

Won't Get .Fooled Again

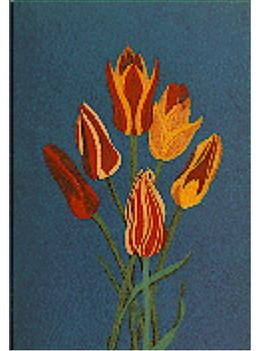
Geoff Huston, APNIC

NANOG 35

Boom and Bust

Is nothing new...

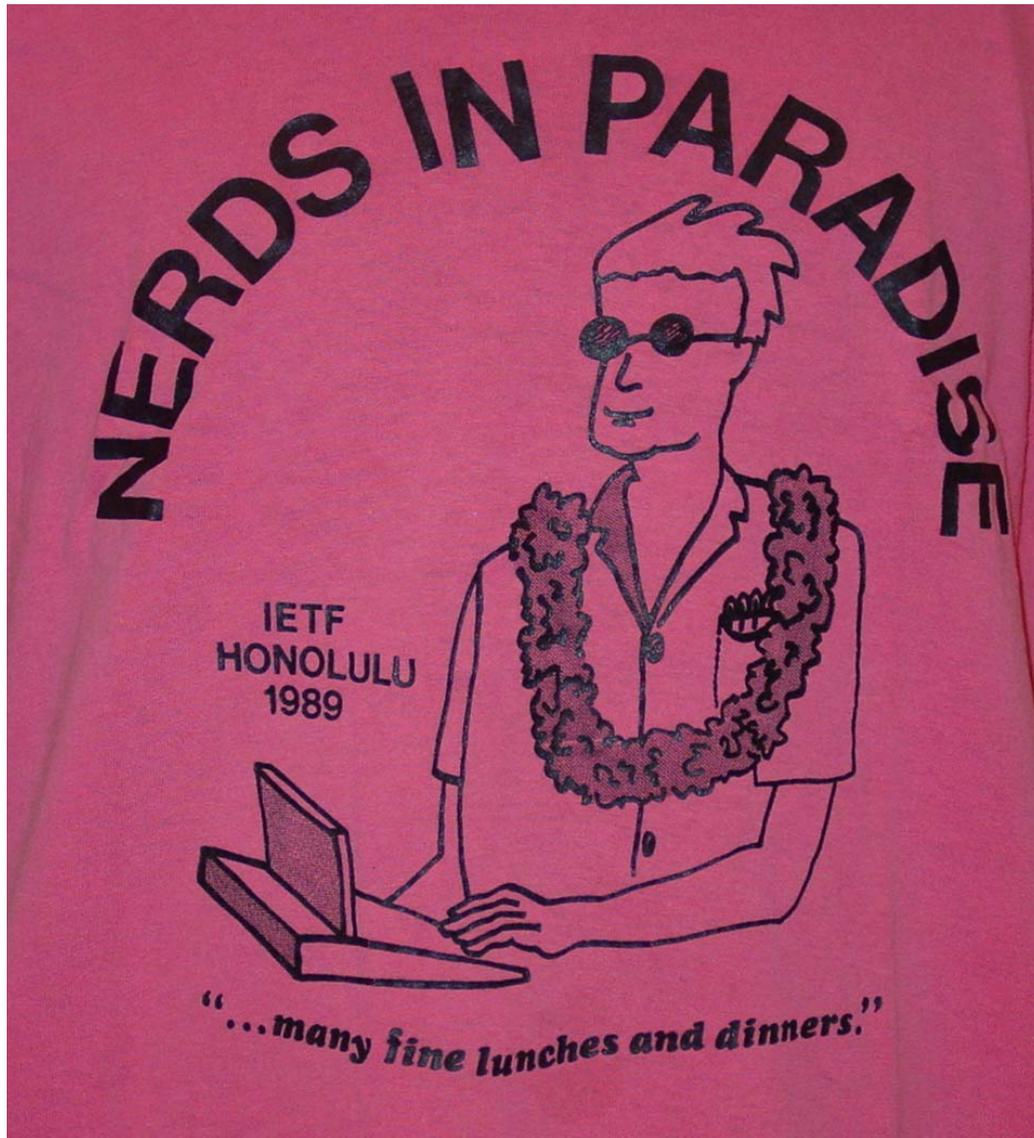
- 1637 – tulip mania takes hold in Holland and the price of tulip bulbs escalates to fantastic levels. The subsequent recovery from the crash took decades to overcome.
- 1719 Banque Royale – John Law introduces the French king to the magical mysteries of bank credit and paper money. At this point the word “millionaire” entered our vocabulary. But by 1720 the Parisian crowd were less than impressed with Law’s sharp dealings as the French economy collapsed utterly and France was brought to the brink of revolution.
- 1847 – the great British railway boom and bust



Oh what a .boom!

There is no doubt that the Internet boom was as euphoric, as imaginative and as inspired as any other boom

Just remember the Tshirts.....



The world was
changing -
and the geeks
were driving
the change

Anything was possible

The 5th Wave

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By Rich Tennant

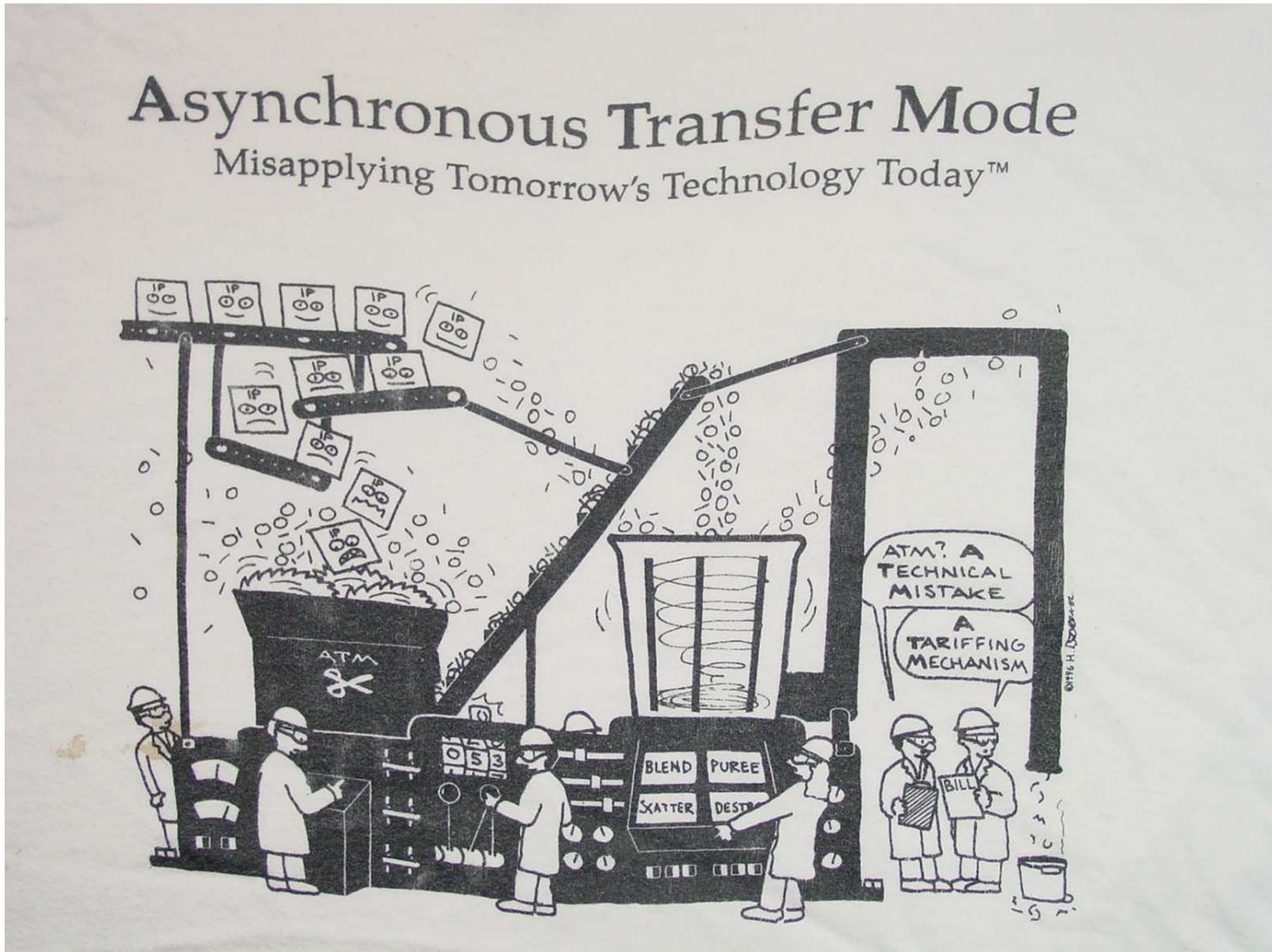


IN A DISPLAY OF PERVERSE BRILLIANCE, SIMON THE REPAIRMAN MISTAKES A COMPACT DISK PLAYER FOR A WORKSTATION SYSTEM UNIT, BUT MANAGES TO TIE IT INTO THE NETWORK ANYWAY.

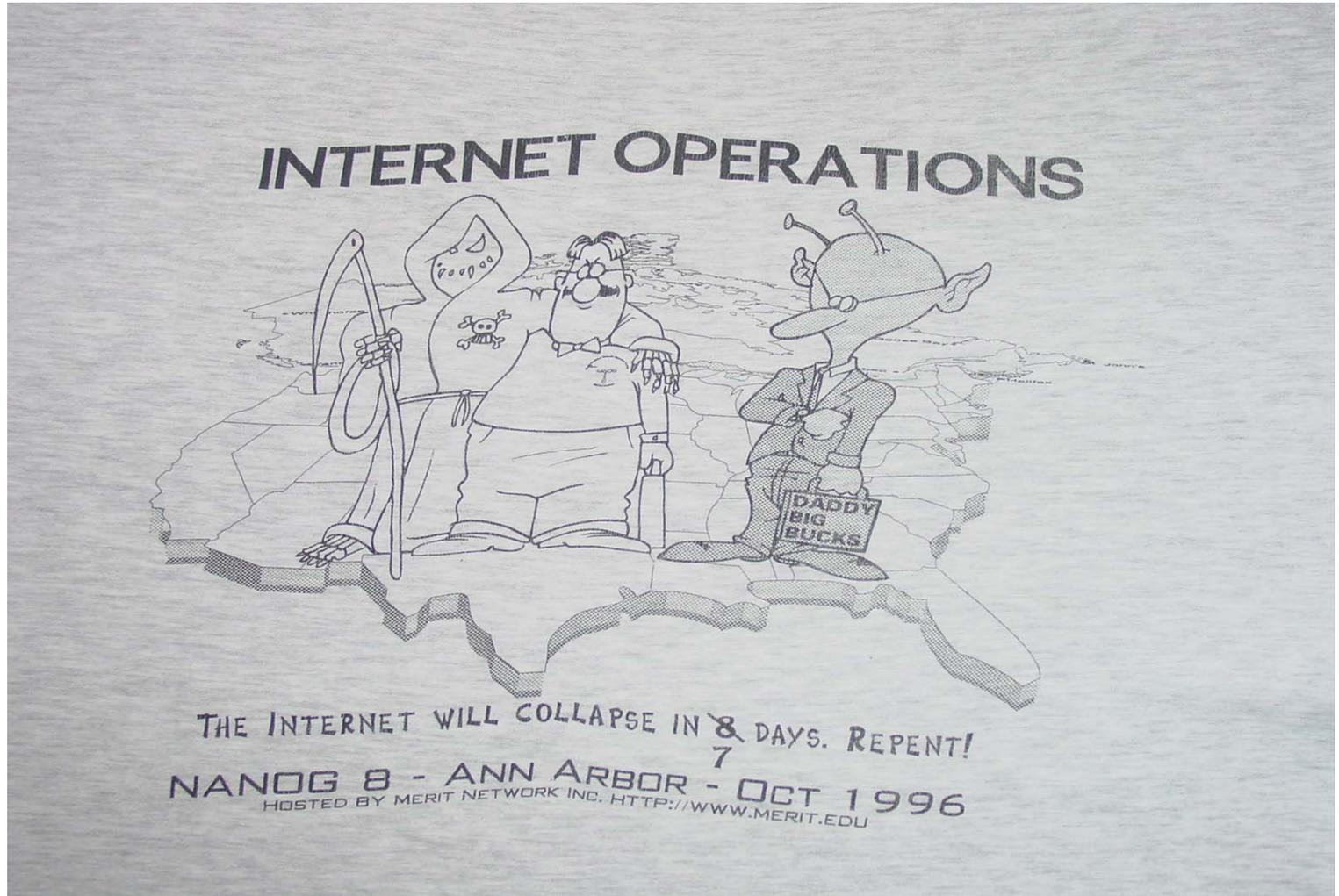


Even Internet Toasters

And the old ways of doing things were ridiculed



But the spectre of a bust was lurking
just around the corner



It's a post-dot-boom-and-bust world

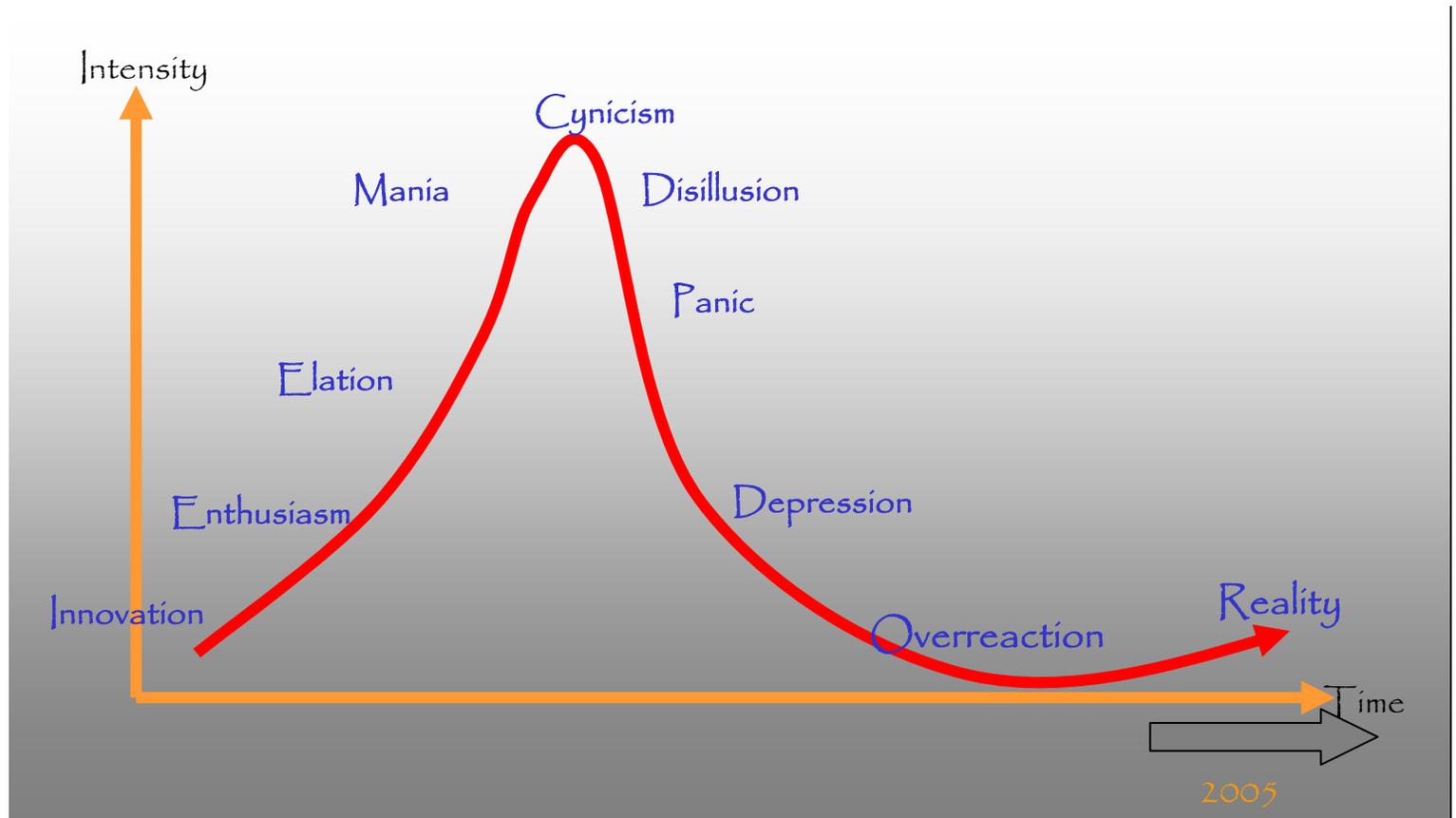
The Internet boom has been pretty mild by comparison with past booms in gold, oil, rail, shipping, ice and, of course, tulips.

The peak of the Internet boom saw stock indices peak at just 3 times their longer-term value



It's a post-dot-boom-and-bust world

- But the lessons from the boom cycle are no different...



Today

- ISPs no longer operate a rapid expansion-based business model
 - Internet service business models are tending to use a common theme of service consolidation
- Industry attention at the ISP level is now concentrating on product marketing aspects of the Internet service model:
 - Dependability and integrity
 - Utility and flexibility
 - Value-add service models
 - Quality and performance
- Applications and Services that meet business case criteria

From Optimism to Conservatism



- We've learned that optimism alone is no substitute for knowledge and capability within the industry
- A conservative period of consolidation rather than explosive growth
 - Investment programs need to show assured and competitively attractive financial returns across the life cycle of the program
 - Reduced investment risk implies reduced levels of innovation and experimentation in service models
 - Attempts to combine communications with additional services to create value-added service bundles
 - Accompanied by greater emphasis on service robustness and reliability

Security Questions

- We've learned that we need to understand more about what stakeholders want from the Internet in terms of security
- The list of outstanding issues include:
 - How can users identify each other?
 - How can users identify network-based services and validate the integrity of such services before entrusting them with data?
 - How can the network protect itself from abuse and attack?
 - How can users protect themselves from abuse and attack?
 - What are a user's obligations and responsibilities?
 - How can abusers be identified? And whose role is it?
 - What is the role of the ISP?
 - Neutral common carrier?
 - Trusted intermediary?
 - Enforcement point?

Security Focus



- We've learned that we cannot operate global networks based on random trust models
 - A highly visible security focus for the next few years
 - Increased end-user awareness of vulnerabilities and weaknesses and a desire for more secure and trustable services
 - Increased public sector agency awareness of the vulnerabilities of the Internet communications environment and its consequences
 - A response based on increased technology effort in dismantling aspects of the Internet's distributed trust model and attempting to replace it with negotiated conditional trust
 - There is now a considerable industry based on insecurity
 - But little actual work based on robust security

Convergence and Multiple Networks



- We've learned that IP is not the panacea of communications protocols and that "convergence" remains a deluded carrier executive fantasy
- Recognise TCP/IP's strengths and weaknesses:
 - ☺ TCP/IP allows adaptable traffic sessions to operate extremely efficiently over wired networks
 - ☹ TCP/IP is probably not the optimal approach to support resource management requirements
 - ☹ TCP/IP is not strong in supporting real time traffic under localized congestion events, various forms of traffic engineering applications
(Unless you are willing and able to overprovision everywhere!)
- "Everything over IP" is still not a viable carrier strategy - continued use of multiple networks to provide specialized service environments for various communications application sectors is likely for some time yet

Convergence and Multiple Networks

- What's the desired model here?
 - Adaptive response networks supporting non-adaptive application transport sessions

Or

- Best effort networks supporting cooperative adaptive transport sessions
- So far, the efforts in IP have obtained the greatest deployment leverage through using adaptive applications through a common base best effort network.

Bandwidth Abundance Lessons



- Dense Wave Division Multiplexing is lifted per-strand optical capacity over a thousand-fold
 - from 2.5Gbps to 6.4Tbps (640 wavelengths, each of 10Gbps per lambda) per optical strand
- The major long haul communications routes worldwide are more than amply provisioned with IP bandwidth
 - The shift from demand-pull to massive supply-overhang has destroyed the business stability of the long haul communications supply market.
- We've learned that when you eliminate one choke point in a system you expose others
 - Doh!
- The network 'choke' points are shifting to the access domain, not the long haul elements
 - Continued pressure for high speed last mile services

Technology – IPv4

- We're learning that we might be stuck with making IPv4 work for longer than we thought we could or should
- IPv4 remains the overwhelmingly dominant protocol choice for the service industry
- Its now a NAT world - but NAT has its problems
 - Peer-to-peer networks
 - Service fragility
 - VOIP
 - Complexity and Cost
- Even with NATS we are running through the IPv4address pool – IP service networks will need to commence some considered investment in IPv6 sooner rather than later

Technology – IPv6

- “IP with larger addresses”
- Address space requirements are no longer being easily met by IPv4
- This is an issue for high volume deployments including:
 - Pocket IP devices
 - Consumer devices
- IPv6 appears to offer reasonable technology solutions that preserve IP integrity, reduce middleware dependencies and allow full end-to-end IP functionality for a device-rich world

BUT

Noone wants to pay for widespread IPv6 deployment just yet!

IPv6 - From iPod to iPOT



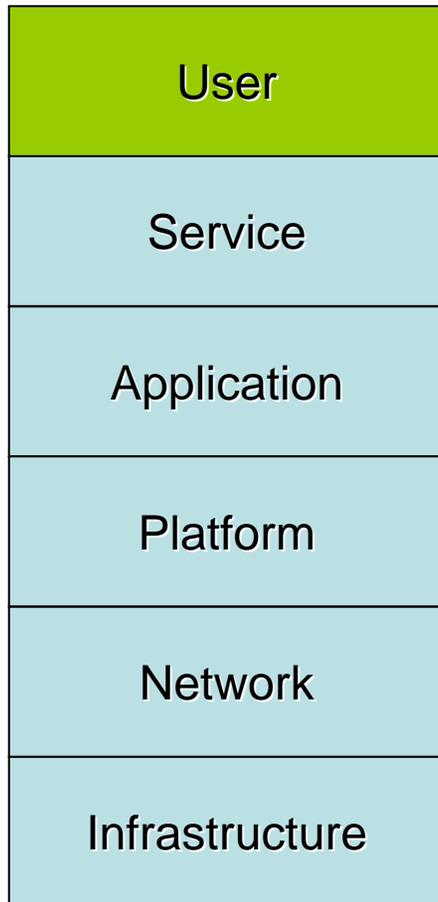
○部分をクリックすると
拡大写真をご覧いただけます。

- IPv4 cannot sustain a device-dense world
- If we are seriously looking towards a world of billions of chattering devices then we need to look at an evolved communications service industry that understands the full implications of the words **“commodity”** and **“utility”**

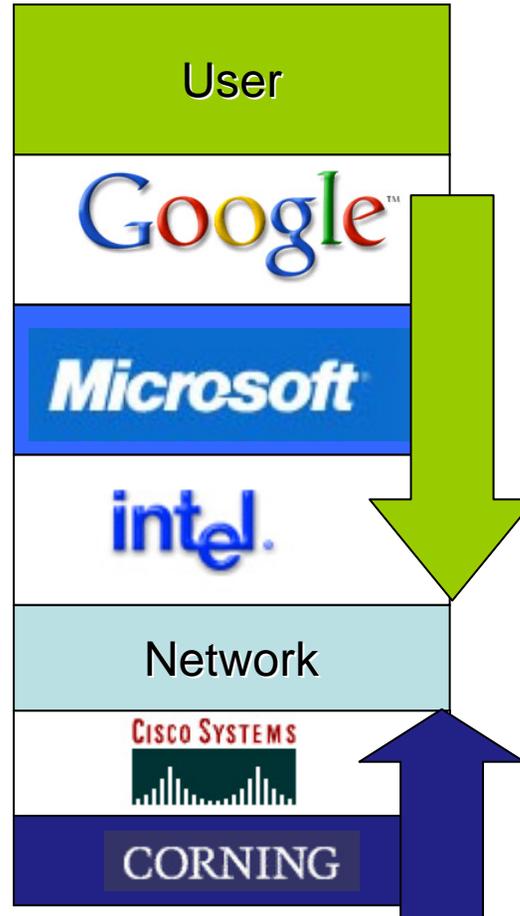
Voice over IP

- We're learning that voice has more dimensions than just emulating simple carriage of a voice signal
- The technology is getting better...
 - Load-sensitive codecs that adjust their signal rate to the current delay / loss characteristics
 - Abundant trunk bandwidth circumvents the need for detailed QoS in the network core
 - Solutions available to map between the telephone address domain and the Internet address domain (ENUM)
 - Intertwining hand-held devices into phone + PDA
- But its more than Skype - there are many practical technology, regulatory and business issues remain on the VOIP path....

Today's Carrier Squeeze Play



The Traditional Model



The Emerging Model

The ISP and The Carrier

- The Carrier ISP business is being pushed into the role of:
 - Commodity IP transit provider
 - Consumer market IP access
 - SME IP access
- The enterprise ISP market is being pushed into the role of:
 - SME service integrator

Optimism vs Reality

Convergence to IP as a multi-media broadcast medium are not well grounded

Triple Play Time is over – BitTorrent wins

Optimism vs Reality

Value Added Service Networks are causing value address service network providers to overstress their business model

Leave overlays to the edge

Optimism vs Reality

The Internet's major point of leverage was ultimately cheaper services, not better quality

QoS in the core has lost

Optimism vs Reality

The Internet is a lousy time switch

High quality real time data needs high
quality real time switching

Optimism vs Reality

VoIP is a regulatory mess

and its going to get a lot messier yet!

Optimism vs Reality

Carrier platform convergence with the mantra of ‘everything in ~~ATM~~ IP” is still a myth

Get over it!

Optimism vs Reality

IP is the not the foundation of high value add networks

From value to volume - IP Transit is heading into a volume-based low-value commodity activity

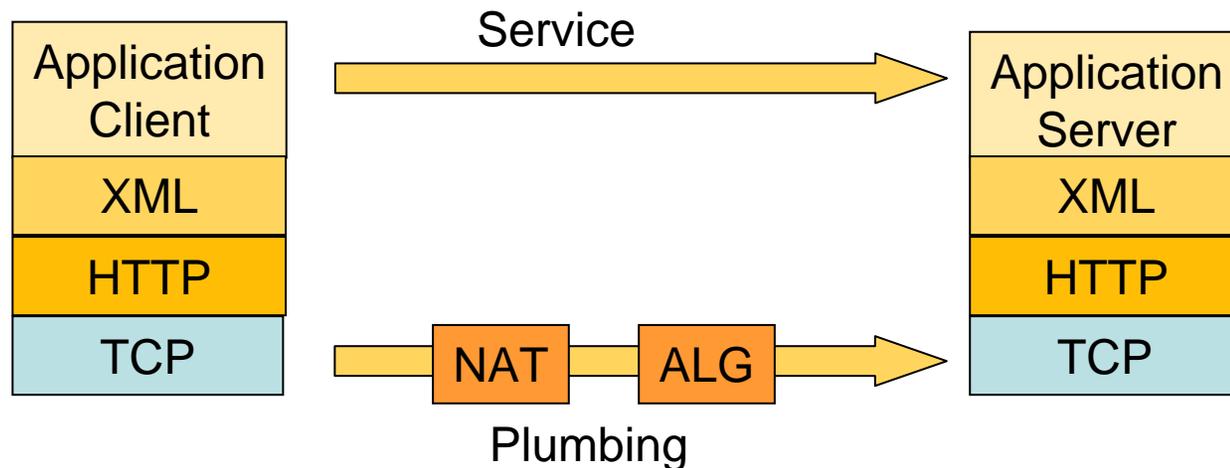
Optimism vs Reality

Stop looking for another “killer app” – now ‘everything over http’ appears to have won the users’ play space!

Think XML, RSS, Wikis, Blogs, Torrents, Podcasts,...

The Current Situation

The entire Internet service portfolio appears to be collapsing into a small set of applications that are based on an even more limited set of HTTP-mediated transactions between servers and clients



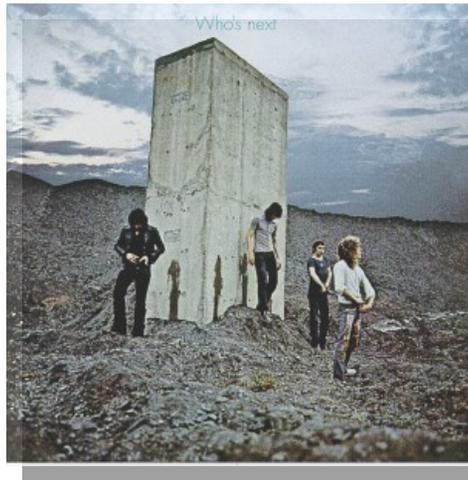
What have we learned?

- That the Internet is not infinitely elastic and some things just cannot fly no matter how much thrust is put under it
- Vertical service providers are fading away- building communications infrastructure is one thing, using it to best effect is another - both aspects require care and attention from dedicated players
- That the Internet may not be the best entertainment medium today – but it's a remarkable exchange medium.
- That this is an immature technology-intensive activity with much that we still have to learn

So what can we expect?

- My personal list of expectations for the next few years:
 - Another round of the battle for the user is looming (.Boom II)
 - Networks are a commodity utility business with commodity returns (the shift from value to volume) – this is just plumbing
 - More surprises from Google et al in terms of compelling user service models and business creativity to capture the user
 - The regulatory pendulum is swinging back - renewed levels of regulatory interest to ensure that public objectives are being achieved
 - More restructuring - industry sector members with longer term objectives phrased more modestly than may have been the case in the past five years

Meet the new economy



The classic The Who song, written by Pete Townshend, *Won't Get Fooled Again* was first recorded in early 1971. It was released on the *Who's Next* album in August 1971.

This song is about the same age as the Internet.

Same as the old economy