ENEA

eBrief

Increasing LTE Capacity by 15% With No RAN Investment

With breakthrough Machine Learning Technology, Enea provides a field-proven solution to expand RAN capacity with no infrastructure investment

Delays in 5G rollout and the growing demand for data

COVID-19 has forced operators to slow down 5G rollout plans[1] and rapidly rethink the efficiency of existing network infrastructure. Meanwhile 4G traffic has soared. During lockdowns, some operators faced a surge of over 90% in peak throughput, while several of the world's largest networks[2] saw overall mobile traffic grow by 100%. This prolonged lifespan of 4G as a complement to 5G's limited coverage creates new challenges and severe restrictions on capex for operators who are trying to manage traffic growth on 4G while at the same time investing in 5G. Adding to the challenge is the contribution of encrypted video. This was 65% of total traffic in Nov 2019 (Mobile Video Index 2019[3]) and estimates now put this figure closer to 70%.

This growing demand for data needs to be addressed intelligently since expensive RAN upgrade is not an option. This eBrief summarises recent results achieved in the field at a major Tier-1 operator using Machine learning RAN Congestion Management.

Enea's RAN Congestion Management Suite

Enea offers a combination of operational techniques to address congestion issues in the RAN. These are summarised below.

RAN Congestion Manager (RCM)

RAN Congestion Manager (RCM) is a patent-pending machine-learning based solution which, despite residing in the core network, determines localized RAN congestion by analysing trends and variations in multiple packets, flows and UE session metrics, grouped by the radio network attachment point.

RCM thus exposes the congestion status at each RAN location enabling Enea's Traffic Management applications to take selective action on individual subscribers and flows to proactively manage the load in the network. Such applications include QoE-driven video optimization (Encrypted Video Manager), and per-application fair usage and bandwidth management policies (IP Traffic Classifier), among others.

Session Congestion Manager (SCM)

For networks where RAN location information is not available, SCM detects UE sessions with poor QoE based on configurable metrics and thresholds that accurately reflect signs of congestion in the network. These sessions can then be also optimized via Encrypted Video Manager.

Explicit RAN Congestion Manager (eRCM)

eRCM enables the operator to propagate the RAN cell, sector or eNodeB utilization by using Enea's RTO protocol, a simple mechanism to progress real-time RAN utilization from the

eNodeB to the GiLAN. It only requires the eNodeB to support IP header enrichment, eliminating the need for a dedicated control plane interface with marginal performance implications on the network.

eRCM correlates subscriber, session, network and RAN utilization information to dynamically determine the level of congestion for a subscriber session, once again exposing it to the Enea's Traffic Management applications.

Congestion Analytics Dashboard

The congestion management suite equips the MNO with a comprehensive analytics dashboard to identify the contribution of congested sessions for a given location and corresponding average throughput values to get an indication of subscriber QoE.

What are the benefits?

For a network experiencing an unpredictable pattern of highly congested cells, the most important benefit from RCM is its ability to differentiate a congested cell from a non-congested one dynamically, and impart relief to the most congested cells in real time via selective enforcement of optimization policies. The benefits can be summarized:

Consistent Quality of Delivery for Videos

Better Browsing, Streaming Experience

Subscriber Quality of Experience

15% Reduction in Highly Congested Cells

10% Reduction in Packet Drops

RAN Key Performance Indicators (KPIs)

RAN Congestion Manager (RCM) and Encrypted Video Manager (EVM)

A summary

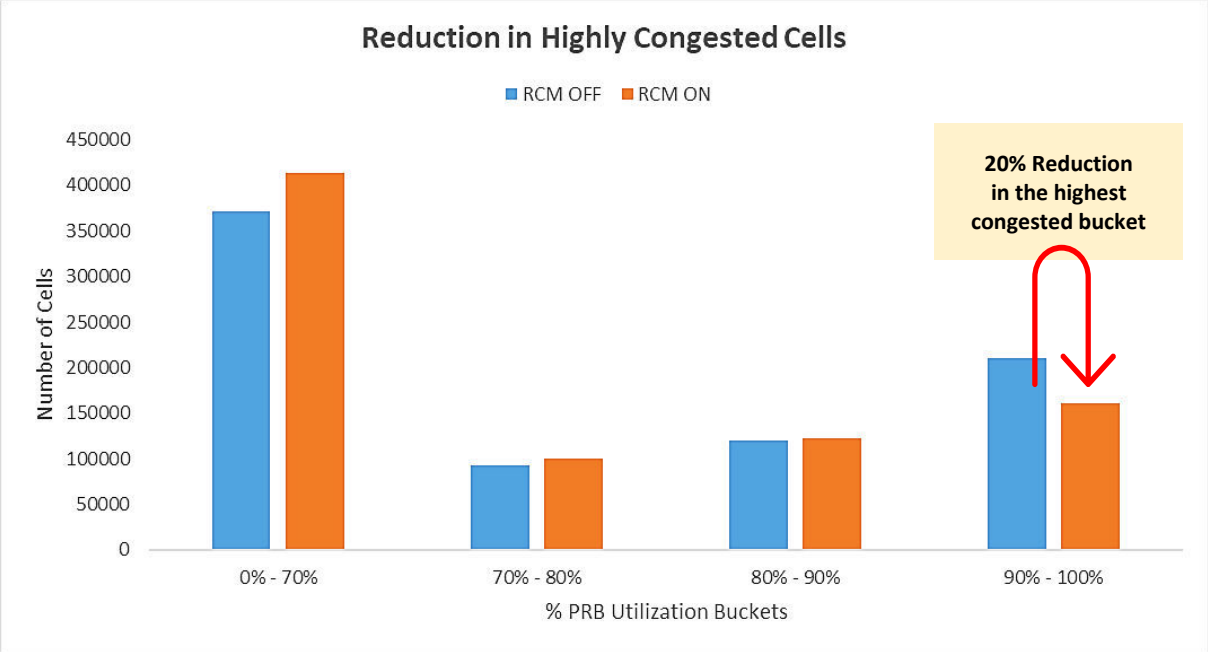
RAN Congestion Manager (RCM) is agnostic to EPC and RAN vendors. It can be seamlessly integrated into the core network, on the SGi interface (Gi-LAN), alongside Enea's Encrypted Video Manager (EVM) which is a solution for optimizing encrypted and non-encrypted video traffic. Despite residing in the core network, RCM can accurately detect congestion events in the RAN. This capability is enabled by machine-learning algorithms trained using the operator's RAN datapoints and corresponding user-plane dataset to produce a RAN congestion model unique to the operator's network. This enables the operator to proactively manage subscribers moving to a congested network location by managing corresponding sessions via EVM.

EVM follows an adaptive optimization approach based on subscriber QoE and content rules. It adapts the streaming quality of ABR video content without affecting the subscriber QoE to ensure its contribution to the load on RAN is reduced. Simultaneously, linear downloads are accelerated so that precious resources in the RAN can be made available promptly.

Live in one of the world's largest Tier-1 Mobile Networks

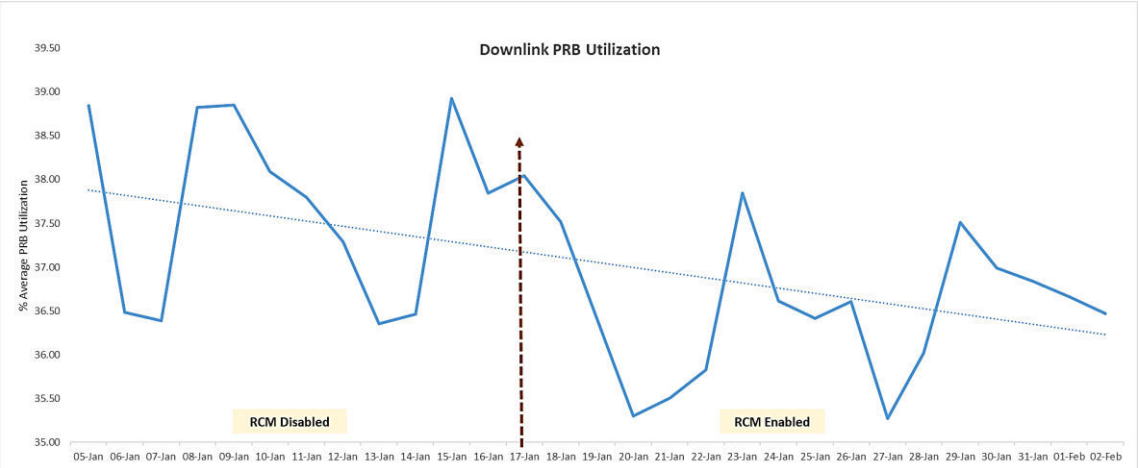
RCM was recently deployed at one of the world's busiest mobile networks (measured in terms of throughput per day). The benefits that were realized by RCM are summarized in the charts below.

Reduction in the number of highly congested cells



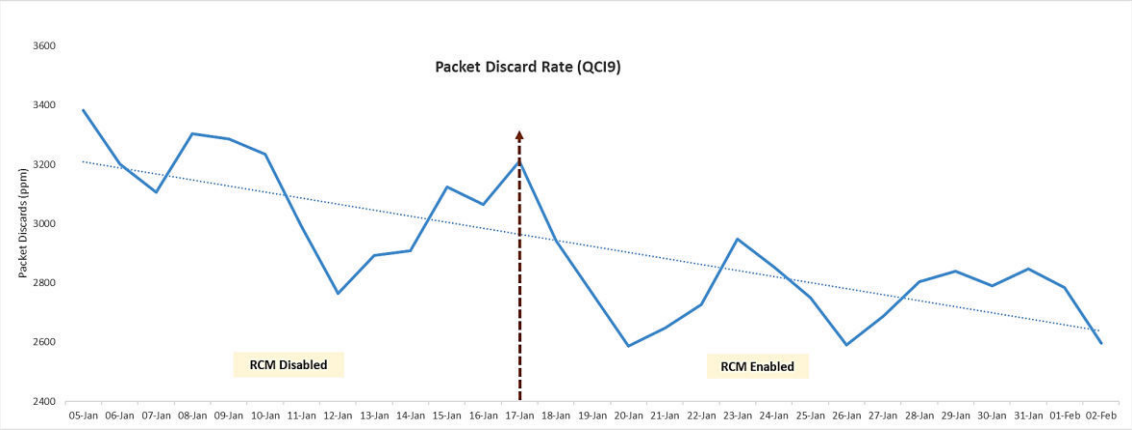
When RCM was deployed, there was a reduction of up to 20% in the number of cells experiencing congestion, while there was a corresponding increase in the number of less congested cells, thus reducing congestion and improving subscriber QoE.

Reduction in downlink PRB utilization (see Definitions)



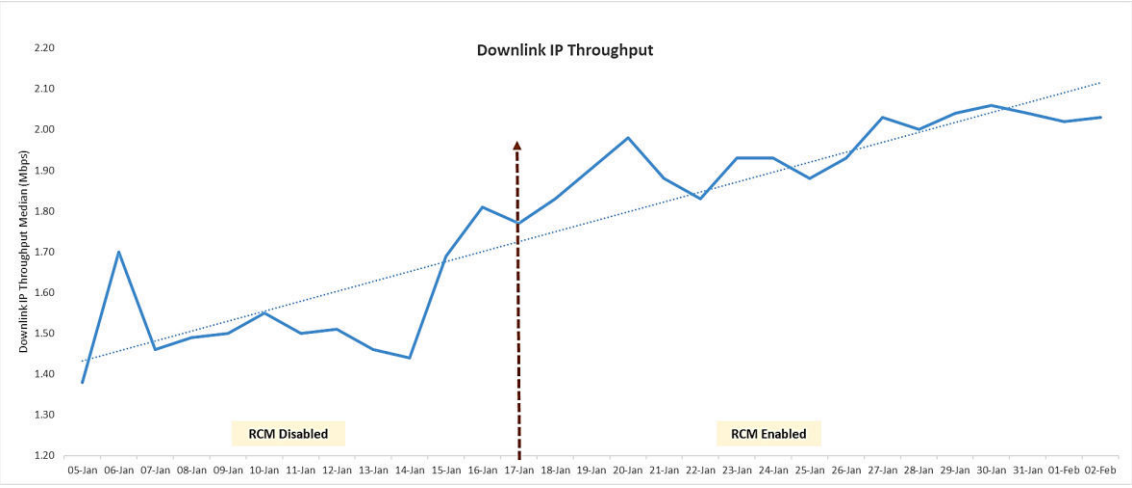
Initially this network witnessed high PRB utilization throughout the day, indicating that radio resources were under stress more or less all the time. After enabling RCM in the network, the peak DL PRB utilization reduced significantly thereby alleviating the network load.

Reduction in packet discard rate



Similarly, the high packet discard rate also indicated congestion in the network. After RCM was deployed there was as significant drop in downlink packet discard rate indicative of the reduction in network congestion.

Improvement in downlink IP throughput (QCI9 – see Definitions)



The final chart shows the downlink IP throughput (Mbps). The initial low values due to congestion were resulting in a poor subscriber QoE. The DL IP throughput improved significantly after enabling RCM in the network, with an immediate postive gain in subscriber QoE.

What makes ML-based congestion detection different?

Other solutions rely on basic rule-based models which, instead of detecting congestion in the RAN, apply bandwidth shaping to individual flows by simply comparing throughput and RTT against pre-defined thresholds.

Unlike RCM, such “blunt instrument” approaches can neither detect congested RAN cells/locations nor optimize subscriber session throughput. Instead, they degrade mobile video QoE and unnecessarily reduce download speeds for large flows which results in inefficient channel utilization, incompatible with third party TCP acceleration technologies.

Summary

RCM has been proven to be highly effective in alleviating congestion in one of the most congested networks in the world. ***By reducing the number of cells in the highest PRB utilization bucket by 20% and overall packet discard rate by more than 5%,*** RCM improved the quality of experience and enabled the operator to cater to the latent demand with no additional capital expenditure in the capacity upgrade.

You can arrange for an online demonstration of RAN Congestion Manager today.
Email info@owmobility.com

References

1. Countering the threat to Europe's 5G rollout (PwC 2020)
2. Figures from Enea's deployments worldwide
3. Mobile Video Index, 2019 Edition

Definitions

PRB – **Physical Resource Block** – unit of allocation in radio resources. The PRB indicates the number of radio resource elements that can be utilized at a given time. If over-utilized, it is a sign of pressure of demand and a leading indicator of congestion.

QCI9 – **Quality of service Class Identifier level 9** – a standardized identification for TCP & video traffic. Packet loss is a leading indicator of poor quality of service.

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