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OFFLINE MODE OF ANDROID APPS

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ABOUT ME

```
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)
```

AGENDA

- Why offline mode?
- What it takes to build an offline mode
- Architecture & Code
- Network factors
- Testing
- Bugs & how to solve them
- Wrap up

WHY OFFLINE MODE?

- Lets understand by an example
- We can’t always get connected to internet
- Mobile networks are not stable

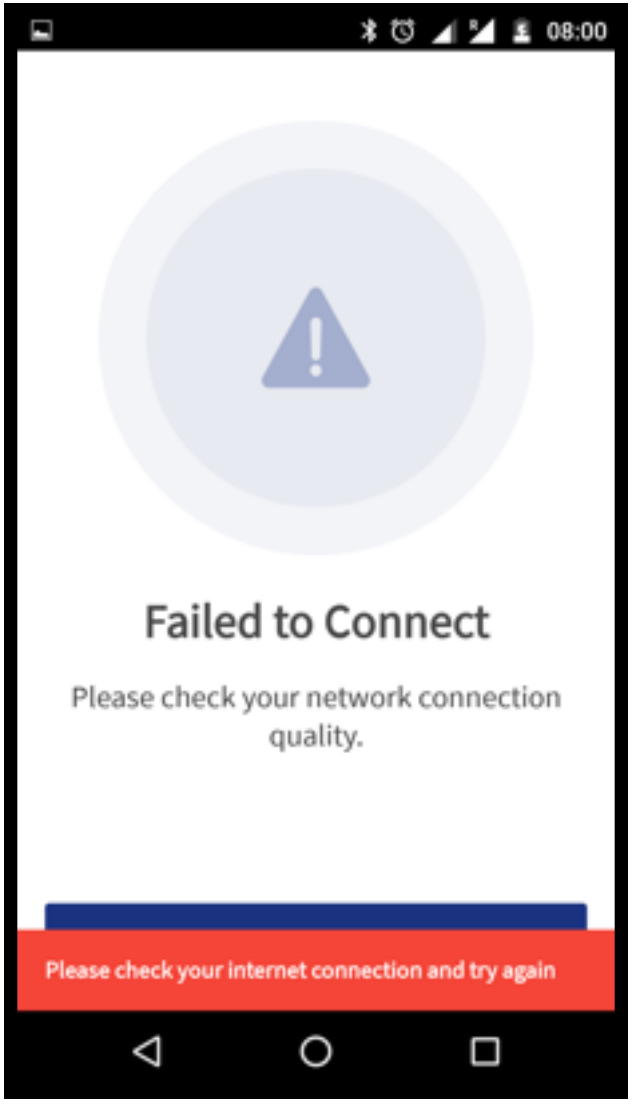
WHAT IT TAKES TO BUILD AN OFFLINE MODE

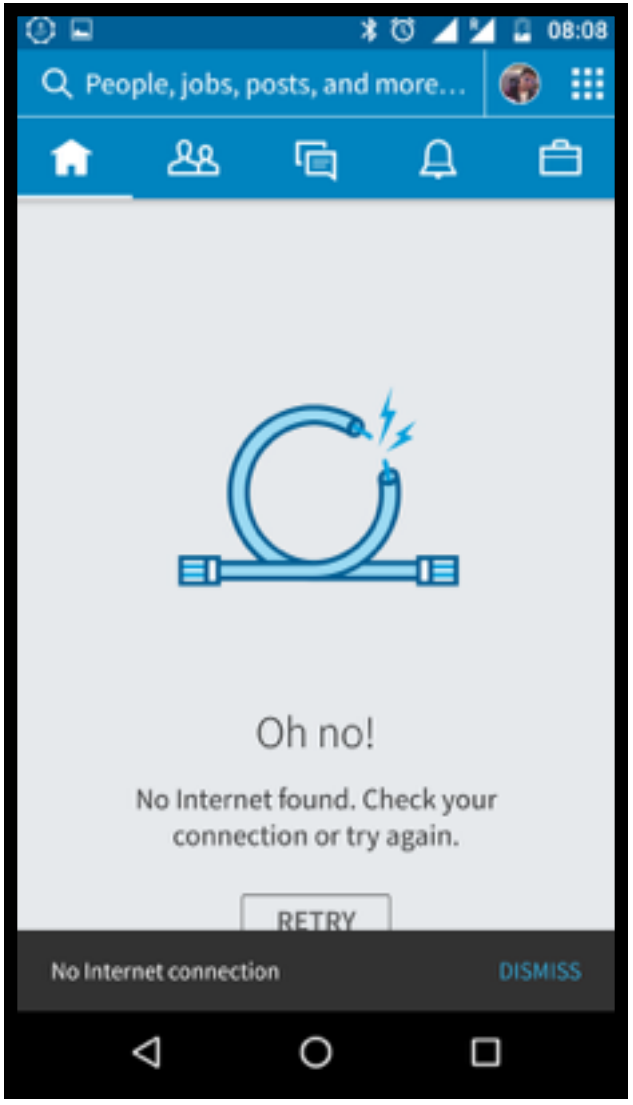
WHAT IT TAKES TO BUILD OFFLINE MODE

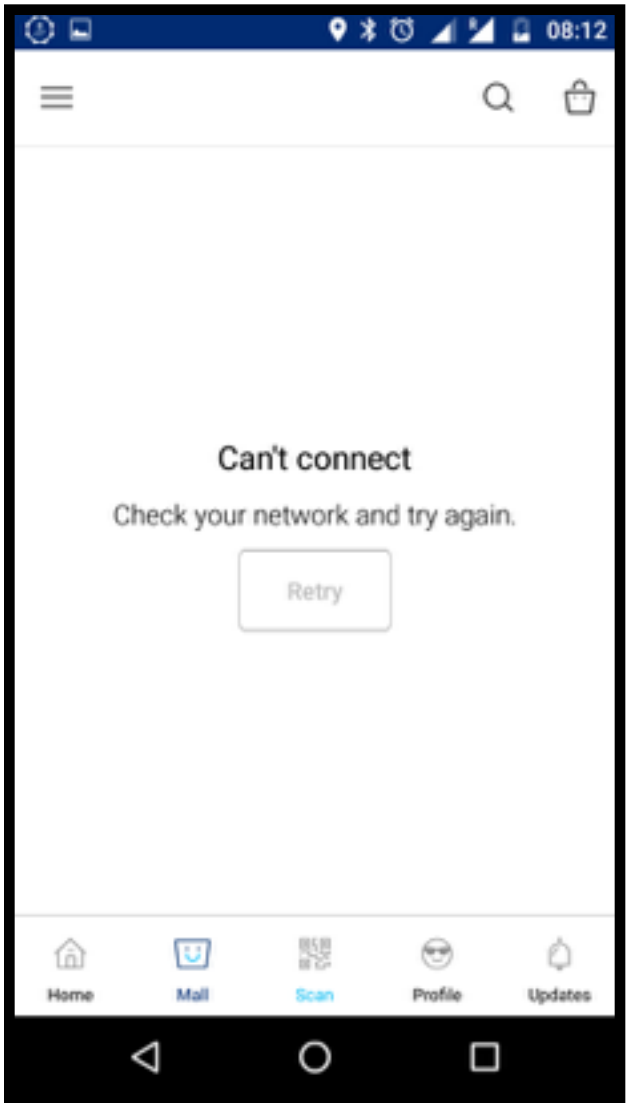
- UX
- Data
- Listening to network state updates
- Manage the network state
- Notifying user with the latest network state

USER EXPERIENCE

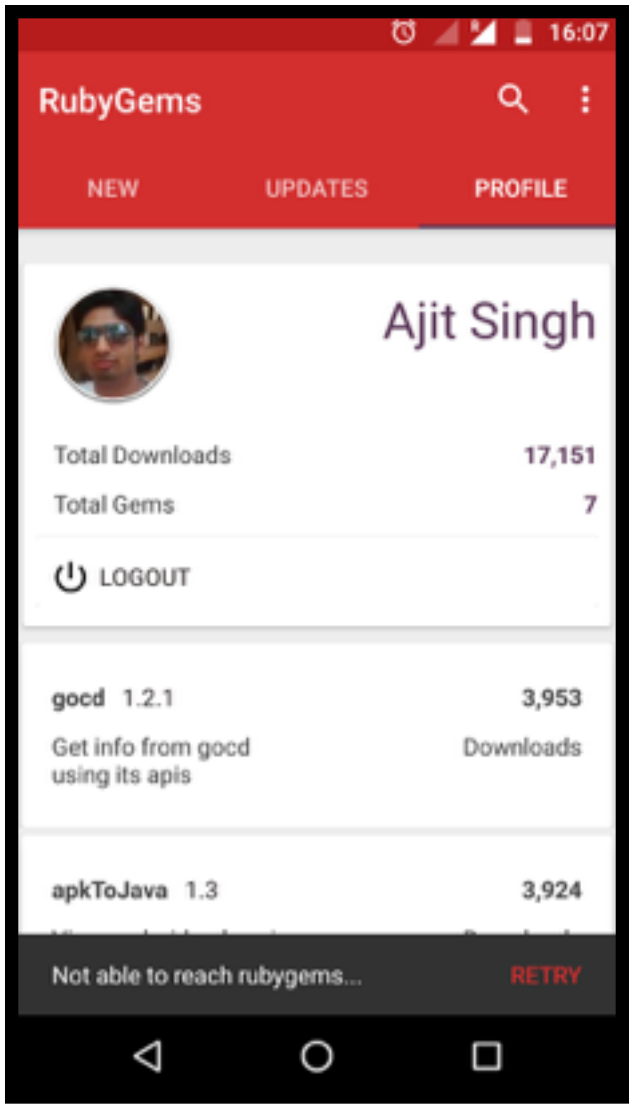
CAN NOT DO ANYTHING OFFLINE!

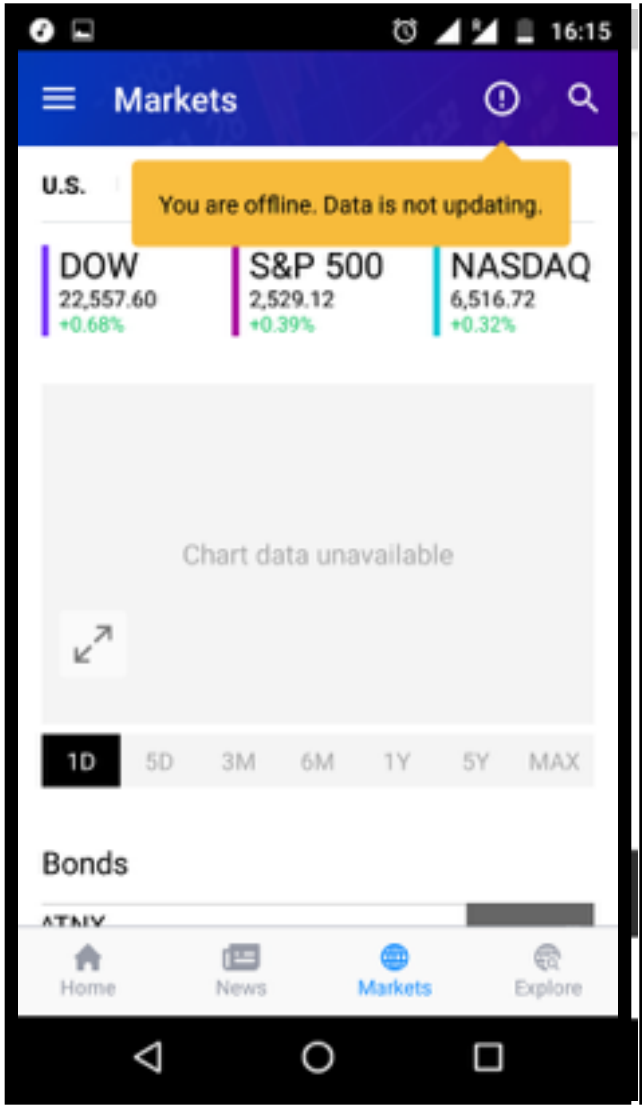


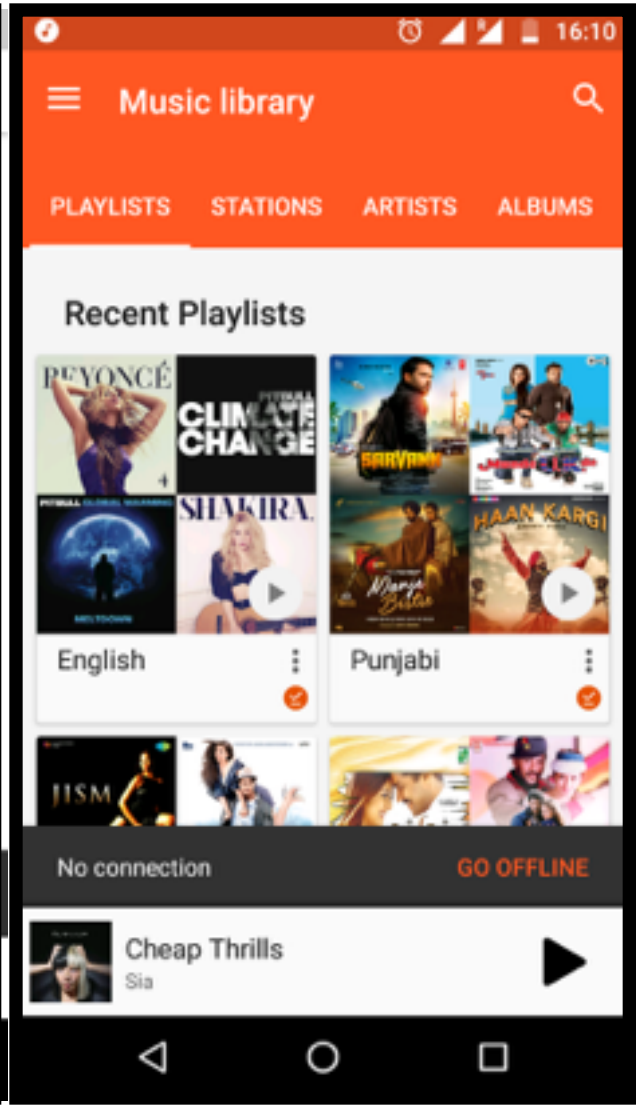




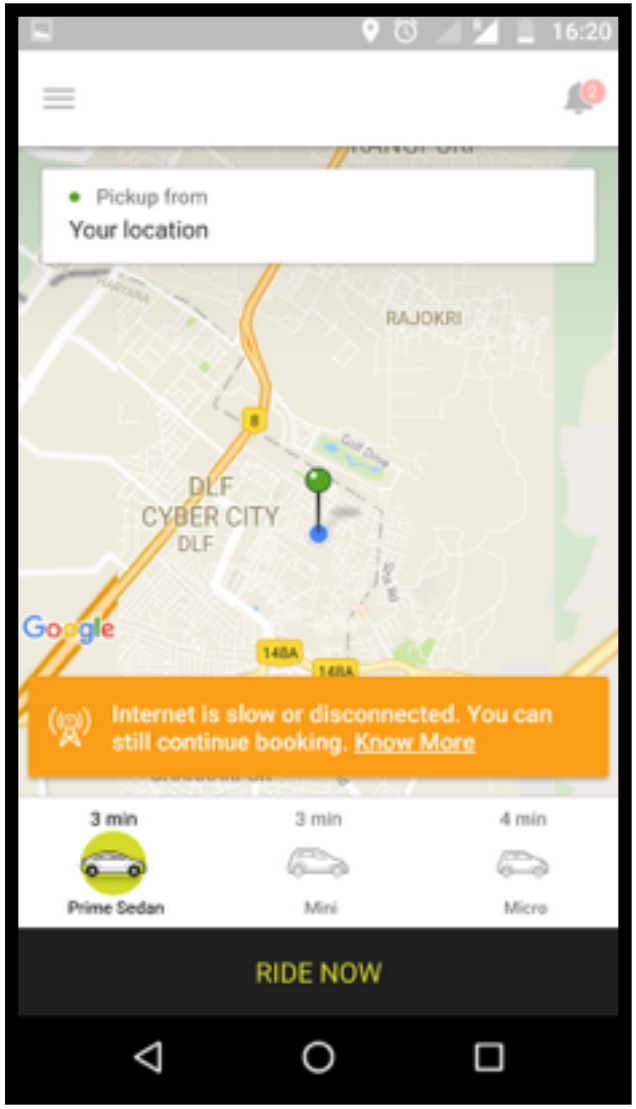
CAN DO SOMETHING!

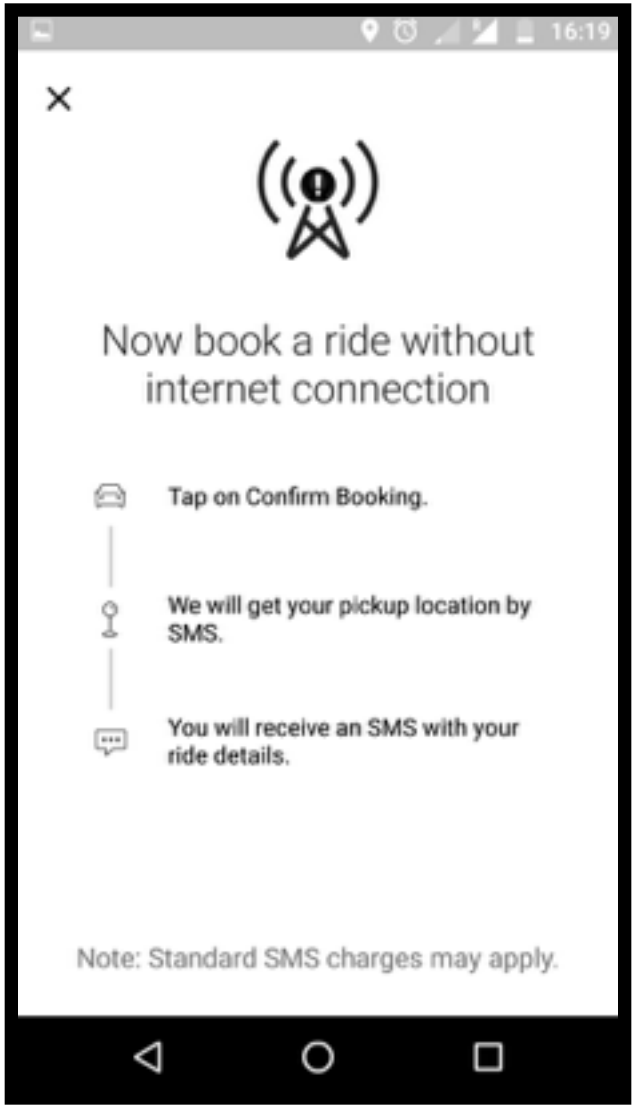


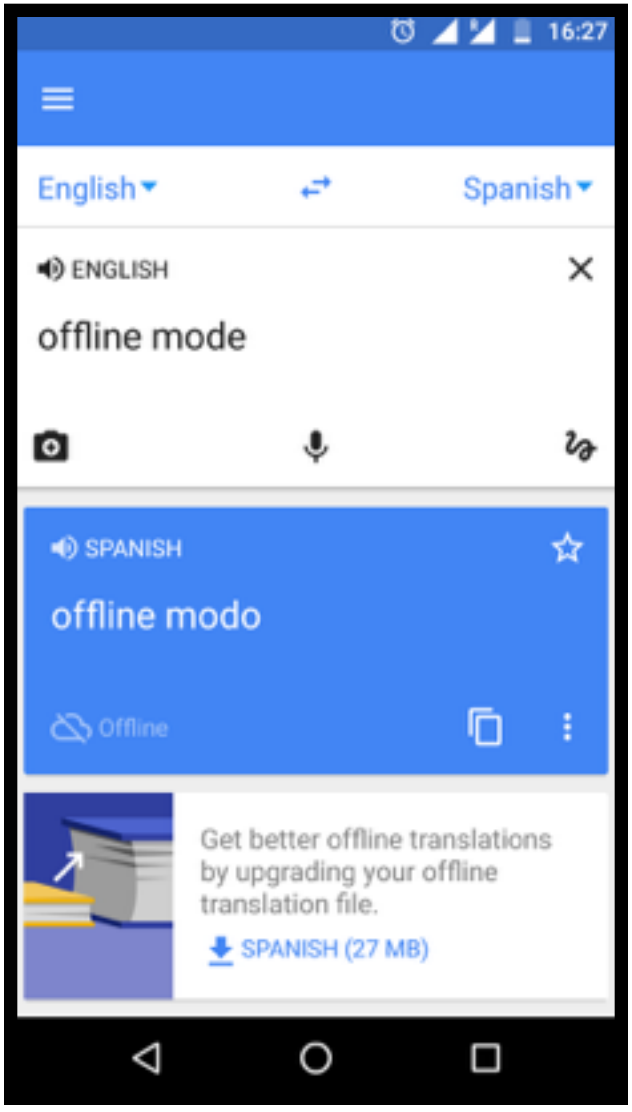




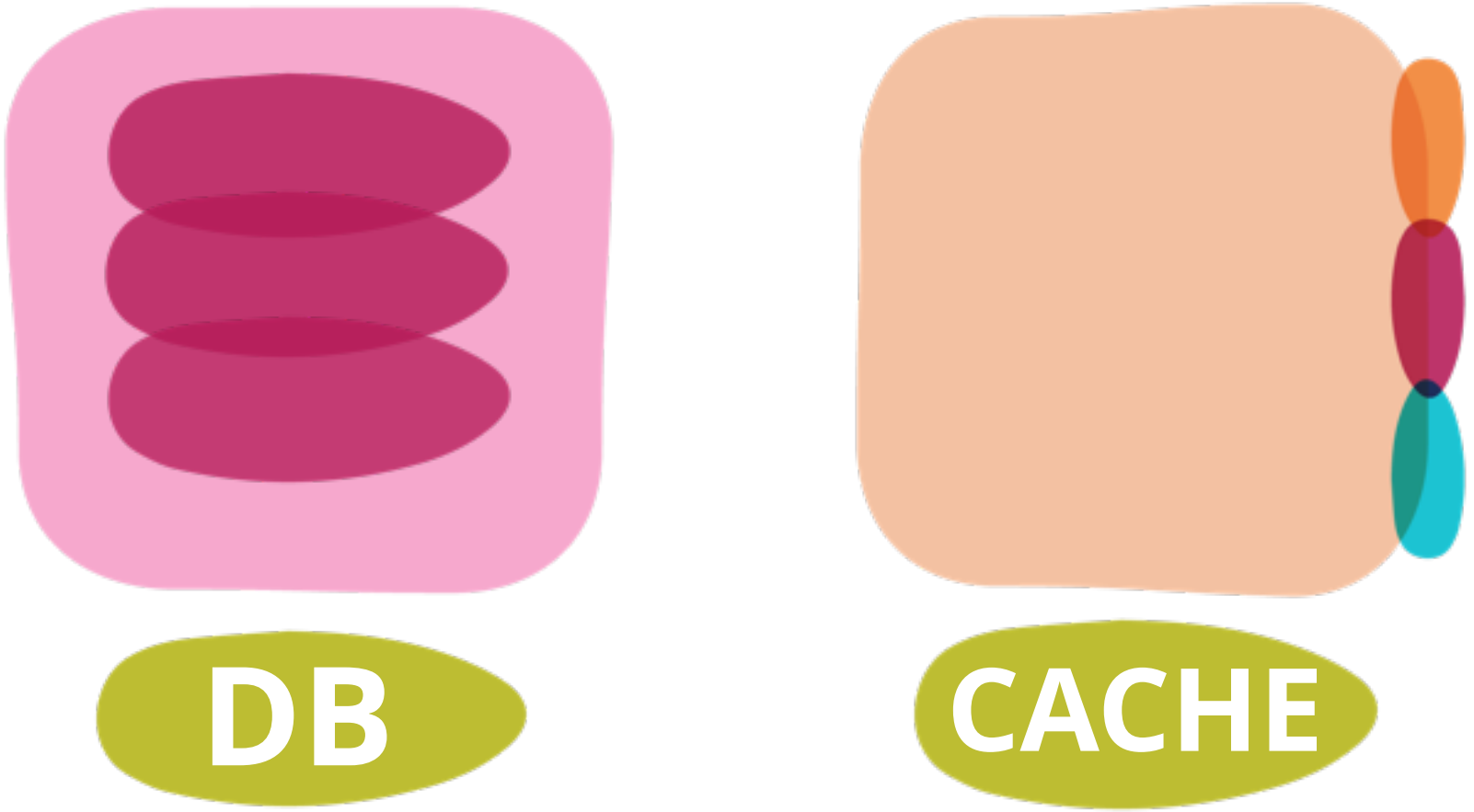
CAN DO A LOT!!


16:20
Pickup from
Your location
RAJOKRI
DLF
CYBER CITY
DLF
Google
Internet is slow or disconnected. You can still continue booking. Know More
3 min
3 min
4 min
Prime Sedan
Mini
Micro
RIDE NOW


16:19
Now book a ride without internet connection
Tap on Confirm Booking.
We will get your pickup location by SMS.
You will receive an SMS with your ride details.
Note: Standard SMS charges may apply.


16:27
English
Spanish
ENGLISH
offline mode
SPANISH
offline modo
Offline
Get better offline translations by upgrading your offline translation file.
SPANISH (27 MB)

DATA



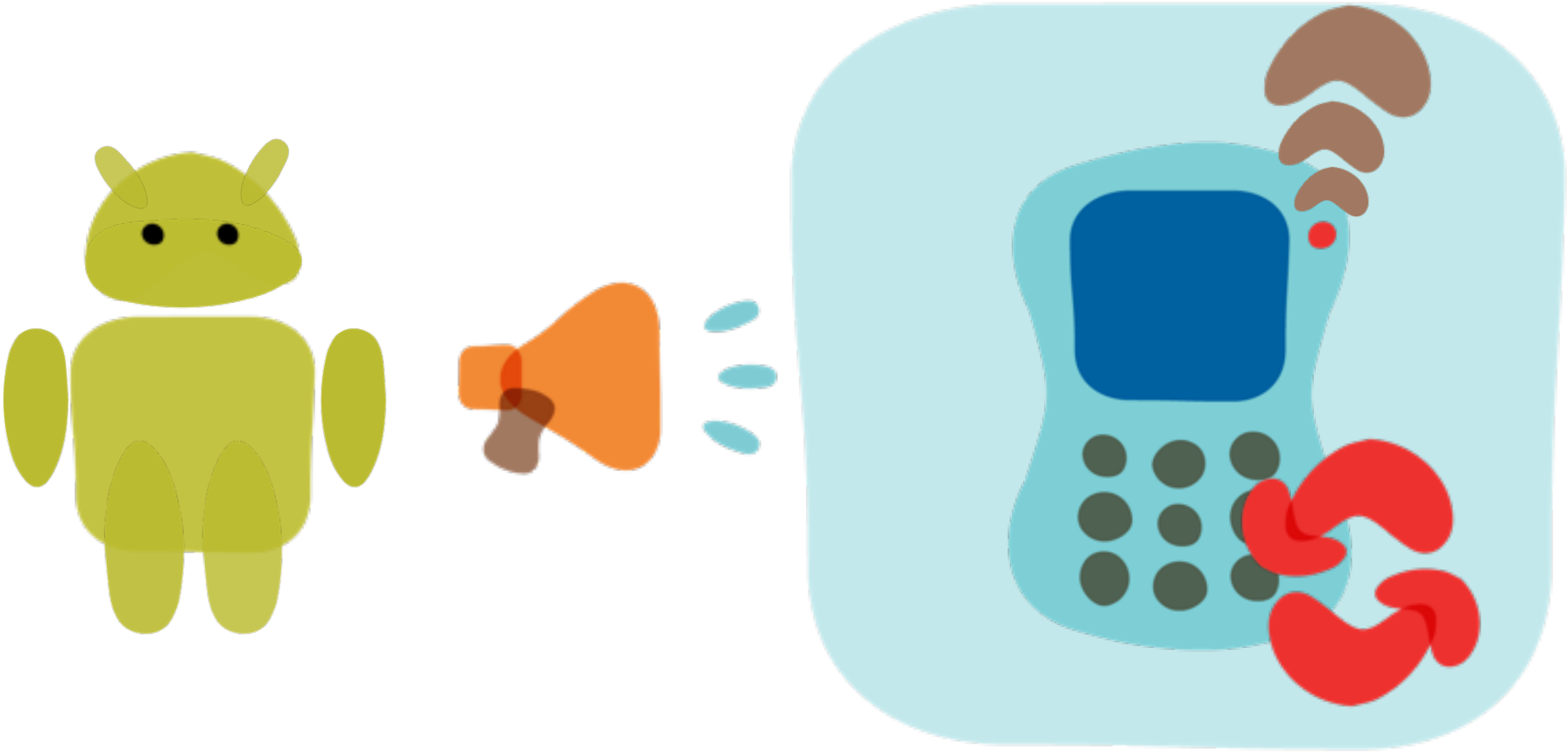
JSON files, sharedPreferences etc..

LISTEN FOR NETWORK CHANGE EVENTS

IDENTIFYING INTERNET CONNECTIVITY

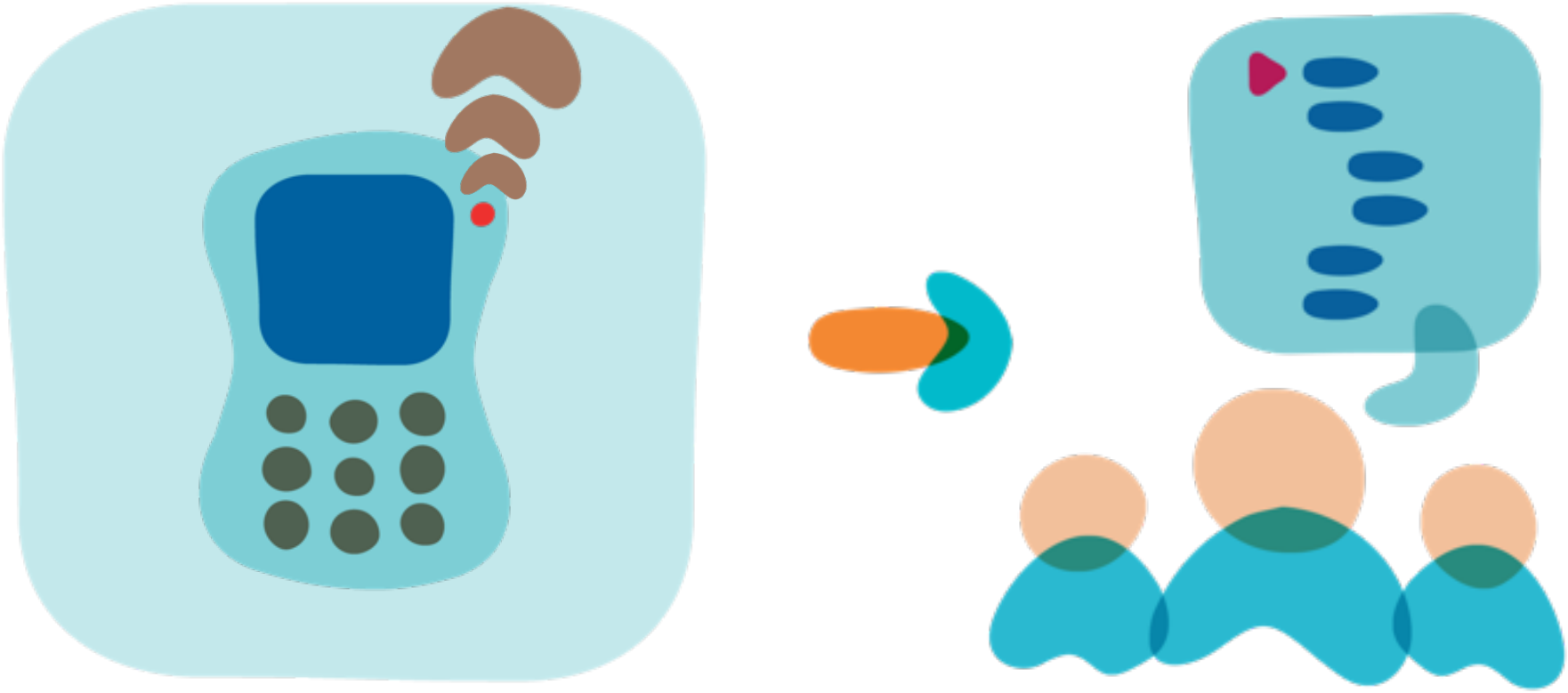
Figure out current network state using the NetworkStateIdentifier

MANAGE NETWORK STATE



Update the network state

NOTIFYING USER WITH THE LATEST STATE



Update UI using the latest network state

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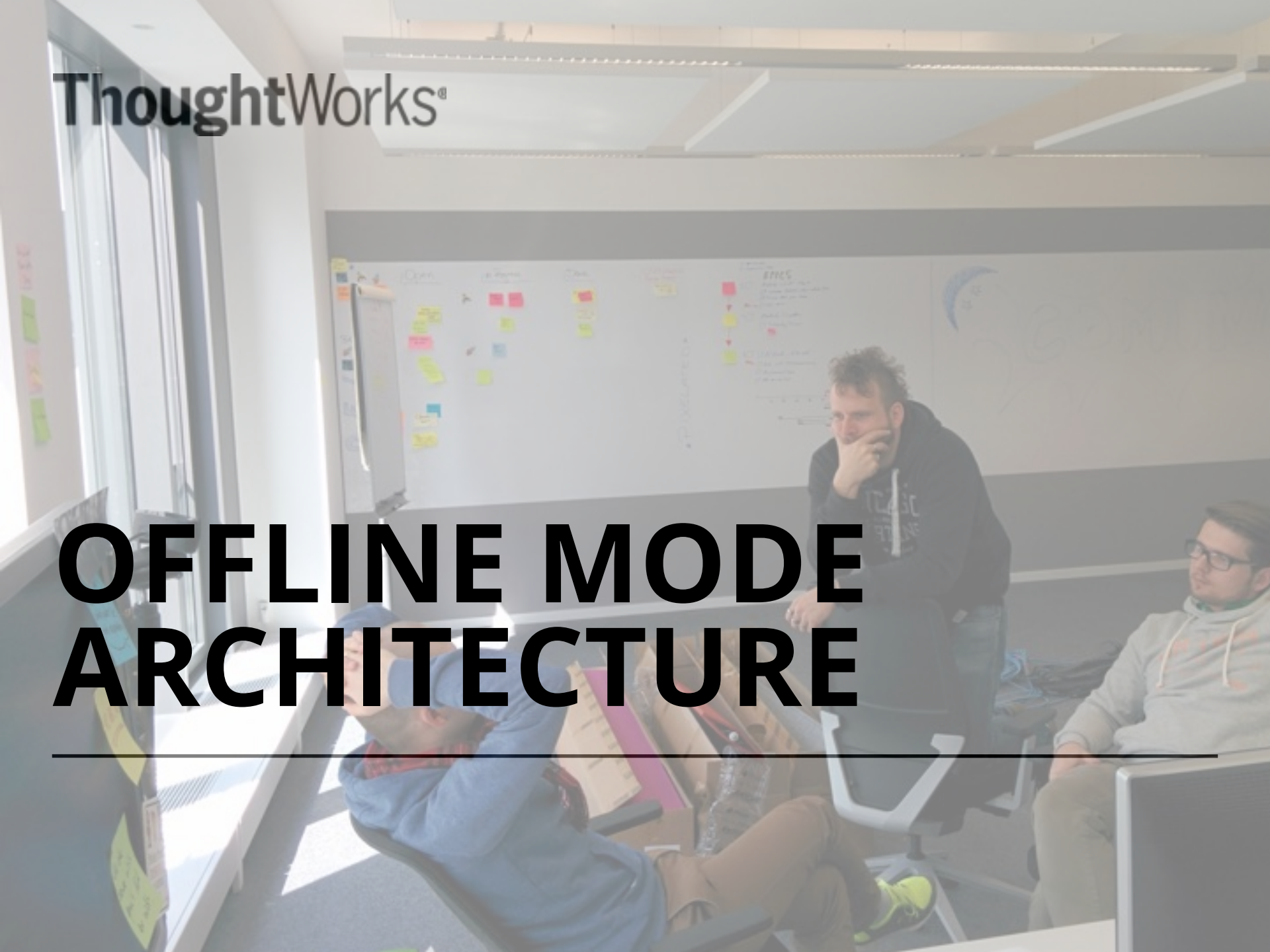
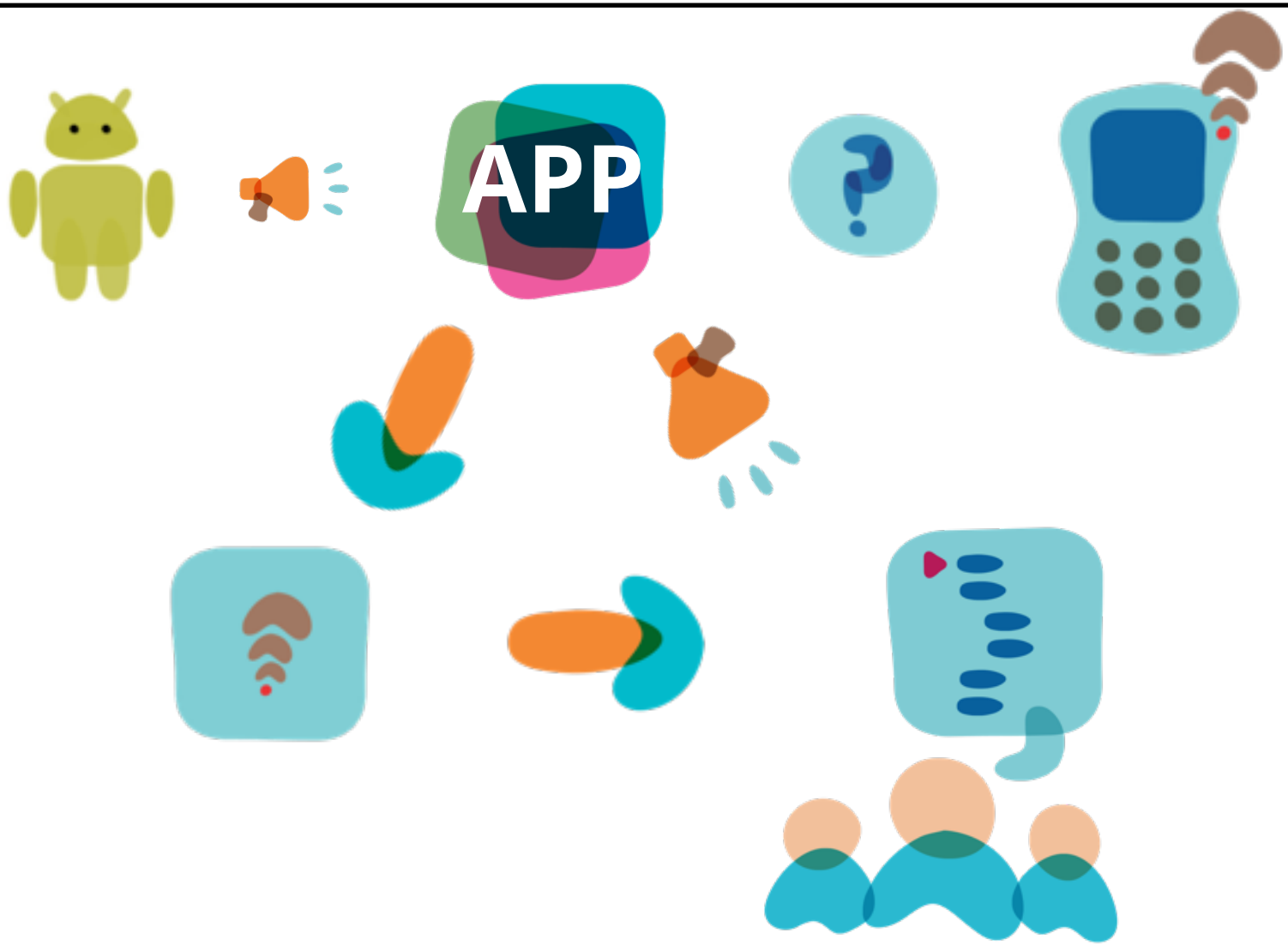


OFFLINE MODE ARCHITECTURE

ARCHITECTURE



BENEFITS OF THIS ARCHITECTURE

- Event driven architecture
- App always has the copy of latest connectivity state
- Utilising less resources
- User gets notified almost immediately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CODE

User Permission

PERMISSION TO ACCESS NETWORK STATE

```
<uses-permission
android:name="android.permission.ACCESS_NETWORK_STATE"/>
```

Registering for network status change events

LISTEN TO NETWORK CHANGE EVENT

```
<receiver
  android:name=".NetworkStateChangeReceiver"
  android:exported="false">
  <intent-filter>
    <action android:name="android.net.conn.CONNECTIVITY_CHANGE"/>
  </intent-filter>
</receiver>
```

Deprecated for Apps targeting to API 24

LISTEN TO NETWORK CHANGE EVENT BELOW API 21

```
if (belowLollipop()) {
  ctx.registerReceiver(receiver,
  new IntentFilter(CONNECTIVITY_ACTION))

  ctx.registerReceiver(receiver,
  new IntentFilter(WIFI_STATE_CHANGE_ACTION))
}
```

LISTEN TO NETWORK CHANGE EVENT BELOW API 21

```
public class NetworkStateChangeReceiver extends BroadcastReceiver {
  @Override
  public void onReceive(Context context, Intent intent) {
    networkStateManager.refresh();
  }
}
```

LISTEN TO NETWORK CHANGE EVENT FOR API 21 & ABOVE

```
NetworkCallback networkCallback = new NetworkCallback() {
  @Override
  public void onAvailable(Network network) {
    networkStateManager.refresh();
  }

  @Override
  public void onLost(Network network) {
    networkStateManager.refresh();
  }
};

cm.registerNetworkCallback(networkRequest, networkCallback);
```

Managing network state

NETWORK STATE MANAGER

```
networkStateManager.refresh();
```

```
public void refresh() {
  updateNetworkState();
  broadcastNetworkChangeIntent();
}
```

Network state identifier

NETWORK CONNECTIVITY IDENTIFIER

```
NetworkInfo networkInfo = cm.getActiveNetworkInfo();
networkInfo.isConnected();
```

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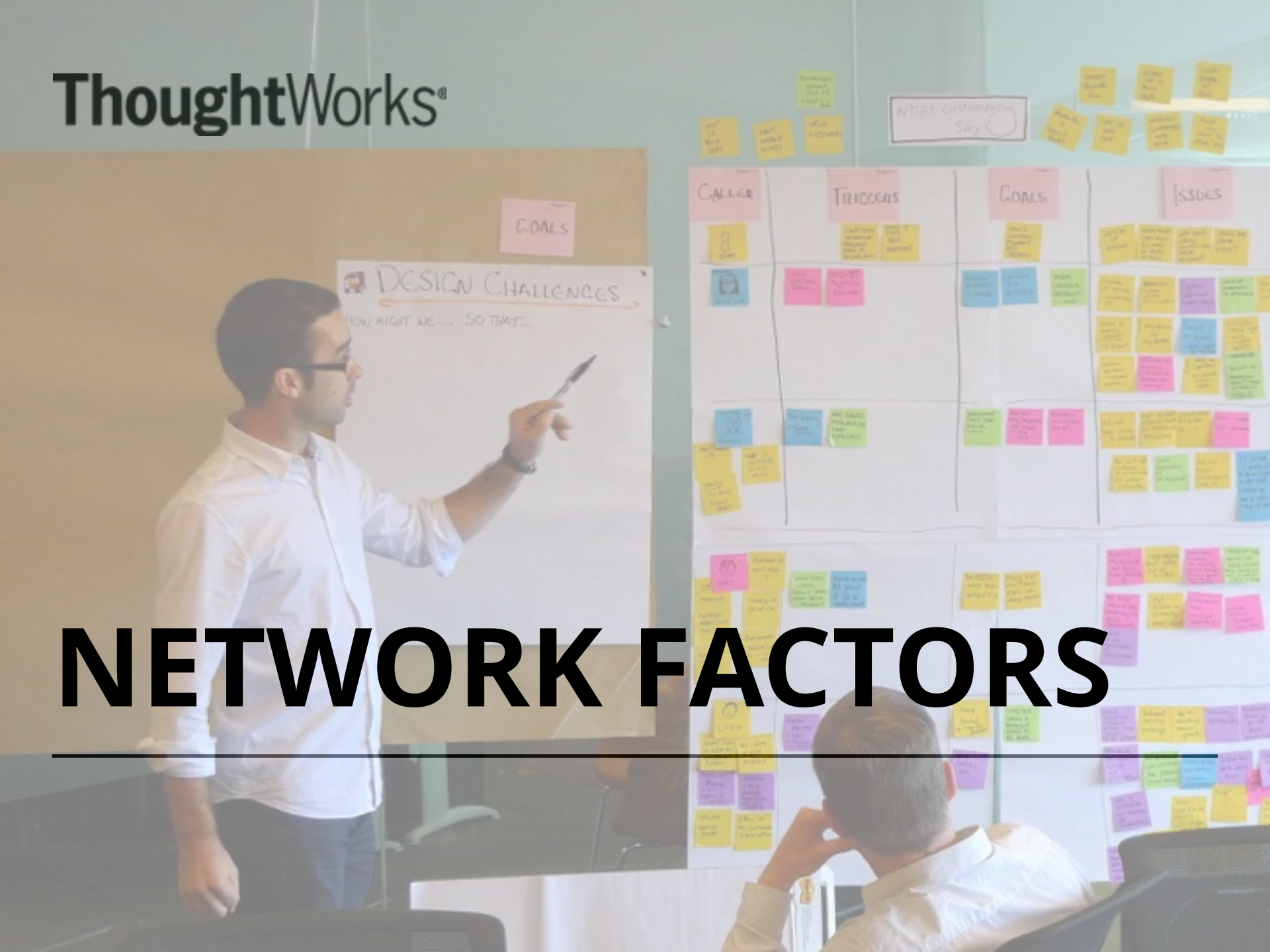


NETWORK FACTORS

NETWORK FACTORS

WiFi

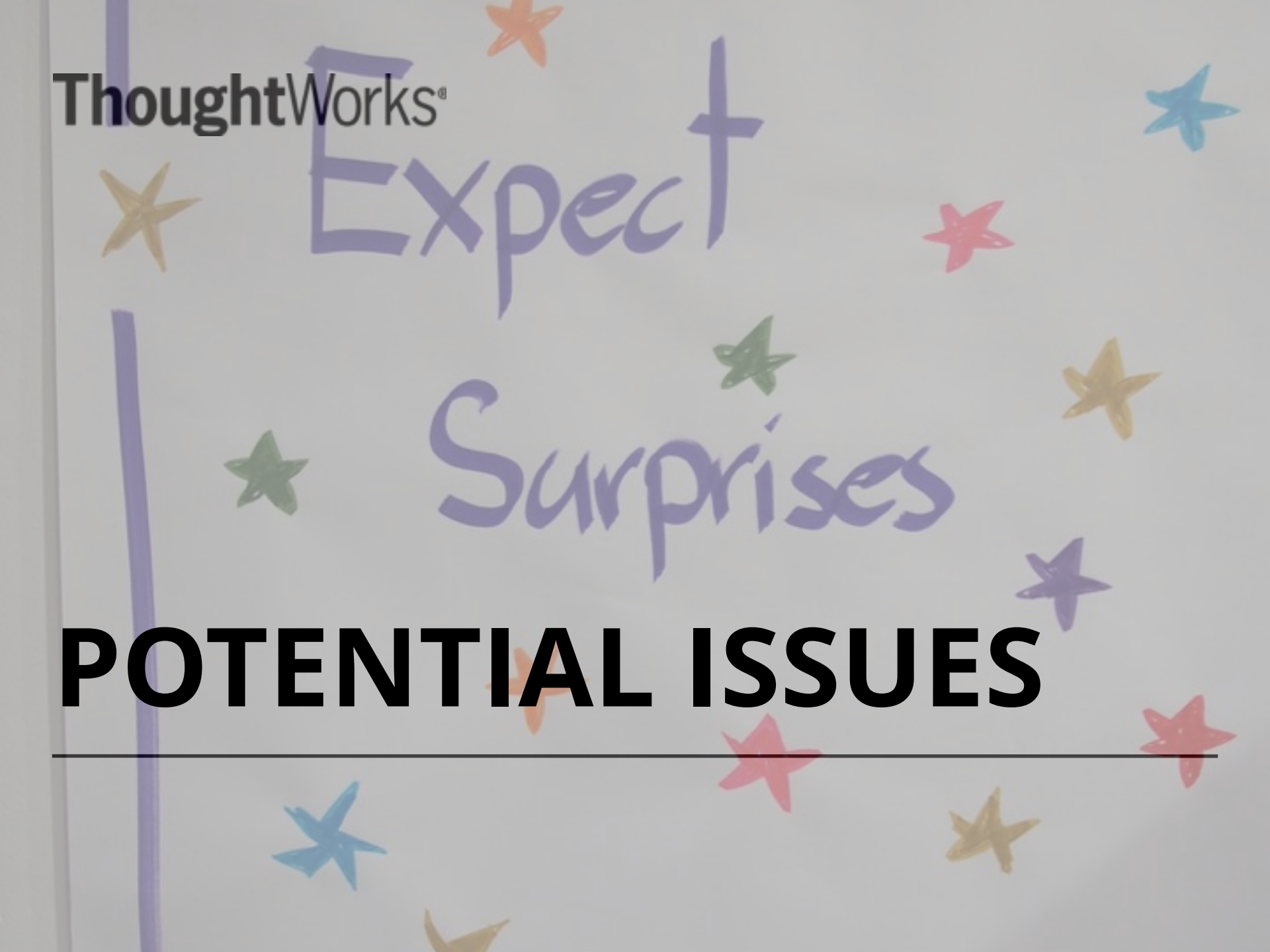
Mobile Data

Low Connectivity

Flight Mode

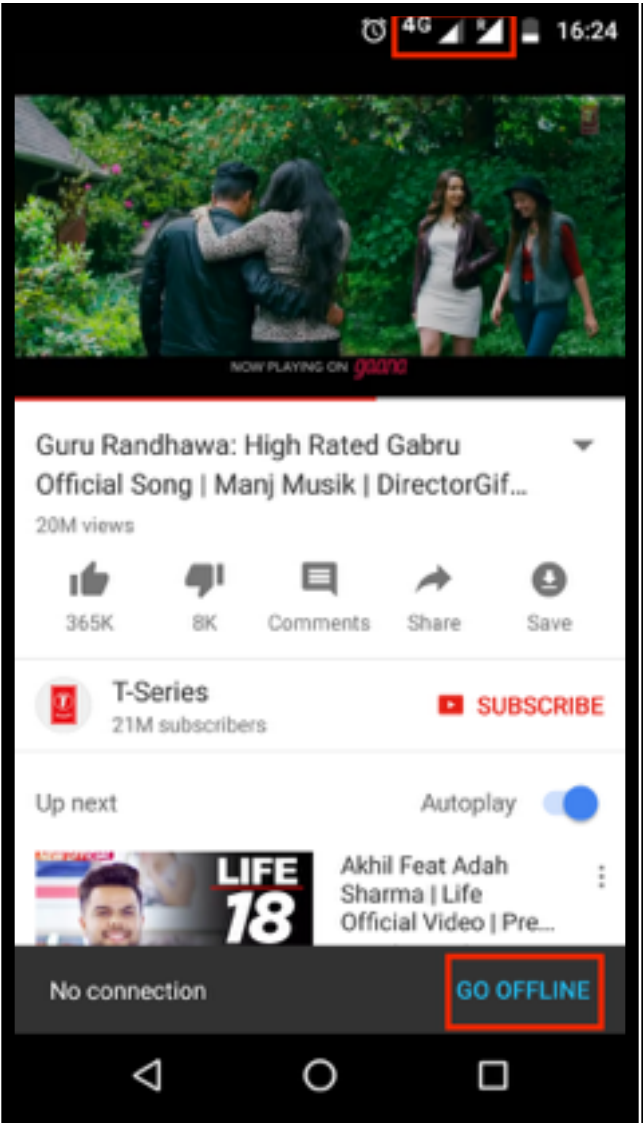
Power Save Mode

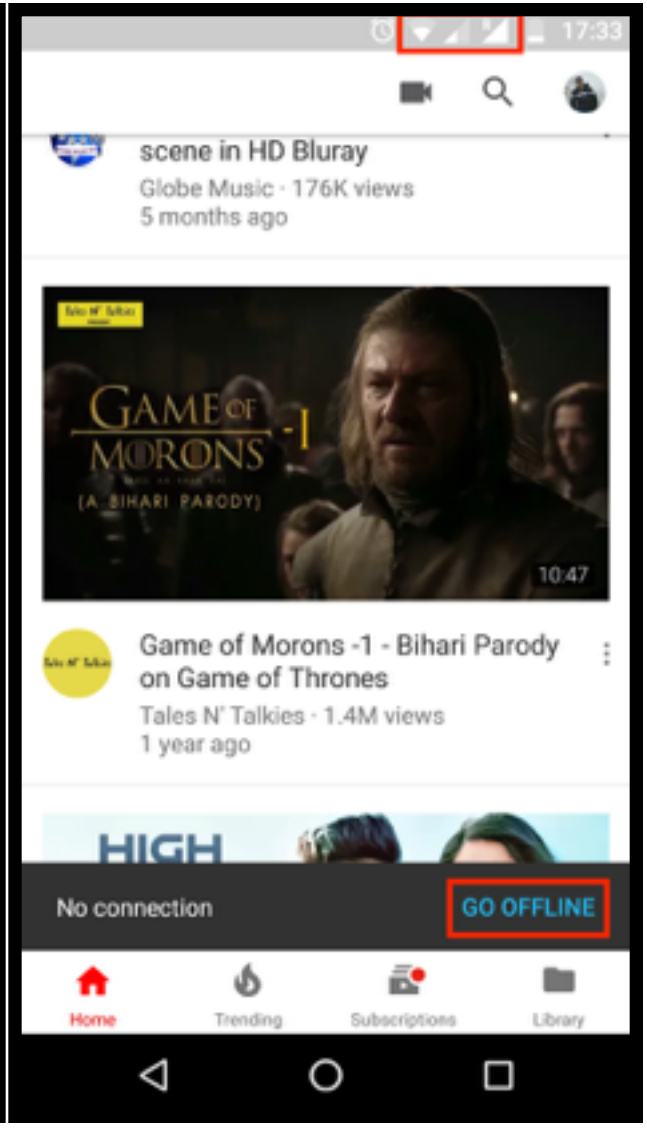
Roaming

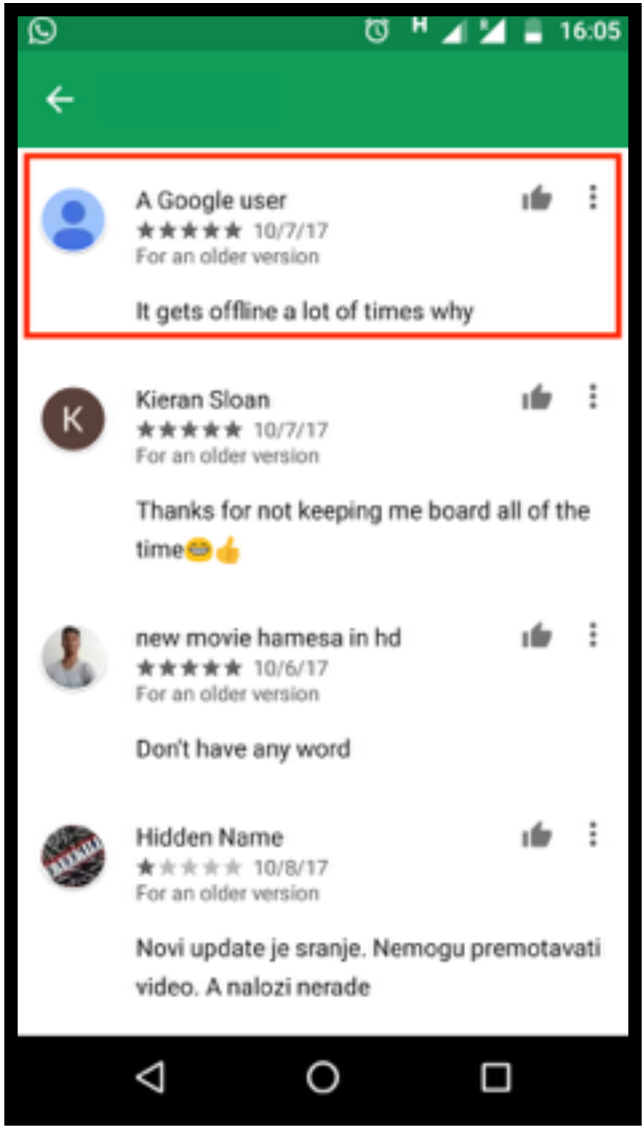


POTENTIAL ISSUES

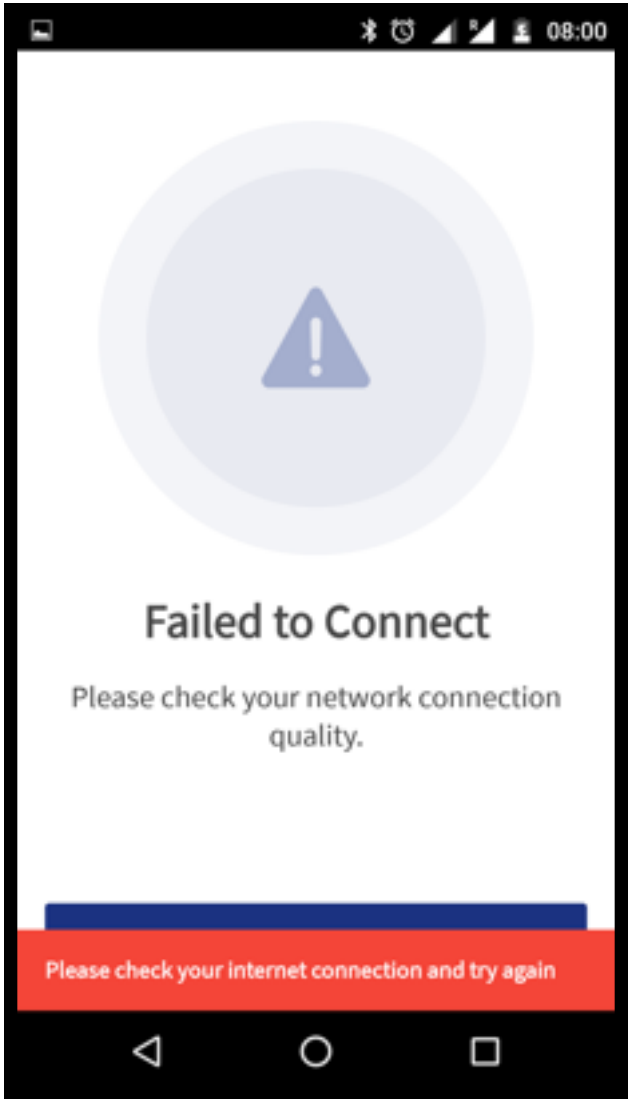
ARE YOU REALLY OFFLINE?

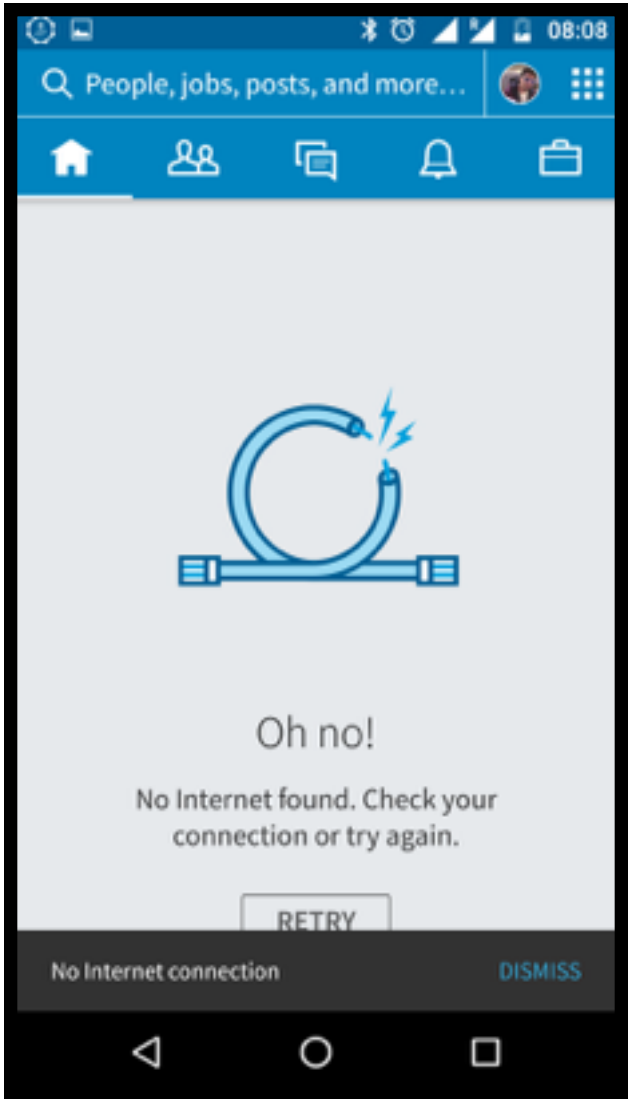


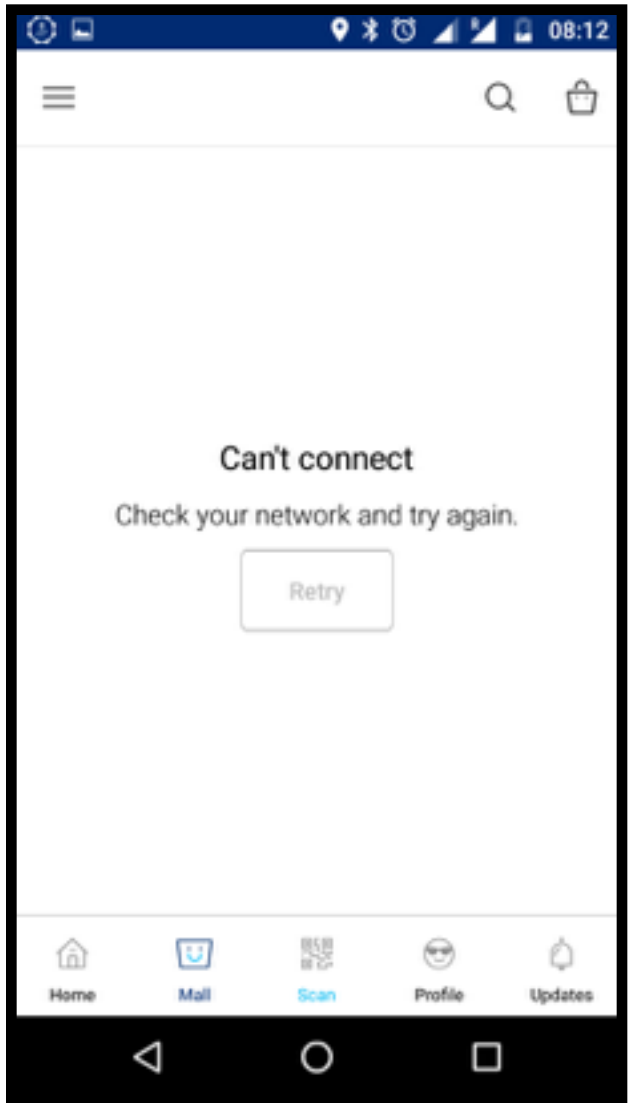




AND...


08:00
Failed to Connect
Please check your network connection quality.
Please check your internet connection and try again


08:08
People, jobs, posts, and more...
Oh no!
No Internet found. Check your connection or try again.
RETRY
No Internet connection
DISMISS


08:12
Can't connect
Check your network and try again.
Retry
Home
Mail
Scan
Profile
Updates

But Why??

WATCH OUT!

NetworkConnectivityIdentifier

NetworkCallback

Lets take a look at some of the common mistakes while using Android Network APIs

NETWORK CONNECTIVITY IDENTIFIER

```
public boolean isConnectedToInternet() {
  NetworkInfo networkInfo = cm.getActiveNetworkInfo();
  return networkInfo.isConnected();
}
```

NullPointerException!!

NETWORK CONNECTIVITY IDENTIFIER

```
public boolean isConnectedToInternet() {
  NetworkInfo networkInfo = cm.getActiveNetworkInfo();
  return networkInfo != null && networkInfo.isConnected();
}
```

What about multiple networks!!

NETWORK CONNECTIVITY IDENTIFIER

```
public boolean isConnectedToInternet() {
  Network[] allNetworks = cm.getAllNetworks();
  for (Network network : allNetworks) {
    NetworkInfo networkInfo = cm.getNetworkInfo(network);
    if (networkInfo != null) {
      return networkInfo.isConnected();
    }
  }
  return false;
}
```

What about unwanted networks!!

NETWORK CONNECTIVITY IDENTIFIER

```
private boolean isWifiOrMobile(NetworkInfo networkInfo) {
  List<Integer> networks = asList(TYPE_MOBILE, TYPE_WIFI);
  return networks.contains(networkInfo.getType());
}
```

WHAT DID WE DO

- Added null check for NetworkInfo
- Handled multiple networks
- Filtered WIFI and Mobile Data networks only

BE CAREFUL WITH NETWORK CALLBACK

```
NetworkCallback networkCallback = new NetworkCallback() {
  @Override
  public void onAvailable(Network network) {
    networkStateManager.setConnectedToInternet(true);
  }

  @Override
  public void onLost(Network network) {
    networkStateManager.setConnectedToInternet(false);
  }
};

cm.registerNetworkCallback(networkRequest, networkCallback);
```

BE CAREFUL WITH NETWORK CALLBACK

```
NetworkCallback networkCallback = new NetworkCallback() {
  @Override
  public void onAvailable(Network network) {
    networkStateManager.refresh();
  }

  @Override
  public void onLost(Network network) {
    networkStateManager.refresh();
  }
};

cm.registerNetworkCallback(networkRequest, networkCallback);
```

Is it good enough??

BE CAREFUL WITH NETWORK CALLBACK

```
NetworkCallback networkCallback = new NetworkCallback() {
  @Override
  public void onAvailable(Network network) {
    networkStateManager.refresh();
  }

  @Override
  public void onCapabilitiesChanged(Network n, NetworkCapabilities nc) {
    networkStateManager.refresh();
  }

  @Override
  public void onLost(Network network) {
    networkStateManager.refresh();
  }
};

cm.registerNetworkCallback(networkRequest, networkCallback);
```

HAVE WE SOLVED ALL THE PROBLEMS?

- Power Save Mode
- Handling on different devices
- Other random connectivity issues

HANDLING ISSUES

UNDERSTANDING THE USER BEHAVIOUR

INCREASE TRIGGER POINTS

GIVE THE USER CHANCE TO GET OUT OF OFFLINE MODE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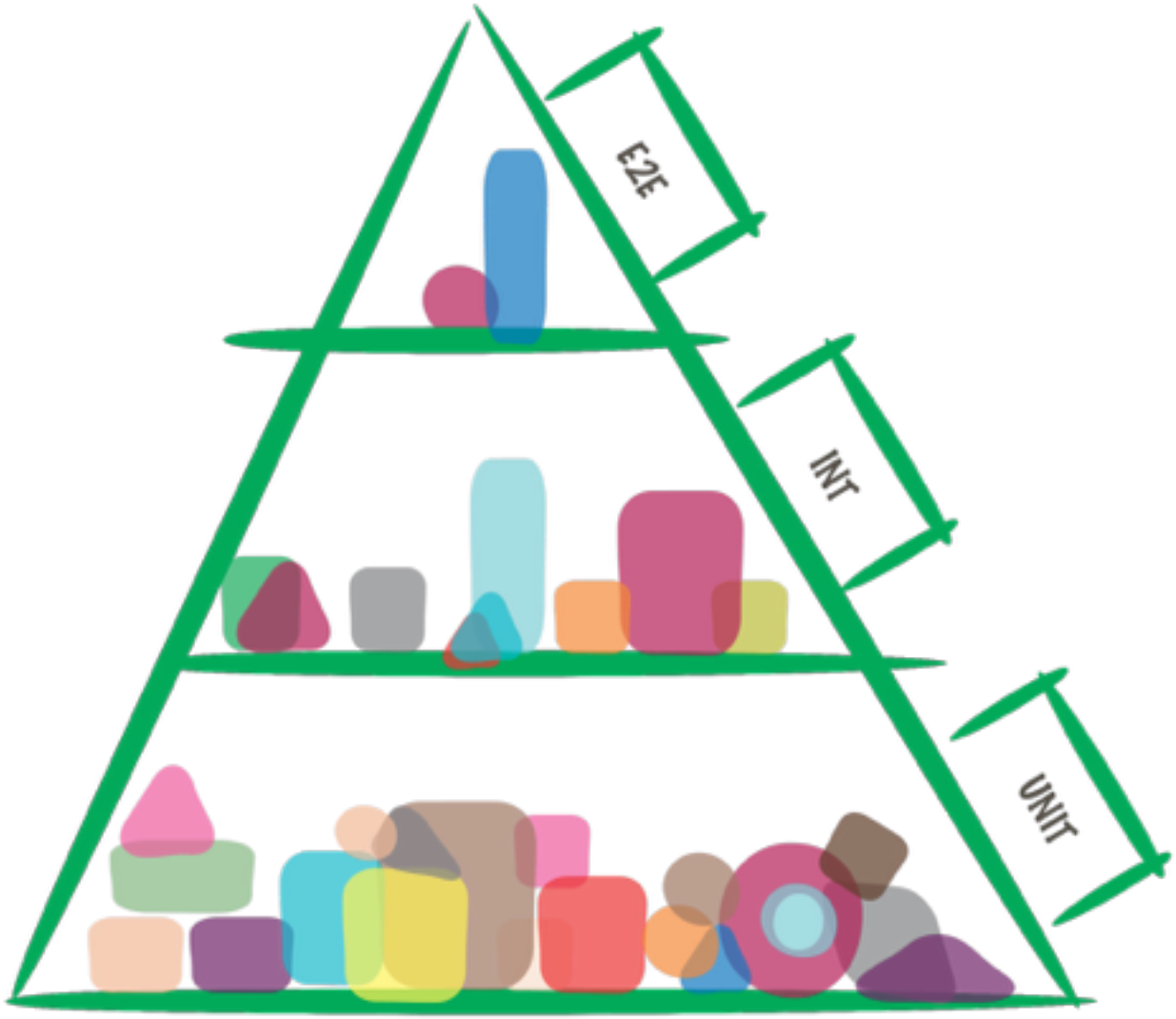
IN QA
(3)
SHOWCASE
Tested by opposite pair
(DONE)
#22
20TH
Feb 20th
#81
ThoughtWorks
As a participant I want to be able to share my

TESTING

TESTING PYRAMID



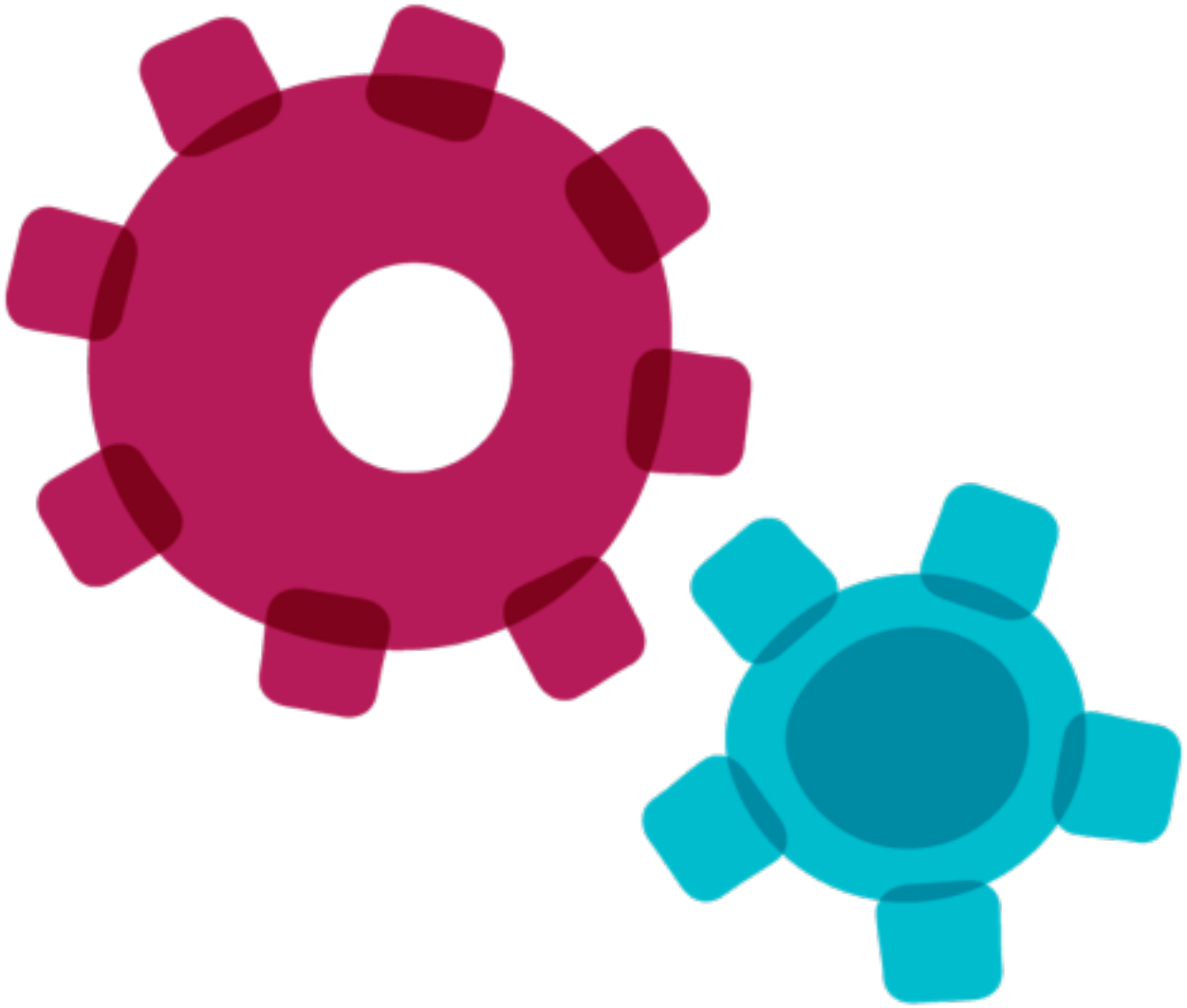
UNIT TESTING

- Network state management logic
- Broadcasting network change event to the app
- Showing offline UI components

INSTRUMENTATION TESTING

- Showing offline UI components on broadcast of network change event
- Content of UI components
- Interactions with offline components

AUTOMATION TESTING



TESTING USER JOURNEYS

- When user goes online to offline
- When user comes back online
- Interactions with offline components

USING ADB TO GO OFFLINE

```
adb shell svc wifi enable
```

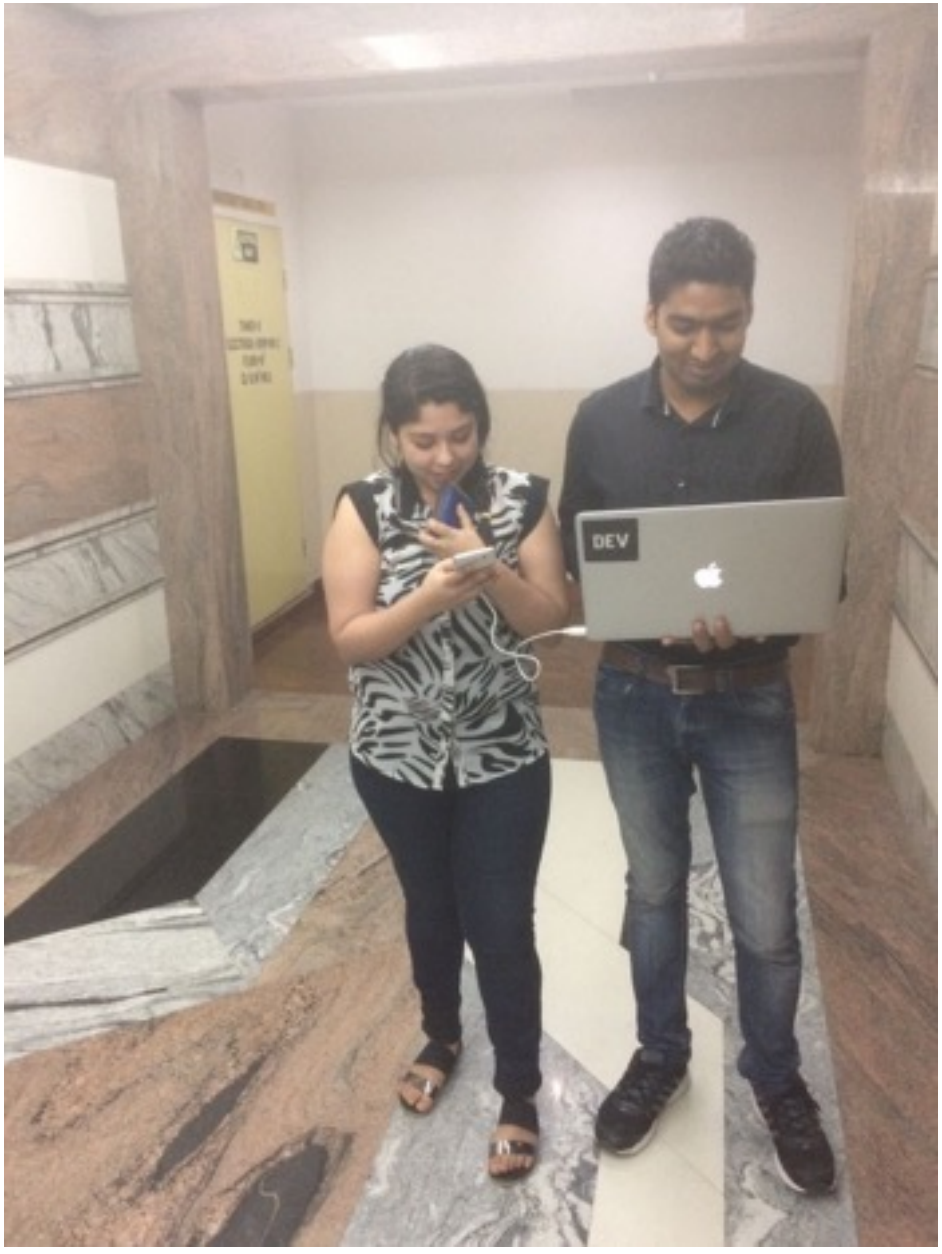
```
adb shell svc wifi disable
```

MANUAL TESTING

WHY MANUAL TESTING?

- Low connectivity scenarios
- Combination of multiple networks
- Fluctuating network conditions

TESTING IN LIFTS



TESTING WHILE TRAVELLING

WRAP UP!

- Build something that is useful to the user
- Be careful while using android network API
- Always read the documentation of network APIs
- Understand user behaviour
- Manual testing
- Test with combination of mobile data and wifi
- Use automation testing to test offline UI components

THANK YOU

Questions? Feedback?

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