Fibre Products
Industry Technical Working Group

11th January 2008
Andrew Sheppard, Senior Product Development Manager - Fibre Products
Disclaimer

• It should be noted that the proposals for the products outlined in this slide-pack represent Openreach’s current view of those products at the time of publication. These proposals may change through further development and feedback.

• The purpose of this slide-pack is to provide additional information to support CP development initiatives. It does not represent a finalised definition/specification of the products. Any developments carried out by CPs based on the contents of this slide-pack are entirely at the CP’s own risk.

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Agenda

• Introductions
• Updates from Previous Actions
• Interface / Handover Port Loading – User Case Examples and Rules
• Reminder of Design Assumptions
• Product Trials Update
• Future Meetings
• AOB
Updates from Previous Actions

John Higgins, Openreach
Interface / Handover Port Loading – User Case Examples and Rules

Amir Rashid - Ethernet Infrastructure Solution Design

Note: All Features discussed in these slides are subject to detailed design and successful testing
Information and Traffic Management Rules

• Product variants:
  – 135kps symmetrical (Engineered for Voice - VEP)
  – 0.5Mbps up / CIR = 0.5Mbps, PIR = 2.5Mbps down
  – 2Mbps up / 10Mbps down
  – 2Mbps up / CIR = 10Mbps, PIR = 30Mbps down
  – 2Mbps up / CIR = 10Mbps, PIR = 100Mbps down
  CIR = Committed Information Rate; PIR = Peak Information Rate

• Link capacity is 1Gbps including overheads
  – Actual user Ethernet throughput will be less

• Traffic Management Rules
  – Max 4094 (tbc) connections per CP handover port
  – CP can manage end users with permutations of product variants as they require within the limit of 4094 (tbc) connections
  – CP is responsible for ensuring that traffic is prioritised downstream and needs to decide what traffic is thrown away during contention
  – CP must use appropriate .1p markings to differentiate above CIR traffic where peak rate services are taken

• All figures are indicative and for illustration purposes only
Information and Traffic Management

• Following information applies to the scenarios illustrated in subsequent slides:
  – Total user traffic upstream
    • Excludes ‘Inter-Frame Gap’ + preamble
  – Total user traffic downstream
    • Excludes ‘Inter-Frame Gap’ + preamble
    • Traffic will be discarded downstream by CP during congestion
    • Downstream prioritisation scheme is CP’s responsibility within the CPs network, before handover to Openreach
    • Within Openreach network all traffic will be prioritised and allocated bandwidth as appropriate to product variant.
Scenario 1

- Excessive 10Mb product variant connections:
  - 135Kb - 100 End Users = 13.5Mb down & up
  - 2.5Mb - 60 End Users = 150Mb down (30Mb up)
  - 10Mb - 150 End Users = 1.5Gb down (300Mb up)
  - 30Mb - 5 End Users = 150Mb down (10Mbps up)
  - 100Mb – 1 End User = 100Mb down (2M up)

- Total user traffic upstream = 355.5Mbps*

- Total user traffic downstream = 1913.5Mbps*

* If all End Users simultaneously transmitting at maximum rate.
Scenario 2

- Excessive 30Mb and 100Mb product variant connections:
  - 135Kb - 100 End Users = 13.5Mb down & up
  - 2.5Mb - 60 End Users = 150Mb down (30M up)
  - 10Mb - 10 End Users = 100Mb down (20M up)
  - 30Mb - 40 End Users = 1.2Gb down (80M up)
  - 100Mb – 10 End Users = 1Gb down (20M up)

- Total user traffic upstream = 163.5Mbps*
- Total user traffic downstream = 2463.5Mbps*

* If all End Users simultaneously transmitting at maximum rate.
Scenario 3

• Collective minor oversubscription across all connection types:
  – 135Kb - 400 End Users = 54Mb down & up
  – 2.5Mb - 200 End Users = 500Mb down (100M up)
  – 10Mb - 20 End Users = 200Mb down (40M up)
  – 30Mb - 10 End Users = 300Mb down (20M up)
  – 100Mb – 1 End User = 100Mb down (2M up)

• Total user traffic upstream = 216Mbps*

• Total user traffic downstream = 1154Mbps*

* If all End Users simultaneously transmitting at maximum rate.
Scenario 4

- Minor Oversubscription on each connection type:
  - 135Kb - 3000 End Users = 405Mb down & up
  - 2.5Mb - 500 End Users = 1.25Gb down (250M up)
  - 10Mb - 150 End Users = 1.5 Gb down (300M up)
  - 30Mb - 40 End Users = 1.2Gb down (80M up)
  - 100Mb – 4 End Users = 400Mb down (8M up)

- Total user traffic upstream = 1043Mbps*
  - Effects explored on following slide
  - All higher priority voice traffic let through
  - All (data) traffic within CIR has same priority
  - All (data) traffic above CIR and up to PIR has lower priority

- Total user traffic downstream = 4755Mbps*

* If all End Users simultaneously transmitting at maximum rate.
Scenario 4 – Upstream

Random discard

- Voice traffic always guaranteed throughput upstream
- Traffic discarded at random from all data traffic, once CIR to PIR traffic removed
- Randomness of discards means that no connection is guaranteed any bandwidth if all End Users transmit simultaneously
- Data connections within same priority level may experience different amount of discard regardless of CIR - Table below shows estimated throughput based on even random discards
- 10M, 30M and 100M GEA variants have same CIR upstream so treated the same

<table>
<thead>
<tr>
<th>Frame size (bytes)</th>
<th>Voice</th>
<th>Data (2.5M)</th>
<th>Data (10M)</th>
<th>Data (30M)</th>
<th>Data (100M)</th>
<th>Total (Mbps)</th>
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</thead>
<tbody>
<tr>
<td>64</td>
<td>405.00</td>
<td>139.85</td>
<td>167.82</td>
<td>44.75</td>
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<td>761.90</td>
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<td>142</td>
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<td>184.77</td>
<td>221.73</td>
<td>59.13</td>
<td>5.91</td>
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<td>405.00</td>
<td>193.57</td>
<td>232.28</td>
<td>61.94</td>
<td>6.19</td>
<td>898.99</td>
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<tr>
<td>2000</td>
<td>405.00</td>
<td>229.27</td>
<td>275.12</td>
<td>73.37</td>
<td>7.34</td>
<td>990.10</td>
</tr>
</tbody>
</table>
Scenario 5 - Excessive oversubscription on each connection type

- 135Kb - 500 End Users = 67Mb down & up
- 2.5Mb - 2500 End Users = 6.25Gb down (1250M up)
- 10Mb - 800 End Users = 8Gb down (1600M up)
- 30Mb - 200 End Users = 6Gb down (400M up)
- 100Mb – 10 End Users = 1Gb down (20M up)

• Total user traffic upstream = 3337Mbps*
  - In contract data traffic discarded

• Total user traffic downstream = 21317Mbps*

• Similar outcome as previous scenario:
  - Random discard of services within same priority level will not give any preference towards higher CIR.
  - Traffic above CIR but below or equal to PIR discarded first
  - Table below shows estimated throughput based on even random discards

* If all End Users simultaneously transmitting at maximum rate.

<table>
<thead>
<tr>
<th>Frame size (bytes)</th>
<th>Total traffic on link excl. IFG + preamble</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Voice</td>
</tr>
<tr>
<td>64</td>
<td>67.00</td>
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<tr>
<td>142</td>
<td>67.00</td>
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<tr>
<td>178</td>
<td>67.00</td>
</tr>
<tr>
<td>2000</td>
<td>67.00</td>
</tr>
</tbody>
</table>
Reminder of Design Assumptions

11th January 2008
Amir Rashid - Ethernet Infrastructure Solution Design

Note - All proposals discussed in slides are subject to detailed design and successful testing
GEA Design Assumptions (Day 1)

- IA for PPPoE is not part of the GEA solution
- Multicasting is not part of the GEA solution
- No traffic contention in the Openreach product. However, CPs can manage their own contention of customer VLANs through the Interface Handover port
- Single tagging of VLANs
- Use of T-CONT Type 3 for VEP product
- CPs will shape their downstream traffic into the Openreach port
- CPs to apply priority markings to traffic below and above CIR level for peak rate services
- Media and Signalling combined in a single VLAN
- Further investigation is being carried out into the management of traffic up to the ‘Peak’ Information Rate

Please advise if you have any difficulties with these assumptions
VEP Bandwidth & Bursting

- Detailed Design Work has shown that using T-CONT Type 1 (Fixed) does not meet requirement for 135kbps with a 7kbyte burst size.

- To allow for bursting to 20Mbps line rate (to limit jitter introduced by any signalling) we have decided to use T-CONT Type 3 (Assured + Non-Assured Bandwidth).

- Access to the 20 Mbps line rate is only available through a policer, which restricts data burst *volume*. The usable VEP service bandwidth is defined by the token bucket policer as 135 kbit/s Ethernet service bandwidth and a 7 kbyte burst size.
Traffic Pattern

Average will always be 135kbps

- The example above is based on Voice media using G7.11
- Voice Media would transmit at 115kbps, which means there would be an accumulation of tokens (up to 7kbytes)
- When a signalling burst occurs the traffic can burst to 20Mbps for 7kbytes, at which point the bucket would be emptied and would need to be re-filled, before another burst is allowed
- Over time the average will always be 135kbps, transmitting at 135kbps would provide no burst capability as tokens would be emptied at the rate of transmission.
GEA - Peak Traffic Management
GEA - Downstream Traffic Management

PIR 30Mbps
Non-Assured Bandwidth - Under congestion may be dropped
Any bandwidth above PIR dropped

CIR 10Mbps
Assured Bandwidth - Booked

0Mbps

Openreach policing rules above apply here
CP policing rules apply here

• Issue raised at previous meeting that Openreach may discard frames without any distinction.
  – Proposal would be that traffic is marked by CP with 802.1p markings
  – Incorrect police markings will be marked/treated by Openreach as Y (and may result in random discard of traffic under congestion scenarios)
  – Assumed that this meets CPs requirements (from last Workshop)
SoR Process

John Higgins
SoR Process

• Requirements agreed by Openreach customers within the Industry Working Group should be raised by a CP/Customer representative attending the meeting using the Openreach Statement of Requirement (SoR) template and process.

• The template and guidance for submission can be found at:

Trials Update

Andrew Sheppard
GEA Product Trial – Status Report

• 62 trialist premises at Kesgrave now enabled with fibre and receiving ‘pseudo broadband’ (10Mbit/s) service until GEA Product Trial starts. Initial end user feedback on this has been positive

• Openreach progressing internal technical trials in advance of the product trial.

• BT Wholesale have applied to take part in the Openreach GEA Product Trial and will bring SP customers to the trial in order to supply service to the end user trialists.

• Openreach is currently working with BT Wholesale to determine the scope of trial activity (fulfilment and assurance processes and fault ‘war-gaming’) as well as pre-trial preparation activity.

• Trial contract has been issued to BT Wholesale as the trialist and agreement on this is anticipated soon.
GEA Product Trial – Dates

• The EMP800 deployment is key to the trial. The launch date for this has been re-scheduled to April 26\textsuperscript{th} (from March 16\textsuperscript{th}). This is a consequence of the delay to the EMP700 release as previously communicated to customers on 24\textsuperscript{th} December. The trial is now planned to start on April 28\textsuperscript{th} as a result.

• The trial assessment period (as input to the GEA product launch decision) will still take place for 6 weeks.

• The trial is still planned to run for a 6 month period.

Note – Other CPs are not precluded from taking part in the Ebbsfleet pilot if they have not taken part in the product trial. Network and OSS/process test facilities would be made available for other CPs preparing to take live GEA service.
## Trial Update – Timeline

<table>
<thead>
<tr>
<th>Time</th>
<th>Task / Milestone</th>
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</thead>
<tbody>
<tr>
<td>3rd Dec 07 – 7th Jan 08</td>
<td>Develop Trial Scope (entry / exit / success criteria / scenarios) through dialogue with committed CPs. Note – <em>The Trial Ts and Cs doc will reference this</em>.</td>
</tr>
<tr>
<td>EXTENDED</td>
<td></td>
</tr>
<tr>
<td>7th Jan 2008 EXTENDED</td>
<td>CPs sign formal Trial Ts &amp; Cs document</td>
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<tr>
<td>11th Jan EXTENDED</td>
<td>Publish STIN (Supplier Trial Information Note) announcing to Ofcom / Industry the names of CPs taking part in the product trial</td>
</tr>
<tr>
<td>Jan – Mar (Dates TBC)</td>
<td>CP Captive Network Connectivity Testing – pre-trial proving of CP and Openreach network component interaction</td>
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<tr>
<td>IN PLANNING</td>
<td></td>
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<tr>
<td>3rd – 14th March TBC – Mid/Late March</td>
<td>CP Testing (Pre-Trial system and process proving)</td>
</tr>
<tr>
<td>28th Apr – 6th June</td>
<td>CP Product Trial takes place at Kesgrave</td>
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<tr>
<td>19th – 23rd May (TBC)</td>
<td>Trial review</td>
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</table>
Fibre IRS Product Trial

• The trial for this is planned to take place at Kesgrave.

• Openreach is working with Land Securities and the Fibre IRS technology supplier to plan this.

• Trial anticipated to start in May 2008
Future Meetings

Andrew Sheppard
## Industry Events – Diary

<table>
<thead>
<tr>
<th>Event</th>
<th>Date</th>
<th>Time</th>
<th>Location</th>
<th>Description</th>
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<tbody>
<tr>
<td>Openreach Future Access Forum</td>
<td>15th January 08</td>
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<td>BT Tower, London</td>
<td>FTTP Process &amp; Technical sub working group</td>
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<td></td>
<td></td>
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<td>14th February 08 am Process pm Technical</td>
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<td>BT Centre, London</td>
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<tr>
<td>Openreach Future Access Forum</td>
<td>13th March 08</td>
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<td>BT Centre, London</td>
<td>FTTP Process &amp; Technical sub working group</td>
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<td>10th April 08 am Process pm Technical</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BT Centre, London</td>
</tr>
</tbody>
</table>
Next Steps / Future Meetings

• Future topics for discussion?
  – Cost efficient GPON Access Network design

• Merge with Process Working Group or hold less regularly?

• Visit to Kesgrave Trial site?
AOB
Back-up Slides
Token bucket policing

- Bucket begins to fill to allow transmission at 135kbps
- Voice media packet requires transmission at 115kbps - therefore tokens begin to accumulate
- Bucket gradually fills up with up to 7kbytes worth of tokens

- Average rate will always be 135kbps
- Frame can only be transmitted if a token is available in the bucket
- Tokens added to support rate of 135kbps
- Tokens used at rate of 115kbps for voice media
- Difference in rates allows accumulation of tokens up to 7kbytes
- Accumulation of tokens allows bursting
- If token fill and use rate are equal (i.e. transmitting at 135kbps) there is no accumulation of tokens and therefore no burst capability.
Downstream Traffic – Customer Experience

• Customer experience with respect to bursting will change over time as GPON is loaded, larger splits are introduced (e.g. 1:128) and potentially if other higher bandwidth products are introduced

• Possible solution (needs further investigation with supplier):

- **ONT**
- **To CP1**
- **OLT cards**
- **To CP2**
- **Ethernet functionality**

2.5Gbps Downstream GPON Bandwidth

Contention/Policing to less than the GPON bandwidth to provide a consistent Customer Experience over time

• Would CPs favour this approach?
VLAN Forwarding at OLT – Solution Clarification

- Above scenario shows how VLANs can be re-used per CP handover port
- Combination of GEM port and VLAN(s) provide uniqueness on GPON system

Example OLT Forwarding table

<table>
<thead>
<tr>
<th>Handover Interface Port</th>
<th>VLAN Port</th>
<th>VLAN ID = 10</th>
<th>GPON System Port</th>
<th>VLAN ID = 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP Interface 1</td>
<td>10</td>
<td>GEM Port 1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>CP Interface 2</td>
<td>10</td>
<td>GEM Port 2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>CP Interface 2</td>
<td>11</td>
<td>GEM Port 25</td>
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