Agenda Item: 9.8

Source: Cingular Wireless

Title: Support of RT Services over HSDPA - HSDPA Mobility Enhancement

Document for: Discussion

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Scope & Purpose

When HSDPA was first designed in 2001, the primary focus was to develop a High Speed Downlink Packet Access scheme optimized for streaming, interactive and background classes of services. This approach has resulted in some of the key HSDPA design decisions including for example the absence of soft handover or a Node B-based resource scheduling. The final design scheme has proven highly efficient for the support of these services and perfectly in tune with its initial purpose.

However, conversational services and speech particularly has always been and will most likely continue to be for some time the most popular service offered by wireless systems. Even with the introduction of the IMS, and the migration of wireless services into the IP space, some believe that conversational services or services carrying a conservational component will be the most attractive to consumers or have the highest chance of being widely adopted by subscribers.

While 3GPP has recognized the need to support conversational services in conjunction with the introduction of the IMS, through a variety of recent Study Items and Work Items[1] the possibility to carry conservational data flows over HSDPA has not received much attention so far [1]. That means that practically, the only possibility to carry conservational services or conservational components of combined IP services is to use dedicated channels over the Air Interface. Cingular Wireless believes that this approach will ultimately prove to be inefficient and will seriously impede the ability of UMTS carriers to offer efficient Packet-based conversational services.

The essential obstacle to the possibility to carry conversational data flows over HSDPA, from the specification point of view, is the absence of soft handover and the poor performances at cell change. Recent contributions [2], [3] on the issue are showing the urgency to improve this particular aspect of the HSDPA specifications. Cingular Wireless supports these initiatives and believes that it is indeed possible to introduce enhancements to the HSDPA specification to overcome this issue as a Release 6 Technical Enhancement.

The purpose of this contribution is to support the on-going discussions in the RAN WGs to enhance the HSDPA performances at cell change and allow an efficient support of real time data flows over HSDPA.

Need for Support of RT Services over HSDPA and HSDPA Mobility Enhancement

The absence of soft handover in HSDPA is making unpractical the use of the high speed downlink packet access channels for the support of conversational services or conversational components of combinational IP services.

In years to come, the large scale deployment of IMS services combining data and speech, or data, video and speech will present a significant growth opportunity for wireless providers. Examples of such services could be:

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[1] Examples of recent or on-going 3GPP Study Items or Work Items dealing with the support of conversation services in conjunction with IMS:
- Optimization of RAB for the support of IMS based Voice over IP (RAN Enhancement)
- FS on IMS with Real Time Services Deployments
- PS domain and IMS impacts for supporting IMS Emergency calls

- Games with high graphic resolution involving more than one player, with the players being able to simultaneously talk to each other as if they were sitting side by side;
- Pictures or video sharing between multiple subscribers with a simultaneous conversation between both ends of the call.

In these cases, HSDPA would be the preferred way to carry the high volume data flow for best system efficiency, but the speech component of the service would require a dedicated channel to provide the expected quality of service. As a result, these services would have to be delivered either:

- Through a dedicated channel carrying all media flows, or
- Partially through HS-DSCH for the data flow and partially through a dedicated channel for the conversational flow.

In both cases, the system capacity would be impacted. In the second case the separation of the data flows and subsequent combination adds an undesirable level of complexity.

If it was possible to carry all data flows irrespective of their QoS requirement over HSDPA, the delivery of this type of services would be significantly simplified and the system capacity would not be impacted by the need to use lower efficiency dedicated DL resources to carry data that could be transferred more efficiently though HSDPA.

In general, because of their higher spectrum efficiency, the High Speed Channels (either Enhanced Uplink or HSDPA), will soon be the preferred way to carry all forms of data flows and eventually, we can expect that HSDPA/E-DCH (and their associated channels) will be the only data channels supported by the Node B.

This evolution path is already happening through the introduction of the Fractional DPCH and the on-going work to carry the DL associated signaling traffic (DCCH) on HS-DSCH.

Another important aspect to consider is the expected growth in IP-based basic conversational services like VoIP or Video Telephony over IP. The current standardization of the Enhanced Uplink channels combined with HSPDA has the potential to provide the necessary tools to support IP-based conversational services without loss of capacity compared to the existing equivalent CS services because of the possibility to repeat erroneously received speech frames or even to trade delay for quality more efficiently than dedicated channels.

On the contrary, there is absolutely no doubt that carrying VoIP over dedicated channels will never match the spectrum efficiency of the CS based voice services, if only for the need to carry an additional potentially compressed IP header.

Unfortunately, while 3GPP has mostly studied the possibility to carry VoIP over dedicated channels, we believe that the only viable route from a spectrum efficiency point of view is to carry VoIP and other packet-based conversational services over E-DCH/HSDPA and are urging 3GPP to reconsider its current strategy.

Cingular Wireless would like to point out also that competitive technologies like cdma2000 EV-DO Rev. A have already included mechanisms to support fast and reliable cell changes to eventually support conversational services.

For all these reasons, Cingular Wireless is convinced that the support of conversational services over HSDPA will be needed in the next few years and 3GPP must urgently introduce in the standard as soon as possible a mechanism that allow for fast and reliable HSDPA cell change to overcome the absence of soft handover. Specifically, Cingular's opinion is that if a proposed solution exists now to a) enable conversational services on HSDPA, and b) provide competitive latency to other standards/technologies it should be adopted and we should not wait to study it in Release 7.

The following section provides a preliminary set of requirement for an HSPDA Mobility Enhancement or Handover solution.

The subsequent section and the companion paper (RP-050107) gives some key characteristics of a potential solution using some of the concepts developed during the HSDPA feasibility study for the support of Fast Cell Selection (FCS).

Preliminary Requirements for a HSDPA Mobility Enhancement / Handover Solution

Requirements for the support of real time: VoIP, Conversational Video…

- Handoff gap: (user-plane interruption) <= [100 ms]
- Handoff latency: (time from stimulus condition to completion) <= [150 ms]
- No additional DL RAN contribution to delay due to HSDPA Handover solution
- No increase in dropped call rate due to handoff errors, delay, etc…

Requirements for the support of near real time: Streaming, Push to Talk…

- Same as for real time services

Requirements for the support of non real time services:

- Re-selection gap: (user-plane interruption) <= [150ms]
- No increase in dropped call rate due to handoff errors, delay, etc…

Backward compatibility:

- No impact for legacy UE's sharing same HS-DSCH
- No impact on inter-RAT and inter-frequency handover

RAN and UE impact:

- No hardware changes for Node B and RNC
- No significant increase in UE processing requirement
- Compatible with inter-RNC handover
- No significant increase in Iu-b and Iu-r transport requirements

Highlights of a Candidate Solution

A potential solution for enhancing HSDPA to support high mobility and real time services is described in the companion paper (RP-050107). The key elements of this solution are listed below:

- When configuring the Active Set, the network provides to the UE a temporary HSDPA related cell id for each neighbor cell, candidate for a potential HS-DSCH cell change, in addition to the characteristics of the associated channels (HS-SCCHs,…);
- Similarly, the network pre-configures all candidate cells Node Bs to accept the UE following a potential HO (but no resources are used until the HO is completed);
- Every reporting period (pre-defined at initialization), the UE reports the best cell (similar event to the existing event 1d) to the network using the FBI bits of the UL DPCCH;
- In order to request a handover, the UE reports a best cell different from the cell carrying the HS-DSCH. The network is then given the opportunity to accept or deny the request;
- If the network accepts the handover, it reconfigures the HS-DSCHs on the serving and target cells by requesting a change of best cell in both Node B;
- At the next reporting period, the UE switches to the target cell and start sending CQI reports to and receiving data from the new Node B;
- The key benefit of this solution is that the network is given prior notice of the need to perform a cell change. Additionally, the cell change is performed without interruption in the data flow.

Way Forward

Cingular Wireless believes that the candidate solution described in the companion paper (RP-050107) can be implemented with limited effort in the standard. We also recognize that other potential solutions may exist and some have already been submitted for discussion to 3GPP [3]. It appears that all these solutions have a lot in common including the need for pre-configuring the Node B and UE, the need for the UE to indicate the new best cell without the need for an RRC procedure and the need for a fast modification of the controlling Node B.

Since that improvement is primary intended to enhance an existing feature, and in light of its relatively modest complexity, it appears that this enhancement, or any solution with similar characteristics, could be standardized as a Release 6 Technical Enhancement [TEI on Release 6].

Alternatively, a solution could be standardized in the scope of Release 7, but that approach would significantly impact the deployment schedule of the corresponding feature.

In consequence, Cingular Wireless preferred approach is to adopt a solution as a small Release 6 Technical Enhancement.

Recommendation

Cingular Wireless is urging 3GPP RAN to recognize the need to support Conversational Services over HSDPA.

Cingular Wireless is asking 3GPP RAN to mandate the RAN WGs to consider the proposed solutions to enhance the HSPDA cell change performances and evaluate the possibility to introduce a Release 6 Technical Enhancement, providing that an agreement can be reach on a single solution between now and June 2005.

A draft Release 6 Submission Form (as agreed in SA#26) is provided in the Attachment in support for these recommendations.

References

[1] R2-041896, "CR 032 to 25.993 Conversational PS RAB for HS-DSCH"

[2] R2-050114, Enhancements for Fractional DPCH and mapping of SRBs on HS-DSCH, Nokia

[3] R2-050548, L2 based serving cell selection for HSDPA, Qualcomm

Attachment: Release 6 Submission form

Feature / Item:		HSDPA Mobility Enhancement					
Affects:	**UE/MS: X**	**CN:**	**UTRAN: X**	**GERAN:**	**Compatibility Issues:**	**Yes:**	**No: X**
Expected Completion Date:		June 2005 – TSG-RAN#28					
Services impacted:		Voice over IP – Conversational Services over IP					
Specifications affected:		RAN Specs					
Tasks within work which are not complete:		- Review & Discuss potential solutions to improve the HSDPA Cell Change procedure - Agree on a solution to improve HSDPA Cell Change procedure					
Consequences if not included in Release 6:		- No possibility to support VoIP or Conversational Services over HSDPA - Potential issues when carrying DCCH over HSDPA					
Accepted by TSG#		**for late inclusion in Release 6:**					

Abstract of document:

The support of VoIP or other conversational services over IP is only possible through dedicated channels.

HSDPA is considered a more efficient solution from a spectrum efficiency and capacity to carry VoIP and Packet-based conversational services.

The major obstacle to supporting conversational services over HSDPA is the absence of Soft Handover and the potentially lengthy HSDPA Cell Change procedure.

It is proposed to review and discuss potential solutions to enhance the HSDPA Cell Change performances and try to come to an agreement on a solution between now and June 2005.

Contentious Issues:

tbd.