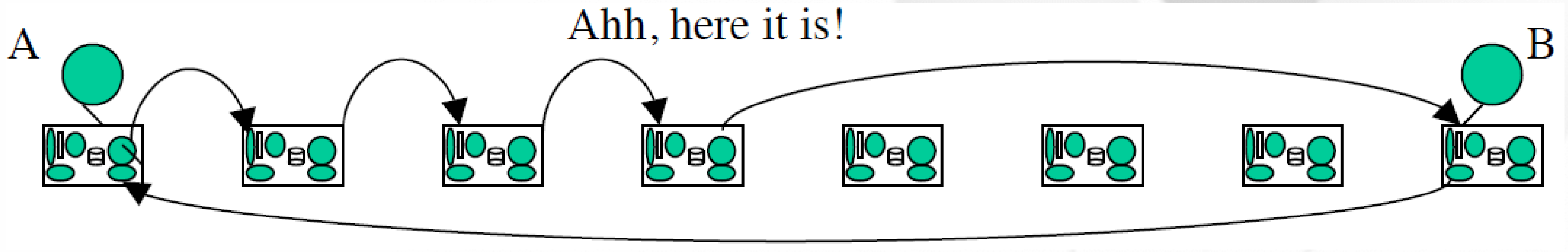
ENROLLMENT

- Joining a DIF is application establishing communication (for management)



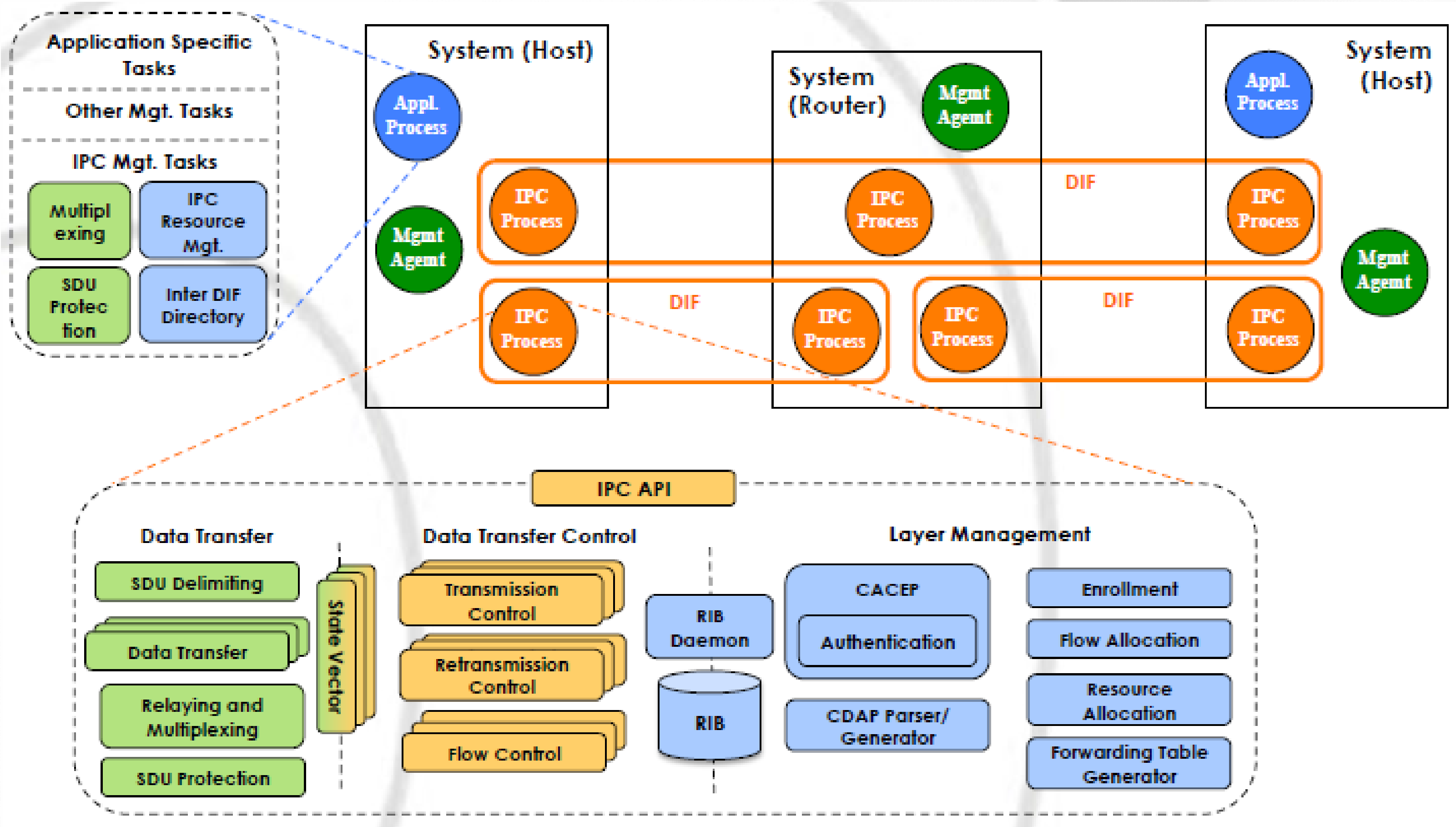
- Steps involved
  1) Authenticating that A is a valid member of the (N)-DIF
  2) Initializing it with the current information on the DIF
  3) Assigning it a synonym to facilitate finding IPC Processes in the DIF, i.e. an address

ESTABLISHMENT



- Steps involved
  1) A asks IPC to allocate communication resources to B
  2) Determine that B is not local to A use search rules to find B
  3) Keep looking until we find an entry for it.
  4) Then go see if it is really there and whether we have access.
  5) Then tell A the result.

ELEMENTS OF IPC PROCESS REVISITED



DELIMITING

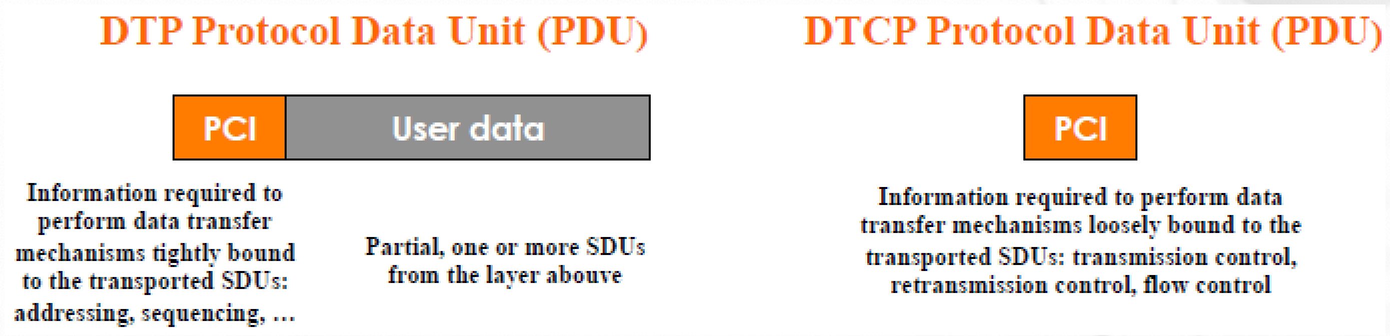
- IPC may fragment or combine SDUs but will deliver same SDUs to the destination.
  - External and Internal Delimiting are possible.
  - For a flow that appears to be streaming, the entire flow is a single SDU and early delivery is allowed.
- This module is entirely policy.

SDU Protection

- SDU Protection is also entirely policy and may include:
  - Data Corruption Protection (CRCs or FECs)
  - Time to Live
  - Integrity and Confidentiality (encryption)
  - Compression - not really protection but this is the right place for it

EFCP = DTP + DTCP / DATA TRANSFER + REXMSN CONTROL

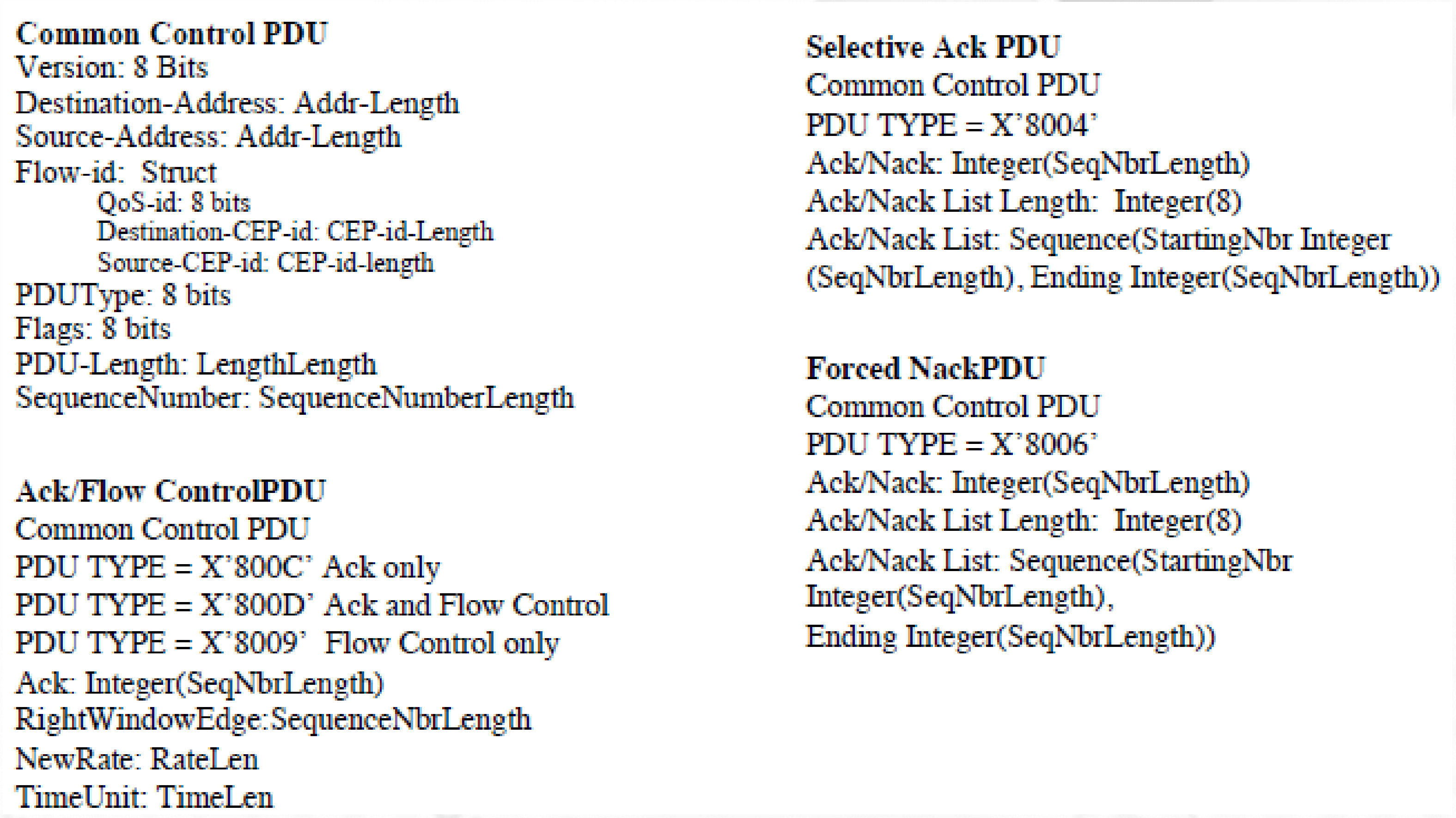
- Based on delta-t with mechanism and policy separated.
- Naturally cleaves into Data Transfer and Data Transfer Control
  - Data Transfer consists of tightly bound mechanisms
    - Roughly similar to IP+UDP
  - Data Transfer Control, if present, consists of loosely bound mechanisms
    - Flow control and retransmission (ack) control
- One instance per flow; policies driven by the QoS parameters.


DTP Protocol Data Unit (PDU)
PCI
User data
Information required to perform data transfer mechanisms tightly bound to the transported SDUs: addressing, sequencing, …
Partial, one or more SDUs from the layer abouve
DTCP Protocol Data Unit (PDU)
PCI
Information required to perform data transfer mechanisms loosely bound to the transported SDUs: transmission control, retransmission control, flow control

DTP PDU

- Version: 8 Bit
- Destination-Address: Addr-Length
- Source-Address: Addr-Length
- Flow-id: Struct
  - QoS-id: 8 Bit
  - Destination-CEP-id: Port-id-Length
  - Source-CEP-id: Port-id-length
- PDUType: 8 bits
- Flags: 8 bits
- PDU-Length: LengthLength
- SequenceNumber: SequenceNumberlength
- Sequence User-Data{DelimitedSDU* | SDUFrag}
- User data

DTCP PDU



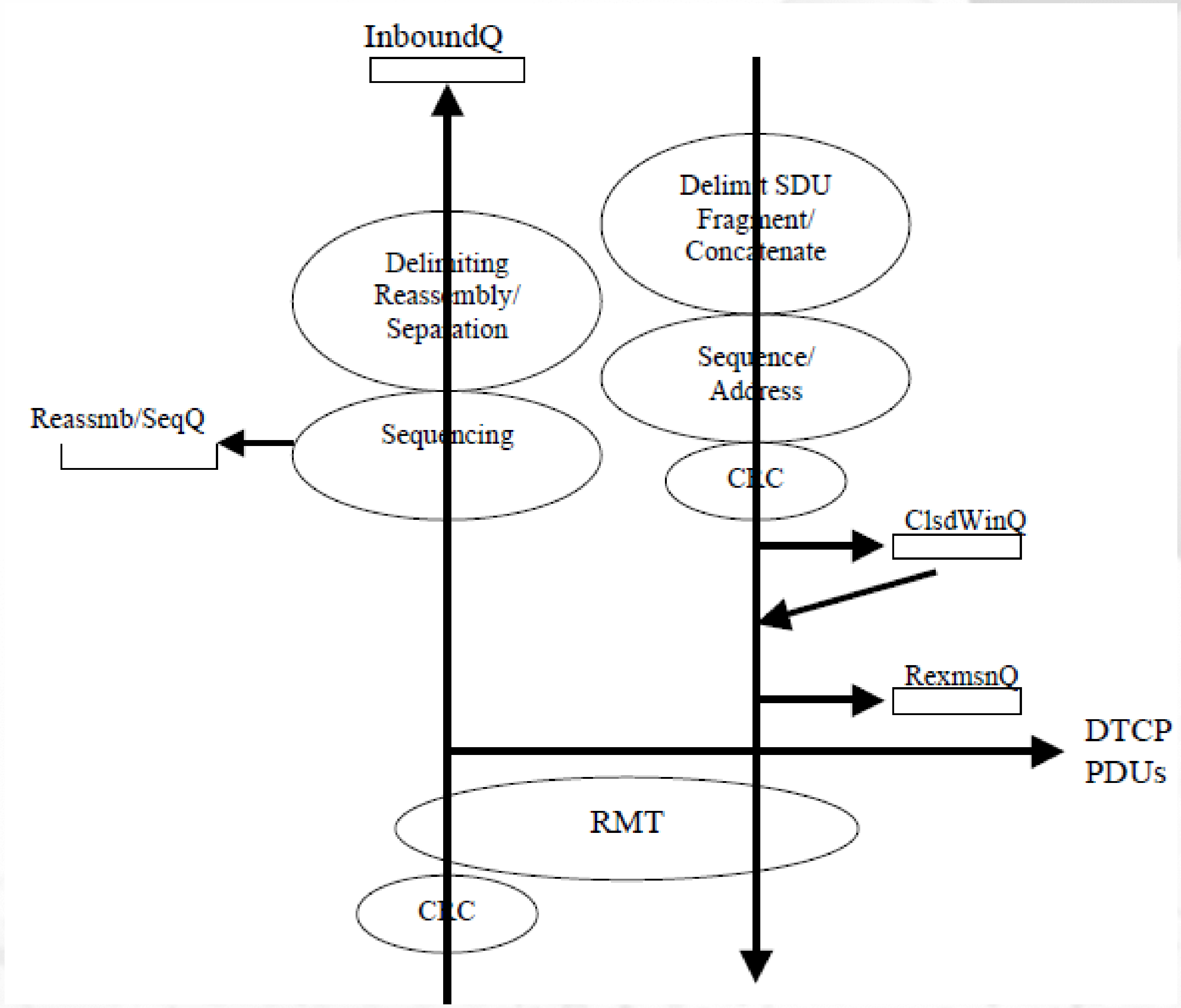
Common Control PDU
Version: 8 Bits
Destination-Address: Addr-Length
Source-Address: Addr-Length
Flow-id: Struct
    QoS-id: 8 bits
    Destination-CEP-id: CEP-id-Length
    Source-CEP-id: CEP-id-length
PDUType: 8 bits
Flags: 8 bits
PDU-Length: LengthLength
SequenceNumber: SequenceNumberLength

Ack/Flow ControlPDU
Common Control PDU
PDU TYPE = X'800C' Ack only
PDU TYPE = X'800D' Ack and Flow Control
PDU TYPE = X'8009' Flow Control only
Ack: Integer(SeqNbrLength)
RightWindowEdge:SequenceNbrLength
NewRate: RateLen
TimeUnit: TimeLen

Selective Ack PDU
Common Control PDU
PDU TYPE = X'8004'
Ack/Nack: Integer(SeqNbrLength)
Ack/Nack List Length: Integer(8)
Ack/Nack List: Sequence(StartingNbr Integer (SeqNbrLength), Ending Integer(SeqNbrLength))

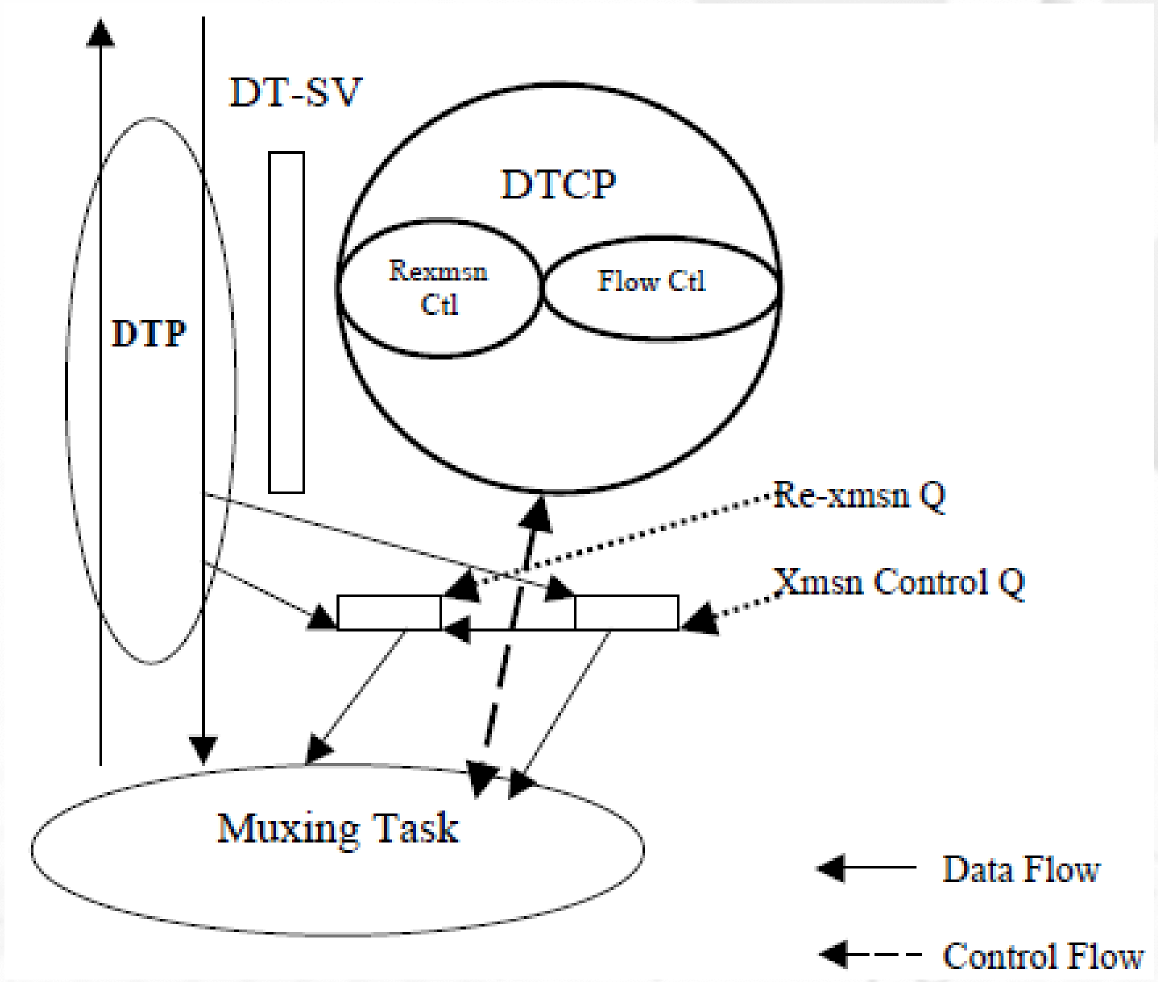
Forced NackPDU
Common Control PDU
PDU TYPE = X'8006'
Ack/Nack: Integer(SeqNbrLength)
Ack/Nack List Length: Integer(8)
Ack/Nack List: Sequence(StartingNbr Integer(SeqNbrLength), Ending Integer(SeqNbrLength))

DATA TRANSFER PATH



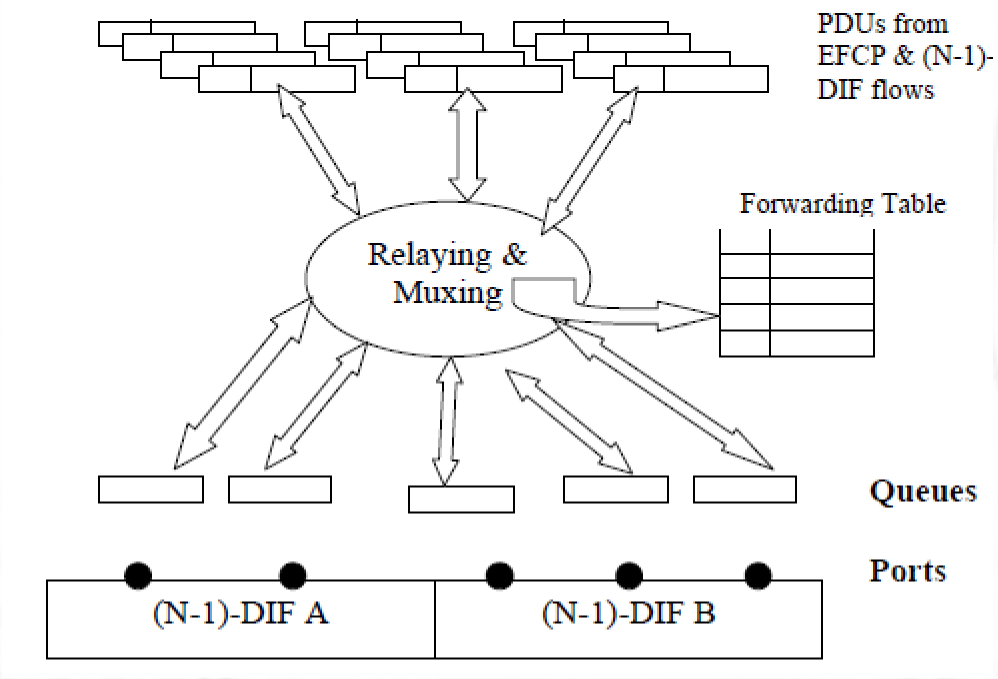
Data Transfer Control Path

- Control stays out of the main data flow.
- This module will not exist for flows that don't need it.



Relaying and Multiplexing Task RMT

- RMT multiplexes the PDUs coming from the N-flows originated at the IPC Process into one or more N-1 flows (in its multiplexing role)
- RMT forwards the incoming PDUs to another IPC Process through the adequate N-1 flow based on the PDU's destination address (in its relaying role)



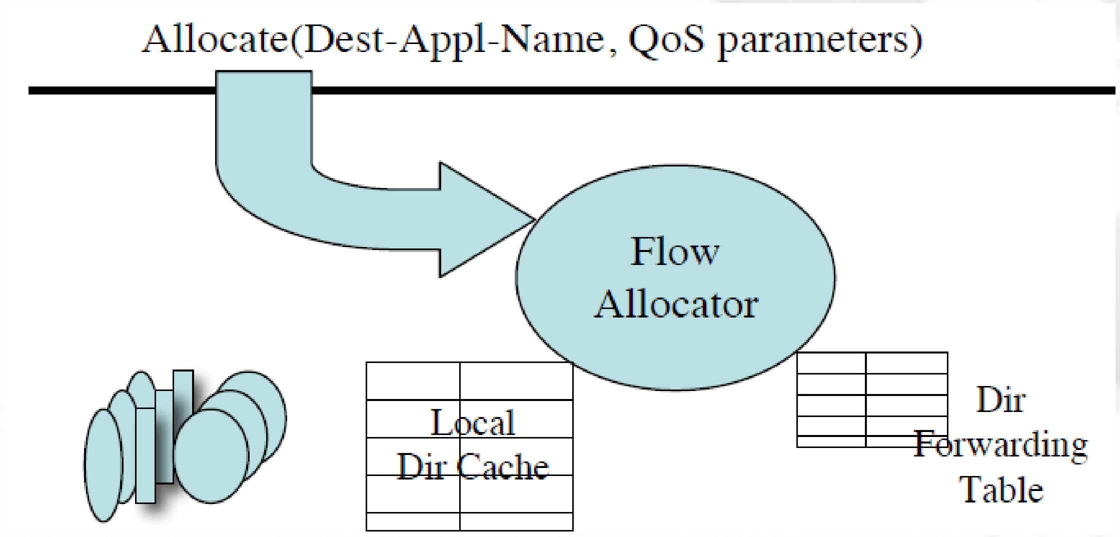
- Queues at the top are at least one per QoS Class.
- Queues at the bottom are created by the Resource Allocator and may berelated to the number of QoS Classes provided by the lower DIF.

Resource Allocator (RA)

- Component that decides how the resources in the IPC Proc. are allocated.
  - Dimensioning of the queues, creation/suspension/deletion of RMT queues, creation/deletion of N-1 flows, and others
- The RA has a set of **meters** and **dials** that it can manipulate
- The meter fall in 3 categories:
  - Traffic characteristics from the user of the DIF
  - Traffic characteristics of incoming and outgoing flows
  - Information from other members of the DIF
- The Dials
  - Creation/Deletion of QoS Classes
  - Data Transfer QoS Sets
  - Modifying Data Transfer Policy Parameters
  - Creation/Deletion of RMT Queues
  - Modify RMT Queue Servicing
  - Creation/Deletion of (N-1)-flows
  - Assignment of RMT Queues to (N-1)-flows
  - Forwarding Table Generator Output

Flow Allocator

- When Application Process generates an Allocate request, the Flow Allocator creates a flow allocator instance to manage each new flow.
- The Instance is responsible for managing the flow and deallocating the ports
  - DTP/DTCP instances are deleted automatically after 2MPL with no traffic



- When it is given an Allocate Request it does the following:
  1) It inspects the **Allocate request** and maps the parameters to the appropriate QoS Class and the associated policy set.
  2) It instantiates a DTP (and DTCP if necessary) for this flow.
  3) Checks its local directory cache for the destination application name.
     - If found, it sends a **Create Flow request** to destination address;
     - otherwise consults the **Dir Forwarding Table** and sends the **Create Flow request** to the address noted there.
  4) When it receives an **Create Flow Response** it executes an **Allocate**
     - Response API call and modifies the state of the DTP as necessary.

RIB DEAMON

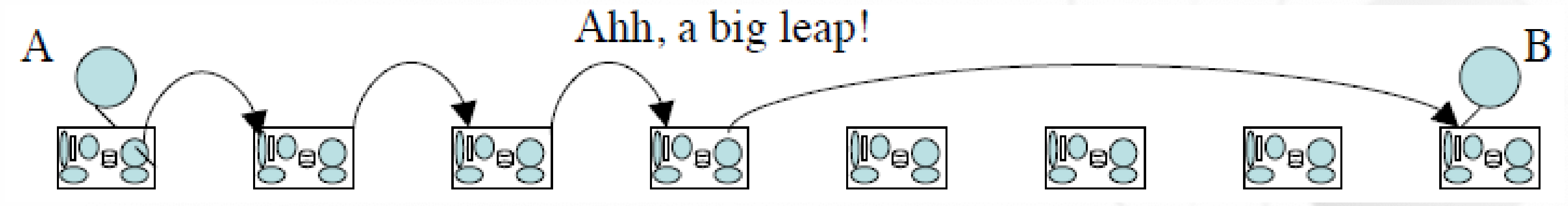
- The RIB is a logical representation of the information known by a an application process.
  - Doesn't need to be a database, the information may be stored in the different application process components.
- The RIB Daemon provides an API to perform operations on the RIB (both objects in the local RIB and objects in remote application processes' RIBs).
- Three facilities
  - routing update
  - event management
  - management agent
- Performs
  - periodically request or notify all or a subset of members of the current value of selected information (routing update);
  - upon certain events, notify all or a subset of members of the current value of selected information;
  - the latter implies that all event notifications occurring within the DIF should be delivered to the RIB Daemon because there may be a subscription that is triggered by the event, (event management);
  - given that elements of the DIF members should be able to request immediate notification of an event's arrival, have it recorded in the RIB, or both (event management);
  - if a log of events received is to be kept (the black box function), then the RIB Daemon is the natural place or it (event management);
  - given that the RIB Daemon responds to requests for information from other members of the DIF, then it is the natural place to respond to external requests for information from the DIF Management System (DMS), (management agent).

Examples

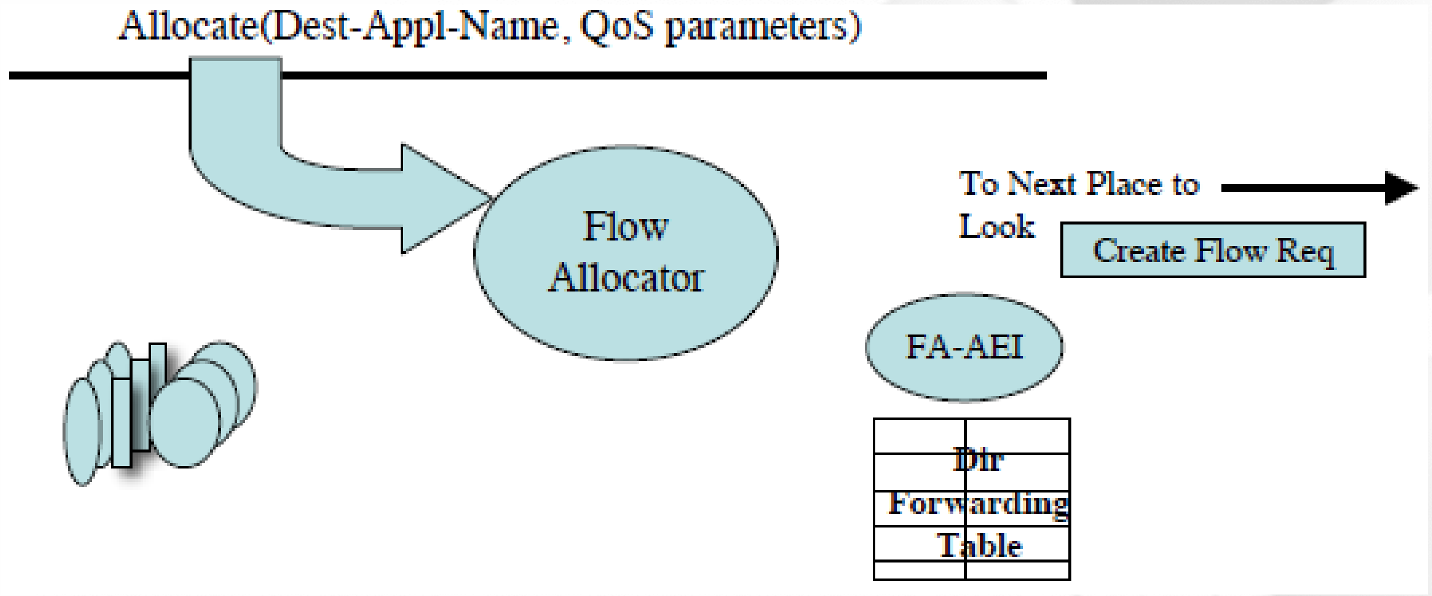
- Flow Allocation
- Application Connection
- Application Search

ESTABLISHING EXAMPLE: BEGINNING

- Means flow allocation in (N-1)-DIF

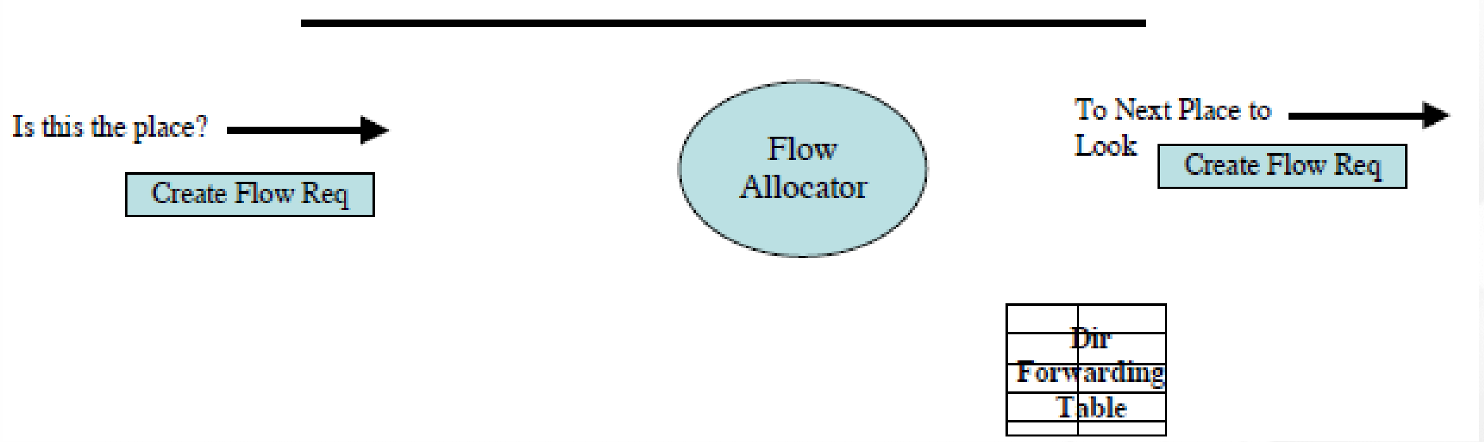


FA Source



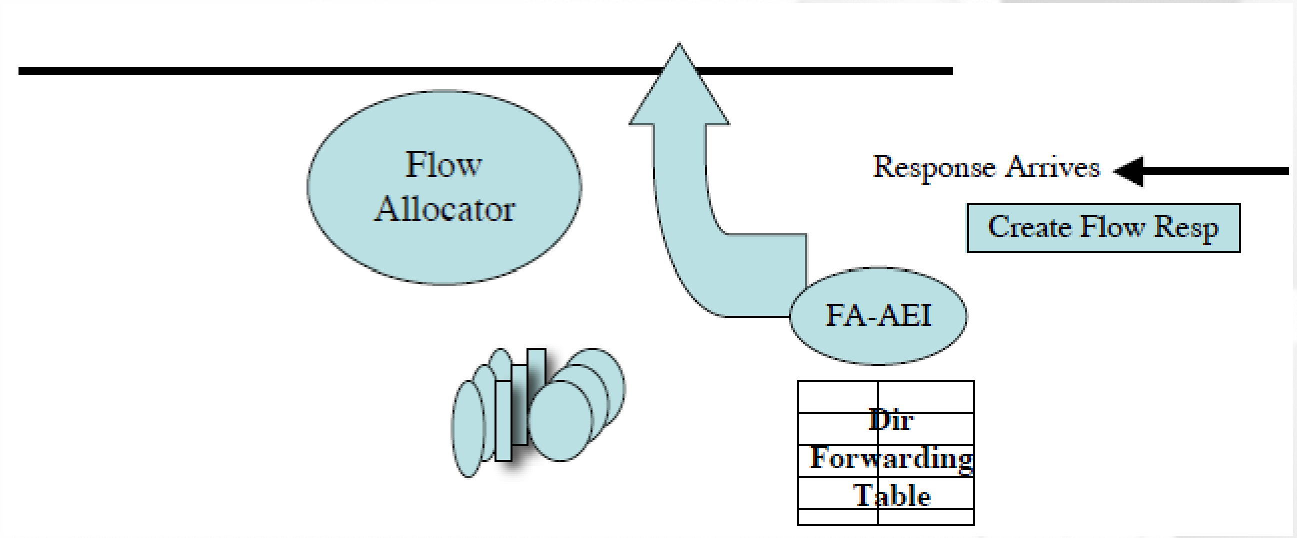
1) An Application issues an Allocate Request to the Flow Allocator.
2) If well-formed, spawns an instance to manage the request and the flow.
3) The Flow-Allocator instance looks up the destination-application-name in its local cache and finds an address to look for the requested application.
4) It then instantiates an EFCP instance (whose id is the CEP-id).
5) Forms a Create flow request and sends it.

FA Interim



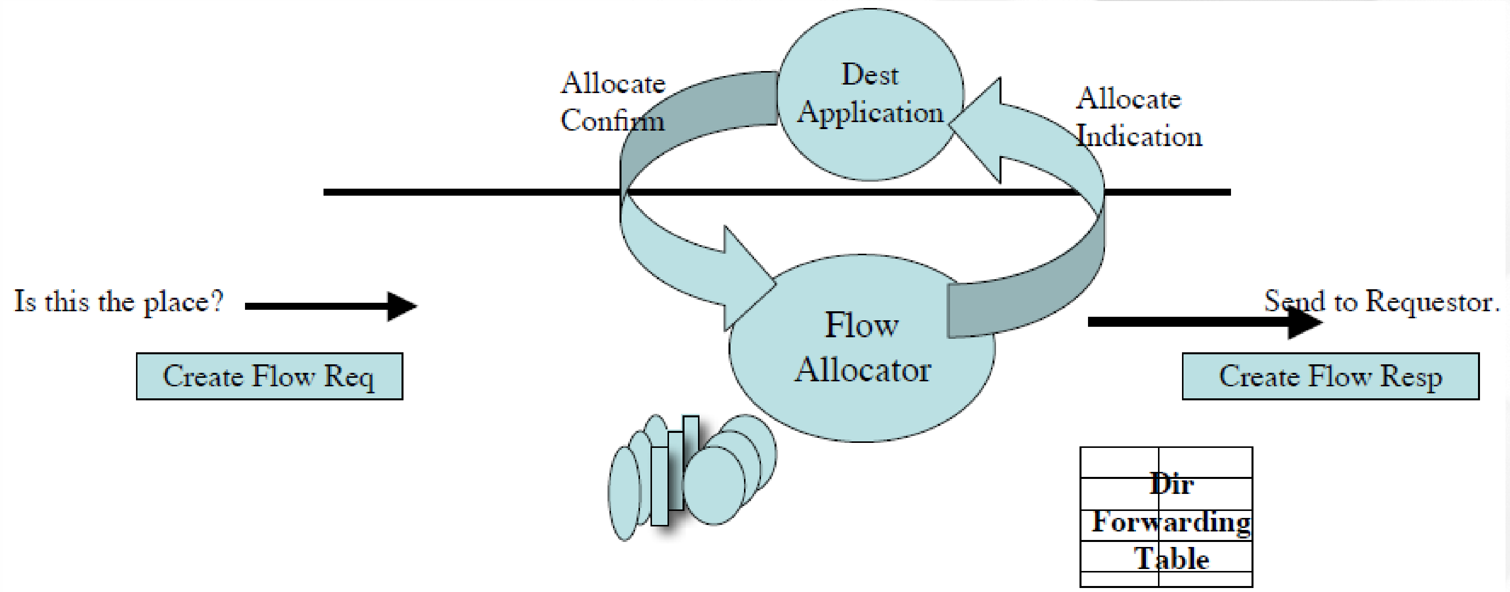
1) Create Flow Request arrives at the next place to look.
2) Flow Allocator looks up the destination application name in its "local cache"
3) Address returned isn't ours, so not here.
4) Send it there

FA Back at Source



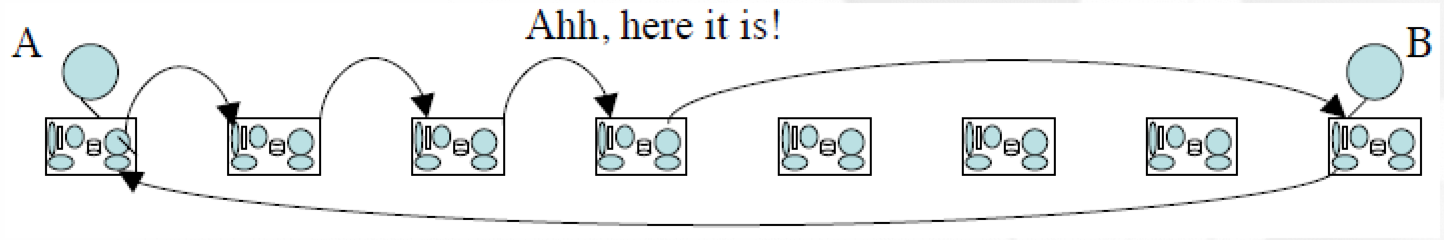
- The Create Flow Response arrives from the Destination
- The Application is notified that the Allocate was successful and is given a port-id (in Unix this might be a file descriptor), i.e. the FA-AEI-identifier.
- The application can now start exchanging information.

FA Destination



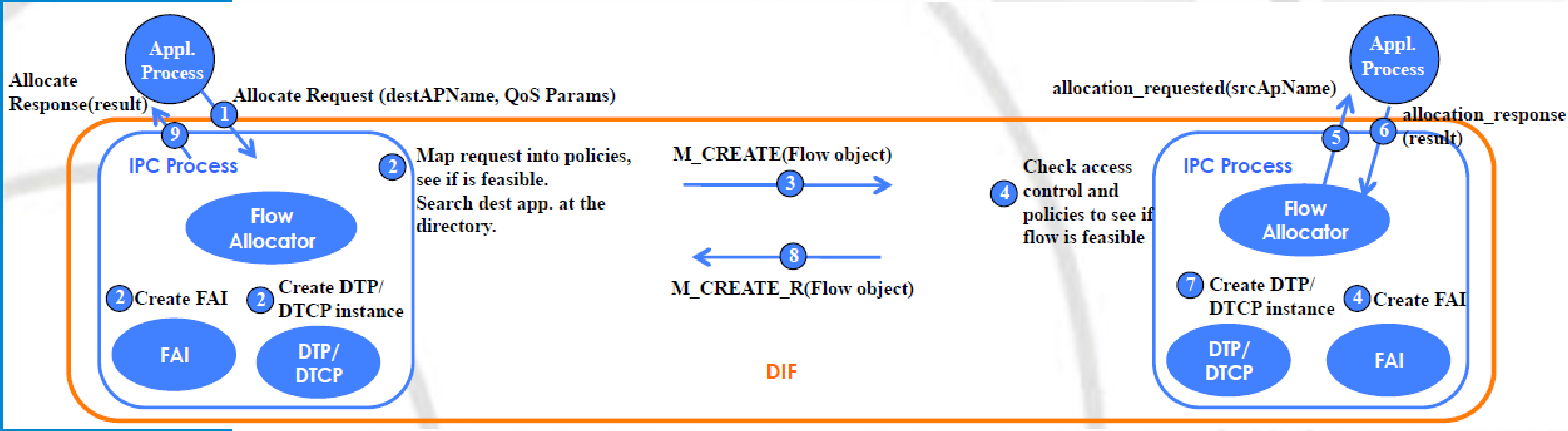
1) Create Flow Request arrives at yet another place to look.
2) Flow Allocator looks up the destination application name in its "local cache"
3) Address returned is ours. Its here! Check requestors credentials, if okay.
4) Deliver Allocate indication to the destination application
5) Which accepts or rejects, if accepts sends a Create Flow Response
6) Instantiates a EFCP-instance
7) The connection is established.

ESTABLISHING EXAMPLE: END

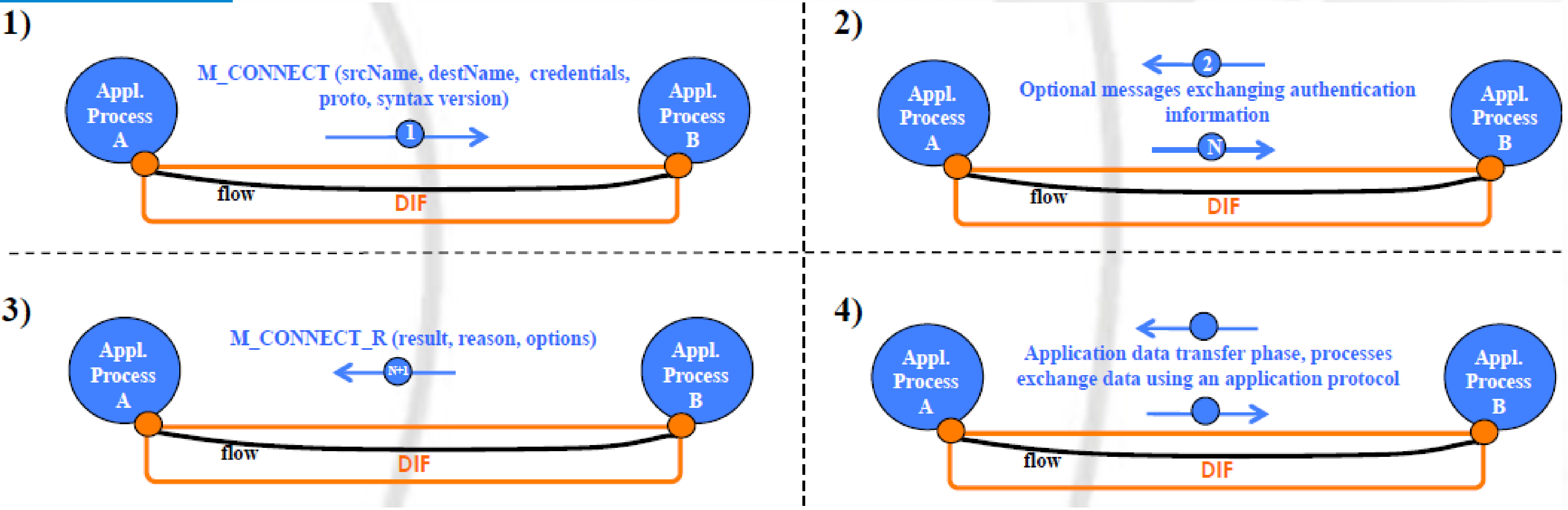


- The Create Flow Response is sent back to the originator.
- Data can now flow.
  - Remember we instantiated the EFCP at the source before we started.
  - Just in case data gets back before the Create Response.
- Either end may start the Application Protocol exchange.

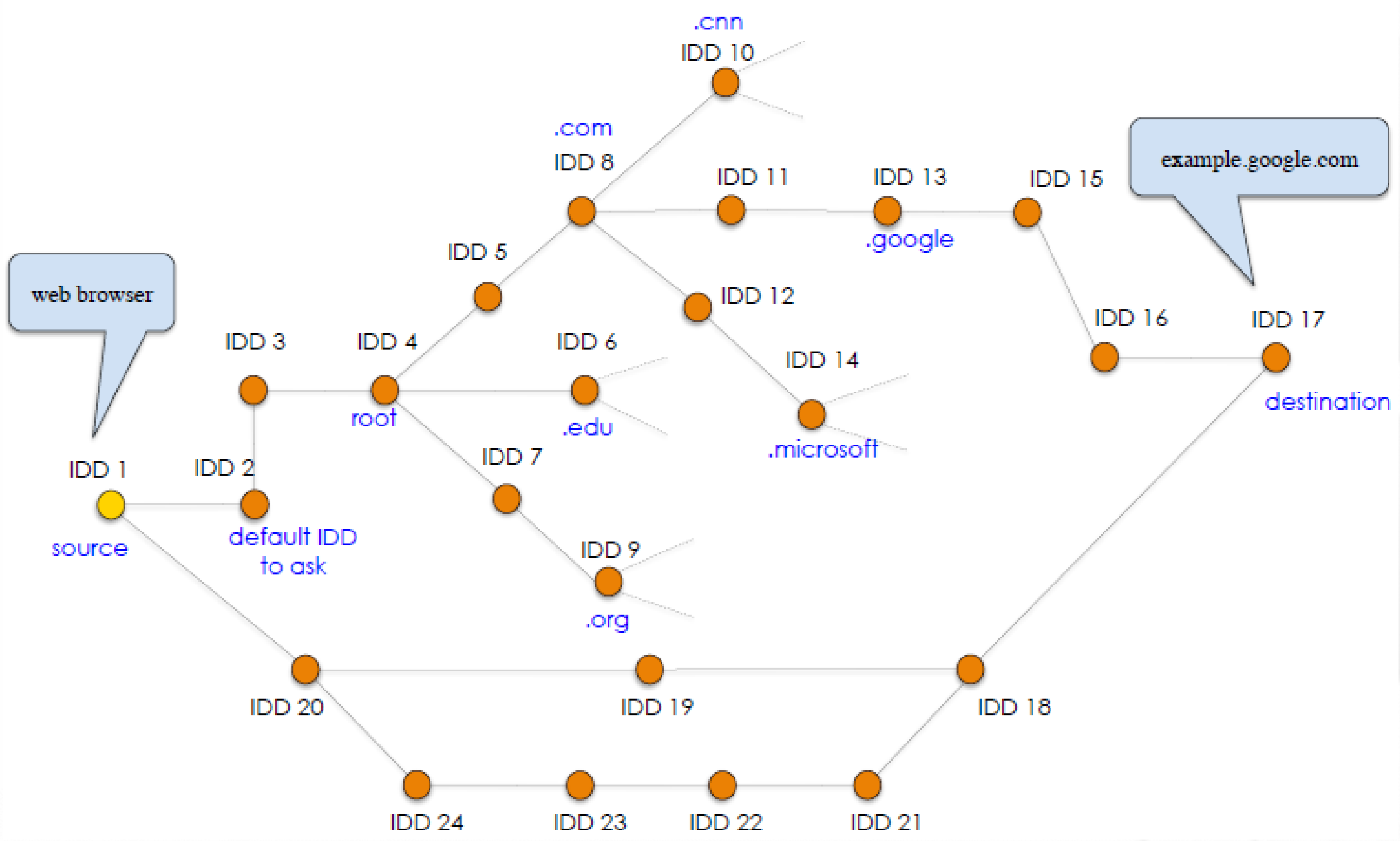
Application Connection - FA

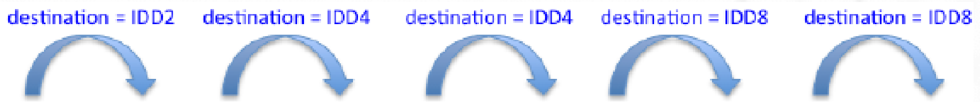

Appl. Process
Allocate Response(result)
Allocate Request (destAPName, QoS Params)
1
9
IPC Process
2 Map request into policies, see if is feasible. Search dest app. at the directory.
Flow Allocator
2 Create FAI
2 Create DTP/ DTCP instance
FAI
DTP/ DTCP
M_CREATE(Flow object)
3
8
M_CREATE_R(Flow object)
DIF
4 Check access control and policies to see if flow is feasible
allocation_requested(srcApName)
Appl. Process
allocation_response (result)
5
6
IPC Process
Flow Allocator
7 Create DTP/ DTCP instance
4 Create FAI
DTP/ DTCP
FAI

APPLICATION CONNECTION - CACE


1)
Appl. Process A
M_CONNECT (srcName, destName, credentials, proto, syntax version)
1
Appl. Process B
flow
DIF
2)
Appl. Process A
2
Optional messages exchanging authentication information
N
Appl. Process B
flow
DIF
3)
Appl. Process A
M_CONNECT_R (result, reason, options)
N+1
Appl. Process B
flow
DIF
4)
Appl. Process A
Application data transfer phase, processes exchange data using an application protocol
Appl. Process B
flow
DIF

IDD Search Example





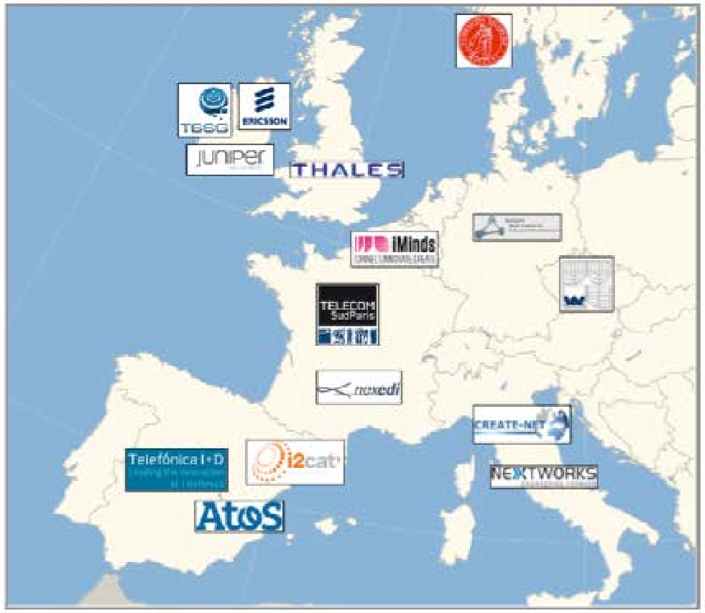
	IDD 1	IDD 2	IDD 3	IDD 4	IDD 5
Neighbor Table	IDD2 - IDD2 ...	IDD 4 - IDD3 ...	IDD 4 - IDD4 ...	IDD8 - IDD5 IDD6 - IDD6 IDD9 - IDD7 ...	IDD8 - IDD8 ...
Search Table	* - IDD2	* - IDD 4	-	.com - IDD8 .edu- IDD6 .org- IDD9	-

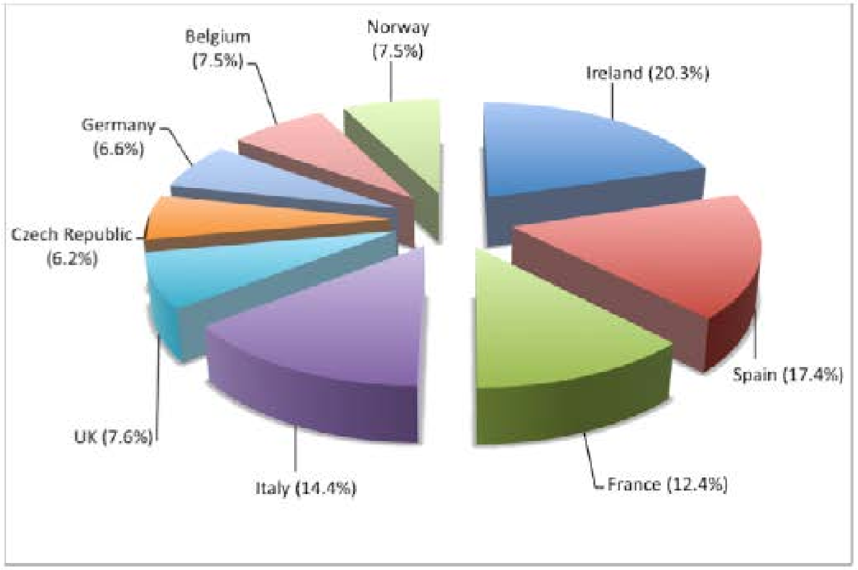
PRISTINE

- Programmability In RINA for European supremacy of virTualised Networks
- http://ict-pristine.eu/

Basic Facts

Call:	FP7-ICT-2013-11
Date:	January 2014 – June 2016
Budget:	5 mil. €
Participants:	15 consorcium members
FIT BUT:	40 pm





Objectives

Objective (Task) / Partner	WIT-TSSG	i2CAT	TID	LMI	NXW	TRT	Nexedi	BISDN	Atos	JUN	UiO	FIT-BUT	IMT-TSP	CREATE-NET	iMinds
1 SDK (T2.2, T2.3)	C	L	L		L			C	C						C
2 Congestion Control (T3.1)				C						C	L	C			
3 Res. allocation (T3.2)		C				C			C	L	C		C	C	
4 Topological address. (T3.3)		C										C	L		
5 Secure DIF enablers (T4.1)			C			L		C				C	C		
6 Security coord. (T4.2)			C			C	L			C		C			
7 Resilient networks (T4.3)	C				C			C				C			L
8 Multi-layer management (T5.1, T5.2, T5.3, T5.4)	L	C	C	L	C	L		L	C					C	
9 Use case trials (T2.1, T6.1, T6.2, T6.3)	L	C	R	R	C	C	R		L,R	R	C			L	C
10 Simulator (T2.4)							C					L	C	C	

RESEARCH INTEREST

- RINA Simulator models in OMNeT++ are the main responsibility
- However, many other topics to explore
  - Routing, currently no routing protocol
  - IDDs (which uses DHT instead of FQDN)
  - Automatic enrollment (i.e. DHCP like behavior)
  - Security, of RINA
  - Deployment (OpenFlow, Linux SDK)