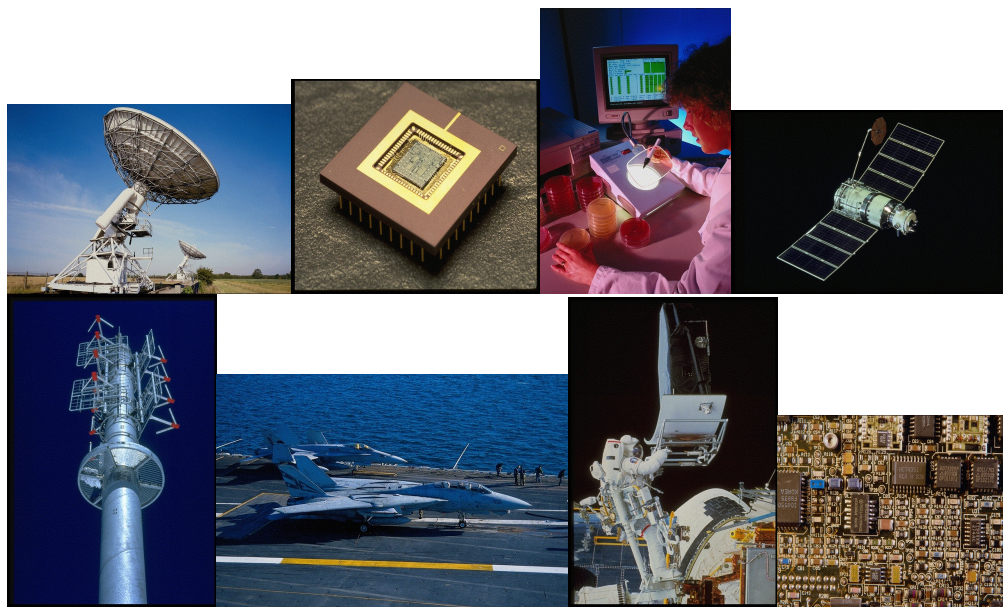


Sample Projects

Redundant File System
Software Update Support
High Availability Boot Code
VxWorks Board Support Packages
Hardware Abstraction Layer and Simulation System
ASIC Design
Reverse Engineering and Validation Software
Windows Device Driver, Library, and Control Application
Windows Applications for Airborne Data Acquisition Systems
Data Archiving Systems
Bug fixing on Network Core Optical Switch



Lextel's mission is to provide solutions to your design and development challenges in a timely, predictable, and cost-effective manner.

Lextel has become a trusted and valued extension of the engineering teams of many firms developing products in the Real Time and Embedded Systems space. Our '5 Step Development Process' helps insure project success. Below is a sampling of the various customer projects we have completed.

Redundant File System

A telecom equipment manufacturing startup required that the storage of system configuration, software images, and logging information be retained and available in the event of a failure of the storage system in a wireless base station controller.

Lextel specified and developed a 'Redundant File System' that was layered on top of the RTOS Dos file system, and was transparent to the application software running on the system. Multiple disc devices were used in parallel, similar to a 'Raid 1'(Mirroring) configuration, using separate data paths through the system. In the event of a failure of the 'primary' device or data path, an alternate 'secondary' device is made primary and the system continues to run. This work was done using a C++ object oriented methodology.

CLI and SNMP based mechanisms were created to manage the file system.

Software Update Support

Lextel engineers specified and developed a mechanism to enable a telecom equipment manufacturer to easily upgrade or downgrade the software and boot code across its complete product line. (over)



Software Update Support (continued)

A release image file format was created that included multiple software images, versioning information, hardware ids corresponding to the images, and other information. Software mechanisms were created to allow an operator to 'install' a new software version on all processors, distributed across multiple cards, on a machine while it was running. Validation and error handling mechanisms were implemented such that a failure during the update process itself would not prevent the machine from continuing to run or restart after a power cycle.

High Availability Boot Code

Lextel has specified and developed several high availability boot systems. These systems usually consist of multiple distributed processors which must download and start their system software from one or more server processors in the same system or alternatively over a remote network connection. Redundant server processors, redundant data paths to the servers, and redundant copies of the system software are provided in case of failure. Mechanisms for maintaining multiple copies of the boot code in flash memory are also provided in case of failure during boot code update.

VxWorks Board Support Packages

Lextel has specified and developed many VxWorks board support packages. Most have been for the various members of the Power PC processor family. This type of project is one where we make the best use of existing bsp's and device drivers in order to minimize engineering man-hours. When possible, we work with the hardware designers prior to board layout in order to recommend design decisions that will simplify the bsp. One recent example was a bsp for a 4 processor cPCI / RapidIO card with 4 mcp7447a processors and no serial line or network connection. A 'virtual console' and shared memory network connection was developed to provide console and network connectivity via a remote SBC over Rapid IO.

Hardware Abstraction Layer and Simulation System

This project was performed for a system vendor whose custom hardware was in development. In order to enable the software team to work in parallel with the hardware designers, Lextel was tasked to develop a hardware abstraction layer in C++. The software team used the API provided by the abstraction layer when accessing the underlying 'hardware'. The abstraction layer ultimately ran on the custom hardware, but, before the hardware was available, it also ran on a system comprised of off the shelf cPCI cards. In addition to simulating the hardware under normal operations, a mechanism was developed that allowed a software engineer to simulate various events, such as card removal and card startup via cli commands. The simulation system was used for many years; even after the vendor hardware became available.

ASIC Design

Lextel participated in the design of a Fiberchannel ASIC, developing the logic and test benches for the arbitrated loop and encoding / decoding logic. A particular challenge with this project was the requirement to run at a 4 Gigabit / sec link rate. To accomplish this, Lextel developed a novel design approach, which resulted in 10 patent disclosures, which were eventually

combined and submitted as 4 patent applications, 3 of which have been granted by the patent and trademark office. In this situation, Lextel not only performed design and development work, but also helped the customer company with their goal of expanding their patent portfolio.

Reverse Engineering and Validation Software

The most successful manufacturer of plug-compatible storage systems asked Lextel to perform reverse engineering work on a Raid 5 storage system produced by the world's leading computer system vendor. Lextel performed an exhaustive analysis of the Raid 5 subsystem, including identification of undocumented, 'secret' behaviors, and created a design specification that the customer's engineers used to design a look-alike product. Lextel developed a large validation test suite that insured the look-alike product behaved as required in order to 'fool' the computer system into thinking it was the original vendor equipment.

Windows Device Driver & Control Application

Lextel developed a Windows WDM device driver, hardware API library, and GUI application to run on a hardware vendor's high-speed fiber optic interface PCI card. The system is used to transmit test image data to an image processing system for military applications, and was developed for one of the large DOD prime contractors.

Windows Applications for Data Acquisition Systems

Lextel developed several Windows GUI Applications for use in controlling airborne data acquisition systems for military use. The project required Lextel to create a 'generic' API running over TCP between the Windows based control computer and the system under control, which was based on cPCI/Raceway Power PC cards with high speed fiber optic interface PMC cards, running vxworks and a custom application.

Data Archiving Systems

Lextel developed data archiving systems for use in creating archive tapes from military image data. The challenge of this project was to move up to 9 Terabytes of image data between Raid-5 storage systems and LTO-3 tapes in a specific amount of time, using a tape format that allowed easy access to any part of the data set. Lextel devised a mechanism that would allow any number of IBM server computers to transfer data in parallel, directly to and from the FAT32 file system on the Raids, while maintaining file system integrity.

Bug Fixing on Network Core Optical Switch

Lextel was asked to help out with a long list of outstanding bugs present in a Telecom core optical switching system by one of the major telecom equipment suppliers. Working on site and remotely, we resolved defects in many areas of the system including provisioning, configuration storage, redundancy, network timing, and protection path switching. The system supports OC3 – OC192 interfaces and consists of multiple power pc based cards running vxworks.