Angular Change Detection

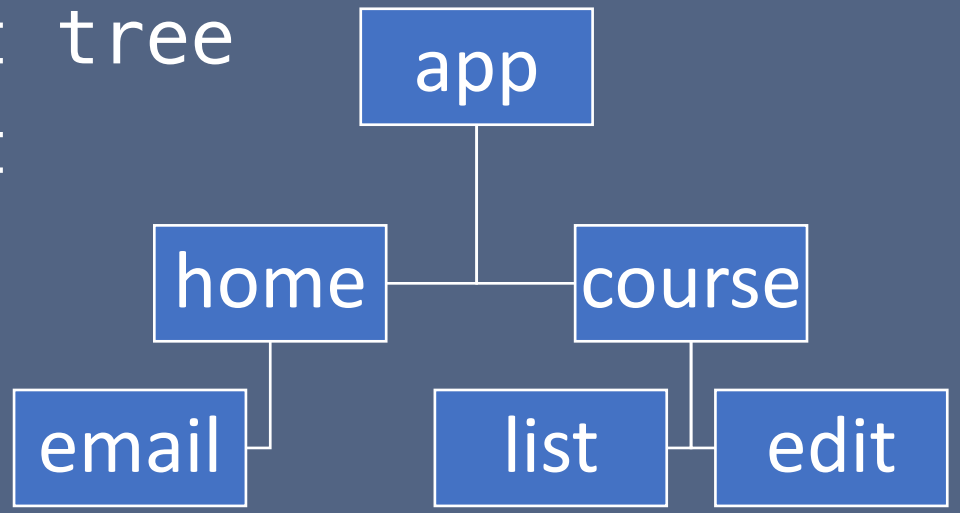
What’s the deal?

What is Change Detection?

- Takes the state of an application
  - Push it to the user interface (DOM)
    - Divs, Tables, Paragraphs, what so ever
- The state can be any kind of
  - Objects
  - Arrays
  - Primitives like Strings, Numbers etc…

Angular Change Detection

- Angular maintains a Component tree
- When the state of a Component changes
  - Angular must update the view
    - Re-create all or part of the HTML DOM



So, what causes changes?

- Three things can cause the state to change
  - DOM Events
    - Click, submit, mouseover, mousedown ...
  - Timers
    - setInterval(), setTimeout()
  - XHR (XMLHttpRequest)
    - Grabbing data from remote servers

Changes 1

course-edit.component.html

```
…
<app-instructor [instructor]="instructor"></app-instructor>
<button (click)="changeInstructor()">Change Instructor</button>
```

course-edit.component.ts

```
export class CourseEditComponent implements OnInit {
  instructor: Instructor = { firstName: Michael' };

  changeInstructor() {
    this.instructor.firstName= 'Chris';
  }
}
```

Changes 2

```
@Component({
selector: 'app-course-list',
templateUrl: './course-list.component.html',
styles: []
})
export class CourseListComponent implements OnInit {
  courses: Course[];

  constructor( private _courseService: CourseService) { }

  ngOnInit() {
    this._courseService.getCourses().subscribe(courses => this.courses =
      courses);
  }

}
```

What do the code have in common?

- They are all asynchronous
  - Every time an asynchronous action occurs
  - Someone tells Angular that a change has ocurred
  - Angular updates the view

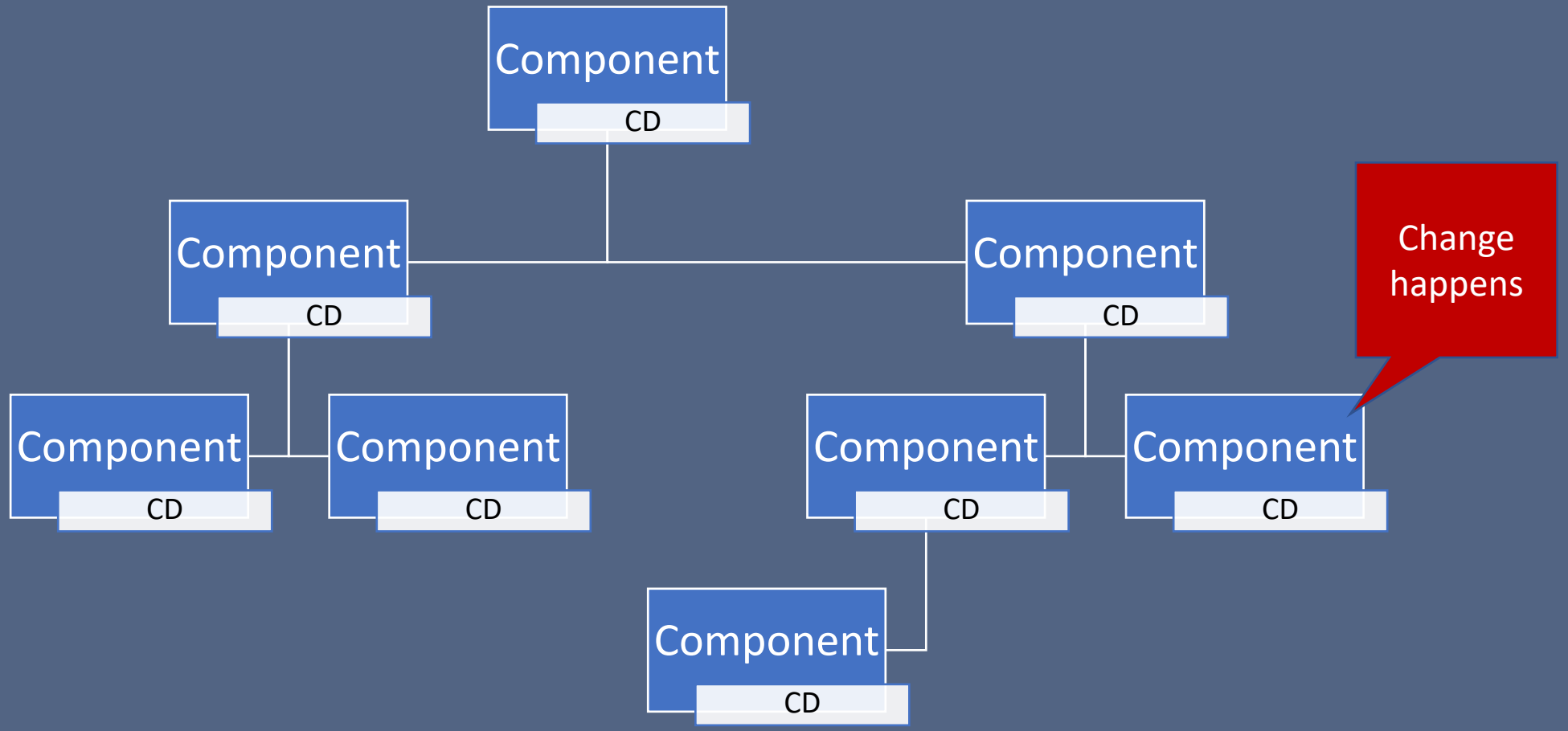
Who tells Angular?

- Is it Magic?
- No, Angular uses Zone
  - Zone is a execution context that persists across asynchronous tasks.
  - A thread-safe environment(storage)
- Specifically it’s own implementation ngZone
  - Angular use in its source code ***ApplicationRef*** to listens to
    - onTurnDone event
    - It executes a tick() function
    - Which in turn performs the change detection

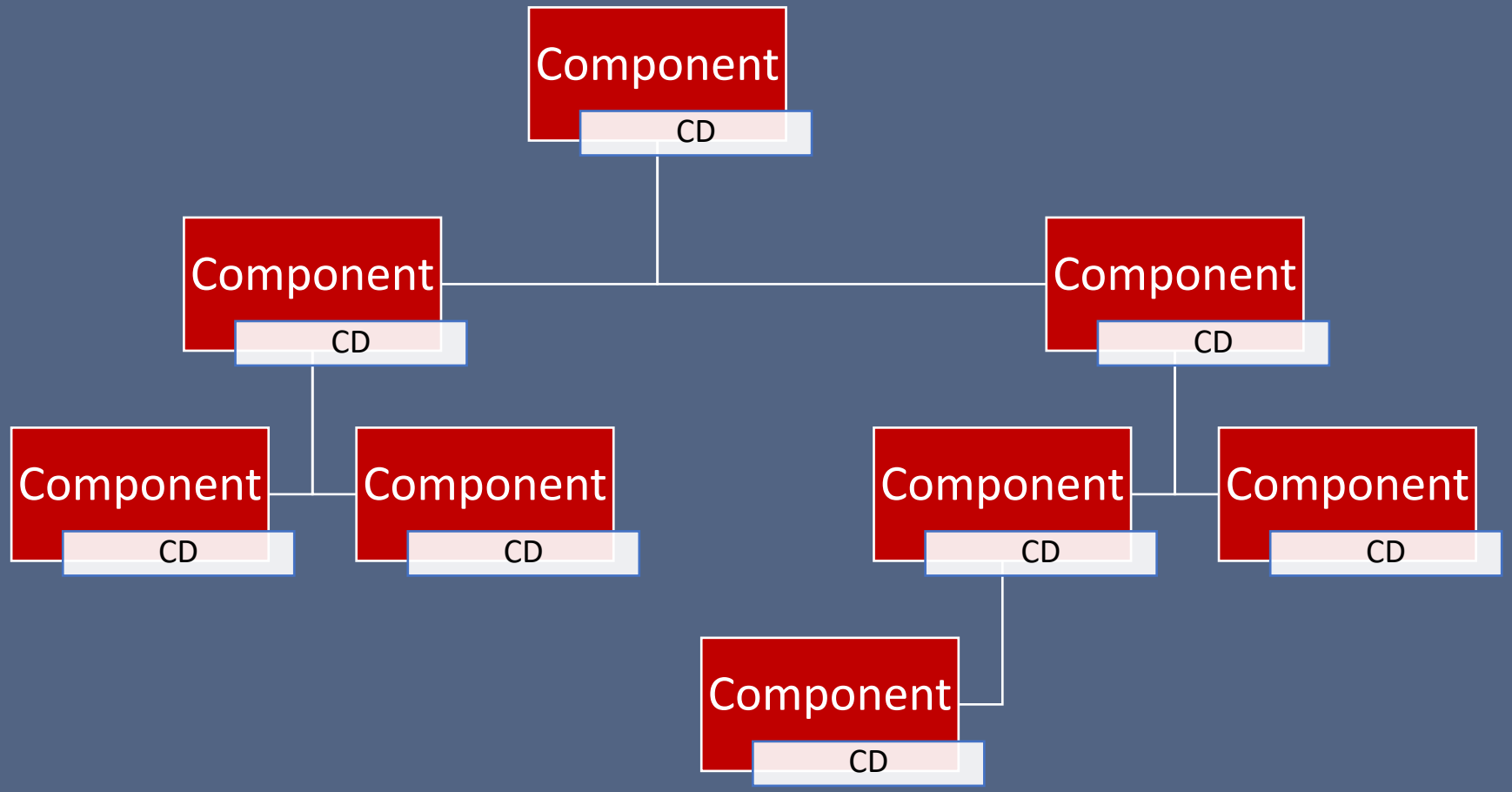
Change Detection

- Important!
- Each component has its own change detector
  - Gives us individual control for each component how and when to run change detection
- Default behavior
  - The change detection flows from top to bottom
  - Regardless of where in the component tree the change happens
  - However it just makes one single pass from top to bottom then the change detection is in a stable state.

Default behavior



Default behavior



Performance

- Even if Angular has to run top to bottom it is scary fast.
  - Angular can perform hundreds of thousands checks within milliseconds
    - Source ”Pascal Precht”
- However in large component trees it could be performance degrading
  - Why should we check every component if we know which one has changed?

Take control

- Use Immutable data structures
- Use Observables
- This gives us some guarantees of when changes or not has happened

Que!

Mutability

- Default CD Behavior
  - Checks every change to every property change in the component
  - So even a small change to a value triggers cd
  - Remember the first code slide

```
changeInstructor() {
    this.instructor.firstName = 'Chris';
}
```

We are changing the property of an object. We are mutating existing value with a new value. Changing the object.

Observables

- Gives us some guarantee of when changes happens
- Does not give us a new reference when changes happens
- However we can subscribe to events fired
  - And react accordingly

So now when we know the difference between mutability and immutability

- Angular's default change detection (again)
  - Angular checks for changes inside an object/component
  - If a value changes the change detection is executed
  - Is very fast, which we said before
- ChangeDetection Strategy
  - We can change cd strategy to only check reference difference
  - Tell the component to use *ChangeDetectionStrategy.OnPush*

```
@Component({
  …
  changeDetection: ChangeDetectionStrategy.OnPush
})
```

Even more Control!

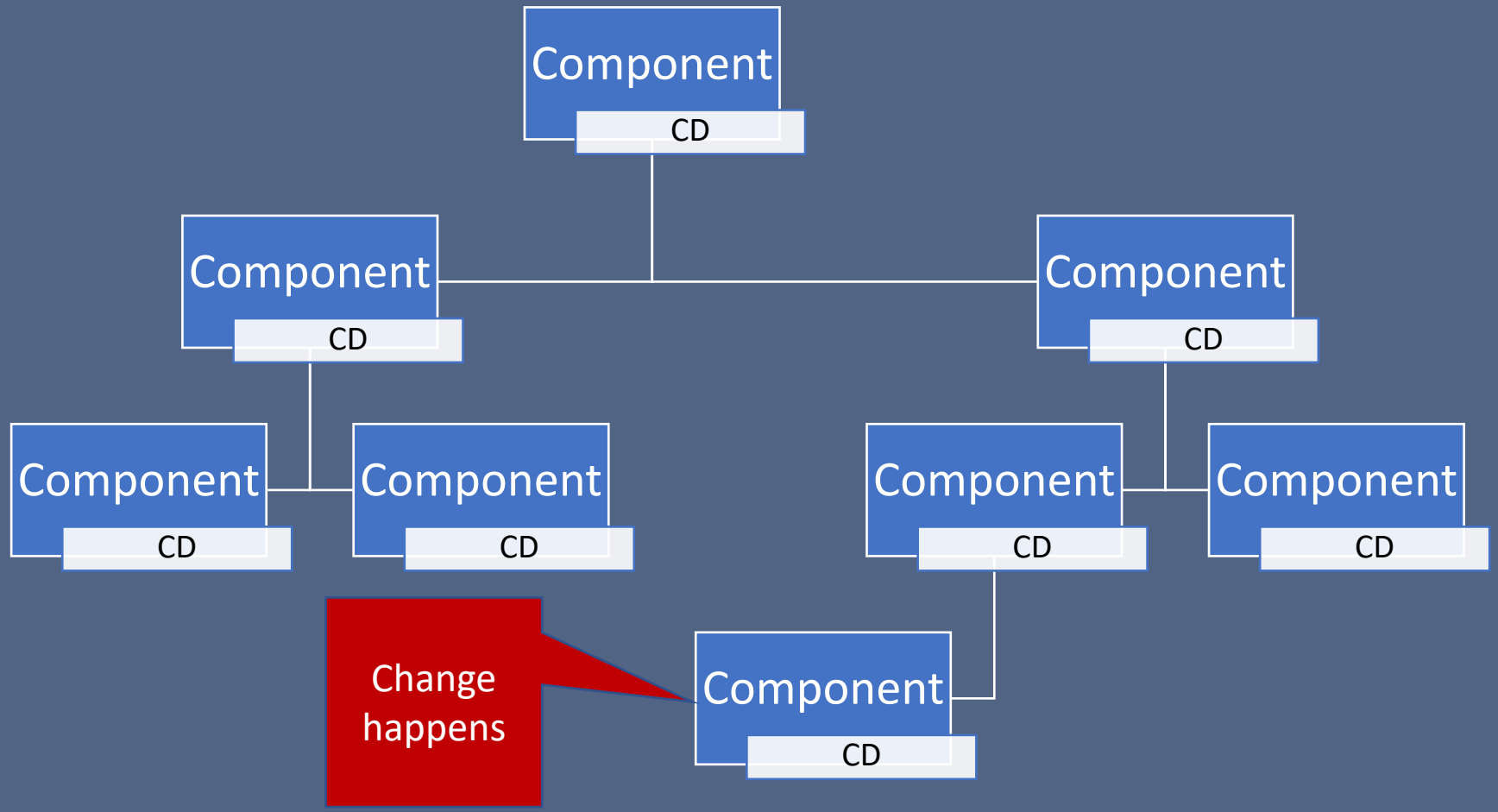
- Even with onPush activated
  - The component tree is traversed top to bottom
  - What if we only want to traverse the subtree for the component that is changed
  - We inject ChangeDetectorRef inside our component

```
@Component({
  …
  changeDetection: ChangeDetectionStrategy.OnPush
})
export class CourseEditComponent implements OnInit {
  …
  constructor(private cd: ChangeDetectorRef) { }
}
```

Even more Control (continued)

```
@Component({
  …
  changeDetection: ChangeDetectionStrategy.OnPush
})
export class CourseEditComponent implements OnInit {
  …
  constructor(private _cd: ChangeDetectorRef) { }

  ngOnInit() {
    this._courseService.getCourse().subscribe(course => {
      this.course = course;
      this._cd.markForCheck();
    );
  }
}
```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Change happens
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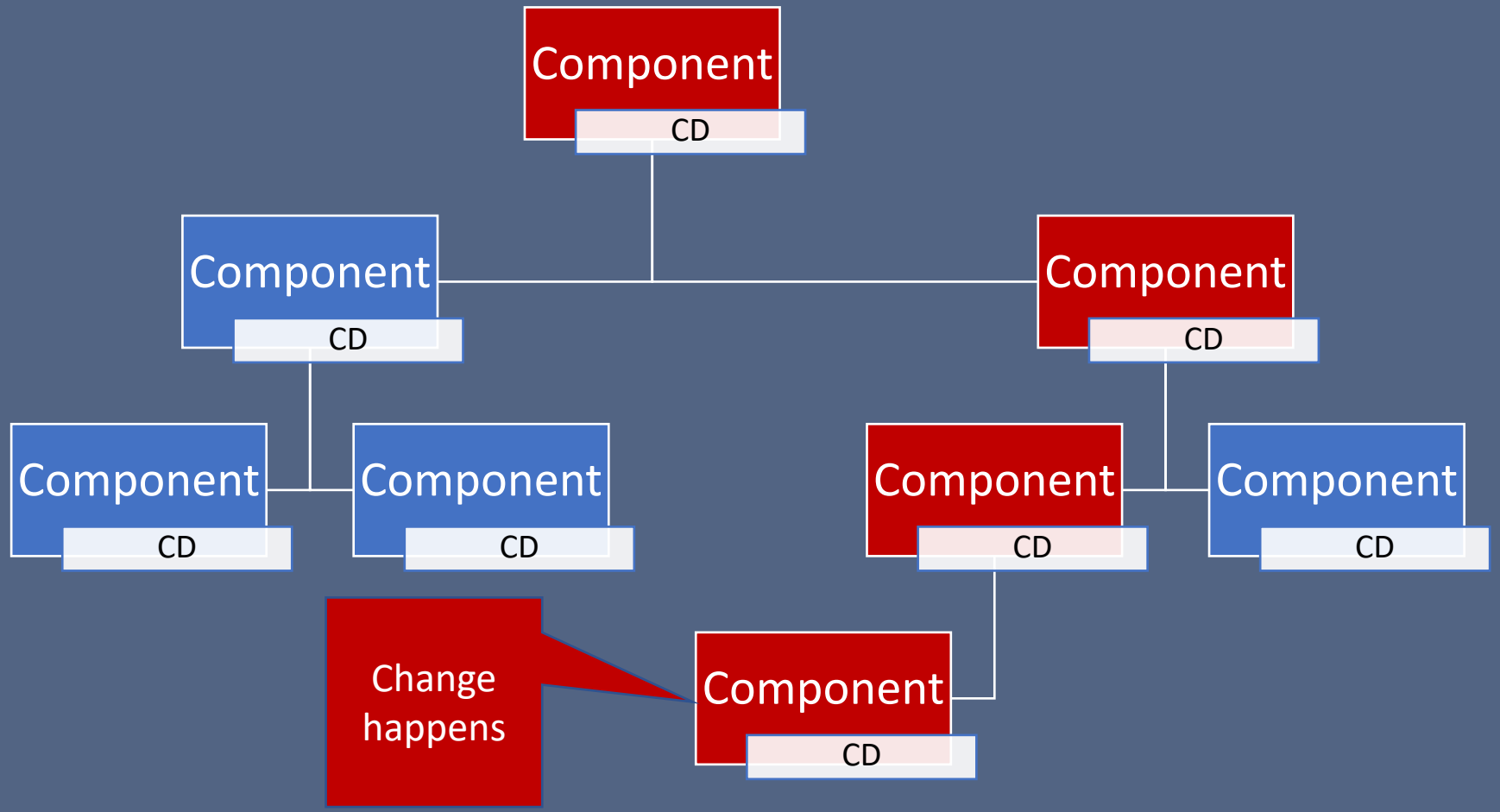
CD


Component
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Change happens
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CD

Wait there is more

```
@Component({
  …
})
export class CourseEditComponent implements OnInit {
  …
  constructor(private _cd: ChangeDetectorRef) {
    _cd.detach();

    setInterval(() => {
      _cd.detectChanges();
    }, 2000);
  }
}
```

That's All