

“Fibre lean, is it mean?”

The aim of this short article is to discuss the issues that may influence the choice of whether to install just a single fibre per home in an FTTH access network, or whether it is worth the marginal increased cost to install additional fibres, and if so how many fibres are enough?

Is Just One Fibre Sufficient?

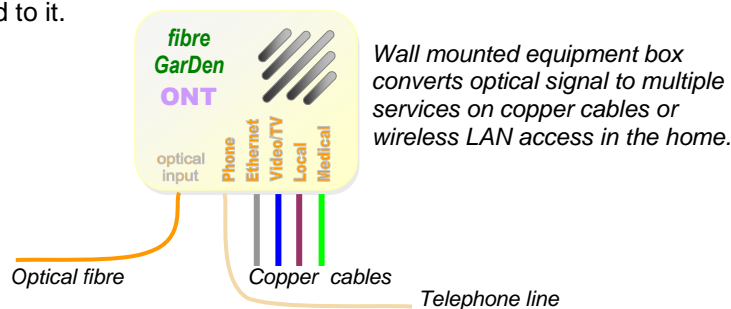
The answer to this question will almost certainly depend on who you ask, with many people having vested interests in a particular answer, so we'll try to summarise the issues.

Firstly, we could just look at the capacity of a single optical fibre, and then we would have to say that for the standard single-mode fibre type (ITU recommendation G.652) typically employed in FTTH access networks, the potential capacity is huge and significantly larger than that which any expert is currently predicting will be required by any home in the next twenty years or so. This answer would convince many that one fibre is enough, but as you will most likely have guessed by now, if only because there is more text below, the decision is not so simple.

In order to review the issues, we need first to consider how things would work with just one fibre.

Single Fibre & Virtual Networks

With a single fibre into the home, the fibre is terminated at Optical Termination Unit (OTU), Optical Network Terminal (ONT) or Network Termination Equipment (NTE), with the name of this box of tricks depending on the manufacturer or vendor company. This ONT box, as we'll call it, converts the optical signal to provide telephone lines, conventional Ethernet broadband signals and video TV signals as required, with the capacity of the ONT being shared amongst the services being offered. Where appropriate, separate services will be delivered to separate ports on the ONT as 'virtual networks', such that each port may have a specific service designated to it.



By employing such virtual networks, it is possible to offer services such as a dedicated port to attach the home to a virtual network reserved for tele-health, tele-care or tele-medicine, or another port for local community use.

This flexibility to deliver a range of services depending on what virtual circuits are configured, will satisfy many, and allows vendors to make claims of network flexibility which are perhaps valid, with the additional claim that this could be 'future proof' which is perhaps less valid.

Advantages of Additional Fibres

If we can do everything with one fibre providing virtually separated network services, then are there advantages to installing more fibres providing true physical network separation? The answer is 'yes', but how significant the advantage may prove is open to debate, and also depends on what future services consumers may desire. The key point is simply that we know there will be additional services required in the future.

The potential benefits of additional fibres could include:

- alternative TV service provision
- alternative service (e.g. ISP) provider
- easier provision of local services
- easier network upgrades for new services
- higher bandwidth without expensive upgrades
- higher security network services
- experimental optical network services

The alternative TV service provision could mean the community broadcasting a Sky satellite feed over a fibre in addition to the standard broadband TV provision. The local service might be a local community TV station transmission over the fibre, whilst an experimental service might include some medical services where the separate fibre may be required to guarantee secure transmission and confidentiality.

Whatever the service, a key point is that a spare fibre provides a level of flexibility that is simply not present with just a single fibre, and particularly where that single fibre might be from a PON network (see "In for a Penny..." information note).

Symmetrical Transmission

Another example arises with the argument for 'symmetrical' transmission, which is easy with a fibre but becomes expensive to provide over typical TDM PONs, since the ONT transmitter needs to operate at a bit-rate approximately 32 times higher than the user required bandwidth, hence requiring more sophisticated and higher cost components.

Since most typical users currently have significantly more requirement for downloading as opposed to uploading, services are almost always asymmetric, with significantly slower upload speeds. This may not be perceived as a significant problem for an average user, but it stifles the potential for new services which might require higher upload speeds. Importantly it limits the quality of broadband video telephony, where the download speed may be fast enough, but the upload speeds of both users is the limiting factor.

Providing a symmetrical high-speed service to all users might be the ideal, but may be prohibitively expensive, as might be the cost of upgrading just one high-end user on a PON access network. With a spare fibre, however, upgrading a user with a particular need is much more likely to be possible at an acceptable cost, and network subscribers need not conform to a single 'one size fits all' solution. This might prove particularly important in attracting high-end business users into a community, and is likely to be more important for rural communities.

Uno, Duo, Quattro?

To ensure we install sufficient fibres in the network we can opt for a 'fibre-rich' design where every part of the network has more fibres than we expect to require initially – that is spare fibres in all fibre cables, and into the home. So how many fibres is enough? Well we'll concern ourselves just with the number of fibres into the home, and here we can say that one may be enough, but a spare fibre might well be handy in the future.

In the UK most operators are installing just one fibre, but in some other countries as many as four fibres per home is the standard. The decision is largely one of cost, with additional fibres increasing the cost whilst the law of diminishing returns states that the benefits will not increase in line with increasing fibre numbers.

Additionally, it is worth mentioning that for many network builders there may be significant disincentives to installing more fibres, which could increase competition, but this is not the case for rural community access networks where the benefits to the community are the main driver.

Cost of Extra Fibres

The cost of installing a second fibre to the home, at the time of the main installation, is likely to be around £60 per property plus £0.02 per metre from the POP (equipment room).

Fibre GarDen Approach

By planning for a fibre-rich network, we are aiming to ensure we have a future-proof solution with the capacity and flexibility to readily adapt to whatever the future throws up. Initially we wanted to install 4-fibres per home, but for a variety of reasons we may compromise and install just 2, but with the potential for more later, if required, with minimal additional build cost.

*This information note was written for **fibre GarDen** by John Colton, FInstP. John is a director of fibre GarDen, technical director of Lucid Optical Services, a fibre optic technology specialist training company, and a director of the Fibre-optic Industry Association (FIA).*