

NeST Expertise on x86

NeST Expertise on x86 Platform



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1 Introduction

This document details NeST's capabilities on hardware and software development capabilities on x86 platform by listing out some of the projects executed on this platform. NeST offers its customers the advantage of total product design and can provide the customer with end-to-end solutions by means of its expertise in Design, Development, Manufacturing and qualifying the products for various markets.

2 Products developed on x86/88

2.1 Geode Based Thin Client

This is a thin client motherboard, aimed for industrial control applications, is based on Geode SC2200 processor from AMD. The device is a member of AMD Geode family of fully integrated x86 system chips.

The PC104 form factor board is manufactured in eight layers with the following set of interfaces/peripherals.

- Memory Interfaces
 - 32MB SDRAM
 - 8MB Flash

- Peripheral Interfaces
 - CRT Interface
 - LCD Interface
 - USB Ports (X 3)
 - CF card Interface
 - UART Interface (X2)
 - IR Interface
 - Paralle Port
 - Mic and Speaker Interfaces

2.2 Frame Relay Interface card

The scope of this project was to design and develop a PC ad-in board for Frame Relay Interface. This was built around Intel i80386EX Embedded processor and Zilog Z85230 Enhanced Serial Communication Controller with EIA 530 interface. The software/firmware development of the above card was done under iRMX Real Time Operating system using "C" / Assembly Language

2.3 Intelligent I/O Modules

This project involved the development of intelligent I/O (Digital I/O, Analog I/O and Multi-loop controller) modules for Process Control applications. The above modules

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were based on the Intel i80386EX embedded processor and had high-speed serial link (using Intel 82530 SCC) to the central control unit over RS 485 lines. In addition, there is an RS232 interface (using Intel 8256 MUART) for monitor program support.

The hardware features include

- Interface to field signals (Analog/Digital)
- RS232 Interface (8256 MUART)
- RS485 Interface (82530 SCC)
- Glue logic

The firmware features include

- PAL logic
- Basic firmware
 - Scanning field inputs
 - Computation
 - Loop-block execution
 - Communication
- Software blocks for DCS (Distributed Control System)

2.4 X.25 PAD

The scope of this project was the design and development of a standalone X.25 PAD with one X.25 channel and up to 8 asynchronous channels. This was built around i80188 processor, Zilog Z82530 Enhanced Serial communication Controller (for the X.25 channel) and i85230 SCC (for asynchronous Channels). MASM and Intel "C" were used for firmware development (using an Event Driven Scheduler) for implementing X.25 PAD protocols.

2.5 X.25 DTE

The scope of this project was the design and development of a PC based X.25 card. This was designed with Intel i80188 processor and Intel i82530 SCC. X.25 protocol was also implemented in this card. A simple embedded OS for implementing the X.25 protocol (firmware) based on the transaction scheduling was developed. MASM and "C" were used for Firmware Development for implementing X.25 DTE protocols.

2.6 ISDN Terminal

The scope of this project was the design and development of a hardware for a standalone ISDN Terminal with "S" interface. This was designed using Intel i80188 embedded processor and MITEL's ISDN components MT8930(SNIC), MT89500(RIM) and MT8995(D-Phone). An application firmware for the demonstration of voice and data transfer for the ISDN terminal was also developed.

2.7 Statistical Multiplexer

The Statistical Multiplexer functions as a Front End Processor to the Paperless Operation of a System for a Trunk Exchange providing multi-drop capabilities using RS-485 interface. The hardware was designed and developed around the Intel i8088 processor and i8274 Serial Communication Controller.

2.8 Six Axis Robot Arm control

The scope of the project was the development of a 6-Axis controller card based on an 80188 processor for controlling the arm of a Robot. Each axis has 2 channels of differential input data. Digital filters were used to ensure noise free measurement. Up/down 16 bit counters for each axis are implemented in FGPA. Configuration data and control algorithms are downloaded from the host machine.

3 OS porting and customization on x86 platform

3.1 Fedora Core 8 Porting to AMD Geode

The scope of the work was to port Fedora Core 8 to Advantec Geode based SBC providing support for the following peripherals.

- USB
- Touchscreen
- LCD display

The following Boot options are provided – CF & HDD. In addition to this, support for JVM 1.5 was also provided. The OS was optimized for Graphical Boot up in 10 sec.

4 Device Drivers on x86 platform

4.1 Win CE

4.1.1 USB WLAN Dongle Driver

The scope of the work was to develop a WinCE 4.2 WLAN driver for a USB Dongle device consisting of a WLAN chip (Intersil's ISL 3890) interfaced with Netchip's Net2280 USB/PCI controller. The device is configured as a Station with 802.11b support. The host platform was an IPTV based on Intel 80386, and the development was done on WinCE 4.2.NET.

4.2 VxWorks

4.2.1 Serial port device driver and SMS Messaging Centre

The scope of this project is to design an SMS message centre on Pentium processor based system with VxWorks as the Operating system. This includes the development of the device driver for communication with GSM Modem using serial port.

4.3 Win2000, XP, Vista

4.3.1 VMC Mouse Emulator

The scope of the work is to emulate mouse movements on the desktop through a BT dongle. When plugged in the BT Dongle is to be detected as an HID USB mouse. The mouse movement data is transferred from a picop projected image via VMC hardware to the BT dongle on the desktop. The kmdf/hid minidrivers were developed based on the Bluetooth driver stack in Vista which provides device driver interfaces (DDIs) that enable kernel mode developers to access Synchronous Connection-Oriented (SCO) links and Logical Link Controller and Adaptation Protocol (L2CAP) links between the host system and remote Bluetooth devices. The drivers can use the Bluetooth L2CAP DDIs to establish BT communication and receive mouse packets.

4.3.2 CD Writer/UDFS File System

The scope of the work is to implement ISO 9660 Level-1/ Joliet, CD-ROM XA Mode2 and DVD format for the CD Writer engine of a biomedical equipment. The CD-RW engine is a back end module for the system, which supports the functionality of writing Windows Image Files (.AVI, .JPEG, .BMP, TIFF etc) to CD/DVD in multi session format for SCSI/IDE drives. The purpose of the module is to output DICOM image data in Windows Format to the CD-R/DVD. The environment was Windows XP/Vista.

4.3.3 Hacker Safe

In Hacker Safe system any file access is checked against a policy to decide whether to grant access or not. This is done using various kernel mode components including the file system access monitoring drivers of the HS System. The parameters against which a check is made are

- File name and its location.
- The process or application name using which a file is accessed
- Type of access made. For example, whether read/write access is requested.
- The time at which access is made

The environment was Windows XP.

4.3.4 Driver for cash dispenser used in Banking Teller Stations

The scope was the development of the software for a Hitachi Pass Book Printer and Cash Dispenser for a banking teller station. The developed software will reside on a teller PC (primary workstation) running windows 2000 chinese version, whereas the Pass Book Printer and Cash Dispenser (secondary stations) are connected to the BTS PC via RS-232-C serial interface. The modules developed are the User Interface and the drivers for Cash Dispenser and Pass Book Printer which are WOSA/XFS compliant.

4.3.5 ADSP 2141 PCI Driver and Library Development for crypto PCI cards

The scope of the project was to develop and document a PCI Driver for the current ADSP-214x SafeNet/DSP encryption accelerator chips which are used in platforms ranging from embedded networking systems to standard PC and workstations used with chips on-board for applications such as firewalls or network security appliances.

Phase 1: Evaluated IRE's existing Windows NT 4.0 driver for the ADSP 2141. Corrected remaining deficiencies and re-worked this driver for efficient operation.

Phase 2: Documented and developed a set of API's used by crypto applications for communicating with the ADSP 2141 Crypto Card. The Crypto APIs communicate with the PCI driver, which in-turn does the actual hardware interaction.

Phase 3: A kernel library module was also developed to allow kernel mode drivers to use the crypto card. This module is specific for Windows NT.

Phase 4: Porting and Development in VxWorks

Phase 5: Porting and Development in Linux

4.3.6 Image Copy of Removable SCSI & IDE storage device on Windows 9x

The objective of the project was to develop an image copy software for removable media using BIOS interrupts 13h extensions. The Win32 applications developed will thunk to the Win16 DLL and have that DLL call the DOS Protected Mode Interface (DPMI) Simulate Real Mode Interrupt function to call Int 13h BIOS disk functions on hard disks.

4.4 Linux

4.4.1 Filter/Legacy Driver

The scope of the project was to develop a File system filter driver to monitor the file access and process related activities (this is similar to an antivirus) and used to enhance the security of the system. The suite can monitor, allow, block or log the activities in a system.

4.4.2 Wireless Drivers

NeST has developed a network driver for wireless access points with 802.11a/g and WDS (Wireless Distribution system) based wireless protocol stack, for Atheros AR5211/AR5212/AR5213 chipset based wireless LAN cards. Atheros features such as SuperG and XR are implemented in the Linux driver. Multiple SSID support for supporting more than eight Access points is an added feature.

NeST has also customized wireless security features on Linux based open source "mad-wifi" driver for Atheros chipset AR5212.

In addition, NeST has added customer requested features on Linux based open source "hostap" driver for Intresil Prism2 chipsets.

5 Design Recovery of x86 based targets

5.1 SCADA Hardware based on 80186

The scope of the project was to replace a module in an existing SCADA system. The original module was based on Intel 80186 microprocessor. The module hardware details were analyzed from the actual hardware. The software details were analyzed from the existing assembly code.

The following were the major features of the existing module.

- x86 Processor Architecture
- Serial Host interface
- Shared RAM between custom interface and x86
- Custom Interface Controlled from x86
- Digital IO controlled from x86

The new module was an enhancement of the existing module architecture. The following are the major features implemented.

- Using latest technology
- Built around ARM 9 microcontroller and FPGA
- Product enhancement
 - Ethernet interface
 - USB interface