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Challenge

Developing Field Applications for either Autonomous or Personal Devices presents a few challenges as these applications face different conditions than Urban Applications.

These challenges will be referred to as “Issues” in this challenge. Participants are welcome to pick one or more of these issues and create a solution that partially or completely addresses them. (Please take a look at the Evaluation Criteria section for more information on how solutions and approaches will be evaluated).

Due to its complexity, the issue of Field Applications handling when Devices wander outside of Internet Connectivity Zones – and conflict resolution during synchronization once they regain internet access – is out of scope.

Issue One: Don't run out of space!

Some Field Activities demand to record Field Events in formats – such as HD video – that can consume a lot of local space on a Device.

Given Field Event information might be of rare occurrences and are necessary for accurate analysis, it is imperative to ensure that Devices don't run out of space.

Implement a mechanism to prevent Devices from running out of space while recording Field Events during Field Activities – such as detecting the rate in which the space is consumed by a Field Application and directing Autonomous or Personal Devices to the nearest Internet Availability Zone before the Device runs out of space.

Issue Two: Don't run out of battery!

Field Activities demand to record the Location of Field Events which uses the Device's GPS and this can cause the Device's battery to be depleted.

Given that Personnel relies on the Device to find their way back, it is imperative that the Device doesn't run out of battery otherwise a rescue operation would need to be carried out.

Implement a mechanism to prevent Devices from running out of battery while recording Field Events during Field Activities – such as detecting the rate in which battery is being depleted at during the usage of a Field Application and directing Autonomous or Personal Devices to the nearest Charging Station before the Device runs out of battery.

Issue Three: Map out your Replenish Zones

Devices replenish consumable resources at Internet Availability Zones and Charging Stations. We shall refer to these zones as Replenish Zones.

In the case of Internet Availability Zones, space can be recovered once all queued requests have been successfully performed, while in the case of a Charging Station, power can be recovered once a Device is fully charged.

However, while some Geographical Zones for Internet Availability Zones and Charging Stations are known in advance, there will be unreported Replenish Zones out in the Field.

As Devices discover Internet Availability Zones or Charging Stations in the Field, data about these Geographical Zones should be managed in a centralized location while allowing Devices to get a local copy of this information to use whenever a Device is outside of an Internet Availability Zone as well as updating the information to report outages in previously visited zones.

Implement a mechanism that would allow Devices to use an offline copy of a map so Devices can be directed to the nearest Replenish Zone to replenish Space or Power. This mechanism should also record updates to the map so they can be later applied to the centralized map version.

Evaluation Criteria

This challenge can be deceptively complex, as such it shall be evaluated with the following methodology.

Criteria:

- **Creativity:** How creative the approach is to solve the issues presented in the challenge.
- **Implementation Feasibility:** How feasible it would be to implement the solution at a larger scale to solve the issues presented in the challenge.
- **Degree of Implementation:** How much of the designed capabilities was implemented within the allocated period of time.

In short: Partial implementations to the issues presented in the challenge are accepted; however, while partial implementations close to being production-ready will get a better evaluation, we encourage you to be creative and innovate.

Additionally, while software solutions are preferred, we will also welcome implementations that design protocols for Device usage that will address the issues presented in the challenge.

Hints

Given that you can pick one or more issues to solve and some of them are interrelated, you can use Dependency Injection to implement a mock component that assumes such issue has been addressed by another team.

Common Hints

- Check the Glossary section for technical terms used in the challenge.
- Partial implementations that design protocols and rules for Device usage can be used in conjunction of complete or partial implementations for other issues.

- Choose the issues you work on, wisely. A good strategy will help you score more points when competing against other participants.

Hints for Issues One and Two

Issues One and Two are very similar in nature so:

- Participants could get more points if they implemented a common solution that addresses both Issues.
- Issue Three provides functionality for Issues One and Two and is a great candidate to Mock for Participants eyeing to implement solutions for at least two issues.
- Participants can assume Devices to be Android based and use Android's APIs to keep track of [location](#), [space](#) and [battery](#) usage.
- While Android APIs might allow you to capture events when a Device is running out of space or battery, these events most likely will not give enough time to reach a Replenish Zone.
- When implementing a mechanism to prevent Devices from running out of space or power, you could either implement it by mocking a component that would send an Autonomous Device instructions to head to the suggested location or by implementing an activity for Personnel to be notified and get directions to head to a suggested location.
- Personnel are expected to follow the directions to head to a suggested location, but you are welcome to add creative ways to "nudge" them if they are disregarding the suggestion.

Hints for Issue Three

Issue Three provides some building blocks for other issues, so:

- Issue Three is a great candidate to implement or mock and focus on solving other issues such as Issues One and Two.
- Issue Three wouldn't need any Dependency Injection, this simplifies implementing any solutions for it.
- Participants can assume Devices to be Android based and use Android's APIs to keep track of the Device's [location](#) and the [availability of internet connectivity](#).

Prize

Prizes will be announced by CodeRED.

Help

You can refer to the Glossary and Hints sections for help and the "Issues" within it, but if you need additional help or clarification, LYB mentors will be available for you in person (at LYB's booth) or virtually (in the LYB mentors Discord server) to provide clarification on the challenge or its hints.

Also, visit this URL for additional information: <https://tinyurl.com/32uwxjp9>

You can reach out to LYB mentors on Discord by joining the following server:

<https://discord.gg/acy4BERJ>

Glossary

Devices: Devices can be either Autonomous Devices or Personal Devices. These can be assumed to be Android based for the sake of the challenge.

Autonomous Devices: Unmanned roves or drones that can perform Field Activities on their own.

Personal Devices: Devices used by Personnel to perform Field Activities such as smartphones, tablets or smart wear.

Personnel: People using a Personal Device who use Field Applications to perform Field Activities.

Field Applications: Client Applications that are developed to help with Field Activities performed on a Device.

Field Applications face harsher conditions than Urban Applications and require more thought to enable functionality when there is intermittent Internet Connectivity and there is a power source readily available.

Urban Applications: Client Applications that are developed with an urban infrastructure in mind, which permits Devices to be in favorable conditions that allows them to be connected to power sources to recharge their batteries and Internet Connectivity is always available for them to call Online APIs.

While there might be hiccups with the urban infrastructure, these are incidents that are meant to be solved in a timely manner as opposed to being expected.

Field Activities: Activities that take place within a Field which include the following:

- Inspect Field Equipment
- Perform maintenance on Field Equipment
- Observe and record Field Events

Field Events: Events occurring in a Field that are being monitored, which could have impact on Field Equipment. Examples of such activities include:

- Weather events
- Internet availability switching on or off
- Geographical events

Field Equipment: Equipment that is deployed on a Field that could be used for monitoring field conditions or manufacturing activities. Some of this equipment could be used for edge computing and IoT.

Field: Geographical zone where Devices and Personnel would perform Field Activities that result in calling API operations that would include the following information:

- **Date and time:** Time of when a field measurement was taken
- **Location:** Location of where a field measurement was taken
- **Field related information** (At least one of the following):
 - o Audiovisual information
 - o Textual information

Geographical Zones: A zone in a geography that can be represented geometrically through geofencing (see [PostGis for examples of geofencing through geometry](#)) and can be displayed on an UI as a regional boundary (see [Google map's definition of a boundary](#))

Internet Availability Zones: Geographical Zones where internet is available and devices can perform any requests that have been queued locally. Note that internet availability zones might operate on different schedules.

Charging Stations: Geographical Zones where a device can be recharged. Note that Charging Stations tend to be inside of Internet Availability Zones but that is not always the case.

Online APIs: APIs hosted online on Vermillion that perform certain operations which might require a Date Time and a Location alongside other information derived from a Field. Most of these APIs are developed by third parties and cannot be modified to accommodate Offline Capabilities.

Client Applications: Applications that are developed with a device's SDK that connect to Online APIs to perform certain operations that could describe status of a Field by performing some observations or measurements of Field Equipment or geographic features or events occurring within the Field.

Offline Capabilities: Capabilities given to Client Applications to allow them to function under conditions where there is no Internet connectivity available. These would take the form of queued requests that are managed once that internet connectivity becomes available, with the ability to perform conflict resolution if a resource is updated by multiple users during the time the Device was off-line.

Vermillion: A cloud computing service operated by an LYB partner on Mars.