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Convergence?

If there is one word in the telecommunications that has suffered from over-abuse for many years now, its **convergence**. The term has been liberally applied to each successive generation of communications technology for their supposed ability to solve a myriad of service delivery problems within a single unifying converged carriage and service delivery solution. Unfortunately, the underlying reality has always been markedly different from these wondrous promises, and we continue to see an industry that deploys a plethora of service delivery platforms and an equally diverse collection of associated switching and service delivery technologies. One can't help but wonder at the collective gullibility of an industry that continues to herald the convergent attributes of each new generation of communications technology, while at the same time being forced to admit that previous convergent promises have never been realized.

Perhaps the industry's collective fondness for convergence has some deeper connotation in terms of underlying motivations and aspirations, and particularly so for the legacy voice carrier industry (the so-called *telcos*), where convergence has perhaps gained its greatest levels of ascendancy and achieved its largest mass of disciples. In this article I'd like to take a deliberately cynical, and perhaps slightly provocative look at convergence and the industry sector that continues to hold the term so dear to their hearts, and look at some of the persistent myths that accompany convergence and all it stands for.

The Converged Utopia

Its interesting to pose the question as to what the communications industry would really look like if the telco's preferred vision of convergence was truly a reality today. This is still an industry with significant economies of scale, so convergence of service delivery into a single network platform would probably result in an associated consolidation of service provider enterprises. The resultant strong levers of control that the small number of large incumbent service providers would impose both on the overall service provider industry sector and their customer base would be markedly different to the current industry landscape.

For the telcos this would appear to be a close to utopian condition, as long as they were the incumbent converged operator, for a converged utopia would imply a supply industry composed of a small number of vertically integrated service providers leveraging their base infrastructure investment in a single service platform into a high margin service delivery retail system for a comprehensive array of services.

Sir Thomas More's *Utopia*, which translates roughly as "no place" in Greek, was published in 1516. The book played a key role in the humanist awakening of the 16th century, which moved away from a more austere and religious medieval outlook toward the more overt secularism of the Renaissance. More had that societal shift in mind with *Utopia*. What he wanted to critique was the corruption of European civil life

of the time. More felt that property should be held communally, and he shows the benefits of this in his fictional society. The first part of the book is organized as a dialogue, with the mariner describing his own philosophy and his listeners responding to his assertions. The book's second part is a straightforward description of the island kingdom, where religious freedom is total, and no one owns anything. "What evils they avoid," by sharing property, says the mariner. "What a multitude of crimes they prevent!" Obviously speaking for More, the mariner goes on to say, "Pride measures her prosperity not by her own goods but by others' wants. Her happiness shines brightly only in comparison to others' misery, and their poverty binds them and hurts them the more as her wealth is displayed." These were of course very radical thoughts at the time, and still are today. More's Utopian legacy is one that is generally associated with unrealistic, even radical, expectations for society.

Such an environment, if achievable, is a certain path to deliver to the operator relatively low service delivery costs, high service value, strong control over the entire industry, and, of course, the opportunity to create a new era of truly awesome financial margins due to the re-establishment of defacto monopoly positions over the market. All of this could be leveraged from the combination of a converged service delivery platform and exclusive ownership and control of the access network.. Sounds good? If you have watched the value erosion of the telco business for the past sector it does indeed sound good. Unbelievably good.

Wouldn't it be good if...

So what would be the elements of such a converged Utopia? What are the essential characteristics that could offer such significant opportunities to one particular sector of the communications industry at the likely expense of all other sectors, including, of course, the end consumer? Here's my list of what it might take to pull service delivery together into a truly converged environment:

- Operating all forms of real time and data services within a single network and a single switching plane. Most multi-service operators find that the rate of creation of new dedicated service delivery networks exceeds the ability of the internal efforts to eradicate them through platform rationalization and amalgamation. The problem today is that all networks represent points of engineering compromise in terms of service capability, and that leads to the pressure to support specialised roles, leading to the ultimate end point of using a distinct network for each delivered service. The constant promise of convergence is the ability to eradicate these specialised networks while not compromising the essential attributes or the economy of the service.
- A network carriage plane that could support graded service responses for each class of service usage. Some services impose more stringent demands on the network than others. Voice, for example operates within relatively tight bounds of total latency, imposed jitter, signal distortion and data loss parameters, while other services, such as TCP, are more tolerant of various forms of vagaries in network service responses. Rather than attempting to make the network perform to the most stringent and exacting service payload for all classes of traffic (using a highest common denominator form of network design and operation), the desired converged Utopia is to have the network simultaneously offer differentiated service responses to different service requirements.
- The implication of these two network attributes is that you could support both high resilience, high quality real time service profiles, and support loss and jitter tolerant data service profiles, and all points in between, within a common switched network platform that was sufficiently adaptable to meet all these service points simultaneously. This would avoid the single service profile issue of many service platforms while the network is designed to meet the desired characteristics of the most stringent potential application, and, by implication, is over-designed, and of course overpriced, for all other applications that are also passed across that network.

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- The network supported only a single protocol, a single carriage architecture and a single Operating Support System (OSS) to drive the entire network operation.
Again here convergence implies cost efficiencies at all levels of the service delivery function. Multi-protocol networks introduce additional cost factors, as do various forms of overlay carriage architectures that are imposed upon the base platform (such as in virtual circuit architectures of ATM or MPLS). The converged Utopian network would avoid such aspects of additional cost elements, and instead operate all forms of service delivery from one single converged service delivery platform, of course.
 - One area where visible service differentiation is seen as highly desirable is in the area of service tariffs, and there is certainly the expectation that converged network operators could account for, and selectively tariff delivered service transactions based on their service profiles, rather than tariffing simple undifferentiated network access.
 - Convergence also implies that service tariffs would reflect both the ability to identify the actual delivered service and to reflect the value of the service to the customer, as distinct from the marginal cost of delivering the service through the network.
In other words its not the cost of the call that matters, its the value of the ability to speak that determines the tariff. What's wanted here is that customers pay the network operator for the value of these service solutions, and not the cost of the actual network transactions.

Good, but Hopelessly Unrealistic

Any student of recent history in the telecommunications industry would quickly observe that the drive for convergence of service delivery platforms into a single framework is a very persistent theme in this industry. It can readily be traced back to the digitization of the trunk carriage and switching systems within the telephone industry. This was followed by the promise of jumping out of the tight constraints of time division multiplexing with ATM, which proposed to allow the flexible interweaving of constant load real time voice and adaptive non-real time data streams within a single converged environment. In attempting to blend the characteristics of ATM (and the virtual circuit model it apparently inherited from X.25 and Frame Relay) and IP we ended up with MPLS, which once more was touted as offering the network operator a new world of converged solutions. And now we have the so-called "Triple Play", the marketing label of an effort to deliver voice, video and data over a single access method, again based on a common denominator of IP. And of course number escalation is also around, with the so-called "Quad Play" that purports to add mobile services to the converged mix

It seems that each new generation of carriage and switching technology is heralded as the harbinger of a wondrous new converged era of communications service provision, and the re-creation of the associated monolithic service provider. Reality is of course somewhat more sordid, and each new generation of technology fails to supplant the existing portfolio of service delivery networks - indeed it simply adds one more set of services and another set of network platforms to the operator's service platform portfolio, and ultimately adds one more source of cost without compensating new revenue streams. The converged service delivery platform promise is proving very elusive for monolithic service delivery enterprises to implement in cost efficient and profitable ways.

The Unconverged Reality

The past decade has certainly proved to be a watershed for the communications industry, and the telcos in particular. Following almost a century of steady concerted efforts focussed on consolidation, there was the promise of a combination of two technologies, digitisation and wireless services, realising unparalleled cost reductions within the network while maintaining a buoyant retail price based on service value rather than network cost. By the early nineties things certainly had never looked better for the industry, and the mid-nineties were certainly a time of some level of industry excess, with lavish conferences, massive ventures, high risk investments, big expansion plans and little care for underlying cost constraint within the industry.

It has been often claimed that the best, fastest, and most efficient sailing ships, the tea clippers, were constructed and deployed even when the steam engine was already exerting its pressure for change in the shipping industry. Journeys that may have taken up to a year were over within 100 days with the tea clippers. Clippers were built for seasonal trades such as tea, where an early cargo was more valuable, or for passenger routes. These relatively small, fast ships were ideally suited to low-volume, high-profit goods, such as spices, tea, people, and mail. The values could be spectacular. The "Challenger" returned from Shanghai with "the most valuable cargo of tea and silk (\$2,000,000) ever to be laden in one bottom." The competition among the clippers was public and fierce, with their times recorded in the newspapers. Although clippers could be much faster than the early steamships, clippers were ultimately dependent on the vagaries of the wind, while steamers could reliably keep to a schedule. The final blow to the clippers came in the form of the Suez Canal, opened in 1869, which provided a huge shortcut for steamships between Europe and Asia, but which was difficult for sailing ships to use.

Pressure for change was already evident while the industry was at its extravagant height in the early nineties. Deregulation of the industry was already proceeding in a number of major regulatory regimes, and at the same time the Internet was starting to capture interest as a far cheaper alternative for provision of data services. The ultimate result of these pressures was the unleashing of intense competition within the industry. But this was not a clash of the titans of the time. This was not a case of competition between two or more of these legacy vertically integrated large telco enterprises. Much of the pressure for change was generated by smaller, more agile, less risk averse specialised competitors. Rather than competing on a whole of converged business model, competition was played out in areas of role and market specialization, where the most lucrative or most exposed areas of the telco market were cherry-picked. This piecemeal approach to competition proved to be the telco's collective point of greatest vulnerability.

Rather than converging, the industry has managed to unleash a new generation of distinct services and related service delivery players, and their associated service delivery networks. From the telco sector perspective this has been cause for some levels of wailing and gnashing of teeth as they headed back to the regulators' office. The complaint was that the pressures of deregulation and technology shift was leading to structural inefficiencies in the industry. They were complaining of the rapid over-construction of many parallel service delivery networks, and the unconstrained exposure of niche markets to their smaller, more agile and, from their perspective under-capitalized competitors. They saw as undesirable the accompanied short-sightedness of these new entrants and the weakness of the regulators in failing to recognise the true nature of structural cost cross-subsidisation associated with the universal service obligations. The industry was moving into an unconverged chaotic situation, with the apparent industry-wide duplication of activities, continual exposure to inefficient resource use, limited planning capability, high investment risks, low prices, low operating margins, negative returns on equity investments.

The shift from general euphoria to investor panic was best expressed in the Internet bust of 2001 - 2002, when the financial markets came to the sober realization that the industry had talked itself up into unsustainable levels based on unrealizable promises. The dream of a truly converged business model for the vertically integrated telco, with its associated attributes of previously unheard of levels of market value and market control ceased at that point. Today's reality is a quite different one. The traditional carrier is being pushed from a role of technology integrator and service delivery agent into the role of a commodity IP transit provider and a commodity IP access provider. Rather than being a vertical integrator for service delivery to a captive user, today's carrier is being pushed into the role of packet plumber. At layers above the carrier one can see that the service delivery platform is increasingly being dominated by the economics of chip designers and manufacturers, including Intel and AMD. The application platform is still largely dominated by Microsoft as the dominant supplier, and the end user is currently captivated by overlay applications such as those provided by Google, Amazon and eBay and their ilk. At layers below the carrier are router and switch vendors, and fibre system contractors. Far from convergence there is intense competition at all levels of the protocol stack, and the previously dominant role of the carrier as the service integrator for the user has been completely supplanted.

Optimism vs. Reality

There still remain a considerable number of myths related to convergence and the telco, and these continue to be paraded out at industry events. What follows is not a complete list, but within this rather selective set of topics are certainly some of the more common of these myths.

Voice remains the backbone of the industry

Voice over IP is certainly the most prevalent conversation within the industry at present. While voice continues to play the role of mainstay of the telco industry, the signs of further disruption to this model are certainly evident. From an Internet perspective voice is a small volume and relatively undemanding UDP application. Call signalling is just a rendezvous application, commonly implemented as an XML application. When combined with the DNS as a line database, and tied into the regular E.164 PSTN numbering plant via ENUM, then all of the critical components of VoIP are defined. VoIP, as a service platform, is both completely functionally compatible with traditional telephony and also poses the greatest risk to the future viability of traditional telephony. It is now largely a matter of the regulatory sector defining the timeline for VoIP adoption, and with that adoption mass market voice services will once more be the subject of further price pressures. If VoIP is priced in a manner consistent with the cost of supporting this application within the larger network, then voice will cease to be the backbone application of the industry.

Triple Play time is here

One of the more active areas of intense competition is in the consumer access market, and the battle for the consumer has been played out most vigorously where both cable TV and copper voice services coincide. Cable systems can deliver voice, video and data in a single package, using IP services for cost effective voice and data delivery. Much the same can be done over the copper pair, using IP for cost effective voice, video and data delivery. So what's the problem with this new converged service delivery model?

By any accounts peer-to-peer file sharing has taken over the Internet, with estimates of between 45% to 70% of total Internet traffic volumes being attributable to music and video sharing. This has turned the Internet into one of the more prodigious music and video distribution systems ever conceived. This shift in user behaviour has significant implications for the entertainment industry's chosen distribution methods, and it is likely that the industry will ultimately come to terms with peer sharing technologies such as BitTorrent. The loser in all this is likely to be real time video delivery systems, so one reasonable conclusion is that real time content delivery, or Triple Play time, is over – BitTorrent has won over the user!

Value Added Network Services

We are hearing a lot about carriers' "valued-added" services, looking at integrating various forms of privacy and service quality into VPN-like carriage solutions. From the initial fascination with Layer 3 MPLS VPNS we've managed to define Layer 2 MPLS VPNS and the latest stage is Layer 1 VPNS. This has been coupled with various forms of triggered Quality of Service (QoS), as well as forms of policy-based routing under the general heading of "Next Generation Networks" (NGNs). Unsurprisingly, the relevant customer base for such services has remained somewhat sceptical of these value-added offerings, and has so far consistently valued them at far less than their true cost of construction and operation.

One emerging body of opinion is that the issue here is not finding the "right" layer for virtualization of the network, nor is it an exercise in finding just the "right" form of value to add to these networks, but in recognising the futility in such exercises in the first place. The Internet's major point of leverage has always been the realization of simpler networks with lowest common denominator service profiles, and coupling this with arming applications with the necessary capabilities to support service transactions. In other words the basic foundations of the Internet lie in cheaper, simpler networks and smarter and more capable applications. The effort to arm networks with complex quality and service manipulation capabilities in the guise of NGNs and QoS networks appears to be a step in precisely the opposite direction to what customers demonstrably want from networks. One would've thought that the optimal and perhaps the most efficient approach would be to arm networks with adequate bandwidth and then let applications operate in whatever fashion they chose as overlay constructs.

The Next Killer App

There is no next vertical killer application coming, and it certainly isn't going to be just VoIP.

We are seeing a new suite of application components in the form of XML, Ajax, RSS, Torrents, Podcasts and similar, and methods of constructing content in previously undreamt of methods. Many of the more captivating services are now in the form of overlay applications, such as Skype for voice or Google's Gmail for mail. The common factor here is that

these services do not use dedicated network infrastructure, but exist as application level overlays. Its clear in this that user's perception of where the value lies is shifting to the application rather than remaining with the network's access infrastructure. This value shift is not coalescing within a single application, however. What is evident is that the application space is now an area of intense innovation, and we are seeing diversification in this space, rather than convergence. The richness of structured data sets and their potential to create innovative services is an obvious outcome of this application level activity.

Structural Value Transfer is Underway

The implications of these trends to continued diversification and role specialization within the industry are also visible in terms of the financial picture of the industry. In a presentation at the ARIN XVI meeting in October 2005 Kim Claffey of CAIDA provided a table of comparison between the financial position of access providers and carriers and the position of those enterprises that work at higher levels of the protocol stack. This is reproduced below:

	Carrier	EPS (\$)	CAP (\$B)	Enterprise	EPS(\$)	CAP(B)
	MCIw	-11.22	6.5	Google	3.41	97
	SPRINT/NXTL	-0.31	34	Amazon	1.25	19
	Verio/NTT	1.98	71.6	Yahoo	1.07	49
	Level3	-0.74	1.9	Ebay	0.73	51
	SBC/T	1.41	78	Apple	1.56	47
	QWEST	-0.45	7.7	Intel	1.33	141
	COGENT	-7.42	0.2	Verisign	0.93	6.15
	GLBC	-13.84	0.3	Dell	1.27	76.3
	SAVVIS	-0.90	0.12	Microsoft	1.12	269
	TELEGLOBE	-0.74	0.2			
	C&W	0.70	4.7			
	TWTELECOM	-1.12	1.0			
	(TWARNER)	0.48	82			
	XO	-2.18	0.4			

Source: finance.yahoo.com, 25 October 2005

This is obviously not the outcome of a process of convergence within the industry. A more rational explanation is that the past decade has seen a restructuring of the industry with role specialization being the dominant feature. It appears that value in this industry has deserted the traditional carrier role and these days it's the enterprises that logically sit "above" the carrier and "below" the user that appear to be the beneficiary of this ability to focus on chosen roles.

What should we be learning?

It would be good to think that we've learned from the recent boom and bust, and that as an industry we will be more critical when looking at the next wave of converged service delivery solutions in this industry. Right now there is a major level of restructuring activity within the industry, with mergers and acquisitions taking their toll on historical icons of the industry, while others are undergoing radical organizational surgery at regular intervals as possibly their last remaining survival strategy.

Perhaps its time to forget about convergence, and instead look at what it takes to survive as a carrier ISP in today's deregulated, competitive, unconverged world. Certainly one of the more important principles is to stop attempting to add value to the network by spending large amounts of effort in providing a panoply of services that customers simply don't want and don't value. It would appear that what customers want today is for packet carriers to stick to the basics - keep overheads low and operate a network that is simple, stable, fast and cheap. User value construction is happening at the edge of the network through overlay structures, and the major attribute of networks today is not convergence per se, but the ability to open the network's edge up for competitive innovation.

It appears that vertically integrated service providers are fading away, and convergence is fading away with it. The deregulated service industry continues to specialize rather than generalize. Valued service delivery is increasingly based

on overlay systems that treat the network as a simple packet transmission service. The harsh lesson here is that the converged Utopia of the old world carrier industry is now no more than a piece of nostalgic mythology. And a rather dull and uninteresting one at that. The unconverged service world of layered applications is vibrant, innovative, exciting and very much alive . And maybe that's a very good thing.

Vive la différence!

Disclaimer

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About the Author

GEOFF HUSTON holds a B.Sc. and a M.Sc. from the Australian National University. He has been closely involved with the development of the Internet for many years, particularly within Australia, where he was responsible for the initial build of the Internet within the Australian academic and research sector. He is author of a number of Internet-related books, and is currently the Senior Internet Researcher at APNIC, the Regional Internet Registry serving the Asia Pacific region. He was a member of the Internet Architecture Board from 1999 until 2005, and served on the Board of the Internet Society from 1992 until 2001.