

# 6.033 Spring 2018

## Lecture #1

- Complexity
- Modularity and abstraction
- Enforced modularity via client/server models

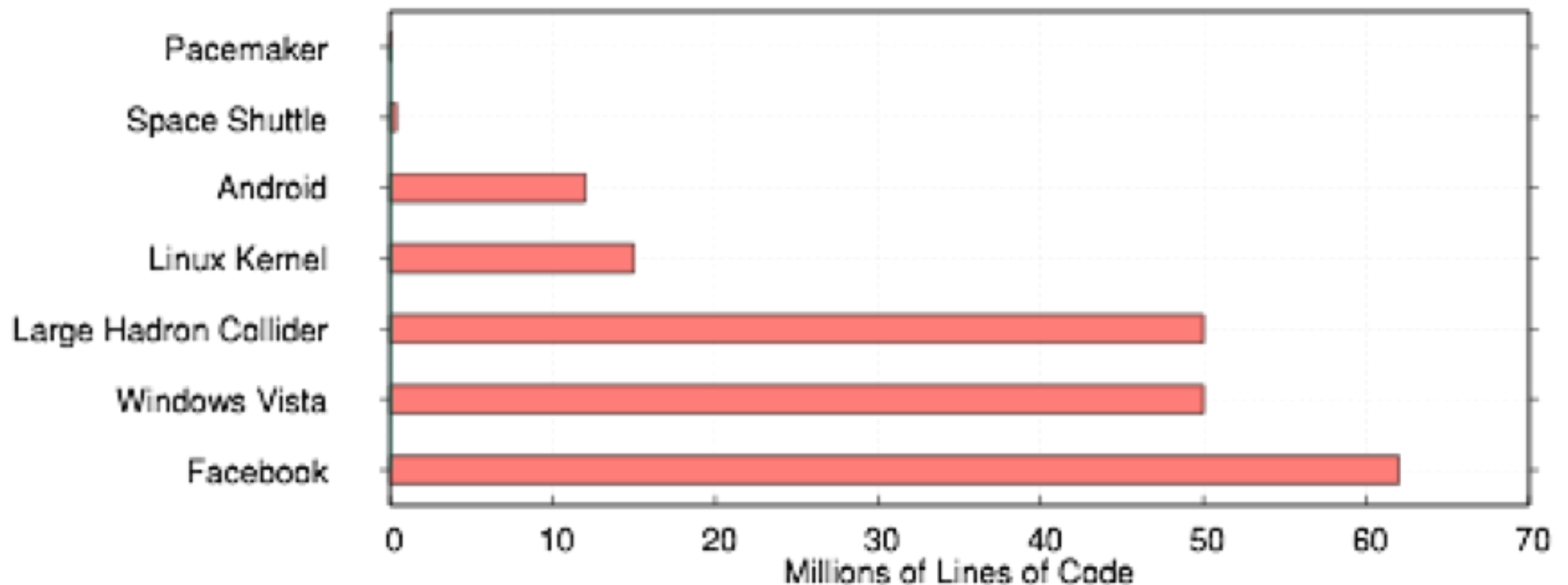
# **what is a system?**

a set of interconnected components that has an expected behavior observed at the interface with its environment

# **what makes building systems difficult?**

complexity

# Today's Systems are Incredibly Complex



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source: <http://www.informationisbeautiful.net/visualizations/million-lines-of-code/>

**complexity limits what we can build and  
causes a number of unforeseen issues**

# how do we mitigate complexity?

with design principles such as **modularity** and  
**abstraction**

# how do we enforce modularity?

*one* way is to use the **client/server model**

## Class Browser

(on machine 1)

```
def main():  
    html = browser_load_url(URL)  
    ...
```

request



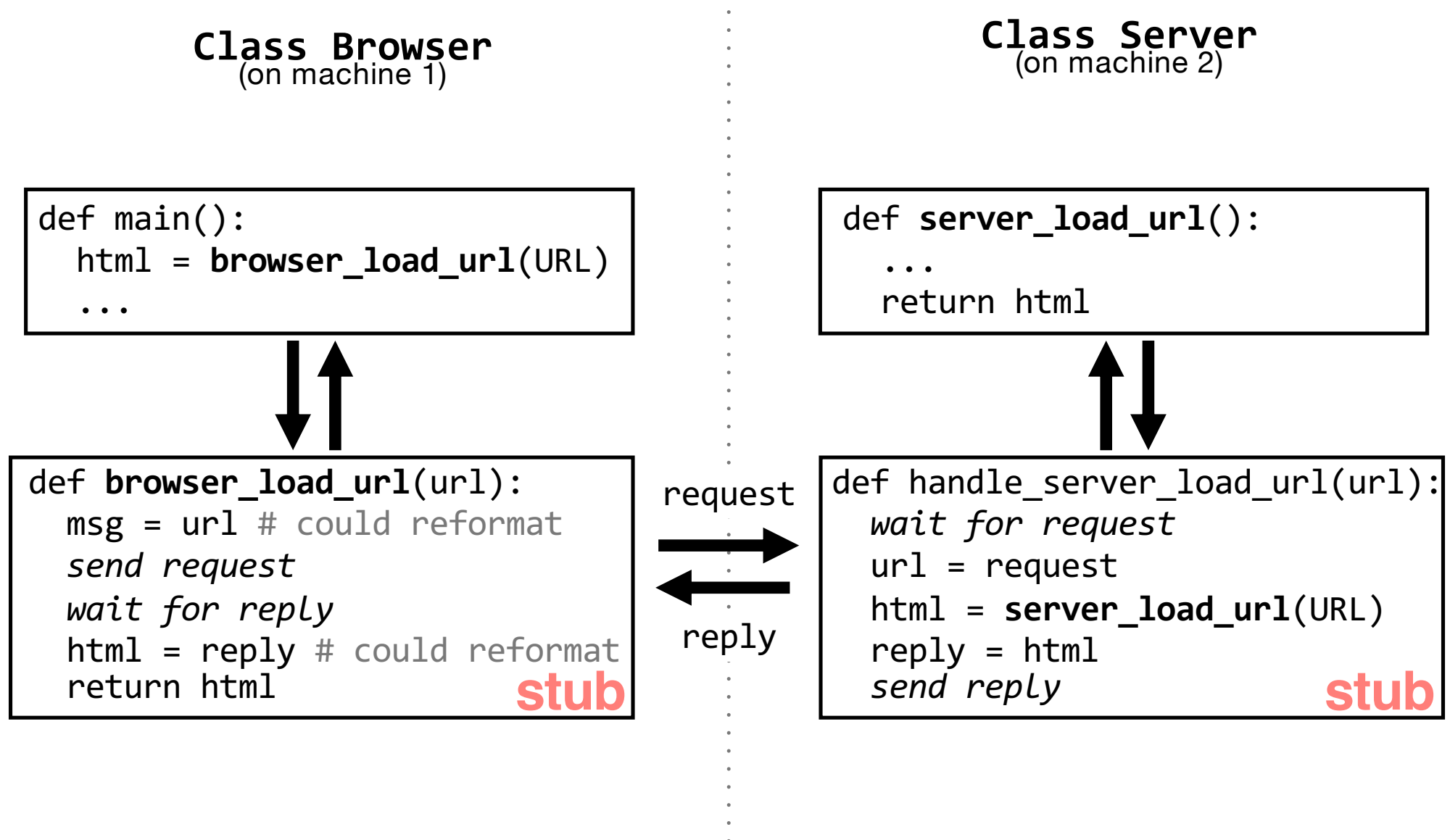
reply

## Class Server

(on machine 2)

```
def server_load_url():  
    ...  
    return html
```

# Stub Clients and RPCs





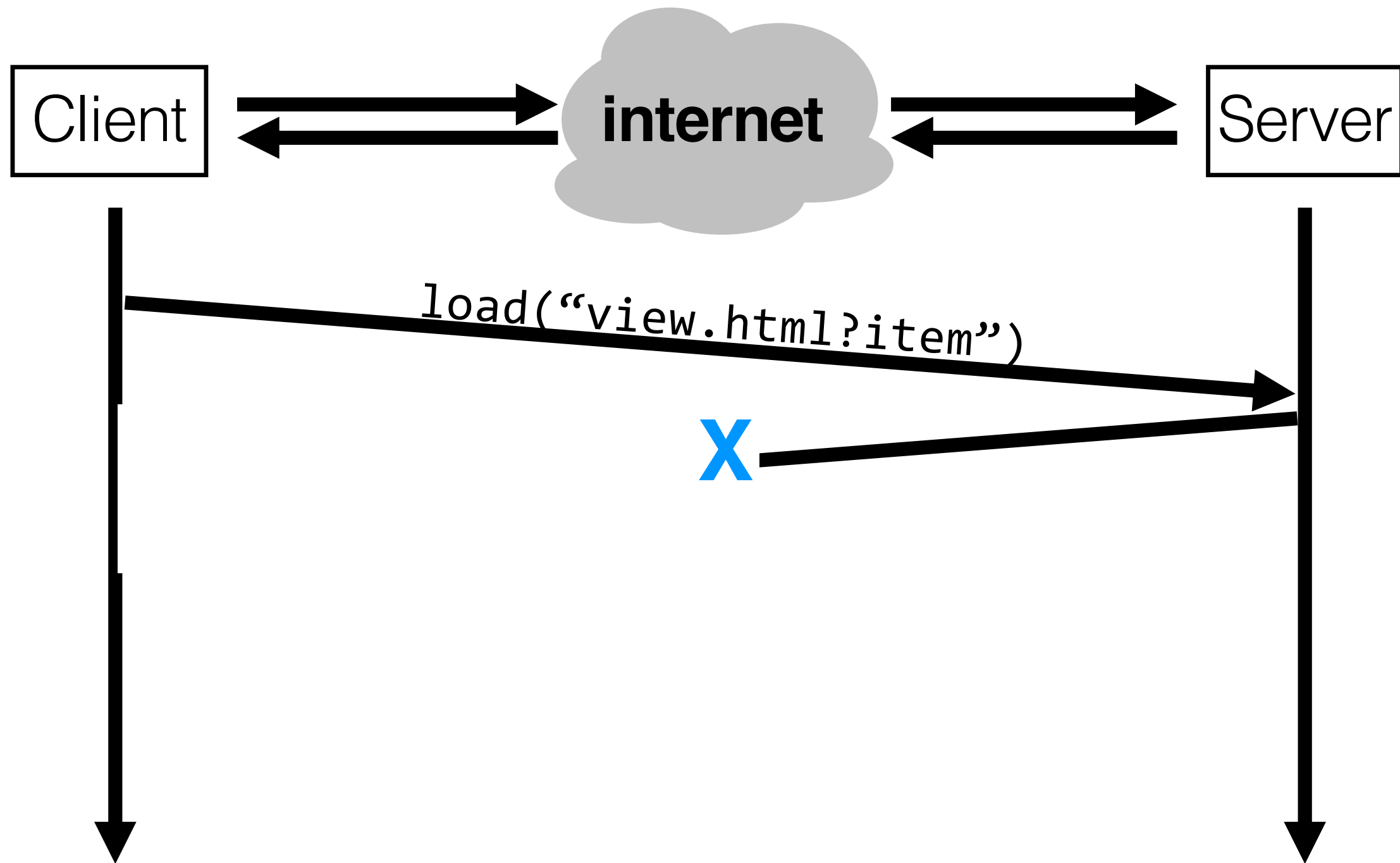
# Challenges with RPCs



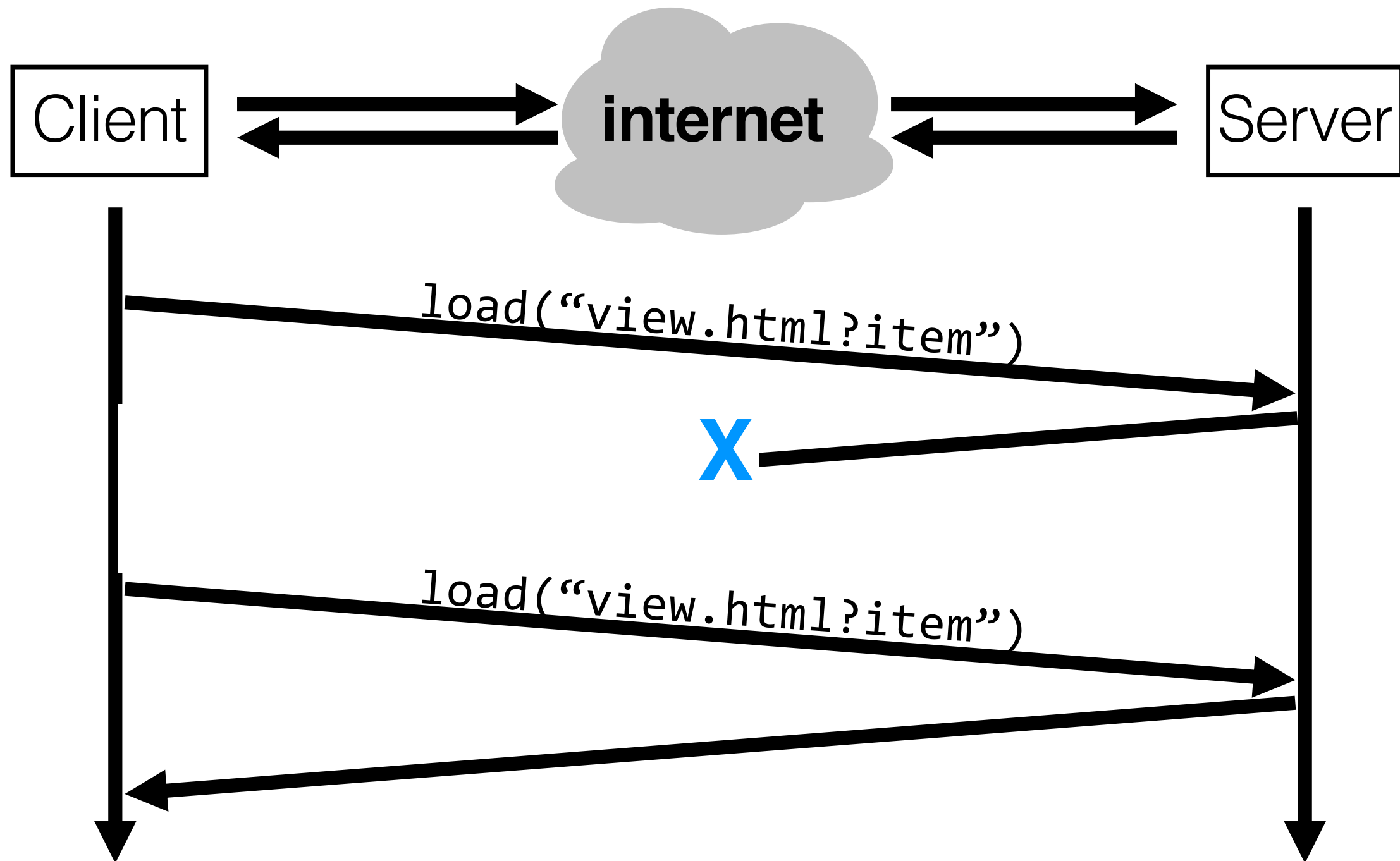
# Challenges with RPCs



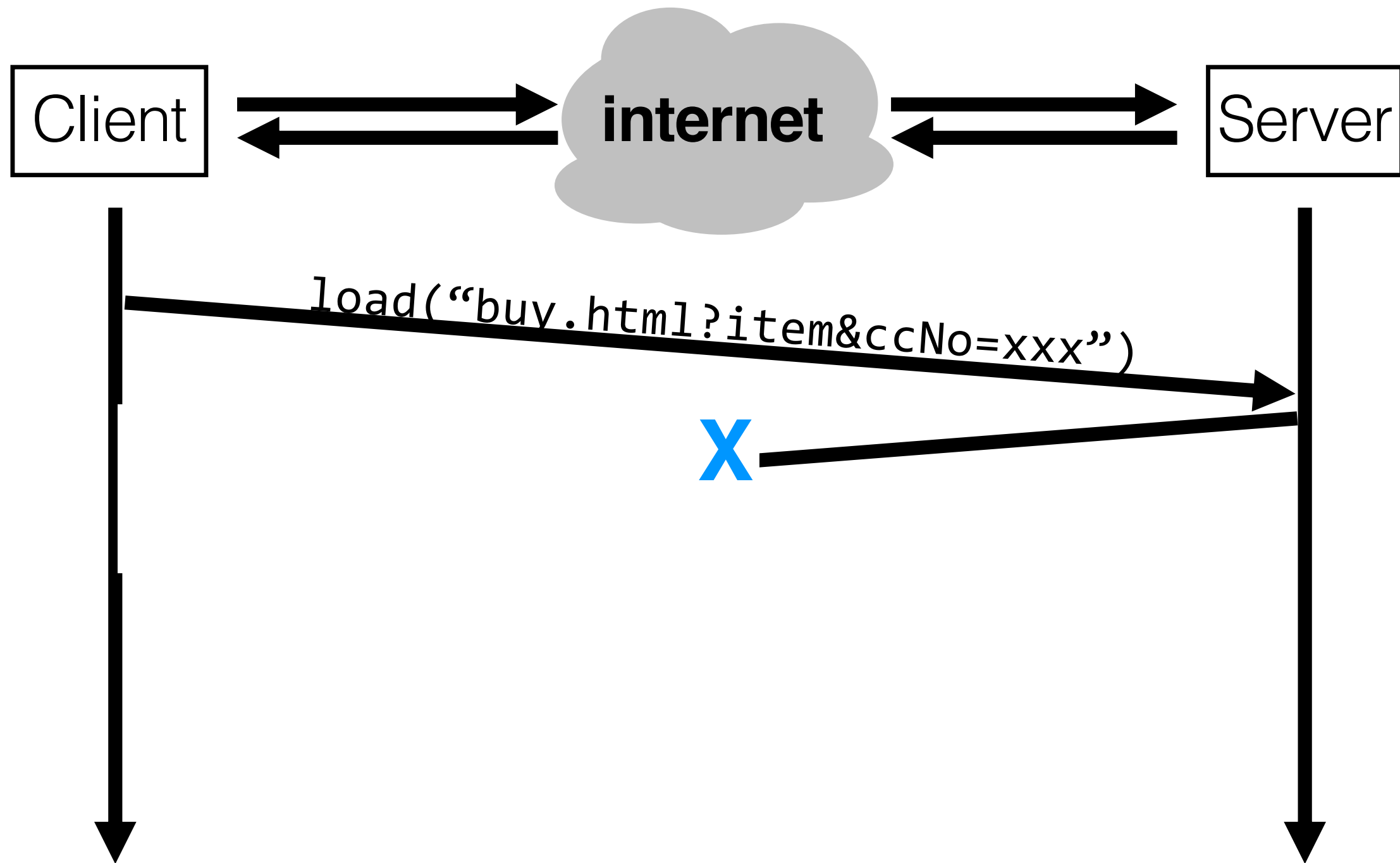
# Challenges with RPCs



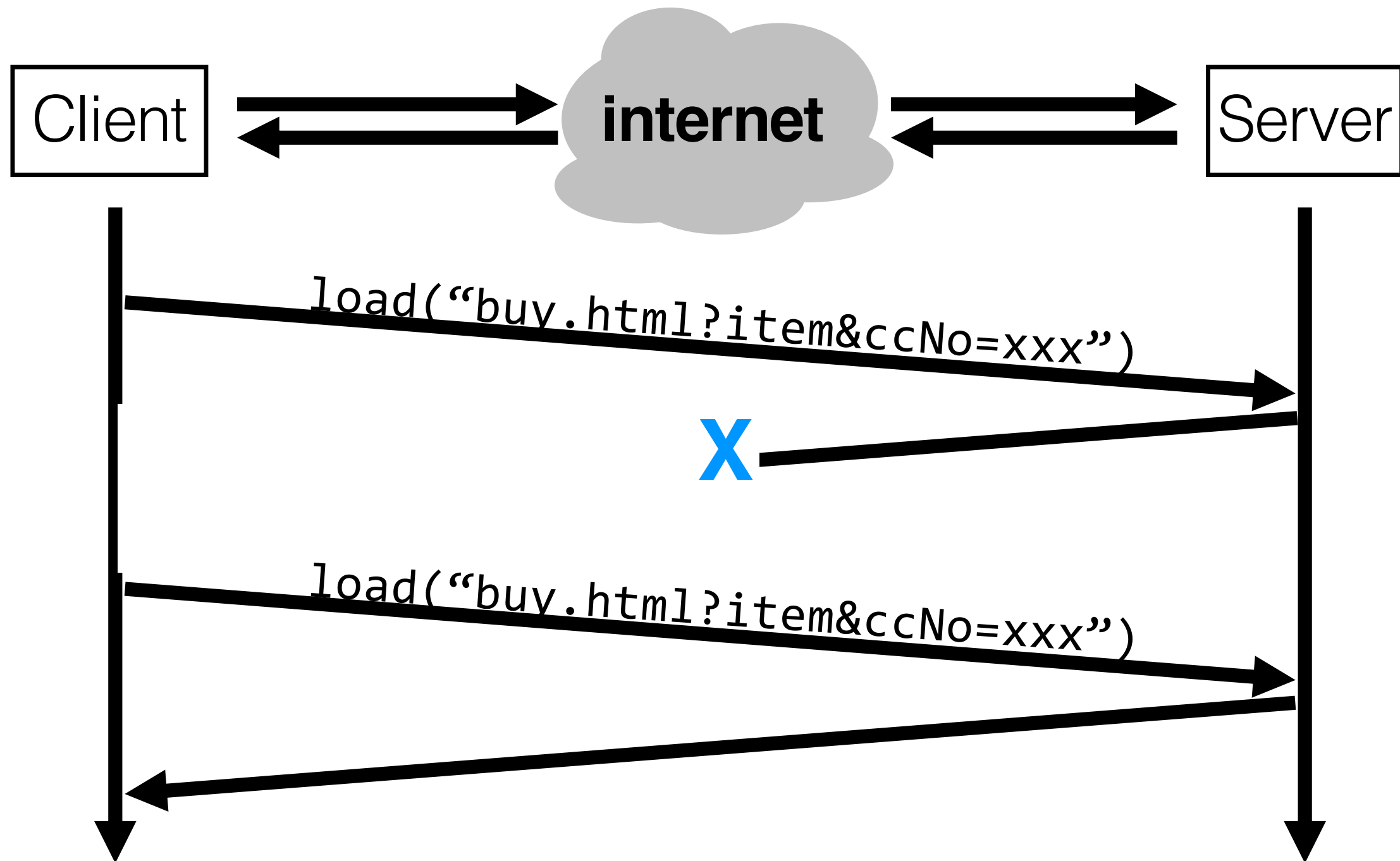
# Challenges with RPCs



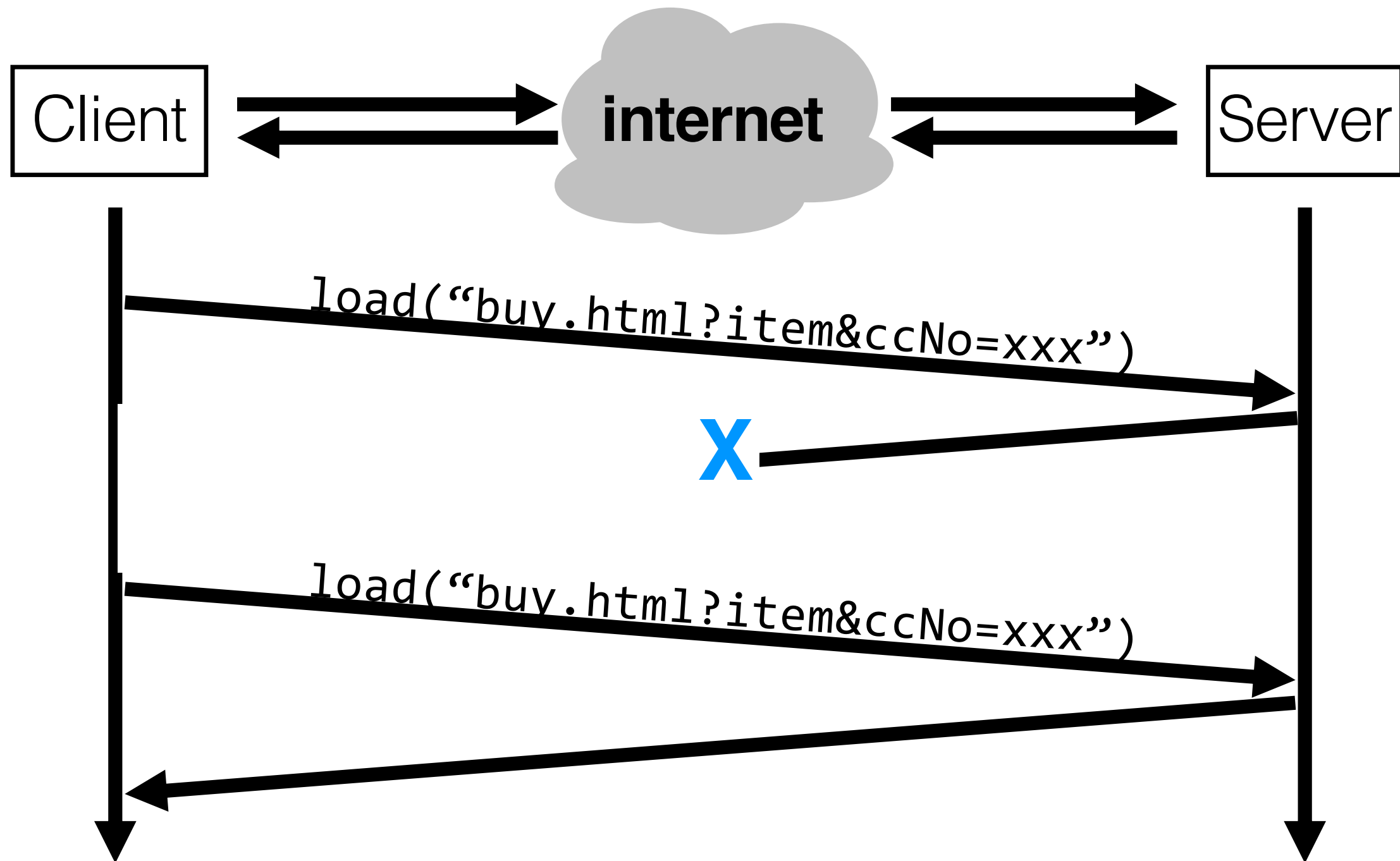
# Challenges with RPCs



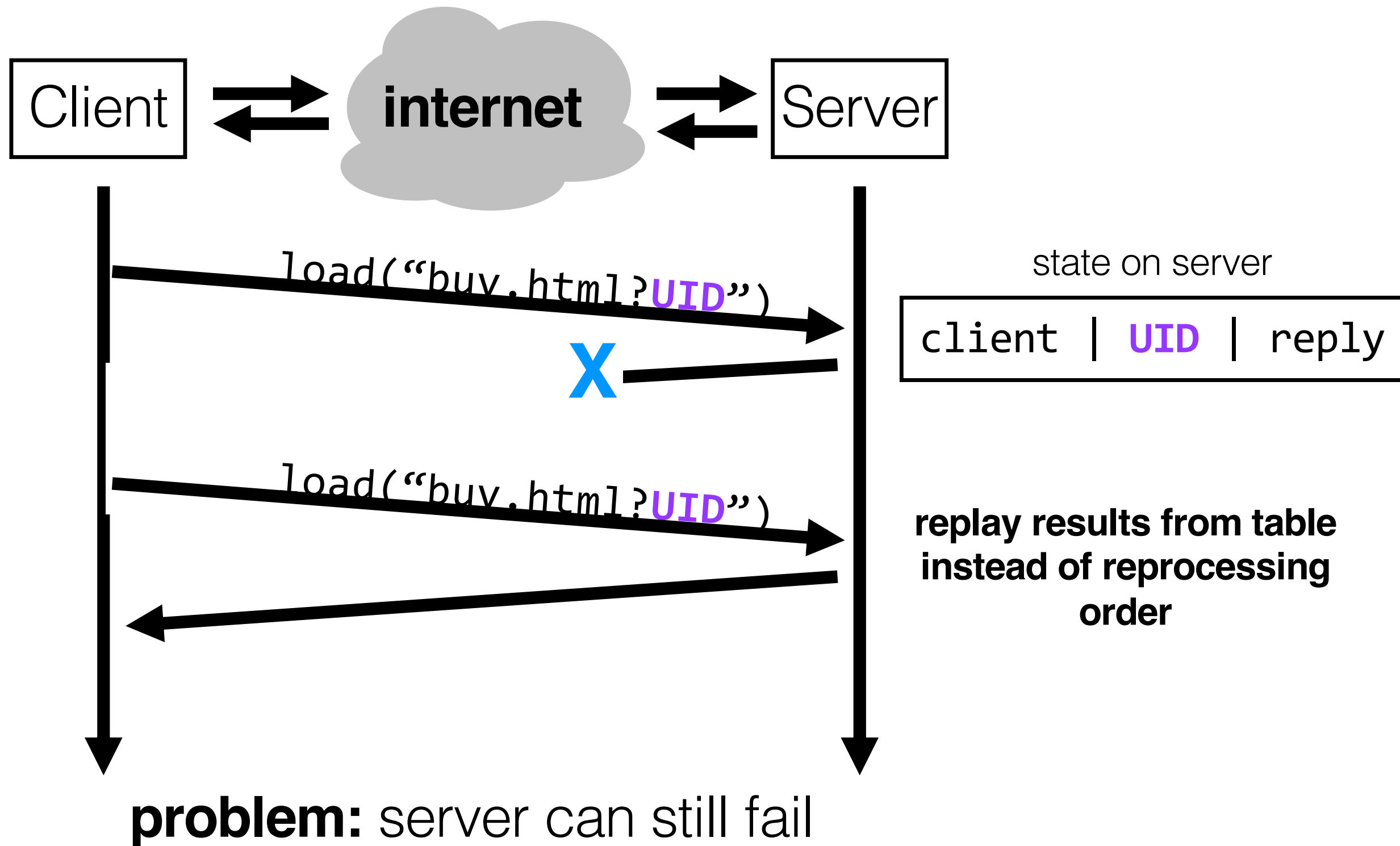
# Challenges with RPCs



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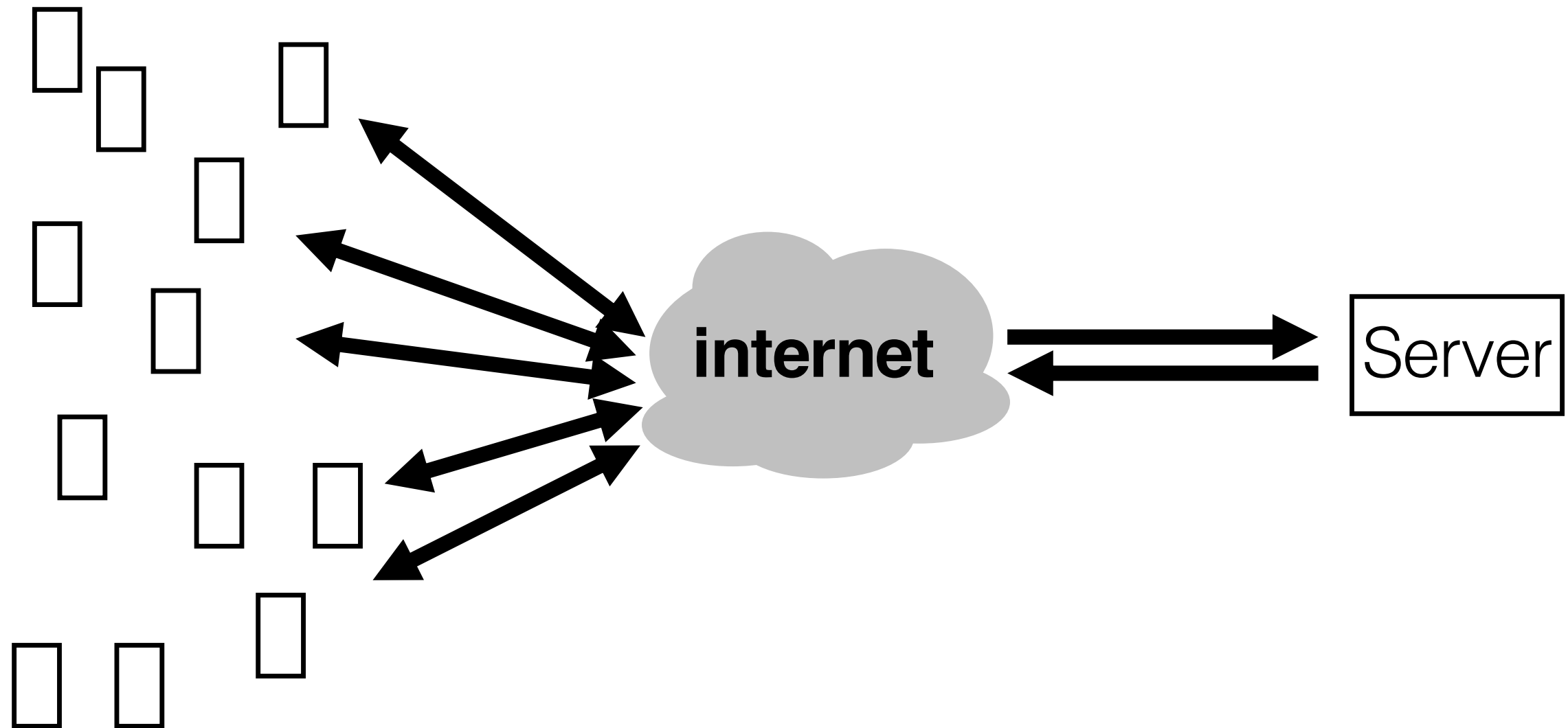


# What else might we want?



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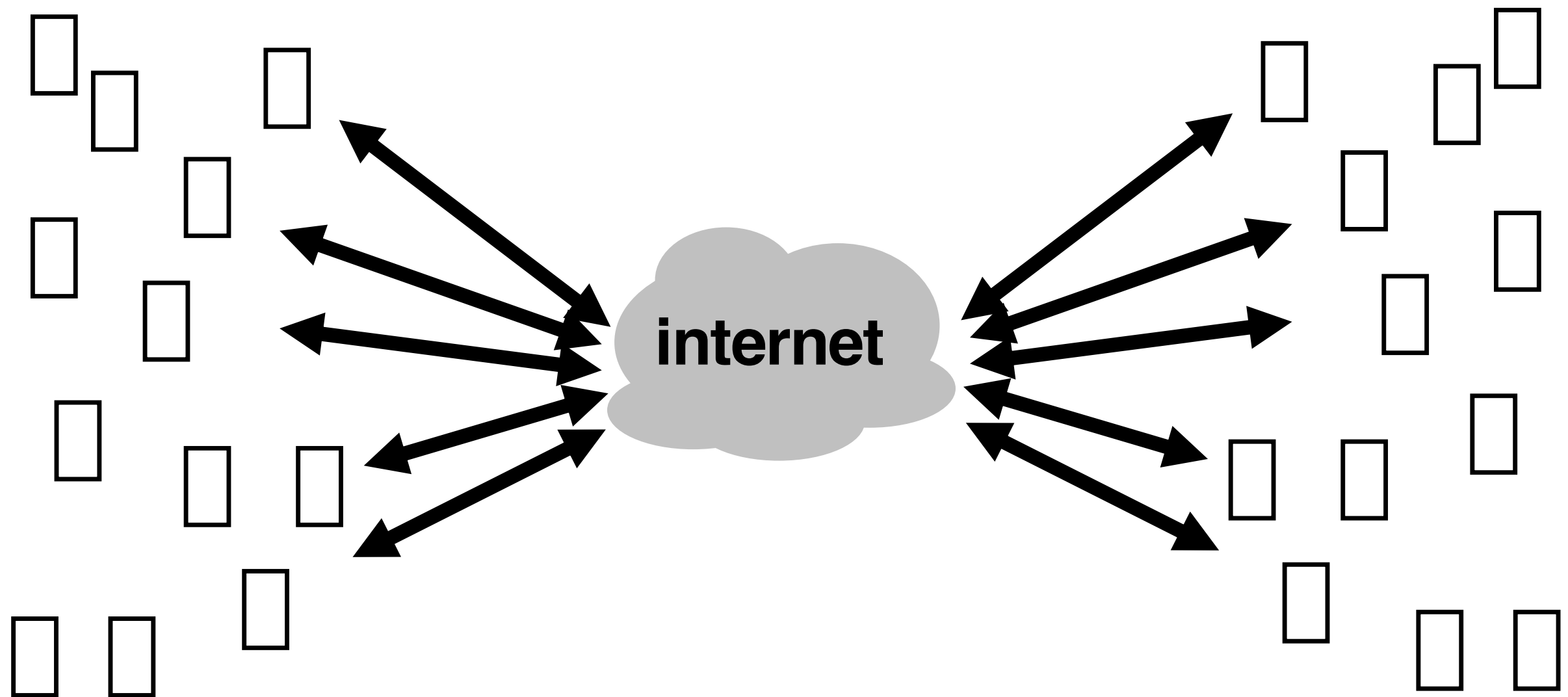
## scalability



# What else might we want?

**scalability**

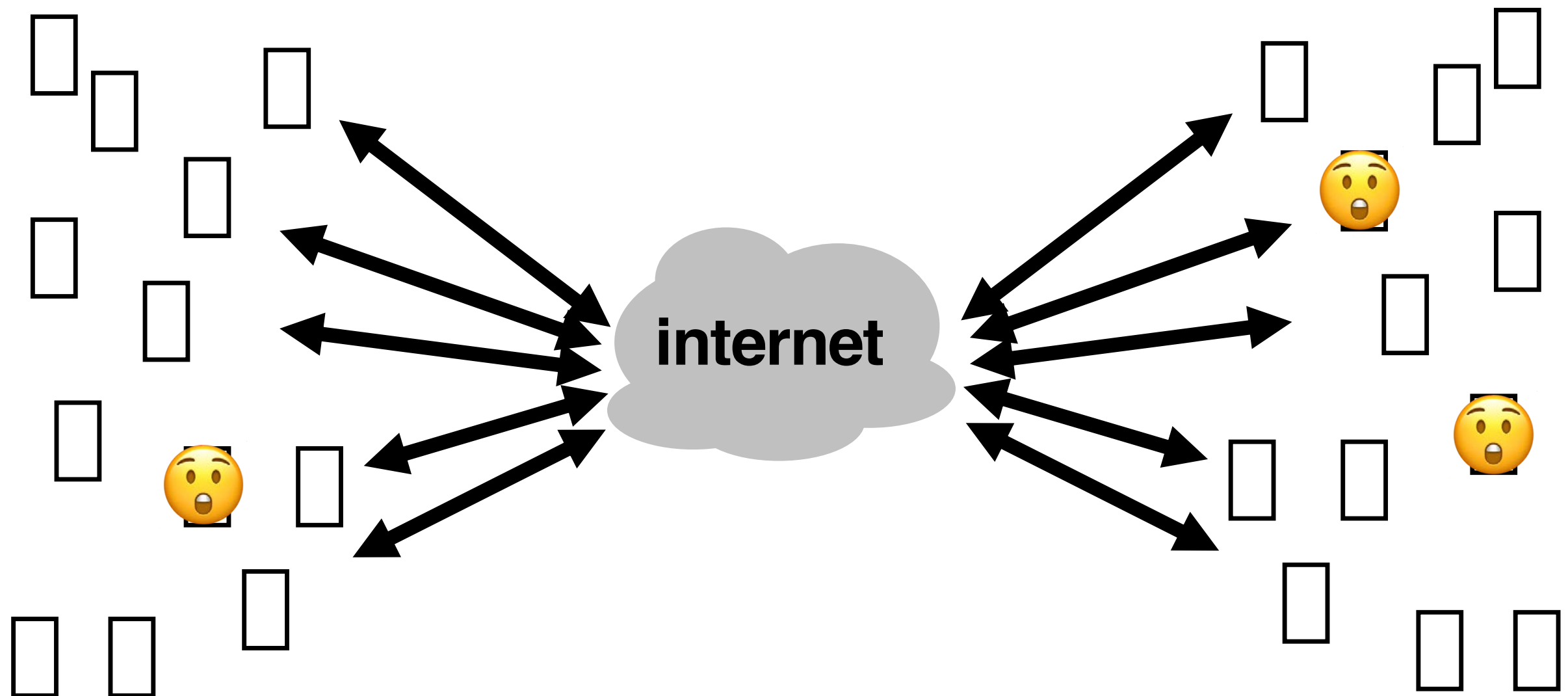
**fault-tolerance/reliability**



# What else might we want?

**scalability**

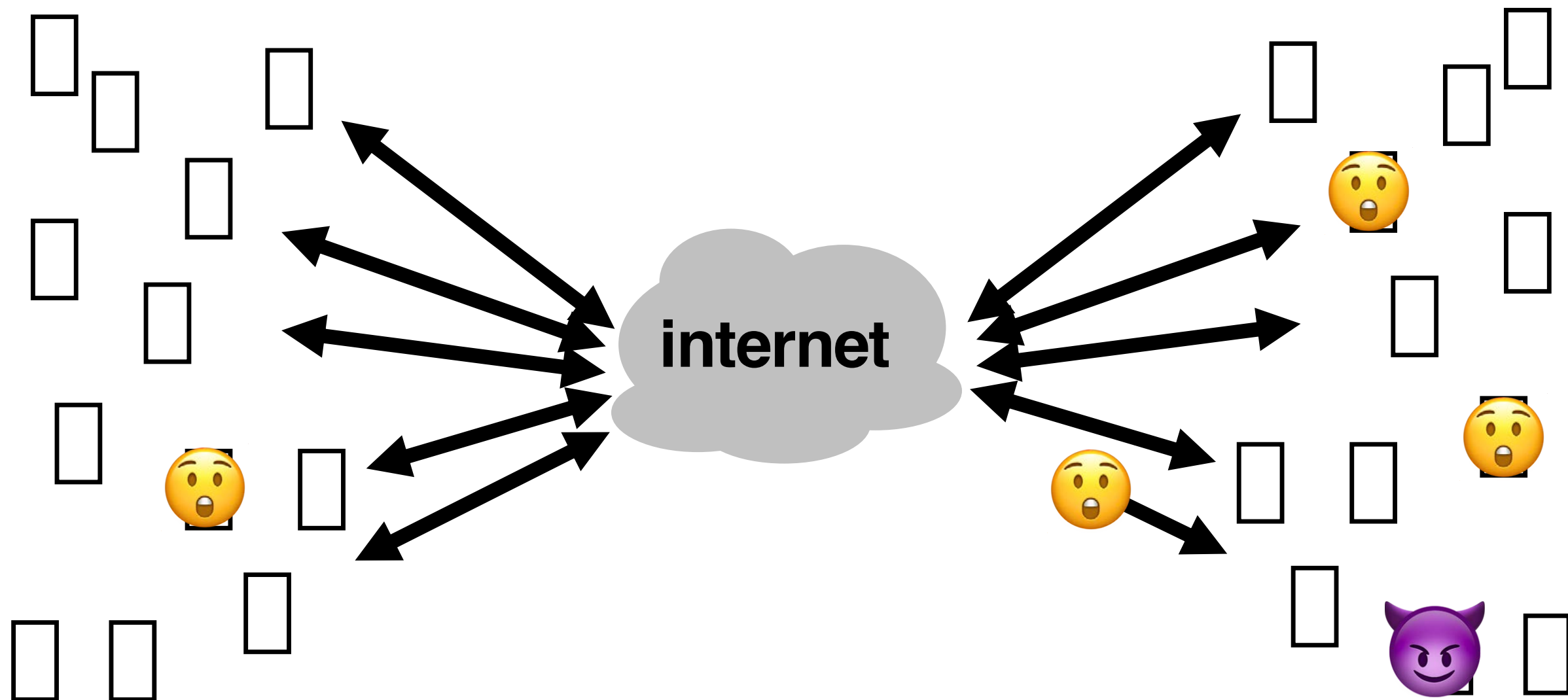
**fault-tolerance/reliability**



# What else might we want?

**scalability**

**fault-tolerance/reliability**



**security**

- **Complexity** limits what we can build, but can be mitigated with **modularity** and **abstraction**
- One way to **enforce modularity** is with a **client/server model**, where the two modules reside on different machines and communicate with RPCs; network/server failures are still an issue

**next lecture:** naming, which allows modules to communicate

**coming up:** operating systems, which enforce modularity on a single machine

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6.033 Computer System Engineering  
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