

The Network Equipment Manufacturer Challenge A Toroki Communications White Paper

*“All successful projects are the same. All unsuccessful projects fail in their own way.”
- With apologies to Leo Tolstoy*

It's almost a cliché to talk about the failure rates of embedded development projects, which include among other vertical markets, the focus of this paper - networking equipment. Estimates have ranged from 30% to 80% depending on whom you ask, and the reasons given vary. If you speak to engineers, the issues usually relate to technical complexity: more sophisticated functionality, greater scale, higher performance, more sophisticated hardware, more lines of software code. The marketing folks will often refer to project requirements either not being well understood or not being specified accurately or completely to engineering. Project managers will speak about unrealistic schedules and insufficient time allocated to testing. What isn't debated is the veracity of the underlying claim, namely that the industry hasn't demonstrated much of a track record when it comes to successful product development.

It was Einstein who defined insanity as doing the same thing over and over again and expecting different results. Well, say what you will about network equipment manufacturers, but they aren't crazy, and a survey of project development practices reveals that real changes are occurring. Before examining some of those changes, however, let's try and gain a better appreciation of the challenges network equipment manufacturers (NEMs) face in bringing successful products to market, and let's do this by looking at some of the market forces at work.

- **Complexity.** This can be measured in many ways, some of which were listed above. As networks continue to grow in scale, speed, and functionality, engineers must grapple with all three parameters simultaneously. The problems are getting harder to solve, and it's just not possible to anticipate a priori every possible post-deployment operational scenario.
- **Reliability.** This relates closely to complexity but deserves its own mention. As consumers and businesses increasingly depend on networks, including the Internet, to conduct their affairs, expectations grow for ubiquitous availability of network services. This translates into serious work for networking engineers.
- **Standards and Interoperability.** In theory, if all vendors adhered to standards and the standards themselves were well specified, all networking products would work well together. The reality, of course, paints a far different picture. Networking products are simply too sophisticated to guarantee that equipment from different vendors will all play nicely together. Products must be extensively field tested to really work out the kinks.
- **Cost pressures.** As with most technology categories, networking products suffer from the phenomenon of having to add significant functionality – at a cost, of course – just to maintain existing pricing levels. ‘Do more with less’ has become the rallying cry of many equipment makers, but this approach must have its limits, or least experience diminishing returns. This trend is likely to

perpetuate as products developed in lower cost geographies continue to come to market.

So what's a poor NEM to do? Clearly, we are observing a work in progress; however, at least three clear responses have emerged to date.

Response #1 – Outsource. This is the obvious one, and of course it transcends embedded networking development. But whereas enterprises tend to outsource primarily to gain cost advantages, NEMs also look for expertise that may be very difficult to find in their home countries. While outsourcing and globalization are here to stay, it's becoming well recognized that returns on this strategy diminish in relation to project complexity: proportionally, more time and energy are spent dealing with distributed teams in different time zones. Many NEMs have learned this the hard way as realities have not lived up to expectations for very complex equipment development projects.

Response #2 – Technology Leverage. The slightly less obvious response sort of represents the technology equivalent of outsourcing, but rather than people, it's intellectual property that is leveraged. The most prolific example of outside technology leverage is open source software, the preeminent example of which is the Linux operating system. In using open source, equipment makers can take advantage of millions of lines of well-vetted code that would have taken many person-years to develop internally. The arguments against open source are pretty well known, but like people outsourcing, it's found a home in embedded networking and is very much here to stay.

Response #3 – Drive integration into the supply chain. This is the least-well understood of all these trends but may have the highest long-term impact on the industry. As any industry evolves, supply chains grow around it, feeding the raw materials, sub-assemblies, and unfinished goods that enable a manufacturer to bring products to market ever more efficiently and profitably (think of the auto industry where the first car companies operated factories to process the natural and made-made materials required for tire production!). When suppliers deliver more highly integrated components, vendors achieve a more advanced starting point in their projects, thereby decreasing both technical and schedule risk. An extreme example of this is those NEMs who do almost no development engineering; rather, they focus their technical resources on product specification and acceptance testing. Over time, it's conceivable that we will see market segments in which one or more suppliers to the network equipment industry will in fact inherit the default role of primary system integrator.

Winners and Losers

If that scenario unfolds (and we're already seeing it in some markets like wireless access points and low end residential gateways), it's interesting to speculate about who among the suppliers to NEMs will be best positioned to fulfill the system integration function. Among the candidates are the embedded software companies like Wind River and Green Hills; intellectual property vendors such as ARM and Synopsis; professional services providers, such as IBM Global Services and Accenture; and finally the silicon vendors, including the more horizontal ones like Freescale and Intel and the vertical ones like Broadcom and Marvell.

They all have their pros and cons, of course. The challenge for the embedded software vendors will be developing the vertical expertise required for high value-add system

integration, which can be resource intensive. The IP vendors and services providers certainly have deep enough pockets to expand their expertise, but the services companies lack experience in the embedded markets, and the IP companies have done very little with application software.

Silicon Vendors in the Driver's Seat?

Perhaps most intriguing to consider is the silicon vendors. Their system-on-chip offerings already convey a deep understanding of vertical markets and they are large enough to continue that investment. From there it's a short step up to providing application software (although some of the historic examples don't bode well here). Because silicon choice is always one of the first decisions made on any project, chip companies usually enjoy the first opportunity to influence a vendor's direction. This provides them with a unique opportunity to offer highly integrated hardware/software solutions that allows the network vendor to focus on their core competencies.

It will be interesting to observe how these dynamics play out over the remainder of the decade. While the outcomes are very much in doubt, we can be sure that the forces at work in the networking equipment industry will have a fundamental impact and affect all of us who work in it.