Interactive Web

Timur Babyuk

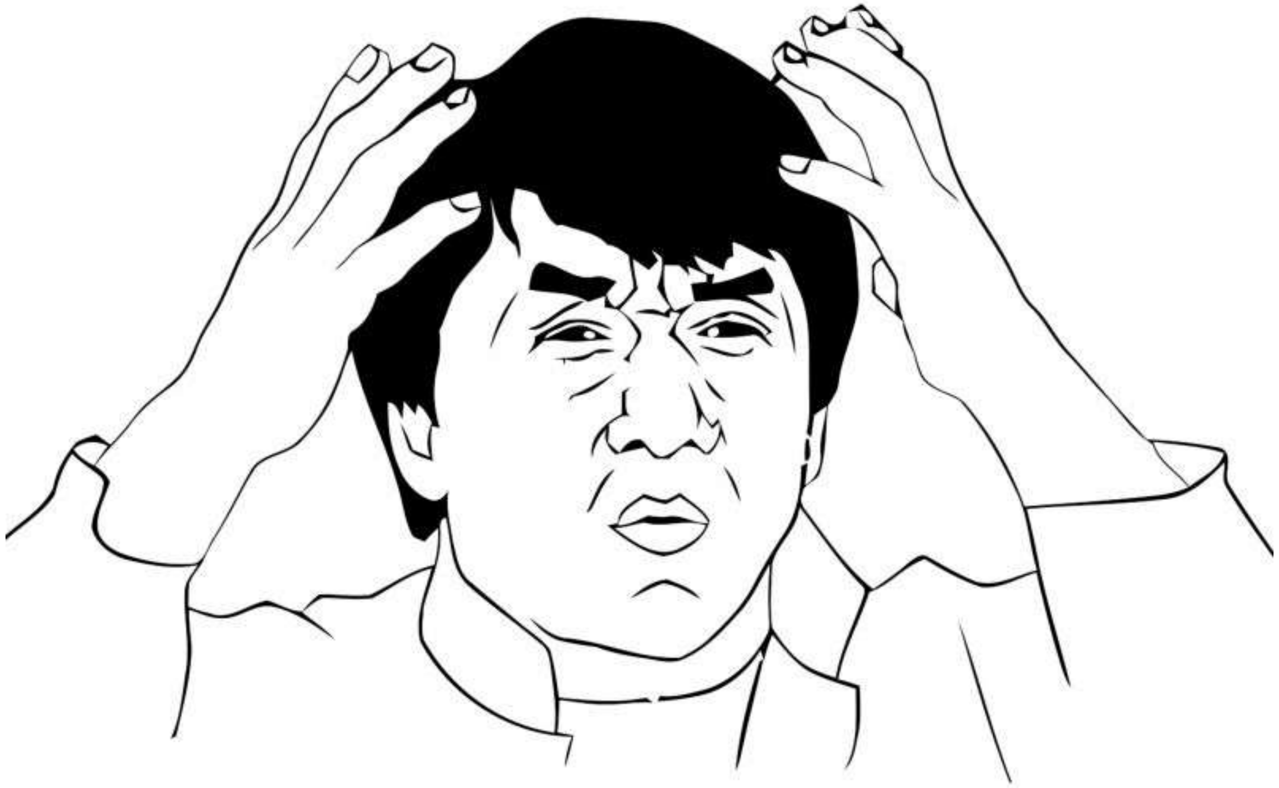
Software engineer @ Lohika

Interactive Web

Interactive Web

YES!

But how??



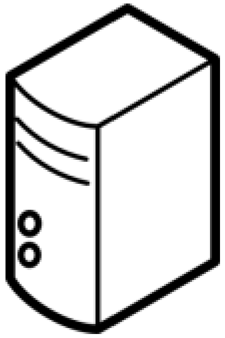
Web + HTTP =

Some fundamentals...

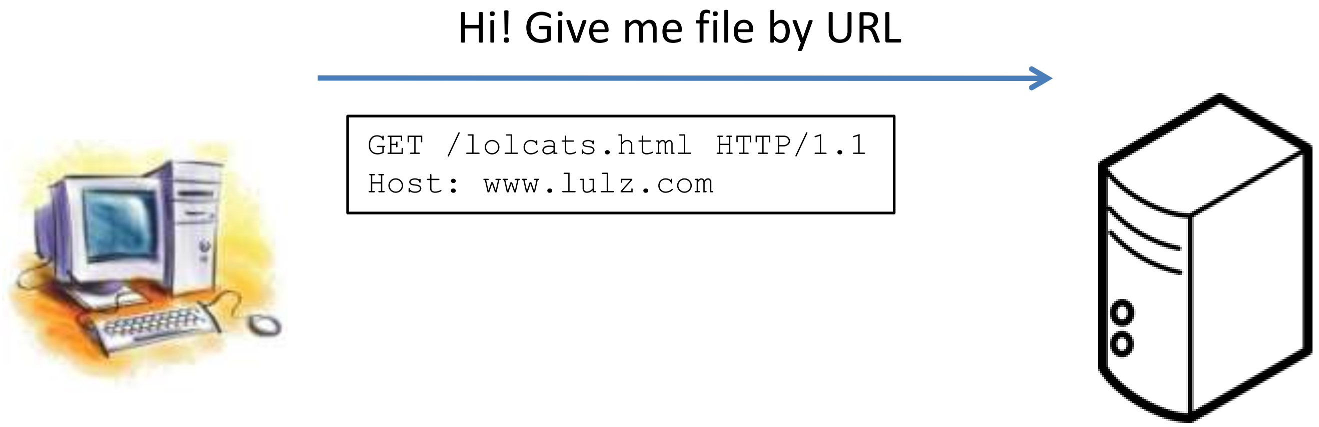
Hyper Text Transfer Protocol

- Created in early 1990s
- Very simple
- Human readable
- Extensible

Very simple



Very simple

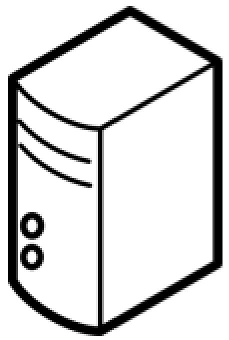


```
GET /lolcats.html HTTP/1.1
Host: www.lulz.com
```

Very simple

Hi! Give me file by URL

```
GET /lolcats.html HTTP/1.1
Host: www.lulz.com
```



Sure, take it. Bye.

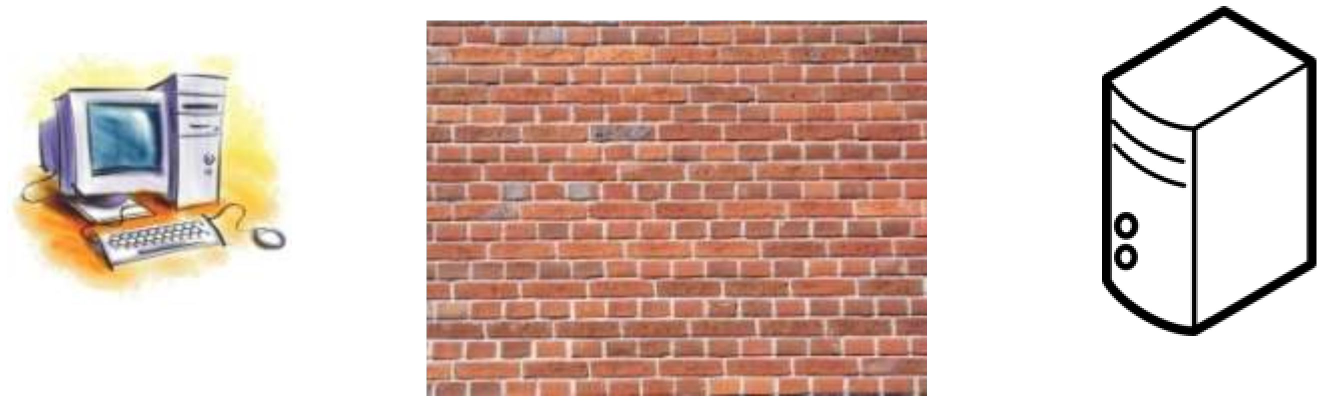
```
HTTP/1.0 200 OK
Content-Length: 11598
Content-Type: text/html

<html>
    <head>
        <title>Lulz Cats</title>
    </head>
    <body>
    ...
```

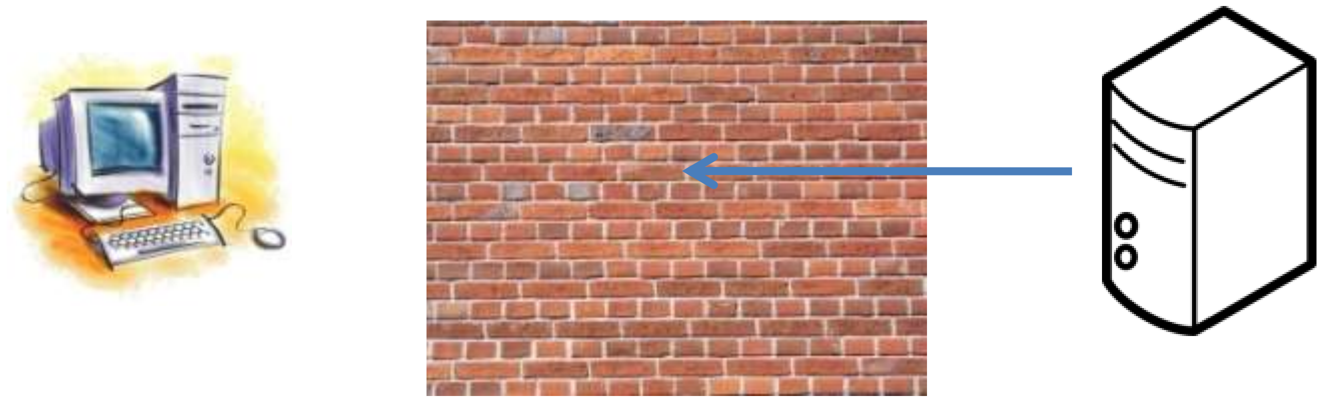
HTTP is One Way

- TCP session between client and server is opened once request is initiating
- Client sends request
- Server handles request
- Server sends result response
- TCP session is closed

How to push data to client?



How to push data to client?



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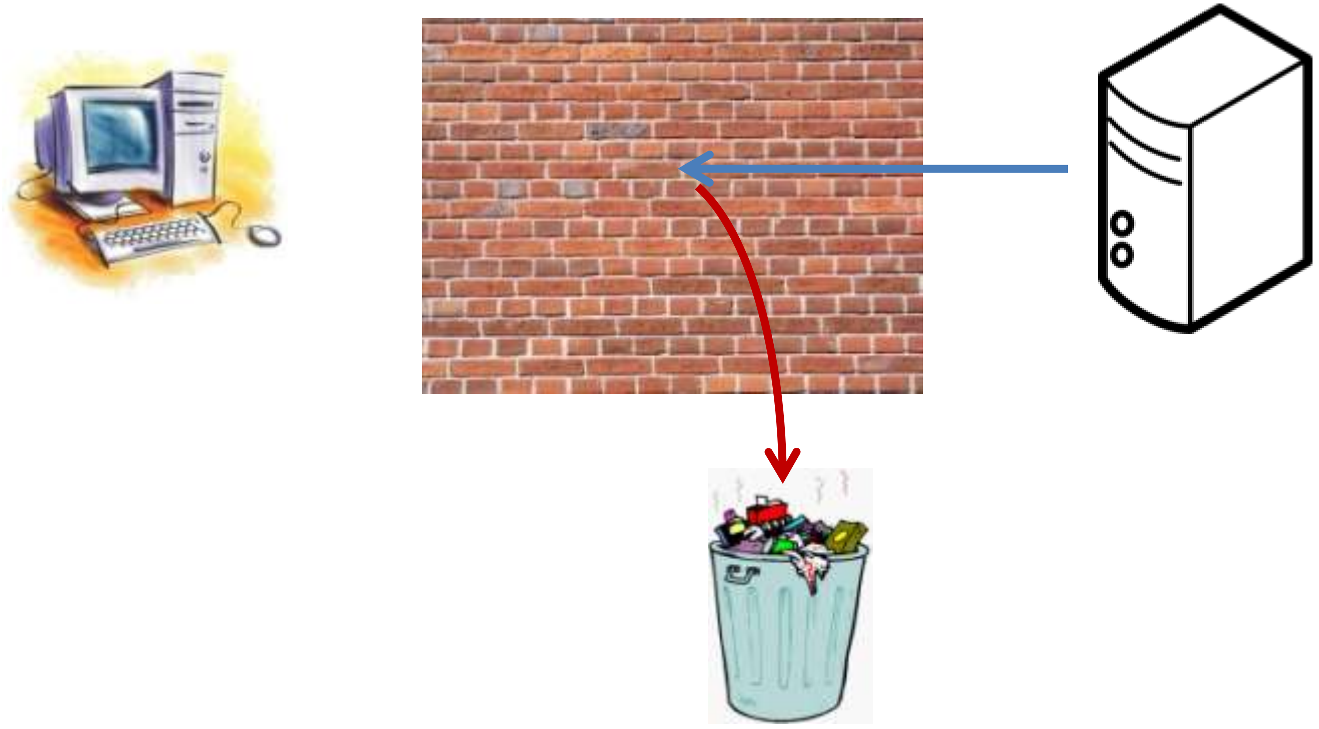
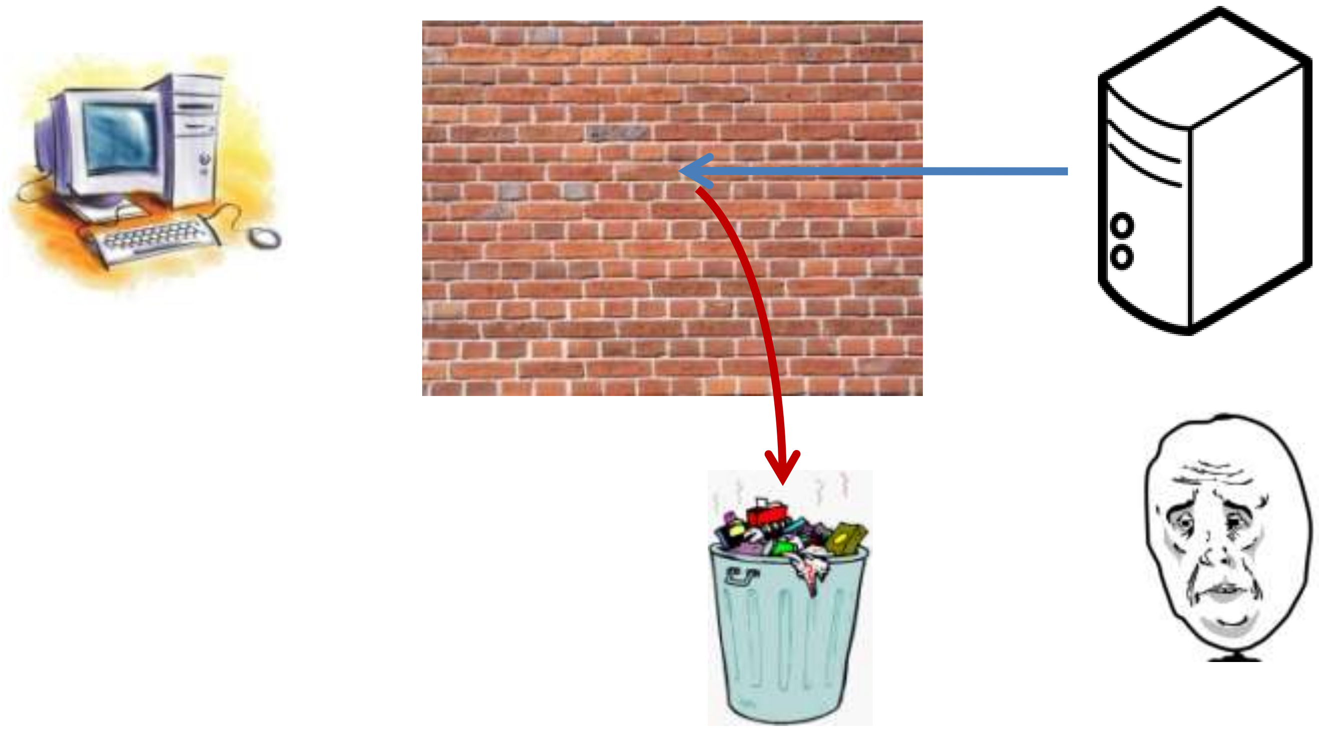
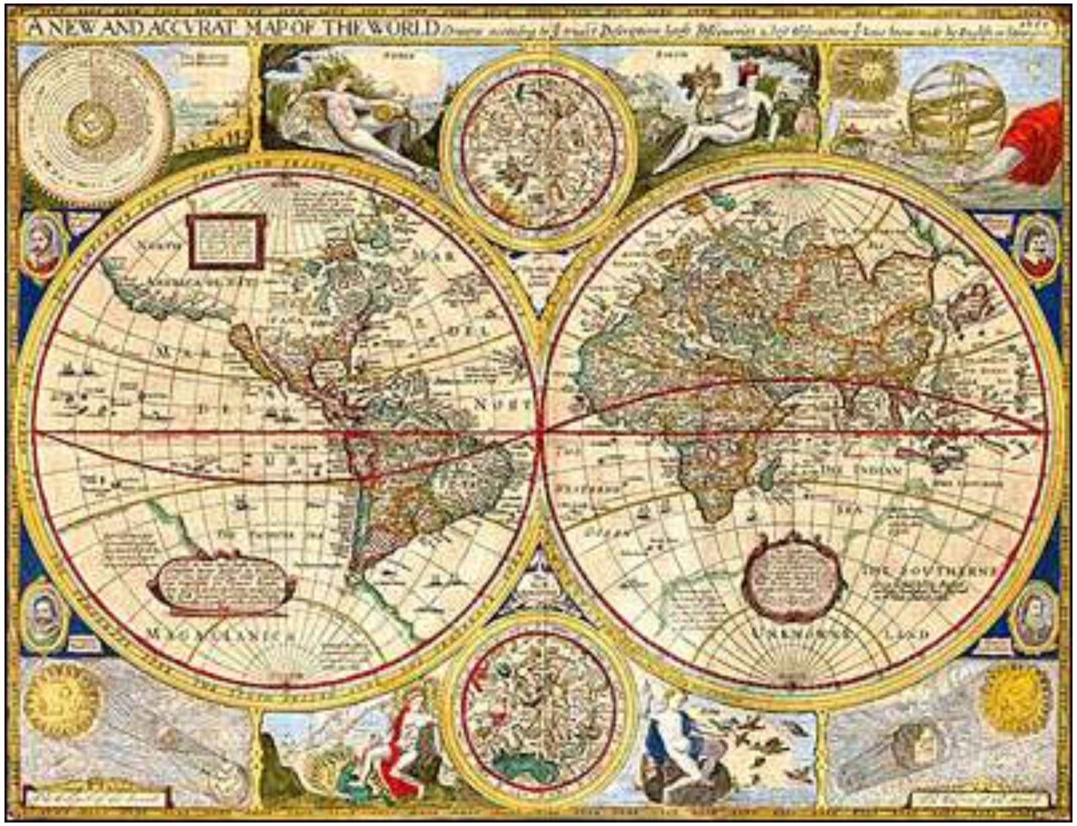


How to push data to client?



History



meta http-equiv="refresh"

meta http-equiv="refresh"

```
<html>
 <head>
  <title>Meta Refresh</title>

 </head>
 <body>
 ...
 </body>
</html>
```

meta http-equiv="refresh"

```
<html>
 <head>
  <title>Meta Refresh</title>
  <meta http-equiv="refresh" content="3">
 </head>
 <body>
 ...
 </body>
</html>
```

meta http-equiv="refresh"

- Legacy HTML feature

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- User can be frustrated by sudden page reload

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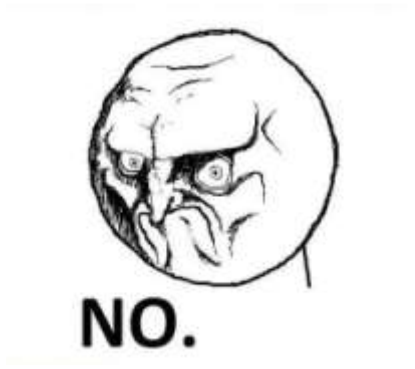
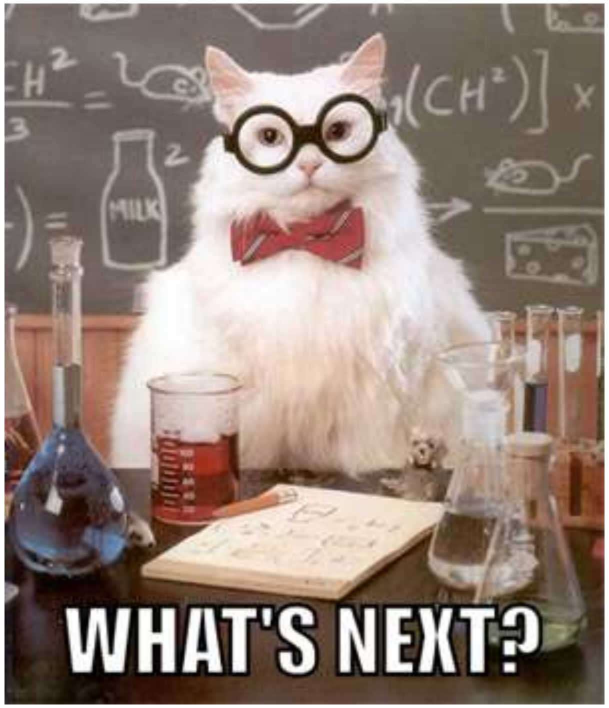



WHAT'S NEXT?

AJAX

AJAX

JavaScript

AJAX

JavaScript + XMLHttpRequest

AJAX

JavaScript + XMLHttpRequest + JSON

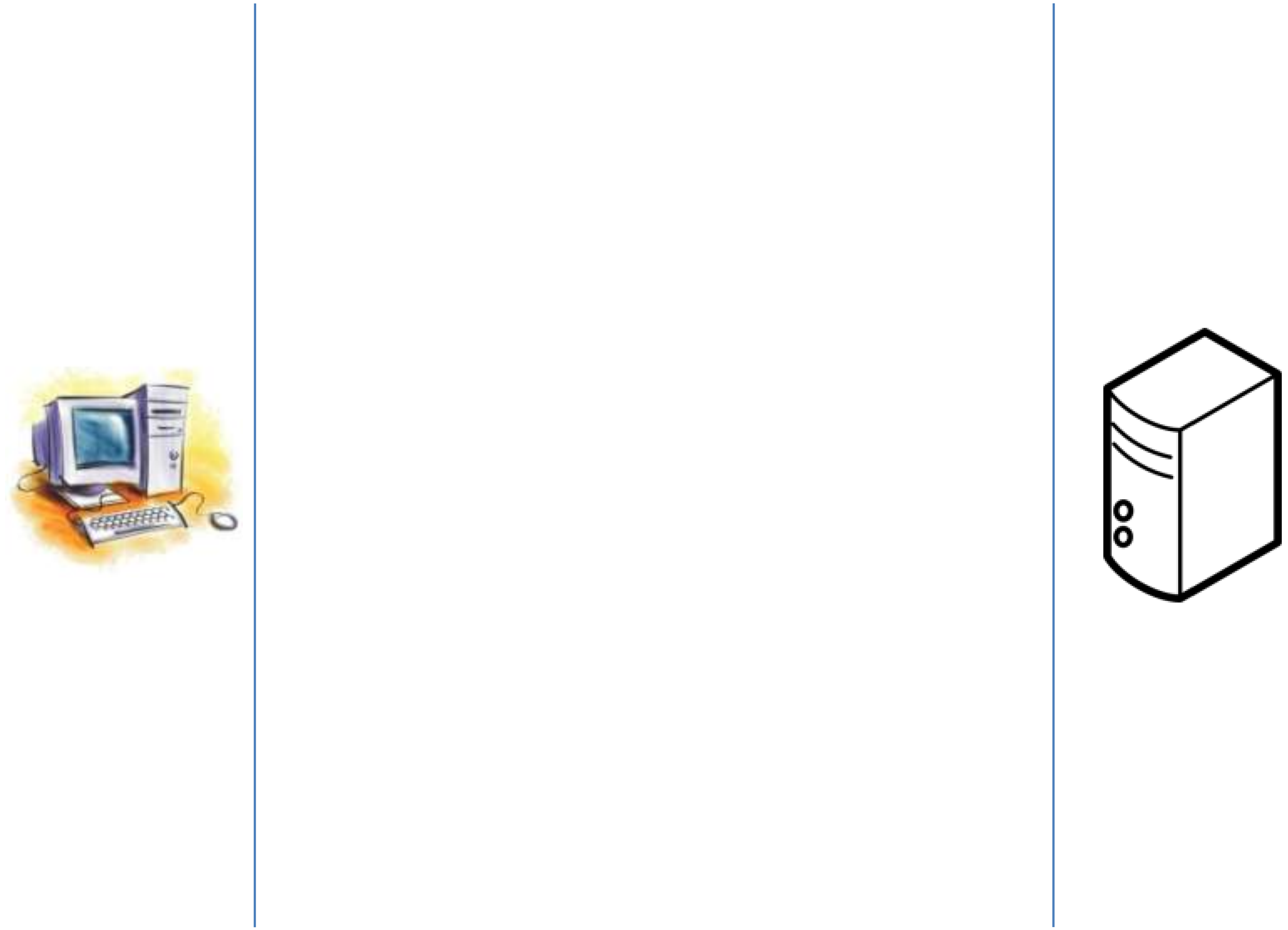
AJAX

JavaScript + XMLHttpRequest + JSON + DOM

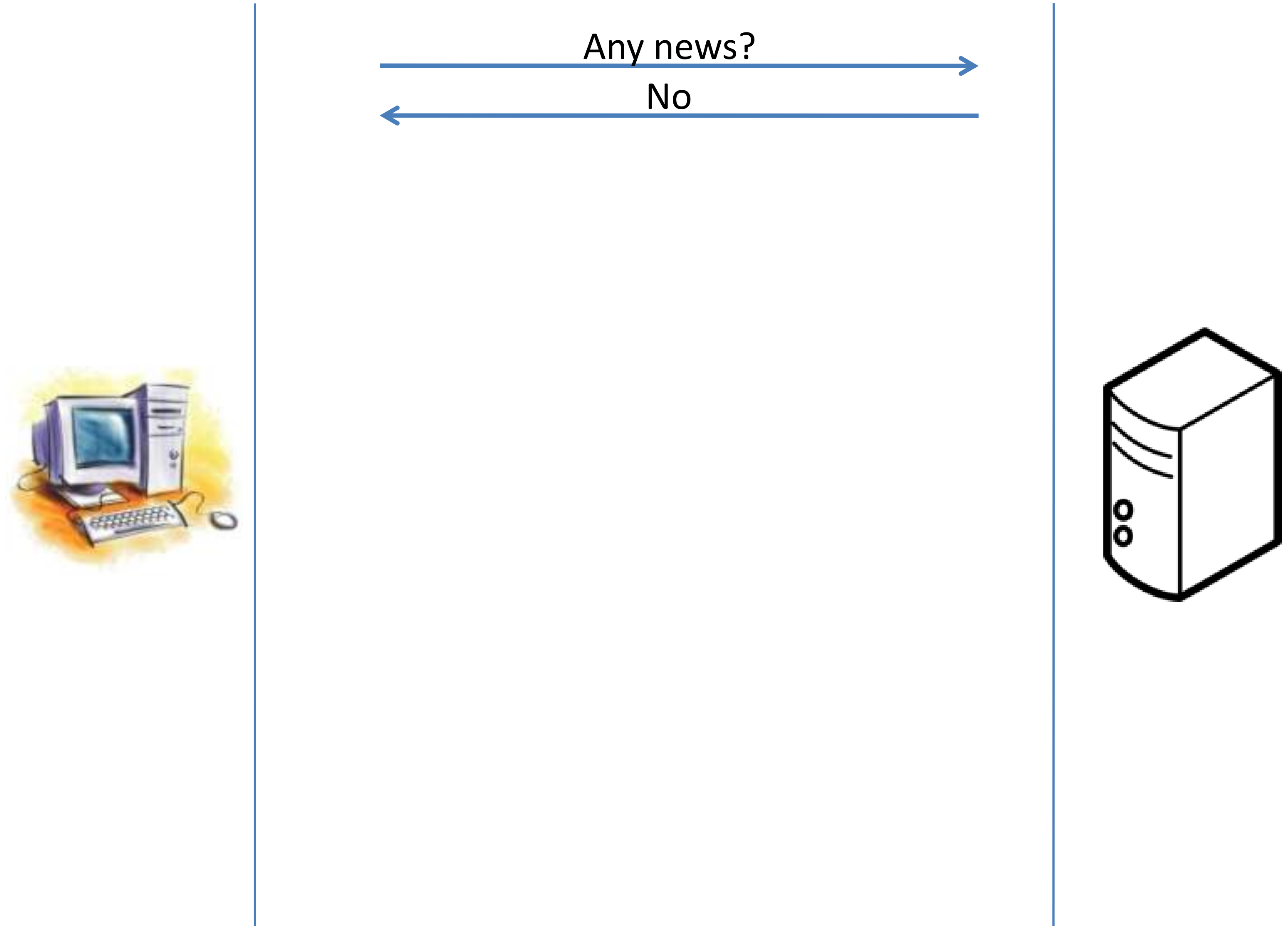
AJAX

JavaScript + XMLHttpRequest + JSON + DOM =

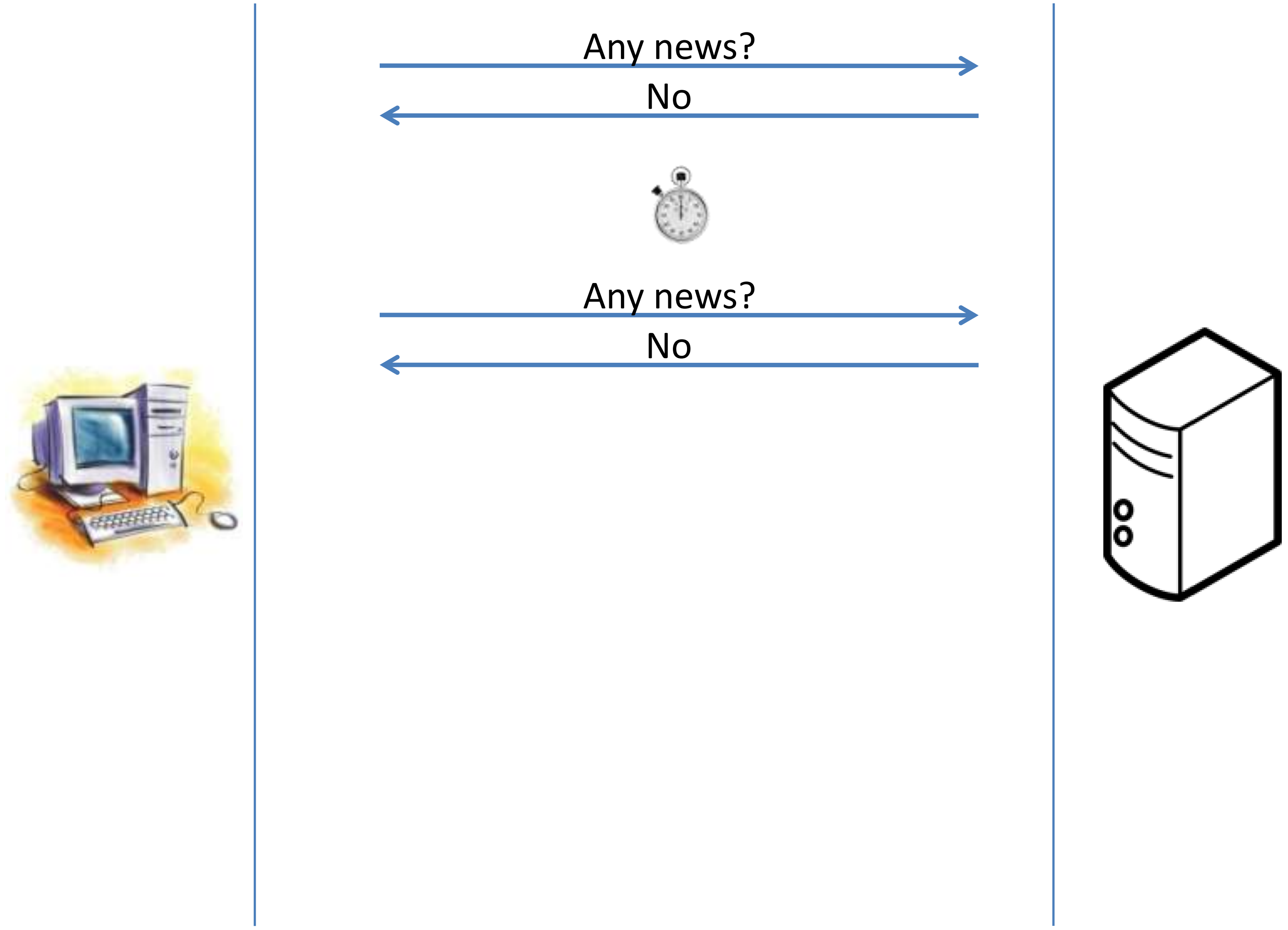
Polling



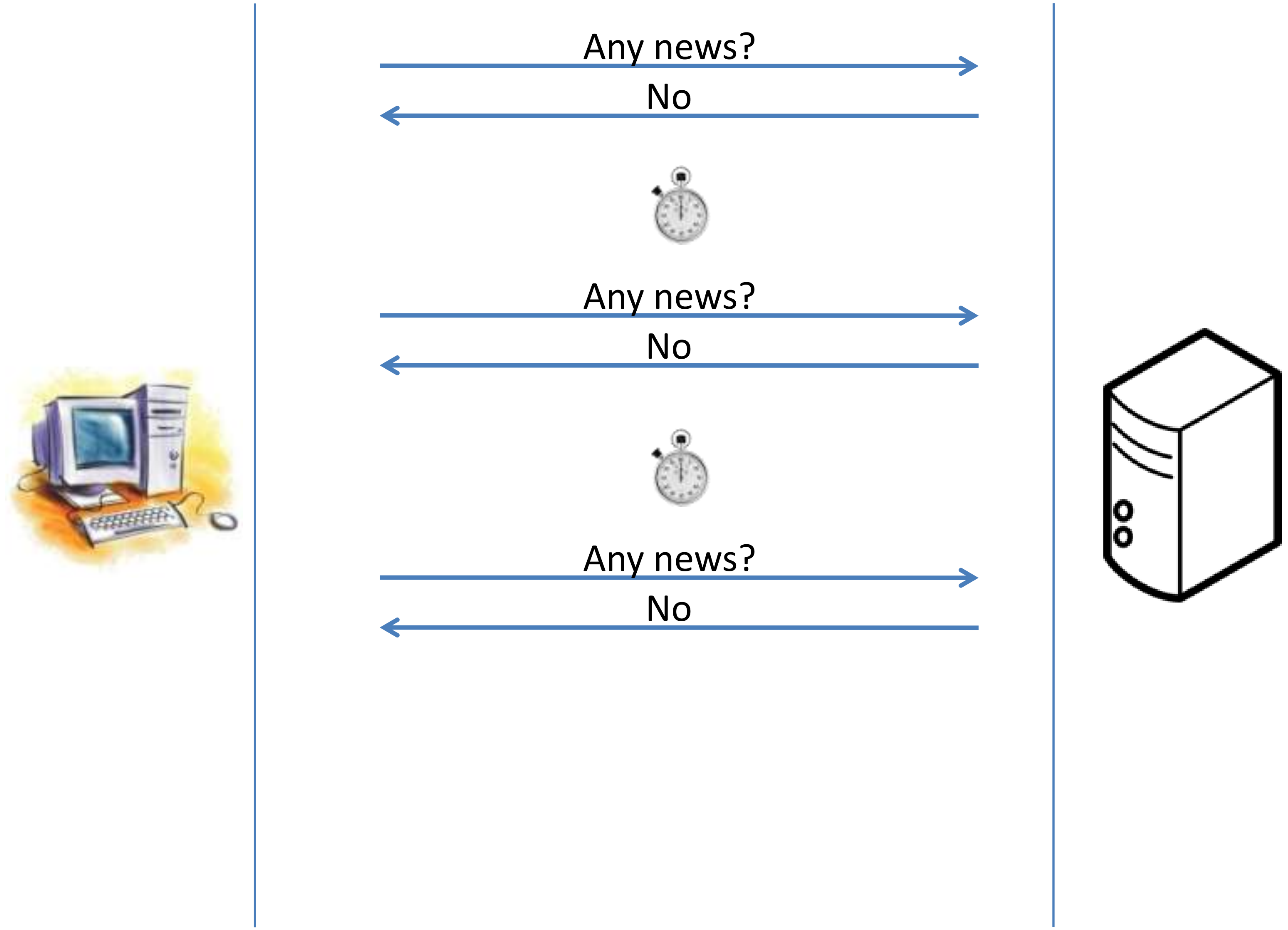
Polling



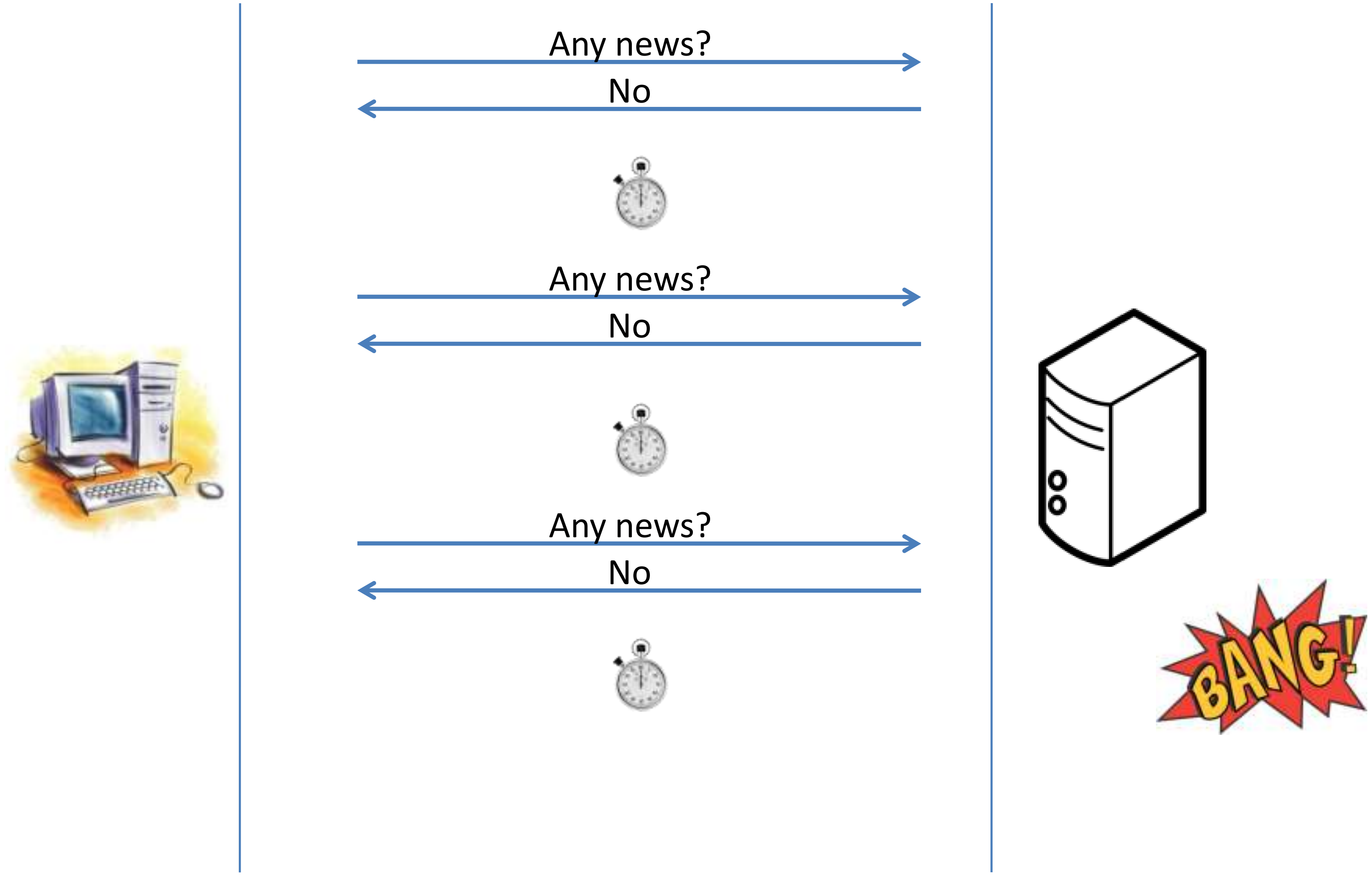
Polling



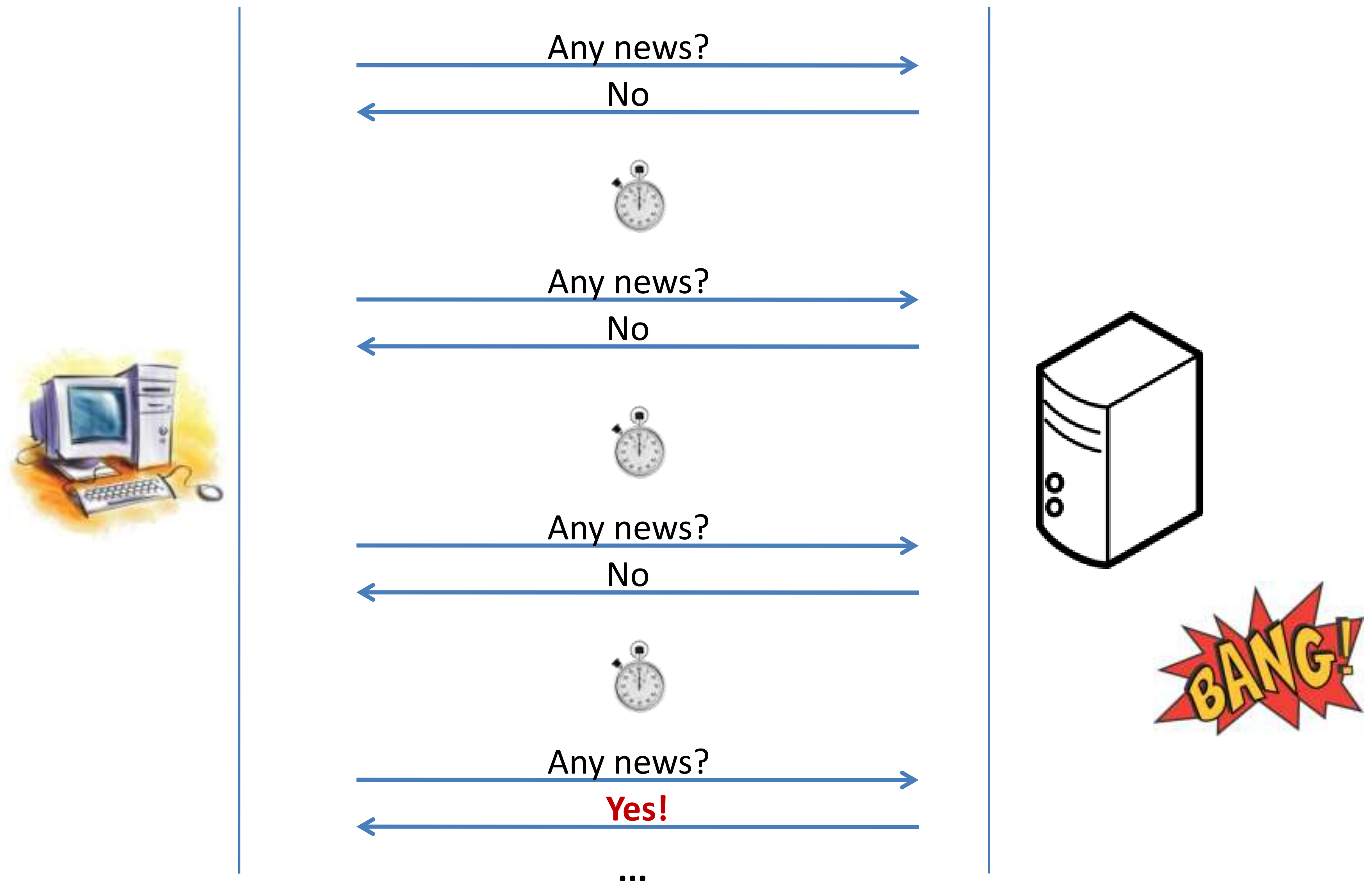
Polling



Polling



Polling



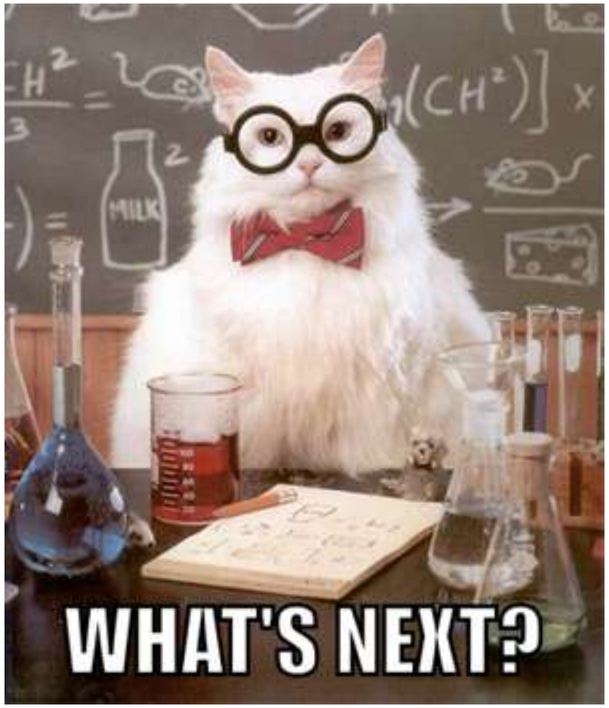
Polling

Pros

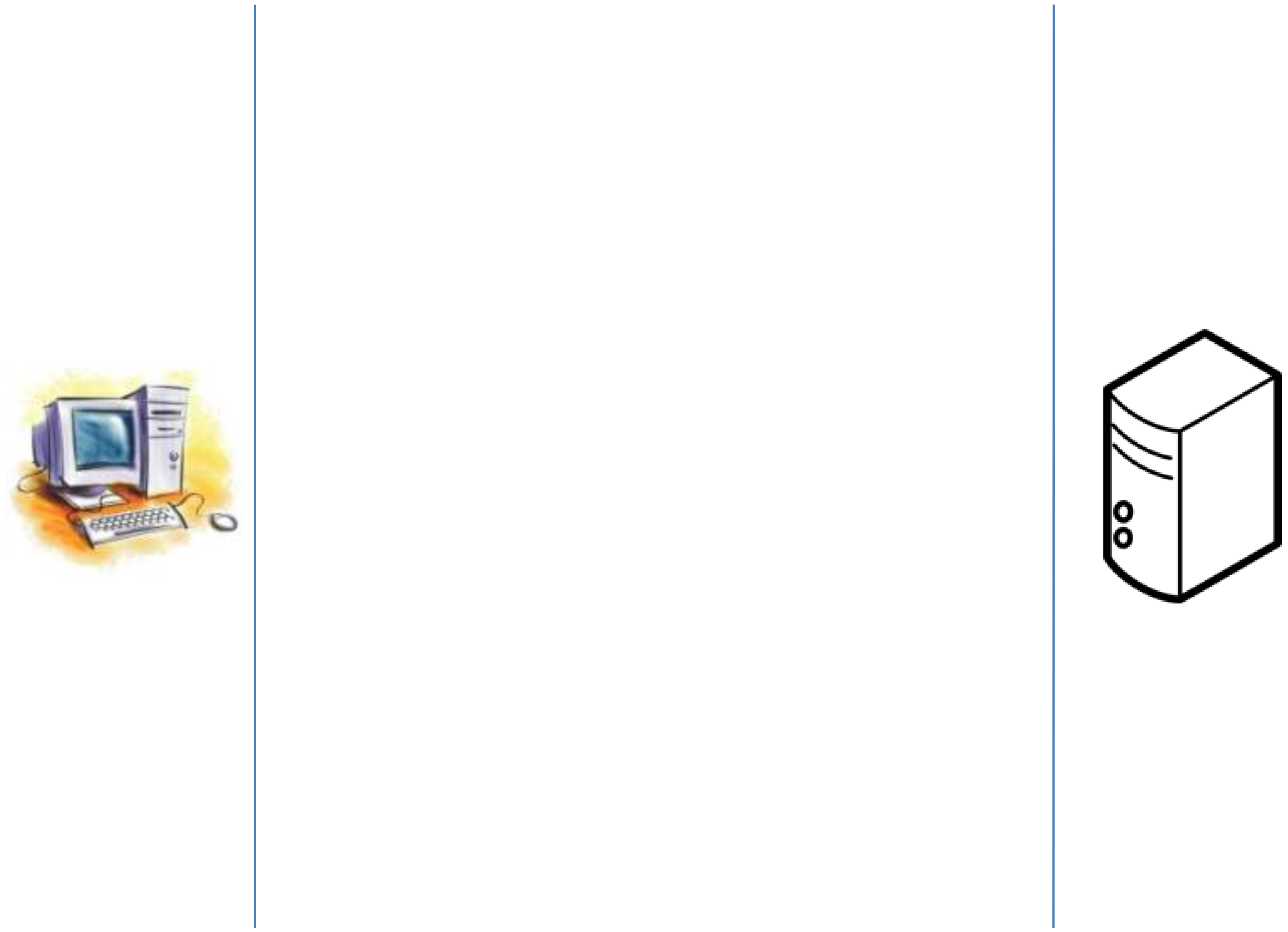
- Easy implementation
- Durable

Cons

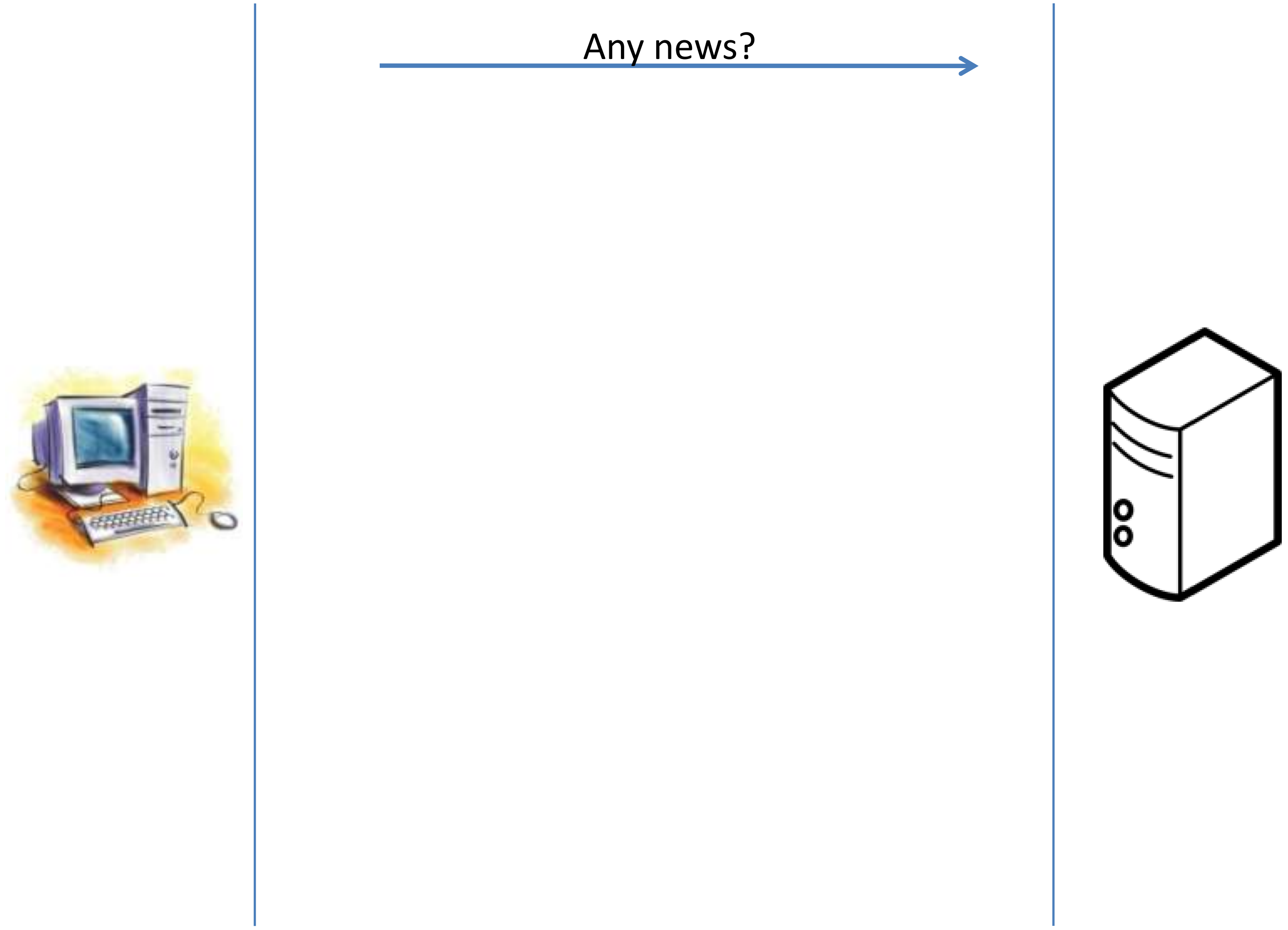
- Not really interactive
- Lots of empty traffic
- High server load


WHAT'S NEXT?
MILK

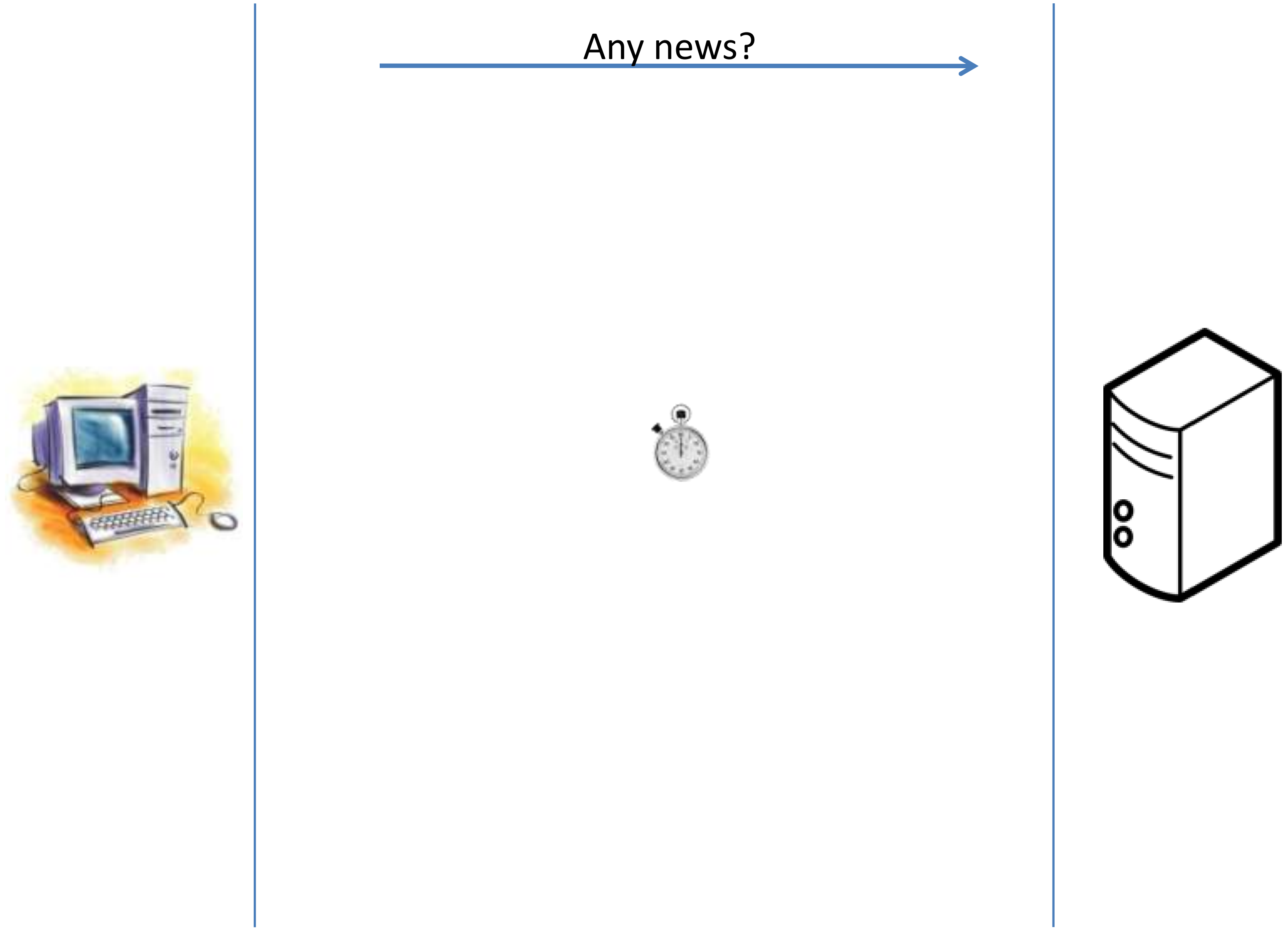
Long Polling



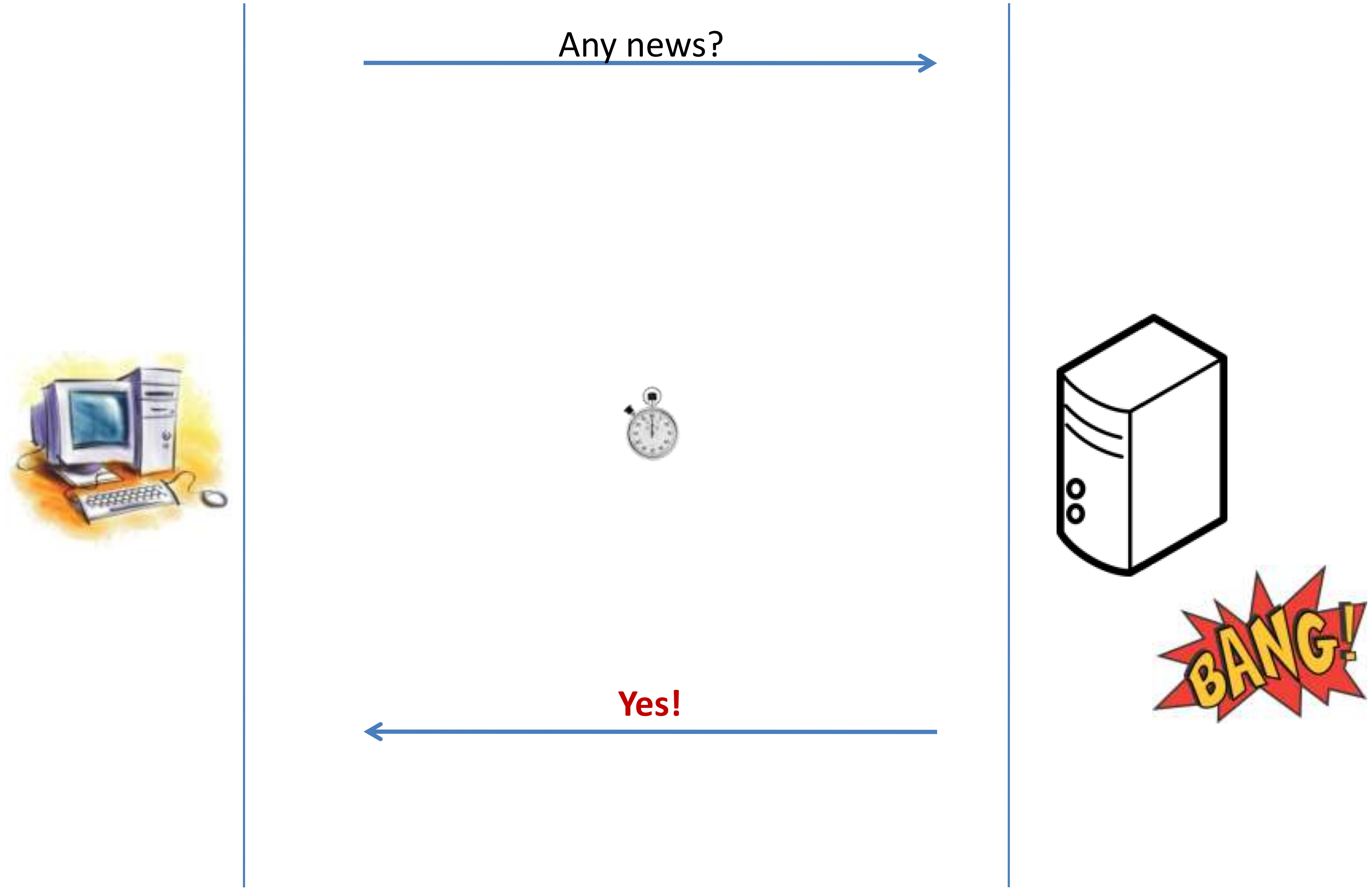
Long Polling



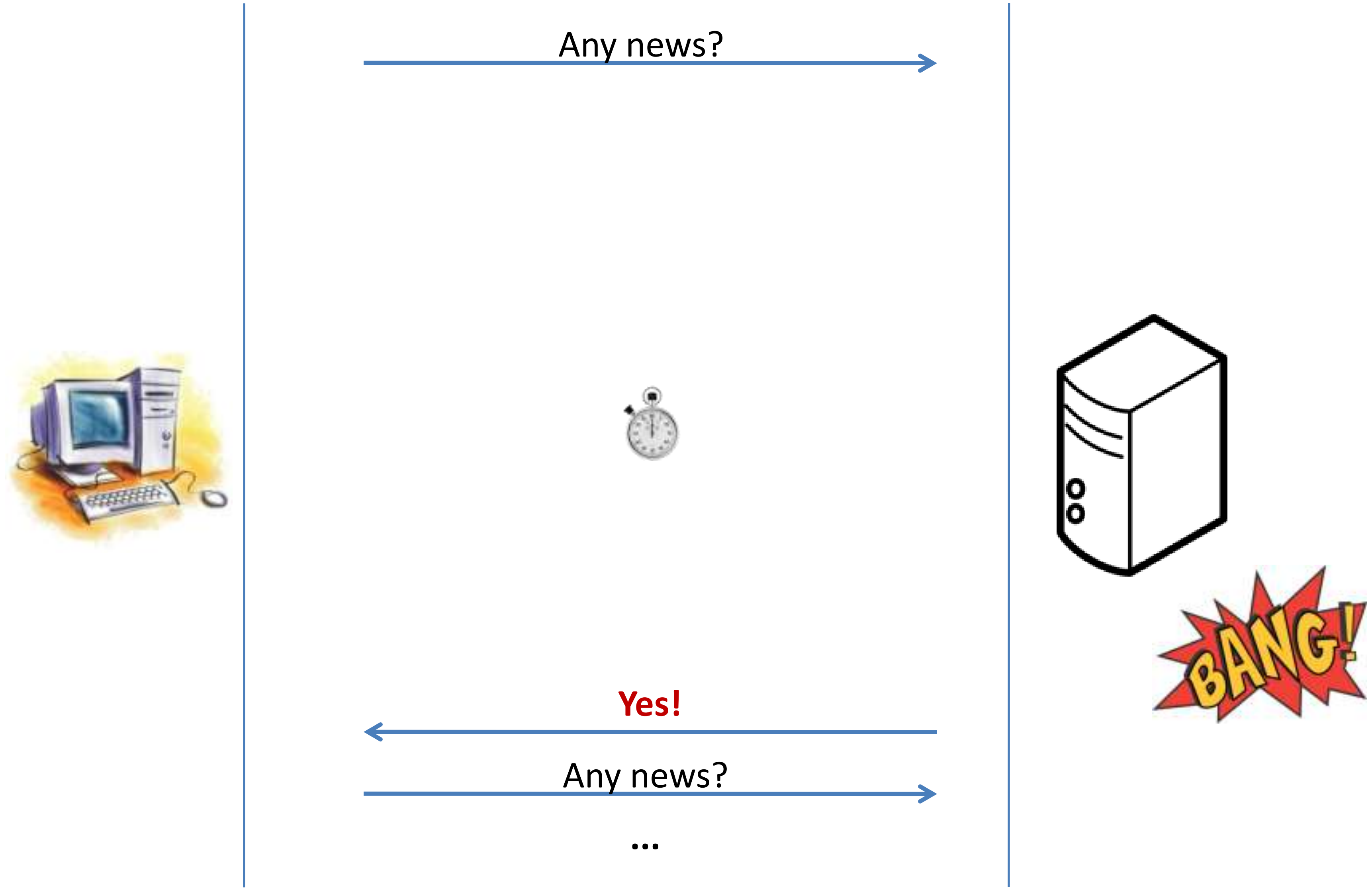
Long Polling



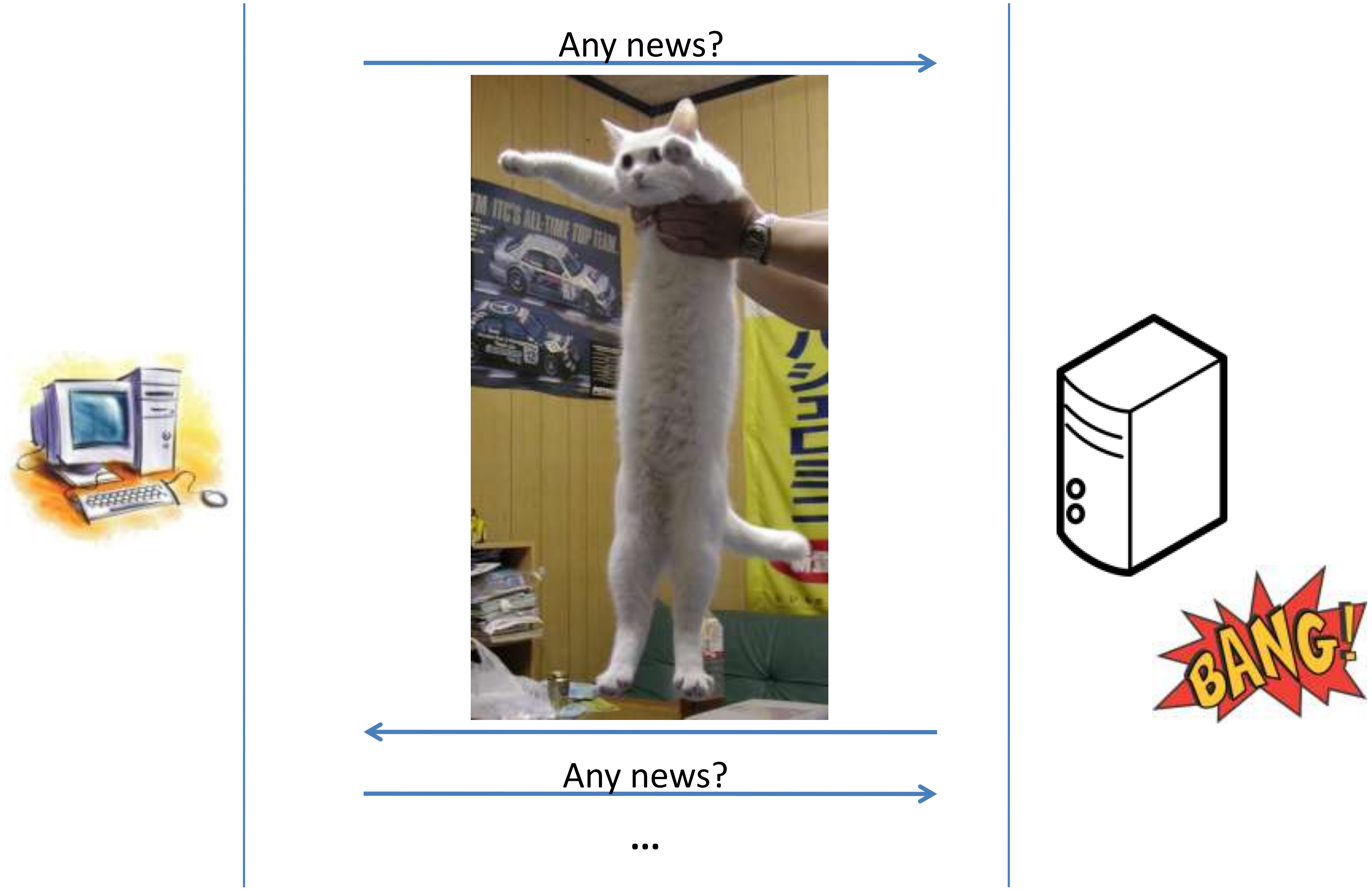
Long Polling



Long Polling



Long Polling



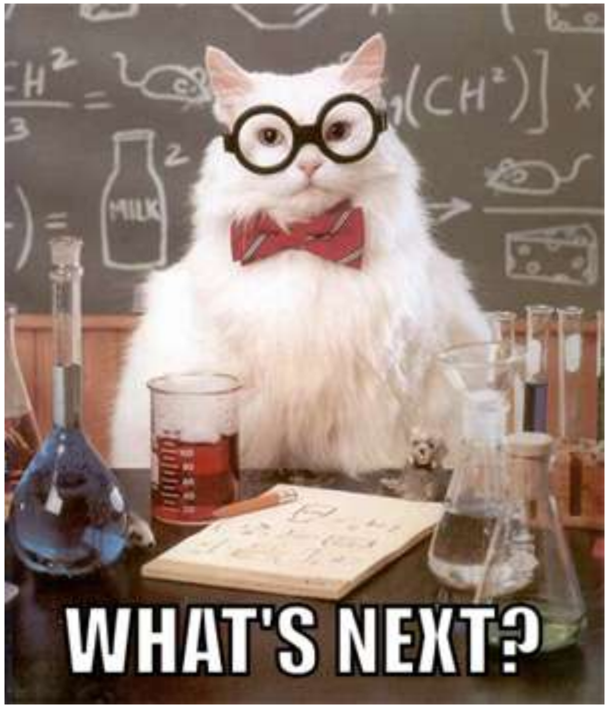
Long Polling

Pros

- Cardinally reduces server load
- Almost real-time interactivity

Cons

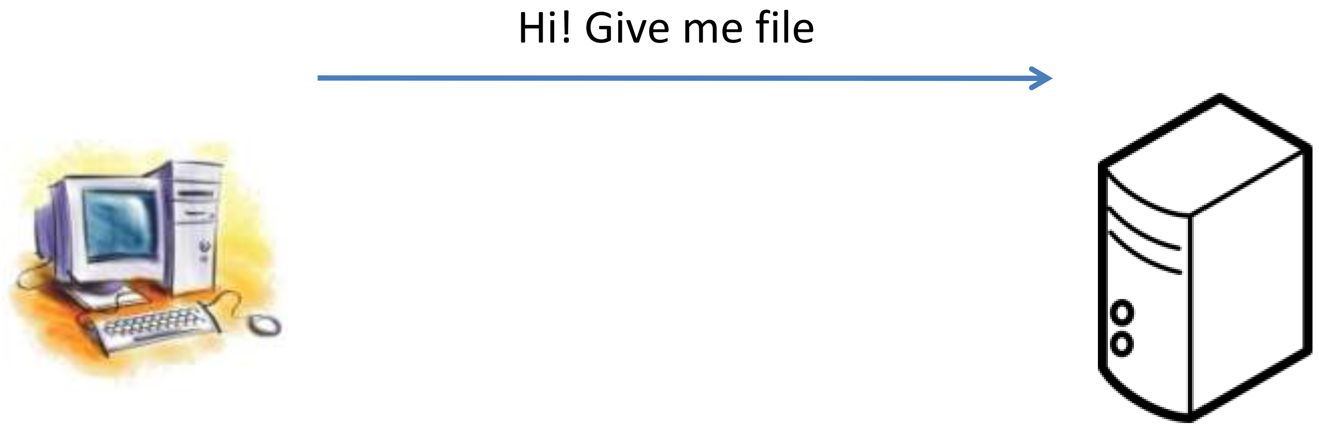
- Need to reconnect, empty traffic remains
- Tricky implementation


WHAT'S NEXT?
MILK

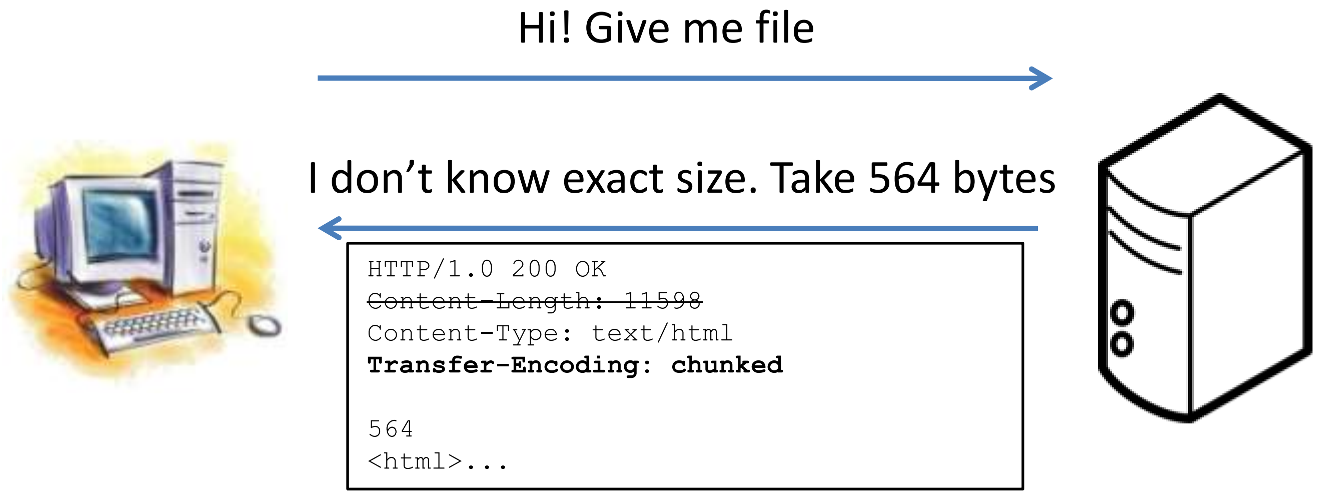
HTTP chunked response

- Part of HTTP protocol
- Available since HTTP 1.1
- Useful when server does not know exact size of requested resource

HTTP chunked response



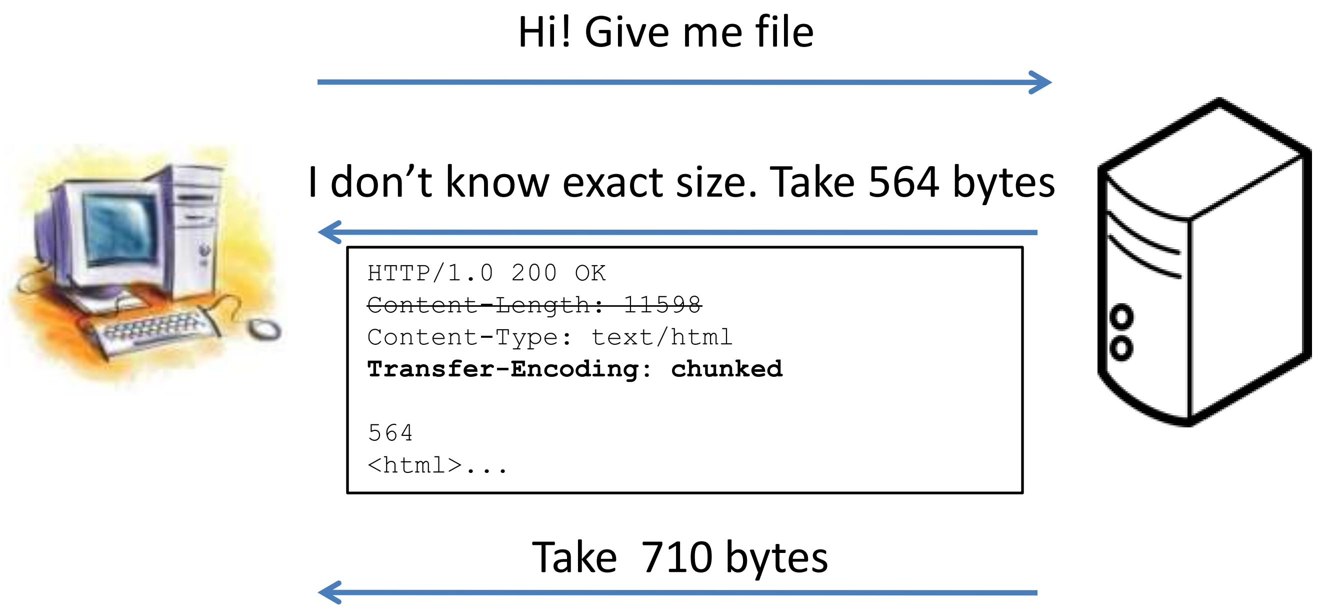
HTTP chunked response



```
HTTP/1.0 200 OK
~~Content-Length: 11598~~
Content-Type: text/html
Transfer-Encoding: chunked

564
<html>...
```

HTTP chunked response



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Content-Type: text/html
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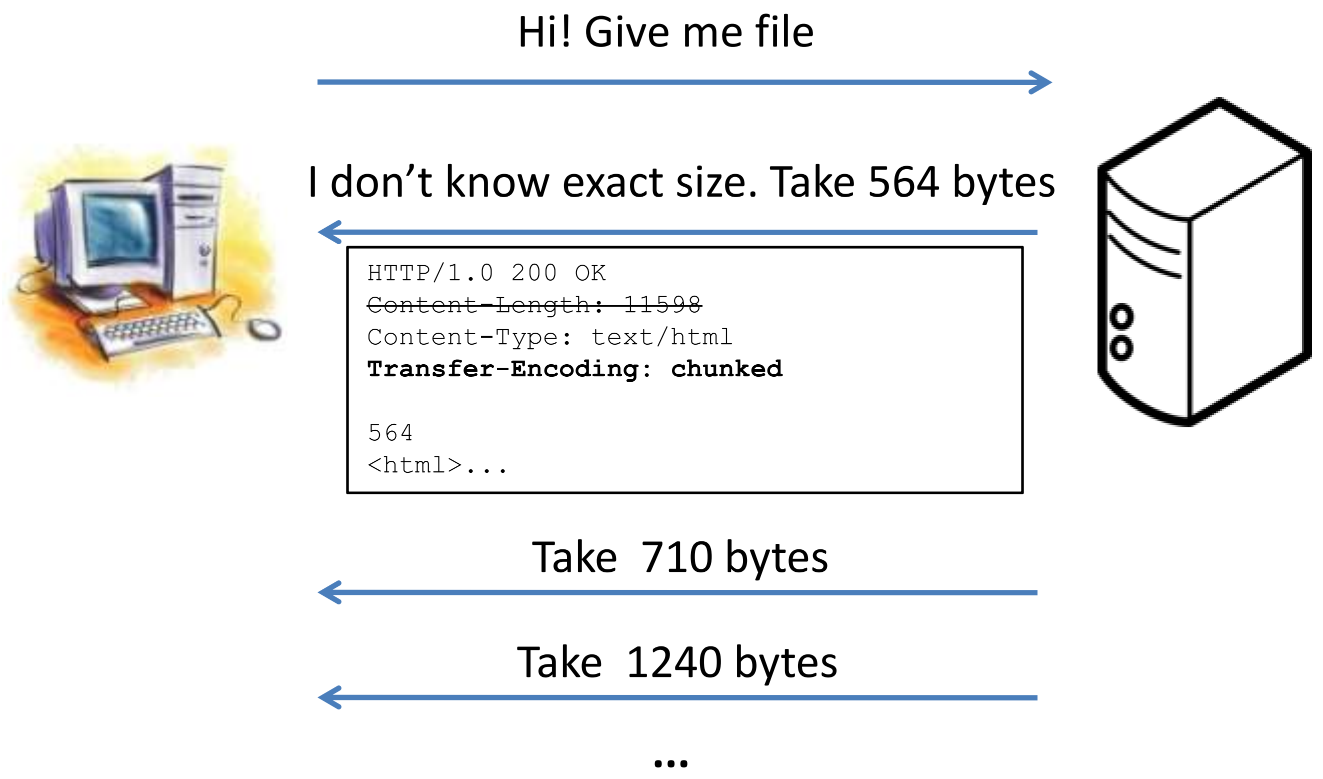
564
<html>...
```

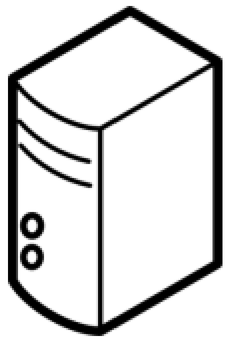
HTTP chunked response



```
HTTP/1.0 200 OK
~~Content-Length: 11598~~
Content-Type: text/html
Transfer-Encoding: chunked

564
<html>...
```

HTTP chunked response



Hi! Give me file

I don't know exact size. Take 564 bytes

```
HTTP/1.0 200 OK
~~Content-Length: 11598~~
Content-Type: text/html
Transfer-Encoding: chunked

564
<html>...
```

Take 710 bytes

Take 1240 bytes

...

That's all!

```
0
```

How to use it?

Forever Frame

Forever Frame

```
<html><head></head><body>
<script>

  var newMessage = function(msg){
    // message handling
  };

</script>

<iframe src="http://host/stream" style="visibility: hidden;"/>

</body></html>
```

Forever Frame

```
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```

Chunked response from http://host/stream:

```
<html><body>
...
```

Forever Frame

```
<html><head></head><body>
<script>

  var newMessage = function(msg){
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  };

</script>

<iframe src="http://host/stream" style="visibility: hidden;"/>

</body></html>
```

Chunked response from http://host/stream:

```
<html><body>
...
<script>window.parent.newMessage("message1");</script>
...
```

Forever Frame

```
<html><head></head><body>
<script>

  var newMessage = function(msg){
    // message handling
  };

</script>

<iframe src="http://host/stream" style="visibility: hidden;"/>

</body></html>
```

Chunked response from http://host/stream:

```
<html><body>
...
<script>window.parent.newMessage("message1");</script>
...
<script>window.parent.newMessage("message2");</script>
...
```

Forever Frame

```
<html><head></head><body>
<script>

  var newMessage = function(msg){
    // message handling
  };

</script>

<iframe src=“http://host/stream" style=“visibility: hidden;”/>

</body></html>
```

Chunked response from http://host/stream:

```
<html><body>
...
<script>window.parent.newMessage(“message1”);</script>
...
<script>window.parent.newMessage(“message2”);</script>
...
<script>window.parent.newMessage(“message3”);</script>
...
```

Forever Frame

Pros

- No gap between near messages
- No reconnections between server events

Cons

- Frame being filled with messages causes browser’s memory leak
- Reconnections handling routine to be implemented manually

What’s your name?

Alex Russell, one of Dojo Toolkit founders gave server to client push technologies stack an exposed name: ***Comet***

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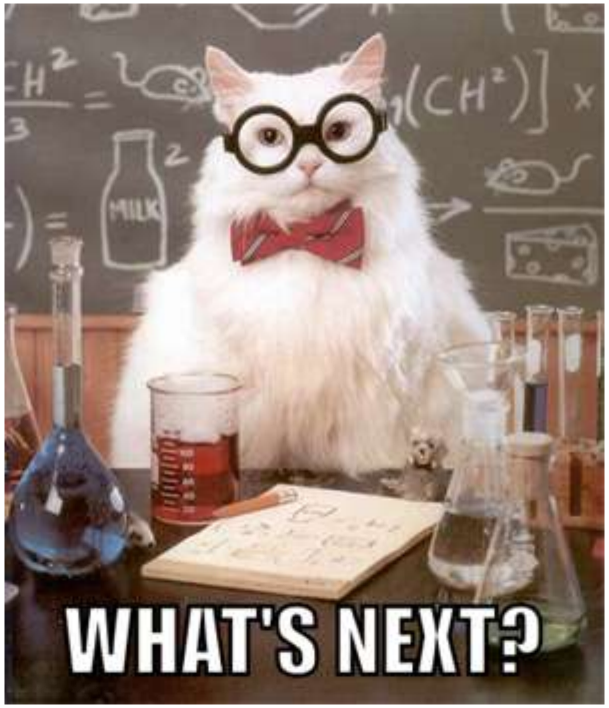
What’s your name?


WHAT'S NEXT?
MILK

HTML

5

Web Socket

- A special protocol over TCP
- Allows full duplex between client and server
- HTTP is used to initialize connection
- Permanent TCP connection

Web Socket

Protocol handshake

```
GET ws://host.com HTTP/1.1
Host: host.com
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Key: x3JJHMbDL1EzLkh9GBhXDw==
```

```
HTTP/1.1 101 Switching Protocols
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Accept: HSmrc0sMlYUkAGmm5OPpG2HaGWk=
```

Web Socket

```
<script>
   var websocket = new WebSocket(wsUri);
   websocket.onopen = function(evt) {};
   websocket.onclose = function(evt) {};
   websocket.onmessage = function(evt) {};
   websocket.onerror = function(evt) {};
   ...
   websocket.send(data);
</script>
```

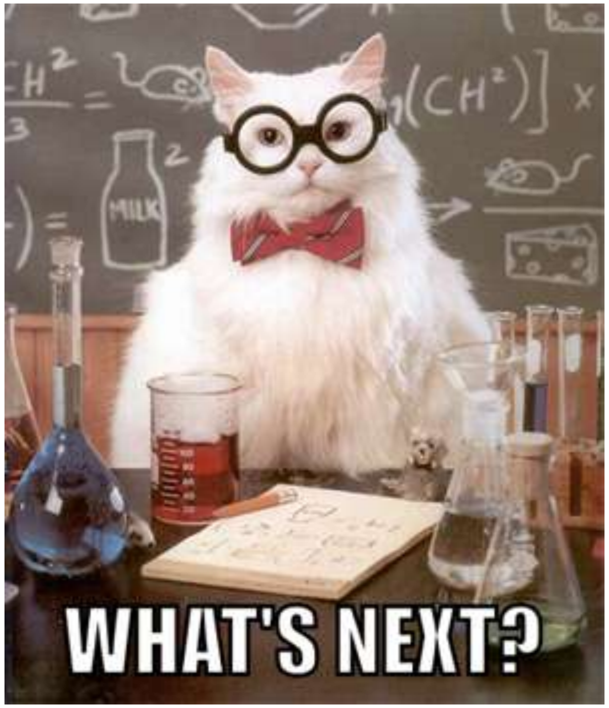
Web Socket

Pros

- Full duplex
- Connection is managed by browser

Cons

- Not supported by all browsers and servers
- Protocol is not HTTP based
- Standard is not fixed as yet


WHAT'S NEXT?

Server Side Events

- New feature of HTML5
- One-way messaging from server to client
- Fully based on HTTP
- Permanent TCP connection
- Implemented using chunked encoding (like Forever Frame)

Server Side Events

Request:
```
GET /eventsource HTTP/1.1
Host: host.com
Connection: keep-alive
Accept: text/event-stream
```

Response:
```
HTTP/1.1 200 OK
Content-Type: text/event-stream
Transfer-Encoding: chunked
Expires: -1
```

Server Side Events

```
<script>
   var source = new EventSource(url);
   source.addEventListener(“message”, function(e){
        // Process message in e.data
   });
   source.addEventListener(“error”, function(e){
        if(e.readyState == EventSource.CLOSED)
        // process
   });
</script>
```

Server Side Events

Pros

- Reconnections are handled by browser
- Based on HTTP

Cons

- No full duplex
- Not supported by all browsers

Conclusions

- 4 real-time messaging technologies:
  - Long Polling
  - Forever Frame
  - Web Socket
  - Server Side Events
- Not everywhere supported the same

What to choose?

What to choose?

ALL OF THEM!

U MAD ?
Troll.me

Implementations?!

Implementations?!

socket.io for Node.js

SignalR for .NET stack

SignalR

- Is being developed by two guys from ASP.NET team
- Open source (github)
- Supports all the 4 messaging technologies
- Automatic fallback from Web Sockets to Long Polling, auto detection of browser capabilities
- High level of abstraction – solves business needs
- …
- Profit!!!

Demo

????????

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Skype: timur.babyuk

http://cometdaily.com
http://en.wikipedia.org/wiki/Comet_(programming)
http://www.html5rocks.com/en/tutorials/websockets/basics
http://www.html5rocks.com/en/tutorials/eventsource/basics
http://signalr.net
http://socket.io