Vodafone view on 3GPP RAN Rel-12 and beyond

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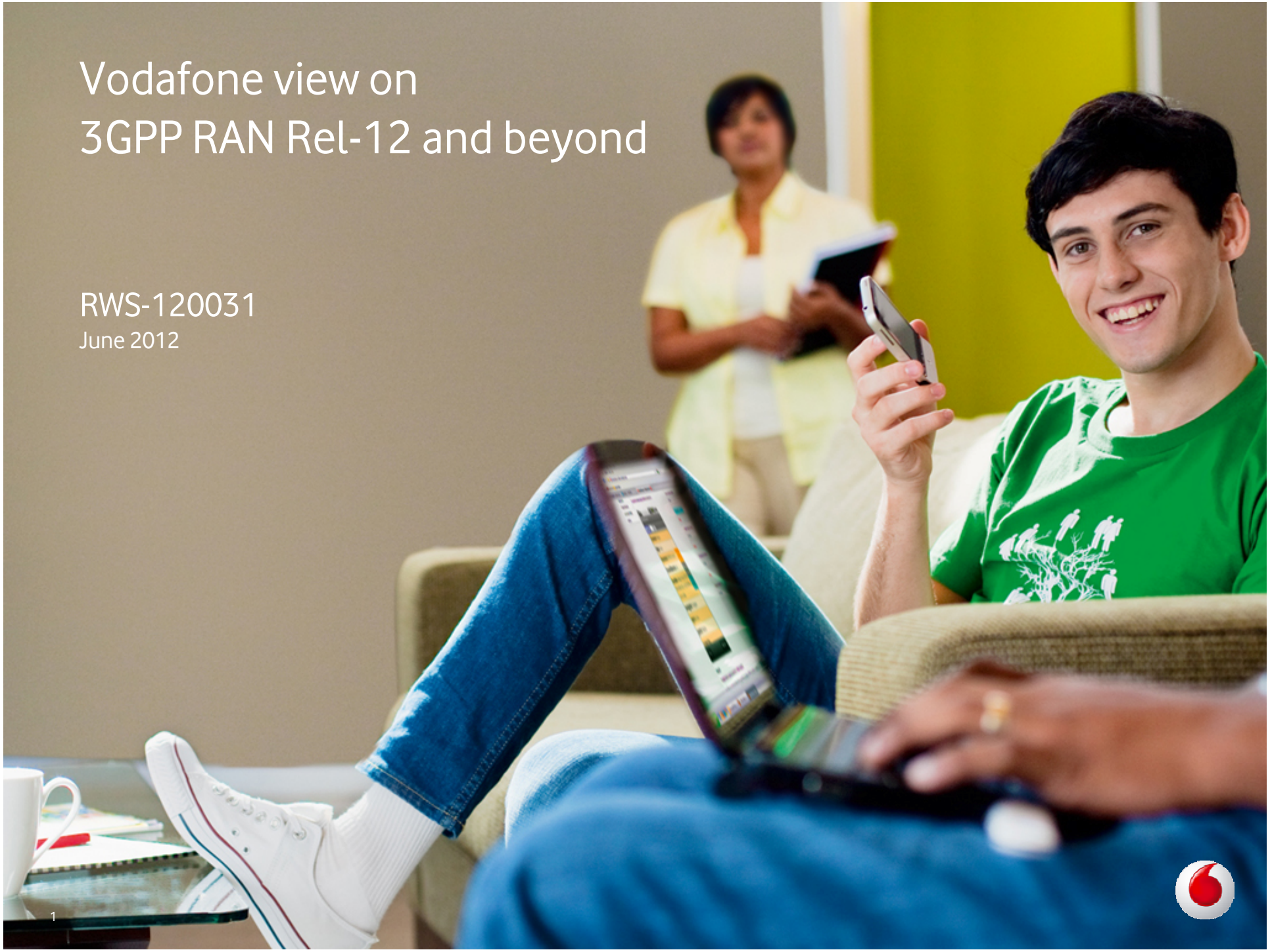

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Vodafone expectations for future mobile networks

QoE expectations of users will continue to increase, but equally they will not expect to pay more.

Number of connected devices will continue to grow as mobile connectivity becomes a solution for other industries

Significantly reduced cost of operating and expanding networks is required

General requirements for RAN

- Improved **user experience**. Smart/smooth handling across different RATs (LTE/3G/GSM/WiFi) and deployments (macro, small cell, femto)
- Higher **throughputs** + more **capacity** for LTE and HSPA
  - Improvements in QoE more noticeable for low SNR users. More focus needed on those users.
- Competitive **LTE coverage** – especially to allow migration of 2G traffic to LTE.
- **Control plane:** Efficient handling of hugely increased number of connected devices, and different applications/device types for LTE and HSPA.
- **Latency:** No urgent need for further work on radio interface solutions.
- Cost-effective, high capacity **transmission backhaul** – especially for small cells.
- Further reduction in **energy consumption** in all deployment scenarios!

...and all of the above needs to manageable by networks whilst significantly reducing relative costs!

Macro cell and general

- **Spectrum efficiency** improvements (especially at cell edge) for LTE and HSPA in downlink and uplink.
- Further **enhanced LTE/HSPA UE receivers** , also more focus on 4-Rx UEs.
- **Faster switching and re-balancing** of load between LTE/3G – consider architecture/UE complexity.
- **MAJOR control channel overhead** issues found in HSUPA today!
  - Solutions needed for HSPA, and should analyse LTE.
  - Define achievable/measurable targets for HSPA/LTE control channel consumption in 3GPP.
- Further improvements for different device types and diverse data applications
  - ...in terms of **reduction in signalling** and UE battery consumption.
  - Anything to enable **smarter traffic steering** between RATs/layers.

Small cells & HetNet

General

- Small cell for LTE and HSPA, shared with macro carrier and dedicated carrier
- Consistent/smooth user experience in heterogeneous network! i.e. avoid interference/mobility issues!
- MDT for accurately targeted small cell deployments.
- Different small/macro cell vendors.

Transmission backhaul...alternatives to fibre needed!

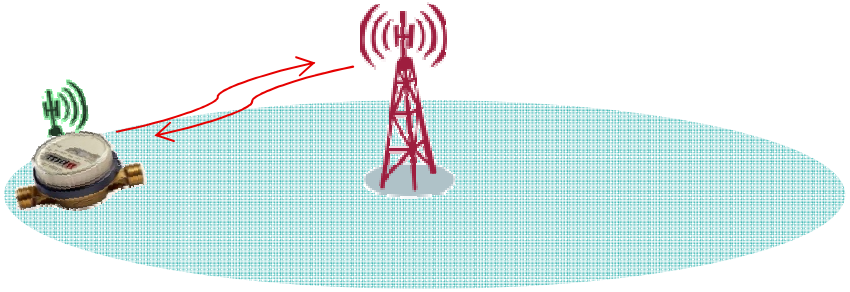
- Relay backhaul improvements ...very high capacity needed, to use in conjunction with unlicensed-band technologies.
- CA, Higher-order modulation, more antennas, other?
- ...so features should work with non-ideal and non-zero latency backhaul between small cell and macro!

UE mobility in het-net environment

- LTE RRC signalling & battery consumption reduction.
  - URA_PCH for LTE? ...mainly for shared carrier deployments.
- **Avoid tight integration of small cell/macro Base Station where no clear need!**

MTC and migration of traffic from 2G

- **Migration of traffic from 2G → eventual switch off and re-farming of 2G spectrum**
  - LTE "low cost MTC" device needed to facilitate migration.
- **Ensure LTE offers a competitive MTC solution against other technologies!**
  - Significant LTE macro-cell coverage improvement needed for low rate M2M traffic (e.g. meter reading from basements).
    - Not requiring new hardware (RF/antennas).
    - Does not necessarily need to apply for "normal" traffic.
    - Common/control/data channels, overhead, and.....low battery consumption!



- **LTE low cost voice**
  - Further consideration needed for e.g. India, Africa

Smarter opportunistic usage of Wi-Fi

- **Smart usage of unlicensed spectrum essential for cellular operators.**
- **LTE/HSPA small cell sites will have integrated Wi-Fi, also consider non-co-sited case.**
- **Operators need to..**
  - Guarantee a minimum QoE to users.
  - Control which traffic/service is handled by Wi-Fi and take advantage of it whenever it makes sense.
  - ...and ensure minimal interruption to service!

- **<u>Some technical requirements</u>**
  - Awareness of QoE provided by Wi-Fi needs to be available to RAN.
  - Fast movement to/from Wi-Fi for opportunistic usage of Wi-Fi.
    - For case where "Wi-Fi" and "LTE/HSPA" sites not co-located, looser integration and restrictions on frequency of toggling between LTE/HSPA and Wifi should be considered.

Operation of Public Safety System via LTE

- The usage of LTE for Public Safety systems is starting to be discussed in 3GPP (LS recently sent to SA1 from ETSI TC TETRA).
- Vodafone acknowledges that "group calls" and "direct device-2-device communication" are the traditional requirements to adapt LTE for this...
- ...however, there are less obvious requirements that need to be addressed.

- **3GPP should understand all of the requirements needed Public Safety before selecting which components to focus on, so that this market can be satisfactorily addressed by LTE!**

Consideration of backwards compatibility for Rel-12 and beyond

Backwards compatibility with legacy should not be compromised unnecessarily.

HOWEVER, Vodafone is concerned that "currently-publicised" Rel-12 proposals are not going to offer the level of cost savings required by operators.

So if there are backwards incompatible solutions, provided that they are likely to provide significant cost savings for the future network scenarios envisaged, these should be also taken seriously and studied further!

....thank you!