



## NGA and ALA

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# Overview

- Broadband competition
- Fostering NGA competition
- What is ALA ?
- Key High Level ALA Requirements
- Overall ALA architecture
- The ALA Service definition
- Access Loop Sharing
- ALA QOS
- Multicast
- ALA and wires-only
- ALA and GEA
- ALA Downstreaming

# What is NGA ?

- NGA = Next Generation Access
- Access technology that goes significantly beyond ADSL in terms of bit rate and service support
- The 2 examples considered here are FTTC-VDSL2, and FTTP-GPON

## Broadband competition

- ADSL based Broadband is a very competitive market
- This is due at least in part to:

### Local loop unbundling

- Allowing any CP to rent bare copper and install their own DSLAMs, backhaul etc in the exchange
  - competition in technology ADSL2+, Annex M
  - competition in services, especially peak bit rate

### A Wires-only interface

- CP can provide the HG
  - competition in HG functionality, design, performance
  - assists customer self install

***Providing NGA competition in the same way is difficult***

# NGA competition in FTTC

## Infrastructure unbundling

- The VDSL electronics has to be at the cabinet, not the exchange
- There are high fixed costs with each deployed cabinet
- The number of addressable customers per node is  $\ll$  than from the exchange
- Having more than one VDSL system at each cabinet location is unlikely to be economically viable
  - also planning permission issues with multiple cabinets

## Wires-only

- Self-install is more difficult with VDSL as a distributed micro-filter solution works less well than with ADSL
  - impact of the home wiring is much greater due to the higher frequencies

# NGA competition in FTTP

## Infrastructure unbundling

- Residential FTTP is normally delivered by a PON
- This is a shared, point to multipoint, infrastructure and so cannot be unbundled at the individual customer level

## Wires-only

- Having a wires-only (bare fibre) interface is risky as one ONT can adversely impact all the other users on the PON

So how is competition provided for NGA ?

# The Ofcom View

- Ofcom is responsible for fostering competition
- Needed a way of ensuring competition in NGA (VDSL and GPON) in the absence of infrastructure unbundling (duct, fibre, sub-loop copper)
- Undertook a lot of industry consultation
- Driven by the UK but looking for wider applicability (in and beyond the EU)

# ALA – Active Line Access



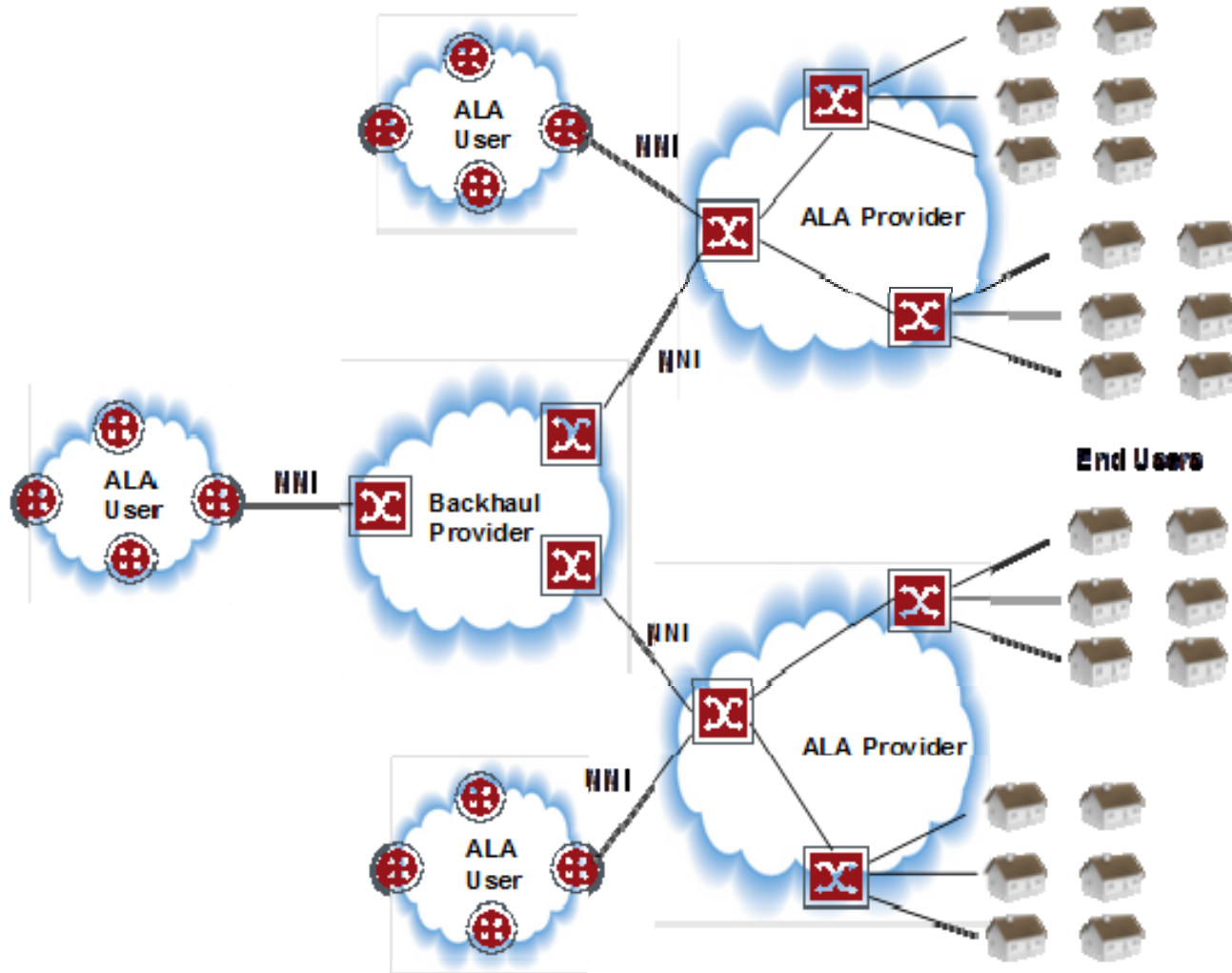
## What is ALA ?

- Bitstream access product
- Layer 2, Ethernet service, with hand-off at various backhaul locations
- Supports a multi-CP, multi-edge, multi-service model

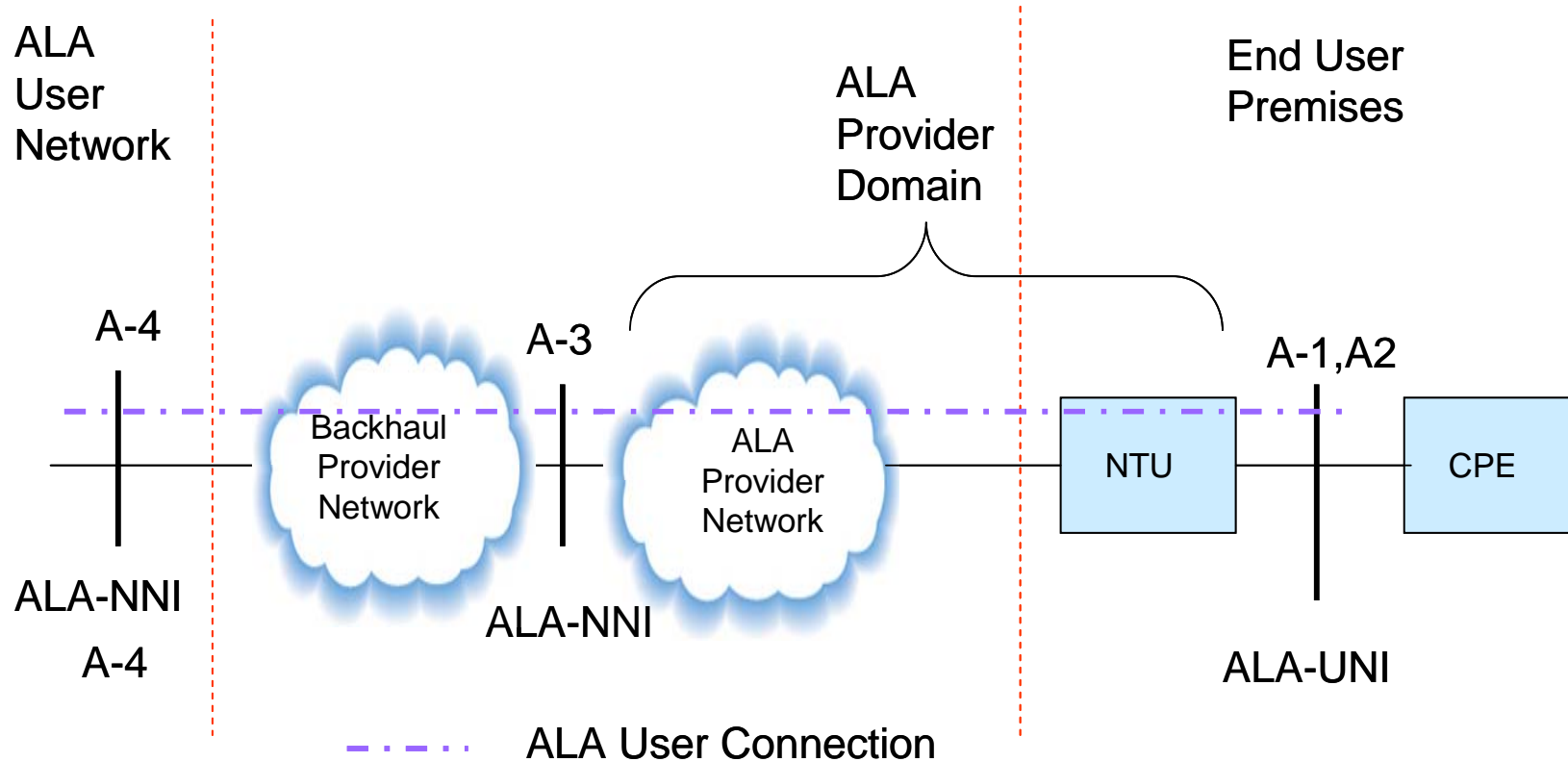
### Roles

- ALA Provider – provides the ALA infrastructure (active and passive) and sells wholesale services to.....
- ALA User – who is a Communications Provider who sells retail services to....
- The end-user
- Also need a backhaul provider whose existence is presumed, interfaces via a defined NNI
  - actual backhaul service is out of scope of ALA

# Example ALA Network



# ALA Architecture



- ALA provides Ethernet connectivity for an ALA User between a handoff at the NNI and a UNI at the end-user premises

## 5 Key Elements of ALA (Ofcom)

Must provide

- QOS support
  - for multiple service types
- Multicast Support
- Flexible interconnect
  - location and degree of aggregation, but subject to commercial reality
- Security (of connectivity)
- Support for different types of CPE

# High Level ALA Requirements

- Residential focus
  - already good competition in high-speed business access
  - must scale to massive deployment and operation
  - but business support also desirable if this can be achieved without significant additional complexity
- Multiservice support
  - not just a bandwidth or best-efforts product
- **Multi CP support**
  - **must be able to provide simultaneous (multiservice) support for more than one ALAU on a given access loop**
- No presumption about the network beyond the ALA segment
- Technology agnostic
  - same kind of service delivered over FTTP and FTTC

*NICC ALA WG set up to turn these high level requirements into something that could ultimately result in ALA products and ALA equipment support*

# ALA Service Requirements

- ALA is a Layer 2 service that needs to be able to support a variety of CP end-user services
- Need an abstract service definition based on generic service types
- The service parameters are defined, but not the *values* of those parameters
  - this allows ALAP differentiation
- Want the minimum possible set of quantified parameters commensurate with the service type support
  - minimise OSS development and OPEX
- Need to define the per ALAU per line service, and the aggregate service at the handover point
  - want to be able to support uncontended and contended handover

# The ALA Service

- ALA provides an AUC (ALA User connection) between the NNI and UNI
- 2 types of connectivity, point to point and point to multipoint (for multicast)
- Each p2p AUC supports up to 4 Classes of service
- These Classes have bandwidth profiles, and relative priority
- There are aggregate bandwidth profiles at the NNI
- Assured and burst bitrates are supported
- Some Classes have defined latency and jitter

**Table 8.1: ALA Classes of Service**

Class	Typical Use
A	Realtime, delay sensitive applications e.g. voice
B	Streaming applications (video)
C	Internet data
D	Guest or 3rd party Access

What's  
this ?

# Service Types

Adopted a first principles approach

4 basic types

1. Real time, delay sensitive

- real time interactive comms, especially voice, games etc.
- typically modest bandwidth

2. Assured rate, less delay sensitive

- e.g. unicast video streaming
- typically higher bandwidth

2a. Multicast video streaming

- only difference is the injection point

3. Data, delay insensitive

4. Defined data share between 2 data services on a given line

- e.g. guest or hotspot access, push VOD



# ALA Service Attributes

<b>Class</b>	<b>CIR</b>	<b>CBS</b>	<b>EIR</b>	<b>EBS</b>
A	C1	CB1	-	-
B	C2	CB2	-	-
C + D	C3	CB3	E3	EB3

<b>Class</b>	<b>One-way Frame Delay</b>	<b>Inter-Frame Delay Variation</b>	<b>Frame Loss Ratio</b>	<b>Availability</b>
A	M	M	M	M
B	O	M	M	M
C + D	O	O	M	O

- In addition there is a defined hierarchy
  - A-B-C/D
  - subject to per class policing
- There is a defined weight between C and D
- There is a defined (data) weight between multiple ALAUs on the same loop for sharing burst capacity

## Sharing the Access Loop

- Current ADSL Broadband model has a single CP per line
  - this CP 'owns' the CPE and the customer
- Both VDSL and FTTP can provide higher access bandwidths
- With bitstream access, can in principle support more than one CP per access
- Is there a business reason for doing so ?
- Expectation is there will normally be one multi-play CP per line
- But in addition there could be 'secondary' providers of:
  - a work at home service – corporate data and voice
  - a second voice service, business, or corporate voice
  - a (second) video only service
  - a utility service – smart metering, security
- There are business reasons for loop sharing
- Main problems are how to share the bandwidth and manage the QOS

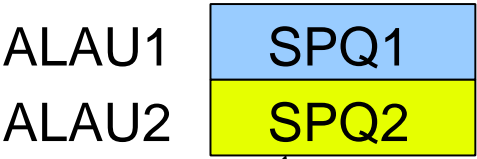
## How to share the access bandwidth

- Could simply have hard bandwidth segmentation between ALAUs on a line
  - i.e. dedicated, sterilised bandwidth
- Data products typically support minimum and burst rates
- Hard segmentation may be OK for GPONs, but not for VDSL
- VDSL line rates vary with time
- If hard segmentation is done on the burst rate, this leads to very inefficient sharing of access bandwidth >> lockout, product inflexibility

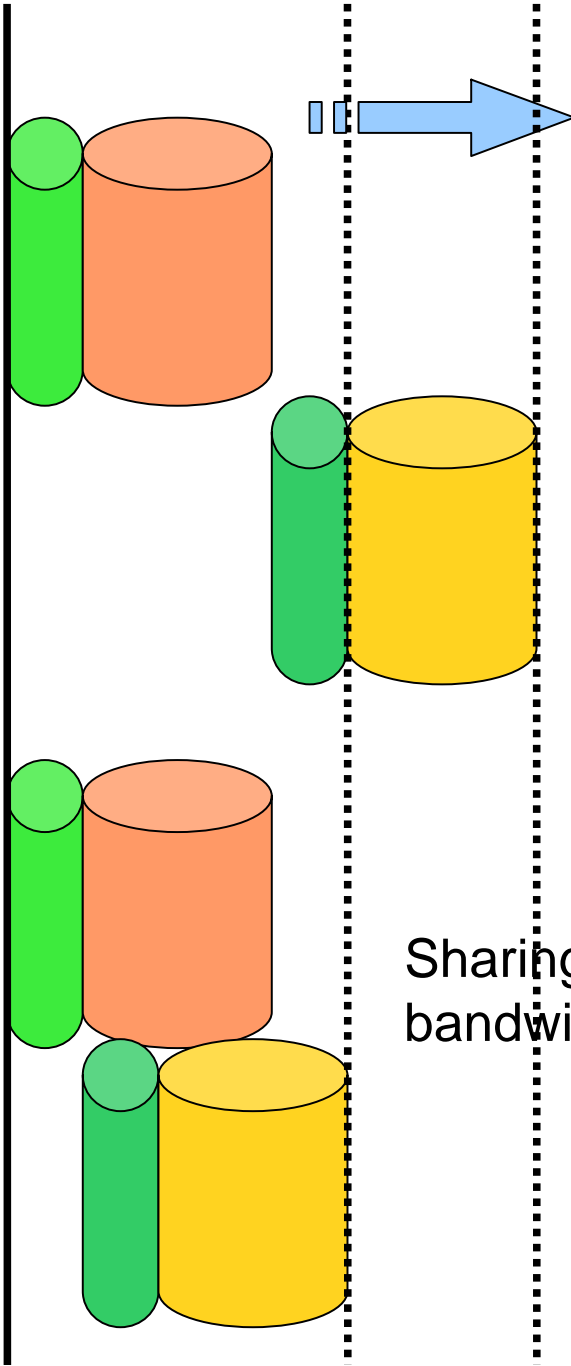
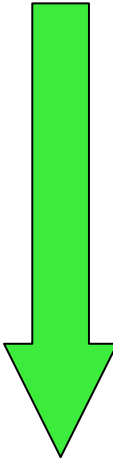
## How to manage QOS on a shared loop

- Common QOS schemes define a set of packet classifications and treatments
- It is then up to the CP to decide how to map services to QOS classes
- Strict priority queues (SPQs) are often used in whole or in part – for simplicity
- Problem with SPQs is they can starve all lower priority queues
- If a CP does this to his own traffic then it is his problem
- If he can impact other CPs (ALAUs) then it become someone else's problem
- This must be avoided

# The 2 QOS problems



Starvation, or non-deterministic jitter



Sharing peak bandwidth

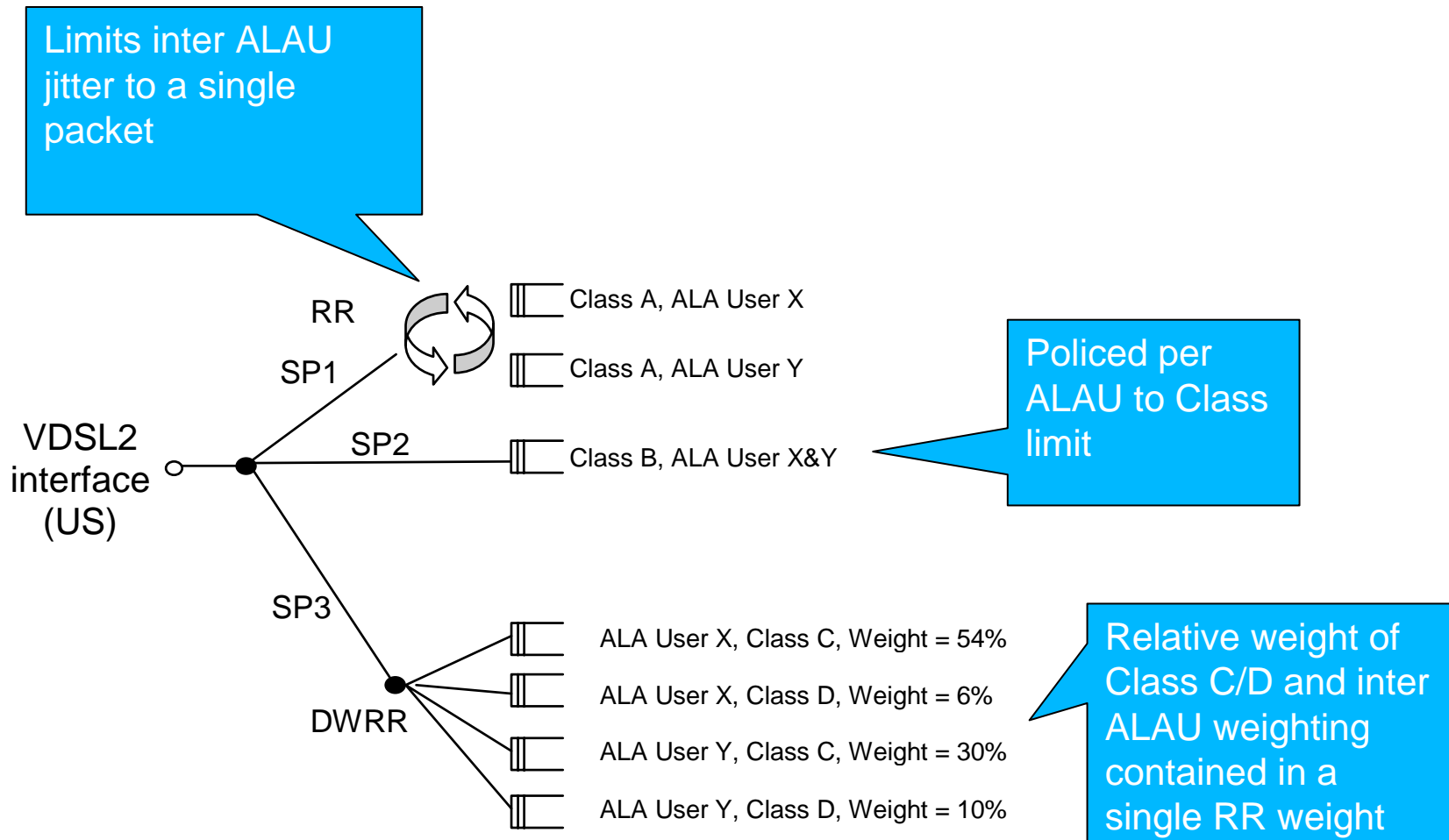
# High-level QOS requirements

- Need to be able to protect the QOS between different ALAUs on the same line
- Need to define a set of packet treatments but then allow the ALAU to use these as he sees fit without impacting other ALAUs
- Need to be able to share some of the capacity on a given line between ALAUs
- Need the same scheme to work for both VDSL and GPON
- Need to be able to support contended and uncontended handover
- Need to be able to dedicate and to share handover ports
- The QOS scheme must take into account multicast traffic generated in the ALAP's network

## Possible QOS control points

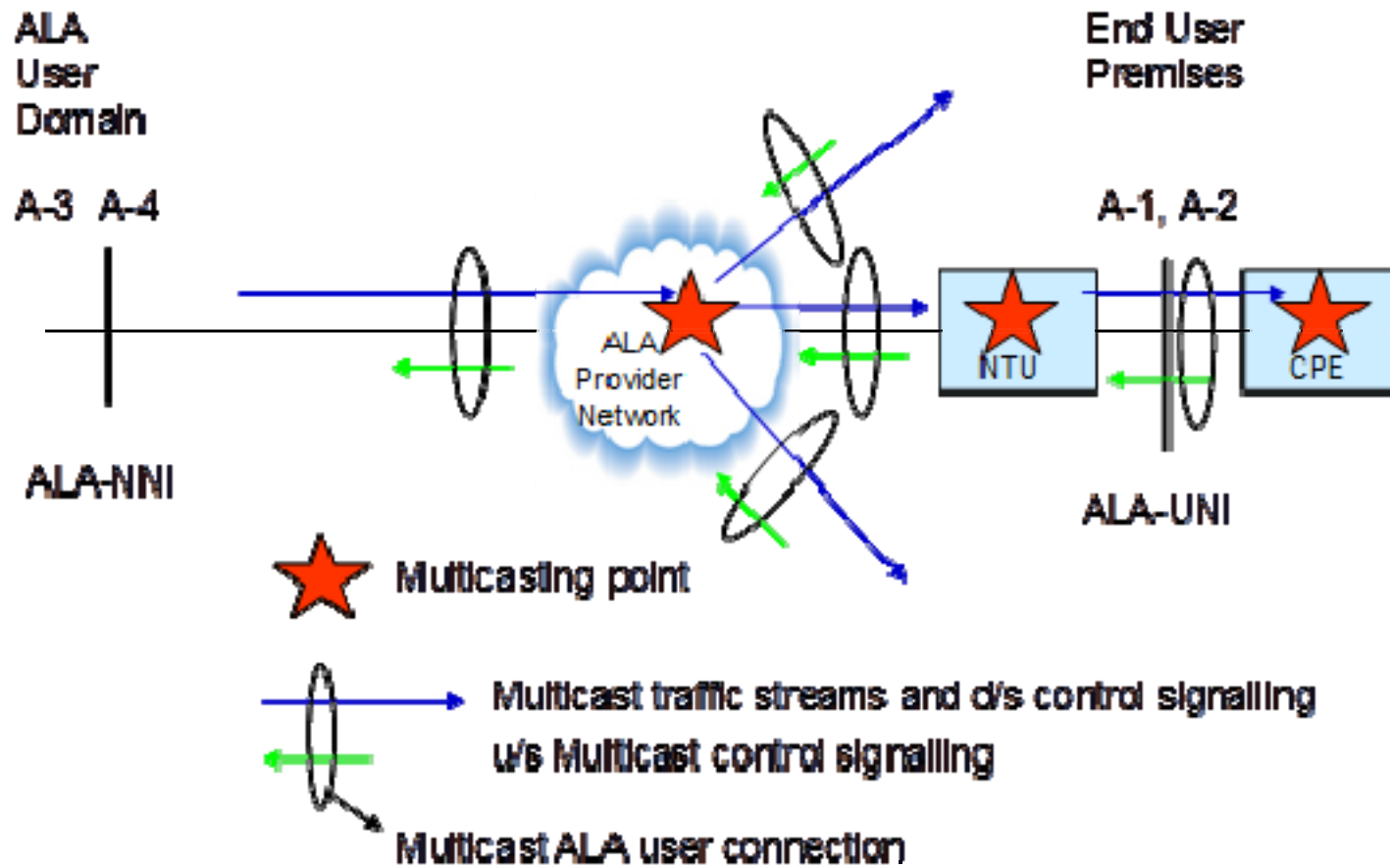
Location	US	DS
UNI	<p>Prioritising US when LAN rate &gt; WAN</p> <p>Managing QOS between ALA users on the same line</p>	n/a
AN	n/a	<p>Prioritising when backhaul rate &gt; access line/product rate</p> <p>Managing QOS between ALA users on the same line</p>
NNI	Supporting contended handover	Ensuring Class aggregates are adhered to

# Example QOS implementation at an upstream VDSL UNI

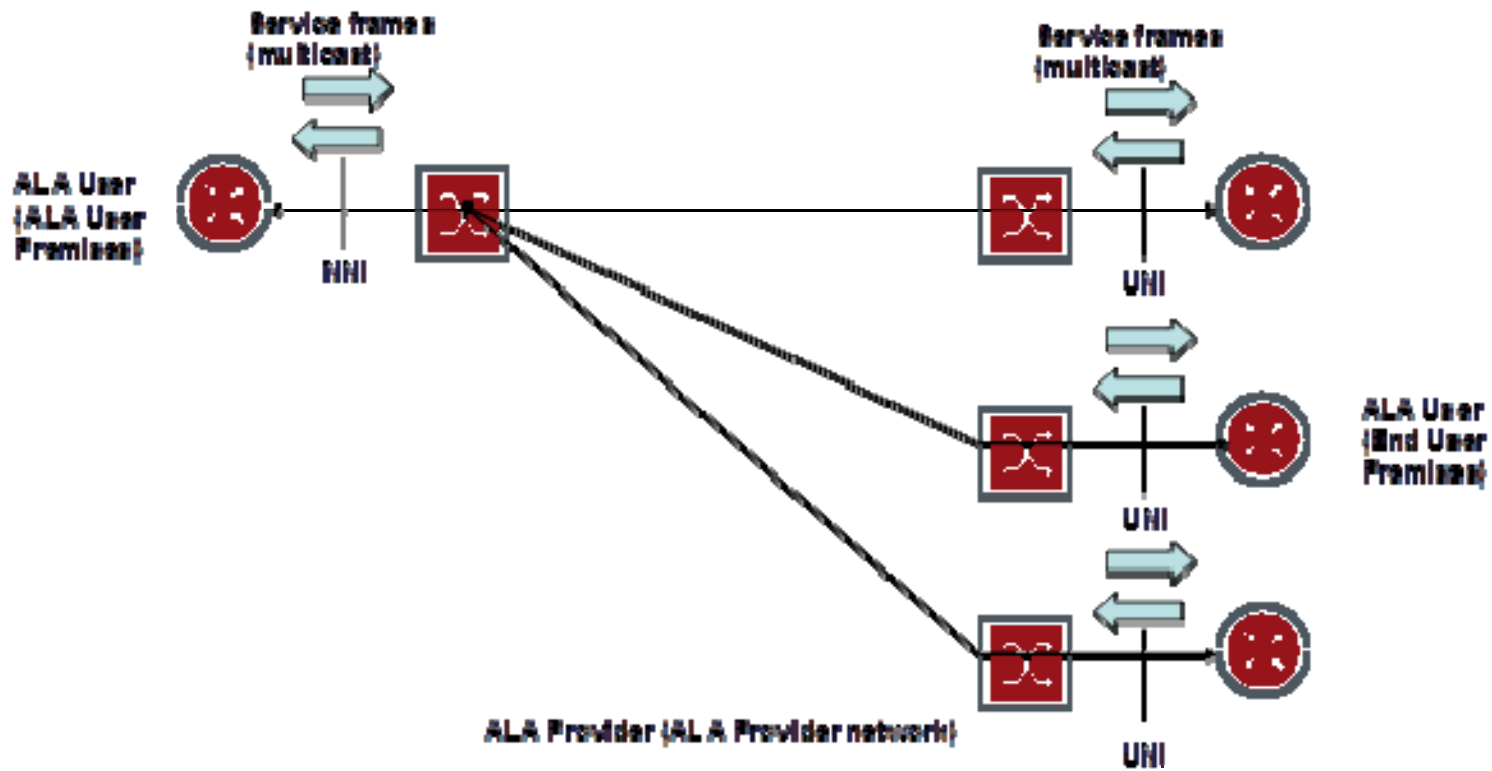




# Multicast Architecture



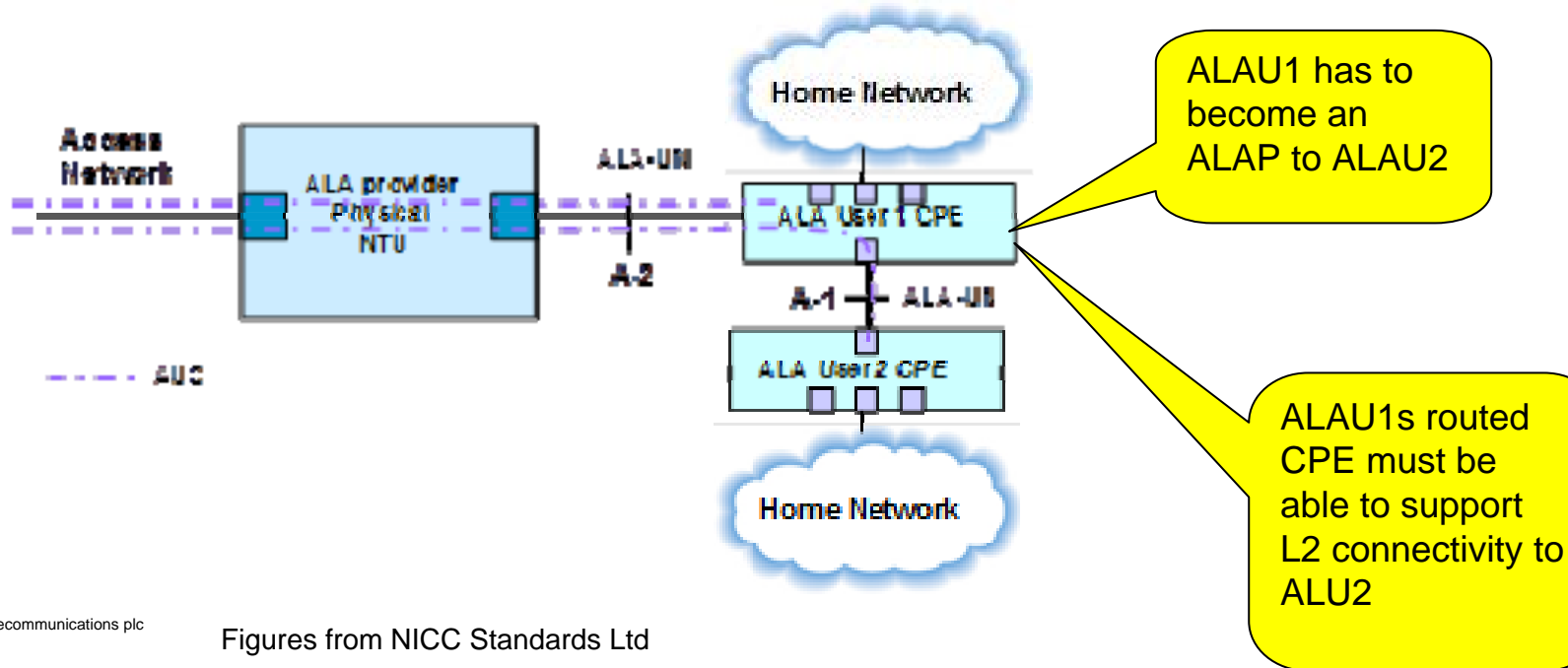
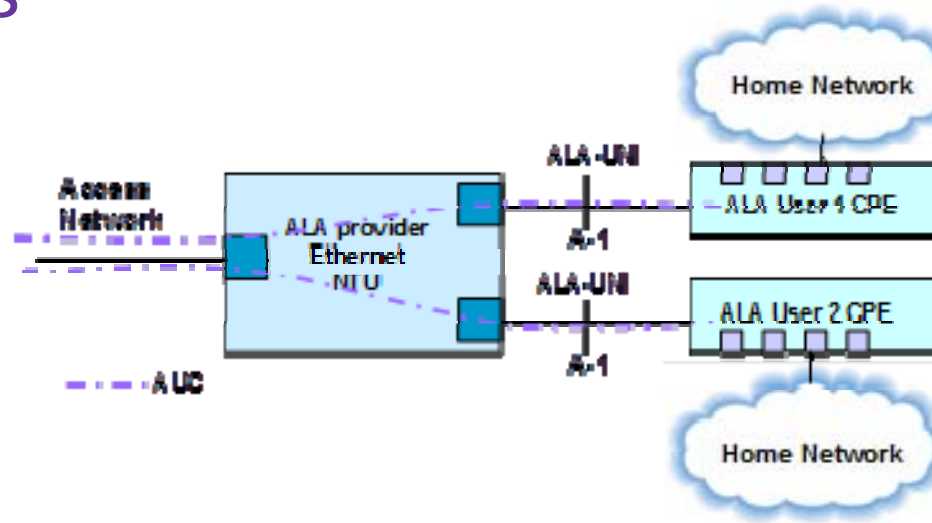
# Multicast AUCs



## Wires-only ALA

- In spite of the ALA name, Ofcom very keen on a wires-only presentation variant
- This will have a product impact, and may have a performance impact
- The ALA service is no longer technology agnostic
- Some particular ALAP concerns about third party ONTs due to the shared medium nature of PONs
  
- How does loop-sharing work in a wires-only environment ?

# UNI Configurations and wires-only



# ALA and GEA

- Not going to do a detailed comparison here
- GEA pre-dates ALA
- GEA also had extensive industry consultation
- No surprise that there are great similarities
- There are currently some differences:
  - Loop sharing (VDSL)
  - QOS details (particularly associated with loop sharing)
  - OAM
- It is a matter for individual ALAPs to decide how and when to implement ALA features in their products, subject to normal commercial demand

# ALA Status and Downstreaming



- There are 4 documents in the ALA set
  - Architecture, Service (SLS), UNI and NNI
- 3 have completed WG review and just gone to the TSG
- The (slim) NNI is undergoing WG review
- Aim is publication by the end of the year
- Then will be liaised to the appropriate SDOs, with an impact analysis

# Acknowledgements

- This work is due to the combined efforts of the small (but perfectly formed) ALA WG
- Like to acknowledge the contribution of all members of the WG but in particular the Chair and editors
- This has also drawn heavily on the work of the MEF
- Good initial engagement from the BBF and more recently the HGI

# Thankyou