Mojolicious
and websockets

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Mojolicious
and websockets

1) Basics
    a) Websockets
2) Two examples
    a) Send message, every 3 sec.
    b) Chat script – multiple clients talking together.

1) Basics

Websockets

`ws://www.server.dk/`
`wss://www.server.dk/`

- Part of HTML5
- Full-duplex communication over single TCP connection.
- Supported by all latest browsers (except for Opera Mini).
- Idle when no data. Eliminates polling.
- Less overhead (cookies, authentication is sent only once)

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Websockets

Websockets can be used for a variety of web applications:

- Games
- Stock tickers
- Multiuser applications with simultaneous editing
- User interfaces exposing server-side services in real time,
- Etc.

Quoted from RFC 6455

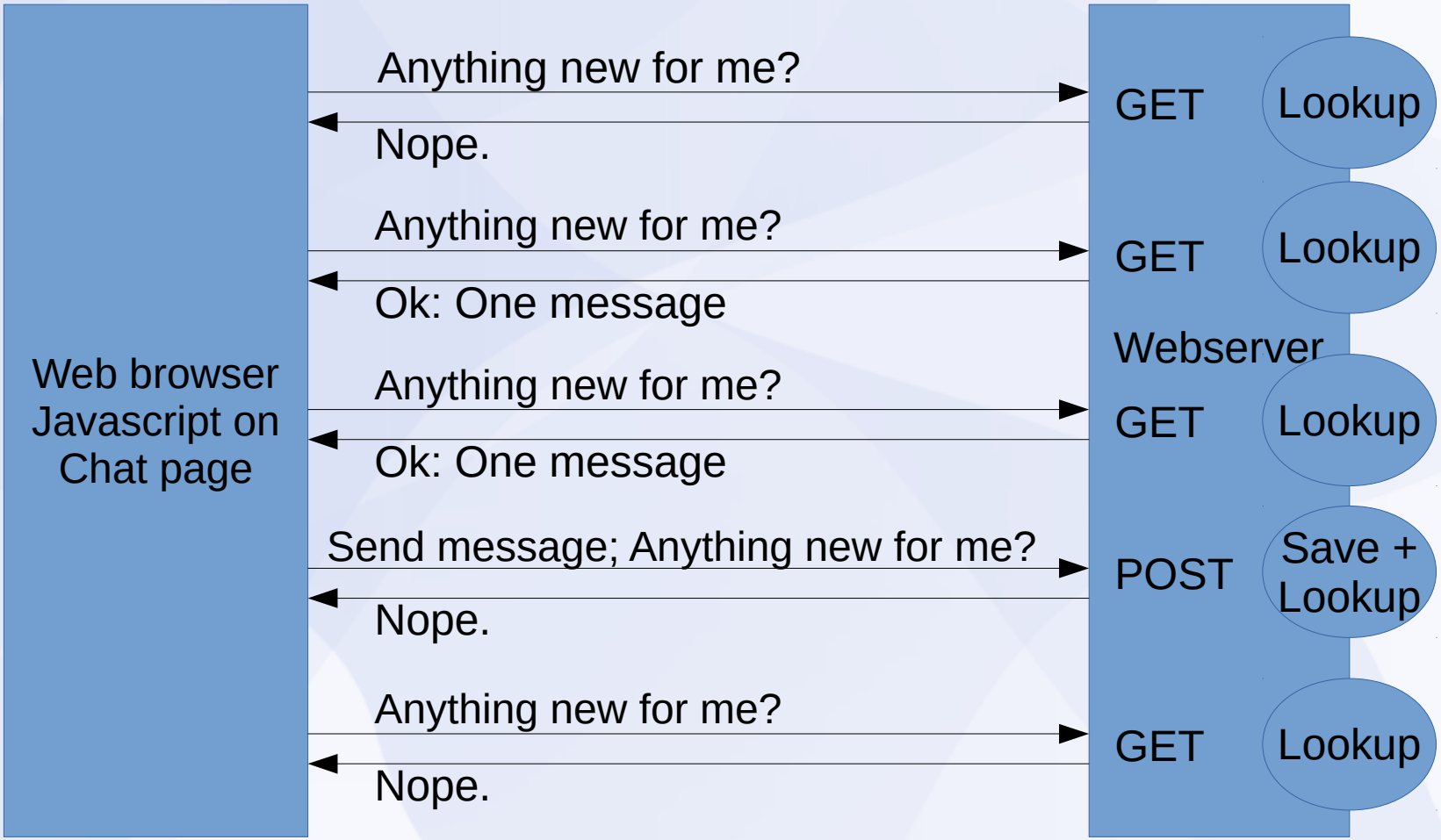
Websockets
without websockets

Polling

Long polling

Poll

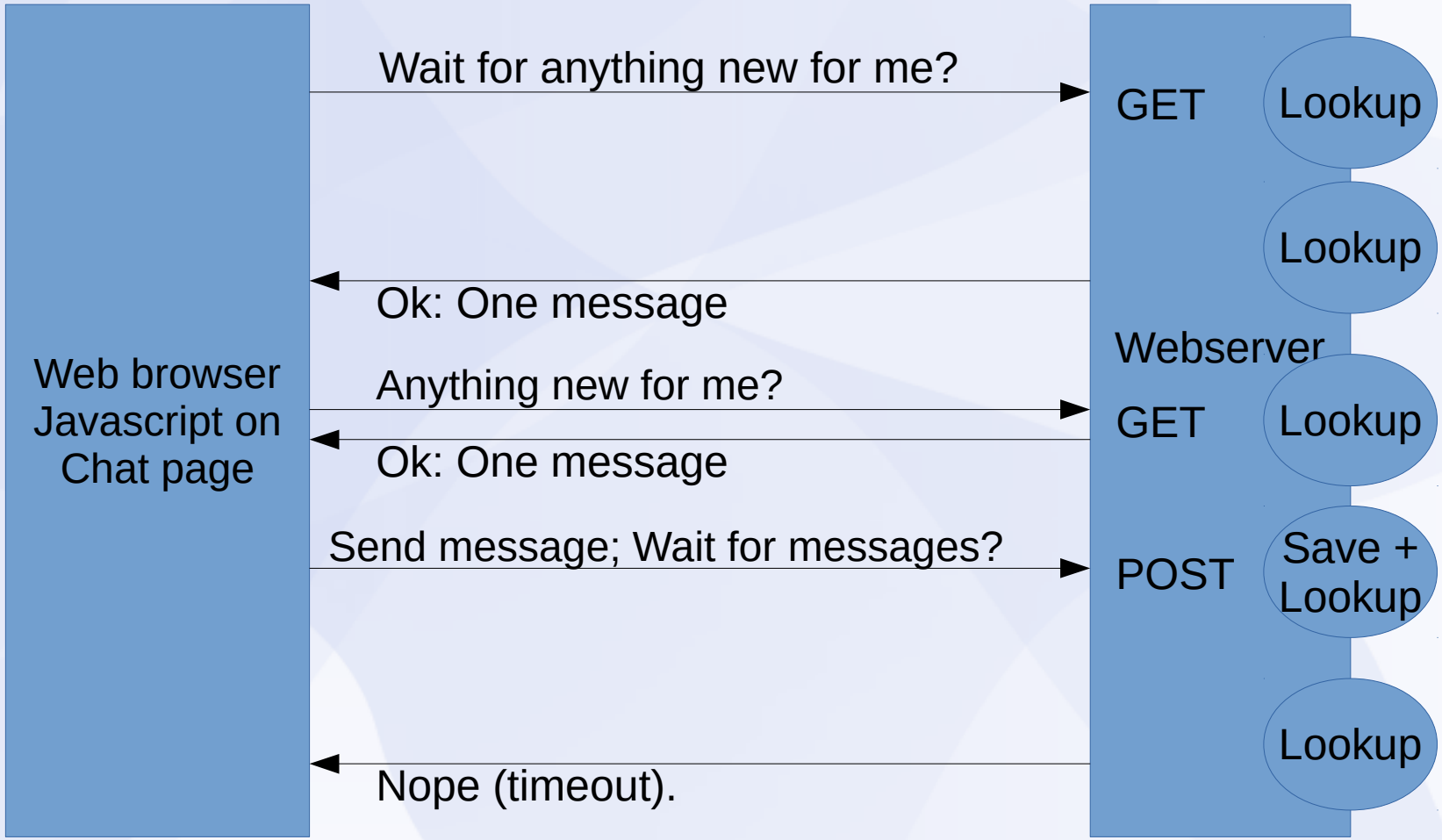
Before websockets



5 requests/responses (tcp+http+cookies etc)

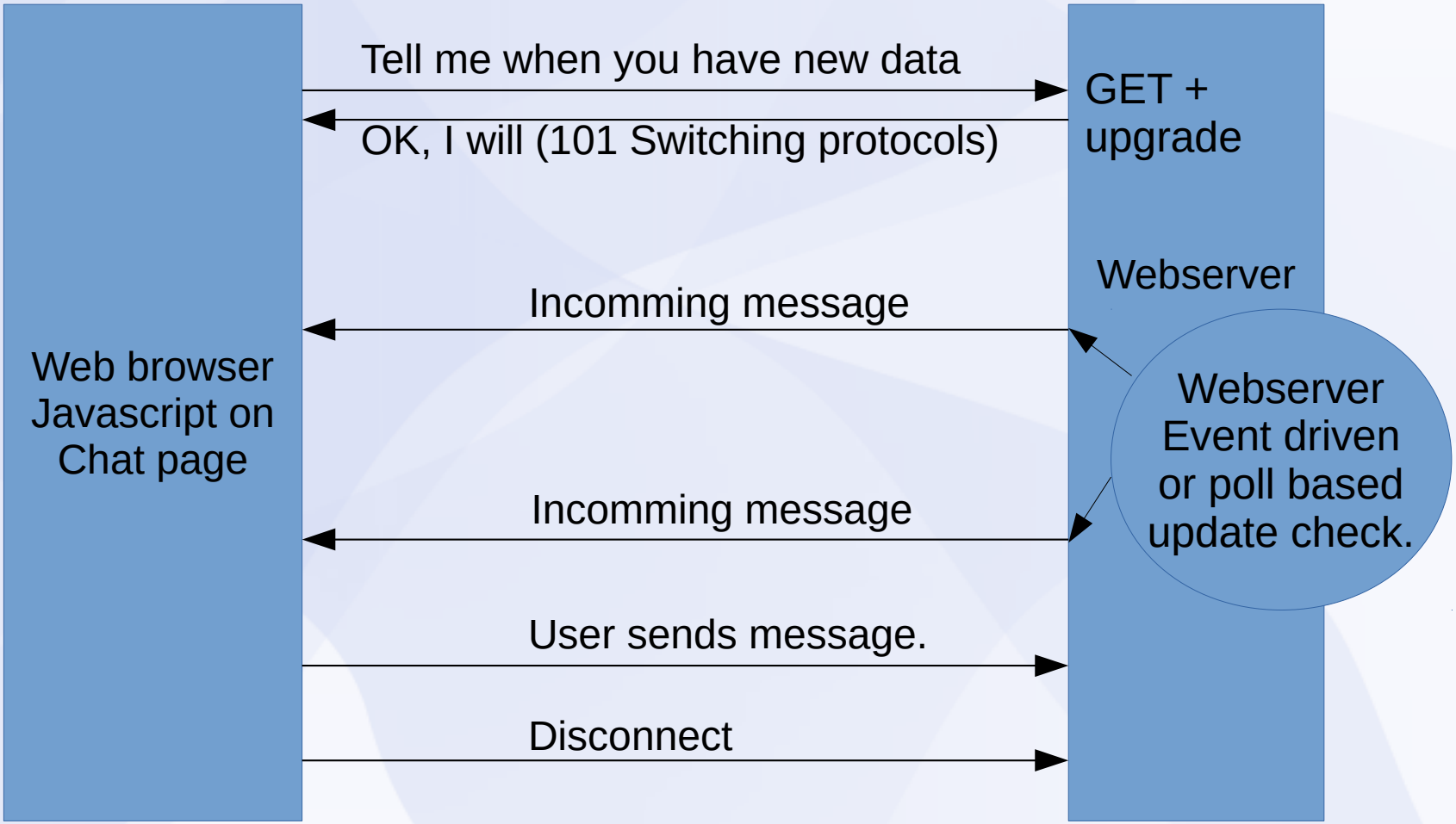
Long Poll

Before websockets



3 requests/responses (tcp+http+cookies etc)

Full duplex
With websockets



1 request/response (tcp+http+cookies etc) + 4 short messages

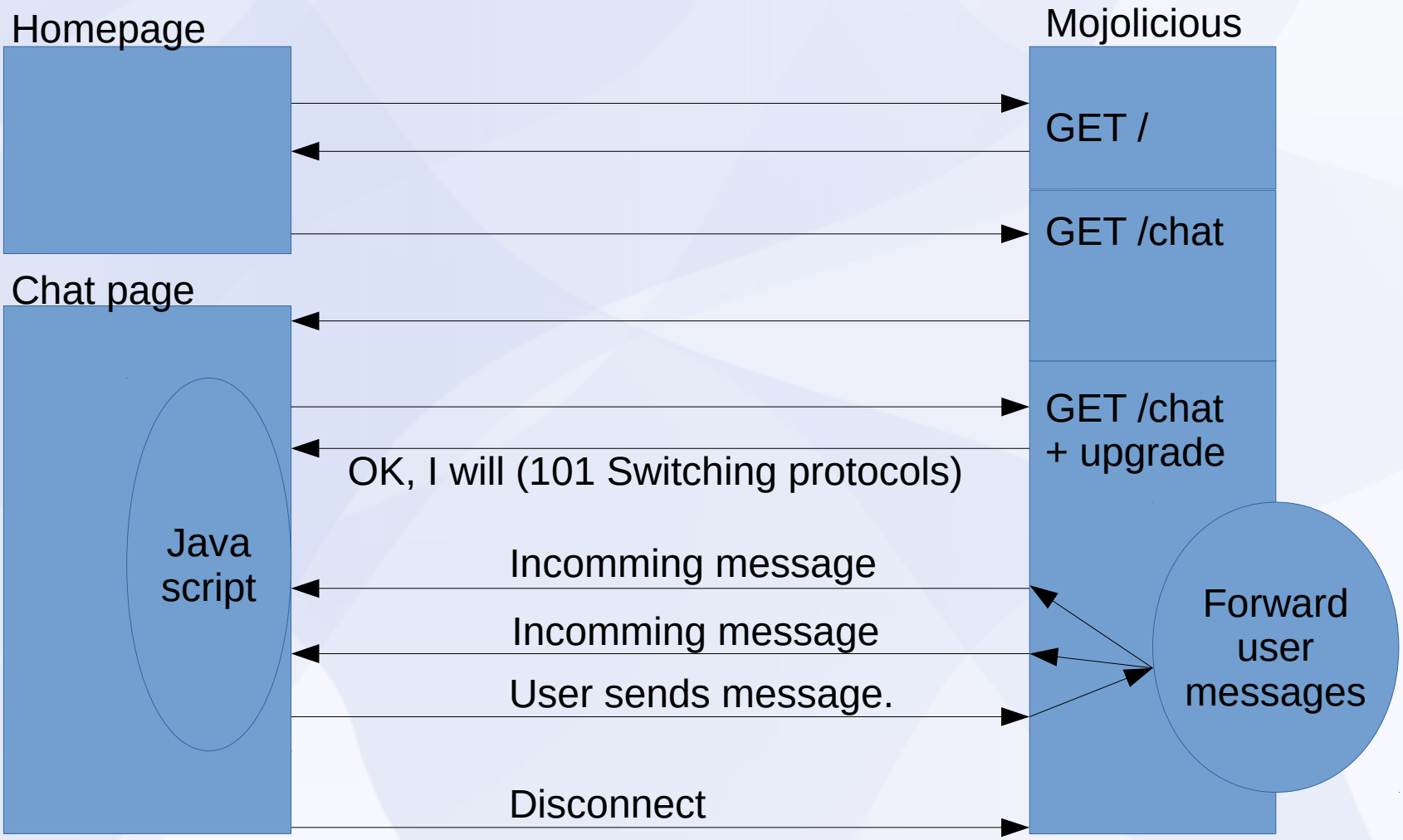
Websockets
long polling and websockets

If connection is lost,
you may want to reconnect.

But make sure
to add a backoff algorithm
in order to reduce load
on the server and network.

Read also: http://blog.johnryding.com/post/78544969349/how-to-reconnect-web-sockets-in-a-realtime-web-app
or search for Exponential Backoff algorithm.

Our setup
With websockets



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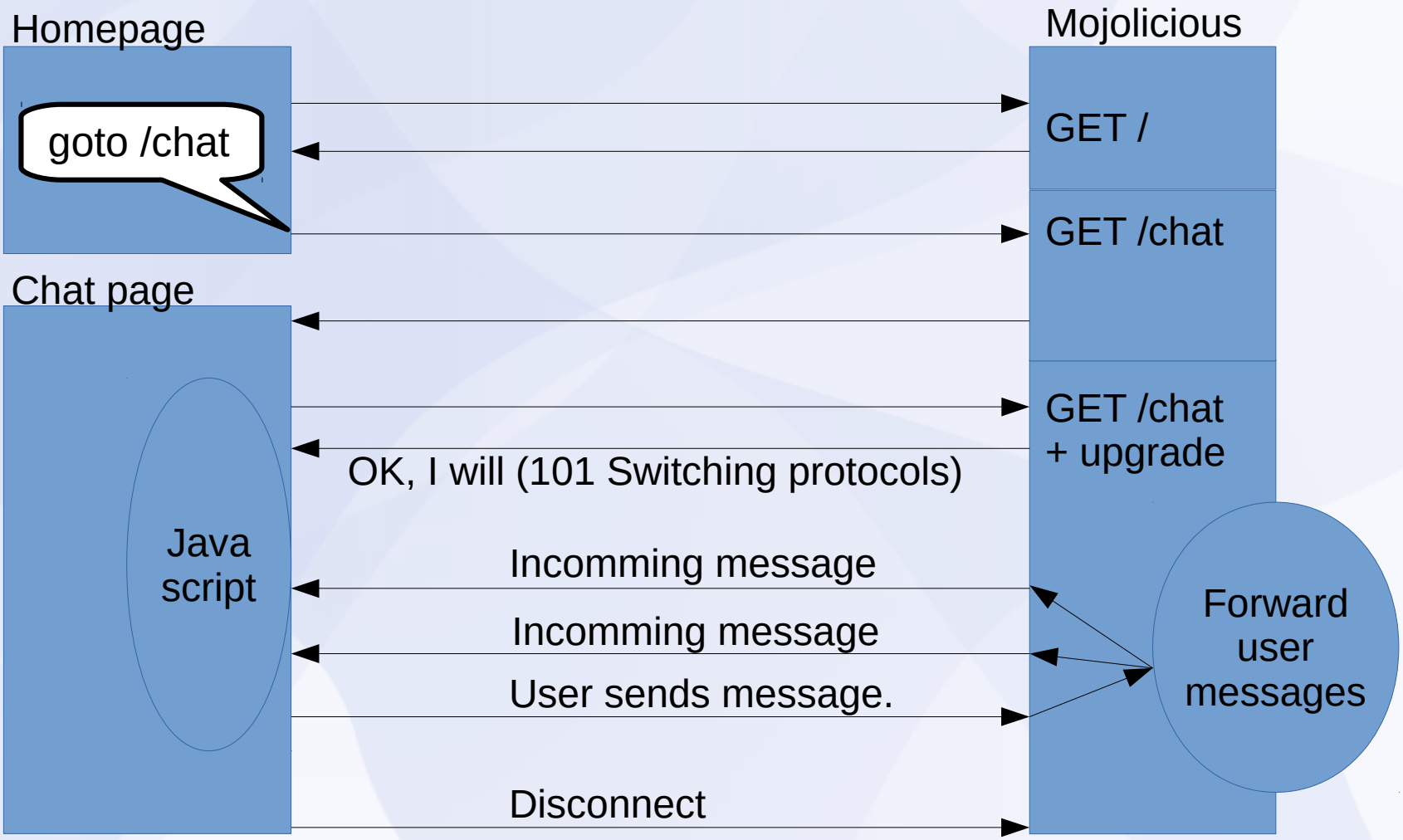

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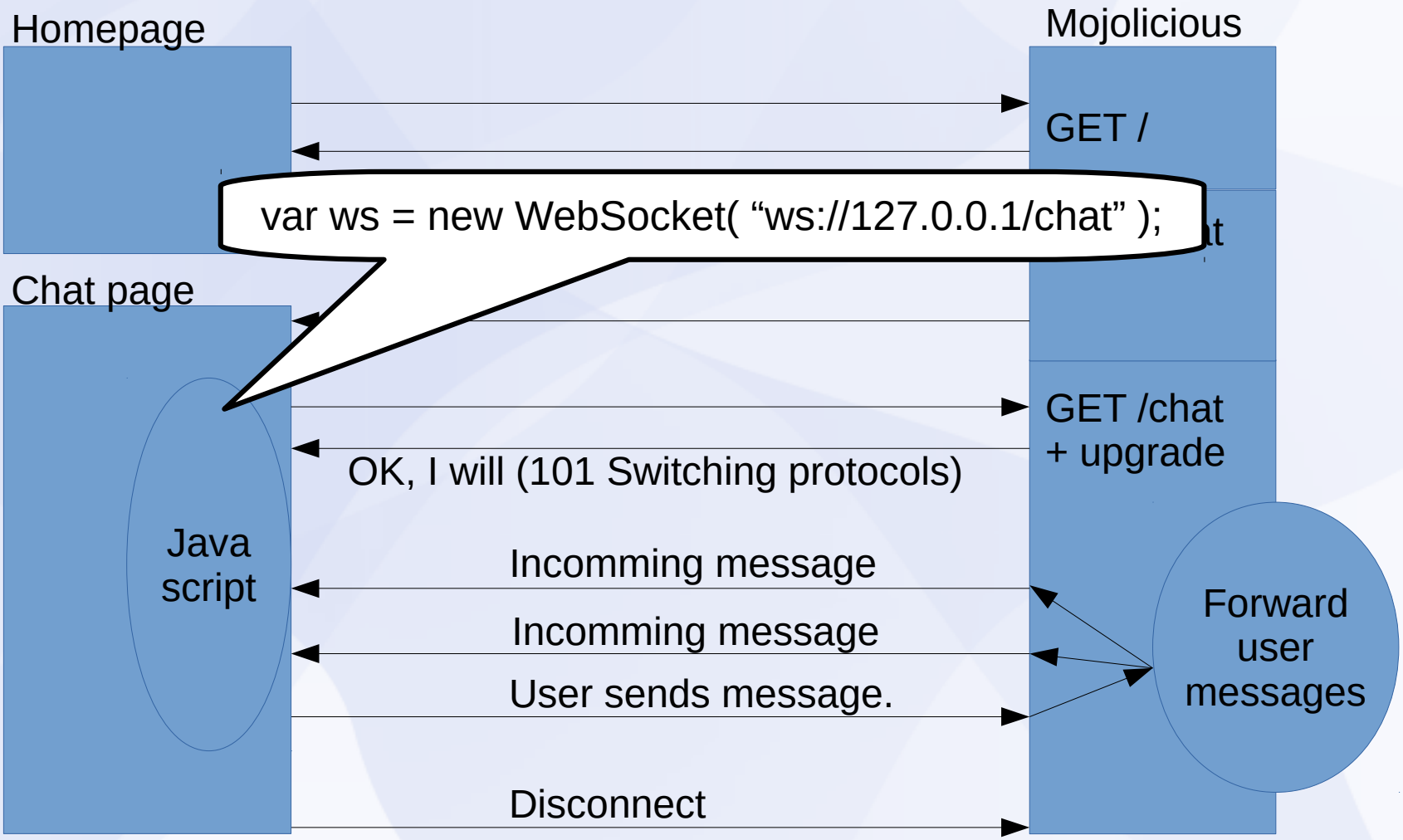

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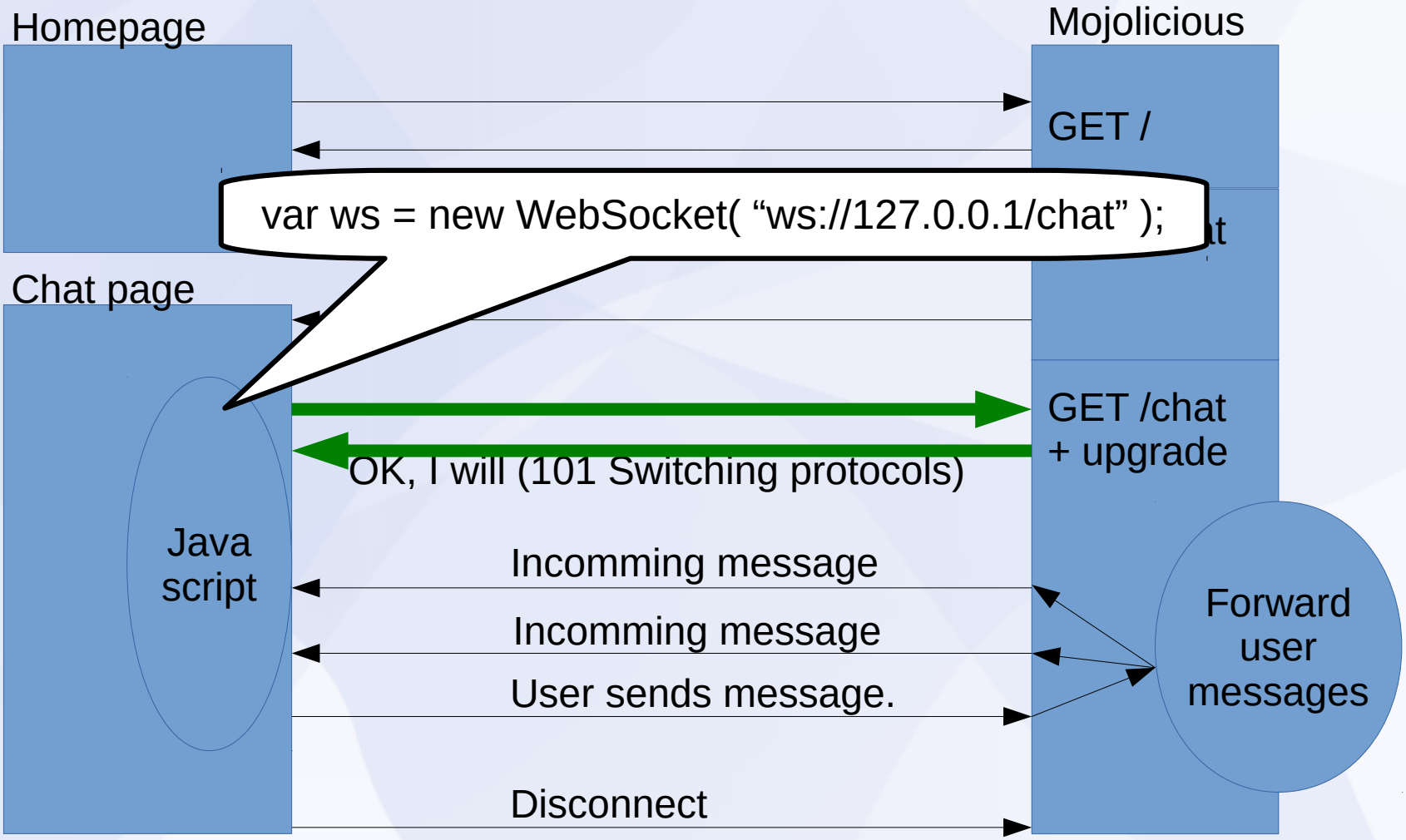
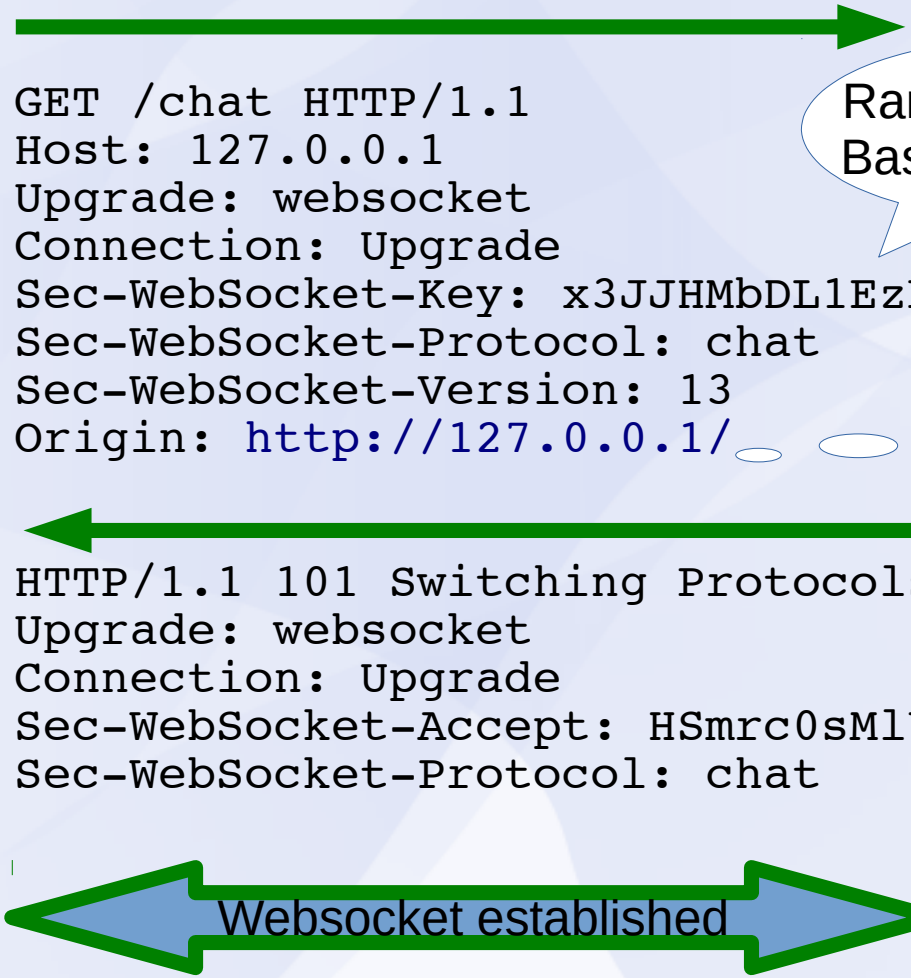


Websockets

Connection setup



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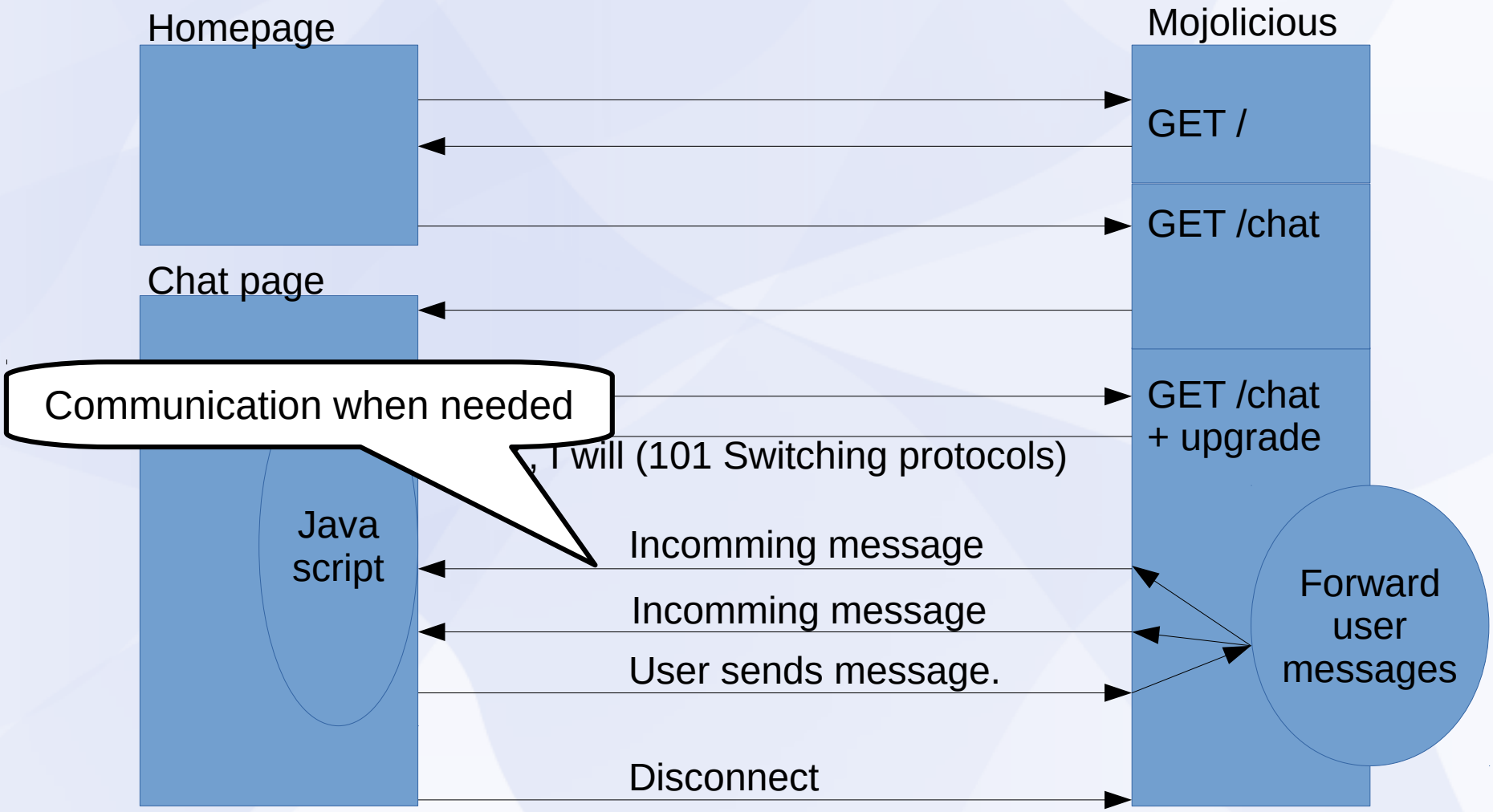

Examples

Examples

- Create new Mojolicious app.

a) Send message, every 3 sec.

b) Chat script – multiple clients talking together.

- Application testing.

Examples

- Create new Mojolicious app.
  http://127.0.0.1/

a) Send message, every 3 sec.
  http://127.0.0.1/time

b) Chat script – multiple clients talking together.
  http://127.0.0.1/chat

- Application testing.

Examples

- Create new Mojolicious app.
  http://127.0.0.1/
  Home page, Wswork.pm, template

a) Send message, every 3 sec.
  http://127.0.0.1/time

b) Chat script – multiple clients talking together.
  http://127.0.0.1/chat

- Application testing.

Create new Mojolicious app

```
$ sudo cpan Mojolicious

$ mojo generate app Wstest


$ cd wstest

$ touch log/development.log
$ tail -f log/development.log &

$ morbo script/wstest
```

Examples

- Create new Mojolicious app.
  http://127.0.0.1/
  Home page, Wswork.pm, template

a) Send message, every 3 sec.
  http://127.0.0.1/time
  Base page, Wstime.pm, template, websocket, javascript

b) Chat script – multiple clients talking together.
  http://127.0.0.1/chat

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b) Chat script – multiple clients talking together.
  http://127.0.0.1/chat
  Base page, Wschat.pm, template, websocket, javascript

- Application testing.

lib/Wstest.pm

```
package Wstest;
use Mojo::Base 'Mojolicious';

# This method will run once at server start
sub startup {
  my $self = shift;

  # Router
  my $r = $self->routes;

  #
  # Top index page
  #
  $r->get('/')->to('wswork#welcome');

  #
  # /time  -- Websocket and GET welcome page
  #
  $r->websocket('/time')->to('wstime#accept' );
  $r->get(      '/time')->to('wstime#welcome');

}

1;
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  # /time  -- Websocket and GET welcome page
  #
  $r->websocket('/time')->to('wstime#accept' );
  $r->get(      '/time')->to('wstime#welcome');

}

1;
```

If you use same URL,
make sure that the websocket comes **first**,

since a websocket is essentially
an upgraded GET request.

lib/Wstest/Wswork.pm
for http://127.0.0.1/

```
package Wstest::Wswork;

use Mojo::Base 'Mojolicious::Controller';

sub welcome {
}

1;
```

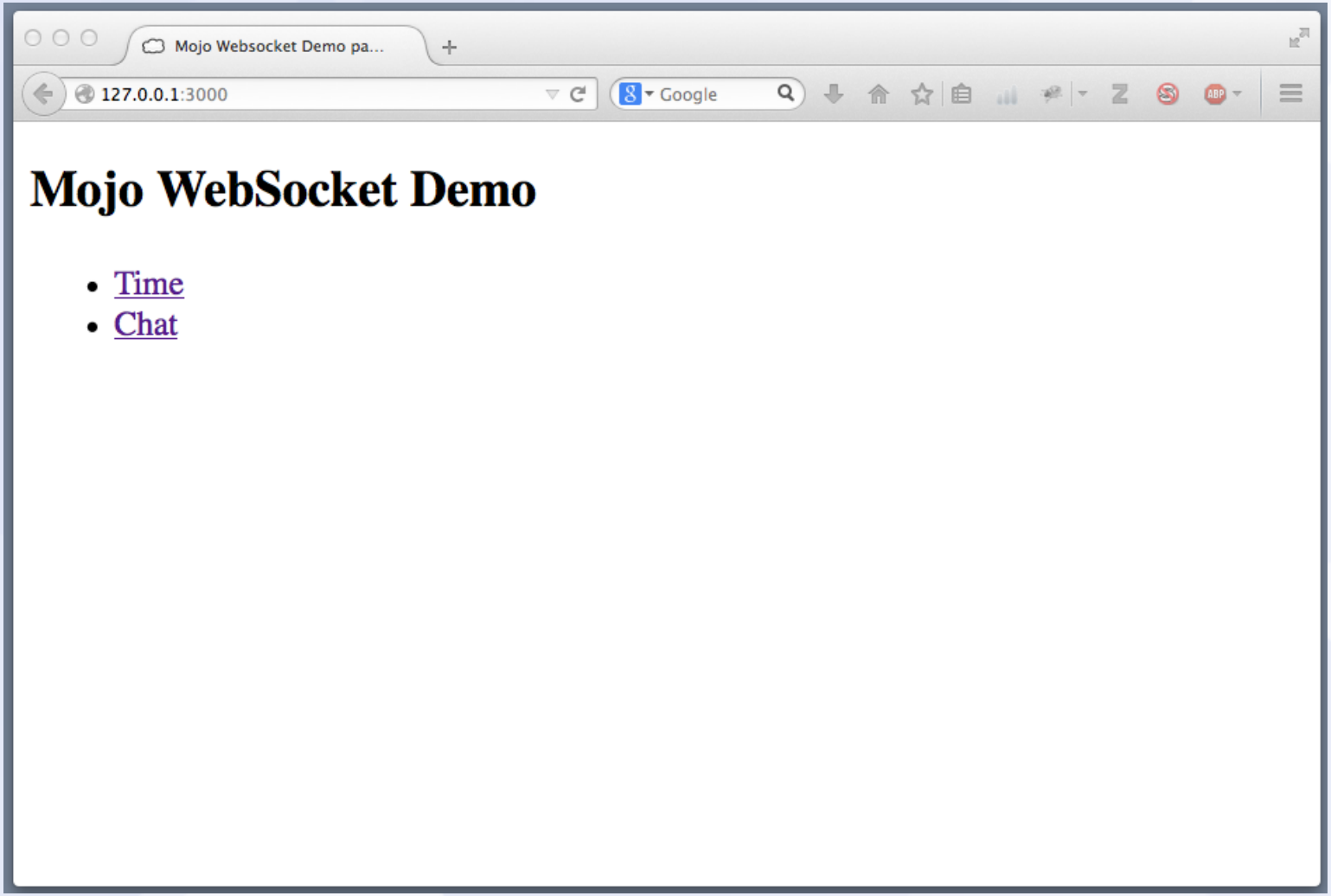
templates/wswork/welcome.html.ep
for http://127.0.0.1/

```
<!doctype html>
<html>
<head>
    <title>Mojo Websocket Demo pages</title>

    <link rel="stylesheet" type="text/css"
href="/css/mystyle.css" />
</head>
<body>
    <h2>Mojo WebSocket Demo</h2>

    <ul>
     <li> <a href="/time">Time</a> </li>
     <li> <a href="/chat">Chat</a> </li>
    </ul>
</body>
</html>
```

http://127.0.0.1:3000/



Examples

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a) Send message, every 3 sec.

b) Chat script – multiple clients talking together.

- Application testing.

templates/wstime/welcome.html.ep
for http://127.0.0.1/time/

```
<!doctype html>
<html>
<head>
    <title>Mojo Websocket Time Demo</title>

    <link rel="stylesheet" type="text/css"
          href="/css/mystyle.css" />

    <script type="text/javascript"
             src="/js/jquery.js"></script>
    <script type="text/javascript"
             src="/js/wstime.js"></script>

</head>
<body>
    <h2>Mojo WebSocket Demo</h2>
    <div>
      <div class="timearea">
        ## Data should appear here
      </div>
    </div>
</body>
</html>
```

templates/wstime/welcome.html.ep
for http://127.0.0.1/time/

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/js/wstime.js
=
public/js/wstime.js

public/js/wstime.js
for http://127.0.0.1/js/wstime.js

```
// Take the current document location href
// and replace http or https with ws or wss

console.log("url  :  " + document.location.href );

var wsurl = document.location.href.replace(/^http/i,"ws");

console.log("wsurl:  " + wsurl );

...
```

public/js/wstime.js
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http://127.0.0.1:3000/time/
=>
ws://127.0.0.1:3000/time/

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=>
wss://127.0.0.1:3000/time/

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public/js/wstime.js
for http://127.0.0.1/js/wstime.js

```
...

console.log("About to connect to websocket on: " + wsurl);

var ws = new WebSocket( wsurl );

ws.onopen = function() {
    console.log("Websocket open");
};

ws.onmessage = function(msg) {
    console.log("Got message: "+ msg);

    // var res = JSON.parse(msg.data);

    // Lets do something with the message
    $('.timearea').append( "<br>" +
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Websocket funtionality
from javascript

```
var ws = new WebSocket( 'ws://some.host/path' );


ws.onopen    = function() {};        On opening socket
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ws.onmessage = function(msg) {};     On socket message

ws.onerror   = function() {};        On broken connection


ws.send("Some message");     Send message.

ws.close();                  Close socket.
ws.destroy();                Destroy socket and free res.
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Websocket funtionality
from javascript

```
var ws = new WebSocket( 'ws://some.host/path' );

if (ws.readyState === ws.OPEN)
{
    // Connection is ready for sending data
}
else if (ws.readyState === ws.CLOSED)
{
    // Connection was closed
}
```

Constant	Value	Description
CONNECTING	0	The connection is not yet open.
OPEN	1	The connection is open and ready to communicate.
CLOSING	2	The connection is in the process of closing.
CLOSED	3	The connection is closed or couldn't be opened.

lib/Wstest/Wstime.pm

```
package Wstest::Wstime;
use Mojo::Base 'Mojolicious::Controller';

sub welcome {
    # default renders templates/wstime/welcome.html.ep
}

sub accept {
    # ... see next slide ...
}

1;
```

lib/Wstest/Wstime.pm

```
sub accept {
    my $self = shift;

    my $interval = 3;

    # How long to go without events before closing connection.
    # Logs timeouts as: "Inactivity timeout"
    Mojo::IOLoop->stream($self->tx->connection)->timeout(300);

    my $scheduler = Mojo::IOLoop->recurring( $interval => sub {

        my $data = scalar localtime();

        $self->app->log->debug("Sending data: ".$data);
        $self->send( $data );  # Possibly add JSON encoding

    });

    $self->on( finish => sub {
        $self->app->log->debug("Finished websocket");
        Mojo::IOLoop->remove( $scheduler );
    });

}
```

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    my $interval = 3;

    # How long to go without events before closing connection.
    # Logs timeouts as: "Inactivity timeout"
    Mojo::IOLoop->stream($self->tx->connection)->timeout(300);

    my $scheduler = Mojo::IOLoop->recurring( $interval => sub {

        my $data = scalar localtime();

        $self->app->log->debug("Sending data: ".$data);
        $self->send( $data );  # Possibly add JSON encoding

    });

    $self->on( finish => sub {
        $self->app->log->debug("Finished websocket");
        Mojo::IOLoop->remove( $scheduler );
    });

}
```

lib/Wstest/Wstime.pm

```
sub accept {
    my $self = shift;

    my $interval = 3;

    # How long to go without events before closing connection.
    # Logs timeouts as: "Inactivity timeout"
    Mojo::IOLoop->stream($self->tx->connection)->timeout(300);

    my $scheduler = Mojo::IOLoop->recurring( $interval => sub {

        my $data = scalar localtime();

        $self->app->log->debug("Sending data: ".$data);
        $self->send( $data );  # Possibly add JSON encoding

    });

    $self->on( finish => sub {
        $self->app->log->debug("Finished websocket");
        Mojo::IOLoop->remove( $scheduler );
    });

}
```

lib/Wstest/Wstime.pm

```
sub accept {
    my $self = shift;

    my $interval = 3;

    # How long to go without events before closing connection.
    # Logs timeouts as: "Inactivity timeout"
    Mojo::IOLoop->stream($self->tx->connection)->timeout(300);

    my $scheduler = Mojo::IOLoop->recurring( $interval => sub {

        my $data = scalar localtime();

        $self->app->log->debug("Sending data: ".$data);
        $self->send( $data );  # Possibly add JSON encoding

    });

    $self->on( finish => sub {
        $self->app->log->debug("Finished websocket");
        Mojo::IOLoop->remove( $scheduler );
    });

}
```

lib/Wstest/Wstime.pm

```
sub accept {
    my $self = shift;

    my $interval = 3;

    # How long to go without events before closing connection.
    # Logs timeouts as: "Inactivity timeout"
    Mojo::IOLoop->stream($self->tx->connection)->timeout(300);

    my $scheduler = Mojo::IOLoop->recurring( $interval => sub {

        my $data = scalar localtime();

        $self->app->log->debug("Sending data: ".$data);
        $self->send( $data );  # Possibly add JSON encoding

    });

    $self->on( finish => sub {
        $self->app->log->debug("Finished websocket");
        Mojo::IOLoop->remove( $scheduler );
    });

}
```

Demo

Examples

- Create new Mojolicious app.

a) Send message, every 3 sec.

b) Chat script – multiple clients talking together.

- Application testing.

lib/Wstest.pm

```
package Wstest;
use Mojo::Base 'Mojolicious';

# This method will run once at server start
sub startup {

  …

  #
  # /time  -- Websocket and GET welcome page
  #
  $r->websocket('/time')->to('wstime#accept');
  $r->get(       '/time')->to('wstime#welcome');









}

1;
```

lib/Wstest.pm

```
package Wstest;
use Mojo::Base 'Mojolicious';

# This method will run once at server start
sub startup {

  …

  #
  # /time  -- Websocket and GET welcome page
  #
  $r->websocket('/time')->to('wstime#accept');
  $r->get(       '/time')->to('wstime#welcome');

  #
  # /chat  -- Websocket and GET welcome page
  #
  $r->websocket('/chat')->to('wschat#accept');
  $r->get(       '/chat')->to('wschat#welcome');

}

1;
```

templates/wschat/welcome.html.ep
for http://127.0.0.1/chat/

```
<!doctype html>
<html>
<head>
   <title>Mojo Websocket Demo pages</title>

   <link rel="stylesheet" type="text/css"
        href="/css/mystyle.css" />
   <script type="text/javascript" src="/js/jquery.js"></script>

</head>
<body>
   <h2>Mojo WebSocket Demo</h2>
   <div>
     <form>
     <div class="chatarea">
       ## Data here
     </div>
     <input class="chatinput" type="text" value="">
     </form>
   </div>
</body>
   <script type="text/javascript" src="/js/wschat.js"></script>
</html>
```

templates/wschat/welcome.html.ep
for http://127.0.0.1/chat/

```
<!doctype html>
<html>
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templates/wschat/welcome.html.ep
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     <form>
     <div class="chatarea">
       ## Data here
     </div>
     <input class="chatinput" type="text" value="">
     </form>
   </div>
</body>
   <script type="text/javascript" src="/js/wschat.js"></script>
</html>
```

public/js/wschat.js

```
var wsurl = document.location.href.replace(/^http/i,"ws");
console.log("About to connect to websocket on: " + wsurl);

var ws = new WebSocket( wsurl );

ws.onopen = function() {
    console.log("Websocket open");
};

ws.onmessage = function(msg) {
    console.log("Got message: ", msg);

    // var res = JSON.parse(msg.data);

    // Lets do something with the message
    $('.chatarea').append("<br>" +
        $("<div/>").text(msg.data).html()
    );

    $('.chatinput').focus();
}

...
```

public/js/wschat.js

```
var wsurl = document.location.href.replace(/^http/i,"ws");
console.log("About to connect to websocket on: " + wsurl);

var ws = new WebSocket( wsurl );

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}

...
```

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    // var res = JSON.parse(msg.data);

    // Lets do something with the message
    $('.chatarea').append("<br>" +
        $("<div/>").text(msg.data).html()
    );

    $('.chatinput').focus();
}

...
```

public/js/wschat.js

```
...

$('.chatinput').keydown( function(e) {
  if ( e.which != 13 ) return true;

  var inp = $('.chatinput');
  var msg = inp.val();
  console.log("Send message: "+msg);
  ws.send(msg);
  inp.val('');
  return false; // Do not use keypress for anything
});
```

public/js/wschat.js

```
...

$('.chatinput').keydown( function(e) {
  if ( e.which != 13 ) return true;

  var inp = $('.chatinput');
  var msg = inp.val();
  console.log("Send message: "+msg);
  ws.send(msg);
  inp.val('');
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});
```

public/js/wschat.js

```
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$('.chatinput').keydown( function(e) {
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public/js/wschat.js

```
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  inp.val('');
  return false; // Do not use keypress for anything
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public/js/wschat.js

```
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  var inp = $('.chatinput');
  var msg = inp.val();
  console.log("Send message: "+msg);
  ws.send(msg);
  inp.val('');
  return false; // Do not use keypress for anything
});
```

public/js/wschat.js

```
...

$('.chatinput').keydown( function(e) {
  if ( e.which != 13 ) return true;

  var inp = $('.chatinput');
  var msg = inp.val();
  console.log("Send message: "+msg);
  ws.send(msg);
  inp.val('');
  return false; // Do not use keypress for anything
});
```

lib/Wstest/Wschat.pm

```
package Wstest::Wschat;
use Mojo::Base 'Mojolicious::Controller';

sub welcome {
}

my %client_ws;
my %client_alias;

sub accept {
   ...
}

sub broadcast {
   ...
}

1;
```

lib/Wstest/Wschat.pm
sub accept

```
sub accept {
    my $self = shift;

    # How long to go without events before closing connection.
    # Logs timeouts as: "Inactivity timeout"
    Mojo::IOLoop->stream($self->tx->connection)->timeout(300);

    # $self->tx stringifies to something like
    #  "Mojo::Transaction::WebSocket=HASH(0x7fed310840b0)"
    # We change this for aliasing

    my $id = $self->tx =~ /(0x\w+)/ && $1;

    ...
```

lib/Wstest/Wschat.pm
sub accept

```
    …

    if ( my @names = values %client_alias ) {
        $self->send("## Talking to: $_")  foreach @names;
    } else {
        $self->send("## Nobody else to talk to at the moment...");
    }
    $self->send("## You are known as $id.");
    $self->send("## Please send your name as the first message.");

    $self->broadcast("## ${id} joined the conversation.");
    $client_ws{ $id } = $self;
    $client_alias{ $id } = $id;

    $self->app->log->debug(scalar(keys %client_ws)." Active
clients.");

    ...
```

lib/Wstest/Wschat.pm
sub accept

```
    ...

    $self->on( message => sub {
        my($ws, $msg) = @_;

        $self->app->log->debug("Got message from ${id}
($client_alias{$id}): ${msg}.");

        return unless $msg && $msg =~ /\S/;

        if ( $id eq $client_alias{$id} and $msg !~ /\b0x\w+\b/ ) {
            $self->app->log->debug("$id is now know as ${msg}.");
            $client_alias{$id} = $msg;
            $msg = "## ${id} is now known as ${msg}.";
        }

        $self->broadcast($msg);
    });

    ...
```

lib/Wstest/Wschat.pm
sub accept

```
    ...

    $self->on( finish => sub {
        delete $client_ws{ $id };
        $self->broadcast("## $client_alias{$id} (${id}) left the
conversation.");
        delete $client_alias{ $id };
        $self->app->log->debug(scalar(keys %client_ws)." Active
clients left.");
    });
}
```

lib/Wstest/Wschat.pm
sub broadcast

```
sub broadcast {
    my( $self, $msg ) = @_;

    my $from_id = $self->tx =~ /(0x\w+)/ && $1;

    if ( $msg =~ /^##(.*)/ ) {
        $self->app->log->debug("${from_id}: $1");
    }

    foreach my $id ( keys %client_ws ) {

        my $prefix =
            $msg =~ /^##/      ? ""    :
            $id eq $from_id    ? "Me" :
                                 $client_alias{$from_id};

        $prefix .= ":  " if $prefix;

        $client_ws{$id}->send( $prefix . $msg );
    }
}
```

Demo

Chat

Examples

- Create new Mojolicious app.

a) Send message, every 3 sec.

b) Chat script – multiple clients talking together.

- **Application testing.**

Test

Test

t/basic.t

```
#!/usr/bin/perl

use strict;
use warnings;

use Test::More tests => 42;
use Test::Mojo;
use FindBin qw($Bin);
use lib "$Bin/../lib";

my $t = Test::Mojo->new('Wstest');

...
```

Test

t/basic.t

```
...

#
#=== Test Timer part
#

$t ->get_ok('/')
   ->status_is(200)
   ->content_like(qr/Demo Page/i);

my $tt = $t->websocket_ok('/time')
   ->send_ok('hello', 'Sent messages are ignored');

diag("Expexct to wait 3 secs for timed message to be sent");

$tt->message_ok
   ->message_like(qr/\b\d{4}\b/)  # Match year of timestamp.
   ->finish_ok;

...
```

Test

t/basic.t

```
...

#
#=== Test Chat part
#

my $c1 = $t->websocket_ok('/chat');

$c1->message_ok->message_like(qr/Nobody else to talk to at the
moment/);
$c1->message_ok->message_like(qr/You are known as (0x\w+)/);
my($id1) = map { /(0x\w+)/ ? $1 : $_ } $t->message->[1];
#diag("Test id1 $id1");
$c1->message_ok->message_like(qr/Please send your name as the first
message/);


...
```

Test

t/basic.t

```
...

my $c2 = $t->websocket_ok('/chat');

$c1->message_ok->message_like(qr/joined the conversation/);

$c2->message_ok->message_like(qr/Talking to: $id1/);
$c2->message_ok->message_like(qr/You are known as 0x\w+/);
my($id2) = map { /(0x\w+)/ ? $1 : $_ } $t->message->[1];
#diag("Test id2 $id2");
$c2->message_ok->message_like(qr/Please send your name as the first
message/);

...
```

Test

t/basic.t

```
...

$c1->send_ok('C1', 'Sent message from c1');
$c1->message_ok->message_like(qr/\Q${id2}\E is now known as C1/);
$c2->send_ok('C2', 'Sent message from c2');
$c2->message_ok->message_like(qr/\Q${id2}\E is now known as C1/);

$c1->message_ok->message_like(qr/C1:  C2/);
$c2->message_ok->message_like(qr/Me:  C2/);

#$c1->send_ok('hello 1 from c1', 'Sent message from c1');
#$c2->message_ok->message_like(qr/C1:  hello 1 from c1/);
#$c1->message_ok->message_like(qr/Me:  hello 1 from c1/);

#$c2->send_ok('hello 2 from c2', 'Sent message from c2');
#$c1->message_ok->message_like(qr/C1:  hello 2 from c2/);
#$c2->message_ok->message_like(qr/Me:  hello 2 from c2/);

$c1->finish_ok;
$c2->finish_ok;

# done
```

Test

t/basic.t

```
$ prove
t/basic.t .. 1/36 # Expexct to wait 3 secs for timed message to be
sent
t/basic.t .. ok
All tests successful.
Files=1, Tests=36,  4 wallclock secs ( 0.05 usr  0.01 sys +  0.42
cusr  0.03 csys =  0.51 CPU)
Result: PASS
```

Live demo

Live demo

Now you can chat

`http://127.0.0.1:3000/chat/`

Downloads

`http://www.uniejo.dk/presentations/2014-05-24.pdf`
This presentation

`http://www.uniejo.dk/presentations/2014-05-24.tgz`
Gzipped tar archive of files used in this presentation.

Files

```
$ find . -type f
./lib/Wstest.pm
./lib/Wstest/Wschat.pm
./lib/Wstest/Wstime.pm
./lib/Wstest/Wswork.pm
./log/development.log
./public/css/mystyle.css
./public/js/jquery.js
./public/js/wschat.js
./public/js/wstime.js
./script/wstest
./t/basic.t
./templates/layouts/default.html.ep
./templates/wschat/welcome.html.ep
./templates/wstime/welcome.html.ep
./templates/wswork/welcome.html.ep
./wstest.conf
```

End of presentation...