

Death of Innovation (Revisited)

By Bart Stuck and Michael Weingarten

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In 1997, we wrote an article called “The Death of Innovation?” ([Business Communications Review](#), April 1997; downloadable at www.signallake.com/publications) questioning the continuing ability of the US electronics high tech industry to innovate.

The article was prompted by the October 1996 spin-off of Lucent from AT&T, and with it, Bell Labs – an organization that was funded by cashflow from the telephone monopoly. Bell Labs used that money to invent the traveling wave tube, the transistor, lasers, UNIX, as well as 800/700/900 services. It also was a major innovator in loading coils, the coaxial cable, millimeter waveguide, fiber optics and cellular telephony. In the absence of monopolist cashflow, we wondered where new innovation was going to come from – particularly since our review of the top 20 telecom innovations of the previous 25 years suggested that many of them originated from these labs.

On the other hand, we recognized that the emergence of the venture capital model potentially could be a replacement (at least in part) for the monopolist corporate lab. Clay Christensen’s book [The Innovator’s Dilemma](#) (also published in 1997) points out that corporations over-emphasize line extensions and synergy opportunities, and avoid disruptive technologies. In theory, VC-backed startups, with nothing to lose and everything to gain, might be the ones leading the charge with brilliant innovations.

It’s now 2004. What’s happened since then? Are we seeing continuing technological innovation, or Houston, do we have a problem?

Methodology: Defining The Relevant Data Base

Our approach to this was quantitative: find a relatively complete set of high-technology startups that came to fruition in the post-96 period, and test the extent to which they represent significant technology innovations. We could then compare the level of innovation to the period just prior, to see if innovation is increasing or decreasing.

After considering various alternatives,¹ we were able to find such a list in the Morgan Stanley Technology IPO Yearbook. This comprehensive report lists 1,303 electronic high tech IPOs for 1993-2002, including market capitalizations as of the IPO date and at year-end 2002 (Table 1). Some of these IPOs (like Lucent or Accenture) clearly were spinoffs or recapitalizations of established companies rather than successful innovation-based startups. After excluding these, we had a database of 1,281 companies that we could review.

We further decided to eliminate from consideration Internet IPOs relying on e-commerce business models (i.e., Ebay), rather than on new technologies. This left us with 823 high-tech IPOs for review.

Table 1
Number of High Tech IPOs

	Number of IPOs 1993-2002
Total IPOs	1,303
Less: Spinoffs	22
Subtotal ex Spinoffs	1,281
Less: Internet E- Commerce	458
Net High Tech IPOs For Review	823

Source: Morgan Stanley Technology IPO Yearbook; Signal Lake Analysis

Having defined our data set, our next step was to divide it into two periods: a baseline, and a follow-on period that we could use to measure innovation changes over time. Using the late 1996 Lucent divestiture as our line of demarcation, we decided to use 1993-1996 as our baseline, and 1997-2002 as the follow-on period (the latter also corresponds to an upsurge in VC spending, which in theory should have resulted in an increase in innovation level).

¹ In addition to IPOs, we also reviewed 213 acquisitions of privately-held startups by companies such as Cisco, Lucent, and Nortel, and tested these according to our T1-T5 methodology. The results substantially mirror the IPO findings that we show here.

Methodology: Ranking IPOs By Level of Technological Innovation

To test for level of innovation among the 823 non-Internet IPOs in our data set, we ranked each company on a scale of 1-5 (with 1 being high and 5 being low):

Our criteria for ranking degree of innovation was as follows:

- We reserved our highest rank (T1) for new technologies representing a fundamental departure from anything existing previously, and whose commercialization made possible an entirely new (and important) business market. A good example is the invention of xerography.
- Moving down one notch, we ranked a company as T2 if it was able to demonstrate fundamental technology improvement in an existing product category. These include Clay Christensen's 'disruptive technologies;' i.e., new technologies that supplanted old technologies in already-established markets, rather than creating new markets.
- Our T3 designation was reserved for companies able to demonstrate non-trivial technical improvements in existing product categories. However, the nature of the improvement was largely one of extending existing technologies (i.e., by using ASICs with .13 rather than .18 nm traces). The result of T3 innovations could well be the next Moore's Law jump in speed/computing capability. However, we see these as obvious (if non-trivial) serial extensions in existing technologies rather than truly disruptive innovations. We also tend to see T3 improvements as substantially less defensible long term than T1s or T2s (unless first mover advantage results in long-term customer lock-in). After all, a first-mover Moore's Law announcement by Player A invariably is matched within months by Players B, C and so on.
- Our T4 designation was used for companies able to demonstrate modest improvement in existing technologies, perhaps by repackaging a combination of already-commercialized technologies in novel ways. In many ways, T4 is like T3 but with less significant improvement over what came beforehand.
- Our T5 designation was used for companies who did not create new technology, but were able to successfully market existing technology. Alternatively, companies developing *new business models* using well-established Internet technologies (i.e., Ebay or Amazon) would receive T5 designations.

Ranking Results

The results of this process (Table 2) were startling, in that ***they indicated a surprisingly low degree of technological innovation generally, and a sharp reduction in the level of innovation since 1996:***

- **There were very few T1/T2 companies in general, and a sharp decrease in the number of T1/T2 companies over time:** In 1993-1996, there were only 20 T1/T2s, representing 4.4% of total IPOs (and 5 IPOs each year). In contrast, the numbers for 1997-2002 were substantially worse: 5 T1/T2s, representing 1.4% of total IPOs (0.8 IPOs per year).

For a list of T1 and T2 IPOs, see table 3.

- **The number of T3s, while significant in the 1993-1996 time period, decreased substantially in the 1997-2002 time period:** In 1993-1996, there were 29 T3 IPOs per year (25.7% of all IPOs). By 1997-2002, there were only 7 T3s per year (11.4% of all IPOs).

Our T3 list includes a number of companies that were acquired for large premiums (for 1993-1996: Ascend, Lycos, Cascade, Etec Systems, XLAN, and DSP Communications; for 1997-2002: E-Tek, MMC, Galileo).

The list also includes companies that were not acquired and were worth \$1B or more as of 12/31/02 (for 1993-1996: DST, Siebel, Network Appliance, Checkpoint, Etrade, National Instruments, Checkfree, IDT, TMP, Adtran and Cymer; for 1997-2002: Juniper, Marvell, Broadcom, Netscreen, BEA, nVidia, RFMD, AMCC and Maxtor).

- **Most of the IPOs were T4s:** In 1993-1996, 66% of all IPOs were T4s, increasing to 87% in 1997-2002.

For 1993-1996, some major T4 companies included: Netscape, Intuit, Aspect Development, Microchip Technology, Jabil Circuit, Mercury Interactive, Spyglass, Sanmina and Citrix Systems.

For 1997-2002, some major T4 Companies included: Network Solutions, Tycom, Alteon Websystems, Verio, broadcast.com, Arrowpoint, LHS Group, and L-3 Communications.

There was a relatively few T5s in either period: This reflects the fact that we excluded most Internet e-commerce plays, many of which would have been ranked T5.

Table 2: IPOs By Technology Ranking and by Time Period

Technology Ranking	1993-1996			1997-2002			Ratio 97-02/93-96: Companies Per Year
	# Companies	% Of Total Companies	Per Year	# Companies	% Of Total Companies	Per Year	
T1	5	1.1%	1.3	2	0.5%	0.3	0.27
T2	15	3.3%	3.8	3	0.9%	0.5	0.13
Combined T1/2	20	4.4%	5.0	5	1.4%	0.8	0.17
T3	117	25.7%	29.3	42	11.4%	7.0	0.24
T4	301	66.2%	75.3	320	87.0%	53.3	0.71
T5	17	3.7%	4.3	1	0.3%	0.2	0.04
Total	455	100.0%	113.8	368	100.0%	61.3	0.54

Source: Morgan Stanley Technology IPO Yearbook; Signal Lake Analysis

Table 3
T1 and T2 Companies by Time Period

Technology Ranking	1993-1996	1997-2002
T1	Yahoo! Security Dynamics (RSA Security) Illinois Superconductor Superconductor Technologies Conductus	Akamai VeriSign
T2	Versant Object Tech. (Versant) Rogue Wave Software Orckit Communications MindSpring Sawtek Pixar SDL Maxis ParcPlace-digitalk (Object Share) Fore Systems Ortel Veritas Software Uniphase (JDS Uniphase_ TriQuint Semiconductor Level One Communications	RealNetworks Ciena Inktomi

Source: Signal Lake Analysis

Examples of Successful T3 Companies

Given that our rankings are surprisingly low, we thought that we should illustrate why some specific companies (generally considered to be high tech success stories) deserve to be ranked, as say, T3, rather than T1/T2 (the rankings for T4 and T5 being more obvious).

Our first example is Juniper, which we rated as T3. Juniper is an excellent company, with a market value of \$2.55B as of 12/31/02 and \$11B as of February 2004. That's not bad, particularly when compared to Lucent's \$18 billion. As VCs, we would have been happy to have been Series A investors.

So why did we rate Juniper as T3? The answer is that we see it largely as a successful execution play rather than as a poster child for brilliant innovation. After all, what did Juniper do? It took well-established routing technology (already commercialized by Cisco, Ascend and Cascade), and created custom ASICs that allowed it to sell the first 1 gbps router, filling a gap left open by Cisco. That's nice, but it's not an example of developing fundamentally new technology or opening up a new product area. At best, it's a T3 Moore's Law advance.

What really made Juniper a success was not its technology per se, but rather its ability to get funding/support from Lucent, Nortel, Siemens and Ericsson simultaneously, and a skilled

management team able to fill a market need quickly to the exclusion of others like Redback and Avici (who had similar technology, but failed to gain traction).

A second example is Broadcom. Broadcom began by working with the CATV industry on the detailed specs for its DOCSIS cable box technology. It then was able to leverage that detailed knowledge by creating chipsets for cable boxes. There wasn't anything particularly innovative about that; simply the leveraging of asynchronous knowledge.

A third example is E-Tek. E-Tek was developing a variety of optical networking components, based on innovative views of market needs and materials and technical capabilities. As such, E-Tek was not innovating per se, but using a sharp focus on market needs to drive product engineering.

A final example is BEA. BEA was originally set up to provide to the Global 200 the open standards based software needed to run enterprises, rather than relying on proprietary IBM oriented offerings. As such, BEA originally bought the Tuxedo transaction processing monitor from Novell, which provided a customer base, and then extended this in a very astute acquisition of Web Logic to move into the Internet based enterprise market. As such, BEA was not innovating per se, but again, using a sharp focus on market needs to drive product development and acquisitions.

Conclusion

After looking at 1,300 high tech IPOs over a ten-year period, we conclude that there wasn't all that much technological innovation generally – and that the level of innovation – measured by the total number of IPOs per year and by the level of innovation -- decreased dramatically in the 1997-2002 period, compared to the four year period just prior – all this, despite the fact that VC spending did just the reverse (Table 4). Apparently, a 10x increase in venture funding led to an 83% reduction in the number of T1 and T2 IPOs each year!

Table 4
Annual US Venture Capital Funding

Year	Number of Companies	Venture Financing
2002	3,134	\$30,438
2001	5,267	52,212
2000	8,859	131,984
1999	4,890	63,990
1998	2,860	24,822
1997	2,122	13,194
1996	1,797	10,457
1995	1,133	6,417
1994	746	2,990
1993	671	2,469
	Per Year	Per Year
97-02	4,522	52,773
92-96	1,087	5,583

Source: Venture Economics quoted in Morgan Stanley Technology IPO Yearbook:
Signal Lake Analysis