

# Towards High Level Communication Protocols and Services in a New Communication Layer

**Michel DIAZ**  
**LAAS CNRS**  
**7 Avenue du Colonel Roche**  
**31077 - Toulouse**  
**Michel.Diaz@laas.fr**

## FROM THE APPLICATION LAYER TO A NEW COMMUNICATION LAYER



**HOW TO DEFINE A NEW TRANSPORT  
LAYER WITH**

- MULTIMEDIA**
- MULTICAST**

**AND HAVING GATEWAYS  
PROXYS**

**FOR GENERAL UNBALANCED NETWORKS**

# FOUR SIGNIFICANT LAYERS

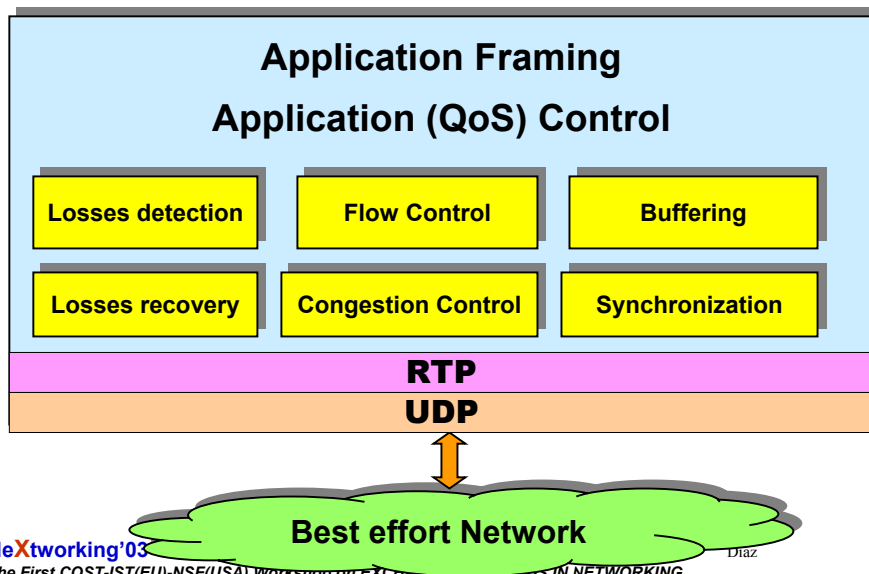
- APPLICATION

- TRANSPORT => ? NEW ?

- IP

- NETWORK INFRASTRUCT

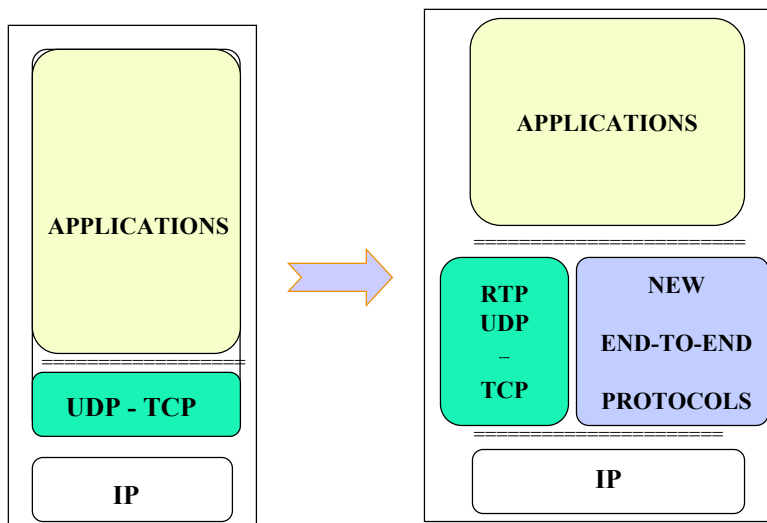
## Classical Architecture



## QUESTION :

# HOW TO DEFINE BETTER and INTEGRATED SERVICES & PROTOCOLS FOR MULTIMEDIA MULTICAST and MULTINETWORKS

## 1. An EXTENDED ARCHITECTURE



# DCCP (Datagram Congestion Control Protocol)

- IETF DRAFT SINCE JULY 2001
- **MESSAGE ORIENTED (Datagrams)**
- **UNRELIABLE (MONOMEDIA)**  
**POINT-TO-POINT Flow**
- **Connection with**  
**RELIABLE HANDSHAKE for setup & teardown**

**-HOLDING CONNECTION**

**-MTU DISCOVERY**

**-CONGESTION CONTROL :**  
**1- Single Window, 2- TCP-like,**  
**3- TCP-Friendly Rate Control TFRC**

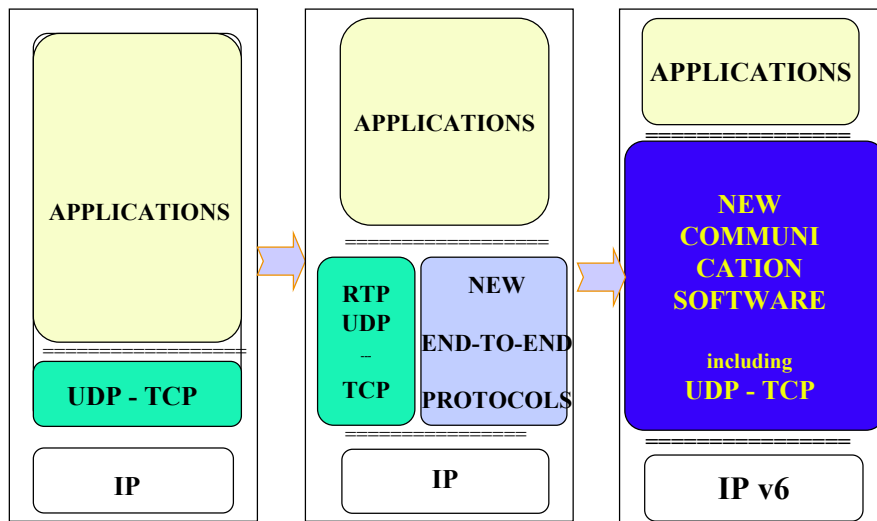
**-SENDER CAN KNOW,**  
**WITH HIGH PROBABILITY,**  
**WHICH PACKETS REACHED RECEIVER**

# SCTP (Stream Control Transmission Protocol)

- IETF DRAFT IN OCTOBER 2000
- **RELIABLE, MESSAGE ORIENTED (Datagrams)**
- **LIMITED CAPABILITY IN TERMS OF**
  - handle a **SET of different FLOWS** and
  - **INDEPENDENCE** between FLOWS

- **Reliable transfer of user messages between SCTP users within an association between two SCTP endpoints (SCTP association)**
- **SCTP association : broader concept than TCP connection as each SCTP endpoint provides a list of transport addresses (IPadd+port) => set of streams & multihoming**

## 2. An INTEGRATED ARCHITECT



## TRANSPORT LAYER FOR MULTIMEDIA

### System Requirements

- SET OF OBJECTS  $O_i$  or FLOWS  $F_j$
- PARTIAL ORDER BETWEEN THEM

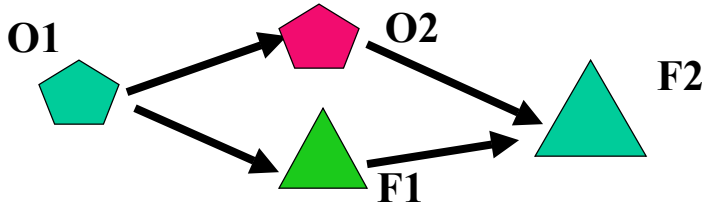
Start  $O_j$

After  $O_j$  start in parallel  $O_k$  and  $F_i$

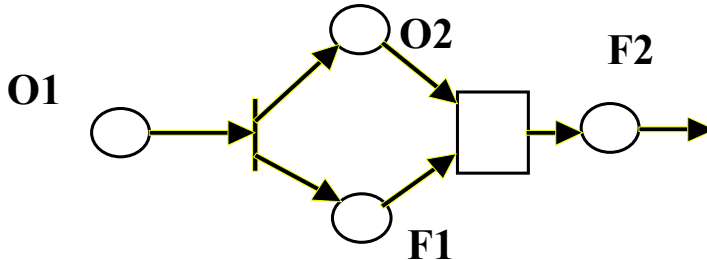
Then end at the same time  $F_i$  and  $O_k$

After their end, start  $F_j$

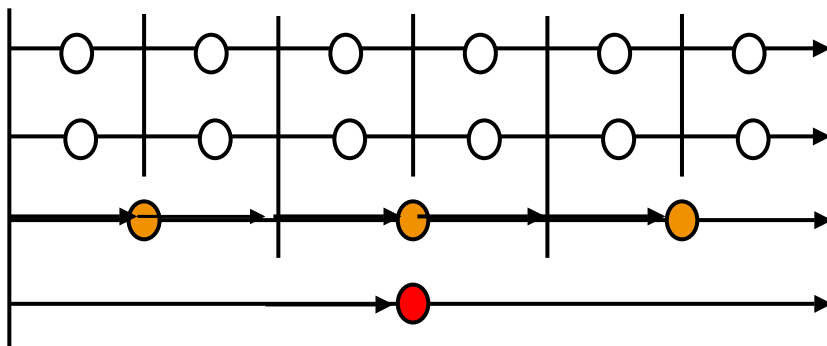
## Ex : PARTIAL ORDER (PO) :



- Simple PO model : Petri nets (PNs are POs)

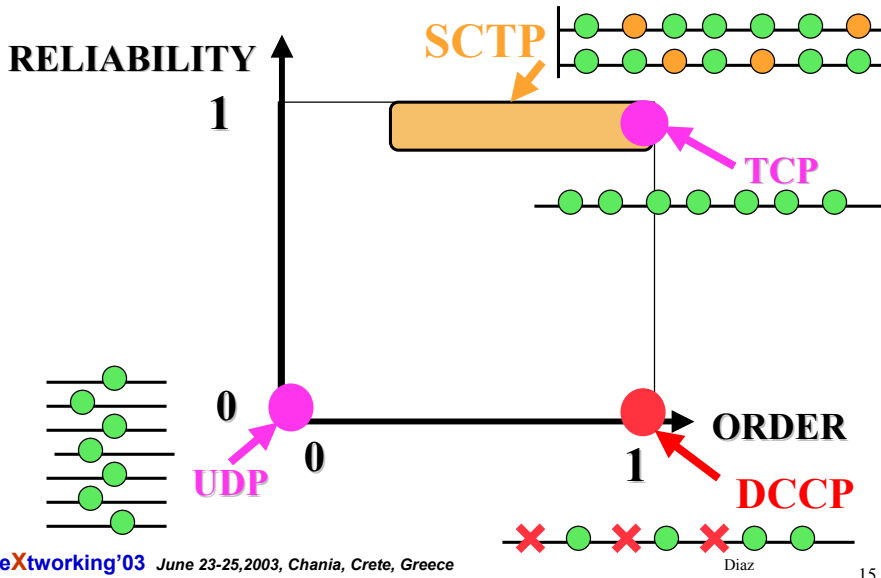


## Ex of a more General MODEL

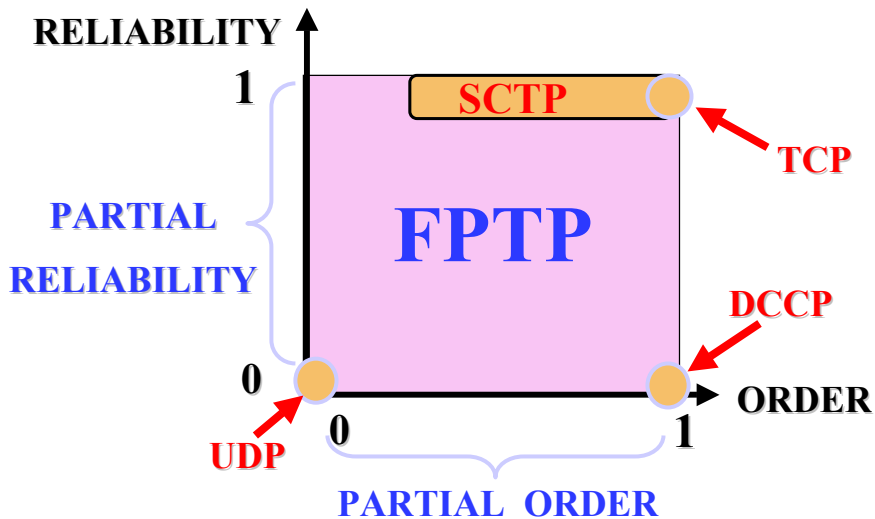


WITH : - DIFFERENT FLOWS  
- DIFFERENT RELIABILITY by FLOW

# Classification UDP TCP DCCP SCTP

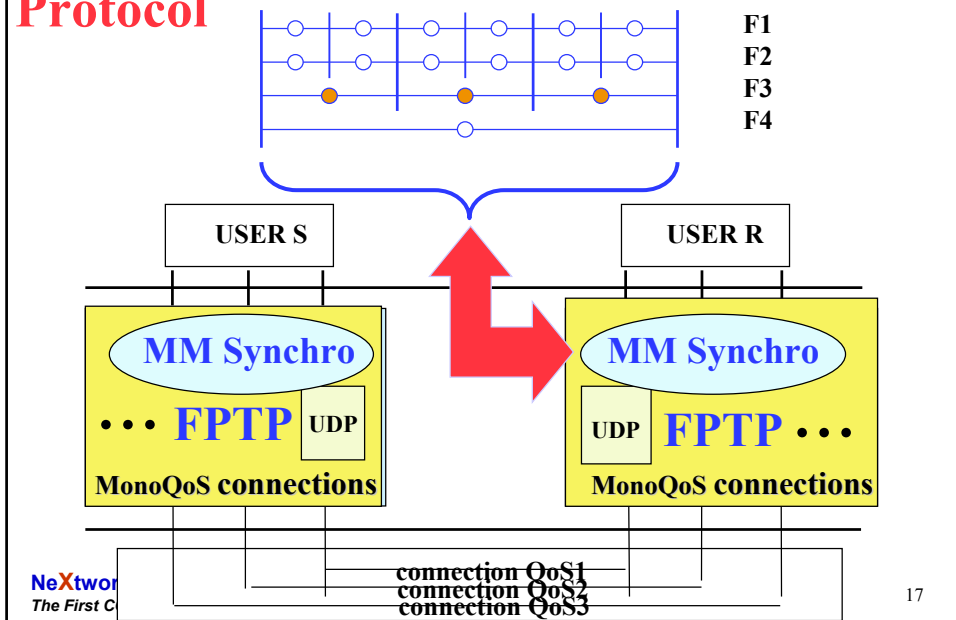


# FPTP : a NEW MM Transport PROT

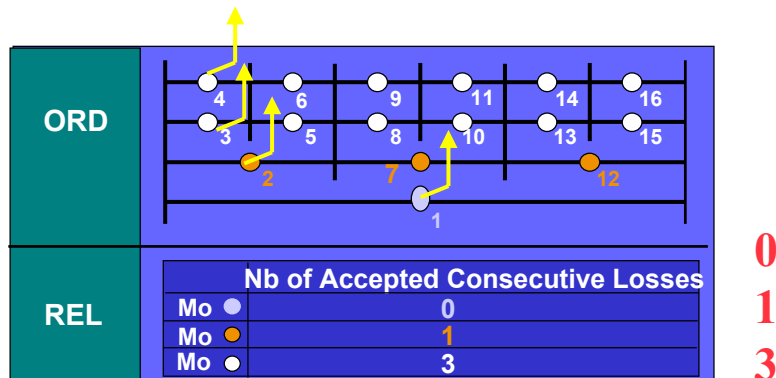




# FFTP Fully Programmable Transport Protocol



## MM and RELIABILITY



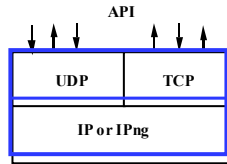
IF

SDUs 1, 2, 3, 4 Received and SENT TO APPLI : ↑

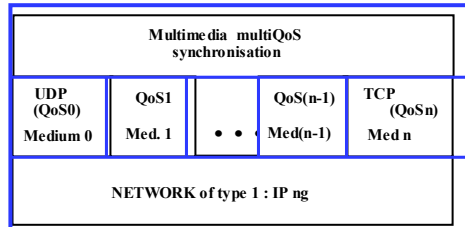
THEN

RECOVERY Function (Nb of Acceptable Losses)

**FROM**



**TO**

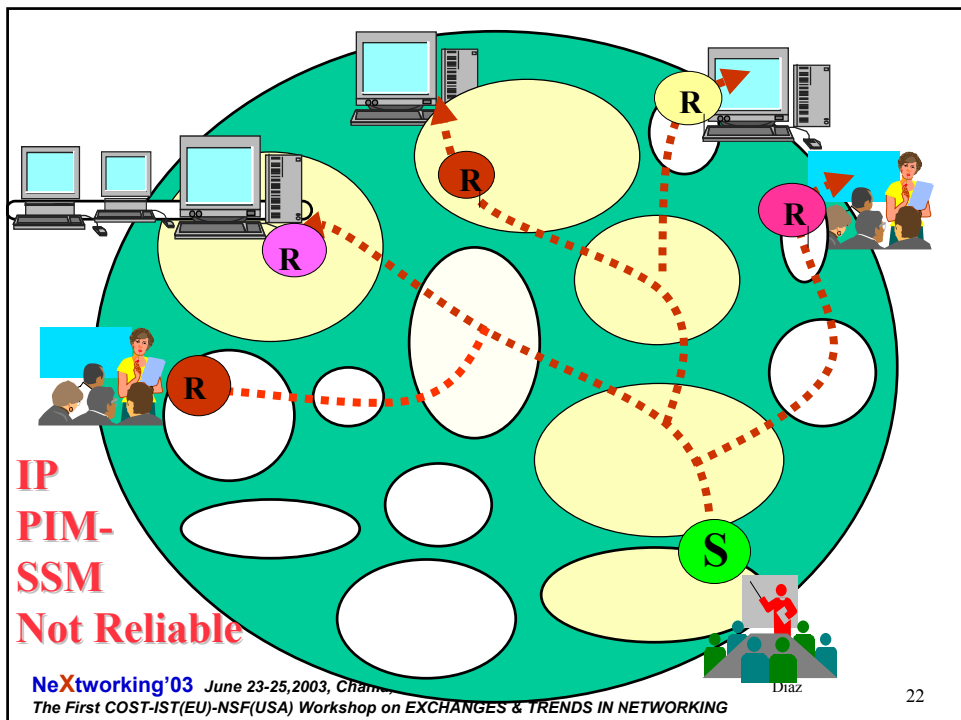


## **INCREASING PROGRAMMING**

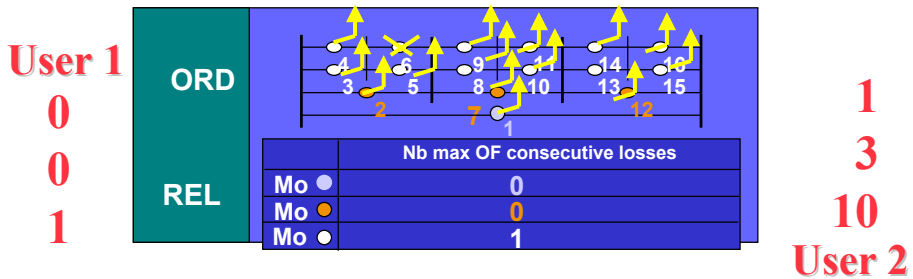
- **UDP : MESSAGE**
- **TCP : FILE**
- **DCCP : UNRELIABLE STREAM**
- **SCTP : RELIABLE SET OF STREAMS**
- **FFTP : UNRELIABLE PARTIAL ORDER**

# EXENDING MULTIMEDIA TO MULTICAST & MULTINETWORKS

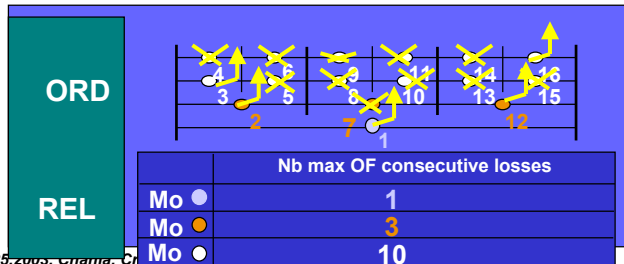
DIFFERENT USERS  
ARE ON  
DIFFERENT NETWORKS  
AND CAN MANIPULATE  
DIFFERENT MEDIAS



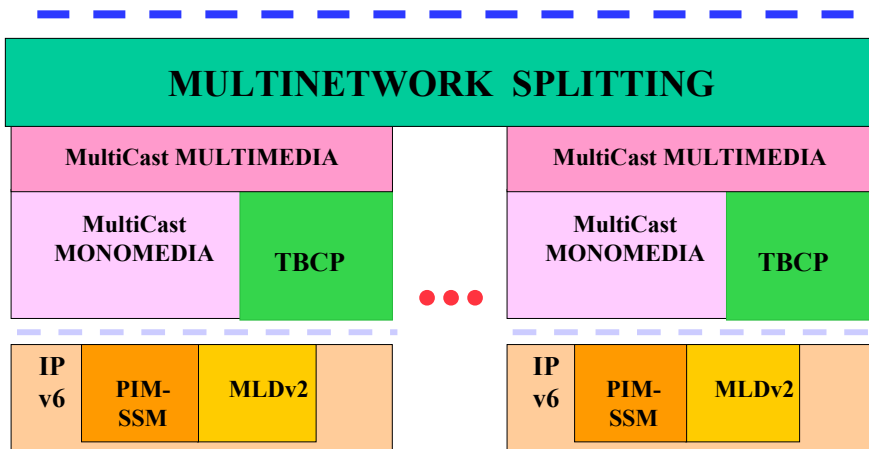
# EXTENSION : 2 QoS For 2 users



Partial  
Reliability  
Locally  
Defined



# A MM MC MULTINETWORK ARCHITECTURE



## OPEN RESEARCH PROBLEMS

- **Families of PO & PR** of interest
- **Langages** for PO and for PO with PR & Deriving **Automatic** language recognizers
- Architecture and **sub-layering**
- **Deriving PO & PR from Specifications**
- **What API**

## OPEN RESEARCH PROBLEMS

- **Optimisations** for PR, congestion control and multihoming
- **Links** with DCCP, SCTP, ...
- **Deployment and Experiments**
- **Active Programmable** support
- **DYNAMIC PO-PR & OBJECTS**