Overview of 3GPP Study Item UPCON

User Plane Congestion Control

TR 22.805 V0.2.0 (2012-02)

Mohammed Shehada

13.03.2012

Introduction

- Mobile operators are seeing significant increases in user data traffic (more than doubling for the fourth year in a row), resulting in:
  - increased network congestion
  - degraded user service experience

- Network operators invest in additional network capacity (network entities and connectivity resources). This additional investment is becoming increasingly costly due to the rapid and continuing increases in user data traffic

- It is necessary to study approaches and mechanisms to manage user plane congestion

Scope

1. To consider scenarios and use cases where high usage levels lead to user plane traffic congestion in the RAN

2. To propose requirements for handling user plane traffic when RAN congestion occurs

3. To make efficient use of available resources to increase the potential number of active users while maintaining the user experience

4. Based on:
   - the subscription of the user
   - the type of application
   - the type of content

Use Cases

Use Case 1: Service subscription to allow higher QoS during RAN congestion

DOCOMO Euro-Labs

- RAN is resource constrained by design. This can lead to congestion in crowded cells, e.g. peak hour at train stations, peak business hours in business areas

- There is a *category of subscribers* (e.g. business users) who would be willing to pay extra for a service plan that provides prioritized (e.g. higher QoS) access than other subscribers during congestion

- Requirements:
  - The system shall be able to detect user plane congestion
  - When making QoS policy decisions, the system shall be able to take into consideration the RAN congestion level and the subscriber's profile
  - The system shall be able to configure such RAN congestion-based policy rules

Use Case 2: User level traffic control

DOCOMO Euro-Labs

- There are always a few heavy users as determined by operator policy, who consume much more network resources than the others

- A compromise to improve the above situation is to *reduce the data rate of heavy users* only when RAN user plane congestion occurs

- Requirements:
  - The system shall be able to detect user plane congested cells
  - The system shall be able to identify active UEs accessing the system via the congested RAN
  - According to the operator's policies, the system shall be able to select specific users (e.g. heavy users, roaming users, etc.) and adjust the QoS of existing connections or the application of relevant policies for new connections depending on the RAN congestion status

Use Case 3: Application data rate control

- The resources required to provide good user experience vary from application to application

- When the RAN is congested due to user plane traffic, operators may want to limit the data rate of *some applications* such as P2P applications and thereby release some resources for other applications or for more users. In this case, application level traffic control is needed

- Requirements:
  - According to the operator's policies, the system shall be able to select specific applications and control the data rate of the identified applications depending RAN congestion

DOCOMO Euro-Labs

- A specific communication service is allocated resources preferentially while a cell is congested due to high data traffic volume during a *disaster situation*

- Requirements:
  - The system shall be able to identify specific high priority communications (e.g. related to a disaster message board service)
  - If the RAN is congested, the system shall be able to (re-)allocate resources to such communications
  - During RAN congestion, the operator shall be able to select the communications which require preferential treatment and allocate sufficient resources for such communications in order to provide these services with appropriate service quality

Use case 5: Use of Application type to allow higher QoS during RAN congestion

DOCOMO Euro-Labs

- The RAN is resource constrained by design. This leads to frequent congestion in crowded cells, e.g. at peak hours at train stations, at peak business hours in business areas.

- The majority of mobile broadband traffic utilizes primary PDP context (for GPRS) or default bearer (EPC) using background service class used for “internet APN”. Subscribers use applications like social networking, OTT (Over The Top) video, blogging, internet games, FTP, software patches and updates, etc

- **Requirements:**
  - The system shall be able to detect user plane congested cells
  - The system shall be able to identify, differentiate and prioritize different applications like social networking, OTT video, blogging, internet games, FTP, software patches and updates etc., based on the QoS attributes of their communications

Use case 6: Content delivery scheduling based on RAN congestion status

DOCOMO Euro-Labs

- Certain mobile services are *not time sensitive*. These services may happen at a designated time or periodically. It is possible that at the time when these services plan to take place, the RAN is congested

- When RAN congestion due to user plane traffic occurs, the operator may want to *delay* some of these *services* to users in congested cells until they move to uncongested cells or the cells become uncongested

- Requirements:
  - The system shall be able to provide mechanisms to detect the RAN congestion
  - The system shall be able to identify whether an active UE is in a user plane congested cell or not
  - The system shall provide a mechanism whereby an application can be made aware of RAN congestion status
  - The system shall be able to provide a mechanism to schedule non-real time services based on the RAN congestion status

Use Case 7: Traffic compression

DOCOMO Euro-Labs

- Operators may expect their networks to provide the capability to *compress/transcode traffic* into a format that requires less bandwidth before sending it to UEs, in order to reduce the pressure on networks and relieve the problems of traffic congestion

- Operators may also expect the network to configure flexible traffic compression based on different attributes (e.g. user, application, location…etc)

- **Requirements**
  - The network shall be made aware of the RAN user plane congestion state
  - When the RAN user plane congestion occurs, per operator policies the system shall be able to subject traffic to compression, taking into account the UE's capabilities in order to optimize traffic delivery to relieve RAN user plane congestion for users affected by RAN user plane congestion

DOCOMO Euro-Labs

- John, Mary and many others are waiting for the train at a station and use their smart phone for entertainment. The cell is loaded and congestion occurs in the RAN

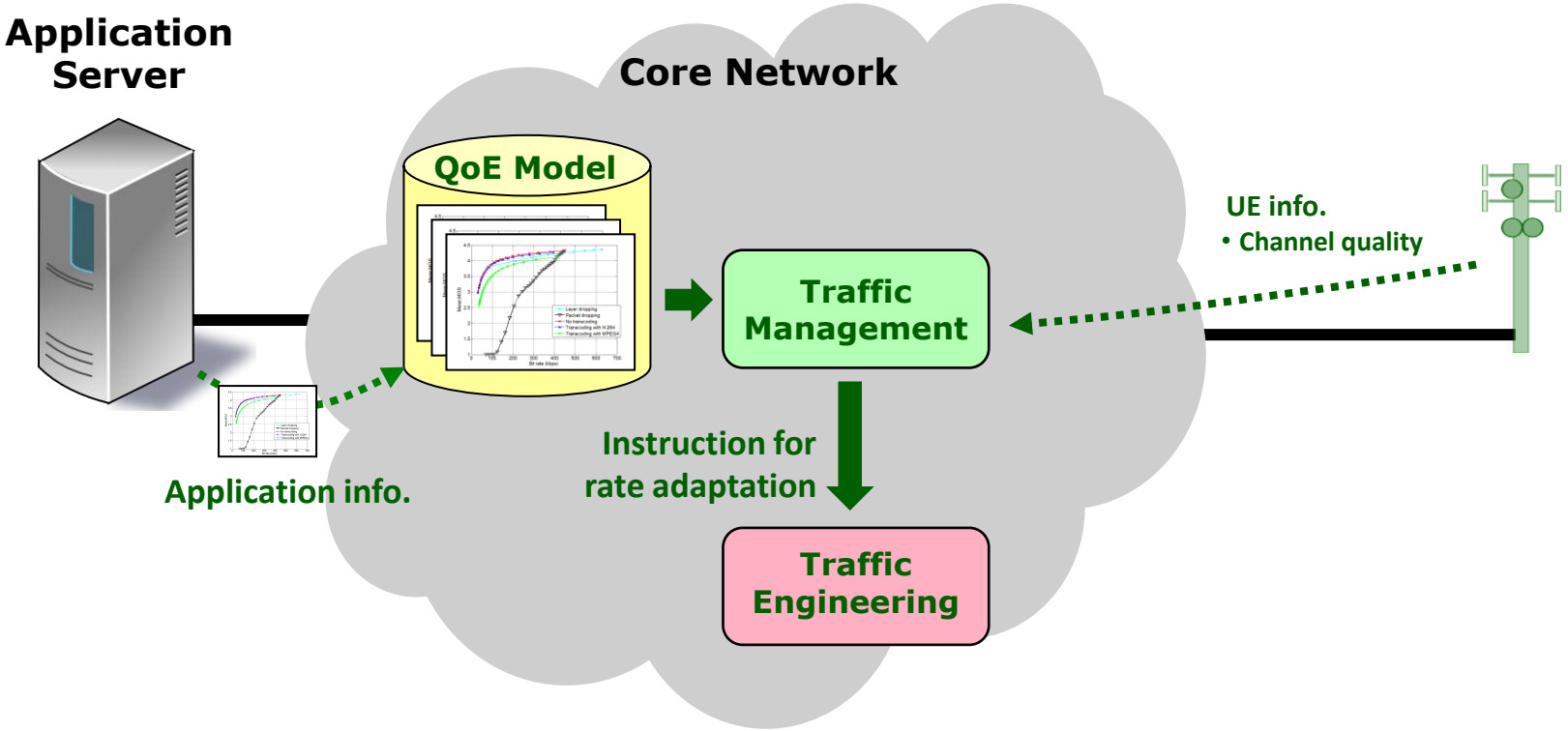
- In spite of the congestion, John and Mary are watching videos with still good quality. At this moment an update for a popular app is released and downloaded by numerous customers. The cell becomes highly congested

- Bob comes to the cell and also starts watching a video. The network accepts the video of Bob and reduce the bandwidth provided to the app updates and give it to Bob's video, however, the bandwidth given to Bob is not sufficient

- The network shall serve the video of Bob with sufficient bandwidth by reducing the bandwidth given to John and Mary. The video QoE offered to Bob, Mary, and John shall be comparable and sufficient

QoE Technology

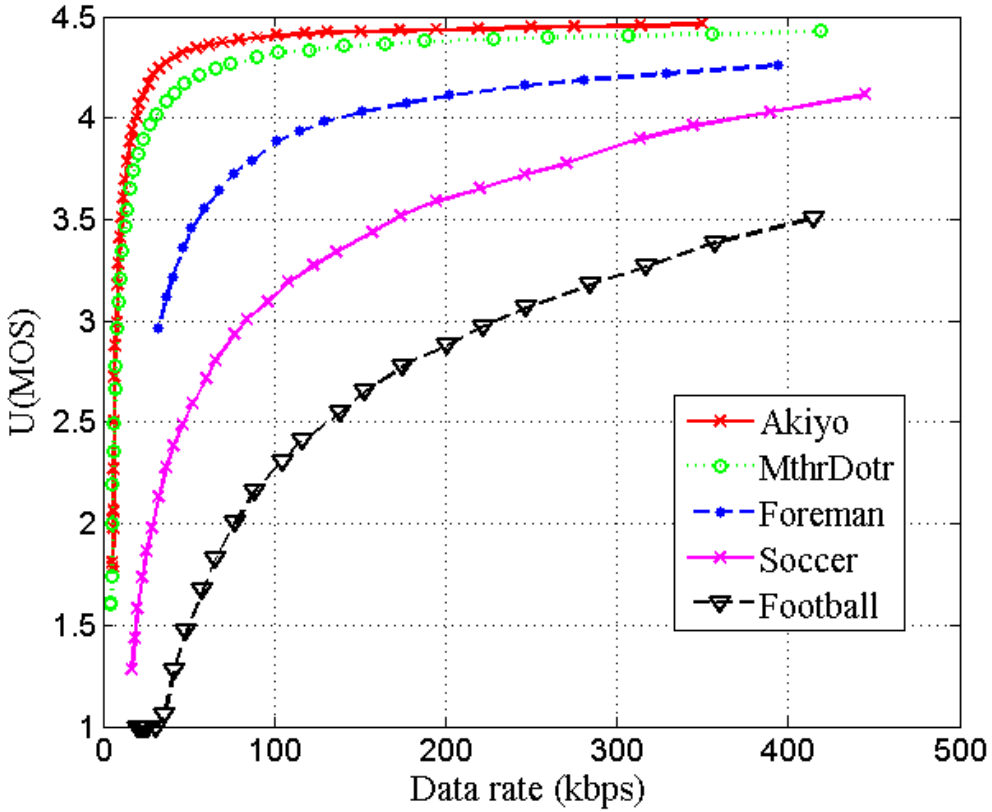
QoE technology overview



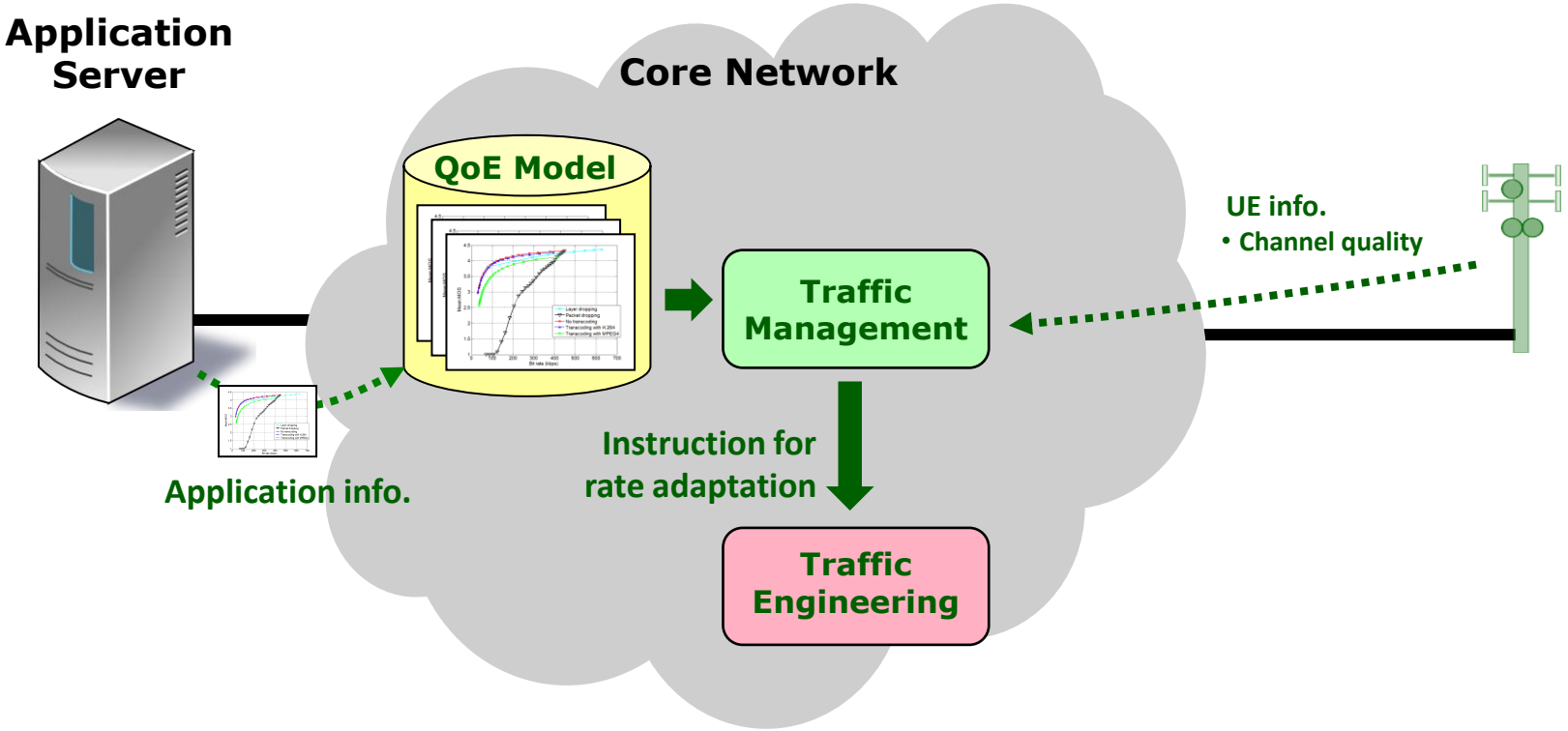
QoE Model: application utility function (U)

DOCOMO Euro-Labs

- Information that describes the relationship between the estimated user-perceived quality to the network performance parameters
  U = f (R) , f : R→MOS



QoE technology overview



TM and TE modules

DOCOMO Euro-Labs

- Traffic Management (TM)

Traffic Management

  - Find optimal rate allocation with best overall QoE

- Traffic Engineering (TE)

Traffic Engineering

  - Rate shaping through transcoding, packet dropping

Harmonize Social contribution beyond borders, across generations

Evolve Evolution of service and network

Advance Advance industries through convergence of service

Relate Creating joy through connections

Trust Support for safe, secure and comfortable living

HEART

Mr. Mohammed Shehada
shehada@docomolab-euro.com

DOCOMO Communications Laboratories Europe GmbH
Landsberger Strasse 312 – 80687 Munich, Germany
Phone: +49 (89) 56824-0 | www.docomolab-euro.com