New Control Plane in 3GPP LTE/EPC Architecture for On-Demand Connectivity Service

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IEEE CloudNet'13

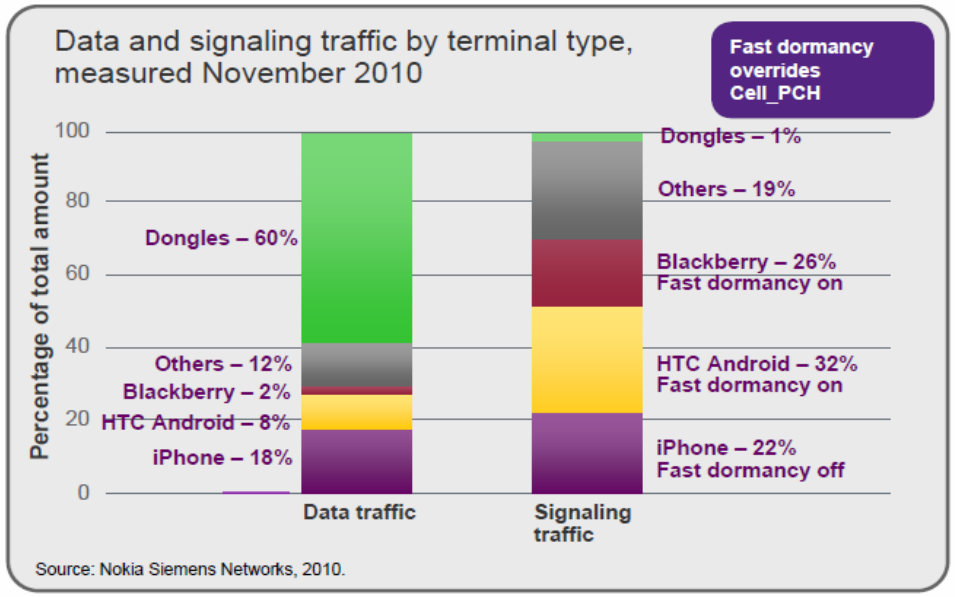
San Francisco, USA

11-13 Nov 2013

Outline

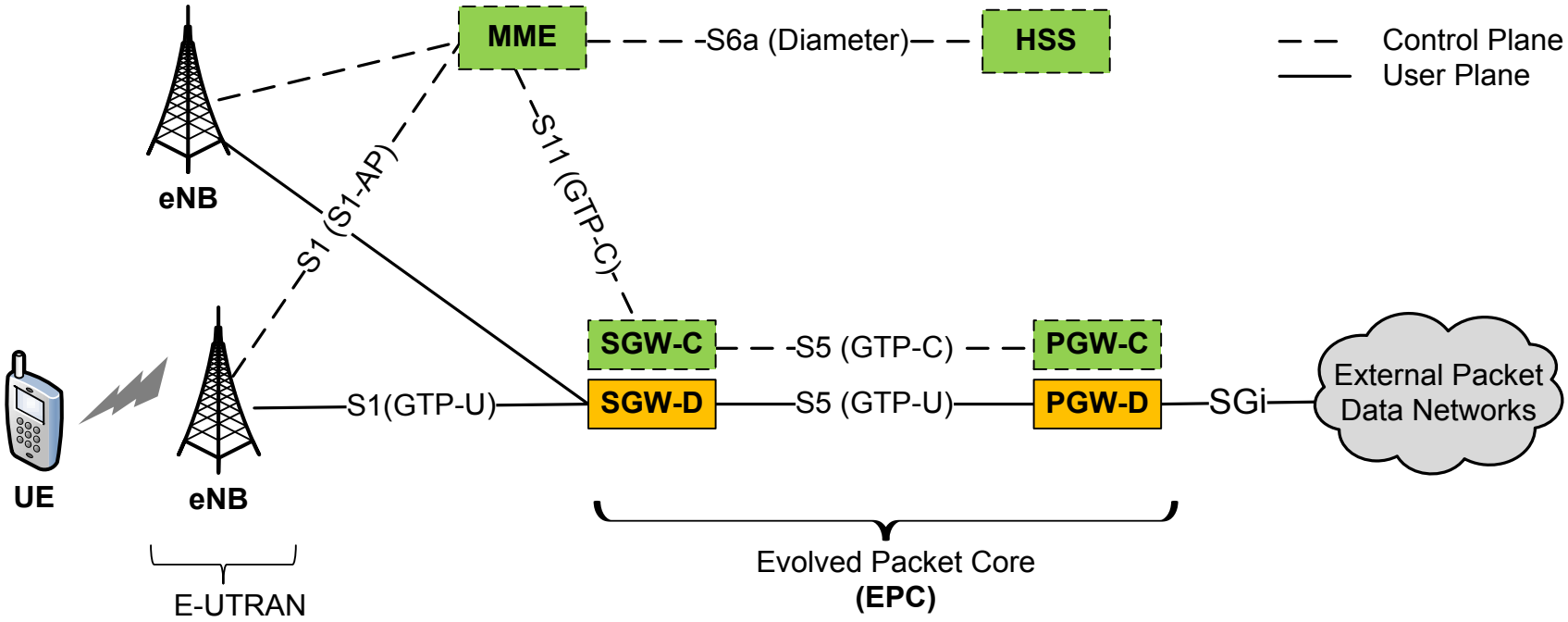
Introduction

- Mobile data traffic has been growing at an unprecedented rate over the last few years.
- Huge data traffic increase and may cause signaling storms in the network.
  - Smartphones and tablets generate 40% of the data traffic and 99% of the signaling traffic.



LTE/EPC Architecture

- The LTE/EPC has been designed to support only packet based services.
- The EPC has a flat, all-IP architecture with separation of control plane and data plane.

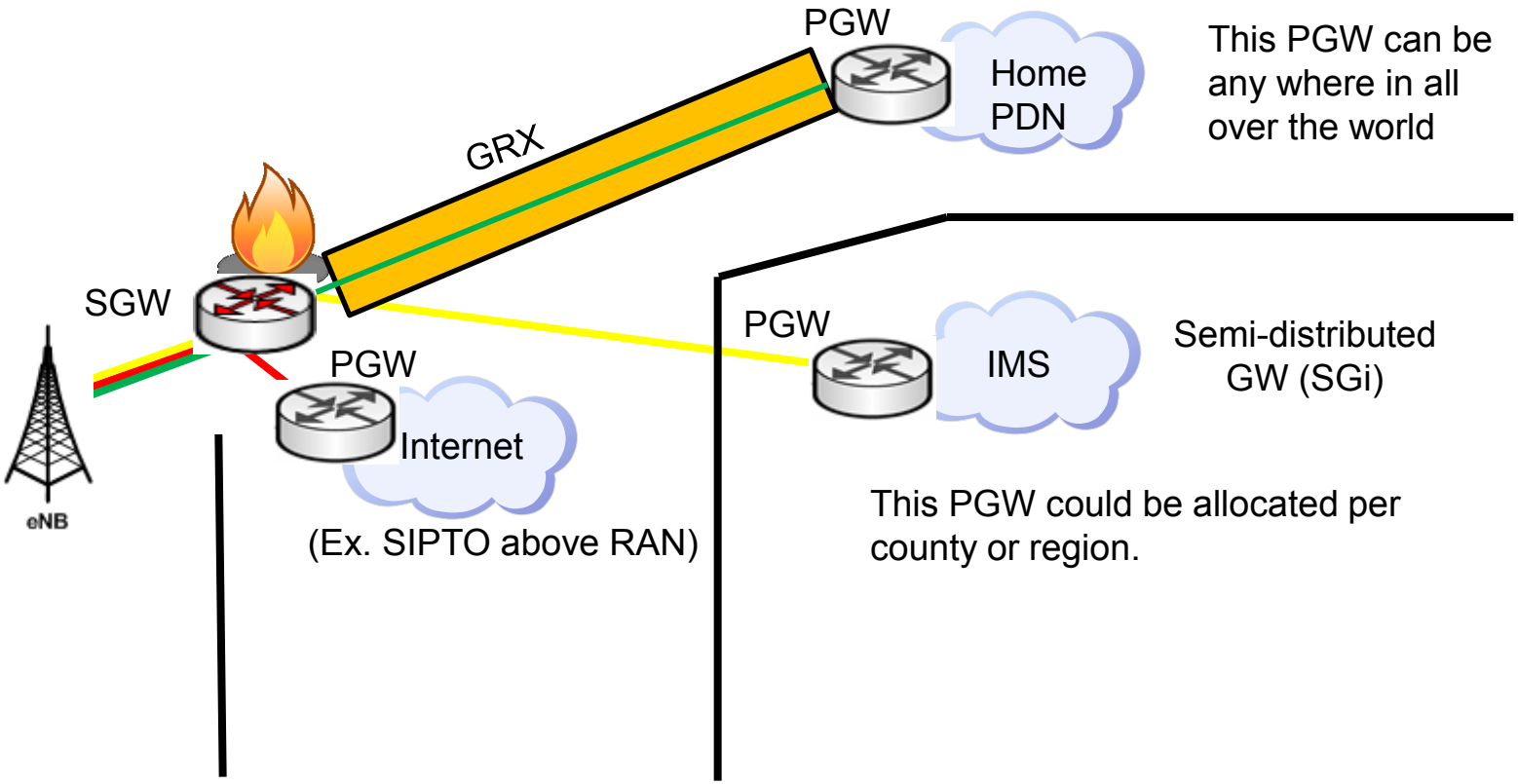


LTE/EPC Drawbacks

- The initial attachments lead to a systematic establishment of the data plane, even when there is no data traffic to be sent.
- The data plane establishment procedure is unaware of the session type.
- The TEID values are locally allocated by each node ➔ new TEID values should be exchanged for each node relocation.

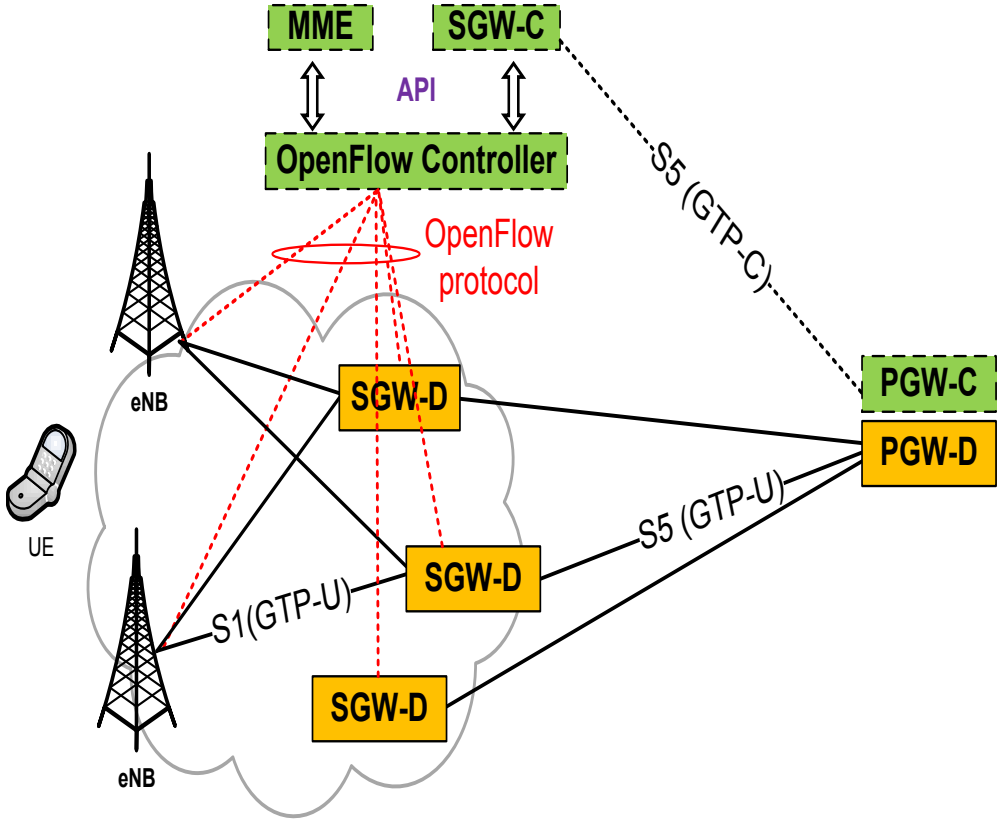
LTE/EPC Drawbacks - 2

- SGW could be a bottle neck for possible user traffic congestion.
- Network equipment failure.



OF-Based LTE/EPC Architecture

- Separation of control and data plane from SGW.
- Replacing S1-MME and S11 interfaces with OF.
- SGW-D represents an advanced OF switch that is able to en/decapsulate GTP packets.
- Unique TEID values per session.
- eNB keeps the same radio functions.

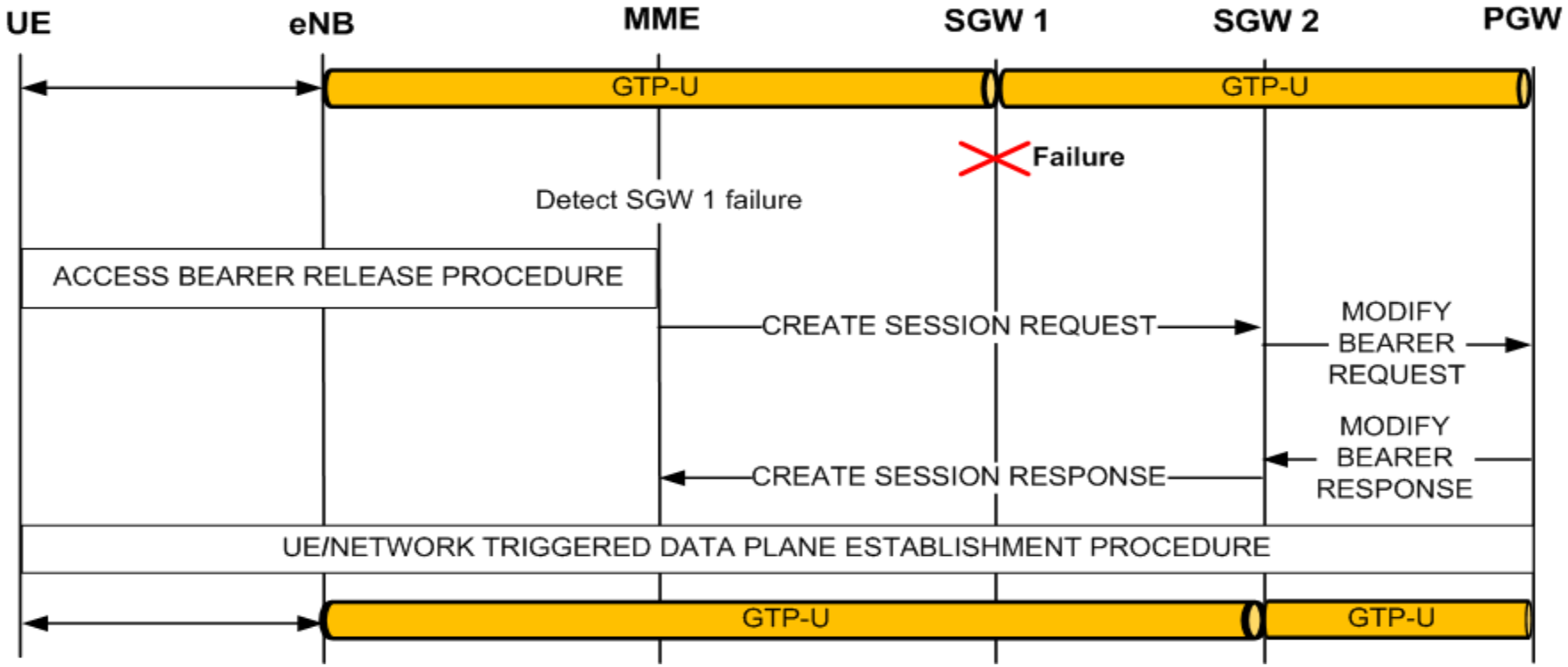


On-Demand Connectivity Service

- Resiliency
- Load Balancing

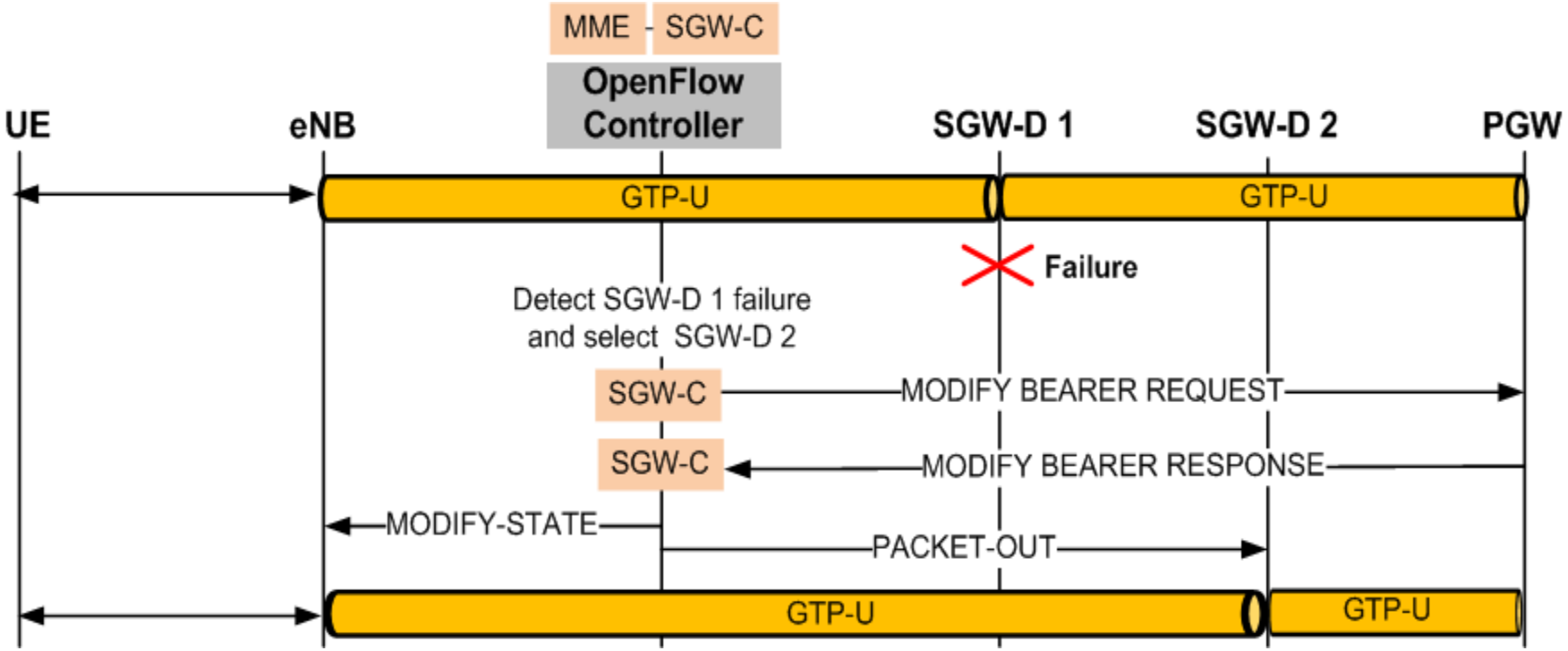
Resiliency – 3GPP LTE/EPC case

- The 3GPP restoration procedure related to the SGW failure is not transparent as it cuts off active sessions.
- Session re-establishment of impacted users may generate significant amount of signaling.



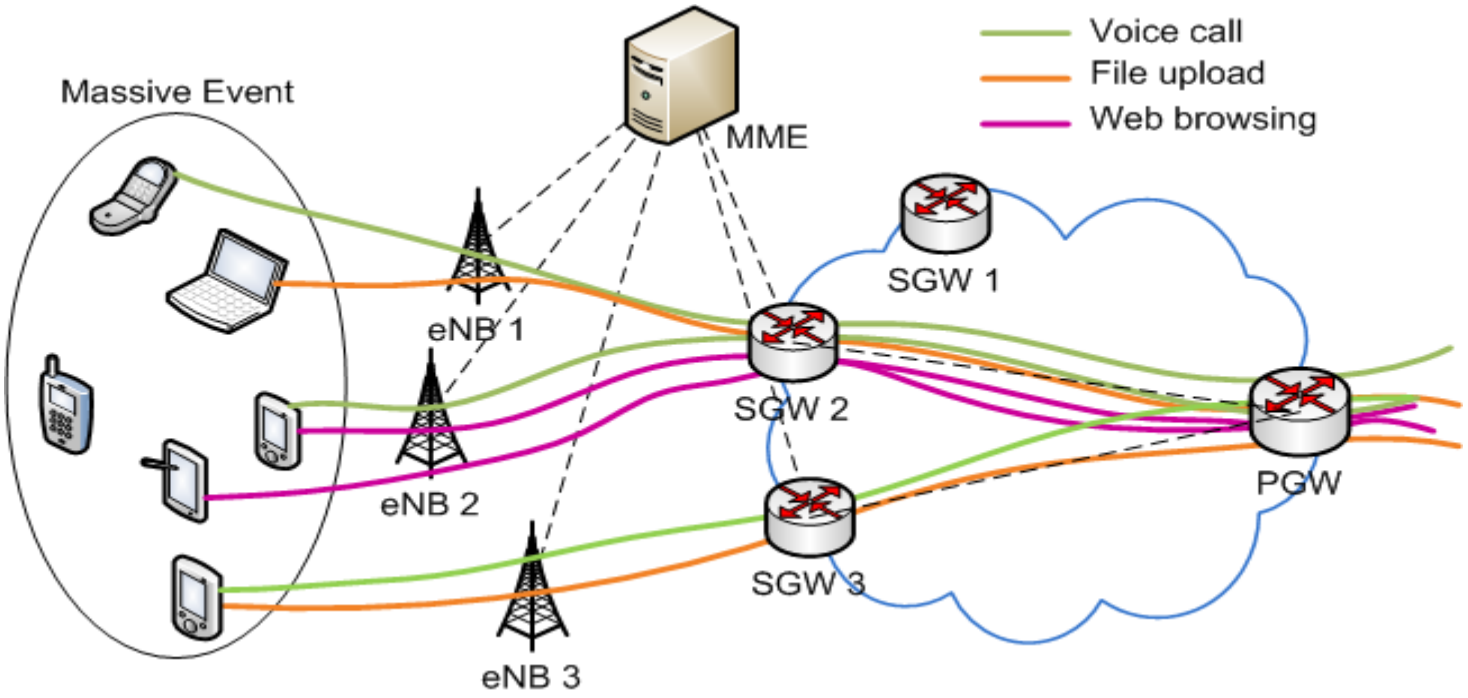
Resiliency – OF-Based LTE/EPC case

- Easily manage the active sessions during any SGW-D failures.
- Less packet loss.
- Centralized the TEID allocation function.



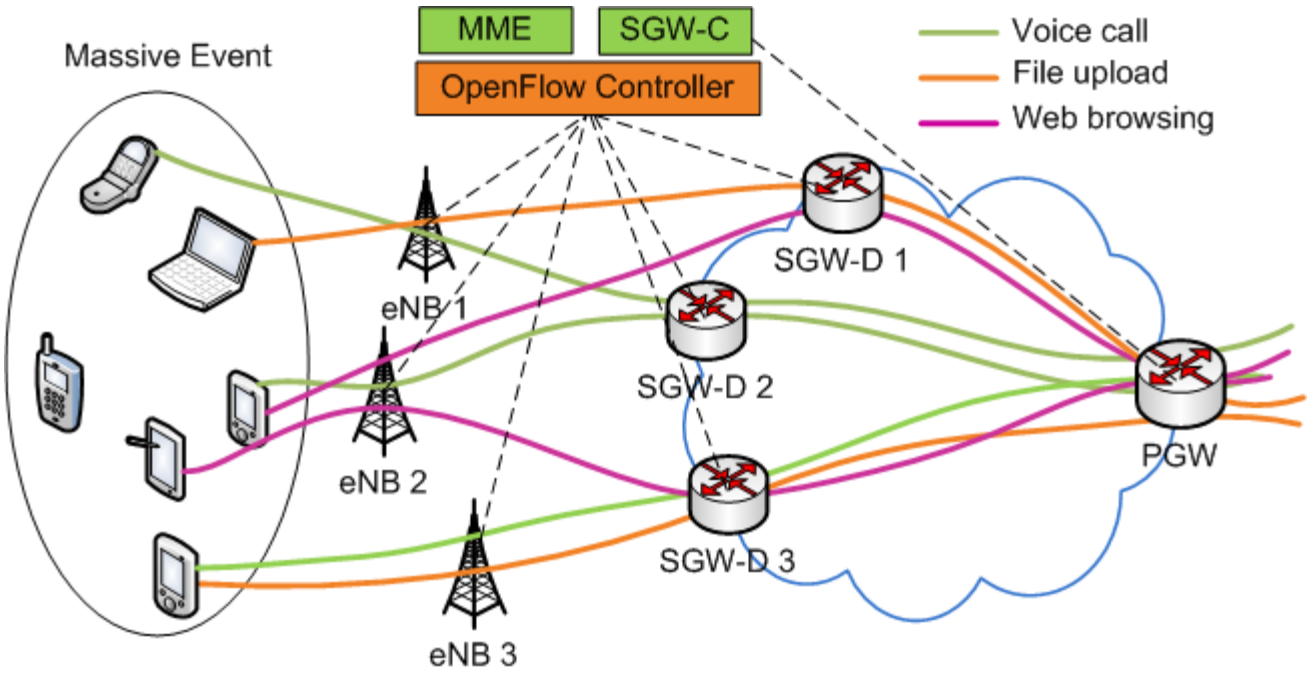
Load Balancing – 3GPP LTE/EPC case

- SGW and PGW selection is performed by the MME.
- Offline weight factors in DNS server.
- Proactive load balancing.
- SGW could be a bottle neck for possible user traffic congestion.



Load Balancing – OF-Based LTE/EPC case

- Real time load statistics.
- Free the overloaded SGW by moving some sessions seamlessly to another SGW in the same domain.



Implementation Challenges

- SGW control and data plane separation.
- Building mobile network based OF controller.
- The OF protocol should be extended to transport the UE-MME exchanges transparently, e.g.
  - Authentication messages
  - Mobility messages
- Shifting all control plane entities into cloud platform.

Conclusion & Perspectives

- **Proposal:** OpenFlow-based control plane for LTE/EPC architecture
  - The SGW control plane is separated from the data forwarding plane
  - The SGW control plane is centralized and uses the OpenFlow protocol to remotely manage the SGW data forwarding plane
  - ➔ The proposed architecture ensures the on-demand connectivity service even in critic situation such as network equipment failure and overload situations
- **Perspectives:**
  - Realize a testbed to validate the resiliency and load balancing aspects in our proposal
  - Try to make standardize the OF-based LTE/EPC in ONF working groups.