

Notes on navigation history

Alan Jeffrey Connor G. Brewster

DRAFT of 2016-06-15

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

- a forest (D, \rightarrow) (the *document hierarchy*),
- a total order (D, \leq) (the *chronological order*),
- an equivalence relation (D, \sim) (the *same-session equivalence*), and
- a set $A \subseteq D$ (the *active documents*),

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 $d \rightarrow e$ and $e \in A$,

- $FA = \{d \mid d_0 \rightarrow^* d\}$ (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 d in H *navigates to* d' in H' when:

- $d \in A$ and $d' \notin D$,
- $D' = D \cup \{d'\} \setminus \{f \mid \exists e . d \lesssim e \rightarrow^* f\}$,
- $e \leq' f$ whenever $e \leq f$, or $f = d'$,
- $e \rightarrow' f$ whenever $e \rightarrow f$ and $f \neq d$, or $e \rightarrow d$ and $f = d'$,
- $e \sim' f$ whenever $e \sim f$, or $e \sim d$ and $f = d'$, or $d \sim f$ and $e = d'$, and
- $e \in A'$ whenever $d \in A$ and $e = d'$, or $e \in A$ and $e \neq d$.

Define H *traverses the history to* d in H' when:

- D' is D ,
- \leq' is \leq ,
- \rightarrow' is \rightarrow ,
- \sim' is \sim , and
- $e \in A'$ whenever $d \not\sim e \in A$, or $d = e$.

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

- the joint session past of H is $d_1 > \dots > d_\delta > \dots$,
- 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 $d_1 < \dots < d_\delta < \dots$,
- H traverses the history to d_δ in H'

Define H *traverses the history by* 0 *to* H' when $H = H'$.

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

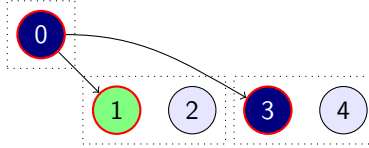
4 Properties

[State some goals, e.g. $\text{go}(\delta); \text{go}(\delta')$ is the same as $\text{go}(\delta + \delta')$, $\text{navigate}; \text{go}(-1)$ has the same fully active documents as doing nothing, session history can be implemented efficiently in memory...]

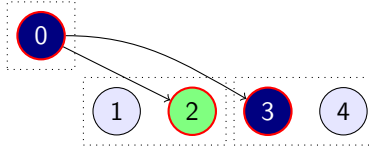
[I suspect none of these are true of the current spec, can we find a model in which they are true?]

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'' .*

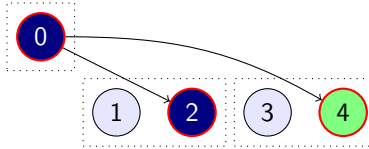
Counterexample 1 *Let H be:*



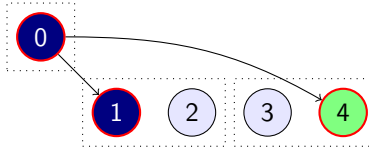
which traverses the history by 1 to:



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 $d_1 < \dots < d_\delta < \dots$,*

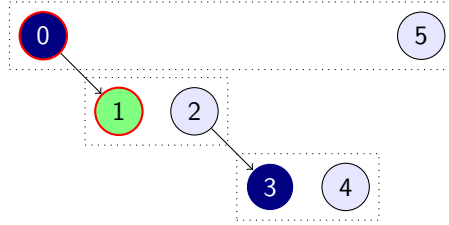
- there is some $H = H_0, \dots, H_\delta = H'$, such that
- H_{i-1} traverses the history to d_i in H_i for each $1 \leq i \leq \delta$.

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

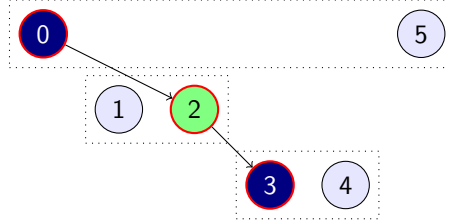
- the joint session past of H is $d_1 > \dots > d_\delta > \dots$,
- there is some $H = H_0, \dots, H_\delta = H'$, such that
- H_{i-1} traverses the history to d_i in H_i for each $1 \leq i \leq \delta$.

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

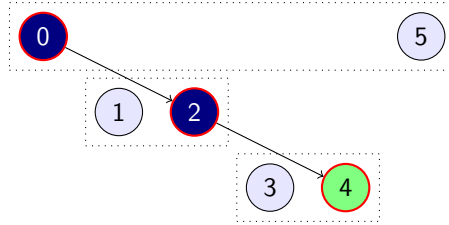
Counterexample 2 Let H be:



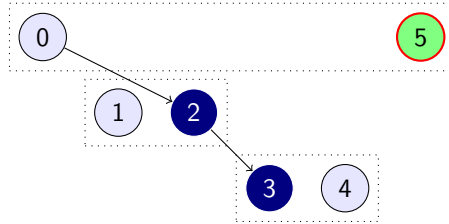
which moves forwards by 1 to:



which in turn moves forwards by 1 to:



but H goes forward by 2 to:



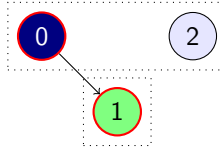
The problem this time is that the definition of ‘joint session history’ only includes the fully active documents, not all active documents.

Patch 2 Define:

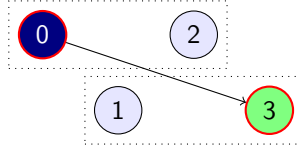
- the joint session future is $\{e \mid \exists d \in A. d \lesssim e\}$, and
- the joint session past is $\{e \mid \exists d \in A. d \gtrsim e\}$.

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

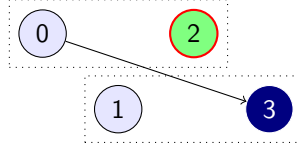
Counterexample 3



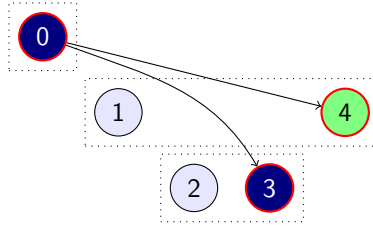
navigates 1 to 3 in:



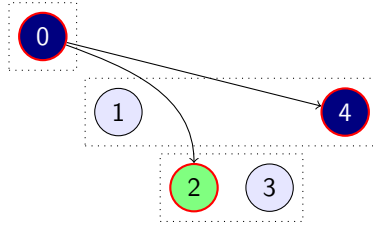
which traverses the history by -1 to:



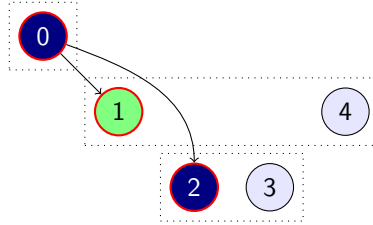
Counterexample 4



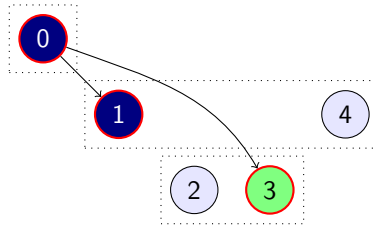
which traverses the history by -1 to:



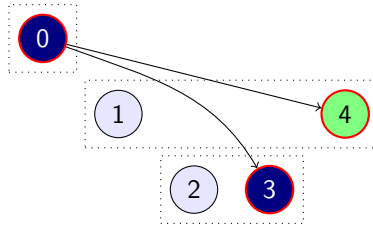
which traverses the history by -1 to:



which traverses the history by 1 to:



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 session history, not just the fully active ones, 3. change the session history order.]

7 Conclusion

[We did stuff.]