

Today

- Lamport's physical clock
- Test Logistics ~~\* \* \*~~ important ~~\* \* \*~~

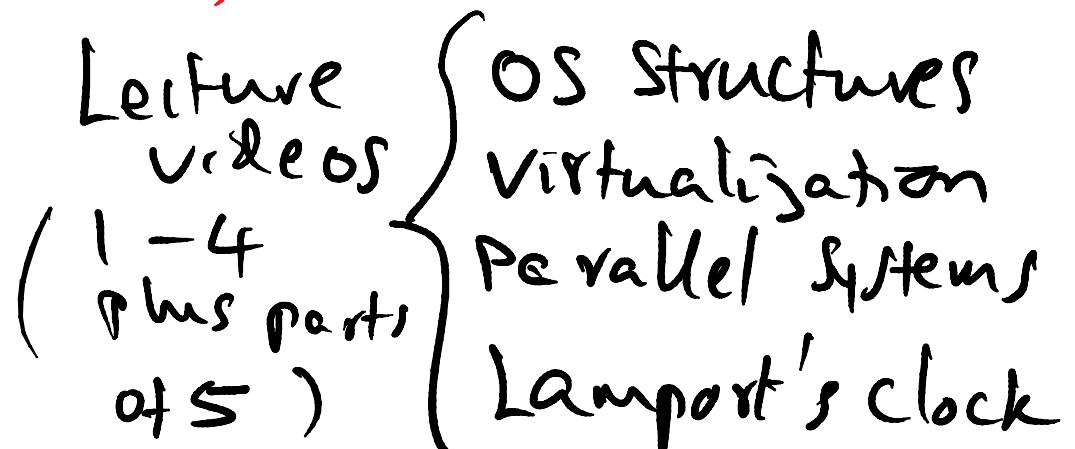
- Townhall

Monday

- Midterm in class

- Syllabus

\* Everything including today's  
lecture



## Real world scenario

real time

my branch

your branch

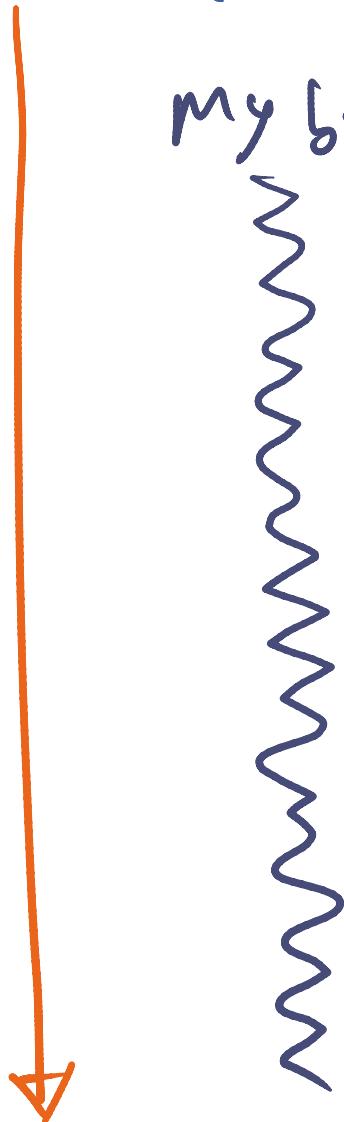
Out of band

me



you

Central  
Bank  
Server



## Real world scenario

real time

my branch

your branch

Out of band

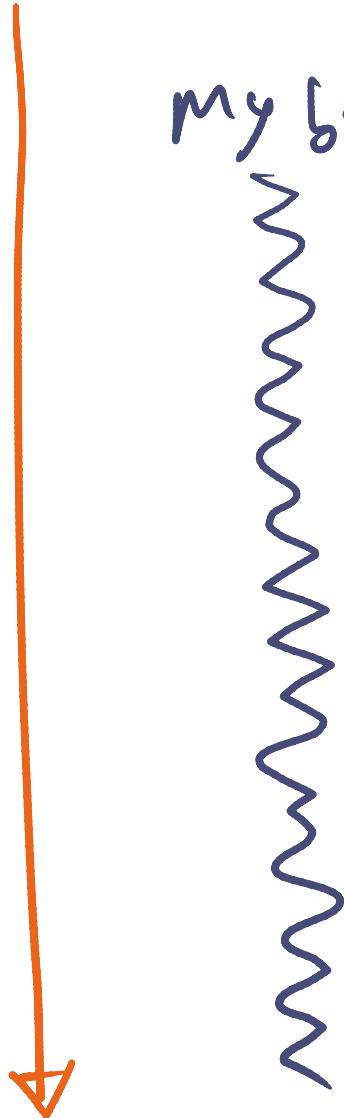
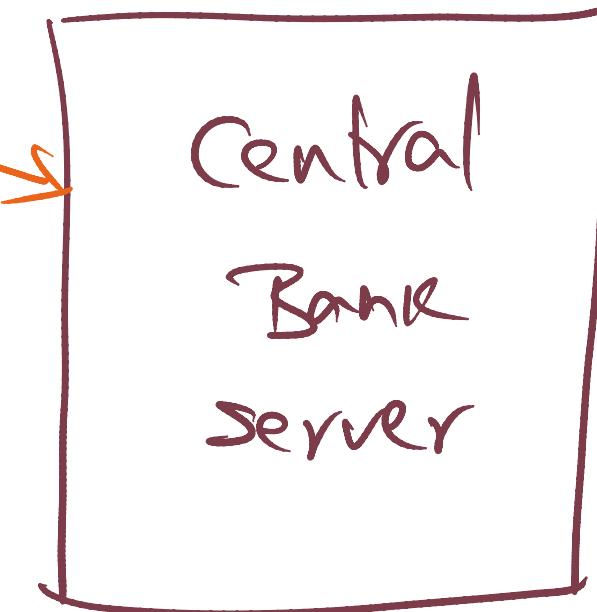
me



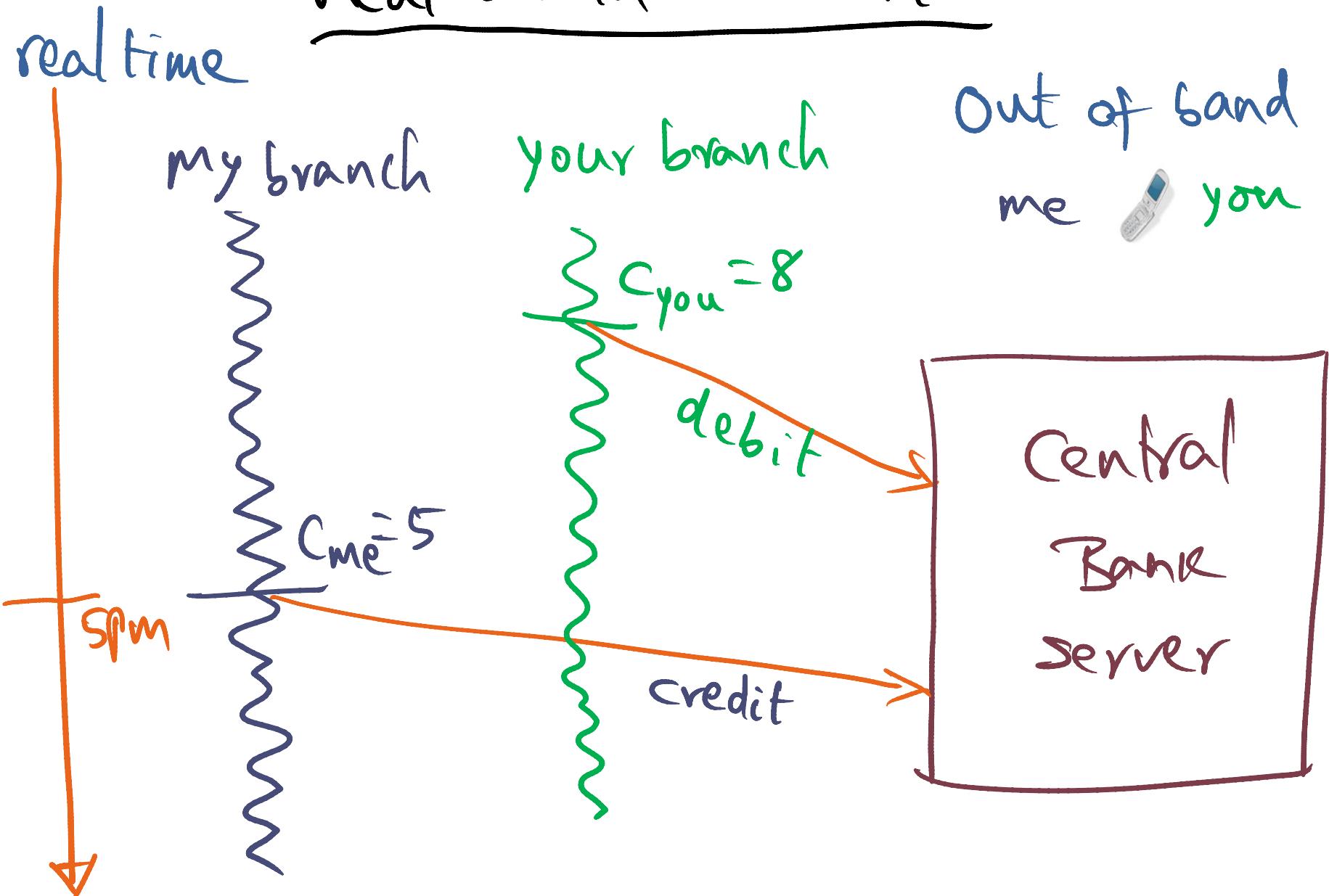
you

$c_{\text{you}} = 8$

debit

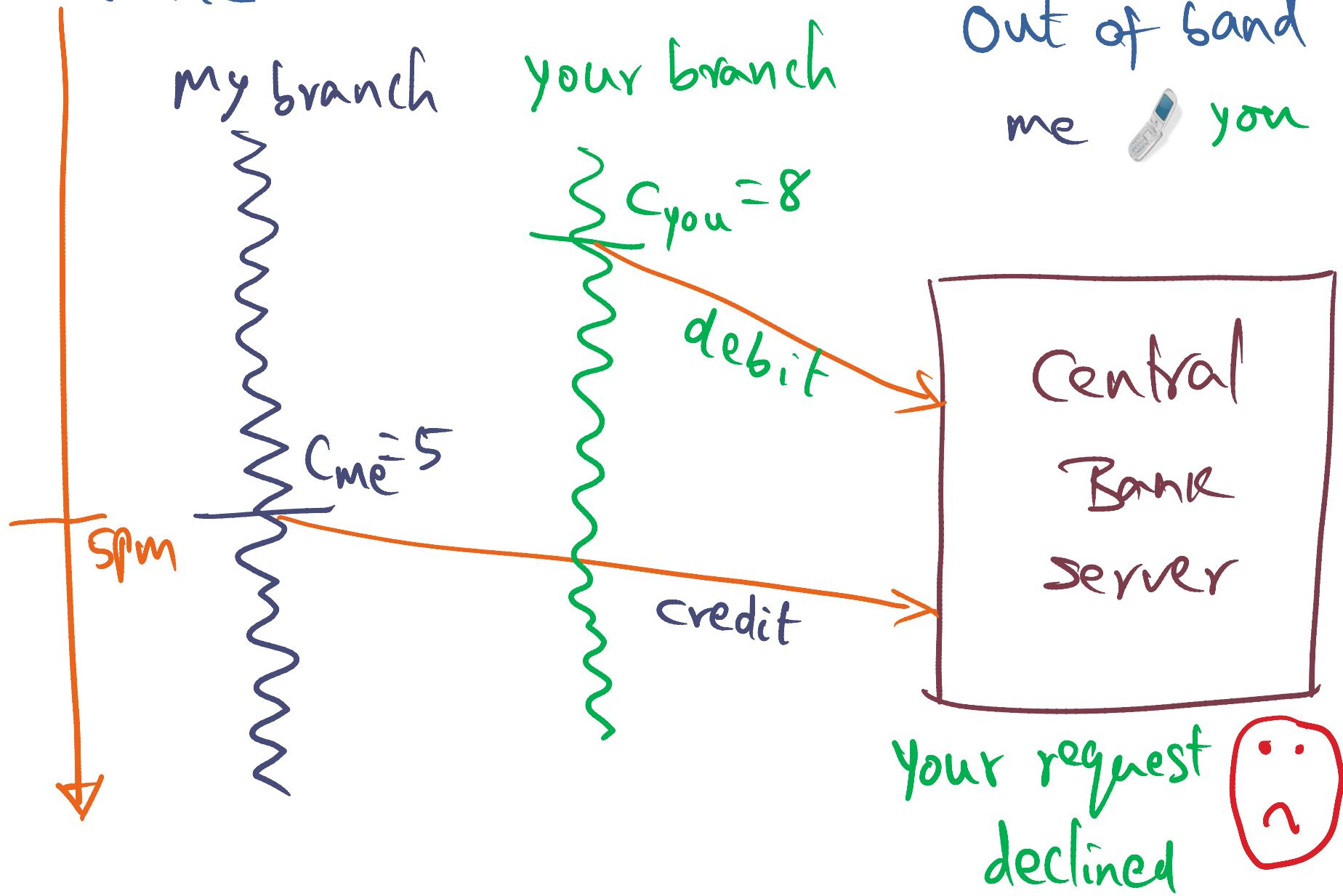


## Real world scenario



## Real world scenario

real time



# Lamport's Physical clock

$a \rightarrow b$

$$\Rightarrow c_i(a) < c_j(b)$$

$$c_i(t) \xrightarrow{a} \begin{cases} p_i \\ p_j \end{cases} \quad \left. \begin{array}{l} c_i(t) \\ c_j(t) \end{array} \right\} s_j(t)$$

Physical clock conditions :

1) PC1 (bound on individual clock drift)

$$\left( \frac{\frac{dc_i(t)}{dt}}{1} - 1 \right) < \kappa \quad \forall i; (\kappa \ll 1)$$

2) PC2 (bound on mutual drift)

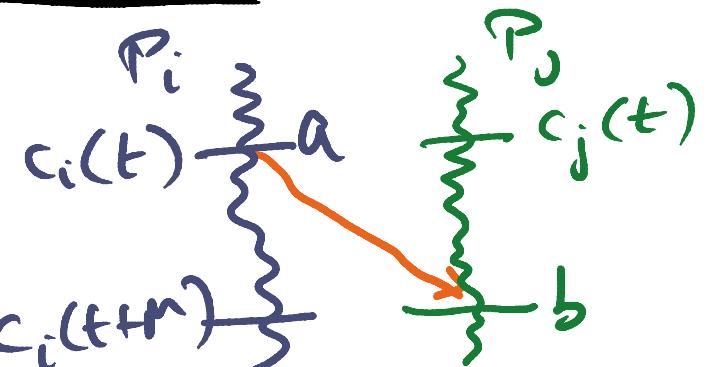
$$\forall i, j: |c_i(t) - c_j(t)| < \epsilon$$

## IPC time and clock drift

Let  $\mu$  be lower bound on IPC

To avoid anomalies if

a on  $P_i \mapsto b$  on  $P_j$



1)  $c_i(t+\mu) - c_j(t) > 0$

2)  $c_i(t+\mu) - c_i(t) > \mu(1-\kappa)$

(difference equation formulation of PCI)  $\xrightarrow{\text{PCI}}$   $\xleftarrow{\text{PC2}}$

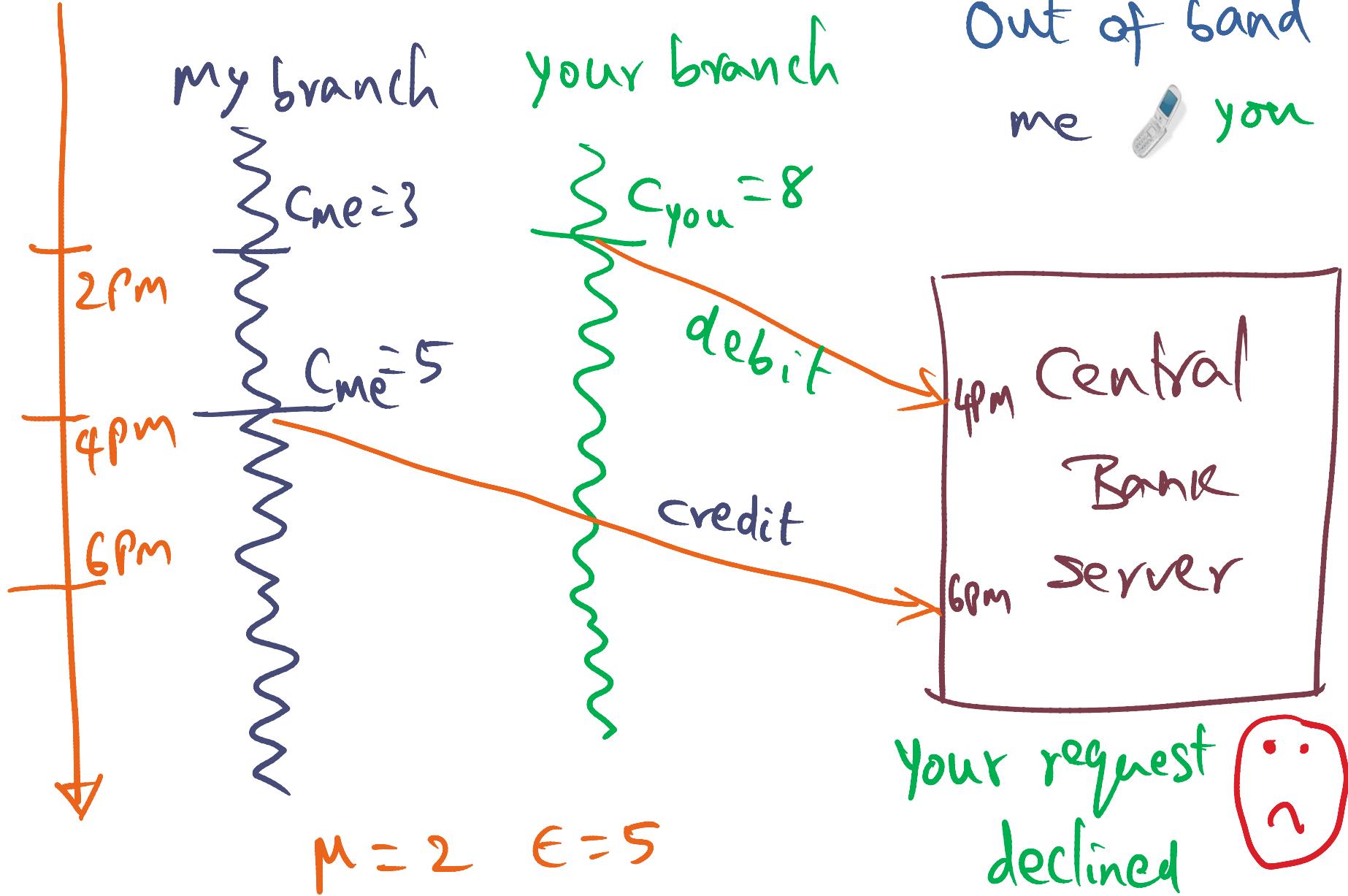
Using ① + ② and sound  $\in$  on mutual drift

$$\mu \geq \epsilon / (1 - \kappa)$$

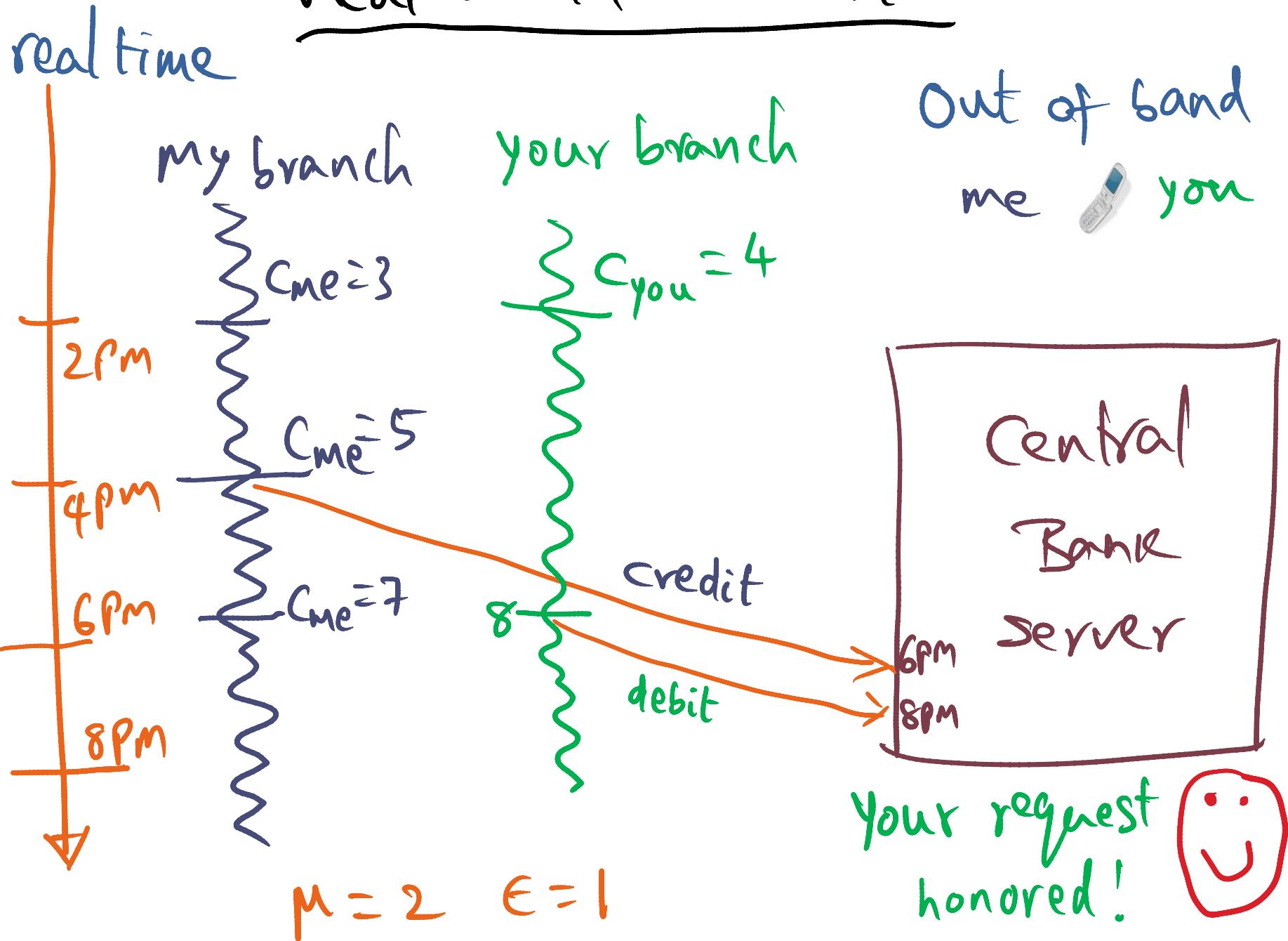
to avoid anomalies

## Real world scenario

real time



## Real world scenario



Details of midterm: Monday Oct 5

- \* Exam available on t-square  
at 6 AM Monday Oct 5
- \* Fair game to prepare  
(papers, Internet, collaborate...)
- \* Take the test in class at 11 AM  
(closed book + notes)  
Which is what we will grade  
(NO Exceptions)