TSG-RAN Meeting #23 RP-040081
Phoenix, USA, 10 - 12 March 2004

Agenda Item: **8.12**
Source: **Ericsson**
Title: **Proposed Work Item on FDD Enhanced Uplink**
Document for: **Approval**

In RAN#17 a study item on "Uplink Enhancements for Dedicated Transport Channels" was approved. The aim of the study was to look at the feasibility of enhancing the uplink DCH operation and performance by several techniques in order to support services like video-clips, multimedia, e-mail, telematics, gaming, video-streaming….

The RAN WG1 study has shown that various techniques, noticeably an uplink scheduler, shorter TTI and a hybrid ARQ layer in the Node-B, can enhance the uplink packet transfer performance. Chapter 12 "Conclusions and Recommendations" of the Technical Report 25.896, which recommends the creation of a work item, is copied and followed by the Work Item sheets.

For the Fast DCH setup, the study item concludes that it would not be part of the FDD Enhanced Uplink work item. Considering the slightly different objective and the limited impact in RAN, this topic can be treated as TEI6.

---

12 Conclusions and Recommendations

12.1 Conclusions

In the study of "Uplink Enhancements for Dedicated Transport Channels", the following techniques have been considered:

- Node B controlled scheduling
- Hybrid ARQ
- Shorter TTI
- Higher order modulation
- Fast DCH setup

Simulation results presented to RAN1 has shown a significant improvement compared to Rel5, in the order of 50%-70% increase in system capacity, 20%-55% reduction in end-user packet call delay and around 50% increase in user packet call throughput, when simultaneously applying Node B scheduling, hybrid ARQ with soft combining, and a shortened TTI. Hence, significant technical benefits have been found for a system using these techniques in conjunction.

Higher order modulation, of which only 8PSK has been studied, has been found to cause a loss in link performance compared to multi-code transmission with BPSK, but may enable peak data rates exceeding 5.76 Mbit/s or may provide implementation benefits in terms of a reduced PAR. The other enhancements studied are not dependent on whether higher order modulation is introduced or not. Thus, from a principal point of view, higher order modulation is independent of the other enhancements studied.

Complexity has been studied in terms of buffering and timing requirements due to hybrid ARQ, PAR impact due to additional physical channels, and power requirements for the associated control signaling. Comments from RAN2 and RAN3 on their respective areas have also been taken into account in the TR. The enhancements can

be introduced into the FDD specifications without impacting the backwards compatibility with Rel5 and earlier releases.

All these enhancements, Node B controlled scheduling, hybrid ARQ, shorter TTI, and higher order modulation, have been found to be technically feasible. At least one company has expressed concerns on the benefits of a shorter TTI in comparison with the potential implementation impacts. Some companies have questioned whether the benefit with 8PSK from a PAR perspective outweighs the loss in link performance.

Fast DCH setup has been partially investigated. Methods for reducing the synchronization time when going from CELL_FACH to CELL_DCH have been described but not evaluated in detail in this report. Other aspects of fast DCH setup, e.g., architectural changes and signaling protocols, have not been covered.

12.2 Recommendations

Base on the findings documented in this report, RAN1 recommends to create a work item on uplink enhancements where:

- Node B controlled scheduling, hybrid ARQ, and shorter TTI are parts of the work item;
- Higher order modulation (8PSK and higher) is not part of the work item;
- Fast DCH setup is not part of the work item.

FDD Enhanced Uplink

Work Item Description

Title: FDD Enhanced Uplink

1 3GPP Work Area

X	Radio Access
	Core Network
	Services

2 Linked work items

- FDD Enhanced Uplink: Physical Layer
- FDD Enhanced Uplink: Layer 2 and 3 Protocol Aspects
- FDD Enhanced Uplink: UTRAN Iub/Iur Protocol Aspects
- FDD Enhanced Uplink: RF Radio Transmission/ Reception, System Performance Requirements and Conformance Testing

3 Justification

In RAN#17 a study item on "Uplink Enhancements for Dedicated Transport Channels" was approved. The aim of the study was to look at the feasibility of enhancing the uplink DCH operation and performance by several techniques in order to support services like video-clips, multimedia, e-mail, telematics, gaming, video-streaming…. The RAN study has shown that various techniques, Node-B controlled scheduling, shorter TTI and a hybrid ARQ layer in the Node-B, can enhance the uplink packet transfer performance significantly compared to Release-99/Rel-4/Rel-5.

4 Objective

The technical objective of this work item is the Enhanced Uplink functionality in UTRA FDD, to improve the performance of uplink dedicated transport channels. The improvements should take into account backwards compatibility aspects.

- For radio interface physical layer, the feature includes:
  - Physical and Transport Channels mapping
  - Multiplexing and Channel Coding
  - Physical Layer procedures
  - Physical layer measurements
  - UE physical layer capabilities

- For radio interface higher RAN layers:
  - Architecture aspects
  - MAC entity (Scheduling and hybrid ARQ protocol)

- Interlayer interactions in connected mode
- Control plane protocols
- User plane protocols
- UE capabilities

- For Iur/Iub interface:
  - Control plane protocols
  - User plane protocols

- For radio transmission and reception:
  - UE radio transmission and reception
  - Base Station radio transmission and reception
  - Base Station conformance testing
  - Requirements for support of Radio Resource Management

5 Service Aspects

None

6 MMI-Aspects

None

7 Charging Aspects

None

8 Security Aspects

None

9 Impacts

Affects:	USIM	ME	AN	CN	Others
Yes		X	X		
No	X			X	X
Don't know					

10 Expected Output and Time scale (to be updated at each plenary)

New specifications						
Spec No.	Title	Prime rsp. WG	2ndary rsp. WG(s)	Presented for endorsement at plenary#	Approved at plenary#	Comments
25.309	UTRA FDD Enhanced Uplink stage 2	R2	R1	RAN#24	RAN#25	Rapporteur: Tania Godard, Nortel

Affected existing specifications				
Spec No.	CR	Subject	Approved at plenary#	Comments

Note: this work item is the parent Work Item dealing with the stage 2 aspects; the stage 3 is defined in each of the 4 work items defined for each WG. The completion date for the stage 2 is September 04, whereas the completion date for stage 3 is December 04.

11 Work item raporteurs

Joakim Bergström (Ericsson)

12 Work item leadership

TSG-RAN WG2

13 Supporting Companies

Ericsson, Nokia, Nortel, Vodafone Group, Motorola, Qualcomm, TeliaSonera, Alcatel, T-mobile, Lucent Technologies, Samsung, Philips, LG Electronics, NEC, Orange, Telefonica, NTT DoCoMo, and Siemens.

14 Classification of the WI (if known)

X	Feature (go to 14a)
	Building Block (go to 14b)
	Work Task (go to 14c)

14a The WI is a Feature: List of building blocks under this feature

(list of Work Items identified as building blocks)
FDD Enhanced Uplink: Physical Layer
FDD Enhanced Uplink: Layer 2 and 3 Protocol Aspects
FDD Enhanced Uplink: UTRAN Iub/Iur Protocol Aspects
FDD Enhanced Uplink: RF Radio Transmission/ Reception, System Performance Requirements and Conformance Testing

14b The WI is a Building Block: parent Feature

(one Work Item identified as a feature)

14c The WI is a Work Task: parent Building Block

(one Work Item identified as a building block)
This WI has not finished yet. See RAN_Work_Items.

FDD Enhanced Uplink: Physical Layer

Work Item Description

Title: FDD Enhanced Uplink: Physical Layer

1 3GPP Work Area

X	Radio Access
	Core Network
	Services

2 Linked work items

- FDD Enhanced Uplink
- FDD Enhanced Uplink: Layer 2 and 3 Protocol Aspects
- FDD Enhanced Uplink: UTRAN Iub/Iur Protocol Aspects
- FDD Enhanced Uplink: RF Radio Transmission/ Reception, System Performance Requirements and Conformance Testing

3 Justification

In RAN#17 a study item on "Uplink Enhancements for Dedicated Transport Channels" was approved. The aim of the study was to look at the feasibility of enhancing the uplink DCH operation and performance by several techniques in order to support services like video-clips, multimedia, e-mail, telematics, gaming, video-streaming…. The RAN study has shown that various techniques, Node-B controlled scheduling, shorter TTI and a hybrid ARQ layer in the Node-B, can enhance the uplink packet transfer performance significantly compared to Release-99/Rel-4/Rel-5.

4 Objective

The technical objective of this work item is the Enhanced Uplink functionality in UTRA FDD, to improve the performance of uplink dedicated transport channels. The improvements should take into account backwards compatibility aspects.

- For physical layer, the building block includes:
  - Physical and Transport Channels mapping
  - Multiplexing and Channel Coding
  - Physical Layer procedures
  - Physical layer measurements
  - UE physical layer capabilities

5 Service Aspects

None

6 MMI-Aspects

None

7 Charging Aspects

None

8 Security Aspects

None

9 Impacts

Affects :	USIM	ME	AN	CN	Others
Yes		X	X		
No	X			X	X
Don't know					

10 Expected Output and Time scale (to be updated at each plenary)

New specifications						
Spec No.	Title	Prime rsp. WG	2ndary rsp. WG(s)	Presented for endorsement at plenary#	Approved at plenary#	Comments
		R1				

Affected existing specifications				
Spec No.	CR	Subject	Approved at plenary#	Comments
25.211		Physical channels and mapping of transport channels onto physical channels (FDD)	RAN#26	
25.212		Multiplexing and channel coding (FDD)	RAN#26	
25.213		Spreading and modulation (FDD)	RAN#26	
25.214		Physical layer procedures (FDD)	RAN#26	
25.215		Physical layer; Measurements (FDD)	RAN#26	

Note: this work item is the Physical Layer part of the stage 3 of the FDD Enhanced Uplink work item.

11 Work item raporteurs

Karri Ranta-aho (Nokia)

12 Work item leadership

TSG-RAN WG1

13 Supporting Companies

Ericsson, Nokia, Nortel, Vodafone Group, Motorola, Qualcomm, TeliaSonera, Alcatel, T-mobile, Lucent Technologies, Samsung, Philips, LG Electronics, NEC, Orange, Telefonica, NTT DoCoMo, and Siemens.

14 Classification of the WI (if known)

	Feature (go to 14a)
X	Building Block (go to 14b)
	Work Task (go to 14c)

14a The WI is a Feature: List of building blocks under this feature

(list of Work Items identified as building blocks)

14b The WI is a Building Block: parent Feature

(one Work Item identified as a feature)
FDD Enhanced Uplink

14c The WI is a Work Task: parent Building Block

(one Work Item identified as a building block)
This WI has not finished yet. See RAN_Work_Items.

FDD Enhanced Uplink: Layer 2 and 3 Protocol Aspects

Work Item Description

Title: FDD Enhanced Uplink: Layer 2 and 3 Protocol Aspects

1 3GPP Work Area

X	Radio Access
	Core Network
	Services

2 Linked work items

- FDD Enhanced Uplink
- FDD Enhanced Uplink: Physical Layer
- FDD Enhanced Uplink: UTRAN Iub/Iur Protocol Aspects
- FDD Enhanced Uplink: RF Radio Transmission/ Reception, System Performance Requirements and Conformance Testing

3 Justification

In RAN#17 a study item on "Uplink Enhancements for Dedicated Transport Channels" was approved. The aim of the study was to look at the feasibility of enhancing the uplink DCH operation and performance by several techniques in order to support services like video-clips, multimedia, e-mail, telematics, gaming, video-streaming…. The RAN study has shown that various techniques, Node-B controlled scheduling, shorter TTI and a hybrid ARQ layer in the Node-B, can enhance the uplink packet transfer performance significantly compared to Release-99/Rel-4/Rel-5.

4 Objective

The technical objective of this work item is the Enhanced Uplink functionality in UTRA, to improve the performance of uplink dedicated transport channels. The improvements should take into account backwards compatibility aspects.

- For radio interface higher RAN layers, the building block includes:
  - Architecture aspects
  - MAC entity (Scheduling and hybrid ARQ protocol)
  - Interlayer interactions in connected mode
  - Control plane protocols
  - User plane protocols
  - UE capabilities

5 Service Aspects

None

6 MMI-Aspects

None

7 Charging Aspects

None

8 Security Aspects

None

9 Impacts

Affects:	USIM	ME	AN	CN	Others
Yes		X	X		
No	X			X	X
Don't know					

10 Expected Output and Time scale (to be updated at each plenary)

New specifications						
Spec No.	Title	Prime rsp. WG	2ndary rsp. WG(s)	Presented for endorsement at plenary#	Approved at plenary#	Comments
		R2				
Affected existing specifications						
Spec No.	CR	Subject			Approved at plenary#	Comments
25.301		Radio Interface Protocol Architecture			RAN#26	
25.302		Services provided by the physical layer			RAN#26	
25.306		UE Radio Access capabilities definition			RAN#26	
25.321		Medium Access Control (MAC) protocol specification			RAN#26	
25.331		Radio Resource Control (RRC) protocol specification			RAN#26	

Note: this work item is the Layer 2 and 3 Protocol Aspects part of the stage 3 of the FDD Enhanced Uplink work item.

11 Work item raporteurs

Joakim Bergström (Ericsson)

12 Work item leadership

TSG-RAN WG2

13 Supporting Companies

Ericsson, Nokia, Nortel, Vodafone Group, Motorola, Qualcomm, TeliaSonera, Alcatel, T-mobile, Lucent Technologies, Samsung, Philips, LG Electronics, NEC, Orange, Telefonica, NTT DoCoMo, and Siemens.

14 Classification of the WI (if known)

	Feature (go to 14a)
X	Building Block (go to 14b)
	Work Task (go to 14c)

14a The WI is a Feature: List of building blocks under this feature

(list of Work Items identified as building blocks)

14b The WI is a Building Block: parent Feature

(one Work Item identified as a feature)
FDD Enhanced Uplink

14c The WI is a Work Task: parent Building Block

(one Work Item identified as a building block)
This WI has not finished yet. See RAN_Work_Items.

FDD Enhanced Uplink: UTRAN Iub/Iur Protocol Aspects

Work Item Description

Title: FDD Enhanced Uplink: UTRAN Iub/Iur Protocol Aspects

1 3GPP Work Area

X	Radio Access
	Core Network
	Services

2 Linked work items

- FDD Enhanced Uplink
- FDD Enhanced Uplink: Physical Layer
- FDD Enhanced Uplink: Layer 2 and 3 Protocol Aspects
- FDD Enhanced Uplink: RF Radio Transmission/ Reception, System Performance Requirements and Conformance Testing

3 Justification

In RAN#17 a study item on "Uplink Enhancements for Dedicated Transport Channels" was approved. The aim of the study was to look at the feasibility of enhancing the uplink DCH operation and performance by several techniques in order to support services like video-clips, multimedia, e-mail, telematics, gaming, video-streaming…. The RAN study has shown that various techniques, Node-B controlled scheduling, shorter TTI and a hybrid ARQ layer in the Node-B, can enhance the uplink packet transfer performance significantly compared to Release-99/Rel-4/Rel-5.

4 Objective

The technical objective of this work item is the Enhanced Uplink functionality in UTRA, to improve the performance of uplink dedicated transport channels. The improvements should take into account backwards compatibility aspects.

- For Iur/Iub interface, the building block includes:
  - Control plane protocols
  - User plane protocols

5 Service Aspects

None

6 MMI-Aspects

None

7 Charging Aspects

None

8 Security Aspects

None

9 Impacts

Affects:	USIM	ME	AN	CN	Others
Yes		X	X		
No	X			X	X
Don't know					

10 Expected Output and Time scale (to be updated at each plenary)

New specifications						
Spec No.	Title	Prime rsp. WG	2ndary rsp. WG(s)	Presented for endorsement at plenary#	Approved at plenary#	Comments
25.42x	Iur user plane protocols for FDD Enhanced Uplink	R3		RAN#25	RAN#26	
25.43x	Iub user plane protocols for FDD Enhanced Uplink	R3		RAN#25	RAN#26	

Affected existing specifications				
Spec No.	CR	Subject	Approved at plenary#	Comments
25.401		UTRAN overall description	RAN#26	
25.420		UTRAN Iur Interface: General Aspects and Principles	RAN#26	
25.423		UTRAN Iur interface Radio Network Subsystem Application Part (RNSAP) signalling	RAN#26	
25.430		UTRAN Iub Interface: General Aspects and Principles	RAN#26	
25.433		UTRAN Iub interface NBAP signalling	RAN#26	

Note: this work item is the UTRAN Iub/Iur Protocol Aspects part of the stage 3 of the FDD Enhanced Uplink work item.

11 Work item raporteurs

Saso Stojanovski (Nortel)

12 Work item leadership

TSG-RAN WG3

13 Supporting Companies

Ericsson, Nokia, Nortel, Vodafone Group, Motorola, Qualcomm, TeliaSonera, Alcatel, T-mobile, Lucent Technologies, Samsung, Philips, LG Electronics, NEC, Orange, Telefonica, NTT DoCoMo, and Siemens.

14 Classification of the WI (if known)

	Feature (go to 14a)
X	Building Block (go to 14b)
	Work Task (go to 14c)

14a The WI is a Feature: List of building blocks under this feature

(list of Work Items identified as building blocks)

14b The WI is a Building Block: parent Feature

(one Work Item identified as a feature)
FDD Enhanced Uplink

14c The WI is a Work Task: parent Building Block

(one Work Item identified as a building block)
This WI has not finished yet. See RAN_Work_Items.

FDD Enhanced Uplink: RF Radio Transmission/ Reception, System Performance Requirements and Conformance Testing

Work Item Description

Title: FDD Enhanced Uplink: RF Radio Transmission/ Reception, System Performance Requirements and Conformance Testing

1 3GPP Work Area

X	Radio Access
	Core Network
	Services

2 Linked work items

- FDD Enhanced Uplink
- FDD Enhanced Uplink: Physical Layer
- FDD Enhanced Uplink: Layer 2 and 3 Protocol Aspects
- FDD Enhanced Uplink: UTRAN Iub/Iur Protocol Aspects

3 Justification

In RAN#17 a study item on "Uplink Enhancements for Dedicated Transport Channels" was approved. The aim of the study was to look at the feasibility of enhancing the uplink DCH operation and performance by several techniques in order to support services like video-clips, multimedia, e-mail, telematics, gaming, video-streaming…. The RAN study has shown that various techniques, Node-B controlled scheduling, shorter TTI and a hybrid ARQ layer in the Node-B, can enhance the uplink packet transfer performance significantly compared to Release-99/Rel-4/Rel-5.

4 Objective

The technical objective of this work item is the Enhanced Uplink functionality in UTRA, to improve the performance of uplink dedicated transport channels. The improvements should take into account backwards compatibility aspects.

- For radio transmission and reception, the building block includes:
  - UE radio transmission and reception
  - Base Station radio transmission and reception
  - Base Station conformance testing
  - Requirements for support of Radio Resource Management

5 Service Aspects

None

6 MMI-Aspects

None

7 Charging Aspects

None

8 Security Aspects

None

9 Impacts

Affects:	USIM	ME	AN	CN	Others
Yes		X	X		
No	X			X	X
Don't know					

10 Expected Output and Time scale (to be updated at each plenary)

New specifications						
Spec No.	Title	Prime rsp. WG	2ndary rsp. WG(s)	Presented for endorsement at plenary#	Approved at plenary#	Comments
		R4				

Affected existing specifications				
Spec No.	CR	Subject	Approved at plenary#	Comments
25.101		User Equipment (UE) radio transmission and reception (FDD)	RAN#28	
25.104		Base Station (BS) radio transmission and reception (FDD)	RAN#28	
25.133		Requirements for support of radio resource management (FDD)	RAN#28	
25.141		Base Station (BS) conformance testing (FDD)	RAN#28	

Note: this work item is the RF Radio Transmission/ Reception, System Performance Requirements and Conformance Testing part of the stage 3 of the FDD Enhanced Uplink work item.

11 Work item raporteurs

Thomas Unshelm (Ericsson)

12 Work item leadership

TSG-RAN WG4

13 Supporting Companies

Ericsson, Nokia, Nortel, Vodafone Group, Motorola, Qualcomm, TeliaSonera, Alcatel, T-mobile, Lucent Technologies, Samsung, Philips, LG Electronics, NEC, Orange, Telefonica, NTT DoCoMo, and Siemens.

14 Classification of the WI (if known)

	Feature (go to 14a)
X	Building Block (go to 14b)
	Work Task (go to 14c)

14a The WI is a Feature: List of building blocks under this feature

(list of Work Items identified as building blocks)

14b The WI is a Building Block: parent Feature

(one Work Item identified as a feature)
FDD Enhanced Uplink

14c The WI is a Work Task: parent Building Block

(one Work Item identified as a building block)
This WI has not finished yet. See RAN_Work_Items.