WINTECHCON

Cross-Layer Optimized MBMS Performance for DSDS User Equipment

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Outline

- Introduction to concerned features
  - Dual SIM Dual Standby [DSDS]
  - Multi-media Broadcast Multicast Service [MBMS]
- Literature Survey
- Problem statement
- Proposed solution with simulation results
- Scope for future work

DSDS

- DSDS UE market share in India is 74%
- RFIC contributes 10% towards UE costing
- Dual SIM devices use common RFIC to save cost
- The RFIC tune-away events are handled by a common resolution entity termed as DSDS scheduler

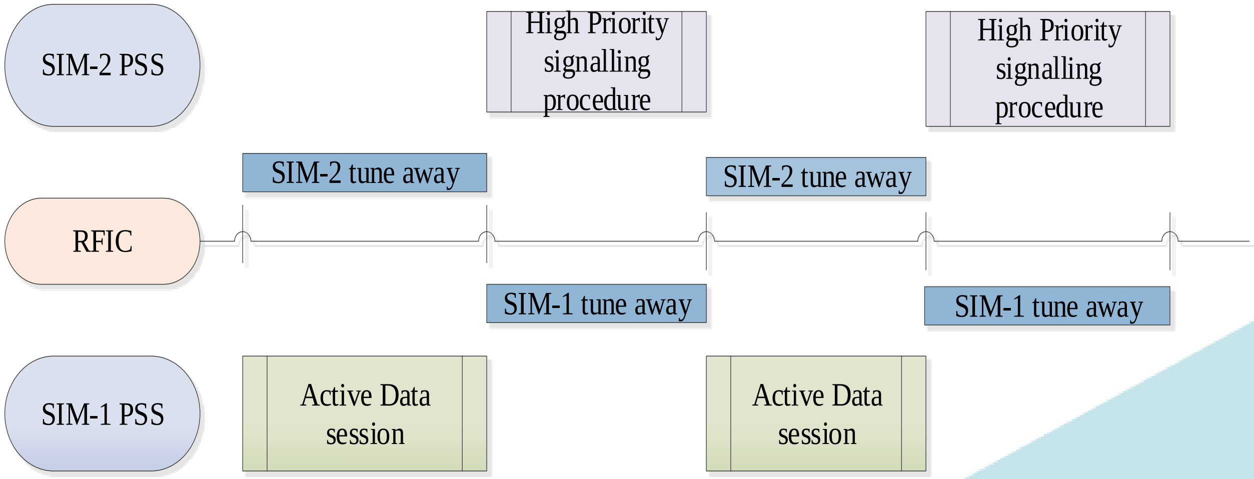
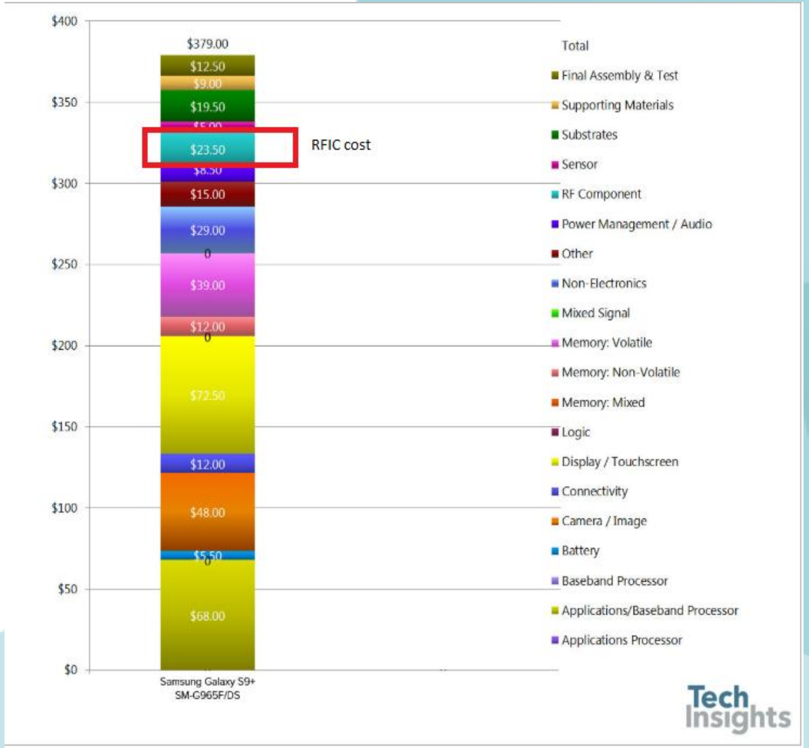


Fig-1 DSDS Operation



Samsung Galaxy S9+ Costing

MBMS

- Studies show video traffic to account for 79% of total mobile data traffic by 2022
- Majority of video to be based on broadcast services
- MBMS is a broadcast service used mostly to cater the services like TV channels
- MBSFN is an MBMS technique which uses same frequency resources and are time-synchronized by multiple cells within an MBMS area

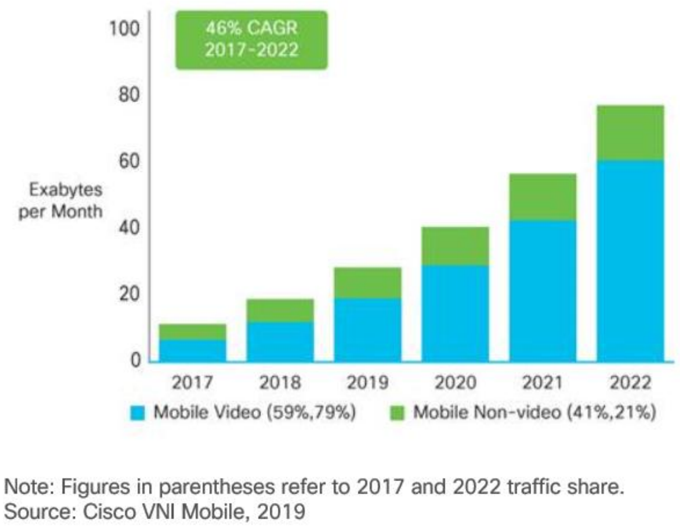


Fig-2 Mobile data consumption

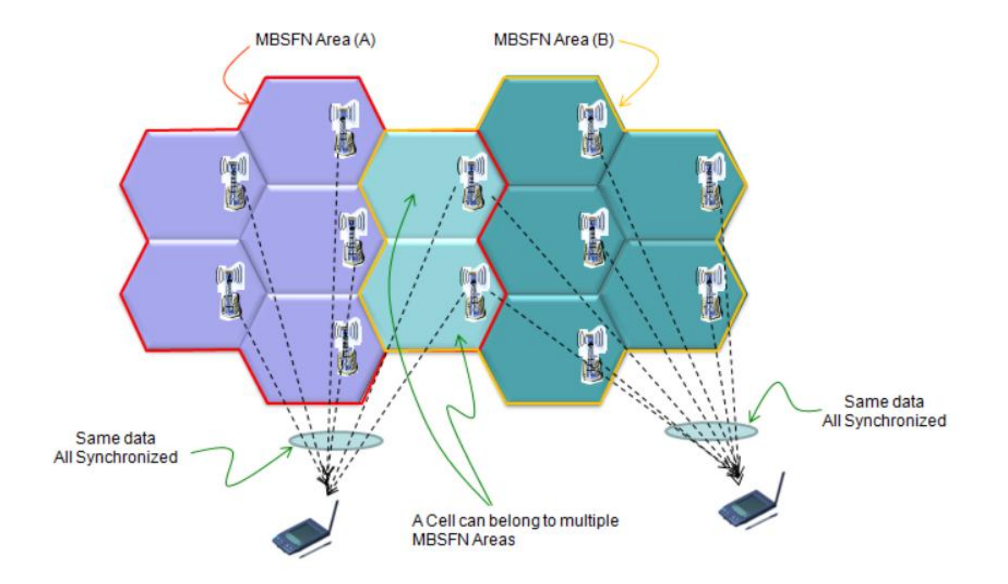


Fig-3 MBMS setup

Literature Survey

- MBMS
  - Performance optimization of MBMS over MBSFN
- DSDS
  - Network resource optimization in DSDS
  - Improving scheduling operation
- To the best of our knowledge, the above features have not been studied together
- This paper proposes to improve DSDS scheduler operation by taking into account the user experience of MBMS video on one SIM and time-critical operations on other SIM

Problem Statement

- MBMS video stream scheduling is independent of UE request or channel condition or UE type
- MBMS packets will be lost while the RFIC is scheduled for time critical operations in SIM-2 PSS
- This loss of packets leads to poor quality of video reception hampering the user experience

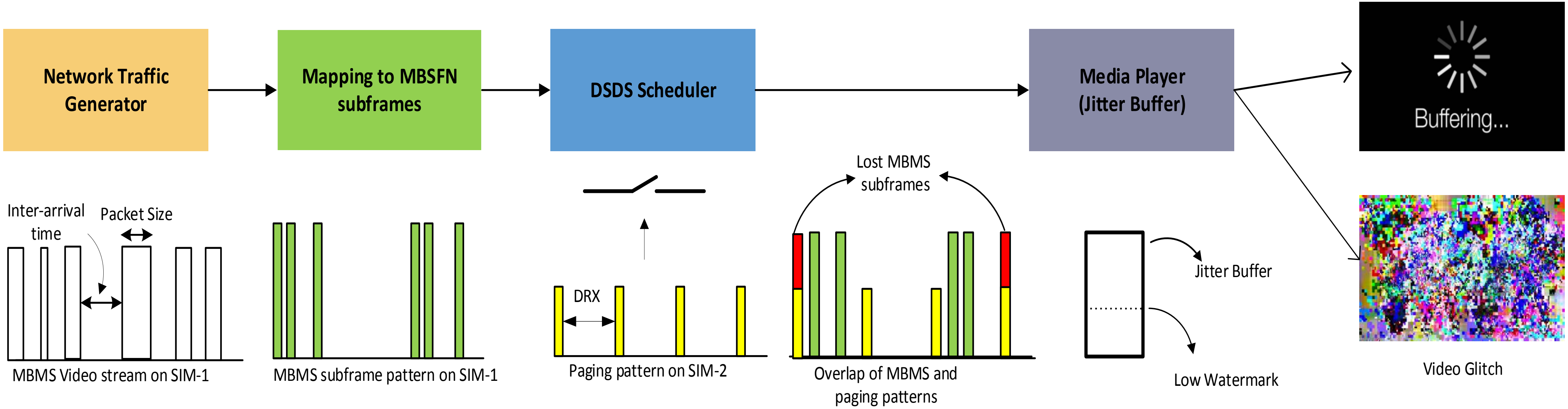


Fig-4 DSDS system setup

Video Quality

- Video Quality Evaluation:
  - To improve user experience
  - To optimize broadcast applications

Subjective VQA metrics		Mean Opinion Score
Objective VQA metrics	Static	FEC and file repair capability, Bit rate, Service delay constraints
	Dynamic	Buffer size status, Playout delay
	Critical	Buffering, Stalling
	Statistics	Packet loss rate statistics in previous scheduling

Proposed Solution

- Translate the video quality metrics to design inputs of the DSDS scheduler
- Derive the packet loss thresholds that would be bearable to sustain the desired video quality

$$W = \mu W_{static} - \beta W_{dyna} - \gamma W_{crit} - \delta W_{stat}$$

- Adapt the RFIC scheduling operation to maintain KPI's on both SIMs at satisfactory level

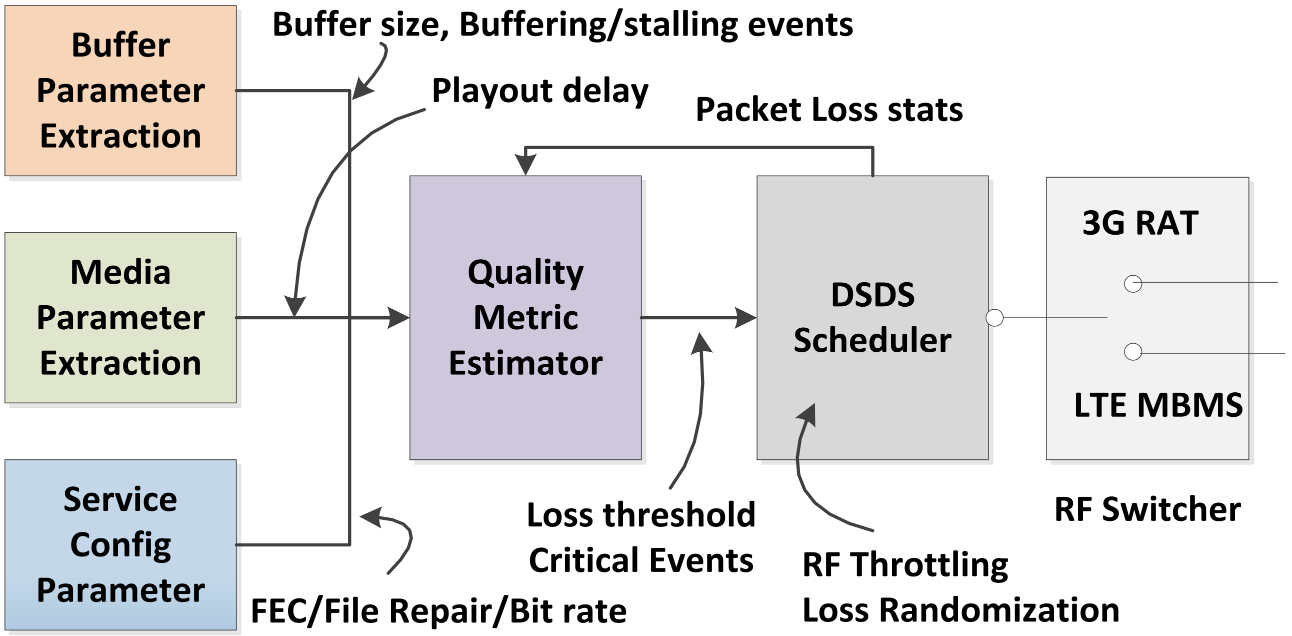
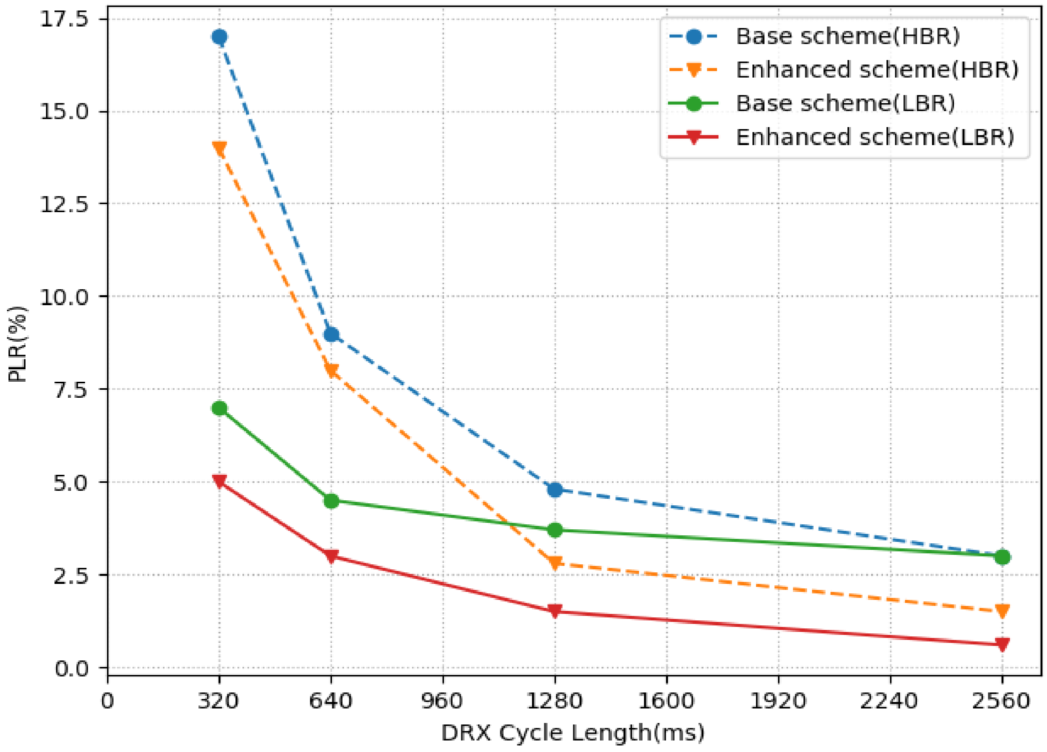


Fig-5 Optimized DSDS scheduler

Simulation Results

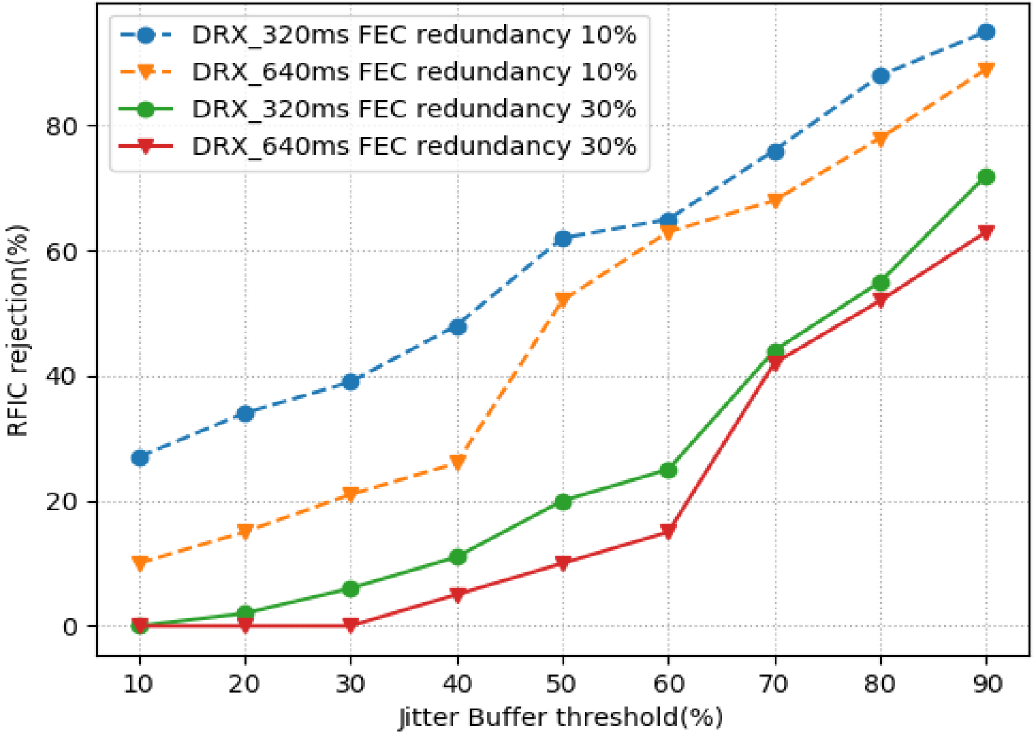
MBMS Packet Loss Rate on SIM-1 for different DRX cycle lengths on Idle SIM



Enhanced scheme performs comparatively better with lesser Packet Loss Rate (PLR)

Simulation Results

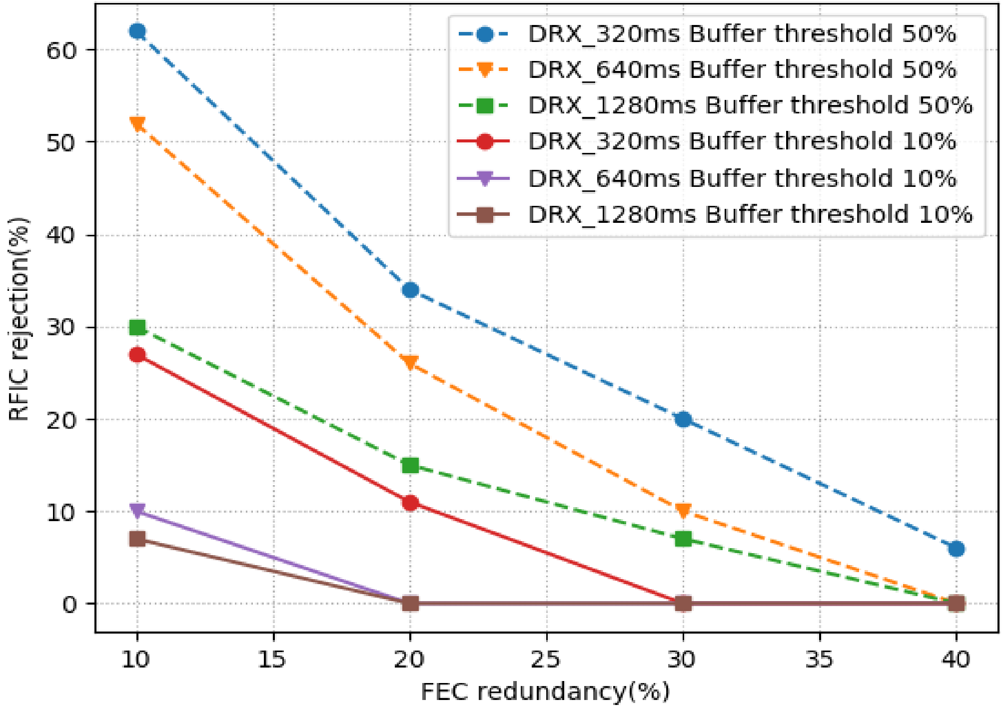
RFIC rejection on Idle SIM as a function of Jitter Buffer thresholds



In order to maintain higher level of watermarks, RFIC rejection for paging stack applied is more

Simulation Results

RFIC rejection on Idle SIM as a function of FEC redundancy for MBMS video stream



With increased FEC redundancy, more PLR can be borne by MBMS stack

Conclusion

- This Paper, to the best of our knowledge, first time provides a cross-layer optimized approach merging the “application-domain” quality metrics to the modem level realization of the DSDS RFIC scheduler algorithm and enhances the performance
- Simulation results provided exemplify the potential gains achievable

Future Work

- Evaluate MBMS video performance with DSDS in mobility scenarios

References

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Thank You

MBMS video streaming traffic model

Information Type	Distribution	Parameters
Inter-arrival time (successive frames)	Deterministic (20 fps)	50 ms
# Packets in a frame	Deterministic	8
Packet size	Truncated Pareto (Mean = 400 bytes , Max= 1000 bytes)	K = 160 bytes α = 1.2
Inter-arrival time (packets in a frame)	Truncated Pareto (Mean = 6 ms , Max= 12.5 ms)	K = 2.5 ms α = 1.2