CUSTOM DIRECTIVES

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Directives

- Directives are JavaScript classes

- Angular has 3 types of directives
  - Component Directives
  - Structural Directives
  - Attribute Directives

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Attribute directives

- Each attribute can be defined as directive
- Angular finds all matching attributes and instantiates a directive instance
- Attribute directive can extends multiple unrelated components
  - Think about a tooltip directive
- Usually an attribute directive changes the look and behavior of an element

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myClass

- Lets write our own version of ngClass

```
<li *ngFor="let contact of contacts" [myClass]="{selected: contact.selected}">
    <span>{{contact.name}}</span>
    <button (click)="select(contact)">Select</button>
</li>
```

- myClass gets a option object where each key is a class name and a value that is a Boolean indicator

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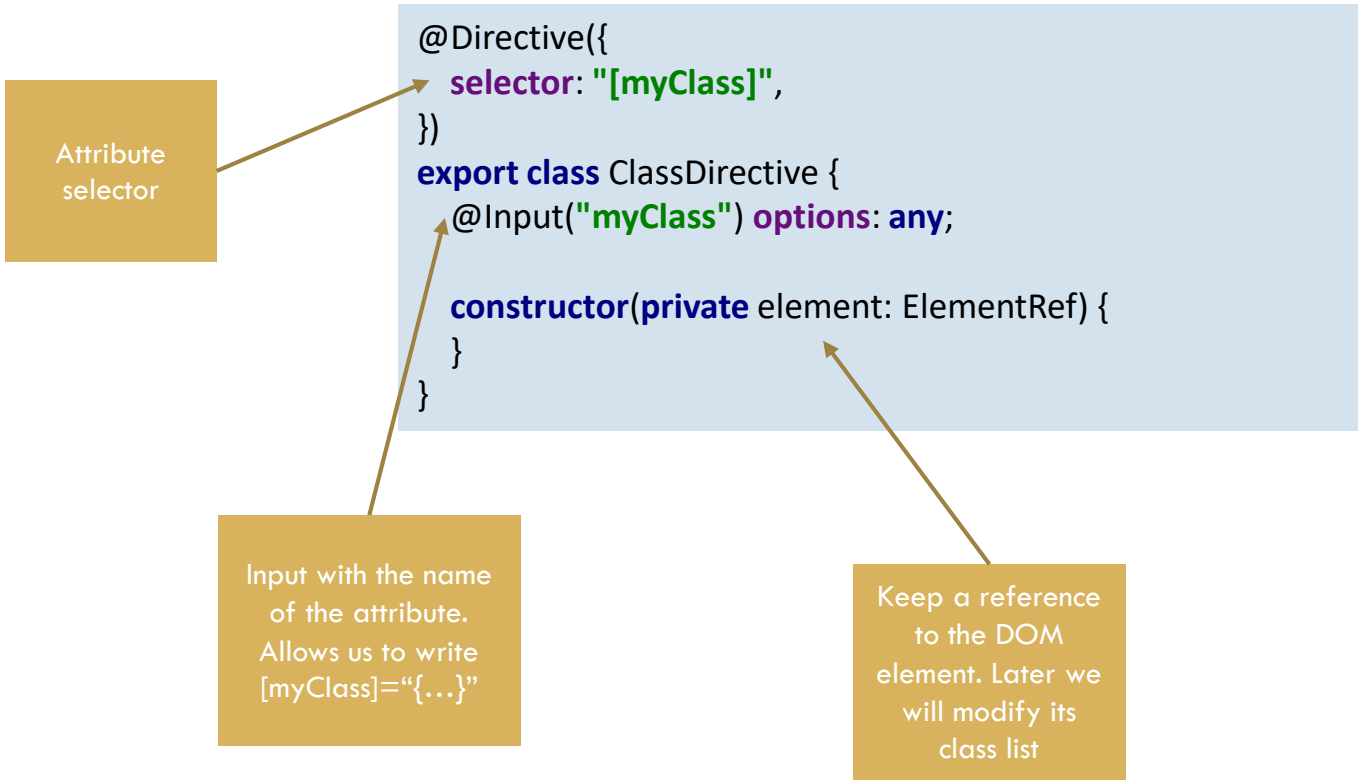
myClass



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Apply Changes

- Each time the options input changes we need to add/remove all CSS classes

```
private applyChanges() {
   for(let className in this.options) {
      if(this.options[className]) {
         this.element.nativeElement.classList.add(className);
      }
      else {
         this.element.nativeElement.classList.remove(className);
      }
   }
}
```

- When should we execute applyChanges ?

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ngOnChanges

- Once a directive has one or more @Input the ngOnChanges is invoked at least once
- No need to use ngOnInit in that case

```
export class ClassDirective {
   ngOnChanges() {
      this.applyChanges();
   }
}
```

- What is wrong with the ngOnChanges approach ?

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Inline Changes

- The options object might change inline

```
<li *ngFor="let contact of contacts" [myClass]="contact.options">
   <span>{{contact.name}}</span>
   <button (click)="select(contact)">Select</button>
</li>
```

The whole options object is send

The options is changes inline

```
select(contact) {
   contact.options.selected = !contact.options.selected;
}
```

- In that case ngOnChanges is not executed ☹

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ngDoCheck

- Is always executed by Angular
- The directive should compare old state with current
  - Must hold a copy of the old
- Angular offers special utility classes named differ

```
export interface KeyValueDiffer<K, V> {
   diff(object: Map<K, V>): KeyValueChanges<K, V>;
   diff(object: {
      [key: string]: V;
   }): KeyValueChanges<string, V>;
}
```

```
export interface IterableDiffer<V> {
   diff(object: NgIterable<V>): IterableChanges<V> | null;
}
```

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ngDoCheck using KeyValueDiffer

- Create a differ object

```
ngOnChanges() {
  this.differ = this.differs.find(this.options).create();
}
```

- Use it

```
ngDoCheck() {
  const changes = this.differ.diff(this.options);

  if(changes) {
    changes.forEachChangedItem(item => {
      if(item.currentValue) {
        this.element.nativeElement.classList.add(item.key);
      }
      else {
        this.element.nativeElement.classList.remove(item.key);
      }
    });
  }
}
```

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Respond to user events

- A directive has no template
- Therefore it need to register user event through code

```
export class ClickDirective {
   @Output("myClick") ev: EventEmitter<any> = new EventEmitter<any>();

   constructor(private element: ElementRef) {
   }

   ngOnInit() {
      this.element.nativeElement.addEventListener("click", () => {
         console.log("Click detected");
      });
   }
}
```

- Don't forget to unregister the event !!!
  - Usually during ngOnDestory

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@HostListener

- The Angular way to “addEventListener” without accessing the DOM
- Automatically unregisters during ngOnDestroy
- There are two different syntaxes

```
export class ClickDirective {
   @HostListener("click", ["$event"])
   private onClick($event) {
   }
}
```

```
@Directive({
   host: {
      "(click)": "onClick($event)"
   }
})
export class ClickDirective {
   private onClick($event) {
   }
}
```

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@HostBinding

- Same as HostListener but for attribute binding instead of event handling

```
export class ClickDirective {
   @HostBinding("disabled")
   private disabled: boolean = true;

   ngOnInit() {
      setTimeout(()=> {
         this.disabled = false;
      }, 2500);
   }
}
```

```
@Directive({
   host: {
      "[disabled]": "disabled"
   }
})
export class ClickDirective {
   private disabled: boolean = true;

   ngOnInit() {
      setTimeout(()=> {
         this.disabled = false;
      }, 2500);
   }
}
```

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Structural directives

- Structural directives are meant to change the DOM structure
- For example ngIf will change the DOM's element structure according to the respective condition
- To understand Structural directive we must first learn how to work with ngTemplate

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Implementing Tooltip

- A tooltip can be attached to any component
- Therefore cannot be implemented as component

```
@Directive({
   selector: "[myTooltip]",
})
export class TooltipDirective {
   constructor(private element: ElementRef) {
   }

   @HostListener("mouseenter")
   private onMouseEnter() {
   }
}
```

- How can we support template based tooltip ?

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ngTemplate

- Every component can define many ng-template(s)
- The template is automatically removed from the DOM
- However, it can be referenced and restored on demand

```
<button myTooltip [myTooltipTemplate]="tooltipTemplate">
   A button with tooltip
</button>

<ng-template #tooltipTemplate>
   This is a custom tooltip
   <button (click)="close()">Close</button>
</ng-template>
```

Is automatically removed

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TemplateRef

- Each ng-template element is associated with TemplateRef instance
- Use @ViewChild to get a reference

```
export class AppComponent {
   @ViewChild("tooltipTemplate") tooltipTemplate: TemplateRef;

   ngOnInit() {
      console.log(this.tooltipTemplate);
   }
}
```

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How to use TemplateRef

- TemplateRef can be injected to any component using a ViewContainerRef object

```
export class TooltipComponent {
   @ViewChild("marker", {read: ViewContainerRef}) marker: ViewContainerRef;
   private viewRef: ViewRef;

   show(template: TemplateRef<any>) {
      this.viewRef = this.marker.createEmbeddedView(template);
   }
}
```

marker is a simple div/span

This is a live view which is bound to the template parent !!!

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ng-template Content

- The content of an ng-template is bound to the component which defined the template
- Not to the component where the template was injected to

```
<ng-template #tooltipTemplate>
   This is a custom tooltip

   <button (click)="close()">Close</button>
</ng-template>
```

close function need to be defined inside the parent component

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exportAs

- A directive may choose to publish itself to the parent component
  - Usually in order to provide a richer API

```
@Directive({
   selector: "[myTooltip]",
   exportAs: "tooltip"
})
export class TooltipDirective {
}
```

```
<button #buttonTooltip="tooltip"
      myTooltip
      [myTooltipTemplate]="tooltipTemplate">A button with
tooltip</button>
```

Requesting a reference to the directive

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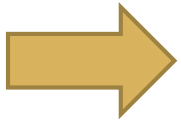
Structural directives

- A directive is considered structural when it is used with the * syntax
  - Every directive can be used that way
- Angular creates an implicit ng-template
- The directive is expected to use the template and "play" with it

```
<div *myIf>
   Dynamic content
</div>
```



```
<div>
   <ng-template myIf>
      Dynamic content
   </ng-template>
</div>
```

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Accessing the template

The template is injectable

```
@Directive({
  selector: "[myIf]"
})
export class IfDirective {
  @Input("myIf") condition: boolean;
  private viewRef: ViewRef;

  constructor(private template: TemplateRef<any>, private viewContainerRef: ViewContainerRef) {}

  ngOnChanges() {
    if(this.condition) {
      if(!this.viewRef) {
        this.viewRef = this.viewContainerRef.createEmbeddedView(this.template);
      }
    }
    else {
      if(this.viewRef) {
        this.viewRef.destroy();
        this.viewRef = null;
      }
    }
  }
}
```

```
<button (click)="show=!show">Toggle</button>

<div *myIf="show">
  Dynamic content
</div>
```

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Multiple Structural Directives

- Angular does not allow multiple structural directives on the same element
- → Cannot use ngIf & ngFor on the same <li> ☹
  - Not like Angular 1
- Can fix that by using the ng-template explicit syntax

What the hell is going on here ?

```
<ul>
  <ng-template ngFor [ngForOf]="[1,2,3]" let-num>
    <li *ngIf="num % 2 == 0">
      <span>{{num}}</span>
    </li>
  </ng-template>
</ul>
```

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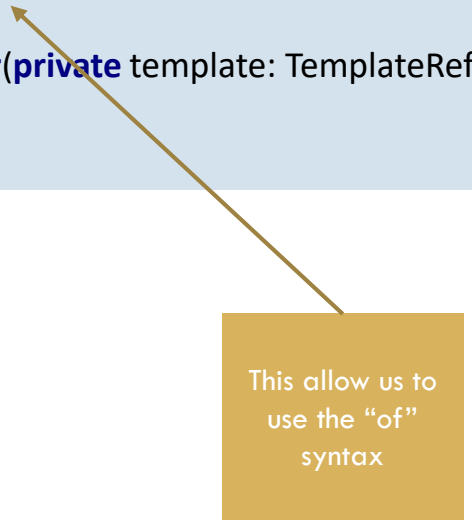
myFor

- Lets build our own simplified version of ngFor

```
@Directive({
   selector: "[myFor]"
})
export class ForDirective {
   @Input("myForOf") items: any[];

   constructor(private template: TemplateRef<any>, private viewContainerRef: ViewContainerRef) {
   }
}
```



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Template input variable

- The client is using the following syntax

```
<ul>
  <li *myFor="let item of items; let i=index">
    <span>{{item}}, {{i}}</span>
  </li>
</ul>
```

- The myFor directive is responsible for defining the contextual item variable
- Please note that myFor does not control the name of the variable
  - As opposed to the index variable

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Template input variable


```
ngOnChanges() {
  this.viewContainerRef.clear();

  if(this.items) {
    for(let i=0; i<this.items.length; i++) {
      this.viewContainerRef.createEmbeddedView(this.template, {
        index: i,
        $implicit: this.items[i],
      });
    }
  }
}
```

$implicit will be set as the value of item variable

index variable defined by myFor

clear the view before rendering new items. Inefficient implementation !!!

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Cooperating Directives

- Think about myTab and myPage directives
- Each page need to notify the tab parent of its existence

Out of the box support. Parent directive can be injected without any additional configuration

```
@Directive({
  selector: "[myPage]"
})
export class PageDirective {
  constructor(private tab: TabDirective) {
  }

  ngOnInit() {
    this.tab.addPage(this);
  }
}
```

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Host Component

- A directive may interact with its host component
- The directive may be hosted by different component types
- Thus the component type cannot be used as provider
- Solution
  - Let the component publish itself using a token defined by the directive

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Accessing host component


```
export abstract class HostComponentWithTooltip {
}

@Directive({
  selector: '[appTooltip]'
})
export class TooltipDirective {

  constructor(component: HostComponentWithTooltip) {
    console.log("TooltipDirective.ctor", component);
  }
}
```

```
@Component({
  selector: 'app-clock',
  templateUrl: './clock.component.html',
  styleUrls: ['./clock.component.css'],
  providers: [
    {provide: HostComponentWithTooltip, useExisting: ClockComponent}
  ]
})
export class ClockComponent {
}
```

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Summary

- We usually build components not directives
- In case where you need close control over the DOM you will use directive
- A directive can extend multiple unrelated components
- Directives can talk to each other