Authentication & Authorization

Who are you and what can you do

Authentication & Authorization

Authentication

- Authentication refers to establishing an actor’s identity sufficiently
  - Driver’s license
  - University CatCard
  - Username and Password
- Only establishes Identity
- Can be satisfied within the service, or through an external Identity Provider

Authentication & Authorization

Authorization

- Authorization refers to establishing what actions a verified actor can perform
  - Depends on Authentication
- Many strategies
  - Groups
  - Roles
  - Usually dependent on the service / application to determine

Authentication

Methods and Use Cases

- There are usually different strategies for Authentication depending on if you are Authenticating a person, or some sort of other actor, like application code.
    - When you log in to D2L we use a different strategy (NetID+Password+DUO) than if you were authenticating to make certain API calls (Access Keys or Certificates

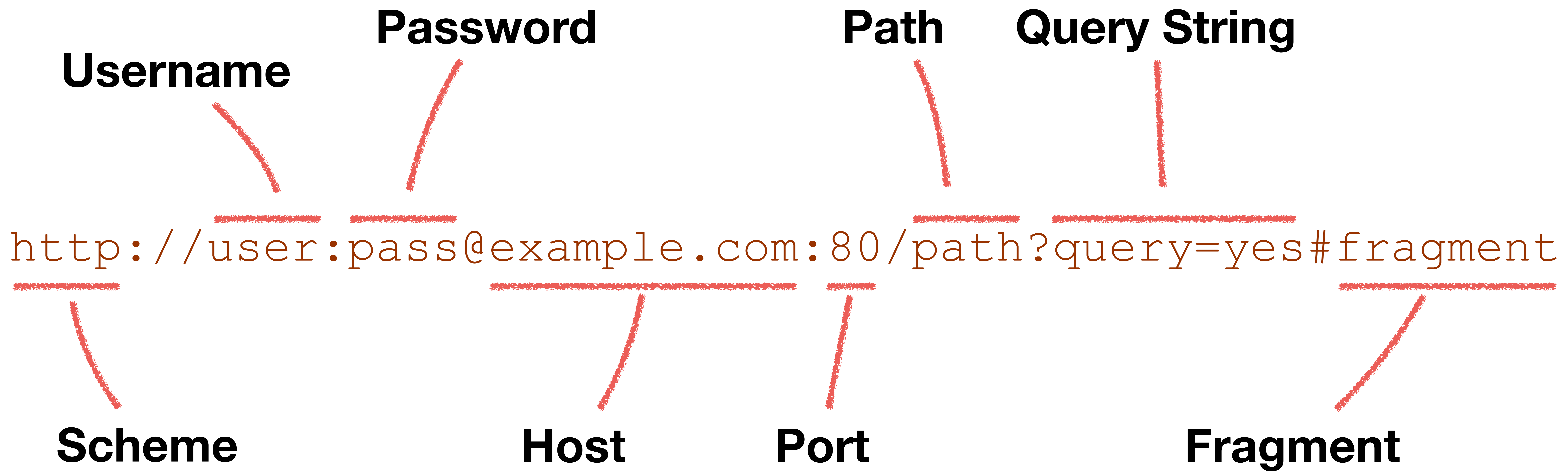
Authentication

Person Authentication

	Memorized Passwords	Password Manager	Password + MFA	Security Keys	Passkeys
Easy to use	✓	✓	✓	!	✓
Always with you	✓	✓	!	!	✓
Widely used	✓	✓	✓	!	!
Security Level	✗	!	!	✓	✓
Recoverable	✗	!	!	✗	!
Phishing resistant	✗	✗	!	✓	✓
Doesn’t require shared secrets	✗	✗	✗	✓	✓

Authentication

HTTP Requests



Authentication

HTTP Basic Authentication

- The username:password portion of a URL is translated into Basic Authentication by user agents (browsers, curl, etc)

```
http://user:pass@example.com/index.html
```

```
GET /index.html HTTP/1.1
Host: example.com
Authentication: Basic dXNlcjpwYXNz
```

Authentication

HTTP Basic Authentication

- Basic Auth must only ever be used with TLS encrypted connections: HTTPS

```
http://user:pass@example.com/index.html
```

```
https://user:pass@example.com/index.html
```

Authentication

HTTP Basic Authentication

- Not encrypted, just base64 encoded

```python
import base64

username = "mark"
password = "aReallyGr8PasswordNoOneWillGuess"

authString = f"{username}:{password}"
binaryAuthString = authString.encode("UTF-8")
b64AuthString = base64.b64encode(binaryAuthString).decode("UTF-8")
authHeader = f"Authentication: Basic {b64AuthString}"

print(authHeader)

# Prints the following
# Authentication: Basic bWFyazphUmVhbGx5R3I4UGFzc3dvcmROb09uZVdpbGxHdWVzcw==
```

Authentication

HTTP Basic Authentication

- Libraries and tools make this really easy

```
import requests

url = "https://example.com/index.html"
username = "mark"
password = "aReallyGr8PasswordNoOneWillGuess"

response = requests.get(url, auth=(username, password))
headers = "\r\n".join(f"{k}: {v}" for k, v in response.request.headers.items())
print(headers)

# User-Agent: python-requests/2.28.1
# Accept-Encoding: gzip, deflate
# Accept: */*
# Connection: keep-alive
# Authorization: Basic bWFyazphUmVhbGx5R3I4UGFzc3dvcmROb09uZVdpbGxHdWVzcw==
```

Authentication

HTTP Basic Authentication

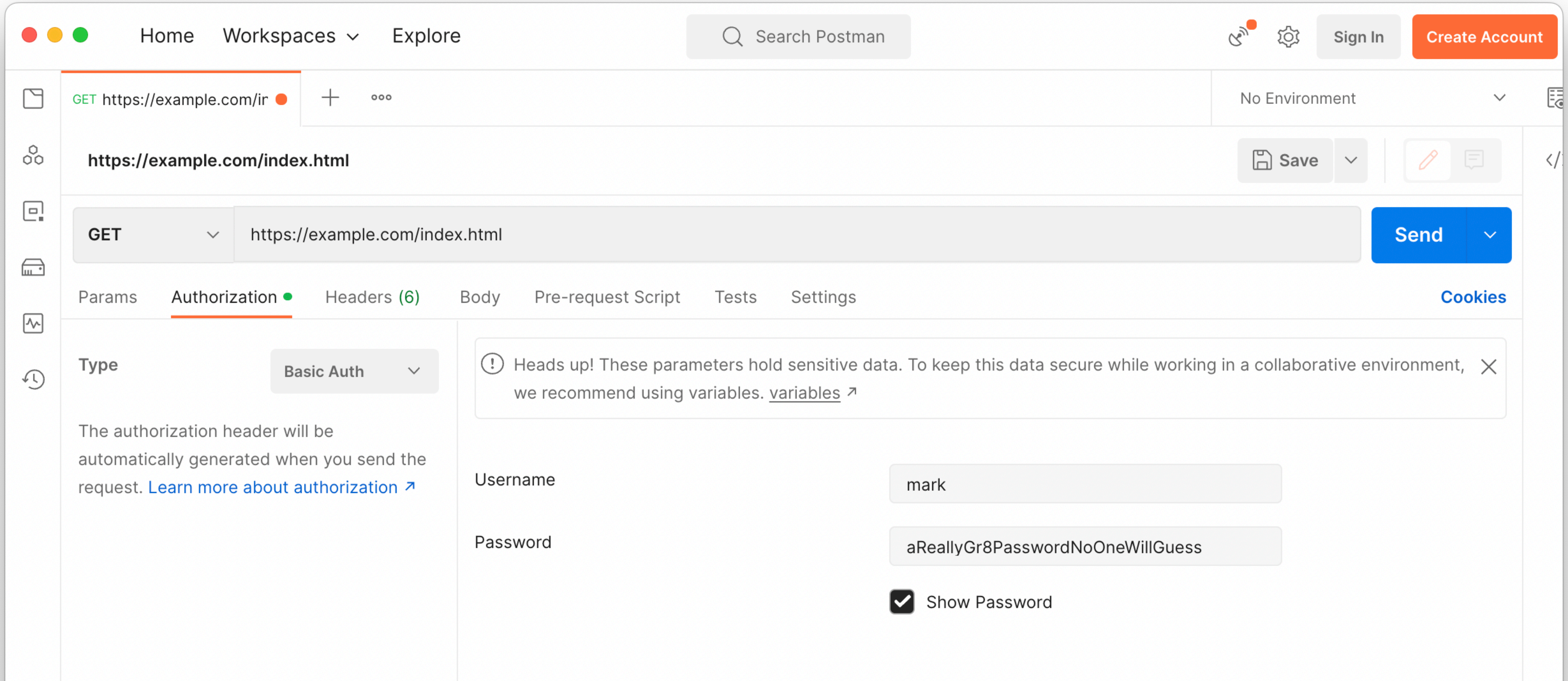
- Libraries and tools make this really easy

```
~ $ curl -v --user "mark:aReallyGr8PasswordNoOneWillGuess" https://example.com/index.html
*   Trying 93.184.216.34:443...
* Connected to example.com (93.184.216.34) port 443 (#0)
* Server auth using Basic with user 'mark'
> GET /index.html HTTP/2
> Host: example.com
> authorization: Basic bWFyazphUmVhbGx5R3I4UGFzc3dvcmROb09uZVdpbGxHdWVzcw==
> user-agent: curl/7.79.1
> accept: */*
>
```

Authentication

HTTP Basic Authentication

- Libraries and tools make this really easy



https://example.com/index.html

GET https://example.com/index.html

Type: Basic Auth

The authorization header will be automatically generated when you send the request. Learn more about authorization ↗

Heads up! These parameters hold sensitive data. To keep this data secure while working in a collaborative environment, we recommend using variables. variables ↗

Username: mark

Password: aReallyGr8PasswordNoOneWillGuess

[✓] Show Password

Authentication

Storing Usernames and Passwords

- How do you securely store passwords?
- Naive way is to just store the plaintext username and password in a data store. When someone logs in, you compare the password they entered with the one you stored.
- Advantages:
  - You can see their passwords if they need to recover them
- Disadvantages:
  - If you can see their passwords, so can the baddies (there are so many baddies)

Authentication

Storing Usernames and Passwords

- Better way is to use a strong hash algorithm with a salt
- Hashes are one-way transformation. Easy to transform an input into an output, but very very difficult to go the other way around.
- Store the hashed value in your data store
- Re-hash each password attempt, and compare the hashes
- If a baddie steals your data store hashes, your passwords are still relatively protected
- A salt value helps protect against pre-computed hash tables

Authentication

Storing Usernames and Passwords

```python
import hashlib

username = b"mark"
password = b"aReallyGr8PasswordNoOneWillGuess"

hashedPass = hashlib.sha3_512(password)
print(hashedPass.hexdigest())

# 07ef323985718aade0fa0e40e86d6f0cf429f6c8ce55dd4e7ec5f9ee0e3fcf533db...

hashedPass = hashlib.blake2b(password, salt=username)
print(hashedPass.hexdigest())

# 4fe792736fbc3d1366b3e63f1223e39abacd208de0378db03c1d27c4b3663b74b11c...
```

Authentication

Identity Providers

- Even better is to not get into the authentication business in the first place
- Use someone else’s set of identities
    - Social IdPs: Google, Facebook, etc
    - Enterprise specific IdPs: University NetID
- Gets you off the hook for having to securely store authentication credentials

Authentication

Identity Providers

- Authentication Protocols
  - OAuth2
  - OpenID Connect (OIDC)
  - Security Assertion Markup Language (SAML)
  - Central Authentication Service (CAS)

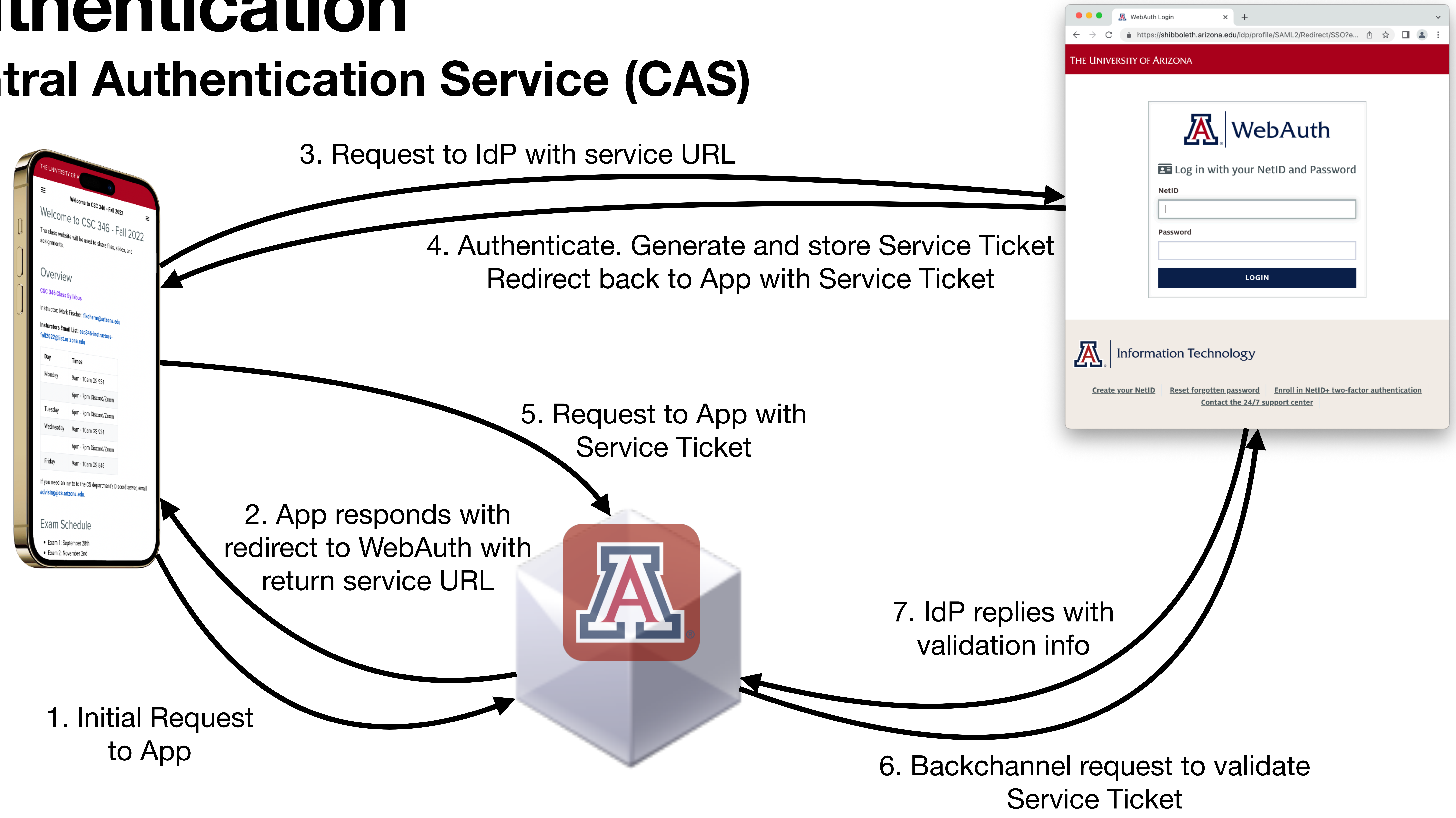
Authentication

Central Authentication Service (CAS)

- CAS is pretty easy to implement ourselves
- Supported by the University's Shibboleth Identity Provider

Authentication

Central Authentication Service (CAS)



3. Request to IdP with service URL
4. Authenticate. Generate and store Service Ticket
Redirect back to App with Service Ticket
5. Request to App with Service Ticket
2. App responds with redirect to WebAuth with return service URL
1. Initial Request to App
7. IdP replies with validation info
6. Backchannel request to validate Service Ticket
WebAuth Login
https://shibboleth.arizona.edu/idp/profile/SAML2/Redirect/SSO?e...
THE UNIVERSITY OF ARIZONA
WebAuth
Log in with your NetID and Password
NetID
Password
LOGIN
Information Technology
Create your NetID
Reset forgotten password
Enroll in NetID+ two-factor authentication
Contact the 24/7 support center
Welcome to CSC 346 - Fall 2022
Overview
Exam Schedule

Demo