Notes on navigation history

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Abstract

Some notes on a model of navigation history.

1   Introduction

[These are rough notes, working towards a model of navigation history for the web.]

2   Preliminaries

[Define forest, tree, root, total order, equivalence.]

3   Model

A *navigation history* $H = (D, A, \rightarrow, \leq, \sim)$ consists of:

- a set D (the *documents*),

- a subset $A \subseteq D$ (the *active* documents),

- a forest $(D, \rightarrow)$ (the *document hierarchy*),

- a total order $(D, \leq)$ (the *chronological order*), and

- an equivalence relation $(D, \sim)$ (the *same-session equivalence*).

such that:

- for every d there is a unique $d' \in A$ such that $d \sim d'$,

- for every $d \rightarrow e \sim e'$ we have $d \rightarrow e'$, and

- for every $d \rightarrow e$, we have $d \leq e$.

Define:

- d_0 is the unique active root document,

- $d \twoheadrightarrow e$ when $d \to e$ and $e \in A$,

- $FA = \{d \mid d_0 \twoheadrightarrow^* d\}$ (the *fully active* documents),

- $d \lesssim e$ whenever $d \sim e$ and $d < e$,

- the *session future* of d is $\{e \mid d \lesssim e\}$,

- the *session past* of d is $\{e \mid d \gtrsim e\}$,

- the *joint session future* is $\{e \mid \exists d \in FA \,.\, d \lesssim e\}$,

- the *joint session past* is $\{e \mid \exists d \in FA \,.\, d \gtrsim e\}$,

Define *deleting d from H*, when $d \notin FA$, to be H' where:

- $D' = d \setminus \{e \mid d \to^* e\}$,

- $e \in A'$ whenever $e \in A$,

- $e \leq' f$ whenever $e \leq f$,

- $e \to' f$ whenever $e \to f$, and

- $e \sim' f$ whenever $e \sim f$.

Define *replacing d by d' in H*, where $d \in A$ and $d' \notin D$, to be H' where:

- $D' = D \cup \{d'\}$,

- $e \in A'$ whenever $e \in A$ and $e \neq d$, or $e = d'$,

- $e \leq' f$ whenever $e \leq f$, or $f = d'$,

- $e \to' f$ whenever $e \to f$, or $e \to d$ and $f = d'$, and

- $e \sim' f$ whenever $e \sim f$, or $e \sim d$ and $f = d'$, or $d \sim f$ and $e = d'$.

Define *navigating from d to d' in H* to be the result of:

- deleting the session future of d, and

- replacing d by d'.

Define *traversing the history to d in H* to be H' where:

- D' is D,

- $e \in A'$ whenever $d \not\sim e \in A$, or $d = e$,

- $e \leq' f$ whenever $e \leq f$,

- $e \to' f$ whenever $e \to f$, and

- $e \sim' f$ whenever $e \sim f$.

Define *H* *traverses the history by* $+\delta$ *to* H' when:

- the joint session past of *H* is $d_1 > \cdots > d_\delta > \cdots$,

- *H* traverses the history to d_δ in H'

Define *H* *traverses the history by* $-\delta$ *to* H' when:

- the joint session future of *H* is $d_1 < \cdots < d_\delta < \cdots$,

- *H* traverses the history to d_δ in H'

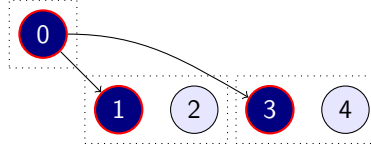Define *H* *traverses the history by* 0 *to* H' when $H = H'$.
[This defn is meant to align with the spec.]

4   Properties

[State some goals, e.g. go(δ);go(δ') is the same as go($\delta + \delta'$), navigate;go(-1) has the same fully active documents as doing nothing, session history can be implemented effeciently in memory...]
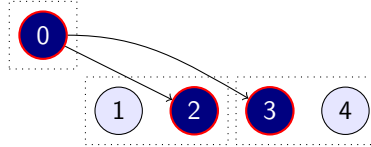
[I suspect none of these are true of the current spec, can we find a model in which they are true?]

Goal 1 *If H traverses the history by δ to H' and H' traverses the history by δ' to H'' then H traverses the history by $\delta + \delta'$ to H''.*
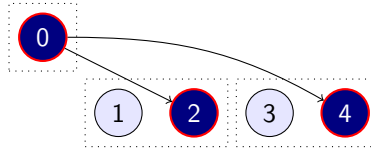
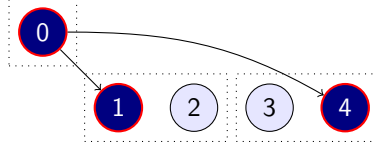**Counterexample 1** *Let H be:*

which traverses the history by 1 to:

which traverses the history by 1 to:

but H traverses the history 2 to:

This counterexample is caused by the definition of 'traverses the history by δ' which only traverses one document's session history. Instead, we should traverse the history of all δ documents.

**Patch 1** *Define H traverses the history by $+\delta$ to H' when:*

- *the joint session future of H is $d_1 < \cdots < d_\delta < \cdots$,*

- *there is some $H = H_0, \ldots, H_\delta = H'$, such that*

- *H_{i-1} traverses the history to d_i in H_i for each $1 \le i \le \delta$.*
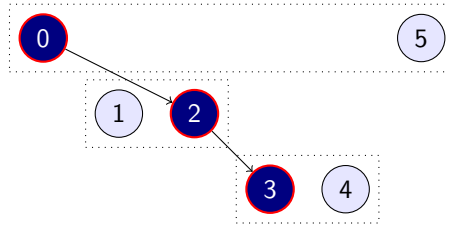
Define H traverses the history by $-\delta$ to H' when:

- *the joint session past of H is $d_1 > \cdots > d_\delta > \cdots$,*

- *there is some $H = H_0, \ldots, H_\delta = H'$, such that*

- *H_{i-1} traverses the history to d_i in H_i for each $1 \le i \le \delta$.*

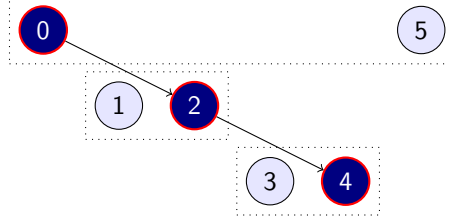Unfortunately, Goal 1 is not satisfied, even with this patch.
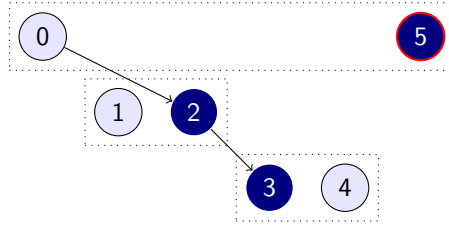
Counterexample 2 *Let H be:*
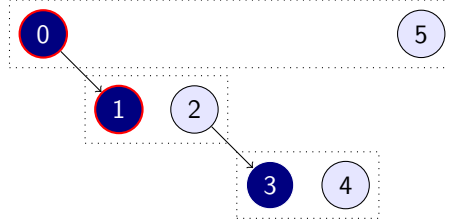
which moves forwards by 1 to:

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which in turn moves forwards by 1 to:
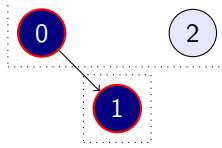

but H goes forward by 2 to:

The problem this time is that the definition of 'joint session history' only includes the fully active documents, not all active documents.
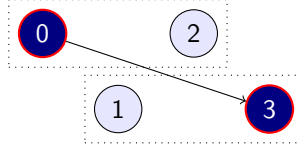
Patch 2 *Define:*

- *the* joint session future *is* $\{e \mid \exists d \in A . d \lesssim e\}$, *and*

- *the* joint session past *is* $\{e \mid \exists d \in A . d \gtrsim e\}$.

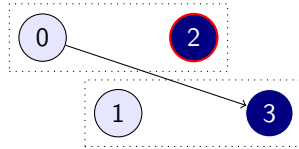**Goal 2** *If d in H navigates to d' in H', and H' traverses the history by -1 to H'', then $FA = FA''$.*

Counterexample 3

navigates 1 to 3 in:

which traverses the history by -1 to:

5 Experiments

[A write-up of CGB's experiments with how different browsers handle navigation.]

6 Specification

[Suggested edits to the spec: 1. traverse to each document, not just the selected one, 2. keep all documents in the seession history, not just the fully active ones, 3. change the session history order.]

7 Conclusion

[We did stuff.]