Fibre Access Extension – Reusing The In-Building Coaxial Cabling for Multi-Gigabit Performance

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## Challenges In MDU GPON Deployments

<table>
<thead>
<tr>
<th>Potential Barrier</th>
<th>Potential Delay</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>New cabling</td>
<td>Several months</td>
<td>Approval from all condo owners</td>
</tr>
<tr>
<td>Cable construction work in apartments</td>
<td>Several months</td>
<td>Condo owner don’t see any benefit of new wiring</td>
</tr>
<tr>
<td>Apartment installation</td>
<td>Several weeks</td>
<td>Key handling and access to apartments</td>
</tr>
<tr>
<td>Reluctant to convert to fibre services</td>
<td>Length of existing subscription contracts</td>
<td>Understand the benefits with fiber based services</td>
</tr>
<tr>
<td>In-building wiring cost (paid by building owner)</td>
<td>Depending of annual condo meeting</td>
<td>Need to be approved by a majority</td>
</tr>
</tbody>
</table>

Reduce Deployment Barriers  ➡️ Use existing infrastructure
**Existing MDU Infrastructure – Coax or Copper**

<table>
<thead>
<tr>
<th>Cable Attribute</th>
<th>Coax Cable Network</th>
<th>Twisted Pair Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of in-building wires</td>
<td>☺</td>
<td>☹</td>
</tr>
<tr>
<td>Cable availability at entry point</td>
<td>☺</td>
<td>☺</td>
</tr>
<tr>
<td>Cabling reach home location of TV-set</td>
<td>☺</td>
<td>☹</td>
</tr>
<tr>
<td>Low cable attenuation @ high frequency</td>
<td>☺</td>
<td>☹</td>
</tr>
<tr>
<td>Support for multi-gigabit</td>
<td>☺</td>
<td>☹</td>
</tr>
<tr>
<td>Roadmap for 10 gigabit</td>
<td>☺</td>
<td>☹</td>
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</tbody>
</table>
## Coax Access Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>DL 900 Mbps / UL 100 Mbps</th>
<th>UL 100 Mbps</th>
<th>Supports only point-to-point topologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>G.fast over coax (106 MHz profile)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G.fast over coax (212 MHz profile)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G.hn (200 MHz profile)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MoCA Access 2.5</td>
<td></td>
<td></td>
<td>Not a baseband technology</td>
</tr>
</tbody>
</table>

**Best technology match to GPON fibre access extension**

MoCA Access 2.5
Coax Network Topologies

• Star, cascade, tap and tap/splitter
• Point-to-point and point-to-multipoint
MoCA Overview

- Alliance established in 2004.
- Fastest and most reliable home networking technology standard available.
- Actual data rates (MAC):
  - 1 Gbps (MoCA 2.0)
  - 2.5 Gbps (MoCA 2.5)
  - 10 Gbps (MoCA 3.0)
- Uses existing coaxial cabling. Not dependent on type or age of wiring.
- MoCA in deployment by cable, telco and satellite operators worldwide.
- More than 270 million chipsets in the field.
- 228 certified products.
- MoCA Access 2.5 in trials at operators in Europe and China.
MoCA Technology Roadmap

Numbers shown indicate actual data rates.

MoCA 1.0
100 Mbps

2005
MoCA 1.0 Field Tests
Demonstrated 100+ Mbps in 97% of all outlets
250 homes (U.S.)

MoCA 1.1
175 Mbps

2006

MoCA 2.0
1 Gbps

2007
MoCA 2.0 Field Tests
Demonstrated 400 Mbps in 90% of all outlets
212 Homes (U.S.)

MoCA 2.5
2.5 Gbps

2010

MoCA Access™ 2.5
2.5 Gbps

2015

MoCA 3.0
10 Gbps

2018
MoCA Wi-Fi® Mesh Field Tests
- MoCA 2.0: 800 Mbps in 100% of homes
- MoCA 2.0: 900 Mbps in 75% of homes
- Orbi: 300 Mbps in 50% of homes
- Eero and Plume: less than 200 Mbps
MoCA Access 2.5 Features

- Transparent IEEE802.3 bridge
- MAC speed up to 2.5Gbps (DL:2.5/UL:2.0)
- Configurable DL/UL ratio
- Profiles for 1.0 /1.5/2.0 or 2.5Gbps MAC rates
- MAC using time division multiple access (TDMA)
- Supports up to 512 multicast addresses and full VLAN range
- Shaping and QoS up to eight classes
- Average latency < 3ms
- Max MTU size 2k
- Client node with three power states
- Frequency range 400-1675MHz
- Profile C 225MHz/profile D 300,400 or 500MHz bands with channel bonding
- P2PM up 63 modems
- PHY using time division duplexing (TDD) and OFDM modulation
- Up to 1024QAM
- Packet error rates < $10^{-6}$ or $10^{-8}$
- Supports multicast over a coax link
- 5 pre-defined bands for AL-IP or co-exist TV services
- AES cryptographic algorithm with 128-bits key with AATEK refreshment within six hours
- Three power contours with 45dB, 55dB or 65 dB link budget
GPON Co-existence With TV
GPON Co-existence With Satellite
GPON Using Full Coax Spectrum
MoCA Access Principals

QoS, Shaping, Link Booking, Security, VLAN, IGMP, Management

Network Processor

MAC-PHY

MoCA 2.5

MAC-PHY

2 RF-channels, 200MHz
3 RF-channels, 300MHz
4 RF-channels, 400MHz
5 RF-channels, 500MHz
250 m

IEEE1905

MoCA Access MIB’s / TR-181 / YANG

CPE

Ethernet

CPE

Ethernet

CPE

Ethernet

INCOAX

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InCoax Fibre Access Extension Node

Key features:
• Accumulated 10 Gbps over four RF-ports
• Each RF-port delivers 2.5 Gbps
• Delivers IPTV, VoIP and high-speed Internet
• Operational bands between 400-1675 MHz
• Co-exist with terrestrial and cable-TV services
• Uses existing in-building coaxial cables
• Delivers broadband through existing antenna outlet
• Fast and cost-efficient in-building deployment
Questions?