# Annexure

| Area | Problem Statement | Possible Approach /Simplified Statement |
|---|---|---|
| RAN & Core | **Problem statement-** Extending Network capabilities through API in 5G network is key to 5G monetisation. The security concerns in application of 5G Network is huge. Mitigating the risk through traditional approach is expensive, less efficient and does not qualify business requirements | Methodologies/Ways to monetize the various data APIs in 5G Software Based Architecture |
| | **Problem statement:** 5G deployment cost increases to address Uplink Coverage typically in TDD bands. When 5G NR is deployed on mid-band, the uplink coverage is expected to suffer from high path loss and penetration loss, which leads to poor user experience, particularly for TDD frame structures with less uplink slots. Although some 5G technologies like multi-antenna transmission could mitigate the issue to some extent, the coverage performance gap between LTE and NR still exists. More NR base stations result in higher CAPEX. | Mechanism to increase uplink coverage in 5G bands |
| | **Problem Uplink Capacity:** Live HD videos demand coverage with high uplink throughput for Industry 4.0 applications like surveillance, smart city/ building. As these applications become popular, they pose a big challenge on 5G network. | Innovative compression technique for handling high uplink video traffic in wireless networks |
| | **Problem Statement:** Device battery drains are contributed by Applications and Network signal strength. In low signal cases, the transmitter in a device amplifies the signal to high levels, which consumes more battery and 5G coverage still has time to become ubiquitous. | Advance device level solution to optimize the battery consumption and increase battery efficiency |

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| | **Problem statement:** The 4G to 5G Data Session Handover feature with following limitations:<br>-Session Management Function (SMF) supports N26 4G to 5G handoff with single User Plane Function (UPF), which implies that UPF selection and UPF modification are not supported.<br>-SMF does not support Policy Control Function (PCF) trigger<br>-SMF does not support charging and PCF integration.<br>-SMF does not support the roaming scenario. | Approach on protocol procedure modification or device side modifications on Handoff management |
| | **Problem Statement**: The frequent movement of the UE between the boundaries of the two neighbour cells results in a ping-pong effect because of high signal fluctuations. | Approach on UE/ device to deal with mobility reporting to create hysteresis effect on HO calculation and reporting |
| | **Problem Statement**: When the RLF (Radio link Failure) is identified during a HO (Hand off), the UEs execute a recovery procedure. In this process, the RLF timer is switched on as soon as UE detects the radio link issues. The RLF timer is usually set at 500 or 1000 ms. The service provider adjusts the RLF timer based on drive tests within the network. Once the RLF time expires, UE sends a connection request to another target cell without disconnecting from the existing cell. UE manages to connect to the target cell if the source gNB has already organized the target cell on receipt of the measurement report from the UE. This process is more time-consuming than the backward HO procedure leading to prolonged service interruption. However, this procedure prevents the loss of temporarily stored data within the source gNB because of the features of data forwarding and in-order delivery. | Approach to solution is by reducing HO procedure time and dealing with loss of temporarily stored data |

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| | **Problem Statement-** HCP (Handover Control Parameter) settings are essential to provide optimal HO decisions. HO performance impacted by the various HCP settings has been investigated. For example, the HOPP (Hand over ping pong) probability is highly affected by TTT (time to trigger) more than HOM (Hand over margin). Moreover, utilizing a high system setting for TTT and HOM, such as 4800 ms and 8 dB, leads to a significant reduction in HOPP probability to approximately 0%. | Possible approach to the Solution could be a stronger self-learning Automatic self-optimisation function. |
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| | **Problem statement:** Increased voice call drops require adequate measures on RF optimization. | Algorithm that will link Call drop to RF optimisation opportunity and recommendation that include RET based orientation and parameter changes |
| **Application** | **Problem Statement:** It needs super experts and longer lead time to conclude on 5G usecase and calculate the ROI. | Possible solution could be 5G Use case recommendation engine which will automatically map and suggest detailed next steps for any Industry business and operational process |

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| | **Problem statement:** Coordinated street traffic light systems are no longer effective because of changing dynamics behaviour of street traffic and infrastructural advance. | Traffic light syncing and optimisation using Google map data, Live video of streets, and connected smart vehicles using 5G network |
| | **Problem Statement:** Personal AR-VR headsets are very uncomfortable and cannot be used for longer duration while studio setups are insanely expensive. This appears as major bottleneck for mass adoption. | Can there be a better form factor or better approach to meet the purpose without directly blocking or intruding on human sensing system |
| **Security** | **Problem Statement-** Zero trust deployment approach in 5G network is highly expensive. Entire investment in 5G network gets penalised to deal with blinded Zero trust architecture. | |
| | Ideas to explore Digital forensics to enhance 5G security. | |
| | Novel approach to perform Malware analysis on 5G ecosystem in regular shorter intervals using minimal infrastructure | |
| | **Problem Statement-** 5G ecosystem is expected to be carrier of Steganography contributing to security breach of own network elements and connected applications | |
| | Approach to secure 5G VNF and CNF deployment in Public domain | |
| | Approach to deploy FCAPS High Performance Computing platform in 5G NOC-SOC | |