Introduction of Multiflow for HSDPA

Jiwon Park
Sep 11th, 2013
Authors

Vesa Hytonen, Oleksandr Puchko
Department of Mathematical Information Technology,
P.O.Box 35 (Agora), FI-40014,
University of Jyväskylä, Finland
{vesa.a.hytonen, oleksandr.puchko}@jyu.fi

2012 IEEE

- Concept: Downlink data is transmitted to a user terminal at the border of two cells from one or both of the cells.
- The cells may belong to the same NodeB or to two different NodeBs. The data flows are separated by different scrambling codes used by each associated cell, the flows can be treated independently.

- This provides increased multi-user diversity by means of **flexibility** in downlink resource management.
- Another important gain mechanism for this scheme is realized by **short-term load balancing between neighboring cells**.
Roles on fairness of the network

• Users at the cell borders are subject to low signal level due to strong path loss caused by long distance to NodeB. Users suffer from high interference from other sites in the network.

• Users at the center cell enjoy good signal quality, the overall fairness in terms of user experience in the network might be low.

• Multiflow will help cell edge UEs as they can receive data from two transmitting cells, located either in the same site or different sites.

• Depending on the scheduler employed this can be achieved by using resources of the neighbor cell.
Performance evaluation

The paper evaluate the performance of Multiflow by semi-static system level simulations.

The presented results reveal

• high throughput gains for users in handover areas.
• slight improvement to overall network performance.
Intra architecture

• **RNC (Radio Network Controller):** decides which sectors in the network participate the multi-cell transmission operations. responsible for selecting which UEs should enable or disable Multiflow support.

• **NodeB scheduler:** dynamically decide based on the feedback messages which cells from those selected by the RNC may apply a Multiflow transmission on each TTI.

![Diagram showing data flow split options for Multiflow](image-url)
HSDPA: Data split options

- Intra-site Multiflow enables the use of fast data flow split on MAC-ehs layer at the NodeB.
- Inter-site operation the split needs to be performed on the PDCP or RLC layer in the Radio Network Controller (SRNC).
- There is no direct link for communication between the NodeBs, thus the split operation in SRNC is the only option for inter-site NodeBs.
Separate results for multiple UE groups (1)

3 UE groups:

SHO (Soft HandOver):
users in the soft handover area
i.e. users who reside at the
border of two cells served by
different NodeBs.

Softer HO (Softer HandOver):
users who reside at the
border of two cells served by the
same NodeBs.

Non-HO: users who don’t reside
at cell borders.
Separate results for multiple UE groups (2)

Fig. 4. Burst rate gains for various load levels

Fig. 5. Mean burst rates for various load levels
Conclusions

• Multiflow (an HSDPA multi-cell transmission scheme) is presented. Requirement, Solutions for the concept is provided.
• In Multiflow, two sectors under the one or two NodeBs transmit independent data block to a user.
• To support Multiflow, UE requires an Interference-aware receiver to reduce the interference between the two received flows.
• Enhanced flow control, data splitting to each participating cell before the transmission in RNC of the NodeB.
• Results show that Multiflow provides substantial gains of around for 40% for cell edge users who otherwise may reach only low or mediocre data rates.
• The gains are realized primarily by utilizing free transmission resources in neighboring cells, amounting to short-term load balancing.
THANKS
AND QUESTIONS