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Memento: Time Travel for the Web

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Memento: Time Travel for the Web

The Memento Team

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Memento is partially funded by the Library of Congress
W3C Web Architecture: Resource – URI - Representation

URI

Identifies

Resource

Represents

dereference

Representation
W3C Web Architecture: Resource – URI - Representation

- URI
  - Identifies
  - dereference
  - content negotiation
  - Represents
  - Resource
    - Represents
    - Representation 1
    - Represents
    - Representation 2

Memento: Time Travel for the Web
UNC Scholarly Communications Working Group, November 10 2010
Resources have Representations
Resources have Representations that Change over Time
Only the Current Representation is Available from a Resource
Old Representations are Lost Forever
Archived Resources Exist

the old representations are lost forever

well, that is not not entirely true
Archived Resources


Finding Archived Resources

Go to http://www.archive.org/ and search http://cnn.com

Finding Archived Resources

Go to http://en.wikipedia.org/wiki/September_11_attacks and click History

Browse History
Navigating Archived Resources

Dec 20 2001, 4:51:00 UTC

archived resource for

http://en.wikipedia.org/wiki/The_Pentagon

Memento: Time Travel for the Web
UNC Scholarly Communications Working Group, November 10 2010

Los Alamos National Laboratory
Old Dominion University
Navigating Archived Resources


Current and Past Web are Not Integrated

- Current and Past Web based on same technology.
- But, going from Current to Past Web is a matter of (manual) discovery.
- Memento wants to make going from Current to Past Web a (HTTP) protocol matter.
- Memento wants to integrate Current And Past Web.
### Dimensions of genericity

When we discuss electronic resources, an interesting fact is that a small number of dimensions of genericity emerge.

<table>
<thead>
<tr>
<th>Time</th>
<th>A resource may vary with time. For example, &quot;The Wall Street Journal&quot; varies with time. Each issue is a time-specific resource, which does not change with time. Most home pages on the Web change with time, in a less periodic way.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Language</td>
<td>When a document is translated, it is useful to be able to refer to it either in the generic, or to a particular specific translation.</td>
</tr>
<tr>
<td>Representation</td>
<td>A given resource may have many ways in which it can be represented on the wire, using different content-types (in HTTP terms). As an example, an image may be represented in PNG or JPEG format.</td>
</tr>
</tbody>
</table>

The fact that there are such a small number of dimensions currently apparent suggests that Web software should handle them individually in its interface with the user, even though the architecture should handle them as a single concept.
In The Beginning… there was the inode

```c
struct stat {
    dev_t st_dev;    /* ID of device containing file */
    ino_t st_ino;    /* inode number */
    mode_t st_mode;  /* protection */
    nlink_t st_nlink; /* number of hard links */
    uid_t st_uid;    /* user ID of owner */
    gid_t st_gid;    /* group ID of owner */
    dev_t st_rdev;   /* device ID (if special file) */
    off_t st_size;   /* total size, in bytes */
    blksize_t st_blksize; /* blocksize for filesystem I/O */
    blkcnt_t st_blocks; /* number of blocks allocated */
    time_t st_atime; /* time of last access */
    time_t st_mtime; /* time of last modification */
    time_t st_ctime; /* time of last status change */
};
```
Limited Time Semantics...

% telnet www.digitalpreservation.gov 80
Trying 140.147.249.7...
Connected to www.digitalpreservation.gov.
Escape character is '^]'.
HEAD /images/ndiipp_header6.jpg HTTP/1.1
Host: www.digitalpreservation.gov
Connection: close

HTTP/1.1 200 OK
Date: Mon, 19 Jul 2010 21:41:04 GMT
Server: Apache
Last-Modified: Thu, 18 Jun 2009 16:25:54 GMT
ETag: "1bc861-10935-dca24880"
Accept-Ranges: bytes
Content-Length: 67893
Connection: close
Content-Type: image/jpeg

Connection closed by foreign host.
Time Semantics Becoming Less, Not More Available

% telnet www.digitalpreservation.gov 80
Trying 140.147.249.7...
Connected to www.digitalpreservation.gov.
Escape character is '^]'.
HEAD / HTTP/1.1
Host: www.digitalpreservation.gov
Connection: close

HTTP/1.1 200 OK
Date: Mon, 19 Jul 2010 21:36:00 GMT
Server: Apache
Accept-Ranges: bytes
Connection: close
Content-Type: text/html

Connection closed by foreign host.
The Past Links to the Present...

explicit HTML link; no HTTP links; opaque URI
The Past Links to the Present...

no HTML links; no HTTP links; implicit from URI
But the Present Does Not Link to the Past

no hints in HTML, HTTP, or URI
Jane Greenberg, Professor and Director, SILS Metadata Research Center
School of Information and Library Science
University of North Carolina at Chapel Hill
205 Manning Hall, CB # 3360
Chapel Hill, NC 27599-3360
Phone: (919)962-8066
Fax: (919)962-8071
Email: janeg@email.unc.edu

- SILS Metadata Research Center &lt;MRC&gt;
- Metadata Research Center's photostream
- Spring 2008: INLS 890-092, Seminar in Knowledge Organization
- Vitae
Jane Greenberg, Assistant Professor
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Chapel Hill, NC 27599-3360

Tel: (919)962-7024
E-mail: janeg@ils.unc.edu
Fax: (919)962-6071
Linking the Past and the Present

• Codify existing methods to create linkage from the past to the present
  – easy: an archived version knows for which URI it is an archived version
• Create a linkage from the present to the past
  – hard: solve with a level of indirection from present to past
Normal HTTP Flow
The Web without a Time Dimension
The Web without a Time Dimension
The Web without a Time Dimension

Need to use a different URI to access archived versions of a resource and its current version
The Web with Time Dimension added by Memento

In Memento: use URI of the current version to access archived versions, but qualify it with datetime.
The Web with Time Dimension added by Memento

... and arrive at an archived version via level of indirection
Content Negotiation in the datetime dimension

- Many systems support content negotiation for media type:
  - Your client by default asks for HTML and gets HTML;
  - But it could get PDF via the same URI.

- Memento proposes a new dimension for content negotiation – time:
  - Your client by default asks for the current time, and gets it
  - But it could get an older version via the same URI

- Can be accomplished with two new HTTP headers:
  - Request header: `Accept-Datetime`
    - Conveys datetime of content requested by client
  - Response header: `Memento-Datetime`
    - Conveys datetime of content returned by server
Memento HTTP Flow

HEAD R, Accept-Datetime → R

200, Link → G

GET G, Accept-Datetime → G

302 → M, Vary, Link → R,B,M

GET M, Accept-Datetime → M

200, Memento-Datetime, Link → R,B,M
Memento HTTP Flow

HEAD R, Accept-Datetime

200, Link⇒G

GET G, Accept-Datetime

302⇒M, Vary, Link⇒R,B,M

GET M, Accept-Datetime

200, Memento-Datetime, Link⇒R,B,M
Memento HTTP Flow

HEAD R, Accept-Datetime

200, Link→G

GET G, Accept-Datetime

302→M, Vary, Link→R,B,M

GET M, Accept-Datetime

200, Memento-Datetime, Link→R,B,M
Memento HTTP Flow

HEAD R, Accept-Datetime

200, Link→G

GET G, Accept-Datetime

302→M, Vary, Link→R,B,M

GET M, Accept-Datetime

200, Memento-Datetime, Link→R,B,M
Memento HTTP Flow

HEAD R, Accept-Datetime

200, Link®️G

GET G, Accept-Datetime

302®️M, Vary, Link®️R,B,M

GET M, Accept-Datetime

200, Memento-Datetime, Link®️R,B,M
Memento HTTP Flow

HEAD R, Accept-Datetime

200, Link⇒G

GET G, Accept-Datetime

302⇒M, Vary, Link⇒R,B,M

GET M, Accept-Datetime

200, Memento-Datetime, Link⇒R,B,M
The Memento Framework

Original Resource → URI-R

URI-R → HTTP Link original

HTTP Link original → URI-G

URI-G → HTTP Link timegate

HTTP Link timegate → URI-M1

URI-M1 → HTTP GET Accept-Datetime: t₁

HTTP GET Accept-Datetime: t₁ → URI-M2

URI-M2 → HTTP Link memento

HTTP Link memento → Mementos

Mementos
Why Not Bypass URI-R and Go Directly to TimeGate?

• The Original Resource (URI-R) might know a "better" TimeGate than the default client value
  – a CMS (e.g., a wiki) or transactional archive will always have the most complete archival coverage for a URI-R
  – the client can always ignore the URI-R's TimeGate suggestion

• Summary: it is good design to check with URI-R before using the default the TimeGate
Long Tail of Archives

Q: Which TimeGate should my server (or client) Link to?

A: There is no one true TimeGate. We envision a competitive marketplace for TimeGates and Aggregators.
Transition Period

• Up until now, we've presented the scenario where both the client and server are compliant with the Memento framework
• Good news: Memento elegantly handles scenarios where either the client or the server are not (yet) compliant
Compliant Client, Non-Compliant Server

HEAD R, Accept-Datetime

200

GET G, Accept-Datetime

302 → M, Vary, Link → R, B, M

GET M, Accept-Datetime

200, Memento-Datetime, Link → R, B, M
Compliant Client, Non-Compliant Server

HEAD R, Accept-Datetime

GET G, Accept-Datetime

302 ➞ M, Vary, Link ➞ R, B, M

GET M, Accept-Datetime

200, Memento-Datetime, Link ➞ R, B, M
Compliant Client, Non-Compliant Server

HEAD R, Accept-Datetime

Client detects absence of Link header in response from URI-R, discards it, then constructs its own URI-G value

GET G, Accept-Datetime

302 ➔ M, Vary, Link ➔ R,B,M

GET M, Accept-Datetime

200, Memento-Datime, Link ➔ R,B,M
**Compliant Client, Non-Compliant Server**

```
HEAD R, Accept-Datetime
```

```
200
```

```
GET G, Accept-Datetime
```

```
302 ➔ M, Vary, Link ➔ R, B, M
```

```
GET M, Accept-Datetime
```

```
200, Memento-Datetime, Link ➔ R, B, M
```
Compliant Client, Non-Compliant Server

HEAD R, Accept-Datetime → R

GET G, Accept-Datetime → G

302→M, Vary, Link→R,B,M → M

GET M, Accept-Datetime → M

200, Memento-Datetime, Link→R,B,M
Compliant Client, Non-Compliant Server

HEAD R, Accept-Datetime

200

GET G, Accept-Datetime

302 ➔ M, Vary, Link ➔ R, B, M

GET M, Accept-Datetime

200, Memento-Datetime, Link ➔ R, B, M
Compliant Server, Non-Compliant Client

GET R

200, Link → G

GET G, Accept-Datetime

302 → M, Vary, Link → R,B,M

GET M, Accept-Datetime

200, Memento-Datetime, Link → R,B,M
Compliant Server, Non-Compliant Client

GET R

200, Link ➔ G

GET G, Accept-Datetime

302 ➔ M, Vary, Link ➔ R, B, M

GET M, Accept-Datetime

200, Memento-Datetime, Link ➔ R, B, M
Compliant Server, Non-Compliant Client

GET R, Accept-Datetime

200, Link⇒G

GET G, Accept-Datetime

302⇒M, Vary, Link⇒R,B,M

GET M, Accept-Datetime

200, Memento-Datetime, Link⇒R,B,M
Some Issues

- Observational uncertainty
- Different notions of time
- When is the past?
No Uncertainty With Self-Archiving Systems

foo.html has `<img src=pic.gif>`
foo.html @ t4

foo.html has <img src=pic.gif>

GET /foo.html
Accept-Datetime: t4
HTTP/1.1 200 OK
Memento-Datetime: t4

GET /pic.gif
Accept-Datetime: t4
HTTP/1.1 200 OK
Memento-Datetime: t0
foo.html @ t4

foo.html has <img src=pic.gif>

GET /foo.html
Accept-Datetime: t4
HTTP/1.1 200 OK
Memento-Datetime: t4

foo.html correct

GET /pic.gif
Accept-Datetime: t4
HTTP/1.1 200 OK
Memento-Datetime: t0

pic.gif correct
Uncertainty in Third-Party Archives

foo.html has <img src=pic.gif>
Missed Updates

foo.html has `<img src=pic.gif>`

<table>
<thead>
<tr>
<th>t0</th>
<th>t1</th>
<th>t2</th>
<th>t3</th>
<th>t4</th>
<th>t5</th>
<th>t6</th>
<th>t7</th>
</tr>
</thead>
<tbody>
<tr>
<td>foo.html</td>
<td>foo.html</td>
<td>foo.html</td>
<td>foo.html</td>
<td>foo.html</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pic.gif</td>
<td>pic.gif</td>
<td>pic.gif</td>
<td>pic.gif</td>
<td>pic.gif</td>
<td>pic.gif</td>
<td>pic.gif</td>
<td></td>
</tr>
</tbody>
</table>

*red italics = missed updates*
foo.html @ t4

foo.html has <img src=pic.gif>

GET /foo.html
Accept-Datetime: t4
HTTP/1.1 200 OK
Memento-Datetime: t4

GET /pic.gif
Accept-Datetime: t4
HTTP/1.1 200 OK
Memento-Datetime: t0
foo.html @ t4

foo.html has <img src=pic.gif>

GET /foo.html
Accept-Datetime: t4
HTTP/1.1 200 OK
Memento-Datetime: t4

GET /pic.gif
Accept-Datetime: t4
HTTP/1.1 200 OK
Memento-Datetime: t0

foo.html correct
pic.gif incorrect
(should be t4)
foo.html @ t4

foo.html has `<img src=pic.gif>`

```
foo.html  foo.html  foo.html  foo.html
|        |        |        |        |
| foo.html | foo.html | foo.html | foo.html |
| pic.gif  | pic.gif  | pic.gif  | pic.gif  |
```

GET /foo.html
Accept-Datetime: t4
HTTP/1.1 200 OK
Memento-Datetime: t4

foo.html correct

GET /pic.gif
Accept-Datetime: t4
HTTP/1.1 200 OK
Memento-Datetime: t0

pic.gif incorrect
(should be t4)

this combination (foo@t4, pic@t0) never existed!
Decrease Uncertainty With More Observations?

foo.html has `<img src=pic.gif>`

<table>
<thead>
<tr>
<th>t0</th>
<th>t1</th>
<th>t2</th>
<th>t3</th>
<th>t4</th>
<th>t5</th>
<th>t6</th>
<th>t7</th>
</tr>
</thead>
<tbody>
<tr>
<td>foo.html</td>
<td>foo.html</td>
<td></td>
<td>foo.html</td>
<td>foo.html</td>
<td></td>
<td>foo.html</td>
<td></td>
</tr>
<tr>
<td>pic.gif</td>
<td><em>pic.gif</em></td>
<td></td>
<td>pic.gif</td>
<td>pic.gif</td>
<td>pic.gif</td>
<td>pic.gif</td>
<td>pic.gif</td>
</tr>
</tbody>
</table>

*red italics = missed updates*
Three Notions of Time: Cr, LM, MD

- **Creation (Cr):** datetime when the resource first came into being
- **Last-Modified (LM):** when the resource was last changed
- **Memento-Datetime (MD):** the datetime that the resource was (meaningfully) observed *on the web* (not the same as the datetime that the resource is "about"; i.e. there is no "Memento-Datetime: Thu, 04 Jul 1776 14:37:00")
Cr == MD == LM
Cr == MD < LM
MD < Cr <= LM
Cr < MD <= LM
When is the Past?

cf. the "chronoscope" in Asimov's "The Dead Past"

doable but hard

tough

easy

challenging

challenging
Why Care About The Past?

From an anonymous reviewer (*emphasis* mine):

"Is there any statistics to show that many or a good number of Web users would like to get obsolete data or resources?"
Replaying the Experience…

…can be more compelling than a summary
CNN’s coverage of Katrina and the aftermath won a 2006 Peabody Award, the oldest honor in electronic media.

Editor’s Note: This special report was archived in September 2006.

Voices from the Gulf Coast

August 25, 2005: Hurricane Katrina made landfall on the Gulf Coast, destroying lives, leveling homes and leaving thousands of survivors with the same story: We lost everything. One year later, many still coped with Katrina’s devastation. Some had moved forward, but for others recovery was at a standstill. CNN.com visited the region to get their stories.
VS.

(thanks to Michele Weigle for the following Memento selection)
Strengthening Katrina to hammer Gulf Coast

Blamed for at least seven deaths in Florida, powerful Hurricane Katrina is becoming stronger as it churns in the Gulf of Mexico. Forecasts say it's poised to deal a hammer blow to the Mississippi Gulf Coast and southeast Louisiana as a possible Category 4 storm early next week. Meanwhile, residents of southeast Florida are cleaning up after Katrina cut across the state packing strong winds and dumping heavy rain.

FULL STORY
- Watch: Oil rig evacuates | Homes flooded
Katrina drives people away from Gulf Coast

People leaving New Orleans pack highways.

Tourists and New Orleans residents are leaving the city as Hurricane Katrina churns closer to Louisiana and Mississippi. Officials fear New Orleans is vulnerable because it sits an average of 6 feet below sea level. Katrina could be a category 4 when it makes landfall. “This is a very, very dangerous hurricane,” says hurricane center Director Max Mayfield.

FULL STORY
Watch "Very concerned" I 'Big Easy' prepares

MORE NEWS
- Northwest strikers stay on picket lines
- California files french fry lawsuit
- Dual protests square off in Crawford | Watch
- CNN/Money: Greenspan: End of home boom inevitable
- Encephalitis outbreak hits children, poor | Watch
- Oprah 'furious' at funeral snub claim
- Watch: Will aging rats lead to younger people?
- Tall, twisted building opens
- 'Milksheek murder' trial nears end
- Dutch investigate producer's 'Big Brother' baby plan

WATCH FREE VIDEO
Living longer (2:05)
Nail polish car (.36)

Now In The News: Your quick news update

BUSINESS at CNNMoney
Markets: As of close Aug 28
DOW -53.34 10,397.29
NAS -13.60 2,120.77

ON CNN TV
Reasonable Doubt: Can crime labs be trusted?
DNA has cleared some innocent people. But forensic
New Orleans orders mandatory evacuation

With powerful and strengthening Hurricane Katrina headed straight for his city, the mayor of New Orleans today ordered the mandatory evacuation of residents. The Category 5 storm has maximum sustained winds near 175 mph and has already been blamed for nine deaths in South Florida. Looking ahead, Max Mayfield of the National Hurricane Center said: “It has the potential for a large loss of life.”

DEVELOPING STORY
Killer Katrina heading inland

Residents in New Orleans struggle to keep above the rising flood waters.

Killer Katrina heading inland

- Mississippi: Three dead, "unprecedented damage"
- More than 50 rescued from floods in New Orleans
- Katrina downgraded to tropical storm
- Parts of six Louisiana parishes "devastated"
- Oil rig breaks loose, hits Mobile River bridge
- "Life-threatening storm surge flooding" occurring

DEVELOPING STORY

- Watch: Wind flogs Mobile | A beaten 'Big Easy'
- Watch: Katrina's destructive day | Biloxi battered
- Gallery: Phoenix | CNN reporters: In the heart of storm
- Special Report: Tracking Katrina | In depth | Gallery
- Citizen Journalist: Your e-mails | Gallery | Share your story

MORE NEWS

- New Orleans refugees told stay away | Watch
- Downtown Mobile under water | Watch
- CNN/Money: Wholesale gas prices soar | Watch
- TIME.com: Is global warming fueling Katrina? | Watch
- CNN/Money: Storm cost could hit $16B | Watch
- Struggling airlines hit by Katrina groundings
- Eight ex-KPMG execs indicted
- Workers struggle to save seals

WATCH FREE VIDEO

Ripping and tearing through the Gulf (2:27)
The Big Easy takes a battering (2:00)

Now In The News (6:30 p.m. ET): Your quick news update

BUSINESS at CNNMoney

Markets: 5:16 p.m. ET, Aug 29

ON CNN TV

Schedule

Katrina continuing coverage
54 DEAD IN MISSISSIPPI

Levee breached in New Orleans

- Estimated 50 dead in 1 Mississippi county, officials say
- Levee breach in New Orleans forces hospital evacuation
- 1.3 million without power
- Tens of thousands to be homeless for months
- American Red Cross launching its largest relief operation

FULL STORY
- CNN Access: My apartment complex is totally leveled
- Watch: Rescued from a roof | Water rises to eaves
- Gallery: Photoblog | CNN reporters: In the heart of storm
- Special Report: Tracking Katrina | In depth | Gallery
- Citizen Journalist: Your e-mails | Gallery | Share your story

MORE NEWS
- Huge relief effort under way
- 54 die in Mississippi, 50 in one county | Watch
- Louisiana evacuees told stay away | Watch
- Downtown Mobile under water | Watch
- CNN/Money: Wholesale gas prices soar | Watch
- TIME: is global warming fueling Katrina?
 STATES OF DEVASTATION

Death toll rising in Katrina's wake

- Impact: Katrina's toll leaves Gulf Coast reeling | Watch
- People: Survivor describes harrowing experience | Watch
- Recovery: Aid groups sending rescuers, supplies | Watch
- Assistance: How to help storm victims | Watch

DEVELOPING STORY
- Watch: Screams for help | Day that wouldn't end
- Watch: Katrina-spawned tornado destroys farm
- Watch: 'Everything is gone' | Rooftop rescue | Katrina's fury
- Special Report: Tracking Katrina | Gallery | Map
- Assisting victims: Do you want to help?
- Citizen Journalist: Your e-mails | Gallery | Share your story

Floodwaters from Hurricane Katrina cover a portion of New Orleans today.

MORE NEWS
- 'Significant' death toll in New Orleans | Watch
- Mississippi governor vows to rebuild | Watch
- Survivors 'screaming for help' | Watch
- Bush cuts short vacation because of Katrina
- CNN/Money: Katrina closes 123 Wal-Marts
- CNN/Money: Oil hits record near $71 | Watch
- Katrina overwhelms weather Web sites

WATCH FREE VIDEO
- Rescue efforts under way (2:47)
- Water pours into New Orleans (1:19)

Now In The News (1:31 p.m. ET): Your quick news update

Featured Video More Video Picks
SLIPPING INTO CHAOS

Unrest grows in New Orleans

- Water still rising in Crescent City, with no way out
- Looting, shootings reported
- New Orleans mayor blasts failure to patch levees
- Louisiana governor declares day of prayer
- Critical patients being airlifted, shelters being evacuated
- Paint marks indicate Mississippi homes with bodies

FULL STORY
- Watch: Chaotic aftermath | Tragedy, devastation
- Watch: The struggle to survive | Nature’s fury explained
- Special Report: Trail of destruction | Gallery | Map | Blog
- Citizen journalist: Your e-mails | Gallery | Share your story
- Hotlines: Emergency info | How to help

MAYO-HOSPITAL PHOTO

A shotgun-toting New Orleans police officer has a word with a man on Canal Street.

MORE NEWS
- Mayor blasts failure to patch levee breaches
- Tensions rising in New Orleans | Watch
- Relief efforts mobilizing | Watch
- Victims left with nothing | Watch
- States struggle with destruction | Watch
- Alabama power outage statewide | Watch
- Mississippi expects heavy death toll | Watch

WATCH FREE VIDEO

Lifted to safety (2:32)

Hurricanes Katrina’s ongoing aftermath (4:00)

Now In The News: Your quick news update

Featured Video | More Video Picks
HEALTH EMERGENCY

Health fears as bodies lie in water

- Public health emergency declared; cholera, typhoid fears
- Katrina death toll so far estimated at least 120
- New Orleans mayor says toll in his city will be hundreds
- Superdome evacuees moving to Astrodome

FULL STORY
- Watch: Saved by a tree | Dome must be evacuated
- Watch: For Slidell, very bad bump in road
- Special Report: Trail of destruction | Gallery | Levee system
- Citizen Journalist: Your e-mails | Gallery | Share your story
- Hotlines: Where to get and give help

Survivors on an apartment building roof try to get the attention of rescuers.

MORE NEWS
- Public health threat looming | Watch
- Superdome victims moving to Texas | Watch
- CNN reporters: Heartbreak across the coast
- Feds fan out for storm recovery efforts | Watch
- Wife makes desperate trip with husband’s body
- Watch: Wife searches for missing husband

WATCH FREE VIDEO

Health risk after Katrina

Clinging to a tree (3.25)

Now in The News [3:31 p.m. ET]: Your quick news update

Featured Video | More Video Picks
GETTING OUT

Evacuation of survivors begins
- Public health emergency declared; cholera, typhoid fears
- First evacuee buses leave New Orleans
- Bush: “One of the worst national disasters”
- Extra 10,000 National Guard troops called up

FULL STORY
- Watch: Heartbreaking trip home | Searching for bodies
- Watch: How the levees broke | Saved by a tree
- Special Report: Trail of destruction | Gallery | Levee system
- Citizen Journalist: Your e-mails | Gallery | Share your story
- Hotlines: Where to get, give help | Tell people you’re safe

Buses leave New Orleans with evacuees who had been holed up in the Superdome.
DESPERATION AND DANGER

Storm victims are stuck without food or water at the New Orleans Convention Center.

Boat rescues suspended

- Boat rescuers asked to stand down due to dangers
- Huge crowd spotted at New Orleans convention center
- Gunfire, looting, small fires disrupt Superdome evacuation
- Citizens holed up in high-rises throng to bus area
- Major buildings "pancaking" in Mississippi

DEVELOPING STORY

- Watch: 'Nobody in control' | Fires at Superdome
- Watch: Newborns rescued | Heartbreaking trip home
- Special Report: Trail of destruction | Gallery | Levee system
- Citizen Journalist: Your e-mails | Gallery | Share your story
- Hotlines: Where to get, give help | Tell people you're safe

MORE NEWS

- Bush tells victims: 'A lot of help coming'
- CNN/Money: Bush: 'Zero tolerance' on gouging
- Town wiped off the map by Katrina
- CNN exclusive: Police unable to aid sick woman
- Spain MP among stranded in New Orleans
- Federal rescue teams arriving
HELICOPTER HEROES

BREAKING NEWS

Rescuers going roof-to-roof

- AP: Army engineers say police shoot dead its contractors
- Helicopters dropping supplies, picking up survivors
- Convention center mostly evacuated
- Mayor: Police, firefighters traumatized

DEVELOPING STORY

- Watch: Coast Guard rescuers | Some refuse to leave
- Watch: Mississippi wipe out | Mayor: Officers traumatized
- Hotlines: How to get, give help | Tell people you're safe
- Citizen Journalist: Your e-mails | Gallery | Share your story
- Special Report: Timeline | New Orleans: Block by block
- On CNN TV: Dr. Phil on healing after Katrina, 9 p.m. ET

A U.S. Air Force rescuer is dropped onto a rooftop to help trapped Katrina victims.
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