# Ensuring quality control and enhanced experience for global multimedia services

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**Paris, 29th November 2011**

# 1921-2011: Celebrating 90 years of Italtel

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**Today: Italtel develops products and solutions for the new Multimedia Communication**

**90s and 2000s: Italtel completes the trasformation of Telecommunication Network Control Centers**

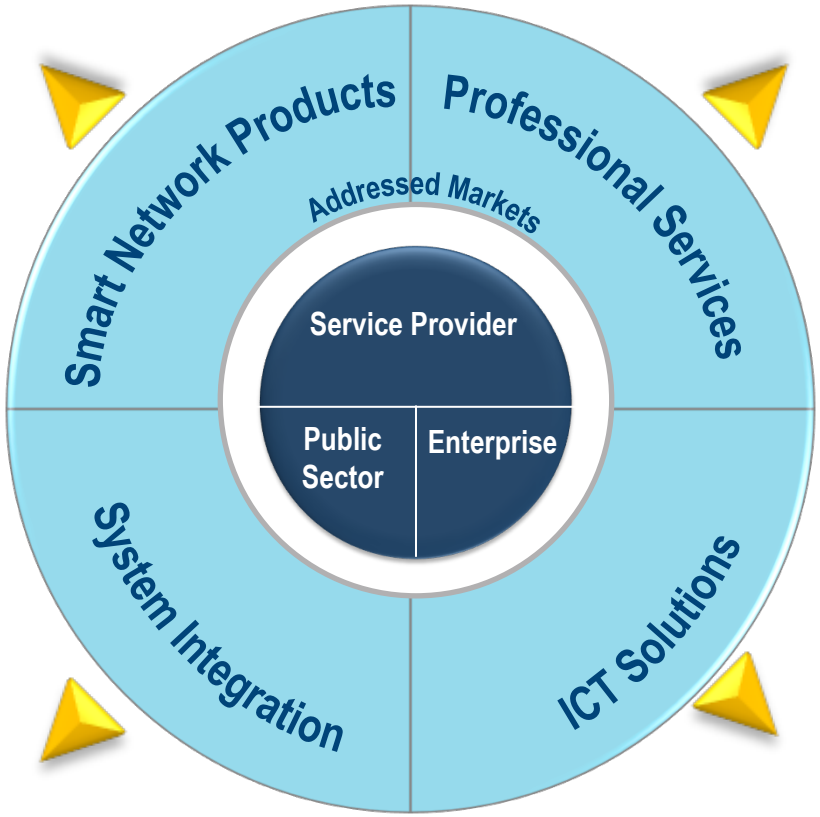

1921 | 80s | 90s | 2000s | 2004-2007 | 2008-2010

**80s and 90s: for twenty years Italtel has been the protagonist of Italian Telephony digitalization**

**2000s: Italtel realizes the transformation of Telephony over the Internet Protocol**

# Italtel offer: Overview

- NGN+IMS Core & Services
- HSS e Subscriber Data Management Systems
- Session Border Controllers, Signalling & Media Gateways
- Multimedia Access




- Engineering & Testing
- Consulting & Assessment
- Managed Services

- OSS
- ICT Security
- Network Management System

- IP Borderless Networks
- Unified Communication & Collaboration
- HD Video Networks
- Intelligent Traffic Management
- NG Data Centers
- NGMN: Packet Core

**15 Offer areas based on Integrated Solutions & Proprietary Products developed in house**

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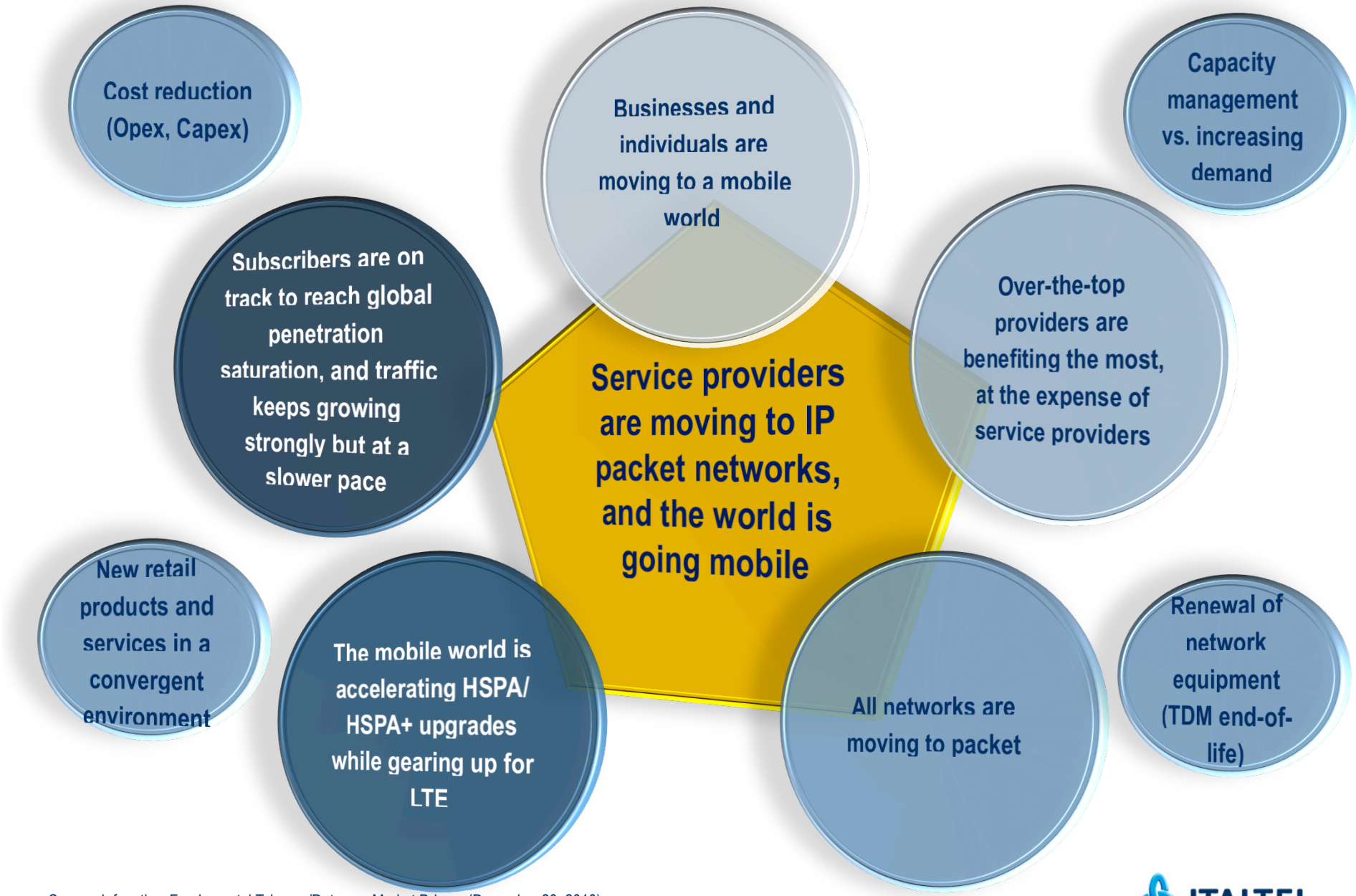
# Advent of IP telephony and Internet

- The advent of IP Telephony (or 'Voice-over-IP') and the Internet represents the most significant industry shift to date and, while the majority of voice traffic is today generated via legacy circuit-switched networks, ultimately, **VoIP will become the norm rather than the exception – shifting TDM traffic to packet-switched networks** and opening up opportunities to extend communities and services seamlessly between the wired and wireless worlds, and vice versa.
- For service providers, **the creation of new revenue streams and the ability to differentiate services has become imperative**. Mobile service providers have experienced phenomenal success with text messaging (SMS), but the proliferation of voice and messaging bundles has resulted in falling ARPU. Meanwhile, fixed-line service providers have seen margins eroded by a combination of fixed-mobile substitution, **intense competition from dynamic alternative telcos and OTT**, and ISPs offering aggressively priced VoIP services.
- **End user behaviour has altered irreversibly**. The popularity of new person to-person communications mediums such as text , video and instant messaging, online gaming and peer-to-peer file sharing has also demonstrated the potential for new IP-based services.

# Global Telecom Trends: Overview




Source: Infonetics, Fundamental Telecom/Datacom Market Drivers (December 20, 2010)

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# Quality of Experience (QoE): Hard to define but for sure a Key Success Factor



***"The overall acceptability of an application or service, as perceived subjectively by the end-user."***

**by ITU-T P.10/G.100**

- **Considers the complete *end-to end system effects* (client, terminal, network, services infrastructure, etc.)**
- **QoE also depends on users' expectations, on the *characteristics of the designed system* and on the *context* within which the interaction occurs**

**Within ETSI TC HF deliverables QoE has been defined (since 2006) as per ETSI EG 202 534 and ETSI TR 102 535:**

***"The performance of users when using what is presented by a communication service or application user interface."***

NOTE: It takes into account the individual Quality of Services and measures the acceptability of a service or application by **including factors such as usability, utility, fidelity and level of support from the application or service provider** (e.g. sales, delivery, error corrections).

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# QoE: OTT and SP perspectives (1)

ETSI has developed (EG 202 670) a **systematic approach for extracting and combining user experience and technical parameters**:

IF <communication situation>;
USING <service prescription>;
WITH <technical parameters>;
THEN <**user experience**>.

- **OTT's are trying to differentiate from each other** and consider E2E QoE as something that can be improved **by acting on Clients and Web applications**

- **Telecom SP's** tend to have less and less control on End User Equipment and Clients, so need to federate and join forces in order **to define a common and converged service offer that definitley provides specific value added vs OTT's ones.**

- At present, Telecom SP's (MNO's and FNO's) may be able to enforce transport layer per-flow or per-application Policies **within their own Network Domain** but cannot guarantee the **End-to-End signalling and media flows**

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# QoE: OTT and SP perspectives (2)

➢ Network operators and service providers must find a way to manage their end-to-end delivery on a global scale, while ensuring, security, QoS and the equitable and sustainable sharing of revenues between all members of the value chain.

**Carriers Interconnects are crucial for end-to-end services :**
**IPX approach is the key!**

➢ IPX is critical for enabling end-to-end multimedia services between service providers because **interoperability and service differentiation are key to the successful**, **widespread adoption of mass-market services**. Social Networking, IM, Presence, HD Voice, Video Conferencing, Video Share, File Share, and Multimedia Collaboration **must work seamlessly across multiple operators to stimulate mass adoption.**

In this context the main Key differentiators are :
• Centralized routing (control) and E2E policy (**QoS/QoE**, CAC and SLA Management..)
• Security
• Media transcoding, Signaling/transport/service interworking

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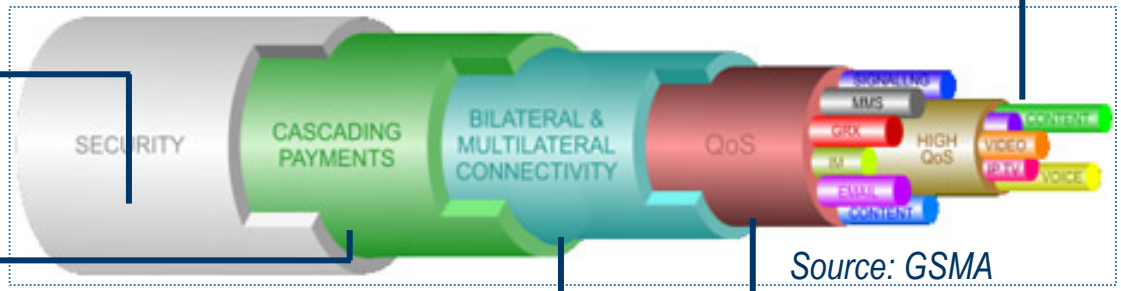
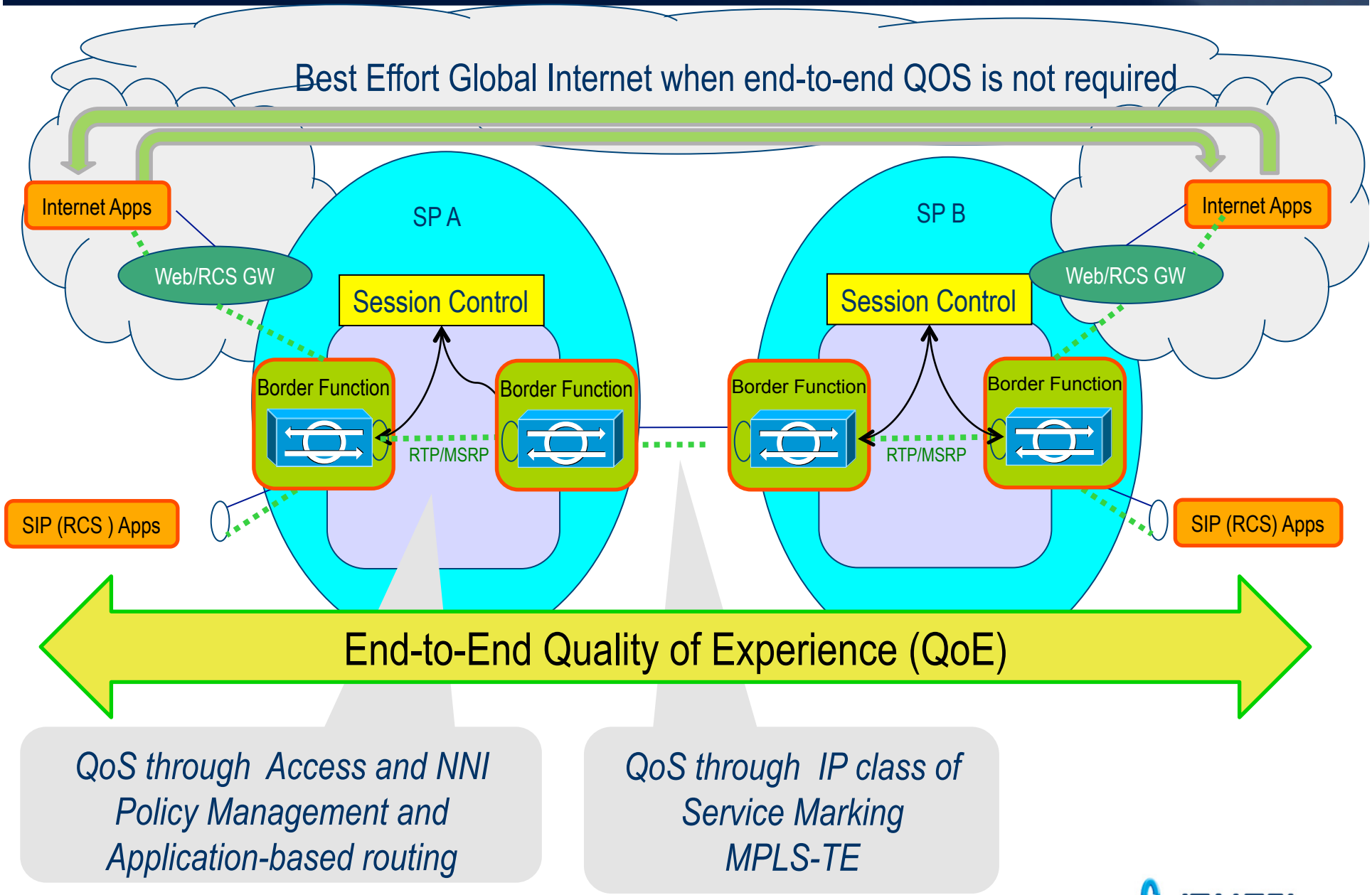
# New generation Interconnection drivers

- **Network simplification**
  - Common IP transport layer shared among CS and PS networks
  - High capacity network elements with centralized deployment and operations & charging functions.
  - OPEX Optimisation.
- **Support of innovative services**
  - Beyond voice (mainly mobile)
  - e2e IP based new ser
  - vices (RCS-e, Videotelephony, Presence, IM, Content Sharing)
  - LTE roaming scenarios
- **Security**
  - Protection of IP-IP NNI
  - Secure environment
- **Flexible Charging support**
  - Usage data for billing reconciliation
  - CDR and/or charging event
- **Connectivity**
  - IP NNI, IPv6
  - Advanced Routing and re-routing, symbolic URI, LCR, etc.
- **QoS and Policy Management**
  - Differentiated SLA mgmt among operators: CAC/bandwidth mgmt per interconnected domain
  - Traffic Controls (origin/destination)




*Source: GSMA*

# End-to-End QoE and End-to-End QoS – Current scenario

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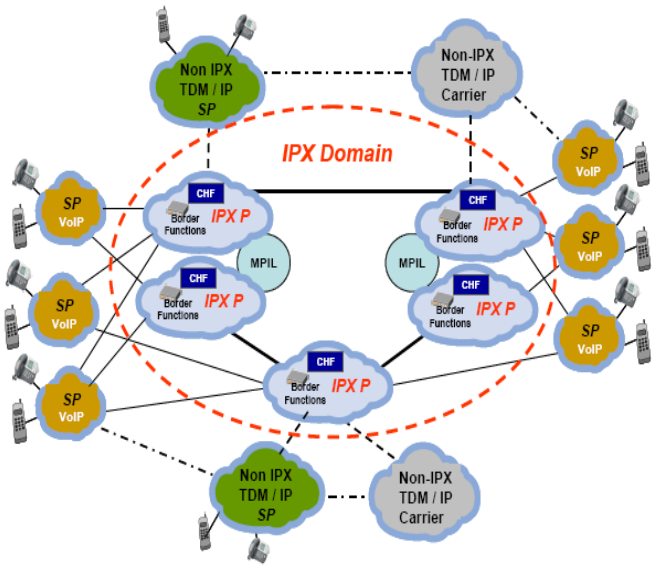
# What is IPX ? (1)

➢ The **IPX** (**I**P **P**acket e**X**change) is a technical network architecture and an ecosystem model elaborated by the GSMA to allow operators to interconnect their IP services in a secure and guaranteed quality environment

- IPX model as a global, trusted and controlled IP backbone,consisting of a number of competing IPX carriers (IPX Providers) that will interconnect Service Providers according to mutually beneficial business models.
- IPX would result in an evolution of the existing architectural model for voice, implying the transition from present local, mono-service (voice) interconnection model, towards a multi-service, converged, global, functionally-layered interconnection model.

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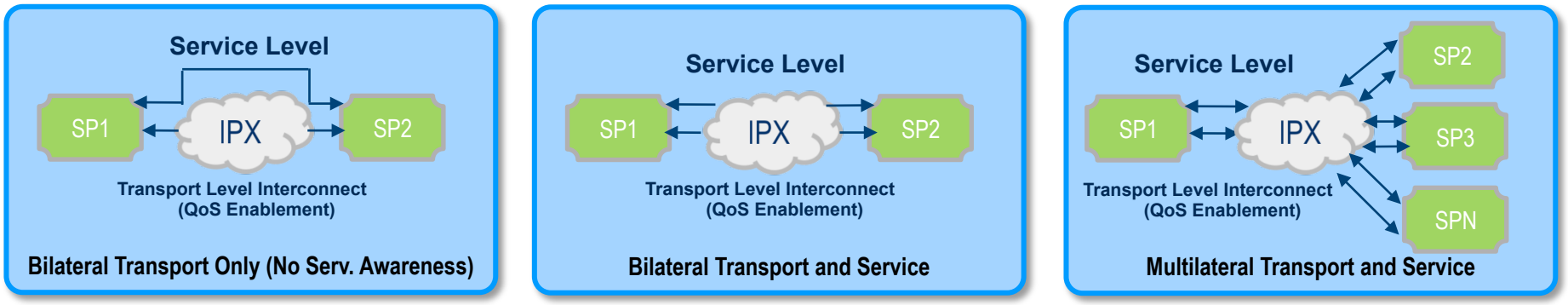
# What is IPX ? (2)

➢While high quality is a key element of the IPX concept, there is much more to it than just quality. One of the main characteristics of IPX is the interconnection and cascading of services across different IPX networks and IPX providers and for several layers of services.

▪There are 3 common IPX interconnection models :




- Model #3 is the most advanced model, the one that most of IPX providers are focused on

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# Benfits of IPX to Service Providers

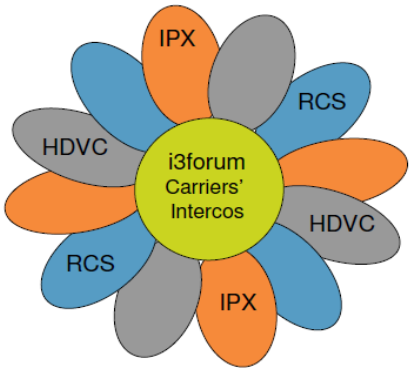
For service providers, the key benefits of IPX include:

- End-to-end QoS, enabling consistent and predictable service delivery between end users
- Prioritization of time-sensitive applications over less demanding services
- Service Level Agreements (SLAs) apply from end-to-end across multiple IPX segments
- Full route traceability and connectivity between 'trusted' entities
- Fair remuneration to all members of the value chain
- Universal service interoperability (across access networks)
- Single connection and commercial agreement for global reach
- Reducing costs of LTE deployments. This need is creating the demand for a successful interconnection system based on secure and reliable IP interconnections to create a common global environment for all services.

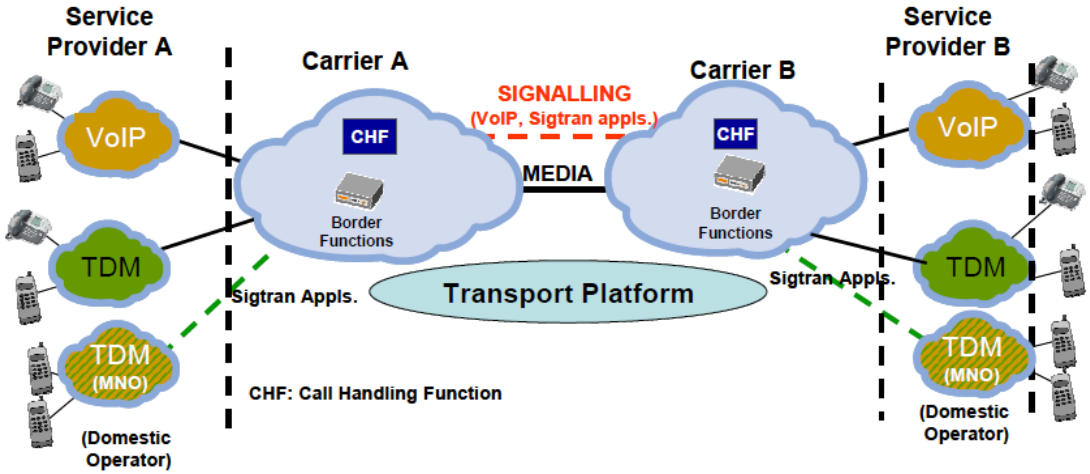
# What is IPX ? (3) – i3forum

➢i3forum develops recommendations for an industry-wide transition of voice and other services to IP

➢ I3forum is actively working with the GSMA to incorporate these GSMA-IPX specifications into its transition to IP.. Carriers need to provide a solution that addresses an end-to-end IP environment in the future but a solution that also takes into account the transition period with mixed TDM and IP environments for both fixed and mobile networks.




## General Reference Configuration

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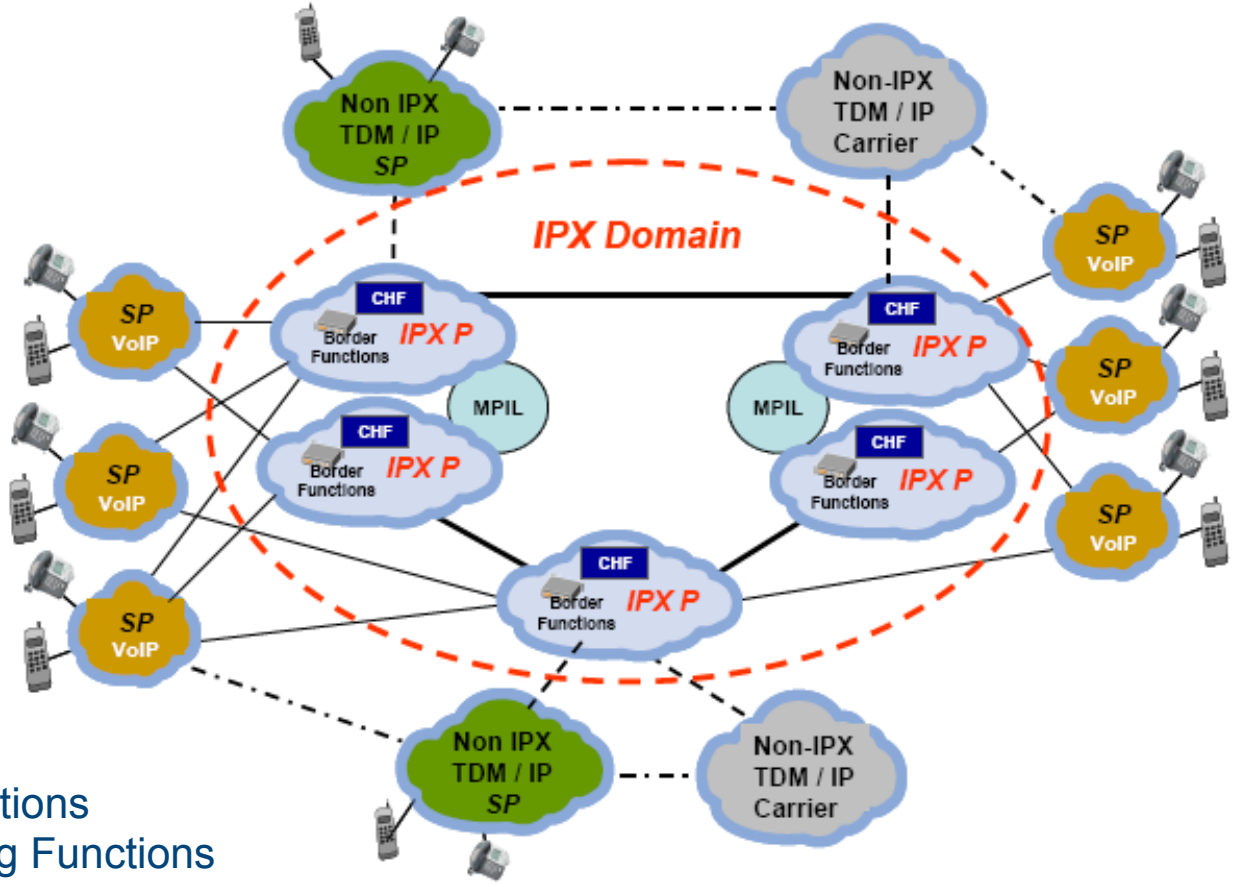
# VoIPX: Recalling General Architecture and Key Functions

*From* "Voice Over IPX" Release 2, October 2011" *:*




- Border Functions
- Call Handling Functions
- Other Functions: Signalling and Media Functions
- Security Functions
- Break-in/out from/to non-IPX SP's and Carriers is allowed
- **QoS Control**
- **Routing and Traffic Management**
- Accounting and Charging functions

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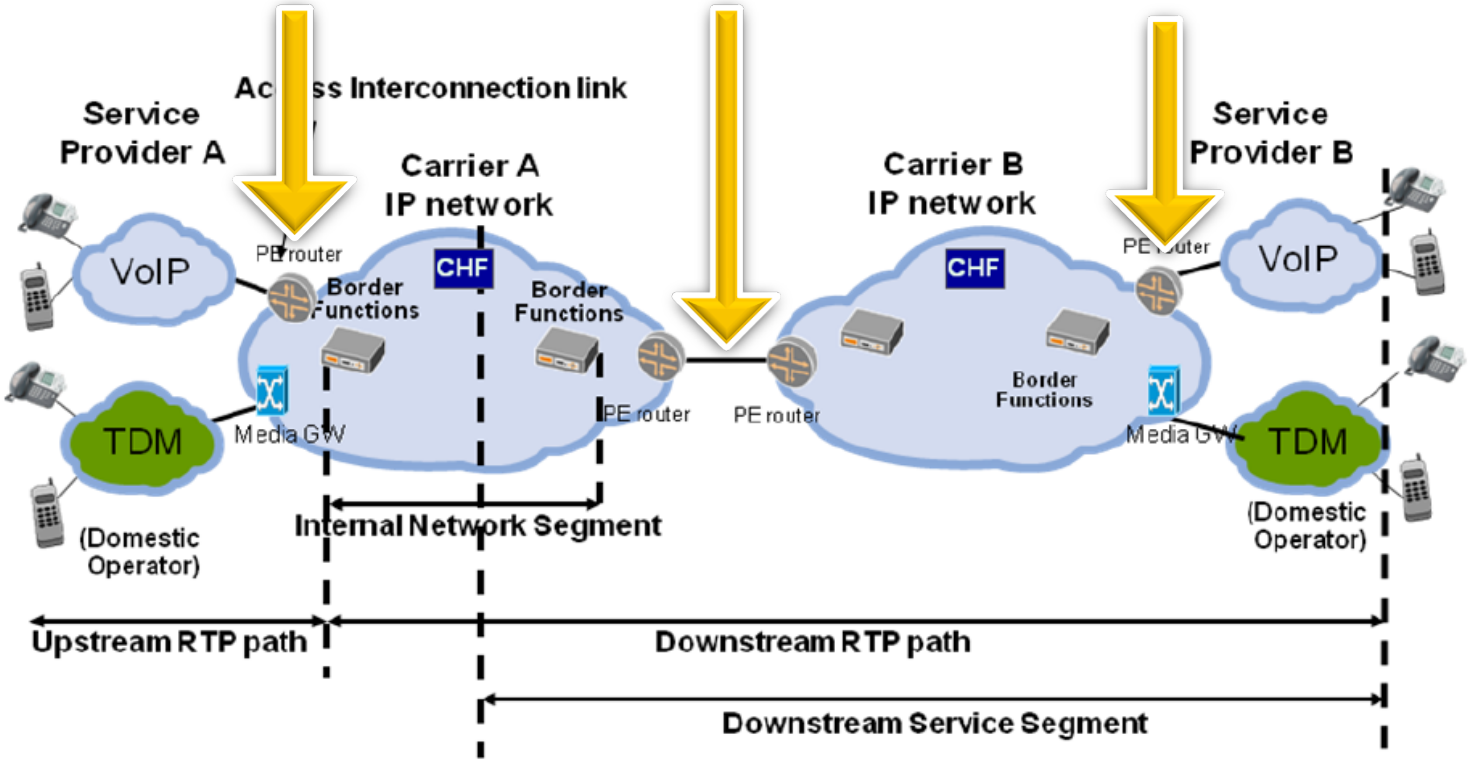
# QoS as a key differentiator

Subscribers have high expectations from VoIP and Multimedia networks

- OTT alternatives
- HD Voice is here, so is video and multimedia
- Keeping subscriber churn low based on QoS/QoE
- IPX-Ps must position themselves as the best option when it comes to peering expertise, interworking, QoS and Security
- As demand for bandwidth and resources increase,maintaining QoS will be a key differentiator between managed services and much cheaper internet based options.

# Let's go straight to QoS guarantees by IPX Carriers

***"In order to ensure that, at the interconnection, sufficient capacity is present with the highest level of confidence, a dimensioning scheme with an over-provisioning factor is suggested."***
*("Voice Over IPX" Release 2, October 2011")*




# How much am I filling the pipes?

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# QoS Business Drivers

Current i3 Forum QoS Measurement Parameters

- Transport Parameters:
  - Round-Trip Delay
  - Jitter
  - Packet Loss

  } IP Quality
- Service Parameters:
  - $MOS_{CQE}$ – Mean Opinion Score, Conversational Quality Estimated
  - **ALOC** – Average Length of Call (a.k.a. ACD)
  - **ASR** – Answer Seize Ratio
  - NER – Network Efficiency Ratio (corrects for user behavior)
  - PGRD – Post Gateway Ring Delay (delay to receiving alerting)

From: "QoS Control & Monitoring" - The i3 Forum approach for QoS Control for international voice services - presented by Ian Campbell, PTGi ICS May 26, 2011

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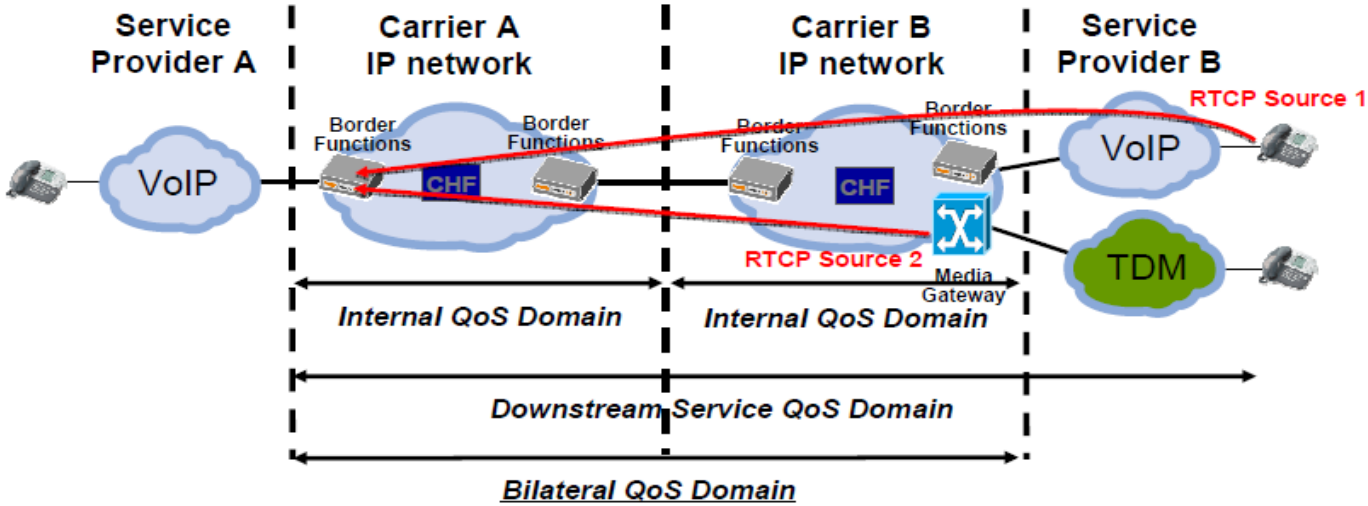
# Ideal requirements for a QoS Monitoring solution

- Controllable or identifiable measurement domain(s)
- Active or Passive
- Provide MOSCQE and optionally R-factor
- Reasonable deployment overhead
- Preferably integrated into existing equipment
- Assist with SLA monitoring and troubleshooting
- Handle multilateral IPX use cases
- Not vendor proprietary / broad industry support
- Recognized standard i.e. IETF/ITU-T/3GPP

# Current I3Forum Approach

- Passive measurement based on RTCP, measured from ingress SBC to downstream RTP end point

## Current i3 Approach (Problem)




- Problem 1: RTCP report source ambiguity between RTCP Source 1 & 2
  - → Carrier border function does not know what it is measuring!
- Problem 2: RTCP measurement to end user device is not useful
  - → Quality across the carrier domains needed, end SP quality useful but not needed

*Problems 1& 2 exists in all use cases, however depending on the relationship between carriers RTCP can be made to work, e.g. in a controlled Bilateral case*

From: "QoS Control & Monitoring" - The i3 Forum approach for QoS Control for international voice services - presented by Ian Campbell, PTGi ICS May 26, 2011

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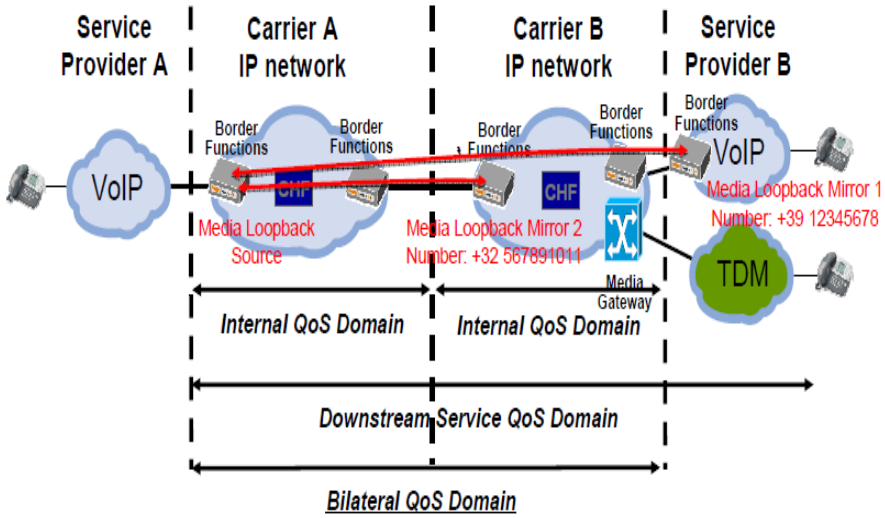
# Current I3Forum Approach – Alternatives solutions (1)

- **Media Loopback**
  - "An Extension to the Session Description Protocol (SDP) for Media Loopback", March 2011
    - Encapsulated source RTP sent back to sender
    - Direct loopback by copying inbound RTP back to sender
    - Media loopback by sending media back to sender
  - Requires session to be created to a known test point, i.e. a test number




• To measure the quality across the Bilateral QoS Domain, Carrier A creates a loopback session to the Border Functions in Service Provider B

- Possible Issues :
  - Very large number of loopback sessions may be required
  - Not measuring same path as actual traffic, possible fraud
  - Loopback mirror (test point) locations will require to be shared:

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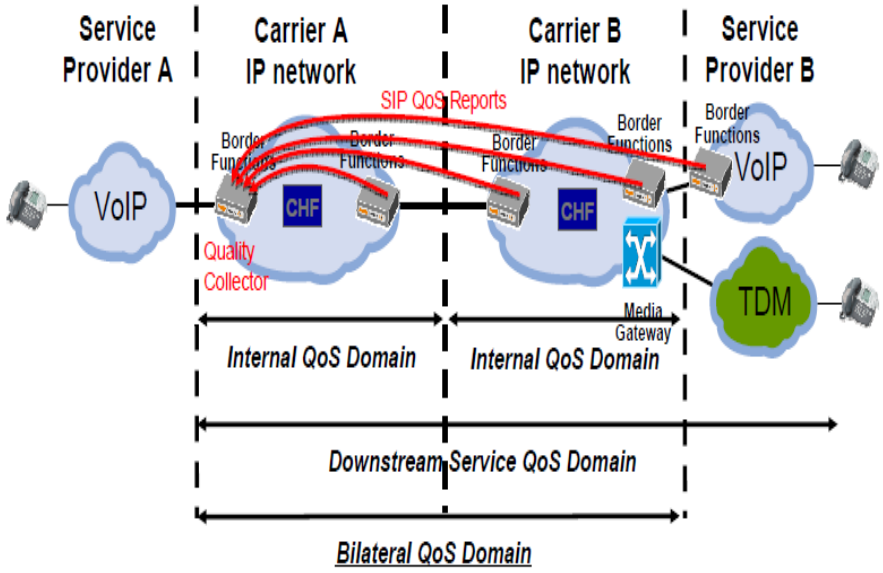
# Current I3Forum Approach – Alternatives solutions (2)

- **SIP QoS Reporting**
  - "Solution would use one of the available SIP message types:
    - PUBLISH/INFO/NOTIFY
  - Approach similar to IETF RFC6035 "Session Initiation Protocol Event Package for Voice Quality Reporting", November 2010
  - Continues to work even if RTCP is broken by intermediate systems




• To measure the quality across the Bilateral QoS Domain, Carrier A uses received QoS reporting information from the SP B Border Function at the ingress Border Function

- Possible Issues :
  - Significant overhead may be created
  - Source of QoS Reports could still be uncertain

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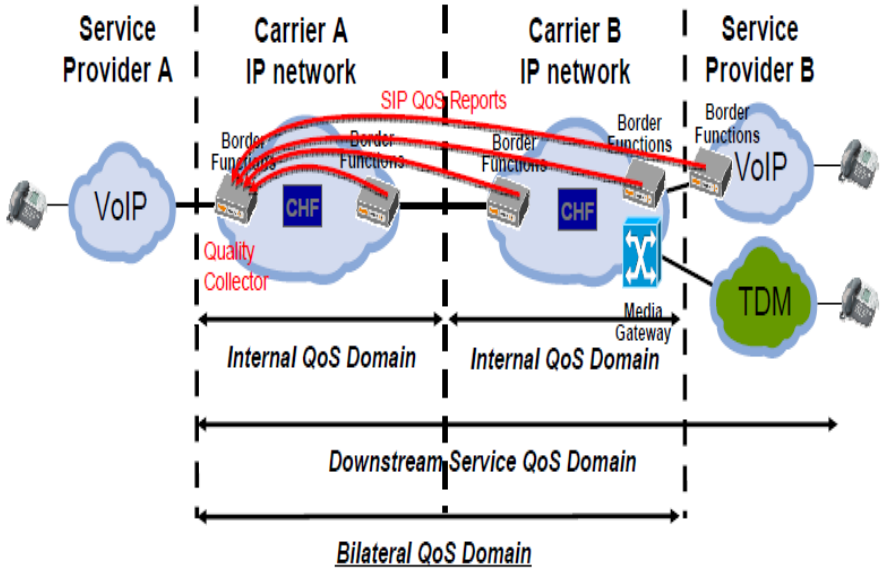
# Current I3Forum Approach – Alternatives solutions (3)

- **QoS Aggregation**
  - Each carrier monitors quality across their internal QoS domain using their chosen mechanism e.g. probe servers or RTCP
  - Carriers share information:
    - Directly with each other
    - Into a 3rd party maintained QoS database




• To measure the quality across the Bilateral QoS Domain, Carrier A uses received QoS reporting information from the SP B Border Function at the ingress Border Function

- Possible Issues :
  - May not scale beyond the bilateral case
  - Who runs and administers central database if present?
  - Carriers may not wish to share information
  - Not always suitable for troubleshooting operations in real time

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# Regulatory - QoS

Differentiated QoS poses new regulatory challenges. But :

- Internet packet protocols were originally designed to transmit data, not necessarily voice and video.
- QoS between networks has not been widely deployed.
- Customers do not perceive much difference(QoE) in certain cases, and are consequently not willing to pay much of a premium for better-than-best-efforts QoS.
- QoS and Network Neutrality sometimes seem to be related: a common concern has been that a network operator might either block or degrade access to disfavoured content in order to favourits own content or affiliated content.

→No proposal yet on QoS topic seems to be done by regulators

# i3 VoIPX: QoS considerations (5)

## Active & Passive Measurement

**What can be embedded in Call Handling and Border Functions?**

### Active

Methodology: Measurement by actively setting up test sessions across test domain

Pros:
- High resolution using $MOS_{LQO}$
- Also can provide $MOS_{CQE}$
- Control of measurement domain
- Other metrics available

Cons:
- Not always representative of real traffic path
- Large number of sessions may be required to provide full coverage e.g. $N^2$ problem

### Passive

Methodology: Measurement by passively monitoring traffic sessions across the test domain

Pros:
- $MOS_{CQE}$
- Accurate representation of real performance
- Easy to configure
- Measurements easy to analyze

Cons:
- Uncertain control of measurement domain
- Limited diagnostic ability

From: "QoS Control & Monitoring" - The i3 Forum approach for QoS Control for international voice services - presented by Ian Campbell, PTGi ICS May 26, 2011

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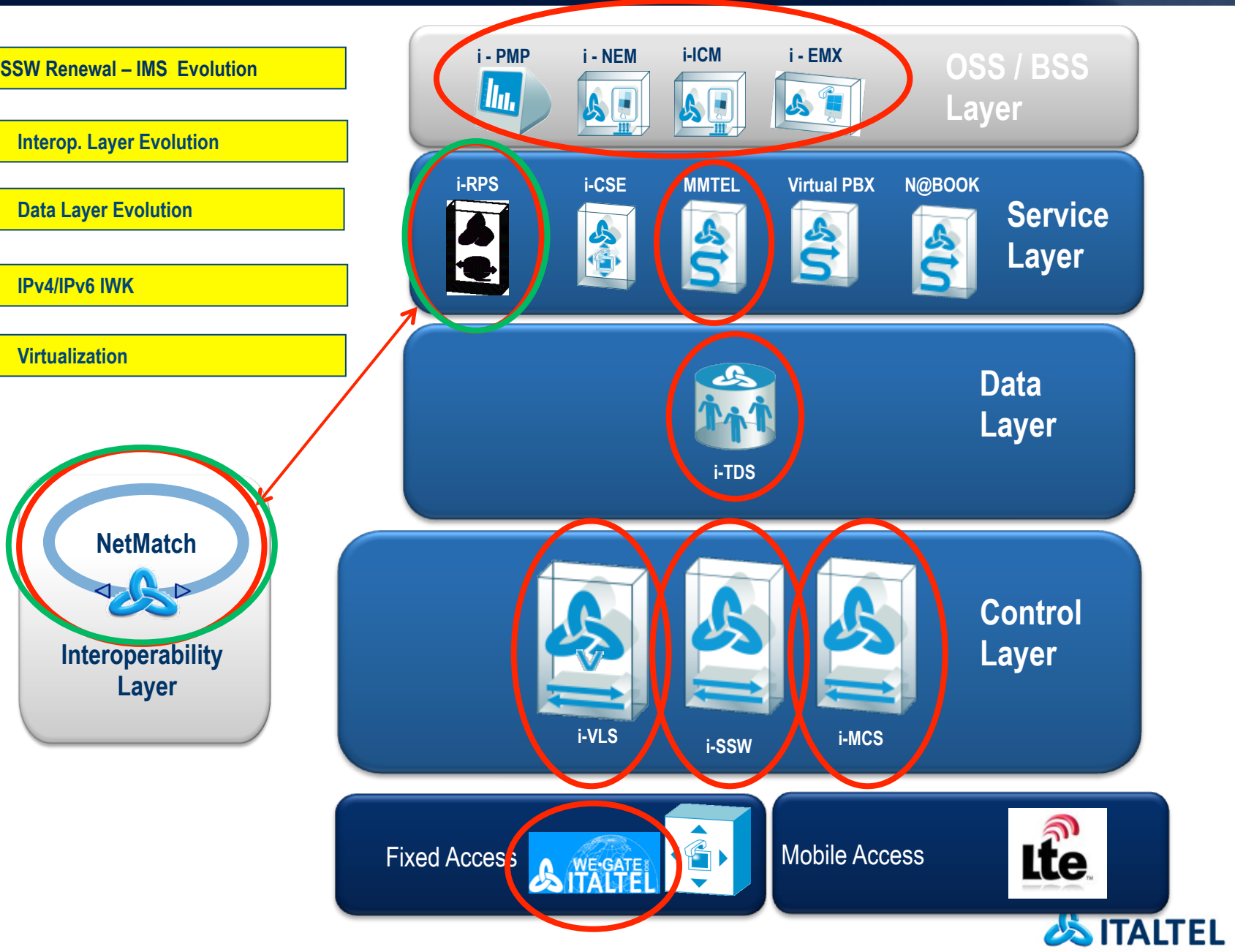
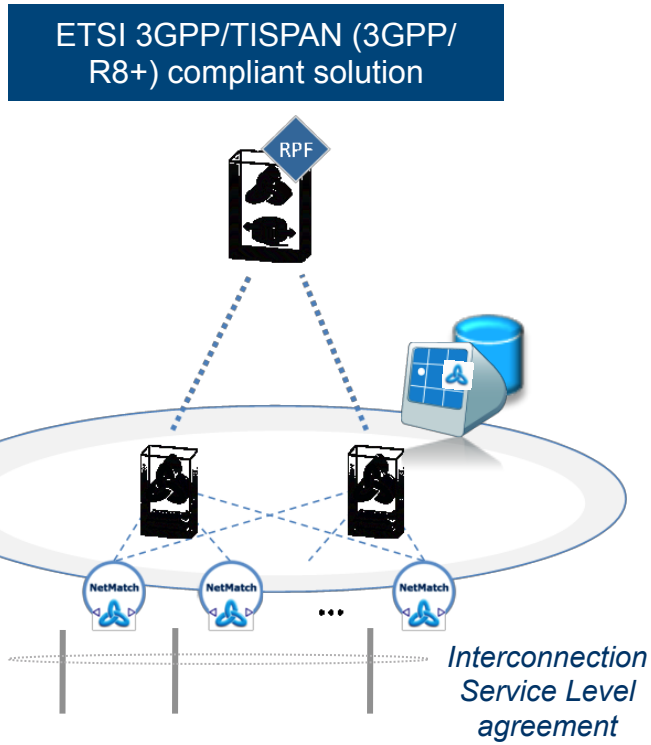
# Italtel Smart Network Products – Focus on interconnection

- i-SSW Renewal – IMS Evolution
- Interop. Layer Evolution
- Data Layer Evolution
- IPv4/IPv6 IWK
- Virtualization



# Italtel NNI Value Proposition

- Functional continuity with traditional interconnection (PSTN, Mobile)
  - ➔ MGF, MGCF
- Advanced interconnection over IP transport
  - ➔ Border Gateway : IBCF, i-BGF
  - ➔ Interworking : IWF, BGCF, Transit Function (TrF)
- Media *management capabilities (es: Transcoding)*
- Security
- Beyond the standard : **Routing & Policy Server (RPS)**
  - ➔ IP-IP Service Level Agreement *policy* verification
  - ➔ Call Admission Control
  - ➔ Routing optimization in multi-*carrier* scenarios

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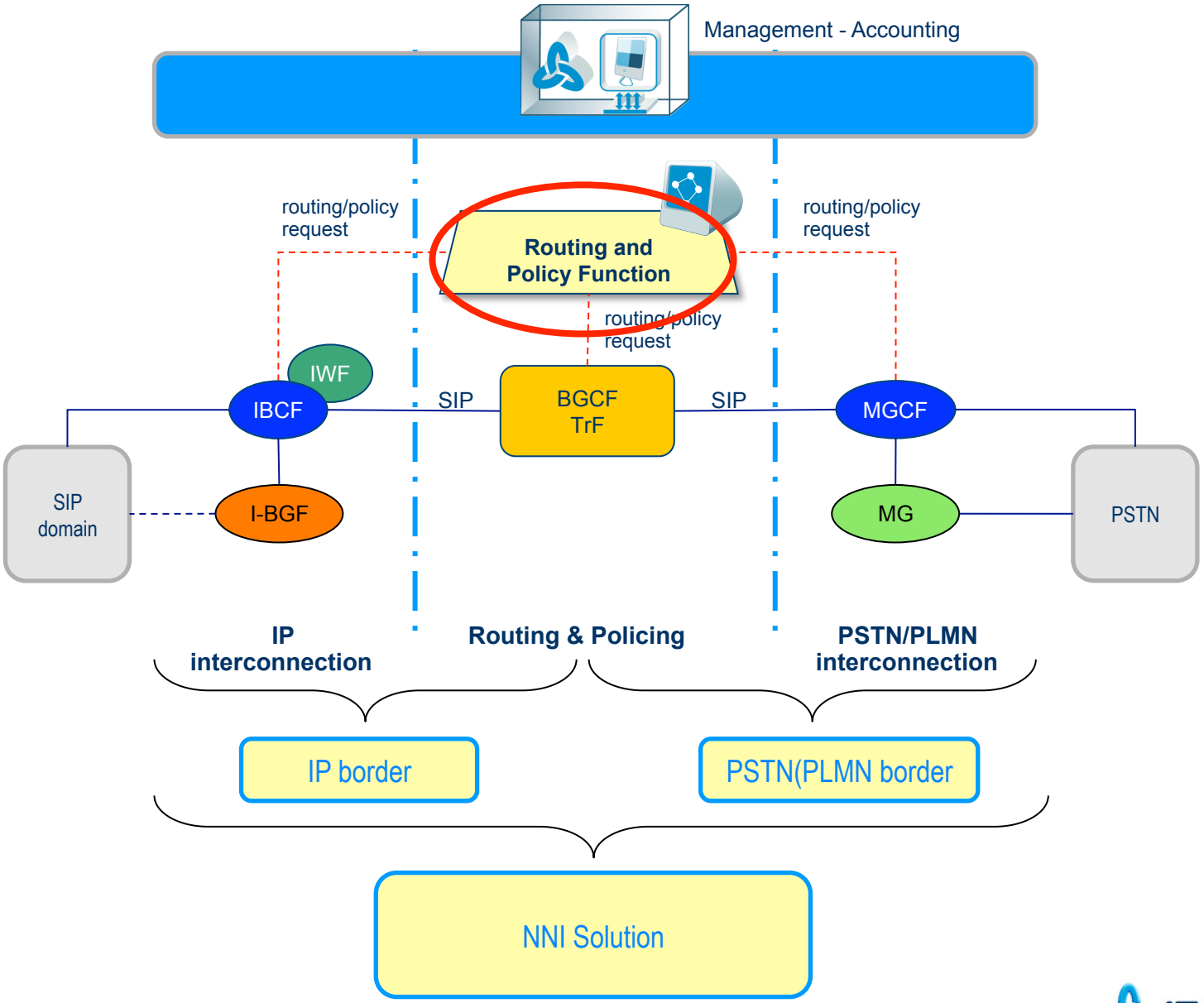
# NNI Solution – High level functional view

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# Product Highlights

## Italtel i-RPS
Centralized Routing and Policy Server

### Innovative features

Centralized Routing & Policy control;
Advanced Service Handler; Number Analysis;
Access external DBs; Service Brokering

### Innovation and continuity

Framework combining a powerful E.164 analysis & routing engine, advanced IN Services and interfaces, Policy control,…plus new ones

### Different Hardware platforms

Available on:
COTS HW (Cisco UCS preferred)
ATCA platform

### Highly scalable & Integrated solution

Deployable as a stand-alone system or as a subsystem of Italtel new generation Softswitch.

### Innovative technologies and solutions

Based on the latest available techologies

### Open Standards

3GPP
TISPAN
OASIS
IETF
GSMA

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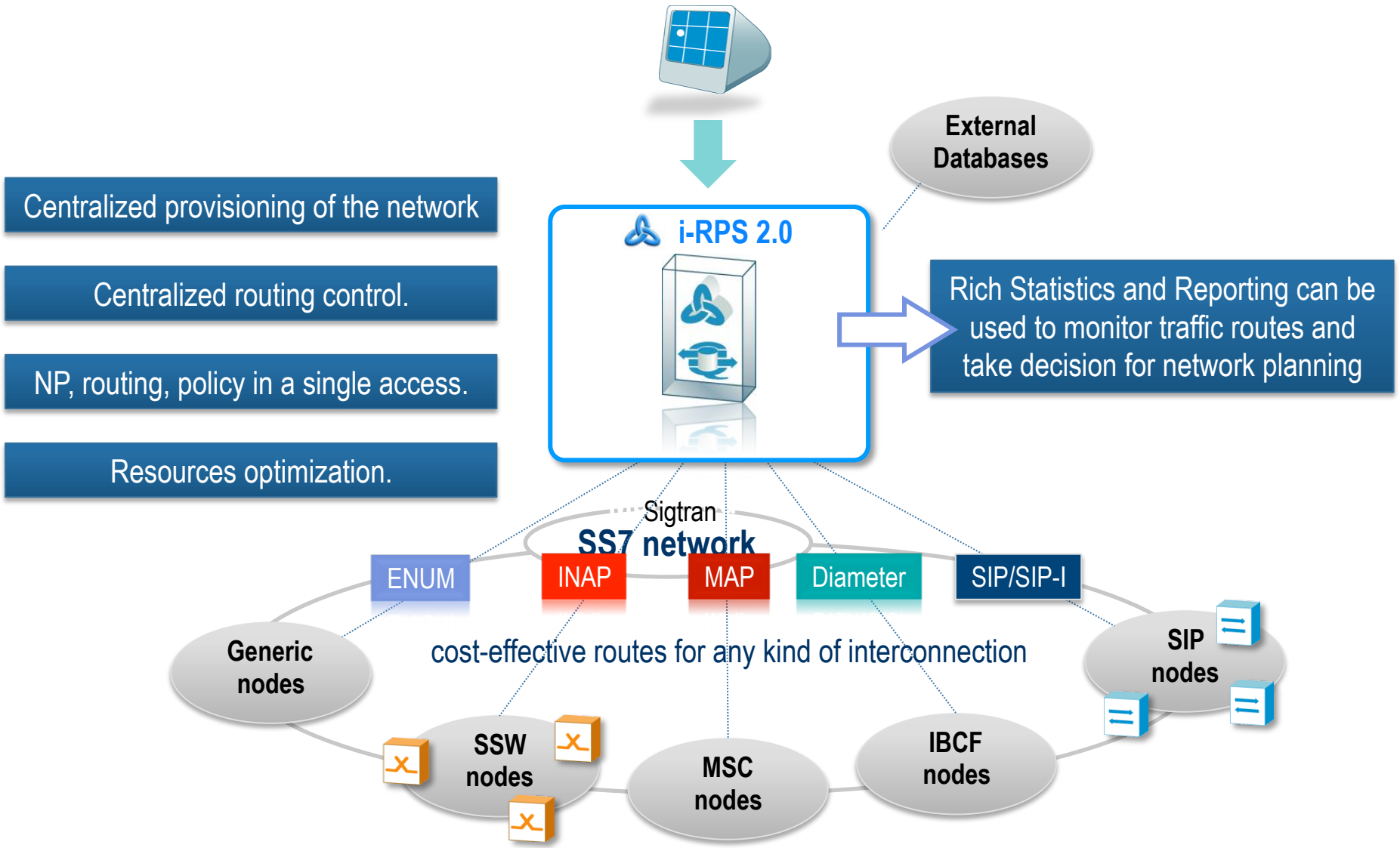
# i-RPS Overview

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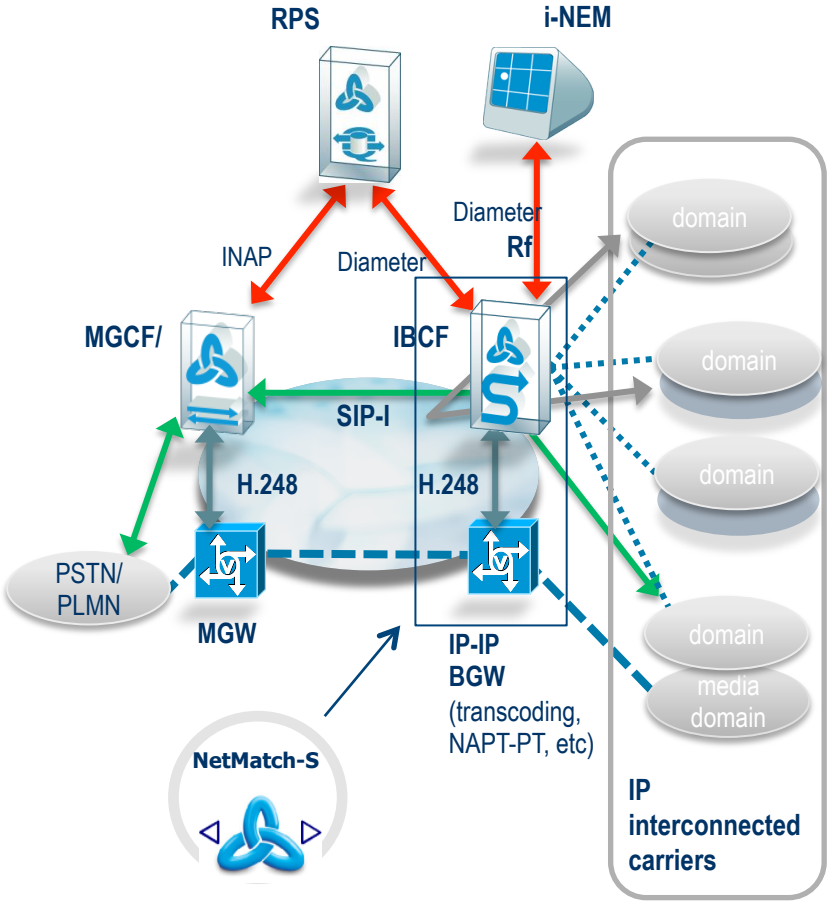
# i-RPS Policy Decision Function (1)

Application of specific policy rules on the border of the network towards interconnected carriers so to guarantee QoS and SLA management.

Goal: measure QoS parameters and provide input back into the control system to ultimately provide a better QoE.




- The Policy Decision Function maintains the description of all the possible routes with the policy rules to control.
- Policies includes:
  - ➔ Call Admission Control (in/out/total number of concurrent calls per interconnected carrier)
  - ➔ Call Admission Control (in/out/total used bandwidth per interconnected carrier)
  - ➔ Bandwidth management from SDP descriptor
  - ➔ High priority calls (no blocking policy)
  - ➔ Emergency calls (no blocking policy)
  - ➔ Policy application on the basis of additional parameters (related to service, VLAN, logical i/f)

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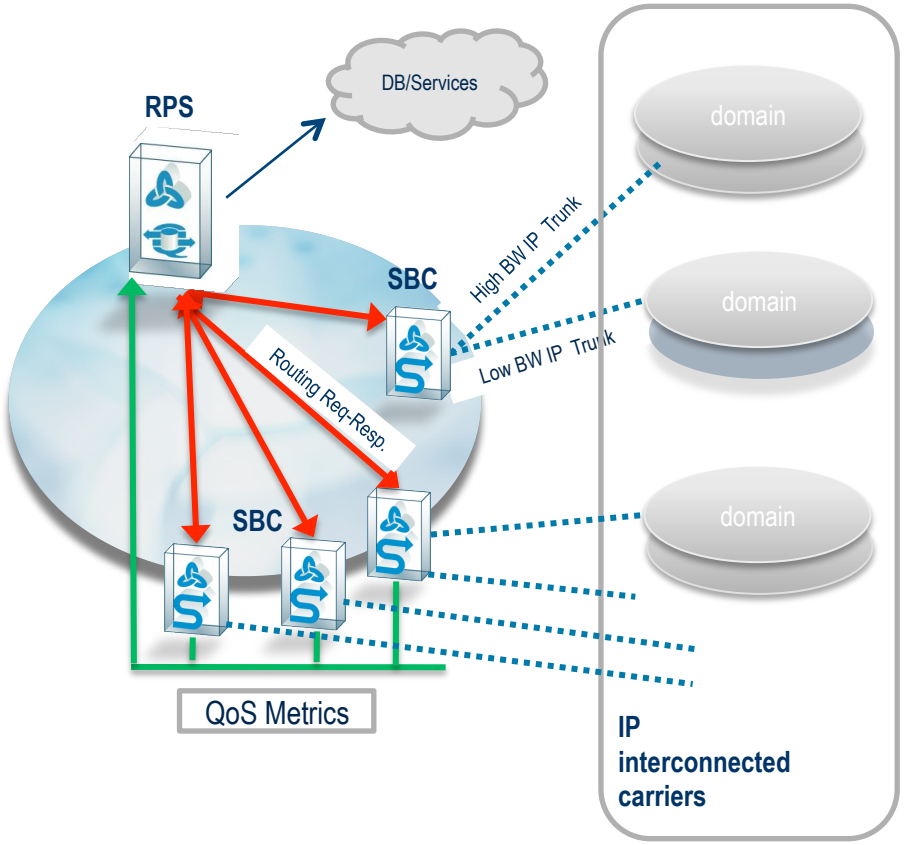
# IP-IP : Centralized Routing and Policy Decision Function (2)

Centralized Routing and Policy Control :
Determining the most adaptable path to transport data relative to the type of application optimizing the use of the interconnection network and guaranteeing QoS/SLA.




Selecting a path or paths based on global network state is a key consideration of any QoS routing scheme

- QoS Aware Routing
- CAC, Police bandwidth based on negotiated codec
- Limit traffic to/from P2P Networks (call rate, Bandwidth, number of calls etc.)
- Opex Reduction
- Unified access to External DB/Services
- ……

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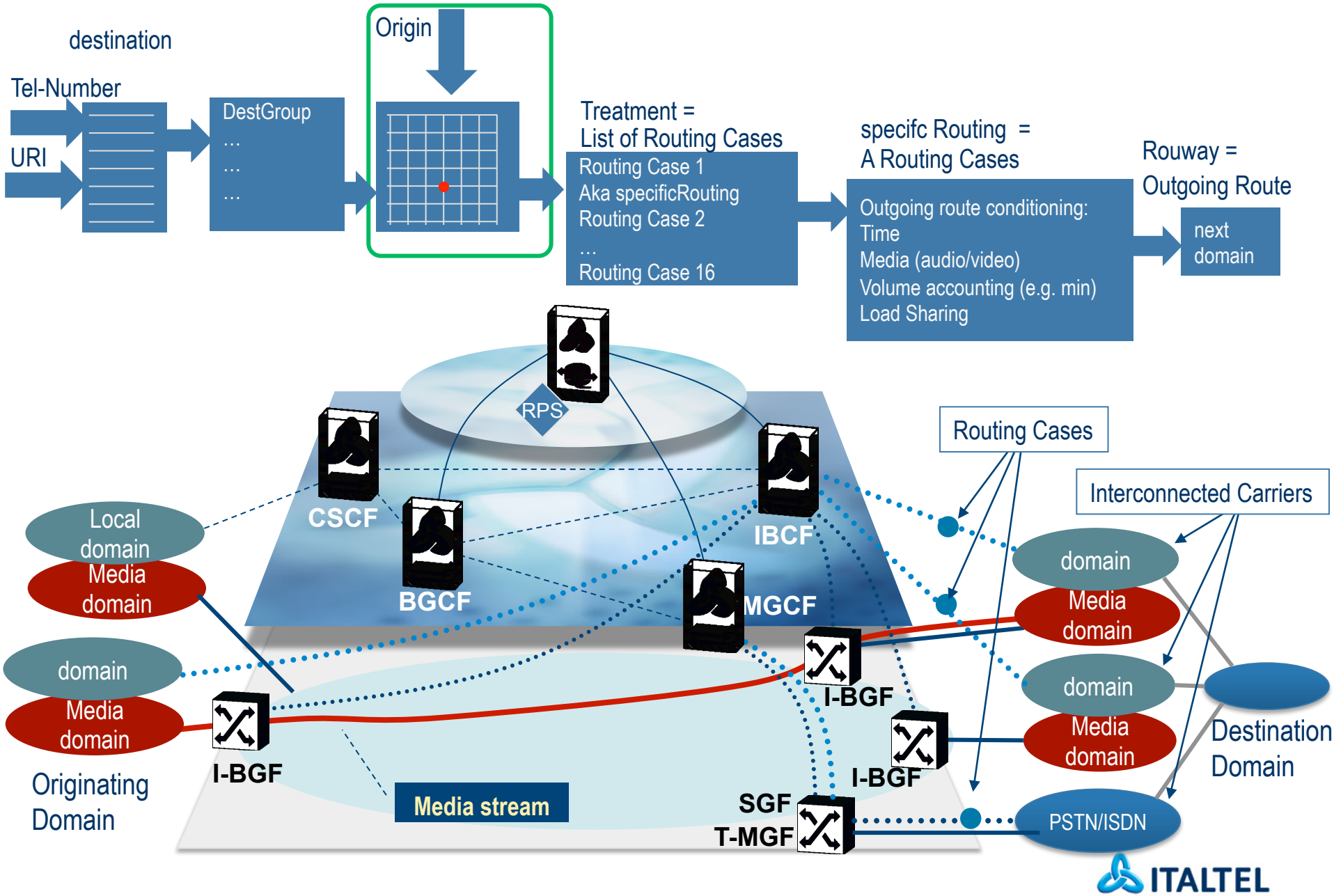
# i-RPS : Centralized Routing Logic

- Routing decisions based on policies set by the network administrator.
- Managing legacy E.164 phone numbers with SIP URI, including also domain based routing;
- Routing conditioning (based on Info related to all the available routes both IP and TDM based):

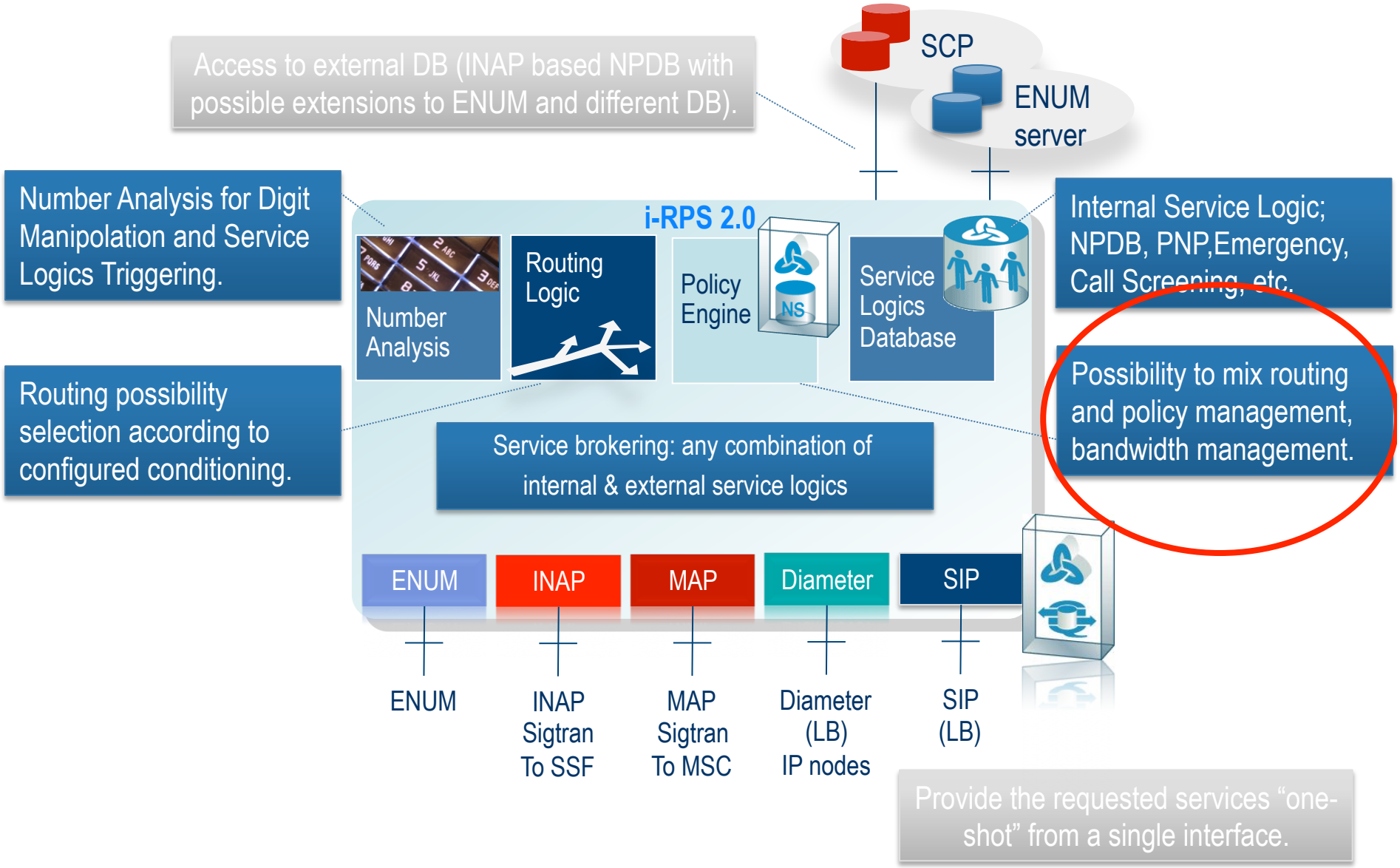
| | |
|---|---|
| Priority (e.g.: low cost) → LCR | Time |
| Origin | Volume of calls → VBR |
| Number of calls | Media (audio, video, etc) |
| Media Transcoding free | Bandwidth |
| QoS Routing | Barring options |
| Signaling compatibility | |

- Load sharing among the possible routes
- Re-Routing.
- Route state monitoring

# i-RPS : Centralized Routing Logic



# i-RPS Main functional blocks 1/2

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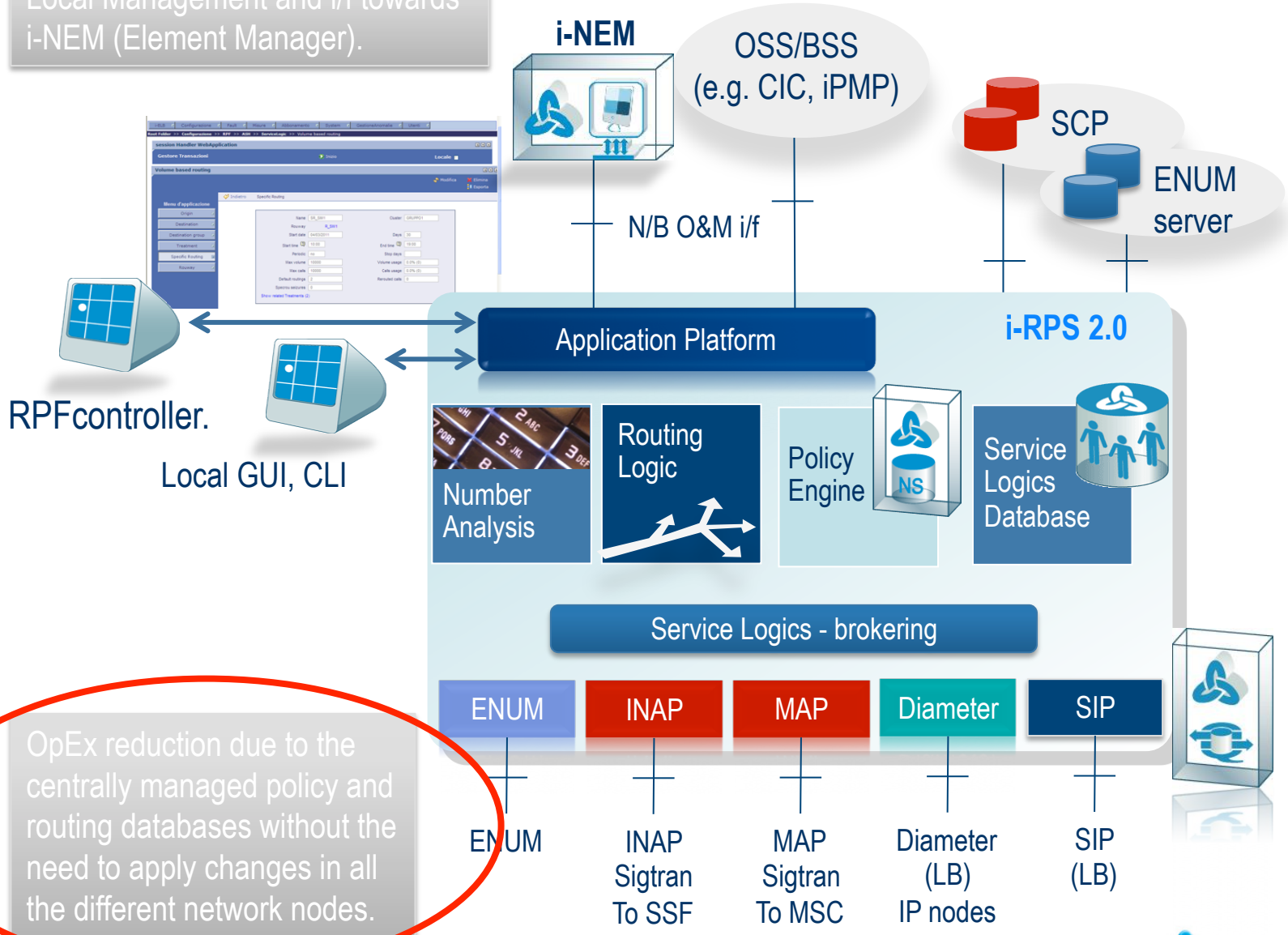
# i-RPS Main functional blocks 2/2

Local Management and i/f towards i-NEM (Element Manager).




OpEx reduction due to the centrally managed policy and routing databases without the need to apply changes in all the different network nodes.

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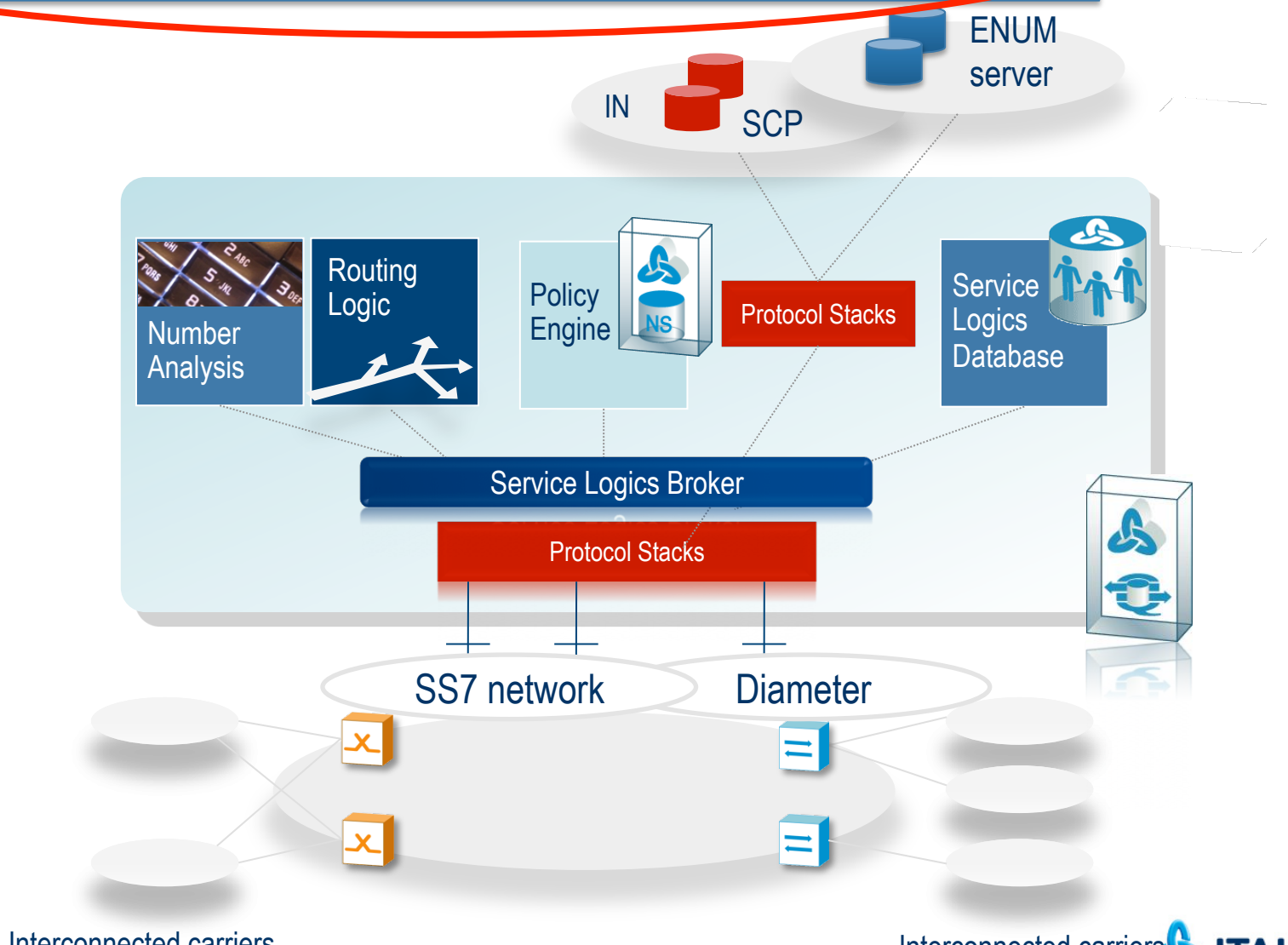
# i-RPS Service logics brokering

Complex service logics combining (with a single access to RPS) many different features

Any possible combination of internal and external functions




*To be implemented (or completed) in R. 2.0*

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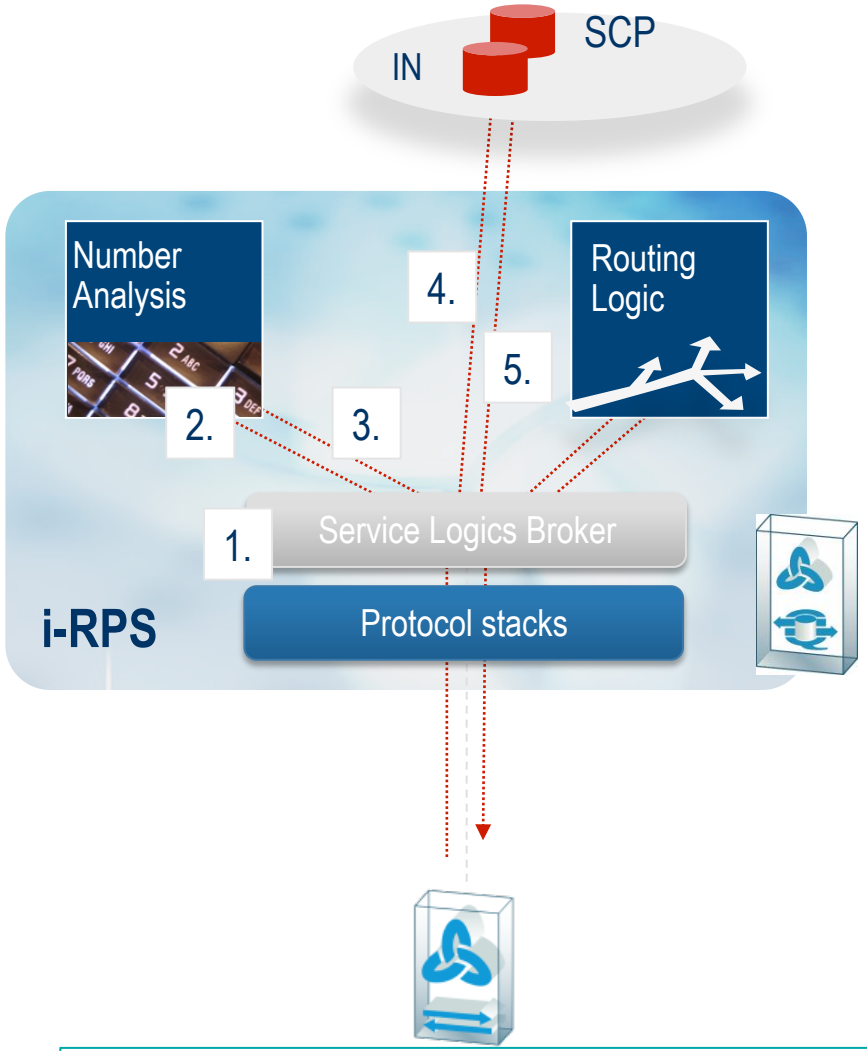
# i-RPS Service brokering – An example (1)

Example: NP DB query plus routing with a single access to RPS.




1. starting from a request coming from a network node, both for mobile and fixed networks scenarios, individuate the specific behavior from “Service Key” in the original request;
2. Perform (if necessary) number analysis with digit manipulation (insertion or removal) and “save & restore” in order to normalize the received dialing information;
3. Identify specific Service Logic (internal or external) to apply (e.g. NP query to external INAP NPDB);
4. Invoke Service Logic;
5. Service Logic provides a “Continue” or a “Connect” indication;

Access to number analysis is flexible and performed, according to the configuration, in different phases during the execution of the service logic, e.g.: first logic invocation, after a response from an external or internal logic (e.g.: routing engine)

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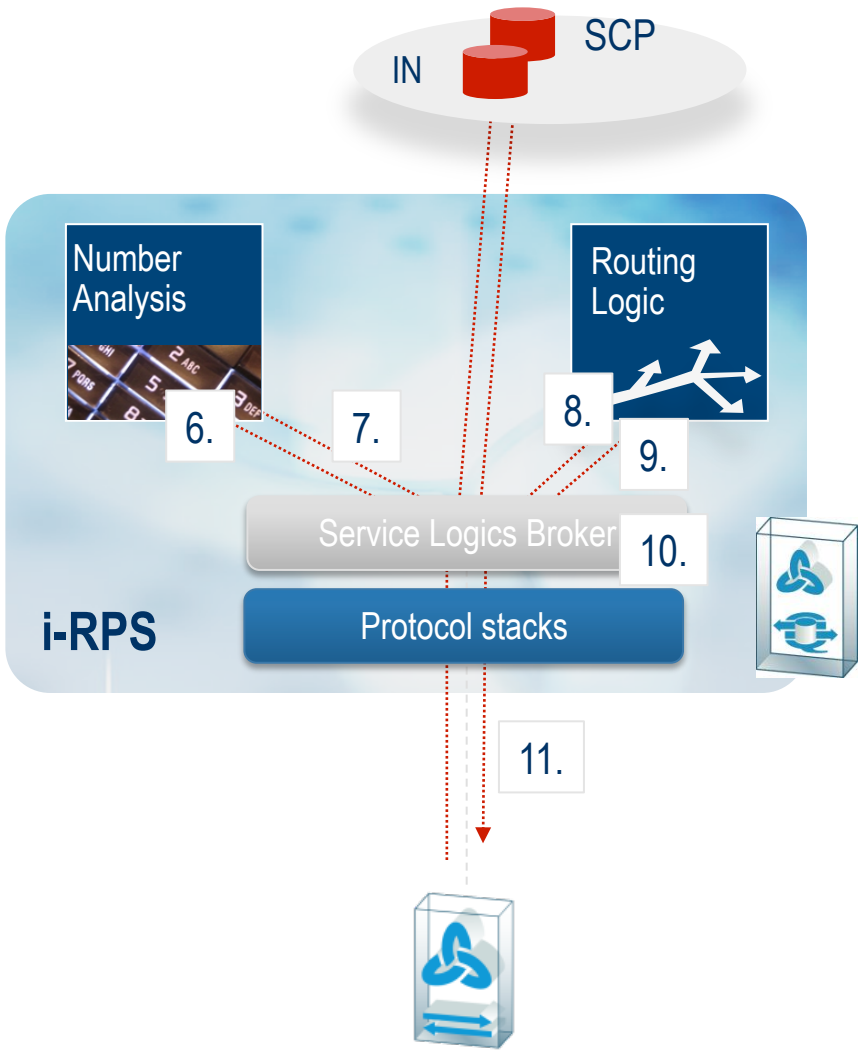
# i-RPS Service brokering – An example (2)




6. possibility to perform again number analysis (e.g. “digit manipulation”, “save/restore”);
7. Determine possible further operations on received answer from the SCP after new manipulation;
8. e.g. invocation of Routing Logic (routing/policy conditioning defined by the network operator)
9. e.g. Routing Logic provides an Internal Routing Number.
10. The process may repeated many times in order to apply again Digit Manipulation and possibly other service logics (Subsequent accesses to “number analysis”, anyway optional, provides also mechanisms for sequentially invoking different service logics).
11. provide final answer.

Apply re-routing procedures whenever necessary..

Other information can be used to complete the complex service logic: Type of call (e.g.: local, long distance, …); Code identifying the carrier; Routing Prefix, etc.

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# i-RPS Evolution : Global Network Traffic Engineering

Dynamic and automatic reconfiguration of routing plans with specific attention to the provision of multimedia services on the basis of input traffic and resources utilization.

- Opportunities:
  - High number of interconnected carriers (incumbent and competitive)
  - High variability for commercial proposals
- Need:
  - Resources usage optimization in the core network
  - Service Reach
  - Quick treatment of new commercial proposals
  - Automatic reconfiguration
  - Simplification of the routing model
- Objectives:
  - Routing configuration browsing possibilities
  - Repository of present routing configuration
  - Determine the “optimal routing configuration” (e.g. Least Cost routing)
  - Determine how to modify the current configuration according to the optimal configuration
  - Upload on RPS and apply the new configuration

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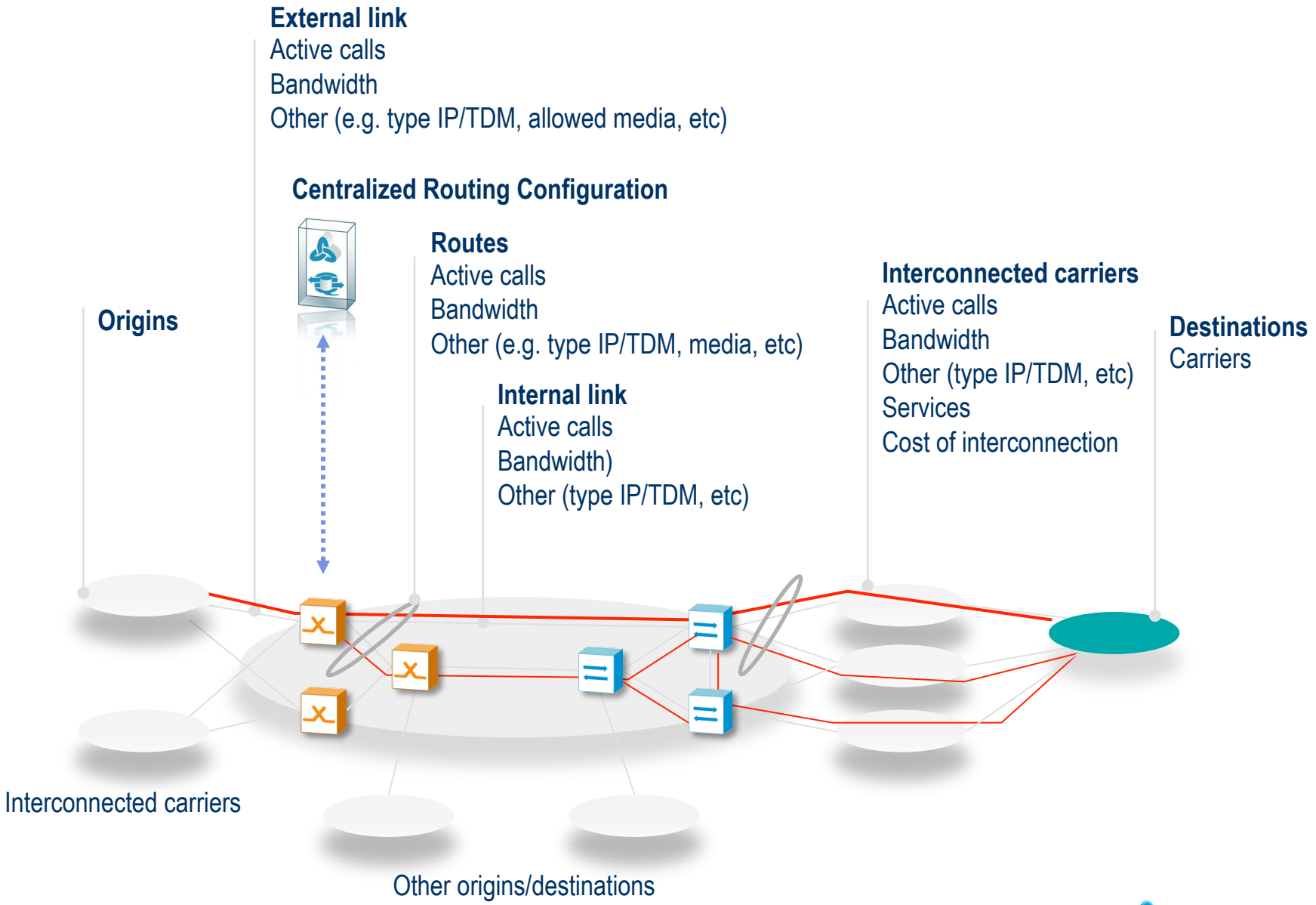
# Traffic Engineering (modelling)

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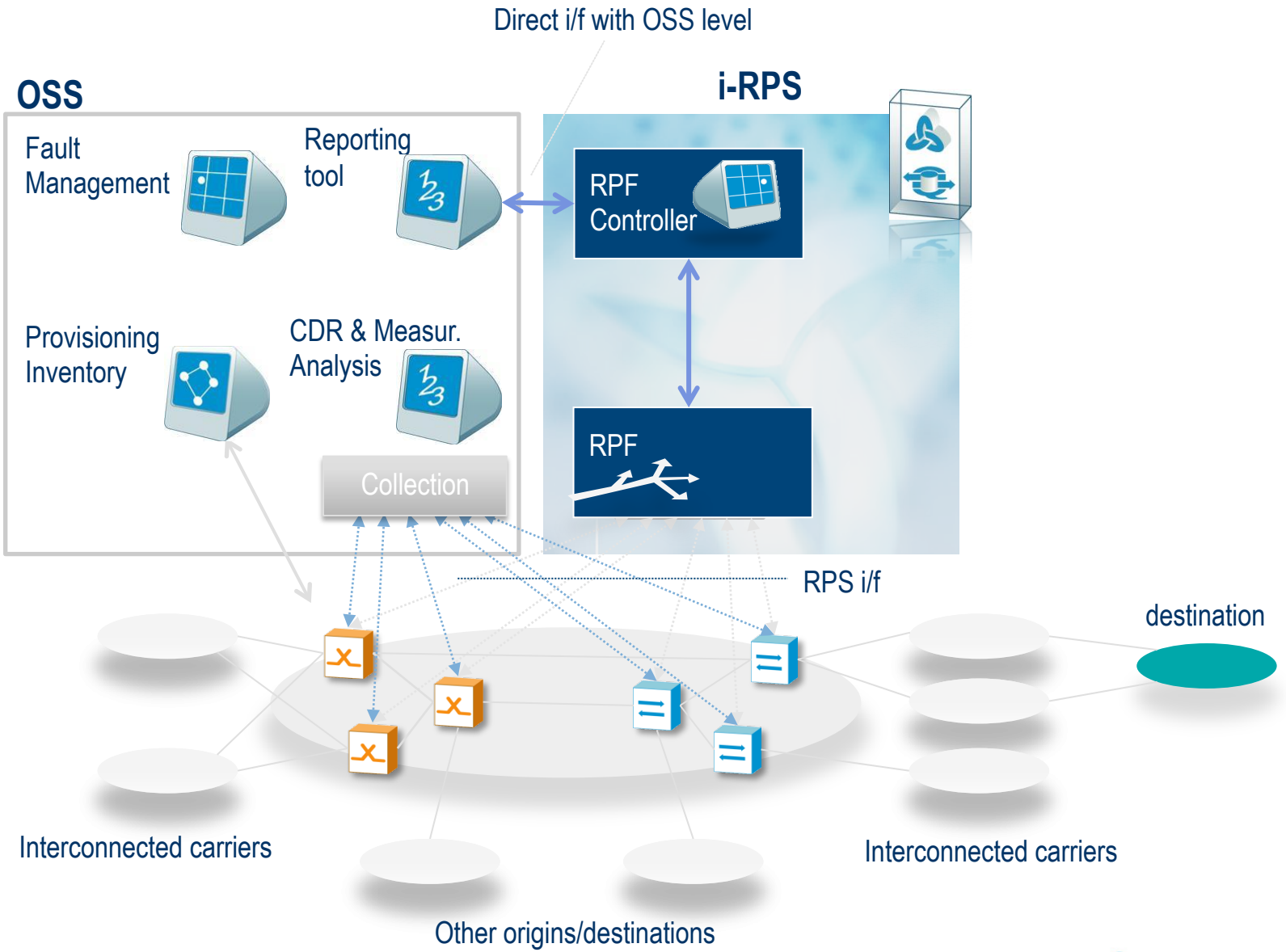
# Traffic Engineering architecture

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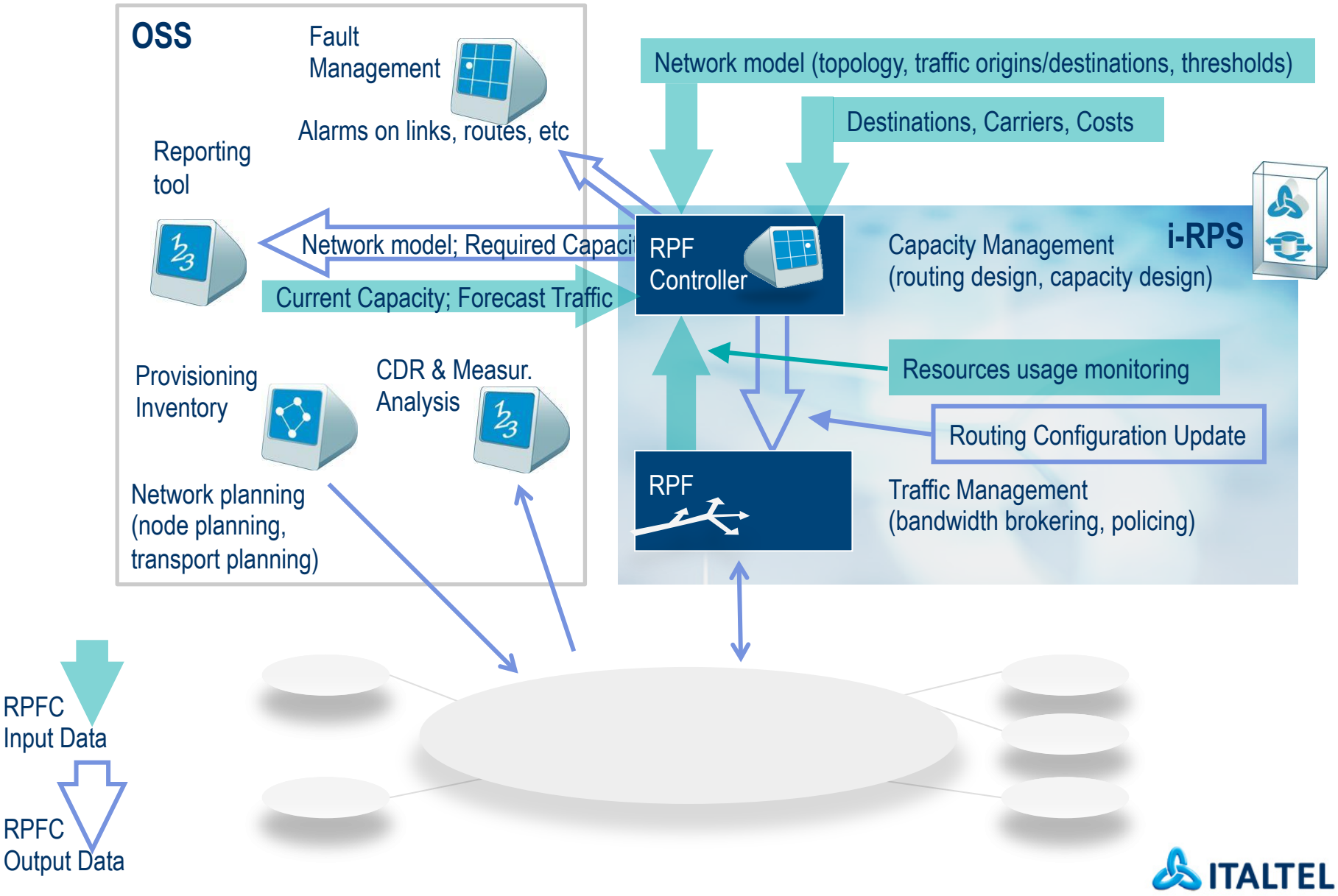
# Traffic Engineering and RPFC (RPF controller)

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# Final Notes – Reason Why

- **Enhanced experience** dictates support for **high-quality, secure connectivity** for IP-based applications such as IM, FMC, presence, P2P, video, and Web 2.0 mash-up services.

- **IP is both the present and future architecture** for value-added services across the spectrum of fixed and mobile services. A new peering architecture will soon be required which goes a step beyond the traditional best-effort Internet for service deliver.

- **The view is an open and flexible IPX** model for service exchange as part of the critical path to realizing this vision.

- IPX is the way forward for **cost-efficient innovation and differentiation** , and **ubiquitous service availability with adequate QoE.**

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# Final notes – SP Needs

- Telecom SP's need to leverage their network and addressing (E.164) assets, in order to provide any-to-any Multimedia communicatons, where **QoS is a key factor for guaranteeing Excellence of Experience**

- Long Distance Carriers can leverage on the VoIPX specs for helping National SP's improving end-to-end QoS and therefore QoE, implementing **advanced Routing and Policing mechanisms**

- Interconnection models will evolve towards "**QoS-enabled exchange platforms**" in order to enable publicly and globally available, open services such as:
  - ➔ HD Videocommunication
  - ➔ Telepresence
  - ➔ CDN exchange

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# Final Notes – IPX is the Key

- The **GSMA-IPX** specifications elaborated by the GSMA aim at providing to the industry an **innovative solution to migrate Voice and other services over IP enabling end-to-end QoS, SLAs, cascading, security and convergence**. Some of these features are aimed at a time when most retail networks will be in IP, over fiber, IMS or LTE to name only a few technologies.

- Besides, at a time where most services and retail networks **are still over TDM**, the challenges are to facilitate the migration over IP in a **transitional form**, with a mix of different technologies that need to interwork among themselves for still quite some time.

# Final Notes – Challenges of IPX

All of the enthusiasm for IPX should be tempered with the fact that important challenges lie ahead. These include:

- Reconciling current mobile and fixed service provider business models (IPX introduces a more transparent pricing model unfamiliar to fixed service providers)
- Fixed service providers may be tempted to continue using the public Internet for its low cost rather than IPX for its quality and security
- Efforts by mobile service providers to orchestrate FMC delivery via IPX may be in vain if web-based service providers conquer that market before the mobile service providers are ready
- A lot of work is still required to establish common technical specifications

# Thank You !

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