

# 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](https://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

# SER 321

## Middleware

We have been:

Serializing  
Messages

Sending  
Messages

Parsing  
Messages

Handle  
Messages

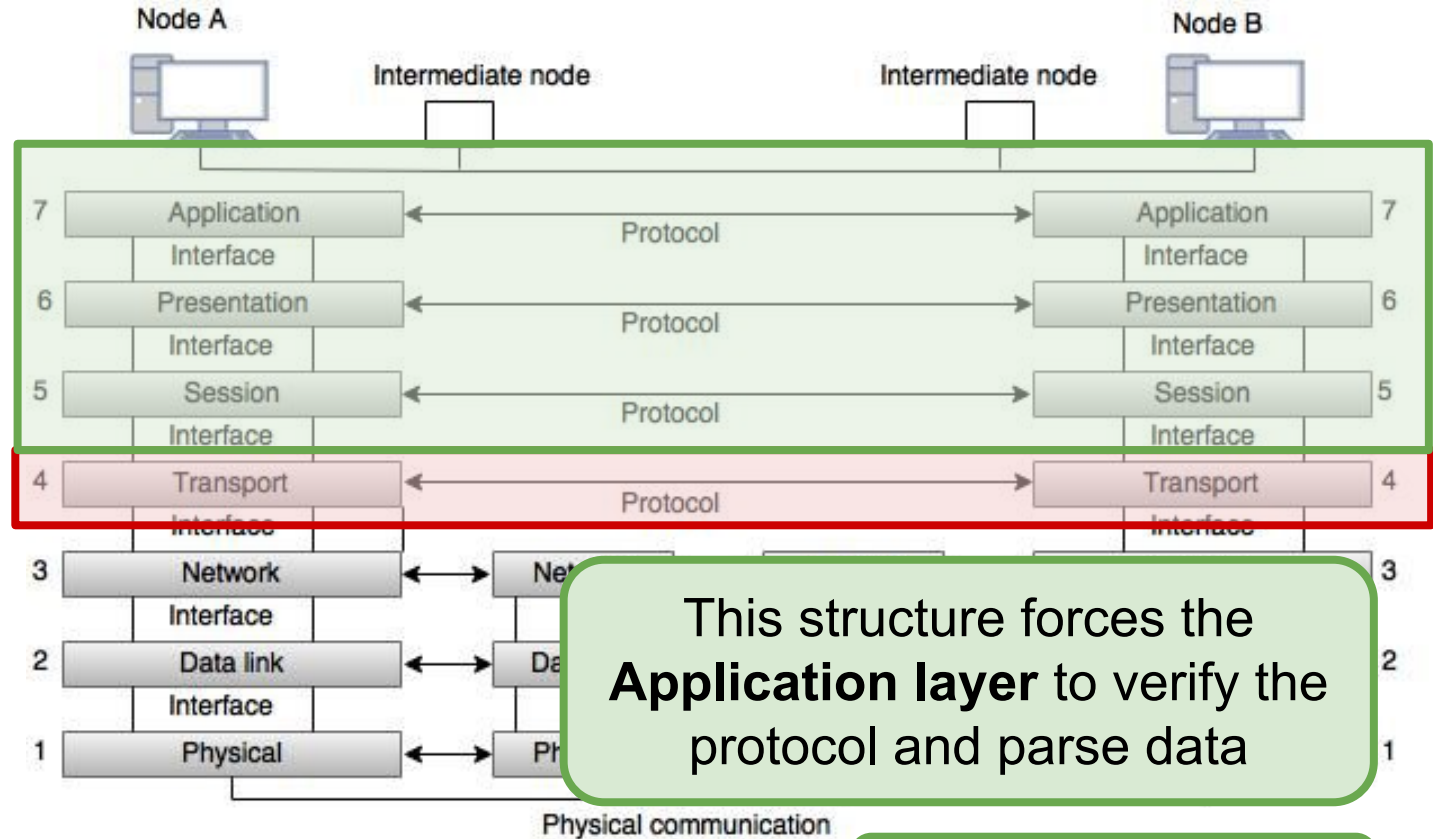


Fig: OSI Model

Not really its job...

# SER 321

## Middleware

With Middleware:

Serializing  
Messages

Sending  
Messages

Parsing  
Messages

Handle  
Messages

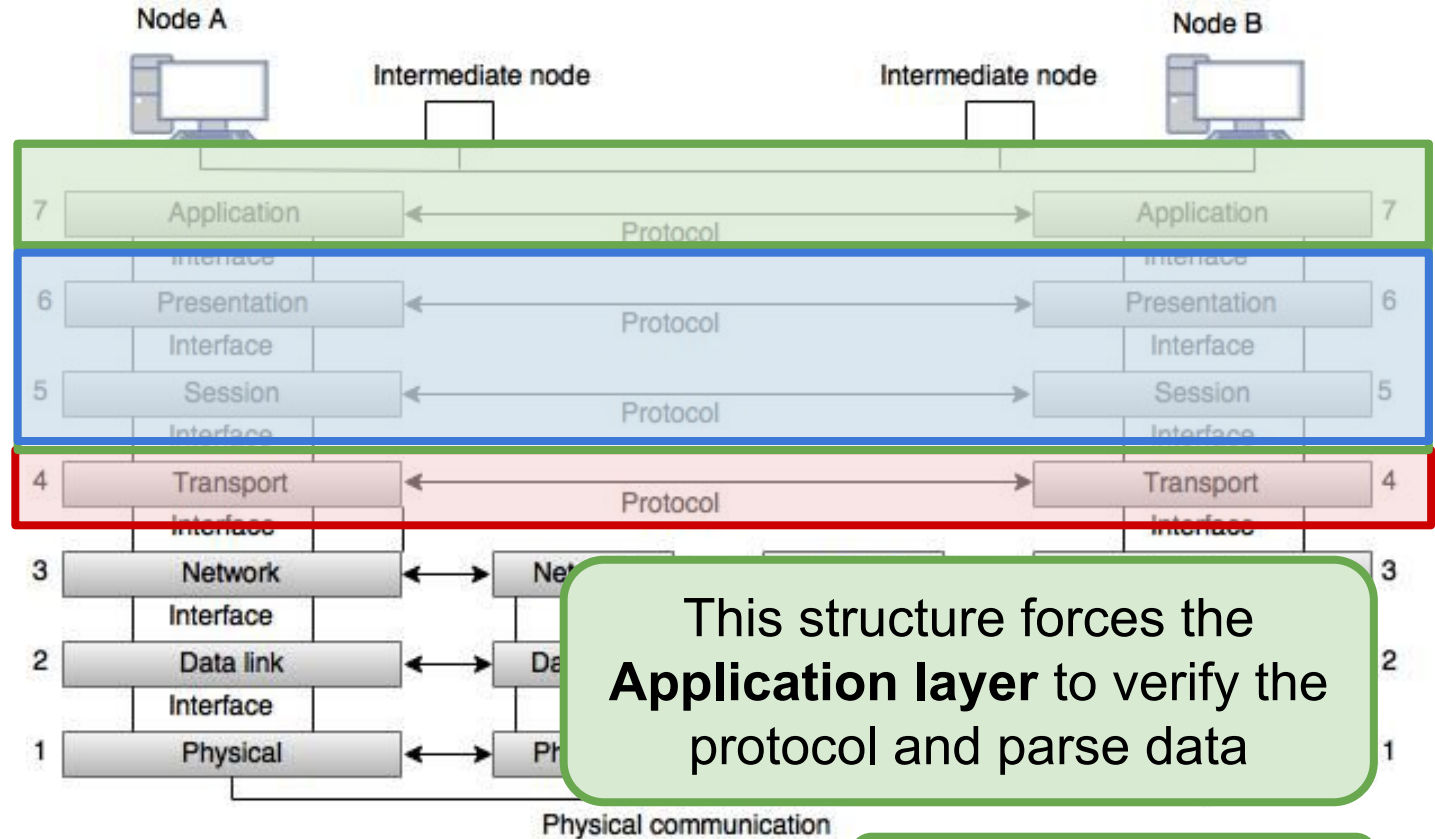


Fig: OSI Model

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

Not really its job...

# SER 321

## Middleware

With Middleware:

Serializing  
Messages

Sending  
Messages

Parsing  
Messages

Handle  
Messages

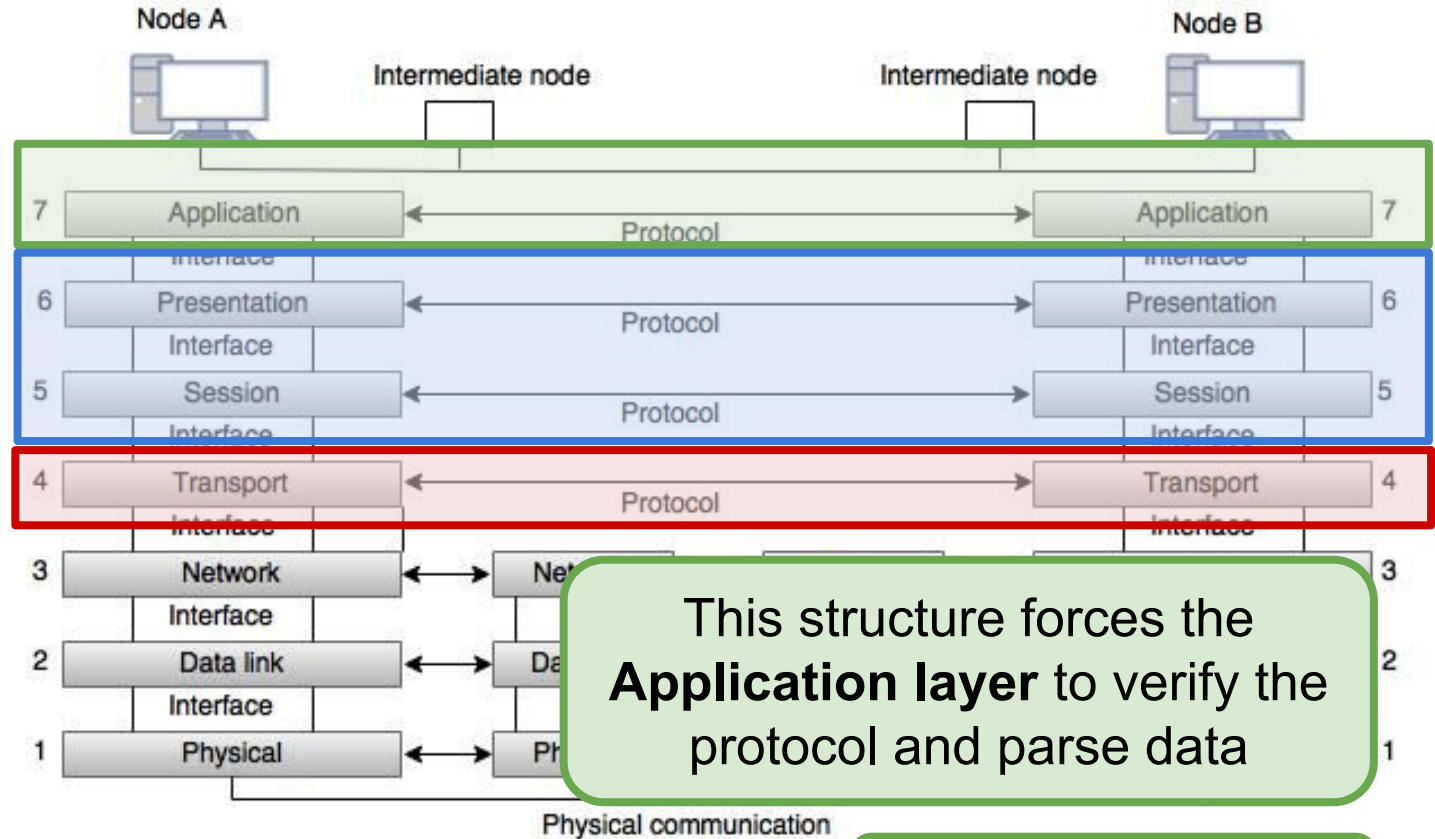


Fig: OSI Model

Not really its job...



# SER 321

## Middleware

Middleware:

*Session Layer Responsibilities:*

Authentication

Authorization

Session Management

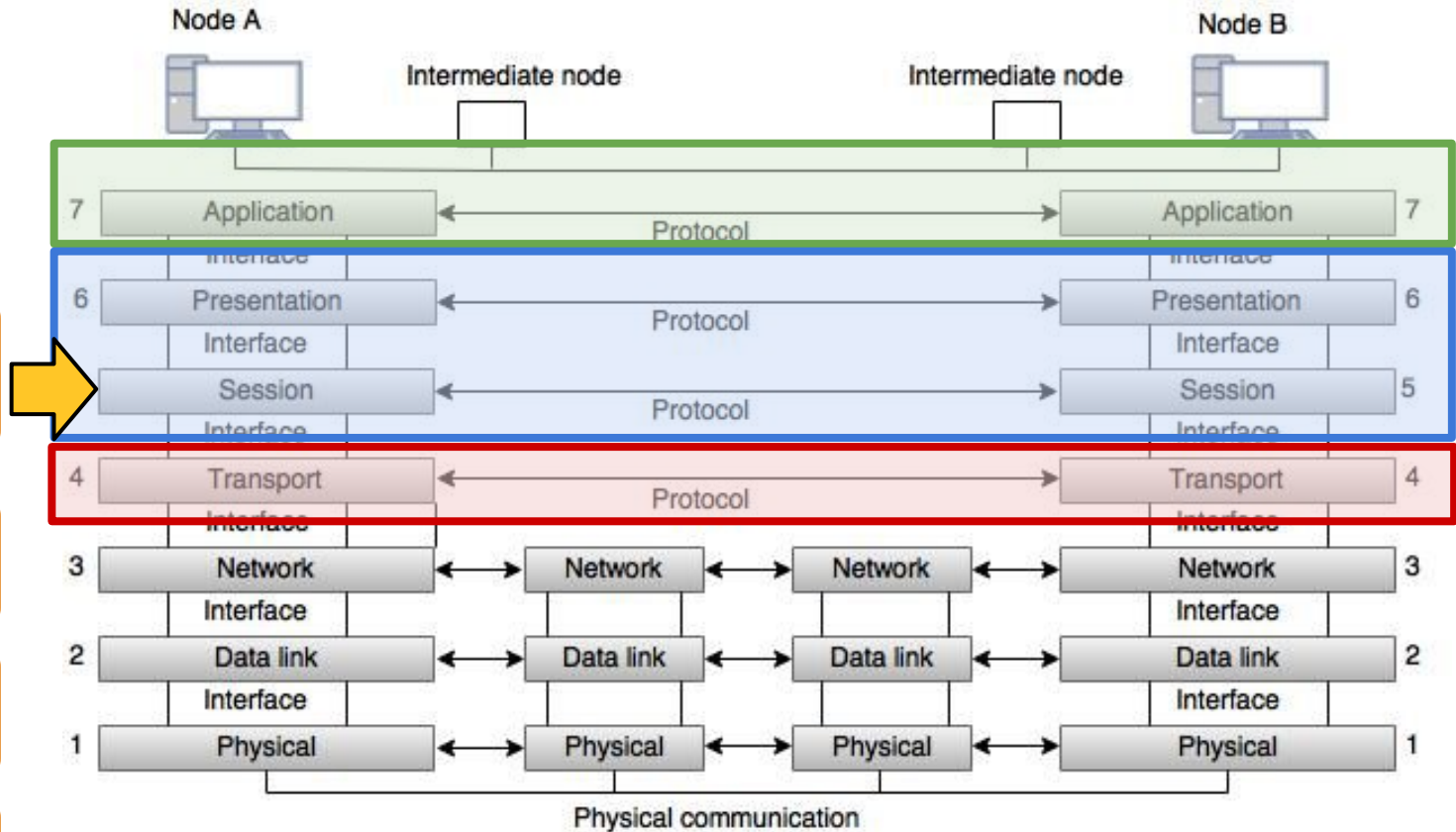


Fig: OSI Model

# SER 321

## Middleware

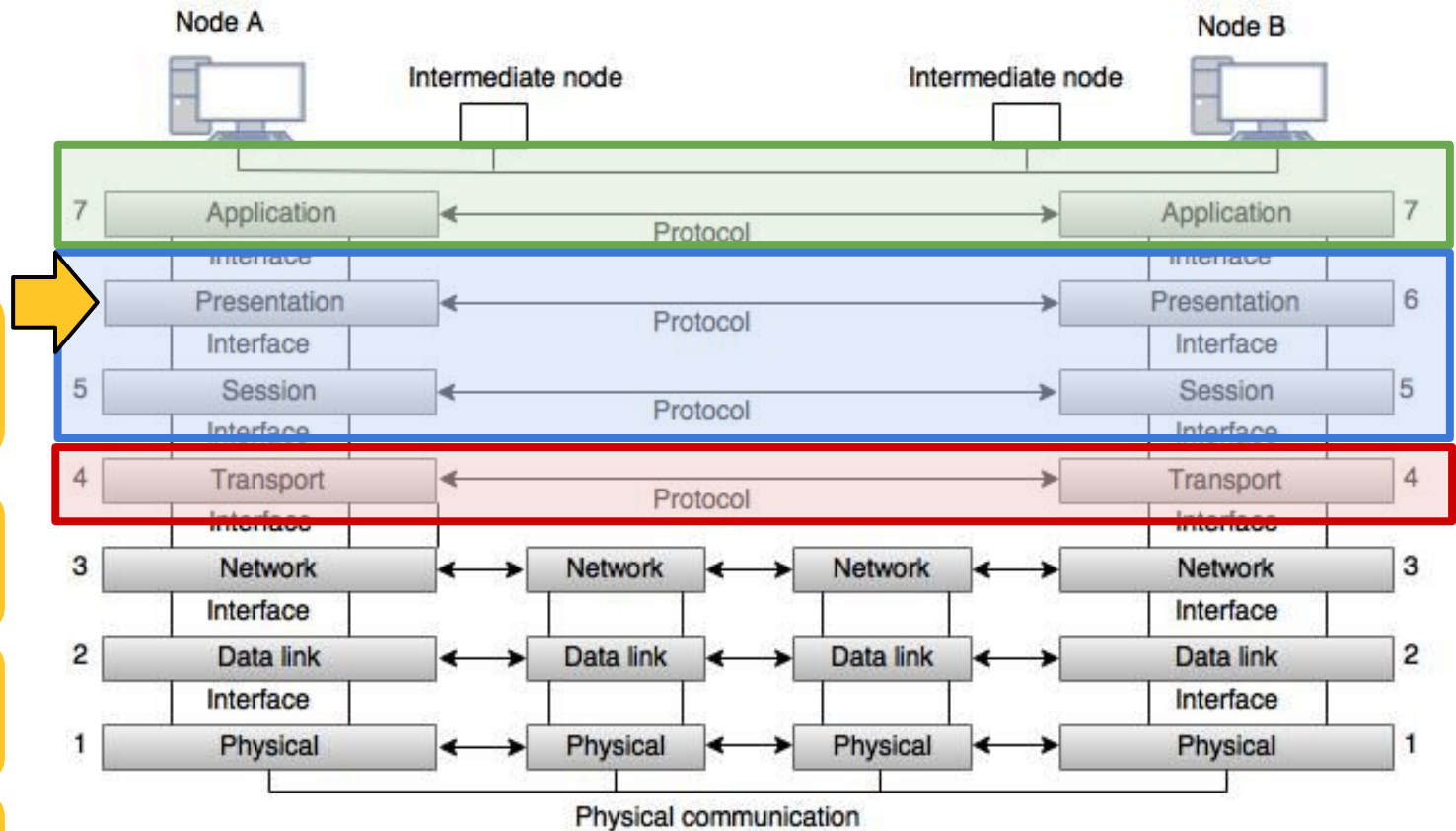
Middleware:

*Presentation  
Layer  
Responsibilities:*

Translation

Compression

Encryption



**Fig: OSI Model**

# Examples?

Message Oriented Middleware (MOM)

Web Frameworks

Remote Procedure Calls (RPC)



App. Programming Interface (API)



**SER 321**

**Middleware**

# Why do we care?

Agility

Reusability

Efficiency

Cost  
Effectiveness

Portability

# Why do we care?

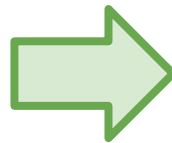
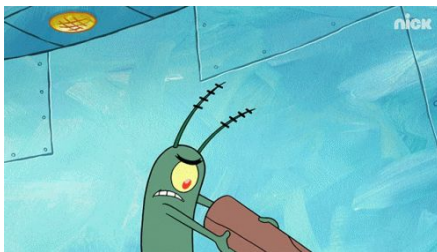


Sort of like publishing a contract

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

# SER 321

## Middleware



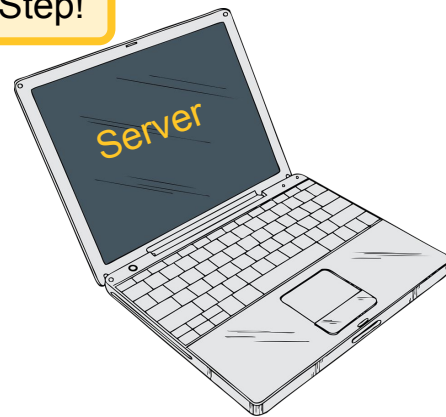
```
{  
  "type": "addUser",  
  "name": "katie",  
  "password": "password"  
}
```

Add User



- 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

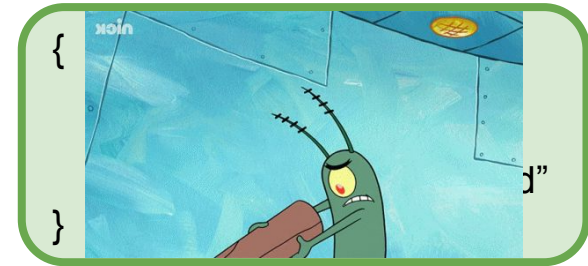
Critical Step!



# 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

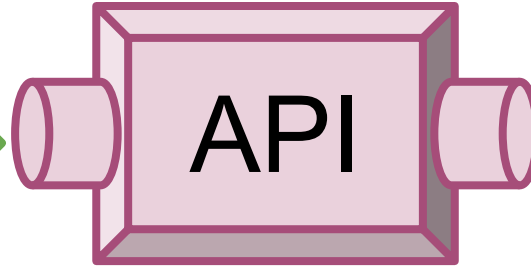


**SER 321**

**Middleware**

Add User:  
Name = Katie  
Password = password

With Middleware:



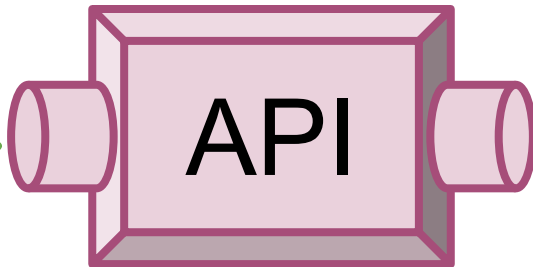


**SER 321**

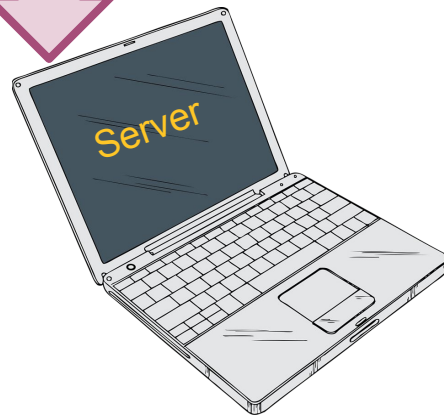
**Middleware**

With Middleware:

Add User:  
Name = Katie  
Password = password



```
{  
  "type": "addUser",  
  "name": "katie",  
  "password": "password"  
}
```



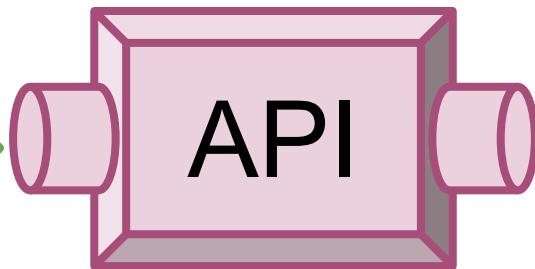
**SER 321**

**Middleware**

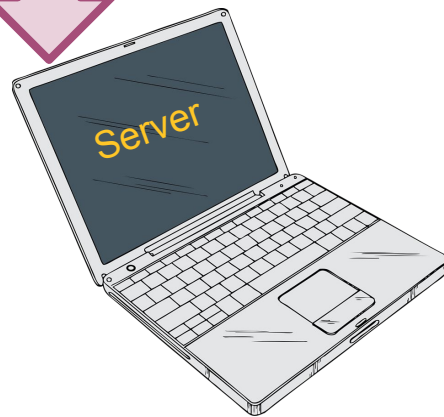
Get repositories for a  
specific user



With Middleware:



**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
```

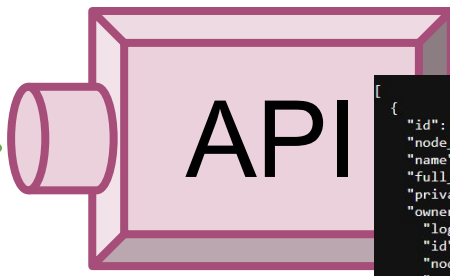
# SER 321 Middleware

## With Middleware:

Get repositories for a specific user



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



Code samples for "List repository"

Request example

GET /users/{username}/repos

cURL JavaScript GitHub CLI

```
curl -L \
-H "Accept: application/vnd.github+json" \
-H "Authorization: Bearer <YOUR_GITHUB_TOKEN>" \
-H "X-GitHub-Api-Version: 2022-11-01" \
https://api.github.com/users/U
```

## GitHub REST API

```
{
  "id": 550568457,
  "node_id": "R_kgDOIIECCQ",
  "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}",
    "starred_url": "https://api.github.com/users/kgrinne3/starred{/owner}/{/repo}",
    "subscriptions_url": "https://api.github.com/users/kgrinne3/subscriptions",
    "organizations_url": "https://api.github.com/users/kgrinne3/orgs",
    "repos_url": "https://api.github.com/users/kgrinne3/repos",
    "events_url": "https://api.github.com/users/kgrinne3/events{/privacy}",
    "received_events_url": "https://api.github.com/users/kgrinne3/received_events",
    "type": "User",
    "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}",
  "teams_url": "https://api.github.com/repos/kgrinne3/assign1git/teams",
  "hooks_url": "https://api.github.com/repos/kgrinne3/assign1git/hooks",
  "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}",
  "git_refs_url": "https://api.github.com/repos/kgrinne3/assign1git/git/refs{/sha}"
}
```

# SER 321

## Assign 6

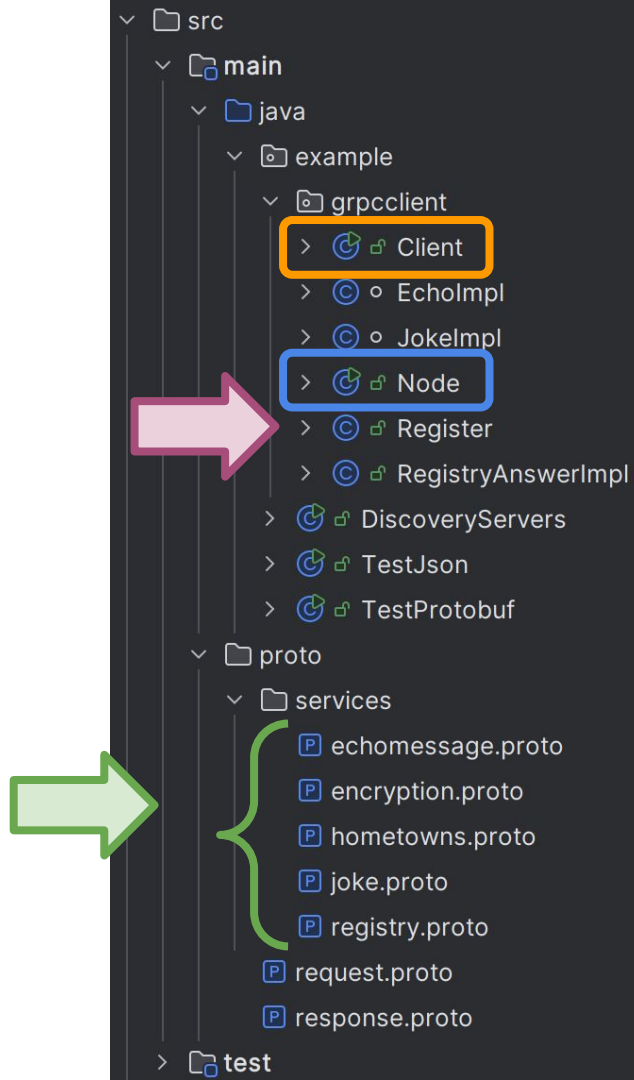
Client

Node

Registry

Protocol Buffers!

Service



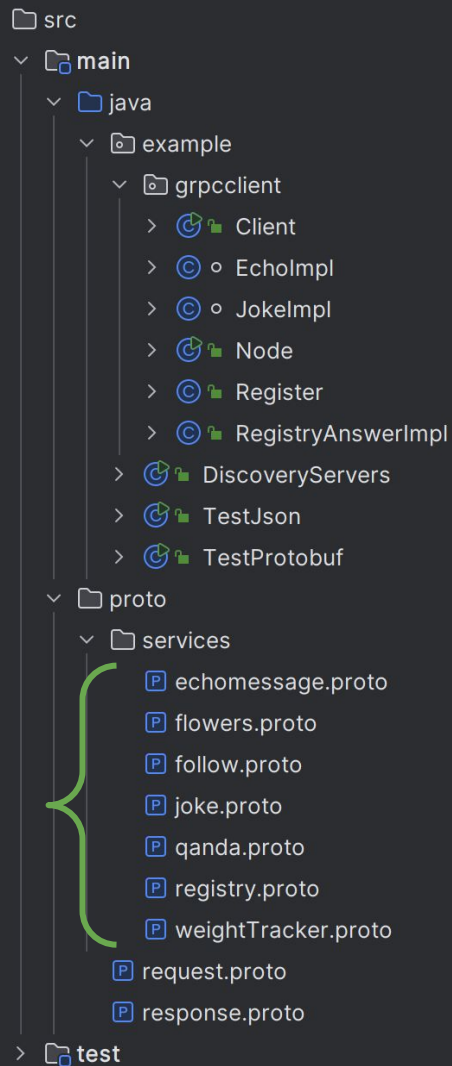
# SER 321

## Protobuf Review

All nodes and clients have agreed to these contracts

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

Think of these as a *contract*



# SER 321

## Protobuf Review

### joke.proto

```
// 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 beginning 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();
    responseObserver.onNext(resp);
    responseObserver.onCompleted();
}
```

```
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;
```

# SER 321

## Protobuf Review

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

Fill with *setters*

Build when done!

joke.proto

How do we use Protobufs again?

```
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 take the joke the user wants to set and put it in our set of jokes
@Override 1usage
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();
}
```



**SER 321**

**Assign 6**

***Two*** new concepts!

Registry

RPC



# SER 321

## Assign 6

Previously...

Registry

Client

Node

Echo

Joke

Node

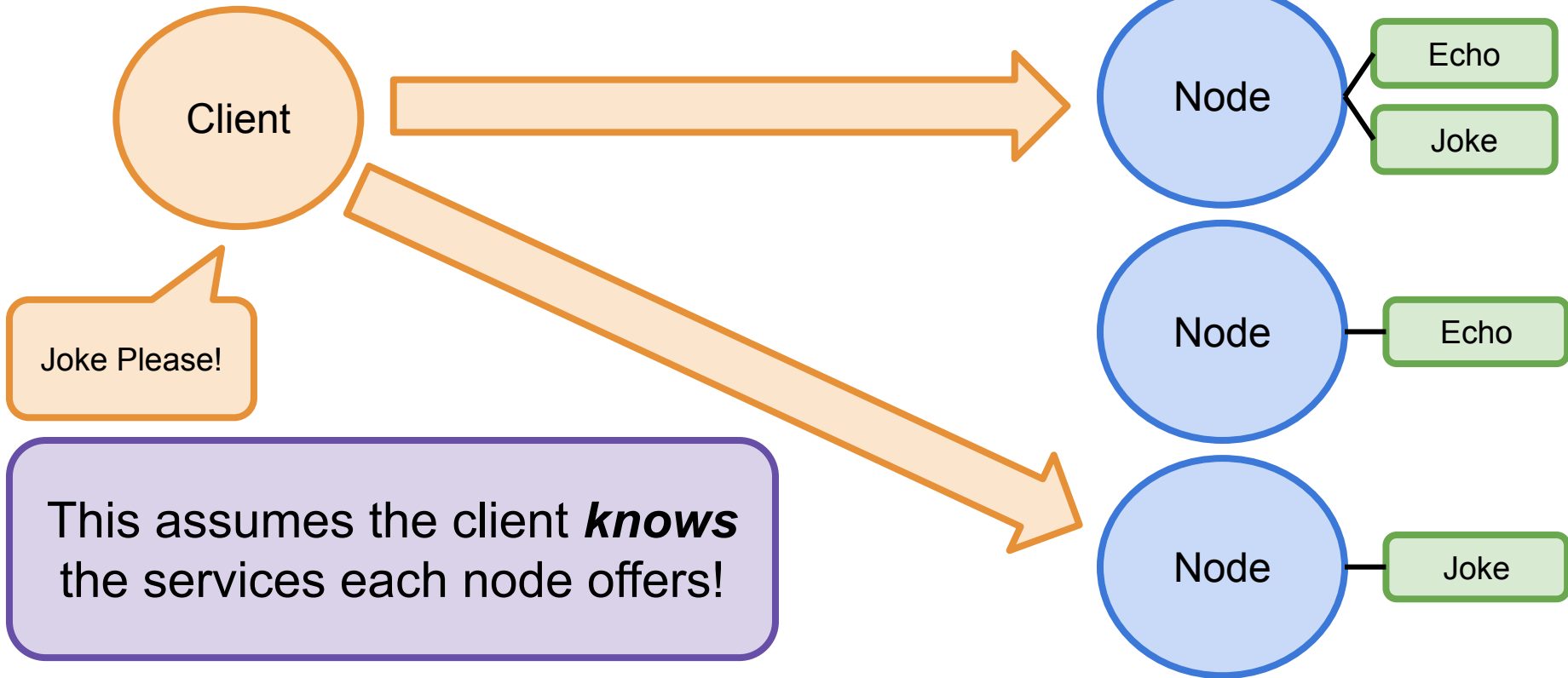
Echo

Node

Joke

Joke Please!

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



**SER 321**

**Assign 6**

With the Registry...

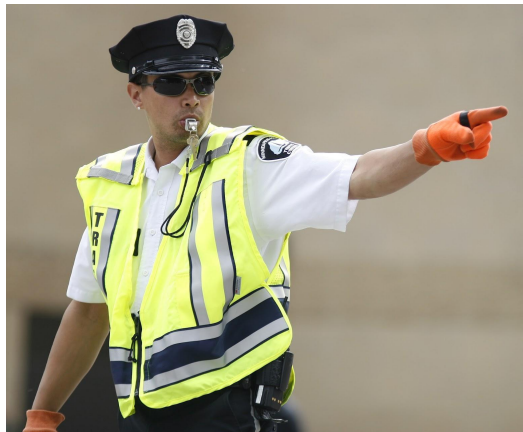
Registry

Client

Joke

Registry

Joke Please!



Node

Echo

Joke

Node

Echo

Node

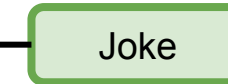
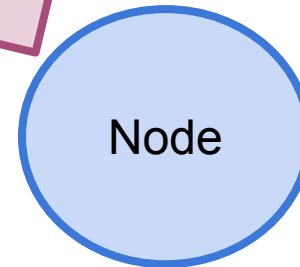
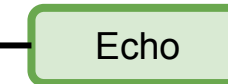
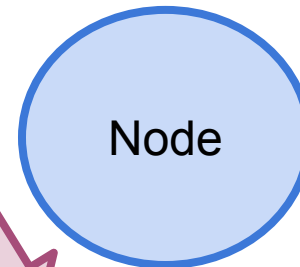
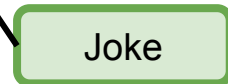
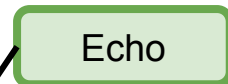
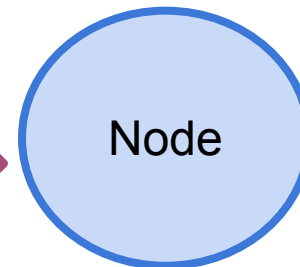
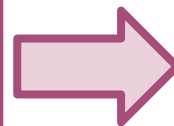
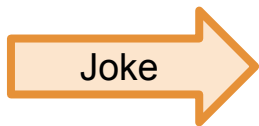
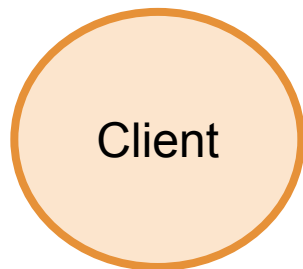
Joke

# SER 321

## Assign 6

### With the Registry...

Registry



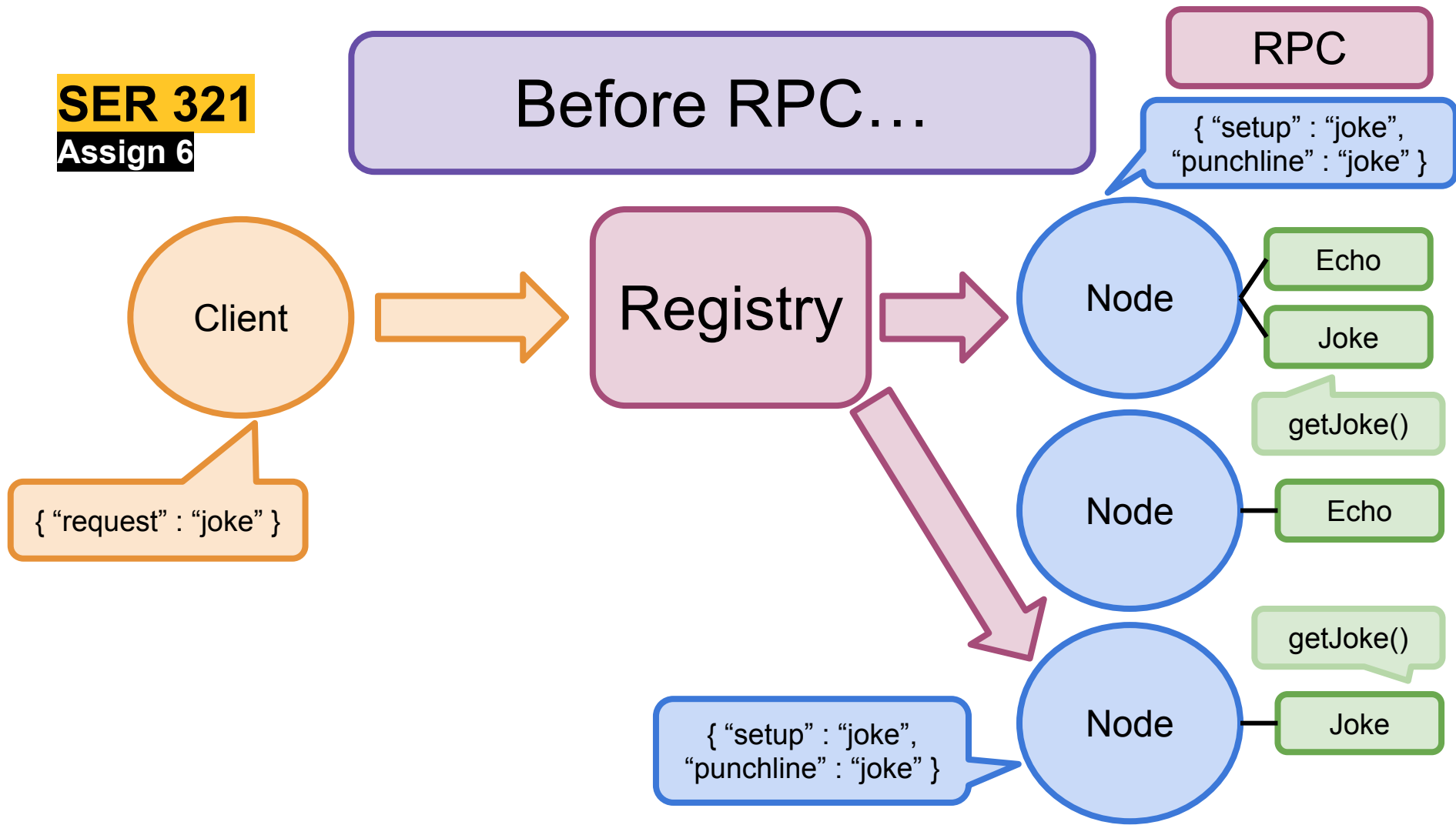
Joke Please!

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

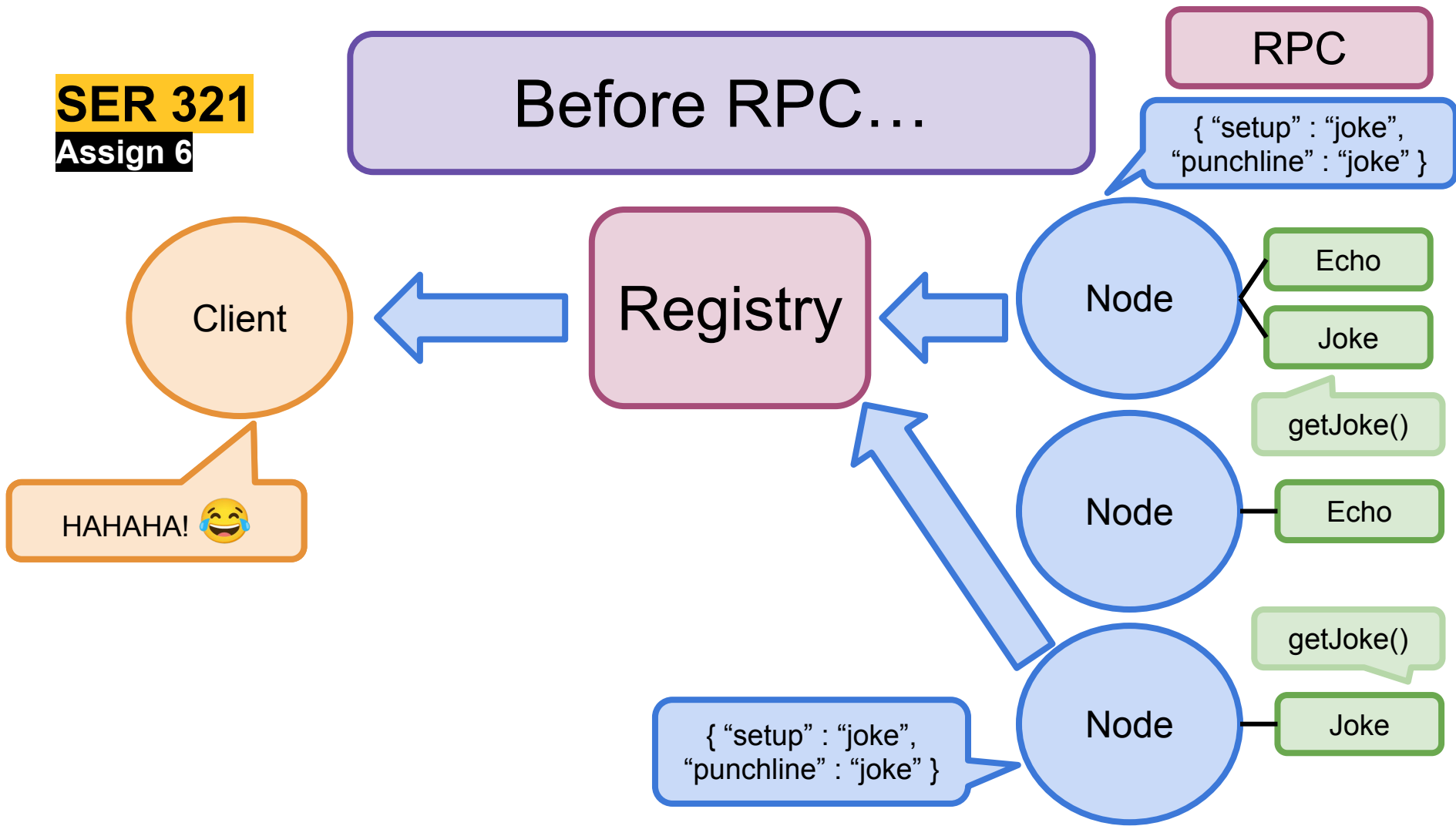


# SER 321

## Assign 6



## Assign 6



**SER 321**

**Assign 6**

*Using RPC...*

RPC

fwd:response

Client

getJoke()

Registry

Node

Echo

Joke

getJoke()

Node

Echo

getJoke()

Node

Joke

fwd:response

## Assign 6

# RPC

fwd:response



# Node

## Echo

## Joke

```
getJoke()
```

# Node

## Echo

```
getJoke()
```

## Joke

fwd:response

HAHAHA!

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

# 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

Looking at **SetJoke**

```
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));
```

```
// 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();
}
```

Client.java (Main)

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

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

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

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

JokeImpl.java

```
// 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!");  
}
```

```
// When the client asks for jokes  
@Override  
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

## SER 321

### Assign 6

What does that imply  
for the system?

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

Client.java

```
try {  
    response = blockingStub2.setJoke(request);  
    System.out.println("Joke set successfully");  
} catch (Exception e) {  
    System.out.println("Error: " + e.getMessage());  
}
```

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 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)

```
@Override  
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);  
    }  
}
```

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>



# More Questions?

Check out our other resources!

tutoring.asu.edu



## Academic Support

Academic Support Network (ASN) provides a variety of free services in-person and online to help currently enrolled ASU students succeed academically.

### Services



#### Subject Area Tutoring

Need in-person or online help with math, science, business, or engineering courses? Just hop into our Zoom room or drop into a center for small group tutoring. We'll take it from there.

[Need help using Zoom?](#)

[View the tutoring schedule](#)

[View digital resources](#)

Go to Zoom



#### Writing Tutoring

Need help with undergraduate or graduate writing assignments? Schedule an in-person or online appointment, access your appointment link, or wait in our drop-in queue.

[Access your appointment link](#)

[Access the drop-in queue](#)

Schedule Appointment



#### Online Study Hub

Join our online peer communities to connect with your fellow Sun Devils. Engage with our tools to search our bank of resources, videos, and previously asked questions. Or, ask our Tutorbot questions.

Now supporting courses in Math, Science, Business, Engineering, and Writing.

Online Study Hub

1-

Go to Zoom

2-

[Need help using Zoom?](#)

[View the tutoring schedule](#)

[View digital resources](#)



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](https://tutoring.asu.edu/online-study-hub)

 **Academic Support Network**

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University College

## Online Study Hub

Online peer communities for students and tutors, YouTube channels, and Tutorbots.



### What are online peer communities?

Individual courses have an online peer community that allows you to connect with your peers to post and answer questions and to develop study groups.



### How can tutoring center videos help?

Videos can help supplement the learning you're doing in and outside of class and include step-by-step methods for how to understand concepts.



### How does the Tutorbot work?

You can ask the Tutorbot questions about course concepts and the Tutorbot will recommend additional resources and examples to help address your questions.

Select a subject

- Any -

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Business

### ACC 231

Uses of Accounting Info I

Peer Community

### ACC 241

Uses of Accounting Info II

Peer Community

### CIS 105

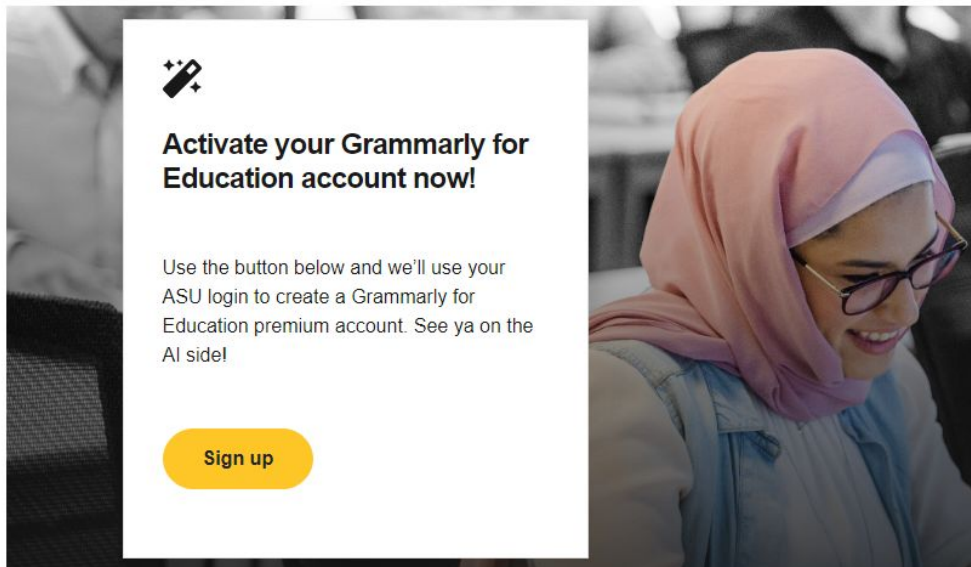
Computer Applications and Information Technology


Peer Community

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

# Expanded Writing Support Available

Including Grammarly for Education, at no cost!





**Activate your Grammarly for Education account now!**

Use the button below and we'll use your ASU login to create a Grammarly for Education premium account. See ya on the AI side!

[Sign up](#)



[tutoring.asu.edu/expanded-writing-support](https://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](#)