WebSockets


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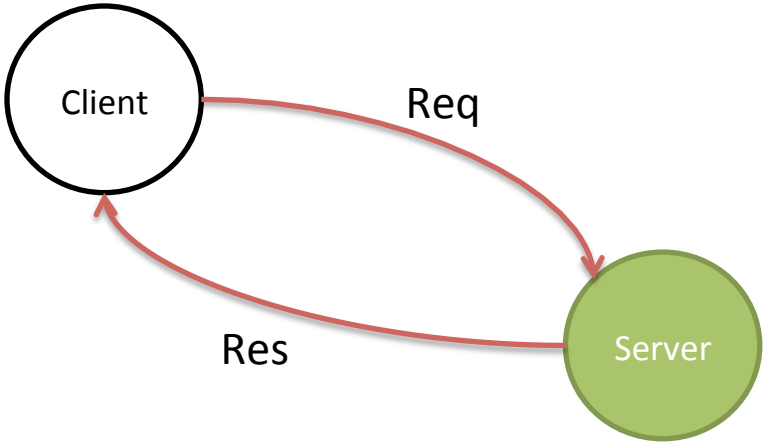
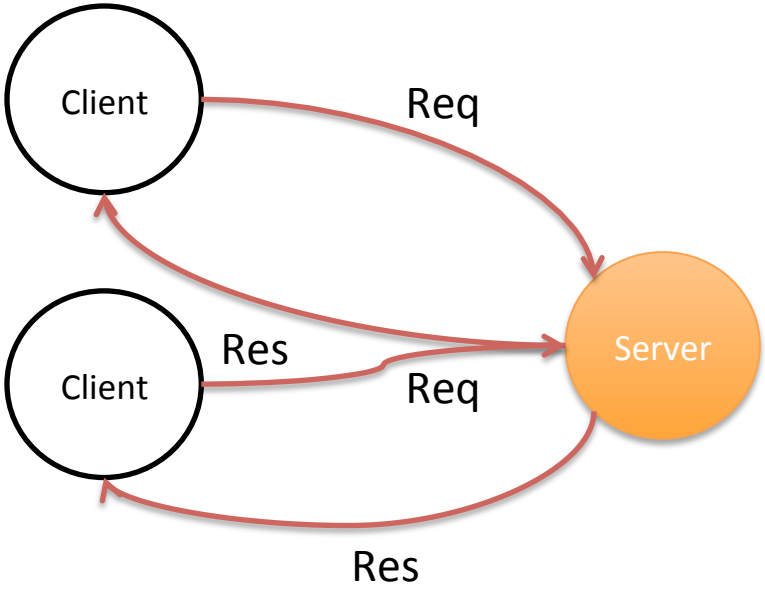
Problem with Ajax?

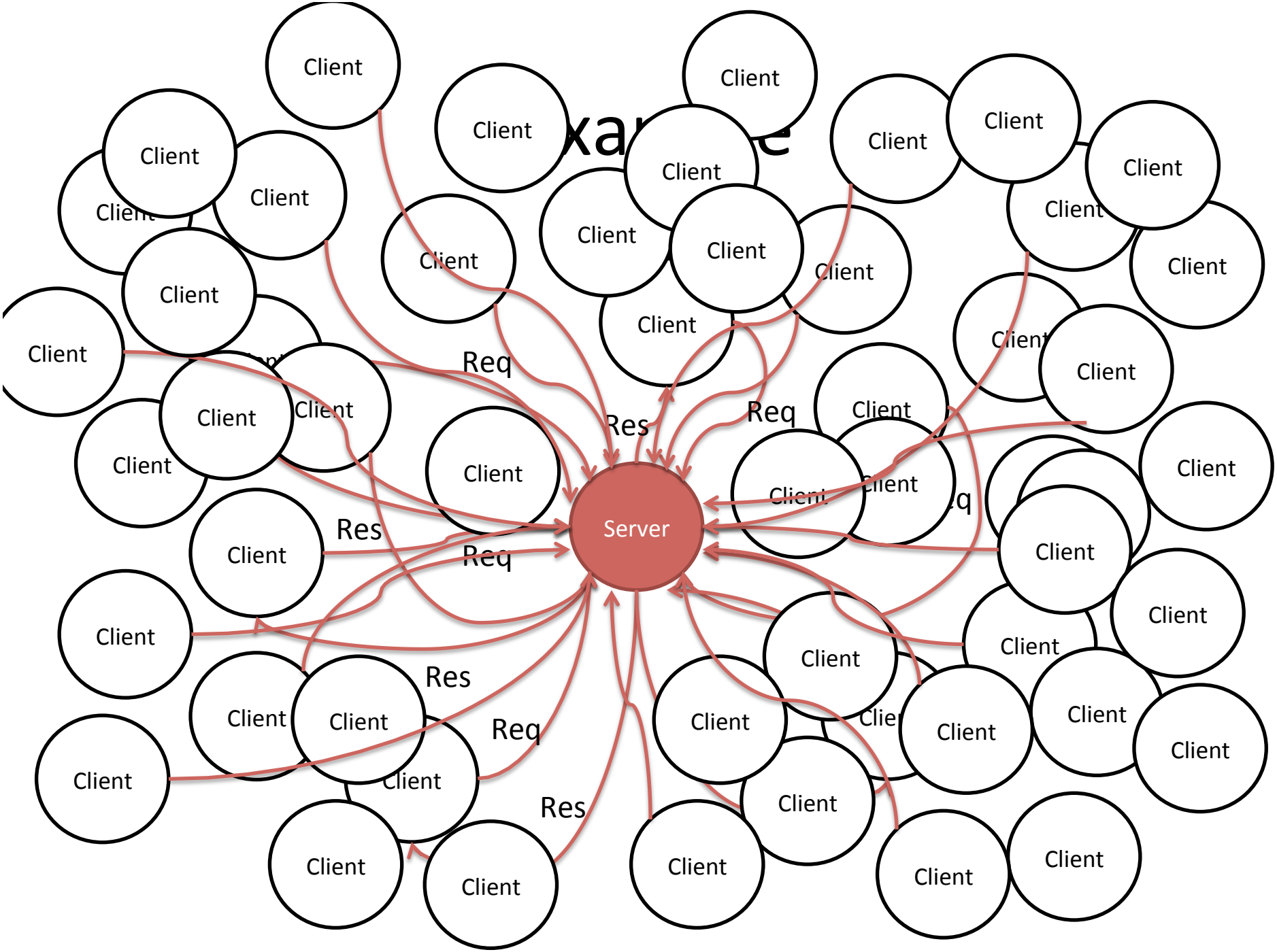
- **Ajax: client must *pull* from the server**
  - This works for many applications
  - What type of application does this work for?
- **But, what about real-time apps?**
  - They require notification **immediately** when state changes on the server!
  - Constant polling can lead to unnecessary overhead that can bog down the server and client

This works fine…



We are still ok, but…




Client
Server
Req
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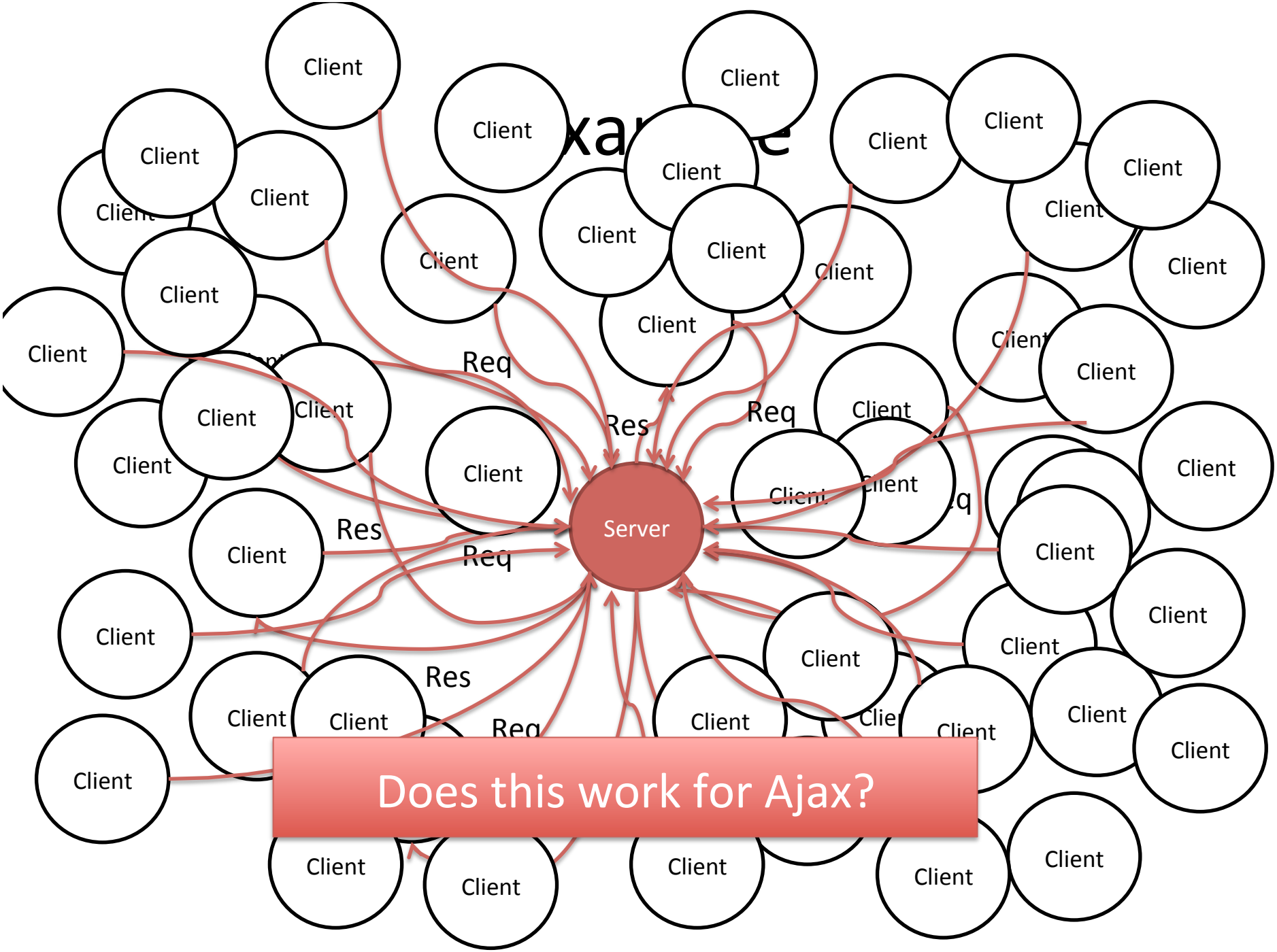
Client
Server
Req
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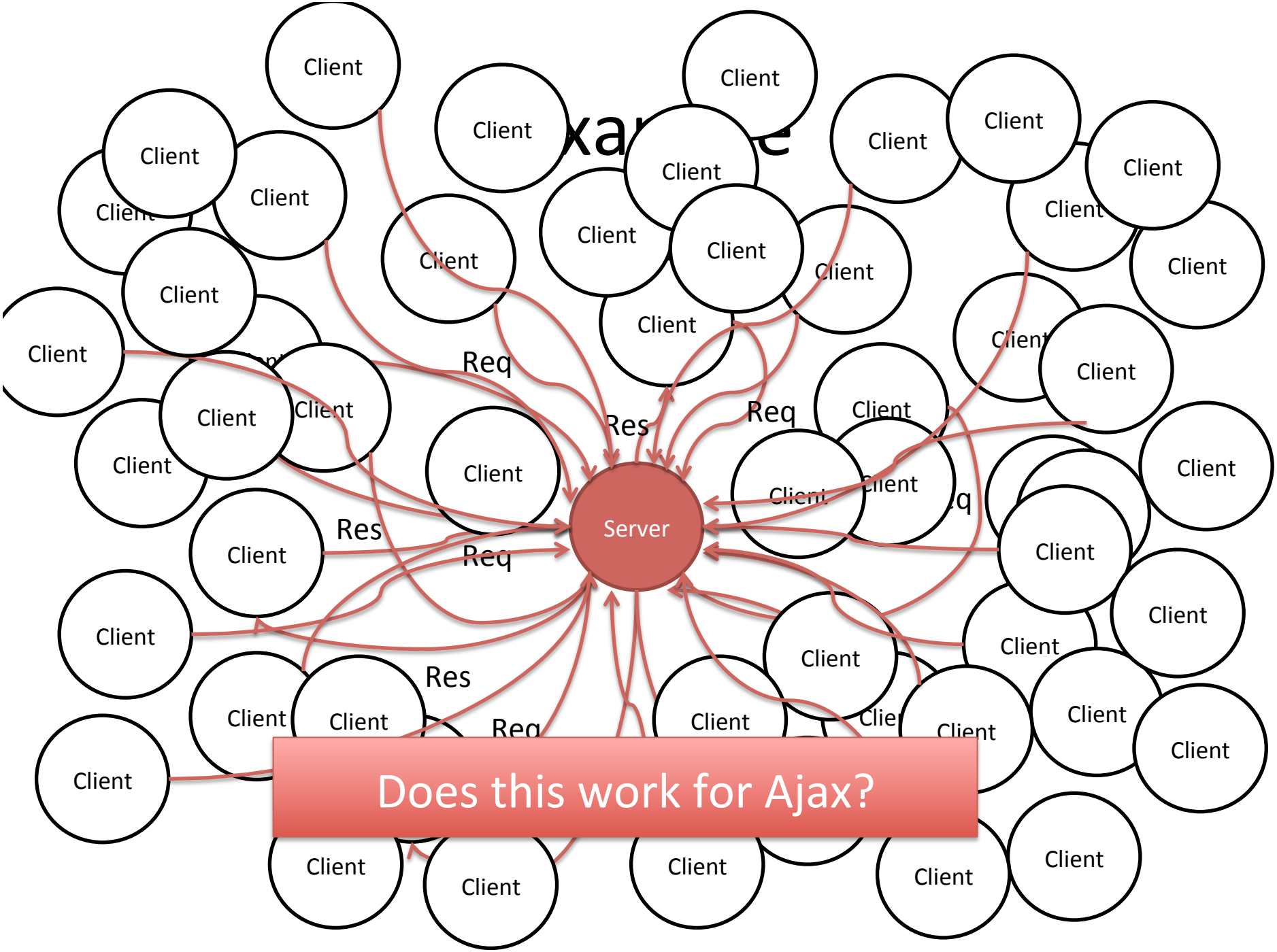
Req
Does this work for Ajax?

Communication Behavior

- **Behavior of Client Communication**
  - How does the client communicate with the server?
  - What is required?
- **Observations**
  - Frequent communication?
  - Real-time communication?
  - How many clients are communicating at once?
  - Scalability?

Ajax Application Properties

- **Communication**
  - Communication with the server does not have real-time constraints, it is not frequent
- **Scalability**
  - Can support many client connections at any given time as the connection is short-lived
  - Server does not need to maintain **many** live connections at once (sort of)
  - Ajax-style applications are scalable to a limit, the overhead of HTTP is substantial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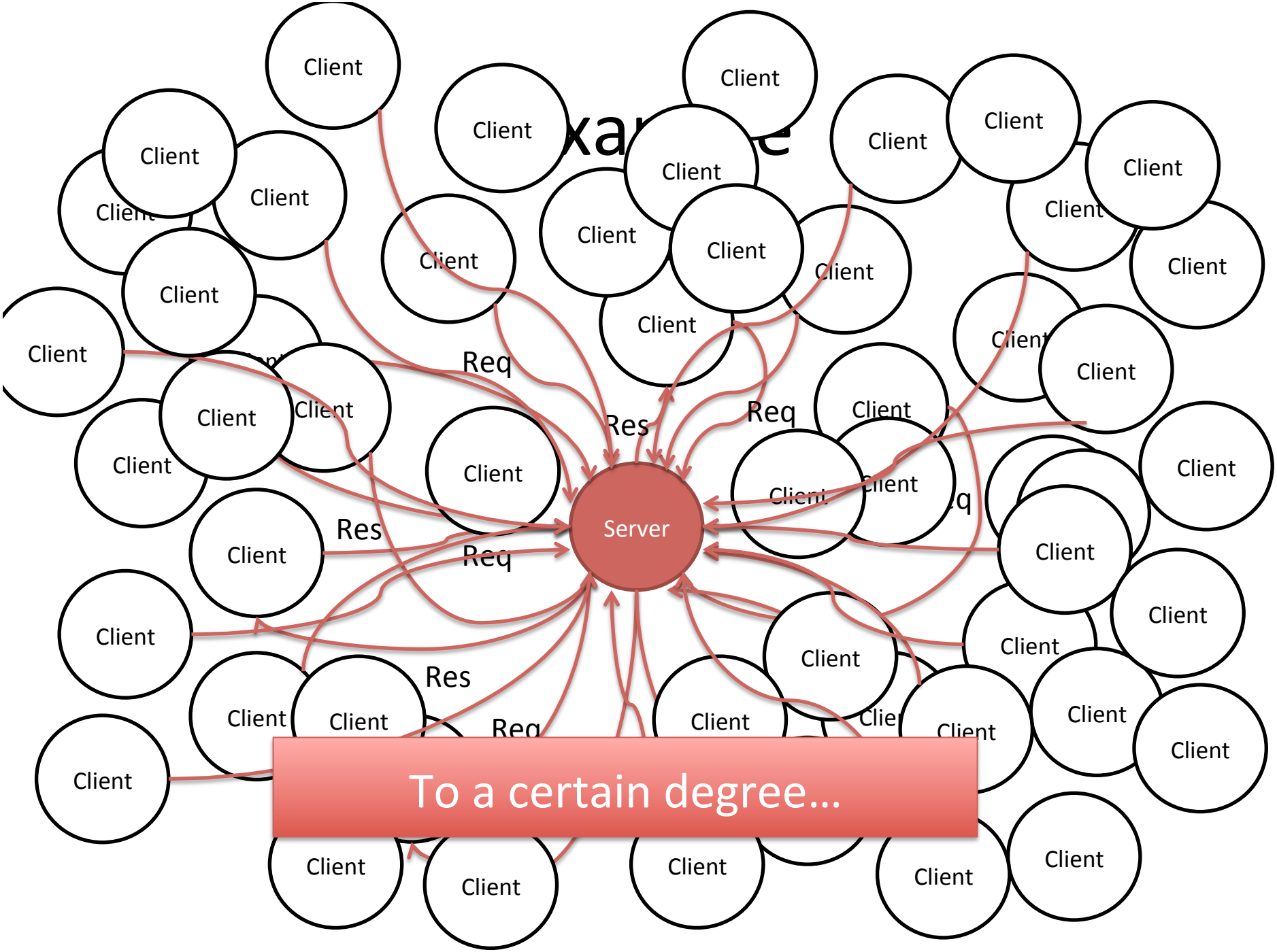
Client
Server
Req
Res
Req
Res
Req
Res
To a certain degree…

Long Polling

- **What if we want real-time –like properties?**
- **Long Polling**
  - Send Ajax request
  - Server does not respond immediately, holds open the connection for a certain amount of time
  - Replies when data is available
- **Pro: reduces computing/network overhead**
- **Con: Still lots of overhead**
- **This is the approach before new techniques**

WebSockets

- **New Approach**
  - Relatively, 2011
- **Provides**
  - *Bi-directional, full-duplex communication*
    - Much like tradition sockets, but not quite
  - *Minimal communication overhead*
    - Binary protocol, no HTTP overhead
  - *Super Scalability*
    - Very Low Overhead
    - Open connections: limited by machine/OS configuration

How does it work?

Initial WebSocket Handshake Request:

```
GET /mychat HTTP/1.1
Host: server.example.com
Upgrade: websocket
Connection: Upgrade
Sec-WebSocket-Key: x3JJHMbDL1EzLkh9GBhXDw==
Sec-WebSocket-Protocol: chat
Sec-WebSocket-Version: 13
Origin: http://example.com
```

Response indicates the protocol switch:

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

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After this, messages can be sent/received from client/server

WebSocket API

- **We will use:**
  - Socket.IO
  - http://socket.io
- **Works with Node.js & Express**
  - Other frameworks have similar libraries

Client API: Connecting

io.connect(URL)

```
var socket = io.connect('http://localhost');
```

Client API: Disconnecting

socket.disconnect()

```
var socket = io.connect('http://localhost');
socket.disconnect();
```

Client API: Receiving

socket.on(event, callback)

```
socket.on('chat-post', function (data) {
  console.log(data);
});
```

Client API: Sending

socket.emit(event, data)

```
socket.on('chat-post', function (data) {
  console.log(data);
  socket.emit('chat-post-rvd', {
    status : 'received'
  });
});
```

Client API: Sending

socket.emit(event, data)

```
socket.emit('chat-post-send', {
  msg : $('input#message').text();
});
```

Server API: Listening

socket_io.listen(server)

```
var socket_io = require('socket.io');
var io = socket_io.listen(server);
```

Server API: Connect/Disconnect

io.sockets.on(event, callback)

event = ‘connection’ | ‘disconnect’

```
var socket_io = require(‘socket.io’);
var io = socket_io.listen(app);

io.sockets.on(‘connection’,
  function (socket) {
    // Now we have a websocket: socket
  });
io.sockets.on(‘disconnect’, function () { });
```

Server API: Receiving

socket.on(channel, callback)

```
var socket_io = require('socket.io');
var io = socket_io.listen(app);

io.sockets.on('connection',
  function (socket) {
    socket.on('chat-post-send', function (data) {
      console.log(data.msg);
    });
  });
```

Server API: Sending

socket.emit(channel, callback)

```
var socket_io = require('socket.io');
var io = socket_io.listen(app);

io.sockets.on('connection',
  function (socket) {
    socket.on('chat-post-send', function (data) {
      socket.emit('chat-post-rcd', { status: 'ok' });
    });
  });
```

Server API: Broadcasting

socket.emit(channel, callback)

```
var socket_io = require('socket.io');
var io = socket_io.listen(app);

io.sockets.on('connection',
  function (socket) {
    socket.broadcast.emit('all', 'user connected');
    // OR
    io.sockets.emit('all', 'user connected');
  });
```

Server API: Session Support

socket.set(key, value, callback)

```
io.sockets.on('connection',
  function (socket) {
    socket.on('set user', function (user) {
      socket.set('user', user, function () {});
    });
  });
```

Server API: Session Support

socket.get(key, callback)

callback : function (err, value)

```
io.sockets.on('connection',
  function (socket) {
    socket.on('get user', function () {
      socket.get('user', function (err, user) {
        socket.emit('user name', user);
      });
    });
  });
```