ETSI SUMMIT
ON
5G NETWORK INFRASTRUCTURE

5G NEXT GENERATION PROTOCOLS – LAST CHANCE TO CHANGE

Presented by Gerry Foster

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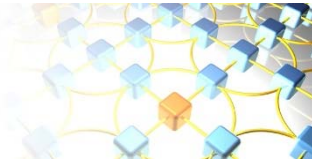

Mobile Internet is one of the most successful technical achievements of our time.

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… its success is largely due to key SDOs involved

3GPP cellular is the most successful mobile system today
- by global roaming mobility, revenue & # citizens connected

GSM is the most efficient mobile voice system today

GPRS, UMTS and LTE have added mobile internet
- National commercial statistics for many countries report that more sessions start & end on mobiles than any other access technology.
- mobile access is becoming the norm!

The IETF has provided the networking protocols to enable mobile internet

IP	Networking
TCP	Transmission
HTTP/ HTML	internet content exchange & language
SCTP/DIAMETER	Signalling: LTE-S1-Access & CORE signalling
SIP	Media sessions used in VoLTE

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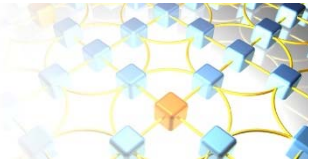
So what's the problem?



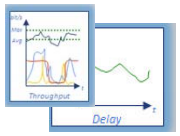
The Internet has been designed for fixed networking and internetworking

3GPP designs for mobile access connectivity & centralised subscriber control

4G-LTE provides a well received integrated 'mobile Internet access' technology

… however, in bringing these technologies together, users note:

Expensive subscriptions to get 3GPP & IP to work together, which need to be cheaper.



Variable performance (throughput & latency) c.f . fixed broadband & patchy coverage

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3GPP LTE Protocol Architecture User Plane (UP)

Note: ERAB = DRB + S1Bearer
EPS Bearer = ERAB + S5 Bearer
ETE Service = EPS Bearer + External Be

1.User IP is tunnelled from UE to SeGW/PGW using 2x GTP bearer tunnels

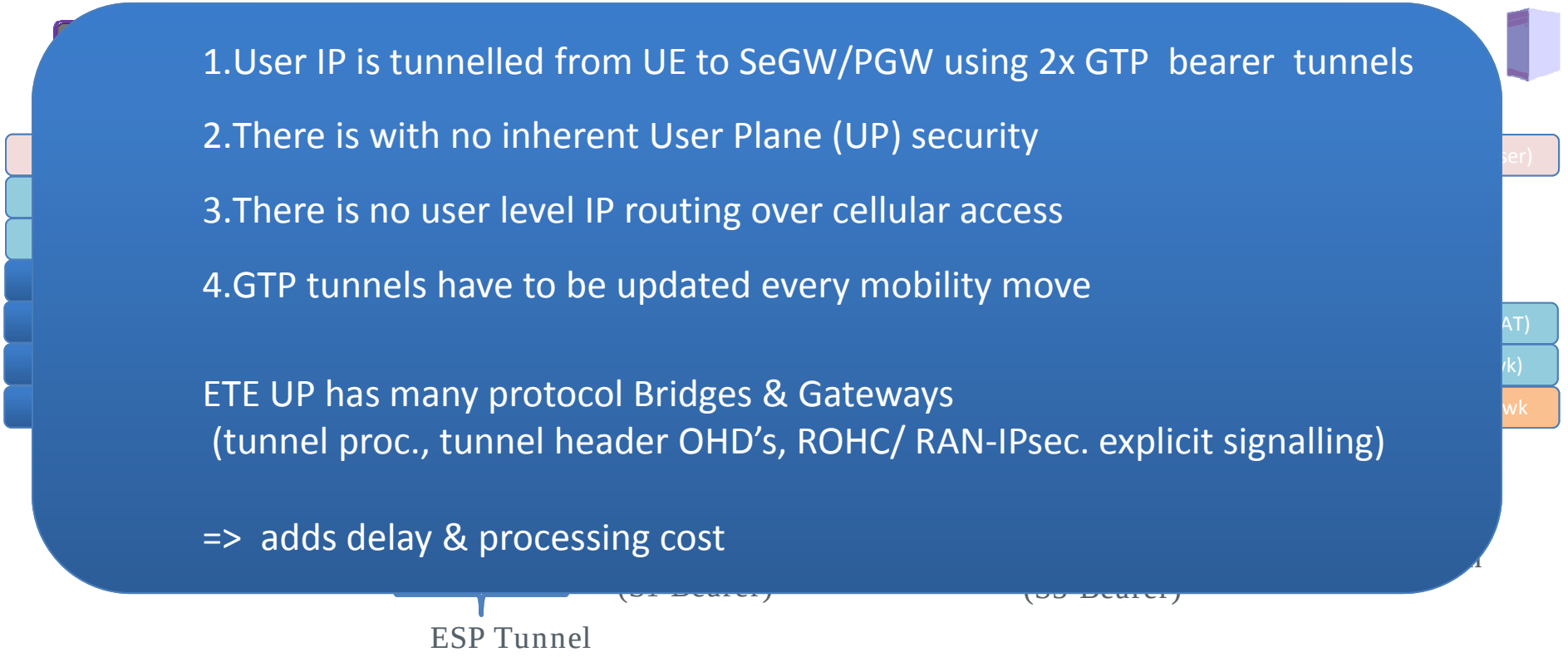
2.There is with no inherent User Plane (UP) security

3.There is no user level IP routing over cellular access

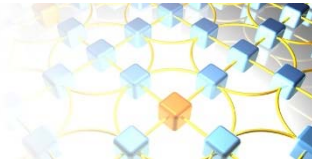
4.GTP tunnels have to be updated every mobility move

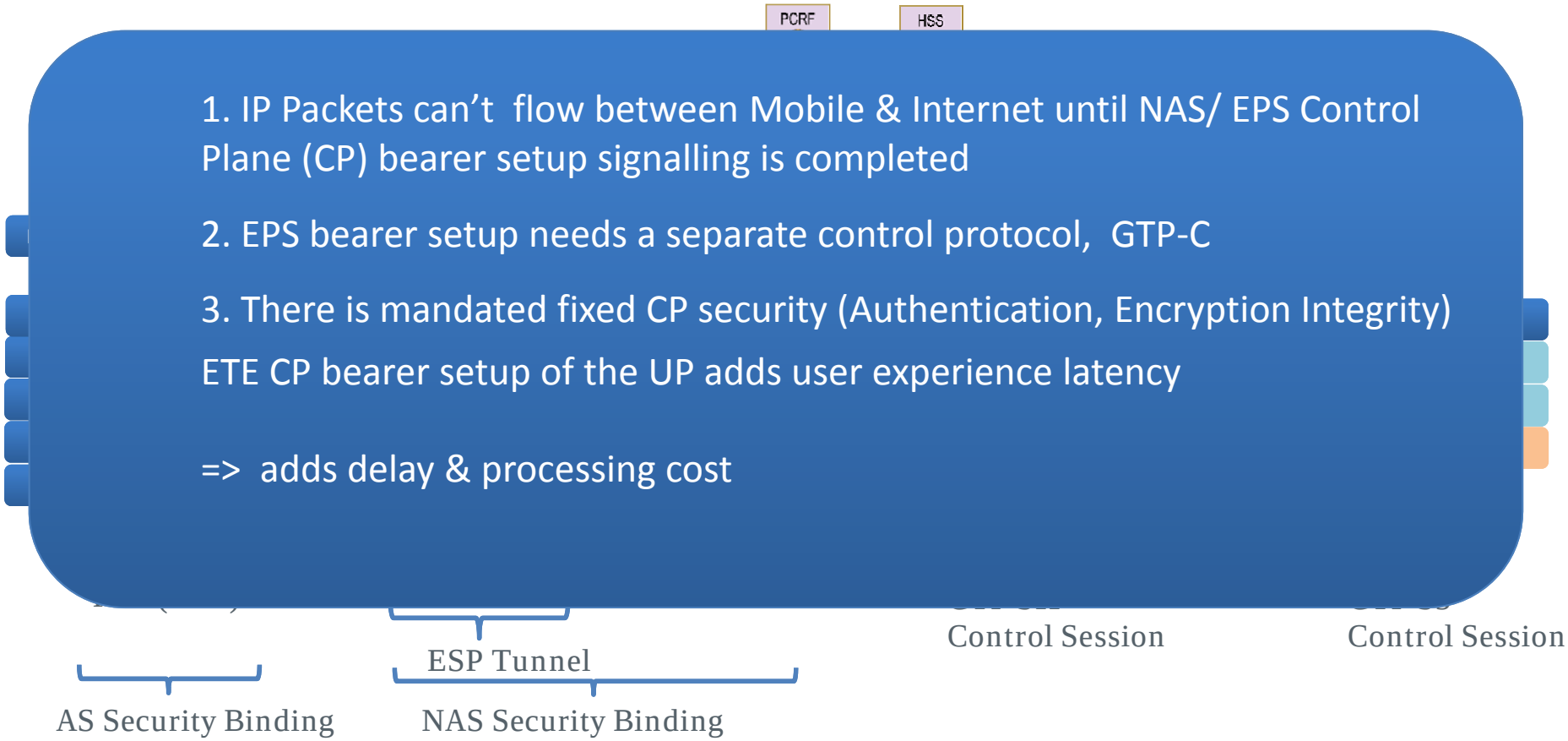
ETE UP has many protocol Bridges & Gateways
(tunnel proc., tunnel header OHD's, ROHC/ RAN-IPsec. explicit signalling)

=> adds delay & processing cost



… & the Control Plane (CP)





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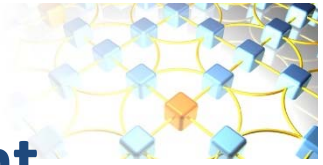
3GPP Mobile Internet Performance Improvement



In summary:

Mobile Internet as an ETE community has not put enough effort into making the Network part more efficient.

Most of the effort/cost has been invested in the Radio technology

This is why we all pay for the headline ‘radio throughput gains’ without realising that the Network technology enhancements are not keeping up

… whilst for 5G, the Radio technology is nearing its limits.

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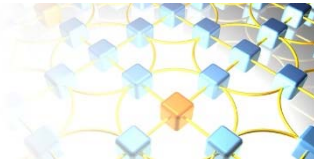

… and the macro scale security problem

There is no inherent user User-Plane Network access security over the Mobile Internet!

SSL, TLS and HTTPS solve the wrong problem:

- one size fits all security that is not needed for many applications and services
- only provides encryption and is only ETE
- adds overhead to all packets

Today users are much more discerning:

- users are not 'one size fits all'
- Banking, IoT, Browsing all have different security needs, some at App level and some at network
- All need basic user plane authentication of some kind but this can be Stakeholder peered and does not need to be centralised all the time

Security Authority should not be a gateway but peered stakeholder security according to scope and resolution of the communication.

If we continue with no basic Stakeholder-based Authentication for NwK UP access then security threat management will cost a large part of overall network OPEX in 5G.

We need Flexible, Scalable, Multi-Homing network security

We have to chose between privacy and secure user plane access authentication beyond basic control plane subscription authentication.

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LAST CHANCE TO CHANGE?

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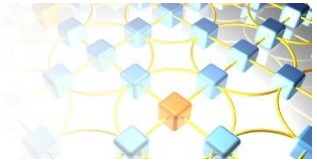

Why Change for 5G?

If we don't improve BS to Internet protocols for 5G, then radio investment will be wasted on legacy GTP & IP inefficiencies across AMPS: addressing, mobility, performance and scalability aspects.

Operators are sweating IP & GTP assets. However, there will be a tipping point when

- Sweat benefit << NGP efficiency & performance improvements (tipping point 5G ?)

Operators need new revenue potential

- justifies adding/ migrating to 5G to support AR/ VR, 4K-TV & IoT.
- but these services are not efficiently supported over a RAN operating IP/ GTP

Better Mobile internet Access in next commercial 10 year timeframe needs definition of NGP at SDO level now!

It is time for 3GPP & IETF to standardise together rather than reference each other?

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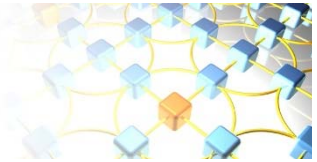

So what's NGP all about?

IS NOT	… trying to change the Internet
IS	… trying to significantly improve MOBILE INTERNET ACCESS
SUPPORTS	… existing IETF protocol evolution in the context of MOBILE INTERNET ACCESS

NGP includes Vendors, Operators & Standards reps, and aims to:

- Provide Scenarios & Requirements for significantly enhanced 5G/ NGN, MOBILE INTERNET ACCESS protocol architecture
- Work with SDOs (3GPP, IETF, ITU-T, IEEE) to stimulate NGP based MOBILE INTERNET ACCESS protocol(s) definition

NGP understands that in 2020 'MOBILE' includes: Static-Nomadic, RF-Cellular, RF-Millimetric & Wi-Fi

Industry view has been that IETF are best placed to develop an NGP solution:

- However, IETF 97 stated that IPv6 is the IETF preferred future networking standard
- This decision does not meet NGP requirements for MOBILE INTERNET ACCESS
- Therefore, 3GPP is the most likely candidate SDO to lead NGP realisation of better MOBILE INTERNET ACCESS NGPs … in sync with IETF, ITU-T, & IEEE

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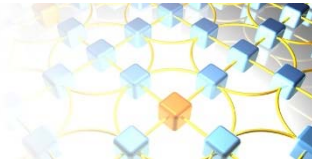

NGP Requirement Summary

Efficiency Need much **Smaller Headers over Access Technologies**, for NGP packets to maximise access efficiency, in particular spectrum efficiency for radio technologies

Security Needs to be **Native & Scalable,** peer **Association Based** per **Stakeholder** based prior to access to the network layer (Sockets, OTT do not meet these requirements)

Addressing **Scalable** protocol addressing and **Location, Network Address and ID separation**

Transmission Significantly **Reduce Packet and Access Latency**

Should be **Dynamically Configurable according to Context** (Access Technology, Network, User Profile/ QoS, …)

Add **Controls for Congestion Avoidance** rather than congestion management

Ability to **Enable/ Disable all Transmission Features** and **adjustable by Profile & Context**

100% Routing &/ or Context based routing, no tunnels

Mobility **Native & Scalable**, with **Dynamic Scope & Resolution** with a **Right-sized set of Mobility Fields** aim to minimise routing updates, and latency, enable lossless handovers when required (e.g. different mobility level for HST, Cars, Pedestrians and turned off for Static things)

Context Aware **Built-in,** to enable intelligence to be added and to drive scalable mobility and transmission

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Why change todays GTP/IPv6 access approach

Issue

Massive IPv6 header unnecessary for most sessions

No inherent user network Security (attach or association)

GTP overheads inefficient and tunnelled not routed

TCP/QUIC Transmission is inflexible and designed for fixed networks so that:

- Latency is poor for todays internet
- and unlikely to be able to support AR/VR demands over cellular

Cost

Inefficient use of Air interface, Inefficient use of transmission

Perpetuates many security issues in UP, includes costly IPsec tunnels over RAN-CN I/F

Inefficient processing, now one of largest costs of cellular Infrastructure

Performance limited with current algorithms and likely to remain for 5G, … difficult to tune to work well with access technologies

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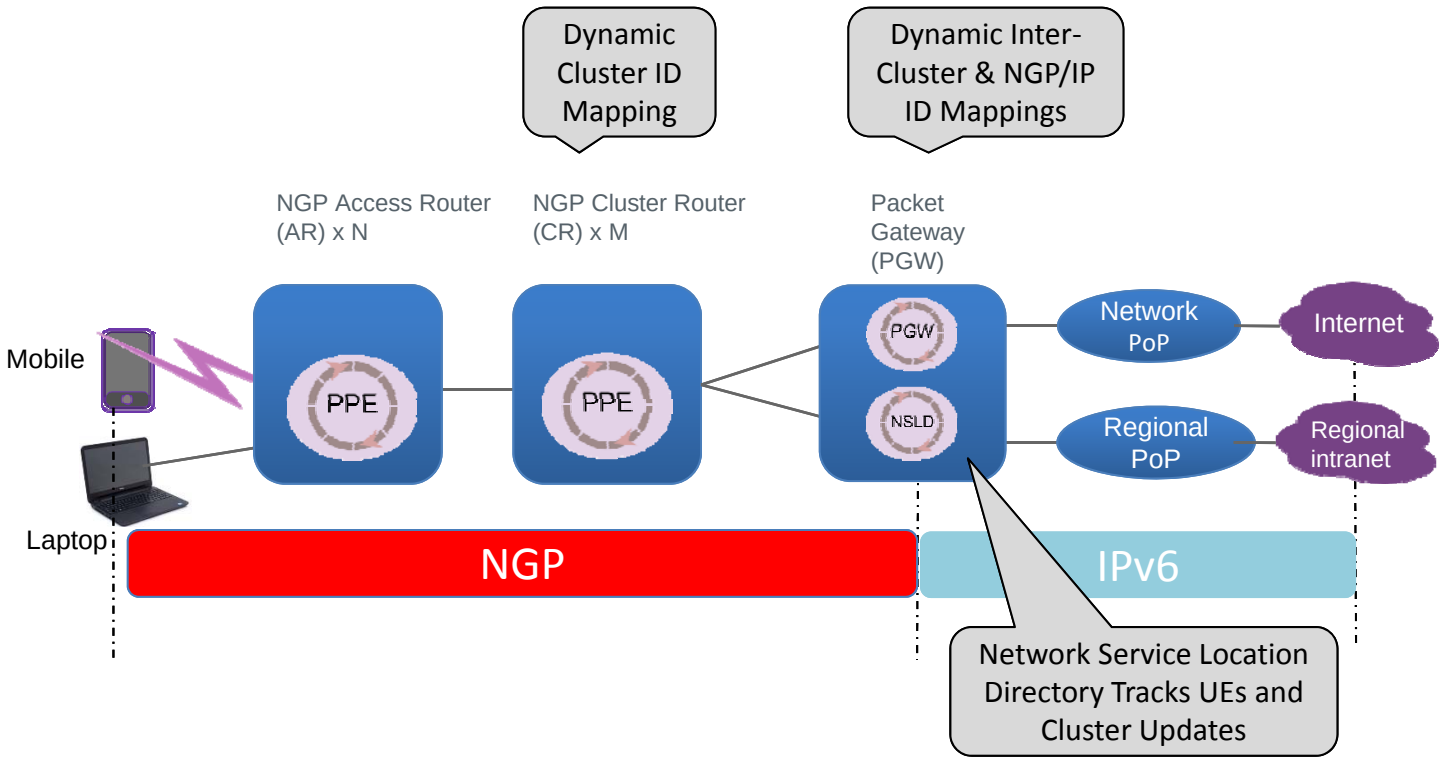
Example view of an NGP Architecture Evolution for INTERNET ACCESS.



Key: PPE – NGP: Packet Processing Entity == IP router plus intelligent scoping based on context

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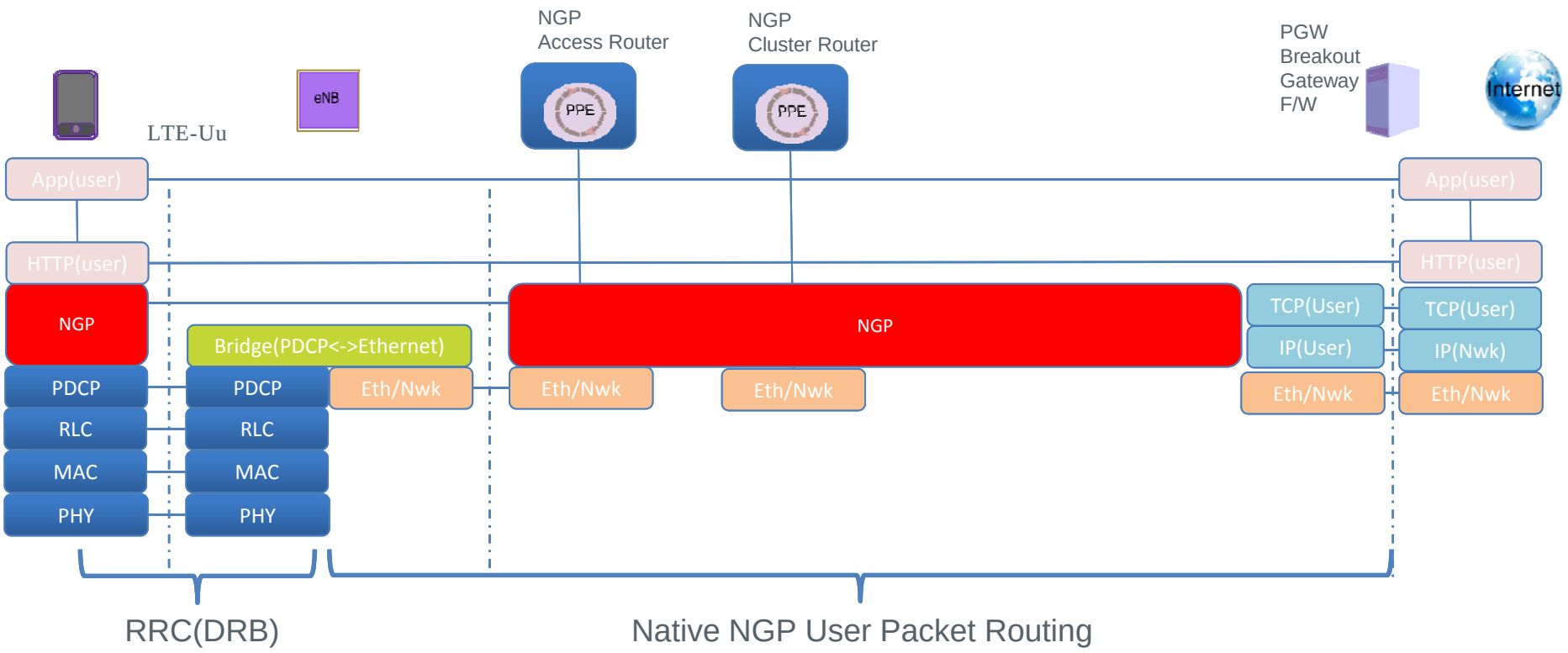
Example NGP UP Protocol Architecture for INTERNET ACCESS



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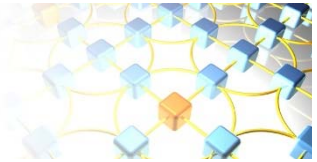

Conclusions

NGP has defined requirements for better MOBILE INTERNET ACCESS, key points:

Efficiency	Smaller Headers, Scalable protocol structures
Security	Native, Scalable, Association and Stakeholder based
Addressing	Location, Network Address separation and ID separation
Transmission	Flexible, Efficient, Context-Aware and Profile based
Mobility	Native, Scalable, Context-Aware

NGP is actively encouraging SDOs to support standardisation of new protocols to improve MOBILE INTERNET ACCESS

If NGP does not succeed, many of the benefits of 5G radio access technology will be wasted in the supporting access network

The next 2-3 years of 5G network definition time, are the LAST CHANCE TO CHANGE for an access generation!

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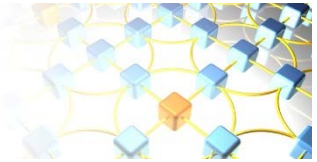
NGP Deliverables



Web-Site: http://www.etsi.org/technologies-clusters/technologies/next-generation-protocols

Standards: https://docbox.etsi.org/ISG/NGP/Open/

GS001: NGP Scenarios	Draft Approved by NGP (V1.2.1), Issued (V1.1.1),
GS002: Network Autonomics	Draft Approved by NGP
GR003: Routing Technologies	Draft Approved by NGP
GS004: ID Oriented Networks	Early Draft
GS005: NGP Requirements	Draft in Remote Consensus
GS006: Intelligence-defined Network	Early Draft
GS007: NGP Reference Model	Stable Draft

Whitepaper:
http://www.etsi.org/images/files/ETSIWhitePapers/etsi_wp17_Next_Generation_Protocols_v01.pdf

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