Pivotal

Explain it to me like I'm 5: Oauth 2

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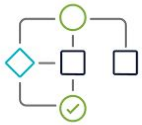
Goals

In the simplest way possible, I hope you will learn about...

- **When & why: Oauth2 & OpenID Connect**

- **How to protect your apps**



- **Concepts: Oauth2 & OpenID Connect**

- **Demos!**

Oauth2 & OpenID Connect

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When & why you need this?

When

- You are developing apps that...
  - have users & require login
  - different types or roles of user
  - need to share users
- You don't want to manage user accounts, password reset and account validation
- Internal/Intranet Apps Single Sign-On
- Users should login through Google, Facebook, Github, (Some Other Site™)
- You want access to data on Google, Facebook, Github, (Some Other Site™)
- You want to provide your own great API

Why

- Managing user accounts correct is hard
  - Secure password storage
  - Strong password requirements
  - Password reset & user support
  - Captcha/Abuse prevention
  - Account lockout
- Less vectors for attack/hackers
- Let someone else deal with it
- Users may not want to create another password
- API Access
  - Many public API's require it
  - You can secure your API's with it
- Your Boss Said so

So what now?

Concepts - Core

Adults

- Authentication

- Authorization

Kids

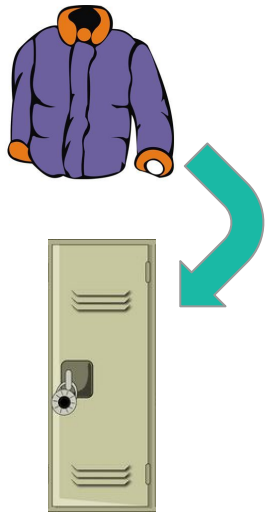
- Stranger Danger
  - Who are you?
  - Do I trust you?
- Going to school
  - You are a student
  - You are a teacher

Concepts - Oauth2 Roles

Adults

- Resource Owner
- Resource Server
- Authorization Server
- Client / Application

Kids



- You bring your jacket to school
  - Jacket is the resource
  - You are the resource owner
- You put it in your locker
  - The resource server
- Your locker is locked
  - The authorization server
- Anyone who goes into your locker to get your coat, other than you
  - Client / Application

Concepts - Tokens

Adults

- Access Token
  - Bearer token?

- Refresh Token

Kids

- Ticket to the carnival
  - Possession is the law

- Mom or Dad's Credit Card, good to buy more tickets to the carnival

Concepts - Scopes

Adults

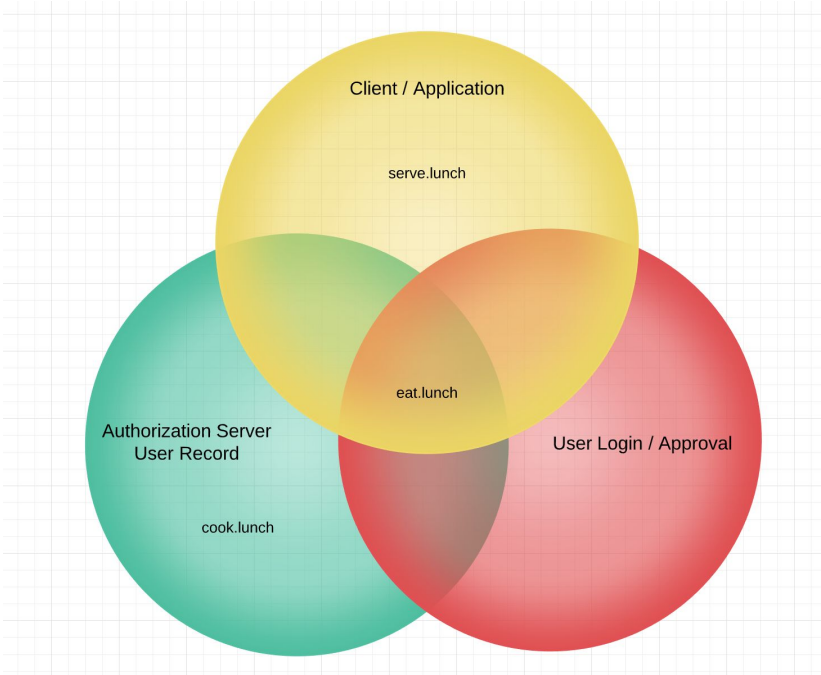
- Often mapped to roles or permissions
- OAuth2 does not require a specific format
- But often dot separated like
  - feed.me.cookies
- But some providers like Google use a URL
  - https://www.googleapis.com/auth/calendar.readonly

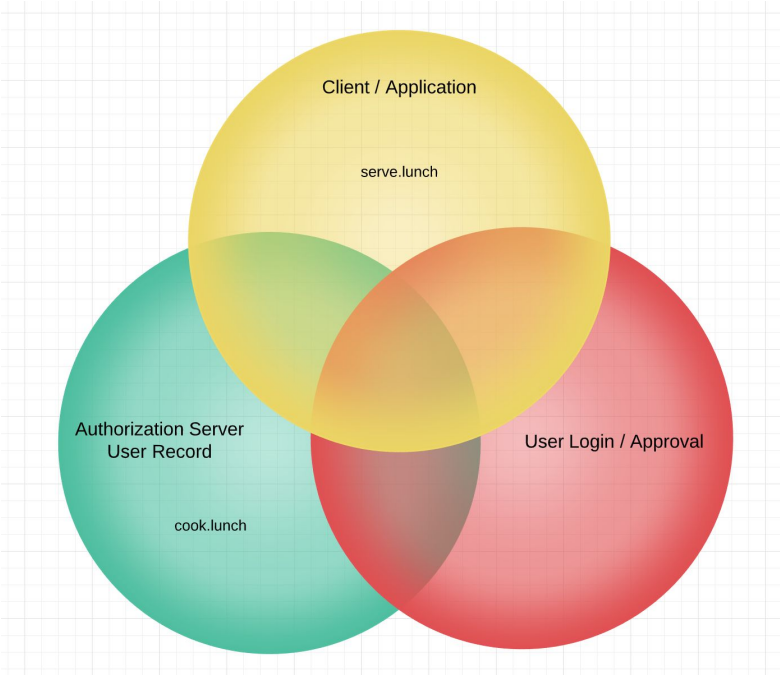
Kids

- At school:
  - Use the restroom
  - Visit the nurse
- At home:
  - Stay up late
  - Eat a cookie
  - Play video games

Concepts - How Scopes are Applied

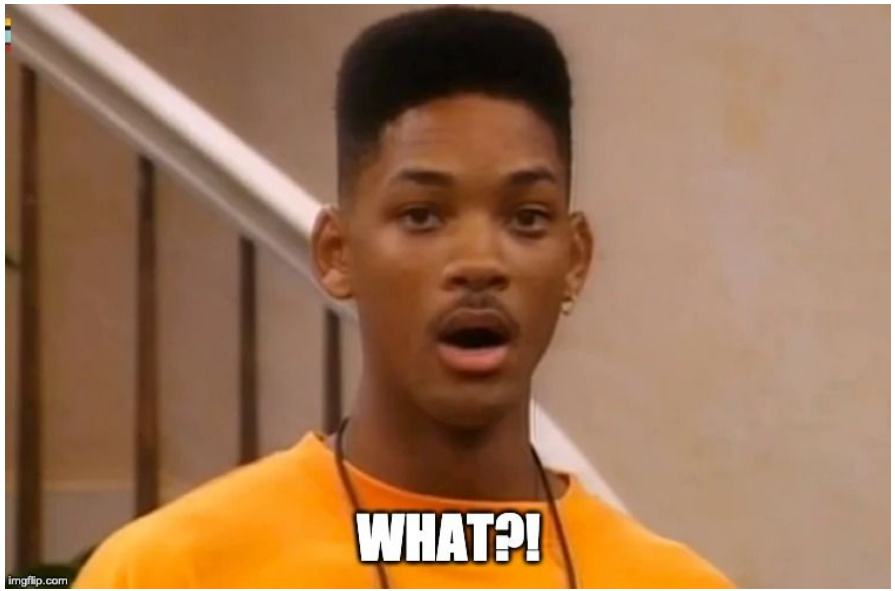
- Scopes are restrictive and filtered in multiple places
- The remaining set is what's available for a user accessing a specific application
- Scopes are enforced or required at the resource server





Concepts - Grant Types

- The three you'll use often:
  - Authorization Code
  - Client Credentials
  - Refresh Token
- Two you might hear about but should try to avoid (legacy):
  - Implicit
  - Password
- One for unique circumstances:
  - Device Code



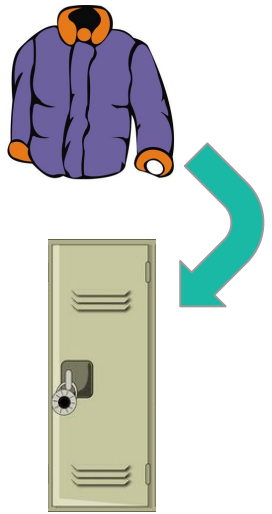
Grant Types

Grant Types - Client Credentials

Adults

- Simplest flow
- Machine-to-Machine or automated interactions
- Flow
  - Client has id & secret
  - Requests a token from the authorization server using id & secret
  - Receives access token back
- Client can now interact with the resource server
- Ex: Cloud Foundry CLI
  - Can use client credentials for automations

Kids



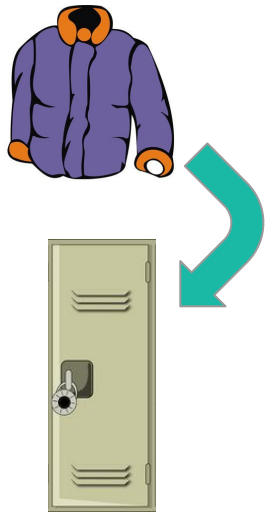
- You bring your jacket to school
  - Jacket is the resource
  - You are the resource owner
- You put it in your locker
  - The resource server
- Your locker is locked
  - The authorization server
- You forgot your key and need your coat
  - Janitor (client) has keys (id/secret), opens lock (get tokens), gets your coat for you (resource).

Grant Types - Password

Adults

- Also a simple flow
- Client obtains actual password ****INSECURE****
- Flow
  - Client obtains user's credentials
  - Requests a token from the authorization server with user's and client's credentials
  - Receives access token back
- Client can now interact with the resource server
- Ex: Cloud Foundry CLI
  - Default mode of authentication

Kids



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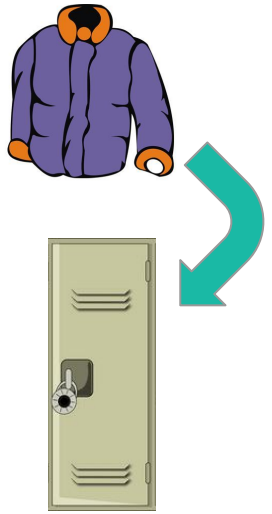
  - Jacket is the resource
  - You are the resource owner
- You put it in your locker
  - The resource server
- Your locker is locked
  - The authorization server
- You need your friend to get your coat
  - Your Friend (client) gets your combination (credentials), opens lock (gets token), gets your coat for you (resource).

Grant Types - Authorization Code

Adults

- Slightly more complicated
- Confidential, secure - browser based
- Flow
  - Client App redirects user's browser to authorization server
  - User logs in and approves client access
  - User's browser is redirected back to client app with an authorization code
  - Client app uses authorization code to get access and refresh tokens
- Client can now interact with the resource server

Kids



- You bring your jacket to school
  - Jacket is the resource
  - You are the resource owner
- You put it in your locker
  - The resource server
- Your locker is locked
  - The authorization server
- You want to lend your jacket to your friend
  - Your friend (client) sends you to your locker (redirect), you enter combination (login), put a different lock on locker, give friend code to that lock (auth code), friend opens lock (tokens), able to borrow your jacket (resource)

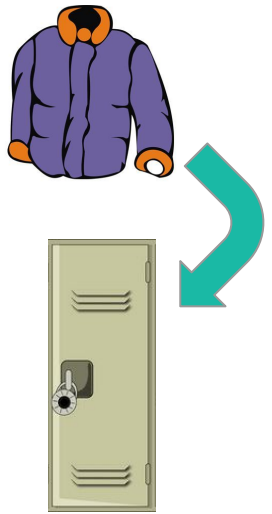
Demo

Grant Types - Implicit

Adults

- Less complicated variation on Authorization Code
- No authorization code, just returns access token ****INSECURE****
- Flow
  - Client App redirects user's browser to authorization server
  - User logs in and approves client access
  - User's browser is redirected back to client app with an access token
- Client can now interact with the resource server

Kids



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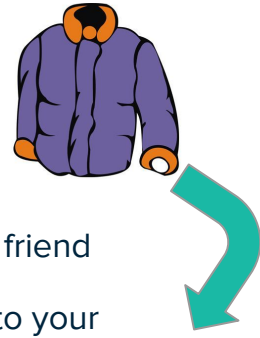
  - The resource server
- Your locker is locked
  - The authorization server
- You want to lend your jacket to your friend
  - Your friend (client) sends you to your locker (redirect), you enter combination (login), locker open (tokens), friend gets access, able to borrow your jacket (resource)

Grant Types - Authorization Code w/PKCE

Adults

- Extension to Authorization Code
- Flow
  - Client App redirects user's browser to authorization server **and includes a secret (cryptographically random string)**
  - User logs in and approves client access
  - User's browser is redirected back to client app with an authorization code
  - Client app uses its secret plus the authorization code to get access and refresh tokens
- Client can now interact with the resource server

Kids



- Scenario is the same as with Authorization Code
- You want to lend your jacket to your friend
  - Your friend (client) sends you to your locker (redirect) and includes a secret
  - You enter combination (login)
  - You put a different lock on locker, the combination is half one you make and half the secret code from your friend
  - You give your friend your half of the combination to that lock (auth code)
  - Your friend opens the lock (tokens) and is able to borrow your jacket (resource)

Demo

Grant Types - Device Code

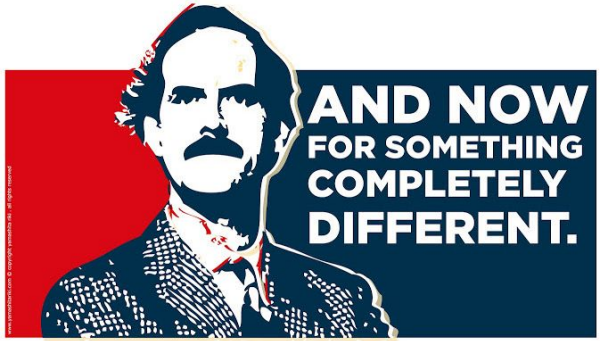
Adults

- Browserless or input constrained clients
- Flow
  - Client App requests a device code from Authorization Server
  - Client instructs user to visit url, login & enter the device code
  - Client polls the token endpoint to wait for the user to enter the code
  - Client gets `authorization_pending` until the user enters the device code. Gets access code after user enters device code.
- Client can now interact with the resource server

Kids

- You want lunch, but Lunch lady (client) must confirm who you are to know if you get lunch
- Lunch Lady calls down to the office and requests a token (device code), gives it to you.
- You must take the token (device code) to the office and prove your identity (login)
- Lunch Lady calls back to the office and asks if you've used the token. Continues calling until you use the token.
- Once used, the office tells the lunch lady it's OK to give out a lunch (access token)

OpenID Connect



Or Not...

- OpenID Connect is an extension to OAuth2
  - Provide authentication (i.e. identity) on top of OAuth2
  - Introduces ...
    - JWT (JSON Web Token) standard token format
    - An ID token with private information identifying the user (not an access token, not used for accessing resources)
    - Some standard scopes like openid, profile, email, etc..
    - Some standard endpoints like /login, /token and /userinfo
    - And other things like discovery, logout, etc...
  - Still has all the OAuth2 Goodness

OpenID Connect Authorization Code

Adults

- Should look very familiar...
- Confidential, secure - browser based
- Flow
  - Client App redirects user's browser to authorization server
  - User logs in
  - User's browser is redirected back to client app with an authorization code
  - Client app uses authorization code **to get an id token**
- Hybrid flow variation where you get id token and an access token

Kids

- You are in line for lunch
- Lunch lady (client) must confirm who you are to know if you get lunch
- Sends you (redirect) to the Office (authorization server)
- You prove your identity (login) in the office and are sent back to the lunch lady with a number
- The lunch lady takes your number (authorization code) to the Office and gets an envelope with your id (id token)
- The lunch lady knows you are you and gives you lunch.

Demo

How to enable your Apps

How to Implement?

- DIY? NO!!
  - Oauth2 & OpenID Connect look easy enough on the surface, it's tempting...
    - But there's enough complication and nuance it's not worth it
    - Plus, it's security. It's high stakes.

- **Use a Library!!!**
  - There are plenty available in your language of choice
    - Java
      - Spring Security & Others
    - Dotnet
      - ASP .Net Core Authentication, Steeltoe Security Providers & Others
    - Node.js, Python, Golang and Others
  - Keys in a Library:
    - Look for one that is well maintained and standards compliant
    - Do your homework and investigate. It's worth a little effort to pick the right library for your app

Demo

Resources

- Oauth2 Reference - https://oauth.net/2/
- Oauth Playground - https://www.oauth.com/playground/index.html
- JWT Token Decoder - https://jwt.io/
- Java & Spring Security
  - Docs - https://docs.spring.io/spring-security/site/docs/5.2.2.BUILD-SNAPSHOT/reference/htmlsingle/#spring-security-oauth2-core
  - Samples - https://github.com/spring-projects/spring-security/tree/master/samples/boot
- Dotnet Core
  - https://developer.okta.com/blog/2019/07/12/secure-your-aspnet-core-app-with-oauth
  - https://github.com/oktadeveloper/okta-aspnet-oauth2-starter-example.git
- Static Apps
  - https://github.com/zmartzone/mod_auth_openidc
- Authorization Server
  - UAA - https://github.com/cloudfoundry/uaa
  - UAA Client - https://github.com/cloudfoundry-incubator/uaa-cli/releases
  - KeyCloak - https://www.keycloak.org/

Questions?