TSG Radio Access Network WG1#10   TSGRAN1#10(00)0026

Bejing, China

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Agenda	**AH 14**
Source:	**GBT**
Subject:	**Comparison of Channel Selection, Fixed Channel Assignment and Flexible Channel Assignment schemes**
Contribution for	**Discussion and Approval**

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In this contribution, pros and cons of various methods are surveyed. We have modified this contribution to reflect some of the discussions that took place on the reflector. Specifically, GBT support the inclusion of UE Channel Selection, Fixed CA and Flexible CA. The L1 cost is only addition of CA message. The Service provider will have the choice of using any scheme or any combination of these schemes.

# Pros and Cons of Fixed Channel Assignment (FCA)
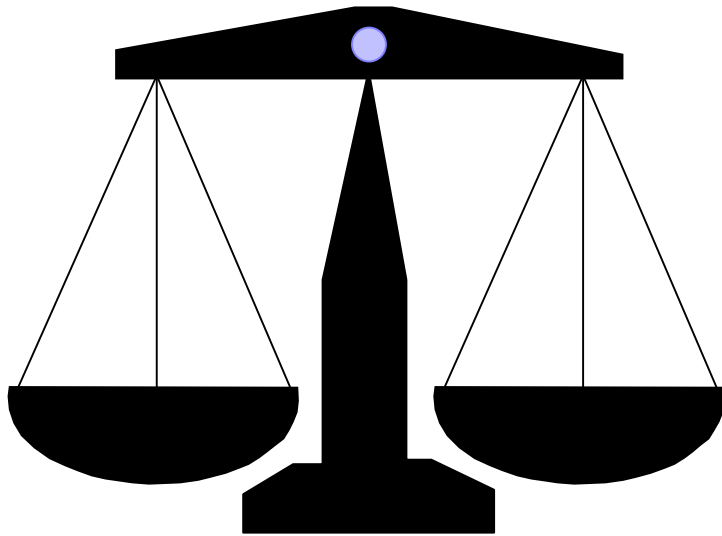
- FCA and Flexible CA have no relevance to a single CPCH case. It serves no function in a single CPCH case.

- No throughput performance gain

- Excessive preamble interference, more UE power consumption **[if less number of signatures are used]**

- Added Complexity in UE with no gain

- FCA requires transmission of availability of each data rate.

- **FCA might be useful in cases where fixed number of channels at a certain rate are required for certain applications.**

Pros and Cons of Flexible Channel Assignment
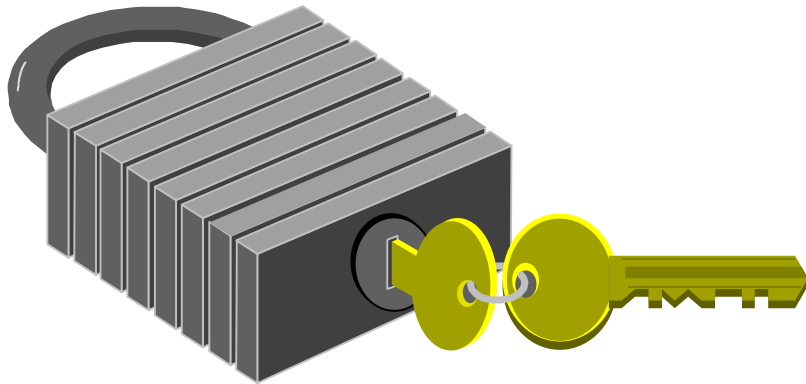
- When high data capacity cell required by service provider, then flexible assignment provides some saving in signature usage. Dynamic resource and bandwidth management is possible with Flexible assignment.

- Flexible Assignment only requires transmission of maximum available bit rate.

- Flexible Channel Assignment is irrelevant to single CPCH case and provides little advantage in case of small number of CPCH channels.

- Added complexity in CA reception traded with achieving gain in flexibility of resource management [physical channels in Base, and the number of required signatures

# Pros and Cons of UE Channel Selection Scheme
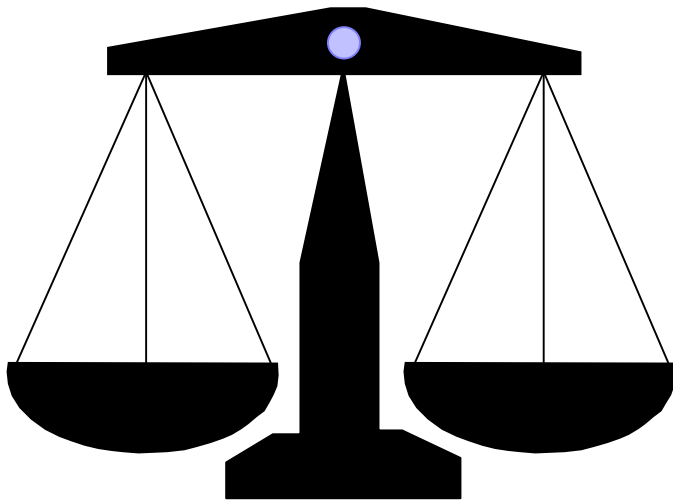
- It works with low number of CPCH channels.
- The monitoring delay is in the order of few ms even with 16 CPCH channels operating at various rates.
- Errors on downlink Status Broadcast channel impacts the performance negligibly.
- Throughput delay performance is comparable with Fixed Channel Assignment and Flexible Channel Assignment given the same number of signatures.
- Flexible Assignment provides the flexible resource and bandwidth management capability.

Comments on the CA simulation analysis

- Poisson Arrival Assumption
- Lack of Multiple Data Rate Capability
- Lack of BO due to Collision in the CA formula
- It shows similar performance between perfect CA and perfect monitoring
- Wrong Back-Off assumptions

1. Poisson Arrival Assumption
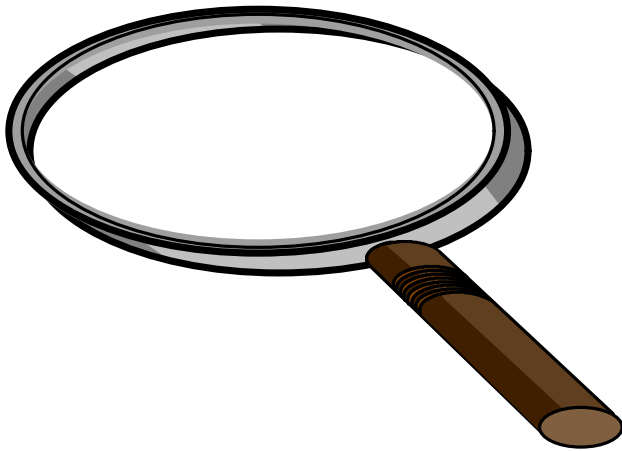
- Packets do not arrive in clusters in Poisson model

- When the packets arrive in cluster, then there is a possibility of piggybacking increasing the packet length changing the delay-throughput behavior.

2. Lack of Multiple Data Rate Capability

- Supporting multiple data rate requires Data Rate Status Broadcast

- This makes the CA scheme similar to Basic Scheme with monitoring.

- This is to avoid BO due to wrong data rate selection.

- This will also remedy the excessive preamble interference problem.

- It is possible to support multiple data rate with both flexible and fixed CA schemes. However, the simulations have been performed with single CPCH rate only.

3. Lack of BO due to Collision in the CA delay formulation
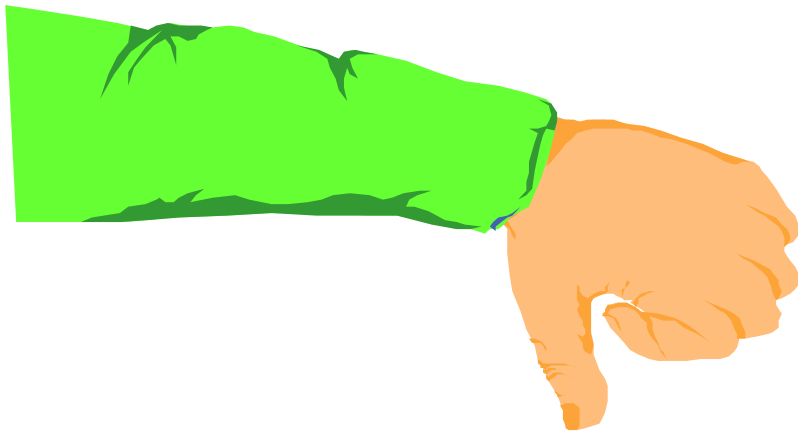
- There is close to 30% collision at peak throughput. This will contribute to worse delay performance. This is not included in the CA Delay formula

4. Similar performance for CPCH with "Perfect CA" and "Perfect monitoring"

- Almost 1% difference in throughput performance.

- Impact of excessive preamble interference is not included in perfect CA case.

- Impact of back off due to wrong data rate selection (simulation is for 16 CPCH @64 kbps) is not incorporated.
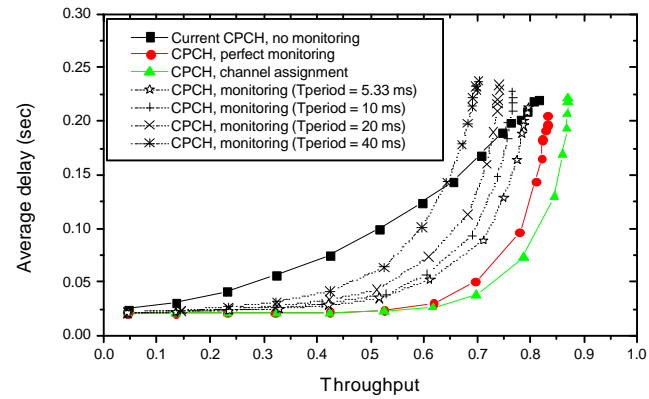
- Impact of back-off due to collision is not added.

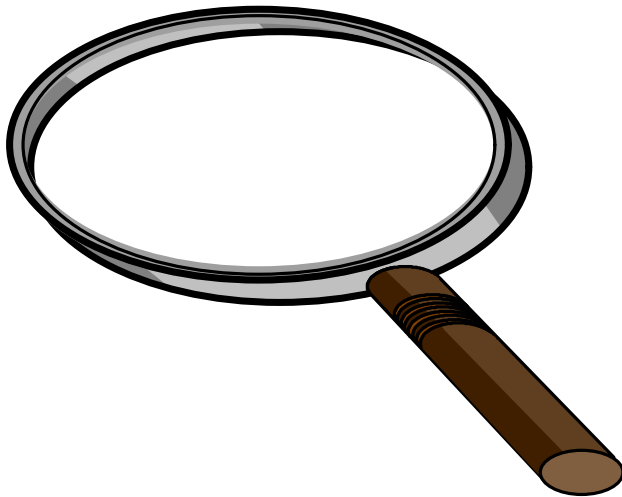# 5. Wrong Back-Off Assumptions exponential back-off vs. random or fixed

- GBT's R299D02
- TBOC1 all-busy: Random 1-16 frames
- TBOC2 channel-busy: fixed 0-15 access slots
- TBOC3 Bo-No-AICH: fixed 1-16 frames
- TBOC4 collision: Random 10-100 frames

Samsung simulation results:
## Throughput performance

Further comments on the simulation results

- The results show that the 5.33 ms period performs best and is near-optimum as compared to perfect monitoring.

- Furthermore, it is interesting to note the behaviour of the "current CPCH" which seems to be getting better than all other cases.

- The CA case reflects the case of Fixed Channel Assignment with a single CPCH rate.

Various DSMA-CD schemes

1. UE Channel Selection 2. Fixed Channel Assignment 3) Flexible Channel Assignment
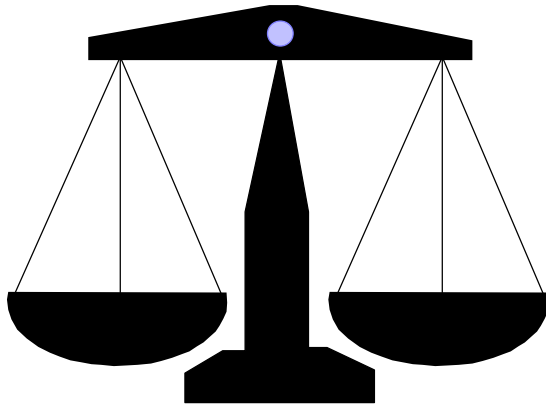
- Fixed CA scheme [7 data rates] shall perform slightly worse than UE channel Selection scheme with less than 7 CPCH channels. FCA provides the flexibility of provisioning fixed rate CPCH channels at certain rates.

- UE channel Selection Scheme required for low number of CPCH channels.

- Flexible CA provides flexibility in resource-bandwidth management and flexibility in trading performance with number of signatures. So, Flexible Assignment is recommended for high number of CPCH channels.

- UE channel Selection provides highest level of information to UE. The UE receives PV values per CPCH. This leads to least UE power consumption.

Use of PVs for various cases
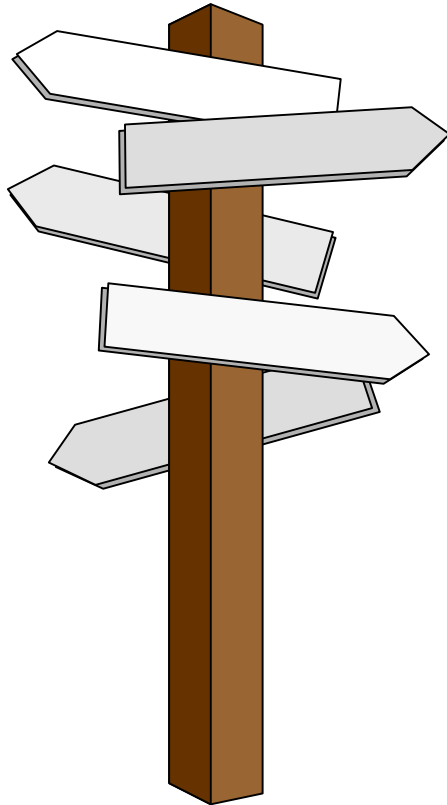
- UE Channel Selection scheme requires transmission of PV per CPCH channel.

- Fixed CA and Flexible Scheme should also be coupled with transmission of PV per data rate.

- Flexible and Fixed CA schemes will require the same or less number of signatures. As a minimum, the required number of signatures is equal to the number of supported data rates. So, PVs should be sent per data rate.

A proposed way forward
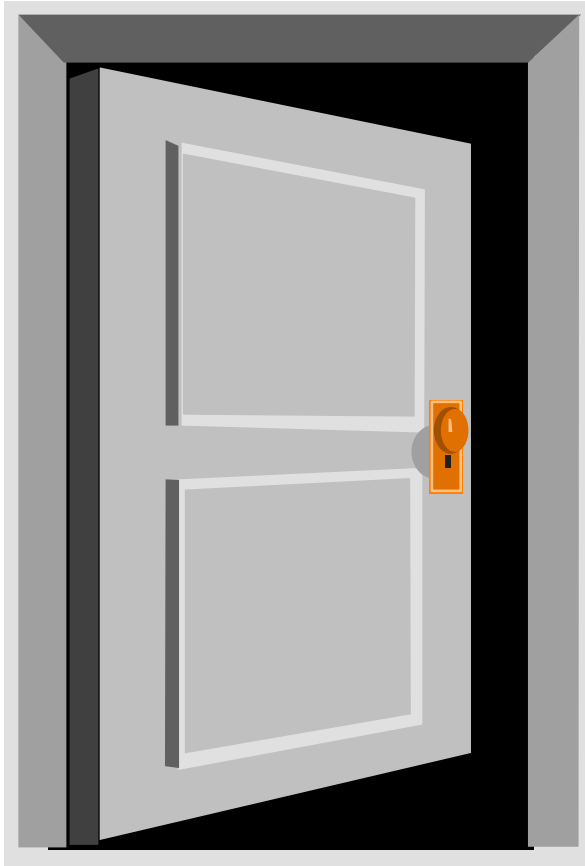
- Use UE Channel Selection for low number of CPCH channels

- Use Flexible Channel Assignment for higher number of CPCH channels. The threshold should be TBD.

- UTRAN should transmit the scheme as part of CPCH system parameters. [not Status Broadcast Channel]

- Use Fixed CA to provision flexibility to the service provider, since there is no additional L1 cost.

Additional Specifications
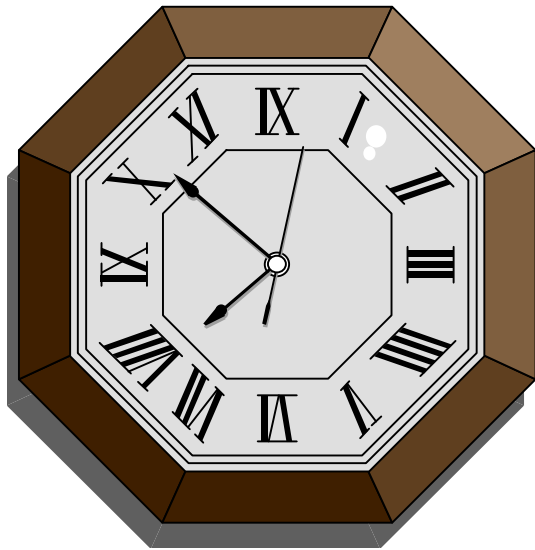
- Use Status Broadcast channel to broadcast availability of each CPCH channel for the Channel Selection scheme.

- Use this channel to transmit the Maximum bit rate in case of Flexible Assignment. Use this channel to transmit availability of each data rate for Fixed CA.

- UEs shall know the mode from the CPCH system parameter message.

- Use PV per data rate for the case of Flexible Assignment and Fixed CA.

- Introduce a higher layer parameter to indicate the usage of CA message.