THE DEVELOPMENT OF HARDWARE AND SOFTWARE COMPONENTS

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Abstract: At the beginning of this decade, after the great political changes in Europe and all over the world, state administrations began to reduce expenses for departments of defense. Military planners began looking for solutions that provide low-cost, rapid deployment, easy upgrade and high reliability. They instituted the Commercial Off The Shelf (COTS) system which meant the end of military standards (MIL) and location of the responsibility for quality to the suppliers. The results of this decision are: quick improvement of quality in the electronic industry, rapid development of standard assembled electronic parts and the beginning of the development of hybrid operations systems.

Razvoj strojne in programske opreme

Ključne besede: deli sestavni elektronski skupni, COTS sistemi delov sestavnih standardnih, HW hardware oprema strojna, SW software oprema programska, zmanjšanje stroškov, razmestitev hitra, razvoj hiter, nadgraditev enostavna, zanesljivost velika, industrija vojaška, industrija civilna, sonarji, sistemi sonarjev mornariških

Povzetek: Po velikih svetovnih političnih spremembah v začetku tega desetletja, so državne administracije vodilnih vojaških sil na svetu zmanjšale proračun za vojsko. Da bi ohranili vodilni položaj svojih armad, so vojaški načrtovalci poizkusili najti take tehnične rešitve, ki bi bile poceni, ki bi omogočala nagel razvoj, enostavno nadgradnjo in bi bile zelo zanesljive. Izbrali so standardne sestavne dele strojne in programske opreme, ki jih razvija in izdeluje civilna industrija. Ta odločitev pomeni konec posebnega razvoja za vojasko po njihovih standardih in prenos odgovornosti za kvaliteto na dobavitelje opreme. Pospešil se je razvoj civilne elektronske industrije in razvoj standardne strojne in programske opreme.

The Sonar Technology Revolution for Industrial Use

In the past decade there was a remarkable increase in the number, type and technical complexity of sonar systems available to industry and the general public. This was the beginning of a sonar system revolution that is largely due to advances in micro-electronics. The sophistication of sonar hardware and the software that is used to process, interpret and display data has increased greatly (figure 1). At first glance the most remarked improvement brought by the sonar revolution is cost reduction. But the most important advance was development of the personal computer and its incorporation into side scan sonar systems /1/. It was done when the standard computer had become reliable enough. The reason for such a late incorporation of the standard computer in sonar systems is due to the great conservatism of the offshore industry which is understandable due to the cost of incorrect equipment. Incorrect equipment on the ocean costs time, money and life.

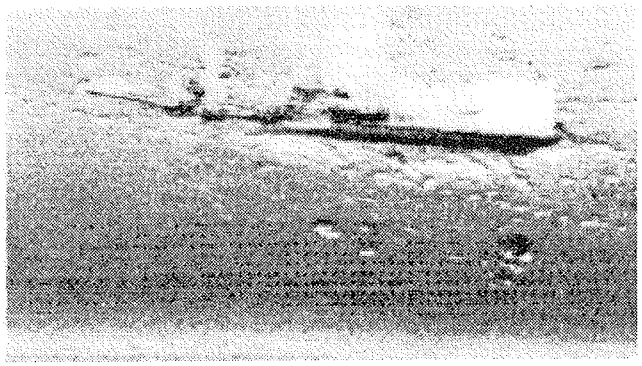

Figure 1: The sonar image of through the second world war foundered submarine in 140 m deep sea. The image was made by sonar System 2000, Klein Associates, Inc., USA

Incorporating the standard PC into the sonar system has great advantages. PC serves as a data collection device, as the sole use interface, control system and image processing hardware. The PC can replace analog paper recording devices and store information in digital mode to the hard drive. If the Global Positioning System (GPS) device interfaces to the computer and gives the true position to the sonar image, this allows the sonar operator to review data together with precise position information.

Digital sonar data can be then entered into a Geographic Information System (GIS). In this way sonar becomes an important tool for cultural and environment resource management, allowing for the correlation of diverse data sets and the predictive modeling of yet unexplored areas of the sea floor /2/.

The new generation of side scan sonar systems must also allow for modular architecture. The same top side system used to collect data can be de-coupled from the towed transducer and connected to modular transducers for other tow bodies, updating older systems. Without computer control a good image of high resolution could not be obtained from such an adapted system. Sonar becomes the most important tool for underwater remote control if the sonar system is inte-

grated with an acoustic navigation system. In such a manner sonar for industrial uses overcomes the sonar which is used in navies.

Rapid Deployment Of Sonar Systems For Navies

In the environment of declining defense budgets after the year 1986 and rapid evolving emission requirements, military planers are looking for solutions that provide low-cost, rapid development, ease of upgrade and high reliability. The recent Commercial Off The Shelf (COTS) initiative of the leading navies after the year 1994, is aimed at combating the impact of declining budgets and assuring their prime positions in the world /3/. The thinking behind this shift was driven by the fact that commercial systems were more reliable and cheaper because of their volume production /figure 2/. Custom engineering needs a long time for development. It suffers from a lack of software and the necessity for complete re-engineering of systems during system upgrades.

The military's transition to open system architecture and

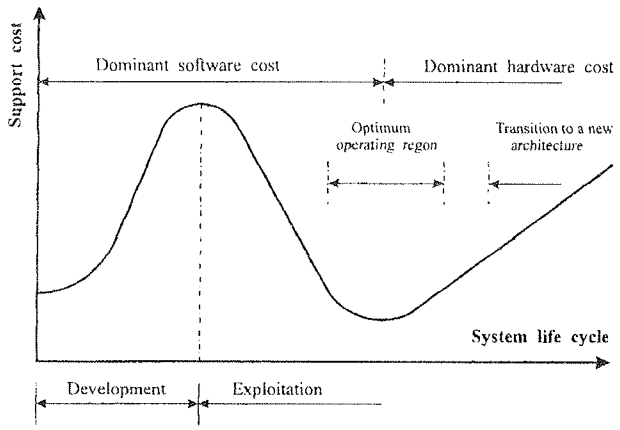

Figure 2: The maximum of the support cost of system is lower if independent software is used for its development

reliance on the COTS hardware and software systems structure has created a culture shock that will take a number of years to overcome and has consequences in the long term. It has become evident that service for future war fighter in the 21st century will have support from civilian industry.

COTS promises lower cost hardware, its faster development and improved reliability all through standard hardware products. COTS hardware and software can be easily upgraded in whole or in the part. They are cheaper and more reliable. This is the key to the success of most integrators in the era of shrinking budgets and cost effectiveness. The reduction in cost and time to system deployment is so dramatic that it is almost unbelievable.

For all sonar and radar applications and the greater part of communications there are three stages in the processing system. The first stage is responsible for telemetry and digital conversion. The second stage consists of programmable signal processors. The third stage consists of display and I/O processors /4/. The different processors are used to tune the hardware to the specific processing jobs required. For these processors local memory is often used because of the high cost of access to the global memory. In last decade almost all the above applications have used COTS hardware and software. Modular and open systems are the rule not the exception /5/.

Host workstations all run Unix. The connection from the host to the client is made over a VMA bus or ethernet using TCP/IP protocols /6/. C, C++ or Ada are being used to program these systems. Ada is used only in extreme cases, but the graphical user interface development tools are often used. We expect that the personal computers running Windows NT will be the right workstations in the near future.

The operating system software needs to be multiprocessor. In the case of heterogeneous processors we need different compilers for each type of processor and then a tool for cobble them together. This is the more complex approach with great integration problems. For this reason COTS software engineers use more and more hybrid operating systems based upon the open standards. This minimizes risk and will offer maximum portability of future systems.

To make COTS tools and libraries effective their testing and evaluating is required. By using such software the development effort can concentrate on unique system requirements and functionality without having to take time to build the support for it. The products from development application software must be isolated from the tools as much as possible. The application access to functionality provided by tools should be made by wrapper. The wrapper minimizes the time for redesigning and resetting.

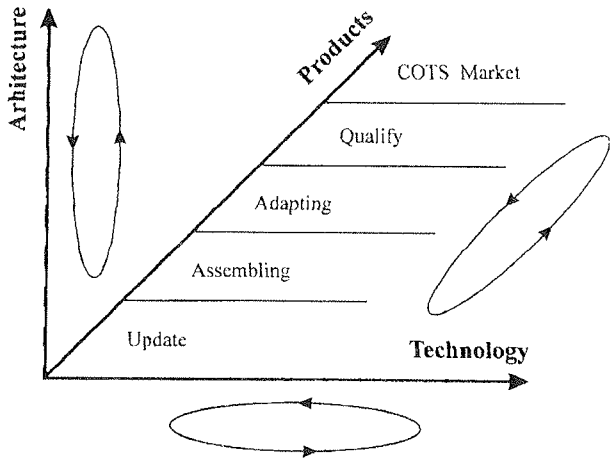

Figure 3: The dimensions of evolution of COTS systems

Conclusion

Users have to understand that the COTS approach in reality is long term approach /7/. The COTS market drives continuous system upgrade (figure 3).

In spite of dramatic productivity results, sound system engineering and project managers are still critical to the success of COTS projects.

- Hardware producers rarely guarantee COTS reliability, which is different from release to release. This reliability is usually determined through money consumption actual use after purchase and through time consuming discussion with other users in time of reconstruction of hardware.
- Complex system integration problems become much more difficult due to a lack of understanding of the internal operation of the sub components /8/. For this reason the integrator of complete system does the selection of vender and products monitoring essential to system survivability. System survivability is influenced by system reliability and the system support plan.
- The software engineering process would be more consistent as a result. The organization would be able to afford a deeper pool of COTS expertise to evaluate, integrate and support the various software packages.

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