Update on 5G Work & The IETF

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Why discuss?

- Understand potential IETF work
    - Major rush if anything new needed for 3GPP Release 15 as it is only 14 months away
        - Fortunately, much is in the regular IETF program
- Also to understand what “5G” is (even as a moving target)
- Understand some of the stresses and future issues on the Internet that come from these developments
    - Underlined items may deserve more discussion

State of Play

- Architectures and protocol needs are becoming clearer in 3GPP
    - But not clear, yet; even some major questions are open, e.g., potential move from “boxes and protocols” to “service-based” type architectures
    - Networking side of 5G will probably continue to evolve for several releases
- Plenty of wild ideas and wild claims
    - E.g., the ETSI 5G Summit experience with new IP as “5G requirement”
- Some features may be required through indirection, e.g., 5G relies on an open source project that relies on IETF work
    - But we found surpassingly little of these

What Is 5G?

- Wonderful new tech, that is going to manage all your communication needs, be super fast

- Also, a complete revolution in how you communicate

What Is 5G?

Ok… but can we get real?

What is this 5G thing, really?

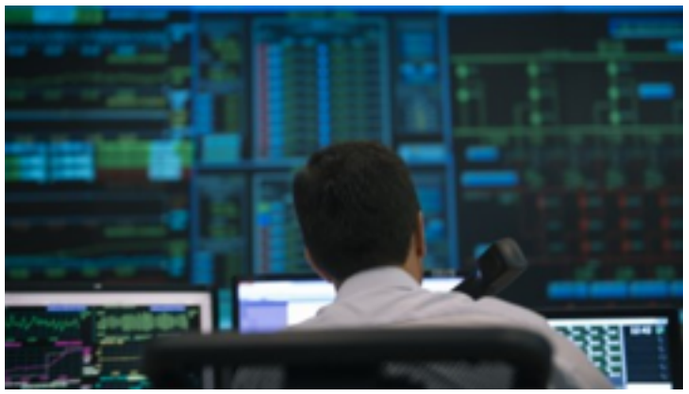
What Is 5G?

Amazing, truly amazing radio:
3.6 GBits/s downlink to a
racecar going at 170 km/h

What Is 5G?

Broadband and media everywhere

Critical control of remote devices



Critical services and infrastructure control

A collection of use cases

What Is 5G?

Network Function Virtualisation

Open Source

Cloud

Redesign of the network: Depending on your point of view, can view this between modest adjustment and revolution

Some concrete examples:

- Interface to terminals relatively similar to 4G
  L2 signalling, security, etc.
  + opening up the “SIM only” model
- Forwarding and tunneling architecture likely retained for now, at least
  +“local breakout”
- More capabilities for differentiated service aka “slicing”, including specific software and network nodes
- Control protocols may evolve, e.g., “legacy DIAMETER” to “REST-based” APIs

Redesign of the network: Depending on your point of view, can view this between modest adjustment and revolution

What Is 5G NOT?

Replacement for Internet-based services or Internet technology:
5G still carries traffic for the Internet

And not immune to impacts from other Internet evolution

Also not a magic way to get <new feature> adopted

And not the only reason to virtualisation/cloud changes

Liaison Status

Gonzalo Camarillo, IETF liaison manager to 3GPP, message to IAB 30 April 2017

3GPP is currently focused on standardizing the upcoming 5G system. The industry has clear deadlines for the delivery and deployment of the first 5G systems. Therefore, 3GPP is working at full speed producing the relevant specs. While the scope of 5G standardization is still not fully defined, 5G systems will include standards from several standardization bodies, one of which will be the IETF. There are also several open source communities that are relevant to 5G.

Traditionally, most interactions between 3GPP and the IETF were in the context of the 3GPP IMS (IP Multimedia Subsystem) and the IETF's RAI area (the real-time part of the current ART area). For 5G, the whole core network is going to be virtualized. Therefore, other IETF areas beyond ART will be involved.

As usual, 3GPP has been requested to send requirements to the IETF, as opposed to already-designed technical solutions. Nevertheless, even the whole set of requirements for 5G is not completely clear yet. At this point, there are already several engineers that are already involved in IETF work that will be relevant to 5G.

Given the wide scope of 5G, I am actively working with Jari Arkko (IAB) and Georg Mayer (3GPP liaison manager to the IETF) to understand the implications that 5G systems will have on IETF technologies. Based on our findings, we will proactively contact the relevant parties at 3GPP and the IETF in order to have fluid communications at all times. Our typical approach to ways of working between 3GPP and the IETF has been to involve 3GPP engineers in the IETF work they are interested in. The approach has been fairly successful so far and we still think it is valid.

Dependencies 5G-IETF

There are number of possible categories of dependencies between 5G and Internet (IETF) technologies.

- New uses of existing Internet technology. For instance, EAP is likely to be in bigger role in 5G than it has been in previous generations.
- New technology. For instance, Detnet work at the IEEE and IETF is likely useful for 5G's low-latency features.
- Impacts of developing technology. QUIC, for instance, affects mobile networks.
- Unclear cases
    - Needs more study. We do not yet know exactly what, if anything, new is needed by slicing functionality, for instance.
    - Also, be aware of tech (unnecessarily) marketed for 5G. Often there are claims that new tech is needed, when that may not actually be the case.

An Approach to Supporting New Developments Such as 5G

- Need to stay focused on key new functions, not attempt to create an unrealistically long list of requirements

- Special-purpose functionality and functionality that may not be easily deployable in the broader Internet may not be worthwhile investment or effort, or even possible to work at the IETF

Back to the Dependencies…

- New uses
- New technology
- Impacts of developing technology
- Unclear cases

New Uses

EAP

- EAP is a framework for different authentication methods, used in network access, e.g., in 802.11 and IKEv2

- Existing authentication methods include passwords, shared secrets, certificates, SIM cards (RFC 4186) and AKA (RFC 4187, 5448)

- Previous systems allowed use of cellular credentials in other contexts, e.g., WLAN

- 5G plans to allow EAP authentication to the 5G network

- Probably with no need for new work

    - But if needed, new versions can be published just as EAP-AKA' (RFC 5448) was published as a revision of EAP-AKA

New Tech 1/5

Routing in general

- Data models as an abstraction needed to consume topology, proximity and other related information as well as set of well defined API's/ bindings to program the network: I2RS, NETMOD, NETCONF, TEAS

- PCE to compute the paths in the network that meet the constrains provided by the 5G infrastructure and policy layer

- Routing protocols to provide distributed networking as well as transport for objective functions, topology, latency, BW available ,etc (BGP-LS, OSPF/ISIS TE metric extensions/PCEP/RSVP)

- Encapsulations to provide abstraction and meta-data not traditionally available: MPLS, NVO3, DETNET

New Tech 2/5

Service Chaining, SDN

- Deployment architectures rely on service-chaining and SDN-control in various ways
- Ongoing work at the SFC and I2RS working groups is required

Spring

- Segment routing is a very likely candidate for transport as a service at L3

New Tech 3/5

DETNET

- Work ongoing in the DETNET WG at the IETF is required
- This technology provides support for various critical applications and media delivery within an administrative domain, with tight jitter and other delivery requirements
- Better delivery guarantees are achieved through:
  - Reserving data plane resources on path for individual flows
  - Explicit routes that do not rapidly change
  - Distribution of packets over time/space for redundancy

New Tech 4/5

Transport networks & abstractions & management

- L2SM, L3SM WGs data models for service are required
- TEAS WG traffic engineering tools are required
- ACTN — what happened with that, and are any of those ideas required somewhere?

New Tech 5/5

QUIC, TSV

- Need to ensure that existing tools that there are for TCP-based solutions have sufficient definitions as new QUIC transport is being developed, e.g.:
  - draft-kuehlewind-quic-manageability
  - PMTU
  - various ways of tuning the transport

Unclear 1/10

- In the following slides we go through issues where we have not found clarity
- … of either whether there is IETF work in this space (in many cases there might not be, and that's fine)
- … or otherwise
- Being marked as unclear isn't meant to disparage a topic, just that we don't yet know how or if to deal with it

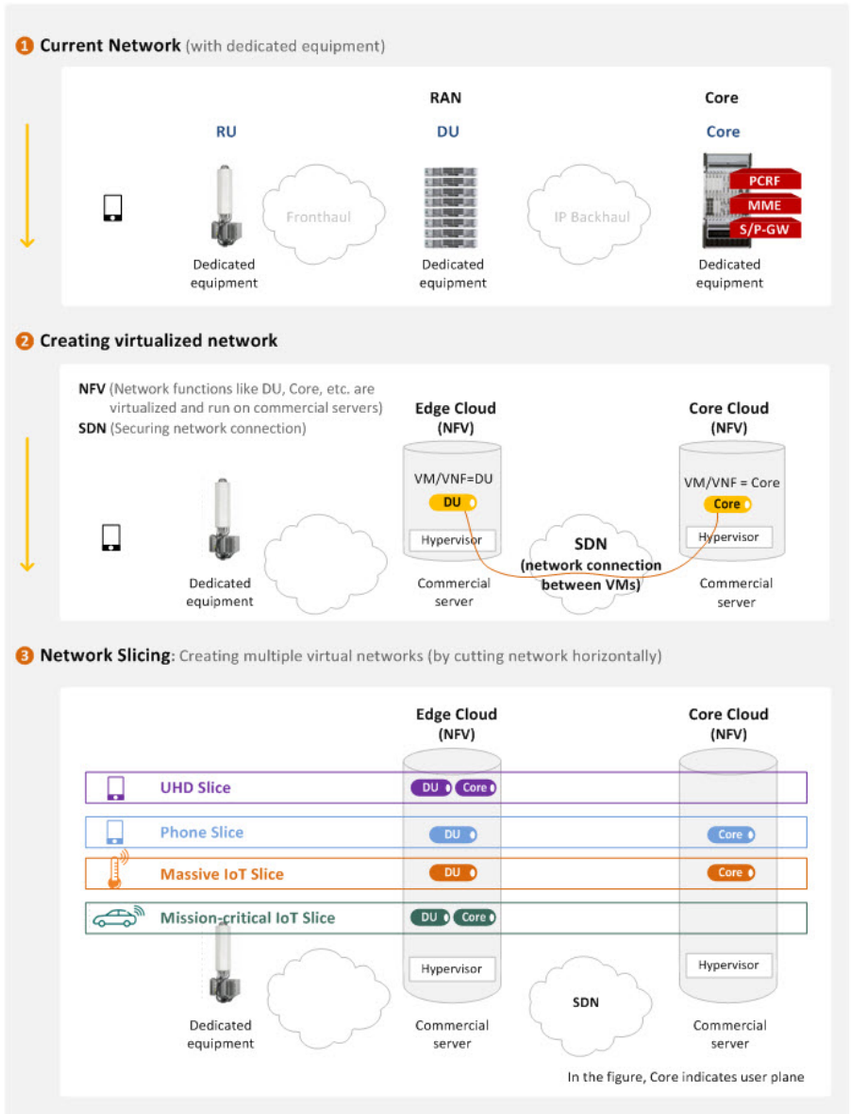
Unclear 2/10

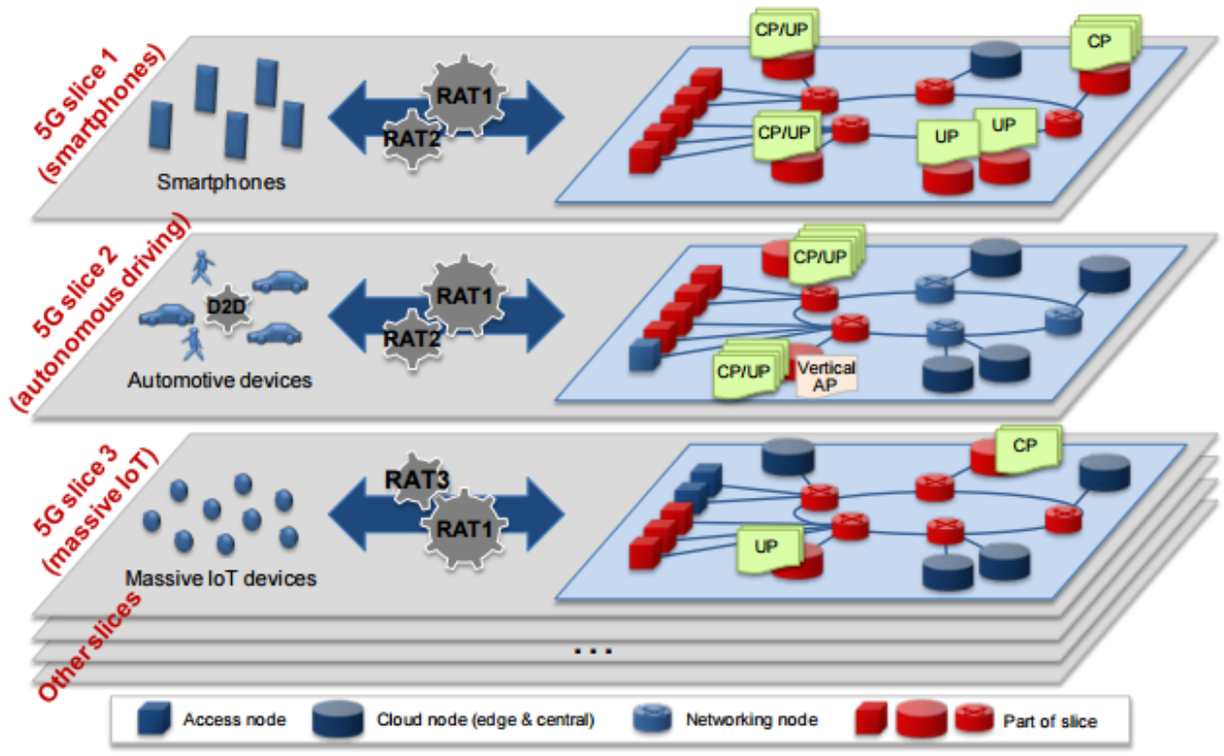
Slicing

- “Slicing” is a new 5G concept — see next slides
- Beyond the already in progress work, is something else required in terms of Internet tech? Unclear…
- Slicing is a modern-day mix of virtualisation, programmable networking, and QoS — are there QoS/ deployment difficulties in this space that we should worry about?
- 5G Network Slicing Side Meeting was on this topic

Unclear 3/10

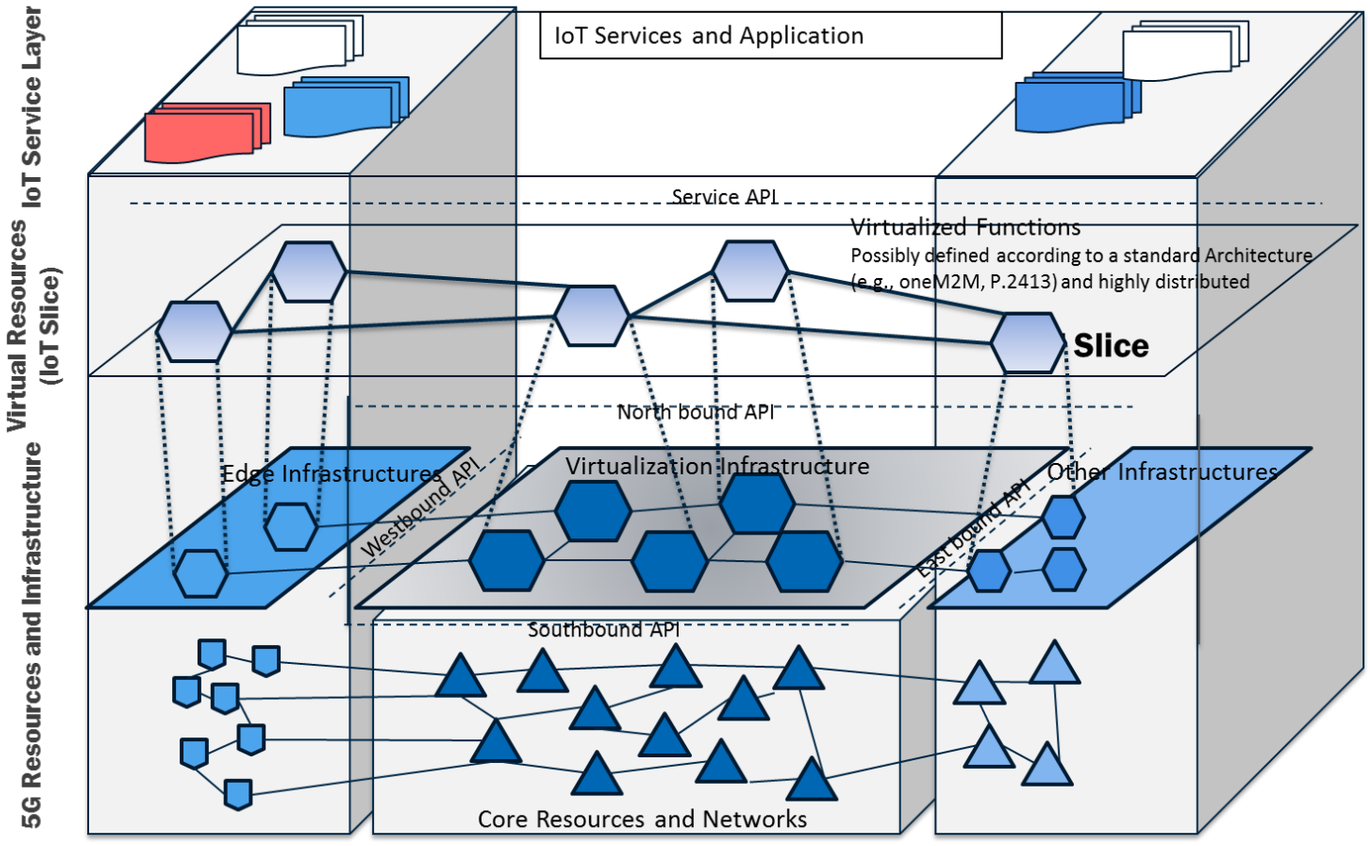
Slicing — the concept





Unclear 4/10

Slicing — the concept



Unclear 5/10

Future Internet -type designs

- ICN
- ETSI NGP
- May be interesting, but probably not for a near-term standards release

Unclear 6/10

Radically new mobility architectures

- DMM; ILNP; LISP
  - Could find use cases particularly if there's significant edge computing going on
  - Personal opinion: <u>May be interesting, but probably not for a near-term standards release</u>

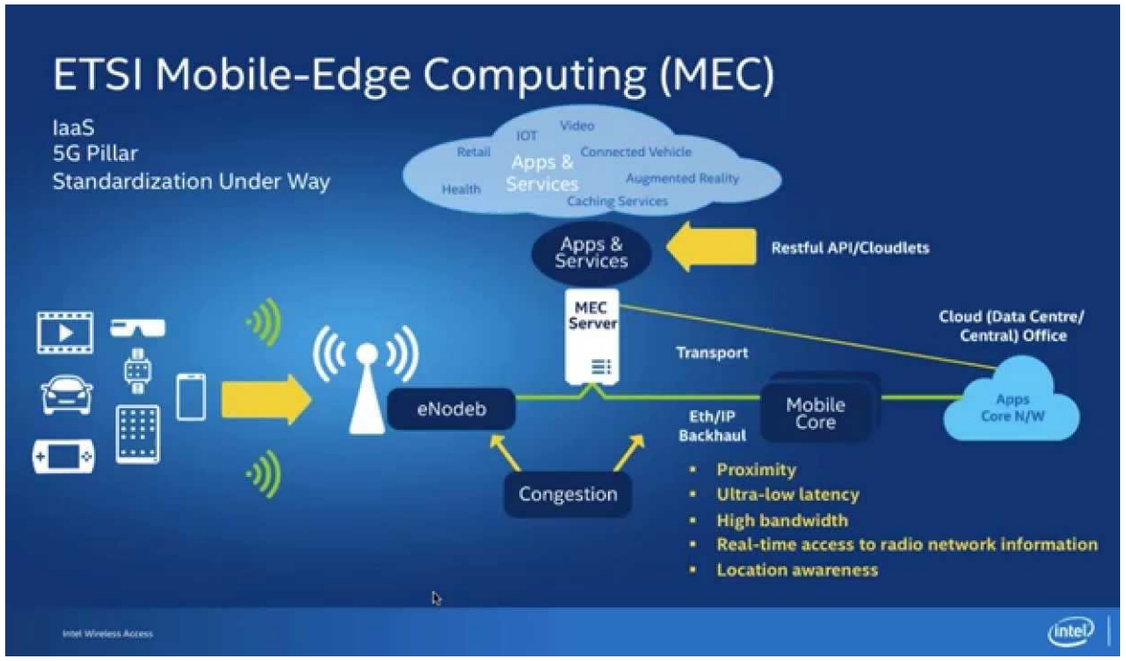
Unclear 7/10

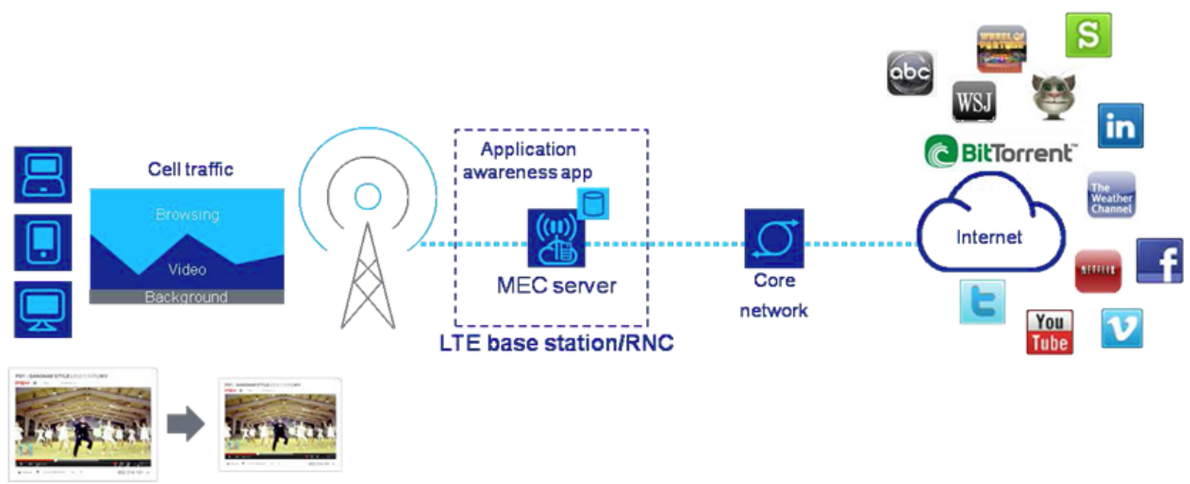
MEC — (Mobile) multi-access edge computing

- An trend in the industry (or at least part thereof)
- Unclear if there's IETF work in directly assisting this
- Unclear if there are impacts to the rest of the Internet architecture and protocols
- Unclear if there are 5G architecture impacts

Unclear 8/10

MEC — the concept





- Application-aware cell performance optimization for each device in real time can improve network efficiency and customer experience. It reduces video stalling and increase browsing throughput
- The solution can also provide independent metrics on application performance

Unclear 9/10

Side meetings

- 5Gangip
  - Discusses 5G
  - But hard to tell what the group is focused on

Unclear 10/10

Side meetings, continued

- IDEAS: identity-based networking
    - Personal opinion: <u>May be interesting, but probably not for a near-term standards release</u>
    - Possible use case is mobility architectures beyond current ones, particularly considering edge computing
- Flex-E: Focuses on slicing/x-haul
    - ?

Additional Future Stress Points

- Highly managed & dynamic & programmable radio environment continues to present opportunities for network & application collaboration

- Low-latency applications and the potential need to manage connections and destinations at a more fine grained level than is typical today

- The effect of edge computing on cellular network architecture and ways of building Internet services; and to what extent edge computing takes off

Thank you