

6. HYBRID FIBRE COAX (HFC) NETWORK

6.1 Hybrid Fibre Coax (HFC) Technology Overview

Hybrid Fibre Coax is a way of delivering video, voice telephony, data, and other interactive services over coaxial and fibre optic cables.

An HFC network provides the necessary bandwidth for home broadband applications, using the spectrum from 5MHz to 450MHz for conventional downstream analogue information, and the spectrum from 450MHz to 750MHz for digital broadcast services such as voice and video telephony, video-on-demand, and interactive television.

In an HFC network the distribution to customer premises via a coaxial with signals and transmission to and from customers on the coaxial cable being broadcast to all customers. Addressing information in the signals ensures that only the intended customer responds. Transmission to and from the local access switch is via optical fibre cable.

How an HFC Network Works

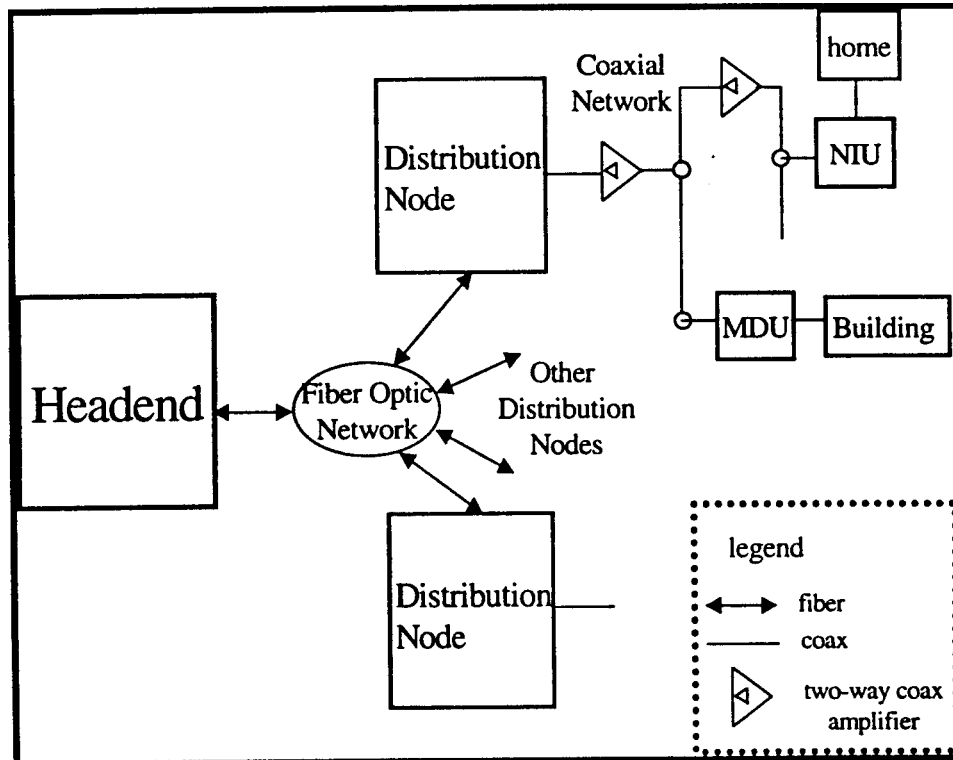
A HFC network consists of a headend office, distribution centre, fibre nodes, and network interface units. The headend office receives information such as television signals, Internet packets, and streaming media, then delivers them through a SDH ring to distribution centres. The distribution centres then send the signals to neighbourhood fibre nodes, which convert the optical signals to electrical signals and redistributes them on coaxial cables to residents' homes where network interface units send the appropriate signals to the appropriate devices (i.e. television, computer, telephone).

Systems classified as HFC have the following characteristics:

- The physical media are fibre and coaxial cable, as shown in Exhibit 6-1. The fibre connects the centralised equipment, eg, hubs, or headends, with the distribution nodes. The transition to coaxial cable takes place in the distribution node. Coaxial cables connect the distribution node to the subscriber service units. Network Interface Units (NIUs) serve single homes, while Multiple Dwelling Units (MDUs) serve multiple customers in either a business or residential environment. The subscriber service units support telephony, video, Ethernet and other services.

- The following figure is a simplified representation of the major types of components and the interconnections in the HFC architecture. Actual HFC deployments are quite complex.

Exhibit 6-1: HFC Architecture



Source: RHK

6.2 The Deployment of HFC Network

Hybrid Fibre Coax (HFC) combines the increased transport capacities of fibre-optic systems with the classical coaxial TV-type distribution architecture. HFC systems are being successfully deployed by cable companies to support digital video, cable telephony, and cable data services. This embedded base of networks and current subscribers makes HFC systems attractive for delivering new telecommunication services to existing customers.

In the capital cities on the eastern seaboard, the hybrid optical fibre and coaxial cable (HFC) networks of Telstra and C&W Optus pass millions of homes and businesses. These networks already offer pay television, cable modem access and, in the case of C&W Optus, telephony as well.

Telstra's hybrid fibre coax (HFC) cable network which passes 2.5 million homes was completed in 1997. It is a state of the art, 2-way 750MHz network. In addition to the pay TV channels, it provides the capability for data channels with a shared 30Mbit/s downstream and 768Kbit/s upstream.

This cable is Telstra's first choice for delivering broadband services. The rollout of this network was targeted at particular demographic areas (mainly urban residential), and provides very high quality interactive capability.

Through the company's acquisition of Optus Vision, C&W Optus has a broadband local network, which has passed about two million addresses in Sydney, Melbourne and Brisbane. It provides premium TV, local telephony, full two-way high-speed transmission and other digital and interactive services.

However, neither Telstra nor C&W Optus has any immediate plan to expand their HFC networks.

On the other hand, regional companies like Neighbourhood Cable, West Coast Radio and Austar are also deploying their HFC network in the rural and regional areas. Neighbourhood Cable Ltd saw the niche telecommunications market capabilities of large rural towns like Mildura, Ballarat, Bendigo and Albury-Wodonga, and quickly moved to supply hybrid fibre-optic and coaxial (HFC) cable infrastructure capable of delivering both broadband Internet and payTV – along with the usual local and long-distance telephone services.

Exhibit 6-2 provides an overview on the HFC network operators in Australia.

Exhibit 6-2: HFC Network Operator Overview

Operator	Operational Status	Coverage
Telstra	1997	Urban areas in Melbourne, Sydney, Gold Coast, Brisbane, Adelaide and Perth.
C&W Optus	1997	Urban areas in Sydney, Melbourne and Brisbane
Neighbourhood Cable	2000	Mildura, Ballarat, Bendigo(c), Albury-Wodonga(c) and other regional towns in VIC(p).
Austar (Windytide)	1999	Darwin
West Coast Radio (iiNet)	2000	Perth (Ellenbrook area)

(c) = constructing (p) = planning

6.3 HFC Network Deployment

In 1994, Telstra commenced rollout of its broadband HFC network. By December 1997, the network passed 2.5 million homes (excluding businesses), instead of the four million planned. Telstra initially aimed to provide broadband cable to more than two-thirds of Australia with an investment of \$4 billion. Network rollout was stopped in 1999.

C&W Optus' broadband network rollout began in February 1995, following electricity lines to homes, primarily via overhead lines. C&W Optus has agreements in NSW with Energy Australia, Sydney Electricity and Integral.

The original rationales for building the HFC network were:

- reduction of interconnection charges paid to Telstra for local telephony access and
- provision of broadband multimedia services (video, data and voice) to residential and small business customers through a single pipe.

The rollout in Adelaide was placed on hold in August 1997. In 1998, C&W Optus indicated to the ACCC that it would commit itself to a further rollout of broadband under the right regulatory conditions.

By the end of 2000, about 21,000km coax cable (0.625" coaxial) and 5,500km fibre cable (single mode optical fibre from 24 to 144 fibres per sheath) had been laid around the suburban residential areas in Brisbane, Melbourne and Sydney.

However, regional operators, Neighbourhood Cable and Austar are building their HFC networks in regional Australia, leaving Telstra and C&W Optus to compete in the State Capitals.

Exhibit 6-3 provides an overview on the HFC networks rollout in Australia.

Exhibit 6-3: HFC Network Rollout

Operator	Coverage	Investment*	Infrastructure	Capacity
C&W Optus	Urban areas in Sydney Melbourne Brisbane	\$3bn	<ul style="list-style-type: none"> • 30 nodes covering 2m households • 21,000km coax cable • 5500km cable 	5-65MHz (up link) 85-700MHz (down link)
Telstra	Urban areas in Melbourne Sydney Gold Coast Brisbane Adelaide Perth	\$4bn	Nodes = 279 Hubs = 4172 40,000km cable (covering 2.5m homes)	5-65MHz (up link) 85-750MHz (down link) <ul style="list-style-type: none"> • 64 Analogue TV Channels • 200MHz Digital Services • 768Kbps (up link) • 30MKbps (down link)
Neighbour hood Cable	Mildura, Ballarat, Bendigo (c), Albury- Wodonga (c)	\$8m	140 nodes 250km cable (120,000 homes)	768Kbps 30MKbps
Austar (Windytide)	Darwin		<ul style="list-style-type: none"> • covering 27,000 homes 	
West Coast Radio (iiNet)	Perth (Ellenbrook)		<ul style="list-style-type: none"> • covering 10,000 homes (planning) 	

(c) = constructing

* estimates

The following section provides an overview on C&W Optus' HFC network coverage.

- Sydney metropolitan area – 3 exchanges;
- Melbourne metropolitan area – 2 exchanges;
- Brisbane metropolitan area – 1 exchange.

Exhibit 6-4: Sydney HFC Network

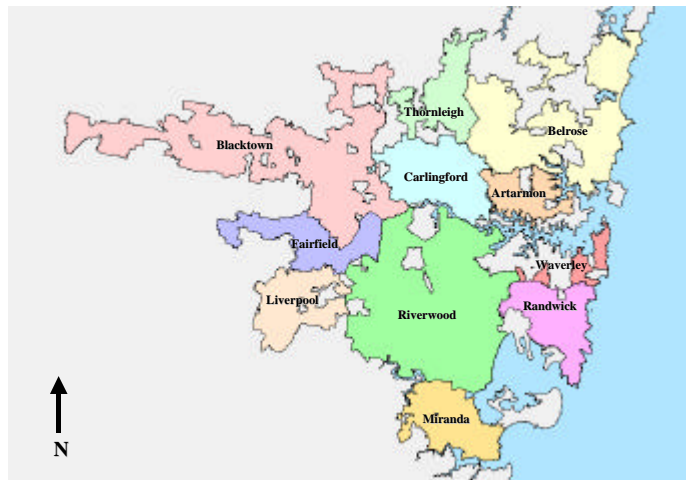
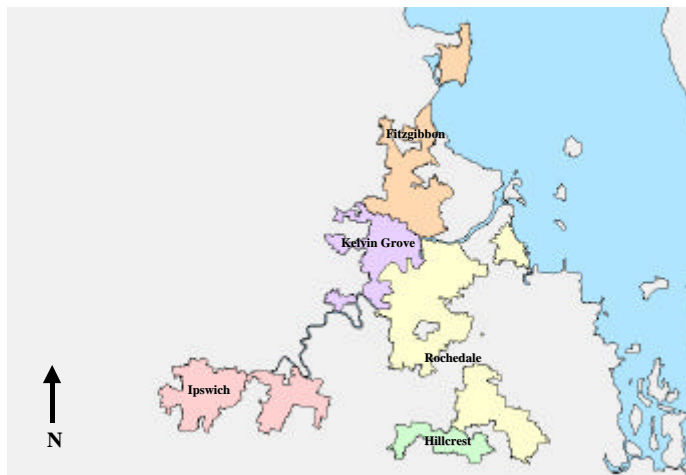


Exhibit 6-5: Melbourne HFC Network



Exhibit 6-6: Brisbane HFC Network



Source: C&W Optus

6.4 HFC Market Perspective

C&W Optus abandoned its HFC network rollout in Adelaide in 1997. Both Telstra and C&W Optus had decided not to expand their HFC networks in 1998/1999. This decision was driven by their HFC network duplication in various cities in Australia.

C&W Optus alleged that the current regime that allows carriers such as Foxtel, to sign up exclusive content is also an inhibiting factor on growth.

On 30 August 1999 the ACCC issued its report declaring analogue subscription television broadcast carriage services under part XIC of the Trade Practices Act 1974. If a carriage service is declared, a provider of that service (effectively Telstra and C&W Optus) must supply that service to an access seeker, subject to certain exceptions.

In justification of its decision, the ACCC said that it was very unlikely that additional broadband cable networks capable of delivering Pay TV to residences will be constructed where there are already cable networks in place.

Neither Telstra nor C&W Optus has any immediate plan to expand their HFC networks.

According to the Telecommunications Performance Report prepared by ACA (2000), the ACCC considered that declaration would promote competition in downstream markets, reducing entry barriers and allowing niche Pay TV service providers the opportunity to offer an alternative range of programming to those offered by Foxtel and Optus Vision.

Earlier in 2001, the ACCC made interim determination in arbitration involving Telstra, Foxtel, TARBS and Seven Network that gave access to some parts of Telstra's network. AAPT indicated that it has plans to offer Pay TV services to its 600,000 retail customers during the next 12 months, and may eventually consider seeking access to the broadband networks of Telstra and C&W Optus.

Exhibit 6-7: HFC Network User Overview

	Homes passed	Cable TV User		
		1998	1999	2000
Foxtel (Telstra)	3m	320,000	500,000	630,000
C&W Optus	2.2m	186,000	210,000	350,000 (2000) 500,000 (2001)
Austar	27,000	215,000*	300,000*	400,000*
Others	N.A.	N.A.	N.A.	N.A.
Total	5.3m	730,000	1,100,000	1,400,000

*including satellite base cable TV users