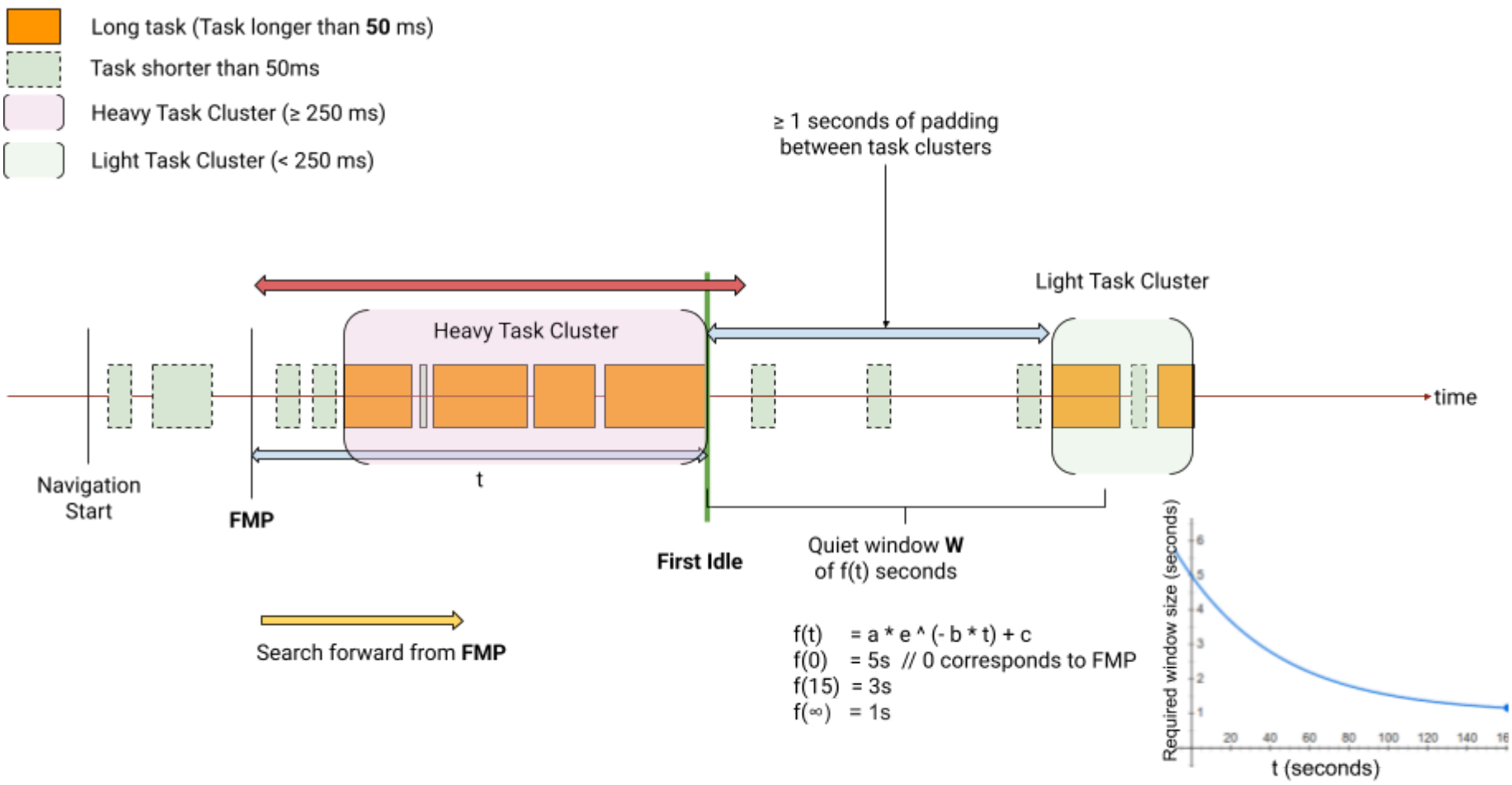
First CPU Idle - Task Cluster Definition

Update: We have renamed First Interactive ⇒ First CPU Idle.

FirstCPUIdle can be defined in terms of *TaskClusters* and characterizing the task clusters as *heavy/light.* This leads to a cleaner implementation compared to the definition in terms of lonely tasks. Credits for introducing this conceptual refactoring goes to *phulce@* and the lighthouse team.

See First Interactive and Consistently Interactive for the original doc motivating the definition. The definition presented here is completely equivalent to the definition given in terms of lonely tasks.



Definitions

Informally, First CPU Idle can be defined as the beginning of a sufficiently large quiet window that doesn't contain a big group of densely packed long tasks. The required size of the quiet window is 5 seconds at FMP, but it slowly decreases, with reaching 3 seconds when the beginning of window is 15 seconds after FMP, and asymptotically reaches 1s.

We provide formal definitions of all the terms here:

Long Task
Any main thread task with duration ≥ 50ms.

TaskCluster
A non-empty set of long tasks such all the tasks in the set are at least 1s second away from any long task not in the set.
It obviously follows that two task clusters have interval of at least 1 second between them with no long tasks.
Duration of a TaskCluster is defined as duration between the beginning of first long task and the end of last long task.

Heavy and Light TaskCluster
A TaskCluster is considered ***heavy*** if it's duration is ≥ 250ms. Otherwise, it is considered ***light***.

Required Quiet Window Size
We become more lenient about the required quiet window size the further away we are from FMP. The required quiet window size at for a window starting at *t* seconds from FMP, *req(t)*, is assumed to have exponential decay with the following constraints:

- req(0) = 5. The required quiet window size is 5 seconds at FMP.
- req(15) = 3
- req(t) → ∞ as t → ∞

Exponential decay is given by the equation $req(t) = ae^{-bt} + c$
Solving for the constraints mentioned above, we get

$a = 4$

$b = -\frac{1}{15}\log(\frac{1}{4}(3-1)) = \frac{1}{15}\log(2)$

$c = 1$

First CPU Idle

Let $req(t) = 4e^{-bt} + 1$, where $b = \frac{1}{15}\log(2)$, be the required quiet window size for a window starting at *t* seconds from FMP.

We find the first window W after FMP such that

- If W does not overlap any **heavy** TaskCluster
- Duration of W ≤ *req*(W.start - FMP)

Let First CPU Idle Candidate = W.start.

First CPU Idle is max(First CPU Idle Candidate, DOMContentLoadedEventEnd).