MVI
New state
New object
New world

MVVM

MVI

MVC

MVP

„Simple, revolutionary, coming from the world where [ ]+[ ] = ”” ”

–Someone Somewhere

Literally

now

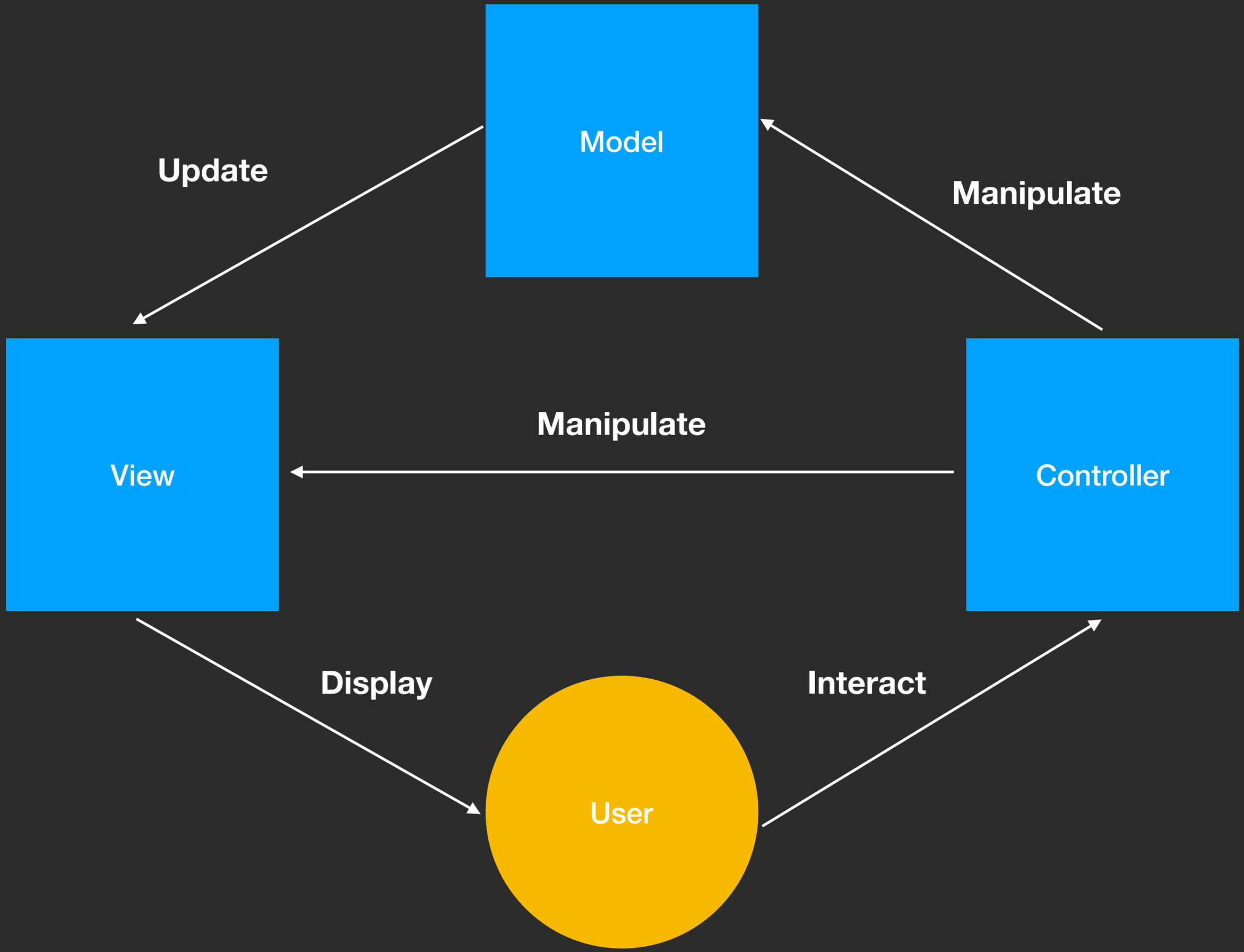
it

is

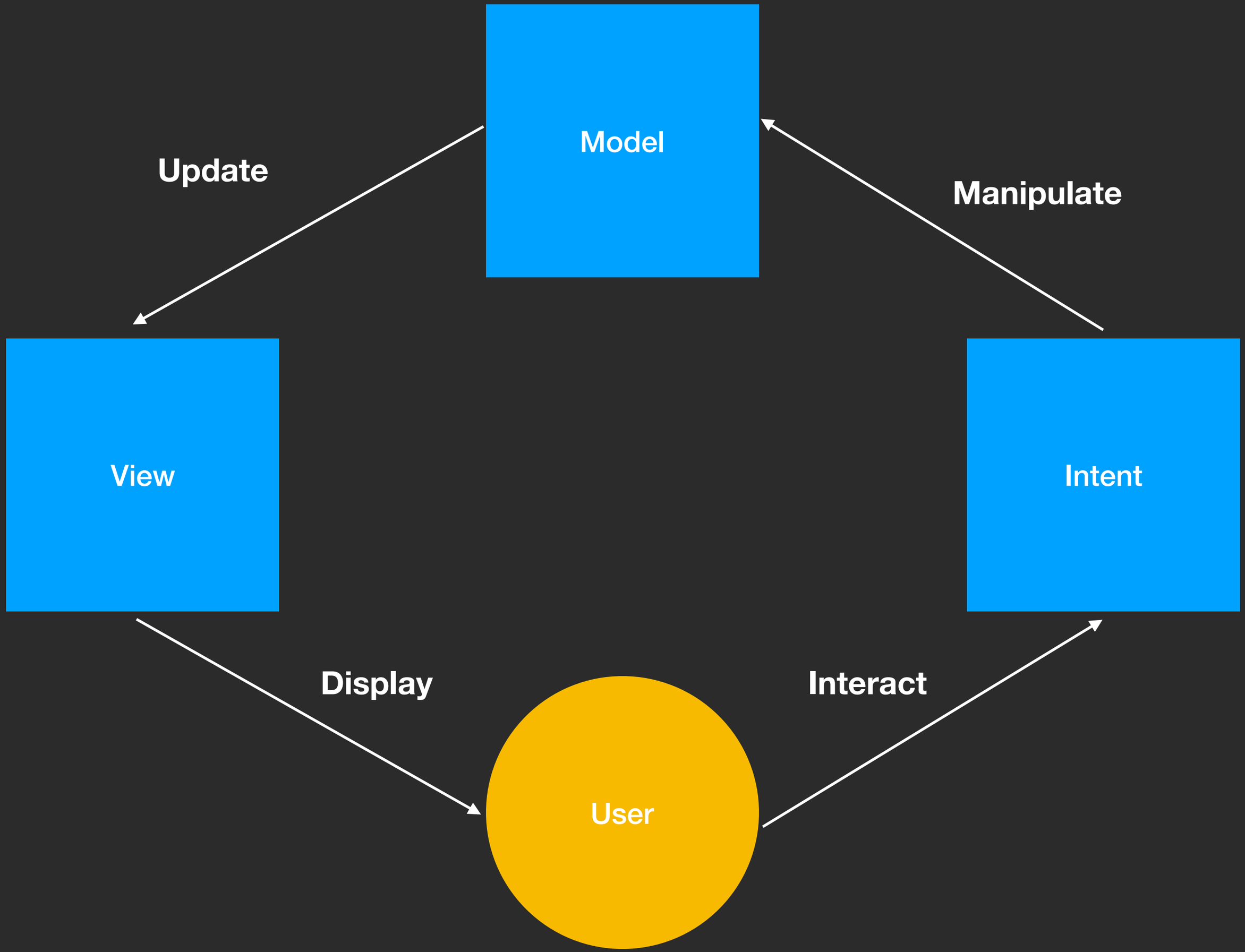
Everything

„What?! There’s such operator in RxJava?”
„What?! You can do that with Rx too?”
„What?! Sealed classes can do that?”

–Me


Model
Update
Manipulate
View
Manipulate
Controller
Display
Interact
User

Where is the state?


Model
Update
Manipulate
View
Intent
Display
Interact
User

Model

Update

Manipulate

View

ProgressBar : Visible

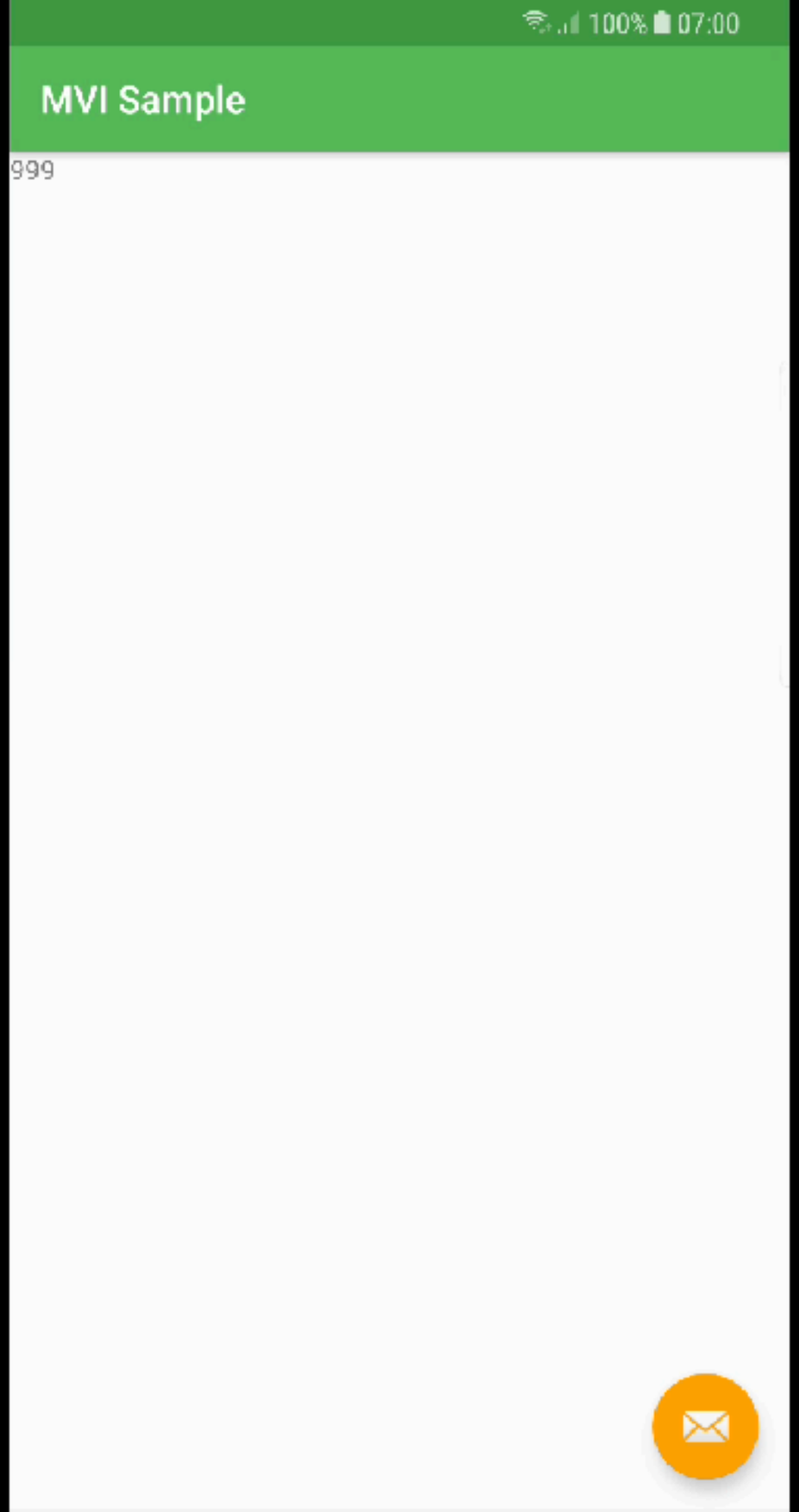
Movie list : Visible

Intent

Display

Interact

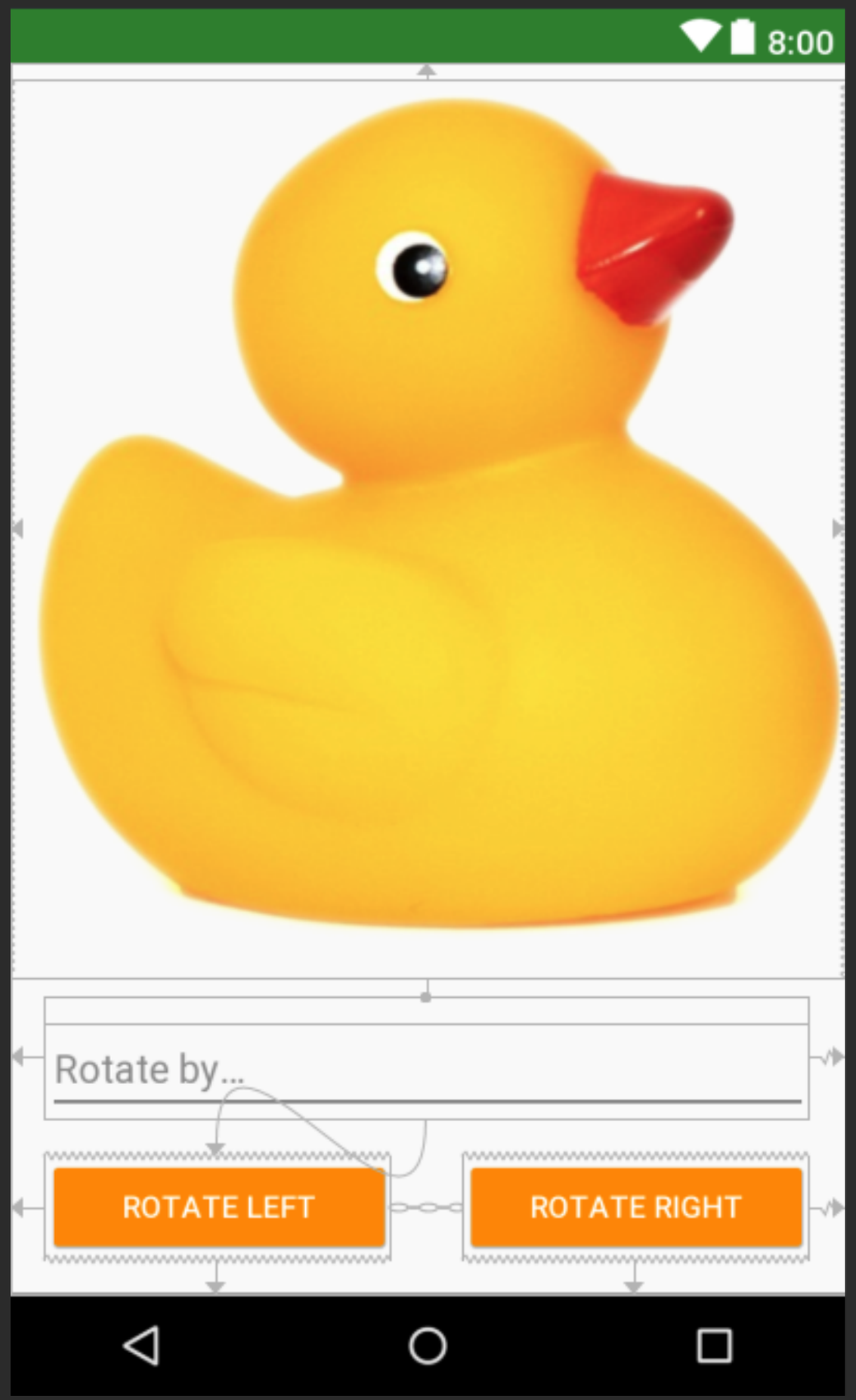
User


100% 07:00
MVI Sample
999

Show me the code!

Let’s spin the duck!

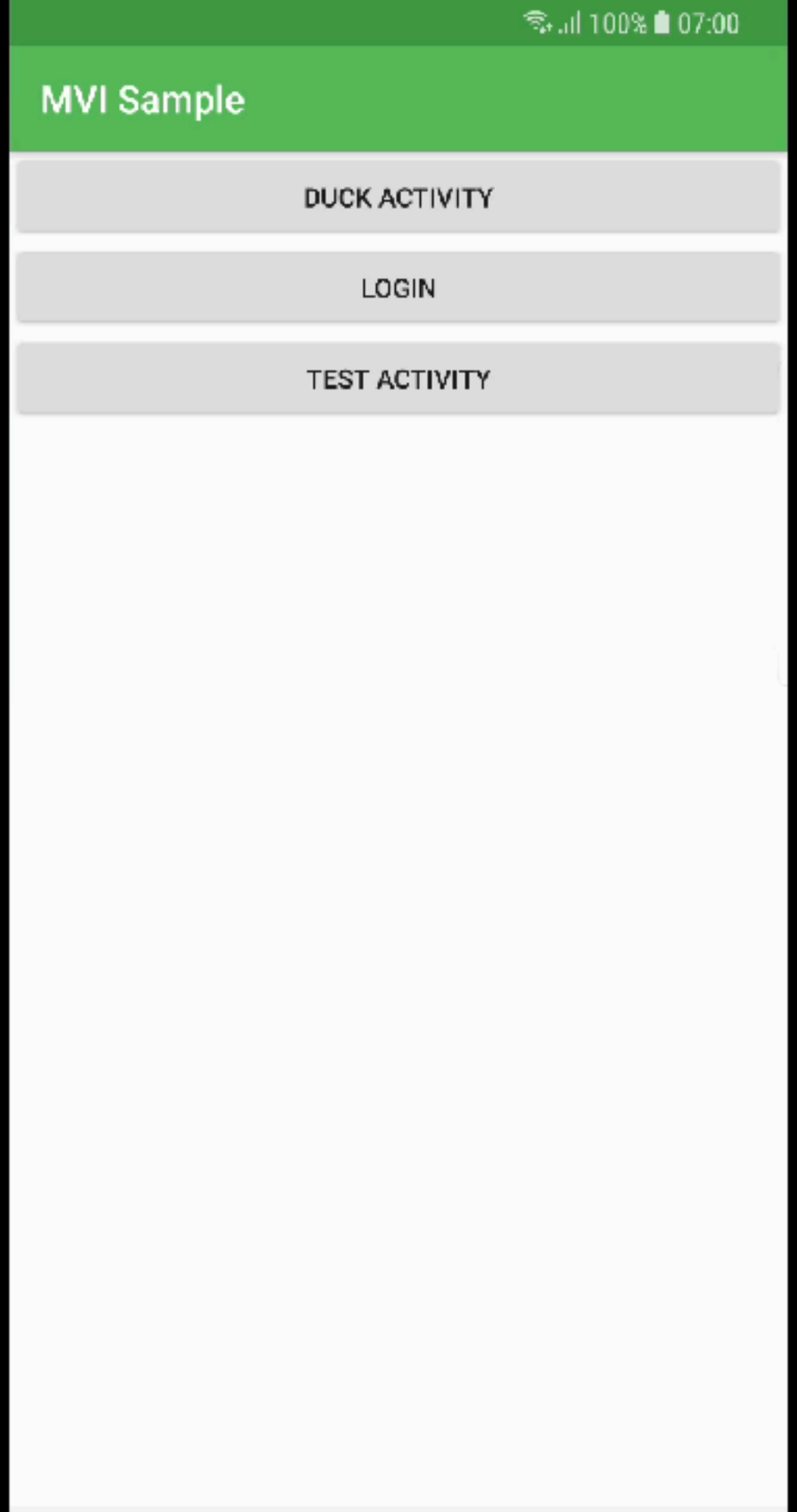
- User can enter degrees
- Rotate left / Rotate right should rotate the static image
- State should be retained



```
class DuckFragment : BaseMviFragment<DuckView, DuckMviViewModel>(),
    DuckView {

    companion object {
        fun newInstance() = DuckFragment()
    }

    override val rotateLeftClicks by lazy { rotateLeft.clicks() }
    override val rotateRightClicks by lazy { rotateRight.clicks() }
    override val rotateBy by lazy { rotateByTextIput.textChanges() }

    override fun getMviViewModel() = ViewModelProviders.of(this)
            .get(DuckMviViewModel::class.java)

    override fun onCreateView(…)

    override fun render(duckViewState: DuckViewState) {
        duckImage.rotation = duckViewState.rotation
    }
}
```

```
data class DuckViewState(val rotation: Float = 0.0f)
```

```
class DuckMviViewModel : BaseMviViewModel<DuckView, DuckViewState>() {

    override fun bindIntents() {
        val rotateByObservable = intent { it.rotateBy }
                .map { it.toString().toFloatOrNull() ?: 0.0f }

        val rotateLeftObservable = intent { it.rotateLeftClicks }
            .withLatestFrom(rotateByObservable) { _, rotation -> rotation }
            .map { -it }

        val rotateRightObservable = intent { it.rotateRightClicks }
            .withLatestFrom(rotateByObservable) { _, rotation -> rotation }

        val stateObservable = Observable.merge(
            rotateLeftObservable,
            rotateRightObservable
        )
            .scan(DuckViewState()) { oldState, rotationChange ->
                oldState.copy(rotation = oldState.rotation + rotationChange)
            }

        subscribeViewState(stateObservable) { view, viewState ->
                view.render(viewState)
            }
        }
}
```


100% 07:00
MVI Sample
DUCK ACTIVITY
LOGIN
TEST ACTIVITY

Simple login screen

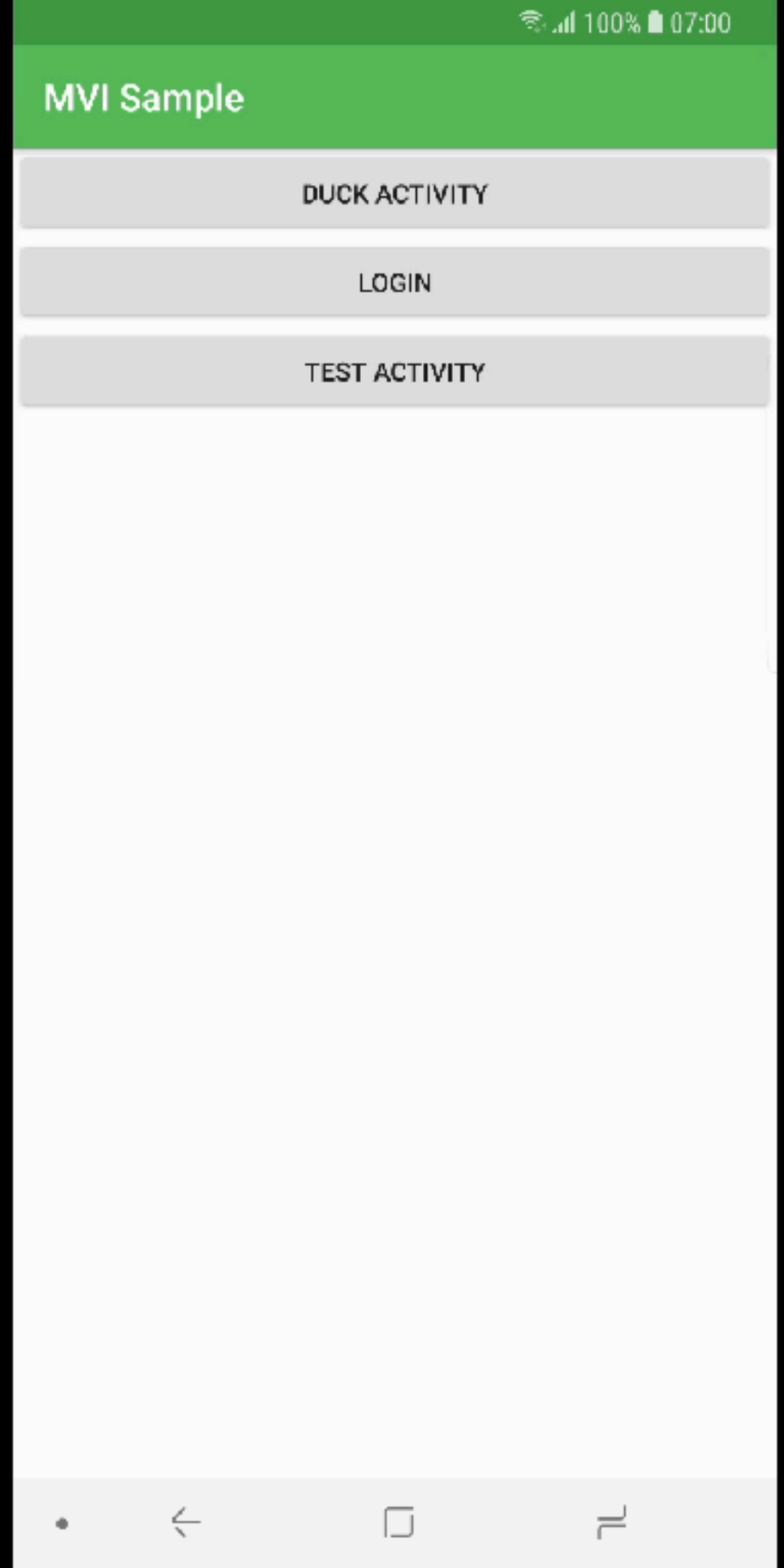
- Should show error when pressing login with empty fields and clear up after reentry.

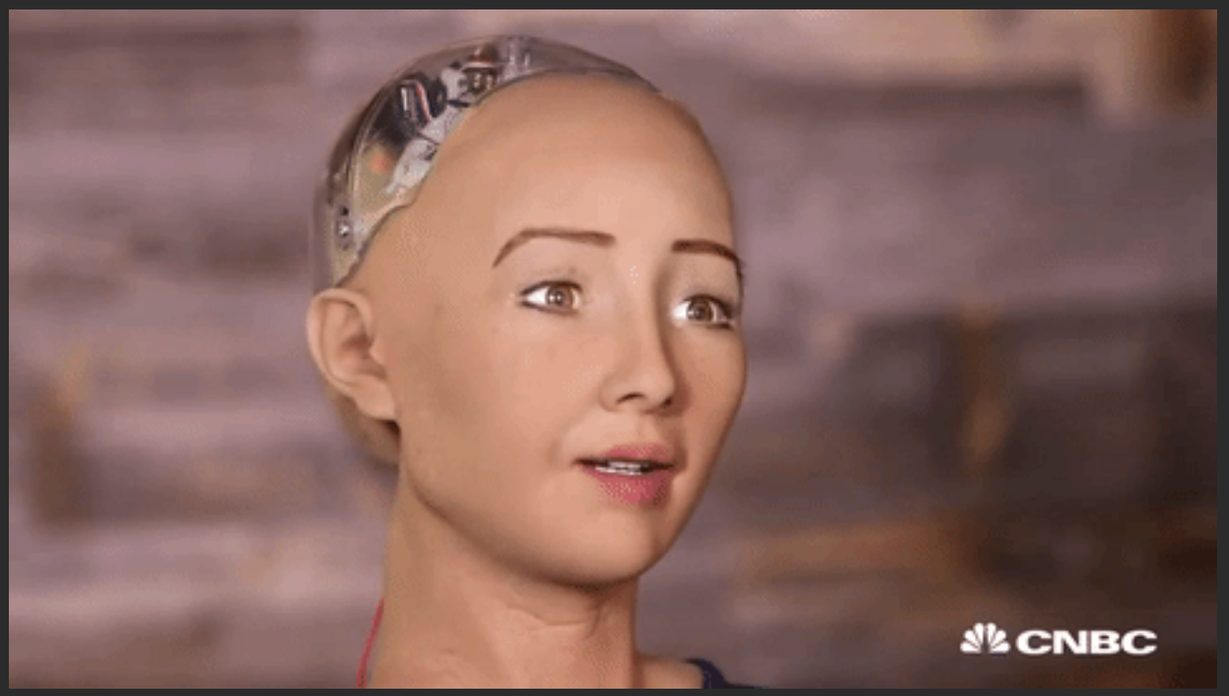
- Should validate email and password before making request.

- Should show progress bar and login when correct password and mail is entered.

- Should show incorrect credentials when authentication error and clean up if any of inputs are modified.

- Should show unknown error for 2 seconds if unknown error occurs while logging in.



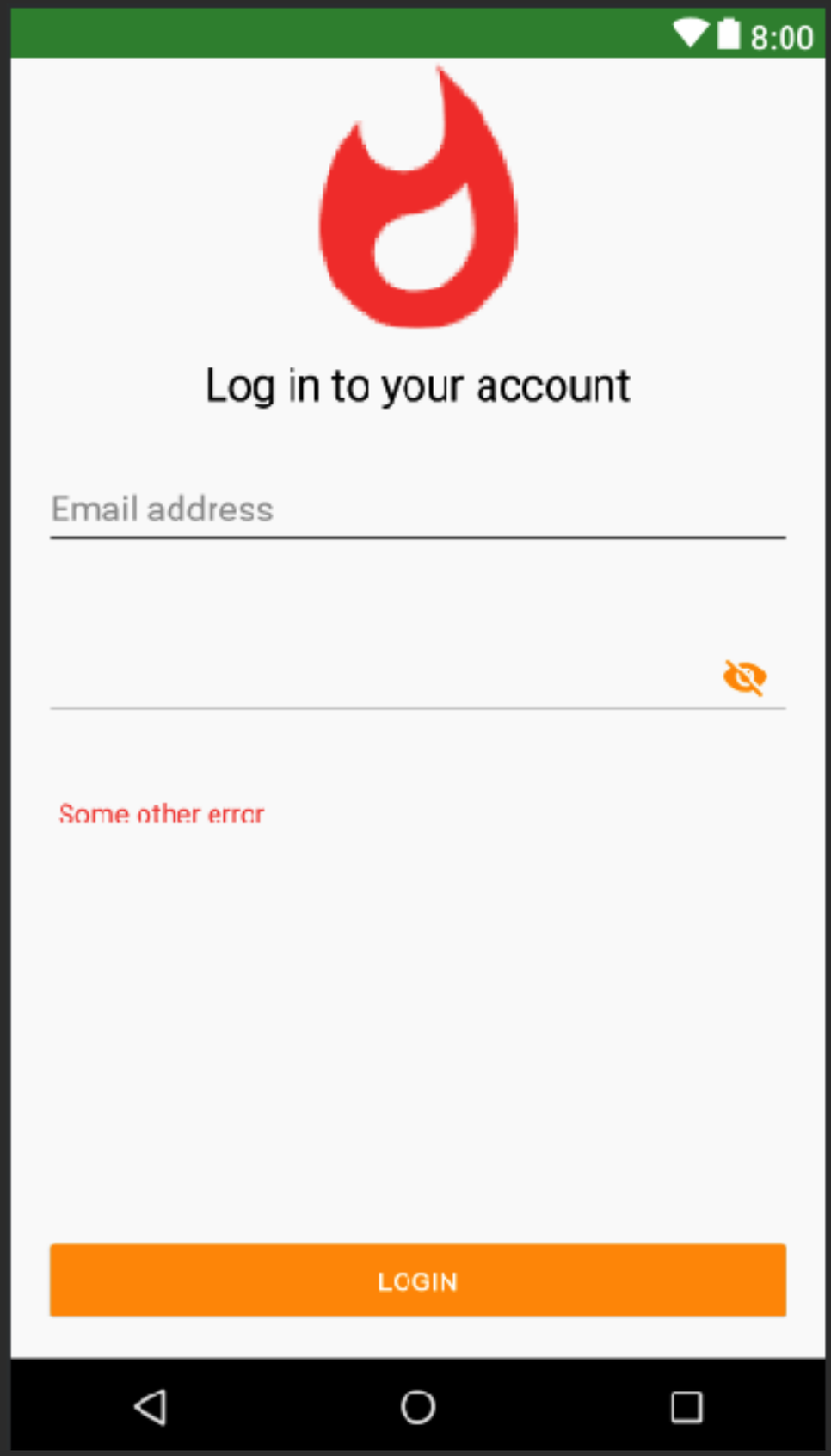


ViewRobot concept

```
class LoginViewRobot(private val presenter: LoginMviViewModel) :
    MviViewRobotBase<LoginViewState>(), LoginView {

    override val loginClicks: Subject<Unit> = PublishSubject.create()
    override val emailTextChange: Subject<String> = PublishSubject.create()
    override val passwordTextChange: Subject<String> = PublishSubject.create()

    init {
        presenter.attachView(this)
    }

    override fun render(viewState: LoginViewState) {
        renderEvents.add(viewState)
    }

    override fun destroyView() = presenter.detachView()

    fun clickLogin() = loginClicks.onNext(Unit)

    fun enterEmail(email: String) = emailTextChange.onNext(email)

    fun enterPassword(password: String) = passwordTextChange.onNext(password)
}
```

```kotlin
abstract class MviViewRobotBase<VS> {
    protected val renderEvents = mutableListOf<VS>()

    fun assertViewStatesRendered(vararg viewStates: VS) {
        Assert.assertEquals(
            "View states list should be the same",
            viewStates.asList(),
            renderEvents
        )
    }

    abstract fun destroyView()
}
```

```kotlin
sealed class LoginViewState{

data class State(
  val mailInputError: MailInputError? = null,
  val passwordInputError: PasswordInputError? =
      null,
  val credentialsError: CredentialsError? =
      null,
  val otherErrors: OtherErrors? = null,
  val progressState: ProgressState =
      ProgressState.WAITS
) : LoginViewState()

object Success : LoginViewState()

}
```



```
@Test
fun `Should show error when pressing login with empty fields and clear up
after modifying given input`() {

    loginViewRobot.enterEmail("")
    loginViewRobot.enterPassword("")
    loginViewRobot.clickLogin()
    loginViewRobot.enterEmail("a")
    loginViewRobot.enterPassword("v")

    loginViewRobot.assertViewStatesRendered(
        LoginViewState.State(),
        LoginViewState.State(
            mailInputError = MailInputError.INCORRECT,
            passwordInputError = PasswordInputError.TO_SHORT
        ),
        LoginViewState.State(
            passwordInputError = PasswordInputError.TO_SHORT
        ),
        LoginViewState.State()
    )
}
```

```kotlin
@Test
fun `Should show progressbar and login when correct password`() {
    loginViewRobot.enterEmail(CORRECT_MAIL)
    loginViewRobot.enterPassword(CORRECT_PASSWORD)
    loginViewRobot.clickLogin()
    loginSingleSubject.onSuccess(USER_TOKEN)

    loginViewRobot.assertViewStatesRendered(
        LoginViewState.State(),
        LoginViewState.State(
            progressState = ProgressState.LOGGING_IN
        ),
        LoginViewState.Success
    )

    verify(tokenRepositoryMock).saveToken(USER_TOKEN)
}
```

```
@Test
fun `Should show unknown error for 2 seconds if unknown error occurs while
logging in`() {
    loginViewRobot.enterEmail(CORRECT_MAIL)
    loginViewRobot.enterPassword(CORRECT_PASSWORD)
    loginViewRobot.clickLogin()

    loginSingleSubject.onError(Throwable("Unknown"))
    overrideSchedulersRule.testScheduler.advanceTimeBy(2, TimeUnit.SECONDS)

    loginViewRobot.enterEmail(CORRECT_MAIL)

    loginViewRobot.assertViewStatesRendered(
        LoginViewState.State(),
        LoginViewState.State(
            progressState = ProgressState.LOGGING_IN
        ),
        LoginViewState.State(
            otherErrors = OtherErrors.UNKNOWN
        ),
        LoginViewState.State()
    )
}
```

```
val viewStateObservable = intent { it.loginClicks }
    .withLatestFrom(emailObservable, passwordObservable) { _, email, password ->
        Pair(email, password)
    }
    .switchMap { (email, password) ->
        val isMailCorrect = loginDataValidator.isCorrectMail(email)
        val isPasswordLongEnough = loginDataValidator
              .isPasswordLongEnough(password)

        if (isMailCorrect && isPasswordLongEnough) {
            login(
                email, password,
                cancelWrongCredentialsObservable(
                      emailObservable, passwordObservable
                )
            )
        } else {
            showPasswordEmailInputError(
                isMailCorrect, isPasswordLongEnough,
                emailObservable, passwordObservable
            )
        }
    }
    .scan<LoginViewState>(LoginViewState.State()) { oldVS, partialChange ->
        when (oldVS) {
            is LoginViewState.State -> reduceState(oldVS, partialChange)
            LoginViewState.Success -> LoginViewState.Success
        }
    }
```

```
private fun login(
    email: String, password: String,
    cancelWrongCredentialsErrorObservable:
Observable<PartialStateChange.CancelApiWrongCredentials>
) = loginApi.login(email, password)
    .flatMapCompletable { tokenRepository.saveToken(it) }
    .toSingleDefault<PartialStateChange>(PartialStateChange.Success)
    .toObservable()
    .startWith(PartialStateChange.StartedLoggingIn)
    .onErrorResumeNext { error: Throwable ->
        parseLoginError(error, cancelWrongCredentialsErrorObservable)
    }
```

The snackbar problem

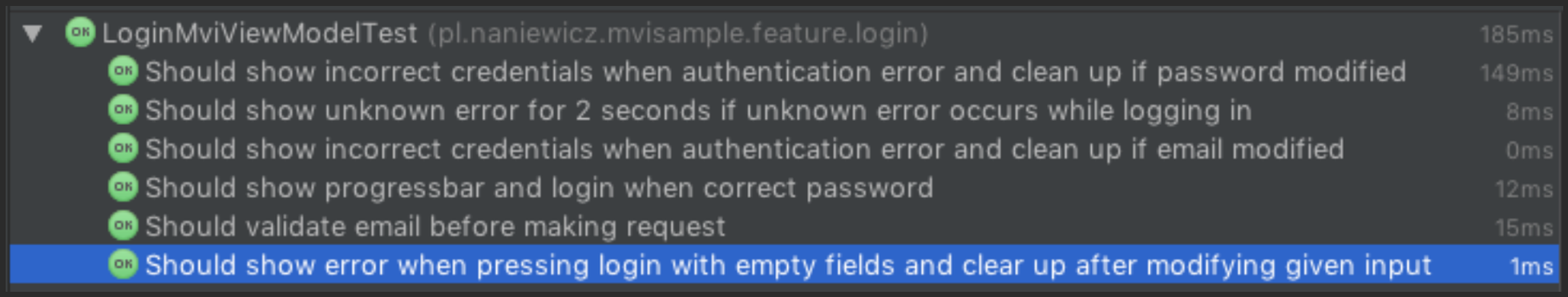
```
private fun timedUnknownErrorObservable(): Observable<PartialStateChange> {
    return Observable.timer(2, TimeUnit.SECONDS)
        .map<PartialStateChange> {
            PartialStateChange.CancelUnknownError
        }
        .startWith(PartialStateChange.ApiUnknownError)
}
```

```
private fun showPasswordEmailInputError(
    isMailCorrect: Boolean, isPasswordLongEnough: Boolean,
    emailObservable: Observable<String>, passwordObservable:
Observable<String>
): Observable<PartialStateChange> = Observable.just<PartialStateChange>(
    PartialStateChange.CredentialsPrevalidationFailed(
        if (isMailCorrect) null else MailInputError.INCORRECT,
        if (isPasswordLongEnough) null else PasswordInputError.TO_SHORT
    )
).concatWith(
    Single.merge(
        emailObservable.firstOrError()
            .map { PartialStateChange.CancelMailInputError },
        passwordObservable.firstOrError()
            .map { PartialStateChange.CancelPasswordInputError }
    ).toObservable()
)
```

Reduce the state

```
private fun reduceState(
    oldState: LoginViewState.State, partialChange: PartialStateChange
) = when (partialChange) {
    is PartialStateChange.CredentialsValidationFailed -> oldState.copy(
        mailInputError = partialChange.mailInputError,
        passwordInputError = partialChange.passwordInputError
    )
    PartialStateChange.CancelMailInputError -> oldState.copy(
        mailInputError = null
    )
    PartialStateChange.CancelPasswordInputError -> oldState.copy(
        passwordInputError = null
    )
    PartialStateChange.StartedLoggingIn -> LoginViewState.State(
        progressState = ProgressState.LOGGING_IN
    )
    PartialStateChange.ApiWrongCredentials -> oldState.copy(
        progressState = ProgressState.WAITS,
        credentialsError = CredentialsError.INCORRECT
    )

  (…)

}
```

```
private fun reduceState(…) = when (partialChange) {
    (…)
     PartialStateChange.CancelApiWrongCredentials -> oldState.copy(
        credentialsError = null
    )
    PartialStateChange.ApiUnknownError -> oldState.copy(
        progressState = ProgressState.WAITS,
        otherErrors = OtherErrors.UNKNOWN
    )
    PartialStateChange.CancelUnknownError -> oldState.copy(
        otherErrors = null
    )

    PartialStateChange.Success -> LoginViewState.Success
}
```


LoginMviViewModelTest (pl.naniewicz.mvisample.feature.login) 185ms
Should show incorrect credentials when authentication error and clean up if password modified 149ms
Should show unknown error for 2 seconds if unknown error occurs while logging in 8ms
Should show incorrect credentials when authentication error and clean up if email modified 0ms
Should show progressbar and login when correct password 12ms
Should validate email before making request 15ms
Should show error when pressing login with empty fields and clear up after modifying given input 1ms


SPEED
23136
km/h

Render!

```
override fun render(viewState: LoginViewState) = when (viewState) {
    LoginViewState.Success -> finishWithsSuccess()
    is LoginViewState.State -> renderState(viewState)
}


private fun renderState(viewState: LoginViewState.State) = with(viewState) {
    emailTextInputLayout.error = when (mailInputError) {
        MailInputError.INCORRECT -> getString(…)
        null -> null
    }
    passwordTextInputLayout.error = when (passwordInputError) {
        PasswordInputError.TO_SHORT -> getString(…)
        null -> null
    }
    credentialsErrorText.text = when (credentialsError) {
        CredentialsError.INCORRECT -> getString(…)
        null -> null
    }
    when (otherErrors) {
        OtherErrors.UNKNOWN -> showUnknownError()
        null -> hideUnknownError()
    }
    progressBar.visibility = when (progressState) {
        LOGGING_IN -> View.VISIBLE
        WAITS -> View.GONE
    }
}
```

MVI good practices

Do:

- Export state reducer’s - when your state reducing is growing uncontrollably - it might be also worth to unit test such class in isolation.
- Export interactors - they can expose wrap(…) methods for passing intent’s and retrieving observable
- Create smaller self manageable parts - mvi view model for view’s, fragments.
- Use KOTLIN
- Create „nice” view state’s

„Nice” view state

- Remember that it’s view state responsibility to represent view state. It shouldn’t be simply mutating your View/ Fragment/Activity.

- Representing view states as Enum’s / Sealed classes often leads to placing additional logic into render functions that can’t be tested, use responsibly.

MVI pros and cons

+ Clear data flow
+ Great testability
+ Makes you stop thinking about configuration changes
+ Dumb views
+ Unleashing the full Rx superpowers
+ Pr’s: Woah dude, that’s cool

- Boilerplate
- Everything needs to be reactive
- Sometimes we might have to work agains’t framework / libraries
- High learning cost
- Pr’s: Woah dude what is going on there


100% DONE

Sample and presentation available here:
https://github.com/freszu/MVI-Sample

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