

## The future in motion

by Jeffrey Cox, Director - Network Research and Technology, BT Innovation & Design (BTID)

Network and information technologies get faster, cheaper and better each year and providers, businesses and consumers need to identify and adopt the truly compelling ideas at the applications and services layer that add value to their business and lives. They need these technologies, not because there is a killer app or because they know how these technologies will be useful. The new technologies will quickly find their uses, they always do, and users either adopt them or get left behind.



*Jeffrey Cox is currently the Director of Network Research and Technology at BT; he has more than 25 years of experience in designing, deploying, and supporting large-scale enterprise and carrier data networks. Prior to joining BT, Mr Cox was the founder of Celion Networks, building optical DWDM transport equipment targeted at transporting enterprise data traffic. At Level 3 Communications Mr Cox was responsible for the global architecture of that company's MPLS backbone and other packet infrastructures. Mr Cox designed and supported a large multi-protocol network infrastructure at Texas A&M University; he also built enterprise networks for various large corporations including Texas Instruments.*

*"Difficult to see, always in motion is the future." - Yoda*

Network and information technologies relentlessly march forward getting faster, cheaper and better - year after year. We can thank Moore's Law and similar notions for much of this progress. Naysayers always question why we need these dramatic new improvements, wonder what we could possibly do with it all, and ultimately hesitate investing because they are unable to envision specific profitable near-term uses. 'What is the killer app?' is a common question.

Think back a little over ten years ago: Who could imagine what we could possibly

do with more than 640K of RAM, or processors running faster than a few hundred megahertz, or network connections that were faster than dial-up? Going back further, similar concerns existed about PCs in general, LANs, and the Internet. Today, these concerns seem utterly ridiculous.

Yet, today we also hear: Who needs 100Mb (or Gb) to the home? How will people use terabytes of storage? What could a home user possibly do with four or more processor cores running at multi-gigahertz rates? Have we learned nothing from the past? Are we doomed to repeat our mistakes of inaction and indecision? With every technological step, all of us find new uses, new applications and new ways of

interacting - every time. Just because we are too nearsighted to envision specifically what those uses are ahead of time does not mean that they will not happen. These new uses always happen.

The truly insightful organisations will embrace the massive improvements in technology - deploying them ahead of specifically identifiable demands - so that they have the advantage as the new uses inevitably reveal themselves. Doing anything less ensures that your organisation will always be the follower, the laggard, watching other organisations reap the benefits of these new technologies before your organisation is able to react.

Which specific ideas become popular or successful is exceedingly difficult to predict with any accuracy. If I were particularly good at predicting the specific details of the future I suspect I would be in another line of work (bookie or broker come to mind) or, more likely, I would have already retired sipping drinks on an exotic beach somewhere. Possibly more difficult than predicting what will happen is predicting when it will happen. This particular fact has foiled many predictions in the past and is no more evident than in those predictions of the late 90s when the telecom bubble was fully inflated and ready to burst. In those exhilarating days we were predicting massive traffic growth (more than doubling each year!), gigabits to the homes, virtual reality displays...all within a few years.

The excitement of the bubble enabled us to think about unbounded uses for the network; but it also skewed our perception of time, causing most to underestimate how much time and effort it would actually take to implement the future. Much of what was predicted then is now underway; it simply took ten years instead of two.

Conversely, the double impact of the bubble bursting in 2000 and the near depression of the later part of the last decade have skewed our time perception in the other direction. We now think it takes ten years to implement any new technology and we are reluctant to invest in anything due to the uncertain future. It is highly likely that the reality of the coming decade is somewhere between these two extremes. Those who cling to the sluggish recessionary pace for too long will be rapidly left behind.

#### Now, my predictions for the coming decade

- Gigabit to the home will become the norm; it will enable video delivery and interactive video applications with more fidelity and features than ever before. The same pipe will be used for high-definition voice, Internet access, remote sensing, smart and secure homes, access to network applications and storage in the Cloud, and much more effective home worker environments - all occurring simultaneously. There will be no single killer app.
- Wired network infrastructure will complete its migration to Ethernet-based link technologies with packet switching on top of that. This approach provides for the most flexible connectivity options and provides for very cost-effective loading of

the network infrastructure and prioritisation of the packets.

- Migration to IPv6 will happen in homes, enterprises and carriers as the IPv4 address space is finally exhausted
- Voice will finally be moved completely to VoIP in all environments
- Wireless/mobile networks will undergo a massive overhaul. Nature created all the spectrum that will ever be approximately 14.7 billion years ago. The quantity of spectrum hasn't changed since, and the physical laws that govern its use have been revealed to us over the last hundred or so years. Until someone invents Star Trek's 'sub-space' communication technology, we are stuck with the spectrum, the 'airwaves', in use today- an exceptionally limited resource. Today's incredibly wasteful and inefficient approach of allocating slices of spectrum to specific companies for specific uses will give way to far more efficient and flexible methods of agile cognitive radios. With such technology, spectrum can be dynamically allocated almost instantaneously and released just as quickly when no longer needed. The pressures of spectrum allocation will force governments and the industry to adopt such technologies. This will be a good thing for the consumers and businesses and will lead to more available bandwidth and applications over a broader coverage area.
- Even with the mobile spectrum enhancements, nothing will beat the wired connection when it comes to bandwidth. For wired communication, fibre will come to dominate. Unlike the airwaves (where everyone must share the spectrum), or copper (where spectrum is very limited), fibre allows us to use the enormous spectrum of light - again and again in adjacent fibres. The industry will accelerate the replacement of all other remaining wired technologies with fibre. Once fibre is ubiquitous, adding bandwidth becomes a matter of upgrading optonics at endpoints.
- The technologies and applications we use in our homes as consumers, in our businesses as employees and in carriers as operators will come together into a common set of hardware, software, applications and services. Only the scales will differ between the entities. This ubiquitous inter-networked infrastructure will provide an always-on, always-connected environment that allows people to securely access whatever

applications and content, wherever they want, whenever they want.

Providers, businesses and consumers must focus on identifying truly compelling ideas at the applications and services layer that add value to their business and lives. The underlying infrastructure and systems need to become much simpler, unified and consistent in order to provide for a cost-effective ubiquitous environment that delivers massive bandwidth. Focusing on adding complexity and features at the lower infrastructure layers will only give an illusion of progress while adding little value.

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