# 6.033 Spring 2019

## Lecture #1

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

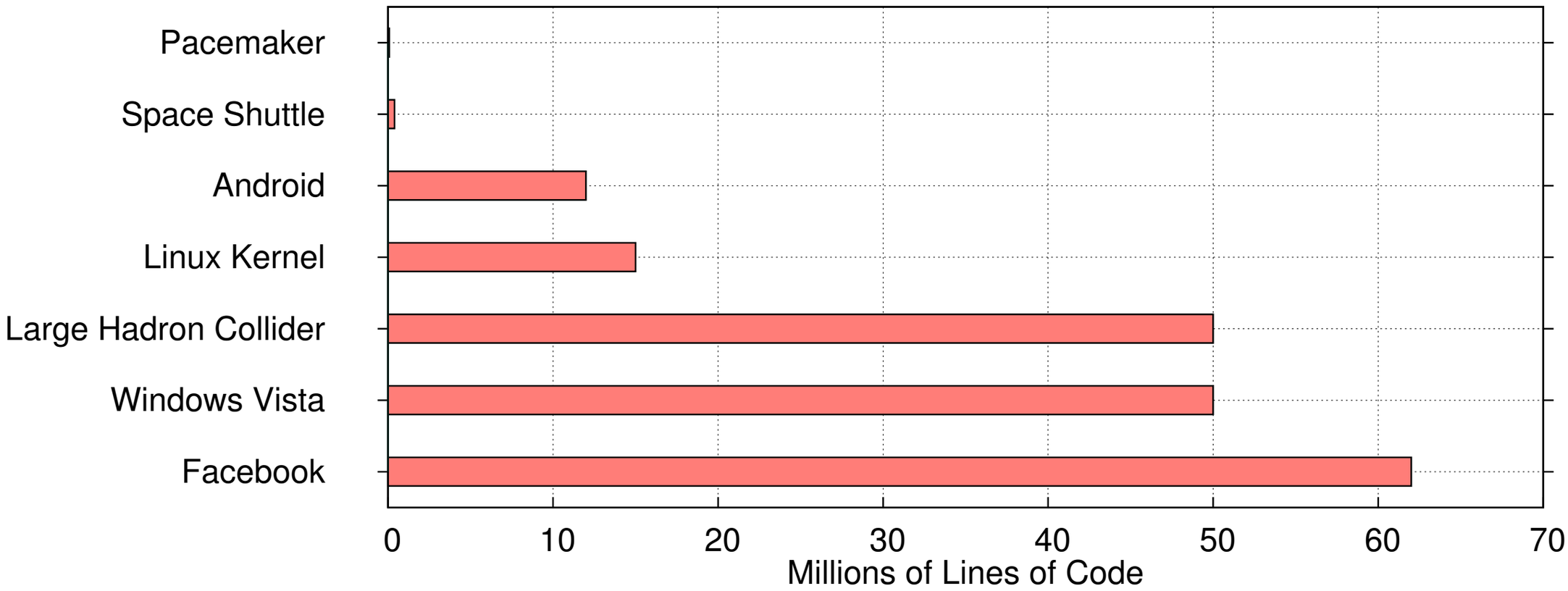
# what is a system?

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




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)

**Class Server**
(on machine 2)

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

request

reply

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

# Stub Clients and RPCs

**Class Browser**
(on machine 1)

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

```
def browser_load_url(url):
  msg = url # could reformat
  send request
  wait for reply
  html = reply # could reformat
  return html
```

stub

request

reply

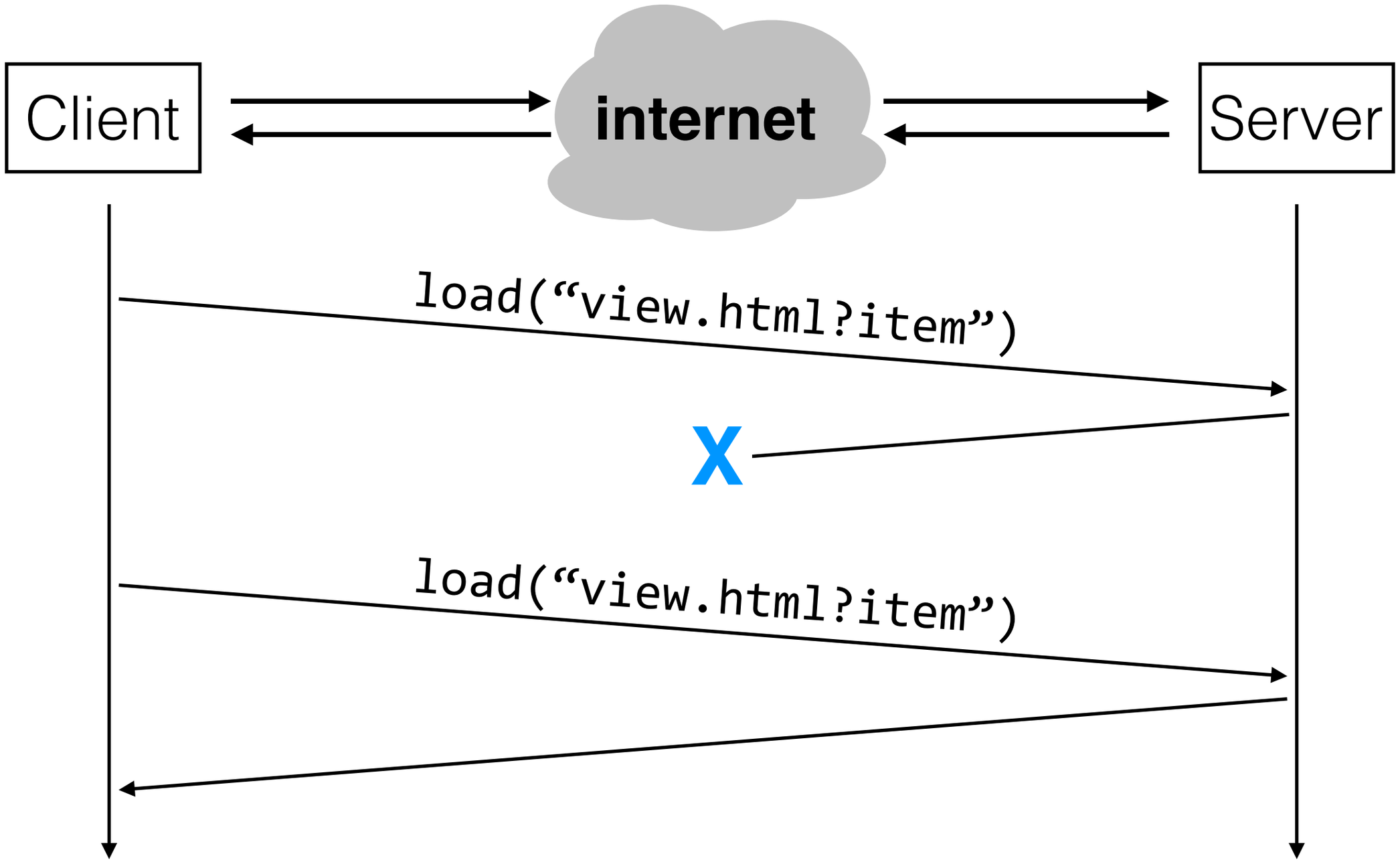
**Class Server**
(on machine 2)

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

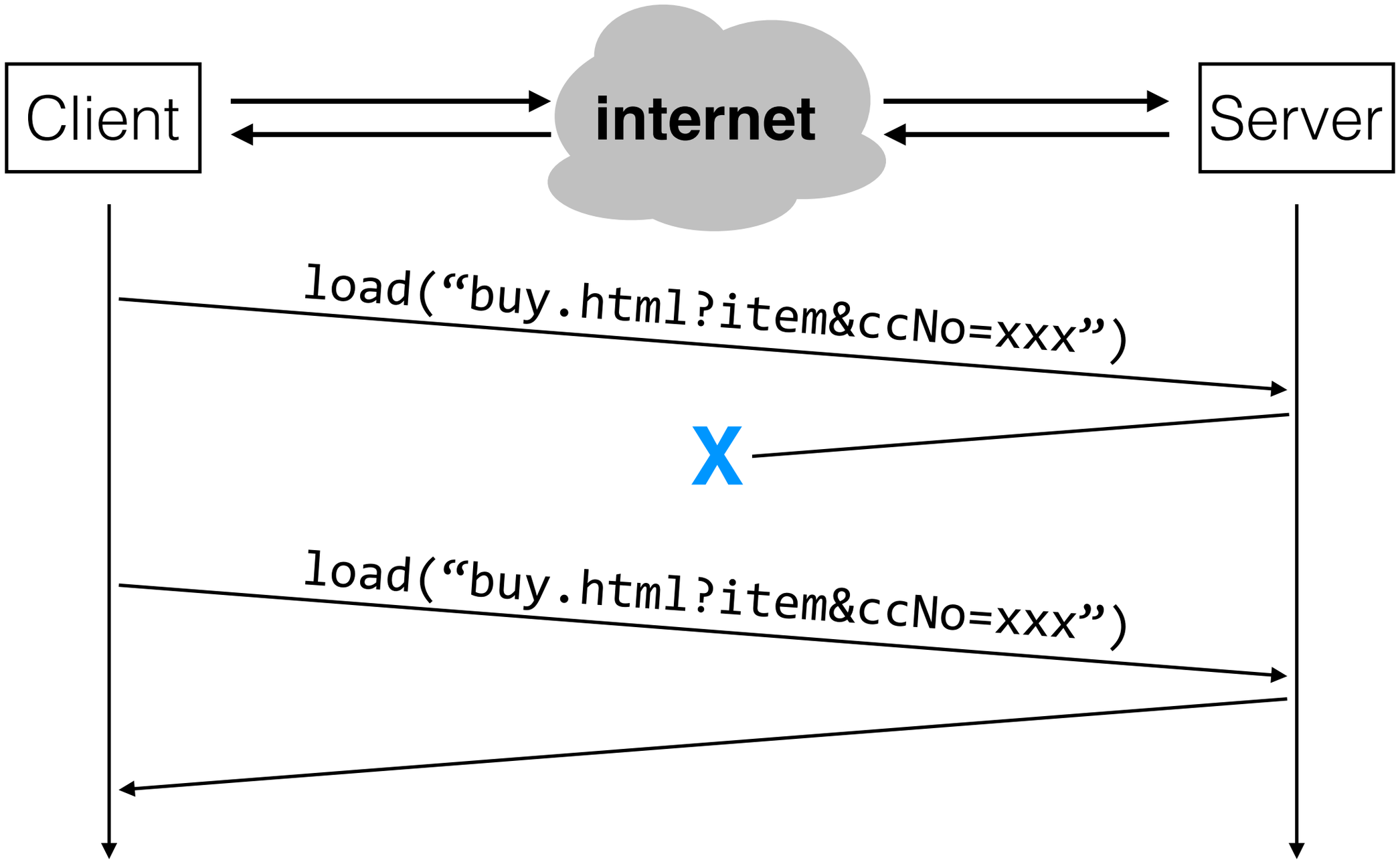
```
def handle_server_load_url(url):
  wait for request
  url = request
  html = server_load_url(URL)
  reply = html
  send reply
```

stub

# Challenges with RPCs

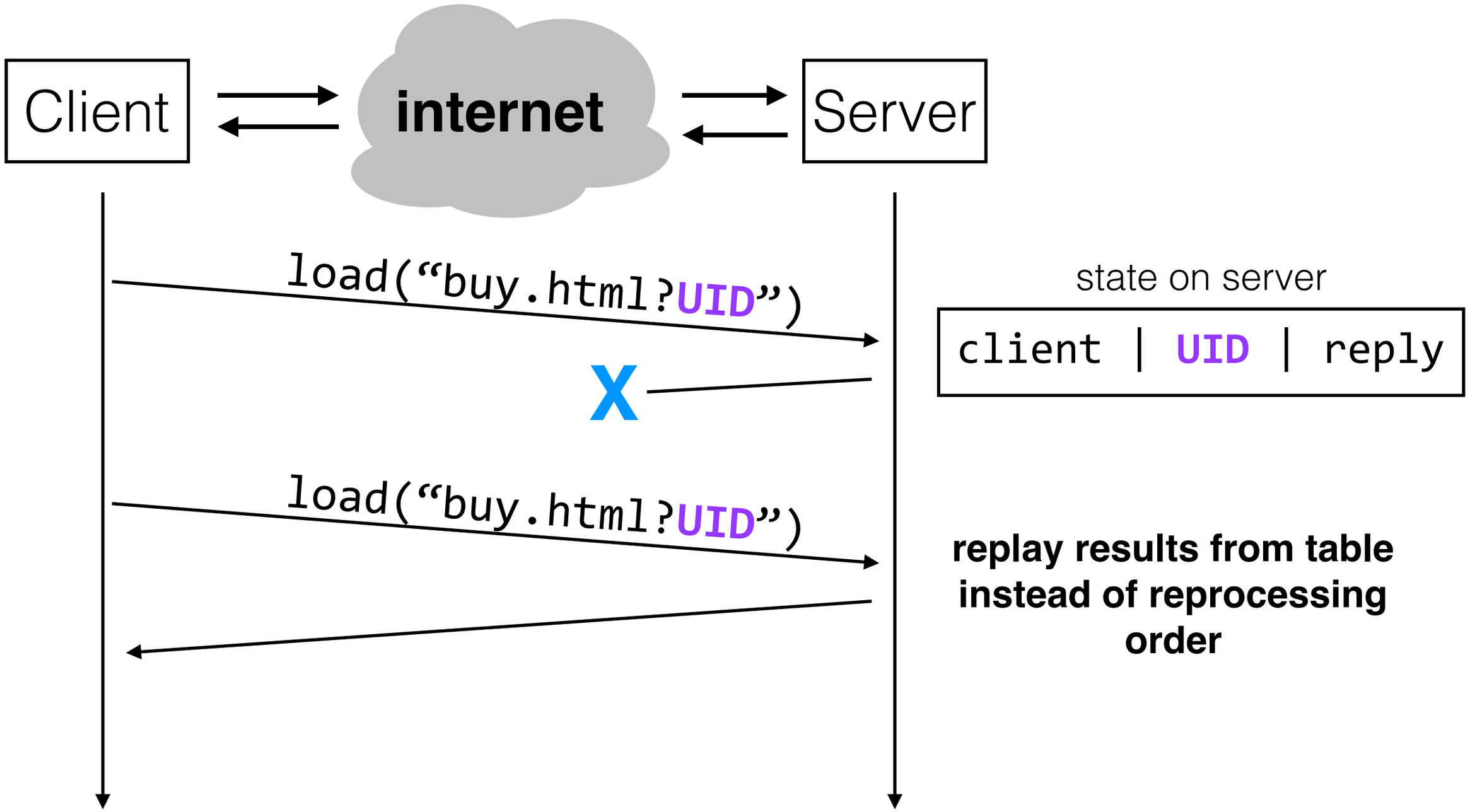


# Challenges with RPCs




**problem:** just bought the same thing twice

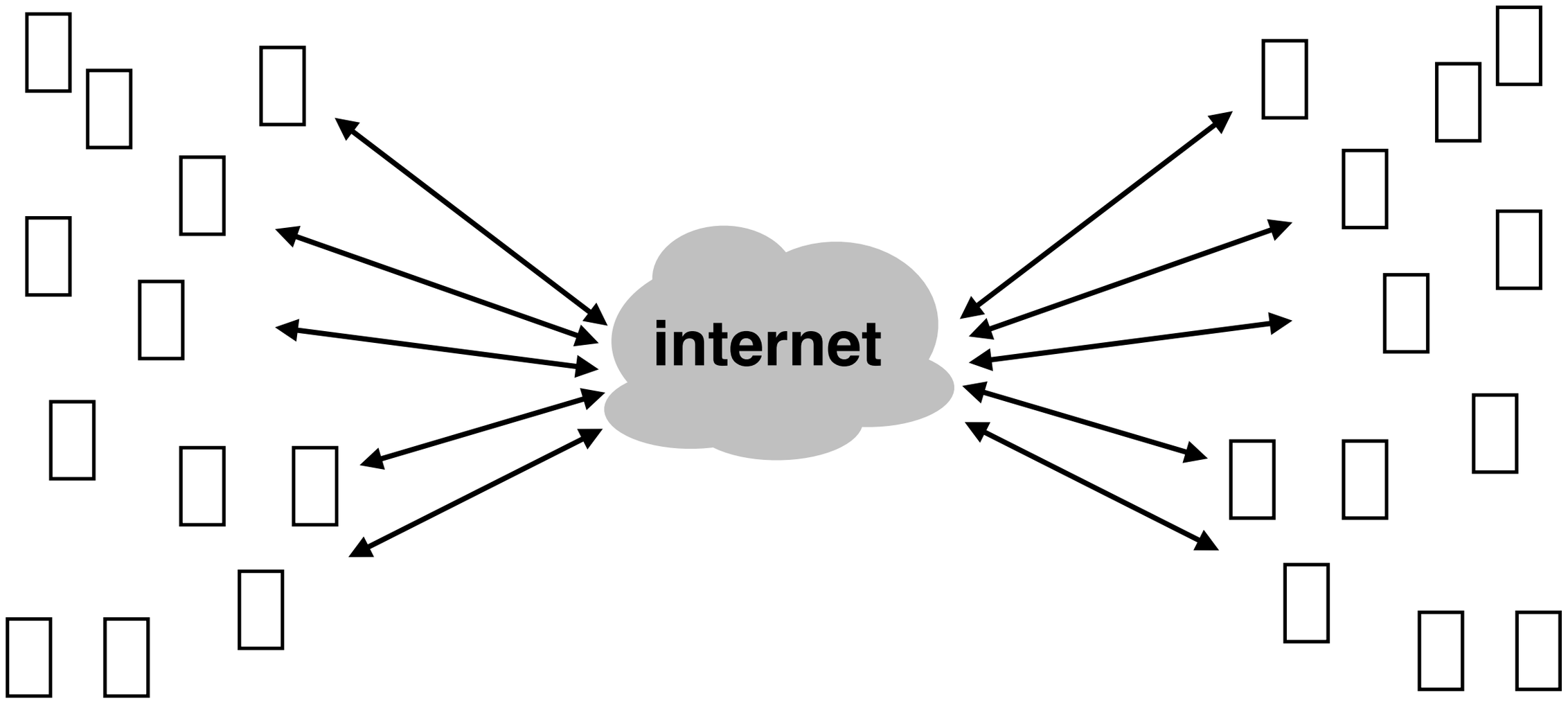
# Challenges with RPCs




**problem:** server can still fail

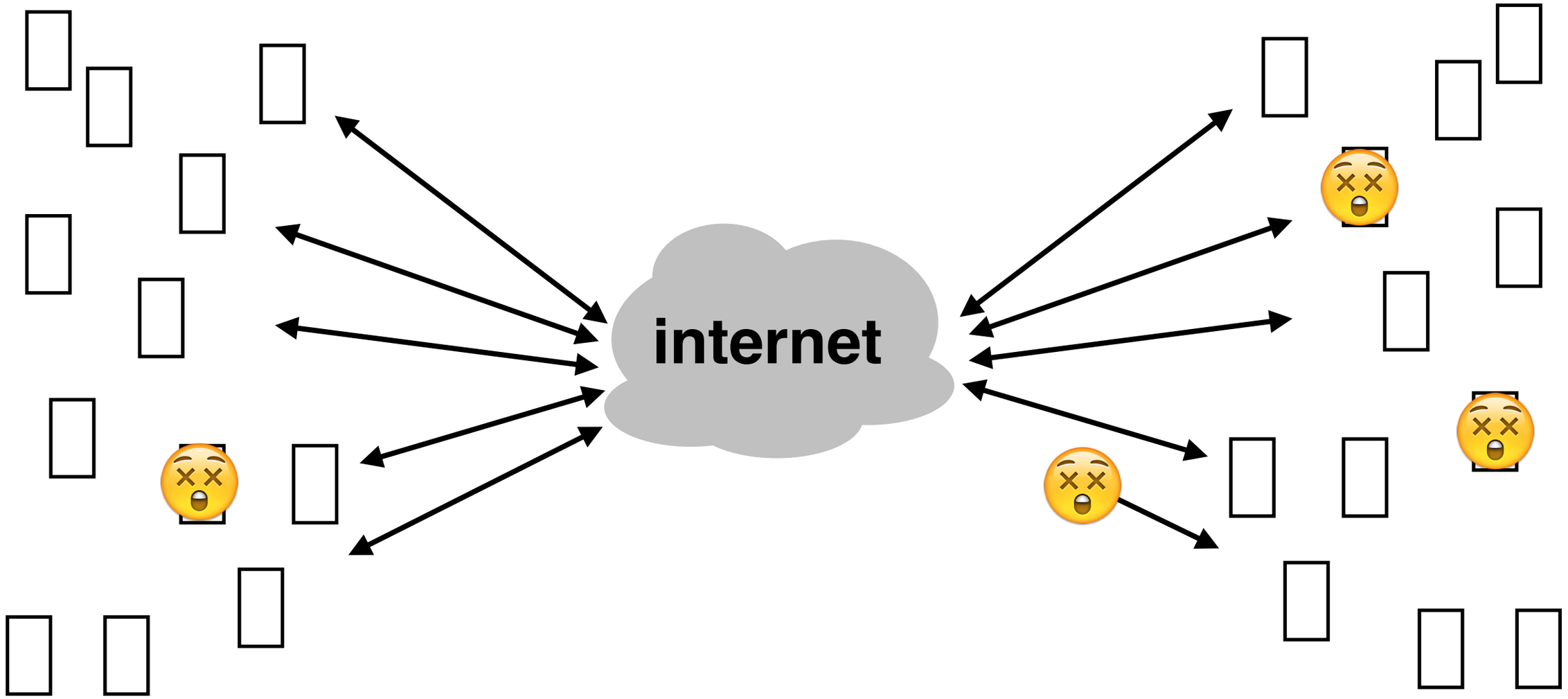
# What else might we want?

**scalability**



# What else might we want?

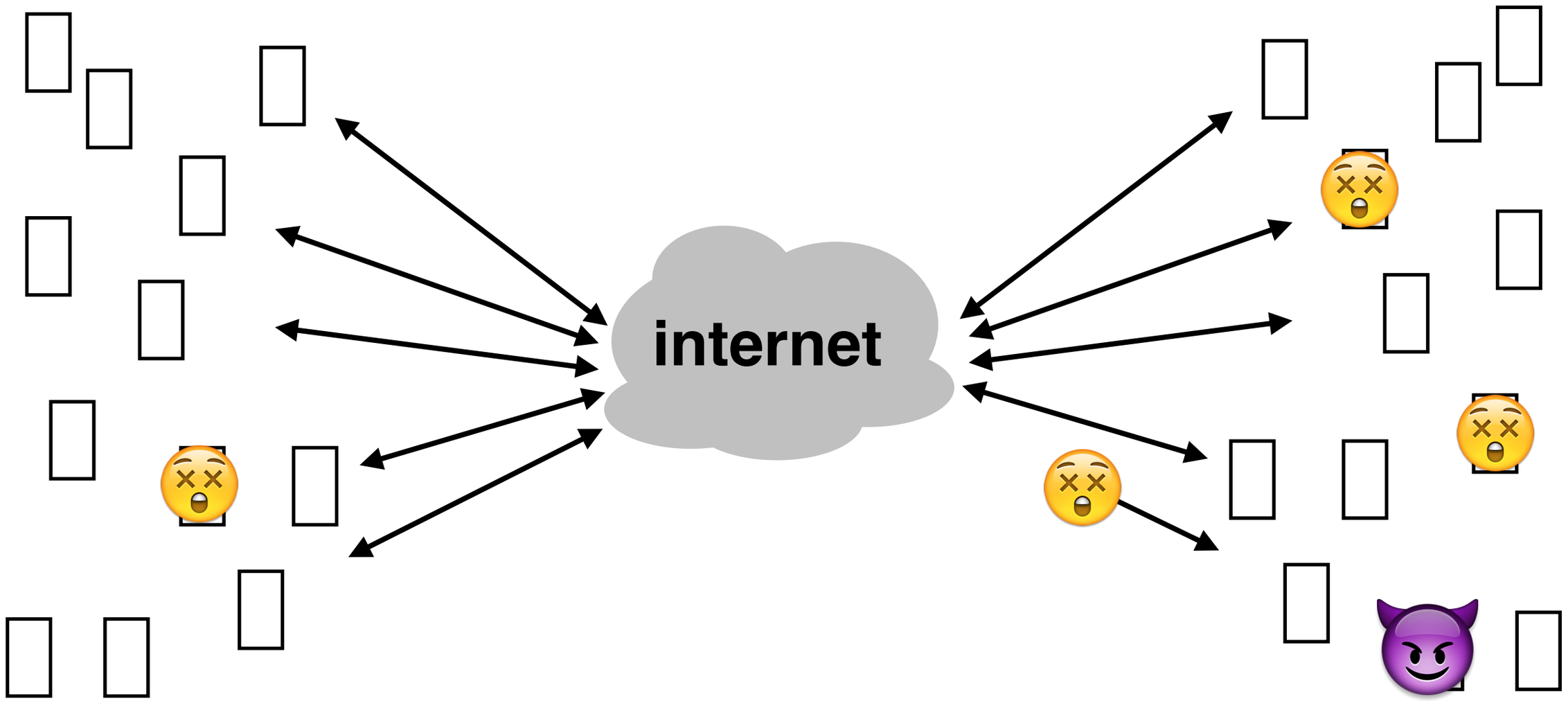
**scalability** **fault-tolerance/reliability**



# What else might we want?

**scalability**

**fault-tolerance/reliability**




**security**

# http://mit.edu/6.033

## Schedule

| Monday | Tuesday | Wednesday | Thursday | Friday |
|---|---|---|---|---|
| feb 4<br><br>*Reg day* | feb 5<br>**REC 1:** Worse is Better<br><br>*First day of classes* | feb 6<br>**LEC 1:** Coping with Complexity: Enforced Modularity via Client/server Organization<br><br>***Reading:*** *Book sections 1.1-1.5, and 4.1-4.3* | feb 7<br>**REC 2:** We Did Nothing Wrong | feb 8<br>**TUT 1:** Intro to 6.033 Communication<br><br>***Assigned****: System critique #1* |

## Class announcements happen via Piazza

- **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