

## INVENTION DISCLOSURE

### 1. Invention Title.

#### **High Availability Mechanism for Modular CMTS Systems**

### 2. Invention Summary.

This invention provides a way to offer high availability with M-CMTS systems. It provides 1+1 redundancy for M-CMTS Cores and n+1 redundancy for EQAMs by exchanging status messages and performing health checks on various components.

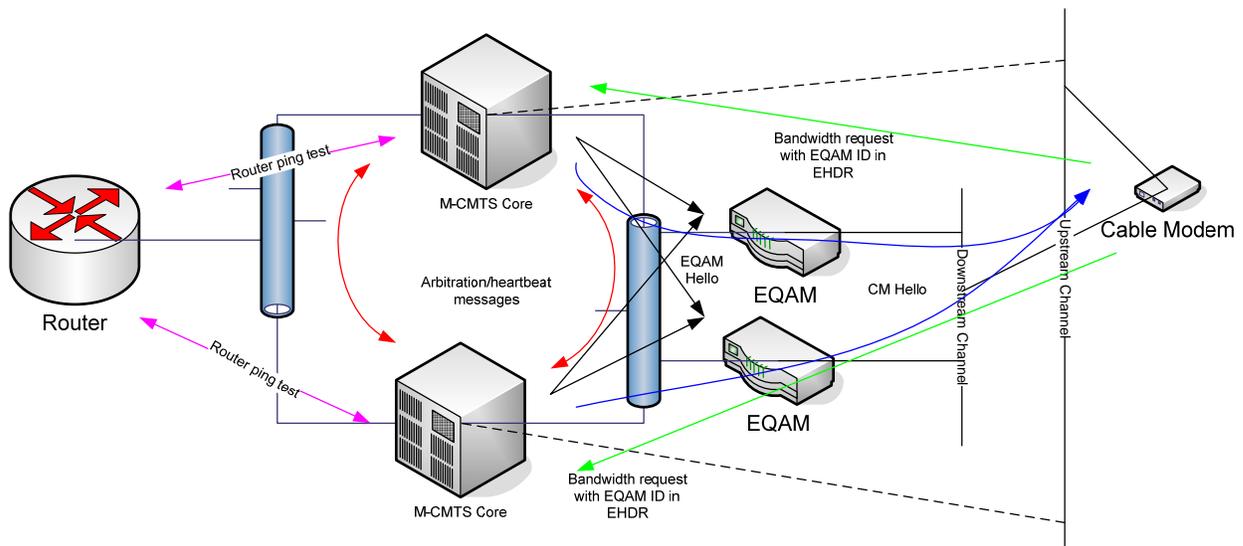
### 3. Invention Description.

- a. **Describe the invention in detail and/or attach a description, drawing(s) and/or diagram(s), if available. Please include flow charts for descriptions of software processes, and block diagrams for descriptions of hardware systems. Include the description/attachments in electronic form if possible.**

During normal operation, M-CMTS cores exchange health information to determine which is active. Each core will also set up an independent DEPI control channel to each EQAM. The EQAMs use failover groups to tie the control connections from each of the cores together. The cores send hello messages to the EQAMs, and the EQAMs respond across both control channels with the list of cores in the failover group that the EQAMs think are operational. The cores use the number of responses with their information in them to help determine their state of health. Thus, if Core A sees itself in responses from 4 EQAMs, while it sees Core B in responses from 3, then it judges itself healthier than B (and B follows a similar process).

The active core stays active until its performance is degraded, then the standby core could take over. When both cores are operational, they establish an arbitration link between them on EVERY Ethernet interface. The arbitration link is used as a heartbeat and to share state-of-health information. If one of the cores detects a problem (e.g. interface down, bus corruption, power supply failures, upgrade in progress, etc.), it lowers its state of health and sends the info to the other core, which could initiate a switchover from standby to active (while the original active core switches to standby). If arbitration packets are lost due to a network failure (or total failure of the other core), each core pings the upstream router, and considers its network health good (and the opposite core's health bad) if it receives a reply. This may trigger the standby core to go active without confirmation from the active core. As a safety check against both cores going active at the same time, the EQAMs can be configured to listen to the core that has been active the longest (or shortest), and discard messages from the other core. The EQAM could also use a configured priority value to determine which core to listen to.

High availability for EQAMs uses a similar mechanism. Standby EQAM(s) are silent on the RF. The Active EQAM for a channel sends an EQAM ID in the EHDR field of MAC management messages. To counteract multiple EQAMs going active on a given channel at the same time, CMs include their list of active EQAMs in their bandwidth request messages that they send upstream to the M-CMTS cores. If the active core detects multiple EQAM IDs for a given channel, it takes corrective action (e.g. changing the DEPI session status to inactive, tearing down control connections, etc.). If the core detects NO activity on a particular upstream channel, it sends a hello message to the CMs. If the core doesn't receive a response from ANY CM, it initiates an EQAM failover. The core can also initiate an EQAM failover based on the EQAM hello responses described above or based on operator intervention.



**b. Why was the invention developed? What problem(s) does the invention solve? How is it better?**

I have been studying Service Level Agreements and QoS for Business Services projects in BA. I discovered an outage around service availability on the CMTS. My invention would offer MSOs a way to keep service operational during a CMTS failure or during scheduled maintenance so that the MSOs can offer higher Service Level Agreements to customers.

**c. Briefly outline the potential commercial value and customers of the invention.**

This invention will facilitate the roll-out of business services, especially those that offer Service Level Agreement, and need greater availability than residential services.

- 4. HOW is your invention different from existing products, processes, systems? Please list the closest publication(s), product(s), method(s), patent(s), etc. to your invention. For each item, how is your invention different?**

To my knowledge, there is no mechanism for CMTS redundancy today. As M-CMTS technology is new and not fully developed or deployed today, redundancy mechanisms have not been standardized, and I am not aware of any under development.