PRESENTATION

ON

CONTROL OF REMOTE DEVICES USING TCP/IP

THE TERM "NETWORK-ENABLED" IS VERY BROAD, BUT GENERALLY MEANS ONE OR MORE OF THE FOLLOWING.

- ALLOWING DATA DYNAMIC/STATIC IN THE EMBEDDED PRODUCT/DEVICE TO BE MONITORED, SOMETIMES IN A WEB PAGE, SOMETIMES THROUGH AN APPLICATION WITH NO DIRECT HUMAN INTERACTION.

- SENDING SUPERVISORY DATA TO THE EMBEDDED PRODUCT/DEVICE VIA N/W OR MODEM.
- ALLOWING THE EMBEDDED DEVICE TO INITIATE AN EVENT DRIVEN E-MAIL MESSAGE, OR PROVIDING OTHER TRIGGERS FOR THE EMBEDDED DEVICE TO SEND AN E-MAIL MESSAGE.
- PROVIDING TRANSPARENT TCP CONNECTIONS BETWEEN THE EMBEDDED DEVICE AND A LEGACY DEVICE/EXTERNAL HARDWARE /CONTROL SYSTEM.

ETHERNET-ENABLED HARDWARE

- THESE HARDWARE PLATFORMS ARE ALL ESSENTIALLY LOW-COST SINGLE-BOARD COMPUTER (SBC) PLATFORMS THAT INCLUDE A 10BASE-T ETHERNET PORT, VARIOUS I/O POINTS, AND AT LEAST ONE SERIAL PORT.

HARDWARE DESIGN

- MICRO CONTROLLER MODULES ARE COMPACT PCBS WITH BUILT IN CORE CPUs, WHICH PLUG INTO A MOTHER BOARD OF THE CUSTOMER'S DESIGN.

- INTEGRATED COMPUTER MODULES ARE IDEAL AS EMBEDDED HARDWARE PLATFORMS AS THEY INCLUDE A 10BASE-T ETHERNET PORT, THE CORE CPU, FLASH MEMORY, SRAM, LOGIC LEVEL I/O, AND LOGIC LEVEL SERIAL PORTS.

AVAILABLE TECHNOLOGIES

TECHNOLOGIES

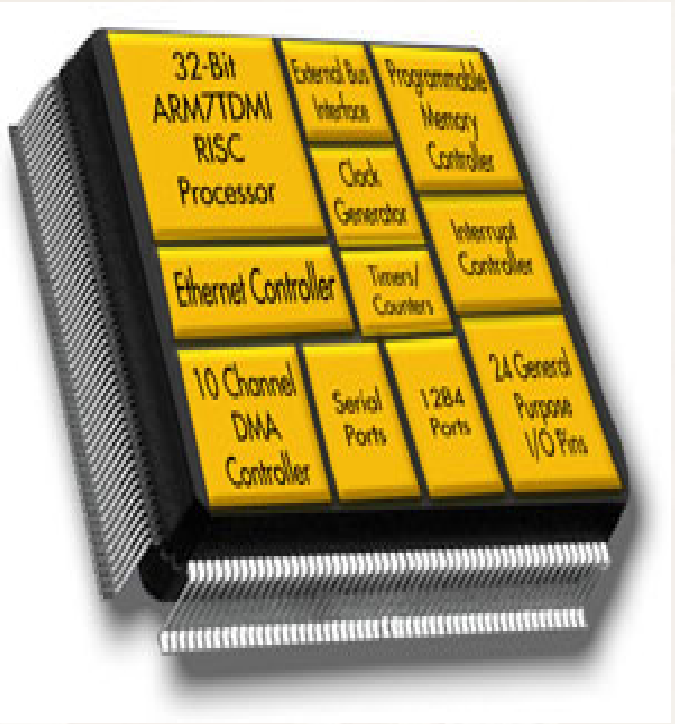
- **THE AXIS NETEYE 200**
  - CONNECTS TO AN ETHERNET BASED NETWORK, OR A MODEM
  - SUPPORT FOR HTTP AND FTP PROTOCOLS
  - BASED ON A 32-BIT RISC PROCESSOR
  - CAN BE USED TO CONTROL OTHER DEVICES

- **DYNALOG SYSTEMS MOXA N-POWER COMMANDER**
  - REMOTE ON/OFF ANY UNATTENDED DEVICES
  - TCP/IP ETHERNET CONTROL THROUGH PPP CONNECTION
  - CONTROL VIA REGULAR TELE LINE.
  - REMOTE FIRMWARE UPGRADE VIA FTP SERVER

- **EMBEDDED SYSTEMS USING SERVERS AND JAVA APPLETS DEVELOPED BY SUN MICRO SYS**
  - REMOTE MACHINE CONTAINS A MINIATURE HYPERTEXT TRANSFER PROTOCOL (HTTP) SERVER
  - JAVA APPLETS USED TO CONTROL THE REMOTE MACHINE
  - ADVANTAGE OF USING CURRENTLY AVAILABLE TECHNOLOGY

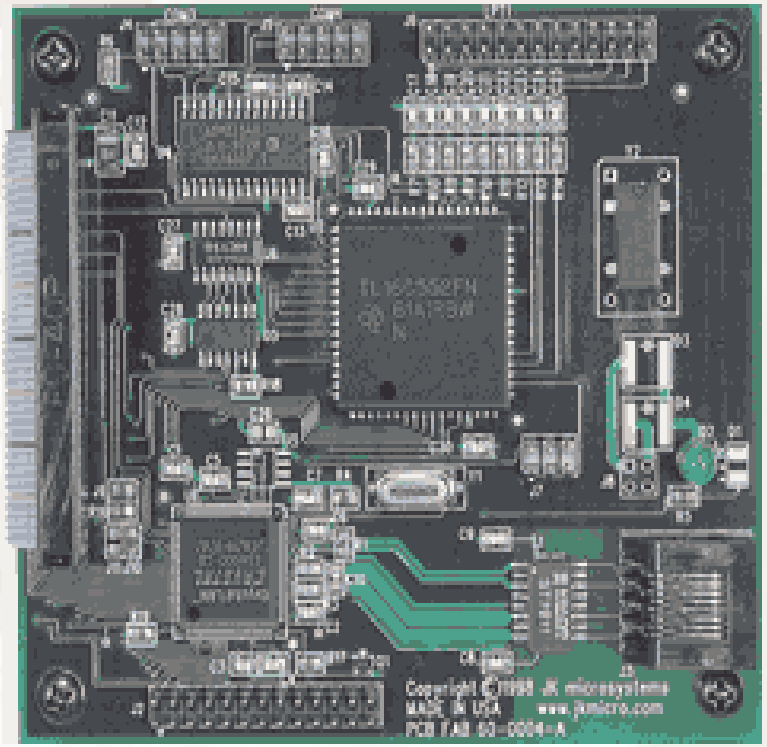
- **PHAR LAP WEATHER STATION**
  - BASED ON MICRO WEB SERVER, A WEB PAGE SERVER THAT SUPPORTS JAVA APPLETS AND THAT CAN CREATE DYNAMIC WEB PAGES THAT CHANGE DEPENDING ON REAL-TIME DATA
  - WEATHER STATION IS BASED ON A 486 SINGLE BOARD COMPUTER AND PROVIDES WEATHER DATA
  - CAN BE USED TO CONTROL EMBEDDED SYSTEMS, SUCH AS ORDINARY HOUSEHOLD APPLIANCES.

- **NET SILICON'S STRONG ARM BASED SOLUTION**
  - 32-BIT ARM7TDMI-BASED "SYSTEM-ON-SILICON" DEVICES WITH ALL OF THE KEY FUNCTIONAL BLOCKS
  - NET+ARM HAS BEEN OPTIMIZED TO WORK EFFICIENTLY ON A 10/100 BASE T LAN CONNECTION AND TO MOVE LARGE AMOUNTS OF DATA AT HIGH SPEED
  - NET+15, A LOW-COST PROCESSOR SUITABLE FOR NETWORK APPLIANCE APPLICATIONS.
  - NET + 50 HIGH END.



- **ETHERNET FOR FLASHLITE 386 DX**
  - ETHERNET
    10BASE-T ETHERNET
    RJ-45 CONNECTOR
    16 BIT INTERFACE
    FULL DUPLEX OPERATION
    AUTOMATIC POLARITY DETECTION/CORRECTION
    PACKET DRIVER
    INCLUDED NE-2000 COMPATIBLE
  - COM3
  - COM4

  16550 USART
  - BI-DIRECTIONAL PARALLEL PORT



NOVELL'S EMBEDDED SYSTEMS TECHNOLOGY

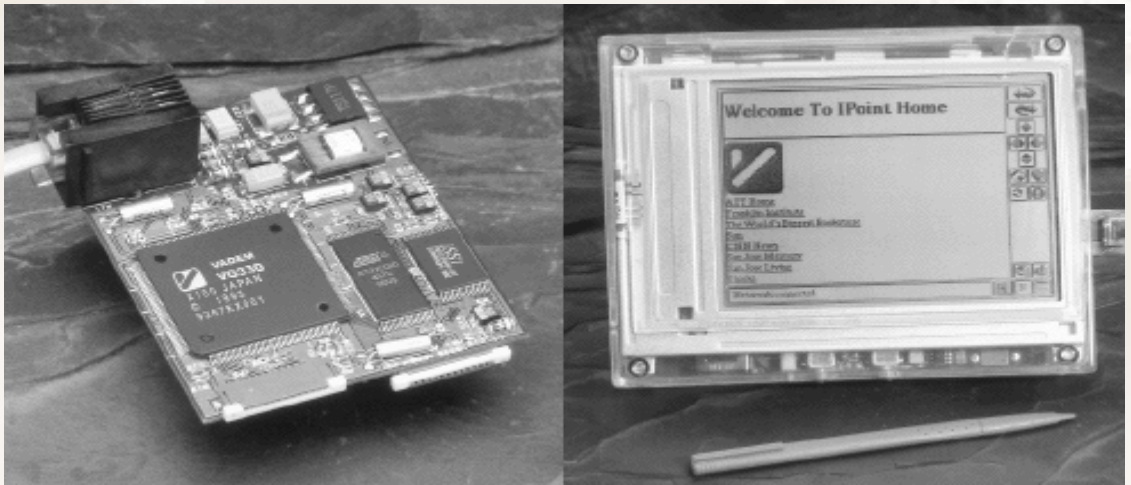
- (NEST) IS A SYSTEM THAT CAN BE USED TO CREATE NETWORKED EMBEDDED SYSTEMS BASED ON ANY PROCESSOR.
- PROTOCOL USED (KNOWN AS THE NEST PROTOCOL) THAT PROVIDES FOR A SECURE AND RELIABLE CONNECTION WITH AN EMBEDDED PROCESSOR OVER A NETWORK.
- A DEVICE USING THE NEST PROTOCOL CAN BE CONNECTED USING A 286-BASED BOARD WITH A 256 KILOBYTE EPROM ALONG WITH A PROGRAMMABLE INPUT/OUTPUT CHIP AND SOME LOGIC TO CONTROL THE DEVICE.

NEST DISADVANTAGE

- SPECIALISED PROTOCOL TO COMMUNICATE WITH THE EMBEDDED SYSTEM, IT IS NECESSARY TO DEVELOP A SPECIALISED PROGRAM TO CONTROL THE APPLIANCE.
- WILL NOT RUN OFF EXISTING PLATFORMS, SUCH AS FTP AND HTTP SERVERS.

- **INTELONET**
  - TECHNOLOGY THAT WAS DEVELOPED BY NOVELL HAS NOW BEEN ACQUIRED BY INTELOGIS INCORPORATED
  - HARDWARE TO ALLOW A NETWORK TO BE CREATED BY USING THE EXISTING POWER LINES INSIDE A HOME OR OFFICE
  - HARDWARE IS KNOWN AS THE *INTELONET POWER LINE* AND IT MAKES IT POSSIBLE TO CREATE A NETWORK BY PLUGGING A DEVICE INTO A WALL OUTLET
  - COMN SPEEDS OF UP TO 1 MBPS
  - SOFTWARE CAN AUTOMATICALLY LOCATE AND CONFIGURE ALL SUCH DEVICES ON THE NETWORK
- **KATIX MINI-IP**
  - HARDWARE CONSISTS OF A MICROPROCESSOR AND AN ETHERNET CONTROLLER ALONG WITH SOME ADDITIONAL MEMORY
  - SOFTWARE CONSISTS OF A BASIC OPERATING SYSTEM AND A BASIC IMPLEMENTATION OF SOME OF THE COMMUNICATION PROTOCOLS USED OVER THE INTERNET/INTRANET
  - SYSTEM MASTER SLAVE CONFIG

- **VADEM VG330**
  - 16-BIT, 32-MHZ, X86-BASED, INFORMATION APPLIANCE REFERENCE DESIGN
  - I POINT FIRMWARE HANDLES PROTOCOLS SUCH AS TCP/IP, PPP, PLUS TASKS LIKE MODEM OR ISP SETUP, AND FTP/SMTP TRANSACTIONS
  - SPECIALIZED CONTROLLERS ARE BUNDLED WITH READY-MADE PROTOCOL STACKS THAT SPEED PRODUCT DEVELOPMENT AND REDUCE INTEROPERABILITY PROBLEMS
  - ROM-BASED NETWORK APPLICATIONS LIKE FTP, HTTP, TELNET, POP3, AND MAIL SERVICE, AS WELL AS THE SNMP MANAGEMENT FUNCTIONS, PROVIDED.



EARLY SOLUTION

- **NETWORK REFRIGERATOR**
  - ONE OF THE EARLIER NETWORK REFRIGERATORS CONSISTED OF A COMPUTER WITH A MODEM, A MICROPROCESSOR AND A NUMBER OF SENSORS. THE SENSORS RECORD THE TEMPERATURE INSIDE THE FRIDGE, WHETHER THE DOOR IS OPEN OR NOT .
  - THE MICRO-PROCESSOR RECEIVES THE DATA FROM THE SENSORS, PROCESSES THE DATA SO THAT THE COMPUTER CAN UNDERSTAND IT AND SENDS THE DATA TO THE COMPUTER.
  - THE COMPUTER THEN INSERTS THE DATA INTO A WEB PAGE THAT CAN BE OBTAINED FROM ITS WEBSITE.

DISADVANTAGE

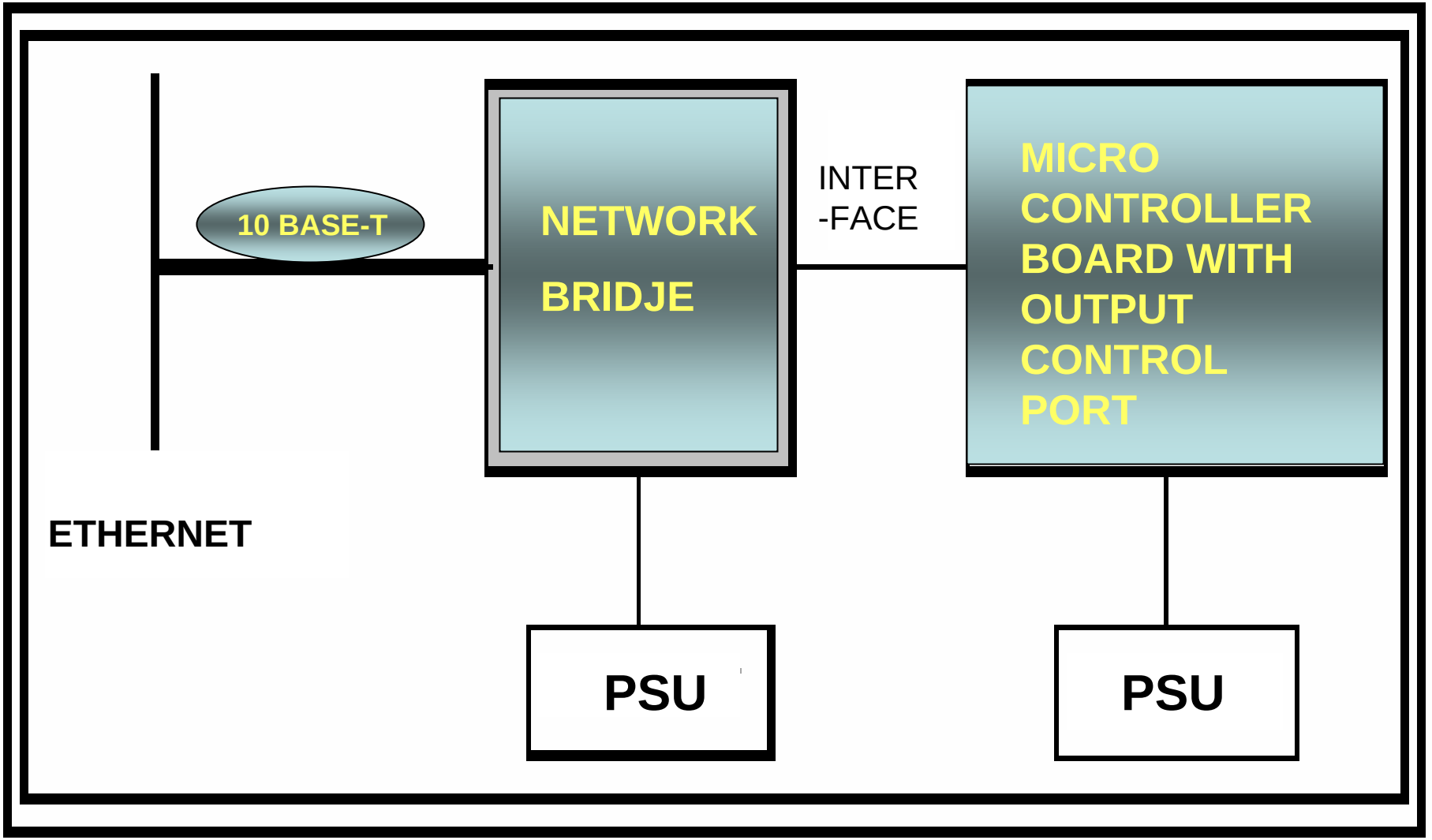
- MAIN DISADVANTAGE IS THAT THE MICRO-PROCESSOR MUST COMMUNICATE THROUGH A COMPUTER AND IS NOT DIRECTLY CONNECTED TO THE INTERNET. A DIRECT CONNECTION TO THE INTERNET WOULD REQUIRE FEWER COMPONENTS, TAKE UP LESS SPACE AND BE A LOT CHEAPER.

PRESENT APPROACH

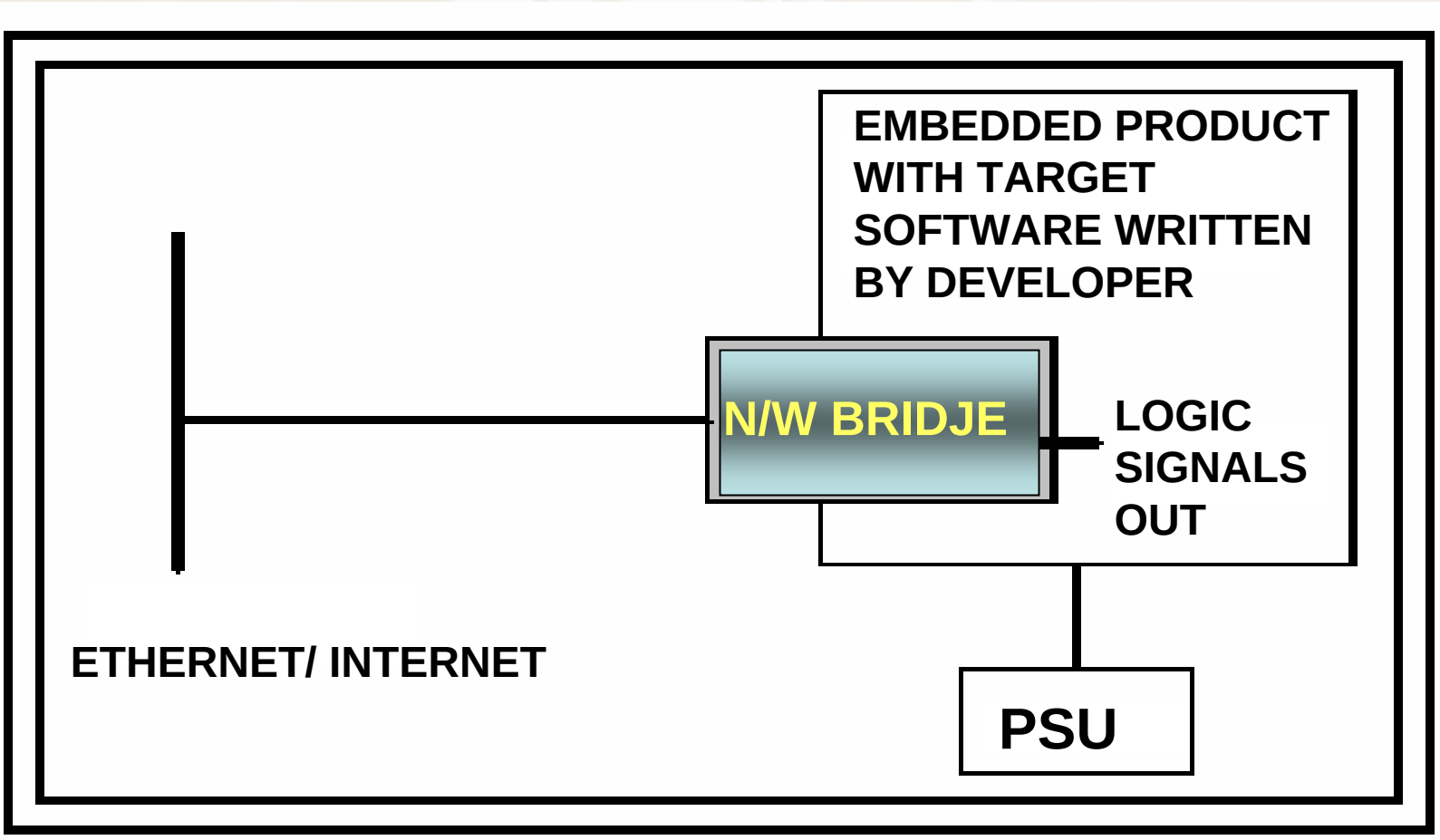
- USE OF NET EBABLED EMBEDDED COMPUTER
- MORE NO OF SENSORS
- ARTIFICAL INTELLIGENCE
- E-COMMERCE CAPABLE
- NET SECURITY
- USER IDENTIFICATION / PASSWORD AUTHENTICATION
- VOICE ACTIVATED
- PROGRAMMABLE VIA FTP

BLOCK SCHEMATIC DIAGRAM OF TYPICAL SYSTEMS

BLOCK SCHEMATIC

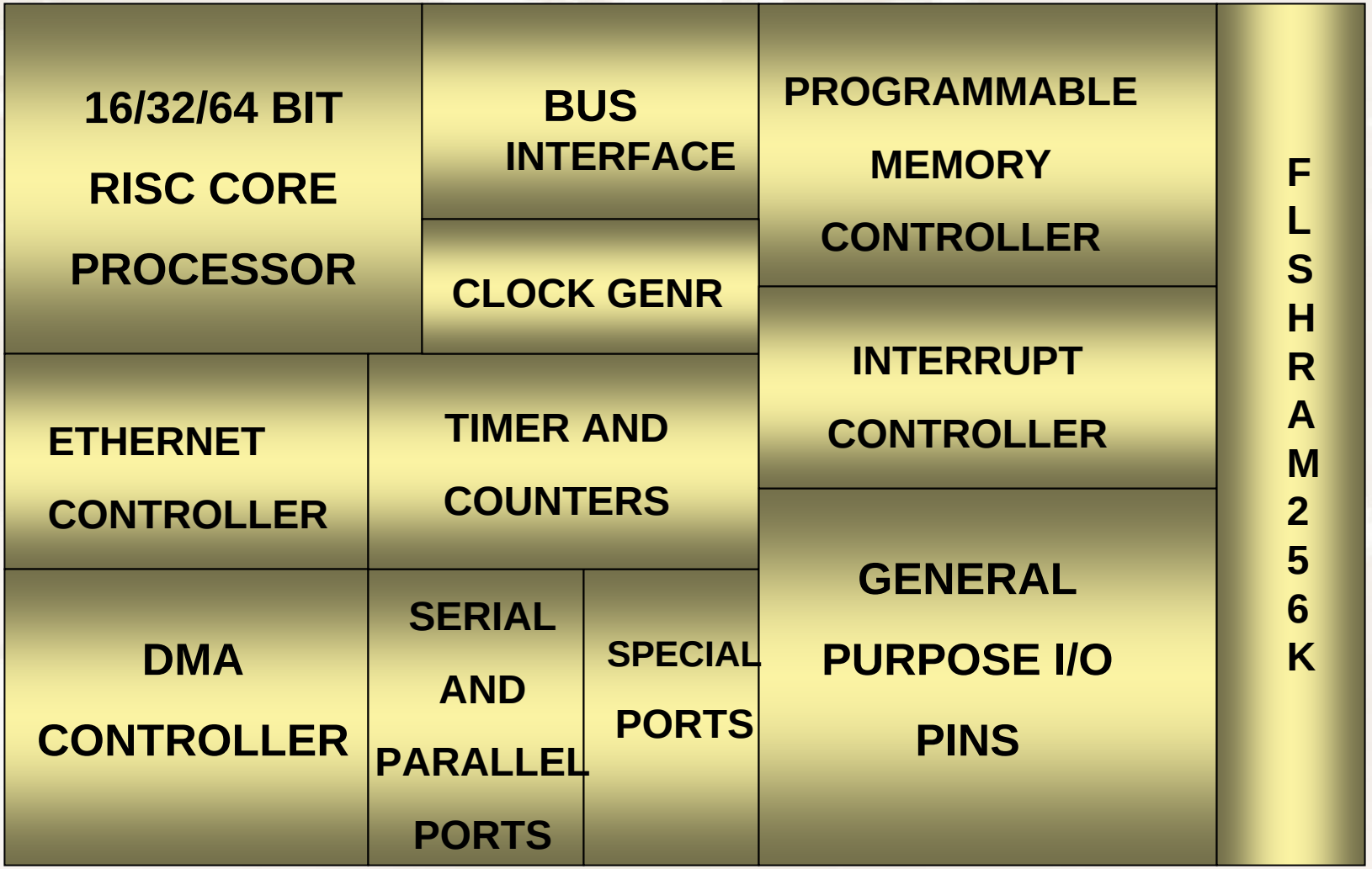


BLOCK SCHEMATIC



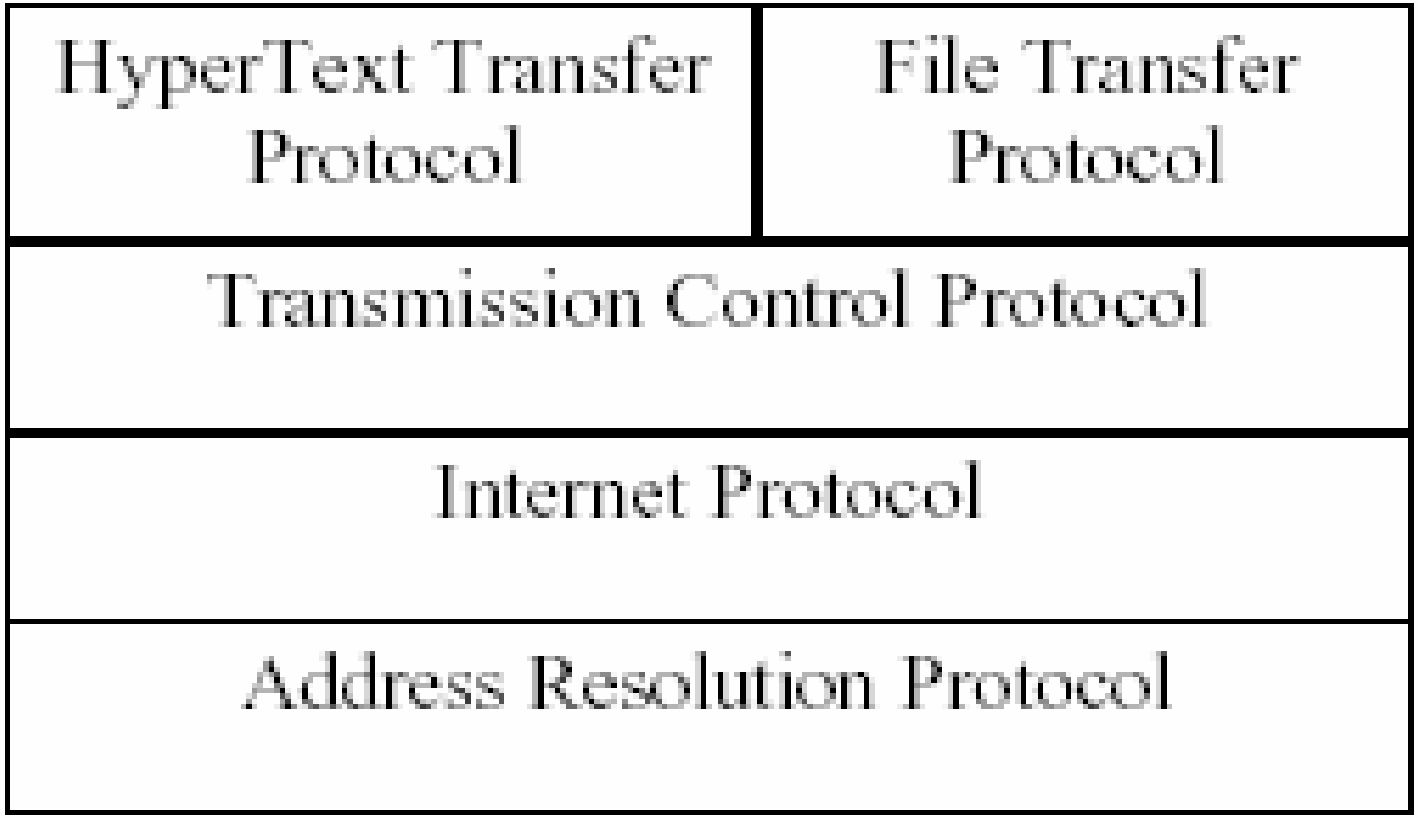
A TYPICAL MODERN MICROCONTROLLER

MICROCONTROLLER

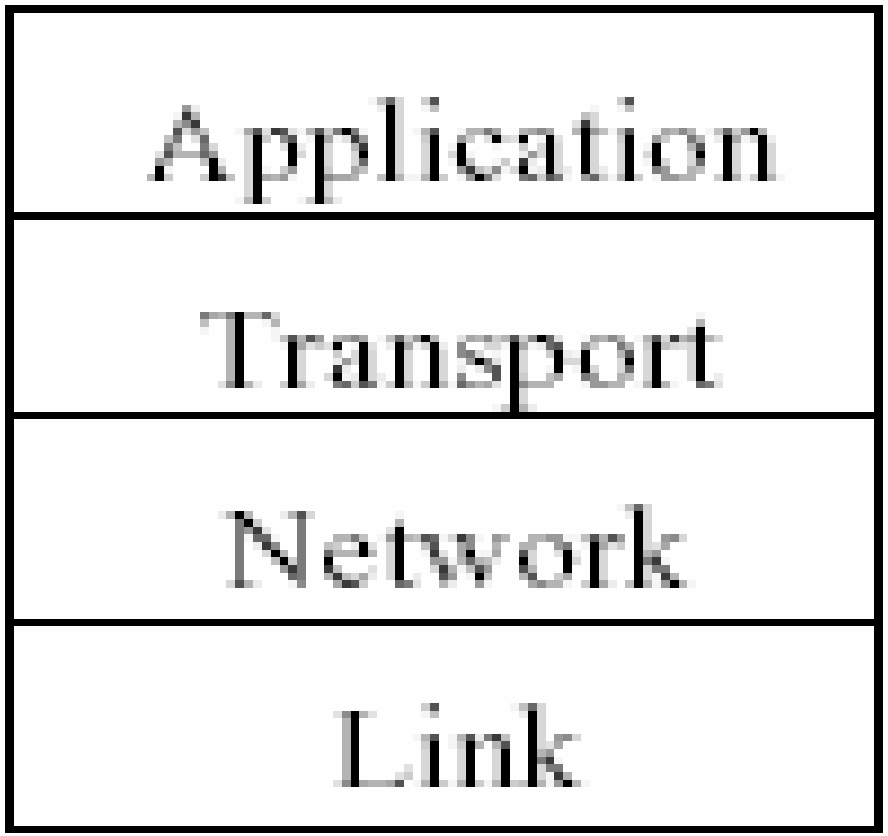


PROTOCOLS

PROTOCOLS


HyperText Transfer Protocol
File Transfer Protocol
Transmission Control Protocol
Internet Protocol
Address Resolution Protocol

LAYERS OF TCP/IP PROTOCOL SUITE



FTP, HTTP

TCP, UDP

IP, ICMP

ARP, PPP

- THE LINK LAYER IS RESPONSIBLE FOR THE TRANSMISSION AND RECEPTION OF THE ACTUAL DATA FROM AND TO THE COMPUTER . ADDRESS RESOLUTION PROTOCOL (ARP) (ETHERNET NETWORKS) AND THE POINT TO POINT PROTOCOL (PPP) (SERIAL TRANSMISSIONS SUCH AS THROUGH A MODEM)

- NETWORK LAYER USES THE INTERNET PROTOCOL (IP). THE MAIN PURPOSE OF IP IS TO FORWARD DATA TO IT'S CORRECT DESTINATION. IP ALSO PROVIDES A MECHANISM FOR FRAGMENTING LARGE PACKETS. INTERNET CONTROL MESSAGE PROTOCOL (ICMP) IS USED TO SEND ERROR AND CONTROL MESSAGES THAT ARE USEFUL IN DEBUGGING PROBLEMS WITH A NETWORK

- TWO COMMON TRANSPORT PROTOCOLS USER DATAGRAM PROTOCOL (UDP) AND THE TRANSMISSION CONTROL PROTOCOL (TCP). UDP IS SIMPLE, NOT VERY COMPLICATED, BUT NOT VERY RELIABLE. TCP PROVIDES FOR A RELIABLE FLOW OF DATA BETWEEN COMPUTERS MORE POPULAR

- SOME APPLICATION LAYER PROTOCOLS ARE THE SIMPLE NETWORK MANAGEMENT PROTOCOL (SNMP) IS USED TO ACCESS NETWORK STATISTICS ABOUT A COMPUTER AND TO NOTIFY A NETWORK MANAGER WHEN A PROBLEM OCCURS IN A COMPUTER IT IS USUALLY BASED ON (UDP).

- THE HYPERTEXT TRANSFER PROTOCOL (HTTP) IS USED TO OBTAIN WEB PAGES AND GRAPHICS FROM A REMOTE SITE. IN GENERAL, A REQUESTS FOR A WEB PAGE IS RECEIVED AND THAT PAGE IS TRANSMITTED BACK TO THE REQUESTING MACHINE THROUGH THE USE OF TCP WHERE THE WEB BROWSER DISPLAYS THE PAGE ON THE SCREEN.

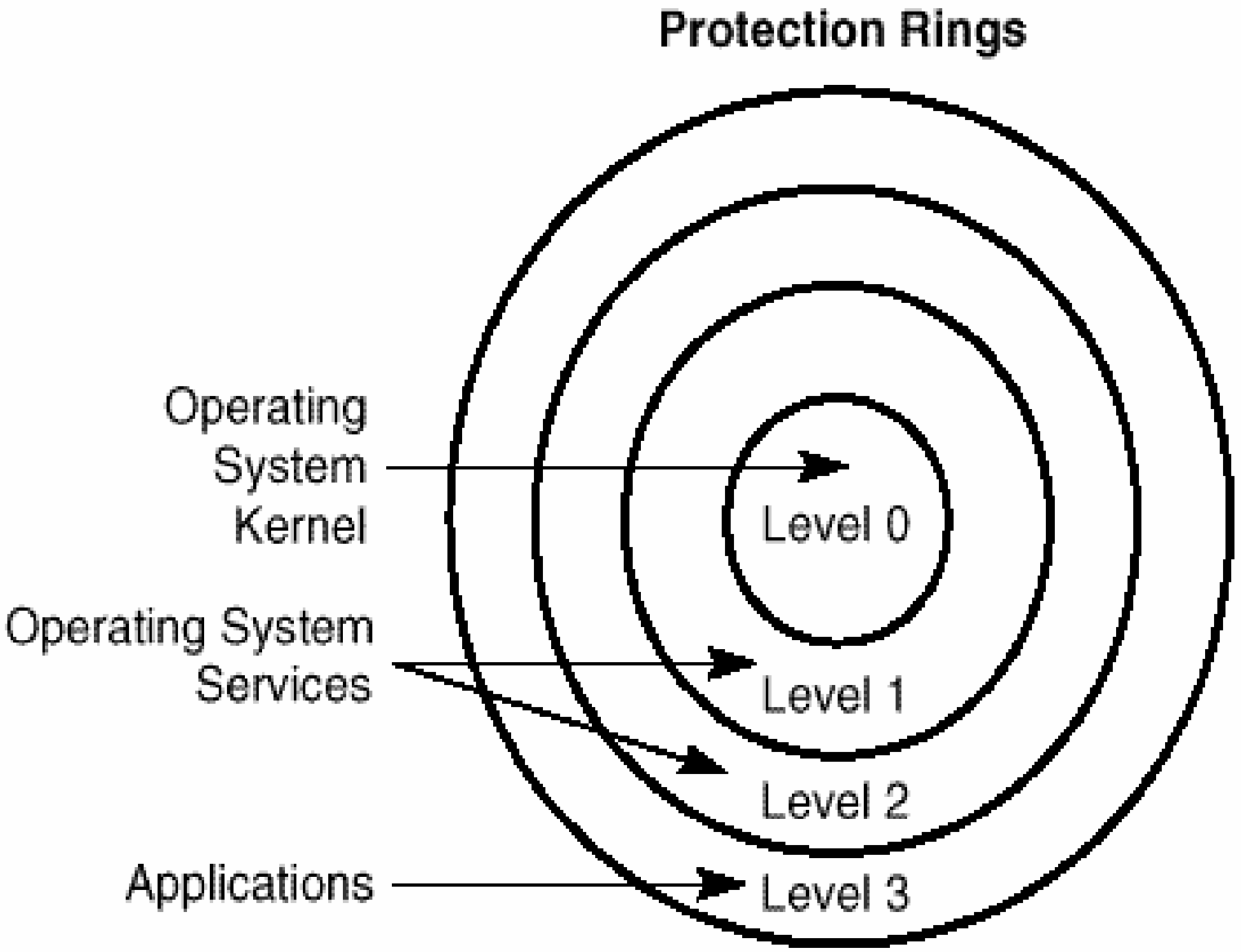
- THE FILE TRANSFER PROTOCOL (FTP) IS SIMILAR TO HTTP EXCEPT THAT THE REQUESTED FILE IS STORED ON THE HARD DRIVE OF THE RECEIVING MACHINE AND THE TRANSFER OF FILES CAN HAPPEN IN EITHER DIRECTION. A FILE CAN BE TRANSFERRED TO OR FROM A REMOTE COMPUTER

SOFTWARE DESIGN

TARGET SOFTWARE

- REGARDLESS OF HARDWARE PLATFORM SOME SOFTWARE IS REQUIRED TO BE WRITTEN OR MODIFIED FOR USE ON THE TARGET DEVICE BASED ON SOME PROCESSOR.
- IF THE TARGET DEVICE IS KIT BASED THEN PRE-WRITTEN ROUTINES ARE AVAILABLE TO MINIMIZE THE SOFTWARE DEVELOPMENT TASK AT THE TARGET. IF THE MICROPROCESSOR ON THE TARGET DEVICE IS NOT KIT BASED THEN, ANSI C ROUTINES ARE AVAILABLE, BUT THE HARDWARE LEVEL DRIVERS MUST BE PORTED FOR THAT PROCESSOR.
- IF THE TARGET CPU IS NOT SUPPORTED OUT OF THE BOX, THEN EXPERIENCED PROGRAMMERS CAN EXAMINE THE SAMPLE TARGET CODE AND PORT IT TO THEIR OWN CPUS.

PROTECTION PROBLEM



APPLICATIONLESS APPROACH

- USE TCP/IP PROTOCOL SUITE.
- THESE ARE THE FILE TRANSFER PROTOCOL (FTP), TO ALLOW THE SOFTWARE ON THE PROCESSOR TO BE UPGRADED REMOTELY OVER A NETWORK.
- AND THE HYPERTEXT TRANSFER PROTOCOL (HTTP) TOALLOW STATUS INFORMATION ABOUT THE REMOTE MACHINE TO BE OBTAINED AND THE REMOTE MACHINE TO BE CONTROLLED VIA A WEB PAGE.

ADVANTAGES

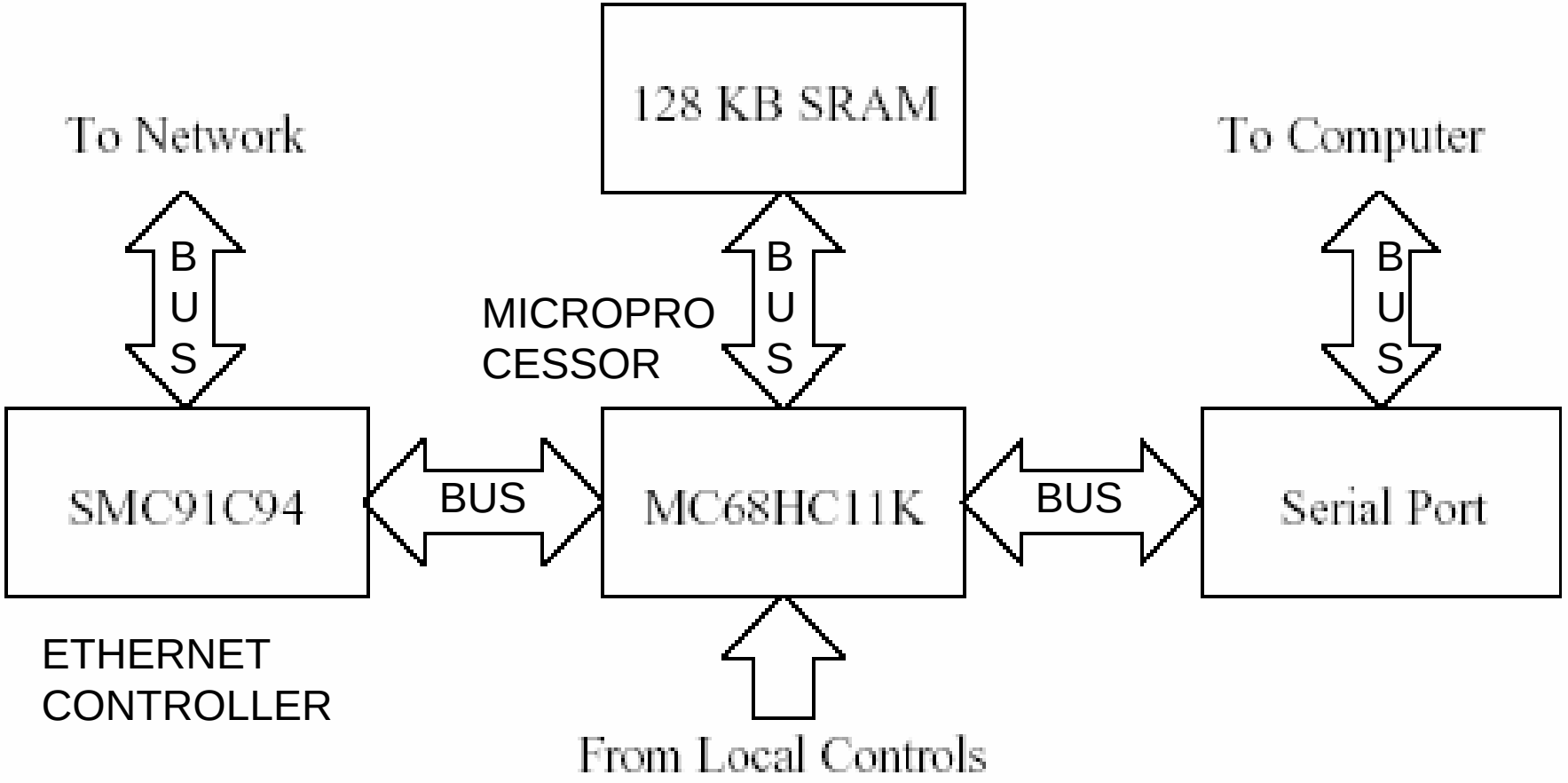
- EASE OF USE AND NO APPLICATION MUST BE DEVELOPED IN ORDER TO CONTROL THE REMOTE MACHINE.
- ANY ERROR INFORMATION CAN BE PROVIDED ON THE WEB PAGE THAT CONTAINS THE STATUS OF THE REMOTE MACHINE.
- IT IS ALSO NECESSARY TO PREVENT TWO REMOTE USERS FROM ATTEMPTING TO CONTROL THE REMOTE MACHINE SIMULTANEOUSLY, ACCOMPLISHED BY ALLOWING ONLY ONE REQUEST TO THE HTTP SERVER AT A TIME AND IGNORING ALL OTHERS. IN OTHER WORDS,THE PROCESSOR WILL FINISH SERVICING ONE REQUEST BEFORE SERVICING A SECOND

DIFFERENCE IN EMBEDED SERVER

- THIS IS QUITE DIFFERENT FROM MOST WEB SERVERS WHICH ARE CAPABLE OF SERVICING MANY REQUESTS AT THE SAME
- SOFTWARE SHOULD ALSO BE ABLE TO ACCEPT INPUTS FROM THE LOCAL CONTROLS AND DETERMINE WHETHER THE REMOTE MACHINE IS CONFIGURED FOR LOCAL OR REMOTE USE.

AVAILABLE PRODUCTS

ETHERNET TO SERIAL CONVERTER USING MOTOROLLA MC68HC11K MICROCONTROLLER

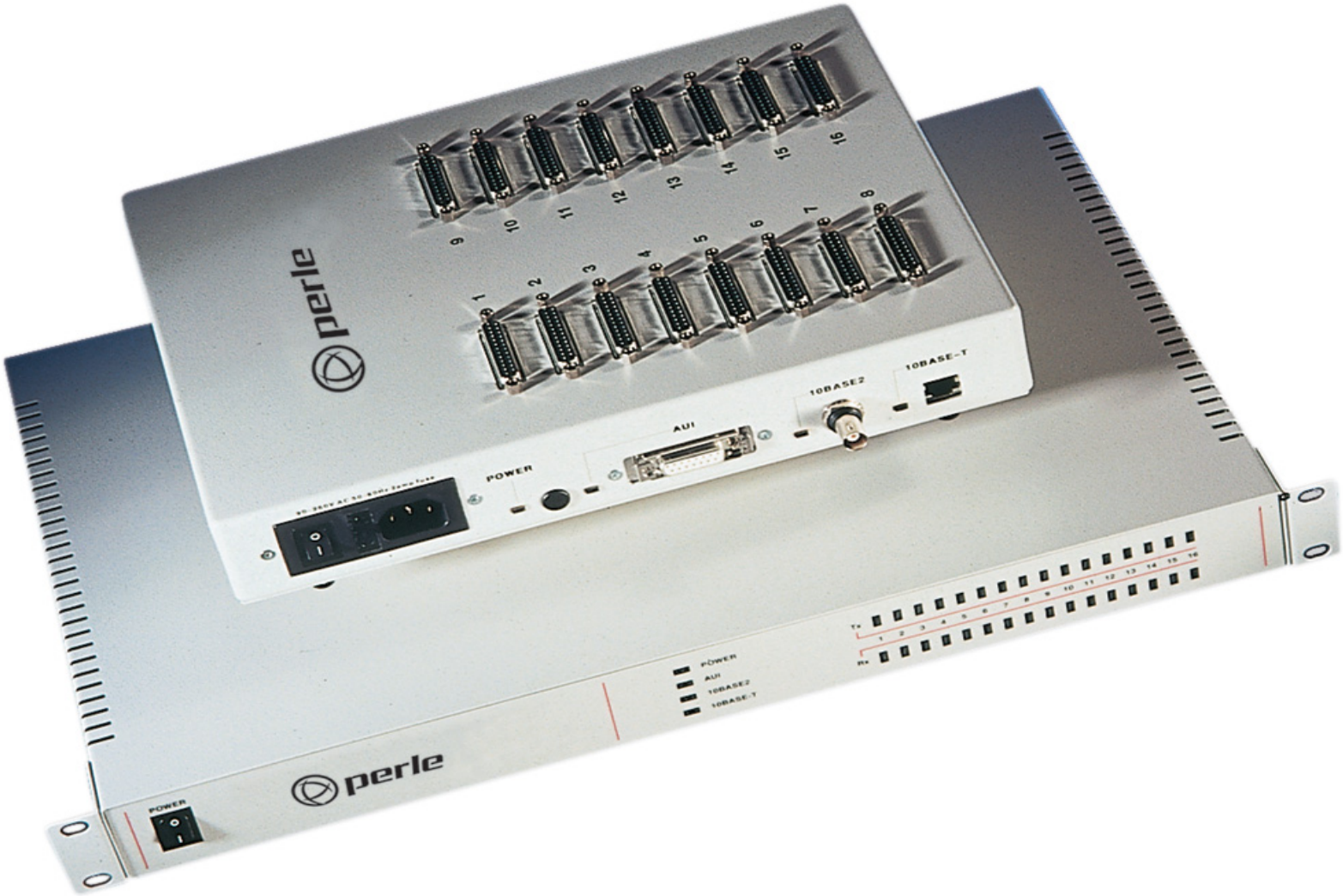


ETHERPATH® SS-1 SS-2 SINGLE PORT SERIAL SERVER

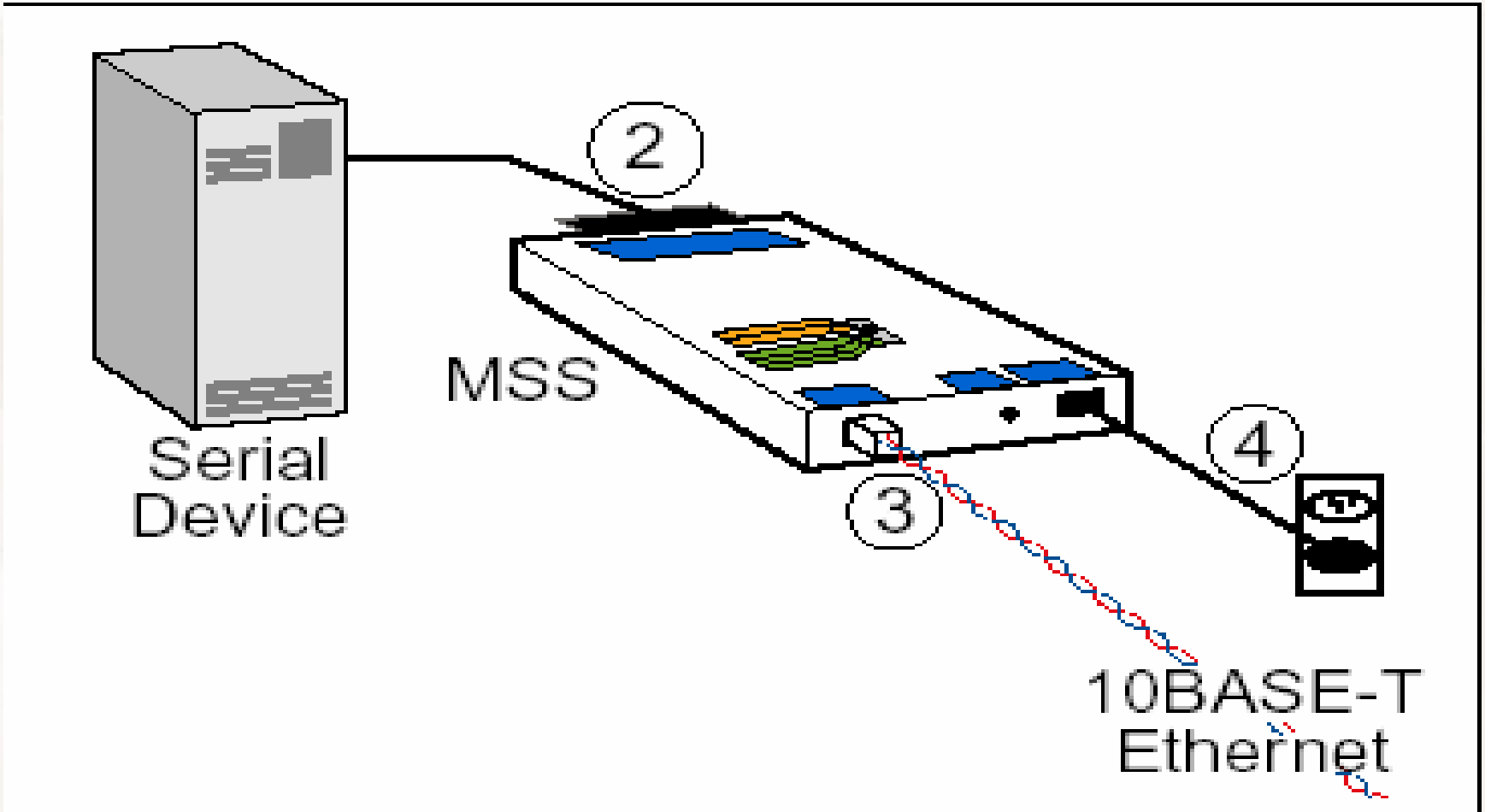
BACK VIEW

FRONT VIEW

MULTI PORT CONVERTERS



LANTRONIX MSS100 FAST ETHERNET MICRO SERIAL SERVERS



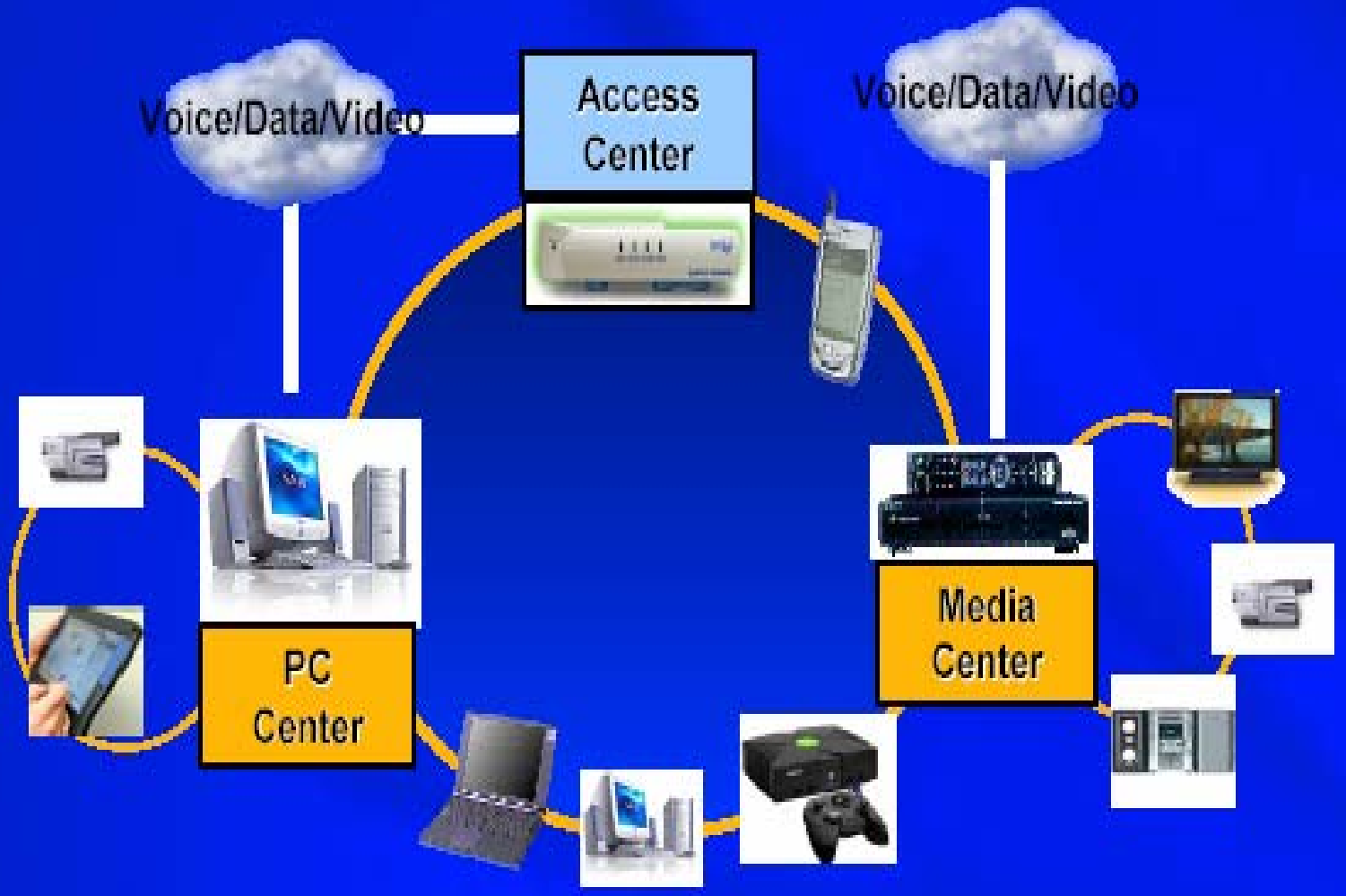
ETHERNET TO PARALLEL ADAPTER FROM SBIG

WIRELESS ETHERNET SERVER AND USB 2.0 TO ETHERNET CONVERTER AND SERVER

TROY XCD RANGE OF 10BASE-T ETHERNET SERIAL SERVER

The Digital Home

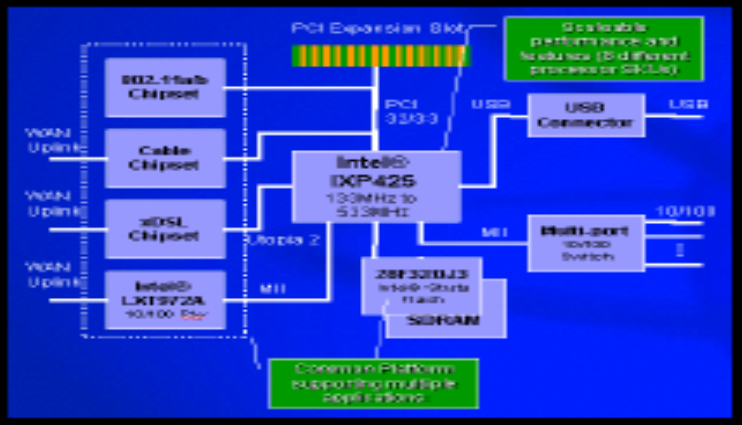
Any Content, Any Place, Any Device, Any Time



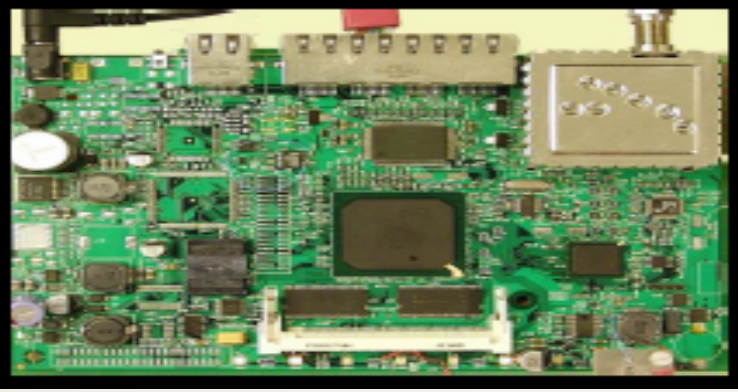
INTEL'S RESIDENTIAL GATEWAYS

- **Intel® IXP425-Based Residential Gateway**
  - Flexible Design Supports Multiple Platforms
  - Support for Advanced Feature Sets
    - 802.11 AP
- **CableHome* Residential Gateway**
  - Standards Driven design
  - Growing Network Processing Workload
  - Linux

Intel® IXP425 RG



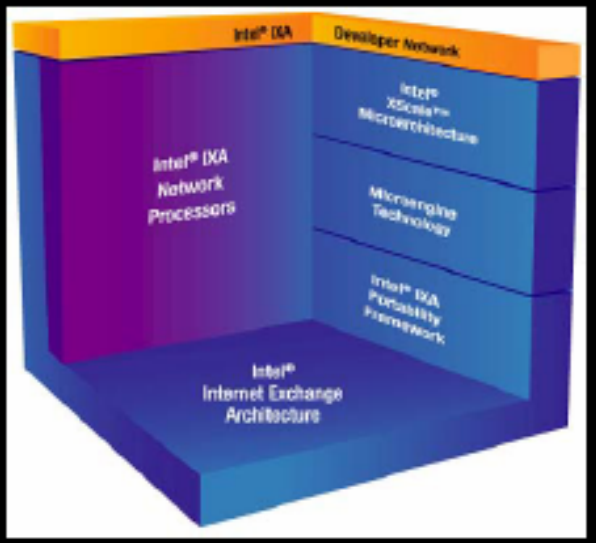
Reference Design Kit



Intel® IXA Network Processor Solutions

- Intel® IXA Solutions
  - Intel® XScale™ Micro-architecture
  - Micro-engine Technology
  - Intel® IXA Portability Framework
- Family of Network Processors
  - Intel® IXP425
  - Intel® IXP2400
  - Intel® IXP2800
- Comprehensive Development Environment
- Advanced Tools and Techniques to Simplify Intel's Network Processor Software

Intel® IXA Model



Tools Speed Development

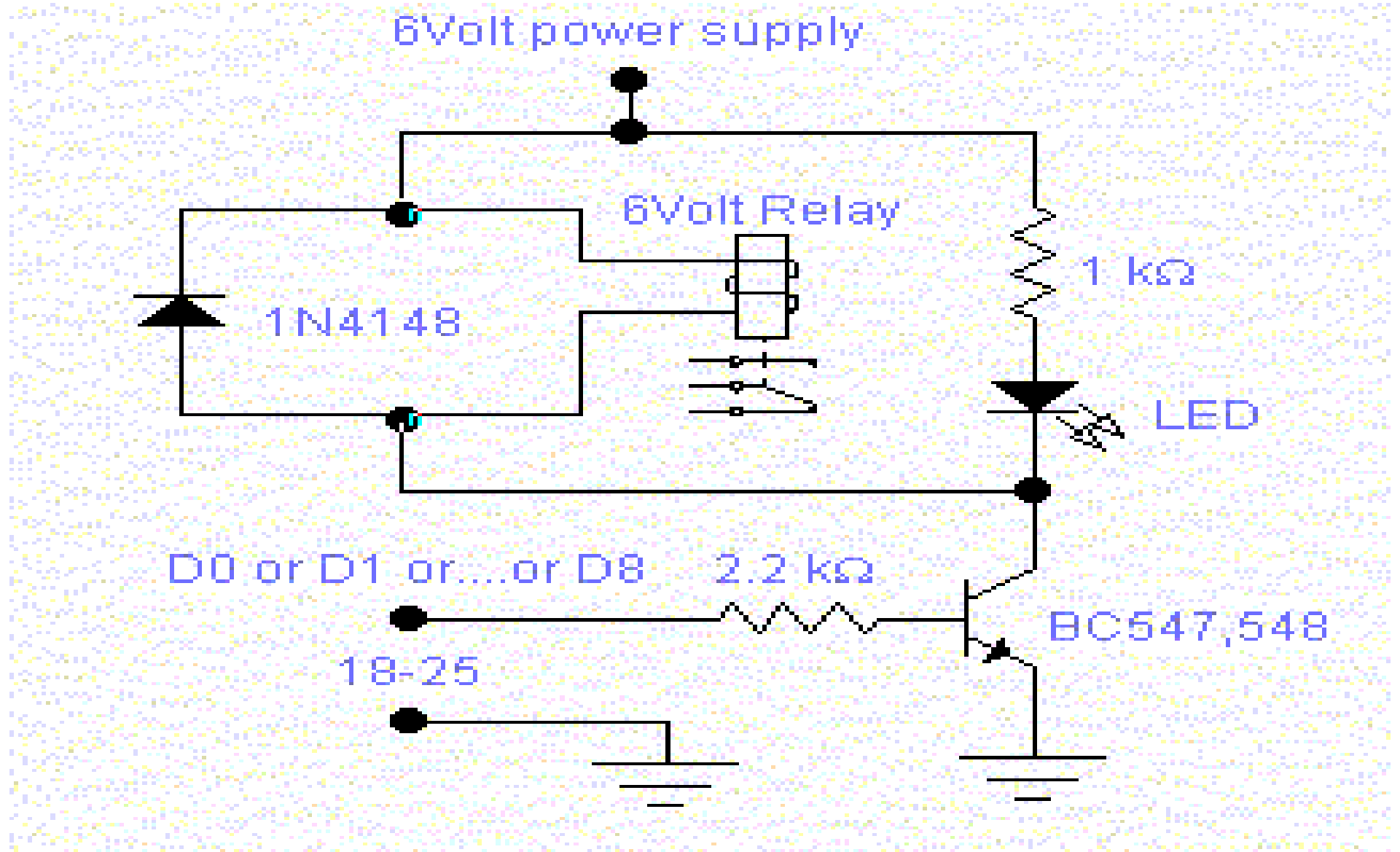
Hardware Development Platform

Software Tools

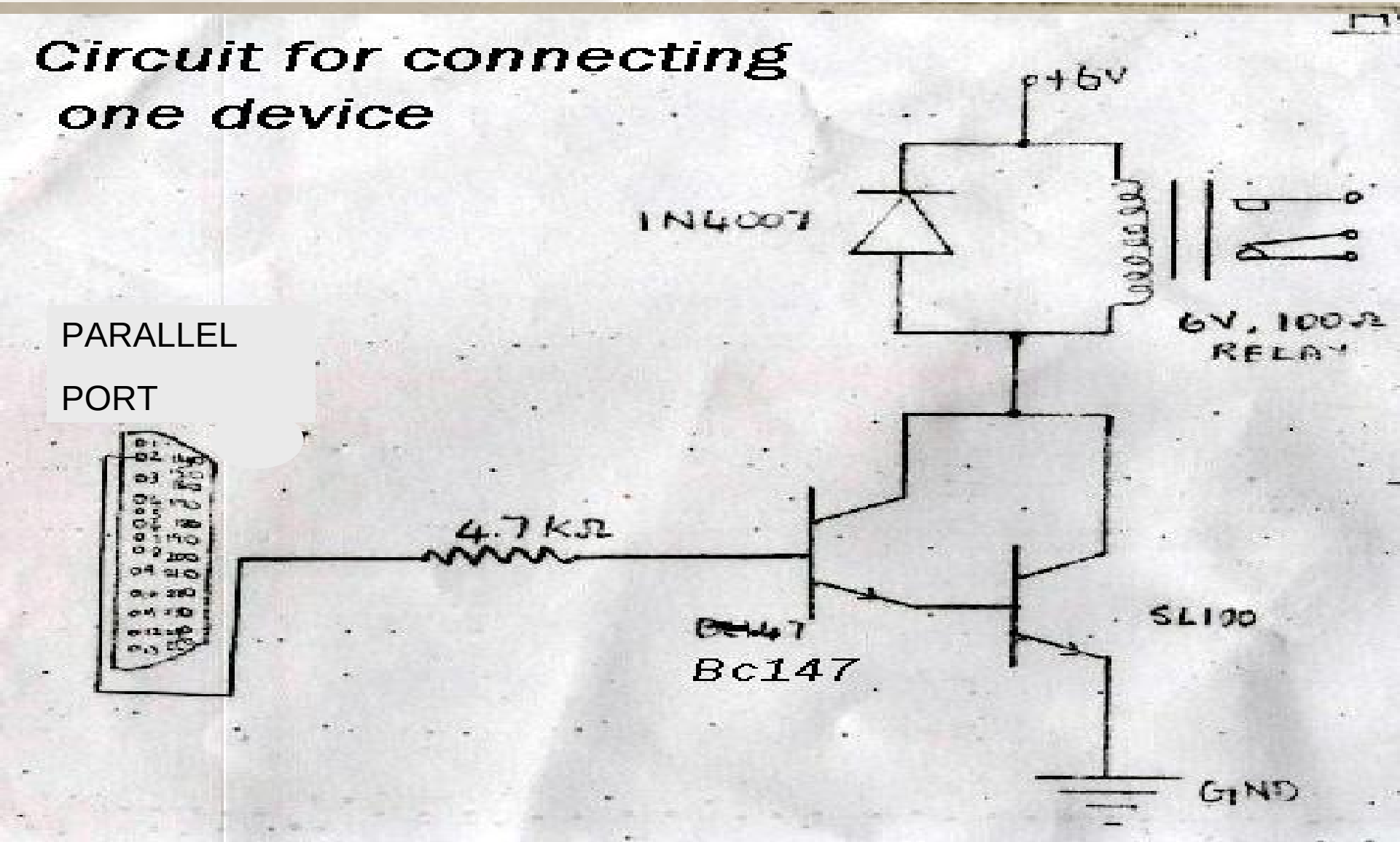
intel

CONTROL CIRCUITS

CONTROL CIRCUITS



CONTROL CIRCUITS



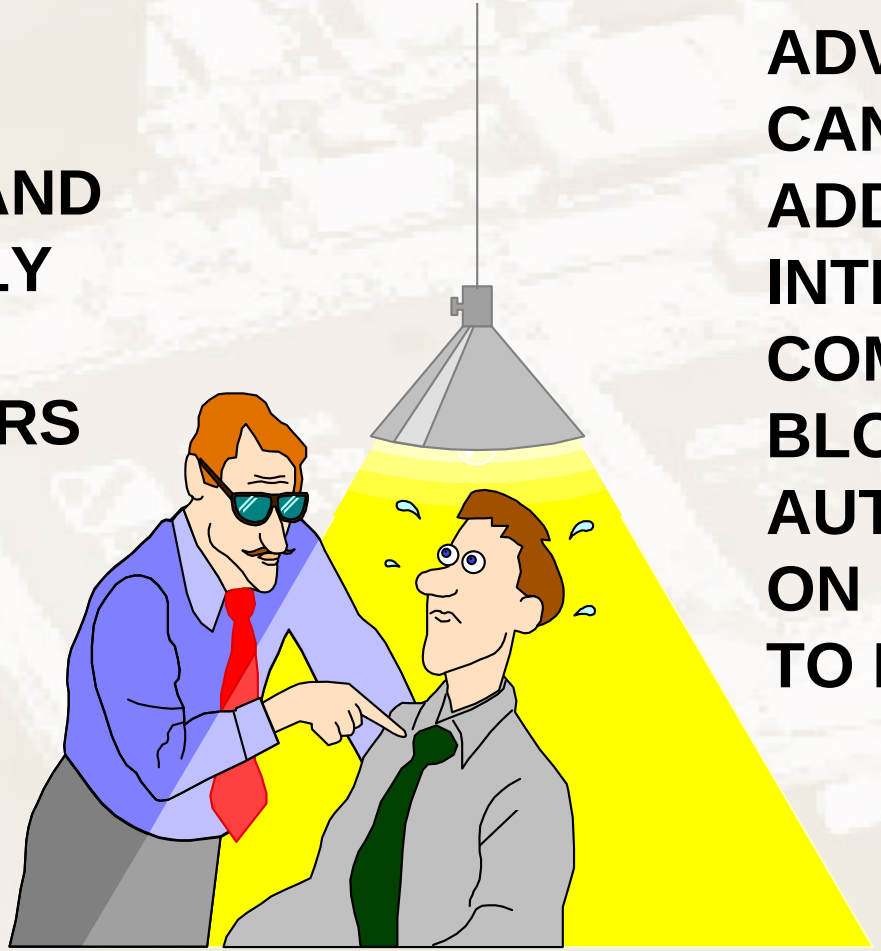
SECURITY

SECURITY FEATURES

- THE MOST IMPORTANT AREA OF SECURITY IS WITH FTP WHEN UPGRADING SOFTWARE.
- USE OF A SECURE LOGIN NAME AND PASSWORD FOR REMOTE USER.
- PERMIT COMPUTERS WITH AN INTERNET ADDRESS WITHIN A CERTAIN RANGE TO CONTROL THE REMOTE MACHINE.
- STATUS INFORMATION -EVERYONE.

INTRUDER DETECTION AND ALARM

SYSTEMS CAN RAISE ALARM AND AUTOMATICALLY INFO SYSTEM ADMINISTRATORS



ADVANCED SYS CAN FIND OUT IP ADDRESS OF INTRUDERS COMPUTER AND BLOCK IT AUTOMATICALLY ON NEXT ATTEMPT TO LOGIN

YOUR QUERIES