Team A3 - LiftOff

Add your 12 slides after this slide… [remember, 12 min talk + 3 min Q/A]

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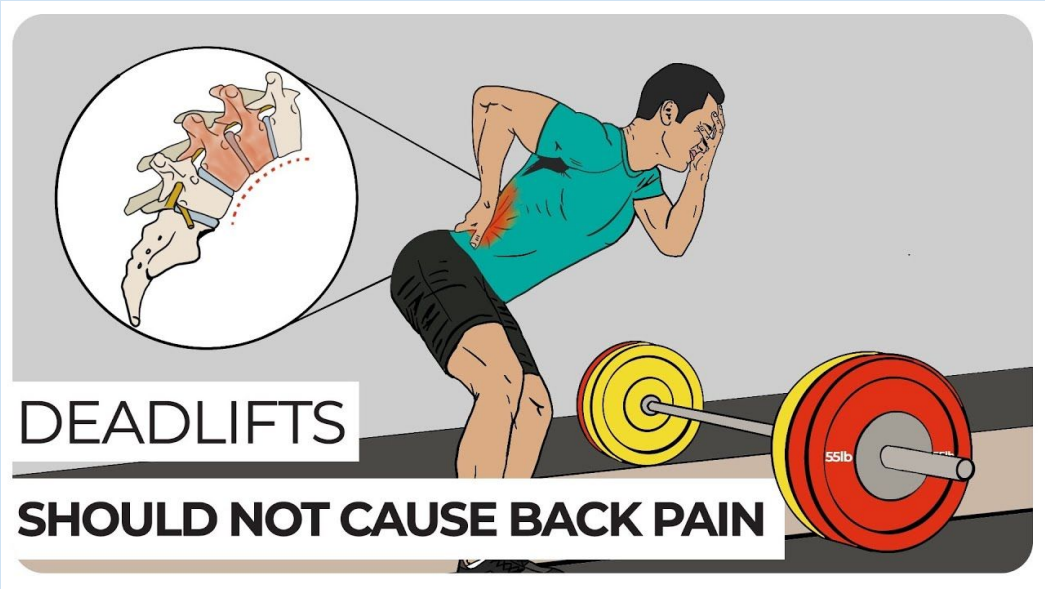
Make sure to cover
(refer to the Design Review Guidance):

- Use Case / Application
- Use-Case Requirements, especially quantitative
- Solution Approach (include Design Requirements here)
- System Specification / Block Diagram
- Implementation Plan (include Design Trade Study(ies) here; i.e why choose that implementation)
- Test, Verification and Validation Plans (including quantitative metrics with target values)
- Project Management

Consider that this slide already works as a introduction slide so use your first slide wisely

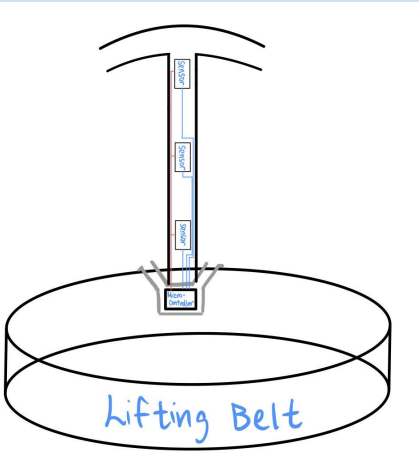
The Problem



Common gym lifts have high potential for back injury when done incorrectly. This creates a barrier to entry for people without gym experience.

Solution Approach

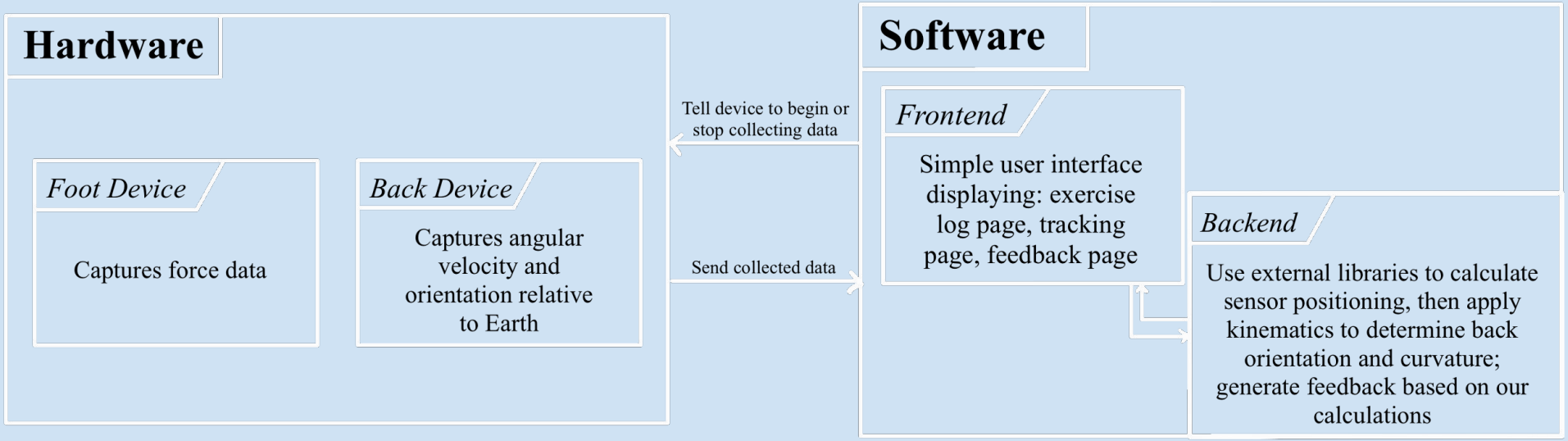
- Wearable devices that connects to a mobile app
- The devices will:
  - Be worn over or without clothing
  - Track the user's spine orientation and curvature
  - Determine the weight the user is carrying
  - Send data to the app
- On the app, users can:
  - Learn how to do different exercises
  - Check if they did the movement correctly
  - Track their progress



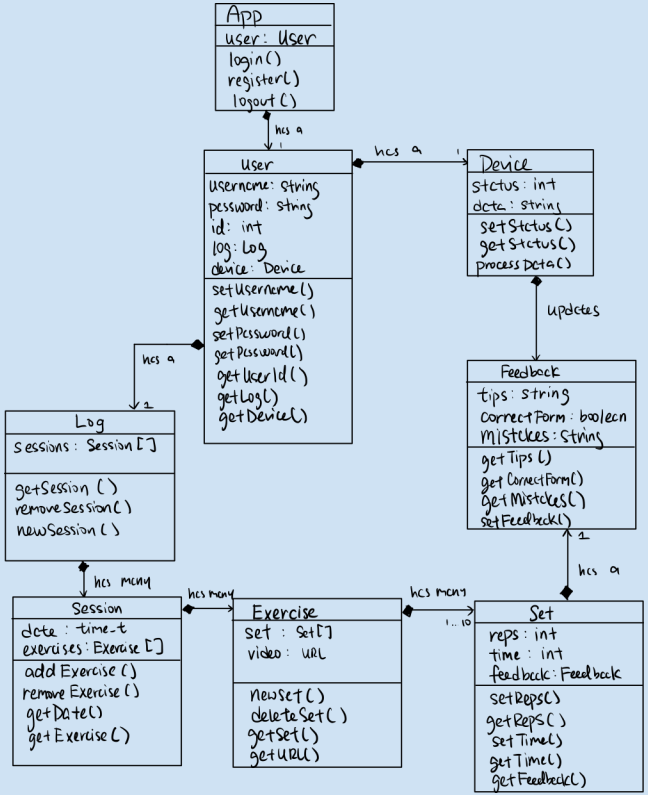
Use-Case Requirements

Use Case Requirement	Quantified Requirement
Back orientation and arch detection	Classify back orientation via back angle relative to earth Classify presence of arch (yes or no) 90% classification accuracy
Weight detection	Able to withstand and measure up to 200 kgs
Easy/Simple Set up	< 2 minutes to set up
Small Form Factor For Primary Computer	< 2.5inches to fit on a weight lifting belt
Water/sweat resistant	Sensors must be water / sweat resistant
Battery Life/ Time between charging	At least 3 hour battery life
Informative / Actionable Feedback	Must give correct feedback
Data Tracking / Logging	Record amount of weight used (kg or lb)

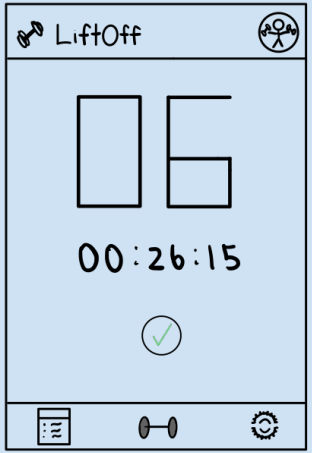
System Specification



System Specification: App Design

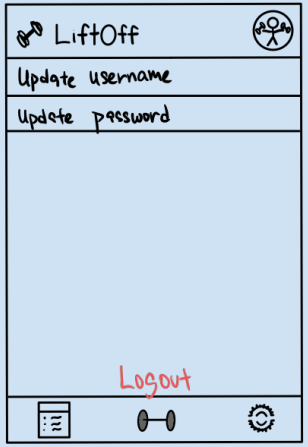


Tracking Page

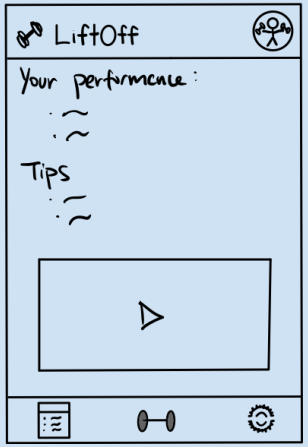


Log Page

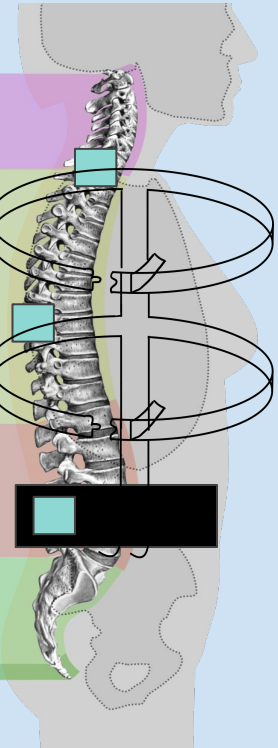
User Profile & Settings



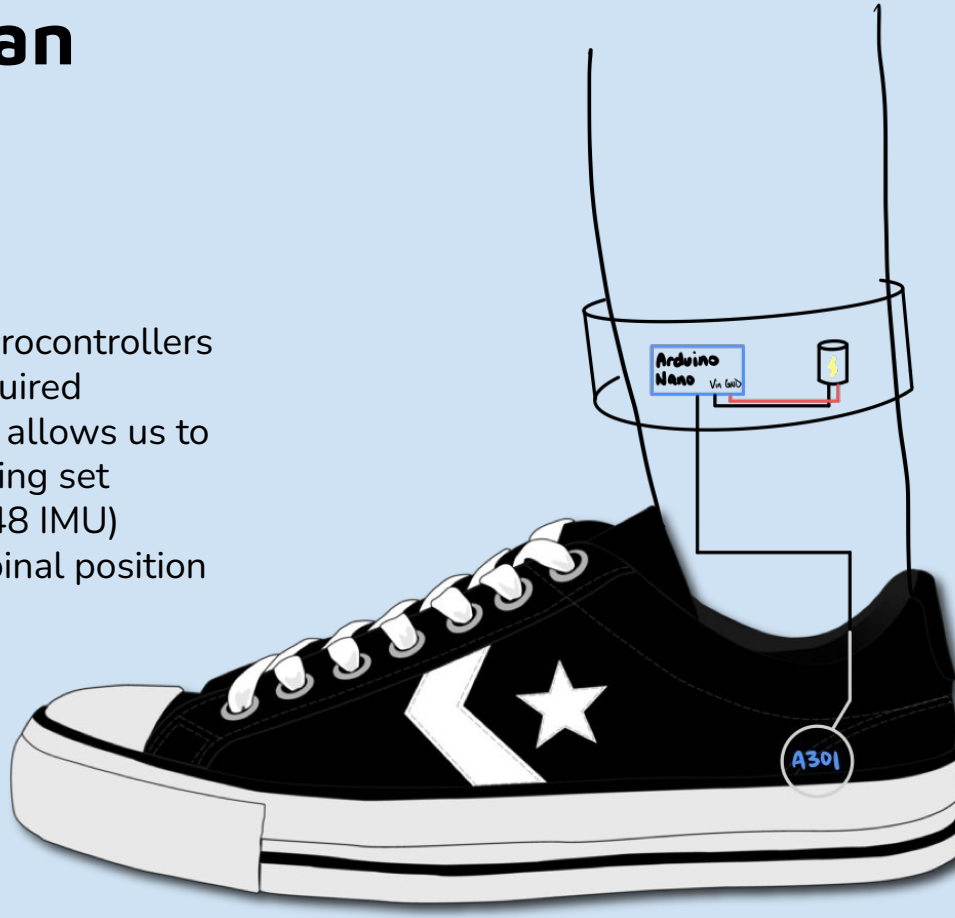
Feedback



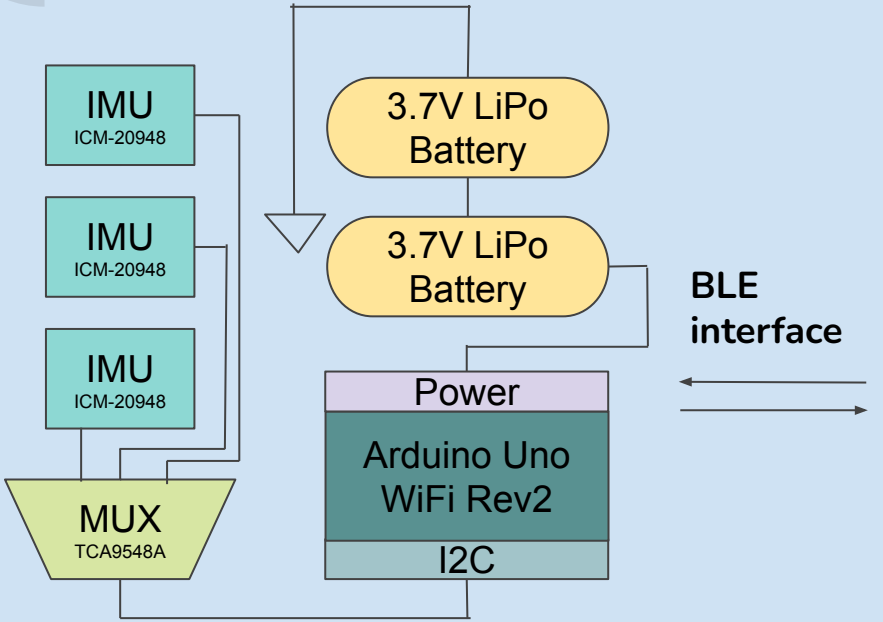
Implementation Plan



- BLE compatible
  - BLE enabled Arduino microcontrollers
- Rechargeable battery units required
- Force Sensitive Resistor(A301) allows us to capture the weight of the working set
- Inertial Motion Units(ICM-20948 IMU) allows us to capture relative spinal position

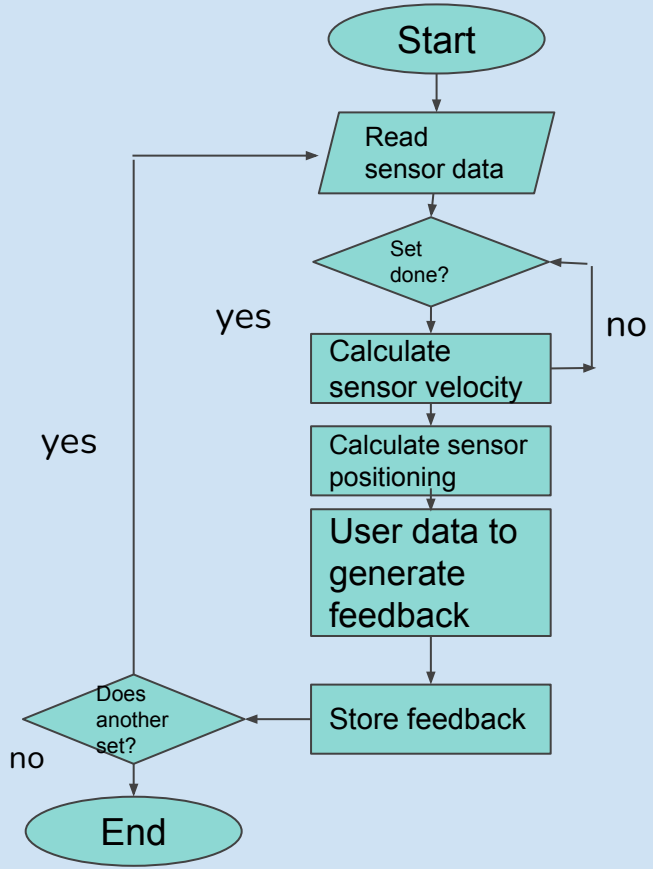


Implementation Plan



Hardware Block Diagram

BLE interface



Software Block Diagram

Implementation Plan

	Hardware	**Detection Algorithim**	**Software**
Copying/Buying	IMUs, FSR, Arduino		Using Flutter
Downloading	Potential BLE library	Quaternion Libraries	Graphing libraries to track progress/data
Assembling	Self assembled	Interfacing with BLE	
Developing	Data collection and forwarding via BLE	Analyzing data points to classify into relative positions	All app pages and interactions

Testing, Verification and Metrics

Use Case Requirement	Testing Plan
Back orientation and arch detection	Hold back in different positions and check data produced by sensors is consistent. Do this with various sensor placements on back, and with people of different heights.
Weight detection	Carry different weight loads and ensure values measured are precise and consistent
Water/sweat resistant	Do research, buy sweat resistant sensors. Sweat with wearable on, check that readings stay consistent through same motions

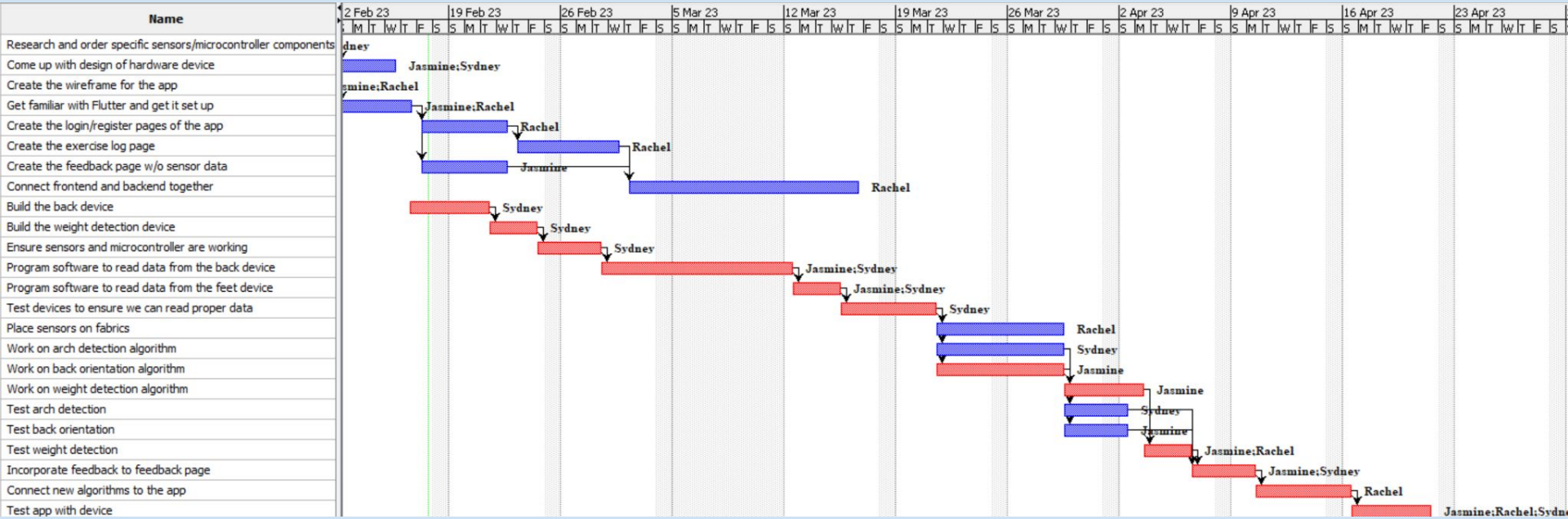
Testing, Verification and Metrics Pt. 2

Use Case Requirement	Testing Plan
Battery Life/ Time between charging	Power our system on, and wait until it dies.
Informative / Actionable Feedback	Provide our own data to ensure conditional coverage such that feedback matches data received
Data Tracking / Logging	Use branch coverage to ensure that when we are counting reps or tracking time, everything is correctly updated
Easy/Simple Set up	Have someone unfamiliar with our project follow set up instructions, time how long it takes.

Tasks & Division of Labor

Sydney (Hardware/Sensors)	Jasmine (Detection Algorithm)	Rachel (App Interface)
Determine specific sensors/microcontroller to use that can work together	Create wireframe of the app	Attach sensors onto fabrics
Connect the sensors and microcontroller together	Create the feedback page	Create the login page and register page
Develop software that can read the data from the microcontroller	Work on back orientation + arch algorithm	Create the exercise log page
Test sensor data collection	Test program with the device	Connect front and backend
Work on foot pressure side of the algorithim	Map user feedback we will provide to data received	Test entire app to ensure everything works together

Schedule


Name
Research and order specific sensors/microcontroller components
Come up with design of hardware device
Create the wireframe for the app
Get familiar with Flutter and get it set up
Create the login/register pages of the app
Create the exercise log page
Create the feedback page w/o sensor data
Connect frontend and backend together
Build the back device
Build the weight detection device
Ensure sensors and microcontroller are working
Program software to read data from the back device
Program software to read data from the feet device
Test devices to ensure we can read proper data
Place sensors on fabrics
Work on arch detection algorithm
Work on back orientation algorithm
Work on weight detection algorithm
Test arch detection
Test back orientation
Test weight detection
Incorporate feedback to feedback page
Connect new algorithms to the app
Test app with device
2 Feb 23
19 Feb 23
26 Feb 23
5 Mar 23
12 Mar 23
19 Mar 23
26 Mar 23
2 Apr 23
9 Apr 23
16 Apr 23
23 Apr 23
Jasmine;Sydney
Jasmine;Rachel
Rachel
Jasmine
Sydney
Jasmine;Sydney
Jasmine;Sydney
Sydney
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