ANGULAR
ARCHITECTS
INSIDE KNOWLEDGE

Angular Runtime Performance Optimization

Hosted by Alex Thalhammer

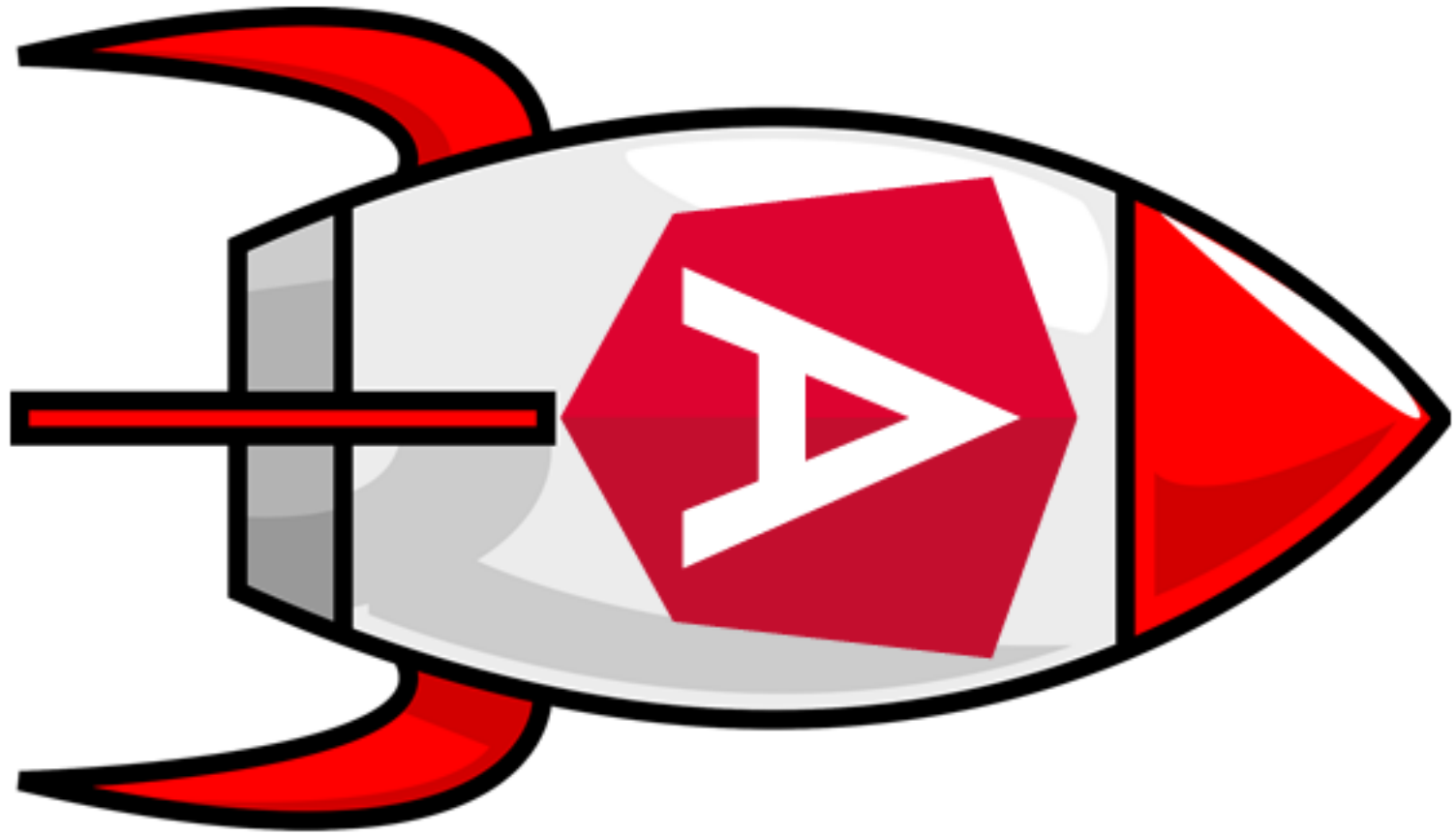


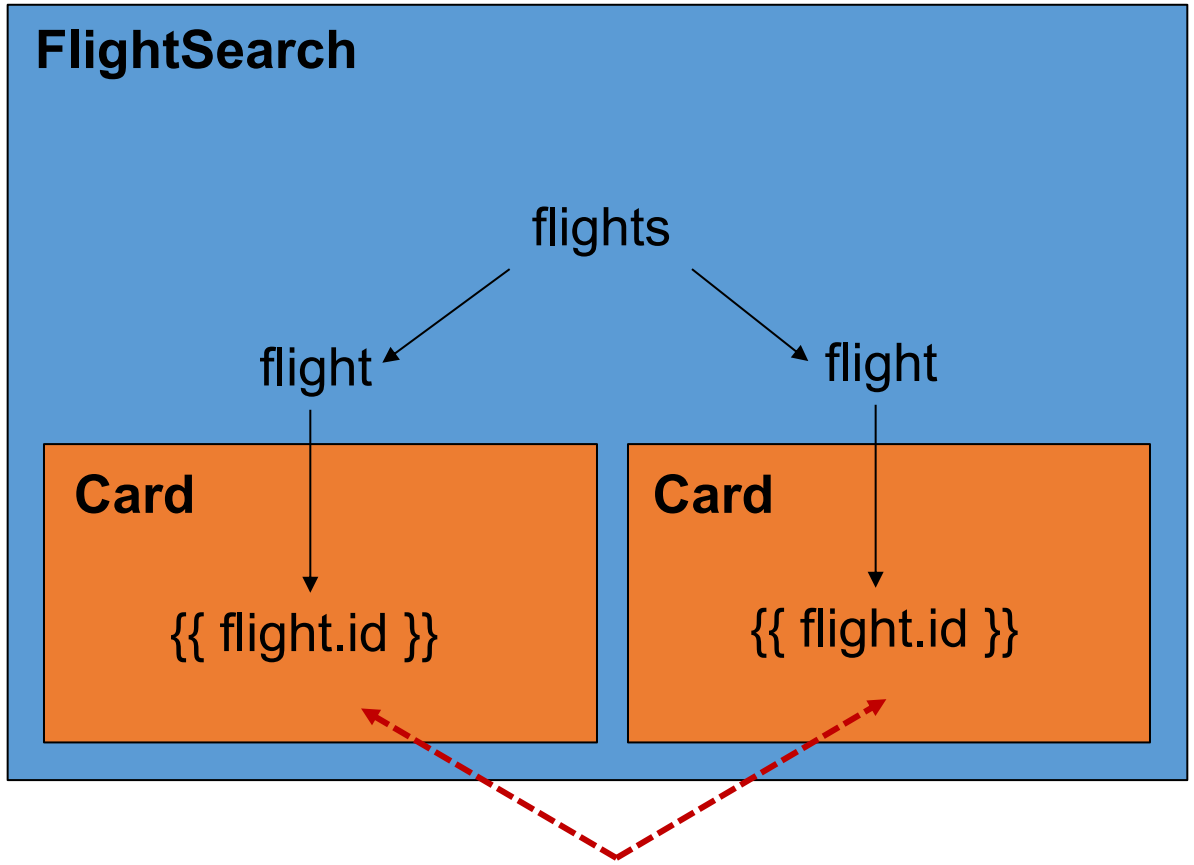
Image from: https://bit.ly/ng-initial-load

Outline

1. Out of bound change detection
2. Zone pollution by 3rd party libs
3. Optimization with state or flags
4. Optimization with Angular Pipes
5. Avoid large component trees
6. Using trackBy in ngFor
7. Optimistic updates
8. Unsubscribing *RxJS* subscriptions

Performance-Tuning with OnPush

OnPush



Angular just checks when “notified”

"Notify" about change?

- Change bound data (@Input)
  - OnPush: Angular just compares the object reference!
  - e. g. oldFlight === newFlight
- Raise event within the component
- Notify a bound observable
  - {{ flights$ | async }}
- Trigger it manually
  - Don't do this at home ;-)
  - At least: Try to avoid this

Activate OnPush

```
@Component({
        […]
       changeDetection: ChangeDetectionStrategy.OnPush
})
export class FlightCard {
   […]
   @Input() flight;
}
```

#1: O.B. change detection

- Problem: *Local state change triggers change detection in other comps*
- Identify: Use the infamous blink() or the Angular DevTools Profiler
  - E.g. Input field keydown triggers change detection in other components
- Solution: ChangeDetectionStrategy.OnPush as default

```
1       "schematics": {
2         "@schematics/angular:component": {
3           "styleext": "scss",
4           "changeDetection": "OnPush"
5         }
6       },
```

angular.json hosted with ❤ by GitHub

#1: detectChanges() vs markForCheck()

- Use cdr.**detectChanges() to trigger CD immediately** when you've updated the model after angular has run it's change detection, or if the update hasn't been in Angular world at all

- Use cdr.**markForCheck() to mark for check in next CD cycle** if you're using **OnPush** and you're bypassing the ChangeDetectionStrategy by mutating some data or you've updated the model inside a **setTimeout**

DEMO – ChangeDetection

ANGULAR
ARCHITECTS
INSIDE KNOWLEDGE

SOFTWARE
ARCHITECT

#2: Zone pollution by 3rd party libs (charts)

#2: Zone pollution by 3rd party libs (charts)

- Problem: *Callbacks that trigger redundant change detection cycles*
- Identify: Use the infamous blink() or the Angular DevTools Profiler
  - E.g. MouseEvent listeners, setTimeout or requestAnimationFrame()
- Solution: Run outside of NG Zone
  - Inject (private ngZone: NgZone)
  - Call this.ngZone.runOutsideAngular(() => doStuff)
- Alternative: Using cdr.detach() for components

#2: ChangeDetectorRef API, once more

detectChanges	• Runs Change Detector for the component and its children • It runs CD once also for the component which is detached from the component tree
markForCheck	• It marks component and all parents up to root as dirty • In next cycle Angular runs CD for marked components
reattach	• Re-attaches the component in the change detection tree • If parent component's CD is detached, it won't help, so make sure to run markForCheck with reattach
detach	• Detaches the component from the change detection tree • Bindings will also not work for the component with detached CD
checkNoChanges	• Changes the component and its children and throws error if change detected

DEMO – Zone Pollution

ANGULAR
ARCHITECTS
INSIDE KNOWLEDGE

SOFTWARE
ARCHITECT

#3: Optimization with state or flags

- Problem: *Redundant calculations for conditions*
- Identify: Methods being executed in ***ngIf** statements
- Solution: Use StateManagement like Subjects or use boolean flags or strings, that only change when they should

#4: Optimization with Angular Pipes

- Problem: *Redundant calculations for content or formatting*
- Identify: Methods being executed in string interpolations in the template or similar things slowing change detection cycles
- Solution: Use (pure) Angular Pipes

#5: Avoid large component trees

- Problem: *Too many (100+) components are loaded*
- Identify: Lots of components slowing down frame rate
- Solution: On demand component rendering
  - E.g. Pagination or Angular CDKs <cdk-virtual-scrolling-component>

#6: Using trackBy in ngFor

- Problem: *Angular will replace all items in ***ngFor** upon changes*
- Identify: Easy - search for "*ngFor"
- Solution: Use the trackBy function

```
<li *ngFor="let dashboard of dashboards; trackBy: trackByDashboardId"

trackByDashboardId(index: number, item: Dashboard): number {
  return item.id;
}
```

#7: Optimistic updates

- Problem: *App waits for backend for confirmations*
- Identify: Spinner showing when clicking on save
- Solution: Confirm action immediately
  - Go back in case of an error (e.g. no netork)

#8: Unsubscribe your subscriptions

- Problem: *Components create subscriptions without closing them*
- Identify: .subscribe() without .unsubscribe() or other methods
- Solution: Unsubscribe from all Observables in your App
  - Except Angular Router Params

Closing Subscription

- Explicitly

  let subscription = observable$.subscribe(…);
  subscription?.**unsubscribe()**;

- Implicitly
  - observable$.pipe(**takeUntil(otherSubject)**).subscribe(…);
  - observable$.pipe(**takeWhile(boolean)**).subscribe(…);
- Implicitly with async-Pipe in Angular

  {{ observable$ | **async** }}
- Automatic by Angular
  - Angular Router Params

DEMO – Unsubscribing

ANGULAR
ARCHITECTS
INSIDE KNOWLEDGE

SOFTWARE
ARCHITECT

Lab

Runtime Performance

ANGULAR ARCHITECTS
INSIDE KNOWLEDGE

SOFTWARE ARCHITECT

Recap

1. **Out of bound change detection**
2. **Zone pollution by 3rd party libs**
3. Optimization with state or flags
4. **Optimization with Angular Pipes**
5. Avoid large component trees
6. Using trackBy in ngFor
7. Optimistic updates
8. **Unsubscribing RxJS subscriptions**

References

- Minko Gechev (@mgechev) for Angular on YouTube
  - https://www.youtube.com/watch?v=FjyX_hkscII
  - https://www.youtube.com/watch?v=f8sA-i6gkGQ
- Resolving Zone Pollution
  - https://angular.io/guide/change-detection-zone-pollution
- Angular Performance Optimization using Pure Pipe
  - https://www.youtube.com/watch?v=YsOf90RZfss
- Angular CDK Scrolling Comp
  - https://material.angular.io/cdk/scrolling/overview