nbn™ HFC Pilot Review

18th February 2016

For further information, please contact:

Nigel Pugh, APAC Consulting Director

Table of Contents

Summary

nbn™ (**nbn)** has commenced a series of HFC construction and commercial pilots across NSW, Queensland and Victoria. Ovum has been asked to review the results of **nbn**'s commercial HFC pilot in Redcliffe, Queensland.

The pilot is being conducted on the Optus HFC network running DOCSIS 3.0 technology and is currently running tests across approximately twenty end users. Three RSPs are currently participating in the pilot: Telstra, iiNet and Exetel.

The pilot has been successfully delivering Layer-3 peak speeds at up to 100Mbps downstream and up to 40Mbps upstream during the period 1 Dec 2015 – 20 Jan 2016 over the RSPs networks. Given the test configuration placed the test devices in parallel with the end users, speeds throughout the day were also dependent on the activities of the end users. **nbn** calculated average Layer-3 speeds at 84 Mbps downstream and 33 Mbps upstream over the same test period.

nbn has been able to deliver these speeds through a redesign of the HFC network by utilizing faster modulation rates and ensuring the number of premises at the node does not exceed their specifications. **nbn** is confident its proposed HFC broadband speeds can be delivered across its HFC network moving forwards through a number of initiatives including detailed network planning, node splitting and a move to DOCSIS 3.1.

Globally, only a small number of operators currently offer upload speeds greater than 20 Mbps which positions **nbn**'s HFC service amongst the fastest upload speeds currently in the global market. Cable broadband continues to be a major broadband delivery method around the world. Indeed, Ovum estimates there are approximately 150 million cable broadband connections globally representing 20% of the global broadband market. The strong base of established cable broadband subscribers combined with opportunities to upgrade cable networks to DOCSIS 3.1, will continue to ensure that cable broadband remains a major broadband technology.

nbn HFC Pilot

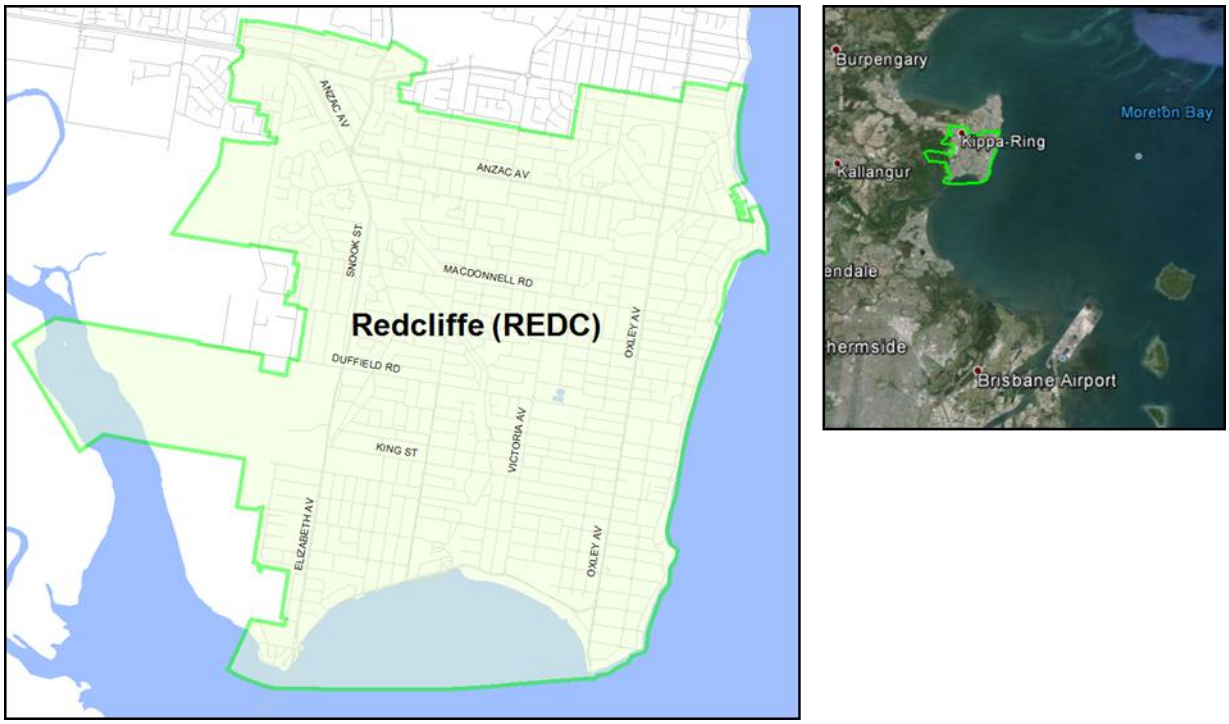
nbn has commenced a series of HFC construction and commercial pilots across NSW, Queensland and Victoria. These pilots will test a range of factors including:

- the construction processes for lead-ins to premises;
- improvements to network capacity;
- speed performance monitoring;
- RSP on-boarding.

nbn has asked Ovum to review the results of the commercial HFC pilot in Redcliffe, Queensland. The Redcliffe pilot commenced in November 2015 and will conclude on February 23rd 2016.

Figure 1 below shows the trial area and location (just north of Brisbane Airport). Within the trial area there are 18,881 premises and a potential HFC base of 4,500 premises (all lead-ins are aerial).

Figure 1: Redcliffe, Queensland Trial Area



Source: **nbn**

The pilot is being conducted on the Optus HFC network (Fitzgibbon Exchange) running DOCSIS 3.0 technology and is currently running tests across approximately twenty end users.

The following three RSPs are currently participating in the HFC Pilot:

- Telstra;
- iiNet;
- Exetel.

The **nbn** HFC service being tested in the pilot has the following product characteristics:

- Ethernet Bitstream service

- Traffic Class TC-4 up to 100/40 (note the pilot is not testing TC1)
- DOCSIS 3.0 NTD + RSP supplied Gateway/Modem
- Single Port NTD

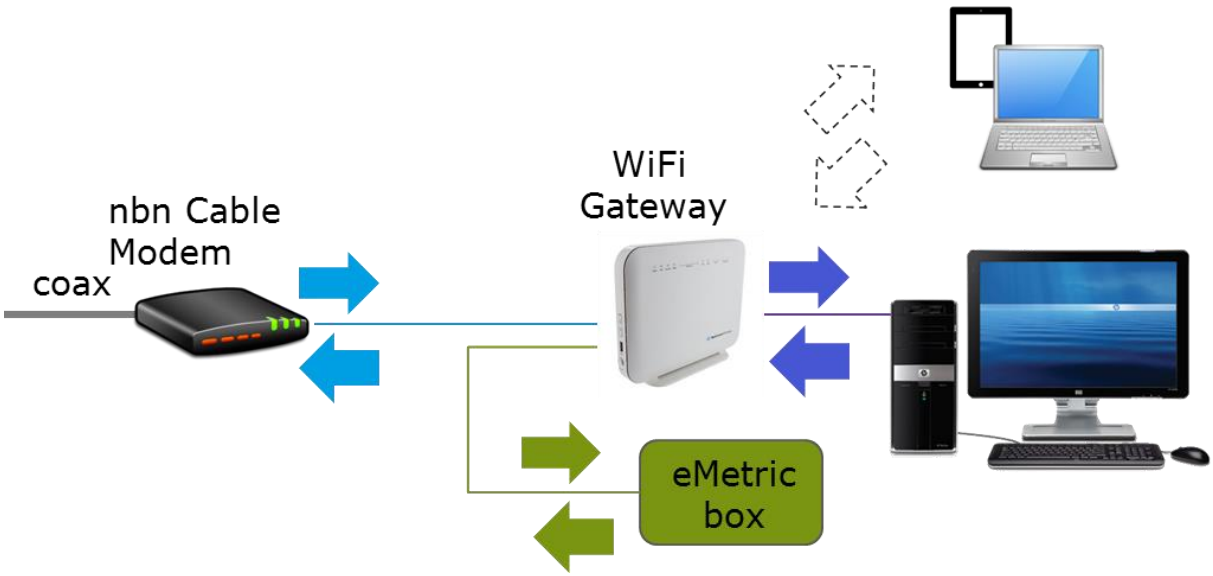
Pilot User Experience Test Configuration

In order to understand the end user experience throughout the duration of the Pilot, **nbn** engaged Test Lab to supply a number of Enex eMetric devices to be installed at the end user premises.

The eMetric box is a hardware device designed to automatically measure and report on network performance. The device can discretely test for features such as network performance (download and upload speeds) and network latency.

As shown in Figure 2 below, the eMetric device connects to the RSP's gateway/router through an Ethernet cable plugged into the network port, and a power adapter is plugged in to the device and onto the main power. The configuration does not monitor internet usage.

Figure 2: End user eMetric device configuration

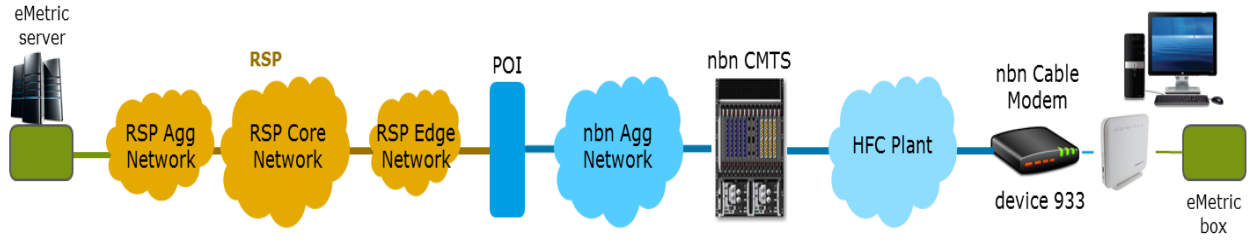


Source: **nbn**

Ovum notes that the eMetric devices were placed in parallel with the end user gateway. As a result the end user device(s) and the eMetric device competed for bandwidth – especially during peak periods. However, the tests were done across a range of users, over several weeks and at different times of the day hence providing a good (if not conservative) overall view of average speeds. In addition, the eMetric configuration performed multiple threads/tests simultaneously which is appropriate for the HFC Access Network.

The eMetric server was positioned at the RSP hence measurement data was taken across both the RSP and **nbn** networks – see Figure 3 below.

Figure 3: Positioning of eMetric service and end user device



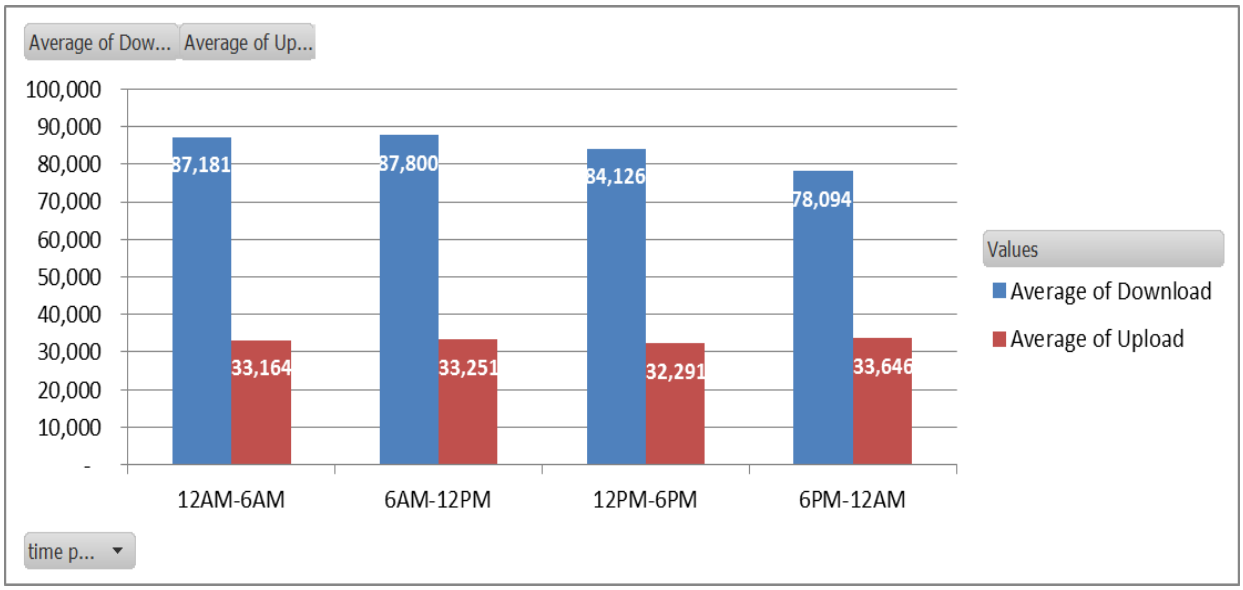
Source: **nbn**

Pilot User Experience Test Results

The Layer-3 speeds recorded for the **nbn** Redcliffe HFC 100/40 pilot service averaged at 84 Mbps downstream and 33 Mbps upstream (based on test data from 1 Dec 2015 – 20 Jan 2016). The average download and upload speeds across 4 time of day periods is shown in Figure 4 below.

It should be remembered that the 84/33Mbps speeds were delivered over RSP networks at Layer-3 so were subject to various external factors not controllable by **nbn** and resulted in a lower speed than would be delivered over a Layer-2 **nbn** connection.

Figure 4: Average download and upload speeds (based on data from 1 Dec 2015 – 20 Jan 2016)



Source: **nbn** Redcliffe HFC Pilot test results

nbn recorded peak Layer-3 speeds at up to 100Mbps downstream and up to 40Mbps upstream during that same period (1 Dec 2015 – 20 Jan 2016) successfully proving the pilot configuration and **nbn** HFC service. As discussed previously, Ovum notes that given the eMetric tests were run in parallel with the pilot end users then lower average speeds would be expected.

In HFC networks, all premises served by a fibre-optic node share the bandwidth (capacity) of that node. Therefore, there are a maximum number of premises which can be served by one node in order to meet the expected take up of services across the defined products/speeds on offer by the operator.

Node splitting can be used to decrease the number of premises sharing the same node which in turn allows greater bandwidth to be offered to the remaining premises.

In discussions with **nbn**, Ovum asked how the pilot performance would translate to a greater number of end users across the HFC network. **nbn** is confident its proposed HFC broadband speeds can be delivered across its HFC network moving forwards through a number of initiatives including:

- Detailed network planning to understand and predict take-up rates across the range of services;
- Utilizing higher upstream modulation rates;
- Node splitting to ensure that the number of homes per node meets the forecast take-up rates;
- Constantly monitoring HFC network performance to ensure any network issues are remediated;
- Investing in the migration to DOCSIS 3.1 and the resulting performance benefits this will provide for both the upstream and downstream components.

HFC – The Global Context

HFC is a major broadband delivery method around the world. Ovum estimates there are approximately 150 million cable broadband connections globally representing 20% of the global broadband market. Although Ovum forecasts slowing growth for cable modem broadband globally, the strong base of established cable broadband subscribers combined with opportunities to upgrade networks to DOCSIS 3.1, will continue to ensure that cable broadband remains a major broadband technology.

Many cable operators see sense in using the existing cable asset and upgrading to DOCSIS 3.1 in areas where cable infrastructure already exists, because this avoids the high last mile roll-out costs of FTTH and keeps their products competitive.

Migrating to DOCSIS 3.1 means more capacity in the network, and hence higher speeds, with 10Gbps peak downlink speed and 1Gbps peak uplink speed. In reality, many operators will launch with a downlink throughput of around 1Gbps (100Mbps on the uplink) since the 10Gbps maximum speed will be shared between hundreds of households, although reducing the number of subscribers per port can help increase bandwidth per user.

Migrating to DOCSIS 3.1 is not just about speed enhancements, which of course, allow operators to provide higher performance services; the technology also improves intelligence in the network. For example, it enables operators to provide better network diagnostics, such as pinpointing bandwidth bottlenecks faster, active queue management and increases in cable modem energy efficiency.

Several operators globally have confirmed their plans to migrate to DOCSIS 3.1 including:

- Comcast (USA)
- TDC (Denmark)
- Rogers (Canada)
- SK Broadband (Korea)
- Liberty Global (UPC Broadband - Western Europe)

Cable operators on DOCSIS 3.0 already deliver a broad range of broadband speeds. Figure 5 below shows a number of operators globally who are all offering download speeds in excess of 100 Mbps with some offering download speeds up to 500Mbps. In the majority of these cases however, upload speeds remain at a 10:1 ratio with many operators offering upload speeds of up to 10 Mbps or 20 Mbps to their end customers.

Only a small number of operators currently offer upload speeds greater than 20 Mbps which positions **nbn**'s HFC service amongst the fastest upload speeds currently in the global market.

Figure 5: Selection of cable operator plans globally (download and upload speeds)

Country	***Operator***	***Download Speed***	***Upload Speed***
Australia	***Telstra***	***100 Mbps***	***2 Mbps***
Australia	***Optus***	***100 Mbps***	***2 Mbps***
Australia	***nbn***	***100 Mbps***	***40 Mbps***
Canada	***Rogers – 250***	***250 Mbps***	***20 Mbps***
Ireland	***Virgin Media (was UPC)***	***360 Mbps***	***10 Mbps***
Netherlands	***Ziggo***	***200 Mbps***	***20 Mbps***
Sweden	***Com Hem***	***500 Mbps***	***50 Mbps***
Switzerland	***UPC Cablecom – 250***	***250 Mbps***	***25 Mbps***
Switzerland	***UPC Cablecom – 500***	***500 Mbps***	***50 Mbps***
United Kingdom	***Virgin Media***	***200 Mbps***	***12 Mbps***
United States	***Comcast – extreme 150***	***150 Mbps***	***20 Mbps***
United States	***Comcast – extreme 250***	***250 Mbps***	***20 Mbps***
United States	***Cox Premier***	***100 Mbps***	***10 Mbps***
United States	***Cox Ultimate***	***150 Mbps***	***20 Mbps***

Source: Ovum. Note: these speeds are typically "up to" the advertised rate.

Appendix

Author

Nigel Pugh, Telecoms Consulting Director, APAC

nigel.pugh@ovum.com

About Ovum

Ovum is a UK headquartered analyst and consulting firm with global reach. It is part of Informa Group, the world's leading provider of business intelligence. Ovum's expertise extends across the Telecoms, ICT and Media and Entertainment markets to provide comprehensive market coverage.

Ovum research analysts maintain a continuously updated set of data analysis tools that provides detailed quantitative insights into market trends. We provide consulting advice on market, regulatory, technical and competition issues to both public and private sector organisations.

.

Copyright notice and disclaimer

CONTACT US

www.ovum.com
consulting@ovum.com

INTERNATIONAL OFFICES

Beijing
Dubai
Hong Kong
Hyderabad
Johannesburg
London
Melbourne
New York
San Francisco
Sao Paulo
Tokyo