



M a k i N G V o L T E W o r k – R A N P e r f o r m a n c e

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VoLTE - RAN Performance



Different connection characteristics between VoLTE and BE traffic

- Longer hold time

- Higher mobility

- More signal messaging at all layers

- Lower throughput demand

Challenges for Retainability (aka Bearer Drop, BD)

- RF environment

- Mobility

- Signaling

- Measuring Retainability

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RF environment

- 3G Voice (3GV) tolerates a higher FER permitting a voice call to be maintained longer (at a lower QoE).
- DL has become the most limited path (noise limited case) when factoring in reverse link features and their uplink (UL) gains.
 - TTI bundling is providing average gains of 4dB
 - 4-way RX provides average UL gains of 3dB.
- RF planning, reuse limitations – more of a challenge for CDMA operators.

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Signaling

- Large number of radio link failures (RLF) are preceded by signaling failures.
- Recovery mechanisms are very robust allowing the radio link to be re-established quickly but also mask the underlying RLF event at the KPI level
- **Overhead signaling** – System Information Block (SIB)
 - 3GPP Standards issue – UE PCI blacklist anomaly
 - UE vendor issue - UE SIB read timer duration
- **Bearer signaling** (sRB) – “Initial Radio Link Failure (RLF)” on HARQ timeout

Analyze signaling failure events and determine if the signaling messaging can be reduced or perhaps making the signaling event more robust will improve performance

3GPP Standard – UE PCI BLACKLIST



Description of current algorithm:

In RRC_connected mode, the UE tries to read SIB1 and SIB2, every 80ms up to 4 times (total 320ms). If the UE cannot read the SIB messages then the UE triggers an RLF and timer t311 is started and while t311 is running, UE will exclude the PCI as a candidate for 5 minutes (3GPP).

Impact to drop rate, when operating in poor RF:

- Events impacted
 - › RRC Re-establishment, Handover target acquisition, Loss of sync
- Effect
 - › **Direct** – prolonged individual UE loss of coverage in the area of the failed PCI
 - › **Indirect** – selection of a “second-best” PCI can create significant interference issues and secondary failures for other UEs

UE log criteria used for “SIB read” failure counts:

```
-----
2014 Nov 20 22:16:10.576 [00] 0x1FFB Event -- EVENT_LTE_RRC_TIMER_STATUS
22:16:10.576 Event 0 : EVENT_LTE_RRC_TIMER_STATUS (ID=1605) Payload = 0x00 00 00 00 00 00 00 00 00 00 02
Payload String = Timer Name = SIB Event1 WT, Timer Value = 0, Timer State = Expire
2014 Nov 20 22:16:10.576 [00] 0x1FFB Event -- EVENT_LTE_RRC_RADIO_LINK_FAILURE
22:16:10.576 Event 0 : EVENT_LTE_RRC_RADIO_LINK_FAILURE (ID=1608) Payload = 0x03 00
Payload String = Counter = 3
-----
```

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Mobility

- VoLTE mobility rates are 2 orders of magnitude greater than BE traffic rates
- Higher mobility rates translate to more UEs operating in marginal coverage.
 - When the focus is on reducing messages, slowing down handover may be an option
 - Reducing hysteresis permits the UE to perform the handover in better signal quality
- These criteria mandate higher quality HO decisions for VoLTE traffic
 - Prior issues with variability in UE RSRQ reporting may limit the ability to fully leverage service-based HO trigger features
 - SON features like Mobility Robustness Optimization (MRO) may be too limited. ***Leverage analytics to modify UE performance based on known performance deltas?***

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Measurement challenge

- With VoLTE, the Core network can be a more significant contributor to Retainability performance and so an E2E metric is mandated. Varying connection types and paths dictate per-connection statistics, which requires a systemic approach to collection and analysis.
- While a Retainability KPI view is relative to a metric definition, metric definitions are open to interpretation. More vendors = More opportunity for disparity.
- VoLTE operators ...
 - define their metrics ← vendors are node-centric
 - define their measuring criteria and thresholds ← typically a vendor agnostic solution
 - develop tools to monitor performance ← scaling issues for E2E & per-connection
 - measure performance to threshold ← incl. assess viability of monitoring method under load
 - drive performance improvements ← incl. driving vendor deltas, relative nature exposed

Monitoring methods are undertaken with a certain confidence interval and often have weaknesses exposed during efforts to drive a minimum level of performance