EQUIREMENT ANALYSIS REPORT

by

ROYALFLUSH

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1. Introduction

This requierements analysis report is prepared for the senior design course of 2007-2008 fall semester to present and describe the project in detail.

1.1. Team Members

Hasan Tahsin KILIÇ (1448893) – The Leader, Initiator, Devil's Advocate, Documentor
Yetkin SAKAL (1395425) – Summarizer, Initiator, Vice Documentor
Hasari YAPICI (1395656) – Optimist, Recorder
Bahattin YALÇIN (1395649) – Gate Keeper, Time Keeper

1.2. Project Description

Our project is about a wireless network traffic monitoring system. This system examines local area network usage on the AP-400 Wireless Access Point Repeater / Bridge / 4-Port Switch and shows these data like upload and download statistics on a graphic lcd display. It will be a real time embedded system which enables every new wireless connection to be registered by the users' MAC address and monitores on the LCD display. On this display, number of computers connected with this access point will be shown. The usage of the access point in past 24 hours will also be displayed. At the progressing stages of the project, we will connect the device to a computer by serial port and using the embedded linux system inside the device, we will conduct the necessary operations

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1.2.1. Possible Application Areas

Current needs of administrators indicate that it is critical to get informed about the traffic flowing across a particular network. This process does not require a specialist to fully engage in network packets sent and received, but getting accustomed to the protocols those packets use to reach or leave the network. Monitoring the network allows one to have a better understanding of how bandwidth is being used. It also helps finding out if users are running

file sharing programs, or if some kind of evil Trojan is silently transmitting information in the background.

As a result, we estimate that this system will be very useful in the industry. For instance, when one needs to access the Web through this access point, s/he can see the flow on the device and make decisions using the parsed data. In the future, this product will be improved to specialize this download/upload flow so that an administrator can change the bandwidths of different applications on the access point for better performance.

The targeted customers of this device will be individuals from higher economical degrees or from SMEs (Small or Medium Enterpriese). In a more formal way, this system will be used by

- WLAN administrators.
- Security professionals.
- Home users who are interested in monitoring their WLAN traffic.
- Programmers developing software for wireless networks.

2. Team Organization

2.1 Team Structure

We are progressing in our project in step by step like analysis, design, implementation etc. Due to this fact, we agreed on implementing the Waterfall Model, a sequential software development model (a process for the creation of software) in which development is seen as flowing steady downwards (like a waterfall) through the phases of requirements analysis, design, implementation, testing (validation), integration, and maintenance.

2.2 Member Roles

As we stated in our project proposal report, we have a Democratic Centralized (DC) team structure; so, our team possesses a leader in the team but all remarkable decisions are made by common interest of all members

The contact people, project manager, documentation person and initiator is Hasan Tahsin KILIÇ and he will be in contact with the instructor, teaching assistant and the company executives. He also makes documentation in the team but submitted material such as reports will be written by the help of all group members.

The summarizer, documentation person and initiator is Yetkin SAKAL. He is also responsible for the initialization of and updates to the project website. He will be one of the initiators of the project besides the project leader, Hasan Tahsin KILIÇ.

The recorder and documentation person is Hasari YAPICI. He will mainly take care of remarkable notes in the meetings and he is also responsible from gathering information about the specifications in the meetings with AirTies Company.

The gatekeeper and time keeper is Bahattin YALÇIN. He will be responsible for the schedule of team meetings as well as specializing in information hiding principle of the group.

3. Market Research

3.1. Literature Survey

Market research is a very important topic for us in our project now that embedded networks can be regarded as newborn babies in terms of their background in the market and we have very few sources about it. With the help of the market research, we found several product that can help us. It would be a good idea to outline some brief information about these projects.

3.1.1 N1 Vision (BELKIN)

The N1 Vision wireless router offers an easy way to monitor a particular network's broadband speed, computer bandwidth usage, and the status of connected devices - all from an easy-to-read display. Packaged in a new sleek and sophisticated design, N1 Vision offers the best in networking performance with its wireless 802.11n* 3x3 radio

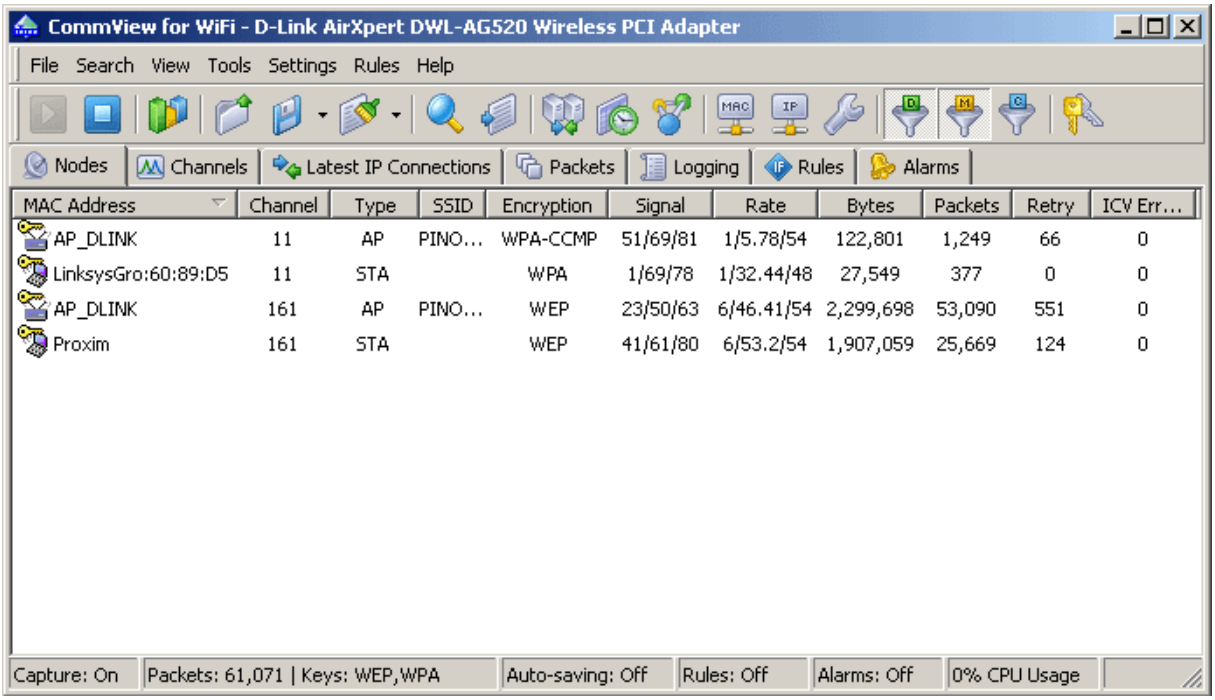
design and wired gigabit ports. The N1 Vision wireless router continues Belkin's commitment in providing the best user experience in the home market through its Plug-and-Play "CD-less" installation and simple network security setup.

3.1.2. CommView® for WiFi

CommView for WiFi is a powerful wireless network monitor and analyzer for 802.11 a/b/g networks. Loaded with many user-friendly features, CommView for WiFi combines performance and flexibility with an ease of use unmatched in the industry.

CommView for WiFi captures every packet on the air to display important information such as the list of access points and stations, per-node and per-channel statistics, signal strength, a

list of packets and network connections, protocol distribution charts, etc. By providing this information, CommView for WiFi can help you view and examine packets, pinpoint network problems, perform site surveys, and troubleshoot software and hardware.



Packets can be decrypted utilizing user-defined WEP or WPA-PSK keys and are decoded down to the lowest layer. With over 70 supported protocols, this network analyzer allows you to see every detail of a captured packet using a convenient tree-like structure to display protocol layers and packet headers. Additionally, the product provides an open interface for plugging in custom decoding modules. A WEP and WPA key retrieval add-ons are available subject to terms and conditions.

A number of case studies describe real-world applications of CommView for WiFi in business, government, and education sectors.

CommView for WiFi is a comprehensive and affordable tool for wireless LAN administrators, security professionals, network programmers, or anyone who wants to have a full picture of the WLAN traffic. This application runs under Windows 2000/XP/2003/Vista and requires a compatible wireless network adapter.

4. Theory

4.1. Real-Time Systems

4.1.1. A General Description of Real-Time Systems

A real-time system can be defined as a system if logical correctness of operations taking place on it fails to determine the overall accuracy of the system, having to be dependent on the time in which the operation is performed. A more critical issue about such systems is that a delayed operation may lead to a complete failure of the system and the completion of the operation at this time is considered useless.

Main application areas for real-time systems are those that are fully dependent on hardware implementation. One example might be the embedded system controlling a car engine. In this context, an unsuccessful operation may lead to loss of human lives, a vital aspect to consider.

5. General Information about AP-400

5.1. Internal Structure of AP-400

AirTies AP-400, which has 54Mbps data transfer speed, consists of access point, repeater, bridge and four-port switch. It can be formed a wireless local area network by connecting AP-400 to a cable ADSL modem. In this way, computers having no wireless property can get on to the Internet.

AirTies Mesh technology solves weak signal problems in the big buildings. When this problem appears, to stremghten the signal where it is weak, the device is involved in wireless computer network. Then the structure, repeater, is operated. Repeater increases the inclusion area and signal.

Computers that have no wireless property can be connected to four ethernet port of AP-400 through its bridge feature. In this way, devices such as computers and printers that have no wireless feature are included in the wireless network. Moreover, AP-400 are fully compliant with WPA2 and WPA standards. Thus, it supports providing the wireless local area network safety. You can determine the user connecting your wireless network in terms of their MAC addresses. It can also prevent malicious code to access your network or ban users from connecting to your restricted area thanks to this facility.

AP-400 Components

ADM6996F

The ADM6996F is an integrated (Controller, PHY and Memory) four-port 10/100 Mbps TX/FX plus two 10/100 MAC port Ethernet switch controller with all ports supporting 10/100 Mbps Full/Half duplex. It provides functions such as : 802.1p (Q.O.S.), 802.1q (VLAN), Port MAC address Locking, Management, Port Status, TP Auto-MDIX, 25M Crystal & Extra MII port functions to meet customer requests on switch demand.

To add, it prevents packet loss when buffers are full by supporting Back Pressure in Half-Duplex mode and 802.3x Flow Control Pause packet in Full-Duplex mode. When there is no input buffer available for the incoming packet, and also Back Pressure is enabled, the ADM6996F will issue a JAM pattern on the receiving port in Half Duplex mode and transmit the 802.3x Pause packet back to receiving end in Full Duplex mode.

ADM6996F also provides priority features by Port-Base, VLAN and IP TOS field checking. By using these features , users can set different priority modes in individual ports. ADM6996F can recognize up to 2048 different MAC addresses and enable filtering and forwarding at full wire speed. In addition, it is used on building Internet access. This feature prevents multiple users from sharing one port traffic. Its applications are SOHO 5-port switch, 5-port switch, Router with MII CPU interface.

Abbreviations

BER Bit Error Rate
CFI Canonical Format Indicator
COL Collision
CRC Cyclic Redundancy Check
CRS Carrier Sense
CS Chip Select
DA Destination Address
DI Data Input

DO Data Output

EDI EEPROM Data Input

EDO EEPROM Data Output

EECS EEPROM Chip Select

EESK EEPROM Clock

ESD End of Stream Delimiter

FEFI Far End Fault Indication

FET Field Effect Transistor

FLP Fast Link Pulse

GND Ground

GPSI General Purpose Serial Interface

IPG Inter-Packet Gap

LFSR Linear Feedback Shift Register

MAC Media Access Controller

MDIX MDI Crossover

MII Media Independent Interface

NRZI Non Return to Zero Inverter

NRZ Non Return to Zero

PCS Physical Coding Sub-layer

PHY Physical Layer

PLL Phase Lock Loop

PMA Physical Medium Attachment

PMD Physical Medium Dependent

QoS Quality of Service

QFP Quad Flat Package

RST Reset

RXCLK Receive Clock

RXD Receive Data

RXDV Receive Data Valid

RXER Receive Data Errors

RXN Receive Negative (Analog receive differential signal)

RXP Receive Positive (Analog receive differential signal)

SA Source Address

SOHO Small Office Home Office

SSD Start of Stream Delimiter

SQE Signal Quality Error

TOS Type of Service

TP Twisted Pair

TTL Transistor Transistor Logic

TXCLK Transmission Clock

TXD Transmission Data

TXEN Transmission Enable

TXN Transmission Negative

TXP Transmission Positive

Block Diagram of ADM6996F

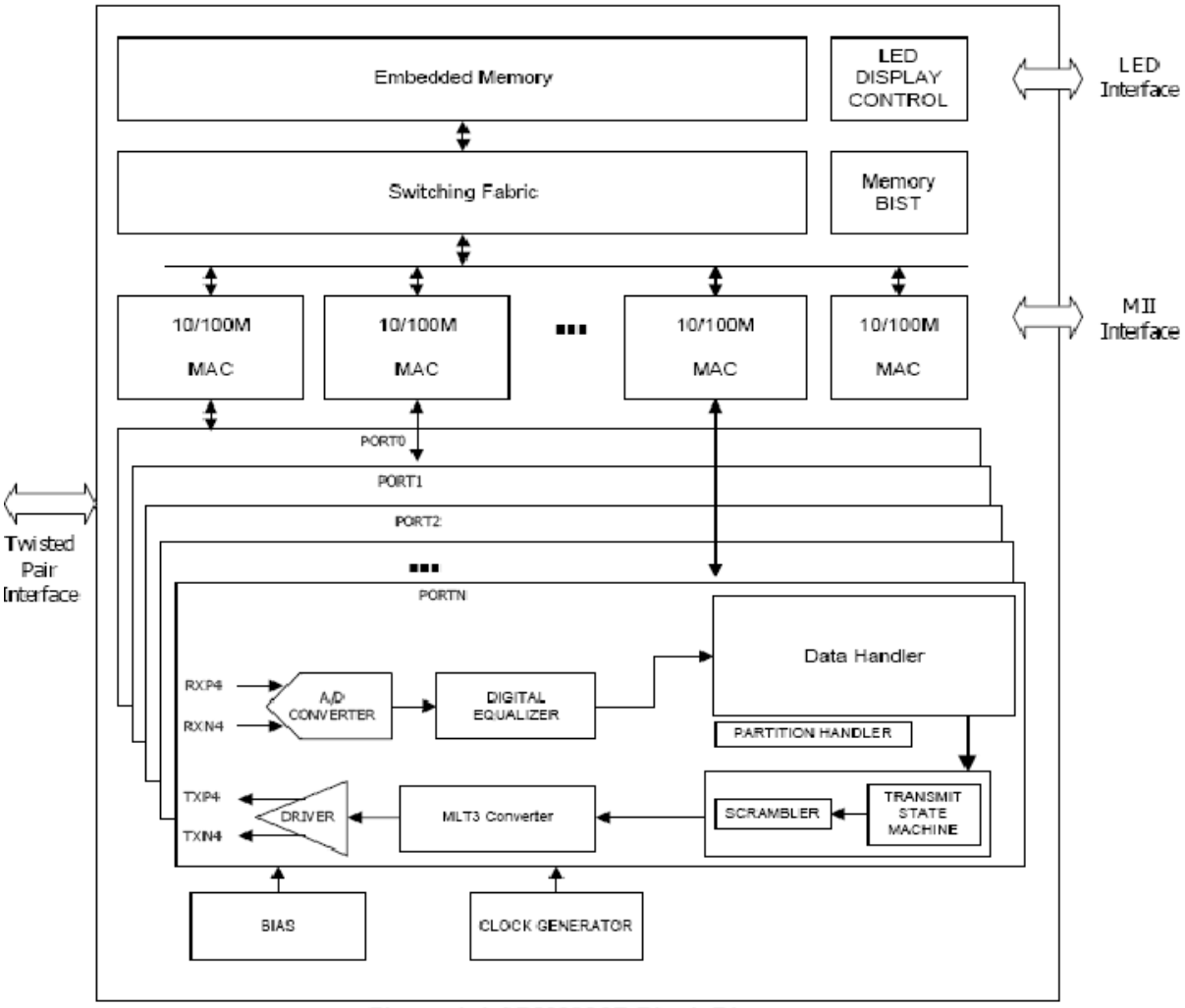


Figure 1-1 ADM6996F Block Diagram

Interface Description of ADM6996F

Pin Diagram

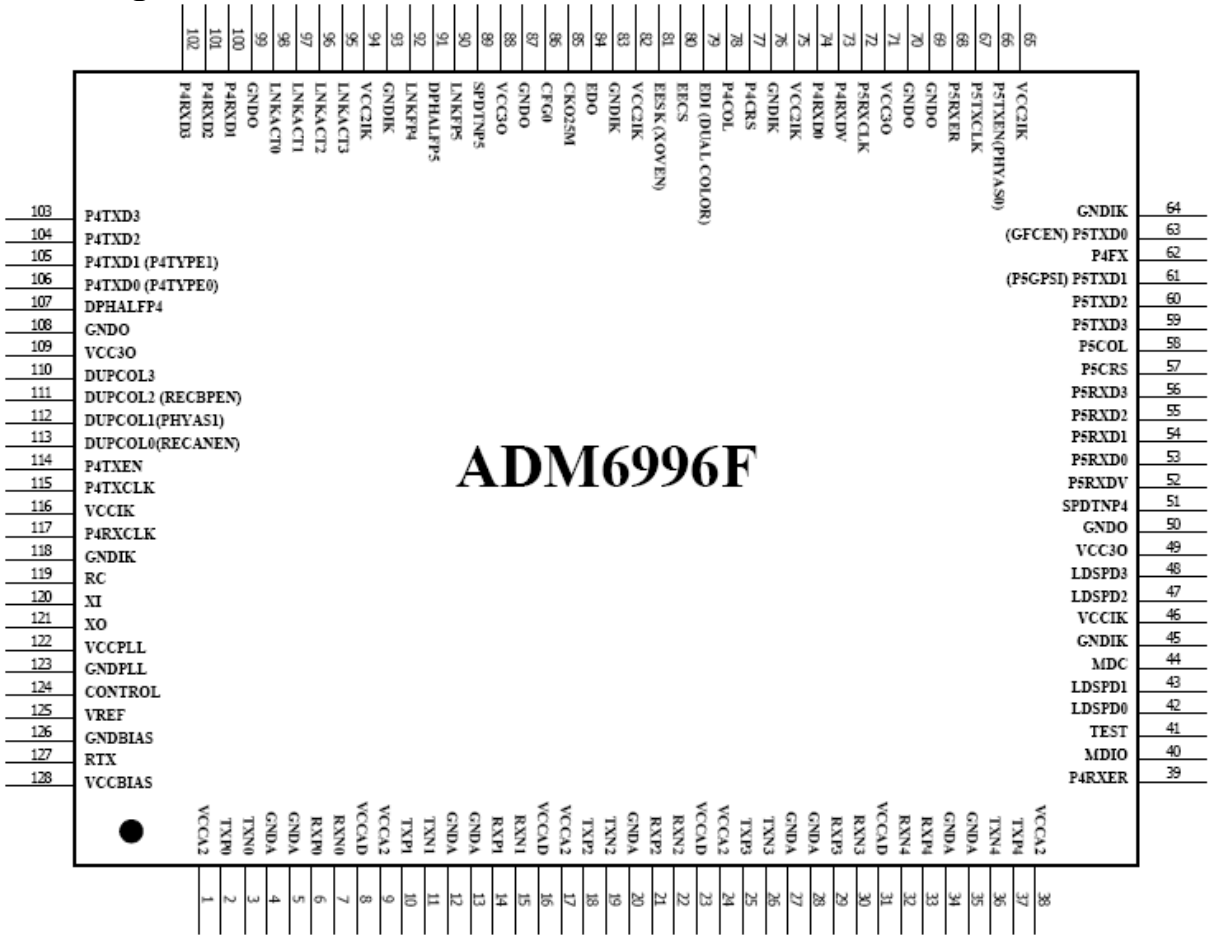


Figure 2-1 4 TP/FX PORT + 2 MII PORT 128 Pin Diagram

ADM6996F pins are categorized into one of the following groups,such as Twisted Pair interfaces, 5th Port (MII) Interfaces, 6th Port (MII) Interfaces, LED Interface, EEPROM/Management Interface, Power/Ground, 48 pins and Miscellaneous.

Fuuctional Properties of ADM6996F

The ADM6996F is composed of four 100Base-X physical sub-layer (PHY), 100Base-TX physical medium dependent (PMD) transceivers, four complete 10Base-T modules, 6 port 10/100 switch controller and two 10/100 MII/GPSI MAC and memory into a single chip for both 10Mbits/s, 100Mbits/s Ethernet switch operation. It has the capability of operating in either Full Duplex mode or Half-Duplex mode in 10Mbits/s and 100Mbits/s. hardware configuration pins can choose operational modes. They also can be chosen by software settings of management registers.
The ADM6996F integrates three main blocks which are 10/100M PHY block, switch controller block and built in SSRAM. The MII interface is used for communication between PHY block and switch core.

One part of the device is the The 100Base-X. It provides fuctional blocks such as, The 100Base-X physical coding sub layer, The 100Base-X physical medium attachment, twisted pair transceiver.And also The 100Base-X and The 100Base-T parts share clock synthesier module, MII registers, and IEEE 802.3u auto negotiation.

The ADM6996F implements 100Base-X PCS. Each of the main functional blocks in PCS provide flexibility for various applications. For example, 100Mbits/s PHY loop back is included for diagnostic purpose. In addition to this, the 100Base-X receiver is composed of fuctional blocks which are required to recover the 125Mbits/s receive data stream. It can be said that the origin of 125Mbits/s receive data stream is the on-chip twisted-pair transceiver in a 100Base-TX application.And also an external optical receiver can generate the data stream.

Our main device also implements a TP-PMD transceiver. This transceiver is used for 100Base-TX operation. Both the 10Base-T and 100Base-TX subsystems share the the differential transmit driver . For this reason, one device has to use the same external magnetic for the transmission with simple RC component connections.

In addition to these functional features, the device also has the 10Base-T Transceiver Module which includes the receiver, transmitter, collision, heartbeat, loop back, jabber, wave shaper, and link integrity functions. In order to receive activity when valid data is detected, carrier sense (CRS) is asserted. It is asserted during either packet transmission or reception. Other than the above properties, there are jabber, link test, automatic link polarity detection, clock synthesizer, auto negotiation, memory block, auto TP MDIX, port locking, VLAN setting & Tag/Untag & port base VLAN, and LED display functions utilized in the device.

Register Description of ADM6996F

ADM6996F has a EEPROM which provides the following options;

- Per Port Buffer number
- VLAN mapping
- Fiber select, Auto MDIX select
- Broadcast Storming rate and Trunk
- VLAN & Tos Priority Mapping
- Port Configuration: Speed, Duplex, Flow Control Capability and Tag/ Untag

General Description of AP1509

The device is used for a step down DC/DC converter. It has the capability of driving a 2A load without additional structure. Logic level can control the external shutdown. The internal compensation makes feedback control and load regulation without external design. It has a thermal shutdown preventing the temperature increases which can damage the system. Also, there is a current limit against excess current operation of the output switch. Both thermal shutdown and current limit are protected functions of the system. The AP1509 operates at a switching frequency of 150KHz. Basic features of the device are;

- Output Voltage: 3.3V, 5V, 12V and Adjustable Output Version
- Adjustable Version Output Voltage Range, 1.23V to 18V+4%

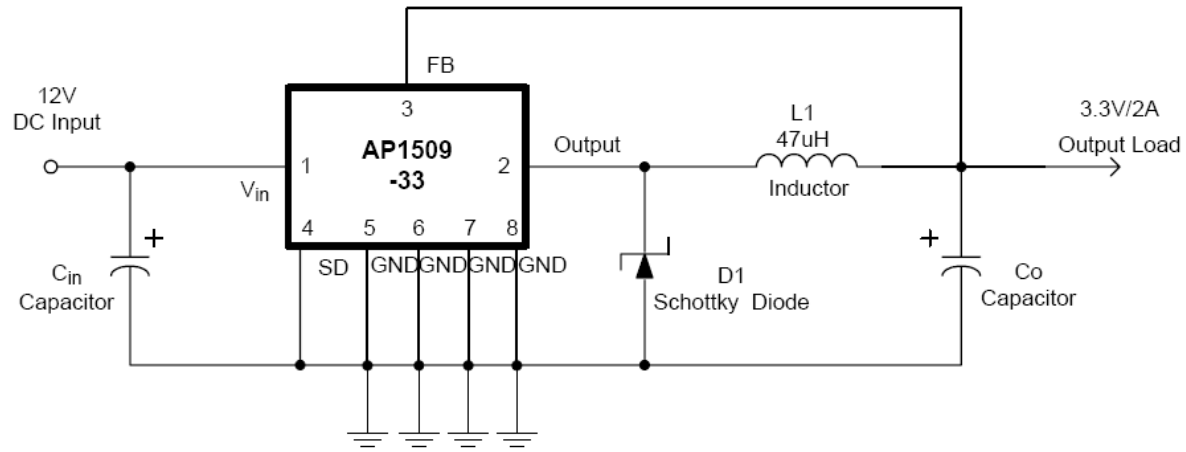
- 150KHz +15% Fixed Switching Frequency
- Voltage Mode Non-Synchronous PWM Control
- Thermal-Shutdown and Current-Limit Protection
- ON/OFF Shutdown Control Input
- Operating Voltage can be up to 22V
- Output Load Current: 2A
- SOP-8L Packages
- Low Power Standby Mode
- Built-in Switching Transistor On Chip
- SOP-8L: Available in “Green” Molding Compound
- Lead Free Finish/RoHS Compliant for Lead Free and “Green” products

Moreover the device is categorized into three groups in terms of applications such as:

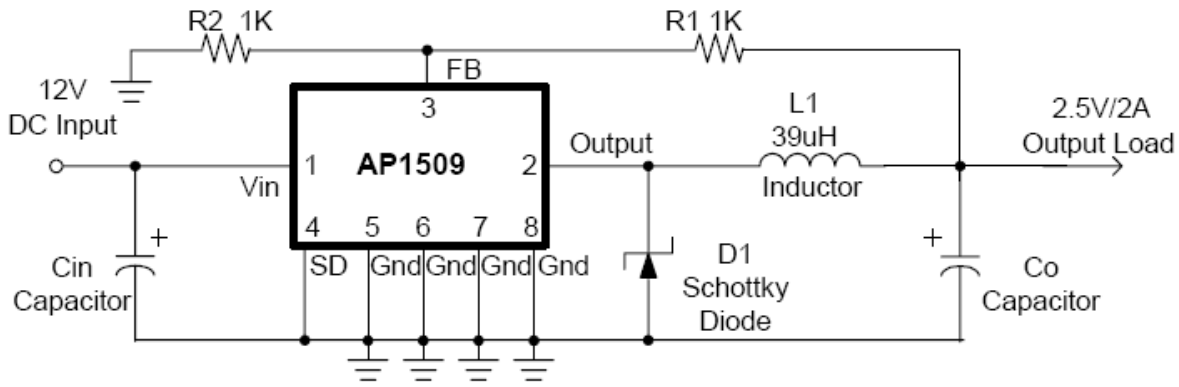
- Simple High-Efficiency Step-Down Regulator
- On-Card Switching Regulators
- Positive to Negative Converter

Typical Application Circuit

Fixed Type



Adjustable Type Circuit



where the following formulas are used for computations.

$$V_{out} = V_{FB} \times (1 + \frac{R1}{R2})$$

$$V_{FB} = 1.23V$$

$$R2 = 1K \sim 3K$$

Serial Flash Memory

We look at the NX25P80, NX25P16 and NX25P32 serial flash memories providing a storage solution for systems with limited space, pins and power. They are differentiated from their counterparts in terms of their capacity. The NX25P80 is 8MB, NX25P16 is 16MB and lastly NX25P32 is 32MB. These models are widely used especially for storing voice, plain text, data and download applications.

Pins, also called as serial clocks, chip select, serial data in and serial data out are included in the serial peripheral interface (SPI). This device supports high speed serial data transfers up to

50 MHz. The serial data input pin is used to write addresses and data to the device. On the other hand, the output pin is used to read data and status from the device. In addition ,there is a hold pin and write/protect pin providing flexibility in device control..

NX25P80 and NX25P16

NX25P16 and NX25P32

NX25P80

The read status register insruction provides condition on the availability of the flash memory array. For configuring the devices write protection properties the write status register instruction is used. To illustrate, Busy is a read only bit in the status register when it is S0. Then it is set to a 1 state while the device is executing a Page Program or Write Status Register insruction. Indeed, during this time the device ignores any insruction except Read status Register insruction. Other features are Write Enable Latch (WEL), Block Protect Bits, Reserveed Bits and Status Register Protect (SRP).

The instruction set of NX25P80, NX25P16 and NX25P32 include thirteen main instructions which are controlled through the SPI bus. The source of the instruction code is the first byte of the data that is clocked into the serial data input. Instructions change in capacity from only a byte to several bytes. They are completed with the rising edge of chip select.

5.2. Embedded Operating System on AP-400

An embedded system, a special-purpose computer system, is designed to perform very small sets of designated activities. They are used for various purposes such as:

- firewall, router, and switch
- home entertainment systems, digital cameras, cell phones and PDAs

- microwaves, washing machines and televisions can be included in household appliances

Moreover, differences between an embedded system and a desktop computer are;
Embedded systems are usually cost sensitive and have real-time constraints. ARM®, MIPS®, PowerPC , multitudes of CPU architectures, are used in embedded systems. A desktop computer has more resources in terms of RAM, ROM, or other I/O devices than an embedded system does. Embedded systems usually have an inbuilt circuitry for debugging purposes as compared to a desktop computer. When an embedded system is to be designed, it must be looked at in terms of both the hardware and software perspectives.

The linux is monolithic. Its kernel can provide a large application software base. In order to make the system more real-time, the real-time kernel provides no memory protection. However, it is at the cost of reliability. On the other hand, the microkernel supports memory protection since it can be required to individual kernel subsystems at the cost of complexity. It can be said that the linux kernel is composed of parts such as the hardware abstraction layer, memory manager, scheduler, file system, IO subsystem, networking subsystem, and IPC.

Board Support Package

Board Support Package (BSP) implements the board-specific routines. These routines are used by the kernel and device drivers. BSP is also used for initializing the hardware devices on the board. It is composed of two parts such as the microprocessor support and the board specific routines. Now let us look at the bootloader included in the board specific routines.

When the system is powered on, bootloader is the first to execute. It is one of the most crucial content of the development process and also one of the most complicated parts. The bootloader operates step by step. First step is booting, namely, bootloaders usually start from flash memory. Then, the device relecotes itself to the RAM since RAM is faster than the flash. As soon as bootloader initializes, the main devices necessary for user interaction are initialized. Then, in order to select the kernel image, the UI is thrown for the user who wants to download onto the target. After all of these processes are complete, the kernel is downloaded. Finally, kernel bot is prepared and then kernel is booted.

6. Project Requirements

6.1. System Requirements

6.1.1. Hardware Requirements

Indicated by the nature of the project, all group members are going to work on the sample AP-400 device provided for us by Air-Ties company. In conjunction with this, we will be in need of personal computers employing several distributions of Linux Operating System such as Debian and Ubuntu in order to comply with the development criteria of the company during the project.

The main objective to have different distributions of operating systems is to ensure the highest compatibility so that end-users feel comfortable with purchasing the product. Had we not planned to pay attention to such crucial details, even the end-product could not have been obtained, mainly due to the variations in software standard taken into consideration in the next section.

We will also require necessary equipment to plug the device (AP-400) to a desktop computer. A RS-32 serial cable will do if we have a serial port on the PC; otherwise, we will have to use a serial-to-USB converter to establish a connection between the working station (the device itself) and the development environment, which is the computer.

Depending on the development tool to be used during the software design process, developers may face memory requirements as high as 1 GB since tools with dense graphical user interfaces usually tend to use high amounts of memory during execution. On the contrary, no extra memory will be needed for AP-400.

Targeted users are expected to have an electronic device to which AP-400 and its counterpart, the LCD monitor, are connected. The end-product will be packaged in such a compact way that users will not have to employ any extra effort to install the product.

6.1.2. Software Requirements

6.1.2.1. Software Requirements for RoyalFlush

- **Programming Language**

The C Programming Language will be used in software development tasks throughout the project. The device incorporating Linux Kernel version 2.4 is subject to a number of speed and space limitations that make developers consider trade-offs between the above mentioned phenomena. Our investigation indicates that the maximum size of software that can be run on the target device could not exceed several megabytes, and no complex system such as mathematical analysis tools or programs that employ graphical components is to be designed. Thus, no object-oriented approach is needed and procedural paradigm best suits our needs.

Yet another factor to be considered prior to making a decision must be the ease of debugging the code produced by a specific programming language. This approach brings about the analysis of compilers since the closer source code is to machine code (in semantic way), the more debugging power can be used; and taking into account that compilers used for C are perhaps the most fruitful of all (GNU C Compiler and Bloodshed Dev C++ Compiler) clears our mind about the programming language to choose: C.

- **Compilers**

Two of the most powerful C compilers extensively used today are GNU C Compiler (aka. Gcc) and Bloodshed Dev C++ Compiler. Currently in its second beta release, the latter uses the same engine as the former and is easily customizable for ranging needs of developers. Its main windows being user friendly, this compiler will be of much help for us during the software implementation phase of the project.

GNU C Compiler is an open-source, easy to use, platform independent, and a very efficient C Compiler that is strongly recommended for low level developers thanks to its

facility to generate readable code hat can easily be debugged using GNU Debugger, which will be explained in detail in the upcoming section.

This project requires us to decide on the compiler version to use among a number of choices ranging from gcc 3.4.6 to gcc 4.1.2. Our examination has so far indicated that gcc 3.x versions are more compatible with source codes written for Linux kernel version 2.4 since we observed some linkage errors related to .h header files which incorporate all definitions of external functions in newer versions of gcc. Thus, we are most likely to work with gcc 3.4.6 and its predecessors when working on UNIX systems, and Bloodshed Dev C++ Compiler v4.9.9.2 Beta when we switch to 32-bit Win32 systems.

- **Debuggers**

As briefly noted above, we are planning to work with GNU Debugger to test, analyze, and optimize the source code we will be writing throughout the project. This choice is mainly due to the software's great abilities ranging from listing the symbol table for the program being debugged to set breakpoints wherever we would like to during execution of it. Other than these, we are also concerned with the amount of time to locate and correct the flaws / errors in the source code and GNU Debugger is one of the best software to help us locate the correct instruction being executed at a specific time.

- **Terminal Operators**

The scope of the project seems to set some limits for developers in terms of complexity of the programs running on AP-400, so we are in a position to employ some additional tools that will help us a lot to clearly observer and analyze the flow of the entire structure (internal relationships between the hardware and software layers). Terminal operators are those software that enable users to execute particular commands that are not available in an alternative environment like a GUI (graphical user interface) component. To illustrate, we can give command-line arguments to a program in case such parameters affect the outcome of the process (output of the program in this scope). It is noteworthy that we would not be able to do the same thing using a window-driven program with no such abilities.

TerraTerm is a developer-friendly, interactive, and customizable software that is capable of fetching the Flash content of the device and listing it on a terminal window on 32-bit Win32 systems. Even though there are similar programs in the market, we decided to use this one because we will have to deal with command-line arguments and environment variables that are easily managed by the program of interest.

CuteCom can be regarded as a UNIX counterpart of TerraTerm since they function exactly the same way as far as program deliverables are concerned. Since we will be working mainly on UNIX systems, this tool will be extensively used and taken help from.

- **GUI Development Tools**

Even though we estimate that we will mainly be working on console programs, some simple functions may be much easier to implement using a graphical user interface environment in terms of comprehensibility. For this reason, we agreed on an open-source GUI library that fits our needs in terms of simplicity and efficiency. The one we are going to use is called GTK+ and it employs the C programming language as its default language. GNOME binding of the library increases our hops about compatibility with our main development environment, the Linux kernel v2.4.

6.1.2.2. Software Requirements for the End-User

Our current estimates indicate that AP-400 is going to have a compact software package, so end-users will not have to own specific software in order to launch the system. On the other hand, we will be providing some helpful tools to clearly explain the details of the entire system to targeted audience via a number of simulation techniques. Clearly, the users will feel comfortable with the ultimate package provided upon purchase of the product.

7. Risk Plan

It is always probable that there can be unexpected difficulties during the project. These risks can set borders in front of us to continueworking on the project and our work may be wasted.

In order not to fail the project, preparing a risk plan is very essential. We can figure out the following risks as our main concerns.

- **Problems due to lack of knowledge and experience**

Since we are not experienced enough in developing such combinatorial systems depending mainly on hardware related issues, unexpected delays could occur. In order to work out this problem, we will continue step by step by searching everything that could lead to a problem. Moreover we are always going to try to keep in contact with our teaching assistant who possesses deep knowledge and experience about the context.

- **Problems resulting from misunderstandings / misconceptions**

Possible disagrements between group members can affect our usual work flow, and also withdrawal of a group member does have a fatal impact on the project. Similarly, our group members may not be able to accomplish the duties from time to time because of time conflicts and the complexity of the assignment. In order to handle this problem, we always arrange meetings and communicate to better analyze the situation and adjust our schedule accordingly. Since relative difficulty of each assignment is different, sharing duties between team members is an efficient solution.

- **Problems arising from system incompatibilities / failures**

We may at times face an unexpected problem in the hardware of the system, and permanent data loss is perhaps the worst outcome of such a nuisance. In order to be prepared for such cases, we will always back up our works and be more careful prior to taking action especially when dealing with the internal structure of the system.

- **Post-production problems**

It may always be the case that customers are not satisfied with a product due to several reasons. In order not to face such difficulties, we are periodically meeting with the project coordinator of the Air-Ties Company and trying to get all necessary

information that can help us about the specifications we are to meet. Above all, our end-product should be of flaws and we will be trying our best to come up with a complete package at the end.

8. Test Plan

Our project, a wireless network traffic monitoring system, examines local area network usage on the AP-400 Wireless Access Point Repeater / Bridge / 4-Port Switch and shows these data such as upload and download statistics on a graphical LCD display. It will be a real-time embedded system which enables every new wireless connection to be registered by the users' MAC address and monitors on the LCD display. On this display, number of computers connected to the access point will be shown. The usage of the access point in past 24 hours will also be displayed. At the progressing stages of the project, we will connect the device to a computer via an RS-32 serial port and using the embedded Linux system inside the device, we will conduct the necessary operations.

In each step of this project, we must test and see which stages we are done with because we must make sure that the system works perfectly. Otherwise, we would have to face fatal errors in upcoming steps of the project which would possibly result in irregularities requring much more work and engineering-time to compensate for. In order not to have an error in the entire system, we prefer dividing the project into small parts each of which are taken care by a group member, and as soon as we have finished these parts an overall testing of the system is employed to see if everything goes well. If our system is perfect, we advance to the next step, but if it fails then we go back and try to locate where the problems arise and correct them as soon as possible to meet deadlines.

9. Quality Plan

The targeted customers of this device will be members from higher economical degrees or from SMEs (Small or Medium Enterprises). In a more formal way, this system will be used by

- WLAN administrators.
- Security professionals.

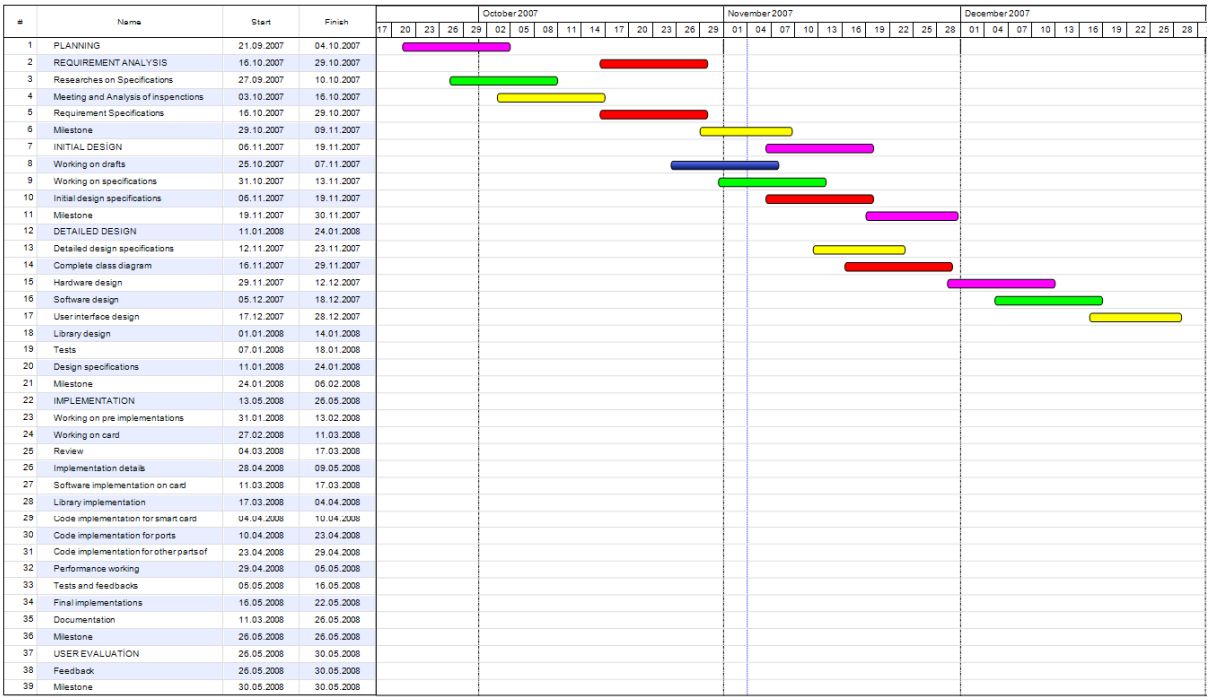
- Home users who are interested in monitoring their WLAN traffic.
- Programmers developing software for wireless networks

The end-product is not a cheap device as stated in our customer profile. In order to satisfy our customers' needs, we must use high quality hardware components. If our product is of insufficient functionally and stability, we cannot be successful regarding the sales of the product. Our group is completely aware of this concept and takes it hard on the project in order to come up with a 100% functioning product at the end.

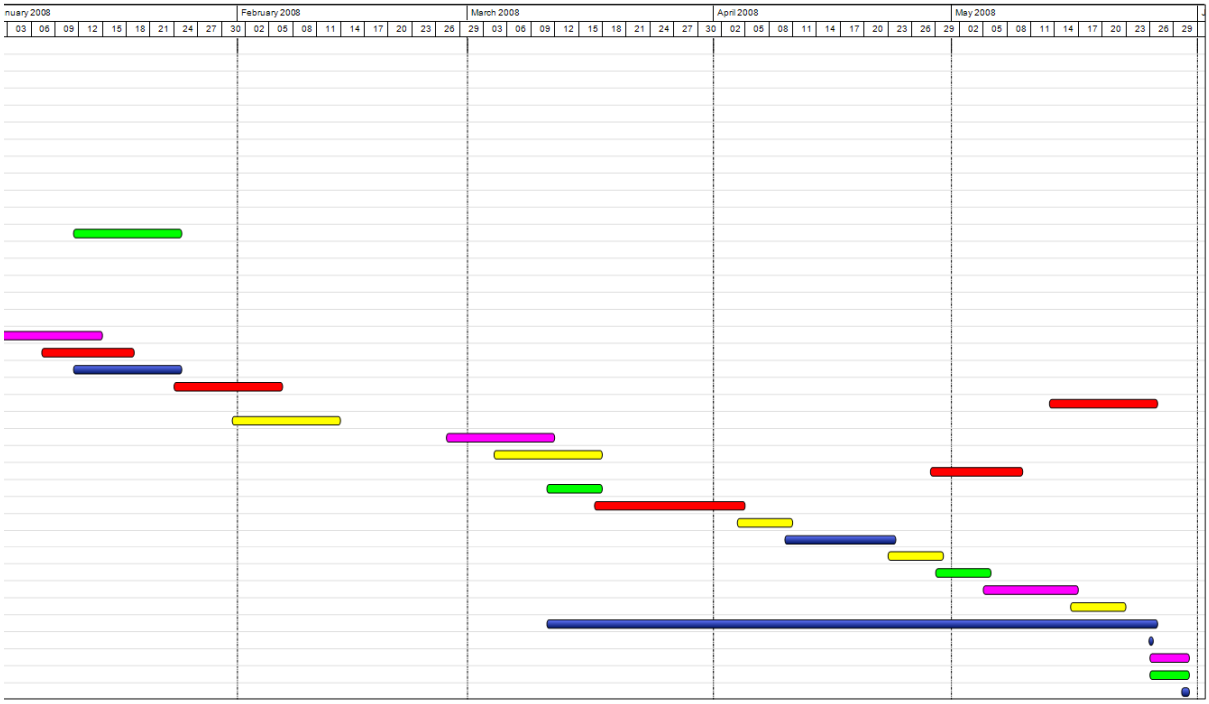
10. Schedule

The gannt chart for our project is as follows. The colored rectangles and group members associated with each are summarized below.

Group member	**Color**
Hasan Tahsin KILIÇ	Yellow, green
Yetkin SAKAL	Blue, green
Hasari YAPICI	Pink, green
Bahattin YALÇIN	Red, green



#	Name	Start	Finish
1	PLANNING	21.09.2007	04.10.2007
2	REQUIREMENT ANALYSIS	16.10.2007	29.10.2007
3	Researches on Specifications	27.09.2007	10.10.2007
4	Meeting and Analysis of inspenctions	03.10.2007	16.10.2007
5	Requirement Specifications	16.10.2007	29.10.2007
6	Milestone	29.10.2007	09.11.2007
7	INITIAL DESIGN	06.11.2007	19.11.2007
8	Working on drafts	25.10.2007	07.11.2007
9	Working on specifications	31.10.2007	13.11.2007
10	Initial design specifications	06.11.2007	19.11.2007
11	Milestone	19.11.2007	30.11.2007
12	DETAILED DESIGN	11.01.2008	24.01.2008
13	Detailed design specifications	12.11.2007	23.11.2007
14	Complete class diagram	16.11.2007	29.11.2007
15	Hardware design	29.11.2007	12.12.2007
16	Software design	05.12.2007	18.12.2007
17	User interface design	17.12.2007	28.12.2007
18	Library design	01.01.2008	14.01.2008
19	Tests	07.01.2008	18.01.2008
20	Design specifications	11.01.2008	24.01.2008
21	Milestone	24.01.2008	06.02.2008
22	IMPLEMENTATION	13.05.2008	26.05.2008
23	Working on pre implementations	31.01.2008	13.02.2008
24	Working on card	27.02.2008	11.03.2008
25	Review	04.03.2008	17.03.2008
26	Implementation details	28.04.2008	09.05.2008
27	Software implementation on card	11.03.2008	17.03.2008
28	Library implementation	17.03.2008	04.04.2008
29	Code implementation for smart card	04.04.2008	10.04.2008
30	Code implementation for ports	10.04.2008	23.04.2008
31	Code implementation for other parts of	23.04.2008	29.04.2008
32	Performance working	29.04.2008	05.05.2008
33	Tests and feedbacks	05.05.2008	16.05.2008
34	Final implementations	16.05.2008	22.05.2008
35	Documentation	11.03.2008	26.05.2008
36	Milestone	26.05.2008	26.05.2008
37	USER EVALUATION	26.05.2008	30.05.2008
38	Feedback	26.05.2008	30.05.2008
39	Milestone	30.05.2008	30.05.2008



11. Conclusion

In today's technological platform of competitive vendors, it is mandatory to design, implement, and release an efficient product so as not to get behind of the current trend both in informative and economical way. Regarding that a successful product is only achieved after a serious study and engineering process, we are sharpening our skills about the contemporary necessities of the market and apply these to the end-product we will be designing.

From the beginning to the end, the whole process will be heavy and challenging for us, but with the help of our all group members and teaching assistant as well as the information we gather through meetings with the AirTies Company, we can come over all of the difficulties. We believe that this product takes its place in the market and users will see what they were expecting.