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WebViews:Accessing Personalized Web Content and Services

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The Ubiquitous Web

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Lots of promises and expectations:

- "Mobile and wireless computing will dominate the Internet industry", *CACM, March 2001*
- "More than 74 million cell phones are in use in the U.S. today, a figure that will rise to 139 million by 2003", *IDC, Nov 2000*
- "The number of wireless data subscribers in the US will explode from 3 million in 1998 to 49 million in 2003 to 78 million in 2004 to 124 million in 2005.", *Gartner Dataquest, April 2001*

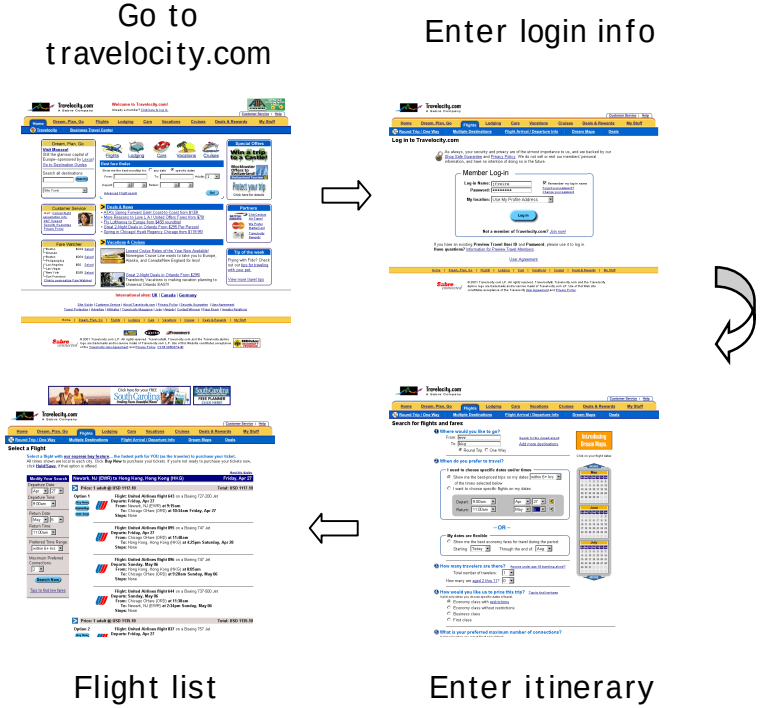
Reality:

- "Wireless Net desperately seeking content providers", *news.com, Dec 1999*
- "What is available is slow, text-based access to a relatively small number of sites", *news.com, January 2001*
- "6.6 million people worldwide subscribed to Internet wireless services in 1999", *Banc of America Securities*

Web pages became very complex

- Almost 90 different actions (85 links and 3 forms)
- 96 gif images
- ~113 lines of JavaScript code
- ~570 lines of HTML

Web navigation became very complex



Find lowest fares at Travelocity

Problems:

- many interactions are needed: 4 pages retrieved, ~400Kb transferred
- lots of irrelevant data and irrelevant choices
- data needs to be input over and over again
- this can be inconvenient from a desktop

Problem is worse from a PDA...

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- Scenario:
  - network: Omnisky wireless data services over CDPD with throughput rates from 5-6kbps up to 12-13kbps
  - time to access flight list: 30-80secs (xfer only)
  - screen size: 160x160 pixels on a 6x6cm surface
  - input: pen-based
- Try to access Travelocity.com:
  - impossible: *ProxiWeb and AvantGo can't handle required features*
  - very slow: *BrowseIt gets there, but after many minutes (and sometimes it times out…)*
  - too many choices: *hard to locate links and forms*

Web Anytime, Anywhere

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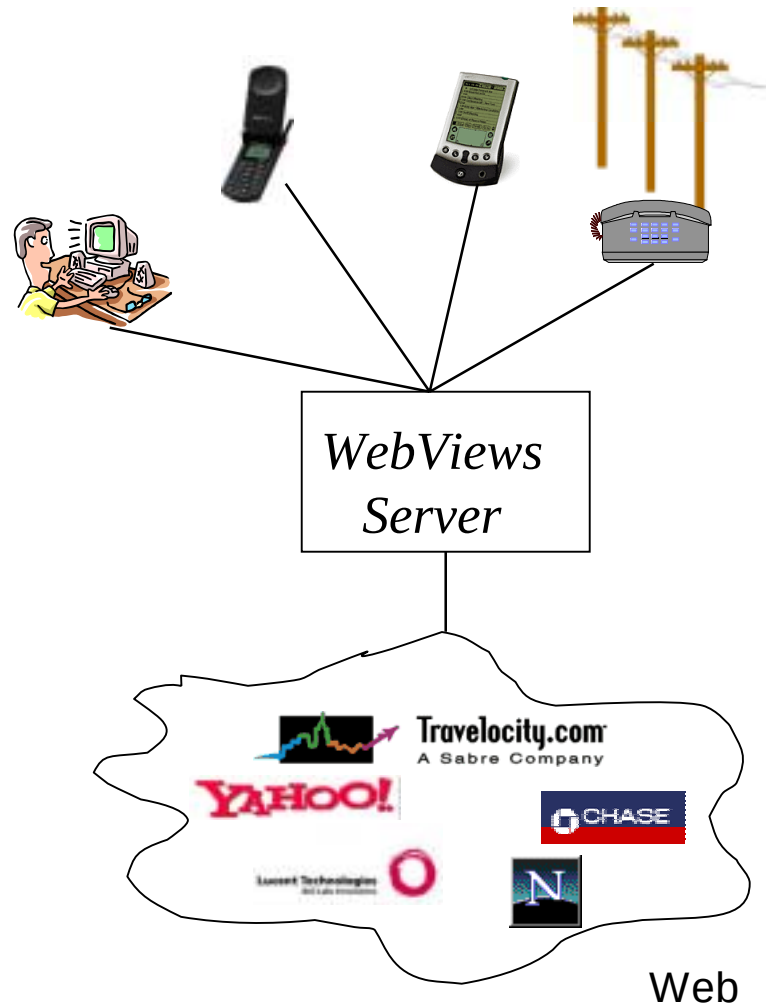
- A lot of hype!
- Internet/WWW was not designed to be viewed/accessed by diverse devices with:
  - limited processing power and memory
  - restricted power consumption
  - small screens, or no screens
  - different input/output devices (e.g., stylus, voice)

	Phone	Palm Pilot	Typical laptop
Screen size	N/A	160x160 (6x6cm)	1024/768 (13.1")
Bandwidth	N/A	9-19kbps (5-15kbps)	56kbps
Input/ Output	Keypad and Voice/ Voice	Grafitti/ Subset of HTML	Keyboard/ HTML,XML ...
Processor	N/A	16-20Mhz	600Mhz
Memory	N/A	8MB	128MB

The Web is just too complex

WebViews: The personal Web simplifier

- A system for creating *simplified* and *personalized* *views* of Web sites that can be accessed from various devices
- Enable *rapid deployment* of *personalized* services that can be accessed from diverse terminals



Features

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- Requires no cooperation from Web sites
- Easy to create, easy to maintain: no programming required
  - beats re-engineering Web sites or creating specialized wrappers (*e.g., everypath.com, oraclemobile.com*)
- Wide coverage: access to virtually any Web site, and from many different devices
  - beats wireless/voice portals: *e.g., Audiopoint, BeVocal, Quack, TellMe* that provide access a limited number of sites (e.g., news, weather, driving directions)
- Personalized access
  - beats proxies that filter/reformat content and provide no personalization or customization *e.g., ProxiWeb, PhoneBrowser*
- Simplifies transcoding

Some examples of Web views

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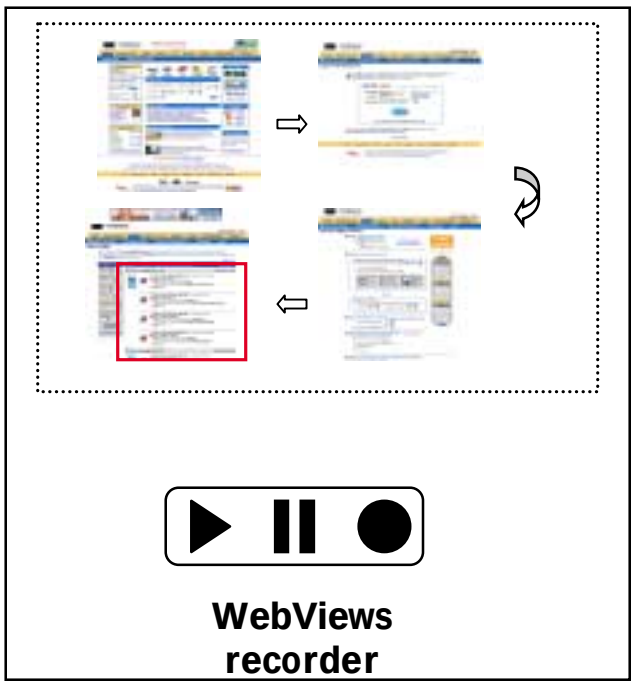
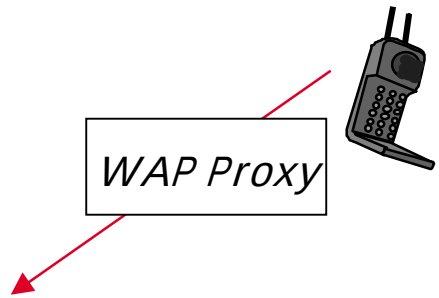
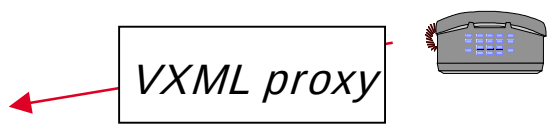
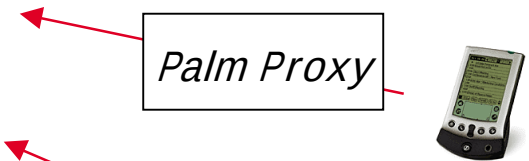
- Travelocity fares to Hong Kong
- Houses for sale in Summit, NJ
- BMWs for sale in NY/NJ/CT
- Account balance at Fidelity
- Webster's thesaurus
- Weather in Murray Hill, NJ
- Lucent's employee directory
- etc….

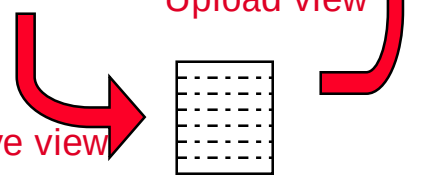
Creating a Web view of Travelocity

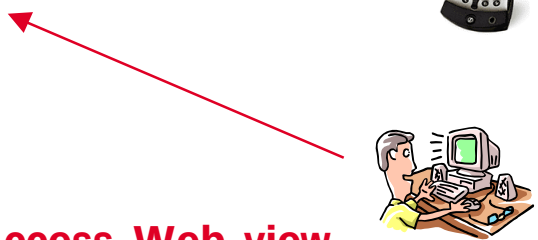












Create Web view

"Juliana's lowest fares to Hong Kong"

Access Web view

Accessing the Travelocity WebView from a PDA

Flight list

Price: 1 adult @ USD 829.10
Flight: Continental Airlines flight 99 on a Boeing 777 Jet
Departs: Friday, Apr 27
From: Newark, NJ (EWR) at 11:35am
To: Hong Kong, Hong Kong (HKG) at 3:15pm Saturday, Apr 28
Stops: None

Flight: Continental Airlines flight 98 on a Boeing 777 Jet
Departs: Saturday, May 05
From: Hong Kong, Hong Kong (HKG) at 12:05pm
To: Newark, NJ (EWR) at 3:35pm
Stops: None

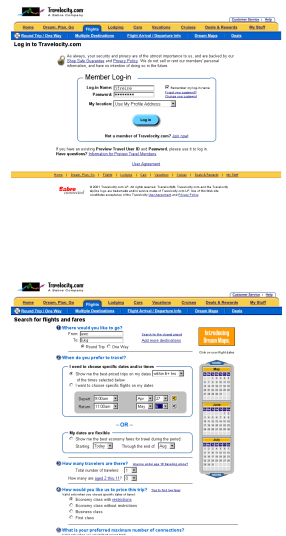
5-13kbps

"Juliana's lowest fares to Hong Kong"

WebViews server

2Mbps

Most of the data is transferred through a fat pipe



Only a subset of the final page needs to be transcoded

Outline

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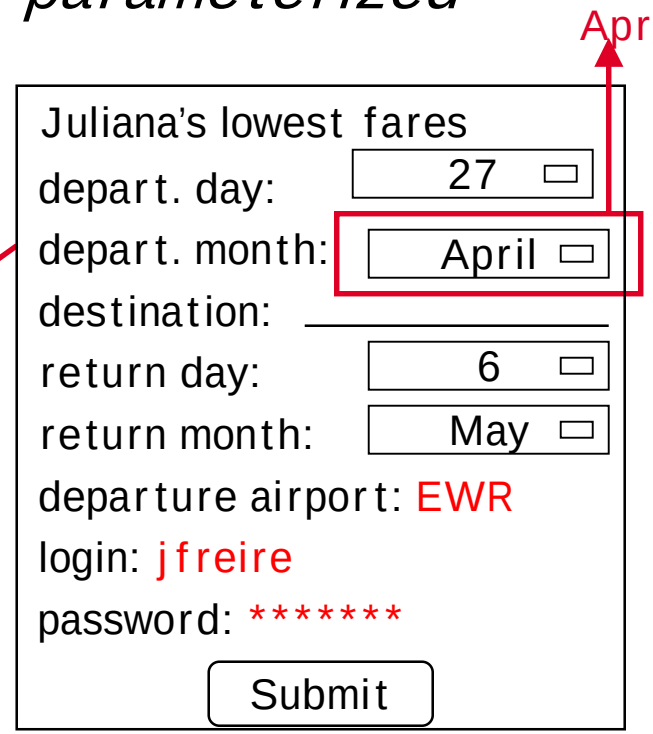
- Creating Web views
- Important issues:
  - Making views robust
  - Transcoding views
- The WebViews service
- Related Work
- Conclusions and Future Work

WebViews Recorder

- Extends WebVCR (WWW9)
- Transparently tracks and records users' browsing actions: generates smart bookmarks - *shortcuts* to Web pages that do not have a well-defined URL
- Adapt to thin-client scenario: create *parameterized* smart bookmarks
  - need descriptive name for parameters
  - invalid selections: need to save more information in order to support user input
- Limitation: deterministic navigation
  - need support for conditional navigation



Clipping Web Pages

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- Specify the components of a Web page to be extracted
- Requirements: standards-based, powerful, portable
- Choice: XPath

  e.g., //html/body/center[2]/div/table[2]/tr/td/table
  [position()>=3 and position()<=8]
- Hard to specify manually - need to provide GUI support
  - automatically generate expressions (details in the paper)
- Drawbacks:
  - ill-formed pages: must "tidy" HTML pages before applying XPath
  - slow processors

Web view specification

```
<WEB-VIEW id="juliana_clippings">
  <BOOKMARK idref="juliana_travel" />
  <REFRESH-INTERVAL> 24 Hours </REFRESH-INTERVAL>
  <EXTRACT fragment_name = "first_3_itineraries">
    <![CDATA[
      (//table/tr/td[(contains(string(),'Price:') or
contains(string(), 'Option')) and
      not(descendant::table)]/parent::tr/parent::table)
      [position() >= 1 and position() <= 6]
    ]]>
  </EXTRACT>
```

PDA

```
  <EXTRACT fragment_name = "first_itinerary">
    <![CDATA[
      (//table/tr/td[(contains(string(),'Price:') or
contains(string(), 'Option')) and
      not(descendant::table)]/parent::tr/parent::table)
      [position() >= 1 and position() <= 2]
    ]]>
  </EXTRACT>
</WEB-VIEW>
```

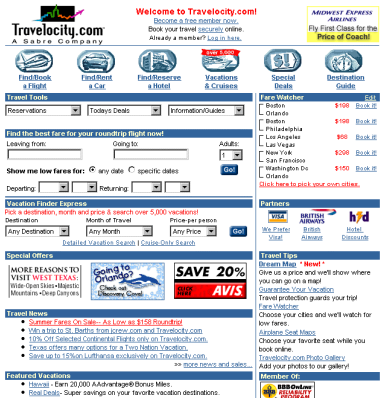
Phone

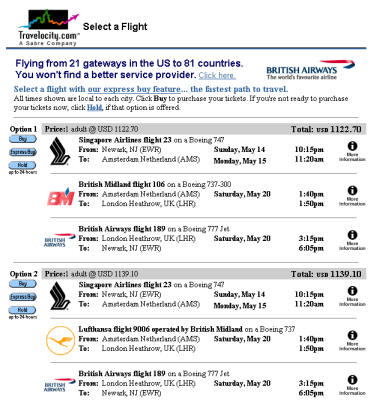
Extract data

```
<BOOKMARK id="juliana_travel">
  <URL> http://travelocity.com </URL>
  <LINK>
    <loc> document.links[8] </loc>
    <href>
        <![CDATA[http://dps1.travelocity.com/lognlogin.ctl?tr_module=AIRG&SEQ=1]]>
        </href>
    <text> null </text> <target> null </target>
  </LINK>
  <FORM>  <!-- Login form --> ... </FORM>
  <LINK>  <!-- 9 Best Itineraries link --> ... </LINK>
  <FORM>
    <loc> document.forms[0] </loc>
    <action> <![CDATA[https://dps1.travelocity.com:443/lognmain.ctl?SEQ=1]]>
        </action>
    <method> POST </method> <name> null </name> <target> null </target>
    <ATTRS>
      <ATTR> <name> trip_option </name> <loc> 5 </loc> <type> radio </type>
          <prop> stored </prop> <val> roundtrp </val> </ATTR>
      <ATTR> <name> depart_airport </name> <loc> 10 </loc>
          <type> text </type> <prop> stored </prop> <val> EWR </val> </ATTR>
      <ATTR> <name> depart_month </name> <loc> 11 </loc>
          <type> select-one </type> <prop> stored </prop>
          <selected_index> 3 </selected_index> <text> Apr </text> </ATTR>
      <ATTR> <name> depart_day </name> <loc> 12 </loc>
          <type> select-one </type> <prop> stored </prop>
          <selected_index> 28 </selected_index> <text> 29 </text> </ATTR>
      ...
    </ATTRS>
  </FORM>
</BOOKMARK>
```

Retrieve page

What happens when Web pages change?





Before April, 2001

After April, 2001

Robustness

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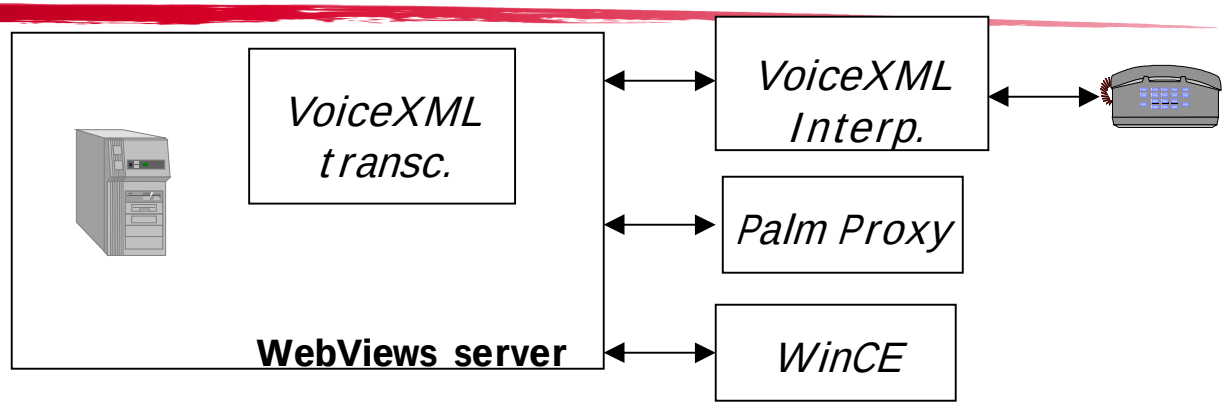
- Ensure that the *intended* content is retrieved even if underlying site changes
- Built-in heuristics for robust navigation
  - identify at each step the correct action
  - use fuzzy matching
  - need to be efficient - executed multiple times
- Hints to identify fragments of Web pages
  - e.g., extract tables that contain “Price” or “Option”, or
  - extract text delimited by string1 and string2
- *Not full-proof : but when Web views break, they are easy to fix*

Transcoding WebViews



- Loosely vs tightly-coupled
- Palm and HTML-friendly devices: use existing proxies or no proxy
  - quality is reasonable for simple and small clippings
- Telephone (voice and touch-tone input/ voice output): built our own transcoder
  - transcoding into VoiceXML is challenging…
  - tighter coupling with transcoder is advantageous

Voice enabling Web views

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- Voice interfaces are very different from the usual visual (HTML) interfaces: intrinsically serial
- Transcoding an arbitrary HTML page into VoiceXML is unlikely to result in a reasonable user experience
- Voice views:
  - focused: simpler to transcode
  - can be annotated to generate better quality transcoding during access, e.g., how to read tables (row-wise vs column-wise), what is the header, which columns/rows to project
  - extra information saved is useful for transcoding into VoiceXML, e.g., user choices can be constrained for better recognition

The WebViews Service

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- Web service accessed via HTTP requests

  http://webviews.bell-labs.com/cgi-bin?user=juliana&view=travel

- Parameters
  - e.g., departure day and month
- Device specific extraction
  - e.g., 1st itinerary if WAP, all itineraries if Palm
- Modes:
  - synchronous vs asynchronous (push/pull)
  - periodic updates (caching)
  - notification

Related Work

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- Wrappers in information integration systems:
  - –query Web sites as if they were databases, e.g., Information Manifold (VLDB'96), Web Integrator (SIGMOD'99)
  - –extract structure from semi-structured data, e.g., NoDoSe (SIGMOD'99)
  - –simpler extraction: less semantics, more robust
- Robust wrappers
  - –WebVCR (WWW9), Phelps and Wilensky (WWW9), Davulcu et al (PODS 2000)
- Personalization systems and portals
  - –e.g., MindIt, Yodlee, Octopus, ezlogin
  - –similar but not very robust, and no support for "complex" navigation
- Wireless and Voice application service providers
  - –e.g., OracleMobile, tellme, heyanita
  - –cooperate with content providers
- Transcoding proxies
  - –no personalization

Conclusions and Future Work

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- WebViews architecture:
  - simplifies the creation of robust views of Web content and services
  - views can be tailored for specific devices
- Explore different application scenarios
  - expert users
  - cooperative Web sites
- More “programmability” (e.g., conditions, iterations)
- Adopt CC/PP (?)
- Scalability/Security

Different Application Scenarios

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- Tool for end-users
  - allows wireless and voice access to far more Web content than other approaches
- For Web content-providers, ISPs, ASPs
  - does not require cooperation with Web sites
  - easy to setup and maintain (hence cheaper)
- For corporations (Intranet)
  - does not require tight cooperation with Web site designers
  - easy to setup and maintain (hence cheaper)

Summary: The WebView Service

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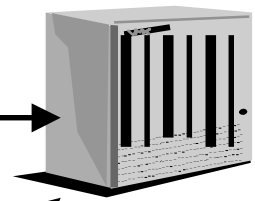
- Allows end-users/content providers to easily create and maintain personalized Web views
  - a Web view is a set of instructions to retrieve a particular page and a specification of which components of the page should be extracted
- Uses existing HTML pages
- Based on standard technology: HTTP, HTML, XML, etc
- Web views give users single-click access to information of their interest, e.g., CNN headlines, weather information etc.
  - Web views can be parameterized, allowing an easy creation of simple Web queries/services
  - different views can be created that are suitable for different types of terminals
- Device independent: allows access from various devices (PDA, mobile phone)
  - "clipped" information is transcoded into the desired format (WML / VoiceXML) before being shipped to the user via the corresponding gateway (WAP proxy / Voice gateway)

VoiceViews: Usage Scenario

Voice Network

VoiceXML Interpretor



3. Customer is identified via ANI (and/or via additional input)

2. User dials 1-800-555-0000

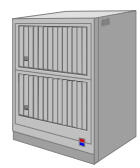
4. WebTalk server is queried for list of customer's views, and the resulting list is sent back to the customer

6. Customer chooses desired view: "Press 1 for 401(k) balance, 2 for breaking news from Times of India, …"

7. Customer request is forwarded to WebTalk server, and the resulting VoiceXML script is sent back to the customer

9. Customer hears: "…"

Internet



WebView Server

5. WebTalk server retrieves list of customer views

8. WebTalk server replays specified view and returns the extracted content in VoiceXML

1. User creates web view on desktop and uploads it to the WebTalk server

401k.com

zacks.com

timesofindia.com

travelocity.com