The loose QoS approach of MUSE

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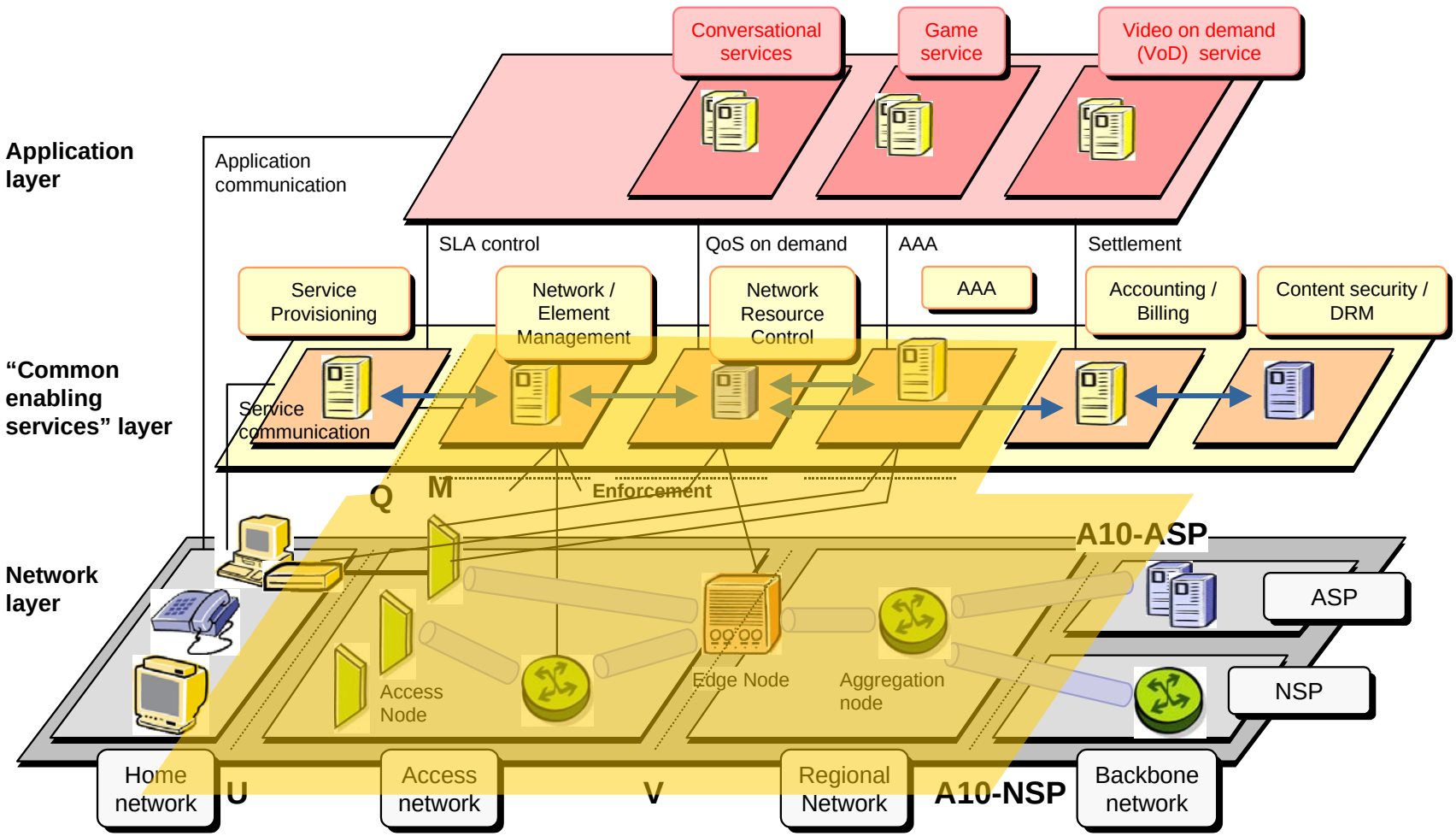
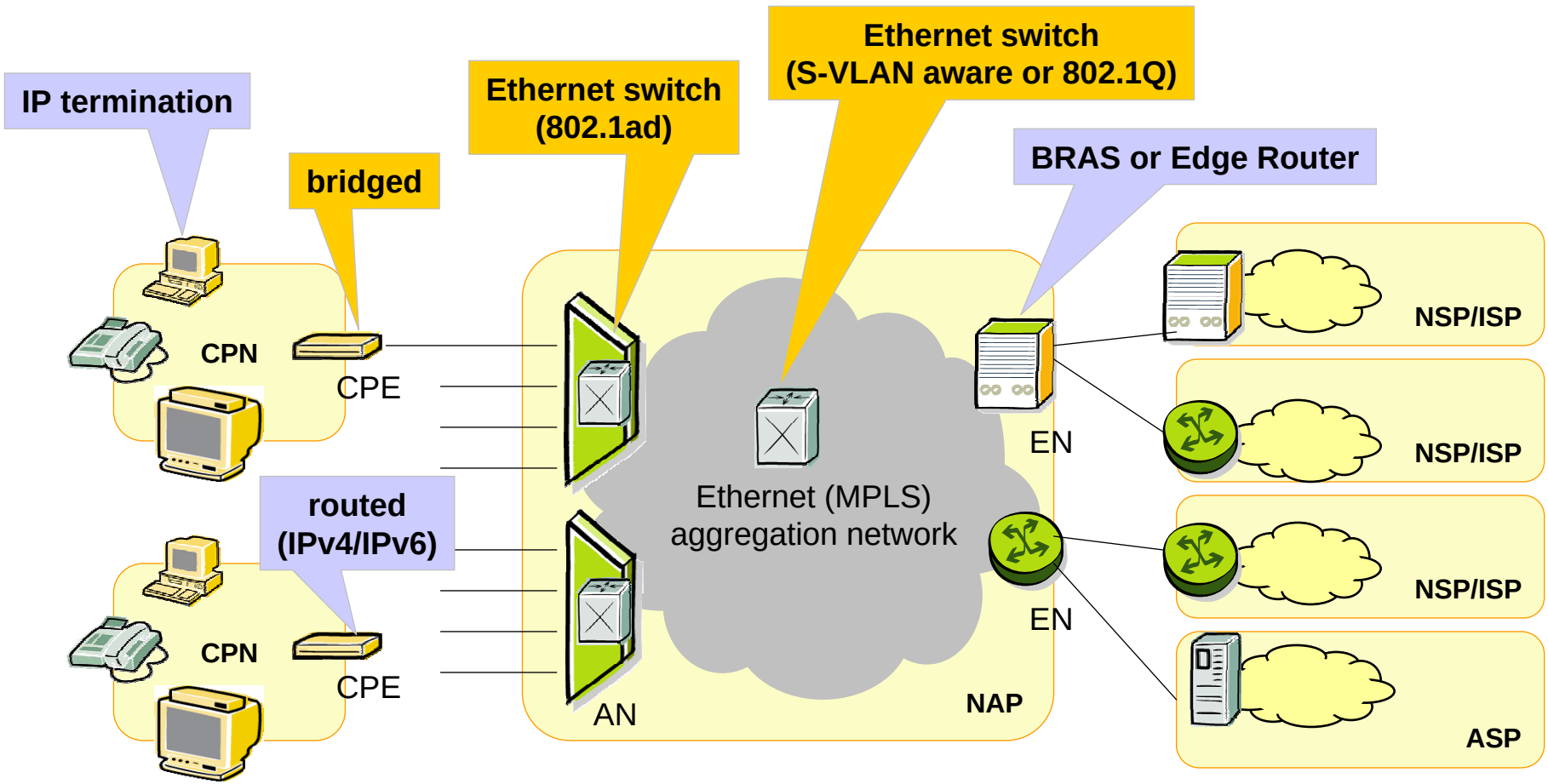
Multi Service Access Everywhere

Positioning of MUSE architecture

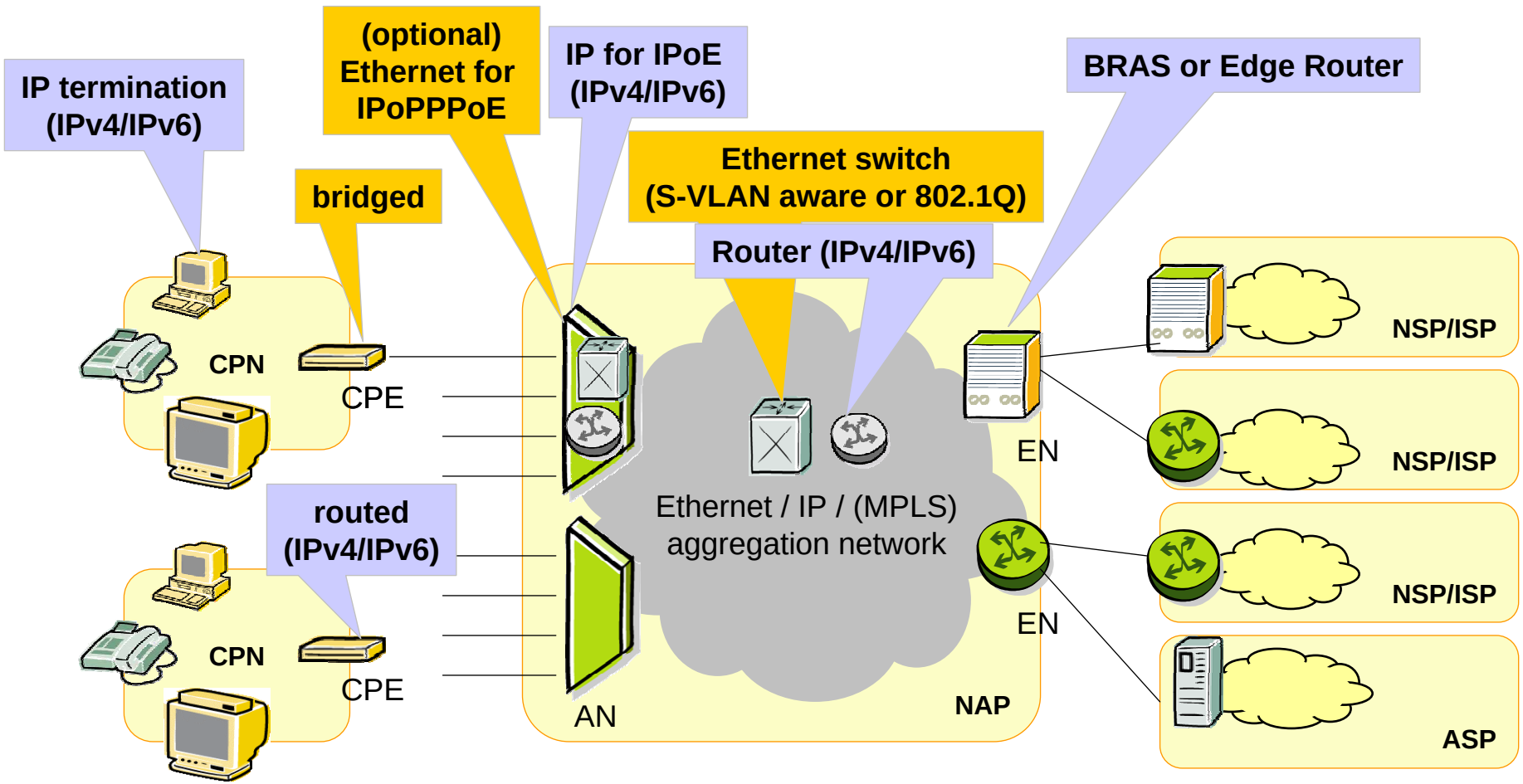


Source: DSL Forum

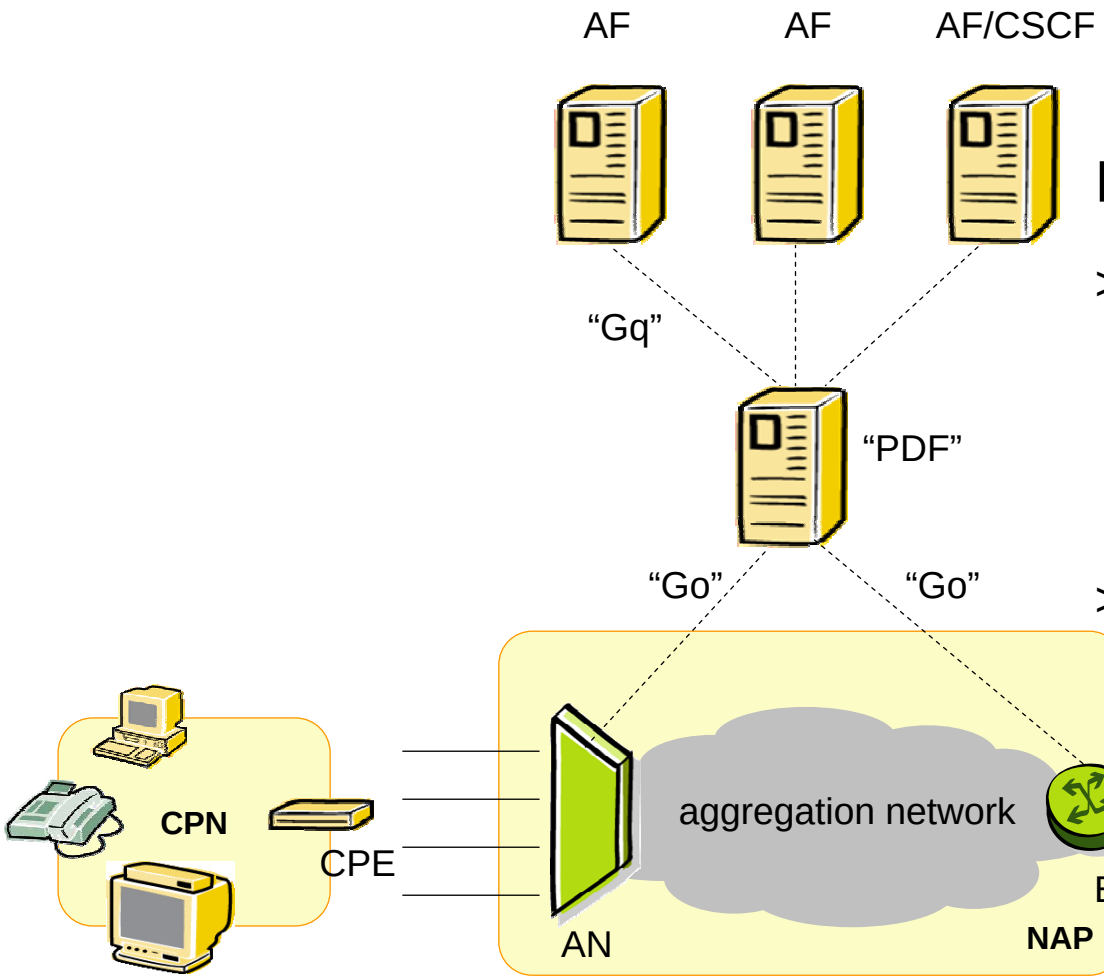
MUSE Ethernet Network Model



MUSE IP Network Model



The initial MUSE approach for QoS control is inspired by 3GPP and TISPAN

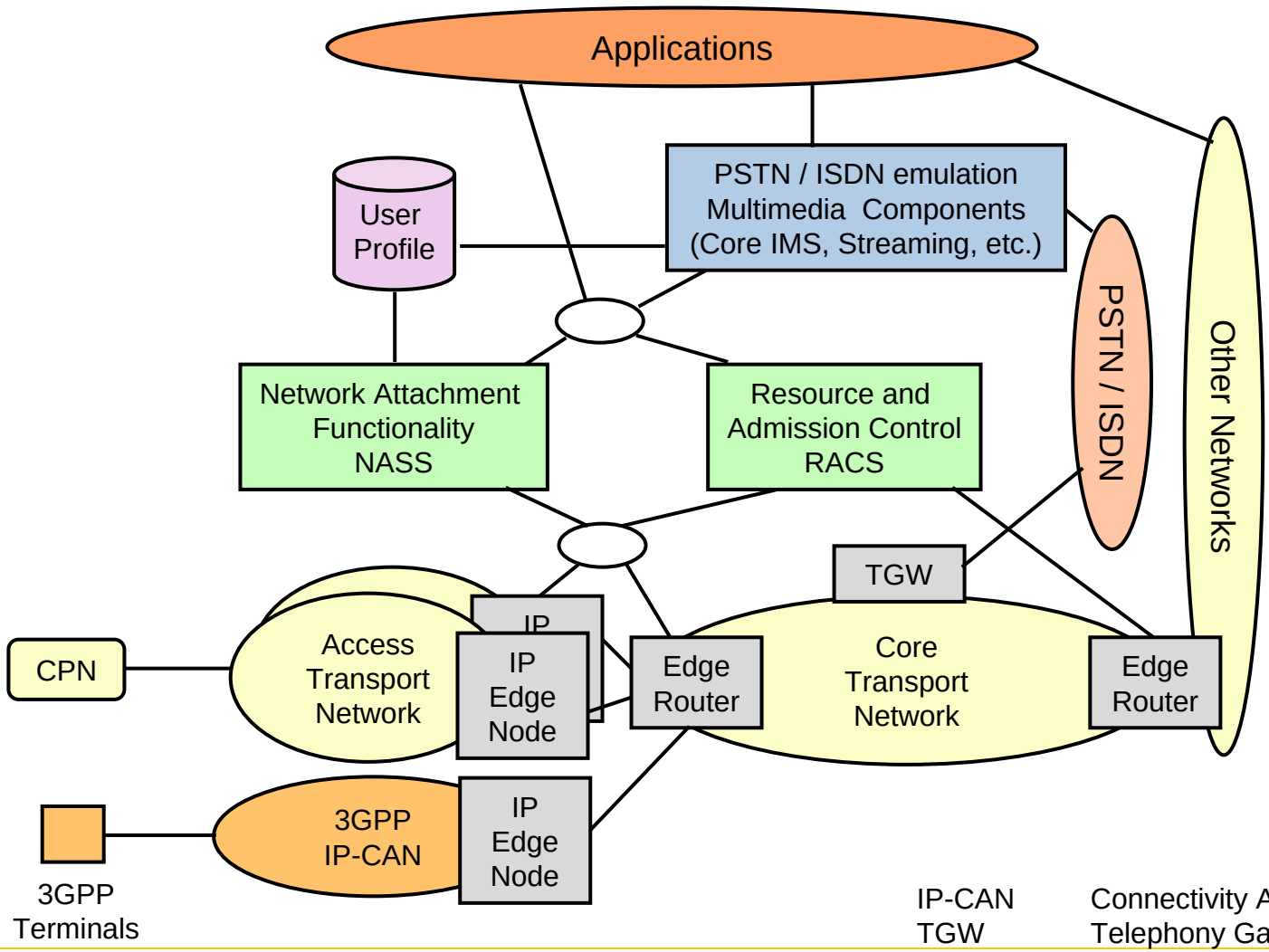


Expected benefits:

> Fixed-mobile convergence, at different levels:
  - services
  - infrastructure

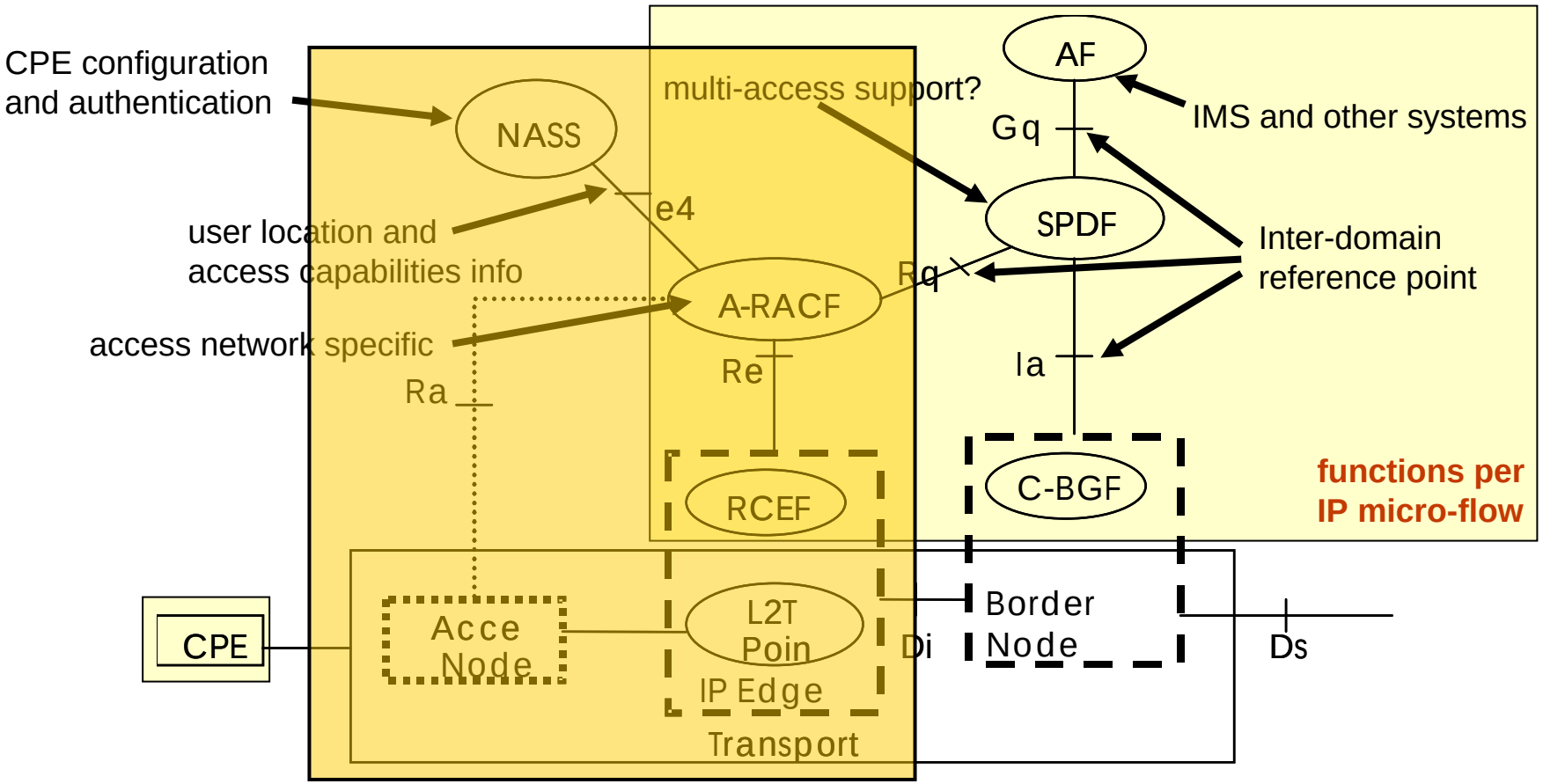
> Nomadicity support

TISPAN NGN Architecture R1 Overview



IP-CAN Connectivity Access Network
TGW Telephony Gateway

TISPAN RACS Key Aspects



AF	Application Function	RACF	Resource and Admission Control Subsystem
C-BGF	Core Border Gateway Function	RCEF	Resource Control Enforcement Function
NASS	Network Attachment Subsystem	SPDF	Service-based Policy Decision Function

The tight QoS approach

- The tight QoS approach can be defined as those solutions that intend to provide hard QoS guarantees by means of a combination of tight QoS control mechanisms such as:
  - Resource reservation through the whole path
  - IP flow policy enforcement in crowded nodes
  - Centralized control

- As such, the tight QoS approach is not scalable
  - The fact that a system is said to be non-scalable does not mean that it cannot be implemented
  - The concept of a solution scalability refers to the capability of the solution to be applied to a system of any size

The IMS/TISPAN model follows the tight QoS approach

- The resource reservation is performed at the finest level of aggregation: the individual IP flow.
- The control for a given access network is concentrated in a small number of centralised resource control entities.
- As a consequence, the IMS/TISPAN approach shows a potential lack of scalability.
  - In this way, IMS/TISPAN is interesting when QoS traffic is a reduced portion of the whole, as is currently in 3G networks, but not for deploying QoS in a **massive way.**

A revision of the QoS principles is needed!!

1st Premise: QoS is end-to-end oriented

- For the end user, only end-to-end QoS is relevant
  - End users must agree on the QoS
    - Recipients must authorise the reception of a given QoS traffic
      - If not, DoS attack can be produced
- However, this does not imply that QoS must be connection oriented!!
  - Resources reservation has not reason to be done along the whole path
  - Services platform intermediation has not reason to be needed if QoS classes have been previously subscripted
- QoS can be (e2e) reached by means of specific peering SLAs
- All the complexity can be shifted to the network edge with the user

2nd Premise: QoS mechanisms are not necessary when resources are unlimited

- At least, if one does not want to differentiate QoS on purpose for different services
  - that is, making worse the QoS received by a specific service or set of services
    - (e.g. routing all best-effort traffic from Madrid to Paris through Alaska).

- When resources are very scarce (e.g. wireless media) dynamic resources reservation is very recommended
  - So that an authorised and established QoS session does not suffer starvation (retainability with good enough QoS)
  - The lack of resources problem becomes an accessibility problem
    - Dimensioning of access points is needed in order to be able to guarantee the availability of QoS services.
      - E.g. In wireless communications, this is solved by an appropriate dimensioning of the cells (number and coverage area).

3rd Premise: Tight QoS controls are not enough for providing QoS

- Tight QoS control mechanisms + underprovisioned network = blocking (not availability) = not satisfying QoS
  - In case of network congestion, users cannot access their QoS services
  - The goal is to avoid the network congestion
    - And this is not achieved by means of tight QoS control mechanisms
- So, provided that network dimensioning is suitable performed, why not using looser QoS control mechanisms?
  - The loose QoS approach (e.g. DiffServ) can be defined as those solutions that intend to provide soft or even hard QoS guarantees by means of looser QoS control mechanisms.
    - It is important to realise that the loose QoS approach does not necessarily imply that QoS guarantees be loose, light or relative.

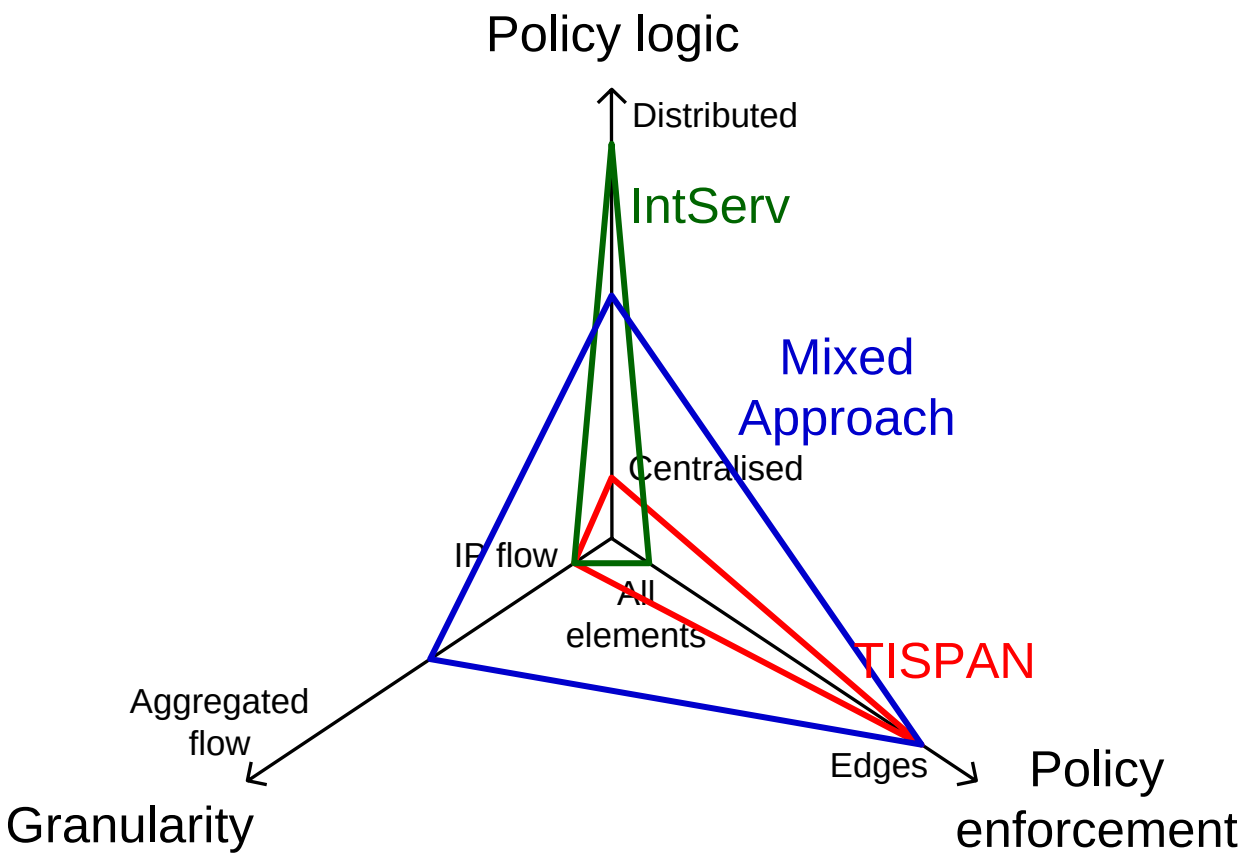
The loosest QoS approach consists on trusting only in classical operational TE

- Foreseeing the demand of every traffic class
  - Including their statistical distributions and the origin/destination matrixes
- Dimensioning the network according to that demand
  - Including the dimensioning of the interconnections (and reaching QoS SLAs) with other network/service/application providers
- Tracking and monitoring the performance and the usage of resources
  - Generation of reports, alarms, checking whether resources usage is as previously foreseen
- Identification of SLAs that need to be modified and resources that must be increased and provided inside the own domain

The loose QoS approach of MUSE: expanding the TISPAN approach

- To control and to enforce the QoS policies at different aggregation levels.
- To distribute the policy logic (TISPAN's A-RACS and SPDF)
  - Policing decisions could partially be performed without disturbing the central element that coordinated the policy logic.
    - For instance, by means of preloading into the edge network elements (during the attachment period after a subscription epoch or a roaming one) the associated set of default policing functions based on the foreseen standard usage for the given user profile (in case of the Access Node) or SLA profile (in case of the Edge Node).
      - So, only when a given request were not under the specified set of standard usages or when congestion had been notified, the requests could be forwarded to and solved by the centralised element coordinator of the policy logic.

Scalability analysis



As a conclusion, more complex QoS mechanisms are needed as resources are more scarce

- The realistic loose QoS approach follows the philosophy of selecting the appropriate complexity grade on each part of the network, so that complexity is naturally shifted to the edges, as DiffServ proposed.
- QoS could be achieved by means of a mix of loose and tight QoS control mechanisms.
  - Loose control for the vast part of the QoS traffic
  - Tight control for QoS mission critical traffic.
    - These tighter control mechanisms could follow a similar approach to IntServ/IMS/TISPAN.