Railway-Oriented Programming

Concept of powerful pattern from functional programming to handle application flow.

Plan of presentation

- Describing the problem
- Real-life usage
- Pros and cons
- Discussion

Describing the problem

Sample of trivial use case

```
void ReserveDoctorAppointmentUseCase (ReserveDoctorAppointmentCommand command) {
  var doctor = doctorRepository.GetById(command.doctorId);
  var patient = patientRepository.GetById(command.patientId);

  appointmentRepository.MakeReservation(doctor, patient, command.startDate, command.endDate);
}
```

Adding some validations…

```
void ReserveDoctorAppointmentUseCase (ReserveDoctorAppointmentCommand command) {
  var doctor = doctorRepository.GetById(command.doctorId);
  if (doctor != null && doctor.IsActive) {
    var patient = patientRepository.GetById(command.patientId);
  }
  appointmentRepository.MakeReservation(doctor, patient, command.startDate, command.endDate);
}
```

Even more validations...

```
void ReserveDoctorAppointmentUseCase (ReserveDoctorAppointmentCommand command) {
  var doctor = doctorRepository.GetById(command.doctorId);
  if (doctor == null || !doctor.IsActive) {
    return;
  }
  var patient = patientRepository.GetById(command.patientId);
  if (patient == null || !patient.IsActive) {
    return;
  }
  appointmentRepository.MakeReservation(doctor, patient, command.startDate, command.endDate);
}
```

And more validations…

```
void ReserveDoctorAppointmentUseCase (ReserveDoctorAppointmentCommand command) {
  var doctor = doctorRepository.GetById(command.doctorId);
  if (doctor == null || !doctor.IsActive) {
    return;
  }
  var patient = patientRepository.GetById(command.patientId);
  if (patient == null || !patient.IsActive) {
    return;
  }
  var patientPackage = patientPackageRepository.GetByPatient(patient);
  if (patientPackage == null || !patientPackage.CanAppointTo(doctor)) {
    return;
  }
  appointmentRepository.MakeReservation(doctor, patient, command.startDate, command.endDate);
}
```

What if we would like to return status?

```
ReserveDoctorAppointmentStatus ReserveDoctorAppointmentUseCase (ReserveDoctorAppointmentCommand command) {
  var doctor = doctorRepository.GetById(command.doctorId);
  if (doctor == null || !doctor.IsActive) {
    return ReserveDoctorAppointmentStatus.createFailed();
  }
  var patient = patientRepository.GetById(command.patientId);
  if (patient == null || !patient.IsActive) {
    return ReserveDoctorAppointmentStatus.createFailed();
  }
  var patientPackage = patientPackageRepository.GetByPatient(patient);
  if (patientPackage == null || !patientPackage.CanAppointTo(doctor)) {
    return ReserveDoctorAppointmentStatus.createFailed();
  }
  var reservationId = appointmentRepository
      .MakeReservation(doctor, patient, command.startDate, command.endDate);

  return ReserveDoctorAppointmentStatus.createSuccessfull(reservationId);
}
```

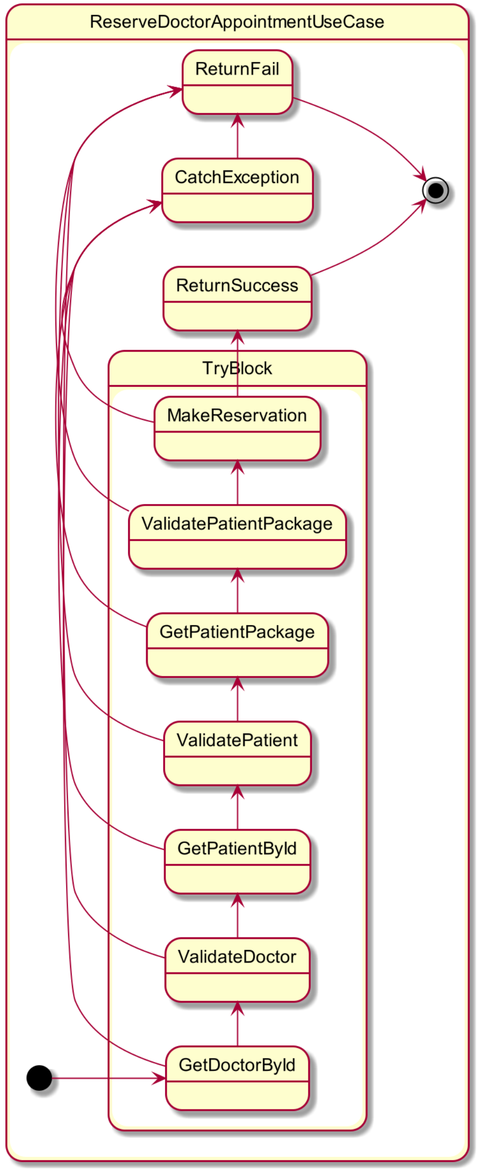
What about exceptions?

```
ReserveDoctorAppointmentStatus ReserveDoctorAppointmentUseCase (ReserveDoctorAppointmentCommand command) {
  try {
    var doctor = doctorRepository.GetById(command.doctorId);
    if (doctor == null || !doctor.IsActive) {
      return ReserveDoctorAppointmentStatus.createFailed();
    }
    var patient = patientRepository.GetById(command.patientId);
    if (patient == null || !patient.IsActive) {
      return ReserveDoctorAppointmentStatus.createFailed();
    }
    var patientPackage = patientPackageRepository.GetByPatient(patient);
    if (patientPackage == null || !patientPackage.CanAppointTo(doctor)) {
      return ReserveDoctorAppointmentStatus.createFailed();
    }
    var reservationId = appointmentRepository
        .MakeReservation(doctor, patient, command.startDate, command.endDate);
    return ReserveDoctorAppointmentStatus.createSuccessfull(reservationId);
  }
  catch (Exception ex) {
    return ReserveDoctorAppointmentStatus.createFailed();
  }
}
```

Can't forget about loggging!

```
ReserveDoctorAppointmentStatus ReserveDoctorAppointmentUseCase (ReserveDoctorAppointmentCommand command) {
  try {
    var doctor = doctorRepository.GetById(command.doctorId);
    if (doctor == null || !doctor.IsActive) {
      return ReserveDoctorAppointmentStatus.createFailed();
    }
    var patient = patientRepository.GetById(command.patientId);
    if (patient == null || !patient.IsActive) {
      return ReserveDoctorAppointmentStatus.createFailed();
    }
    var patientPackage = patientPackageRepository.GetByPatient(patient);
    if (patientPackage == null || !patientPackage.CanAppointTo(doctor)) {
      return ReserveDoctorAppointmentStatus.createFailed();
    }
    var reservationId = appointmentRepository
        .MakeReservation(doctor, patient, command.startDate, command.endDate);
    log.LogEvent($"Reserved doctor appointment with ID: {reservationId}")
    return ReserveDoctorAppointmentStatus.createSuccessfull(reservationId);
  }
  catch (Exception ex) {
    logger.LogError("Reserving a doctor appointment failed!", ex);
    return ReserveDoctorAppointmentStatus.createFailed();
  }
}
```

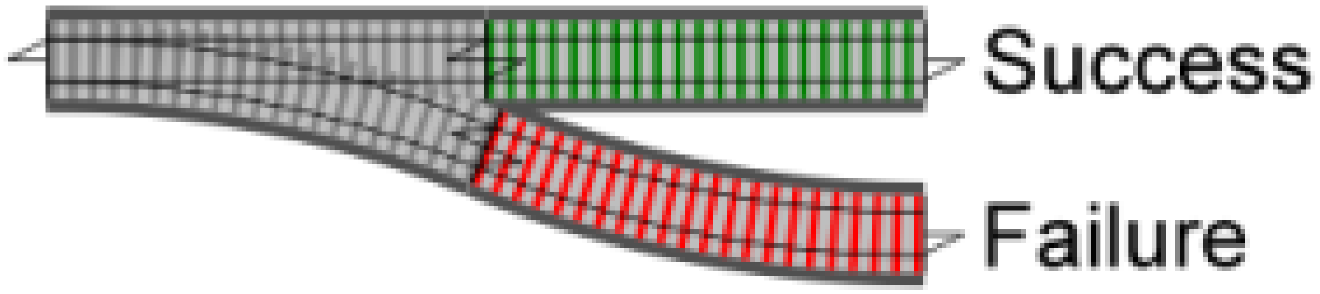
How would process flow look like?



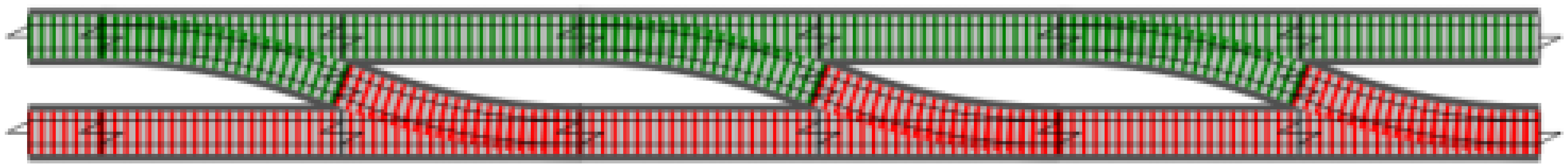
Let's introduce Result type

```
type Result<'A, 'B> =
    | Ok of ResultValue: 'A
    | Error of ErrorValue: 'B
```

Define two branches in process flow



We could create two track road

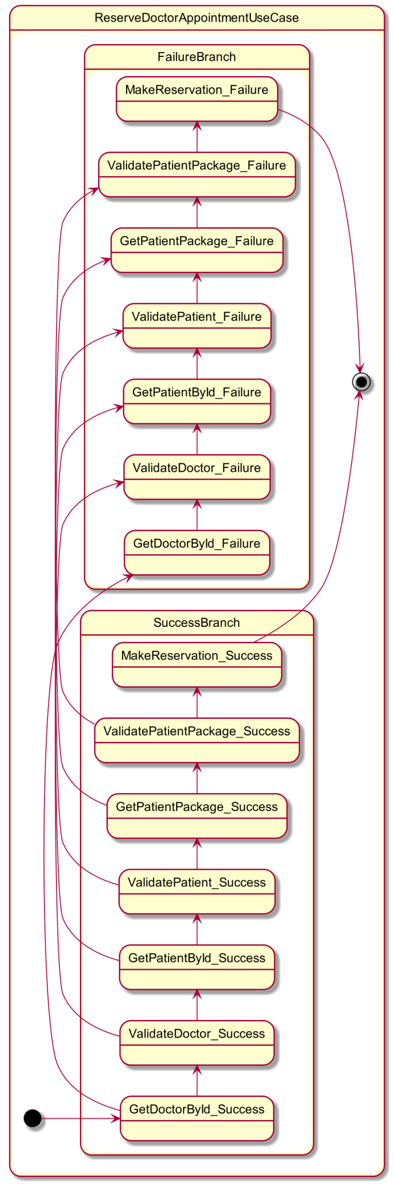


`Bind` function

```
let bind (switchFunction: 'A -> Result<'C -> 'D>) (input: Result<'A, 'B>)
  : Result<'C, 'D> =
  match input with
  | Ok success -> switchFunction success
  | Error failure -> Error failure
```

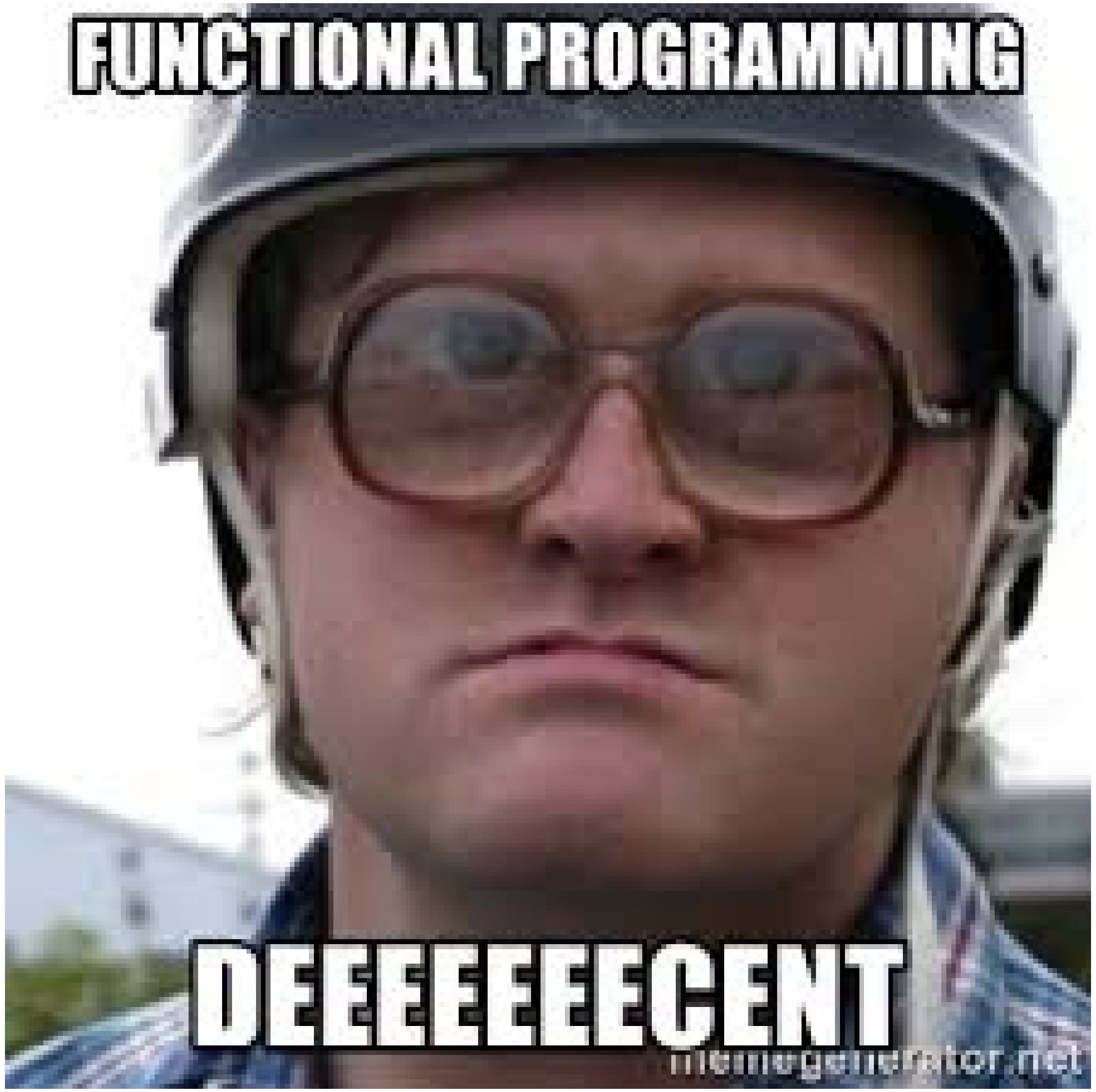
How would sample use case look like with `Bind` function?

How would process flow look like in ROP?



Real-life usage - Qlib.Environment Project

Discussion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