The Hitchhiker’s Guide to Time in Computers

Mistral Contrastin (mojpc2)
UNIX Creationism
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January 1st, 1970

We’re here! January 19th, 2038

We hope by that time, everything switches to 64 bits, postponing the problem by 293 billion years!
Local clocks run behind

11:00

Facebook HQ

10:42
Just use the receiver time
There are many receivers

Facebook HQ

Thousands and thousands of computers
Time is a matter of perspective
Transactions under ~100ns

- Goldman Sachs: 80ns
- BNP Paribas: 120ns
- Citadel: 100ns
- Morgan Stanley: 90ns

sec: 123456.123456789
Financial forensics

- Are buy & sell orders consistently simultaneously?
- Are there synthetic patterns of buy and sell orders?
Versioning essays

essay.doc → essayFinal.doc → essayFinalFinal.doc

essayFinalB.doc → essayReallyFinalB.doc
Versioning software
Versions explain evolution

- Where does this data fragment come from?
- How did my software grow over time?
Game of Thrones
Spoiler Alert!
Hold the door!

Adult: die while someone screaming “hold the door!”

Child: Hodor becomes the only word he can say.
Cyclical time as “accident”

- Corrupted hard disks
- Faulty routers
- Software faults in general
- Bad protocol design
- Covering up evidence
1. Bring a pot of salted water to barely simmer
2. Make a whirlpool with a spoon
3. Crack an egg in the middle of the whirlpool
4. Wait for 4 minutes
5. Take out the egg with a slotted spoon
6. Go to step (2) until no eggs left
7. Season eggs with black pepper
Natural cyclical time: egg poached egg recipe
Useful queries to code poached egg recipe

- Do I ever finish cooking?
- Is the slotted spoon always necessary?
Temporal logic to the rescue

- “It is raining.”
- $O \text{“It is raining.”} = \text{“It will rain in the next hour.”}$
- $\Box \text{“It is raining.”} = \text{“It is always raining.”}$
- $\Diamond \text{“It is raining.”} = \text{“It will eventually rain.”}$
- $\forall \Box, \exists \Box, \forall \Diamond, \exists \Diamond, \forall O, \exists O \text{ when time is branching}$
Questions?