

Evaluation Test Cases for Interactive Real-time Media over Cellular Networks

draft-sarker-rmcat-cellular-eval-test-cases-00

Zaheduzzaman Sarker
Ingemar Johansson

Agenda

- Introduction
- Cellular Network- facts
- Test cases
- Desired metrics
- Discussion/question

Introduction

- Cellular networks are an integral part of the Internet
- A cellular environment is more complicated than a wireline
- RMCAT evaluation criteria [I-D.ietf-rmcat-eval-criteria] document provides-
 - guidelines to perform the evaluation on candidate algorithms.
 - recognizes cellular networks as important access links.
- This document defines test cases specifically targeting the cellular networks

It is important to evaluate the performance of the proposed RMCAT candidates in the cellular networks

Cellular Network- the facts

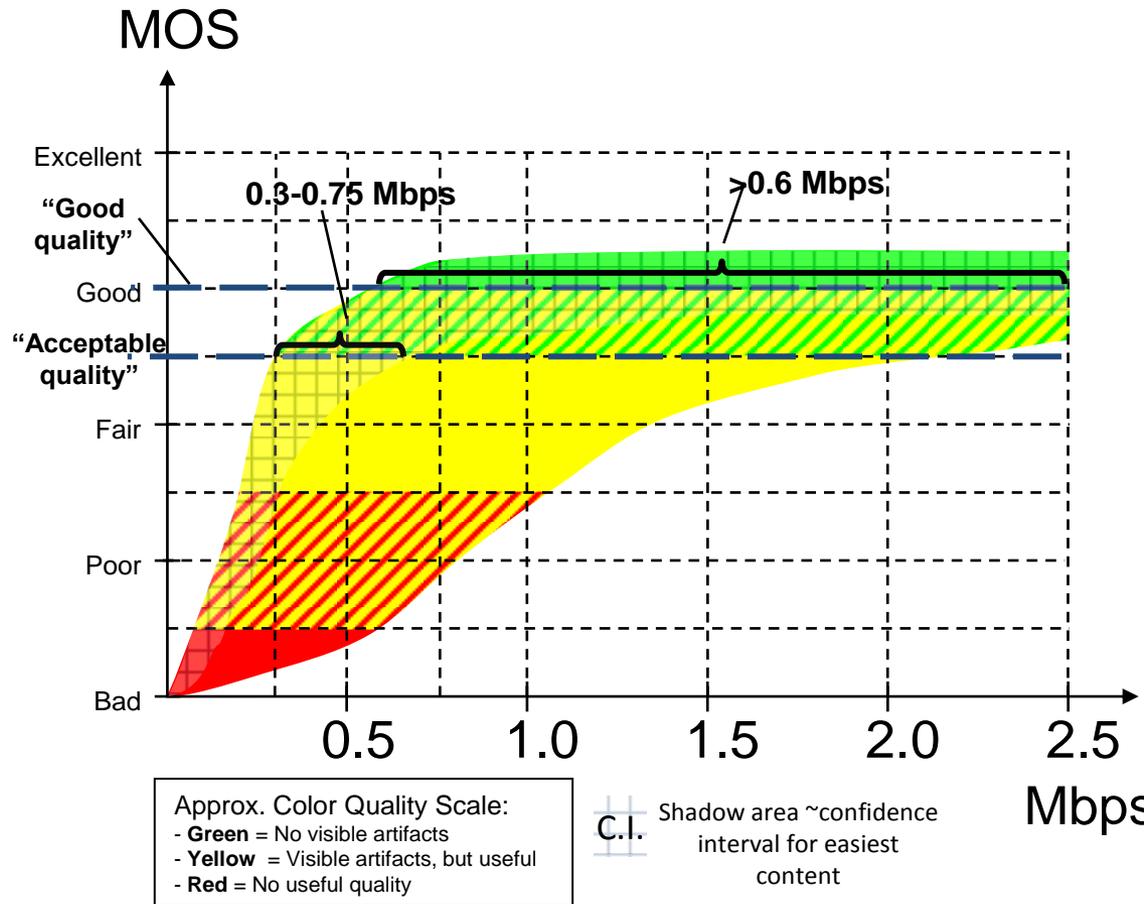
- The bottleneck is often a shared link with relatively few users.
 - Left over/ unused resource can be grabbed by other greedy users
- Queues are always per radio bearer hence each user can have many queues
 - The default is however one default bearer for all media
- Users can experience both Inter and Intra Radio Access Technology (RAT) handovers
 - might cause user plane interruptions
- The network decides how much the user can transmit
- The cellular network has variable link capacity per user
- Both Quality of Service (QoS) and non-QoS radio bearers can be used

Test cases

- Key factors
 - Shared and varying link capacity
 - Mobility
 - Handover
- Two test cases are defined for LTE networks
 - Varying network load
 - Bad radio coverage

Why focused on LTE?

- For a good quality video call
 - More than 350kbps is preferred
 - And we want to have low delay as well.
- The future real-time interactive application will impose even greater demand on cellular network
- Hence it is logical to define test cases focusing on 4G cellular networks



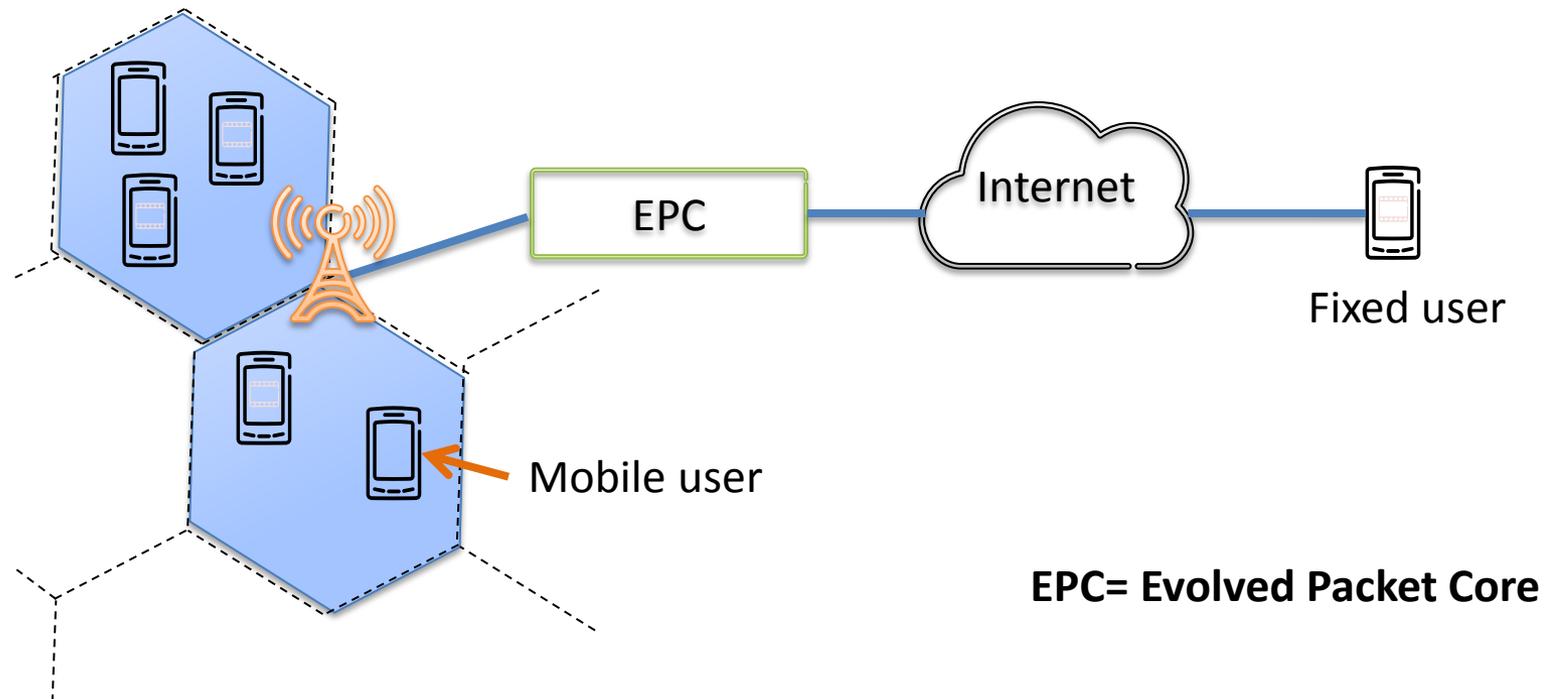
Source video formats includes 480p to 1080p content and displayed as 1080p on smartphones

Test case description structure

- General description
- Network connection model
- Simulation Setup
 - Radio environment
 - End to end RTT
 - User arrival model
 - Simulation duration
 - Evaluation period
 - Media traffic models
 - Voice and Video
 - Other traffic models
 - TCP

Test case description structure

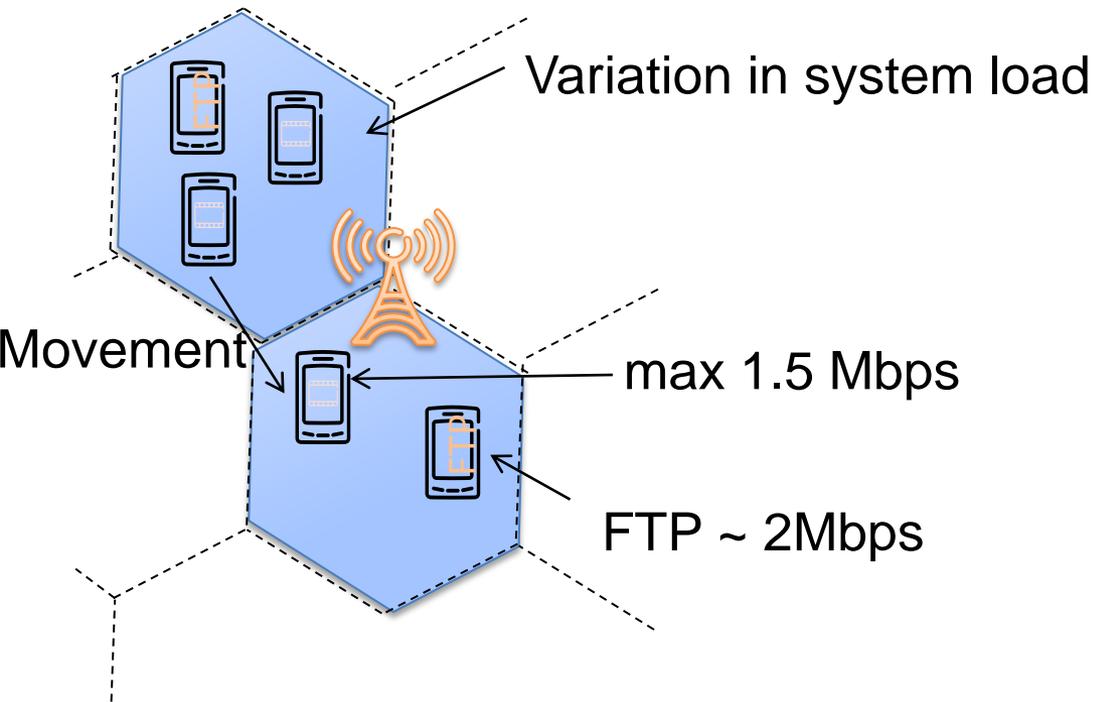
- General description
- Network connection model



Test case description structure

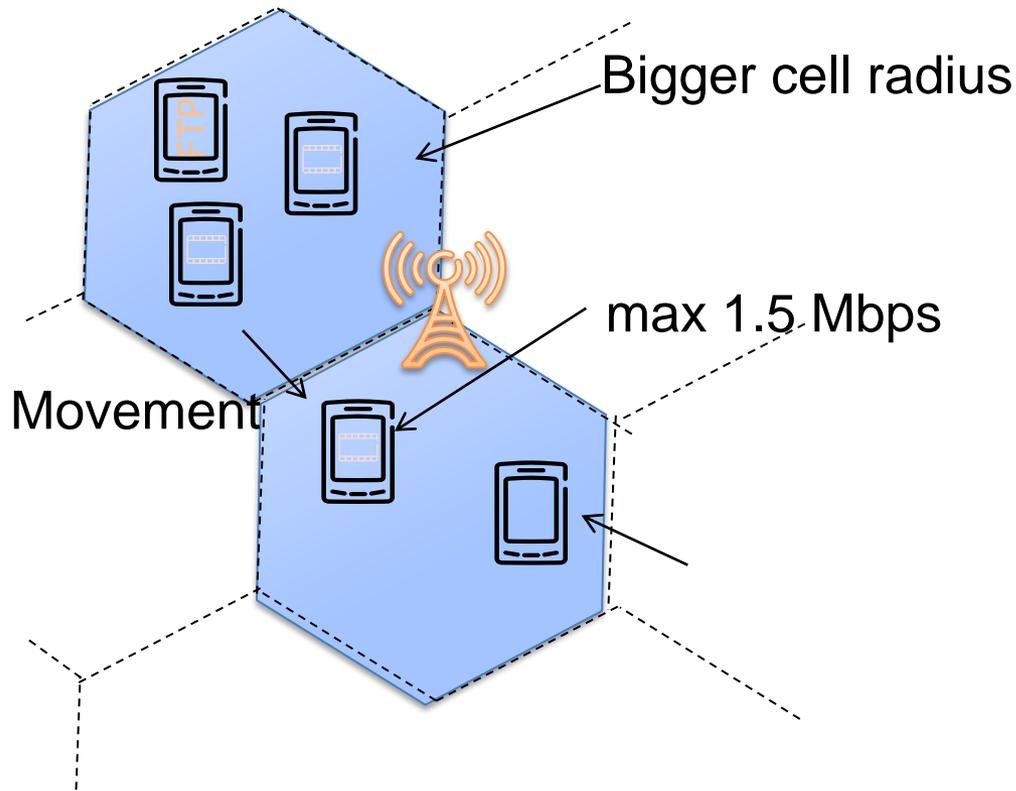
- General description
- Network connection model
- Simulation Setup
 - Radio environment
 - Round Trip Time
 - User arrival model
 - Simulation duration
 - Evaluation period
 - Media traffic models
 - Voice and Video
 - Other traffic models
 - TCP

Varying Network Load



- Evaluate the performance under varying network load
- Variation created by adding and removing users
 - Follows Poisson arrival model
- Users are RMCAT compliant and includes
 - Real-time voice and video traffic
- Background traffic is created using FTP /Web traffic.
- Network deploys
 - 3GPP case 1 deployment
 - Best effort bearer
 - 10Mhz transmission bandwidth

Bad Radio Coverage

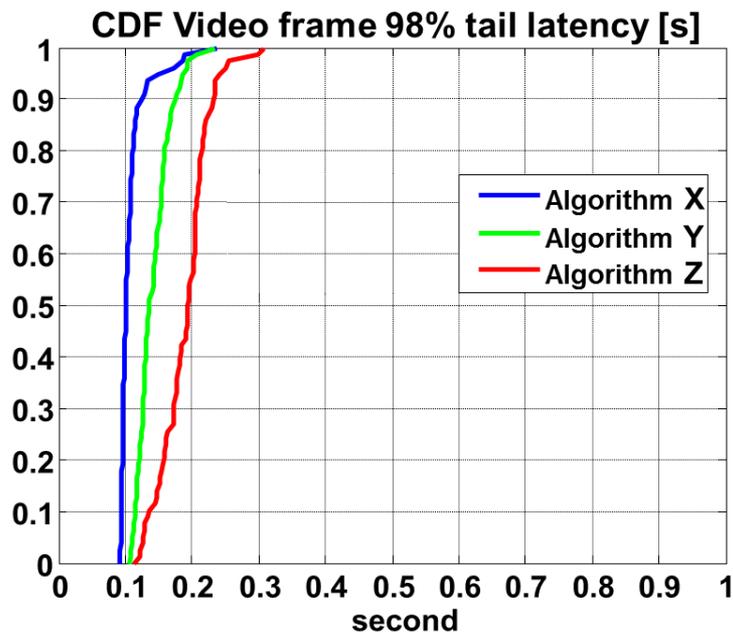
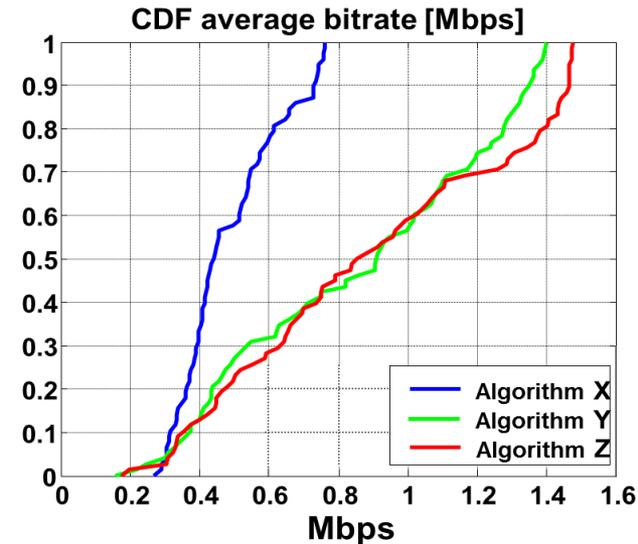
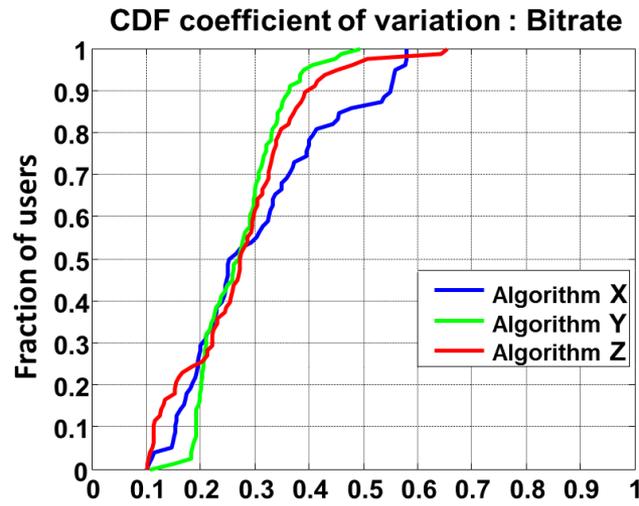
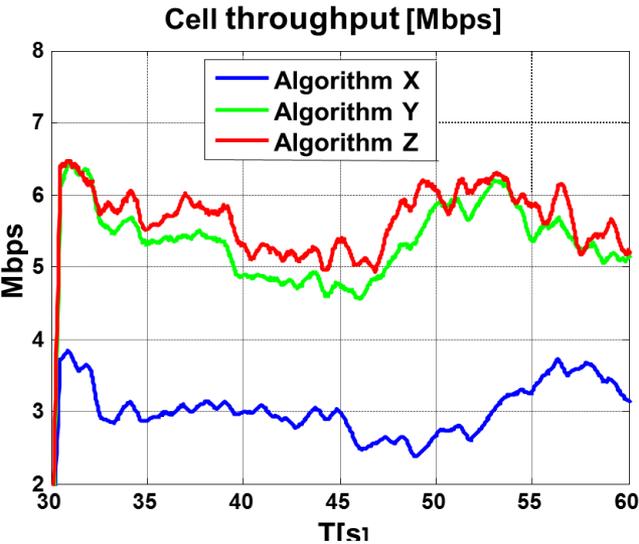


- Evaluate the performance when user experience bad radio condition
- Simulation setup is almost same as previous one but with the following changes
 - 3GPP case 3 deployment
 - No traffic other than media

Desired metrics

- Average cell throughput (for all cells),
 - Mean cell throughput
- Application sending and receiving bitrate
 - CDF of average bitrate
- Packet Loss Rate (PLR)
 - CDF of PLR
- End to end Media frame delay, Transport delay
 - CDF of 98% tail latency
- Algorithm stability in terms of rate variation
 - Coefficient of Variance (CoV)

Desired metrics (examples)



Algorithm Z is able to bound the video frame delay within 300ms while achieving higher cell throughput, higher average bitrate, lower rate variation.

Algorithm X is able to bound the video frame delay within 200ms but failed to achieve higher cell throughput, higher average bitrate, lower rate variation. This means algorithm X is very sensitive to changing radio conditions¹³

Questions to the WG

- Is this document useful?
- Working group item?

Any suggestion to improve the documents will be well appreciated.