

## Angular 2+

### Workshop. Forms.

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## Task 01. Template-Driven Form

1. Create file **app/models/user.ts**. Run the following command from a command line:

```
> ng g cl models/user
```

2. Replace the content of the file with the following content:

```
export class User {  
  
  constructor(public firstName = '',  
    public lastName = '',  
    public email = '',  
    public sendProducts = false,  
    public addressType = 'home',  
    public street1?: string,  
    public street2?: string,  
    public country = '',  
    public city?: string,  
    public zip?: string) { }  
}
```

3. Make changes to **SignupFormComponent**. Use the following snippet of code:

```
import { Component, OnInit } from '@angular/core';  
import { NgForm } from '@angular/forms';  
import { User } from './../../models/user';
```

4. Add properties:

```
countries: Array<string> = ['Ukraine', 'Armenia', 'Belarus', 'Hungary', 'Kazakhstan',  
'Poland', 'Russia'];  
user: User = new User();
```

5. Add method:

```
save(signupForm: NgForm) {  
  // Form model  
  console.log(signupForm.form);  
  // Form value  
  console.log(`Saved: ${JSON.stringify(signupForm.value)}`);  
}
```

6. Make changes to **SignupFormComponent template**. Use the following snippet of HTML:

```
// 1  
<form class="form-horizontal"  
  novalidate  
  #signupForm="ngForm"  
  (ngSubmit)="save(signupForm)">  
  
// 2  
<div class="form-group"  
  [ngClass]="{'has-error': (firstNameVar.touched || firstNameVar.dirty) &&  
    firstNameVar.invalid }">  
  
<input class="form-control"  
  id="firstNameId"
```

```

        type="text"
        placeholder="First Name (required)"
        required
        minlength="3"
        [(ngModel)]="user.firstName"
        name="firstName"
        #firstNameVar="ngModel" />
<span class="help-block" *ngIf="(firstNameVar.touched || firstNameVar.dirty) &&
firstNameVar.errors">
    <span *ngIf="firstNameVar.hasError('required')">
        Please enter your first name.
    </span>
    <span *ngIf="firstNameVar.hasError('minlength')">
        The first name must be longer than 3 characters.
    </span>
</span>

// 3
<div class="form-group"
    [ngClass]="{'has-error': (lastNameVar.touched || lastNameVar.dirty) &&
lastNameVar.invalid }">

    <input class="form-control"
        id="lastNameId"
        type="text"
        placeholder="Last Name (required)"
        required
        maxlength="50"
        [(ngModel)]="user.lastName"
        name="lastName"
        #lastNameVar="ngModel" />
    <span class="help-block" *ngIf="(lastNameVar.touched || lastNameVar.dirty) &&
lastNameVar.errors">
        <span *ngIf="lastNameVar.hasError('required')">
            Please enter your last name.
        </span>
    </span>

// 4
<div class="form-group"
    [ngClass]="{'has-error': (emailVar.touched || emailVar.dirty) && emailVar.invalid
}">

    <input class="form-control"
        id="emailId"
        type="email"
        placeholder="Email (required)"
        required
        pattern="[a-z0-9._%+-]+@[a-z0-9.-]+"
        [(ngModel)]="user.email"
        name="email"
        #emailVar="ngModel" />
    <span class="help-block" *ngIf="(emailVar.touched || emailVar.dirty) &&
emailVar.errors">

```

```

        <span *ngIf="emailVar.hasError('required')">
            Please enter your email address.
        </span>
        <span *ngIf="emailVar.hasError('pattern')">
            Please enter a valid email address.
        </span>
    </span>

// 5
<input id="sendProductsId"
    type="checkbox"
    [(ngModel)]="user.sendProducts"
    name="sendProducts" >

// 6
<div *ngIf="user.sendProducts">
    <div class="form-group" >
        <label class="col-md-2 control-label">Address Type</label>

// 7
<input type="radio" id="addressType1Id" value="home"
    [(ngModel)]="user.addressType"
    name="addressType">Home

<input type="radio" id="addressType2Id" value="work"
    [(ngModel)]="user.addressType"
    name="addressType">Work

<input type="radio" id="addressType3Id" value="other"
    [(ngModel)]="user.addressType"
    name="addressType">Other

// 8
<select class="form-control"
    id="countryId"
    [(ngModel)]="user.country"
    name="country">
        <option value="">Select a Country...</option>
        <option *ngFor="let country of countries"
            value="{{country}}">{{country}}</option>
</select>

// 9
<input type="text"
    class="form-control"
    id="cityId"
    placeholder="City"
    [(ngModel)]="user.city"
    name="city">

<input type="number"
    class="form-control"
    id="zipId"

```

```

        placeholder="Zip Code"
        [(ngModel)]="user.zip"
        name="zip">

<input type="text"
        class="form-control"
        id="street1Id"
        placeholder="Street address"
        [(ngModel)]="user.street1"
        name="street1">

<input type="text"
        class="form-control"
        id="street2Id"
        placeholder="Street address (second line)"
        [(ngModel)]="user.street2"
        name="street2">

// 10
<button class="btn btn-primary"
        type="submit"
        [disabled]="!signupForm.valid">
    Save
</button>

```

7. Add the following snippet of code at the end of template

```

<br>Dirty: {{ signupForm.dirty }}
<br>Touched: {{ signupForm.touched }}
<br>Valid: {{ signupForm.valid }}
<br>Value: {{ signupForm.value | json }}

```

8. Make changes to the file **signup-form.component.css**. Use the following snippet of code:

```

input.ng-valid.ng-touched{
    background: lightgreen;
}

```

## Task 02. ReactiveComponent Class

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
import { FormGroup, FormControl } from '@angular/forms';
import { User } from './../../models/user';

countries: Array<string> = ['Ukraine', 'Armenia', 'Belarus', 'Hungary', 'Kazakhstan',
'Poland', 'Russia'];
user: User = new User();
userForm: FormGroup;

private createForm() {
  this.userForm = new FormGroup({
    firstName: new FormControl(),
    lastName: new FormControl(),
    email: new FormControl(),
    sendProducts: new FormControl(true)
  });
}

ngOnInit() {
  this.createForm();
}

save() {
  // Form model
  console.log(this.userForm);
  // Form value w/o disabled controls
  console.log(`Saved: ${JSON.stringify(this.userForm.value)}`);
  // Form value w/ disabled controls
  console.log(`Saved: ${JSON.stringify(this.userForm.getRawValue())}`);
}
```

2. Make changes to **SignupReactiveFormComponent Template**. Use the following snippet of html:

```
<select class="form-control"
id="countryId">
  <option value="">Select a Country...</option>
  <option *ngFor="let country of countries"
    value="{{country}}">{{country}}
  </option>
</select>
```

## Task 03. formGroup, FormControlName directives

1. Make changes to **SignupReactiveFormComponent** template. Use the following snippet of HTML:

```
<form class="form-horizontal"
      novalidate
      (ngSubmit)="save()"
      [formGroup]="userForm">

  <button class="btn btn-primary"
        type="submit"
        [disabled]="!userForm.valid">
    Save
  </button>

  <br>Dirty: {{ userForm.dirty }}
  <br>Touched: {{ userForm.touched }}
  <br>Valid: {{ userForm.valid }}
  <br>Value: {{ userForm.value | json }}
  <br>Form Status: {{userForm.status }}

  <input class="form-control"
        id="firstNameId"
        type="text"
        placeholder="First Name (required)"
        required
        minlength="3"
        FormControlName="firstName"/>

  <input class="form-control"
        id="lastNameId"
        type="text"
        placeholder="Last Name (required)"
        required
        maxlength="50"
        FormControlName="lastName"/>

  <input class="form-control"
        id="emailId"
        type="email"
        placeholder="Email (required)"
        required
        pattern="[a-z0-9._%+-]+@[a-z0-9.-.]+)"
        FormControlName="email" />

  <label>
    <input id="sendProductsId"
          type="checkbox"
          FormControlName="sendProducts" />
    Send me your products
  </label>
```

## 2. Comment template from

```
<div>
  <div class="form-group" >
    <label class="col-md-2 control-label">Address Type</label>
```

to the closed tag

## 3. Add attribute [ngClass]

For firstName

```
[ngClass]="{'has-error': (userForm.get('firstName').touched ||
userForm.get('firstName').dirty) && !userForm.get('firstName').valid }"
```

For lastName

```
[ngClass]="{'has-error': (userForm.get('lastName').touched ||
userForm.get('lastName').dirty) && !userForm.get('lastName').valid }"
```

For email

```
[ngClass]="{'has-error': (userForm.get('email').touched || userForm.get('email').dirty)
&& !userForm.get('email').valid }"
```

## 4. Add span block after each input – block for displaying validation error messages

For firstName

```
<span class="help-block" *ngIf="(userForm.get('firstName').touched ||
userForm.get('firstName').dirty) && userForm.get('firstName').errors">
  <span *ngIf="userForm.get('firstName').hasError('required')">
    Please enter your first name.
  </span>
  <span *ngIf="userForm.get('firstName').hasError('minlength')">
    The first name must be longer than 3 characters.
  </span>
</span>
```

For lastName

```
<span class="help-block" *ngIf="(userForm.get('lastName').touched ||
userForm.get('lastName').dirty) && userForm.get('lastName').errors">
  <span *ngIf="userForm.get('lastName').hasError('required')">
    Please enter your last name.
  </span>
</span>
```

For email

```
<span class="help-block" *ngIf="(userForm.get('email').touched ||
userForm.get('email').dirty) && userForm.get('email').errors">
  <span
    *ngIf="userForm.get('email').hasError('required')">
    Please enter your email address.
  </span>
  <span *ngIf="userForm.get('email').hasError('pattern')">
    Please enter a valid email address.
```



```
</span>  
<span *ngIf="userForm.get('email').hasError('email')">  
    Please enter a valid email address.  
</span>  
</span>
```

## Task 04. setValue(), patchValue()

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
private setFormValues() {
  this.userForm.setValue({
    firstName: 'Vitaliy',
    lastName: 'Zhyrytskyy',
    email: 'vitaliy_zhyrytskyy@ukr.net',
    sendProducts: false
  });
}

private patchFormValues() {
  this.userForm.patchValue({
    firstName: 'Vitaliy',
    lastName: 'Zhyrytskyy'
  });
}

ngOnInit() {
  this.createForm();
  this.setFormValues();
  // this.patchFormValues();
}
```

2. Look at the result. Comment method **this.setFormValues();** in ngOnInit() and uncomment method **this.patchFormValues();** Look at the result.

## Task 05. FormBuilder

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
import { FormBuilder, FormGroup, FormControl } from '@angular/forms';

constructor(
  private fb: FormBuilder
) { }

private buildForm() {
  this.userForm = this.fb.group({
    firstName: '',
    lastName: {value: 'Zhyrytskyy', disabled: true},
    email: [''],
    sendProducts: true
  });
}

ngOnInit() {
  this.createForm();
  this.buildForm();
  this.setFormValues();
  this.patchFormValues();
}
```

## Task 06. Setting Built-in Validators

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
// 1
import { FormBuilder, FormGroup, FormControl, Validators } from '@angular/forms';

// 2
private buildForm() {
  this.userForm = this.fb.group({
    firstName: '',
    firstName: ['', [Validators.required, Validators.minLength(3)]],
    lastName: {value: 'Zhyrytskyy', disabled: true},
    email: [''],
    sendProducts: true
  });
}
```

2. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```
<input class="form-control"
  id="firstNameId"
  type="text"
  placeholder="First Name (required)"
  required
  minlength="3"
  formControlName="firstName"/>
```

3. Check the validation for the field First Name

4. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
private buildForm() {
  this.userForm = this.fb.group({
    firstName: ['', [Validators.required, Validators.minLength(3)]],
    lastName: {value: 'Zhyrytskyy', disabled: true},
    lastName: [
      { value: 'Zhyrytskyy', disabled: false },
      [Validators.required, Validators.maxLength(50)]
    ],
    email: [''],
    email: [
      '',
      [Validators.required, Validators.pattern('[a-z0-9._%+-]+@[a-z0-9.-]+')],
      Validators.email
    ],
    sendProducts: true
  });
}
```

5. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```
<input class="form-control"
  id="lastNameId"
  type="text"
  placeholder="Last Name (required)"
  required
  maxlength="50"
  formControlName="lastName"/>
```

```
<input class="form-control"
      id="emailId"
      type="email"
      placeholder="Email (required)"
      required
      pattern="[a-z0-9._%+-]+@[a-z0-9.-]+"
      formControlName="email" />
```

6. Check the validation of the fields: FirtsName, LastName, Email

## Task 07. Adjusting Validation Rules in Runtime

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
// 1
placeholder = {
  email: 'Email (required)',
  phone: 'Phone'
};

// 2
private buildForm() {
  this.userForm = this.fb.group({
    firstName: ['', [Validators.required, Validators.minLength(3)]],
    lastName: [
      { value: 'Zhyrytskyy', disabled: false },
      [Validators.required, Validators.maxLength(50)]
    ],
    email: [
      '',
      [Validators.required, Validators.pattern('[a-z0-9._%+-]+@[a-z0-9.-]+')]
    ],
    phone: '',
    notification: 'email',
    sendProducts: true
  });
}
```

2. Make changes for the Email input in **SignupReactiveFormComponent template**. Add the following snippet of HTML **after the field email**

```
<input class="form-control"
  id="emailId"
  type="email"
  placeholder="Email (required)"
  placeholder={{placeholder.email}}
  formControlName="email" />
```

3. Make changes to **SignupReactiveFormComponent template**. Add the following snippet of HTML **after the field email**

```
<div class="form-group"
  [ngClass]="{'has-error': !userForm.get('phone').valid }">
  <label class="col-md-2 control-label"
    for="phoneId">Phone</label>

  <div class="col-md-8">
    <input class="form-control"
      id="phoneId"
      type="tel"
      placeholder={{placeholder.phone}}
      formControlName="phone" />
    <span class="help-block" *ngIf="userForm.get('phone').errors">
      <span *ngIf="userForm.get('phone').hasError('required')">
        Please enter your phone number.
      </span>
    </span>
  </div>
</div>
```

```

        </span>
      </div>
    </div>

    <div class="form-group">
      <label class="col-md-2 control-label">Send Notifications</label>
      <div class="col-md-8">
        <label class="radio-online">
          <input type="radio"
            value="email"
            formControlName="notification">Email
        </label>
        <label class="radio-online">
          <input type="radio"
            value="text"
            formControlName="notification">Text
        </label>
      </div>
    </div>
  </div>

```

4. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```

onSetNotification(notifyVia: string) {
  const phoneControl = this.userForm.get('phone');
  const emailControl = this.userForm.get('email');

  if (notifyVia === 'text') {
    phoneControl.setValidators(Validators.required);
    emailControl.clearValidators();
    this.placeholder.email = 'Email';
    this.placeholder.phone = 'Phone (required)';
  }
  else {
    emailControl.setValidators( [Validators.required, Validators.pattern('[a-z0-9._%+-]+@[a-z0-9.-]+')], Validators.email]);
    phoneControl.clearValidators();
    this.placeholder.email = 'Email (required)';
    this.placeholder.phone = 'Phone';
  }
  phoneControl.updateValueAndValidity();
  emailControl.updateValueAndValidity();
}

```

5. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```

<label class="radio-online">
  <input type="radio"
    value="email"
    formControlName="notification"
    (click)="onSetNotification('email')">Email
</label>
<label class="radio-online">
  <input type="radio"
    value="text"
    formControlName="notification"
    (click)="onSetNotification('text')">Text
</label>

```

## Task 08. Custom Validator

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
private buildForm() {
  this.userForm = this.fb.group({
    firstName: ['', [Validators.required, Validators.minLength(3)]],
    lastName: [
      { value: 'Zhyrytskyy', disabled: false },
      [Validators.required, Validators.maxLength(50)]
    ],
    email: [
      '',
      [Validators.required, Validators.pattern('[a-z0-9._%+-]+@[a-z0-9.-]+')],
      Validators.email
    ],
    phone: '',
    notification: 'email',
    serviceLevel: '',
    sendProducts: true
  });
}
```

2. Make changes to **SignupReactiveFormComponent template**. Add the following snippet of HTML after the block div for the element «Send Notifications»:

```
<div class="form-group"
  [ngClass]="{'has-error': (userForm.get('serviceLevel').touched ||
userForm.get('serviceLevel').dirty) && !userForm.get('serviceLevel').valid }">
  <label class="col-md-2 control-label"
    for="serviceLevelId">Service Level</label>

    <div class="col-md-8">
      <input class="form-control"
        id="serviceLevelId"
        type="number"
        formControlName="serviceLevel" />
      <span class="help-block"
        *ngIf="(userForm.get('serviceLevel').touched || userForm.get('serviceLevel').dirty) &&
userForm.get('serviceLevel').errors">
        <span
          *ngIf="userForm.get('serviceLevel').hasError('serviceLevel')">
            Please enter correct number from 1 to 5.
          </span>
        </span>
      </div>
    </div>
  </div>
```

3. Create file **app/validators/custom.validators.ts**. Use the following snippet of code:

```
import { AbstractControl } from '@angular/forms';

export class CustomValidators {
  static serviceLevel(c: AbstractControl): { [key: string]: boolean } | null {
    if (c.value !== undefined && (Number.isNaN(c.value) || c.value < 1 || c.value > 5))
    {
```



```

        return {
          serviceLevel: true
        };
      }
      return null;
    }
  }
}

```

4. Create file **app/validators/index.ts**. Use the following snippet of code:

```
export * from './custom.validators';
```

5. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```

// 1
import { CustomValidators } from '../../validators';

// 2
phone: '',
notification: 'email',
serviceLevel: '',
serviceLevel: ['', CustomValidators.serviceLevel],
sendProducts: true

```

## Task 09 Handle Validators Run Moment

1. Make changes to the file **app/validators/custom.validators.ts**. Use the following snippet of code:

```
static serviceLevel(c: AbstractControl): { [key: string]: boolean } | null {
    console.log('Validator: serviceLevel is called');
    if (c.value !== undefined && (Number.isNaN(c.value) || c.value < 1 || c.value > 5))
    {
        return {
            serviceLevel: true
        };
    }
    return null;
}
```

2. Look at the console. You can see that validator runs very often.
3. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
// 1
private createForm() {
    this.userForm = new FormGroup({
        firstName: new FormControl(),
        firstName: new FormControl('', {
            validators: [Validators.required, Validators.minLength(3)],
            updateOn: 'blur'
        }),
        lastName: new FormControl(),
        email: new FormControl(),
        phone: new FormControl(),
        notification: new FormControl('email'),
        serviceLevel: new FormControl('', {
            validators: [CustomValidators.serviceLevel],
            updateOn: 'blur'
        }),
        sendProducts: new FormControl(true)
    });
}

// 2
ngOnInit() {
    // this.buildForm();
    this.createForm();
}
```

4. Look at the console. You can see that validator runs more rarely.
5. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
// 1
private buildForm() {
    this.userForm = this.fb.group({
        // firstName: ['', [Validators.required, Validators.minLength(3)]],
        // It works!
        firstName: new FormControl('', {validators: [Validators.required,
Validators.minLength(3)], updateOn: 'blur'}),
        // It doesn't work!, will work in future. (Date: 20 Nov 2017)
        // firstName: this.fb.control('', { validators: [Validators.required,
Validators.minLength(3)], updateOn: 'blur' }),
    });
}
```

```

        lastName: [
            { value: 'Zhyrytsky', disabled: false },
            [Validators.required, Validators.maxLength(50)]
        ],
        email: [
            '',
            [Validators.required, Validators.pattern('[a-z0-9._%+-]+@[a-z0-9.-]+')],
            Validators.email
        ],
        phone: '',
        notification: 'email',
        serviceLevel: ['', CustomValidators.serviceLevel],
        sendProducts: true
    });
}

// 2
ngOnInit() {
    // this.buildForm();
    // this.createForm();
}

```

6. Look at the console. How often does validator run?

## gitTask 10. Custom Validator w/ Parameters

1. Make changes to the file **custom.validators.ts**. Use the following snippet of code:

```
// 1
import { AbstractControl, ValidatorFn } from '@angular/forms';

// 2
static serviceLevelRange(min: number, max: number): ValidatorFn {
  return (c: AbstractControl): { [key: string]: boolean } | null => {
    if (c.value !== undefined && (Number.isNaN(c.value) || c.value < min || c.value >
max)) {
      return {
        serviceLevel: true
      };
    }
    return null;
  }
}
```

2. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
serviceLevel: ['', CustomValidators.serviceLevel],
serviceLevel: ['', CustomValidators.serviceLevelRange(1, 3)],
```

3. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```
Please enter correct number from 1 to 5.
Please enter correct number from 1 to 3.
```

## Task 11. Custom Validator Directive

1. Create file **ValidatorsModule**. Run the following command from the command line:

```
ng g m validators -m app --spec false
```

2. Make changes to file **custom.validators.ts**. Use the following snippet of code:

```
// 1
export function checkServiceLevel(
  c: AbstractControl,
  min: number = 1,
  max: number = 5
): { [key: string]: boolean } | null {
  if (
    c.value !== undefined &&
    (Number.isNaN(c.value) || c.value < min || c.value > max)
  ) {
    return {
      serviceLevel: true
    };
  }
  return null;
}

// 2
static serviceLevel(c: AbstractControl): { [key: string]: boolean } | null {
  console.log('Validator: serviceLevel is called');
  if (
    c.value !== undefined &&
    (Number.isNaN(c.value) || c.value < 1 || c.value > 5)
  ) {
    return {
      serviceLevel: true
    };
  }
  return null;
  return checkServiceLevel(c);
}

// 3
static serviceLevelRange(min: number, max: number): ValidatorFn {
  return (c: AbstractControl): { [key: string]: boolean } | null => {
    if (c.value !== undefined && (Number.isNaN(c.value) || c.value < min || c.value >
max)) {
      return {
        'serviceLevel': true
      };
    }
    return null;
    return checkServiceLevel(c, min, max);
  };
}
```

3. Create **ServiceLevelDirective**. Run the following command from the command line:

```
ng g d validators/service-level --spec false --export true -m validators
```

4. Replace the content of **ServiceLevelDirective**. Use the following snippet of code:

```

import { Directive } from '@angular/core';
import { Validator, AbstractControl, NG_VALIDATORS } from '@angular/forms';

import { checkServiceLevel } from './custom.validators';

@Directive({
  selector: '[appServiceLevelValidator]',
  providers: [{
    provide: NG_VALIDATORS,
    useExisting: ServiceLevelDirective,
    multi: true
  }]
})
export class ServiceLevelDirective implements Validator {

  validate(c: AbstractControl): { [key: string]: boolean } | null {
    return checkServiceLevel(c, 1, 3);
  }
}

```

5. Make changes to file **app/validators/index.ts**. Use the following snippet of code:

```

export * from './custom.validators';
export * from './service-level.directive';

```

4. Make changes to **ValidatorsModule**. Use the following snippet of code:

```

import { ServiceLevelDirective } from './service-level.directive';

```

5. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```

serviceLevel: ['', CustomValidators.serviceLevelRange(1, 3)],
serviceLevel: [''],

```

6. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```

<input class="form-control"
  id="serviceLevelId"
  type="number"
  formControlName="serviceLevel"
  appServiceLevelValidator />

```

## Task 12. Custom Validator Directive w/ Parameters

1. Make changes to **ServiceLevelDirective**. Use the following snippet of code:

```
// 1
import { Directive, Input } from '@angular/core';

// 2
export class ServiceLevelDirective implements Validator {
  @Input() rMin = 1;
  @Input() rMax = 3;

  validate(c: AbstractControl): { [key: string]: boolean } | null {
    return checkServiceLevel(c, 1this.rMin, 3this.rMax);
  }
}
```

2. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```
<input class="form-control"
  id="serviceLevelId"
  type="number"
  formControlName="serviceLevel"
  appServiceLevelValidator rMin="1" rMax="4" #serviceLevelVar />
```

```
Please enter correct number from 1 to 3.
Please enter correct number from
{{serviceLevelVar.getAttribute('rMin') || 1}} to
{{serviceLevelVar.getAttribute('rMax') || 3}}.
```

## Task 13. Async Custom Validator Directive

1. Create **AsyncEmailValidatorDirective**. Run the following command from the command line:

```
ng g d validators/async-email-validator --spec false --export true -m validators
```

2. Replace the content of **AsyncEmailValidatorDirective**. Use the following snippet of code:

```
import { Directive } from '@angular/core';
import { NG_ASYNC_VALIDATORS, Validator, AbstractControl } from '@angular/forms';

import { Observable } from 'rxjs';
import { debounceTime, distinctUntilChanged, first } from 'rxjs/operators';

@Directive({
  selector: '[appAsyncEmailValidator][formControlName],
[appAsyncEmailValidator][ngModel]',
  providers: [
    {
      provide: NG_ASYNC_VALIDATORS,
      useExisting: AsyncEmailValidatorDirective,
      multi: true
    }
  ]
})
export class AsyncEmailValidatorDirective implements Validator {
  validate(c: AbstractControl): Promise<{ [key: string]: any}>|Observable < {[key:
string]: any}> {
    return this.validateEmailPromise(c.value);
    // return this.validateEmailObservable(c.value)
    // .pipe(
    //   debounceTime(1000),
    //   distinctUntilChanged(),
    //   first()
    // );
  }

  private validateEmailPromise(email: string) {
    return new Promise(resolve => {
      setTimeout(() => {
        if (email === 'existsemail@example.com') {
          resolve({
            asyncEmailInvalid: true
          })
        } else {
          resolve(null);
        }
      }, 2000);
    });
  }

  private validateEmailObservable(email: string) {
    return new Observable(observer => {
      if (email === 'existsemail@example.com') {
        observer.next({asyncEmailInvalid: true});
      } else {
        observer.next(null);
      }
    })
  }
}
```



```

    });
  }
}

```

3. Make changes to file **validators/index.ts**. Use the following snippet of code:

```
export * from './async-email-validator.directive';
```

4. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```

<input class="form-control"
      id="emailId"
      type="email"
      placeholder="Email (required)"
      formControlName="email"
      appAsyncEmailValidator />

<span *ngIf="userForm.get('email').hasError('asyncEmailInvalid')">
  This email already exists. Please enter other email address.
</span>

```

5. Enter the value **existsemail@example.com** to the field and ensure that validation runs.
6. Make changes to file **validators/async-email-validator.directive.ts** and ensure that validation runs.

```

validate(c: AbstractControl): Promise<{ [key: string]: any}>|Observable < {[key:
string]: any}> {
    // return this.validateEmailPromise(c.value);
    // return this.validateEmailObservable(c.value)
    // .pipe(
    //   debounceTime(1000),
    //   distinctUntilChanged(),
    //   first()
    // );
}

```

## Task 14. Cross-Field Validation

1. Make changes to **SignupReactiveFormComponent** template. Add the following snippet of HTML after the block of email:

```
<div class="form-group"
  [ngClass]='{\'has-error\': (userForm.get(\'confirmEmail\').touched ||
                                userForm.get(\'confirmEmail\').dirty) &&
                                userForm.get(\'confirmEmail\').invalid }'>
  <label class="col-md-2 control-label"
    for="confirmEmailId">Confirm Email</label>

  <div class="col-md-8">
    <input class="form-control"
      id="confirmEmailId"
      type="email"
      placeholder={{placeholder.confirmEmail}}
      formControlName="confirmEmail" />
    <span class="help-block" *ngIf="(userForm.get(\'confirmEmail\').touched ||
                                    userForm.get(\'confirmEmail\').dirty) &&
                                    userForm.get(\'confirmEmail\').errors">
      <span *ngIf="userForm.get(\'confirmEmail\').hasError(\'required\')">
        Please confirm your email address.
      </span>
    </span>
  </div>
</div>
```

2. Make changes to **SignupReactiveFormComponent**. Ensure that the validation of the field `confirmEmail` runs.

```
// 1
placeholder = {
  email: 'Email (required)',
  confirmEmail: 'Confirm Email (required)',
  phone: 'Phone'
};

// 2
email: ['',
  [Validators.required, Validators.pattern('[a-z0-9._%+-]+@[a-z0-9.-]+')], ,
  Validators.email]
],
confirmEmail: ['', Validators.required],
```

3. Make changes to **SignupReactiveFormComponent** template. Add the following snippet of HTML before the block of email and put into it blocks for email and `confirmEmail`:

```
<div formGroupName="emailGroup">
  <!-- Put here email and confirmEmail blocks -->
</div>
```

4. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
email: [
```

```

    '',
    [Validators.required, Validators.pattern('[a-z0-9._%+-]+@[a-z0-9.-]+')],
    Validators.email]
  ],
  confirmEmail: ['', Validators.required],
  emailGroup: this.fb.group({
    email: ['',
      [Validators.required, Validators.pattern('[a-z0-9._%+-]+@[a-z0-9.-]+')],
      Validators.email]
  ]),
  confirmEmail: ['', Validators.required],
  })),

```

5. Make changes to **SignupReactiveFormComponent** template. Use the following snippet of HTML:

```

<div class="form-group"
  [ngClass]="{'has-error': (userForm.get('emailGroup.email').touched ||
    userForm.get('emailGroup.email').dirty) &&
    userForm.get('emailGroup.email').invalid }">

  <label class="col-md-2 control-label"
    for="emailId">Email</label>

  <div class="col-md-8">
    <input class="form-control"
      id="emailId"
      type="email"
      placeholder={{placeholder.email}}
      formControlName="email"
      asyncEmailValidator />
    <span class="help-block"
      *ngIf="(userForm.get('emailGroup.email').touched ||
        userForm.get('emailGroup.email').dirty) &&
        userForm.get('emailGroup.email').errors">
      <span
        *ngIf="userForm.get('emailGroup.email').hasError('required')">
        Please enter your email address.
      </span>
      <span
        *ngIf="userForm.get('emailGroup.email').hasError('pattern')">
        Please enter a valid email address.
      </span>
      <span
        *ngIf="userForm.get('emailGroup.email').hasError('email')">
        Please enter a valid email address.
      </span>
      <span
        *ngIf="userForm.get('emailGroup.email').hasError('asyncEmailInvalid')">
        This email already exists. Please enter other email
        address.
      </span>
    </span>
  </div>
</div>

<div class="form-group"

```

```

[ngClass]="{'has-error':
(userForm.get('emailGroup.confirmEmail').touched ||
userForm.get('emailGroup.confirmEmail').dirty) &&
userForm.get('emailGroup.confirmEmail').invalid }">
  <label class="col-md-2 control-label"
    for="confirmEmailId">Confirm Email</label>

  <div class="col-md-8">
    <input class="form-control"
      id="confirmEmailId"
      type="email"
      placeholder="{{placeholder.confirmEmail}}"
      formControlName="confirmEmail" />
    <span class="help-block"
*ngIf="(userForm.get('emailGroup.confirmEmail').touched ||
userForm.get('emailGroup.confirmEmail').dirty) &&
userForm.get('emailGroup.confirmEmail').errors">
      <span
*ngIf="userForm.get('emailGroup.confirmEmail').hasError('required')">
        Please confirm your email address.
      </span>
    </span>
  </div>
</div>
</div>

```

6. Make changes to file **custom.validators.ts**. Use the following snippet of code:

```

static emailMatcher(c: AbstractControl): { [key: string]: boolean } | null {
  const emailControl = c.get('email');
  const emailConfirmControl = c.get('confirmEmail');

  if (emailControl.pristine || emailConfirmControl.pristine) {
    return null;
  }

  if (emailControl.value === emailConfirmControl.value) {
    return null;
  }

  return { 'emailMatch': true };
}

```

7. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```

// 1
emailGroup: this.fb.group({
  email: ['',
    [Validators.required, Validators.pattern('[a-z0-9._%+-]+@[a-z0-9.-]+') ,
    Validators.email]
  ],
  confirmEmail: ['', Validators.required],
}, {validator: CustomValidators.emailMatcher}),

```

```
// 2 Replace method onSetNotification with new one
onSetNotification(notifyVia: string) {
  const controls = new Map();
  controls.set('phoneControl', this.userForm.get('phone'));
  controls.set('emailGroup', this.userForm.get('emailGroup'));
  controls.set('emailControl', this.userForm.get('emailGroup.email'));
  controls.set(
    'confirmEmailControl',
    this.userForm.get('emailGroup.confirmEmail')
  );

  if (notifyVia === 'text') {
    controls.get('phoneControl').setValidators(Validators.required);
    controls.forEach(
      (control, index) =>
        index !== 'phoneControl' && control.clearValidators()
    );

    this.placeholder = {
      phone: 'Phone (required)',
      email: 'Email',
      confirmEmail: 'Confirm Email'
    };
  } else {
    controls
      .get('emailControl')
      .setValidators([
        Validators.required,
        Validators.pattern('[a-z0-9._%+-]+@[a-z0-9.-]+'),
        Validators.email
      ]);
    controls.get('confirmEmailControl').setValidators([Validators.required]);
    controls.get('emailGroup').setValidators([CustomValidators.emailMatcher]);
    controls.get('phoneControl').clearValidators();

    this.placeholder = {
      phone: 'Phone',
      email: 'Email (required)',
      confirmEmail: 'Confirm Email (required)'
    };
  }
  controls.forEach(control => control.updateValueAndValidity());
}
```

8. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```
<div formGroupName="emailGroup"
  [ngClass]="{'has-error': userForm.get('emailGroup').errors}">

  <span class="help-block" *ngIf="(userForm.get('emailGroup.confirmEmail').touched ||
    userForm.get('emailGroup.confirmEmail').dirty) &&
    userForm.get('emailGroup.confirmEmail').errors">
    <span *ngIf="userForm.get('emailGroup.confirmEmail').hasError('required')">
      Please confirm your email address.
    </span>
  </span>
```

```
</span>
<span class="help-block" *ngIf="(userForm.get('emailGroup.confirmEmail').touched ||
                                userForm.get('emailGroup.confirmEmail').dirty) &&
                                (userForm.get('emailGroup.confirmEmail').errors ||
                                userForm.get('emailGroup').errors)">
  <span *ngIf="userForm.get('emailGroup.confirmEmail').hasError('required')">
    Please confirm your email address.
  </span>
  <span *ngIf="userForm.get('emailGroup').hasError('emailMatch')">
    The confirmation does not match the email address.
  </span>
</span>
```

## Task 15. Adjusting Validation Rules

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
// 1
import { Component, OnInit, OnDestroy } from '@angular/core';
import { Subscription } from 'rxjs';

// 2
export class SignupReactiveFormComponent implements OnInit, OnDestroy

// 3
private sub: Subscription;

// 4
private watchValueChanges() {
  this.sub = this.userForm.get('notification').valueChanges
    .subscribe(value => console.log(value));
}

// 5
ngOnInit() {
  this.buildForm();
  this.watchValueChanges();
}

// 6
ngOnDestroy() {
  this.sub.unsubscribe();
}
```

2. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```
<div class="form-group">
  <label class="col-md-2 control-label">Send Notifications</label>
  <div class="col-md-8">
    <label class="radio-online">
      <input type="radio"
        value="email"
        formControlName="notification"
        (click)="onSetNotification('email')">Email
    </label>
    <label class="radio-online">
      <input type="radio"
        value="text"
        formControlName="notification"
        (click)="onSetNotification('text')">Text
    </label>
  </div>
</div>
```

3. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
// 1
```

```
private watchValueChanges() {  
    this.sub = this.userForm.get('notification').valueChanges  
        .subscribe(value => console.log(value));  
        .subscribe(value => this.setNotification(value));  
}  
  
// 2  
private onSetNotification(notifyVia: string) {
```



## Task 16. Displaying Validation Messages

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
// 1
import { FormGroup, FormControl, FormBuilder, Validators, AbstractControl } from
 '@angular/forms';

// 2
userForm: FormGroup;
validationMessage: string;

// 3
private sub: Subscription;
private validationMessages = {
  email: {
    required: 'Please enter your email address.',
    pattern: 'Please enter a valid email address.',
    email: 'Please enter a valid email address.',
    asyncEmailInvalid:
      'This email already exists. Please enter other email address.'
  }
};

// 4
private setValidationMessage(c: AbstractControl, controlName: string) {
  this.validationMessage = '';

  if ((c.touched || c.dirty) && c.errors) {
    this.validationMessage = Object.keys(c.errors)
      .map(key => this.validationMessages[controlName][key])
      .join(' ');
  }
}

// 5
private watchValueChanges() {
  ...

  const emailControl = this.userForm.get('emailGroup.email');
  const sub = emailControl.valueChanges.subscribe(value =>
    this.setValidationMessage(emailControl, 'email')
  );
  this.sub.add(sub);
}

// 6
onBlur() {
  const emailControl = this.userForm.get('emailGroup.email');
  this.setValidationMessage(emailControl, 'email');
}
```

2. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```
<div class="form-group"
```

```

[ngClass]="{'has-error':
(userForm.controls.emailGroup.controls.email.touched ||
userForm.get('emailGroup.email').dirty)
&&
userForm.get('emailGroup.email').invalid
}">
[ngClass]="{'has-error': validationMessage}">
  <label class="col-md-2 control-label"
    for="emailId">Email</label>

  <div class="col-md-8">
    <input class="form-control"
      id="emailId"
      type="email"
      placeholder="{{placeholder.email}}"
      formControlName="email"
      asyncEmailValidator
      (blur)="onBlur()" />
    <span class="help-block"
      *ngIf="(userForm.get('emailGroup.email').touched ||
userForm.get('emailGroup.email').dirty) &&
userForm.get('emailGroup.email').errors">
      <span
        *ngIf="userForm.get('emailGroup.email').hasError('required')">
          Please enter your email address.
        </span>
        <span
          *ngIf="userForm.get('emailGroup.email').hasError('pattern')">
            Please enter a valid email address.
          </span>
          <span
            *ngIf="userForm.get('emailGroup.email').hasError('email')">
              Please enter a valid email address.
            </span>
            <span *ngIf="userForm.get('emailGroup.email').hasError('asyncEmailInvalid')">
              This email already exists. Please enter other email
              address.
            </span>
          </span>

        </span>
      <span class="help-block" *ngIf=" validationMessage ">
        {{ validationMessage }}
      </span>
    </div>
  </div>

```

## Task 17. Reactive Transformations

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
import { Subscription } from 'rxjs';  
import { debounceTime } from 'rxjs/operators';
```

2. Внесите изменения в метод **watchValueChanges**

```
private watchValueChanges() {  
  ...  
  const sub = emailControl.valueChanges  
    .pipe(  
      debounceTime(1000)  
    )  
    .subscribe(value => this.setValidationMessage(emailControl, 'email'));  
  this.sub.add(sub);  
}
```

## Task 18. Define the input element(s) to duplicate

1. Make changes to method **buildForm**. Use the following snippet of code:

```
sendProducts: true,  
addressType: 'home',  
country: '',  
city: '',  
zip: '',  
street1: '',  
street2: ''
```

2. Uncomment HTML of **SignupReactiveFormComponent**, which starts from  
<!--<div >

3. Replace the div element. Use the following snippet of code:

```
<div >  
<div *ngIf="userForm.get('sendProducts').value">
```

4. Make changes to the markup of the fields **Home, Work, Other**

```
formControlName="addressType"
```

5. Make changes to the markup of the fields **Country, City, Zip Code, Street Address 1, Street Address 2**

```
// Country  
formControlName="country"
```

```
// City  
formControlName="city"
```

```
// Zip Code  
formControlName="zip"
```

```
// Street Address 1  
formControlName="street1"
```

```
// Street Address 2  
formControlName="street2"
```

## Task 19. Define a FormGroup

1. Make changes to the method **buildForm**. Use the following snippet of code:

```
addressType: 'home',  
country: '',  
city: '',  
zip: '',  
street1: '',  
street2: ''  
addresses: this.fb.group({  
  addressType: 'home',  
  country: '',  
  city: '',  
  zip: '',  
  street1: '',  
  street2: ''  
})
```

2. Wrap 4 div blocks, which are in the block  
`<div *ngIf="userForm.get('sendProducts').value">` and contain the fields for address. Use the following snippet of HTML:

```
<div formGroupName="addresses">...</div>
```

## Task 20. Refactor to Make Copies

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
// 1
private buildAddress(): FormGroup {
  return this.fb.group({
    addressType: 'home',
    country: '',
    city: '',
    zip: '',
    street1: '',
    street2: ''
  });
}

// 2
addresses: this.buildAddress()
addresses: this.fb.group({
  addressType: 'home',
  country: '',
  city: '',
  zip: '',
  street1: '',
  street2: ''
})
```

## Task 21. Create a FormArray

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
// 1
import { FormGroup, FormControl, FormArray, FormBuilder, Validators, AbstractControl }
from '@angular/forms';

// 2
get addresses(): FormArray {
  return <FormArray>this.userForm.get('addresses');
}
```

2. Make changes to the method **buildForm**. Use the following snippet of code:

```
addresses: this.buildAddress()
addresses: this.fb.array([this.buildAddress()])
```

3. Make changes to **SignupReactiveFormComponent template**. Create wrapper block for the block `<div formGroupName="addresses">`. Use the following snippet of HTML:

```
<div formArrayName="addresses">
</div>
```

4. Replace the expression of attribute **formGroupName="addresses"**. Use the following snippet of HTML:

```
<div formGroupName="addresses">
<div formGroupName="0">
```

## Task 22. Loop through the FormArray

1. Make changes to **SignupReactiveFormComponent** template. Use the following snippet of HTML:

```
<div formArrayName="addresses">
  <div formGroupName="0">
    <div *ngFor="let address of addresses.controls; let i = index" [formGroupName]="i"
  >
```

2. Replace the value of attribute **id** for the fields **Home, Work, Other**. Use the following snippet of HTML:

```
id="addressType1Id"
id="{{ 'addressType1Id' + i }}"
```

3. Replace the value of attribute **for** for the label elements «**Country, City, Zip Code**», «**Street Address 1**», «**Street Address 2**». Use the following snippet of HTML:

```
// Country, City, Zip Code
for="cityId"
attr.for="{{ 'countryId' + i }}"

// Street Address 1
for="street1Id"
attr.for="{{ 'street1Id' + i }}"

// Street Address 2
for="street2Id"
attr.for="{{ 'street2Id' + i }}"
```

4. Replace the value of the attribute **id** for the fields **Country, City, Zip Code, Street Address 1, Street Address 2**. Use the following snippet of HTML:

```
// Country
id="countryId"
id="{{ 'countryId' + i }}"

// City
id="cityId"
id="{{ 'cityId' + i }}"

// Zip Code
id="zipId"
id="{{ 'zipId' + i }}"

// Street Address 1
id="street1Id"
id="{{ 'street1Id' + i }}"

// Street Address 2
id="street2Id"
id="{{ 'street2Id' + i }}"
```



## Task 23. Duplicate the Input Elements

1. Make changes to **SignupReactiveFormComponent**. Use the following snippet of code:

```
onAddAddress(): void {  
    this.addresses.push(this.buildAddress());  
}
```

2. Make changes to **SignupReactiveFormComponent template**. Use the following snippet of HTML:

```
// 1  
<div formArrayName="addresses">  
...  
</div>  
  
    <div class="form-group">  
        <div class="col-md-4 col-md-offset-2">  
            <button class="btn btn-primary"  
                type="button"  
                (click)="onAddAddress()">  
                Add Another Address  
            </button>  
        </div>  
    </div>  
  
// 2  
<br>userForm.get('emailGroup').errors {{userForm.get('emailGroup').errors | json}}  
<br>Street: {{addresses.get('0.street1')?.value}}
```