

Agenda Item:	AH14
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Introduction

GBT proposes a method, which allows use of UE Channel Selection and the flexible channel assignment. It is possible to accommodate fixed Channel Assignment as well. GBT does not see any performance advantage in adding the Fixed Channel Assignment specially when multiple data rate operation is desirable. As an example if we needed to operate in eight different data rates, as a minimum we will have to have eight CPCH channels when operating in Fixed Channel Assignment or UE channel Selection. There is also no difference between UE channel Selection and Fixed Channel Assignment performance in this case. However, by using Flexible Channel Assignment, we can use lesser number of CPCH channels to accommodate all the rates. So another characterization of this method is multi-rate CPCH method. GBT supports the UE Channel Selection, i.e., Fixed Rate CPCH and Flexible Channel Assignment, i.e., Multi-Rate CPCH. When a single CPCH or low number of CPCH channels are allocated to the Base Node for operation, then the Fixed Rate CPCH/UE channel selection is unavoidable. When the number of CPCH channels increases, then the use of Multi-rate CPCH or flexible Channel Assignment is desirable. The use of either mode should be parameterized by higher layers. So, the Fixed Rate CPCH is a mode where CA is either Active or not Active and Multi-Rate CPCH is a mode where CA is active. In the Fixed Rate CPCH, there is either a one-to-one mapping between signatures and CPCH physical channels or there is ambiguity. In case of ambiguity, CA is needed to resolve this ambiguity and provide the mapping between the signature and the physical channel. The role of CA in flexible channel assignment is expanded in the following ways:

1. UE channel selection is a one-to-one mapping scenario [heavy role for PV and Status Broadcast information) whereas Fixed Channel Assignment is a one signature to N1 physical CPCH mapping where $N1 = \text{Number of CPCH channels operating at rate 1}$. Flexible Channel Assignment is a one signature (desired rate) to N mapping where $N = N1+N2+N3+\dots+N8$. Although the throughput performance of these methods might be close, but from the flexibility perspective, flexible channel assignment scores higher. Dynamic CPCH configuration is feasible with this method, decreasing the number of physical resources to support multiple rates.
2. It is possible for UTRAN to grant lower rates to the UE in the first phase in the flexible channel assignment method. Whereas this is not possible in the other methods. It permits bandwidth negotiations in the CR phase. There is no back off due to non-availability of a data rate in the flexible method. While this is not true for fixed assignment, in the UE channel selection case, UE has near-perfect knowledge of availability and congestion condition [PV], so this is not an issue.
3. Dynamic bandwidth management is possible in that RNC does not have to re-configure the CPCH physical resources at the base node when it decreases or the increases the allocated bandwidth to the base node for CPCH services. It only can notify the Base Node of this change. It is also not necessary to notify the UE of any changes in CPCH info set [no change is necessary]. So, simple dynamic bandwidth management is possible with this method.

4. Flexibility in choosing the number of signatures to trade performance with physical resources such as the number of signatures. This is true for both fixed assignment and flexible assignment.
5. Adding Fixed Channel Assignment provide an additional flexibility of configuring the CPCH channels for known applications with known traffic. For example, certain applications might require a few lowest rate such as 15 kbps channels. Having the Fixed CA will provide the flexibility to the service provider to pick and choose from the three schemes for this kind of applications.

Status Broadcast Modes

Three modes are possible. We propose that UTRAN notify the UEs which mode is operational.

1. Broadcast availability of each CPCH channel (UE Channel Selection)
2. Broadcast availability of each data rate (Fixed Channel Assignment)
3. Broadcast the availability of the maximum data rate (Flexible Channel Assignment)

Flexible Channel Assignment

1. Transmit the maximum bit rate on the Status Broadcast Channel
 2. Each AP signature is mapped to a data rate.
- There is a common downlink channelization code to be used by all UEs. The uplink channelization code can be picked from a code tree such that by truncation, the code can be used for various data rates. So, various segments of the same channelization code are used for all transmission.
3. There is a one-to-one mapping between the CA signature and uplink scrambling code, ul channelization code. There is no correspondence between AP signature and physical resources.
 4. There are a fixed number of CPCH channels that are assigned to the Base Node.
 5. The CPCH channel configuration is done flexibly and dynamically in that it is not necessary to pre-determine which rate each channel operates in.
 7. n channels operate in the maximum rate and the remaining channels [ex: 2] will be set to operate in other data rates [Ex: if max rate is 240, then 2 physical channels could operate in 120 and 60 kbps].

UE Procedure:

1. UE reads the Maximum available Rate is broadcast on the Status Broadcast Channel
2. UE selects a data rate based on several factors including the available max rate.
3. UE requests a data rate by picking an appropriate AP [Assume a low rate was requested].
4. In the CD phase, the Base Node responds by sending a CA corresponding to a maximum data rate CPCH channel and configuring that channel to the requested UE rate. In this case the UE knows what data rate to operate in and which ul scrambling code, ul channelization code and dl channelization code to utilize.
5. In case the limits of the capacity is reached and UTRAN can only afford a lower rate, then it will send a CA associated with one of the lower rates. This indicates to the UE that its originally requested data rate was rejected, but it is allocated a new rate with the CA-indicated resources. The motivation to lower the rate could be changing the offered QoS or granting lower rate to lower priority users reserving more bandwidth to the higher priority users.
6. UTRAN can dynamically allocate more bandwidth if required without a need to adjust the CPCH configuration. The CPCH configuration can be performed on the fly by Base Node as the need arises and based on traffic conditions.

An example of flexible channel assignment:

Mapping of the AP signature to the requested bit rate

Mapping identifier	Signature identifier	Bit Rate (kbps)
0	0	960 kbps

1	1	480
2	2	240
3	3	120
4	4	60
5	5	30

Mapping of the CA – signature to the physical resources and the granted bit rate.

CA- signature	Physical channel identifier	CPCCH Set Info Ul scrambling, Dl channelization code	Granted Bit Rate
0,1,2,3,4	0,1,2,3,4	Uls0,uls1,uls2,...uls4 Dlc0,dlc1,dlc2,...dlc4 Common ul channelization code Bit Rate =Max PCP length N_Max	Requested rate was granted if this CA is sent.
5	5	Uls5 Dlc5 Common ul channelization code Bit rate = Max -1 PCP length N_Max	Requested Rate – 1 was granted if this CA is sent.

Data rate selection rule for Flexible Channel Assignment

Requested Data Rate is related to the AP signature.

If the CA-response is associated with the maximum rate, then it indicates the requested rate was accepted.

If the CA-response is associated with lower rates, then it indicates a rate change.

Choice of ul channelization code is related to the granted bit rate. Based on what the rate is, the UE will truncate the common long ul channelization code.

Comparison of various proposed methods:

This table is a first attempt to compare the three methods:

	name	RNC resource assignment	Resource configuration	Support single CPCCH	Mixed mode possible?
GBT	Hybrid Fixed Rate CPCCH and Multiple Rate CPCCH	Fixed	Dynamic By Base Node	Yes	Yes
Samsung	Flexible channel Assignment	Fixed	Dynamic by Base Node	No	No
Philips	UE channel Selection/ UTRAN channel Selection	Fixed	Fixed by RNC	yes	Yes

Conclusion

GBT's new proposal accommodates the three methods at the cost of incorporating the CA message in the physical layer. GBT proposes adoption of the CA message to be used when ordered by the higher layer parameters which indicates CA mode is active.