Invention Disclosure

1. **Invention Title: Method and system for providing mobile broadband services utilizing DOCSIS ® or EPON**

2. **Invention Summary.**
This invention disclosure proposes a method for implementing a system that provides mobile broadband services by utilizing the Data-Over-Cable Service Interface Specifications (DOCSIS) or Ethernet Passive Optical Network (EPON) protocols over the top of any radio frequency communication links, without the need to modify the existing DOCSIS protocol.

3. **Invention Description**.

a. **Describe the invention in detail and/or attach a description, drawing(s) and/or diagram(s), if available.**

The DOCSIS protocol provides point to multi-point communications between cable modems (CMs) that reside in customer premises and the cable modem termination systems (CMTS) that reside in the cable operators' back office. Traditionally, the DOCSIS protocol is run over the hybrid fiber coax (HFC) networks. This invention disclosure proposes a system that allows the DOCSIS protocol to be implemented over a hybrid fiber coax wireless (HFCW) network. This is all done without the need to modify the existing DOCSIS protocol. See attached for proposed system architecture.

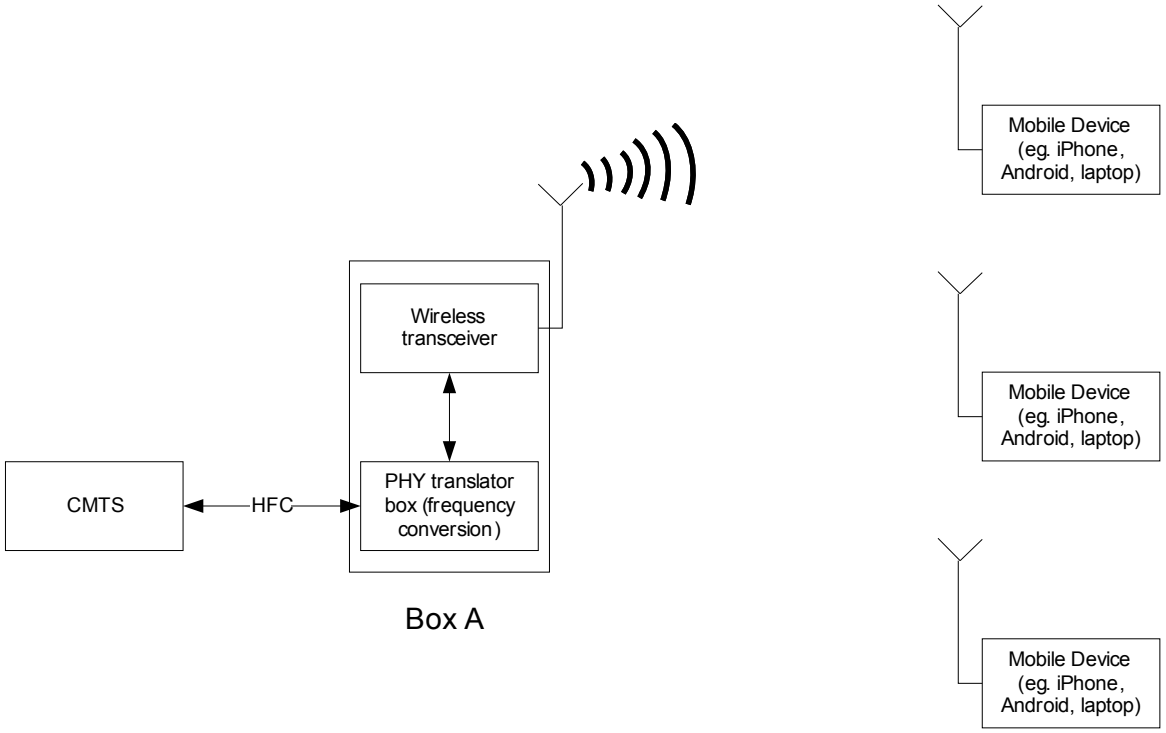
Between the CMTS and Box A, any portion of the traditional HFC network can exist. Between Box A and mobile end devices, any radio frequency range suitable for wireless transmission to portable devices is used.

The mobile end devices use a combination of wireless transceiver and integrated DOCSIS cable modem. This technology is integrated into existing portable consumer electronic devices such as smartphones, PDAs, laptops, or adapters.

Without any modification to the DOCSIS protocol, the communication from the headend to the mobile end devices remains point to multi-point, with the CMTS acting as the central scheduler. On the downstream the CMTS utilizes its existing downstream scheduler to transmit to the multiple mobile end devices at different time slots, frequency range, or other multiplexing domains. On the upstream, the CMTS sends MAP messages to allocate transmission time slots to each mobile end devices. Because both the downstream and upstream transmissions are time, frequency, or code multiplexed, collision is avoided on the wireless link.

The PHY translator box takes the downstream DOCSIS traffic and converts it to the appropriate wireless frequency range and formats it for wireless transmission. For the upstream transmission, the PHY translator box takes the upstream wireless traffic and converts it back to the HFC frequency range determined by the CMTS and reformats it to the DOCSIS format. The PHY translator box also adds a jitter buffer on both the upstream and downstream, to account for the propagation delay changes on the wireless link due to mobility of the mobile device. The jitter buffer should be sized to 1.6 usec (2 x 800 nsec) per 1-mile radius.

The wireless transceivers integrated in Box A and the mobile end devices are responsible for synchronizing the wireless link between them. Like traditional DOCSIS, one or more downstream channels and one or more upstream channels can be assigned to the HFCW network. Box A is also responsible for Frequency Mapping between the wireless frequency and the frequency range used for DOCSIS channels.



This idea can apply to other wired point to multi-point access technologies such as EPON.

Timing / ranging tolerance

The maximum amount of plant timing drift specified under DOCSIS protocol is 800 nsec (see Table III-1 in CM-SP-PHY specification) in TDMA. This invention can be applied to

two mobile use cases: walking (2 mi/hr or 3 ft/sec), and driving (< 35 mi/hr or 50 ft/sec). The propagation delay is 1.5 ns/ft for fiber. Typically, the CMTS unicast ranging interval is set at 10 sec. This translates to a maximum delay variation of 45 nsec (1.5 ns/ft x 10 sec x 3 ft/sec) for the walking case, and 750 nsec for the driving case. Both cases are under the maximum peak to peak delay variation of 800 nsec. Therefore, mobile DOCSIS can be supported at speeds of up to (about) 35 mi/hr under existing DOCSIS requirements.

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

This invention was developed to address the following potential opportunities for the cable operators:

1. Replace and / or backup for the residential broadband services;
2. Expand the DOCSIS protocol to new mobile devices such as iPod or iPhone. The mobile devices will need to have an embedded DOCSIS chip;
3. Expand the business services opportunities through last mile extensions.

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

This invention disclosure provides the MSOs a new way to provide mobile broadband services without requiring an investment in the cellular infrastructure and technologies, e.g., 3G.

4. HOW is this invention different from existing products, processes, systems?

a) There are several DOCSIS over fixed wireless network products such as the ARRIS WiDox.

- http://www.wwpi.com/index.php?option=com_content&task=view&id=812&Itemid=44
- http://www.tacticalteam.net/documents/wireless_DOCSIS.pdf
- http://www.arrisi.com/products/widox/overview.asp
- http://www.cableaml.com/ing_wirelessint_docsis_overview_and_key_features.html

Our proposal differs from the above in that all existing products are focused on fixed wireless networks, and they all terminate the DOCSIS transmission at the fixed CM. Our proposal addresses DOCSIS for mobile wireless devices which have different characteristics than fixed devices.

b) This patent proposes translating DOCSIS MAC Management Messages into another access network protocol.

- http://www.faqs.org/patents/app/20090044240
  "METHODS AND SYSTEMS FOR DELIVERING DOCSIS SERVICES OVER HETEROGENEOUS ACCESS NETWORKS"

In contrast, our idea is to transparently bridge the DOCSIS control messages and data PDUs upstream and downstream.