Agenda Item:

Source: Nortel Networks

Title: RACH partitioning using access slots

Document for: Approval

Introduction

The concept of Access Service Classes allows to partition the PRACH capacity in sub-groups with a given priority level. Services with different priority levels will have access to a different part of the PRACH.
The PRACH can be partitioned based on a subdivision of the PRACH signatures. Another method is to partition the PRACH into subgroups of access slots. A combination of the two can also be used.

### *Partitioning using PRACH access slots*

There are 15 access slots per two frames for the PRACH.

The principle is to divide to PRACH into a certain number of sub-channels. One class of service is mapped to one or more sub-channels.
The sub-channels are defined as follows :
- The cycle of a sub-channel is 60 slots, i.e. 4 times 2-frames of 15 access slots
- The distance between two access slots of the same sub-channel is 12. There are therefore 5 access slots per sub-channel cycle.
- The SFN of the current frame is used to determine the access slots in that frame.

Ex : Sub-channel number 0
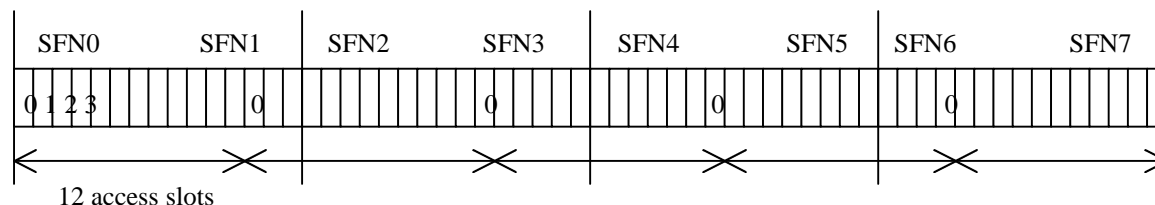
12 access slots

Groups of access slots for each sub-channel at each frame :

Frame number	Sub-channel Number												
	0	1	2	3	4	5	6	7	8	9	10	11
SFN modulo 8=0	0	1	2	3	4	5	6	7				
SFN modulo 8=1	12	13	14						8	9	10	11
SFN modulo 8=2				0	1	2	3	4	5	6	7	
SFN modulo 8=3	9	10	11	12	13	14						8
SFN modulo 8=4	6	7					0	1	2	3	4	5
SFN modulo 8=5			8	9	10	11	12	13	14			
SFN modulo 8=6	3	4	5	6	7					0	1	2
SFN modulo 8=7						8	9	10	11	12	13	14

This sub-division allows to support the L1 preamble ramping sequence, both when the minimum distance between two Access Preambles is three (AICH transmission timing parameter=0) and four (AICH transmission

timing =1) access slots. The maximum distance between two access slots for a certain ASC is 12 access slots (for one sub-channel), but can be less when there is more than one sub-channel in the ASC.

For a given Access Service Class, the first preamble is transmitted in the next access slot that belongs to one of the sub-channels that are mapped to that ASC. After the first preamble, the consecutive preambles are transmitted in the next access slot that belongs to the ASC group of sub-channels, with a minimum of three or four AS.

Example :
Access Class 1 with 6 sub-channels number : 0, 2, 4, 6, 8, 10
Access Class 2 with 4 sub-channels number : 1, 5, 9, 11
Access Class 3 with 2 sub-channels number : 3, 7

Note that the proposal in Tdoc R2#5(99)664 "Control of available PRACH and AICH access slots" to define less than the maximum of 15 access slots per two frames, can still be met by restricting the number of available sub-channels for each ASC, so that the total sum is less than 12.

The number of classes of services is proposed to be three.
A 12-bit bitmap can be used to code which sub-channels belong to an Access Service Class. This requires a total of 12*3 = 36 bits.

Another solution would be to consider that the sub-channel numbers for each ASC are consecutive, and to code the offset in sub-channel index on four bits for each ASC.
Ex :
ASC 1 : sub-channels   0,1,2,3,4,5
ASC2 : sub-channels   6,7,8,9   index offset = 6
ASC3 : sub-channels   10,11   index offset = 10

This solution is less flexible, but requires only 8 bits.

Conclusion

It is proposed to define the Access Service Classes with a combination of signatures and access slot sub-channels. The UE would first select an access slot based on the above rules, then choose which signature to use according to the available signatures and the ASC sub-division.