

### **Is Electronics Obsolete?**

*...“It’s a Bird, It’s a Plane...It’s a Photon!”*

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The photon is here - the new messenger of the Internet Age. This chargeless quantum of energy is now zipping around much of the world at 186,000 miles per second. A trip from Boston to Los Angeles takes only .002 seconds if we factor out router delays. The data-rich photon has become the darling of technologists and investors. These magic bits of light energy carry your e-mail and web content across the continents and under the oceans riding the World Wide Web spun of fine glass filament. But the photon can also leap tall buildings as wireless photonics is unleashed in metro areas. Soon, you may connect to the Internet at ultra-broadband rates in airports and other centers with invisible infrared photons spewed from ceiling domes that link laptops, PDAs and cell phones.

Photonics is the technology of harnessing light and includes telecom, imaging, analysis and many other sub-divisions. Telecom is the action arena for photonics and much of our newer electronics. Nearly all of the long haul or backbone Internet has adopted photonics because nothing is faster, has more bandwidth or better economics. The recent deployment of WDM (Wave Division Multiplexing) is expanding capacity by more than 100-fold as a rainbow of “colors” is squeezed through a single fiber to bring data rates up to over a trillion bits/second. The number of wavelengths, or lamdas, could exceed 1000 in the future. Now add additional hair-thin glass fibers and we begin to approach unlimited bandwidth.

But will we in electronics be left behind as fleet photons sideline the slower and troublesome electrons? Will future board builders weave circuits of fiberglass and assemblers “solder” with optical plastics? A few contract assemblers are already dabbling with opto-electronic boards for Internet hardware customers, but the opto world is different, perhaps as strange as an alien planet. Dielectrics, like glass, become conductors and metals become insulators. The good news is that photonics is just part of the electromagnetic spectrum that includes familiar radio waves. The much higher frequencies of light still follow well-understood laws of science that has patiently waited for the technology.

While predicting the course of disrupted technology is complex, the 21<sup>st</sup> century Telecom Revolution, even with its new photonics “poster kid”, could be a multiple win for the electronics industry. First, photonics is enabling and catalyzing core broadband and this is accelerating “last mile” (“last link” is a better term) interconnectivity. Bluetooth (short range RF – radio frequency) and other net-to-consumer wireless links are launching and boost electronics manufacturing. But photonics products have high electronic content. The electronics industry can become the heir to the photonics windfall and the host for high volume assembly. Another bit of good news is that photonics is really embryonic even though the science is hundreds of years old. We will see the integration of photonics during this decade as we move from discrete manual assembly to integration and automation.

But who will build the products? It's like stepping back to the 1970's of electronics, but with hindsight turned to foresight and the power of modern technology. Complex photonics devices, called MOEMS (micro-electro-mechanical systems), are built with semiconductor processes that are part of our 200-billion industry. Wisely, these integrated optical devices are built using modified semiconductor processes and equipment to tap into the world's largest infrastructure. Electronics has honed its high volume manufacturing skills over the last two decades to become very cost-effective and is well-positioned to adopt photonics. We can therefore predict that our electronics industry will expand and adopt this young prodigious child. And telecom is only the beginning of the convergence of technologies. Also expect biotech to kick into high gear as it adopts photonics for diagnosis, DNA analysis and a host of other emerging areas.

So let's get enlightened to catch the old and new waves, radio, photonics and, yes....solder.