EUROTECH

Know Product Lifecycle Cost to a DIME

Control Risk, reduce time to market, and improve product features

Whitepaper

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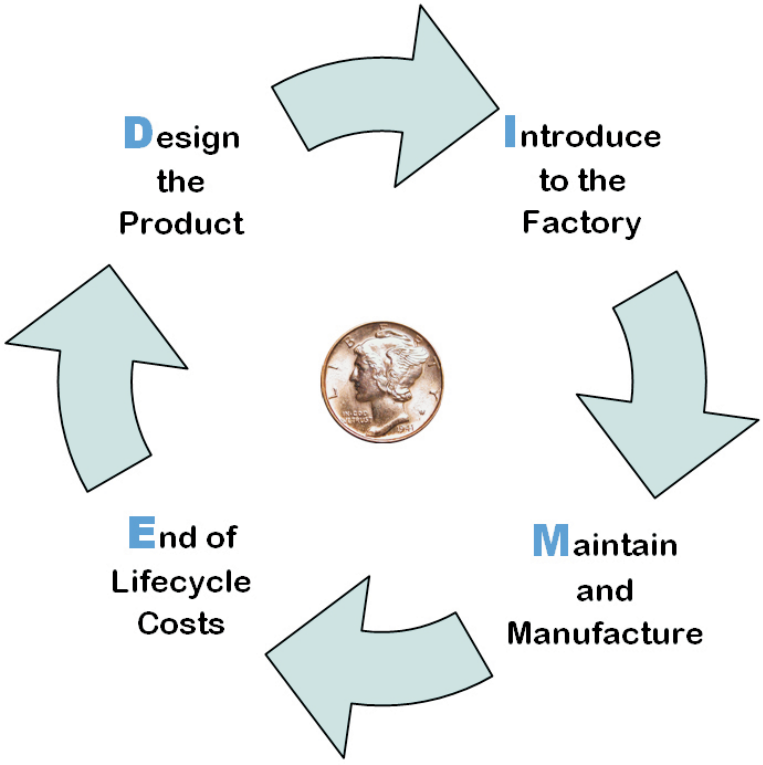
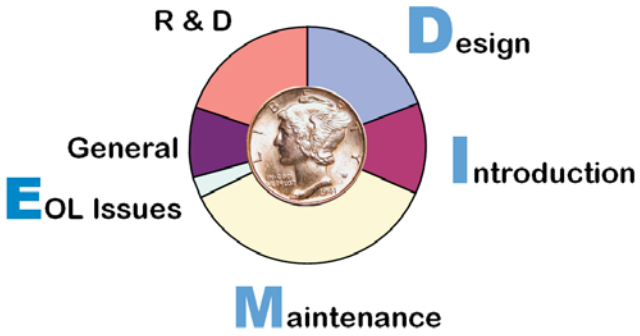
Abstract

The industrial, commercial OEM is pressured with an ever growing wish list of product features, and constrained by limited resources to deliver them. Applied Data Systems has developed a unique, partnership business model where we undertake the costs and risks of the back end, 32-bit computer portion of the product, allowing the OEM to focus on developing the core technology: the application. The partnership offered by Eurotech spans **D**esign, **I**ntroduction, **M**anufacturing & Maintenance and **E**OL considerations, hence the DIME mnemonic. The mnemonic is also suggestive of the commercial terms between Eurotech and its partner OEMs. All product lifecycle costs are paid as simple unit costs of the product. All product side risks such as design cost overruns, component EOL, and supply chain uncertainties are absorbed by Eurotech - all for a DIME.





This PIE chart reflects engineering hours at Eurotech's Columbia design center for the first 4 months of 2006. The hours are divided according to our customer's product lifecycle, and are generally reflective of an embedded system lifecycle cost, except the growth rate of Eurotech and long product lifetime of Eurotech products tends to exaggerate the "Design" and "Introduction" effort at the expense of "Maintenance" and "End-Of-Life"..

Introduction

Eurotech developed its current business model in the 1990s as OEMs were looking to employ the new 32-bit RISC CPUs and companions operating systems like Windows CE and Linux. OEMs wanted the ability to focus on their applications and develop against a well known and published API, but they found the supply chain associated with 32-bit systems was difficult to manage. The OEMs predecessor products had been based on stable CPU product families with long life and few specification updates. The new technologies were driven by consumer markets like cell phones and PDAs, and were just the opposite. Eurotech found itself filling the gap between OEMs who needed constant and dependable monthly supply, and silicon and software suppliers who raced themselves to bring new features and capabilities to successive generations of component. Gradually, Eurotech built a solid business model that meets the needs of a rapidly growing embedded market, and today Eurotech is one of the leading suppliers of 32-bit ARM embedded systems to the North American OEM community.

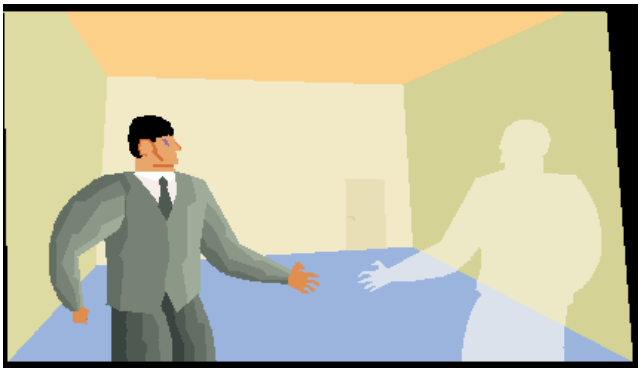


Figure 1- Eurotech works as the invisible partner to our OEM customers.

Eurotech puts these OEMs into the market at a rate of 2-3 per month, most with Architected Designs. Our success in putting OEMs into revenue production has won Eurotech accolades from our silicon and software suppliers, and the company, funded by cash flow, continues to grow.

The relation between Eurotech and its customer partners is best understood by looking at each component of the DIME.

Design- People, Tools & Support

The designer of the system is its' architect and as such sets the pattern for the full product lifecycle. A typical design package, sometimes referred to as "Schematic, Bill of Material, Gerber's and BSP" is typically sold in competitive bid, for somewhere between $250K and $750K depending on scope and how new the design is in comparison to the CPU release date. More than a dozen companies contend for this business, so the observed market pricing should be considered a reasonable indication of underlying costs. Costs can be manipulated a bit by the use of plug in modules but this typically only moves the cost from one portion of the device at one time in its lifecycle, to another portion of the device an another time. Good, architected design costs money.

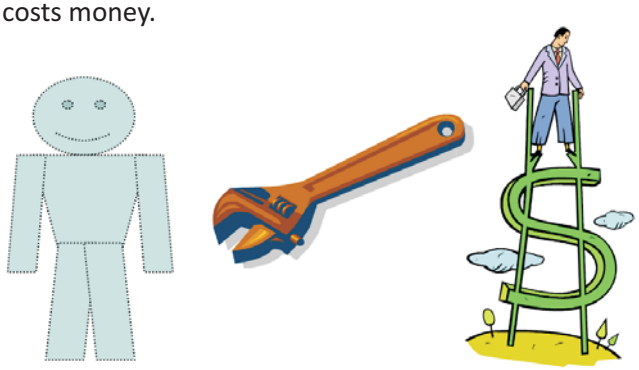


Figure 2- Good people, quality tools and first tier vendor support are required for an Architected Design.

In its DIME model, Eurotech routinely supplies a design PLUS the first 1000 units of inventory for the price others charge for just design. How is this possible? The answer is simple; we have optimized our people, tools and support structure for the class of projects we undertake.

Procifient Staff

The proficiency of our staff in their designated field of expertise is our biggest advantage. The manual for a state-of-the-art 32-bit ARM CPU is about the size of a telephone book, and information from virtually every page will be encoded, somehow, into a registry setting, CPLD, or assembler code. Windows CE Platform Builder is the largest, most complex product sold by Microsoft. Distributed on 7 DVDs, Platform Builder has over 10,000 menu options, and these myriad functions are not exactly self evident without extended study. In addition, for Linux and the GNU tool chain, the instructions themselves are a build-it-yourself kit. This incredible complexity requires our engineers to specialize in CE or Linux BSP, Display Drivers, Communications Drivers and other particular tasks. Similarly, Hardware Engineers specialize in schematic, layout, power supplies, component qualification, CPLD programming and so forth.

In the course of a typical project, ten or twelve specialists with varied skill sets might work on a customer's Architected Design.

Proficiency born of experience is the only way to deal with this information torrent. There are two types of engineers- those with their head in the manual and those with the manual in their head. Since Eurotech engineers typically work with the same CPUs, operating systems and components again and again, they carry a meaningful part of the manuals with them.

Simply put, our customers enhance value by focusing all of their engineering on what matters most: the application, while enjoying confidence in the embedded computer subsystem beneath it.

Quality Tools

We also invest in the highest quality tools, and we, through continued and repetitive applications, become proficient in their use. Eurotech maintains best in class schematic capture, board layout, simulation, in-circuit emulation and mechanical design tools. These tools are priced well outside of what most OEM companies can afford. Also, each of these tools has a steep learning curve, so our staff is specialized in their use.

Supplier Support

In an environment where technology upgrades every two years or so, deep, multi-level supplier relationships are required. By focusing on ARM, CE and Linux, Eurotech has developed close relations with the principle suppliers. Eurotech is active in the beta programs from Intel and Microsoft, and we contribute to the Debian community as well. Our connections go deeper than the sales and support organizations; we routinely call into, and get support from, our suppliers' product management, development and even research teams. Indeed, the path runs both ways, where sometimes our senior personal are asked to participate in pre-alpha reviews and actually direct our supplier's development.

Figure 3- Eurotech has multiple Vendor certifications and awards.

This supplier support is not free. Our suppliers recognize the commitments Eurotech makes to their platform, and are therefore are a bit more willing to 'open the kimono' early in product rollout. We also participate and support their product releases and trade show efforts, and provide them with case

studies and testimonials. Eurotech make this investment so our OEM customers are better connected to the technology they need.

Introduction- It's not polite to throw a design over the wall

In our experience, design is not as big a part of lifecycle cost as most people think. Getting the product into production, with required tools, test fixtures, and an operative supply chain is just as big an effort. The central problems are that with fast changing technologies, supply chains and manufacturing methods are not uniform across all factories. The device must be designed for the specific facility where it is made.

Figure 4- Component selection, manufacturing process and factory selection.

Passing the Test

Test fixtures are a major effort, and must adapt to the equipment at the factory. Some combination of functional, in-circuit test and JTAG testing is generally required and fixtures need to be in place for software load. Typically, test time in the factory is much greater than assembly time so efficiency and speed of test software and procedures is important; indeed variations in test time can affect product cost as much or more than variations component costs. Typically, for each board we deliver, we create two or three boards for test and software load operations. Finally, the actual programs we write for functional, in-circuit and JTAG test, as well as software load, are an appreciable fraction of the overall software work on a project.

The factory is only the anchor of the supply chain

Developing a supply chain is also not easy. The exact same part might have radically different costs in different geographies- a function of the suppliers central, national, and distributor pricing models. Even where supposedly 'plug compatible' cost effective components exist, the space and energy constrained environment in many mobile devices means specific item testing must be done. Many odds-and-ends components, while not costly, may have large minimum buys (for example a reel of parts) and MOQ (Minimum Order Quantities). End-of-run scrap outs become important parts of the low volume OEM cost model.

To be Thousands in the Land of Millions

Finally, the biggest problem faced during factory introduction is that 32-bit high tech major components are targeted at high volume consumer applications where production runs are measured in the hundreds of thousands, 'take or pay' contracts are the norm, and distributor stock is unheard of. Eurotech, who consolidates demand for more than 100 OEMs, has moved to global source arrangements with silicon suppliers that cover national companies, distributors and contract manufacturers everywhere. It is agreements like this that allow us to reliably design and introduce a given BOM to our manufacturing process.

Manufacturing and Maintenance

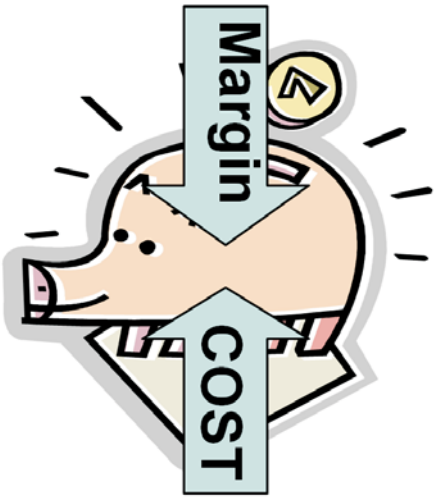


Figure 5- For most OEM products, maintenance is the big Lifecycle Cost.

As difficult as Design and Introduction are, they are over for most OEMs in a year or so. For the OEM, Manufacturing and Maintenance can go on for years and eventually becomes one of the major lifecycle cost items.

Keeping it Going

The industrial/commercial OEM faces a problem very different from the manufacturer of cell phones, PDAs or other consumer products. Consumer products are built based on fully loaded production runs a few months in duration, with perhaps 100,000 chips purchased off the same die under a single 'take or pay' contract. The pick and place machine is probably never reconfigured during the run, and the design is stable. On the other hand, the commercial OEM wants to take a few dozen to a few hundred devices a month, and do this for a period of years, even a decade or more. He faces a very different situation.

The problem is these high-tech components are subject to specification updates from production lot to production lot. Each of these updates requires changes to microcode, software or even schematic. Other peripheral chips go EOL and have to be changed as well. On occasion, the changes can be dramatic. For example, at this writing (June 2006) Eurotech is in process of changing out almost all of its Flash chips to a new part that requires a different voltage on the board; the power supplies must be redesigned!

While Eurotech can amortize this effort across its 100 + customers, the reality is maintenance activity is a major effort here. In fact, even though we complete 2-3 OEM designs per month, a review of time sheets shows we spend twice as much time doing maintenance programs as in developing new OEM configurations. It is not clear to us how a typical industrial/commercial OEM with a five year product life and a demand of just hundreds or thousands of units per year could keep up with maintenance responsibility.

The fact is most of them probably don't, they mask problem with costly lifetime buys of parts. This strategy means they may have to purchase 80%+ of their lifecycle product cost in the first 2-3 years of a 5 year product life- not very economical.

Keeping Costs Under Control

Parts can go EOL, but they also can go up in cost. It is hard for an OEM to manage the hundreds of items on the BOM for a typical computer, especially when the distributor realizes he has the OEM locked in. Negotiating continued low prices usually means developing and qualifying technical alternatives, and that means more engineering effort and cost. The tendency is to just let it go, but the conversion of penny parts to nickel parts can ultimately cut meaningfully into margins.

End of Life should Mean Rebirth

Ideally, new products should be developed according to evolving market demands and competitor activities. Sadly, we too often see designs done to circumvent end-of-life notices from the supply side. This means that some designs are excessively time pressed and may not incorporate the features they should. In addition, the cost of the design and introduction effort must be amortized over a shorter lifecycle thereby raising lifecycle cost.

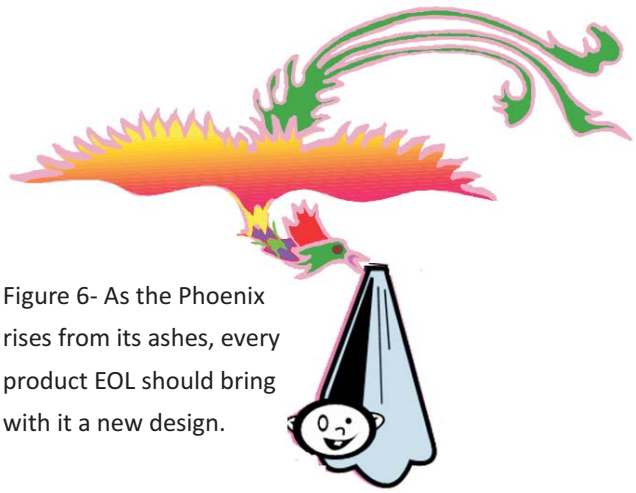


Figure 6- As the Phoenix rises from its ashes, every product EOL should bring with it a new design.

Stretching the Lifetime

Working closely with its suppliers, Eurotech has proven adept at helping our customers keep their product in the market for appropriate product lifecycles. We can hold the API (Application Interface) constant, for multiple generations of hardware and multiple generations of software. Since we are active in hardware and software Beta programs, we can start out our OEMs early in one product lifecycle. Then, by inventory management and selective engineering we can keep the product stable and supplied to the OEM for years after the chips go end-of-life.

Skipping the Generations

When we stretch the lifetime of a product, we can, and have, on occasion skipped entire generations of OS or Silicon, while maintaining a constant application interface. We do this fairly often, sometimes requiring the porting of an older OS onto brand new Silicon, sometimes putting a new OS onto older Silicon. The OEM customer application moves forward on top of a carefully managed march of enabling technologies. Notice that these strategies reflect adoption of the OEMs product lifecycle strategy, and are quite different from the product strategy of a standard board supplier. The standard board supplier will typically apply high prices near the release of a new generation of CPU, followed by price declines, and then perhaps either a fire-sale as component EOL nears, or possibly a transfer to a very high priced traditional product category. The Eurotech pricing is essentially flat for the lifetime of the product.

It's About Time

The pennies of the DIME are spent over a period of years. Future revenue or savings must be discounted compared to initial costs or immediate cash inflow. Product development is not like development of a bond portfolio; the bank is not going to loan much money to a firm that needs to develop a product, and even if the firm can get a bank rate loan, that loan will be only for a portion of the cash on hand diverted to the development effort.

Figure 7- "Time is Money" is not just a proverb; it is the very core of the notion of investment. For good investments, Time is worth a great deal of Money.

The net effect of the discount to present dollars is perhaps best expressed by the IRR (Internal Rate of Return) of the project development itself. To a first approximation, a project with zero duration and a one year payback has an IRR of 100%, so you can see the real discount, applied by conventional rule of thumb measurements for project payback, is quite high.

Time and the time-weighted value of money becomes the major determinate in creating a real estimate of product lifecycle cost, even when we think of time as a smoothly flowing river.

In reality, time flow is punctuated by events. Seasonal delivery dates, regulatory approvals, and competitor activities all enhance the value of time at selected moments.

Likewise, time is tied to risk- most of the potential risk in any multi-year product lifecycle is associated with project delays (longer time to get the product to market) and component EOL events (shorter than expected product lifetime).

Summary

Design, **I**ntroduction, **M**aintenance and Manufacturing and **E**OL costs. A full "DIME". You can learn more about the DIME and how to estimate its components by contacting Eurotech at its Columbia offices, 301-490-4007. We can supply you with drill down material, including checklists and estimating tools to let you count the pennies in your DIME, and measure risk in an organized, parameterized manner.

If you would like to see how the Eurotech Value proposition could affect your product development, please contact us.