

## Pragmatic Engineering and the Vision of the NBN

Despite statistics suggesting that the NBN rollout is progressing well, the reality appears to be that of a deployment that will require significant continued engineering and construction activity in the years, and perhaps decades ahead.

There are considerable forces of inertia that appear to have prevented the NBN corporate entity from focussing sufficiently on long-term benefit to the nation. Continued impact from such forces is foreseen moving forward. Reassuringly, technology decisions and deployment learnings are likely to improve slowly over time, even with external inputs and cultural factors that do not necessarily optimise progress in this regard.

From a pragmatic engineering perspective, while the original FTTP vision of the NBN is commendable, practicalities of delivery were seriously underestimated. There are many factors at play historically over the last 20-30 years of telecommunications engineering in Australia that contribute. The NBN organisation has displayed that they are capable of evolving technology design choices through several iterations since 2009, to finally arrive at a “skinny fibre” design involving small distributed splitters mounted in pits. Again, the reasons why such a design was not chosen far earlier in the process are many and complex. While the nation cannot turn back the clock, we must ensure that we focus appropriately on these learnings to ensure that we are addressing the challenges ahead in optimal fashion.

The challenges of deployment of an access network at scale extend far beyond the basic fibre deployment design. Again, it is pleasing to see progress by NBN in efficient fibre design automation techniques bringing innovation into the process. From a construction engineering perspective, there are undoubtedly many avenues for continued refinement of processes to deliver benefits. Very small changes to productivity of teams on the ground, potentially translate to significant gains in cost and time over the project.

These same fibre design and deployment improvements and innovations apply equally to FTTdp/FTTC, as to FTTP. By eliminating the need to individually deploy fibre lead-ins to many millions of premises, FTTC has clear advantages over FTTP deployment on the broader national scale. (On a local level FTTP is likely to remain the preferred option in some circumstances.) Both FTTP and FTTC cater for the full breath of consumer bandwidth demand (ignoring the vexed question of CVC charging structures). FTTC with very short copper lengths using VDSL technology is capable of up to several hundred Mbps, and with G.fast and other variants, can achieve significantly more than this.

Should individual premises require fibre connectivity (most obviously due to premises copper factors that are impractical to remedy, such as where copper taps providing poor signal characteristics for DSL technologies are embedded deeply within the building fabric), it can be supplied on a commercial basis outside of the public NBN entity. In this sense, the vision is of the NBN boundary remaining at the street pit, with licensed installers adding fibre lead-ins through contracting directly to premises owners.

It is important to note that the very short copper distance of FTTC compared to FTTN, is expected to considerably reduce the proportion of premises that will not be able to obtain sufficient DSL connectivity due to in-premises copper conditions. Crucially, an economically viable option is present within the FTTC approach, to those premises that experience such problems.

In summary of above, both FTTP and FTTC deliver NBN capability that fully matches the vision of long-term flexible communications infrastructure for the nation.

HFC using DOCSIS 3.1 or better, can also deliver infrastructure that has long-term suitability. However, to do so requires that node sizes are tightly constrained as traffic demands increase over time and as bandwidth usage patterns change. The costs of these upgrades to the HFC network over time must not be underestimated. The recent history of severe underestimation of the cost of incorporation of HFC networks into the NBN must not be allowed to be forgotten. The nation needs to ensure that pragmatic engineering realities are fully understood, and not filtered out by many layers of senior management and political interpretation. Most crucially, an NBN Statement of Expectations that sets a very low bar for network capability, at the expense of longer-term national goals, must not be allowed to pervert decision making.

FTTN has allowed the NBN to reach a significant number of premises relatively quickly. However, despite protestations of some, the prospects for network upgrade from FTTN are severely limited. This does not imply that there are no upgrade prospects short of deploying FTTC or FTTP, but it does mean that the value equations related to such upgrades do not appear to be overly exciting.

The NBN organisation recently estimated that the additional cost of FTTC compared to FTTN was only of the order of \$600 per premises. On this basis, the choice to move to FTTC and provide long-term benefit is hard to argue against, given the relative difficulty of upgrading FTTN in any form. The relative neglect of the FTTC option in recent years means that there would be considerable ramp-up to cease deployment of FTTN. However, there is little in the way of sustainable argument to suggest that the deployment of FTTC is in any way slower than that of FTTN. In fact, there are reasons to suggest that relative simplicity and parallelisation of activities for FTTC deployment is likely to obtain significant gains in overall deployment timeframes. Of course, there are many pragmatic engineering and deployment challenges to address in optimised fashion, including the crucial issue of cutover and PSTN decommissioning. With FTTC there are also expectations that deployment costs can be reduced further over time compared to the baseline of the recent NBN estimates.

It would seem clear that political decision making, both external and internal to the NBN organisation, has played a key role in delaying focus on FTTC. The nation now faces a future of addressing upgrade from FTTN at substantial scale. This represents significant time and expense ahead before we can rest knowing that the job of communications infrastructure renewal, being the original vision of the NBN, is complete.

Fixed wireless and satellite components of the NBN deployment will also present ongoing upgrade challenge. While broad growth in bandwidth demand to 1 Gbps and above is not clearly on the horizon, as might be predicted by Neilsen's Law, clear forces in bandwidth demand and usage demand growth are nonetheless apparent.

As a nation, it is crucial that qualified engineering input is present. This input must consider pragmatic realities of construction in synergy with network technology factors, and realistic demand growth projections. The engineering realities of cost and time must be at the forefront of all technical decisions.

The nation can continue to trust the structures currently in place to deliver NBN capability, hoping that past lessons have been fully learned. Alternatively, the nation is likely to obtain value from additional engineering infrastructure oversight by an independent panel of pragmatic engineering technology experts. Admittedly, it is difficult to see where a significant number of suitably qualified engineering experts with appropriate technology and pragmatic focus, and with otherwise

independent perspectives, can be sourced. However, this challenge is perhaps a sensible one to tackle from a risk management perspective, to optimise the prospects of long-term success of the NBN vision.

Wireless connectivity and the issue of providing communications access to mobile platforms, such as trains and boats, is not currently covered within scope of the NBN. There is reason to expect that commercial forces will continue to serve this sector adequately. However, as we move towards 5G connectivity models, the scope of wireless and fixed line infrastructure will increasingly merge. The NBN project is likely to need to consider their role here very carefully in the years ahead.

In conclusion, major engineering and deployment effort remains ahead prior to the nation achieving the goal of communications infrastructure renewal. The voice of pragmatic engineering expertise must be heard in sufficient weight to counter other tendencies toward ill-informed or short-sighted decision making. Insufficient voice from the pragmatic engineering element has been heard in the past. Trajectories have evolved over time to more rational ones, but the risk of ongoing biases to pragmatic decisions remains real. The case for additional oversight of key technical decisions is strong for the long road ahead.