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Website optimization, design, and restructuring.

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WEBSITE OPTIMIZATION, DESIGN, AND RESTRUCTURING

By

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ABSTRACT

The website has become a staple in the business environment, to provide information and services, and connect business-to-business and business-to-customers. Many of these sites require re-engineering in order to facilitate the needed complexities and frequent changes demanded. For such efforts, it is essential for web management to be adequately quantified with relevant metrics and measures. This thesis investigates useful metrics through a case study approach and presents usability and maintainability as the two primary categories of metrics, which provide useful information for web engineering analysis and development.

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NOMENCLATURE

MABel: This is the name of the online banking product

Sub-site: a secondary level of the website that identifies a collection of related webpage documents, namely based upon division of products and services offered

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I. INTRODUCTION

Today, many web-sites require a dynamic maintenance and re-engineering outlook. Business needs require changes and web sites must present consistency and be current in their web-content. Websites for the spectrum of small to large organizations can have substantial complexity and hence demand careful quality control for changes. Towards this end, this thesis will employ a case study approach to determine useful metrics and measures for web-site management [13].

1.1 Purpose of the Case Study

The case study chosen is to redesign and re-engineer the Kentucky Telco Federal Credit Union website found at http://www.kytelco.com. The goals of the redesign project case-study are to better meet the mission statement of the credit union

i) By enhancing the website design, layout, formats, color schemes, organization, navigation structure, and file structure of the website

ii) by maintaining consistency with other marketing publications and print media information,

iii) by improving the usability of the website, and

iv) by improving the maintainability of the website from a technical perspective.

1.2 Related work in literature

There has been much research and many efforts made in recent years in the area of web development using a variety of different technologies. With the emergence and mass availability of communication channels, this is no surprise. Many authors have written books and articles identifying good practices in the realm of web design [5][10][12][15][16][17]. Some have sought out metrics and measures to quantify a website design to give some level of evaluation of the quality of a website [6][9][11][13][18][19][20]. This thesis seeks to add value to the understanding of website design by investigating web metrics in relation to improving a site through this case study.

A lion’s share of the material was found to be related to web usability. There appears to be much research and analysis in recent literature that has investigated and sought best practices in web usability. This is an

expected phenomenon because much of the success of a website is the ability for its users to make use of the site.

The literature suggests that in re-engineering a website, it is important to approach the design from a user perspective, in order to see what the user will see [8][9][10][12][15][16]. Each user will have different opinions, knowledge, and abilities which may make it impossible to account for all of the potential users of the website. However, a good consensus of user-perspective can be achieved for a majority of the users [9][10]. This is a good mindset for the web engineer to establish when undergoing a web design project such as this case study.

Steve Krug suggests that the design should make it essentially mindless to peruse a website and get the information desired in his book, *Don't Make Me Think*. There are many elements that go into the a useable website, so each should be evaluated for the level of thought by a user that must go into learning what those elements are, what can be found on the website and what can be done at the website [12].

One effective way to reduce the learning curve for users is by utilizing standards of conformance where possible [10][15]. There are many web standards that are

loosely followed by most professional sites on the net, and using such standards make it easier for a new user to the site to quickly evaluate and understand what the site is, how to navigate around the site, and what the site has to offer.

Items such as the navigation placement, the use of simple search boxes, and inclusion of a company logo at the top left of the page help the user along in their understanding of the website, and make it more likely for them to revisit and use the website [9][15][16]. Use of abnormal placement or styles can increase the need for the user to think, and should be avoided, unless a truly innovative and easier-to-use structure is developed [12]. The likelihood of this, however, will be very rare.

Users will generally muddle through learning how to navigate and use a website to some degree [12]. Clicking through a series of pages to find content or services of interest may be something users are somewhat willing to do, however, relying upon this would be unwise when creating the design. Designing more complex designs using non-standard elements make the learning process more difficult. The moral is that if the user has to invest too much time into understanding and using the website, the usage is going to be limited at best [12][15][16].

Nearly all of the material addressed the issue of the navigation structure and its role in making the website user-friendly. The readings suggested that navigation should be evident and easily distinguished from other page content [10][16]. This is one major component where conformance to best practices has a lot of weight.

Placement of navigation should be either across the top of the page or down the left side, below the company logo. Also, use of inline links in page content is a useful way to include non-obtrusive links. Buttons should stand out as buttons, perhaps changing color, shape, or some other visual indicator to convey the presence of navigation. Consistency of such navigation on all pages of the site also makes it much easier and more usable [12][16].

Another important factor addressed by much of the literature, was the importance of appropriate information architecture. This often goes hand-in-hand with the navigation structure. The organization of information in a logical manner on the website makes navigation and understanding much easier. Users can more quickly identify grouped sets of information that is related if logically arranged [9][15][17].

The proper placement of materials which are related into sub-site categories helps users distinguish the content and directs them to areas of interest. The navigation structure integrates with this grouping as it provides access to these areas, and provides visual clues, such as the use of tabbed content areas and breadcrumbs [12][16].

Several sources pointed to the importance of using simple search boxes. Many users use search functionality to navigate a site, instead of seeking out desired content by clicking around. Use of search should be consistent and clearly labeled. It is also important that the search box is concise, making it easier to identify and less hassle for a user to determine exactly how it should work. The best solution seems to be identified as a blank text box followed by a button labeled simply “Search”, although other variations may be just as effective [12][15][16].

Another very critical point made in several of the sources indicates the necessity of abbreviated and concise presentation of information. Web users are quickly browsing for the information of importance and are looking for the highlights, not detailed and wordy descriptions of every possible thing that could be mentioned [12][15][16].

The literature suggests that simple, short sentences should be used. Paragraphs should contain no more than about four to five sentences at most. Each line should have only about 10 to 14 words. Use of bulleted lists should be used whenever possible to more quickly summarize information [12][15][16].

The use of distinguishing marks, text sizes, fonts and colors is also a recommendation of usability material. Each page should have a title clearly identifying the page contents. This title should stand out through use of increased size, different colors and appropriate placement at the top of the document. Headings should also be used to separate sections of page content into more bite-sized pieces for faster scanning and reading by users. This can also be done using appropriate increased sizes, bolding of text and use of color [12][16].

Each of the usability components identified in the research all centered on clarity, conciseness and consistency in each of the elements of the website in order to ensure the best usability. The focus of these recommendations stressed the importance of building the site to users' short attention span and general unwillingness to put a whole lot of effort into figuring out the website. The value of such focus in a re-

engineering effort is very high, and probably the most important driver in designing a new website.

One suggestion stressed by Krug, and highlighted by others was the need for user testing. Krug argued that testing was not an expensive and time-consuming operation, but a valuable and quite inexpensive operation. He also suggested that testing should not be an after-thought but used throughout the design process to re-evaluate the current stage in making improvements for the next. His plan recommended the use of paid test users, camera recording and a formal test plan that a moderator would direct the test user through. While these could be very beneficial methods to incorporate testing, not even this level of tests seems necessary. Simply getting input from employees of the organization not directly tied to the initiative can be an essentially free engagement, using an informal process to observe and get comments back to make necessary improvements [12].

The research turned up essentially no material in relation to the maintainability of a website project. This was surprising given the importance of this factor from a developer’s standpoint. One article made some mention of such thinking in this area indicated the need to have an agile web engineering process which could adapt and change,

and be used to develop a website in three months or less [14]. However, most all material found was directed toward or directly addressing web usability.

It is a goal of this thesis to investigate and determine aspects of web engineering related to maintainability and promote a framework for development and evaluation in this area. As well, this thesis seeks to sort through the material on web usability and narrow in on some key attributes that can be harnessed in design and evaluation. The attributes mentioned in this review will be assessed and addressed through the case study. And in keeping with maintainability, fast change handling and development for developer agility will be sought in publishing and maintaining a website using these usability factors.

II. PROBLEM STATEMENT

2.1 Lead-In Situation at KYTELCO:

Kentucky Telco’s original website is functional and services its members relatively well. However, there are several aspects of this design that make it less than desirable. First, there is a lack of consistency between the website and other print media and marketing documents provided at Telco. There are consistency issues among different pages on the current site, including some pages that resemble prior design schemes rather than the schemes currently being used on most of the pages. Site navigation, fonts, styles, and colors also vary between pages. Due to these inconsistencies, and other design elements, usability of the website is not optimal, making it difficult for users to navigate between pages and locate desired information.

The second area of concern is the maintainability of the website by the information systems department. Due to the current constructs of the website, change handling is cumbersome and time-consuming, and it is difficult to maintain consistency across the website when changes are

needed. These are the elements that were addressed in the course of this project. The new website at http://www.kytelco.com should prove to address the issues of usability and maintainability during the re-engineering process of the website.

2.2 Audience

The audience intended for use of the website is a critical element in determining the specific goals of the website [10]. Understanding users of the website and catering the site to them as well as encouraging others to employ its use is very important [7]. The website must therefore be accessible and useful to as many members as possible. In tandem with this concept, is the realization that not every member will utilize the website, and most will likely not use all components that are provided. As well, there will likely be specific functionality or services which are provided that will receive the most use, and others that will only be used minimally. Taking all these aspects into consideration, before determining the audience it is necessary to adequately and appropriately focus on a target audience preference to provide the best website possible for members' use.

Determination of the target audience takes into account the user ability and technology used [10]. In general, the target audience consists of all the members of the credit union. However, since not all of the members have internet access, a better definition of the target audience encompasses only those members of the credit union who have internet access. Primarily, this group includes those who use online banking, but also includes others as well. Though, not all members that have internet access make use of the website. Hence, the goal here is to fashion the website to meet the needs of our members who currently use the website, and to incorporate those who currently do not use the website, by making it more easily accessible to them.

To aid in the discussion of the target audience, a classification of “typical member” will be assigned to the typical expected member-user of the website, with corresponding technical abilities and knowledge. A typical member will be defined as a person with basic computer and internet browsing skills that understand the concepts of scrolling, text and graphics hyperlinks, and point-and-click navigation. The typical member is assumed to connect from work or at home via a fast internet connection. It

will also be assumed that this typical member will be using the Internet Explorer browser, version 5.5 or higher.

As a side note, there are people who are not members of the credit union who will visit the site, whether by finding it using search engines or linking to the site directly. Some of these people will be seeking information about the Kentucky Telco and its products and services to determine their member eligibility and if they would be well served with Telco as their financial institution. This group is also considered in the target audience and will fall under the general description of a typical member, though they are currently not a member. Other people will browse and locate the site that will not be seeking Kentucky Telco specifically, and these people will not be included in the target audience, though they are a factor to be considered.

2.3 Goals

The website is one of the services that Kentucky Telco provides its members. This website includes information about Telco’s service offerings, applications, online banking, online bill payment, current promotional offers, current investment and loan rates, contact information, and other material related to the credit union. The website is

expected to be a resource that will enable Telco to further its overall goals. Kentucky Telco's mission statement is "To provide cost-effective professional and innovative financial services at fair rates that encourage thrift among members." The website, then, must fall under this main goal header for the credit union.

The usability of the site is a primary goal, and is directly related to the conditions for a typical member. Each page must be easily accessed and viewed and the site itself must be easily navigated by members [10]. This goal encompasses the structure, layout, design, and useful nature of the information, navigation, and services provided through the website. The second goal is to maintain consistency among the website with all other media publications, forms and logos of the credit union. The internal consistency of the website is also important and each page should maintain a general layout and design throughout the site [10].

A third goal for the website is that it be aesthetically pleasing to the typical member, while providing all the information in a concise and nicely arranged manner [8]. The marketing goals establish the need to present the members fast and reliable information regarding all products and services, current rates,

promotional offers, current events and other information related to credit union and its members, in a consistent and timely fashion. The maintainability goals of the website represent the importance for the website to be easily maintained, monitored and updated as necessary by the information systems staff. This goal includes changes and modifications made to content, navigational elements, style, and design as well as the addition of new pages and features.

Each of these aspects and their associated components must be considered for development of the website in order to build an effective website and to best meet the mission statement of the credit union. These goals lay the foundation for the design of the website and determine the direction that is taken in developing pages, navigation, online services, and all related items that are provided via the website. The requirements for the website are derived from these goals and considerations.

III. REQUIREMENTS AND DESIGN OBJECTIVES

3.1 Requirements

The requirements that the new website should adhere to are directly related to the goals of the project and correspond to methods and design components that are expected to accomplish those goals. There are specific desired items that pertain to each of the goal categories of usability, consistency, aesthetics, marketing, and maintainability. Many of these required items overlap between categories since a good style will be aesthetically pleasing, but also work to enhance the usability of the website.

Requirements will be logically grouped, though it is understood that the goals they seek to meet overlap in this way, and thus the requirements may seek to achieve multiple goals at the same time. Tables I and II summarize the requirements for the new design. More detailed information regarding each of the requirement categories follow in the several remaining sections of this chapter.

TABLE I
LIST OF REQUIREMENTS

Usability	Consistency	Aesthetics
• one or two hops • logical grouping of navigational elements • drop-down menus hidden unless mouseOver • menu titles link to link index • primary contact info on every page • prominent links to common pages • image clarity • text/font clarity • 800x600 pixel screen resolution • 216-websafe colors whenever possible • no side scrolling @ 800x600 or larger • page size under 60kB	• resemblance to informational brochures • sub-sites for each product or service category • secondary color scheme for sub-sites	• look-and-feel comfortable, pleasing, professional • color use coordinates with Telco blue and green • readable text • easily identifiable nav elements • moderate use of images • concise, orderly, logical arrangement of elements • make use of white space

TABLE II
LIST OF REQUIREMENTS (continued)

Marketing	Maintainability
• resemblance to informational brochures • Telco blue and green • secondary colors for sub-sites • Balloon logo maintained • Fonts: Arial title: 20px, headings: 18px, content 16px, small print: 10px • swoop curve blue: top, green: bottom • promotional as primary homepage content • professional appearance	• changes done globally and locally at sub-site levels • adding new pages develop only content, use templates for design • file structure folders for each sub-site, images, and scripts • images and scripts not localized at sub-site level • addition of sub-sites match existing structure • concise, logical naming

3.1.1 Usability Requirements

There are several criteria that are desired for the usability goals of the website. The site must provide

access to all information within one or two hops, meaning that each page should provide navigational elements that will join it to any other page with a maximum degree of separation of two. This rule may have exceptions, such as the online banking pages or popup help information pages, but in general should be followed. Navigational elements should be grouped and arranged in a logical and consistent manner.

Drop-down menu navigation should not interfere with the content of the page. Specifically, when the mouse is not directed over a drop-down menu, the menu should be hidden. As well, drop-down menu functionality should be provided, but also a work-around should be provided so that the drop-down functionality does not have to be used in the absence of javascript-enabled browsers, or in consideration of knowledge that a typical member might or might not have concerning drop-down menu navigational elements.

Primary contact information must be displayed on each page, including the main branch address, primary phone numbers and a link to contact information for each of the other branches. Pages that are commonly used or visited, including the MABel online banking service, loan application and loan calculator should have prominent links to them on each of the pages. Images should be clear and

obvious as to the nature of what they are related to, and images used as links should provide the typical member an understanding of what the linked document will provide. Text should be easily read and links easily distinguished.

In support of older browsers, the design elements and layout of the website should maintain usability in the absence of newer technologies, such as higher bit-depth for color resolution [10]. The pages should provide users that are utilizing older browser technology and older computer hardware, the ability to navigate and browse the information provided on the website, as well as utilize the services offered therein. Related to this, all pages should be designed for view on 800 by 600 pixel resolution monitors and should respect the 216 web-safe colors whenever possible. Side-scrolling, or scrolling from left to right, should not be needed by any user utilizing a browser and computer with monitor resolution set at 800x600 pixels or higher.

Page sizes should be maintained under an approximate size of 60 kilobytes or be able to be downloaded using a 56k modem in less than 10 seconds. This applies primarily to the main home page, but generally applies to all other pages of the website. This factor will mostly affect images and their corresponding sizes used in navigational

elements and pictures that correspond to textual information. The main page needs to follow this requirement strictly, though there can be some leniency for non-primary pages of the website.

3.1.2 Consistency Requirements

Consistency should be maintained between the website and other publications of information by the credit union. To do this, each webpage should resemble the current informational brochures, including colors, styles, and contextual information provided.

The website should also maintain consistency by having segments or sub-sites that match each of the categorical areas of products and services offered by the credit union. These segments include, but are not limited to, member services, checking products, savings and investment products, loan and credit products, and online services. The sub-sites within the site should maintain consistency across each of the pages for the sub-site, in secondary color schemes and content. All sub-sites within the site must maintain a consistent style, design and layout, with the same primary color schemes, fonts, font sizes, and other design components.

3.1.3 Aesthetic Requirements

The look and feel of the website should be comfortable, pleasing, and professional. Colors should be selected that correspond to the primary Telco blue and green, and secondary colors on pages should coordinate with this primary color scheme. Text should be large enough to be read easily and in a readable font, and colored in such a way that it is easily differentiated from backgrounds or images. Navigational elements should stand out as navigation and clearly present concise information to be found in the linked document [7][10].

Design elements may be used to enhance the presentation of the pages, but they should not detract from the presentation of the content of the documents. Images may and should be used in moderation, though appropriate use to enhance the presentation of the content is expected. Pages should refrain from having a busy look, with too many elements, images and text, but instead should be concise and arranged in a logical and standard manner. White space should be used generously to prevent overcrowding of information and other components.

3.1.4 Marketing Requirements

Once again, the website design should resemble the marketing print publications, mailings, and brochures for style, design and color schemes. The color scheme should follow the standard Telco blue and green as the primary coloration for the website. As well, there are secondary colors that correspond to categories of information, such as checking, that should be observed.

The Telco logo with the image of the balloon should be maintained on the website as the primary logo. Fonts should be Arial and should be sized appropriately for the contextual information. Page titles should be 20 pixels in height with section headings at an 18-pixel height. Document text should be sized at 16-pixel height. Captions and notes should be smaller print using a 10-pixel height. The style should match the swooping design of the informational brochures with blue being the top color and green being the bottom color.

Promotional ad campaigns should be highlighted on the homepage as the primary content. These online ads must be maintained to be consistent with print documents and mailings, and be changed or discontinued at the appropriate times corresponding to the end of the promotional campaign.

All pages should be designed and filled with text and images that are professional in nature, except as

appropriate, such as the youth Dollar Dog account page, or special promotional ad campaigns. Such pages should still be upheld to professional standards, despite design for younger audiences. The design should promote a positive image of the credit union to its members and others as well.

3.1.5 Maintainability Requirements

From a maintainable aspect, the website should be designed in such a way that change handling and new developments should be easily completed. Changes to styles, formats and colors should be able to be done globally across the entire site, or among sub-site pages. Changes to common elements, such as the navigation bar or logos, should also be able to change based on global or sub-site level.

The addition or creation of new pages should be straight-forward, and should remove the creator from having to add the common design and styles, excepting only a minimal amount of work. This means that for someone developing a new page, all of the design elements and common components, like the logo or navigation bar, should be easily implemented on the page. The task of building the new page should only require adding the page content

and images and not require the rebuilding of common site elements.

The site file structure should be logically arranged, considering each of the sub-site groups [17]. A subdirectory for each of the sub-site areas are expected, containing all of the pages for the sub-site. Images and scripts should be stored globally in appropriate folders, and should not be localized to any specific sub-site. New sub-sites may be added in future development, and should be created in individual folders under the root directory, just as existing sub-site folders are arranged. The naming convention for the sub-site, image, and scripts folders should be appropriate for their associated content.

IV. DEVELOPMENT TOOLS

Several development tools were used for completion of this project and for continued maintenance of the website. These tools include, but aren't limited to, Macromedia Dreamweaver 4.0, Paint Shop Pro 7, notepad, Internet Explorer 6.0, Netscape Navigator 7.0, Mozilla Firefox 1.0 and other tools and browsers as needed. Dreamweaver was used to develop the templates, pages, and corresponding code for the pages. Notepad was employed for page editing, script development, stylesheet development, and other coding as necessary. Paint Shop Pro was used to develop images needed on the site. The various browsers were used to test the pages for multi-browser support.

4.1 Development Tools

Dreamweaver was the primary development tool for codifying the pages of the website. Dreamweaver 4.0 provides support for many of the desired elements of the site and provides support for all of the technologies used. Page templates and pages were developed in this environment. Notepad was used in conjunction with

Dreamweaver to assist in the development of pages, for the writing and codifying of scripts and stylesheets, and debugging of page documents.

Paint Shop was the primary image development package used. This program offers many image manipulation tools that proved to be more than sufficient for all the needs of image creating, developing, and modification for the site. With this package, all of the needed logos, pictures, buttons, and other images were built and manipulated for size, color and styles, edited, cropped and scaled, text images and other related image processing functions.

4.2 Browser Testing

Various browsers were used to test each of the pages. These browsers were used during the development process to test and debug pages, and to verify the design specifications. Primarily, Internet Explorer 6, Netscape 7.1 and Firefox 1.0 were used to test multi-browser support for different elements of the website. However, other browsers were used as needed, including newer versions of Firefox, to better plan for the maximum number of member-users. Use of different browsers was determined based upon web usage logs of the current website and each were

considered as the new website was implemented in order to accommodate as many users as possible.

4.3 Web Technologies Used

There were three main technologies employed in the development of the website. HTML was the primary language of choice for handling the page content and some of the page structuring, as well as other document control aspects such as the inclusion of images. Javascript was used to handle events for the navigation bar, and to process actions inside of HTML forms. Cascading Style Sheets (CSS) were used to handle a large portion of the placement and page structuring of the website. CSS was also used to provide color schemes, textual formats, and other formatting components for the website.

V. DESIGN AND DEVELOPMENT PROCESS

The design determination initiated as an analysis of the current website, Telco’s printed publications, and review of other financial institution websites. This resulted in realization of the need for a re-engineering effort. Review of the current website was done to better understand the existing design and layout and to begin to shape elements that would meet the requirements for the new design. Printed publications were assessed to establish consistency and infuse the new designs with marketing’s direction. Other websites were reviewed for concepts, layout, clarity, ease of use, and presentation of content to give new insights for reaching the goals set forth by this developing project. The design and development phase was truly a process of revisions and corrections that proved to optimize the design and layout for the website, enhancing the design’s aspects and abilities to match up with the project requirements.

5.1 Levels of Design and Sub-design

To aid in the discussion, each of the designs and sub-design levels of significance are outlined. To distinguish between the old and new site designs, each will be labeled in series as old-site-X and new-site-Y, where X and Y correspond to the design iteration beginning with 0 and incrementing for each significant update for the design.

5.1.1 The Pre-existing Website

The pre-existing website consisted of two former designs, both of which had been used up until the development and release of the re-engineered website as completed in this project. The original site design, old-site-0, constituted the design on most of the pre-existing site's pages. It represented design corresponding to early web technology usage with simple HTML, when the web was first becoming available to private consumers. This design layout was table-based and was simple text and colored backgrounds which presented the material for the website. Navigation was simply text links in green table cells located at the top of the page. Figure 1 shows an example of the old-site-0 design.

Figure 1 - Example of old-site-0 design

The second design found on a few of the pages of the pre-existing site is labeled old-site-1. This design reflected more advanced techniques of web design relative to the old-site-0 design, though still relatively primitive in its design and structure. The main homepage was the focus of this design, though some of the design had been used on a small number of other pages found throughout the site. Site navigation was a simple list of hyperlinks found on the left side of the homepage, with updates to the top navigation from old-site-0 to include background fills

to make the links appear as rectangular buttons. See Figure 2 below for an example of this site design.

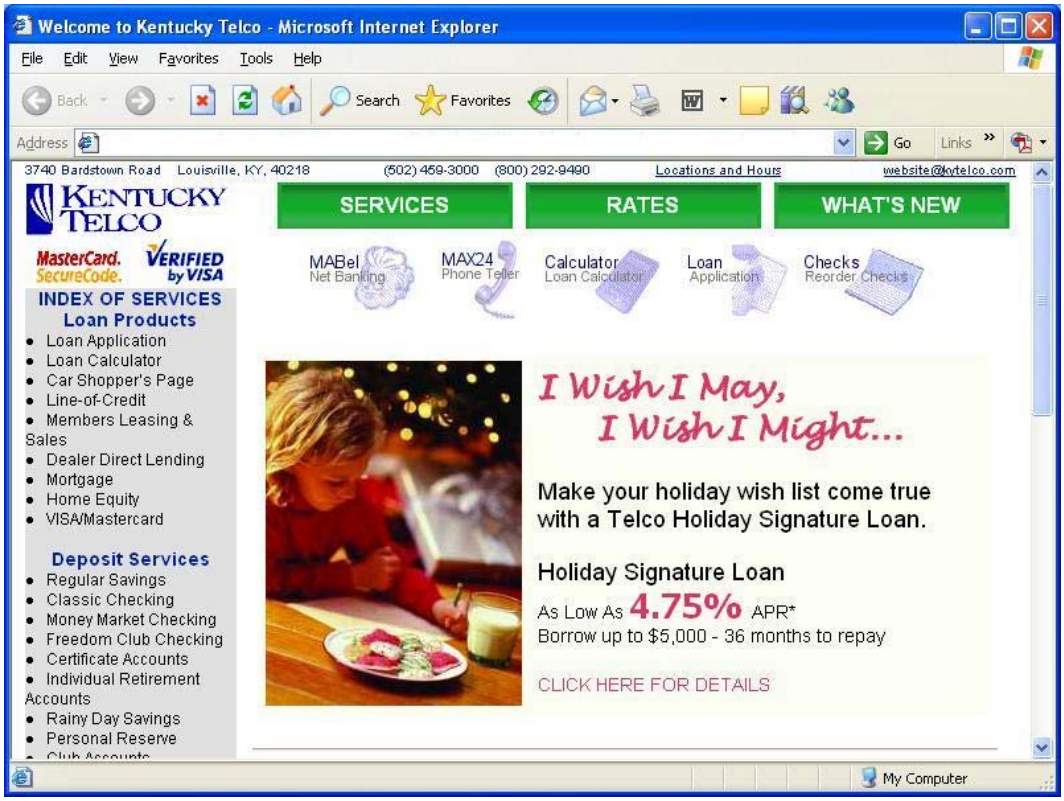

Figure 2 - Example of old-site-1 design

Together, old-site-0 and old-site-1 were conglomerated together to make the pre-existing site. Navigation was focused on using the homepage links, and the look-and-feel of the website not on par with aesthetics of the printed publication materials, nor the current web designs and technologies used commonly on the web. This made the site

difficult to navigate, and unappealing to visit for members and likely contributed to lower usage.

5.1.2 New Website Design

Ultimately, there was only one major new site design; however, there were many corrections and revisions to design elements throughout the process. Some of the major points in the new design will be identified to distinguish the improvement process that the new design underwent.

The initial hand-sketch design constituted the new-site-0 design. This sketch is displayed in Figure 3. This design included placement of navigation items on the left just beneath the logo which was affixed to the top of the template. This navigation menu was located below the swoop curve that included an image related to the contents for the current page. The address and contact information was presented in small text above the logo bar in the top margin of the template. Common links were rounded buttons with short text identifying each button link.

A breadcrumb bar was included in the top logo area that was to indicate the current page position in the site file structure. Also included in this breadcrumb bar were to be included, other important links as well as the search textbox. The bottom border of the top logo bar area was to

be a swoop curve to match the existing marketing documentation. The main content of the page would be located under the swoop curve and to the right of the navigation menu. This menu itself would consist of colored bars indicating the sub-site level of content with links and a drop-down menu style interface. Included at the bottom of the page template would be all the images and compliance information required for the website.

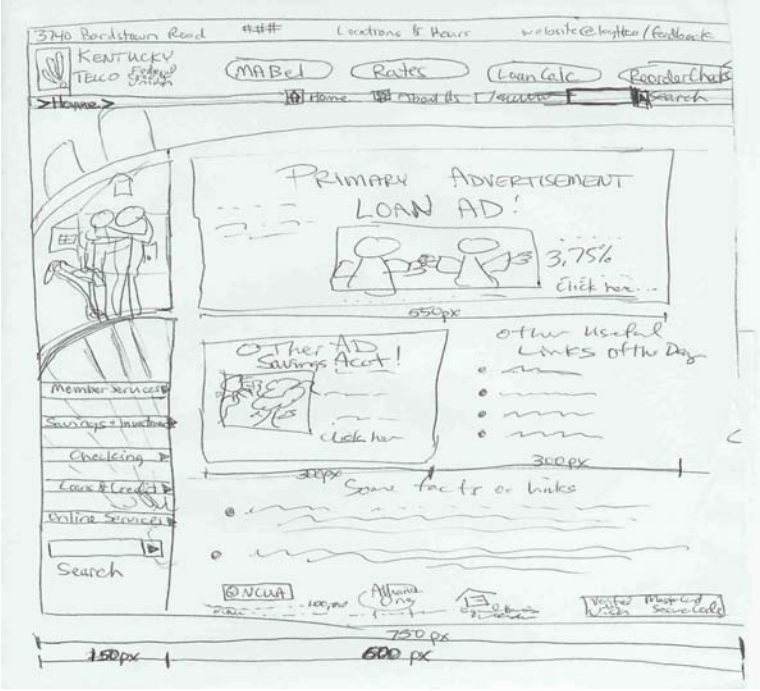

Figure 3 - Initial Hand Sketch Design, new-site-0 design

The second level of design revision took shape during proof-of-concept development as manipulation of basic elements and their placement on the template was tested.

This design was an offshoot to explore navigational possibilities in the design. Thus, the new-site-1 design was developed, swapping the top and menu navigational elements. Some existing images from old-site-1 were used for quick viewing of possible design. The swoop curve also changed to carry both blue and green across the entire page as shown in Figure 2. This deviation from new-site-0 design was abandoned, though the concept of using mouseOver technology to colorize the navigation menu items was a bi-product of this design.

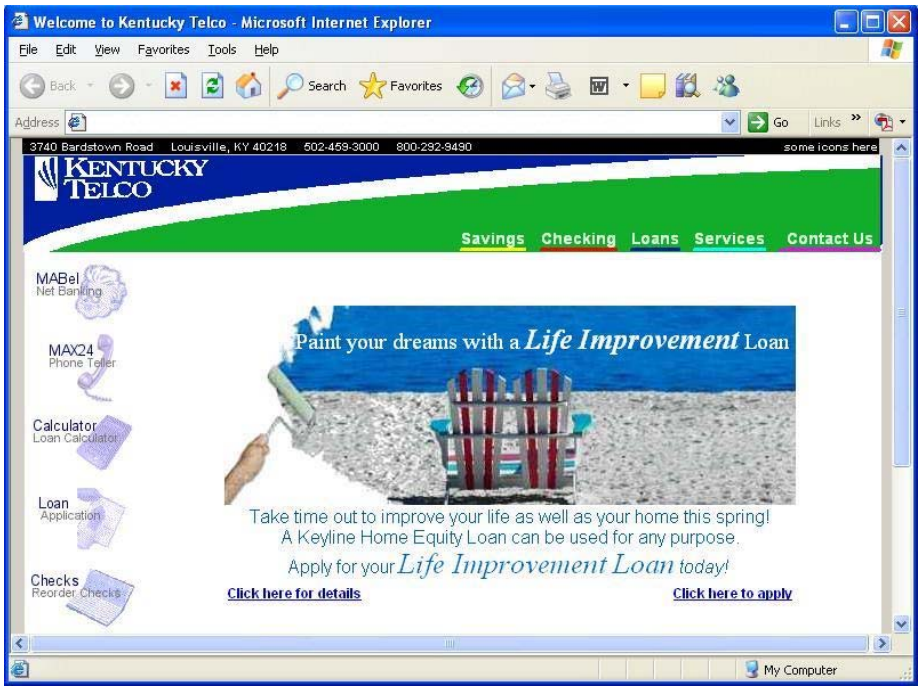

Figure 4 - Proof of Concept Design in HTML, new-site-1 design

The next revision adapted from new-site-0, with changes to some of the elements. The new-site-2 design dropped the use of the breadcrumbs bar in the top logo area. The colored bars for left-side navigational menu were deemed to be distracting from the page content area and conflicted with each other due to the varied colors used.

The navigation menu changed to be a simple Telco blue text of menu items, retaining the drop-down menu functionality, but losing color coordination between product categories for each of the sub-sites. This new menu navigation was quickly modified to be more professional presentation and easily usable without making it overly prominent. To add a slight three dimensional effect using the menu, a cut-out design was sought for each of the main menu items representing each of the sub-sites, such as savings.

Incorporation of a secondary color scheme for sub-site identification was still a priority, and a more appealing design yielded the creation of buttons resembling LED lights that would have an on/off functionality based on mouseOver events. This component of the design proved to be the final design for the navigation menu.

The fourth and final significant revision of the design related to the top navigational elements and the appropriate use of icons and/or text. Use of icons was initially attempted, then rejected as unclear to the nature of the links. Text only became the linkage method of choice for the top links, but then developed to re-include icons as secondary items, displaying through use of mouseOver technology to provide a nice menu style popup of the icon with a longer description of text to better identify the linked page's contents. This design is referred to as new-site-3 and is shown below in Figure 5.

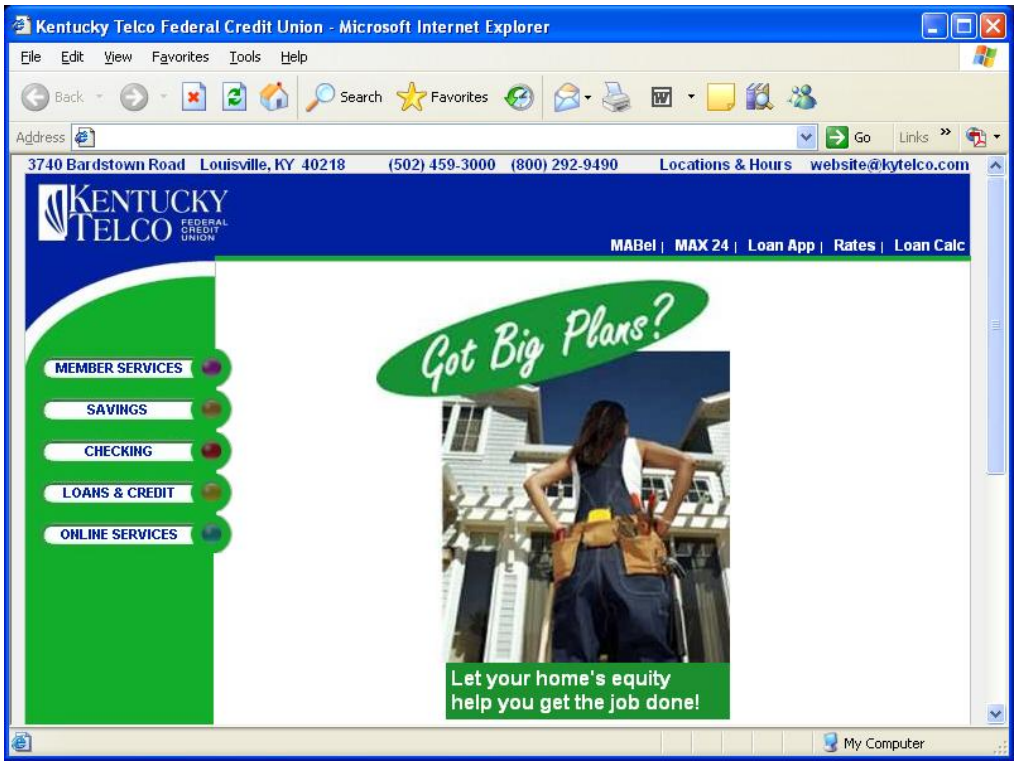

Figure 5 - Final Design, new-site-3

5.2 Design Process

The design conceptualization process began with a review of the printed brochures and publications of the credit union (see Figure 6). This review served to provide a direction for the development of the design and layout of the site in general. The layout, color schemes and major design themes found throughout the marketing publications and brochures formed the underlying basis on which the direction of the website design would take. After careful review and notation of the common elements among the brochures, the first hand-sketched design, new-site-0, was developed.

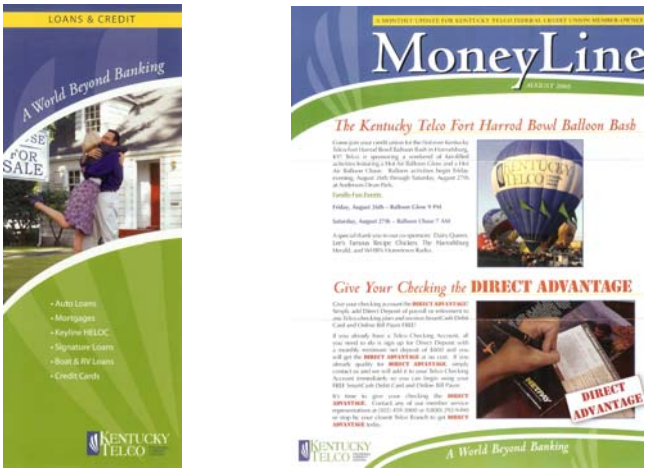

Figure 6 - Sample Marketing Publications

Loan Brochure and Money Line Newsletter

There were considerations of existing elements from the previous old-site-1 design that might be salvageable for use on the new designs. However, the only element that was carried over was the Telco logo, and even that was eventually re-created. Items and other elements were added or removed as needed based upon applicability toward meeting the requirements of the project.

Modifications were made to the developing design and layout based on new understandings, research, or through trial-and—error throughout the course of the design and development phase of the project. To follow the requirements and goals of the project itself as closely as possible, this method of incremental design and development proved to be the optimal foundation for the design process.

The design process was approached systematically, taking from the brochure design and applying its elements to that of the page layout elements. Each of the components of the brochures was reviewed and subsequent elements were designed for the webpage requirements. Each of the elements were reviewed individually, and then as a whole. Several sketches and proof-of-concept pieces were created to simulate the design ideas, which were put together quickly in Paint Shop or hand-sketched.

Figure 7 - Design Sketch for the new-site-0 design

The design process on each of the design elements began from a conceptual level and proceeded to be sketched by hand or electronically to gain an understanding of how each would appear. Figure 7 shows an example of new-site-0 electronically sketched. Following sketching, the elements were codified, first by proof-of-concept coding, then further development to gain the desired functionality and style desired for the design in order to validate the functionality, style and layout. This process allowed for assessment of the design and provided assistance in the revising process of the design and layout. During this process, several pieces of code were developed, and many

images were developed to aid in the understanding and enhancement of the design.

5.3 Design Components and Incremental Evaluations

There were two categories of design considerations, those of a visual nature and those of a functional nature. These elements encompassed all the elements developed during the template design phase and were redesigned incrementally through trial-and-error. The process began from proof-of-concept development which then was expanded to the full nature of each of the components, then modified as necessary to best meet the project requirements.

i) The first element of consideration was the swooping image that divided the blue and the green areas with a picture. This was considered to be a fairly challenging element of the visual design given the non-rectangular nature of the swoop. The determination of how to implement the rounded swoop using rectangular dimensions provided by current web technologies, presented a considerable challenge. The initial concept was that this swoop would span the width of the page contents at the top of the page just below the credit union logo. The curve would begin lower at the left and end higher up on the page on the

right side. As discussion of this notion proceeded, this concept evolved into the creation of the swoop on the left side, just above the navigational elements, leaving a straight border between the top and the page contents.

Originally, the concept was to include a picture in the swoop between the blue and the green. The idea was to place a rotating photo image that would match the images found in the informational brochures. After some deliberation, following some revisions in the design, this element's inclusion in the design was revoked at new-site-2. This decision resulted after determining that the pictures added no value to the design or the contents of the site, and that the visual enhancement that it provided was only marginal, and unnecessary. It also proved to reside in prime retail space on the page which would be better served containing more important components such as the navigation menu. Thus, the rotating pictures were dropped from the design during the design revision process. This evolution is shown in Figure 8 below.

Figure 8 - Design evolution of swoop curve

ii) The second item of consideration for the visual design was the inclusion of the “A World Beyond Banking” tag line. This statement is found on the brochures and other media publications. However, during the early design phase, this was dropped from the design because it also didn’t add value, and proved to clutter the layout of the logo. This was dropped from the design after new-site-0.

iii) Another element both visual and functional in nature was the inclusion of a search box. This search box was initially proposed to be in a swooping-border box, similar in nature to the swoop that would go under the logo, and be colored in the Telco green. This was to be placed in the lower right hand corner of each page. This idea was quickly abandoned before finalizing the new-site-0 design, however due to the difficulty in anchoring any elements to either the right side or the bottom of a page. This followed some discussion and research into placement

and layout which suggests that placement should be solely done from the top and left side of the page [1][3][7][10]. This proved to be a major discovery that drove the further design of the website, setting the pace for all the other elements of the layout, as well. The removal of added complexity that this concept revealed reduced the difficulty of layout scheme design, allowing attention to be directed elsewhere to more important components. The search box eventually became placed on the left hand side navigation area below the site navigation menu for easy accessibility.

iv) The fourth item considered was the layout of the navigational elements to provide the site mapping and traversing capabilities. Much research went into the appropriate placement of navigational items and it was finally determined that the right side and the bottom were not good locations for navigation items. By contrast, the prime implementation was found to be both left side and top navigation [1][3][7][10]. Drop-down navigational elements were found to be common throughout the web. This fact pointed to broad use and acceptance by general web users of such navigation schemes, and was attributed as a skill for the typical member. This style of navigation became a candidate for the design of the navigational elements.

The optimal placement for the navigational elements was chosen to be the left side area initially, and this held throughout the designing revisions. The nature and appearance of the navigation elements changed, however, as the design process unfolded. Originally, the elements were going to be white text links for each of the categories of navigation, which would expand to the right with links to pages under the selected category (see Figure 9). This developed into a colored bar that would match the secondary color schemes of the brochures, such as red for checking.

Figure 9 - Initial left-side navigation menu

v) As a result of the colored bar item in the navigational design, the development of a color bar to indicate the sub-site was established as well. This color bar would reside at the top and bottom of the contents area of the page which would be located under the top navigational and logo area and to the right of the left

side navigation. The color of the color bar would match the appropriate sub-site category, depending on which page a user was on. This element went through several revisions for positioning and height, and was discontinued at the new-site-2 point in the design. Later, a portion of this design element was recouped, using the colored bar for indication of sub-site level in new-site-3. The placement of this color bar was at the top of each of the pages, just under the blue logo and navigation area and just above the contents of the page.

vi) At this point, the navigational elements went through a revision as well, during development of the new-site-2 design. The style of liquid-looking buttons was discovered, and research went into developing these types of images. The design concept changed to incorporate circular buttons that resembled LED lights that would turn off and on based on mouseOver and mouseOut events. These buttons would accompany the textual versions of the links to indicate the sub-site area and the color of the button LEDs would correspond to the appropriate sub-site color. Figure 10 shows a developmental progression of left-side menu navigation elements.

Figure 10 - Evolution of LED button design for navigation menu

The navigation button design changed again in later developments to make the entire text and button an image where the text would be inset from the left side background and a reduced size for the buttons to make them better resemble LEDs. Each of these components to the navigational elements would provide a drop-down (or open right) menu which would contain links to all of the pages found within the corresponding sub-site. The menu for each would have a color-coordinated background with text links, and a menu title which would provide a link to a sub-site index page. In addition, each of the navigational images with LED buttons would be a link to the corresponding sub-site index page (see Figure 11).

Figure 11 - Final left-side navigation with LED buttons

vii) Another topic of consideration was the use of quick links or hot buttons that would provide easier links to the most commonly viewed pages. These links would need to be easily found by users, though not distracting from the informational contents of the page itself. The best place for this navigational element was determined to be at the top inline with the logo within the blue background. The logo would be placed at the top left of the page, so the common navigation buttons were to be located at the right side of the page, inline with the logo.

The best representation for the common access buttons was difficult to determine, and went through several revision steps in order to make the links most obvious and easily distinguished to the users, during the development of new-site-3. It was determined that iconic images would be created to mimic the liquid look of the other navigation buttons as far as shading and lighting effects. The buttons would be various images that would represent the contents to be found at the linked pages, such as a percentage sign to link to the current loan and share rates. As well, the inclusion of a text indicator for each of the links was deemed necessary for clarity.

Despite the aesthetic appeal in this design, clarity was still difficult to establish, as a result in difficulty

determining appropriate images for representation. As well, the icons created were cartoon-like in design, not meeting the requirements for professional presentation. A quick review of other financial websites showed that most used text links, and the ones that used graphical links were not clear as to the contents to be accessed by the links. As a result of these issues, iconic links were dropped for a time, lending exclusively to text links for the hotlinks at the top.

Eventually, the iconic images were re-instituted, though in a secondary way to preserve the clarity that text links provided, but still give the member iconic representations of the links. In this regard, the use of mouseOver and mouseOut functionality was employed to provide the user with further expanded textual descriptions of each of these common access buttons for better clarity and easier use. As well, the images were re-created to be less cartoon-like and represent the contents more professionally. Figures 12 and 13 show the advancement of the use of icons on the website.

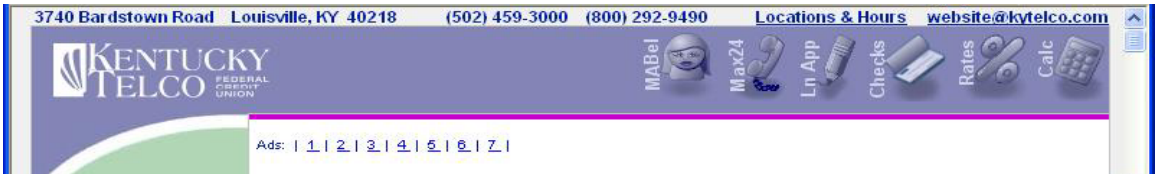

Figure 12 - Initial top navigation with labeled icons

Figure 13 - Final top navigation: use of mouseOver technology to popup an icon with longer text descriptions for text links

5.4 Design of File and Site Structure

The navigational structure for the site was developed to give users an at-most, two hops linkage between any one page on the website and any other page to improve usability [17]. The site was broken into sub-sites that were arranged by category, and identified by the navigational menus. The file structure was developed to correspond with this divisional structure of sub-sites. Figure 14 shows the general sub-site breakdown structure of both the file structure and the user interface site structure.

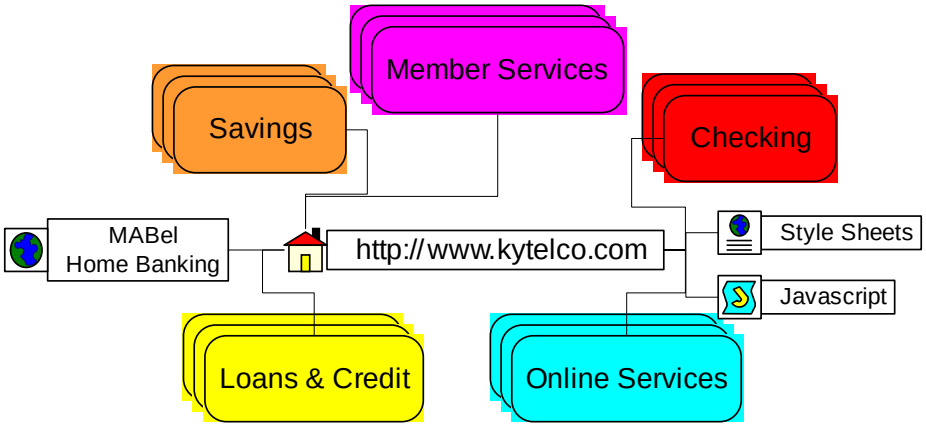

Figure 14 - General Site Structure with Sub-site Divisions

5.4.1 File Structure

The file structure of the site is constructed in a logical manner under a main root folder for the website. The root folder houses all the sub-folders and files for the entire site so that all files will be maintained in a single location on the development network drive as well as in a single location on the web server. Each of the sub-folders contains a logical grouping of page documents and associated files, scripts and code. For example, the images for the entire site are stored in a single sub-folder, named images, for easy location and use throughout the site. Similar sub-folders exist with intuitive naming conventions.

There is a set of sub-folders in the root folder which contains each of the page document files for each of the sub-sites. For each of the product and service offerings, a separate sub-folder is established and appropriately named to easily distinguish and partition the site into its sub-site level structure. The site division folders are checking, online, loans, savings and services with online folder containing the online services sub-site and the member services sub-site contained under the services folder.

For development purposes, a sub-folder named templates was created to house the developmental templates used to build each of the sub-sites and the main site page documents themselves.

5.4.2 User Interface Menu Structure

The user interface somewhat follows the layout of the sub-site file structure in its logical arrangement. The user is presented with drop-down menu navigation with categories for each of the sub-sites. This includes each of the page documents found per sub-site as separate menu items located under the appropriate menu heading. Figure 15 shows the breakdown for the checking sub-site and its linkage to the main homepage. This structure is repeated

for all of the sub-sites as well as pages under the root directory.

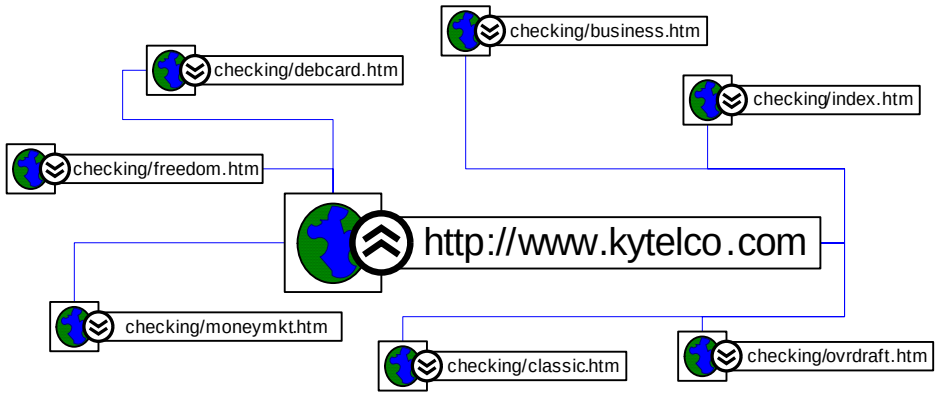

Figure 15 - Site Breakdown for Checking Sub-site Pages

The navigation menus are primarily text based menus, but they also contain graphical representation buttons and highlighting utilizing javascript technology for visual clues indicating the current mouse hover selection. The colors of the buttons and backgrounds of the menus correspond with the appropriate sub-site secondary color schemes as another visual clue to the users as a means of identifying the sub-site material. The opened checking menu is displayed below in Figure 16.

Figure 16 - Example of colored navigational menu item

All of the menus are hyperlinked to a sub-site mapping of the page documents in the sub-site. This feature is useful for site-mapping bots and spiders that crawl the web for search engines [10][17]. These sub-site indices also serve to add accessibility to the site for users with disabilities and those using browsers without javascript support, or with javascript disabled.

The drop-down menus themselves, which are driven by javascript technology, link to each of the page documents directly, making it much easier for the majority of users to access page documents. However, this is not required to easily and quickly navigate the site. This structure adheres to the requirement that the site be maintained so that all pages may be linked to in as few as one and a many as two hops, or links between page documents.

Several of the page documents contain material that might be regarded by a typical member as being in multiple sub-sites. In realization of this, links to the appropriate page documents are located in more than one menu to make the site navigation experience more simplified and intuitive for the user. For example, a typical member might expect to find the Applications & Forms document on the online menu, or perhaps by looking under Member Services so a link to this page is provided in both menus. The pages themselves are not duplicated, and the hyperlinks themselves both direct users to the same document, despite being found in different menus on the menu interface. The duplication of entries in different menus is thus only for enhancement of the user experience while browsing the site [10]. The user interface menu is located on the left hand side of each of the page documents in a consistent location just under the Telco logo. This allows for freedom of site-wide traversal regardless of the current page that a user is on, making all the documents of the site within the two-hop requirement.

Located at the top of each of the pages, a set of links to highly visited sites are placed inside the logo color bar for easy visibility and access by a typical user. These links direct members to the most highly viewed pages

as identified through the web usage logs and site statistics. There are five links which include the MABel Online Banking link, MAX24 Telephone Teller page link, link to the Loan Application, link to the Current Rates, and Online Loan Calculator link. Each of these are short textual links that utilize mouseOver functionality to pop-up more descriptive text descriptions of each of the links as well as an associated icon graphic that serves to help further distinguish links as described previously.

Throughout the site, found in various individual pages, hyperlinks are found inline with the text or as identified links, directing users to pages of material related to the material of the current page. This feature is not found on all of the pages of the site, but is used as appropriate to serve as a static recommender sub-navigation system [17].

The homepage itself serves as a spring board of links that direct the user toward a variety of topics of interest, promotional offers, current events and other specials. Current promotions and specials are highlighted containing text and graphical links as appropriate for the context of the promotion. A special list labeled “What’s New” identifies items of current interest for a typical member to easily access.

Overall, by use of the menu-driven navigation scheme, the website as a whole and each of its individual pages are linkable by a one-hop, or at most, two-hop link which allows the contents of the entire site to be navigated by users more easily than under the old-site designs. Users may browse from page to page without having to backtrack or return to certain menus to access other sub-sites or locations on the site. Rather, the users are able to quickly navigate to another sub-site or page of the same sub-site in as few as one click. This site structure follows usability guidelines, as well as meets aesthetic and consistency requirements.

5.5 Development

The development work on the site flowed out of design improvements and proof-of-concept coding. Elements of the emerging designs were investigated, sketched and positioned, then proceeded to be codified at basic levels to get a simple electronic representation. Then, based on the results of initial proof coding, the design was modified to better meet requirements, improvements made, other elements added, or components removed from the design.

5.5.1 Page Layout and Template Development

The overall page layout came together with positioning of components during the design process. The navigational elements were aligned to the top logo bar and the left-side menu bar as identified previously. The requirement to ensure the prominent placement of the address and contact info led to the extreme top placement of this information, though using smaller font size, and background color distinction. The content area of the page was kept to a width of 600 pixels to meet page width requirements, and formatting the content text to appear in document page style. Other sections of the layout were added as described earlier.

All of the components had to be aligned in relation to one another in proper placement and positioning, as well as central placement in the browser overall. Stylesheets were used to identify absolute and relative positioning schemes to properly align and anchor components to proper locations. After this was complete, the template design layout was constructed from this design, leaving the content pane section of the page open to insert contents on new page creation. This involved creation of a scheme to allow dynamic page height sizing in order to adjust to

varied document lengths, and preserving the bottom compliance information at the bottom of the template.

The primary template was then developed to handle the division of primary site files and sub-site files. For files at the root level of the site's file structure, the primary template would serve well. However, a second template, adapted from this primary template was created for adjusting the navigational and graphical references needed to access other site files from within sub-site folders. Thus, the second template served to handle the development for sub-site page documents, while the primary template served the global site documents construction.

5.5.2 Content Population

Once the templates were complete, content population development began. The main homepage for the site was the initial candidate for content population to ensure that the primary design template would appropriately accommodate its use in creating new pages for the site. This step involved several revisions and fine-tuning of the templates in relation to placement and positioning as well as the dynamic page height functionality.

After a successful and satisfactory build of the homepage, additional pages were built. At first, this was

handled and reviewed page by page to ensure continued adherence to requirements. More small revisions were made, and code was streamlined to provide equivalent functionality, using less file size requirements. This proved to aid in download size requirements once the site was released as well as simplifying the code for easier development. The secondary template was changed in accordance to the necessary modifications, and was used to develop all of the sub-site level page documents. Eventually, all the site content had been added, and each of the pages were complete.

5.5.3 Image Development

Development of images was a similar process to the coding and design development process. Images were sketched for concept, proofed electronically for quick use in review, and then finalized to place. Much of this development required several sequences of images to arrive at a final acceptable image to be used. The logo, for example went through seven creations and revisions before it was deemed complete. Issues in image development ranged from clarity, graininess, color conformance, dimensions, smoothed edges, and file size.

5.6 Template and Site Testing

Testing was an integrated tool used throughout the design and development process as well as used in final site-wide page testing. Working with proof-of-concept development, testing on components as changes were made allowed for visual confirmation on-screen of validity of such changes. This style of testing mainly involved the development of proposed improvement to a component, followed by a test view of the improvement on the working template to assess the change. This method of development and testing was used extensively during the design/development process.

At the completion of content population for the site, when the entire site had been built, each page was tested for content, navigational control, and proper functionality within the site as a whole. During this process, each link was visited in the navigational menu from both global pages and sub-site pages to ensure proper functionality of all menus and navigational components. All of the content was reviewed to ensure accurate information and proper wording on all page documents. All pages were scanned for consistency and checked for adhering to size requirements.

After sufficient testing had been done, the new site was rolled out (http://www.kytelco.com). Each sub-site was

released first, to perform spot checks before releasing the global pages and main homepage as a double check on previous testing. Once the entire site had been rolled out, a second round of full testing of the live version of the site was completed, to verify the user-side availability and proper functionality of the website.

VI. MANAGING WEB ENGINEERING DESIGN IMPROVEMENT

Now that the website (http://www.kytelco.com) was active, it needed to be analyzed in relation to the project requirements to validate the improvements made upon the website through the re-engineering process. There is a wealth of methods and figures that can be used in addressing and quantifying the old and new website, however, there must be a distinction made between data and information. The difference is the value of data versus that of information, where data is a general category including any identifiable attribute or related measure. Information is a subset of data that is useful for measuring, assessing, and making conclusions or decisions. In this regard, it is important to identify informational metrics and measures in assessing the re-engineering effort made so that useful conclusions can be drawn on the value of a web engineering project [19].

6.1 Analysis Metrics and Measures

Useful and informative metrics for website assessment proposed by this research are grouped into two categories.

The primary grouping of metrics is the usability of the website, which includes issues related to ease of navigation, consistency, and clarity. The second grouping of metrics is the maintainability of the website, which considers the development times and costs associated with maintaining and improving the site. All useful and informative metrics can be associated into these two categories. The selected metrics of value for usability and maintainability are summarized in TABLE III and IV, along with more detailed discussion on these metrics in the following sections.

There is a third broad category that should be mentioned, the area of aesthetics of user preference. However, it is different than the other two because it identifies a subjective area difficult to measure except on an individual basis. This stems from a grey area of style and design which considers subjectivity and different preferences among users. Sections of user preference can in some ways be considered measurable and placed under usability metrics, yet it can be difficult to distinguish between pure user preference and possible objective measures. The subjective nature of design will not be addressed in this work, though its existence is important to acknowledge.

6.1.1 Usability Metrics

Usability metrics are perhaps the most important measures for assessing websites. Usability is directly concerned with the user perspective and thus inherently proves its worth since the user is the target audience [10][19]. In this category there are many measures that can be utilized in determining website usability. Choosing a subset of these which will prove to be appropriate for analysis may be a difficult task. However, this case study suggests that there is a subset of measures which can be utilized to adequately assess usability of a site. A summary of the metrics applied are listed in TABLE III below.

TABLE III
USABILITY METRICS

Metric	Measures
Navigation Structure	Visibility Average page depth Number of hops Consistency
Effectiveness	Page traffic Clarity Concise content
Efficiency	Page loading and page size Consistency

The application of a navigation structure is critical in the development of a website [17]. For users to access page documents found on a site, they must be able to locate

those documents easily. The level of visibility relates to the placement and clarity of a navigation system where higher visibility yields easier access to pages on a site.

Number of hops relates to the number of links that must be traversed to go from a start page to a destination page. This can be as few as one, but can be unbounded. Average page depth relates to the average number of hops from the main home page to any other page within a website, or sub-site. Consistency in navigation structure refers to the consistent use of navigation throughout the site, which aids in visibility and reduces learning time for new users of the site.

Measuring effectiveness is adequately done by viewing page traffic, image clarity, and concise content. The number of hits, or views, of a website is the primary measure of page traffic. Time spent on a page is also a component of page traffic that has value [5]. However, the web hosting company used by KY Telco did not offer this measure in its traffic reporting tools. As a result, it will not be used, though it is suggested to measure the value provided in the content or interest of a page document.

Image clarity refers to lack of distortion in image quality. This metric also looks at the image relevancy

with the associated content or linked material. Concise and clear textual content considers size and number of paragraphs, groups of text, use of bulleted points, and words per line. Most web users view pages by quickly scanning and thus more concise textual content makes for increased reception and use of page contents.

The efficiency metrics used here include page size, page loading time, and consistency. Response times for page downloads must be as small as possible. User attention spans and patience window for page loads is measured in a few seconds, and thus a page must load quickly [10]. Page size is a direct factor in this load time, including all linked documents, script files, and style sheets as well as images found on the page.

Consistency once again is important here in efficiency as it lowers the learning time for a new user of the site. As well, use of common elements on multiple pages reduces page download times by loading images, style sheets, and script files from browser cache instead of re-downloading them for each page accessed from the site.

6.1.2 Maintainability Metrics

Maintainability metrics assess the website from a developer’s point of view. Maintainability is very

important in that it considers design and development time and the ability to improve the website efficiently and effectively over the life of the site, as well as re-design or replace it as needed. This category also contains a large base of measures that could be used, however, a subset will be used that is most relevant and provides a meaningful assessment as determined through the case study. The measures for maintainability are summarized here in TABLE IV.

TABLE IV
MAINTAINABILITY METRICS

Metric	Measure
File Quantity Counts	Number of pages Number of directories Number of images
Development Time	One page with/without images Entire sub-site
Change Handling Time	Time to update content Time to update image Time to release

One important figure that maintainability considers is the costs associated with development in attempts to align the work required to the quality of the output to assess return on investments. This component will not be addressed in this study as every business has different perspectives for analysis, and this is more a topic for business professionals than engineers. However, it is important to factor this into the equation when a company actually pursues such a project. For the purposes of this

case study, development time alone will be used, and it is expected that this can be translated into costs appropriately in its applied setting.

Maintainability metrics important to the developer of a website mainly focus around time and complexity of development of new pages, as well as making changes and updates to existing pages. The file quantity count is the first metric listed here, though its measure in number of page documents, images, other files, and directories has relevance in a relative sense. Having an exact number for these areas isn't critical, though having a general idea for each of these is useful.

Development time is used to measure the time required for creation of one page of content with or without images as well as development time required to build an entire sub-site. The time for building an entire site could also be considered here, though its usefulness is better served as a measure for the outset of a web engineering project, and not ongoing maintenance of an existing website. Change handling time measures the time required to make changes in textual content or images at the individual page level, at the sub-site level, or site-wide. It considers time from request for a change to the release of that change to the web.

Using the measures and metrics of usability and maintainability provided here, both the old website and the new are assessed, and a comparison made for determining the level of improvements made by the case study project.

6.2 Analyzing the Old Site Design

The old site design, including both old-site-0 and old-site-1 designs will be addressed here in regards to usability and maintainability.

6.2.1 Usability of the Old Site

First, usability will be addressed on the old site design. The navigation structure found in old-site-0 and old-site-1 was primarily only visible on the main home page. A list on the right hand side of this page displayed links to most of the pages found on the site. A set of three simple rectangular buttons at the top of each page provided the only means of navigation from one page to the next on the site. Two of these buttons linked to two pages of content only, thought to be of primary interest to the typical member. The third button linked to a service listing page in old-site-0 design style with an unorganized list of links to most of the pages found on the site.

Ultimately, the navigation structure on the old site forced users to link back to either the home page, or to the services list page to navigate to any other page on the site. The lack of consistency among pages on the old site, made identifying this structure more difficult. The average number of hops to arrive at any given page from any other page on the site is two to three, and it is one to two if linking directly from the main page. Page traffic volumes seem to indicate the difficulty of navigation as many pages were requested minimally, if at all.

The traffic on the site shows a huge volume of requests on the main home page, with relatively few for all other pages. Typically, the home page received an average of about 60,000 requests per month for the six months leading up to the release of the new site. This resulted from a 41,000 to 67,000 range hitting 64,000 in the month just before the old site was replaced. The 41,000 figure was an outlier, so a survey of previous reports was also reviewed, covering the past 12 months of usage, indicating a more stable average of about 55,000 hits per month to the main page. This also reflected a very slow and steady growth, typically over that time period, with the exception of that 41,000 figure.

The next highest requested page was the rates page averaging around 1,100 requests per month in the six month period. The volume on the remaining pages of the site quickly trailed off, for the top 16 viewed pages, dropping from 1,100 to 100 requests per month. This number fell to below 100 per page per month for remaining pages, if viewed at all. The average number of page views per month per page across the 73 other pages requested on the site over the six month period was 140. This also indicates that of the nearly 95 pages on the site, only about 75 of them were accessed in a given month, thus about 78% of pages were accessed from the site during the course of a month, on average.

Some of the common pages with higher volumes were the loan calculator, loan application, branch locations and hours, and services index pages, having a combined volume range of about 2700 to 3200 views per month. The primary reason for such a disparity between volumes of requests on most pages versus the requests on the main page relates to the fact that the typical member is coming to the site, only to access the online banking portion, which is outsourced. This is speculated to also be a result of the poor navigation scheme.

Image clarity was not much of an issue for the old site, except on the main home page, since images were not really used. The images on the home page were carefully developed to find the best mix of image clarity and reduced file size as possible. However, use of image development software had not been taken full advantage of to truly minimize file sizes while preserving image quality. As a result, images were often somewhat distorted to observe slower download speeds. The content of the pages were generally well developed. Use of short sentences and paragraphs coupled with use of bulleted lists on most informational pages was done well throughout the site. This was probably the feature of the old site that met up best with web best practices.

Another good feature of the old site was the speed of downloads and low page sizes. The old site was designed with the anticipation that the typical member would be connecting from home on a 14.4kbps modem or at best a 56kbps modem. As a result, mainly text-only pages were used, which made for very fast download response times. However, this made for a very unprofessional and unattractive design, and identifies another main reason for low traffic volumes.

Consistency of the site was split in three segments. The first were low visibility, low volume pages that were mainly text. These pages were strictly based around old-site-0, and were consistent in a simplistic and unappealing manner. The second segment was essentially the main home page which most of the development effort in recent months had been placed, forming the old-site-1 design. This reflected improved uses of color, backgrounds and use of images. The third segment of pages, was about 7-8 pages which had taken the updated style of top navigation buttons from the old-site-1 design and applied them to the text-only pages of old-site-0 design.

Overall usability was low, where the main home page was the only page with any real design and style. Navigation visibility was almost non-existent, except from the main page or services list page. Consistency was divided between the home page, old-site-0 pages, and old-site-0 pages that had begun to adopt the top navigation of old-site-1. The primary positive aspects of the old site were very fast download times, and use of concise content.

6.2.2 Maintainability of the Old Site

Maintaining the old site had several obstacles that made making changes and developing new components

difficult. Each page was built independently of the others, thus when a change was needed to a site-level component, such as the top navigation, each page would have to be modified separately. This was a time-consuming and arduous task, so much so, that development efforts along this line were avoided almost entirely. This was the primary reason for the disparity in styles for the old site. There were about 30 pages under the main directory of the site, roughly 65 pages under the single subdirectory, 10 script and stylesheet files, and nearly 30 images at any given time.

Time to create an additional page was small. However determining the appropriate style to use was sometimes a challenge. It was determined, in general, that the modified old-site-0 design would be used, encompassing the new top navigation buttons of old-site-1. This required a copy and paste operation of the header structure of an existing page, followed by html coding and insertion of the textual content. Total time for this centered somewhere around three hours. If an image was to be included on the page, then another two to three hours was required. Similarly, if a change to an individual page needed to be made, it took only a matter of under an hour to locate and make the change, and finally release the change. A change

to an image, depending on the size and quality requirements might take anywhere from one hour up to five hours.

The old site design was difficult to update, and consistency was an ongoing issue in development efforts. As improvements were made to the design on the home page, it became more evident that the site needed a redesign to make it more maintainable, reducing the times for development, especially on a site-wide level. Thus the re-engineering project became evident as a result of the poor level of maintainability of the site as a whole, especially when improvements to design and navigation was more than evident, though development times to adjust each page individually were too excessive to engage in such updates under the old design.

6.3 Analyzing the New Site Design

The re-engineering case study project sought to remedy the shortcomings found in the old site. An understanding of the subjective opinions of the typical member of the website has significant importance. The new design received a lot of feedback from typical members, largely praising the new design for its enhancement, easy of use, and overall general aesthetic appeal. Several minor negative comments have been submitted that relate to

specific elements of the new website, all of which are included in TABLE V along with a sampling of all the positive feedback received. Further, a discussion of usability and maintainability which follows analyzes the objective components for the new website.

TABLE V
FEEDBACK ON NEW WEBSITE DESIGN

Positive Comments	Negative Comments
• The website is always up to date and very informative • It is always easy to find your way around the site due to the design and it always has a pleasant and warming feeling about it • The website is not intimidating for the user at all • The front page of the web allows access to all of Telco's features • The website has lots of nice colors & pictures & is easy to read • Every headline has a list of what is available so it guides you in the direction you need to go • In comparison to other web pages of this purpose I believe Telco's is top of the line • I think the new website has a very clean look to it and is extremely user friendly. It's wonderful! • Thanks so much for all of the work you did on the new website. It really shows. • Your website is great and very informative • Very easy to navigate (I can find what I am looking for) • Visually pleasing • KY Telco is truly one of the best websites that I visit regularly	• I see the website has changed and I'm having a little trouble getting around on it. I am used to checking my account balance a few times a day but now I'm not sure how to access the information. Can anyone help? • I like the new web site but where are the volunteer applications? I could not find them. • The menu buttons are somewhat confusing. They would work better if they changed color on hover. • Mabel should be labeled Online Banking

6.3.1 Usability of the New Site

The navigation structure on the new site design centered on drop-down menu based functionality. Instead of listing most of the pages for the site, pages were segmented into product categories, with each menu being a product line, and all associated products pages linked by options under the menus. The total menu could easily fit on the screen of a typical member. This menu was placed on the right hand side of every page throughout the site, making the effective average page depth equal one to traverse from any page on the site to any other page. Top navigation was also consistently positioned at the top of each page.

Page traffic for the new site was reviewed for six months after release of the new site to allow for the newness effect to wear off. Essentially, this took into consideration a small period of usage on first release as typical members learned the new interface and explored the new site, potentially generating a non-normal volume of traffic. The volume for six months following the initial site release were viewed to account for periods of usage variations and to allow for the normalization of usage to return.

The number of hits on the main home page fluctuated between 65,000 and 74,000 per month, averaging about 69,000. The number of hits grew steadily to the high usage of 74,000 in the last of the six months. Interestingly, the number of hits in the first month was not relatively high or low as was thought a possibility. Instead, the number seemed to be in line with normal usage of the website leading up to the new site release. However, the pattern after release over the six month period shows an improved growth rate in usage of the site.

The MABel online banking informational page averaged about 3,200 hits per month, which was an interesting bi-product, possibly indicating a reduced visibility of the quick navigation link in the top navigation area. The Online Services sitemap along with the rates and loan calculator pages received an average of about 1,200 page hits per month. An average of 42 pages had over 100 hits per month during the six month period. 70 pages were requested on average per month with an average number of hits of about 270 per page per month. With a total of about 75 pages on the site per month, this yields access of 93% of the pages on the site per month, on average.

The proficient use of image development software yielded in creation of clear images with smaller file

sizes. This provided professional quality images that yielded to faster download times. The content used was essentially the same as from the old site for most pages, thus it was fairly concise with good use of bulleted lists and short paragraphs. Total page sizes were only slightly larger than the text-only equivalents in the old site due to the addition of images in the navigation structure and linked stylesheets. However, page sizes remained under the 60kb size requirement, maintaining acceptable download speeds. Consistency among pages in design, style and navigation persisted across all pages of the site.

Overall, the usability of the new site was effective and efficient as navigation structure was consistent across the pages of the site with high visibility. The navigation menu structure provided accessibility from any one page to any other page of the site in one hop. The content was concise, and image sizes were small, making total page sizes small and download speed fast.

6.3.2 Maintainability of the New Site

The maintainability of the new site is relatively high as components can be quickly updated at a site-wide or sub-site level as easily as at an individual page basis. The entire site is built upon two templates, using either one

for root directory pages, or the other for subdirectory pages. As well, stylesheets are included in the templates to allow for site-wide and sub-site level changes to be completed by changing the template or stylesheet.

The new site consists of 5 subdirectories, each matching the product categories identified in the navigation menus. The number of files in each of these subdirectories range from 7 to 15. The root folder contains 7 page documents as well as 8 script files and stylesheets. The number of images used in the new site just under 40.

Time to develop a single page, given the content is small, requiring 30 minutes to one hour to develop. The creation and development effort on new images ranges from 30 minutes to 4 hours. Building of an entire sub-site of 10 pages would require roughly 8-12 hours total, given the content was pre-existing.

The general outlook of maintainability on the new site shows a small time requirement for change or additions at the individual, sub-site and site-wide levels. The only difference in time for development of new components or modifications to existing components and actual time to release all of the pages with the update or addition is the time required to upload the pages to the web host. This

amount is essentially negligible since it is only a matter of a few seconds.

6.4 Assessment of Improvements

Given the analysis of both old and new sites, a comparison can be made to understand the improvements achieved through the processes in this case study, focusing in on usability and maintainability. The major points of improvement will be addressed and any adverse results highlighted.

TABLE VI and TABLE VII show a review listing for both the old and new sites using the metrics identified here. The tables are broken down into objective measures and subjective issues related to the each of the design measures under each metric category. Items are paired up from the old site design and the new site design to allow easy comparison between individual traits under each metric. A discussion relating the highlights of each of these improvements for both usability and maintainability follow the respective tables.

TABLE VI
USABILITY ANALYSIS

Metric	Old Site Design	New Site Design
Navigation Structure **Objective**	• Site map on homepage and services list page only • Top navigation style inconsistent • Navigation inconsistent across pages • 2-3 hops between pages	• Menu navigation on each page • Top navigation on each page consistent • Navigation consistent across all pages • Only 1 hop between pages
Subjective	• Very Low visibility	• High visibility
Effectiveness **Objective**	• 60,000 average hits on home page • average of 1,100 hits for next highest volume page • 16 pages with 100 hits or more • 140 hits per page per month • 78% of pages requested per month	• 69,000 average hits on home page • average of 3,200 hits for next highest volume page • 42 pages with 100 hits or more • 270 hits per page per month • 93% of pages requested per month
Subjective	• Medium image clarity • Very Concise content	• High image clarity • Very Concise Content
Efficiency **Objective**	• Low page file sizes • Low use of images • Inconsistent Design (3 different levels)	• Low page file sizes • Smaller image file sizes with more images • Consistent Design (1 design for whole site)
Subjective	• Very Fast load times	• Fast load times

In consideration of usability, a big factor of improvement was navigation. This component was made consistent across all pages of the site, and changed from purely list-based links to a menu-driven system, associating pages under product-lines. This increased

visibility of the navigation and sub-site areas and reduced number of hops required to traverse pages to only one. The consistency of style improved the overall cohesiveness of the site, and increased its professional presentation.

Page traffic increased significantly on the site, not only to the home page, but also across the site, increasing volume on a number of pages and span across the pages of the site. The number of hits per page per month on average nearly doubled from 140 to 270. The home page enjoyed an increase in average hits per month of approximately 9,000 additional visits. The number of pages receiving traffic above 100 hits per month increased from 16 to 42. This increase in volume across the site directly identifies the effectiveness of the new design to bring typical members to areas of interest more easily.

The only potential tradeoff to the improved style and design is the use of images and stylesheets which slightly increased the page sizes from their text-only ancestors, thus increasing time to download a page. However, the sizes were kept under the 60kb requirement, and page load response times remained favorable. Thus the efficiency of site dropped only negligibly. As well, the use of common images and stylesheets allowed improvements in download speed due to browser caching.

TABLE VII
MAINTAINABILITY ANALYSIS

Metric	Old Site Design	New Site Design
File Quantity Counts	• Approx. 30 pages in root directory • Approx 65 pages in single sub-directory • Approx. 95 total pages in any given month • Approx. 30 images • Approx. 10 script and stylesheet files	• 7 pages in root directory • 7-15 pages in 5 sub-site directories • Approx 75 pages total in any given month • Approx. 40 images • 8 script and stylesheet files
Development Time	• One page development time: 3-6 hours • Sub-site or site development: (3-6 hours)*(number of pages)	• One page development time: 0.5–1 hour • Sub-site or site development: (0.5-1)*(number of pages)
Change Handling Time	• page change: 1 hour • image change: 1-5 • Sub-site change: (1-5 hours)*(number of pages) • Site-wide change: (1-5 hours)*(number of pages)	• Page change: 0.5-1 hour • Image change 0.5-4 hours • Sub-site change: 0.5-2 hours total • Site-wide change: 0.5-2 hours total

The maintainability greatly increased from the old design to the new design. The ability to make changes or additions to the site on an individual page basis, sub-site level, or even site-wide through use of templates and stylesheets reduced development and change handling time from an unmanageable amount, to just under a few hours of work. This was the significant improvement the new design brought in relation to maintainability. It turns out that the number of pages, files, and directories was only needed

as a relative measure. This relative total gave some general ideas about improvements on development times, and was useful in determining the difference between development under the old site design and under the new.

Overall, the usability of the site increased significantly as the improved navigation structure and consistency among pages increased visibility and cohesiveness, and higher traffic across the site was obtained. Maintainability greatly improved, as development times were reduced dramatically on site-wide and sub-site level additions and changes. From these two metrics, and the associated valuable measures, the re-engineering of the website has proven to add much value for both users and developers alike.

VII. CONCLUSIONS AND FUTURE DEVELOPMENT

7.1 Summary

It is apparent that web technologies will continue to be a valuable and pervasive means of communication and commerce for small and large businesses and customers alike. For small businesses it is especially important to employee a website effectively to service its customers and be competitive in the marketplace. For such organizations, it is possible to undergo web projects to incorporate into their business strategy, and do so with relative speed while providing improved lines of communication for customers.

Using useful metrics and measures can ensure the optimal pursuit of such a project, so developers will focus in on critical elements in the development effort. Such metrics allow a company to quickly evaluate an existing site, provide guidelines for re-engineering a site, or a framework which can be used in initial development of a site. Focusing in on usability and maintainability as the primary assessment and planning factors provide easy and effective tools which are also easily understood in the

presence of cross-functional teams. Utilizing the approach and methods in this case-study indicate promising techniques for ongoing improvement web engineering processes.

7.2 Future Work

To continue the work in this field, it would be interesting and of great value to establish a methodology to align usability and maintainability to the profitability for an organization. Very little work was found in the literature review that addressed these concepts. A proper linkage between the metrics identified in this research and the increase of business to a company would be highly valuable. Other areas of pursuit may be in customization of design interfaces on an individual or group basis to better target segments of the user populations. This has been done on many levels, though doing so based on user knowledge and skills with web technology is an area that could be further exploited.

APPENDIX I – SAMPLE STYLESHEET CODE

```
#topnav {
  vertical-align: bottom;
  position: absolute;
  top: 14px;
  left: 395px;
  width: 350px;
  height: 40px;
}

#topnav a, a:hover {
  font-family: Arial, Helvetica, sans-serif;
  font-size: 12px;
  font-weight: bold;
  text-decoration: none;
  color: #FFFFFF;
}

#topnav a:hover {  color: #12AD2B;}

#topnavhelp {
  visibility: hidden;
  overflow: visible;
  position: absolute;
  top: -8px;
  left: 100px;
  width: 215px;
  height: 32px;
  font-family: Arial, Helvetica, sans-serif;
  font-size: 12px;
  font-weight: bold;
}

#mabel,#max24,#rates,#app,#calc {
  visibility: hidden;
  overflow: visible;
  position: absolute;
  color: #00209F;
  text-align: left;
  top: 0px;
  width: 215px;
  height: 32px;
  border-width: 2px;
  border-style: solid;
  border-color: #12AD2B;
  background-color: #FFFFDD;
  background-color: #FFFFFF;
}

#leftnav {
  background-color: transparent;
  position: absolute;
  top: 70px;
  left: 10px;
  width: 150px;
}

#leftnav a, a:hover {
  font-family: Arial, Helvetica, sans-serif;
  font-size: 11px;
  color: #000000;
  text-decoration: none;
}
```

```
#leftnav a:hover {
  color: #00209F;
  background-color: #FFFFFF;
  font-weight: bold;
}

#memserv,#savings,#checking,#loans,#online {
  visibility: hidden;
  overflow: visible;
  font-family: Arial, Helvetica, sans-serif;
  font-size: 10px;
  color: #FFFFFF;
  vertical-align: top;
  position: absolute;
  top: 0px;
  left: 153px;
  width: 185px;
  border-width: 4px;
  border-left-width: 0px;
  border-right-width: 0px;
  border-style: solid;
}

#memserv table,#savings table,#checking table,#loans table,#online table {
  text-align: left;
  width: 185px;
  padding: 0px;
}

#memserv {  border-color: #CC00CC;}
#memserv table {  background-color: #F0D0F0;}
#savings {  border-color: #FFCC00;}
#savings table {  background-color: #F0E0B0;}
#checking {  border-color: #FF0000;}
#checking table {  background-color: #F0C0C0;}
#loans {  border-color: #FFFF00;}
#loans table {  background-color: #F0F0C0;}
#online {  border-color: #00FFFF;}
#online table {  background-color: #C0F0F0;}
```

APPENDIX II – ROOT TEMPLATE CODE

```
<html>
<head>
<!-- #BeginEditable "doctitle" -->
<title> Kentucky Telco Federal Credit Union </title>
<!-- #EndEditable -->
<link rel="stylesheet" type="text/css" href="../texts.css" />
<link rel="stylesheet" type="text/css" href="../style.css" />
<link rel="stylesheet" type="text/css" href="../nav.css" />
<link rel="stylesheet" type="text/css" href="../color.css" />
<link rel="shortcut icon" href="../images/favicon.ico">
<script language="JavaScript" type="text/javascript" src="../telco.js"></script>
</head>

<body bgcolor="#F0F0F0">
<table align="center" cellpadding="0" cellspacing="0"><tr><td width="750" align="left">

<div id="addressbar" align="left">
<table cellpadding="0" cellspacing="0">
  <tr>
    <td width="290" height="14" valign="top">
       3740 Bardstown Road    Louisville, KY  40218
    </td>
    <td width="215" valign="top">
      (502) 459-3000    (800) 292-9490
    </td>
    <td width="115" valign="top">
       <a href="../branches.htm">Locations &amp; Hours</a>
    </td>
    <td width="130" valign="top" align="right">
      <a
href='javascript:openWindow("online/emailus.htm","400","400");'>website@kytelco.com</a></
td><td width="1">
    </td>
  </tr>
</table>
</div>

<div id="top" align="left">
  <a href="../index.htm"><img border=0 src="../images/logo.jpg" width="171" height="62"
alt="Kentucky Telco Federal Credit Union Home Page"></a>

  <div id="topnav">
    <table height="50" align="right" valign="top" border="0" cellspacing="0"
cellpadding="0" style="color:FFFFFF;">
      <tr valign=top>
        <td align="center" valign="bottom">  
          <a href="https://www.kytelcoonline.com/onlineserv/HB"
onMouseOver="toggleDiv('topnavhelp',1); toggleDiv('mabel',1);"
onMouseOut="toggleDiv('topnavhelp',0); toggleDiv('mabel',0);">MABel<!--img
src="images/mabel.jpg" align=top width=28 height=28--></a> |
        </td>
        <td align="center" valign="bottom">  
          <a href="../online/max24.htm" onMouseOver="toggleDiv('max24',1);"
onMouseOut="toggleDiv('max24',0);">MAX 24</a> |
        </td>
        <td align="center" valign="bottom">  
          <a href="../online/forms.htm" onMouseOver="toggleDiv('app',1);"
onMouseOut="toggleDiv('app',0);">Loan App</a> |
        </td>
        <td align="center" valign="bottom">  
```

```
          <a href="../online/rates.htm" onMouseOver="toggleDiv('rates',1);"
onMouseOut="toggleDiv('rates',0);">Rates<!--img src="images/rates.jpg" align=top width=28
height=28--></a> |
        </td>
        <td align="center" valign="bottom">  
          <a href="../online/loancalc.htm" onMouseOver="toggleDiv('calc',1);"
onMouseOut="toggleDiv('calc',0);">Loan Calc</a>
        </td>
      </tr>
    </table>
    <div id="topnavhelp">
      <div id="mabel"><img src="../images/mabel.jpg" height="32" width="32"
align="center">  MABel Online Banking</div>
      <div id="max24"><img src="../images/max24.jpg" height="32" width="32"
align="center">  MAX 24 Telephone Teller</div>
      <div id="rates"><img src="../images/rates.jpg" height="32" width="32"
align="center">  Current Share and Loan Rates</div>
      <div id="app"><img src="../images/loanapp.jpg" height="32" width="32"
align="center">  Loan Application</div>
      <div id="calc"><img src="../images/calc.jpg" height="32" width="32" align="center">
 Loan Calculator</div>
    </div>
   </div>
  <div id="colorbar"></div>
</div>

<div id="middle">

  <div id="content">
    <table height="350" align="center" cellspacing="0" cellpadding="0">
      <tr><td width="150" height="100%" bgcolor="#12AD2B"></td>
        <td width="600" align="left" valign="top" bgcolor="#FFFFFF">
               <!-- #BeginEditable "PageContents" -->

        <!-- #EndEditable -->
               </td>
      </tr>
    </table>

  </div>

  <div id="left">
    <img border="0" src="../images/swoop.jpg" width="150" height="87">
    <div id="leftnav" style="visibility:hidden;">
      <map name="menumap">
        <area shape="rect" coords="0,0,128,33" href="../services/index.htm"
onMouseOver="toggleDiv('memserv',1);document.ms.src='images/ms-on.gif';"
onMouseOut="toggleDiv('memserv',0);document.ms.src='images/ms-off.gif';" alt="MEMBER
SERVICES">
        <area shape="rect" coords="0,33,128,65" href="../savings/index.htm"
onMouseOver="toggleDiv('savings',1);document.sv.src='images/sv-on.gif'"
onMouseOut="toggleDiv('savings',0);document.sv.src='images/sv-off.gif'" alt="SAVINGS">
        <area shape="rect" coords="0,65,128,97" href="../checking/index.htm"
onMouseOver="toggleDiv('checking',1);document.ck.src='images/ck-on.gif'"
onMouseOut="toggleDiv('checking',0);document.ck.src='images/ck-off.gif'" alt="CHECKING">
        <area shape="rect" coords="0,97,128,129" href="../loans/index.htm"
onMouseOver="toggleDiv('loans',1);document.ln.src='images/ln-on.gif'"
onMouseOut="toggleDiv('loans',0);document.ln.src='images/ln-off.gif'" alt="LOANS &
CREDIT">
        <area shape="rect" coords="0,129,128,162"
href="../online/index.htm"onMouseOver="toggleDiv('online',1);document.on.src='images/on-
on.gif'" onMouseOut="toggleDiv('online',0);document.on.src='images/on-off.gif'"
alt="ONLINE SERVICES">
      </map>

      <table cellspacing="0" cellpadding="0" border="0" height="162" width="154"
style="visibility:visible;">
        <tr>
          <td align=left valign=top>
            <img src="../images/menu.gif" height="162" width="128" usemap="#menumap"
border="0">
```

```
          </td>
          <td align=left valign=top height="162" width="26">
            <table cellspacing="0" cellpadding="0" border="0" height="162" width="26">
              <tr><td align=left valign=top height=33 width=26><a
href="../services/index.htm"
onMouseOver="toggleDiv('memserv',1);document.ms.src='images/ms-on.gif';"
onMouseOut="toggleDiv('memserv',0);document.ms.src='images/ms-off.gif';"><img name=ms
src="../images/ms-off.gif" border="0" height=33 width=26 alt="MEMBER
SERVICES"></a></td></tr>
              <tr><td align=left valign=top height=32 width=26><a
href="../savings/index.htm"
onMouseOver="toggleDiv('savings',1);document.sv.src='images/sv-on.gif';"
onMouseOut="toggleDiv('savings',0);document.sv.src='images/sv-off.gif';"><img name=sv
src="../images/sv-off.gif" border="0" height=32 width=26 alt="SAVINGS"></a></td></tr>
              <tr><td align=left valign=top height=32 width=26><a
href="../checking/index.htm"
onMouseOver="toggleDiv('checking',1);document.ck.src='images/ck-on.gif';"
onMouseOut="toggleDiv('checking',0);document.ck.src='images/ck-off.gif';"><img name=ck
src="../images/ck-off.gif" border="0" height=32 width=26 alt="CHECKING"></a></td></tr>
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SERVICES"></a></td></tr>
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onFocus="this.value='';">
               <input type="submit" size="3" value=" ">
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Telco</a></td></tr-->
            <!--tr><td>  <a href="../services/careers.htm">Careers</a></td></tr-->
            <tr><td>  <a href="../services/traveler.htm">Traveler&#145;s
Checks</a></td></tr>
            <tr><td>  <a href="../services/wire.htm">Wire Transfers</a></td></tr>
            <tr><td>  <a href="../services/atm.htm">No Surcharge ATMs</a></td></tr>
            <tr><td>  <a href="../services/notary.htm">Notary Public
Service</a></td></tr>
            <tr><td>  <a href="../services/nitedrop.htm">Night Drop</a></td></tr>
            <tr><td>  <a href="../services/dirdep.htm">Direct Deposit &amp
NetPay</a></td></tr>
            <tr><td>  <a href="../services/safebox.htm">Safety Deposit
Boxes</a></td></tr>
            <tr><td>  <a href="../services/tickets.htm">Theme Park
Tickets</a></td></tr>
            <tr><td>  <a href="../services/moneyord.htm">Money Orders</a></td></tr>
            <!--tr><td>  <a href="../services/tipslink.htm">Useful Tips &amp;
Links</a></td></tr-->
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            <!--tr><td>  <a href="serivces/mem.htm">Membership
Qualification</a></td></tr>
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Works</a></td></tr>
            <tr><td>  <a href="services/join.htm">How to Join</a></td></tr>
            <tr><td>  <a href="online/forms.htm">Membership
Application</a></td></tr-->
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Savings</a></td></tr>
            <tr><td>  <a href="../savings/reserve.htm">Personal
Reserve</a></td></tr>
            <tr><td>  <a href="../savings/club.htm">Special Club
Accounts</a></td></tr>
            <tr><td>  <a href="../savings/youth.htm">Dollar Dog Savings
Club</a></td></tr>
            <tr><td>  <a href="../savings/cds.htm">Share Certificates</a></td></tr>
            <tr><td>  <a href="../savings/ira.htm">Individual Retirement
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            <tr><td>  <a href="../checking/freedom.htm">Freedom Club
Checking</a></td></tr>
            <tr><td>  <a href="../checking/moneymkt.htm">Money Market Plus
Checking</a></td></tr>
            <tr><td>  <a href="../checking/business.htm">Business
Checking</a></td></tr>
            <tr><td>  <a href="../checking/debcard.htm">Smart Cash VISA Debit
Card</a></td></tr>
            <tr><td>  <a href="../checking/ovrdraft.htm">Overdraft Protection
Options</a></td></tr>
            <tr><td>  <a href="../services/atm.htm">No Surcharge ATMs</a></td></tr>
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            <tr><td>  <a href="../loans/vehicle.htm">Vehicle Loans</a></td></tr>
            <tr><td>  <a href="../loans/personal.htm">Personal Loans</a></td></tr>
            <tr><td>  <a href="../loans/mortgage.htm">Mortgage Loans</a></td></tr>
            <tr><td>  <a href="../loans/heloc.htm">Keyline Home Equity</a></td></tr>
            <tr><td>  <a href="../loans/loc.htm">Line of Credit (LOC)</a></td></tr>
            <tr><td>  <a href="../loans/credcard.htm">Credit Cards</a></td></tr>
            <tr><td>  <a href="../online/forms.htm">Loan Application</a></td></tr>
            <tr><td>  <a href="../online/loancalc.htm">Loan Calulator</a></td></tr>
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href="../online/index.htm">Online Services</a></td></tr>
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            <tr><td>  <a href="../online/billpay.htm">Electronic Bill
Payer</a></td></tr>
            <tr><td>  <a href="../online/forms.htm">Applications &amp;
Forms</a></td></tr>
            <!--tr><td>  <a href="../online/chkimg.htm">Check Imaging</a></td></tr--
>
            <tr><td>  <a href="../online/reorder.htm">Reorder Checks</a></td></tr>
            <tr><td>  <a href="../online/loancalc.htm">Loan Calculator</a></td></tr>
            <tr><td>  <a href="../online/max24.htm">MAX 24 Telephone
Banking</a></td></tr>
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window.open("","win",'toolbar=1,location=0,directories=0,status=1,menubar=1,scrollbars=1,
resizable=1,width=500,height=450');' onClick='javascript:alert("You are being directed to
a page outside Telcos web site. Telco has no control over the operation, content or
security of the page you will be visiting.");'>My Travel Wallet</a></td></tr>
            <!--tr><td>  <a href="../online/website.htm">Comments or
Suggestions?</a></td></tr-->
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      <area shape="rect" coords="355,0,480,55" href=http://www.atmallianceone.org/
onClick='javascript:alert("You are being directed to a page outside Telcos web site.
Telco has no control over the operation, content or security of the page you will be
visiting.");' alt="Find a No-Surcharge ATM">
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border="0">
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      </tr>
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          <a href="../tis.htm">Truth in Savings</a> |
          <a href="../disclose.htm">Universal Disclosure</a><br />
        </td>
      </tr>
      <tr><td width="750" height="10"></td></tr>
          <tr>
            <td class="smallprint" align="center" width="750">
                  APR = Annual Percentage Rate     APY = Annual Percentage
Yield
                </td>
          </tr>
      <tr><td width="750" height="10"></td></tr>
    </table>
  </div>
</div>



</td></tr></table>
</body>

</html>
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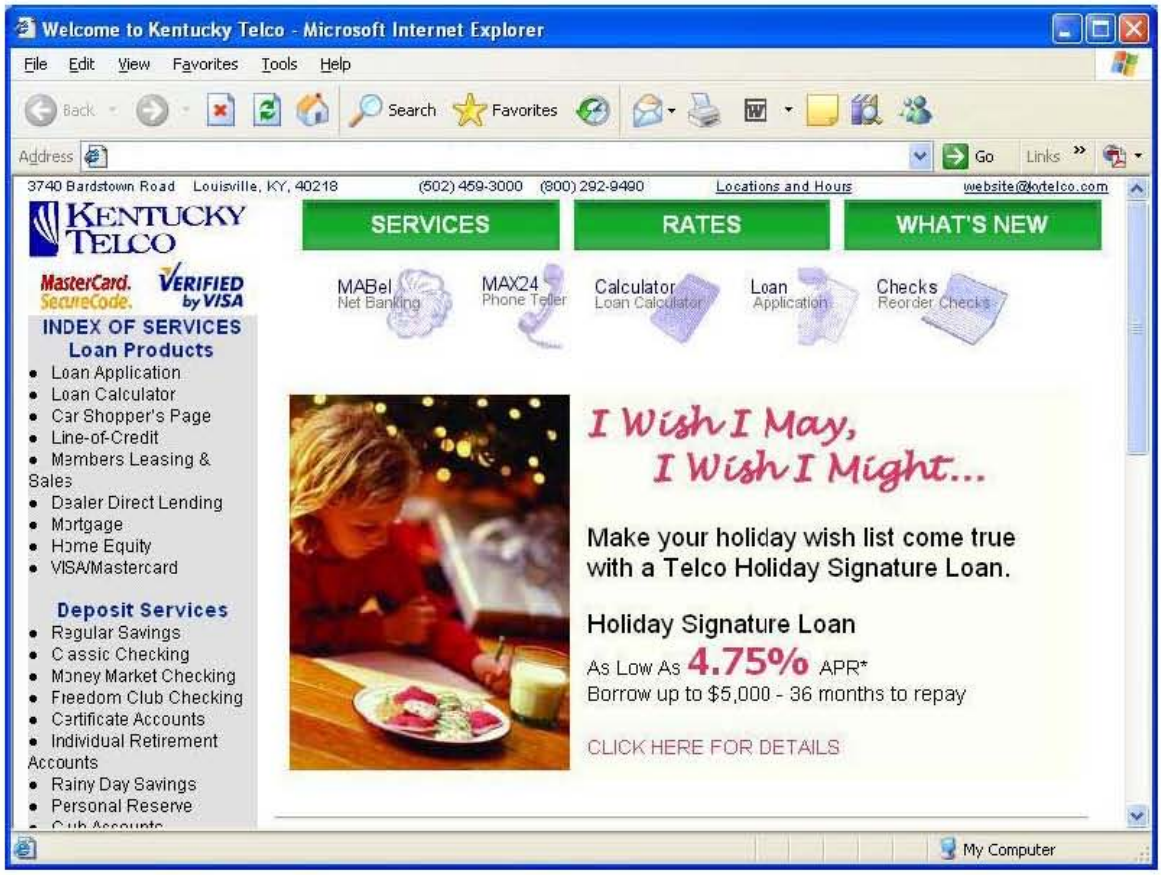
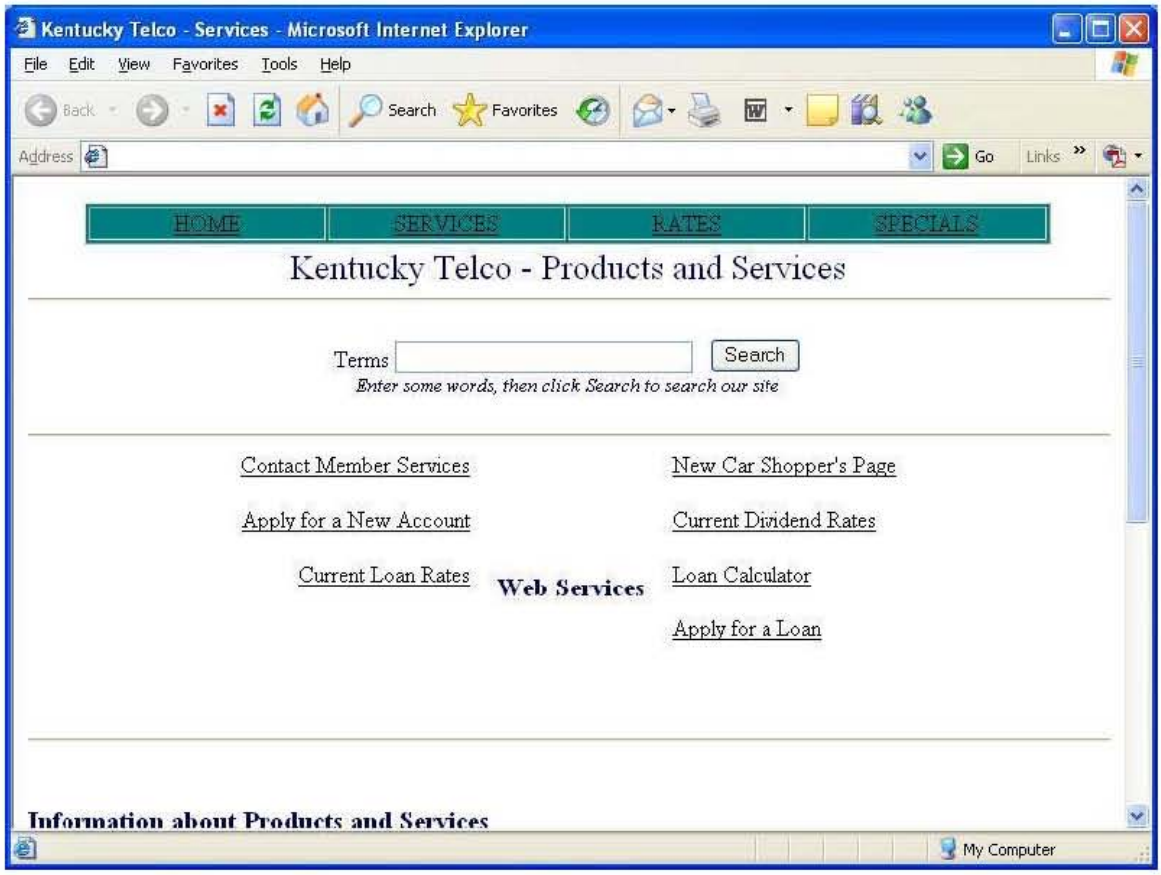
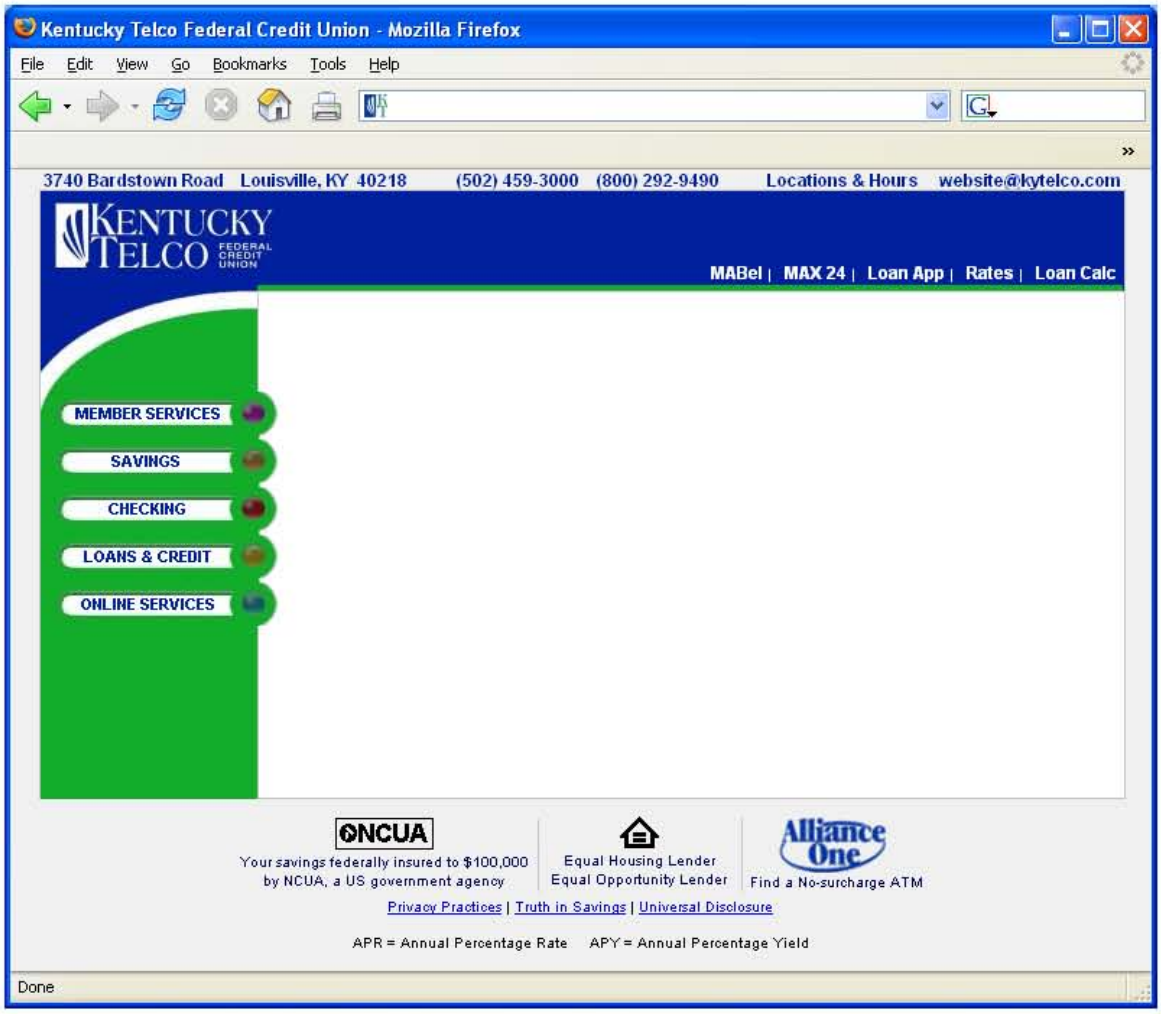
APPENDIX III – OLD SITE MAIN HOME PAGE



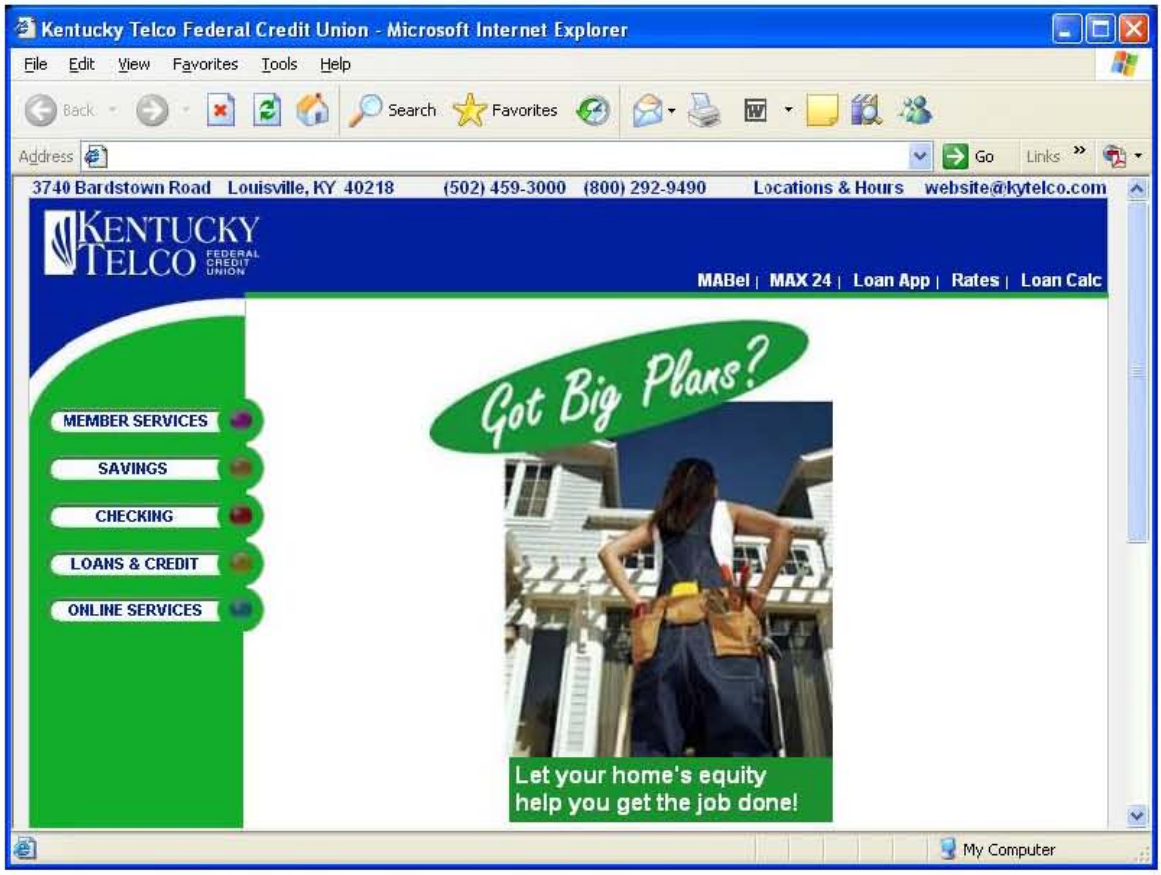
APPENDIX IV – OLD-SITE-0 PAGE



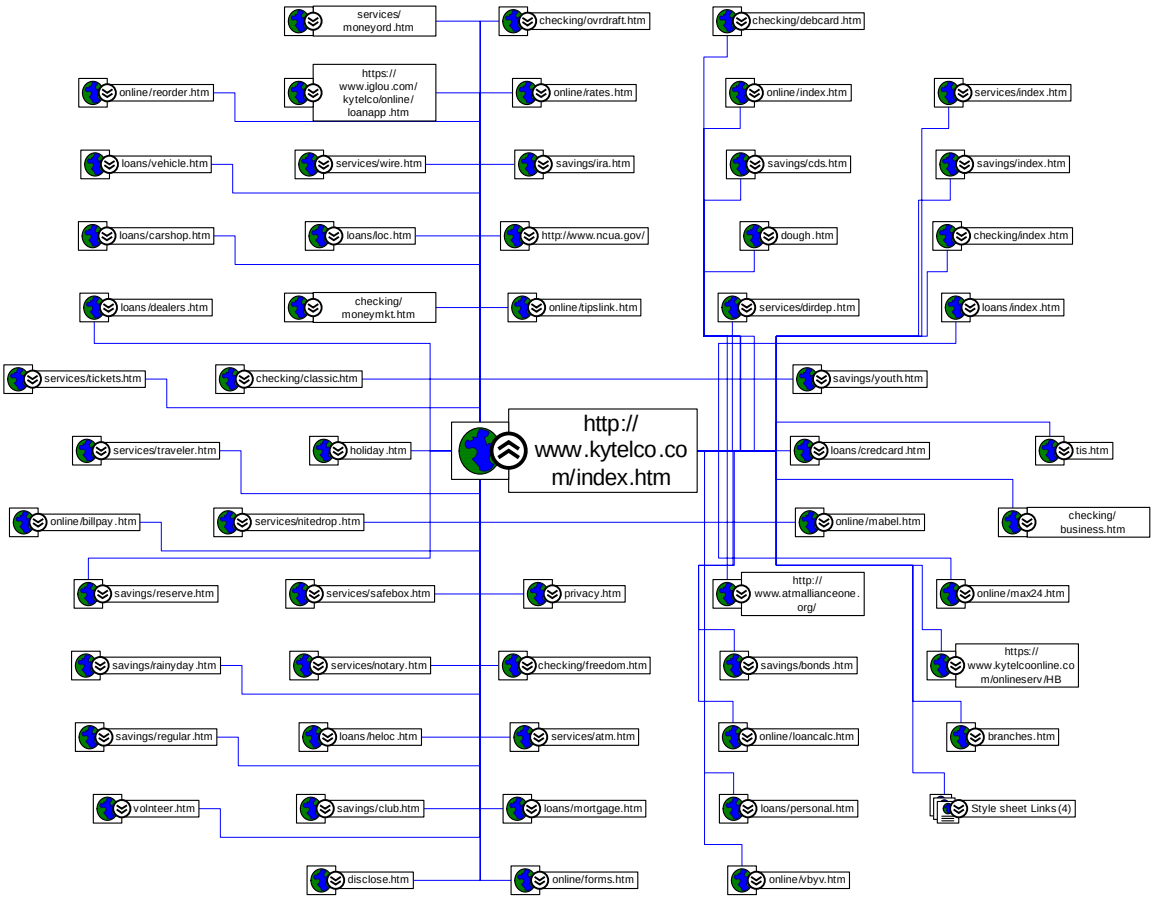
APPENDIX V – NEW SITE ROOT TEMPLATE



APPENDIX VI – NEW SITE MAIN HOME PAGE



APPENDIX VII – SITEMAP DIAGRAM



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VITA

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EDUCATION

May 2004 — University of Louisville,
Speed Scientific School, Louisville, KY
Degree: BS Computer Engineering & Computer Science

TECH SKILLS

Microsoft Windows (98, 2000, XP)
Linux (Fedora Core 4—RedHat)
Microsoft Office (97, 2000, XP, 2003), VBA with Excel
SQL, MySQL, PowerBuilder
C/C++, Java, JSP, XML, VB, Assembly
Dreamweaver, HTML, CSS, JavaScript, Perl
Back-office operations, PC setup, Network support
Setup and use of sound systems

HONORS & ACTIVITIES

Trustee's Academic Scholarship
Kentucky Governor's Scholar

RELEVANT WORK EXPERIENCE

8/03 – 12/05 — Kentucky Telco Federal Credit Union, Louisville, KY
Information Specialist/Network Administrator

- Data processing support of daily and back office operations
- PC setup and installation, troubleshooting, user tech support
- Website management and development

1/01 – 5/01, 8/01 – 12/01, 5/02 – 8/02 — Gallatin Steel Company, Ghent, KY
Information Systems Co-op

- Data integrity
- Database application maintenance and development