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Lightweight Representation of Multi-origin Web Content

ABSTRACT

Certain features such as browser tab previews, low-memory frame representations, etc., use low-fidelity snapshots of webpages. Low-fidelity snapshots can be created by rasterizing the webpage or by converting it to PDF format. Screenshots can use substantial memory, lose the hyperlinks on a page, and do not provide the ability to scroll and zoom without pixelation artifacts. Typical print-to-PDF applications do not support scrolling screenshots and sub-frames.

This disclosure describes techniques to record content of the frames of a webpage, including multi-origin iframes, such that each frame (or sub-frame) of a webpage can be scrolled independently. For security, hyperlink information, e.g., the hit regions and the URLs, are stored separately from webpage recordings, and frame recording and rasterization are carried out using sandboxed processes. The techniques produce a low-memory representation of a webpage with minimal pixelation effects, with full text fidelity regardless of zoom level, and active hyperlinks and scrollable sub-frames.

KEYWORDS

- Tab preview
- Webpage thumbnail
- Low-memory representation
- Screenshot
- Sub-frame scrolling
- Document object model (DOM)
- Full text fidelity

BACKGROUND

Certain features such as browser tab previews, low-memory frame representations, etc., use low-fidelity snapshots of webpages. For these purposes, the exact content of a website at a given point in time is to be captured. A URL to the page is unacceptable, as the page could change and may appear differently when reloaded. Low-fidelity snapshots can be created by rasterizing the webpage or by converting it to PDF format, both of which use substantial memory. Rasterized formats such as screenshots use substantial memory. Screenshots are also typically confined to the viewport of the device or of the web content. Additionally, screenshots lose dynamic properties such as the hyperlinks on a page and the ability to scroll/zoom without pixelation artifacts. Screenshots and typical print-to-PDF implementations produce recordings that do not support the scrolling of sub-frames, e.g., multi-origin inline frames (iframes) that have content from diverse websites.

DESCRIPTION

This disclosure describes techniques that produce vector-format representation of a webpage that, when stored on disk, take up less space. The representation is tailored to a minimal rasterization engine, with minimal pixelation effects, with full text fidelity regardless of zoom level, and with active hyperlinks and scrollable sub-frames. Even as the dynamic properties of the webpage are preserved, the resulting representation can provide substantial compression, e.g., 50% over PNG format and 25% over MHTML format, especially in typical cases, e.g., when there are relatively few fonts or pictures. The techniques apply to the capture of content that originates from multi-origin websites as well as native, system, and other content.

When the representation thus generated is displayed, the player software used for display may be more lightweight than other players such as a pdf viewer or full browser. For example, a

well-compressed screenshot image may be displayed in an image viewer that is very light in terms of RAM. Overall, the techniques may use less memory, e.g., RAM, than a full render process, which is used when showing a full page.

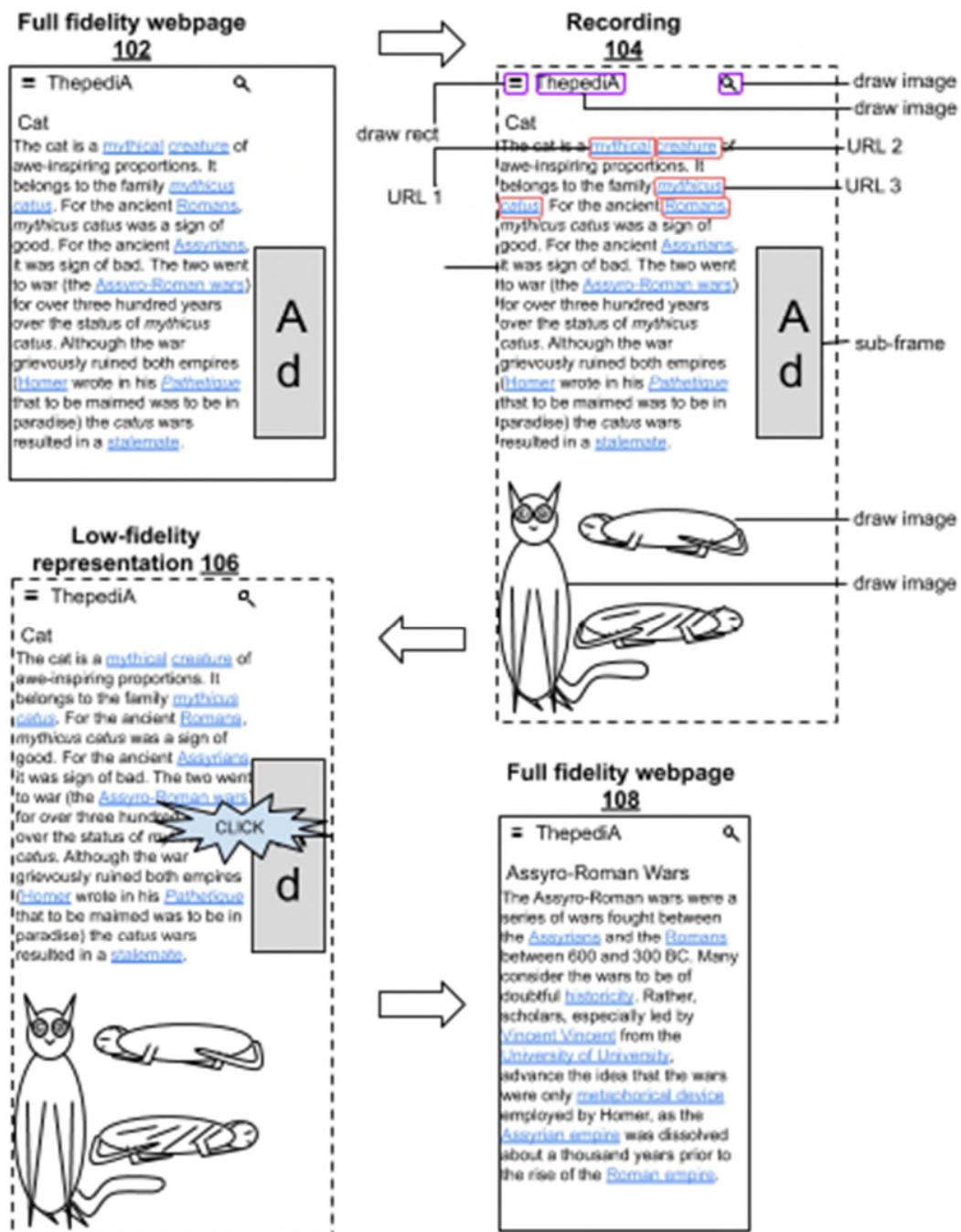


Fig. 1: Lightweight capture of multi-origin web content

Fig. 1 illustrates the capture of a webpage with multi-origin web content, per techniques of this disclosure. Given a full-fidelity webpage (102), a substantial portion of the content of its constituent DOM frames, including multi-origin inline frames if any, is recorded (104), such that the frames can be scrolled through independently. The amount of content to be recorded is dynamically determined, and, as illustrated, is not restricted to the viewport of the device.

The recordings are decorated with hyperlink information, e.g., URLs, and their positions and hit regions (shown as pink and purple rectangles in 106). For security reasons, rasterization is separated from navigation, e.g., the hyperlink information is stored separately from the frame recordings. Further, frame recording and rasterization take place in separate, sandboxed processes. In this manner, the frame-recording and rasterization processes, which are not usually run in secure computing regions, are not entrusted with valid hyperlink information; rather, hyperlink information is processed separately and securely, e.g., in the trusted region of an operating system or browser process.

A low-fidelity representation of the webpage is obtained (106), with active hyperlinks, full text fidelity regardless of zoom level, and scrollable sub-frames. Upon clicking a hyperlink on the low-fidelity webpage, the user is redirected, in a manner similar to the original webpage, to the (full-fidelity) page (108) that is pointed to by the hyperlink.

The techniques are usable in many different situations where low-fidelity snapshots of webpages are used. For example, some use cases include:

- Fast previews, switching, and restoration of tabs, where, rather than loading a full page, a preview is shown.
- Instant-start of browsers or tabbed applications, where, rather than loading a full page, a preview is shown, e.g., immediately upon starting the browser.

- Overview of thumbnails in a tab, where, rather than a small screenshot, the more general format as described herein is shown.
- Displaying frame content under low-memory (e.g., RAM) conditions, where, rather than an error message, the renderer process of a frame is killed and a low-fidelity representation of the frame is shown.
- Sharing webpages, where a version of the webpage is shared that is lighter than a screenshot and still permits flexible recording and playback. The user opts in to recording for this use case.
- Downloading, synchronization, or offline pages, where a user captures a page and resumes reading it later or on a different device. The user provides permission for recording for this use case.

The described techniques can be used to obtain lightweight representations of webpages or other content for use by browser applications, or mobile applications that display webpages. Users are provided with options to disable use of the described techniques, e.g., for specific websites or for the application or browsing session as a whole. The low-fidelity representations are utilized for specific purposes as permitted by the user. If storage of such representations is enabled, the representations are stored securely in a manner configured by the user, e.g., locally on the user's device.

Local, on-device capture of web pages can include capture of a user's personal data, e.g., that is part of the webpage representation being stored. The user is provided with controls allowing the user to make an election as to both if and when systems, programs or features described herein may enable such capture and local on-device storage of webpages. In addition, data is treated in one or more ways before it is stored or used, so that personally identifiable

information may be removed. For example, a user's identity may be treated, e.g., by removing or obfuscating data fields that may include identity-related information (e.g., username or other identifier) such that no personally identifiable information can be determined by any party for the user from data that is stored. Thus, the user has control over what information is stored about the user and how that information is used. For example, the user can select that the stored representations may be used for one or more specific use cases from the list above, e.g., tab previews, instant start, etc. and not be used for other purposes, e.g., sharing.

CONCLUSION

This disclosure describes techniques to record content of the frames of a webpage, including multi-origin iframes, such that each frame (or sub-frame) of a webpage can be scrolled independently. For security, hyperlink information, e.g., the hit regions and the URLs, are stored separately from webpage recordings, and frame recording and rasterization are carried out using sandboxed processes. The techniques produce a low-memory representation of a webpage with minimal pixelation effects, with full text fidelity regardless of zoom level, and active hyperlinks and scrollable sub-frames.

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