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 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* $-\delta$ *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* 0 *to* H' when $H = H'$.

[This defn is meant to align with the spec.]

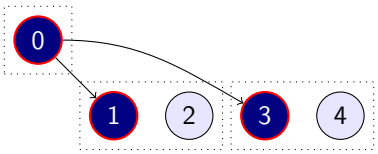
4 Properties

[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...]

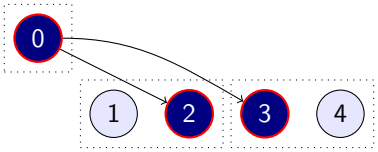
[I suspect none of these are true of the current spec, can we find a model in which they are true?]

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''.

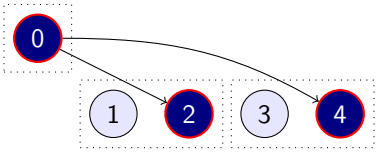
Counterexample 1 *Let* H *be:*



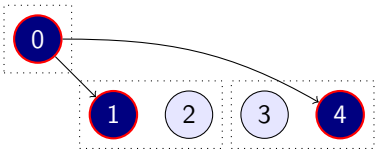
which traverses the history by 1 *to:*



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:*

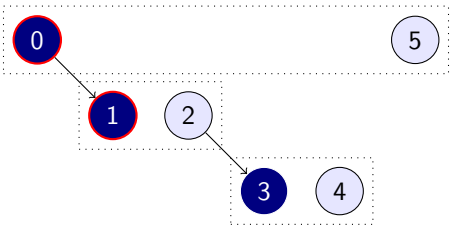
- *the joint session future of H is $d_1 < \cdots < d_\delta < \cdots$,*
- *there is some $H = H_0, \ldots, H_\delta = H'$, such that*
- *H_{i-1} traverses the history to d_i in H_i for each $1 \leq i \leq \delta$.*

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

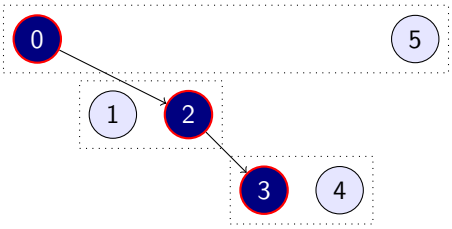
- *the joint session past of H is $d_1 > \cdots > d_\delta > \cdots$,*
- *there is some $H = H_0, \ldots, H_\delta = H'$, such that*
- *H_{i-1} traverses the history to d_i in H_i for each $1 \leq i \leq \delta$.*

Unfortunately, Goal 1 is not satisfied, even with this patch.

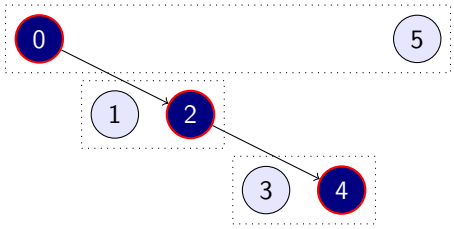
Counterexample 2 *Let H be:*



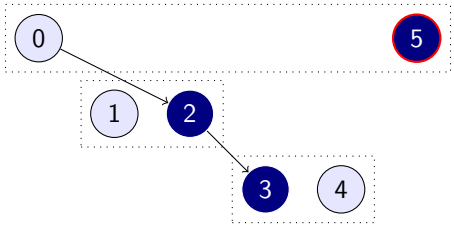
which moves forwards by 1 to:



which in turn moves forwards by 1 *to:*



but H *goes forward by* 2 *to:*

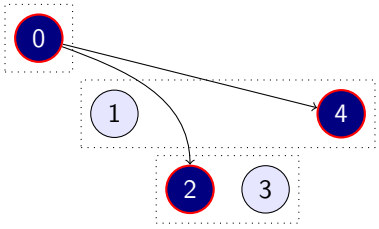


The problem this time is that the definition of 'joint session history' only includes the fully active documents, not all active documents.

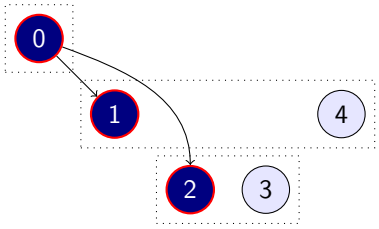
Patch 2 *Define:*

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

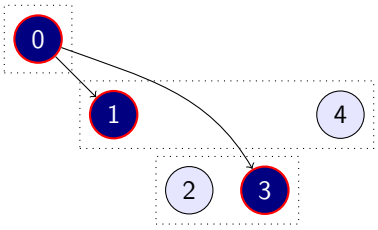
Counterexample 3 *Let* H *be:*



which traverses the history by -1 *to:*



which traverses the history by 1 *to:*



which is not the same as H*.*

[ASAJ: Not sure about this...]

Patch 3 *Define* H traverses the history from d' *when there is some* d *such that:*

- $d \lesssim d'$*,*
- *for any* $e \lesssim d'$ *we have* $e \leq d$*, and*
- H *traverses the history to* d*.*

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

- *the joint session past and active documents 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 from* d_i *in* H_i *for each* $1 \leq i \leq \delta$*.*

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

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.]