Multiple TDD PHYs Controlled Jointly by a Single Point-to- Multipoint MAC

Subir Varma

Aperto Networks
1637 South Main Street
Milpitas, CA 95035

1.0 Current State of the Art

The following figure illustrates a traditional TDD system.

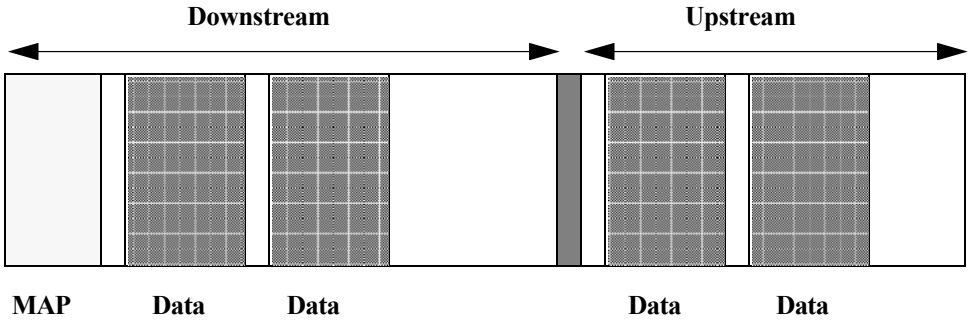

FIGURE 1.

The system operates over a single channel. Each TDD frame has a MAP packet that describes the contents of the following frames, and enables the system to opererate using the TDMA protocol.

2.0 Shortcomings of Current Art

If more than one channel is available, then the TDD structure in Fig. 1 is used independently on all channels, with no co-ordination in the TDMA slot allocations between channels. As a result, all data grants to a particular CPE are made on the same channel, which is chosen at the time the CPE is initialized. This scheme is sub-optimal from the point of view of load balancing, since if one of the channels is overloaded, then the system does not have the ability to dynamically re-allocate CPEs across channels, to even out the traffic load across all channels.

3.0 Description

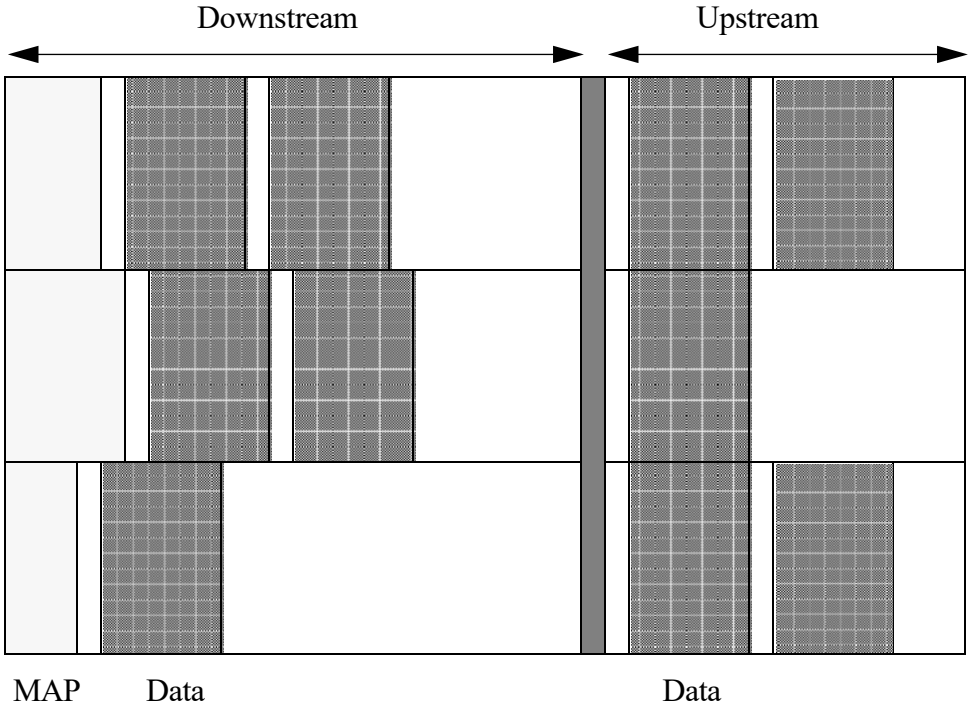

FIGURE 2.

The proposed invention suggests a new way in which multiple channels can be controlled by a single MAC entity. It works as follows:

- Al the channels are time synchronized, so that the start and end of their TDD frames coincide.
- Every CPE is given one of the channels on which to receive all its MAP messages. The CPE should be able to dynamically switch its transceiver between multiple channels on a rapid basis, on order to support this mode of operation.
- As part of the MAP message, the BSC scheduler specifies not just the time slots that a CPE should use, *but also the channel on which the burst is located*.
- Instead of a scheduler for each channel, the BSC has a centralized scheduler that allocates slots for all CPEs across all channels. Once the allocation is done, the BSC builds multiple MAP messages, one for each channel, such that all the grants for a specific CPE are always on a MAP sent on one of the channels, irrespective of where the actual grants are located.

4.0 How the Proposed Invention Extends the Current Art

The proposed invention has the following benefits:

- The proposed design allows the BSC scheduler to allocate grants to CPEs jointly across two dimensions, time and frequency. As a result it is able to optimally load balance data traffic across all channels, and make sure that all available transmission space is fully utilized.
- If one of the channels is taken out of service, then the system gracefully transitions to a state with one less channel. For the case in which CPEs are tied to a channel, the loss of a channel is a very disruptive event, simce all the CPEs on that channel have to individually re-allocated on other channels.