Experimenting with real application-specific QoS guarantees in a large-scale RINA demonstrator (ERASER): Initial steps

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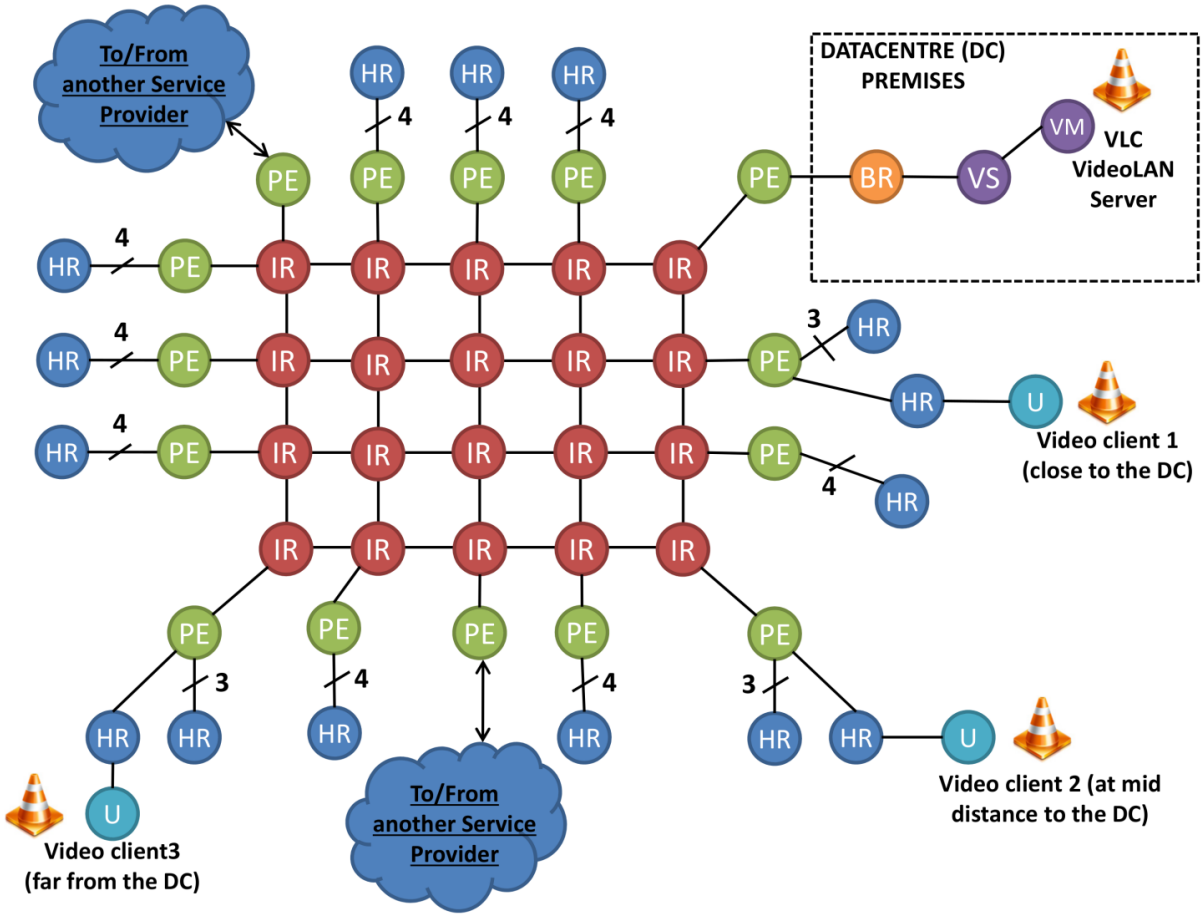
In previous ERASER presentation... (1/2)

- An 88-Node metro-regional network scenario is planned to be setup on the Fed4FIRE+ Virtual Wall test-bed hosted by imec in Ghent:



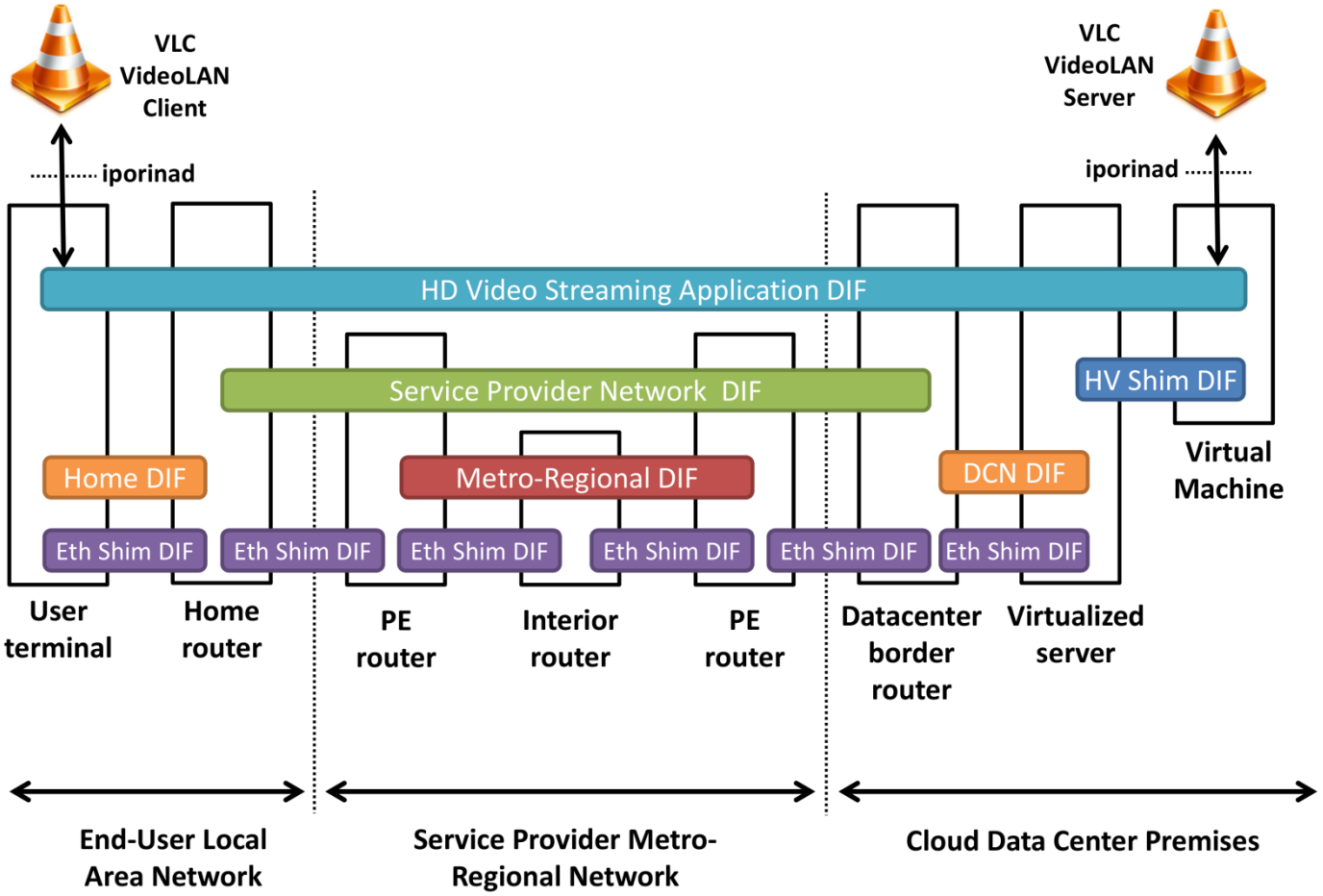
A slice of 88 physical machines with Linux OS will be requested, acting as:

20 Interior Routers (IRs)
15 Provider Edge (PE) routers
48 Home Routers (HRs)
3 end-user terminals (Us)
1 DC Border Router (BR)
1 Virtualized Server (VS)

...interconnected by GbE links

In previous ERASER presentation... (2/2)

- Moreover, the following DIFs are planned to be configured there:



QTA-Mux deployment scenarios (1/3)

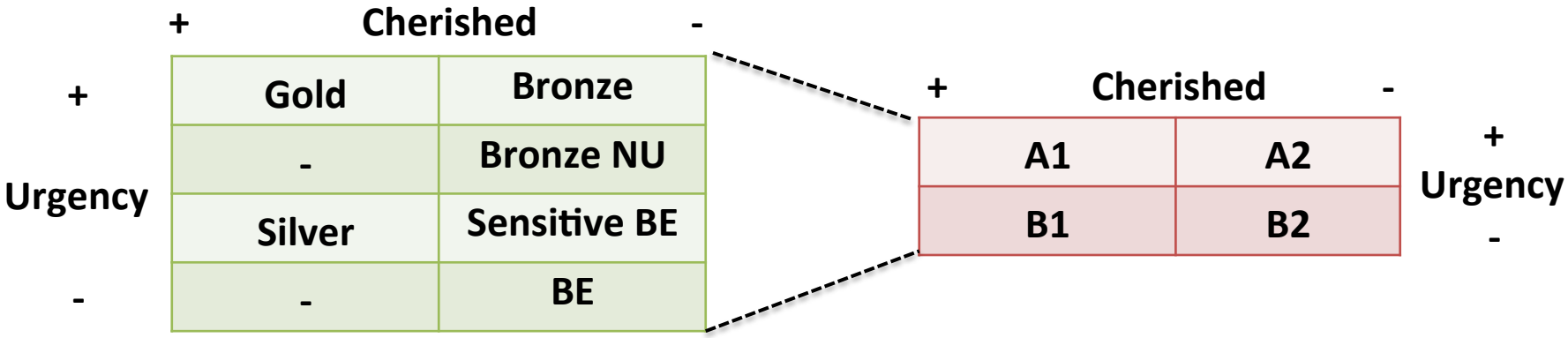
- The first step in ERASER has been to define the QTA-Mux deployment scenarios and QoS Cubes that this policy shall differentiate
- As the Metro-Regional (MR) DIF will carry aggregated traffic flows, 4 “coarse” QoS Cubes have been introduced, differentiated by the C/U multiplexer as described by the following 2x2 C/U matrix:

Urgency \ Cherished	+	-
+	A1	A2
-	B1	B2

- **A1**: Prioritized w.r.t. losses & prioritized w.r.t. delay
- **A2**: Un-prioritized w.r.t. losses, but prioritized w.r.t. delay
- **B1**: Prioritized w.r.t. losses, but un-prioritized w.r.t. delay
- **B2**: Un-prioritized w.r.t. losses & un-prioritized w.r.t. delay

QTA-Mux deployment scenarios (2/3)

- QoS Cubes supported by the Service Provider Network (SPN) DIF are built upon those supported by the underlying MR DIF:
  - Being closer to the applications, more QoS Cubes shall be supported to better differentiate among heterogeneous application flows



  - Gold and Silver flows map to A1 and B1 (N-1) flows, respectively
  - Bronze flows map all to A2 (N-1) flows, but differentiation between Bronze and Bronze Non-Urgent is provided in the SPN DIF. Similar with Sensitive Best-Effort (BE) and BE flows, both mapped to B2

QTA-Mux deployment scenarios (3/3)

- **QTA-Mux only at the MR DIF:**
  - Capable to differentiate among aggregated A1, A2, B1 and B2 flows
  - The SPN DIF supports 6 QoS cubes but has no ways to differentiate among Bronze and Bronze NU flows, all mapped to A2 (N-1) flows, and among Sensitive BE and BE flows, all mapped to B2 (N-1) flows
- **QTA-Mux only at the SPN DIF:**
  - The SPN DIF supports 6 QoS Cubes and differentiates flows assigned to them, but the underlying MR DIF treats all flows as equal (differentiation may be lost there)
- **QTA-Mux at both DIFs:**
  - The SPN DIF supports all 6 QoS Cubes and differentiates flows accordingly. Flows assigned to each of these QoS cubes are assigned to QoS Cubes of the MR DIF accordingly.

Synthetic traffic generation (1/2)

- Employing user-developed client-server applications (based on RINA-tgen), five types of synthetic flows will be injected into the network:

Application flow	Traffic distribution	Traffic direction	Details
VoIP	ON-OFF	Bidirectional	ON-OFF period avg. duration: 3s – 3s CBR bitrate during ON period: 64 kbps
HD video distribution	ON-OFF	Unidirectional	ON-OFF period avg. duration: 180s – 30s CBR bitrate during ON period: 4 Mbps
HD video call	CBR	Bidirectional	CBR bitrate: 1.5 Mbps
File transfers over VPN	ON-OFF	Bidirectional	ON-OFF period avg. duration: 10s – 1s CBR bitrate during ON period: 10 Mbps
Interactive traffic	Poisson	Bidirectional	Avg. bitrate: 1 Mbps

Synthetic traffic generation (2/2)

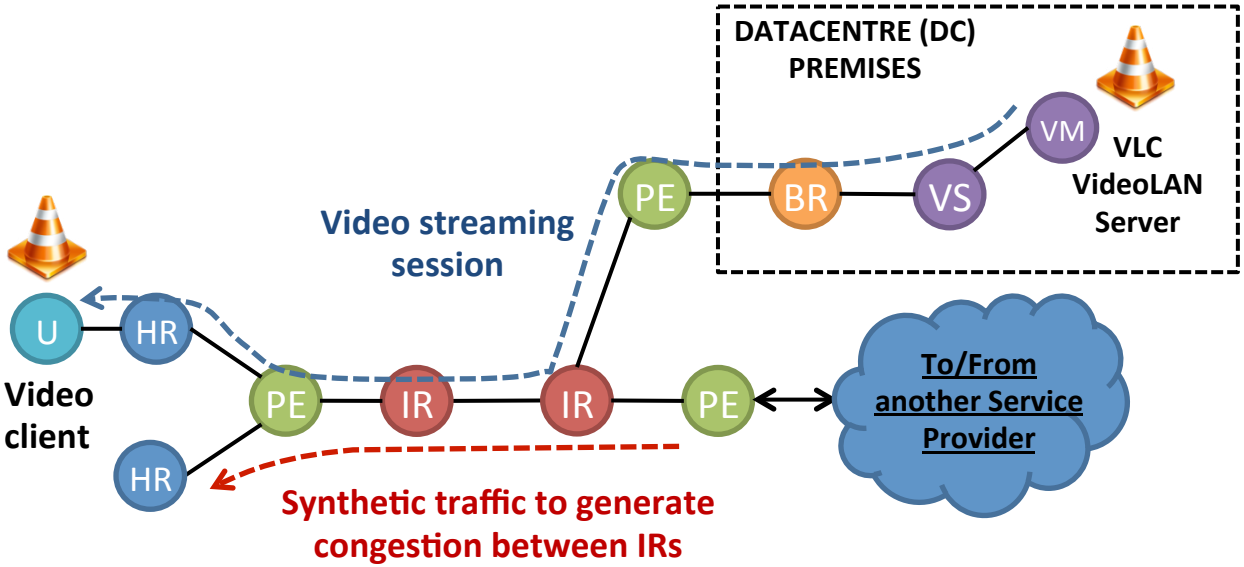
- Synthetic application flows will be injected at PE routers into the SPN DIF, matching them to the supported QoS Cubes as follows:

Urgency \ Cherished	+	-
+	HD Video streaming (demo)	HD Video call
	-	VoIP
	Business VPN	HD Video distribution
-	-	Interactive

- Later on, video streaming flows will be matched to other QoS Cubes to appreciate the effect on the perceived QoE!

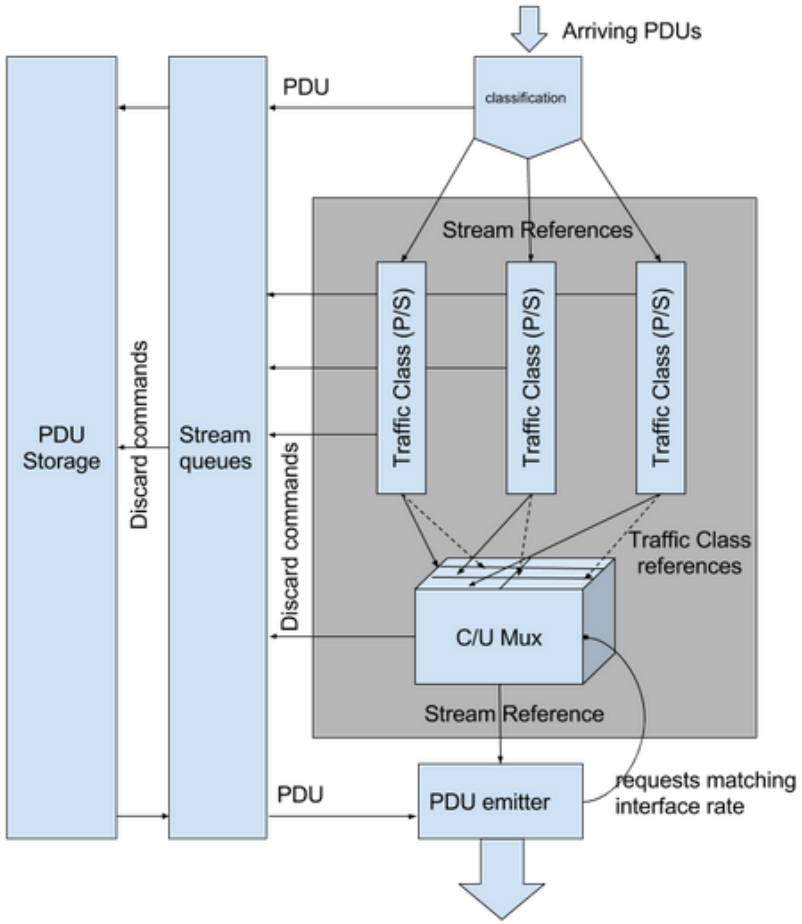
Initial tests

- To ensure that all pieces needed in the final demo work fine, we have started to conduct initial tests in a 10-node network scenario:



- To enforce certain load conditions: 1) Inject synthetic traffic flows; 2) Measure avg. bitrate at physical interfaces; 3) Limit capacity so that avg. bitrate is 70, 90, 120% of the capacity; 4) Configure QTA-Mux parameters

QTA Mux Configuration




```
"rmtConfiguration" : {
  "pffConfiguration" : {
       ...
  },
  "policySet" : {
   "name" : "qta-mux-ps",
   "version" : "1",
    "parameters" : [{
      "name"  : "cumux",
      "value" : "2:2:120,120,0:100,90,10"
     }, {
      "name"  : "1.qosid",
      "value" : "1:1:25000:10000000"
     }, {
      "name"  : "2.qosid",
      "value" : "1:2:12000:20000000"
     }, {
      "name"  : "3.qosid",
      "value" : "2:1:10000:30000000"
   }, {
      "name"  : "4.qosid",
      "value" : "2:2:10000:40000000"
     }]
  }
},
```

Rumba

- Used to deploy automatically the scenario: In qemu and jfed (Virtual Wall)
  - Define Nodes
  - Define DIFs and DIFs registration
  - Define Storyboards: Experiment definition
- Link bandwidth modification: Interior router links to 70, 90 and 120% of the capacity
  - During scenario creation
  - During storyboard run time
- QTA Mux configuration
  - During scenario creation
  - Dynamically: Executing “irati-ctl set-policy-set-param” in the nodes

Traffic generator

- Tg-server / Tg-client
- Based on rina-tgen
- Traffic types: data, expo, poisson, on-off, video, audio
- Statistics:
  - Received PDUs and bytes, lost PDUs, min,max and mean latency
  - Per flow and per QoS cubes group

Drawbacks

- Virtual Wall is quite slow setting the initial scenario
  - Run different storyboards dynamically in the same scenario
  - Modify on the flight: Traffic generator matrices, link bandwidth, QTA Mux parameters
- IRATI doesn't support propagation of QoS requirements between DIFs yet
  - Will be supported at beginning of June
  - Simplified scenario to only one DIF

Thank you for your attention!
Questions?