What is Optical Fibre?

An optical fibre is a thin glass or plastic strand that carries light along its length. Light from lasers is shone down the fibre, and is detected by a receiver at the other end of the fibre. Due to their special design, the light within the fibre does not escape out of the sides of fibre (called total internal reflection) and the loss of the light is very low over the fibre length. Because they don't conduct electricity and lightning, optical fibre cables can be a lot safer than electrical cables because there's never a risk of receiving a shock. They are also immune from electrical interference caused by heavy industry or other appliances in the home.

Optical Fibre vs Copper Wires

Just as broadband consumers in other parts of the world have found, we don't expect the copper network to meet the future demands for bandwidth that Australian households and businesses will require. Optical fibre is a logical choice for 'future-proofing' the network as the need for higher speeds and usage continue to grow over time.

Optical fibre is capable of transmitting information at a practically unlimited rate over long distances of tens of kilometres. The kind of optical fibre services NBN Co is deploying can assure speeds of 100 Mbps and higher, that's 100 million bits per second – and order of magnitude greater than the broadband speeds most Australians currently receive on their old copper cables.

Network Topology – Passive Optical Network (PON)

The preferred solution world-wide for fibre networks to households is to deploy a 'shared' fibre service known as a Passive Optical Network (PON). The electrical equipment to 'drive' the optical fibre, including lasers, consumes power. This equipment is located in a central location, a Fibre Access Node (or FAN), and within the Optical Network Terminal unit at each home.

A PON uses small dedicated optical fibre runs from the home to a small cabinet in the street, known as a Fibre Distribution Hub (FDH). In this cabinet the individual fibres from a small number of homes (normally less than 32 homes) are combined together into a single fibre back to the central equipment (akin to a telephone exchange for fibre services). The PON therefore uses fewer lasers at the central equipment, and also significantly fewer fibres. As a result, the PON uses less power than dedicated fibre (an estimated saving of 30MW across Australia, where fibre is provided to 90% of premises[1])

Reduces the cost of network deployment

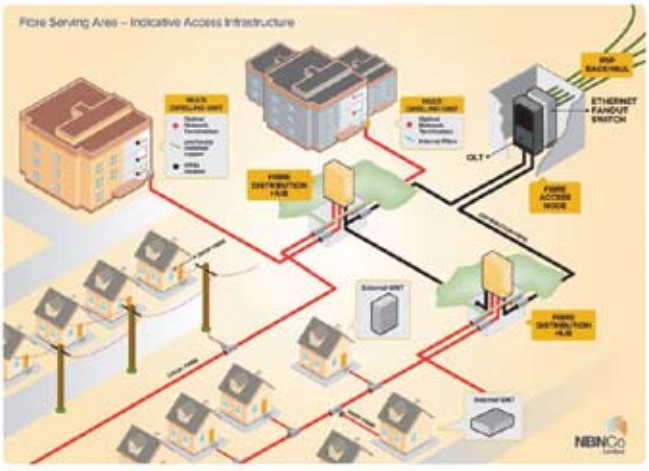
Current PON technologies, such as Gigabit PON (GPON) support speeds of up to 100Mbps per household, or higher if fewer homes are connected to the PON. This speed is achievable at distances of up to 15km from the central exchange. These longer distances mean that fewer 'exchanges' will be needed compared to traditional copper-based telecommunication services.

Optical fibre is also suitable for large business, schools, universities and research organisations, hospitals and for corporate users. Fibre is already used extensively for some of these purposes today and will be put to even greater use in the future. For institutions that have the highest information requirements, dedicated 'point-to-point' fibre services will continue to be available and deployed..

Optical Fibre and the Home

Unlike copper-based telecommunications, optical fibre does not have the ability to carry a voltage or power down the line. In addition, optical fibre services support a wide range of applications – telephony, Internet, TV – which all have different connector types. In order to deliver these connectors and to provide power to the devices connected (eg. ringing the telephone) the optical fibre requires a special network termination unit to be attached. This device is called an Optical Network Termination (ONT), and it requires power to be supplied to it – much in the same way a DSL modem requires power today.

The diagram below provides a diagrammatic representation of the NBN Co fibre network.



1. ARC Special Research Centre for Ultra-Broadband Information Networks (Cubin) presentation to FTTH Council Annual Conference, May 2009 "FTTH: The Green Access Technology". 3W power difference across 10m premises.