Time for Gaming

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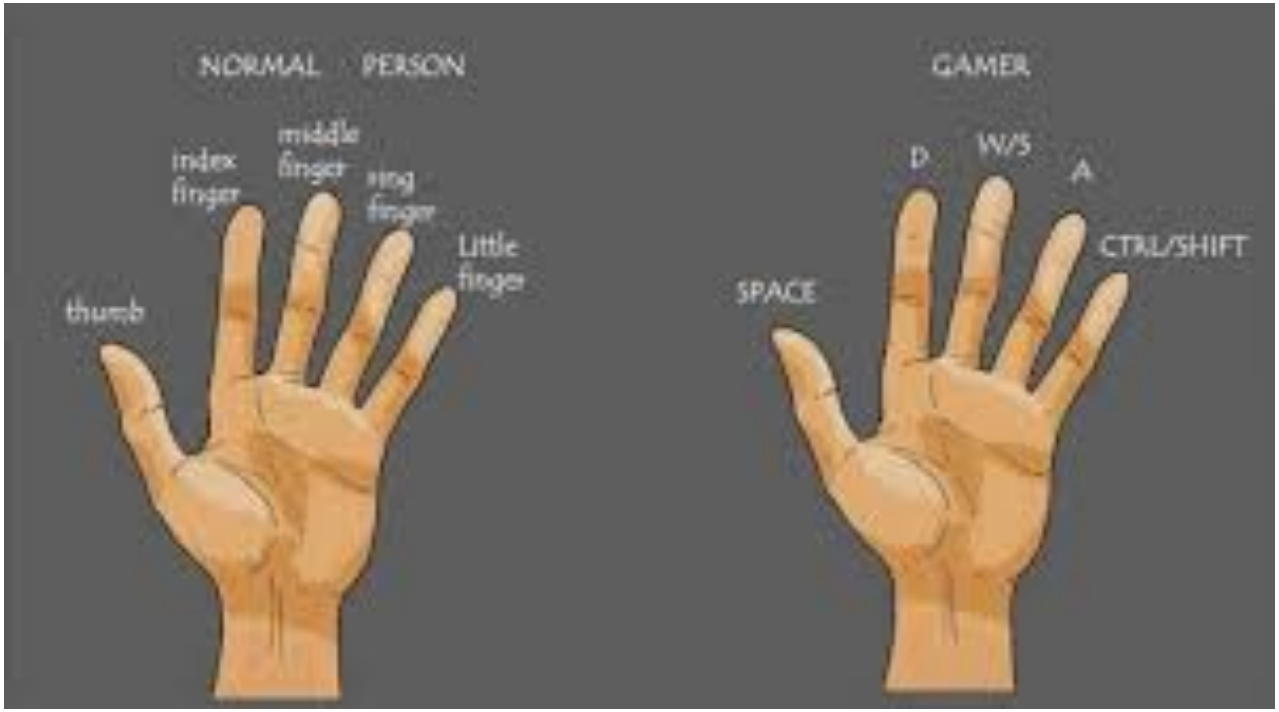
Some Context

- EU COST Action
- Autonomous Control for a Reliable Internet of Services
- TAACCS Subgroup
  - Time Awareness
    - SDN
    - Gaming

Layout

- Cloud Gaming
- Time Awareness
  - Game Server
  - Network – Timing for SDN
- Case Study – Gaming Anywhere

Anatomy of a Gamer



Cloud Gaming

- Recent evolution in Gaming
  - High growth potential
- Thin client + Fat pipe
  - Game hosted on cloud
  - User client device sends user control-events to server
  - Server replays actions, renders scene and streams data flow video to client
  - Client displays scene
- Online connectivity critical

Cloud Gaming- Benefits

- Users
  - Reduced software/hardware specification → lower cost
    - Eg. Run on resource constrained devices/ in browser etc
  - Multiplatform
    - PCs, laptops, tablets, and smart-phones
- Developers
  - Easily support more platforms
  - Reduced hardware/software incompatibility issues
  - Reduced production/version control costs

Gaming QoE $_2$

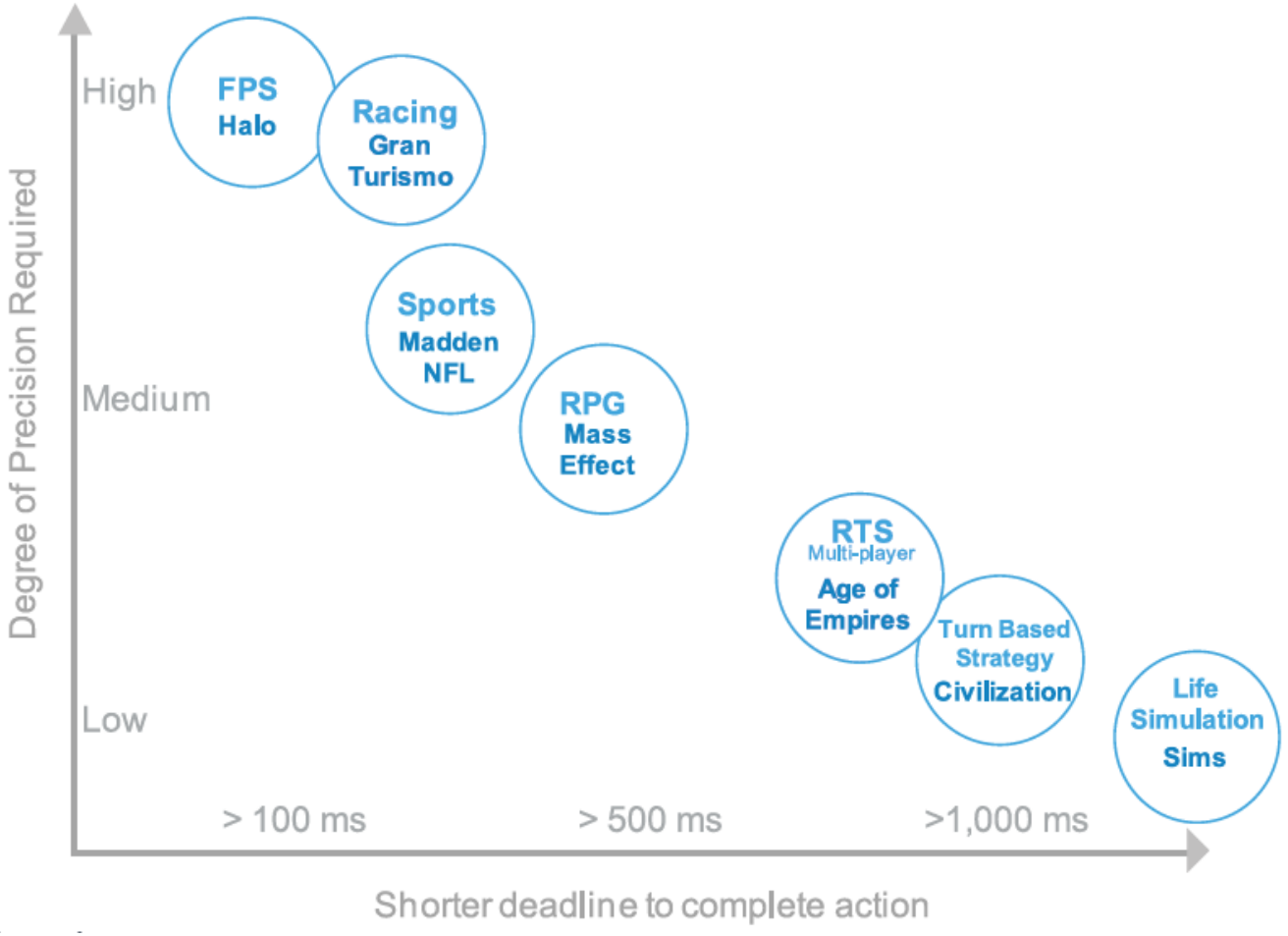
- User QoE - core requirements
  - High quality graphics + High interactivity
    - High FPS/Resolution ➔ High Bandwidth
    - High interactivity ➔ Low + stable delay
      - Multiplayer ➔ Delay equality important
  - More suited to certain Game types
    - First Person Shooter < 100 ms ideally
      - Significant challenge for widely distributed scenario

Lag


VIDEO GAMES
DON'T MAKE
YOU VIOLENT
LAG DOES!


Games don't make you violent, lag does.
Reply from <server>: Bytes=32 Time=30ms TTL=51
Reply from <server>: Bytes=32 Time=120ms TTL=51
Reply from <server>: Bytes=32 Time=625ms TTL=51
Save our kids,
Install faster internet.

Latency & Precision for Gaming[3,4]



Lag_1 = Response Delay

- Response delay (RD)
  - time diff between a user submitting a command and the corresponding in-game action appearing on the screen
- Processing delay (PD)
  - time required for the server to receive/process a player's command, encode/ transmit the corresponding frame
- Playout delay (OD)
  - time required for the client to receive, decode, and render a frame on the display
- Network delay (ND)
  - Round Trip Delay
- RD = PD + OD + ND

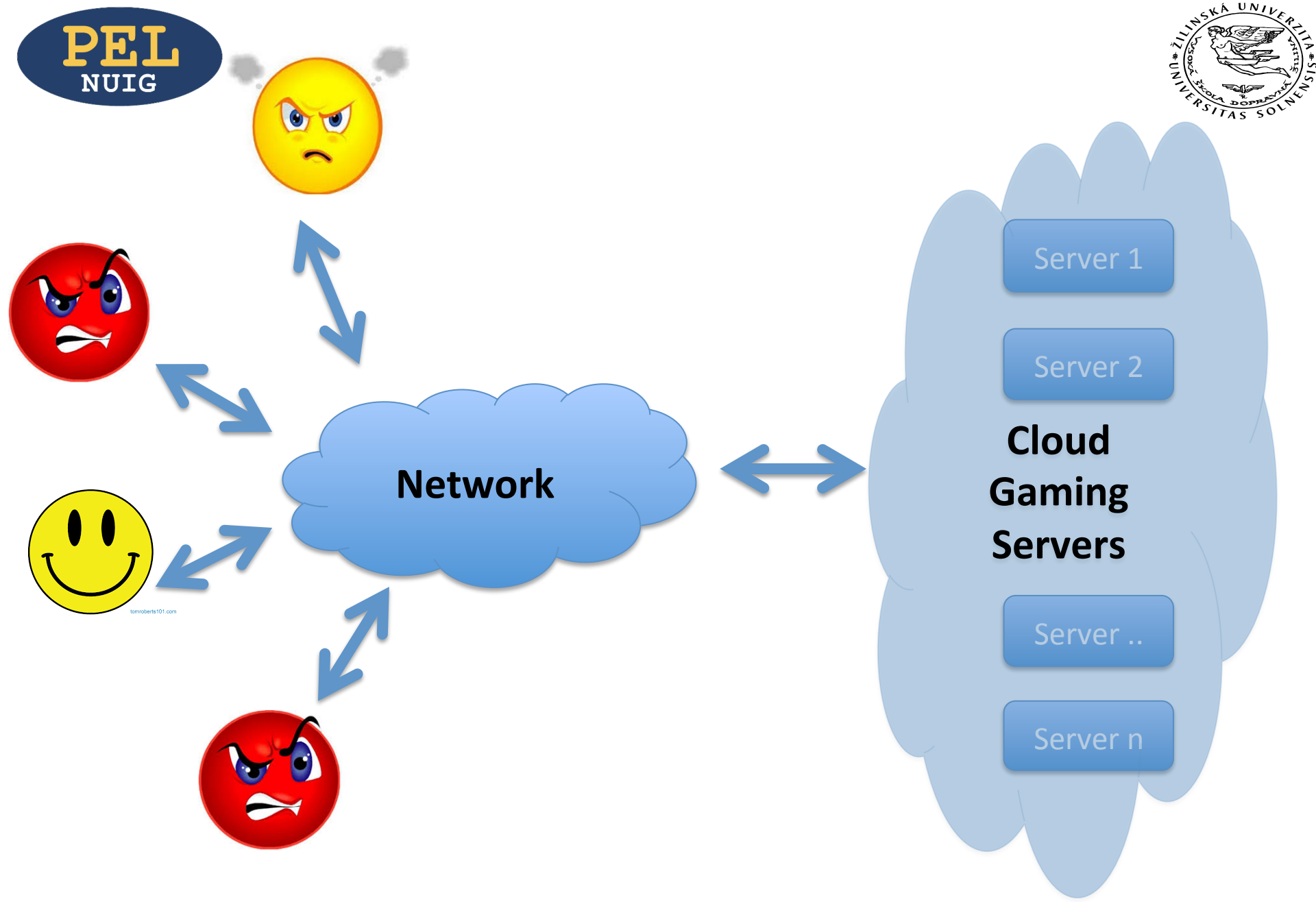
Lag & QoE

OD ND PD

Network

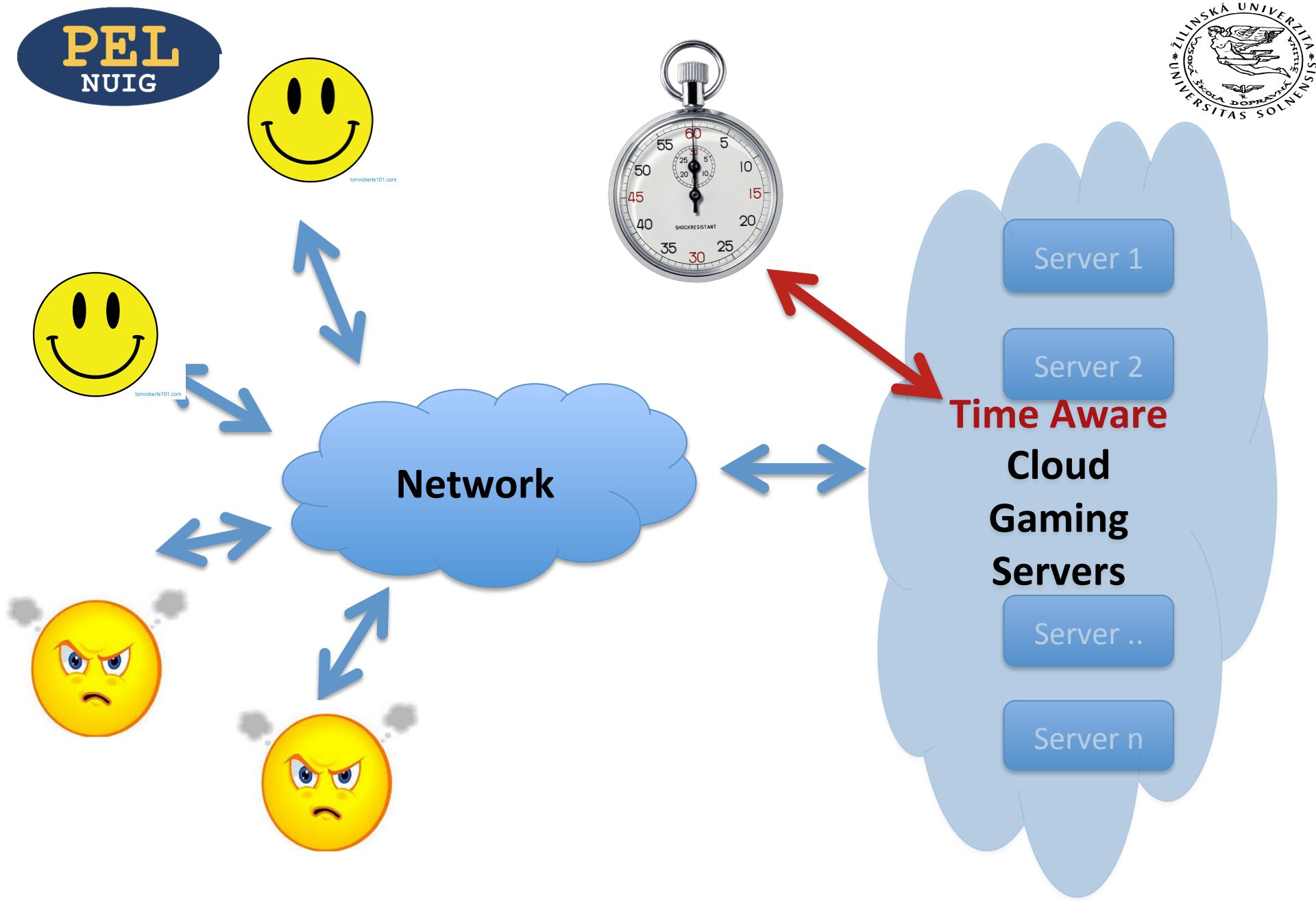
Server

OD ND PD


Network
Server 1
Server 2
Cloud Gaming Servers
Server ..
Server n

Phase 1 –Server side

- Monitor – Model – Manage
- Process
  - Realtime network delay (ND) calculations
  - QoE model : delay ⟷ QoE
  - Server side delay management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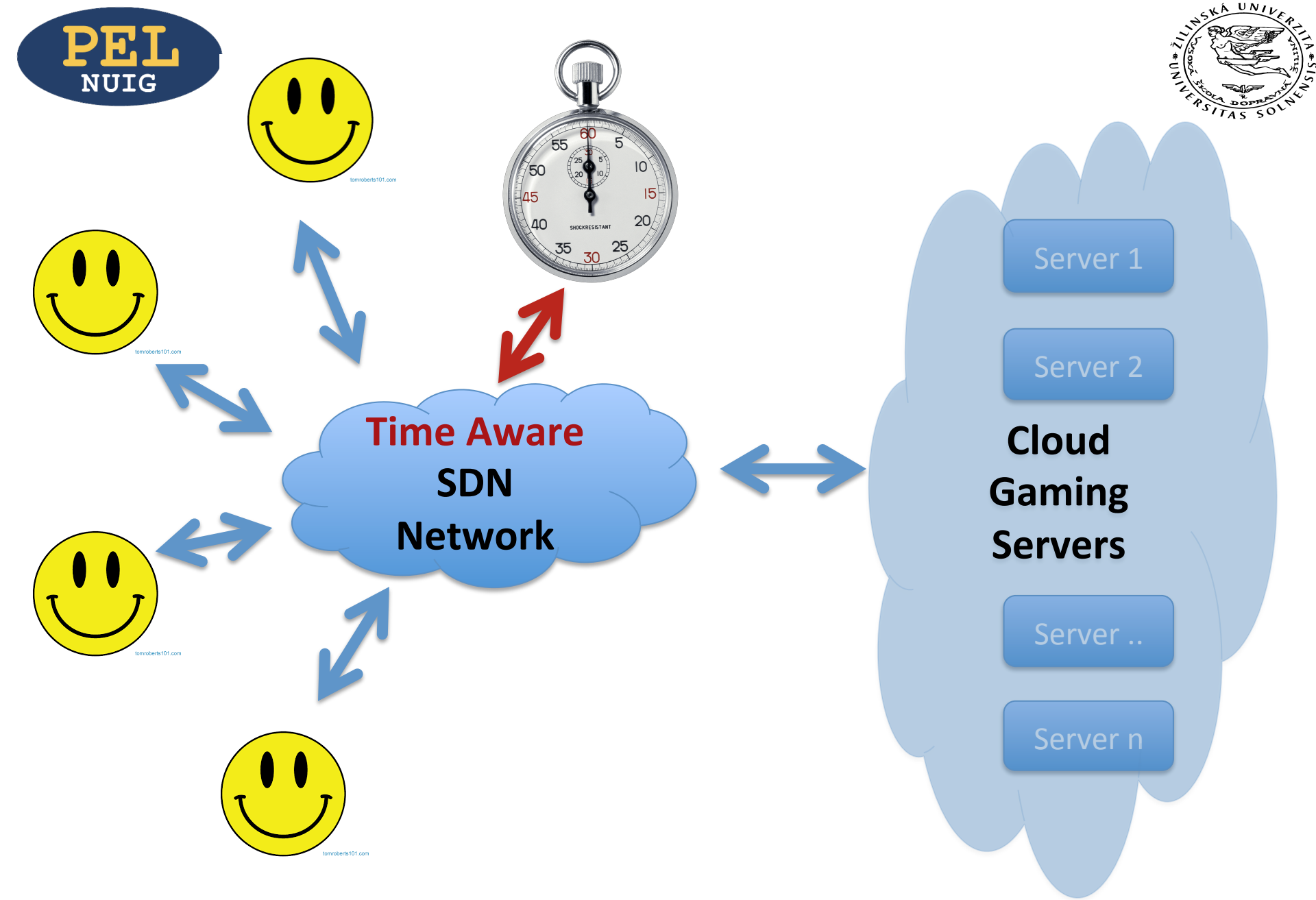
Phase 2 –Network side

- Monitor – Model – Manage
- Process
  - Realtime network delay (ND) calculations
  - QoE model : delay ⬅➡ QoE
  - SDN Controller – Traffic prioritisation
- Previous research
  - Timing for QoS over WiFi for VoIP


Time Aware
SDN
Network
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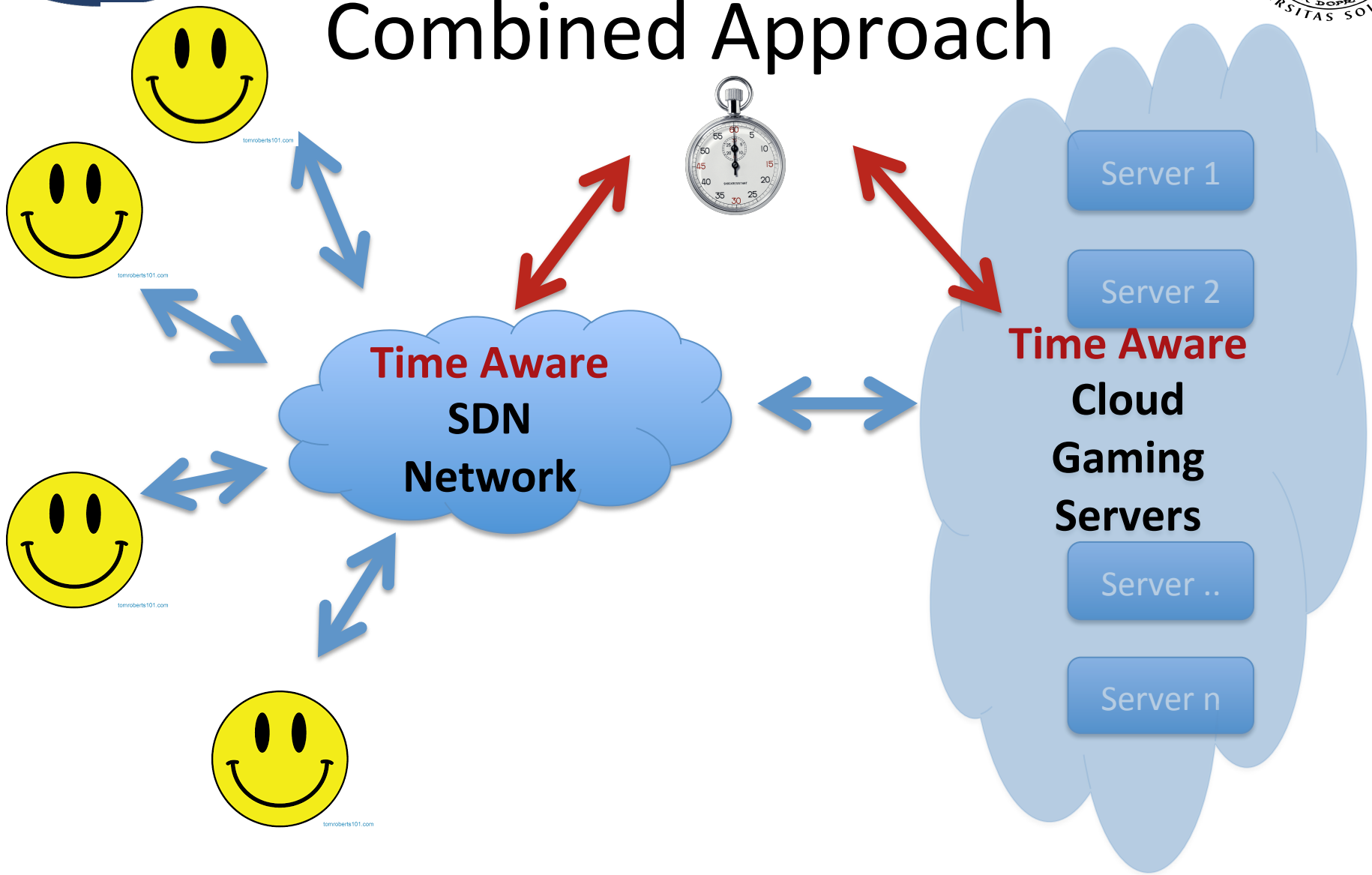
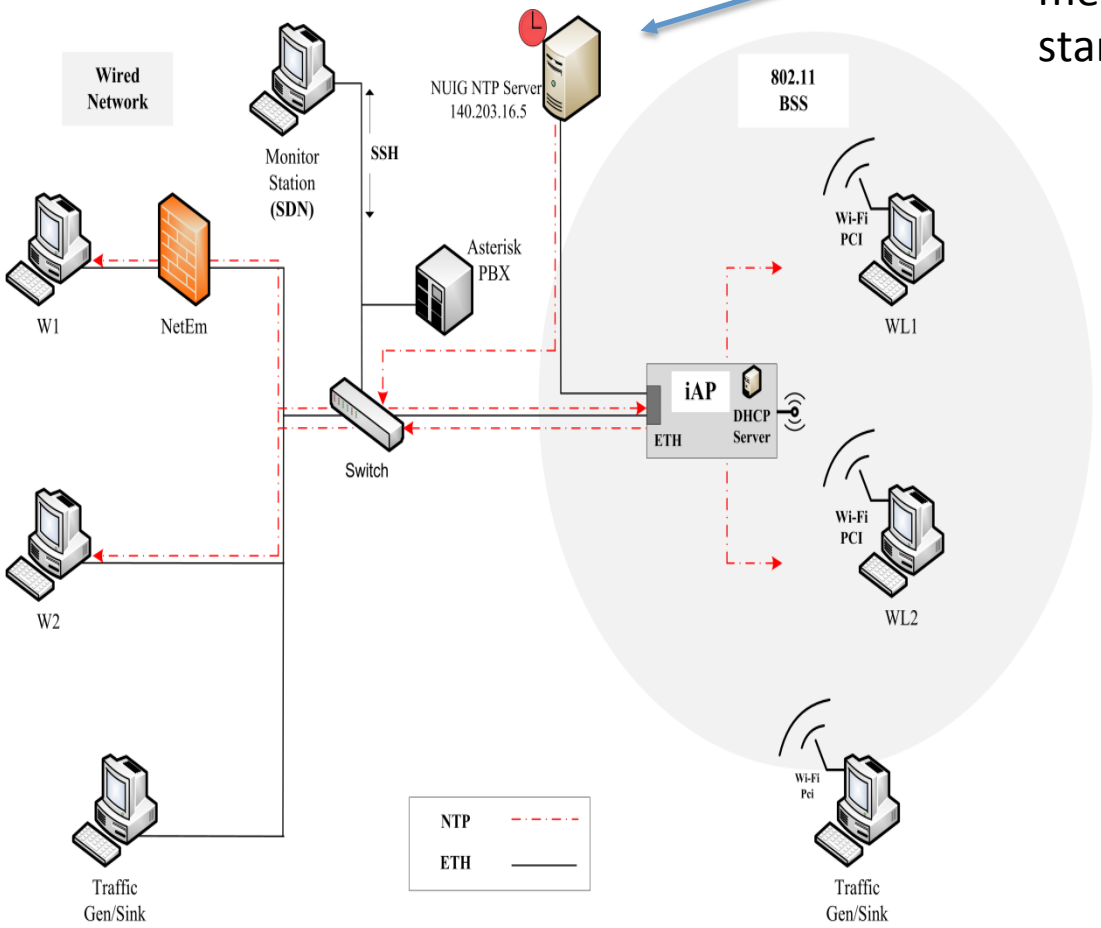
Combined Approach

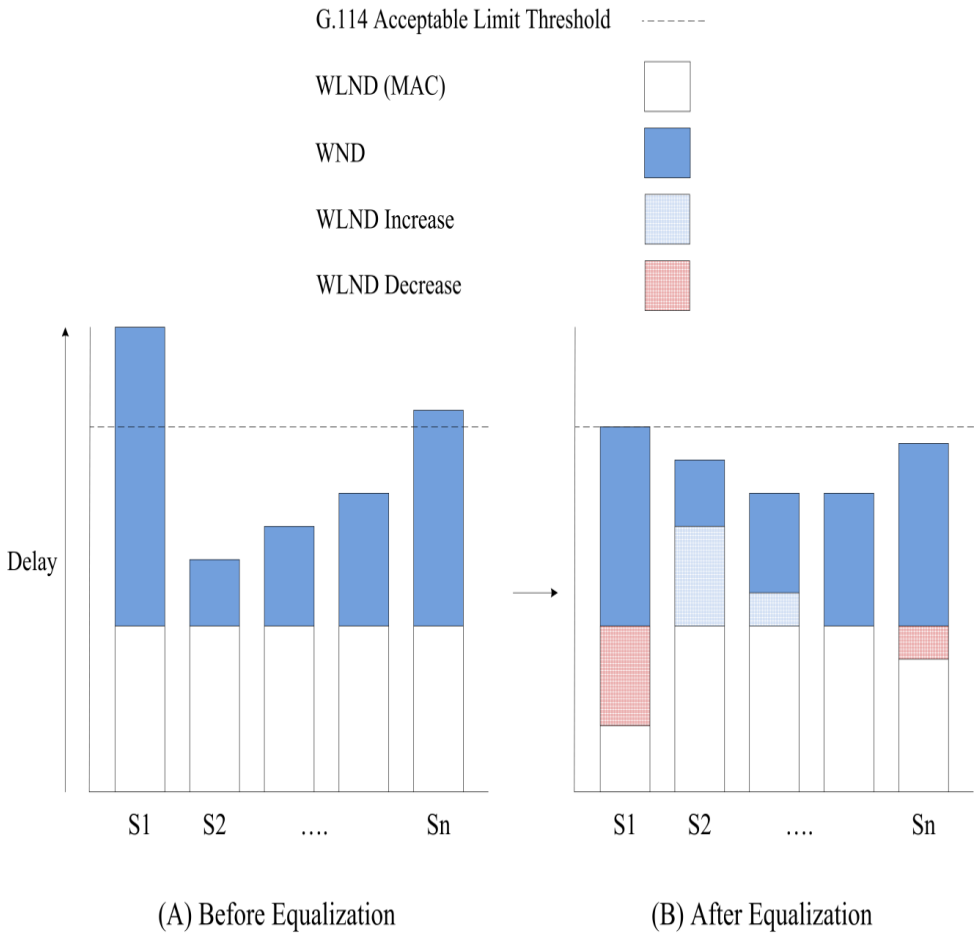


Timing for VoIP QoS

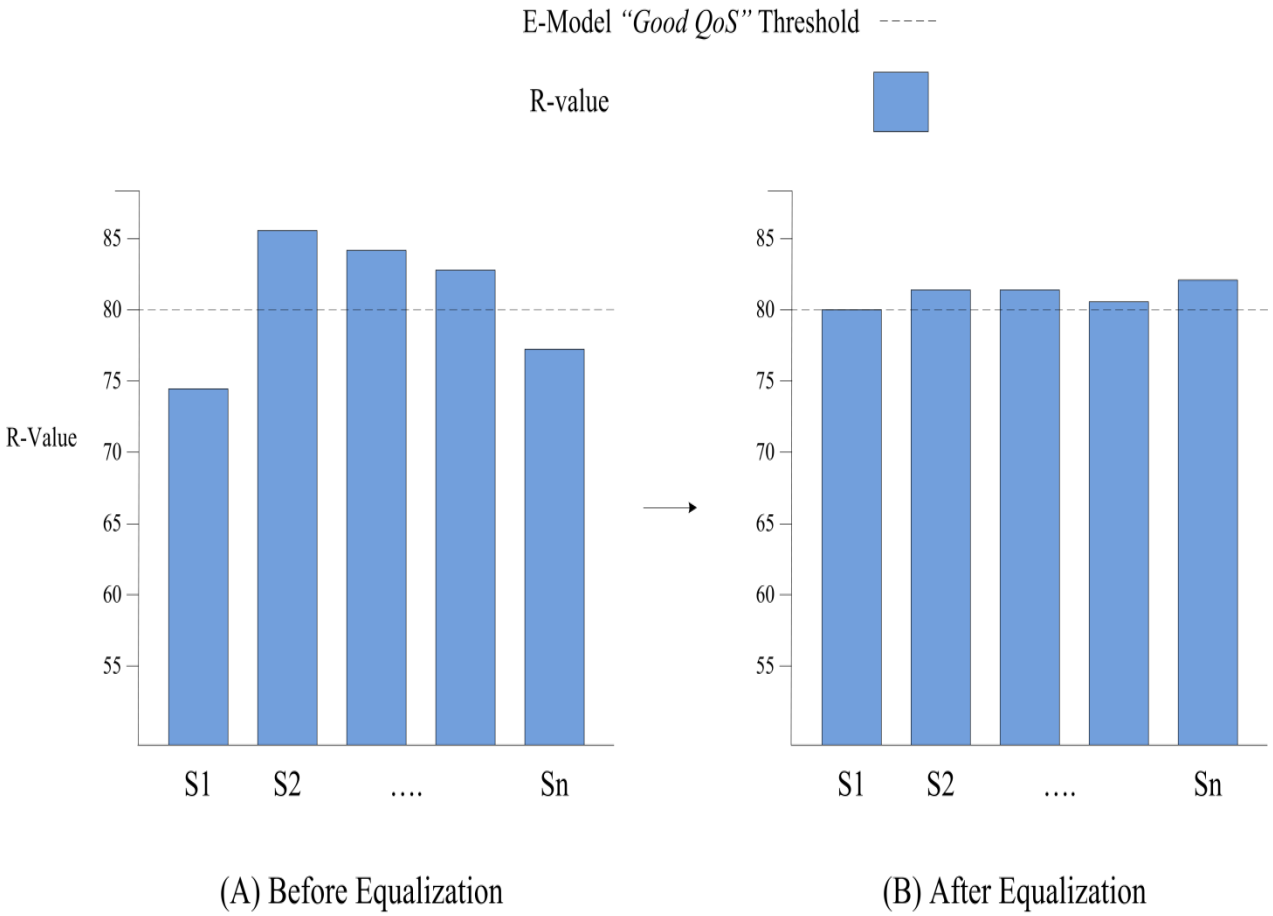
Synch Time for delay measurement over standard WiFi



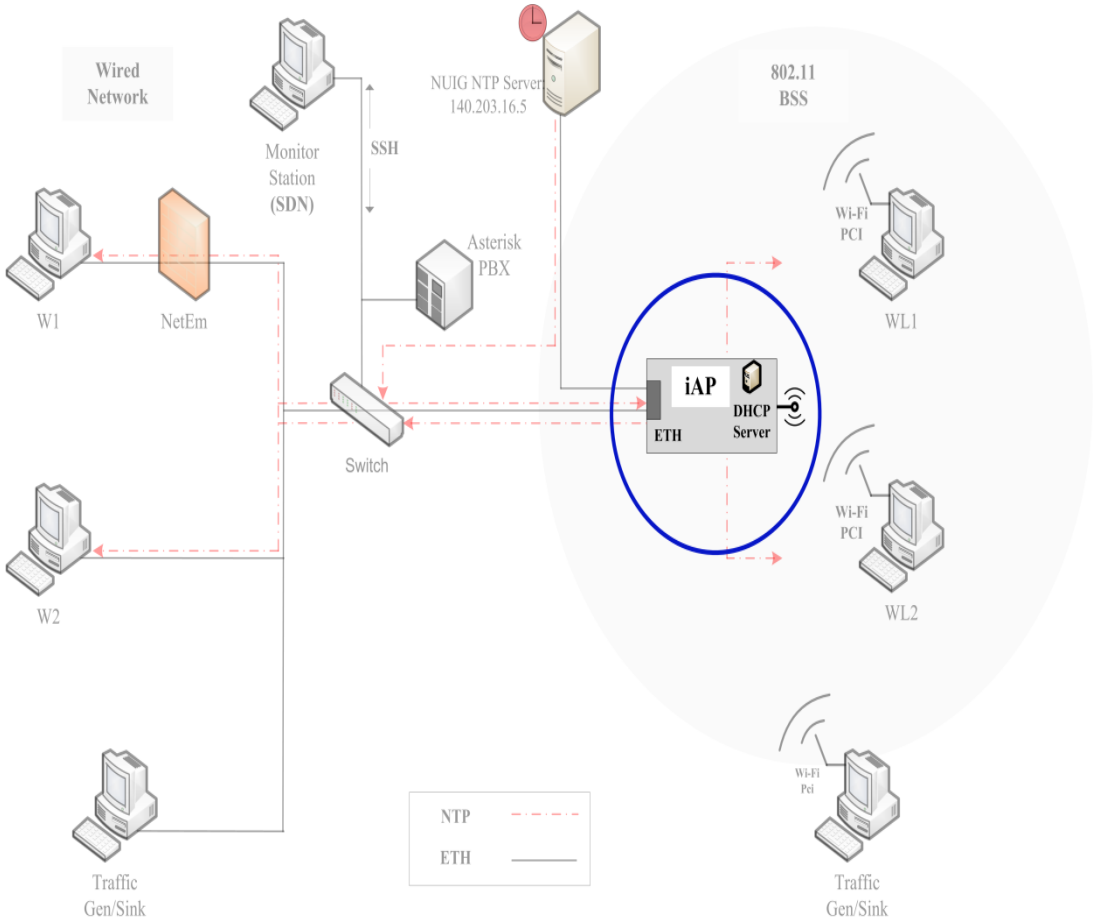
iAP Concept – Delay Optimisation



…applied to ITU-T E-Model



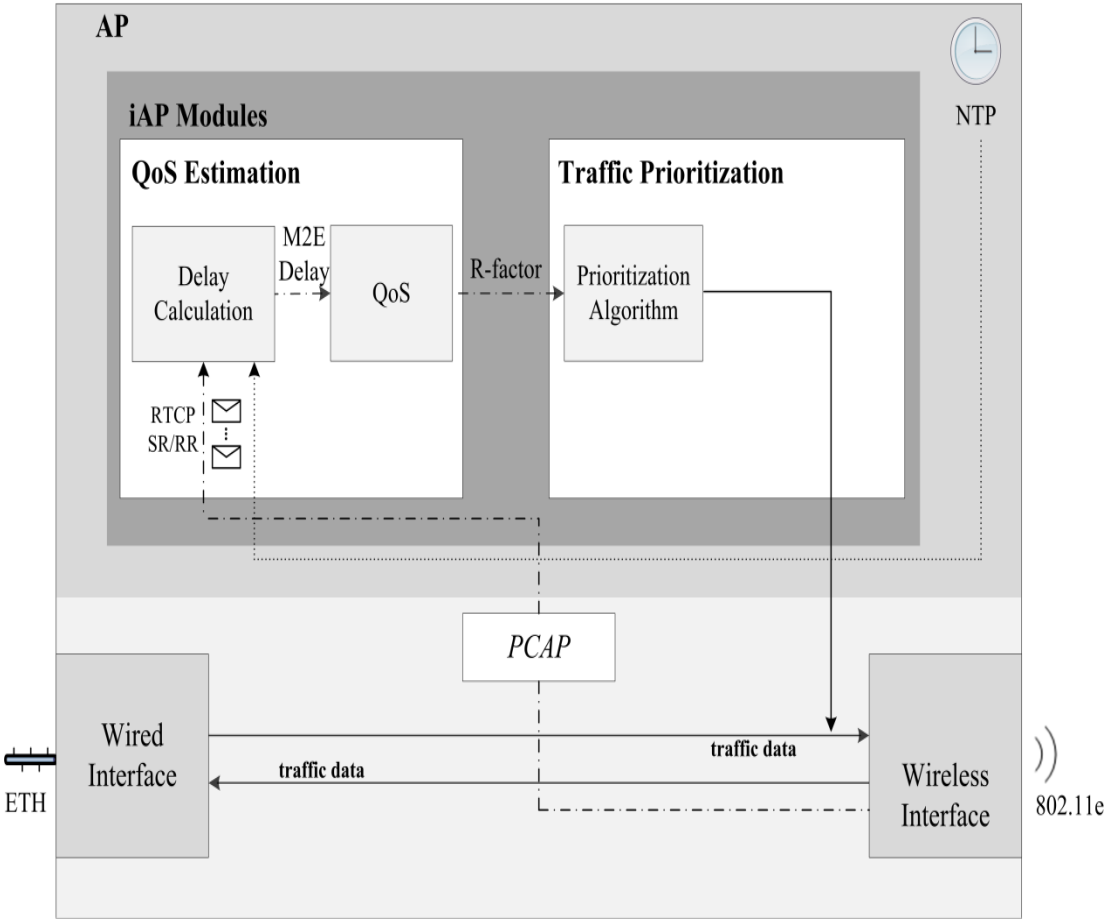
Experimental test-bed



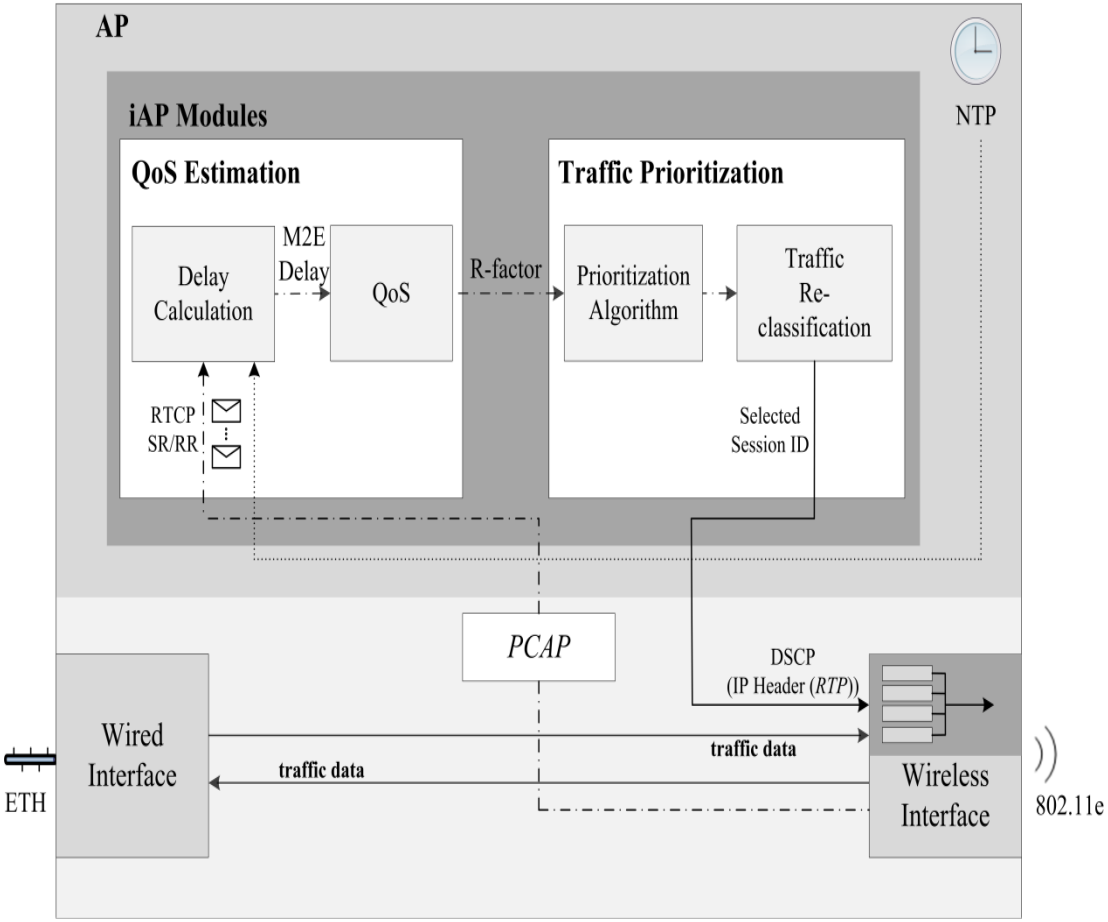
iAP Mechanism

1. Identify individual VoIP sessions
2. Calculate one-way (and intra-one-way) delay for each session
3. Calculate each way QoS R-factors for each session
4. Run prioritization algorithm for VoIP sessions
5. Implement session prioritization on AP downlink
6. Remote management - SDN

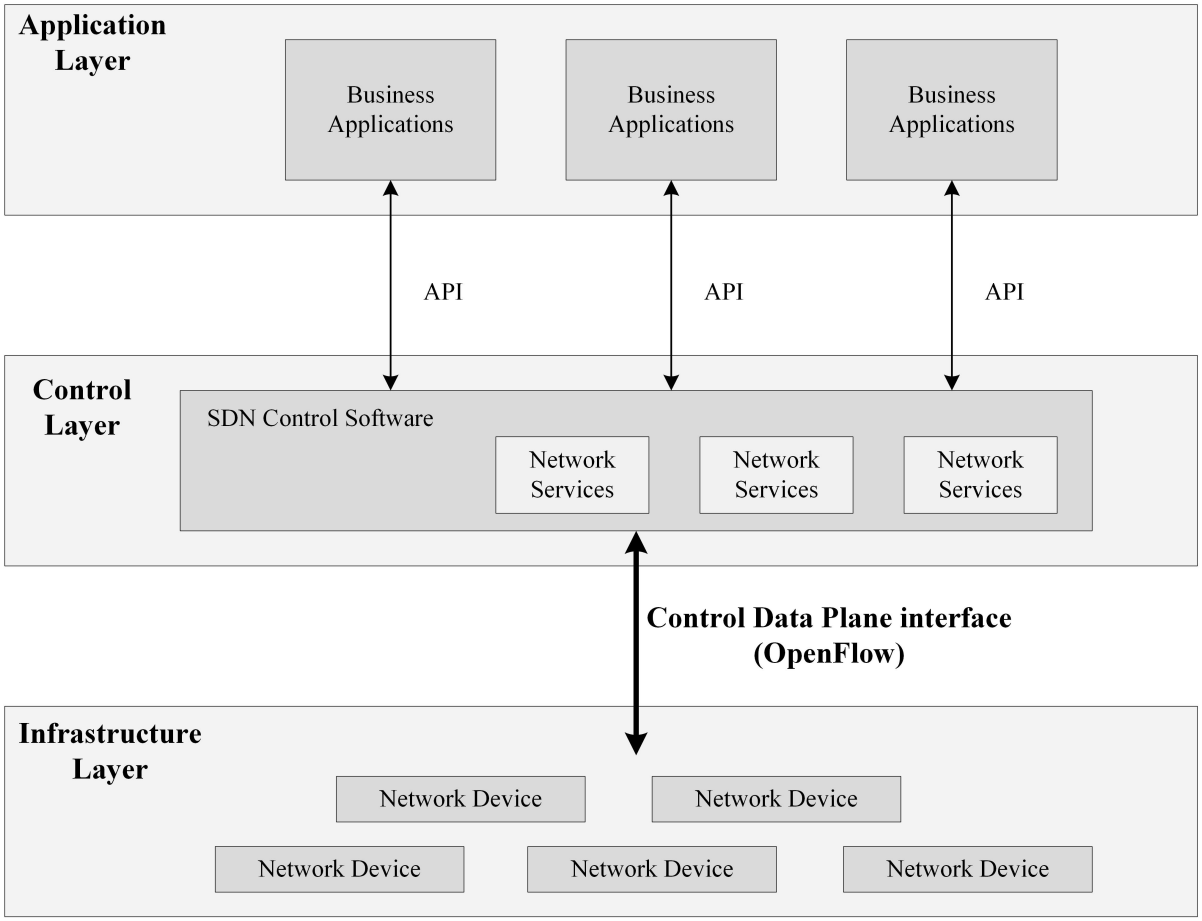
iAP Architecture – Delay calculation



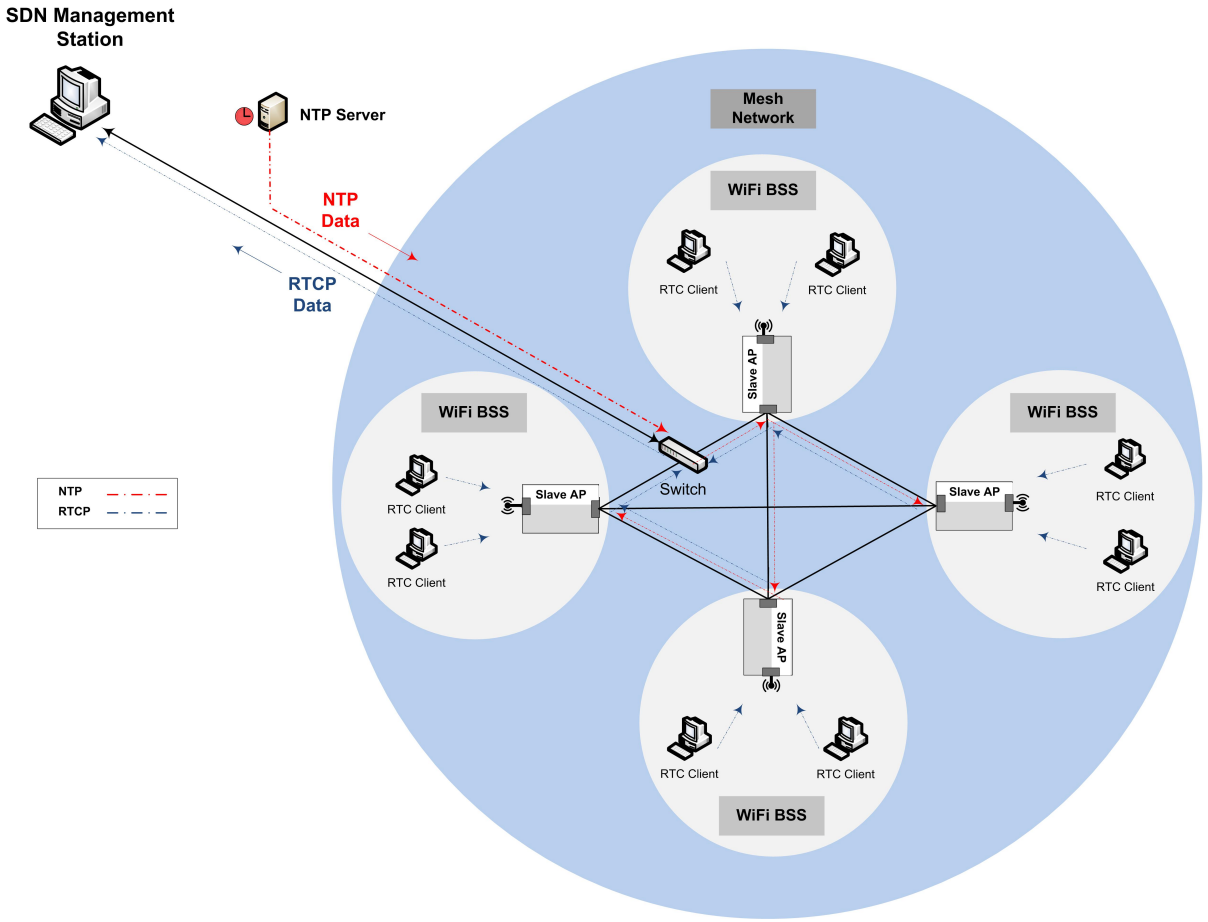
iAP – Full Architecture



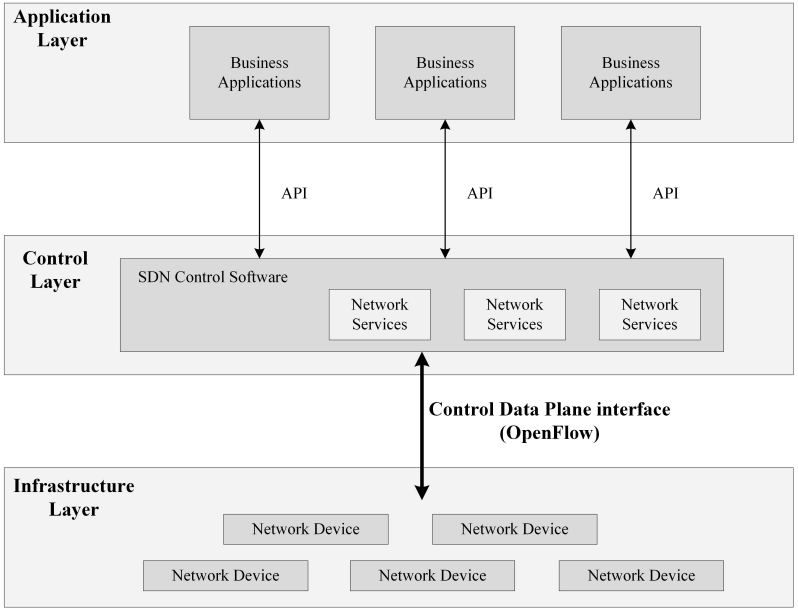
Moving towards SDN



Moving towards SDN



SDN - Gaming



Game Server

Case Study : Gaming Anywhere

- Open source Cloud Gaming Platform
  - Released 2013
  - http://gaminganywhere.org/
- Platform for
  - Researchers
  - Game Developers

Gaming Anywhere[1]

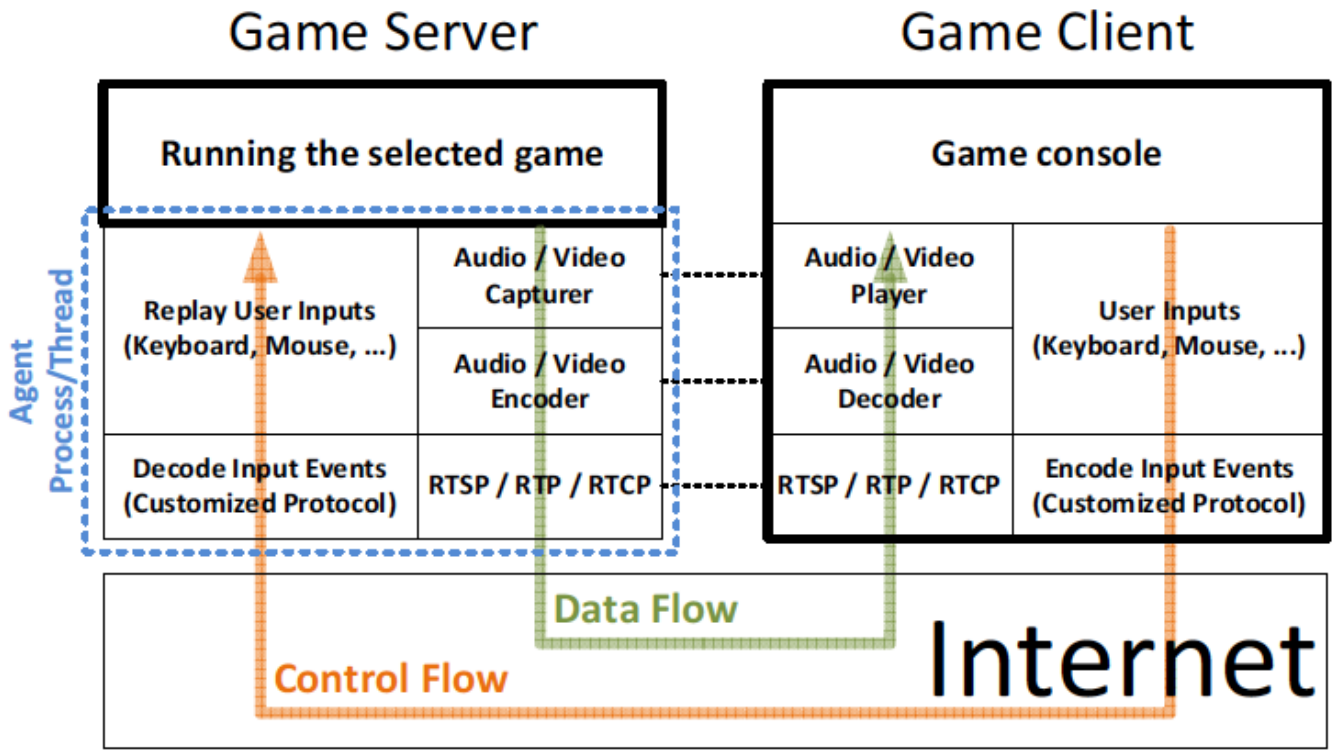
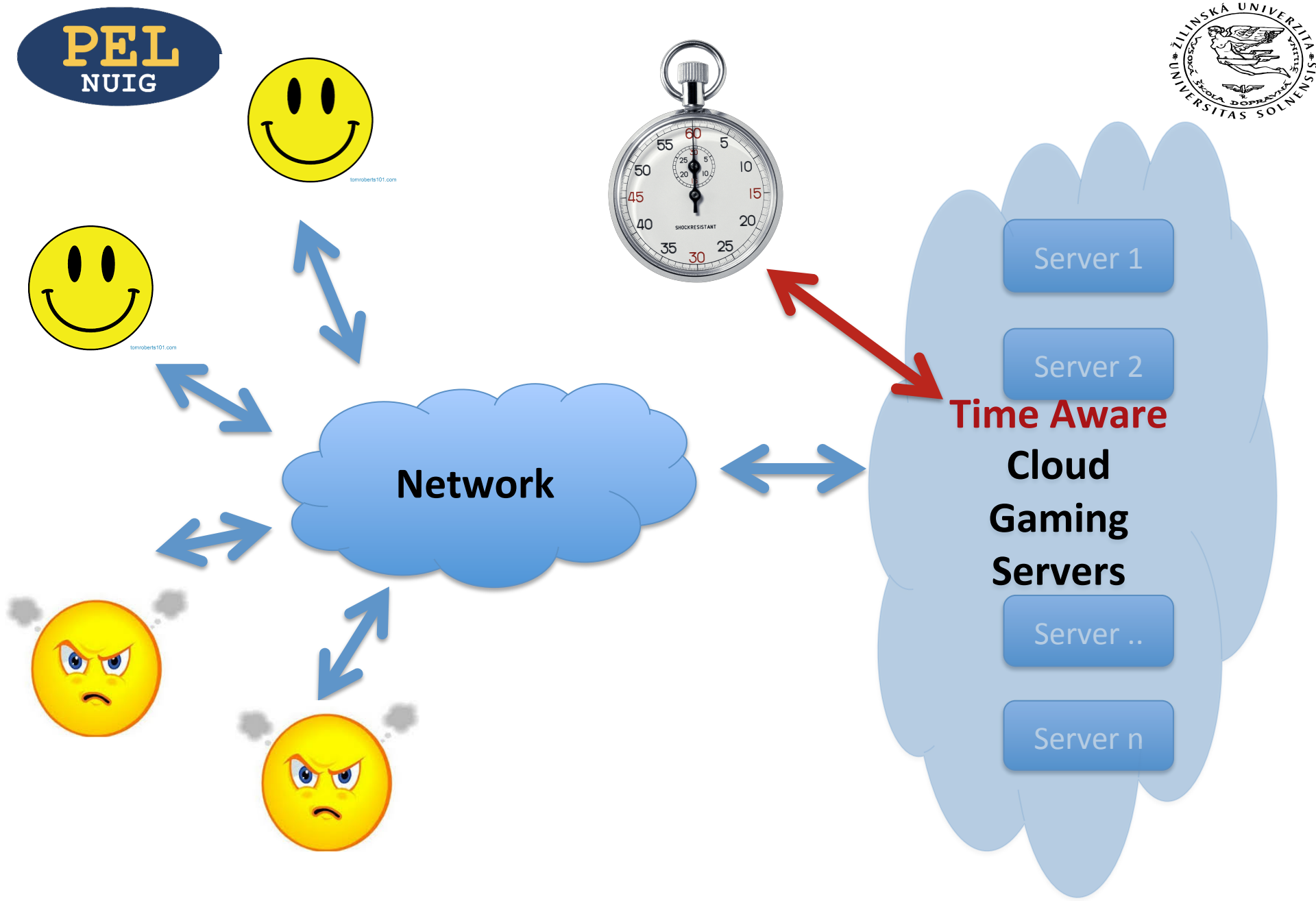


Figure 2: A modular view of GamingAnywhere server and client.

GA – Time Awareness

- Control Flow
  - User events sent to server
- Data Flow
  - Video streaming from server to client
- Use of RTP/RTCP
  - Facilitates delay measurement via NTP
  - Similar to SDN approach


PEL
NUIG
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UNIVERSITAS SOLNENSIS
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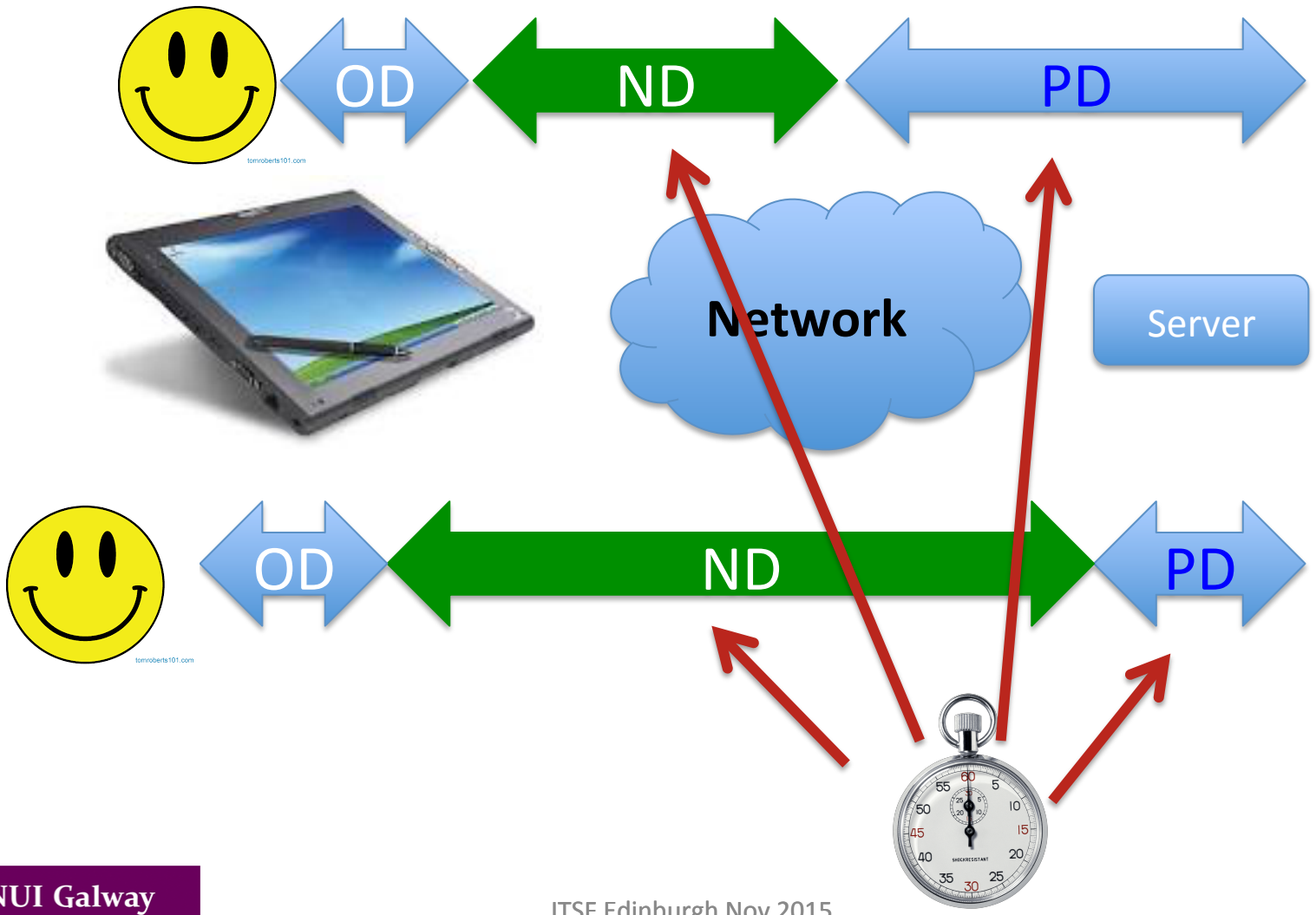
QoE Optimisation



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2. Chun-Ying Huang, Kuan-Ta Chen, De-Yu Chen, Hwai-Jung Hsu, and Cheng-Hsin Hsu, "GamingAnywhere: The First Open Source Cloud Gaming System," ACM Transactions on Multimedia Computing, Communications and Applications, Vol 10, No 1s, Jan, 2014
3. Five Considerations for Building Online Gaming Infrastructure from http://www.internap.com/resources/five-considerations-building-online-gaming-infrastructure/
4. Claypool, Mark and Kajal Claypool, “Latency Can Kill: Precision and Deadline in Online Games”, the Association for Computing Machinery. 2010.