Distributed Networks

Networked Communication

- Communication over a distributed networks is different to what we've been doing so far.
- We need to dynamically create connections between processes at runtime.
- We can do this on local machines as well, but there's not much point in doing so if it can be avoided.

Dynamic Creation

Dynamic Creation

```
@process
def receiver():
    receivers_channel = Channel('A')
    print(receivers_channel.address)
    reader = receivers_channel.reader()
    while True:
        message = reader()
        print(message)

if __name__ == '__main__':
    Parallel(receiver())
```

Dynamic Creation

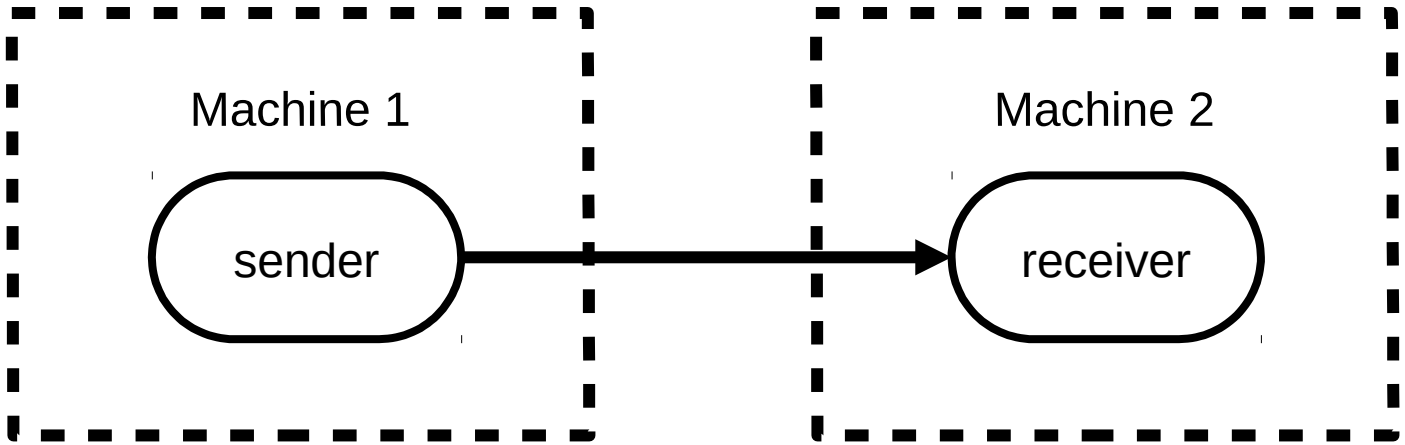
```
@process
def sender():
    receiver_ip = raw_input("Receiver IP? :")
    receiver_port = int(raw_input("Receiver Port? :"))
    tuple = (receiver_ip, receiver_port)
    sender_channel = Channel(name='A', connect=tuple)
    writer = sender_channel.writer()
    writer("hello across a dynamic connection")

if __name__ == '__main__':
    Parallel(sender())
```

Dynamic Creation

- It works (Hopefully).
- Remember that you can only connect to a channel if it was given a name.
- So why won’t this work over a distributed network?
- As an aside, how many channels did we create in the previous example?

Dynamic Network Creation



Dynamic Network Creation

- We’re going to need a new type of process, @multiprocess
- A multiprocess is very much like a process except it is built on top of Pythons multiprocessing module.
- The key difference is that we can define its host address.
- For this part to work we need to use Python 2.6 or above, but not Python 3 (Probably).

Dynamic Network Creation

```
@multiprocess(
        pycsp_host='172.24.5.60',
        pycsp_port=10000)
def receiver():
    channel_in = Channel('A')
    print(channel_in.address)
    reader = channel_in.reader()

    while True:
        message = reader()
        print(message)

if __name__ == '__main__':
    Parallel(receiver())
```

Dynamic Network Creation

```
@multiprocess
def sender():
    to_receiver_channel = Channel('A',
        connect=('172.24.5.60', 10000))

    writer = to_receiver_channel.writer()
    print("ready to send")
    writer("hello over a network")
    print("send complete")

if __name__ == '__main__':
    Parallel(sender())
```

Network Problems

- Communication is usually very slow.
- Messages can take a long time to propagate through a network.
- The network is unreliable.
- Global memory doesn’t exist (yay!).
- Global time doesn’t exist (boo!).

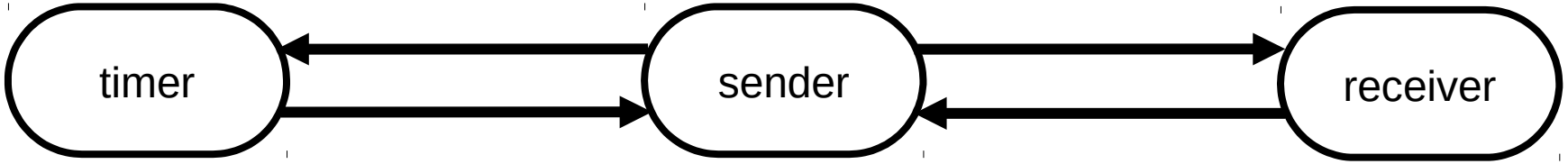
Network Problems

- We can help mitigate some of these problems by:
- Minimising the amount of communication between network processes.
- Minimising the amount of processes, communications and states within a system.
- Not using any global time, and assuming everything is out of order from the off.

Network Problems

- Timers might just be our best friend in Distributed Systems.
- If we send a message over a network we want to know it has gotten there.
- The Receiver sends a response to the Sender.
- During sending the Sender starts a timer process. This will send a notification to the Sender after a given time.
- If the timer sends before the response, then we’ve probably deadlocked.

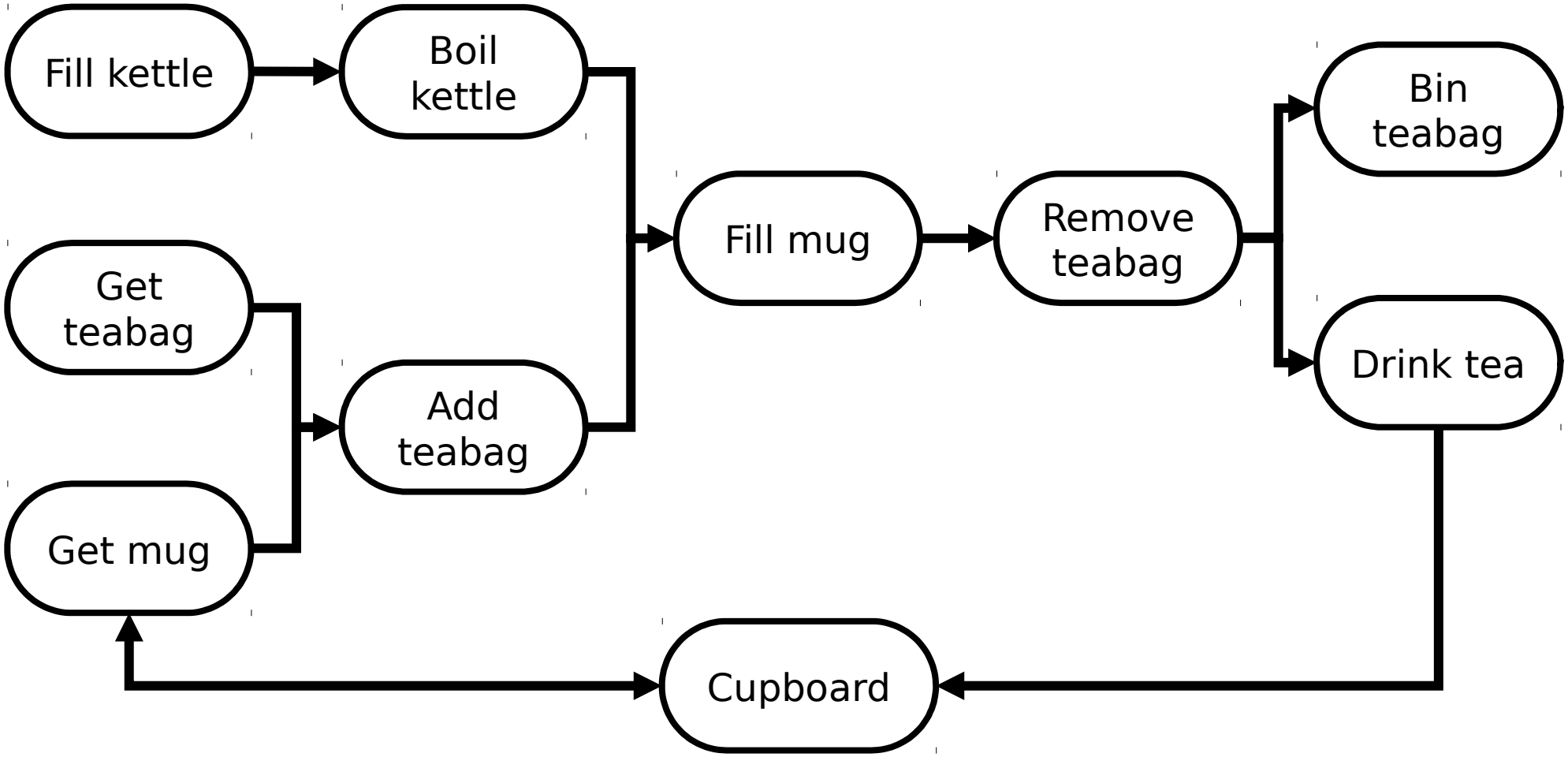
Network Problems



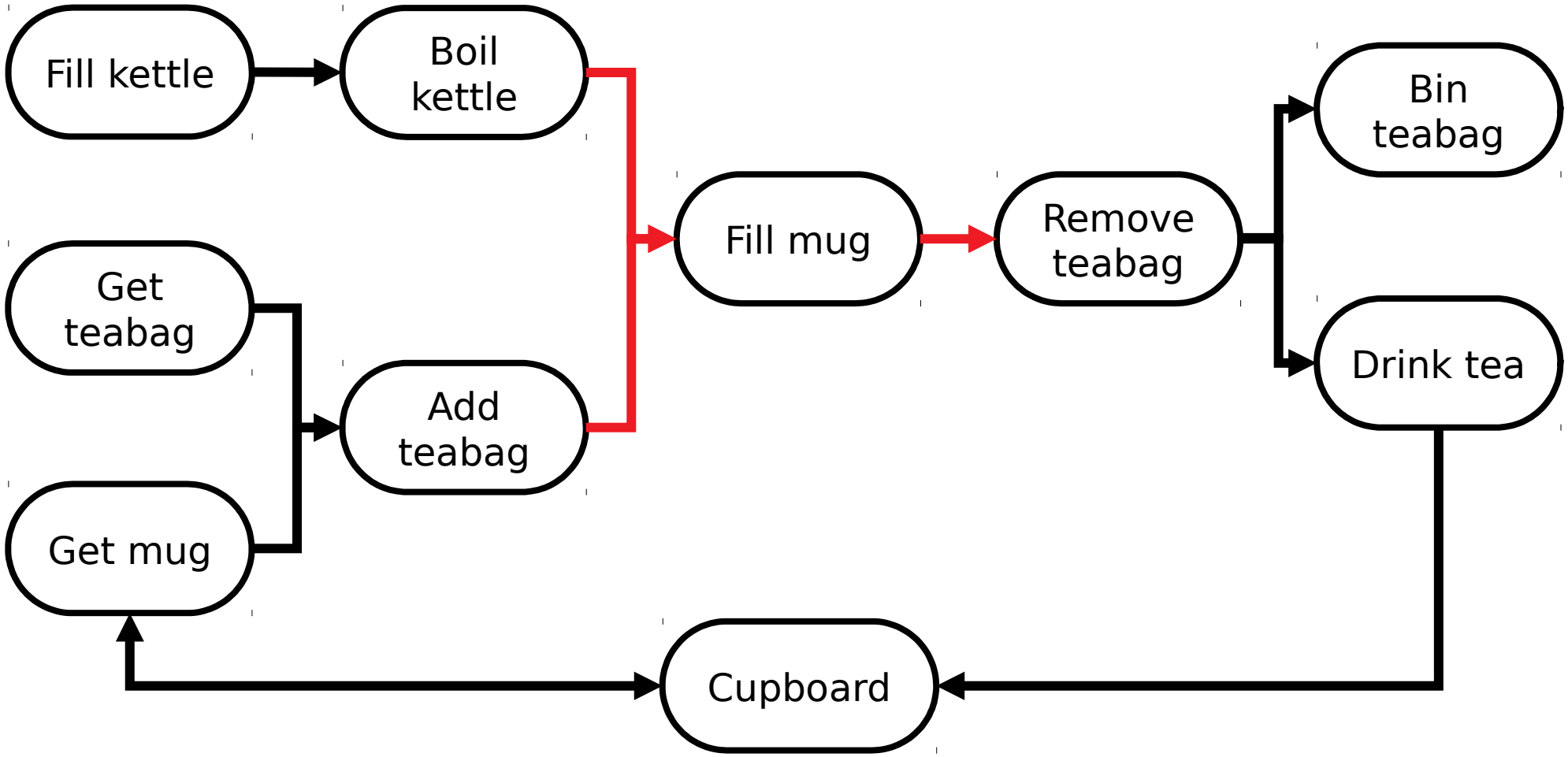
Poisoning

- To ‘help’ shutdown system, CSP defines Poisoning
- Any channel can be poisoned. Once poisoned, it will throw an Exception any time a process tries to send a message over it.
- The idea is that Poisoning will propagate over a network, shutting down everything.

Poisoning


Fill kettle
Boil kettle
Get teabag
Add teabag
Get mug
Fill mug
Remove teabag
Bin teabag
Drink tea
Cupboard

Poisoning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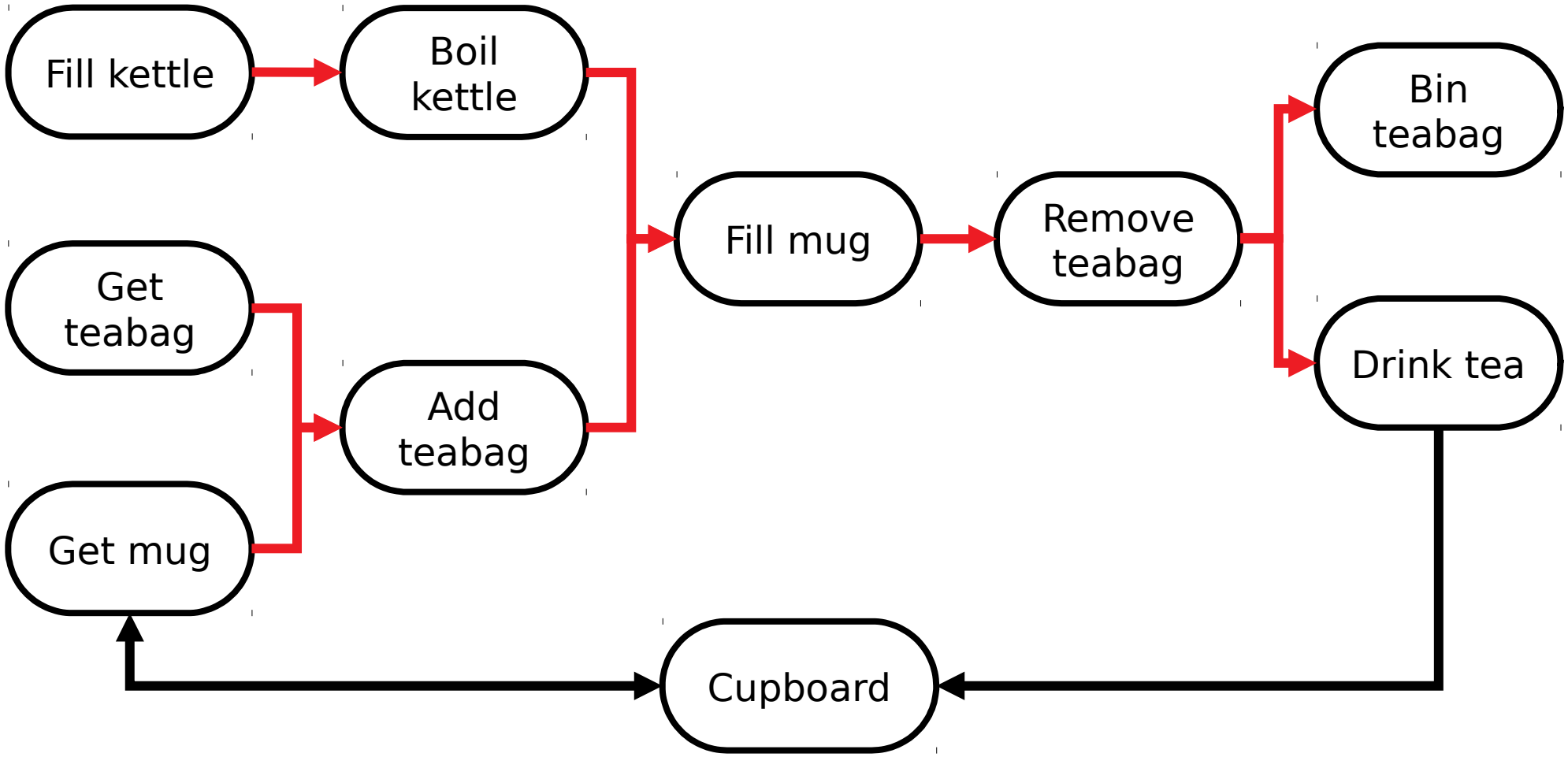
Cupboard

Poisoning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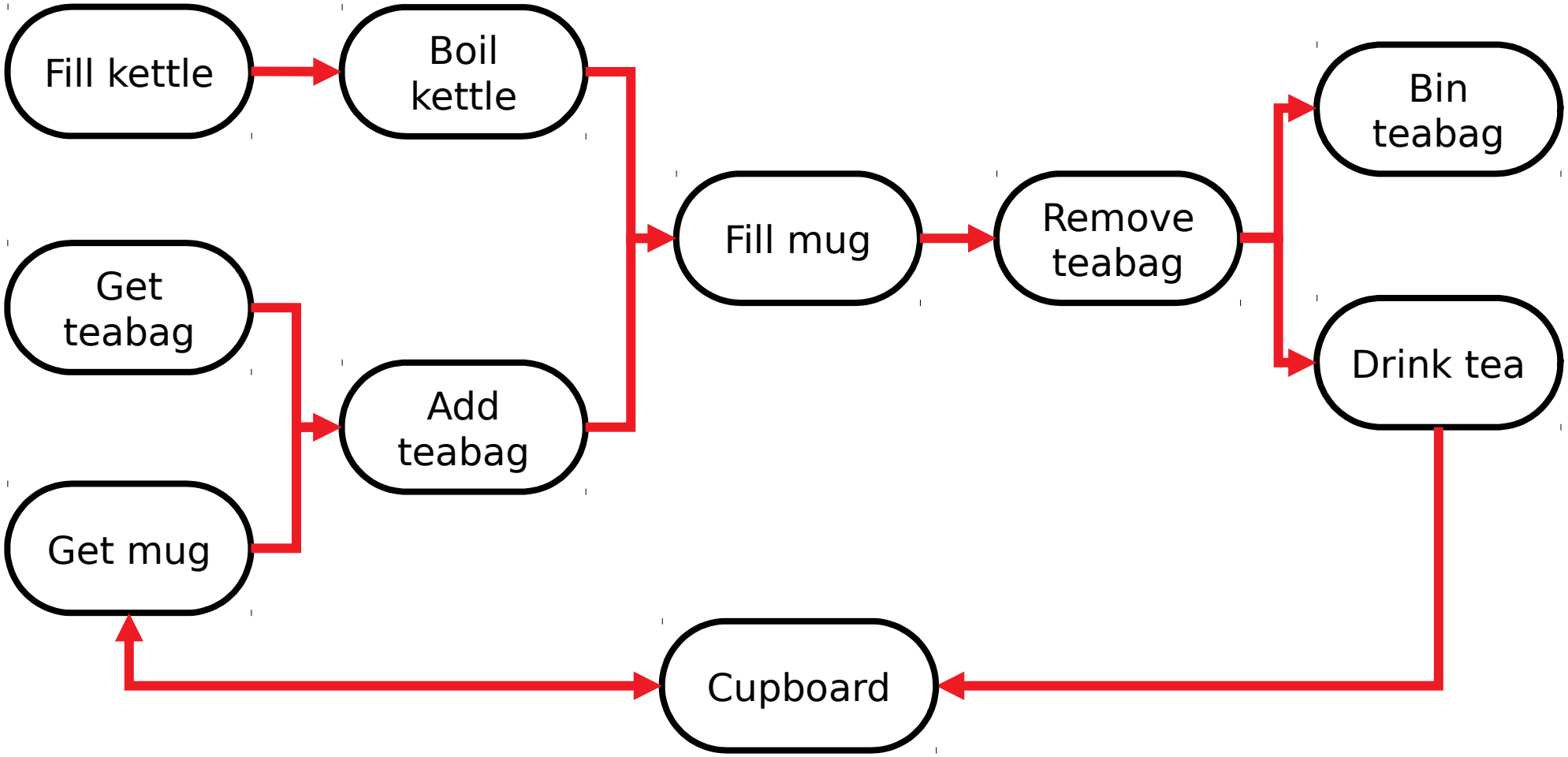
Poisoning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Poisoning

- Poisoning relies on throwing lots of exceptions.
- You might find this to be perfectly acceptable.
- I prefer other methods, like more careful management of interactions.
- This is a stylistic choice though.