AMERICAN-ARAB ANTI-DISCRIMINATION COMMITTEE
INTERNET CONNECTION

EXPERT CHOICE MODEL

JAWAD ABULHASAN
RYAN HACKETT

UPGRADING ADC'S INTERNET CONNECTION

ABSTRACT

ADC has decided that their Internet connection has to be upgraded. Jawad Abulhasan is currently working for the American-Arab Anti-Discrimination Committee and has been contracted to research some alternative Internet connections. Ryan Hackett was hired as a consultant to help Jawad in his research. As a team, Jawad and Ryan will help the company identify the problem and offer goals and objectives that will find the best solution to the problem. The team will use AHP and the Expert Choice software.

PROBLEM

The American-Arab Anti-Discrimination Committee (ADC) is a civil rights organization committed to defending the rights and promoting the cultural heritage of people of Arab descent. ADC is the largest Arab-American grassroots organization in the United States and has chapters nationwide. The ADC national office consists of several departments including: Legal Services, Media & Publications, Organization Department, Educational Programs of ADC, and the ADC Research Institute. 20 full-time employees run these departments with the aid of 20 additional summer interns.

Because of the growth of the company, the present structure of ADC's Internet connection is no longer adequate to allow efficient use of network resources. Currently, ADC is connected to the Internet by a 28.8K modem. All inflow and outflow of electronic traffic must pass through this connection. Increasingly, ADC is relying on the Internet for communication, research, and web access. Consequently, as the demand grows and the traffic increases, the current connection is bottlenecking the flow of information making web access a painfully slow process.

Following is a list of problems as effecting the current Internet connection:

- The server is easily bogged down with increased usage.
  - Summer interns increase the usage of the Internet well over capacity.
- Mailing list subscribers have quadrupled in the past year.
  - Action alerts and press releases sent to mailing list subscribers burden the server and slow the connection, making the modem inaccessible for other office users.

- Web sites are being designed to accommodate high-speed modems.
- A slower connection disables Internet researchers as the time substantially increases to load single pages while searching for information.

As a result of the inefficient nature of ADC's Internet connection, we have set the goal of improving the efficiency of the Internet connection. Improving the efficiency of the connection is defined to mean that a faster connection speed to the Internet is needed. A faster connection to the Internet will allow the network to accommodate a higher traffic volume and provide more services than currently offered.

OBJECTIVES

The consulting team and the COI of the company have outlined several objectives that are important to ADC and that will aid in the achievement of the goal of improved connection efficiency.

Speed*:* This is the main reason that ADC must upgrade their Internet connection.

- High-speed connection ranges from 125K – 7.1 Mbps.
- Ensures faster processing and delivery of action alerts and press releases to the members of ADC's mailing list.
- Ensures faster access to the World Wide Web.
- Efficiency is maintained as additional traffic is added to the connection.

Monthly Cost*:* The Company is a not-for profit entity, and must take budget limitations into account.

- ADC is paying a $50 monthly fee for the 28.8 connection that is currently in use.

Installation Cost*:* This includes hardware, wiring and installation.

- Budget implications must also be considered.

Upgrade**:** Whether or not increasing the Internet connection speed requires new hardware.

Setup: The setup must be completed in a timely manner. Will an in-house technician be substantial or will an outside technician need to be hired.

Security: Whether transactions of both inflows and outflows of information are secure.

- The ability to use a firewall.
- A firewall is a layer between the internal office network and the Internet. Many businesses use firewalls to protect their internal office network(s) from intrusions.

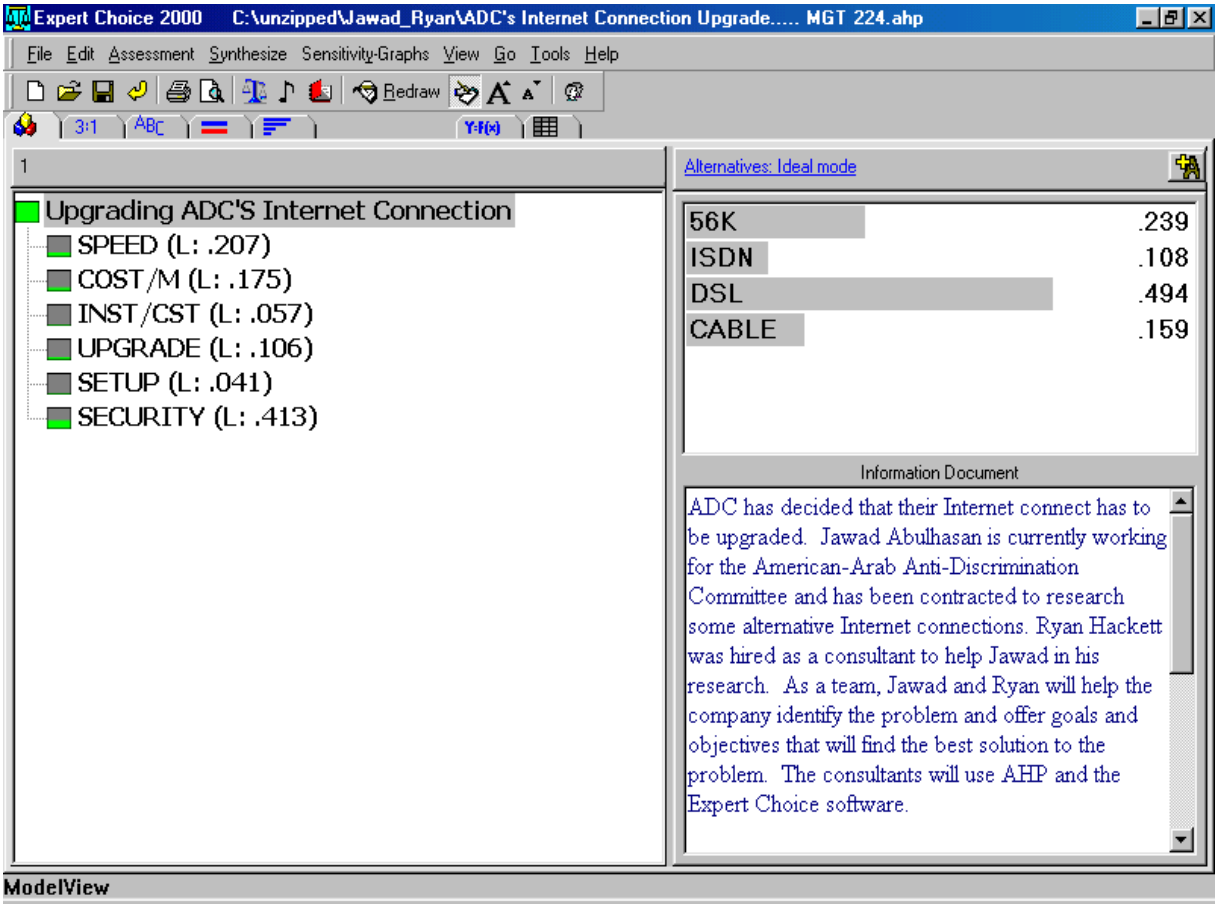
- Using a firewall allows a network to control its traffic according to its security standards.
- Currently, ADC maintains a closed network to all access, except email. However, with a firewall ADC would be able to open their network with minimum compromise to network security.

ALTERNATIVES

The following are alternative connection solutions that would replace the current 28.8K:

- 56K Modem
- ISDN (Integrated Services Digital Network)
- Cable Modem
- DSL (Digital Subscriber Line)

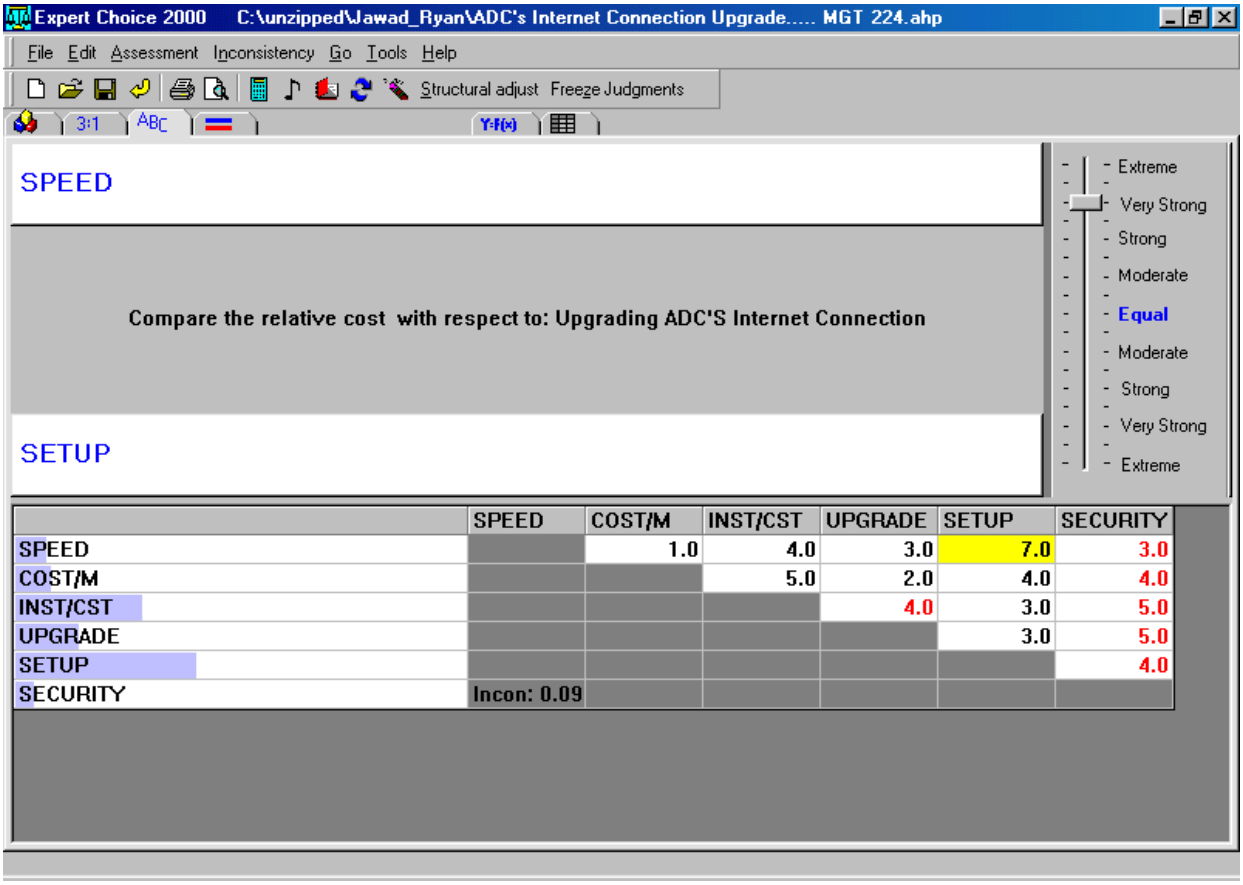
A detailed description and analysis for each of the alternatives is located in attachment 1. The complete model is set forth in the graphic below. The goal followed by the objectives on the left, and the alternatives with their corresponding preferences is shown as follows:



METHODOLOGY

Using the Expert Choice 2000 Software, the team was able to derive weights for each of the objectives with respect to the goal. Using pairwise verbal comparisons, Jawad and the COI of the company, derived the initial weights of the objectives with respect to the goal.

For example: They decided that *speed* was **very strongly** more important to *setup costs* with respect to the goal of improved efficiency. This is shown in the chart below:



Another example would show the same thing, however, the preferences would be allocated according to their importance with respect to the goal: They decided that *monthly cost* was **slightly** more important than *upgrade* with respect to goal of improved efficiency. As preferences are given to each set of objectives, Expert Choice derives weights and priorities that can be seen in the chart below.

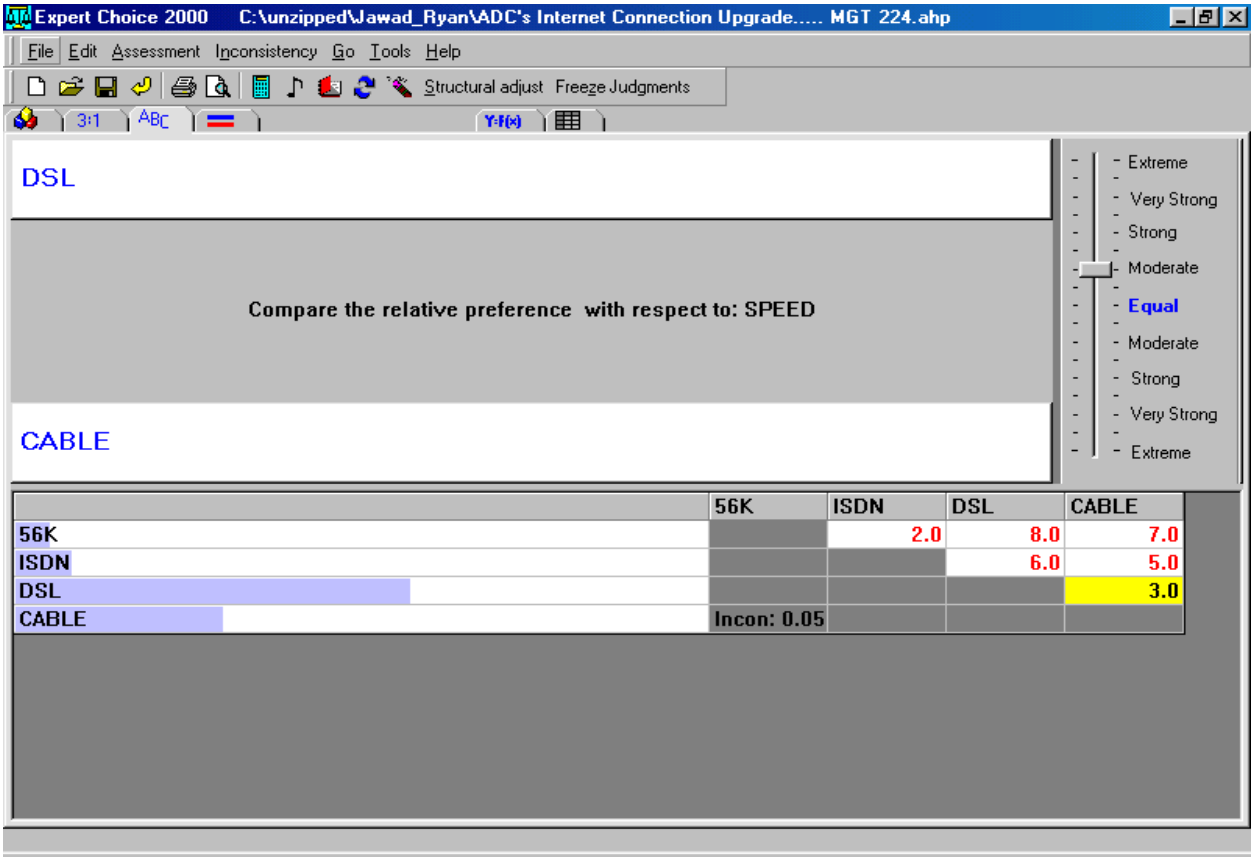
Priorities with respect to: Goal Inconsistency = 0.09 with 0 missing judgments.

1	SPEED	.207	
2	COST/M	.175	
3	INST/CST	.057	
4	UPGRADE	.106	
5	SETUP	.041	
6	SECURITY	.413	

From the derivation of the weights one can see that the security objective was actually more important than the speed objective. For more information about the preference of the objectives, see attachment 2.

After the weights for the objectives were derived with respect to the goal, weights for each of the alternatives were then derived with respect to the objectives.

For example: *DSL* is **moderately** more preferable than *cable* with respect to the objective speed. Meaning that the DSL connection is moderately faster than the cable connection.



As with the case above, another example: *ISDN* is **equal to moderately** more preferable with respect to speed than the *56K*.

Once the weights were derived with respect to the objectives, Expert Choice could synthesize the data.

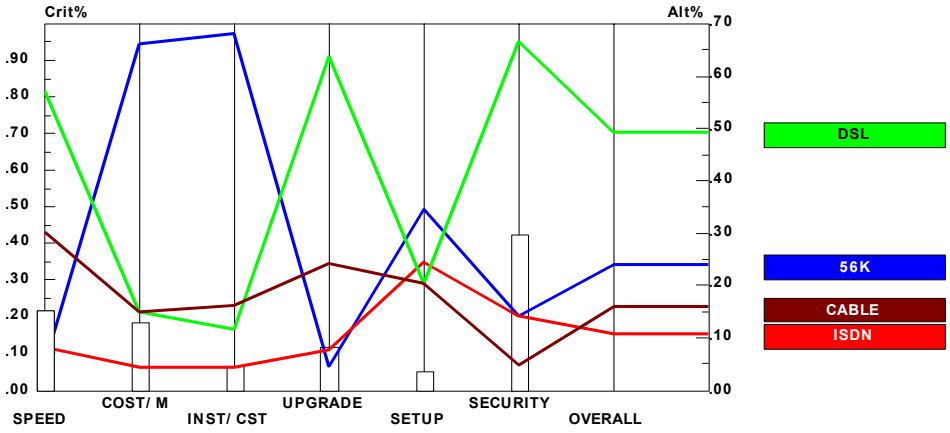
Alternative	**Priority**
56K	.239495
ISDN	.108125
DSL	.493814
CABLE	.158567

The graph above clearly shows that the DSL modem resulted in the highest priority of 49 percent. The second best alternative was the 56K modem, which received a 24 percent priority. Although the cable modem is one of the faster alternatives, its poor security puts it in third place with 16 percent. And finally, without any surprise to anyone, the ISDN modem ranked last with only 11 percent.

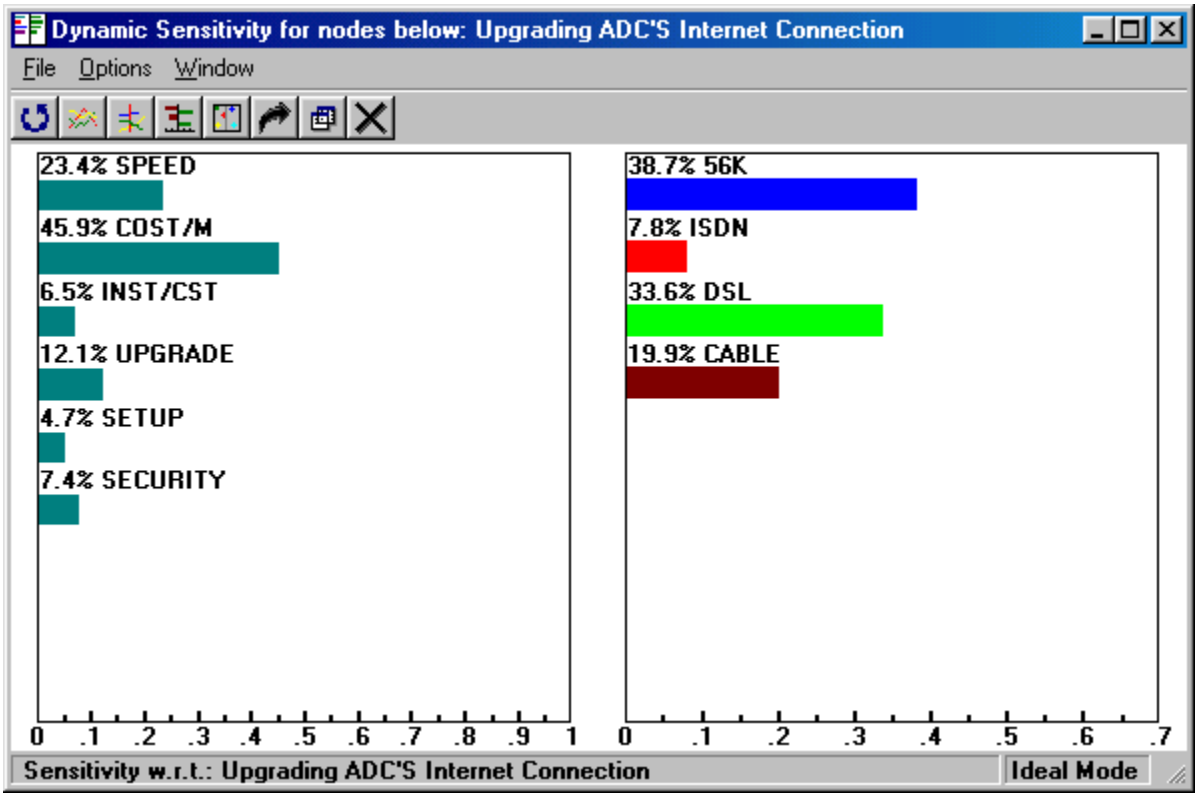
SENSITIVITY ANALYSIS

With the weights that were derived in the Expert Choice model, the DSL alternative is by far the top alternative. The graph below is a performance graph that shows the preference levels of each alternative with respect to the objectives.

Performance Sensitivity for nodes below: Goal



The dynamic sensitivity graph below shows how much the objective weights would have to change in order for another alternative to be the best choice. The team ran several sensitivity projections, for example: What if security was less important and staying within a more confined budget was more important to ADC? Other alternatives such as ISDN might have been the best choice. As shown below the importance of the objectives would have to change dramatically for the priorities of the alternatives to change.

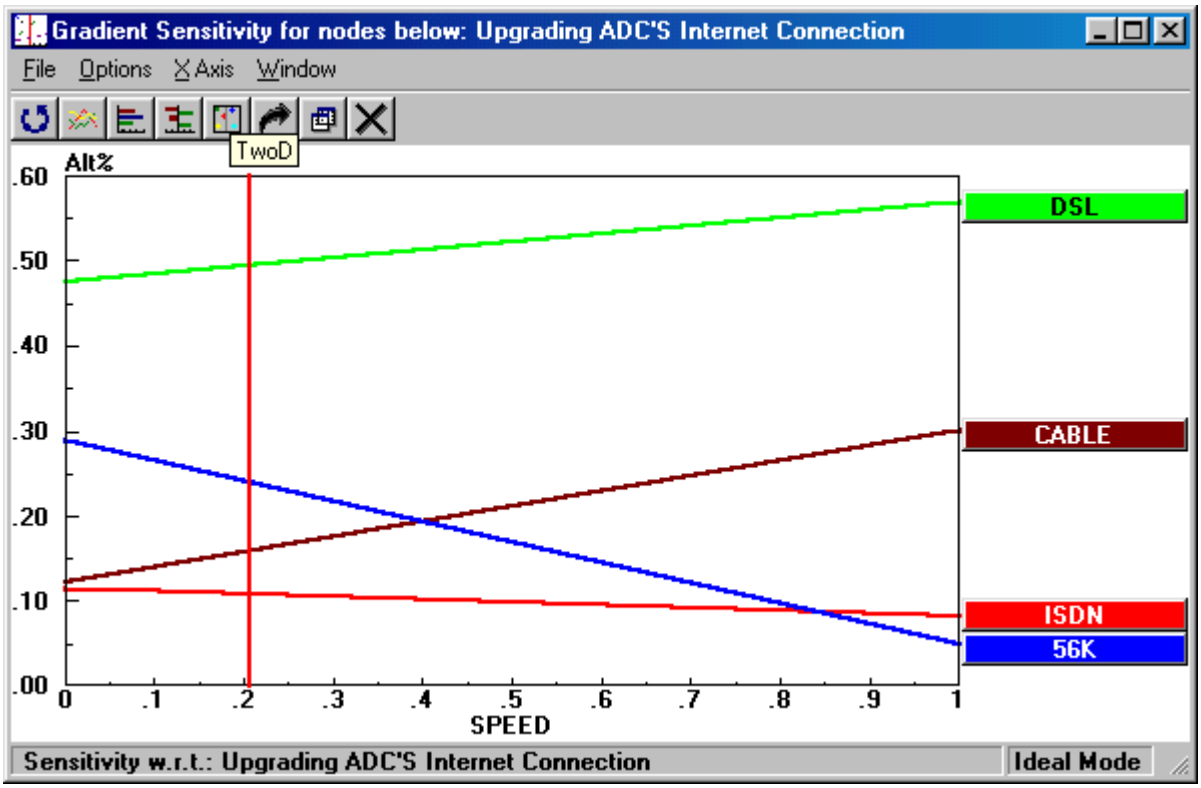


As the preferences changed in the sensitivity analysis the gap between the alternatives increased and decreased. However, none of the changes were significant enough to change the decision that DSL is the best alternative. As far as the team's technical knowledge is concerned, every objective that should be looked into when selecting a new Internet connection was considered. Ryan and Jawad are confident that with the help of Expert Choice, the DSL solution is the best alternative for ADC.

Ryan Hackett
Jawad Abulhasan

CONCLUSION

Given the demand on the Internet services that are currently in use, a high-speed connection is necessary for ADC. Based on the Expert Choice results, the DSL connection is the most preferred alternative for ADC considering the objectives mentioned. The second choice was the 56K modem. For reiteration, the weights would have to move significantly in some of the key objectives such as in *Speed* (as seen below).



A DSL connection does not require ADC to switch ISP and/or set-up new wiring. It is the most secure and least expensive to upgrade in the future. For ADC's needs, a DSL connection provides a workable solution that helps in minimizing the pressure on the Internet server and will allow ADC to provide better and improved Internet services to our staff.

CAIS, the current Internet Services Provider, is offering a $99/Month promotion for a 192K DSL line with free set-up and installation. CAIS also promised to keep the 255 IP** Addresses that ADC currently has, instead of the 30 they offer with the DSL line.
Based on the Expert Choice model and recommendation, ADC decided to go for the DSL service. As a result, ADC is using Capital Area Internet Service (CAIS) 1.2 Mbps DSL service for $120 per month. CAIS has a promotion of providing a free modem and setup when signing a 1-year contract, which ADC did.

**An IP address is used to identify our machines on our local office network, for communicating over the internet for a backend tasks on our services.

ATTACHMENT 1 - ALTERNATIVES

56K MODEM:

A modem modulates outgoing digital signals from a computer or other digital device to analog signals for a conventional copper twisted pair telephone line and demodulates the incoming analog signal and converts it to a digital signal for the digital device.

In recent years, the 2400 bits per second modem that carried e-mail has become obsolete. 14.4 Kbps and 28.8 Kbps modems were temporary landing places on the way to the much higher bandwidth devices and carriers of the future. From early 1998, most new personal computers came with 56 Kbps modems. By comparison, using a digital Integrated Services Digital Network adapter instead of a conventional modem, the same telephone wire can carry up to 128 Kbps. With Digital Subscriber Line systems, now being deployed in a number of communities, bandwidth on twisted-pair can be in the megabit range.

Simply, this option requires replacing our 28.8K modem with a 56K modem. There are no additional monthly charges and/or setup fee, since this could be done in-house. The price of a new 56k modem is between $90-$150. Using this type of connection will increase the speed of our Internet access. However, it will soon require an upgrade to one of the other alternatives. Given the demand on our network, this option lessens our problems, but does not eliminate them.

ISDN – INTEGRATED SERVICES DIGITAL NETWORK:

Integrated Services Digital Network (ISDN) is a digital transmission over ordinary telephone copper wire as well as over other media. Home and business users who install an ISDN adapter in place of a modem can see highly graphic Web pages arriving very quickly (up to 128 Kbps). ISDN requires adapters at both ends of the transmission so your access provider also needs an ISDN adapter. ISDN is generally available from the phone company in most urban areas in the United States and Europe.

ISDN is a digital phone line; therefore it requires a separate phone line. ISDN is a dedicated connection but its speed does not exceed 128K. The price of an ISDN modem is between $400-$500, not including the ISP monthly cost. ISDN is the most expensive of all and most likely will not be sufficient for the office by next year.

CABLE MODEM:

A cable modem is a device that enables you to hook up your PC to a local cable TV line and receive data at about 1.5 Mbps. This data rate far exceeds that of the prevalent 28.8 and 56 Kbps telephone modems and the up to 128 Kbps of ISDN and is about the data rate available to subscribers of Digital Subscriber Line telephone service. A cable modem can be added to or integrated with a set-top box that provides a TV set with channels for Internet access. In most

cases, cable modems are furnished as part of the cable access service and are not purchased directly and installed by the subscriber.

This type of connection provides high-speed access to the Internet through a special cable line, separate from the phone lines. In Washington, D.C., this service is offered by the only cable company in the market (Starpower). A cable connection is not entirely dedicated to one customer; the cable line connects to the cable company's network and then to the Internet. This makes the speed of access dependent on how heavy the ISP's network is used. On days of heavy traffic, the connection might be slower than promised. However, this is much faster than ADC's current connection.

DSL – DIGITAL SUBSCRIBER LINE:

DSL (Digital Subscriber Line) is a technology for bringing high-bandwidth information to homes and small businesses over ordinary copper telephone lines. Assuming your home or small business is close enough to a telephone company central office that offers DSL service, you may be able to receive data at rates up to 6.1 megabits (millions of bits) per second (of a theoretical 8.448 megabits per second), enabling continuous transmission of motion video, audio, and even 3-D effects. More typically, individual connections will provide from 1.544 Mbps to 512 Kbps downstream and about 128 Kbps upstream. A DSL line can carry both data and voice signals and the data part of the line is continuously connected. DSL installations began in 1998 and will continue at a greatly increased pace through the next decade in a number of communities in the U.S. and elsewhere. DSL is expected to replace ISDN in many areas and to compete with the cable modem in bringing multimedia and 3-D to homes and small businesses.

This type of connection provides high-speed access to the Internet through a special configuration of the existing phone lines. Using a DSL modem does not require a special phone line and/or installing new cables/wires. In addition, DSL is offered by CAIS (ADC's current ISP). Many other companies offer this service and the prices are competitive and depend on the speed of the DSL line chosen. The speed of a DSL line ranges from 144Kbps to 7.1Mbps.[*]

[*]1Mbps is equivalent to 100Kbps

Ryan Hackett
Jawad Abulhasan

ATTACHMENT 2 – OBJECTIVES AND PREFERENCES

5 objectives and reasoning for importance:

Speed: **(0.207)**

Speed is the main reason ADC has decided to upgrade its Internet connection.

Cost/M: **(0.175)**

Monthly cost connection is another important objective that should be taken into consideration since most Internet Service Providers require their customers to sign a minimum 1-year contract. And for a non-profit organization with a limited budget, monthly cost is a concern.

Installation Cost: **(0.057)**

This cost varies from as little as nothing, for 56K modes, to as high as $500, which is the case with ISDN. This is only a one-time cost and ADC would not object to pay a few hundred dollars for it; therefore, its importance is lower than many of the other objectives with respect to the goal.

Upgrade: **(0.106)**

Internet usage has come a long way in the past 10 years, and it is progressing at high speed. It is clear that any of the alternative Internet connections ADC is going to go with at this time would not be sufficient in 2-3 years. Therefore, it is necessary to select a connection that is upgradeable to the adequate speed of the time and for the lowest cost possible.

Setup: **(0.041)**

Set up is the least important objective but important to mention because with some Internet connections, setup could be more complicated than an in house technician would be able to handle, which will therefore require hiring a technician.

Security: **(0.413)**

Surprisingly enough, security was more important that the other objectives. ADC, being a civil rights organization that battles against defamation of Arab Americans, is subject to continuous threats. For instance, fifteen years ago a West-Coast regional director was killed by a bomb that was planted in his office. Since then, ADC has always given security a top priority and apparently it is no different even with the Internet.