## Guidelines for Adding Congestion Notification to Protocols that Encapsulate IP (draft-ietf-tsvwg-ecn-encap-guidelines-02) IP-a **APN #1** GTP-a1 GTP-a2 (e.g., IMS Network) IP-b GTP-b1 GTP-b2 PDCP-b **APN #2** Application (e.g., internet) IP IP Relav Relay PDCP GTP-U GTP-U GTP-U PDCP GTP-U RLC RLC UDP/IP UDP/IP UDP/IP UDP/IP MAC MAC L2 L2 L2 L2 L1 L1 L1 L1 L1 L1 LTE-Uu S1-U S5/S8 SGi UE eNodeB Serving GW PDN GW ECN mark – set on radio congestion, Lower layer transport (MPLS, Ethernet)

## used to trigger rate adaptation

## carrying GTP and IP packet

## Snippets from liaison statement to 3GPP

" .... However, ECN is now being used in a number of environments including coder selection and rate adaptation, where 3GPP protocols such as PDCP encapsulate IP. As active queue management (AQM) and ECN become widely deployed in 3GPP networks and interconnected IP networks, it could be incompatible with the standardized use of ECN across the end-to-end IP transport [draft-ietf-aqm-recommendation]. ....."

"The IETF is now considering new uses of ECN for low latency [draft-welzl-ecn-benefits] that would be applicable to 5G mobile flows. However, the IETF has realized that it has given little if any guidance on how to add explicit congestion notification to lower layer protocols or interfaces between lower layers and ECN in IP."