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HPML: HYPER PHONE MARKUP LANGUAGE AND ITS APPLICATIONS

Chung-Ming Huang and Ming-Yuhe Jang
Department of Computer Science and Information Engineering
National Cheng Kung University, Tainan, Taiwan, R.O.C.
Email: {huangcm, jangmy}@locust.iie.ncku.edu.tw

ABSTRACT

In this paper, a new concept called "Quality Of Information (QOI)" is proposed. The concept of QOI is that information with different qualities is delivered to the client users depending on the client I/O devices, e.g., computers or telephones. With the QOI concept, people can have the happiness of enjoying versatile WWW application services no matter what I/O devices that people use are. In order to realize the concept of QOI, a hyper phone markup language (HPML) is proposed for specifying the QOI service information over WWW. Additionally, a phone browsing system called Phone Web has been built up to interpret the HPML-based service information. Using the proposed HPML, a home page designer can specify Web pages that are accessible to both telephone-accessed users and computer-accessed users. With the Phone Web system, telephone-accessed users can hear the WWW information from their telephones. Using regular browsers, e.g., Netscape Navigator and Microsoft Internet Explorer, computer-accessed users can read the same information on their computer monitors. In this way, the I/O mechanisms of WWW can be realized using (1) keyboard, mouse, and monitor, or (2) a telephone set. As a result, the concept of QOI is fulfilled in HPML over WWW!

1. INTRODUCTION

With the widespread of Internet, HyperText Mark Up Language (HTML) and World-Wide-web (WWW) have become a common communication backbone in our daily live. Many WWW applications have been established in entertainment domain, human's daily life, career work, etc. In spite of currently existing versatile WWW applications, the future researches on WWW can be divided into two orientations: (1) the enhancement of WWW system performance and (2) the functional extension of WWW applications.

In the research of the enhancement of system performance underlying WWW, there are a lot of papers that focus on how to achieve efficient access and communication in WWW, such as the development of searching [5], caching or prefetching algorithms [6]. In the case of functional extension of WWW applications, the World Wide Web consortium (W3C) strongly promotes a lot of domain-specific and mission-specific applications based on the eXtensible Markup Language (XML) concept [1]. For carrying molecular information, there is a Chemical Markup Language (CML) [2]. In order to specify mathematical information, a Mathematical Markup Language (MathML) is carried out [3]. In the field of handheld device applications such as personal digital assistance (PDA), a Handheld Device Markup Language is proposed [4].

A lot of telephone information services, e.g., 1-800 services, over telephone networks have been established since 10 or more years ago. Currently, a lot of HTML-based WWW information services have been setup. People use telephones (computers) to access telephone (HTML-based WWW) information services. In order to provide information services for various users with different I/O devices over a single platform, i.e., WWW, we propose a new concept that is called "Quality Of Information (QOI)". The concept of QOI is that information with different qualities is delivered to the client users depending on the client I/O devices, e.g., computers or telephones. Different users with different I/O devices receive different quality of information for the same piece of information. A typical example is as follows. APEC International Bank provides foreign exchange rates, which are based on Taiwan dollar, to both computer-accessed users and telephone-accessed users. Using a regular browser, the computer-accessed user X, who retrieves the rate information via WWW, may get the information of foreign exchange rates that are associated with the other content, e.g., the nations' flags that are depicted in Figure 1. With the Phone Web system [7], the telephone-accessed user Y, who gets the rates information via a telephone, may hear the information of foreign exchange rate as follows: "US currency, buying rate, 32.52000, selling rate, 32.62000", etc.

In this paper, to realize the concept of QOI, we define another XML that is called Hyper Phone Markup Language (HPML). HPML that this paper focuses on tries to integrate two application domains, i.e., computer-accessed domain and telephone-accessed domain, into a unified application domain in the sense that any application service in the unified application domain can be accessed either by a telephone set or by a computer. That is, a copy of HPML web page set, which contains the information service for both computer and telephone users, can be accessed either via a telephone set or by a computer. In this way, people can "hear"

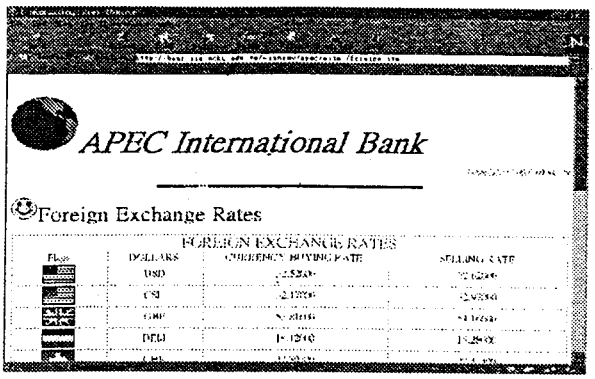

Figure 1: A web page (Foreign Exchange Rates) of the APEC banking service.

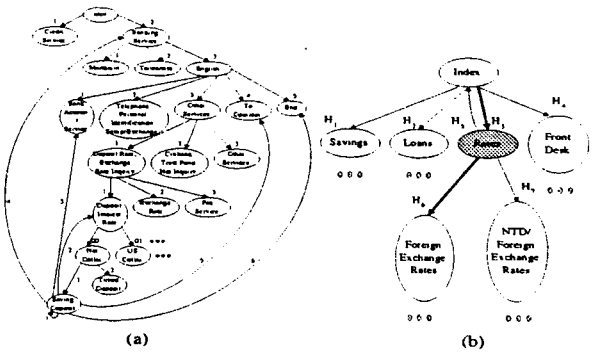

Figure 2: (a) The user behavior in the telephone information system. (b) The user behavior in WWW.

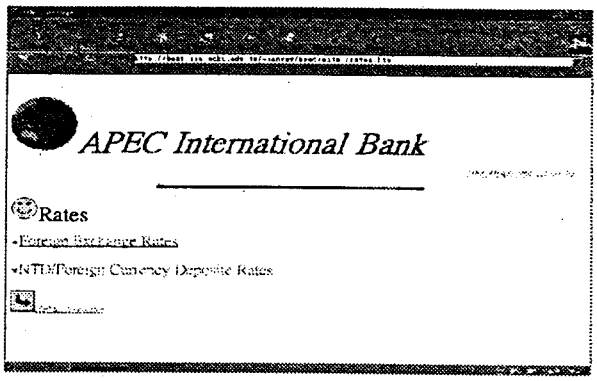

Figure 3: The look of a web page of APEC banking service on Netscape's Navigator.

the rich WWW information in the acoustic form from WWW systems and applications, and can navigate the WWW information using the telephone keypad; people also can use regular browsers, e.g., Internet Explorer (IE) and Netscape Navigator, to navigate the same WWW information.

The remaining of the paper is organized as follows. Section 2 is the preliminary, which introduces the proposed concept "Quality Of Information (QOI)" based on the mergence of telephone-accessed information systems and computer-accessed information systems. Section 3 depicts the content and hyperlink classifications of the web pages that are able to be fetched by both computer-accessed users and telephone-accessed users. Section 4 presents the language structure of HPML. Section 5 has a brief description about the usage of HPML and the Phone Web system for realizing HPML applications. Section 6 depicts examples of the HPML application. Section 7 has conclusion remarks.

2. PRELIMINARY

Some telephone-accessed information systems, e.g., banking service and air line information service, are provided by a lot of business companies since 10 or more years ago. Figure 2-(a) depicts part of the service flow graph of Citibank telephone banking service in Taiwan. In Figure 2-(a), a circle represents a piece of speech that contains (1) the requested information and (2) orally guided information that can direct users to get the following services. For example, in the "root" circle, user can hear the following statement: "If you want to have the credit card service, please dial 1; if you want to have the banking service, please dial 2". An arc that is associated with a number k represents that a user can dial k to get the selected service that is directed by the arc. For example, a user U can select the English service by dialing number 3 when U hears the orally guided information in the "banking service" circle. A user can get his required service following the top-to-down service flow graph. A user can also be back to a service that is located at the upper part of the service flow graph. For example, at the lowest circle that is depicted in Figure 2-(a), after a user U has heard the saving deposit interest rates, U can (1) continue the saving deposit rate by dialing 1, (2) get back to the deposit interest rate service by dialing 2, (3) get back to the bank account service by dialing 3, (4) get back to the banking service by dialing 4, (5) go to the operator service by dialing 5, or (6) end the telephone banking service by dialing 6. In other words, users are allowed to navigate the service flow graph from top to down or from down to top.

In the case of current WWW, the user behavior in WWW is illustrated in Figure 2-(b). In Figure 2-(b), a circle represents a look of a web page that can be interpreted and presented to users by regular browsers, e.g., Microsoft Internet Explorer or Netscape Navigator; an arc stands as a hyperlink, which is provided for users to do navigation if users click it. For example, in the "index" circle (page), users can choose and click hyperlink "H_3" to go to the "Rates" circle (page) after the clicking. That is, the look of the web page "Rates" becomes appeared to users after clicking hyperlink "H_3". Figure 3 shows the look of the web page "Rates" using Netscape Navigator. There are three hyperlinks, i.e., "Foreign Exchange Rates", "NTD/Foriegn Currency Deposite Rates", and "Return to Home", in Figure 3. Users can click any one of the three hyperlinks for viewing the associated page content. A chosen page, e.g., the "Foriegn Exchange Rates" page that is depicted in Figure 1, can have its

look be displayed to users using Netscape Navigator. The user behavior model in WWW is clicking a hyperlink and then reading/hearing the content of clicked page that is played out on a monitor, sound blaster card, or other computer peripherals.

According to the above observation, the user behavior model in a telephone-accessed information system is similar to that in the WWW system. Dialing a number is similar to clicking a hyperlink; hearing the contained information is similar to read/hear the content in a home page.

However, telephone sets have the following characteristics. The I/O behaviors are mainly in the acoustic form with some keystrokes. That is, (1) the output information is in the acoustic format, and (2) the input is achieved by using a series of keystrokes[1], in which, normally, only 12 keys may be available on telephone keypad. (In contrast, there are more than 100 keys in the computer keyboard!) Users can "listen to" the output information that they request, and can input commands by pushing a series of keystrokes using the telephone set.

Since a telephone set can only play out acoustic information, some relations should be derived to map the multimedia information, e.g., text, speech, audio, image, video that are stored in WWW servers, into the acoustic information, e.g., audio and speech, that can be presented to telephone-accessed users. We call the relations as media conversion. In general, media conversion can be realized by the following ways: (1) the WWW information stored in the speech or audio format can be presented to telephone-accessed users directly; (2) the WWW information stored in the text format can be converted into the speech format, which can be achieved by a Text-To-Speech (TTS) converter, such that users can hear it via telephone sets; (3) the WWW information stored in image or video format can be filtered out because it is very hard (or even non-sense) to convert image or video information into the equivalent acoustic information.

In order to realize the media conversion, we propose Hyper Phone Markup Languages (HPML) that provides the appropriate language structure, i.e., content and hyperlink markups, for specifying information in computer and/or telephone uses. Using the appropriate language structure, web page designers can identify and design their HPML web pages for both computer-accessed and telephone-accessed applications. That is, computer-accessed users can use computers with regular HTML-based browsers, e.g., Internet Explorer and Netscape Navigator, to watch HPML-specified web pages; telephone-accessed users can use telephone sets to hear HPML-specified web pages. In this way, a lot of dual-accessed, i.e., both computer-accessed and telephone-accessed, applications, e.g., telephone banking service, 1-800 telephone service, stock information query service, etc., can also be built on WWW.

[1]The other way is the speech style, in which a powerful speech recognition system is adopted. For simplicity, we focus on the keystroke input style.

3. CONTENT AND HYPERLINK CLASSIFICATIONS

A web page consists of several links and content, which can have various looks that are in text or non-text format, e.g., image or graphics, etc. However, not all of the page information, e.g., the image of smiling face depicted in Figure 3, is required to be presented to telephone-accessed users because of the characteristics of telephone sets. The decision of what kinds of information are necessary and meaningful to telephone-accessed users or computer-accessed users is up to the web page designers.

Different kinds of hyperlinks can be identified in web pages. In the hyperlink part of the web page that is depicted in Figure 3, the three hyperlinks, i.e., "Foreign Exchange Rates", "NTD/Foreign Currency Deposit Rats", and "Return to Home", are visible and computer-accessible to computer users using regular browsers. These three hyperlinks should also be hearable by telephone-accessed users for the following navigation. For example, the visible hyperlink "Foreign Exchange Rates" can be mapped and converted into a orally guided statement: "If you want to have the information of foreign exchange rates, please dial 1." The mapping between the visible hyperlinks in computer use and those hearable ones in telephone use should be specified. On the other aspect, computer-accessed users can randomly read some specific interesting information within a web page when the full information of the web page is displayed on the screen. However, this fact is not true for telephone-accessed users because the acoustic information is presented sequentially, like the way of playing a music tape. Therefore, some speech-directed operations, i.e., "hearable but not visible" backward and forward hyperlinkings that are required only in telephone use should be provided for telephone-accessed users to have the following navigation. For example, a "hearable but not visible" backward hyperlinks can be as follows: "If you want to get back to have the information of foreign exchange rates previously presented, please dial 8." These "hearable but not visible" hyperlinks that exist in telephone use are not visible for computer-accessed users, who use regular web browsers, because these hyperlinks are for telephone use only.

Different kinds of content can be identified in web pages. In the content part of the web page that is depicted in Figure 3, (1) it is not suitable to convert the image of the smiling face directly into an oral statement, like "Here is a smiling face", to telephone-accessed users because the information is redundant for telephone-accessed users. Visible information, e.g., the image of smiling face depicted in Figure 3, is appropriate only for computer-accessed users but not for telephone-accessed users; (2) the text segment, "APEC International Bank", can be directly converted to speech for telephone-accessed users. But it sounds better for telephone-accessed users if several welcome words are added to make it a complete sentence, e.g., "Welcome to APEC International Bank". The two added words, i.e., "Welcome to", can be heard by telephone-accessed users but not necessary to be visible on regular web browsers, e.g., Internet Explorer and Netscape Navigator. Meanwhile, the text segment "APEC International Bank" keeps no change and is visible to regular web browsers as it is; (3) it is awkward to orally present the tabulated informa-

tion, e.g., the content that is depicted in Figure 1, to telephone-accessed users. To resolve the problem, appropriate content markups should be provided for specifying the tabulated information, which are suitable for telephone-accessed and also can be smoothly understood by telephone-accessed users; (4) some text segments, which are visible to regular web browsers, can be directly converted to speech for telephone-accessed users if they are complete sentences and contain the key information of the page's subject.

Based on the above illustration, the contents of a web page, which are written in HPML specifications, are classified into four parts: (1) The content that is only presented to telephone-accessed users, (2) The content that is only presented to computer-accessed users, (3) The content that can be presented to both computer-accessed and telephone-accessed users, and (4) The content that is presented neither to computer-accessed users nor to telephone-accessed users.

The fourth content type is in fact the comment part in an HPML specification.

To have more flexibility, hyperlinks that are written in HPML are classified into three types: (1) The hyperlinks that are accessed only by telephone-accessed users, (2) The hyperlinks that are accessed only by computer-accessed users, and (3) The hyperlinks that can be accessed by both computer-accessed and telephone-accessed users.

4. LANGUAGE STRUCTURE

To specify the content into four types and hyperlinks in three types, appropriate markup delimiters should be provided to delimitate the types of content and the types of hyperlinks in a web page. As a result, four types of markup delimiters are defined in the language structure of HPML.

(1) HPML type: For the HPML browser[2], markup delimiters of the HPML type are interpreted as to invoke the corresponding telephone-accessed reactions. On the contrast, these markup delimiters of the HPML type are considered as just some comments for the regular HTML-based WWW browsers.

(2) HTML type: For the existing HTML-based browsers, markup delimiters of the HTML type are interpreted as to invoke the regular computer-accessed reactions. These markup delimiters are skipped and are interpreted as to do nothing in the HPML browser.

(3) Dual type: Markup delimiters of the Dual type are interpreted as to invoke the corresponding reactions by both regular HTML-based browsers and the HPML browser. That is, markup delimiters of the Dual type are interpreted as to invoke the corresponding computer-accessed reactions by regular HTML-based WWW browsers; markup delimiters of the Dual type are interpreted as to invoke the telephone-accessed reactions by the HPML browser.

(4) Comment type: Markup delimiters of the Comment type are interpreted as just some comments by both HTML-based and HPML browsers.

Among these four classes of markup delimiters, Type (1) and Type (3) are interpreted as to invoke the telephone-accessed reactions in the HPML browsing system. From one viewpoint, augmenting Type (1) and Type (3) markup delimiters to an HTML-written home page, the augmented HTML page can become interpretable by the HPML browser. From the other viewpoint, an augmented HTML home page using these four classes of markup delimiters becomes an HPML home page.

The principle of processing web page specifications is as follows. The regular HTML-based browser, which is for computer-accessed users, skips specifications within special markup delimiters that are not interpretable but interprets specifications that are not within special markup delimiters.The HPML browser, which is for telephone-accessed users, skips specifications that are not within special markup delimiters but interprets specifications that are within special markup delimiters. In this way, web page designers can prepare one set of home pages that can be accessed by both computer-accessed and telephone-accessed users.

4.1 Hyperlink Markups

Hyperlinks embedded in an HPML web page can be divided into three classes, i.e., HPML type, HTML type, and Dual type. To have a brief explanation, A stands for a computer-accessed user, and B stands for a telephone-accessed user in the sub-Section.

Since B just can "listen to" the hearable hyperlinks, in addition to the key mapping between the addresses of URLs and keystrokes, the language structure of HPML should also provides some acoustic information scheme, e.g., some aural statement embedded in hyperlinks, which B can listen to. Aural statements are either character strings, which can be converted into speech, or in the speech format. The aural statement can lead B to input correct keystrokes to reach what B would like to navigate, i.e., the following requested HPML web pages. For example, an aural statement for guiding telephone-accessed users to select the hyperlink of "Foreigen Exchange Rates", which is depicted in Figure 3, can be specified as follows: "If you want to have the information about current Foreign Exchange Rates, please dial 1".

In the following part, markup delimiters for three classes, i.e., HPML type, HTML type, and Dual type, of hyperlinks are explained in detail.

HPML type:

The hyperlink of HPML type is represented as $' <!Voice...key = "x" oralguide = "y" >'$, in which $<!Voice...$ indicates that it is a hyperlink for telephone-accessed users, "x" represents the corresponding keystroke x on the telephone keypad for the hyperlink, and "y" is the aural statement. Computer-accessed

[2]For simplicity, the HPML browser denotes the browsing system Phone Web that is adopted for telephone-accessed users; the regular browser denotes the HTML-based browsing system that is adopted for computer-accessed users.

users cannot access the hyperlink because the regular HTML browser interprets the markup delimiters as some comments and just skips this specification.

- An example:
  $<!VOICE$ $HREF$ = "*http : // bear.iie.ncku.edu.tw/ ~jangmy/apec/ehtml/rates.htm*" KEY = "9" *OralGuide* = "If you want to get this page's information again, please dial 9." >

With the example mentioned above, $<!VOICE$ $HREF$ = "*http : //bear.iie.ncku.edu.tw/ ~ jangmy/ apec/ehtml/rates.htm*" indicates the URL address of the linked HPML web page; KEY = "9" identifies that keystroke 9 represents the associated hyperlink; *OralGuide* = " If you want to get this page's information again, please dial 9." specifies the aural statement that is able to lead telephone-accessed users to input the correct keystroke, i.e., keystroke 9. The sentence, " If you want to get this page's information again, please dial 9.", can be converted to speech using a TTS converter. In this way, B can be guided to input keystroke 9 to visit the page again after B has heard the aural statement.

HTML type:

HPML browser can skip the interpretation of hyperlinks of HTML type. Thus telephone-accessed users can skip the hyperlink information of the HTML type.

- An example:
  $<$ *A* $HREF$ = "*http : //bear.iie.ncku.edu.tw/ ~jangmy/apec/ehtml/rates.htm*" > Foreign Exchange Rates $<$ */A* >

The above hyperlink specification of the HTML type is valid in current HTML-based browsers. The HPML browser would skip the interpretation of the hyperlinks of HTML type because there is no special markup delimiters.

Dual type:

The hyperlink of Dual type can be derived by adding KEY and *OralGuide* clauses into an HTML hyperlink. The HTML hyperlink that associates with both the KEY clause and *OralGuide* clause, which specify the correct telephone keystroke and the aural statement respectively, characterizes itself as Dual type. In this way, an HPML browser can identify hyperlinks of the Dual type according to the two clauses KEY and *OralGuide*; a regular HTML-based browser can skip the interpretation of the two clauses KEY = "x" and *OralGuide* = "y" because a regular HTML-based browser just presents the interpretable part of the hyperlink specification to computer-accessed users.

- An example:
  $<$ *A* $HREF$ = "*http : //bear.iie.ncku.edu.tw/ ~ jangmy/apec/ehtml/foreign.htm*" KEY = "1" *OralGuide* = "If you want to get the current information of Foreign Exchange Rates, please dial 1." > Foreign Exchange Rates $<$ */A* >

With the example mentioned above, both KEY and *OralGuide* clauses are added in the anchor $<$ *A* $HREF$ = *http : //bear.iie.ncku.edu.tw/ ~ jangmy/apec/foreign.htm* >, where the anchor contains the URL address of the linked HPML web page; KEY = "1" identifies that keystroke 1 represents the associated hyperlink; *OralGuide* = " If you want to get the current information of Foreign Exchange Rates, please dial 1." specifies the aural statement that is able to lead telephone-accessed users to input the correct keystroke, i.e., keystroke 1. The sentence, " If you want to get the current information of Foreign Exchange Rates, please dial 1.", can be converted to speech using a TTS converter. Thus, telephone-accessed users, e.g., B, can be guided to input keystroke 1 to visit the linked page after B has heard the aural statement. On the other hand, a regular HTML-based browser can skip the interpretation of the two clauses KEY = "1" and *OralGuide* = " If you want to get the current information of Foreign Exchange Rates, please dial 1." A regular HTML-based browser just presents the interpretable part, i.e., $<$ *A* $HREF$ = "*http : //bear.iie.ncku.edu.tw/ ~ jangmy/apec/ehtml/foreign.htm*" > Foreign Exchange Rates $<$ */A* >, of the hyperlink specification to computer-accessed users. In this way, a copy of the hyperlink specification can be accessed by both computer-accessed users and telephone-accessed users.

4.2 Content Markups

The content of an HPML web page can be divided into four classes, i.e., HPML type, HTML type, Dual type, and Comment type. To have convenient explanation, A stands for a computer-accessed user, and B stands for a telephone-accessed user in the sub-Section.

HPML type:

String $<!SPEECH$ = "x" > is adopted to stand for the content of HPML type, in which "x" is the piece of information that is presented to telephone-accessed users. Computer-accessed users cannot access the information because the regular HTML-based browser interprets this markup delimiters as some comments and just skips this specification.

- An example:
  $<!SPEECH$ = "Welcome to APEC International Bank!" >

With the example mentioned above $<!SPEECH$ = " Welcome to APEC International Bank!" > describes a piece of welcome information in banking service that is presented to telephone-accessed users. The string " Welcome to APEC International Bank!" is converted to an equivalent speech using a TTS converter. The piece of information is not visible to computer-accessed users using a regular HTML-based browser because it is regarded as a comment specification.

HTML type:

Any character string containing no special or control symbol, e.g., ' <', '!', ' >', '/', ' :', '&', '+',

' =', etc., that stands for the content information of HTML type can be presented to computer-accessed users. Telephone-accessed users cannot access the information because the HPML browser skips the interpretation of strings without special markup delimiters.

- An example:
  'APEC International Bank'

With the example mentioned above, ' APEC International Bank ' describes the bank's title information that is presented to computer-accessed users. A regular HTML-based browser can view the string as an interpretable part to computer-accessed users. However, the HPML browser just skips the interpretation of the string ' APEC International Bank ' because there is no special markups.

Dual type:

String <!*COMMON* > *token* < /*COMMON* > represents a piece of content of the Dual type, in which 'token' carries the information to be presented to both computer-accessed users and telephone-accessed users. The HPML browser can delimit and interpret the piece of information carried in *token* according to the pair of markup tags, <!*COMMON* > and < /*COMMON* >; a regular HTML-based browser skips the interpretation of what <!*COMMON* > and < /*COMMON* > mean and just does the interpretation of the information carried in *token*. Thus, computer-accessed users and telephone-accessed users can obtain the content of Dual type.

- An example:
  <!*COMMON* > APEC International Bank < /*COMMON* >

With the above example, a regular HTML-based browser can present the string ' APEC International Bank ' to computer-accessed users and skip the interpretation of <!*COMMON* > and < /*COMMON* >, which are regarded as comments in regular HTML-based browser. The HPML browser can delimit the piece of information as an interpretable part with the pair <!*COMMON* > and < /*COMMON* >, and can convert "APEC International Bank" to an equivalent speech using the TTS converter. In this way, telephone-accessed users (computer-accessed users) can hear (watch) the piece of information carried in the content with the Dual type.

Comment type:

Markup delimiters of the Comment type are interpreted as just some comments to both HTML-based and HPML browsers. The content of the Comment type is the standard comment for regular web browsers, i.e., the text between the pair of ' <!– –' and ' – – >'.

- An example:
  <! – – APEC International Bank – – >

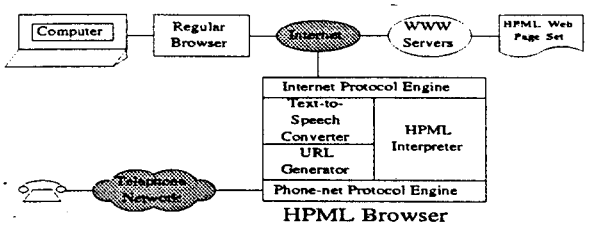

Figure 4: The configuration of Phone Web system.

5. PHONE WEB SYSTEM AND ITS USAGE

Based on the proposed HPML, a browsing system called Phone Web has been built up to interpret HPML-based service information. The kernel part of the Phone Web system is the HPML browser. The HPML browser is a bridge between Internet and the telephone network. Figure 4 depicts the configuration of Phone Web system. A computer-accessed user using a regular browser can access the HPML web page through an IP connection that is setup from the client site to the remote server site. A telephone-accessed user using an HPML browser can access the same web page through a connection that is setup from the telephone set to the remote WWW server via an ISP or an individual company that installs the HPML browser. Main components of the HPML browser are (1) two protocol engines, i.e., (i) a phone-net protocol engine that deals with transmitting messages over the telephone network and (ii) an Internet protocol engine that deals with transmitting messages over Internet, (2) an URL generator that is in charge of generating URLs of the selected hyperlinks, (3) a media converter, i.e., Text-to-Speech converter, that converts the retrieved text into the corresponding oral statement to be hearable to telephone users and (4) an HPML interpreter that is in charge of parsing HPML specifications. Because of the length limitation in publication, the details of the HPML Browser contained in Phone Web System is not included in this publication. Interested readers can find more details of the HPML Browser in the reference [7].

A possible usage scenario of an HPML-based service is as follows. Let the NCKU ISP company have the service TEL 2757575, and have the following 5 URL services:
(1) NCKU WWW System: http://www.ncku.edu.tw
(2) CNA RealTime News : http://www.sinanet.com/rtn
(3) Taiwan Central Weather Bureau: http://www.cwb.gov.tw
(4) Taiwan Headline News: http://www.sinanet.com/news
(5) Taiwan Stock Exchange: http://www.tse.com.tw
(6) Other WWW Servers

When a user X dials 2757575 and is successfully connected with NCKU ISP company, X can hear the following speech:

"Welcome to the NCKU ISP HPML system. If you want to connect to National Cheng Kung University's WWW System, please dial 1; if you want to connect

to CNA RealTime News WWW System, please dial 2; if you want to connect to Taiwan Central Weather Bureau, please dial 3; if you want to connect to Taiwan Headline News, please dial 4; if you want to connect to Taiwan Stock Exchange WWW System, please dial 5; if you want to connect to other WWW servers using the URL input mode, please dial 6."

Initially, the system operates in its menu select mode for user X. If user X selects the URL input mode, i.e., X dials 6, the system enters into its URL input mode and X can hear the following speech:

"Welcome to the URL input mode. Please dial the Star sign (*) before key in the URL address. Please end with a Prompt sign (♯) when finish entering the URL address."

6. APPLICATION EXAMPLE: BYE BYE 1-800, I LOVE HPML - A TELEPHONE-ACCESSED BANKING SERVICE OVER WWW

Based on the underlying Phone Web system, the proposed HPML can be applied to many applications. A typical application of HPML is replacing 1-800-like services over WWW. Let APEC International Bank allocate a set of HPML browsing system in each its branch office, in which each telephone area code's covered area has at least one branch office. APEC International Bank's computer center, which is in charge of the telephone banking services, is located in New York City. Customers in the other places, i.e., L. A., Seattle, Tokyo, Taipei, Djakarta, etc., can have local phone call to their local APEC International Bank to have the telephone Banking services. In this way, APEC International Bank can save a lot of money for the 1-800 collect calls, and customers only pay local call rate for their calls.

For simplicity, we use the web pages depicted in Figure 1 and Figure 3 to illustrate the HPML specifications. One can have the web pages of the Banking Service, e.g., the home pages depicted in Figure 1 and Figure 3, to be both telephone-accessed and computer-accessed over WWW using the proposed HPML markups. To have convenient explanation, the HPML specification depicted in Figure 5 (6), which is numbered line by line for the web page depicted in Figure 3 (1).

The hyperlink part of the web page is explained as follows:

(1) The hyperlink "Foreign Exchange Rates" is vision-based and computer-accessed in regular browsers. However, it should be presented to telephone-accessed users in the acoustic form for users' next navigating. This hyperlink specification can be specified by the hyperlink markup of the Dual type. Therefore, the corresponding HTML code, i.e., $< a\ href = "foreign.htm" >$ Foreign Exchange Rates $< /a >$, is modified to $< a\ href = "foreign.htm"\ KEY = "1"\ OralGuide = "If\ you\ want\ to\ get\ the\ current\ information\ of\ Foreign\ Exchange\ Rates,\ please\ dial\ 1." > Foreign\ Exchange\ Rates < /a >$, which is specified in lines 24 and 25 of Figure 5. In this way, the hyperlink is visible to computer-accessed users as that it is using regular web browsers, while the corresponding hyperlink in telephone use is hearable to telephone-accessed users. Similarly, the other two vision-based hyperlinks, i.e., "NTD/Foreign Currency Deposit Rats" and "Return to Home", can be specified into the hyperlinks of the Dual type, which are depicted in (i) lines 29 and 30, and (ii) lines 33 and 34 respectively of Figure 5.

```
Line 1   <html>
Line 2   <head>
Line 3   <meta http-equiv="Content-Type" content="text/html; charset=big5">
Line 4   <title>Rates</title>
Line 5   <meta name="Microsoft Theme" content="none, default">
Line 6   <meta name="Microsoft Border" content="none">
Line 7   </head>
Line 8   <body>
Line 9   <p>  </p>
Line 10    <!COMMON>
Line 11  <h1 align="left"><img src=" ./images/Eanthani.gif" width="117" height="113"
Line 12  alt="Eanthani.gif (10689 bytes)"><font face="Arial" color="#0000FF"><big><em>      <!speech="Welcom to">  APEC International
         Bank </em></big></font></h1>
Line 14    </COMMON>
Line 15  <p align="right"><font face="Arial" color="#0000FF"><em><!--webbot bot="Timestamp"
Line 16  S-Type="REGENERATED" S-Format="%Y/%m/%d %p %I:%M:%S" --></em></font></p>
Line 17    <!speech="Different rates support different financial policies you need!">
Line 18  <p align="center"><img src=" ./images/Sfidbar.gif" width="466" height="5" alt="Sfidbar.gif (5636 bytes)"></p>
Line 19
Line 20  <h1 align="left"><img src=" ./images/Smiling.gif" alt="Smiling.gif (1578 bytes)"
Line 21  WIDTH="48" HEIGHT="48"><font face="Times New Roman">Rates</font></h1>
Line 22
Line 23  <p align="left"><img src=" ./images/TBALL.GIF" alt="TBALL.GIF (1653 bytes)" WIDTH="14"
Line 24  HEIGHT="14"><font face="Times New Roman" color="#8000FF"><big><big><a href="foreign.htm"          KEY="1" OralGuide="If
         you want to get the current information of Foreign Exchange Rates, please dial 1."          >Foreign Exchange Rates</a></big></
Line 26  big></font></p>
Line 27
Line 28  <p align="left"><img src=" ./images/TBALL.GIF" alt="TBALL.GIF (1653 bytes)" WIDTH="14"
Line 29  HEIGHT="14"><big><font color="#000080" face="Times New Roman"><a href="ntforeign.htm"          KEY="2" OralGuide="If you
         want to get the current information of NT Dollars for Foreign Currency Deposit Rates, please dial 2."          ><big>NTD/Foreign
Line 31  Currency Deposit Rates</big></a></font></big></p>
Line 32    <!speech="Entering an URL you need using the URL input mode, please dial 6.">
Line 33  <p align="left"><em><font face="Times New Roman"><a href="index.htm"          KEY="9" OralGuide="If you want to      return to
         home page! Please dial 9."  ><img src=" ./images/RETURNER.GIF" width="39" height="40" alt="RETURNER.GIF (1353
Line 35  bytes)">Return to Home</a></font></em></p>
Line 36    <!VOICE HREF="bank.htm" KEY="9" OralGuide="If you want to return to previous page! Please dial 9.">
Line 37  </body>
Line 38  </html>
```

Figure 5: The HPML specification of the web page depicted in Figure 3.

(2) Some speech-directed operations, i.e., backward and forward hyperlinkings that are required in telephone use, should be provided for telephone-accessed users to assist the navigating. These speech-directed hyperlinkings that are required in telephone use are not visible on regular web browsers because they are telephone use only. In this case, hyperlinks of the HPML type can be adopted. For example, the specification of hyperlink, $<!VOICE\ HREF = "bank.htm"\ KEY = "9"\ OralGuide = "If\ you\ want\ to\ return\ to\ the\ previous\ page,\ please\ dial\ 9.">$, which is specified in line 36 of Figure 5, is not visible to regular browsers and is for telephone use only.

The content part of the web page is explained as follows:

(1) It is not required to convert the image of smiling face, which is depicted in Figure 3, to an oral statement, e.g., "Here is a smiling face", to telephone-accessed users because it is redundant for telephone-accessed users. The specification of the HTML type in lines 20 and 21 of Figure 5, i.e., $< imgsrc = "../images/Smiling.gif"\ alt="Smiling.gif\ (1578\ bytes)"\ WIDTH="48">...$, that is associated with the image of smiling face, is skipped for the interpretation.

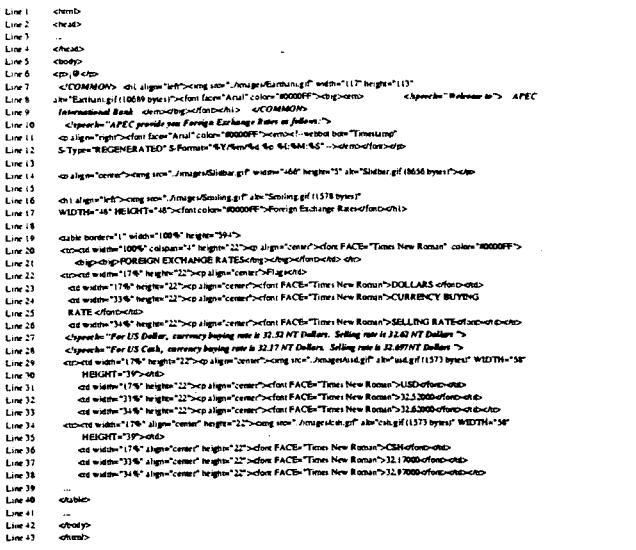

Figure 6: The HPML specification of the web page depicted in Figure 1.

(2) In lines 12 and 13 of Figure 5, text segment "APEC International Bank", which belongs to the content of the HPML type, can be hearable to telephone-accessed users. But the text segment sounds better for telephone use if several welcome words are decked using <!*speech = "Welcome to"*> markup of the HPML type. The two decked words, i.e., "Welcome to", can be heard by telephone-accessed users but not able to be visible on regular web browsers, e.g., Microsoft Internet Explorer and Netscape Navigator. A page designer can make use of the <!*speech* = "x" > markup of the HPML type to specify the augmented information to make the page more comprehensive in telephone use. For example, the italicized code, <!*speech = "Different rates support different financial polices you need!"*>, that is in line 17 of Figure 5; the another italicized code, <!*speech = "APEC provide you Foreign Exchange Rates as follows:"*>, that is in line 10 of Figure 6.

On the other aspect, it is not straightforward to play out the tabulated information depicted in Figure 1 to telephone-accessed users. To resolve the problem, HPML provides page designers appropriate content markups for specifying the tabulated information to be telephone-accessible and to be understandable by telephone-accessed users. A sequence of brief acoustic statements are specified in Figure 6 using <!*speech* = "x" > markup of the HPML type: (i) <!*speech = "For US Dollar, currency buying rate is 32.52 NT Dollars. Selling rate is 32.62 NT Dollars"*> in line 27, and (ii) <!*speech = "For US Cash, currency buying rate is 32.17 NT Dollars. Selling rate is 32.697 NT Dollars"*> in line 28. These two acoustic statements correspond to the two tabular entries that appear on the tabulated information, which is depicted in Figure 3, generated by using regular browsers.

(3) In lines 7, 8, and 9 of Figure 6, text segment "APEC International Bank" is specified as the content of the Dual type, which is surrounded by the pair of <!*COMMON* > and < /*COMMON* >, in order to be visible and hearable to both computer-accessed users and telephone-accessed users.

(4) The remaining part of the specification that is depicted in Figure 6 is skipped for interpretation in the HPML browser but can be interpretable in regular browsers.

7. CONCLUSION

Since WWW is becoming part of our daily life in the near future, some improvements should be made such that WWW can be accessed no matter who they are and no matter where they are. The main characteristic and the main challenge that we have overcome for the HPML design is that adopting HPML specifications in the current WWW servers would not disturb the use of current HTML-based browsers. In this way, telephone-accessed users and computer-accessed users can get the corresponding information based on a single copy of a web page specification.

The proposed HPML is designed for both computer-accessed and telephone-accessed applications. The usage of HPML is multi-purpose. HPML can be domain specific use, e.g., replacing 1-800-like service over WWW; HPML can also provide generic domain service, e.g., allowing people to access WWW using telephone sets. Based on HPML, users can hear WWW information using telephone sets. In this way, the I/O mechanisms of WWW can be realized using (1) keyboard, mouse, and monitor, or (2) a telephone set. As a result, people can access WWW application services everywhere as long as there is a telephone set!

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