Angular Master Class

Forms

Goals

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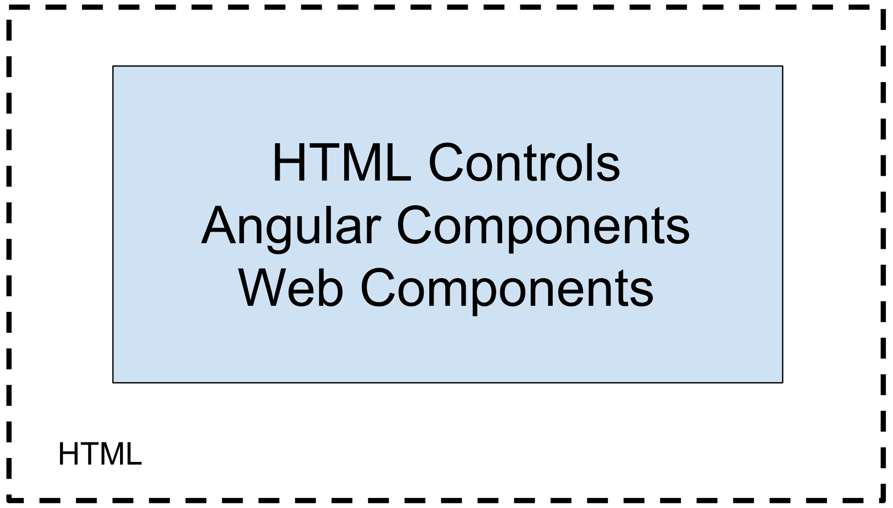
- Prevent the form from causing a page reload when submitting
- Validate form controls before form is submitted
- Display error and validation methods as user interacts with form

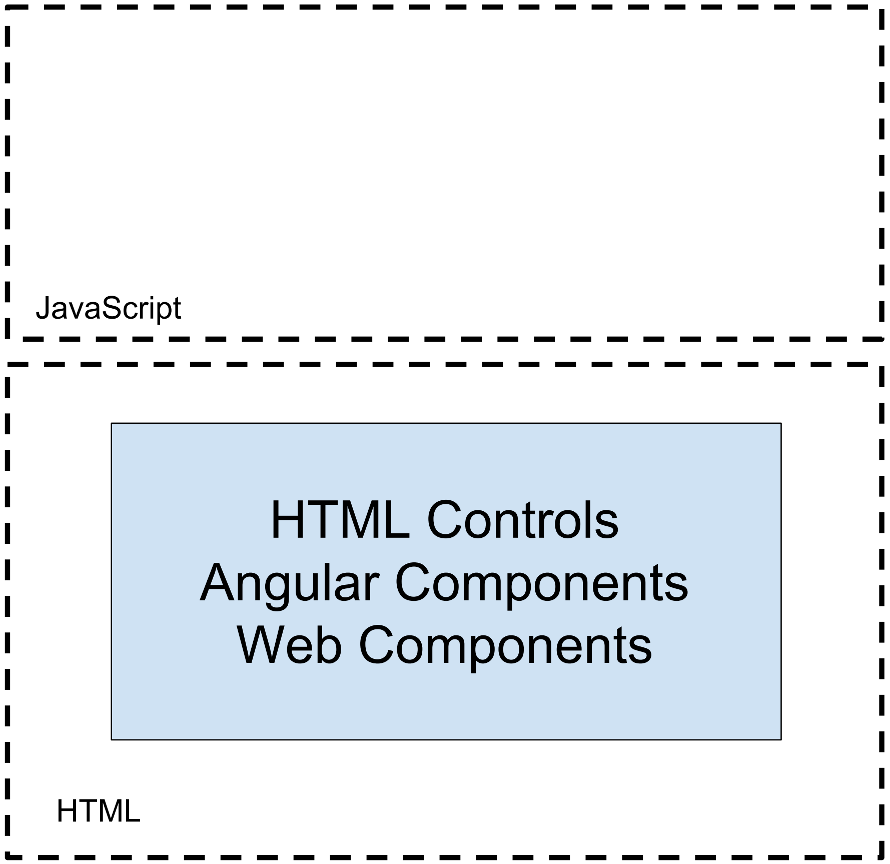
Forms in Angular

Angular provides two different ways of creating forms:

- **Template-driven** - Everything we need to build forms declaratively
- **Reactive** - Enables testing forms, reactive data-flow and thinner markup

HTML


HTML Controls
Angular Components
Web Components
HTML


JavaScript
HTML Controls
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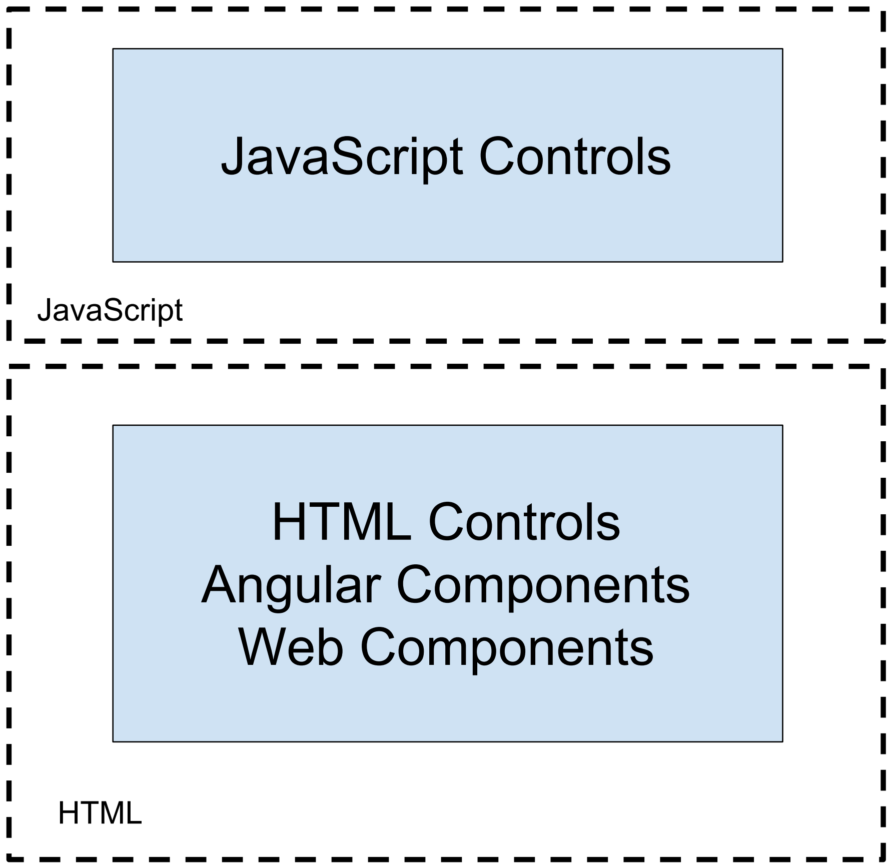
JavaScript Controls
JavaScript
HTML Controls
Angular Components
Web Components
HTML

Template-driven Forms

Activate Form API

We activate the new Form API by importing **FormsModule**

```
import { FormsModule } from '@angular/forms':

@NgModule({
  imports: [
    ...
    FormsModule
  ]
  ...
})
class ContactsModule {}
```

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@NgModule({
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ngForm Directive

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`ngForm` provides us information about the current state of the form including:

- A JSON representation of the form value
- Validity state of the entire form
- Also delegates submission events

```
<form>
  <label>Firstname:</label>
  <input type="text">

  <label>Lastname:</label>
  <input type="text">

  <button type="submit">Save</button>
</form>
```

```
<form #form="ngForm">
  <label>Firstname:</label>
  <input type="text">

  <label>Lastname:</label>
  <input type="text">

  <button type="submit">Save</button>
</form>
```

Accessing `ngForm` instance with local template variable.

Submitting Forms

We bind to the `ngSubmit` event to handle form submissions.

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We bind to the `ngSubmit` event to handle form submissions.

```
<form (ngSubmit)="submit()">

  ...

</form>
```

Doesn't cause page reload when error is thrown.

Accessing Form values

`ngForm.value` returns a JSON representation of the form's control values.

```
<form
  #form="ngForm"
  (ngSubmit)="submit(form.value)">

  ...

</form>
```

Demo →

Adding Form Controls

We register form controls at a form using `ngModel` directive `name` attribute.

```
<form>

  <label>Firstname:</label>
  <input>
  ...

</form>
```

Adding Form Controls

We register form controls at a form using `ngModel` directive `name` attribute.

```
<form>

  <label>Firstname:</label>
  <input name="firstname" ngModel>
  ...

</form>
```

Control structure will be represented in `ngForm.value`

Adding Control Groups

Sometimes, controls need to be semantically grouped. `ngModelGroup` enables us to do that.

```
<div ngModelGroup="name">

  <label>Firstname:</label>
  <input name="firstname" ngModel>

  <label>Lastname:</label>
  <input name="lastname" ngModel>

</div>
```

Adding Control Groups

Sometimes, controls need to be semantically grouped. `ngModelGroup` enables us to do that.

```
<div ngModelGroup="name">

  <label>Firstname:</label>
  <input name="firstname" ngModel>

  <label>Lastname:</label>
  <input name="lastname" ngModel>

</div>
```

Demo →

Exercise: Template-driven form

Built-in Validation and Messages

Built-in Validation

Angular comes with the following built-in validation directives:

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- `maxlength` - Value has to match given maxlength

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Angular comes with the following built-in validation directives:

- `required` - Value mustn't be empty
- `minlength` - Value has to match given minlength
- `maxlength` - Value has to match given maxlength
- `pattern` - Value must match given RegExp pattern

Applying Validators

Validator directives can simply be applied to the form control element.

```
<input required minlength="3">
```

Validation State

`ngForm`, `ngModelGroup` and `ngModel` track validation state of form controls.

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- **invalid** - Form/Group/Control is invalid
- **dirty** - Form/Group/Control has changed

Validation State

`ngForm`, `ngModelGroup` and `ngModel` track validation state of form controls.

- **valid** - Form/Group/Control is valid
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- **pristine** - Form/Group/Control hasn't changed

Validation State

`ngForm`, `ngModelGroup` and `ngModel` track validation state of form controls.

- **valid** - Form/Group/Control is valid
- **invalid** - Form/Group/Control is invalid
- **dirty** - Form/Group/Control has changed
- **pristine** - Form/Group/Control hasn't changed
- ...

```
<form #form="ngForm">

  <input ngModel name="firstname" required>

  <button [disabled]="!form.valid">Save</button>
</form>
```

```
<form #form="ngForm">

  <input ngModel name="firstname" required>

  <button [disabled]="!form.valid">Save</button>
</form>
```

Accessing Errors

Form control instances expose the error state on the `errors` property.

```
<input #firstname="ngModel" minlength="3">

<p *ngIf="firstname.errors.minlength">
  Whoops!
</p>
```

Accessing Errors

Form control instances expose the error state on the `errors` property.

```
<input #firstname="ngModel" minlength="3">

<p *ngIf="firstname.errors.minlength">
  Whoops!
</p>
```

Error Values

Different validators might expose different information about the error.

```
firstname.errors = {

  minlength: {
    actualLength: 2,
    requiredLength: 3
  },

  required: true
}
```

Exercise: Validation and Messages

Custom Validators

Custom Validators

A validator is a function that takes a `Control` and returns `null` or an error object.

```
function integerValidator(c: FormControl) {

  const REG_EXP = /^\-?\d+$/;
  var valid = REG_EXP.test(c.value);

  return (!valid) ? {
    integer: false
  } : null;
}
```

Validator Directive

We register validators via directives by supplying the `NG_VALIDATORS` provider.

```
@Directive({
  selector: '[validateInteger][ngModel]',
  providers: [
    {
      provide: NG_VALIDATORS,
      useValue: integerValidator,
      multi: true
    }
  ]
})
class IntegerValidator {}
```

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  selector: '[validateInteger][ngModel]',
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    {
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      useValue: integerValidator,
      multi: true
    }
  ]
})
class IntegerValidator {}
```

Multi Provider

Multi providers allow us to provide multiple dependencies for a single token.

```
@NgModule({
  ...
  providers: [
    { provide: 'MULTI_DEP', useValue: 'foo', multi: true },
    { provide: 'MULTI_DEP', useValue: 'bar', multi: true },
  ]
})
```

Multi Provider

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```
@NgModule({
  ...
  providers: [
    { provide: 'MULTI_DEP', useValue: 'foo', multi: true },
    { provide: 'MULTI_DEP', useValue: 'bar', multi: true },
  ]
})
```

Multi Provider Injection

We can inject all registered values using the multi provider token.

```
@Component({
  ...
})
export class MyComponent {

  constructor(@Inject('MULTI_DEP') deps: []) {
    // deps == ['foo', 'bar']
  }
}
```

Built-in Multi Providers

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Angular comes with several multi providers that we can extend with our custom code.

- **NG_VALIDATORS** Providers for validators
- **NG_ASYNC_VALIDATORS** Providers for async validators

Exercise: Custom Validator

Async Validators

Async Validator

Async validators return either a `Promise`, or an `Observable`.

```
checkEmailAvailability(contactsService: ContactsService) {
  return (c: FormControl) => {
    return contactsService.isEmailAvailable(c.value)
      .pipe(map(response => !response.error ? null : {
        emailTaken: true
      }));
  };
}
```

Async Validator

Async validators return either a `Promise`, or an `Observable`.

```
checkEmailAvailability(contactsService: ContactsService) {
  return (c: FormControl) => {
    return contactsService.isEmailAvailable(c.value)
      .pipe(map(response => !response.error ? null : {
        emailTaken: true
      }));
  };
}
```

Async Validator Directives

Validator Objects

If a validator has dependencies, we can create objects and take advantage of DI.

```
@Directive({
  providers: [
    {
      provide: NG_ASYNC_VALIDATORS,
      useExisting: forwardRef(() => AsyncValidator),
      multi: true
    }
  ]
})
class AsyncValidator {

  constructor(contactsService: ContactsService) {}

  validate(c: FormControl) {}
}
```

```
@Directive({
  providers: [
    {
      provide: NG_ASYNC_VALIDATORS,
      useExisting: forwardRef(() => AsyncValidator),
      multi: true
    }
  ]
})
class AsyncValidator {
  _validate: Function;

  constructor(contactsService: ContactsService) {
    this._validate = checkEmailAvailability(contactsService);
  }

  validate(c: FormControl) {}
}
```

```
@Directive({
  providers: [
    {
      provide: NG_ASYNC_VALIDATORS,
      useExisting: forwardRef(() => AsyncValidator),
      multi: true
    }
  ]
})
class AsyncValidator {
  _validate: Function;

  constructor(contactsService: ContactsService) { ... }

  validate(c: FormControl) {
    return this._validate(c);
  }
}
```

Demo →

Exercise: Custom Async Validator

Reactive Forms

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Reactive forms can be implemented using the following APIs:

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- **FormControl** - Represents a single form control
- **FormGroup** - Represents a group of form controls
- **FormArray** - Similar to `FormGroup` but dynamic
- **FormBuilder** - Factory API creating controls and control groups

Reactive Forms

Reactive forms can be implemented using the following APIs:

- **FormControl** - Represents a single form control
- **FormGroup** - Represents a group of form controls
- **FormArray** - Similar to `FormGroup` but dynamic
- **FormBuilder** - Factory API creating controls and control groups

Reactive forms are **easier to test**.

Activating reactive APIs

To activate reactive form APIs, we need to import **ReactiveFormsModule**

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

@NgModule({
  imports: [
    ...
    ReactiveFormsModule
  ]
  ...
})
export class ContactsModule {}
```

Activating reactive APIs

To activate reactive form APIs, we need to import **ReactiveFormsModule**

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

@NgModule({
  imports: [
    ...
    ReactiveFormsModule
  ]
  ...
})
export class ContactsModule {}
```

FormControl

Defines a part of a form and has its value and validity state (determined by optional validator).

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

@Component(...)
export class ContactCreatorComponent {
  firstname = new FormControl();
}
```

FormControl

Defines a part of a form and has its value and validity state (determined by optional validator).

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

@Component(...)
export class ContactCreatorComponent {
  firstname = new FormControl();
}
```

formControl Directive

We bind existing **FormControl**'s to a DOM element using **formControl**.

```
<input [formControl]="firstname">
```

Useful when using standalone input control **without** control group.

FormGroup

Defines a part of a form of fixed length, that contains other controls.

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

@Component(...)
export class ContactCreatorComponent {
  form = new FormGroup({
    firstname: new FormControl(),
    lastname: new FormControl()
  })
}
```

FormGroup

Defines a part of a form of fixed length, that contains other controls.

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

@Component(...)
export class ContactCreatorComponent {
  form = new FormGroup({
    firstname: new FormControl(),
    lastname: new FormControl()
  })
}
```

formGroup Directive

We bind existing **FormGroup** to a DOM element using **formGroup** directive.

```
<form [formGroup]="form">
  <input formControlName="firstname">
  <input formControlName="lastname">
</form>
```

FormGroup fields are bound using **formControlName**.

formGroup Directive

We bind existing **FormGroup** to a DOM element using **formGroup** directive.

```
<form [formGroup]="form">
  <input formControlName="firstname">
  <input formControlName="lastname">
</form>
```

FormGroup fields are bound using **formControlName**.

FormBuilder

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- **.control()** - Constructs a new control

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FormBuilder provides convenient abstraction methods for all form control APIs.

- **.group()** - Constructs a new control group
- **.control()** - Constructs a new control
- **.array()** - Constructs a new control group from array

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

@Component(...)
export class ContactsCreatorComponent implements OnInit {
  form : FormGroup;

  constructor(private fb: FormBuilder) {}

  ngOnInit() {
    this.form = this.fb.group({
      firstname: '',
      lastname: ''
    });
  }
}
```

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

@Component(...)
export class ContactsCreatorComponent implements OnInit {
  form : FormGroup;

  constructor(private fb: FormBuilder) {}

  ngOnInit() {
    this.form = this.fb.group({
      firstname: '',
      lastname: ''
    });
  }
}
```

Applying Validators

Validator functions need to be added to a form model's field when building **reactive** forms.

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

...

ngOnInit() {
  this.form = this.fb.goup({
    firstname: ['', Validators.required],
    lastname: ['', Validators.required]
  });
}
```

Applying Validators

Validator functions need to be added to a form model's field when building **reactive** forms.

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

...

ngOnInit() {
  this.form = this.fb.goup({
    firstname: ['', Validators.required],
    lastname: ['', Validators.required]
  });
}
```

Composing Validators

Multiple validators need to be composed when building **reactive** forms.

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

...
ngOnInit() {
  this.form = this.fb.group({
    firstname: ['', [
      Validators.required,
      Validators.minlength(3)
    ]],
    lastname: ['', Validators.required]
  });
}
```

Composing Validators

Multiple validators need to be composed when building **reactive** forms.

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

...
ngOnInit() {
  this.form = this.fb.goup({
    firstname: ['', [
      Validators.required,
      Validators.minlength(3)
    ]],
    lastname: ['', Validators.required]
  });
}
```

Applying async validators

We add async validation as third argument when creating controls.

```
ngOnInit() {
  this.form = this.fb.goup({
    firstname: ['', syncValidator, asyncValidator],
    lastname: ''
  });
}
```

Exercise: FormBuilder

FormArray

FormArray

FormArray enables us to create **FormGroup**`s of unknown size.

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FormArray enables us to create **FormGroup**`s of unknown size.

- **FormArray.push(control: FormControl)** - adds new form control to collection
- **FormArray.removeAt(index: number)** - removes form control from collection by index

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

export class ContactsCreatorComponent implements OnInit {
  ...
  ngOnInit() {
    this.form = this.fb.group({
      ...
      phone: this.formBuilder.array([''])
    });
  }
}
```

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

export class ContactsCreatorComponent implements OnInit {
  ...
  ngOnInit() {
    this.form = this.fb.group({
      ...
      phone: this.formBuilder.array([''])
    });
  }
}
```

Adding fields

Form controls can be dynamically added using **push(control: FormControl)**

```
export class ContactsCreatorComponent implements OnInit {
  ...
  addPhoneField() {
    const control = <FormArray>this.form.get('phone');
    control.push(new FormControl(''));
  }
}
```

Adding fields

Form controls can be dynamically added using
push(control: FormControl)

```
export class ContactsCreatorComponent implements OnInit {
  ...
  addPhoneField() {
    const control = <FormArray>this.form.get('phone');
    control.push(new FormControl(''));
  }
}
```

Removing fields

Form controls can be removed using **removeAt(index: number)**

```
export class ContactsCreatorComponent implements OnInit {
  ...
  removePhoneField(index) {
    const control = <FormArray>this.form.get('phone');
    control.removeAt(index);
  }
}
```

Removing fields

Form controls can be removed using **removeAt(index: number)**

```
export class ContactsCreatorComponent implements OnInit {
  ...
  removePhoneField(index) {
    const control = <FormArray>this.form.get('phone');
    control.removeAt(index);
  }
}
```

```
<div formArrayName="phone">

  <div *ngFor="let phone of form.get('phone').controls;
               let i = index;">

    <md-input-container>
      <input placeholder="Phone" [formControlName]="i">
    </md-input-container>

    <button (click)="removePhoneField(i)">...</button>
    <button (click)="addPhoneField()">...</button>
  </div>

</div>
```

```
<div formArrayName="phone">

  <div *ngFor="let phone of form.get('phone').controls;
               let i = index;">

    <md-input-container>
      <input placeholder="Phone" [formControlName]="i">
    </md-input-container>

    <button (click)="removePhoneField(i)">...</button>
    <button (click)="addPhoneField()">...</button>
  </div>

</div>
```

ercise: FormArray for dynamic forms

Custom Form Controls

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- How can we make it accessible?

Custom Form Controls

Custom form controls provide functionality beyond native form controls. **Things to consider**:

- Is there a native element with the same semantics?
- Can we rely on it and use CSS/progressive enhancement instead?
- How can we make it accessible?
- How does it validate?

Creating custom controls

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- It properly propagates changes to Model
- Adds validity state

Creating custom controls

When creating custom form controls there are a couple of things we need to make sure:

- It properly propagates changes to DOM/View
- It properly propagates changes to Model
- Adds validity state
- It's accessible

ControlValueAccessor

Angular provides an interface **ControlValueAccessor** to implement custom form controls

- **writeValue(obj: any)** - Updates underlying DOM/View with new value
- **registerOnChange(fn: any)** - Registers handler to propagate changes to model
- **registerOnTouched(fn: any)** - Registers handler to propagate touched state

Custom address input

```
<fieldset formGroupName="address" fxLayout="column">
  <legend>Address</legend>
  <mat-form-field fxFlex>
    <input matInput placeholder="Street" formControlName="st
  </mat-form-field>
  ...
</fieldset>
```

should be:

```
<trm-address-input formControlName="address">
</trm-address-input>
```

```
@Component({
  selector: 'trm-address-input',
  providers: [






  ]
})
export class AddressInput {
  ...
}
```

```
@Component({
  selector: 'trm-address-input',
  providers: [
    {
      provide: NG_VALUE_ACCESSOR,
      useExisting: forwardRef(() => AddressInputComponent),
      multi: true
    }
  ]
})
export class AddressInput implements ControlValueAccessor {
  ...
}
```

```
export class AddressInput implements ControlValueAccessor {

  constructor(private fb: FormBuilder) {}

  ngOnInit() {
    this.form = this.fb.group({
      ...
    });
  }

  writeValue(value) {...}

  registerOnChange(fn) {...}

  registerOnTouched(fn) {...}
}
```

```
export class AddressInput implements ControlValueAccessor {

  constructor(private fb: FormBuilder) {}

  ngOnInit() {
    this.form = this.fb.group({
      ...
    });
  }

  writeValue(value) {...}

  registerOnChange(fn) {...}

  registerOnTouched(fn) {...}
}
```

writeValue()

writeValue() writes a new value from the form model into the view

```
export class AddressInput implements ControlValueAccessor {
  ...
  writeValue(value) {
    this.form.setValue(value)
  }
}
```

registerOnChange(fn)

registerOnChange() registers a function that can be later called to propagate changes from DOM/View

```
export class AddressInput implements ControlValueAccessor{
  propagateChange = (_: Address) => {};

  ngOnInit() {
    this.form.valueChanges.subscribe(value => {
      this.propagateChange(value);  // notify parent
    });
  }

  registerOnChange(fn) {
    this.propagateChange = fn;  // Cache callback to parent
  }
}
```

registerOnTouched(fn)

registerOnTouched() registers a function that can be later called to propagate touched state

```
export class AddressInput implements ControlValueAccessor {
  ...
  registerOnTouched(fn) {
    this.propagateTouched = fn;
  }
}
```

registerOnTouched(fn)

registerOnTouched() registers a function that can be later called to propagate touched state

```
<fieldset formGroupName="address" fxLayout="column">
  <legend>Address</legend>
  <mat-form-field fxFlex>

    <input matInput placeholder="Street"
           formControlName="street"
           (blur)="propagateTouched()" >

  </mat-form-field>
</fieldset>
```

registerOnTouched(fn)

registerOnTouched() registers a function that can be later called to propagate touched state

```
<fieldset formGroupName="address" fxLayout="column">
  <legend>Address</legend>
  <mat-form-field fxFlex>
    <input matInput placeholder="Street"
      (blur)="propagateTouched()" formControlName="street">
  </mat-form-field>
  ...
</fieldset>
```

Exercise: Custom Form Control

THOUGHTCAM

EXTEND YOUR MEMORY

- git add .
- git commit -am "(completed) - forms"
- git tag classroom/forms