SER 321 A Session

SI Session

Tuesday, February 25th 2025

11:00 am - 12:00 pm MST

Agenda

- Review Game
- Middleware
  - OSI w/ and w/o Middleware
  - Why We Care
- Assignment 6 Concepts & Workflow

SI Session Expectations

Thanks for coming to the **SER 321** SI session. We have a packed agenda and we are going to try to get through as many of our planned example problems as possible. This session will be recorded and shared with others.

- If after this you want to see additional examples, please visit the drop-in tutoring center.
- We will post the link in the chat now and at the end of the session.
  - tutoring.asu.edu
- Please keep in mind we are recording this session and it will be made available for you to review 24-48 hours after this session concludes.
- Finally, please be respectful to each other during the session.

Interact with us:

Zoom Features

Zoom Chat

- Use the chat feature to interact with the presenter and respond to presenter's questions.
- Annotations are encouraged

SER 321
Review Game

Matching!

flippity

Want to make your own review game? Check out the options here!

Check out the recording for the discussion!

SER 321
Middleware

We have been:

- Serializing Messages
- Sending Messages
- Parsing Messages
- Handle Messages

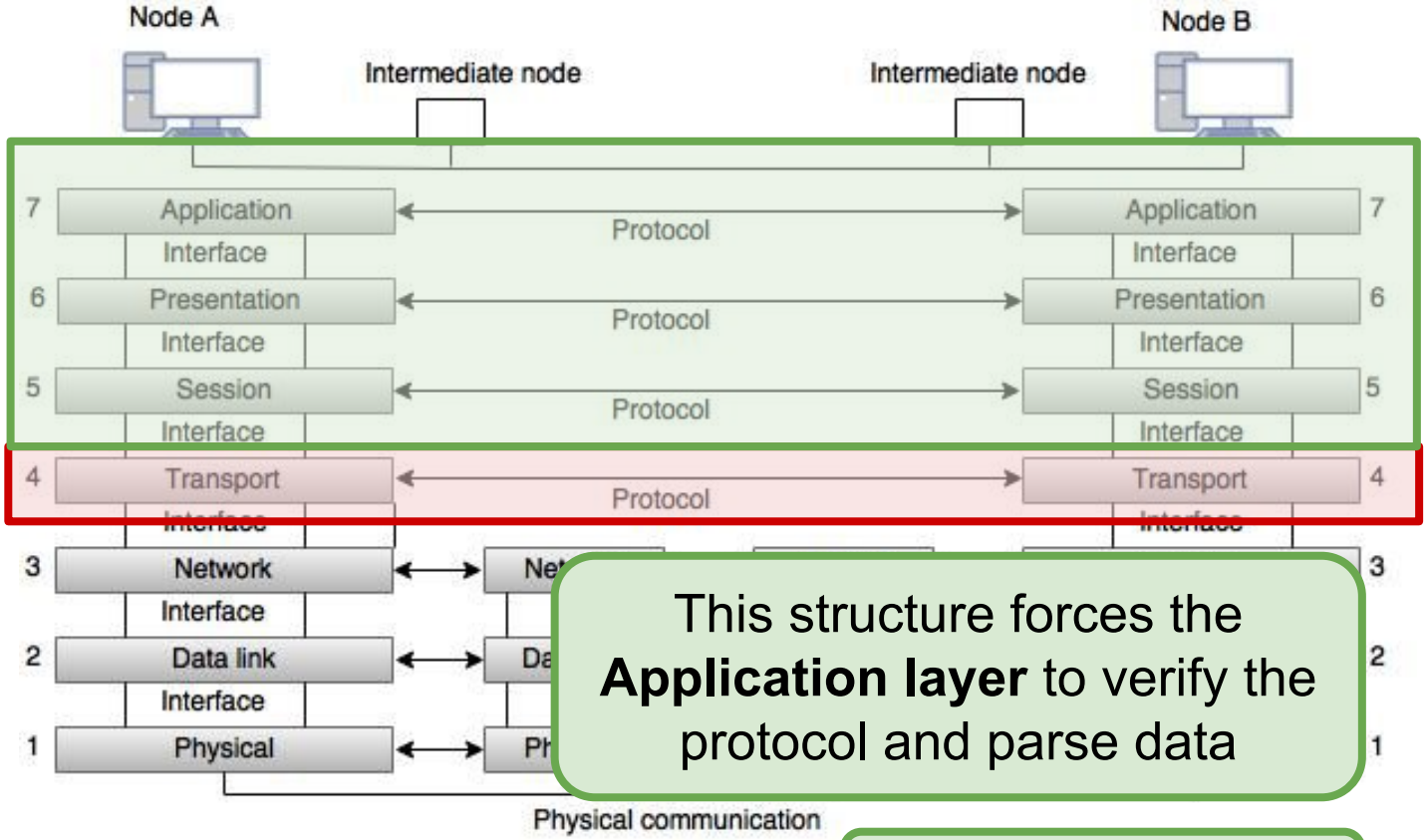

Fig: OSI Model

This structure forces the **Application layer** to verify the protocol and parse data

Not really its job…

Check out the recording for the discussion!

SER 321
Middleware

With Middleware:

- Serializing Messages
- Sending Messages
- Parsing Messages
- Handle Messages

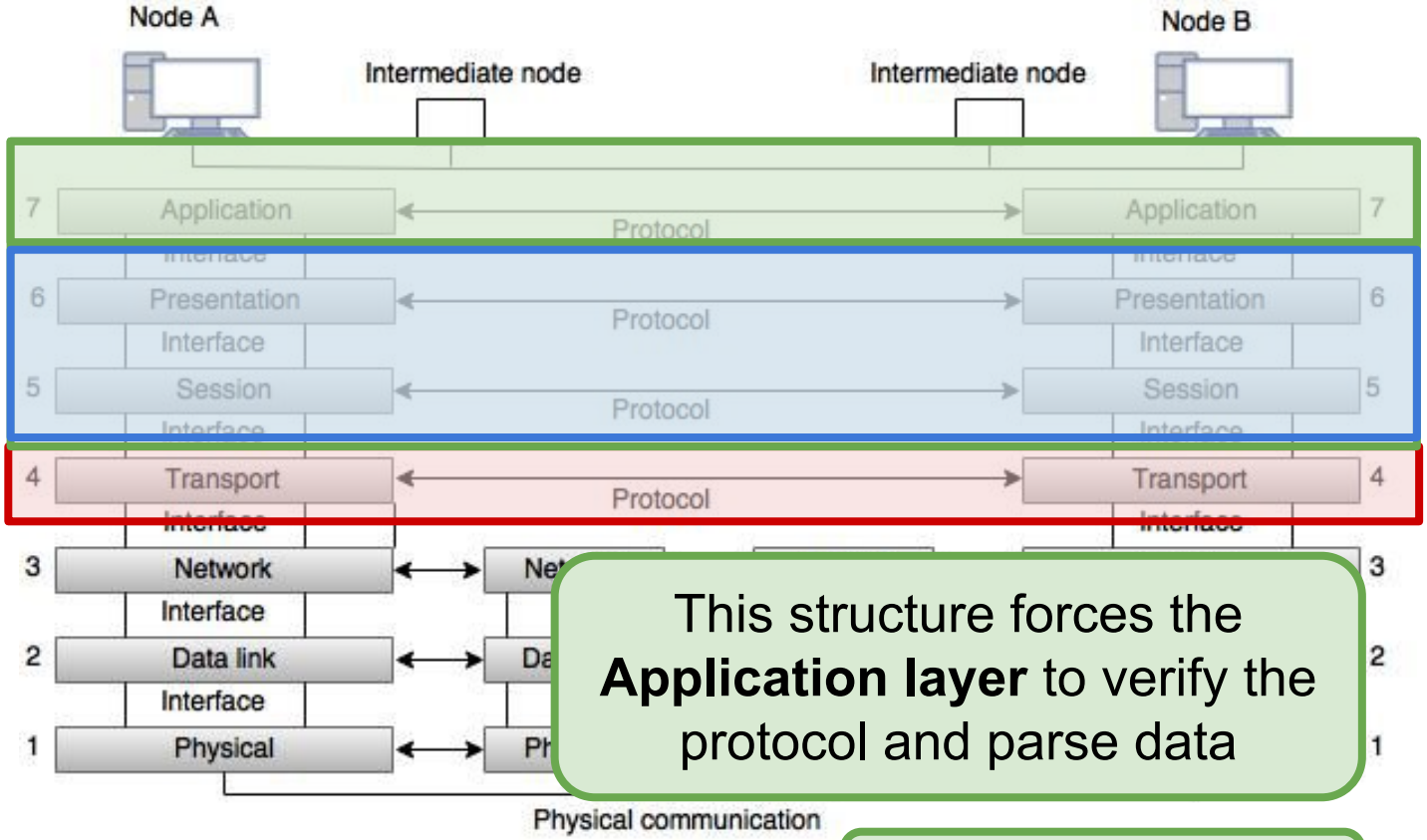

Fig: OSI Model

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Middleware

With Middleware:

- Serializing Messages
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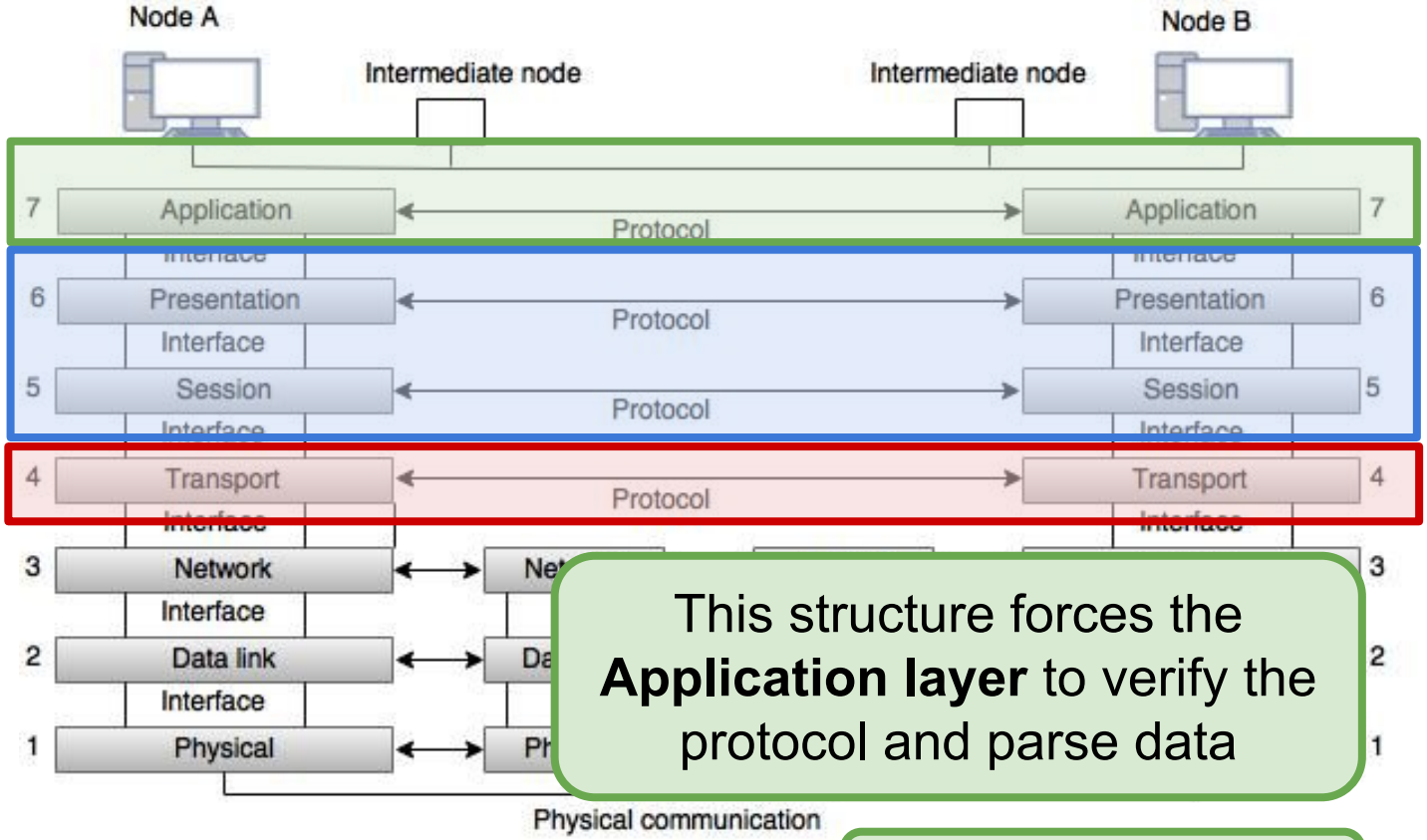

Fig: OSI Model

This structure forces the **Application layer** to verify the protocol and parse data

Not really its job…

Check out the recording for the discussion!

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Middleware

Middleware:

Session Layer Responsibilities:

Authentication

Authorization

Session Management

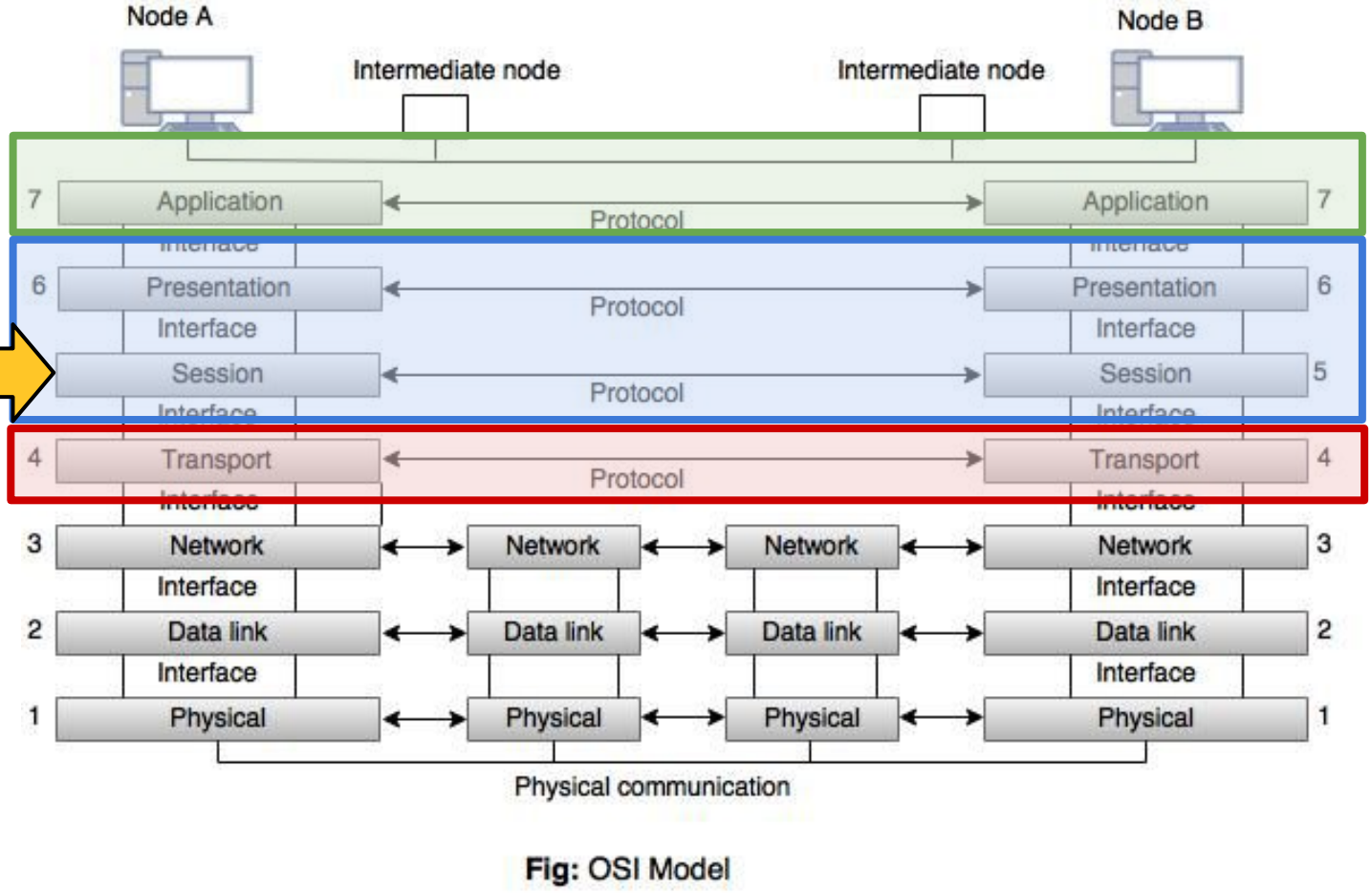

Fig: OSI Model

Check out the recording for the discussion!

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Middleware

Middleware:

Presentation Layer Responsibilities:

Translation

Compression

Encryption

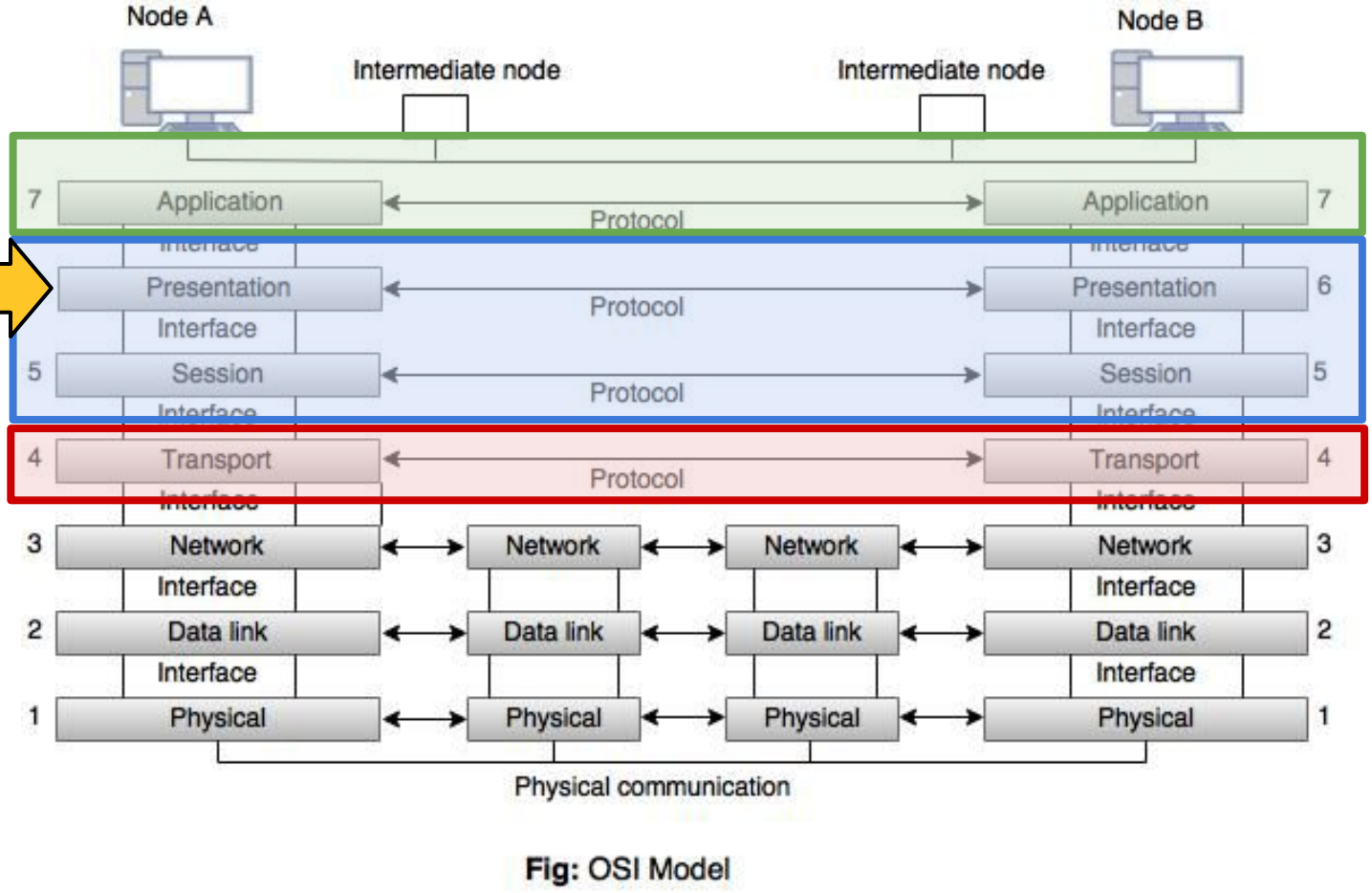

Fig: OSI Model

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Middleware

Examples?

Check out the recording for the discussion!

Message Oriented Middleware (MOM)

Web Frameworks

Remote Procedure Calls (RPC)

App. Programming Interface (API)

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Why do we care?

Agility

Reusability

Efficiency

Cost Effectiveness

Portability

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Why do we care?

Sort of like publishing a contract

"If you follow these rules, I will handle your request."

Check out the recording for the discussion!

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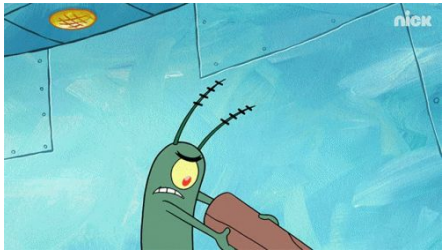
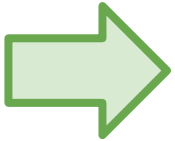
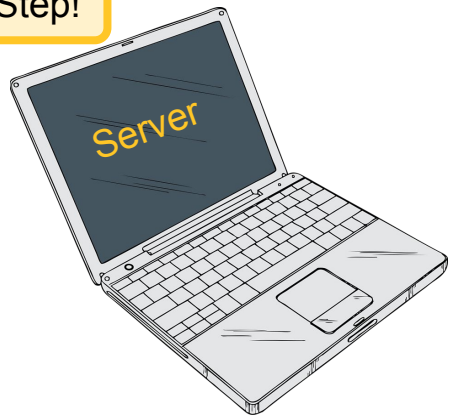




```
{
        “type” : “addUser”,
        “name” : “katie”,
        “password” : “password”
}
```

- Get data from user
- Validate data
- Determine Request Format
- Construct Valid Request
- Establish Connection
- Send Request
- Wait for Response
  - Read Response from Stream
  - Parse Response
  - Display Response to User

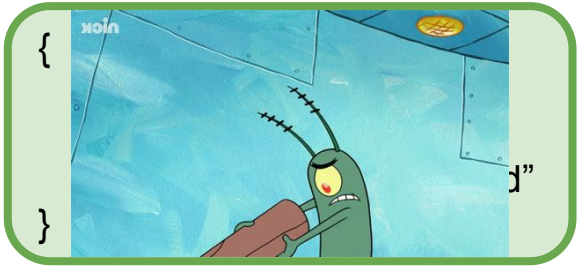
Critical Step!



Check out the recording for the discussion!

SER 321
Middleware

- Get data from user
- Validate data
- Determine Request Format
- Construct Valid Request
- Establish Connection
- Send Request
- Wait for Response
  - Read Response from Stream
  - Parse Response
  - Display Response to User



How do we know?

Add User

- Read data from Stream
- Parse Data
- Validate Request Format
- Determine Request Type
- *Perform Requested Action*
- Determine Response Format
- Construct Valid Response
- [Re-establish connection]
- Send Response

Done!

Wants to Add User

Check out the recording for the discussion!

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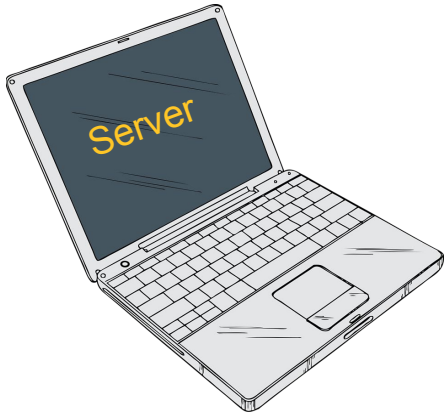
Middleware

With Middleware:

Add User:
Name = Katie
Password = password

API



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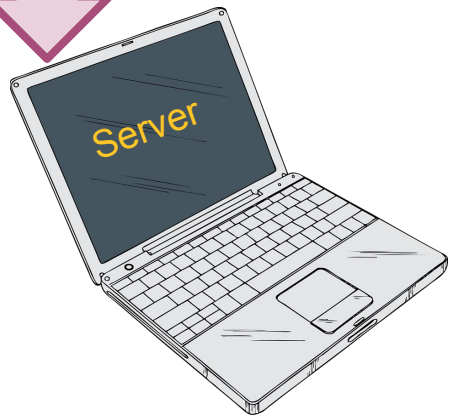
Middleware

With Middleware:

Add User:
Name = Katie
Password = password

API

```
{
        “type” : “addUser”,
        “name” : “katie”,
        “password” : “password”
}
```



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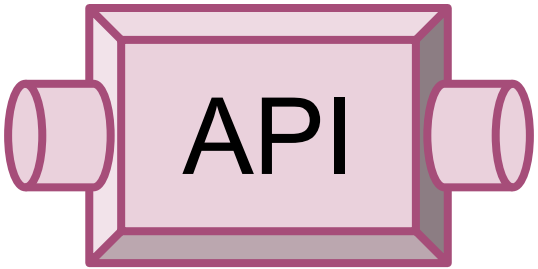
With Middleware:

Check out the recording for the discussion!

Get repositories for a specific user



GitHub REST API

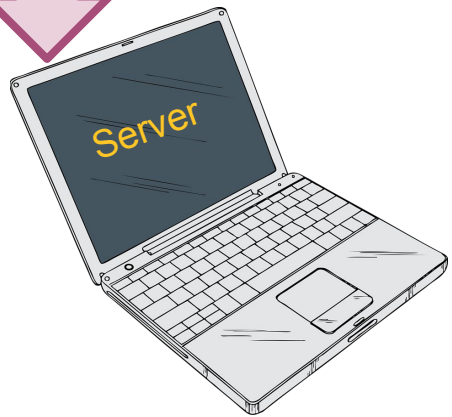
Code samples for "List repositories for a user"

Request example

GET /users/{username}/repos

cURL | JavaScript | GitHub CLI

```
curl -L \
  -H "Accept: application/vnd.github+json" \
  -H "Authorization: Bearer <YOUR-TOKEN>" \
  -H "X-GitHub-Api-Version: 2022-11-28" \
  https://api.github.com/users/USERNAME/repos
```



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Middleware

With Middleware:

Check out the recording for the discussion!

Get repositories for a specific user

API

GitHub REST API

https://api.github.com/users/kgrinne3/repos

Code samples for "List reposito

Request example

GET /users/{username}/repos

cURL JavaScript GitHub CL

```
curl -L \
  -H "Accept: application/vnd.gi
  -H "Authorization: Bearer <YOU
  -Api-Version: 2022-
  github.com/users/U
```


```
[
  {
    "id": 550568457,
    "node_id": "R_kgDOINECCQ",
    "name": "assign1git",
    "full_name": "kgrinne3/assign1git",
    "private": false,
    "owner": {
      "login": "kgrinne3",
      "id": 115493885,
      "node_id": "U_kgDOBuJL_Q",
      "avatar_url": "https://avatars.githubusercontent.com/u/115493885?v=4",
      "gravatar_id": "",
      "url": "https://api.github.com/users/kgrinne3",
      "html_url": "https://github.com/kgrinne3",
      "followers_url": "https://api.github.com/users/kgrinne3/followers",
      "following_url": "https://api.github.com/users/kgrinne3/following{/other_user}",
      "gists_url": "https://api.github.com/users/kgrinne3/gists{/gist_id}",
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      "received_events_url": "https://api.github.com/users/kgrinne3/received_events",
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      "site_admin": false
    },
    "html_url": "https://github.com/kgrinne3/assign1git",
    "description": "Katie Grinnell",
    "fork": false,
    "url": "https://api.github.com/repos/kgrinne3/assign1git",
    "forks_url": "https://api.github.com/repos/kgrinne3/assign1git/forks",
    "keys_url": "https://api.github.com/repos/kgrinne3/assign1git/keys{/key_id}",
    "collaborators_url": "https://api.github.com/repos/kgrinne3/assign1git/collaborators{/collaborator}",
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    "issue_events_url": "https://api.github.com/repos/kgrinne3/assign1git/issues/events{/number}",
    "events_url": "https://api.github.com/repos/kgrinne3/assign1git/events",
    "assignees_url": "https://api.github.com/repos/kgrinne3/assign1git/assignees{/user}",
    "branches_url": "https://api.github.com/repos/kgrinne3/assign1git/branches{/branch}",
    "tags_url": "https://api.github.com/repos/kgrinne3/assign1git/tags",
    "blobs_url": "https://api.github.com/repos/kgrinne3/assign1git/git/blobs{/sha}",
    "git_tags_url": "https://api.github.com/repos/kgrinne3/assign1git/git/tags{/sha}",
```

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SER 321

Assign 6

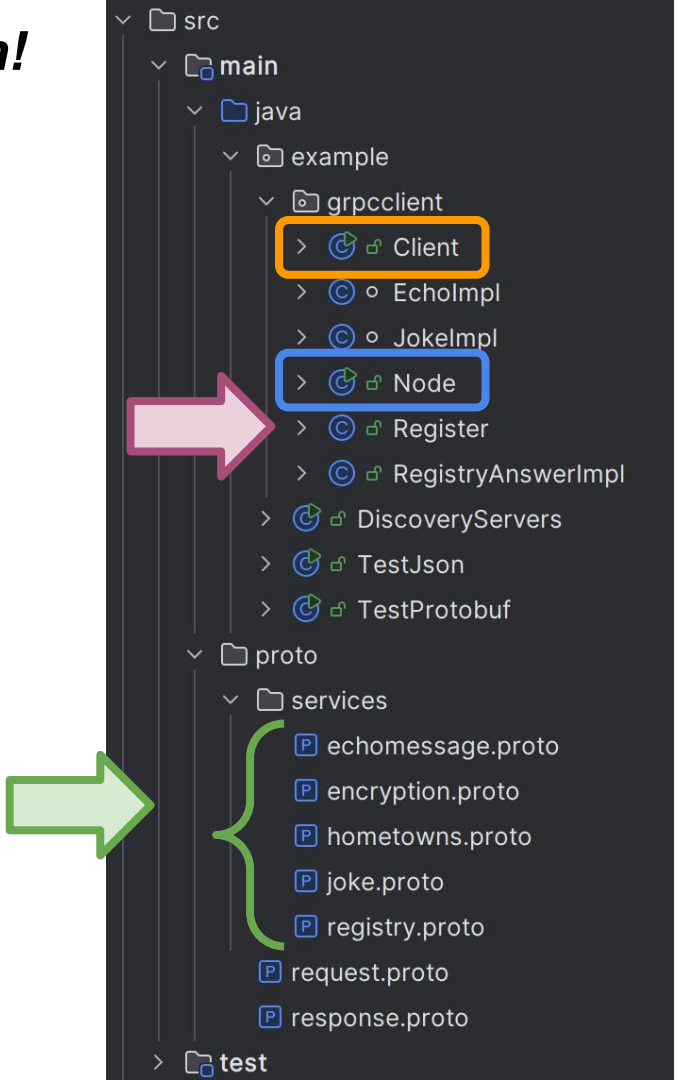
Client

Node

Registry

Service

Protocol Buffers!



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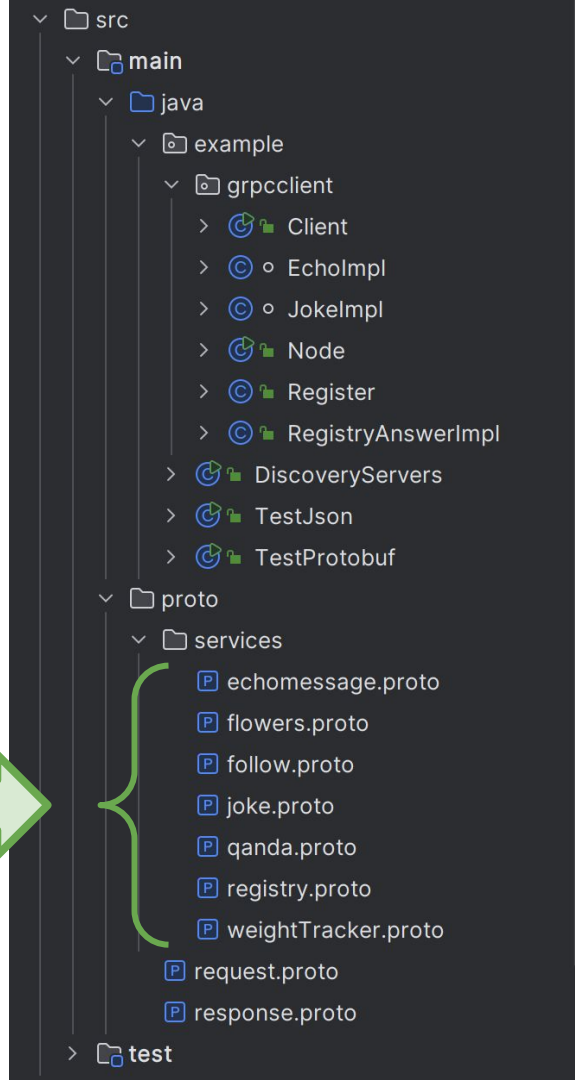
SER 321

Protobuf Review

All nodes and clients have agreed to these contracts

So ***DON'T CHANGE THEM!***

Think of these as a *contract*



Check out the recording for the discussion!

SER 321

Protobuf Review

joke.proto

```
syntax = "proto3";

option java_multiple_files = true;
option java_package = "service";
option java_outer_classname = "JokeProto";

package services;

service Joke {
  rpc getJoke (JokeReq) returns (JokeRes) {}
  rpc setJoke (JokeSetReq) returns (JokeSetRes) {}
}

// The request message
message JokeReq {
  int32 number = 1;
```

```
// We are reading how many jokes the clients wants and put them in a list to send back to client
@Override 1 usage
public void getJoke(JokeReq req, StreamObserver<JokeRes> responseObserver) {
    System.out.println("Received from client: " + req.getNumber());
    JokeRes.Builder response = JokeRes.newBuilder();
    for (int i=0; i < req.getNumber(); i++){
        if(!jokes.empty()) {
            // yes, I take the joke out when it was used already,
            // should probably be done differently since this way
            // a joke cannot be told twice even to different clients
            response.addJoke(jokes.pop());
        }
        else {
            // this is more of a hack, better would be to either
            // check the number at the beginnig and say right away
            // if you do not have enough. Or send an error code or
            // similar as well.
            response.addJoke( value: "I am out of jokes...");
            break;
        }
    }
    JokeRes resp = response.build();
    responseObserver.onNext(resp);
    responseObserver.onCompleted();
}
```

```
// We take the joke the user wants to set and put it in our set of jokes
@Override 1 usage
public void setJoke(JokeSetReq req, StreamObserver<JokeSetRes> responseObserver) {

    System.out.println("Received from client: " + req.getJoke());
    JokeSetRes.Builder response = JokeSetRes.newBuilder();
    if (req.getJoke().isEmpty()) { // we do not want to add empty jokes
        response.setOk(false);
    } else {
        jokes.add(req.getJoke());
        response.setOk(true);
    }

    JokeSetRes resp = response.build();
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Check out the recording for the discussion!

SER 321

Protobuf Review

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}

// The request message
message JokeReq {
  int32 number = 1;
```

How do we use Protobufs again?

Use a ***Builder*** to construct the proto object

Fill with *setters*

Build when done!

```
// We take the joke the user wants to set and put it in our set of jokes
@Override  1 usage
public void setJoke(JokeSetReq req, StreamObserver<JokeSetRes> responseObserver) {

    System.out.println("Received from client: " + req.getJoke());
    JokeSetRes.Builder response = JokeSetRes.newBuilder();
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        response.setOk(true);
    }

    JokeSetRes resp = response.build();
    responseObserver.onNext(resp);
    responseObserver.onCompleted();
}
```

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Assign 6

Two new concepts!

Check out the recording for the discussion!

Registry

RPC

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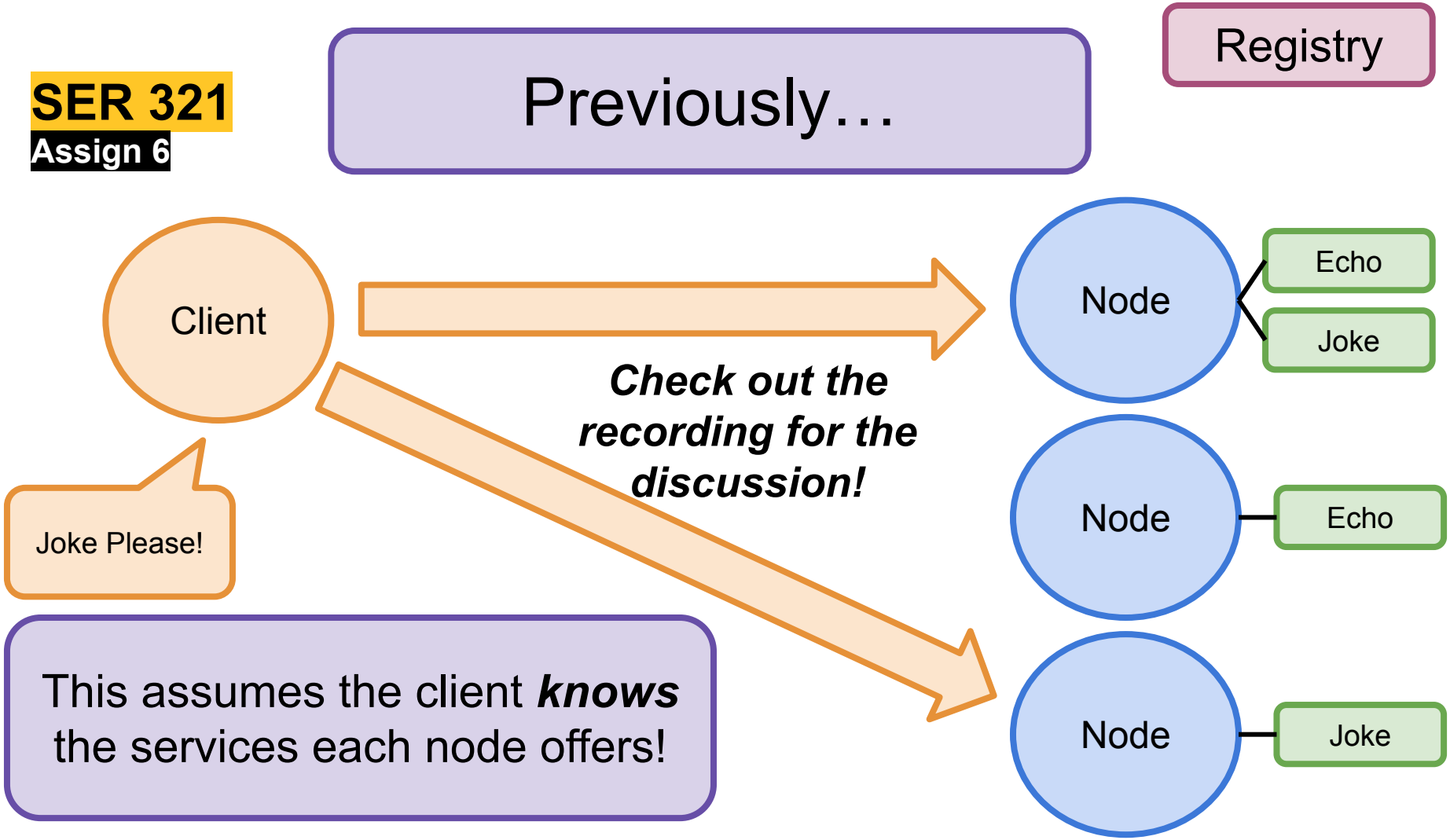
Previously…



This assumes the client ***knows*** the services each node offers!

Registry

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With the Registry…

Client

Joke

Registry

Joke Please!

Check out the recording for the discussion!

Node
- Echo
- Joke

Node
- Echo

Node
- Joke

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Assign 6

With the Registry…

Registry

Client

Joke

Registry

Node

Echo

Joke

Node

Node

Echo

Node

Joke

Joke Please!

Check out the recording for the discussion!

Registry directs us to a node that can handle our request!

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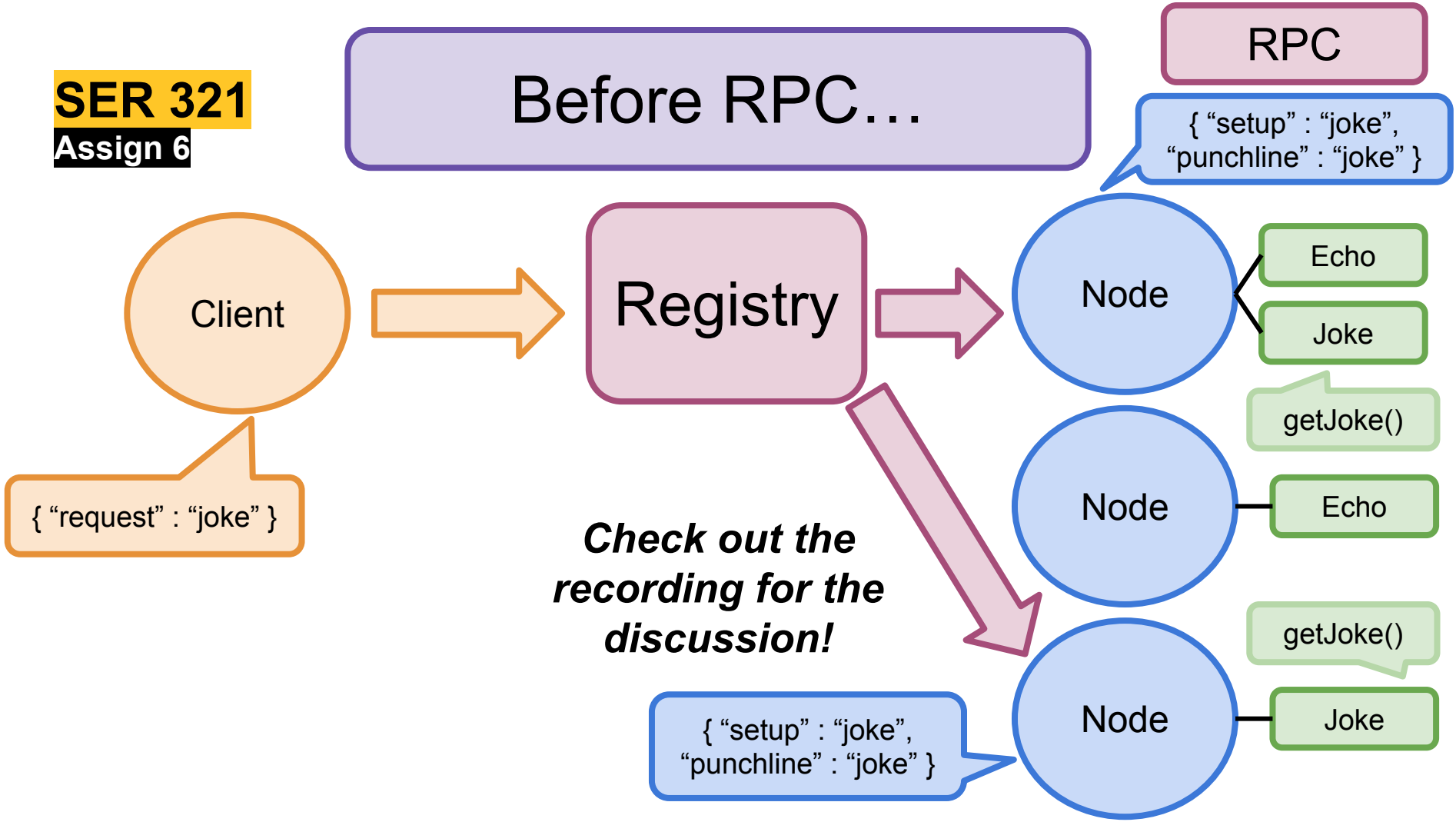
Before RPC…



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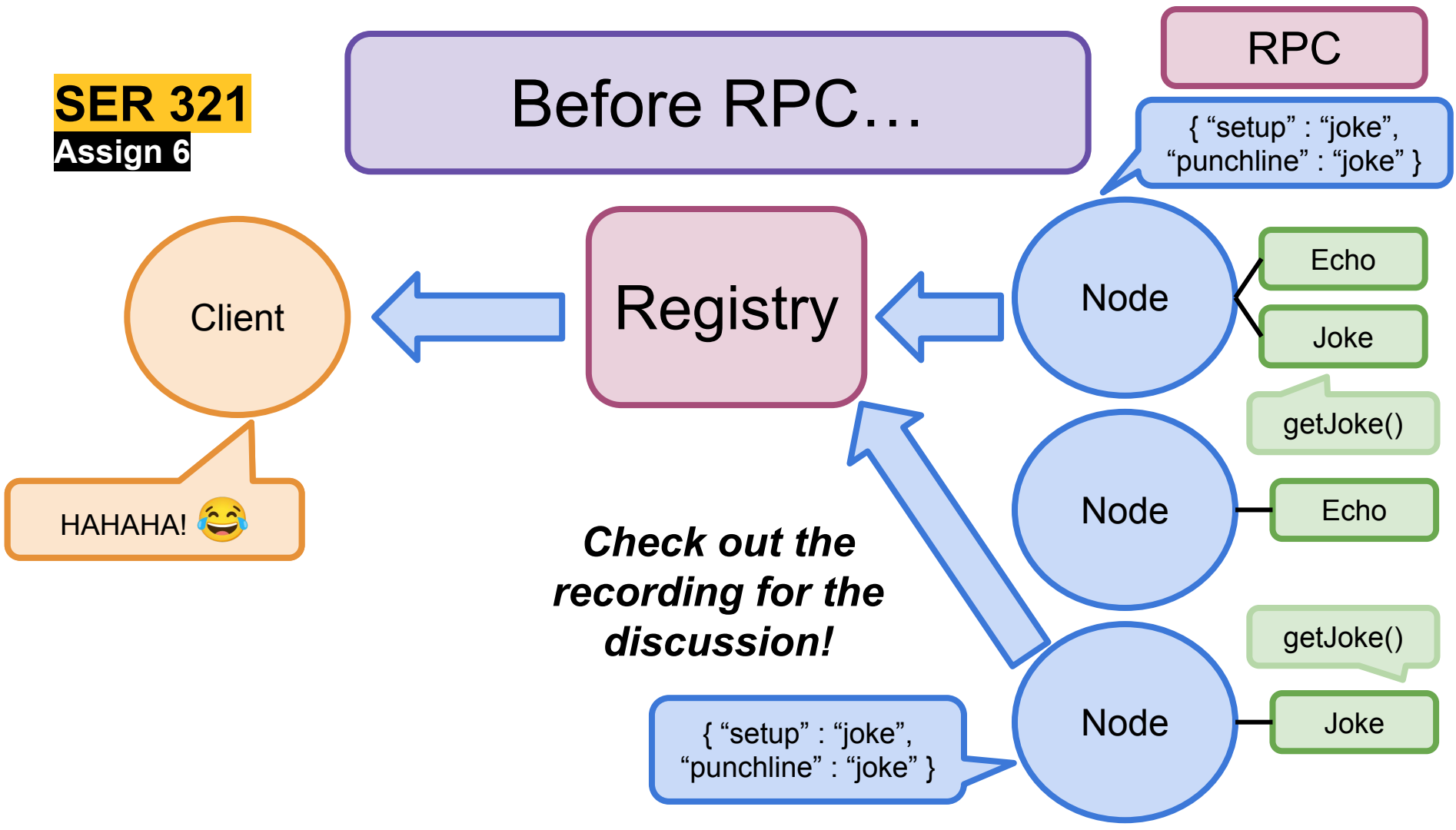
Before RPC…



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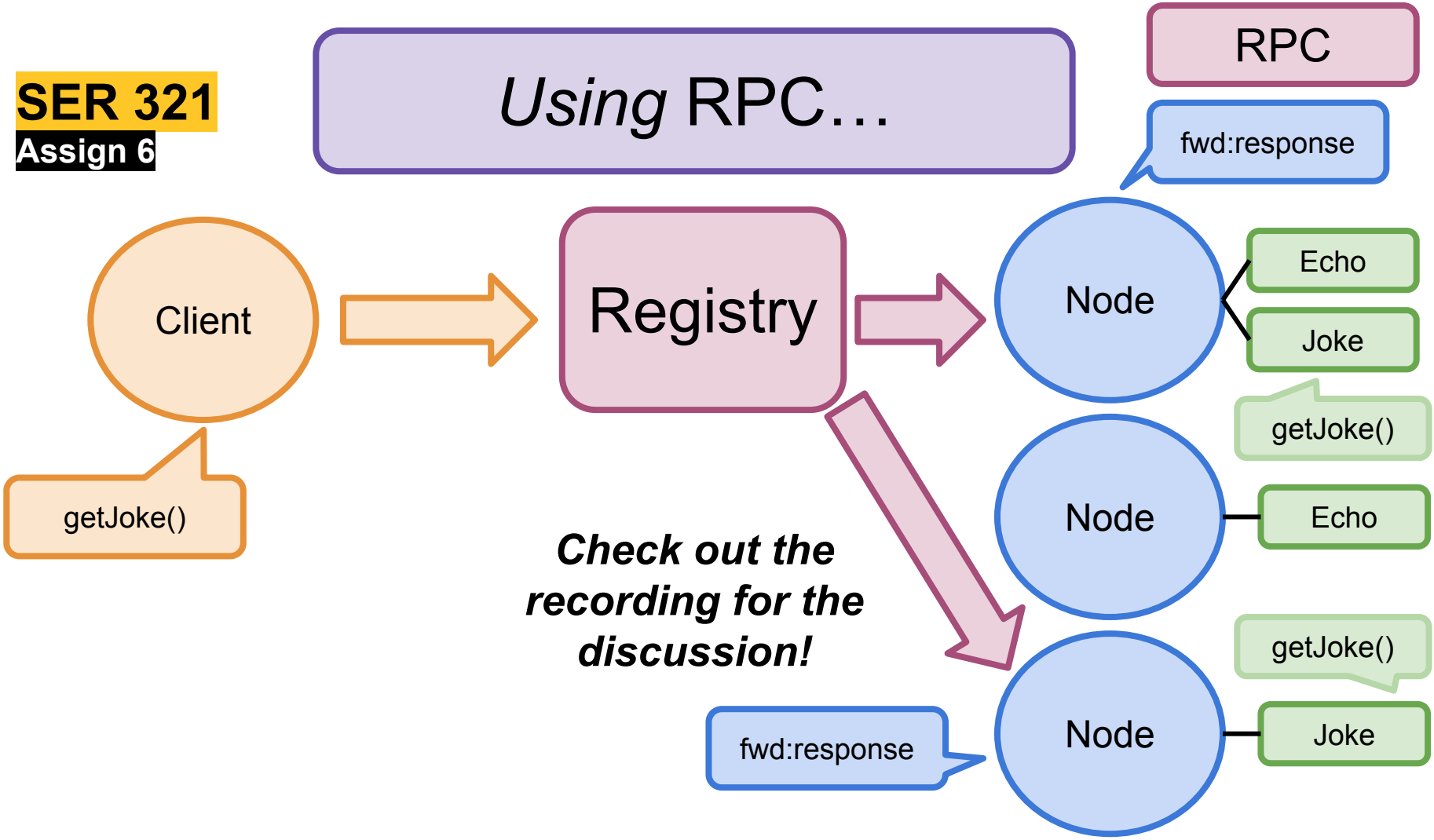
Using RPC…



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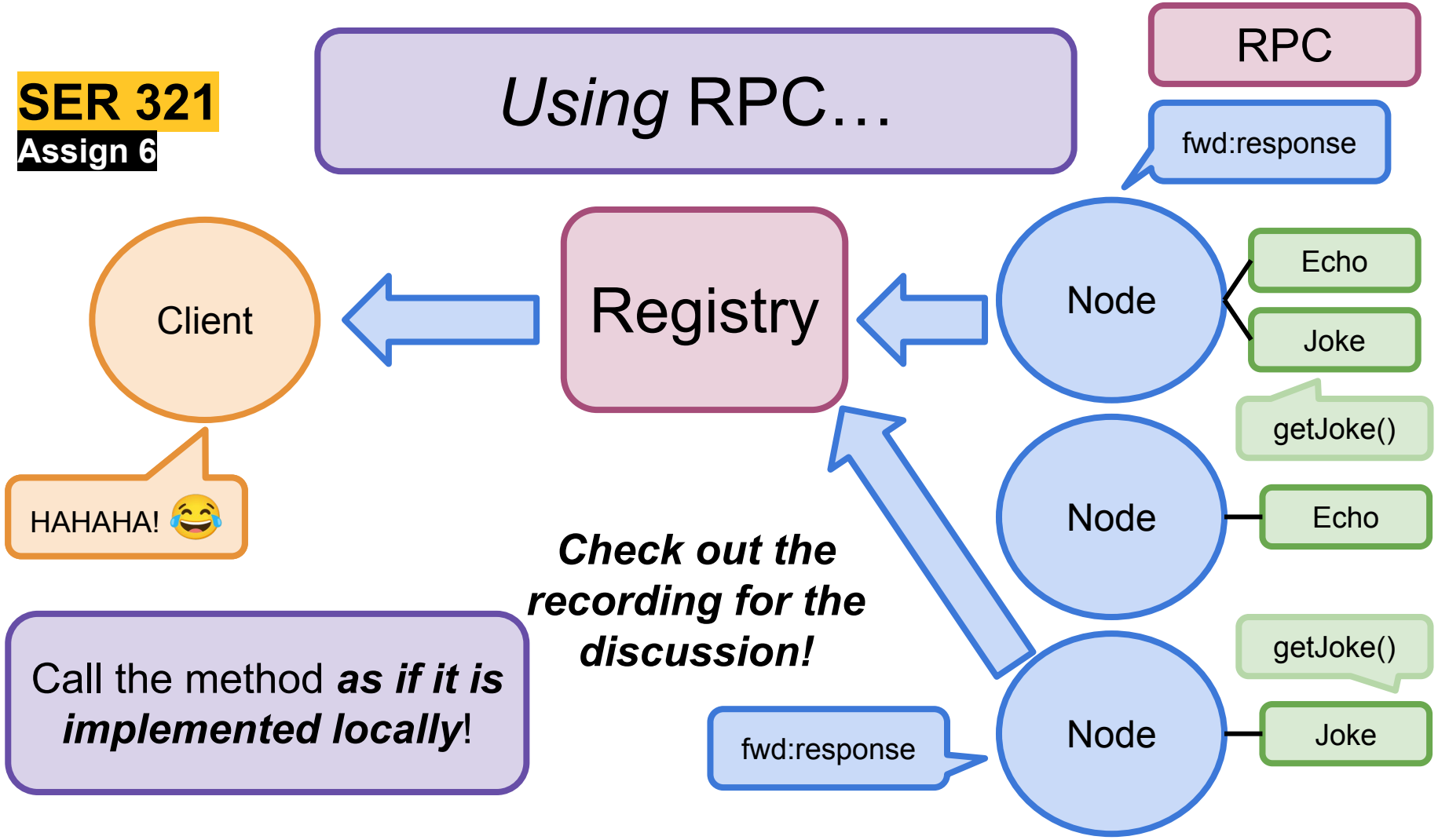
Using RPC…



Call the method ***as if it is implemented locally***!

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Okay so how do we actually *use* this setup?

```java
public void setJoke(String joke) {
  JokeSetReq request = JokeSetReq.newBuilder()
      .setJoke(joke).build();
  JokeSetRes response;

  try {
    response = blockingStub2.setJoke(request);
    System.out.println(response.getOk());
  } catch (Exception e) {
    System.err.println("RPC failed: " + e);
    return;
  }
}
```

Client.java

```java
Client client = new Client(channel, regChannel);

// call the parrot service on the server
client.askServerToParrot(message);

// ask the user for input how many jokes the user wants
BufferedReader reader = new BufferedReader(new InputStreamReader(System.in));

// Reading data using readLine
System.out.println("How many jokes would you like?"); // NO ERROR handling of wrong input here.
String num = reader.readLine();

// calling the joked service from the server with num from user input
client.askForJokes(Integer.valueOf(num));

// adding a joke to the server
client.setJoke("I made a pencil with two erasers. It was pointless.");

// showing 6 joked
client.askForJokes(Integer.valueOf(6));
```

Client.java (Main)

Check out the recording for the discussion!

Looking at **SetJoke**

```java
// W
@Ove
public void setJoke(JokeSetReq req, StreamObserver<JokeSetRes> responseObserver) {

    System.out.println("Received from client: " + req.getJoke());
    JokeSetRes.Builder response = JokeSetRes.newBuilder();
    if (req.getJoke().isEmpty()) { // we do not want to add empty jokes
        response.setOk(false);
    } else {
        jokes.add(req.getJoke());
        response.setOk(true);
    }

    JokeSetRes resp = response.build();
    responseObserver.onNext(resp);
    responseObserver.onCompleted();
}
```

JokeImpl.java

SER 321
Assign 6

Okay so how do we actually *use* this setup?

```
public void setJoke(String joke) {
  JokeSetReq request = JokeSetReq.newBuilder()
      .setJoke(joke).build();
  JokeSetRes response;

  try {
    response = blockingStub2.setJoke(request);
    System.out.println(response.getOk());
  } catch (Exception e) {
    System.err.println("RPC failed: " + e);
    return;
  }
}
```

Client.java

Client provides the info

Client creates request

```
Client client = new Client(channel, regChannel);
```

```
// Implement the joke service. It has two sevices getJokes and setJoke
class JokeImpl extends JokeGrpc.JokeImplBase {  1 usage

    // having a global set of jokes
    Stack<String> jokes = new Stack<~>();  7 usages

    public JokeImpl(){  1 usage
        super();
        // copying some dad jokes
        jokes.add("How do you get a squirrel to like you? Act like a nut.");
        jokes.add("I don't trust stairs. They're always up to something.");
        jokes.add("What do you call someone with no body and no nose? Nobody knows.");
        jokes.add("Did you hear the rumor about butter? Well, I'm not going to spread it!");

    }
```

JokeImpl.java

```
client.askForJokes(Integer.valueOf(6));
```

```
public void setJoke(JokeSetReq req, StreamObserver<JokeSetRes> responseObserver) {

    System.out.println("Received from client: " + req.getJoke());
    JokeSetRes.Builder response = JokeSetRes.newBuilder();
    if (req.getJoke().isEmpty()) { // we do not want to add empty jokes
        response.setOk(false);
    } else {
        jokes.add(req.getJoke());
        response.setOk(true);
    }

    JokeSetRes resp = response.build();
    responseObserver.onNext(resp);
    responseObserver.onCompleted();
}
```

JokeImpl.java

Check out the recording for the discussion!

Everything else we have had to do is handled in the Implementation Class!

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What does that imply for the system?

```
public void setJoke(String joke) {
  JokeSetReq request = JokeSetReq.newBuilder()
      .setJoke(joke).build();
  JokeSetRes response;

  try {
    response = blockingStub2.setJoke(request);
    Sys
  } cat
    Sys
    ret
  }
}
```

Client.java

Client Class acts like a middleman!

Everything else we have had to do is handled in the Implementation Class!

```
Client client = new Client(channel, regChannel);

// call the parrot service on the server
client.askServerToParrot(message);

// ask the user for input how many jokes the user wants
BufferedReader reader = new BufferedReader(new InputStreamReader(System.in));

// Reading data using readLine
System.out.println("How many jokes would you like?"); // NO ERROR handling of wrong input here.
String num = reader.readLine();

// calling the joked service from the server with the number of jokes
client.askForJokes(Integer.valueOf(num));

// adding a joke to the server
client.setJoke("I made a pencil with two erasers. It was pointless.");

// showing 6 joked
client.askForJokes(Integer.valueOf(6));
```

Client.java (Main)

Check out the recording for the discussion!

```
// W
@Ove
public void setJoke(JokeSetReq req, StreamObserver<JokeSetRes> responseObserver) {

    System.out.println("Received from client: " + req.getJoke());
    JokeSetRes.Builder response = JokeSetRes.newBuilder();
    if (req.getJoke().isEmpty()) { // we do not want to add empty jokes
        response.setOk(false);
    } else {
        jokes.add(req.getJoke());
        response.setOk(true);
    }

    JokeS
    respo
    respo
}
```

JokeImpl.java

Implementations need to be robust and thorough!

SER 321

Scratch Space

Upcoming Events

SI Sessions:

- Thursday, February 27th at 7:00 pm MST - **Exam Review Session (2hrs)**
- Sunday, March 2nd at 7:00 pm MST - **Q&A Session**

Review Sessions:

- Thursday, February 27th at 7:00 pm MST - **Exam Review Session (2hrs)**
- Sunday, March 2nd at 7:00 pm MST - **Q&A Session**

Questions?

Survey:

https://asuasn.info/ASNSurvey

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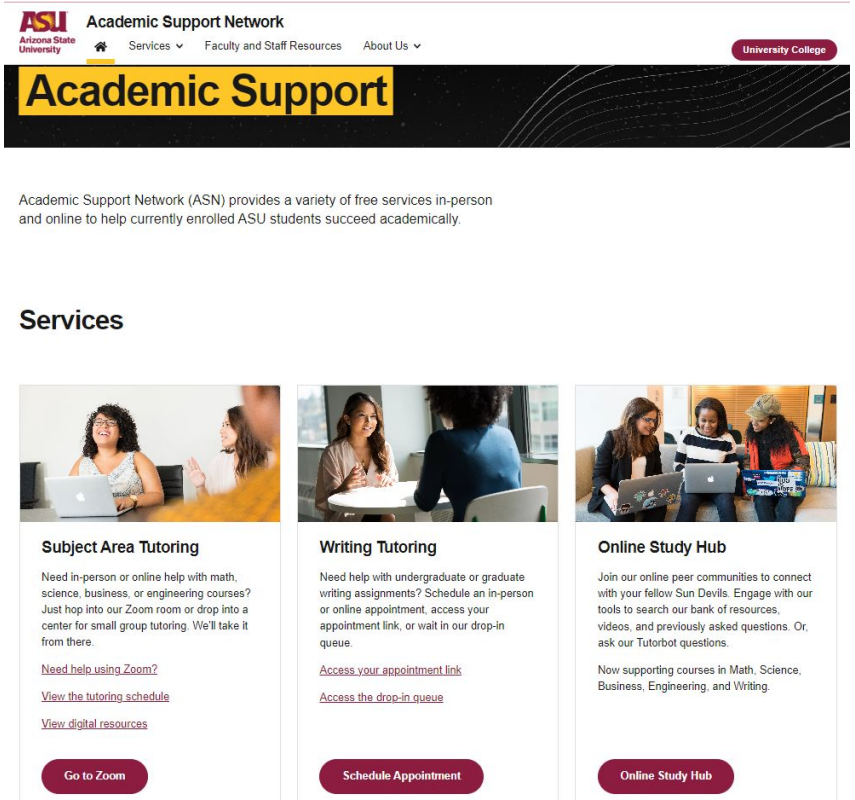
More Questions?

Check out our other resources!

tutoring.asu.edu

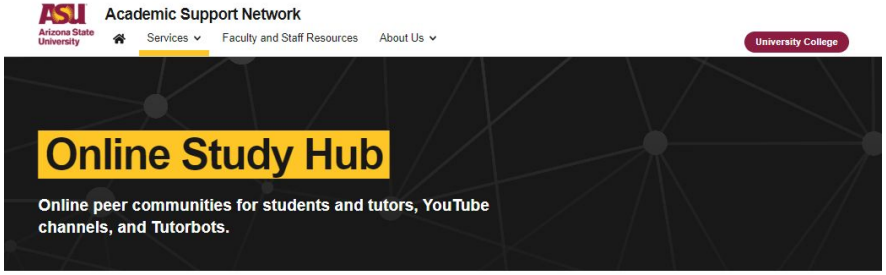


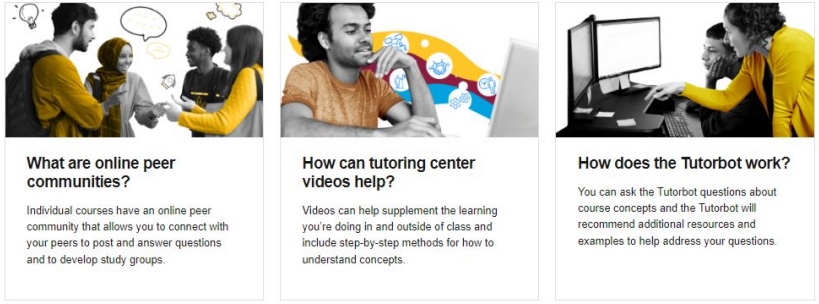
1. **Click on ‘Go to Zoom’ to log onto our Online Tutoring Center.**
2. **Click on ‘View the tutoring schedule’ to see when tutors are available for specific courses.**

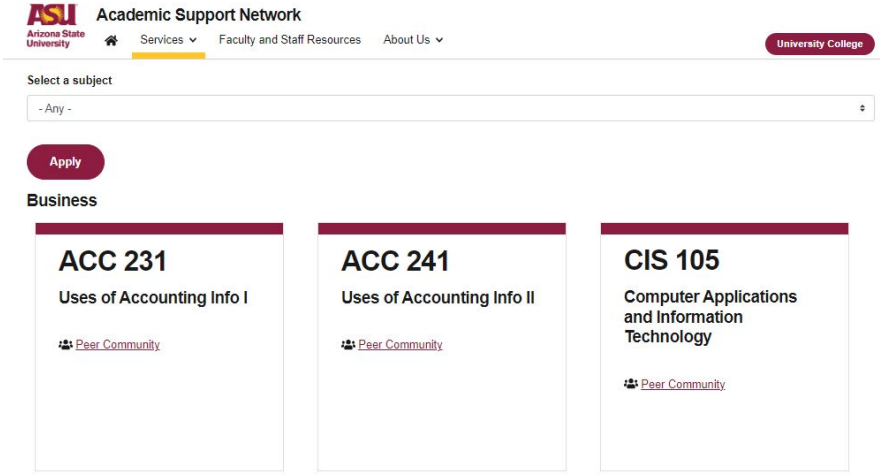
More Questions?

Check out our other resources!

tutoring.asu.edu/online-study-hub



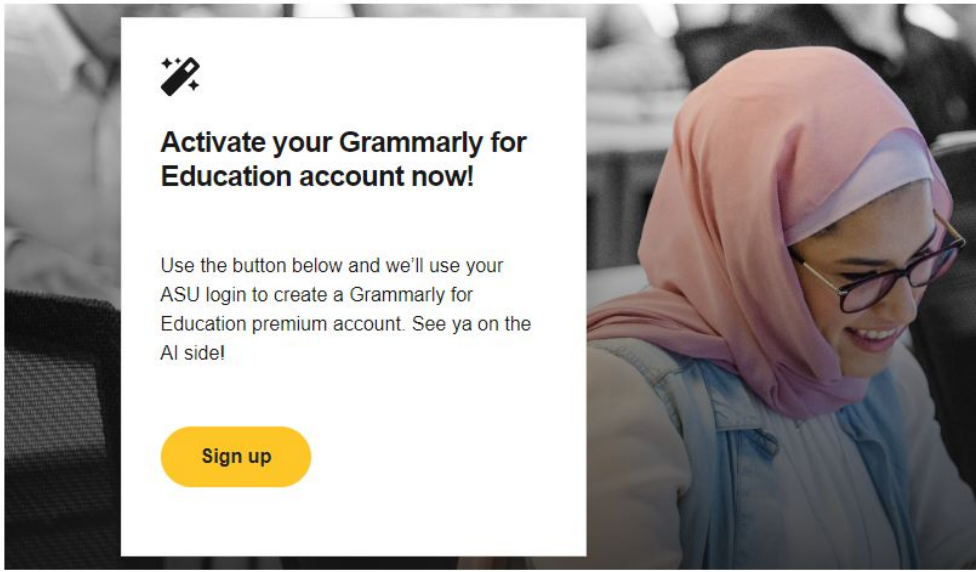




Don't forget to check out the Online Study Hub for additional resources!

Expanded Writing Support Available

Including Grammarly for Education, at no cost!



tutoring.asu.edu/expanded-writing-support

*Available slots for this pilot are limited

Additional Resources

- Course Repo
- Gradle Documentation
- GitHub SSH Help
- Linux Man Pages
- OSI Interactive
- MDN HTTP Docs
  - Requests
  - Responses
- JSON Guide
- org.json Docs
- javax.swing package API
- Swing Tutorials
- Dining Philosophers Interactive
- Austin G Walters Traffic Comparison
- RAFT