



ANGULAR
ARCHITECTS
INSIDE KNOWLEDGE

Performance Tuning

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Turbo Button



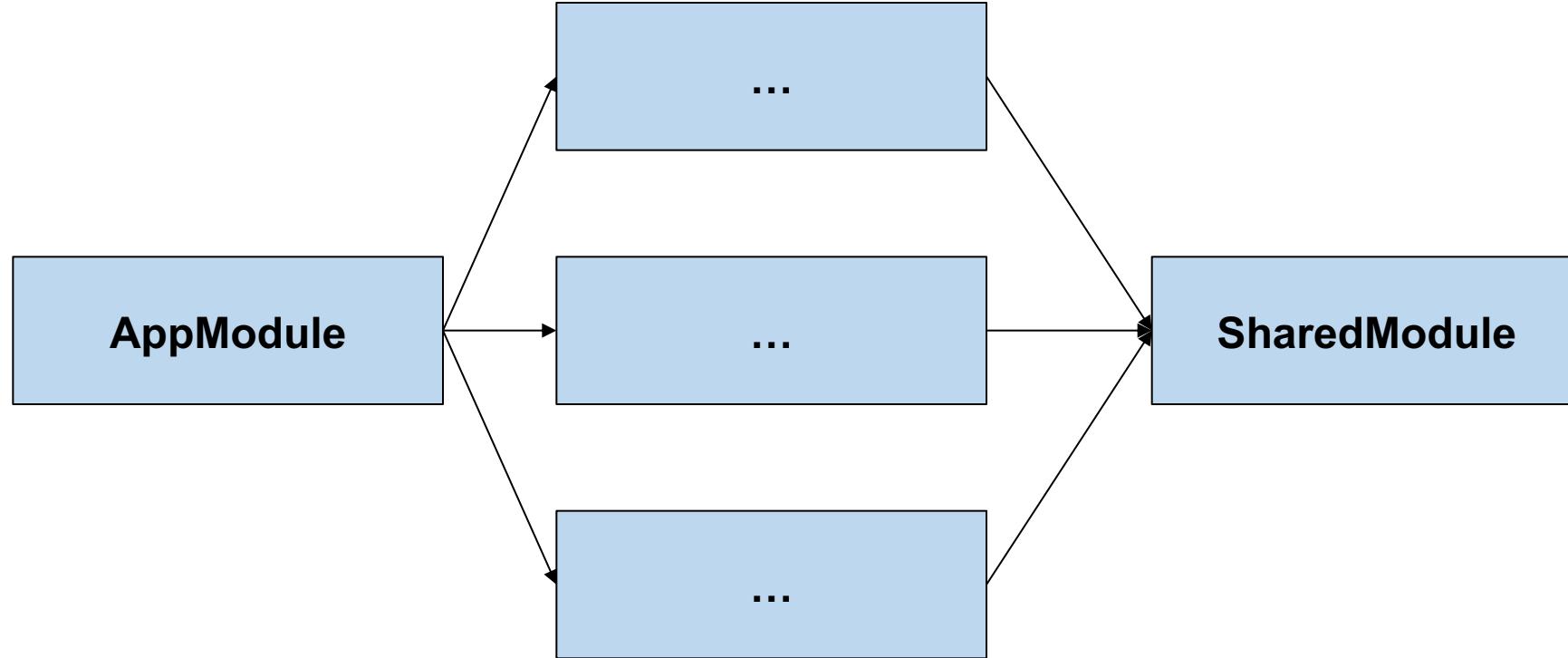
Contents

- Lazy Loading and Preloading
- Performance for Data Binding with OnPush
- AOT and Tree Shaking

Lazy Loading



Module Structure

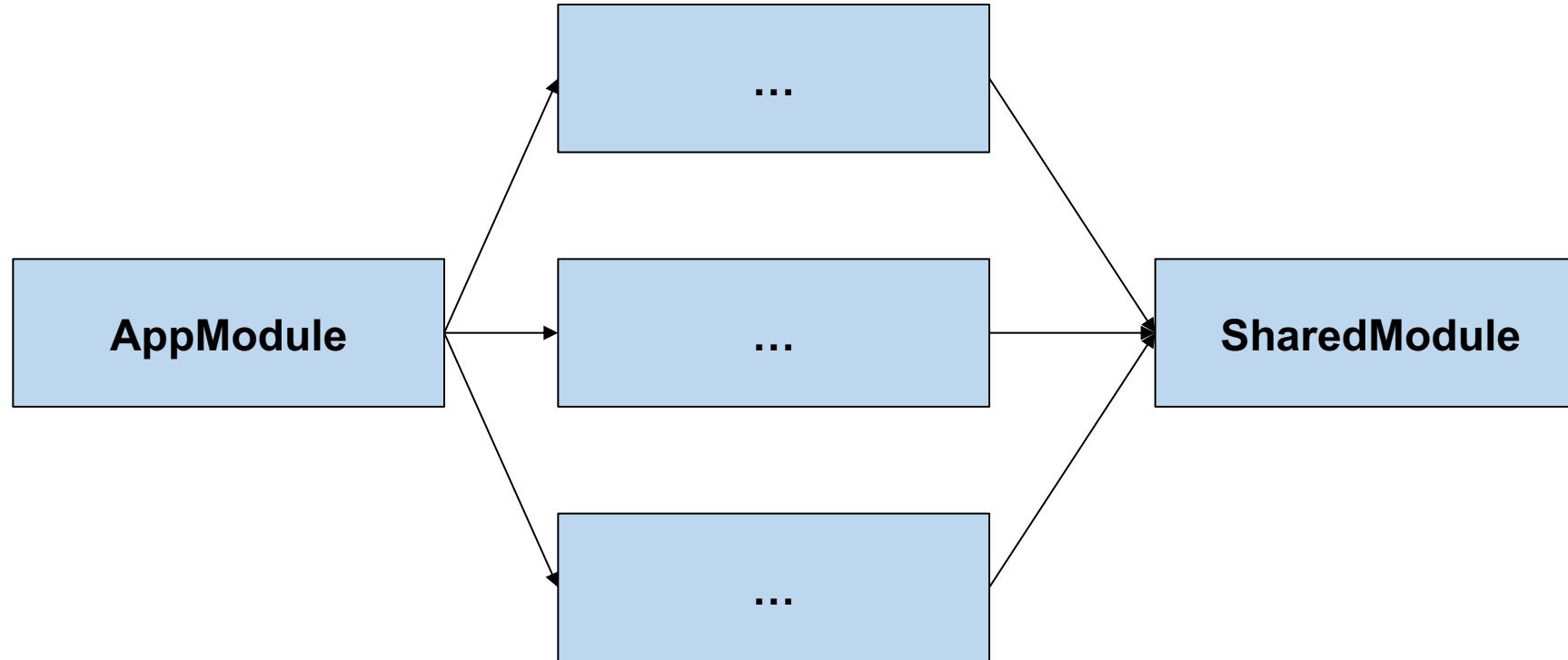


Root Module

Feature Modules

Shared Module

Lazy Loading



Root Module

Feature Modules

Shared Module

Root Module with Lazy Loading

```
const APP_ROUTE_CONFIG: Routes = [
  {
    path: 'home',
    component: HomeComponent
  },
  {
    path: 'flights',
    loadChildren: () => import('./flight-booking/flight-booking.module')
      .then(m => m.FlightBookingModule)
  }
];
```

Routes for "lazy" Module

```
const FLIGHT_ROUTES = [
  {
    path: '',
    component: FlightBookingComponent,
    [...]
  },
  [...]
}
```

Routes for "lazy" Module

```
const FLIGHT_ROUTES =      [
  {
    path: 'subroute',
    component: FlightBookingComponent,
    [...]
  },
  [...]
}
```

flight-booking/ subroute

Triggers Lazy Loading w/ loadChildren

Lazy Loading

- Lazy Loading means: Loading it later
- Better startup performance
- Delay during execution for loading on demand

Preloading



Idea

- Module that might be needed later are loaded after the application started
- When module is needed it is available immediately

Activate Preloading

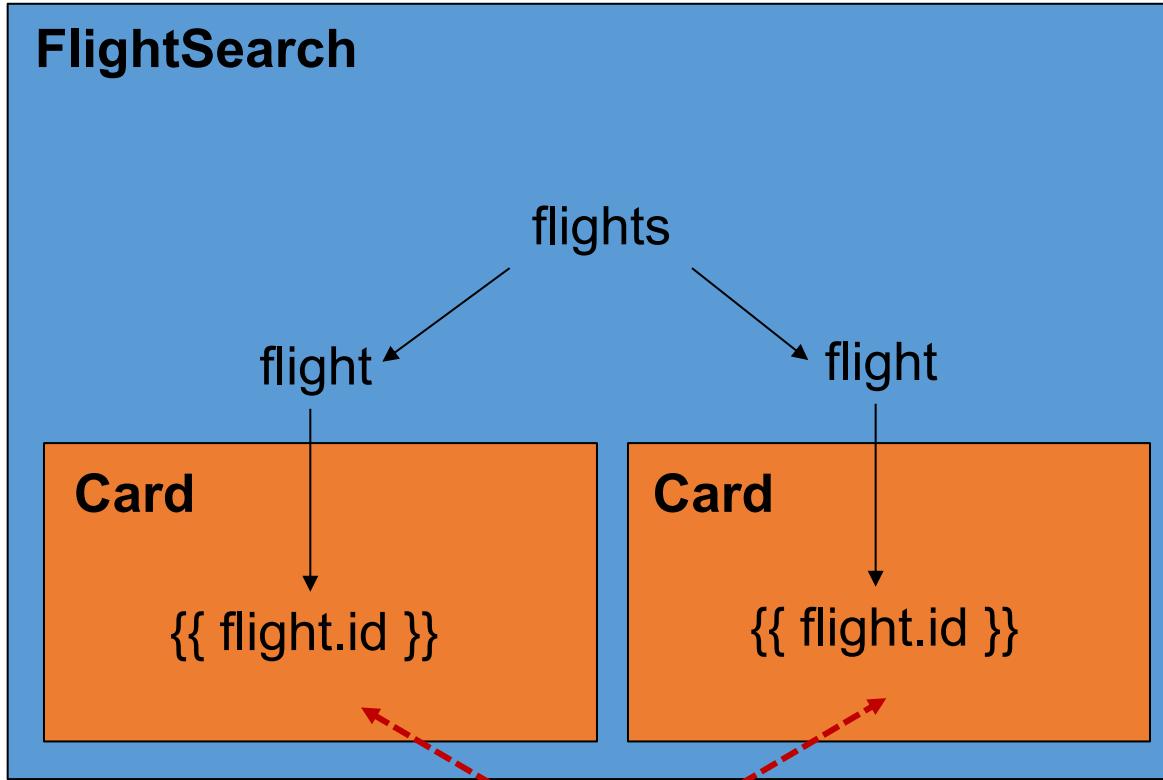
```
...
imports: [
  [...]
  RouterModule.forRoot(
    ROUTE_CONFIG,
    { preloadingStrategy: PreloadAllModules });
]
...
```



Performance- Tuning with OnPush

DEMO

OnPush



Angular just checks when “notified”



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"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;
}
```

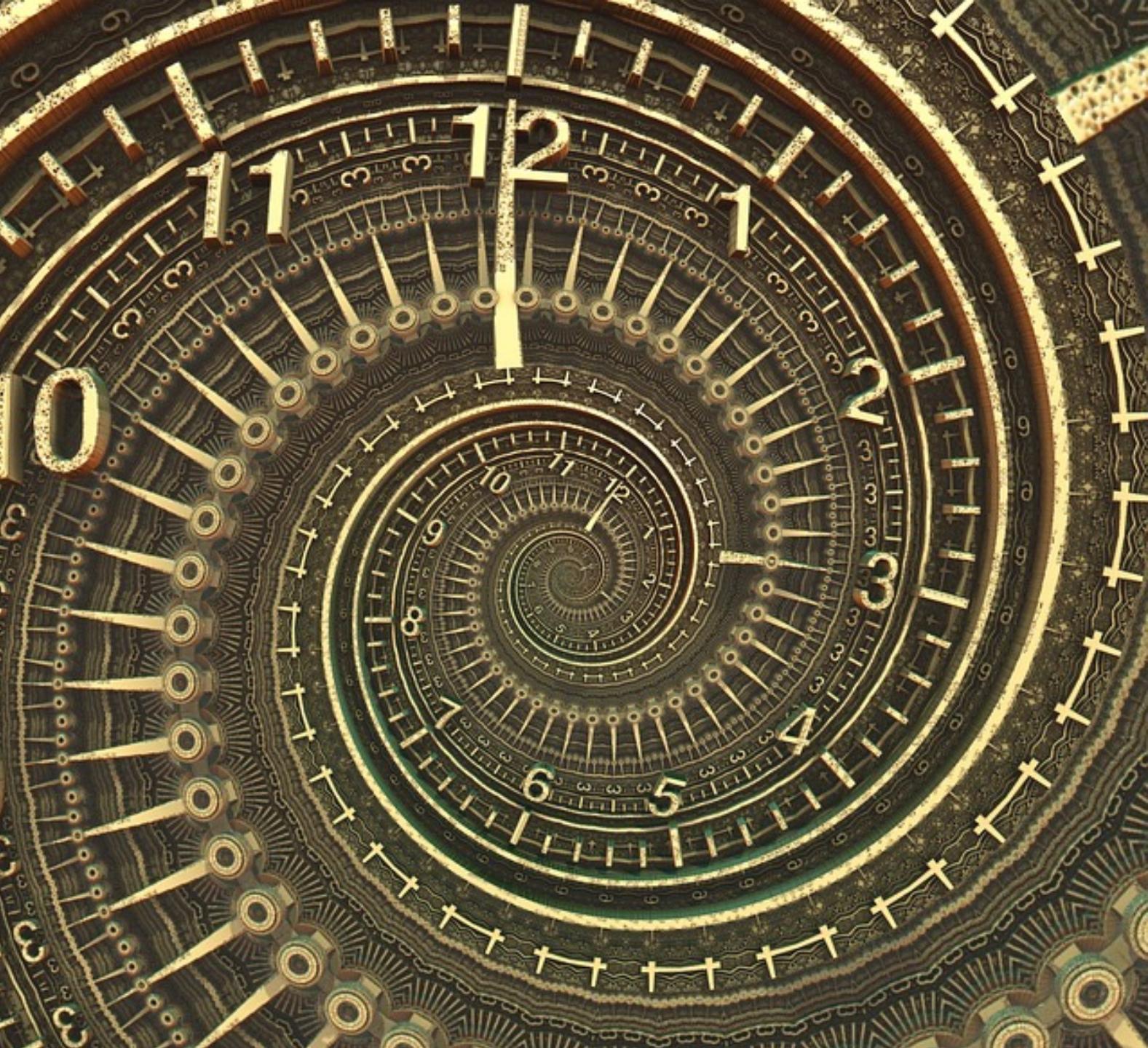
DEMO



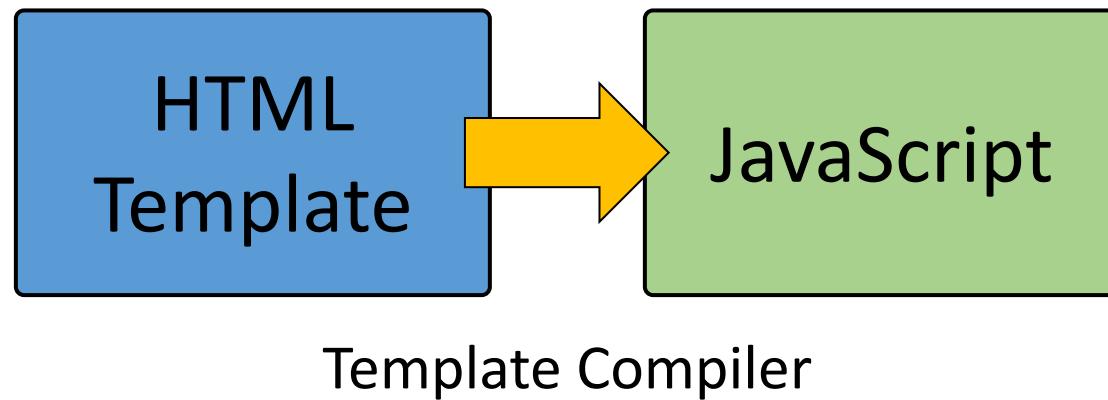
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Ahead of Time (AOT) Compilation



Angular Compiler



Approaches

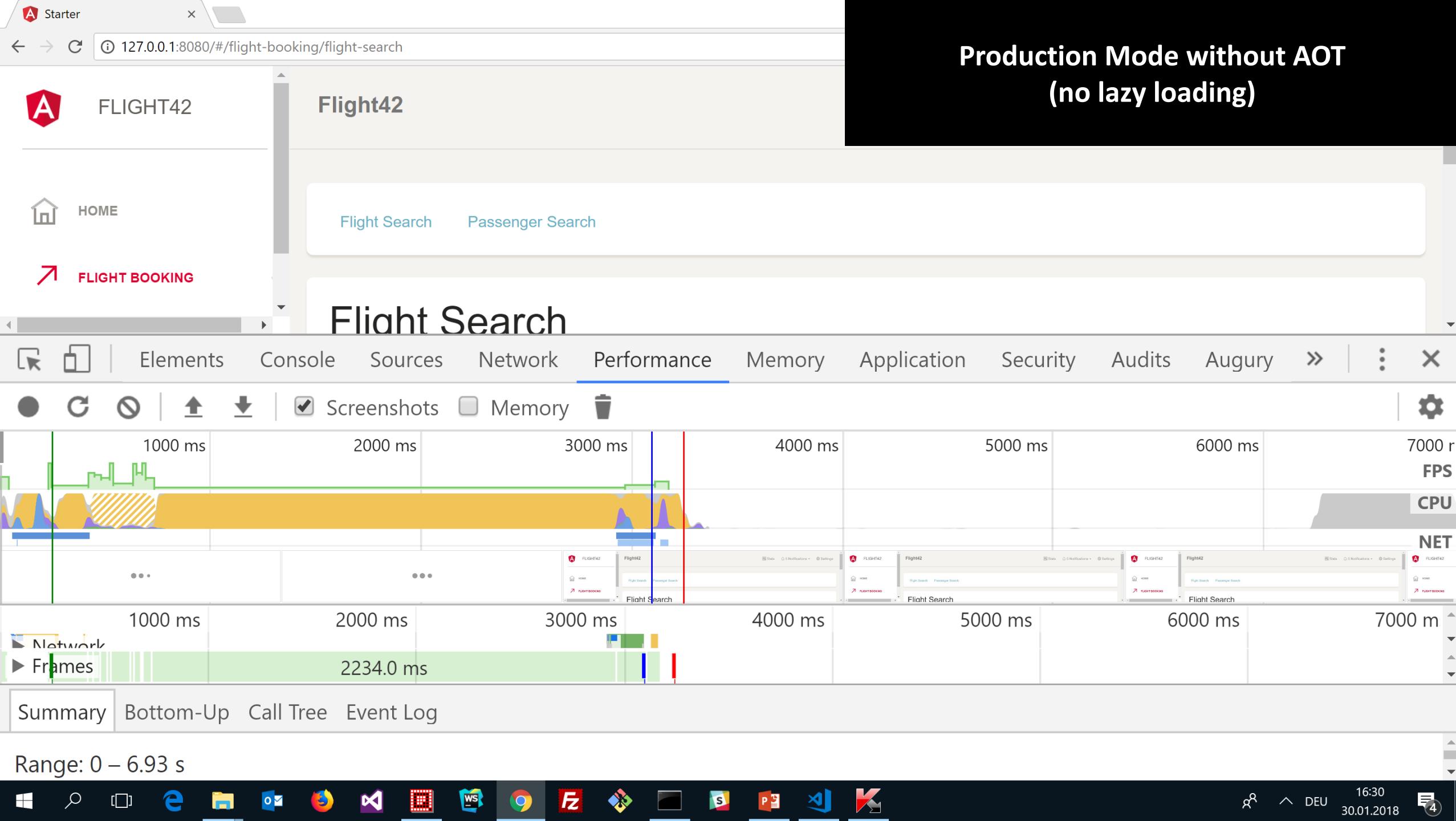
- JIT: Just in Time, at runtime
- AOT: Ahead of Time, during build

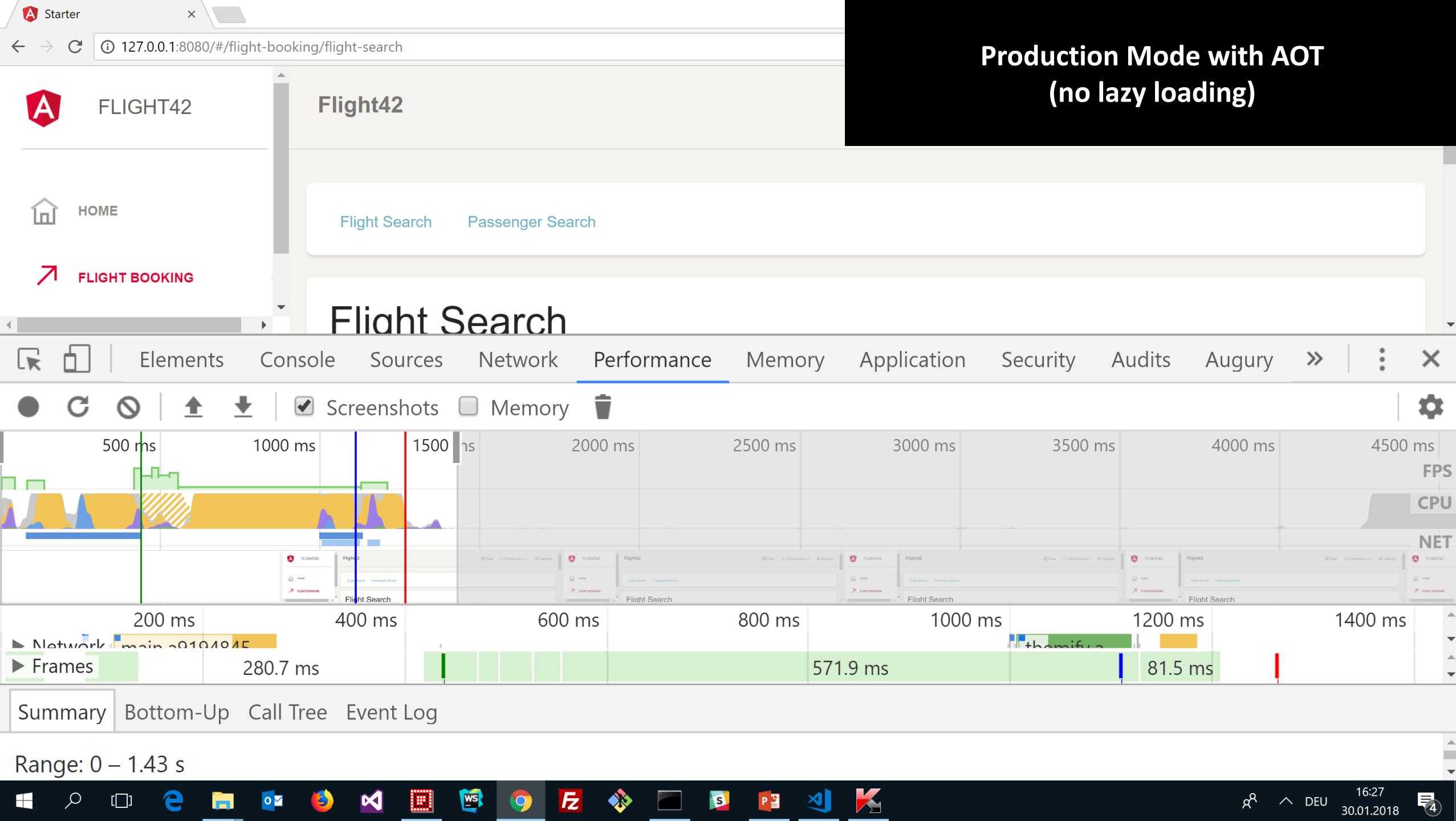
Advantages of AOT

- Better Startup-Performance
- Smaller Bundles: You don't need to include the compiler!
- Tools can easier analyse the code
 - Remove unneeded parts of frameworks
 - Tree Shaking

Angular CLI

- ng build --prod
- @ngtools/webpack with AngularCompilerPlugin
- Can be used without CLI too



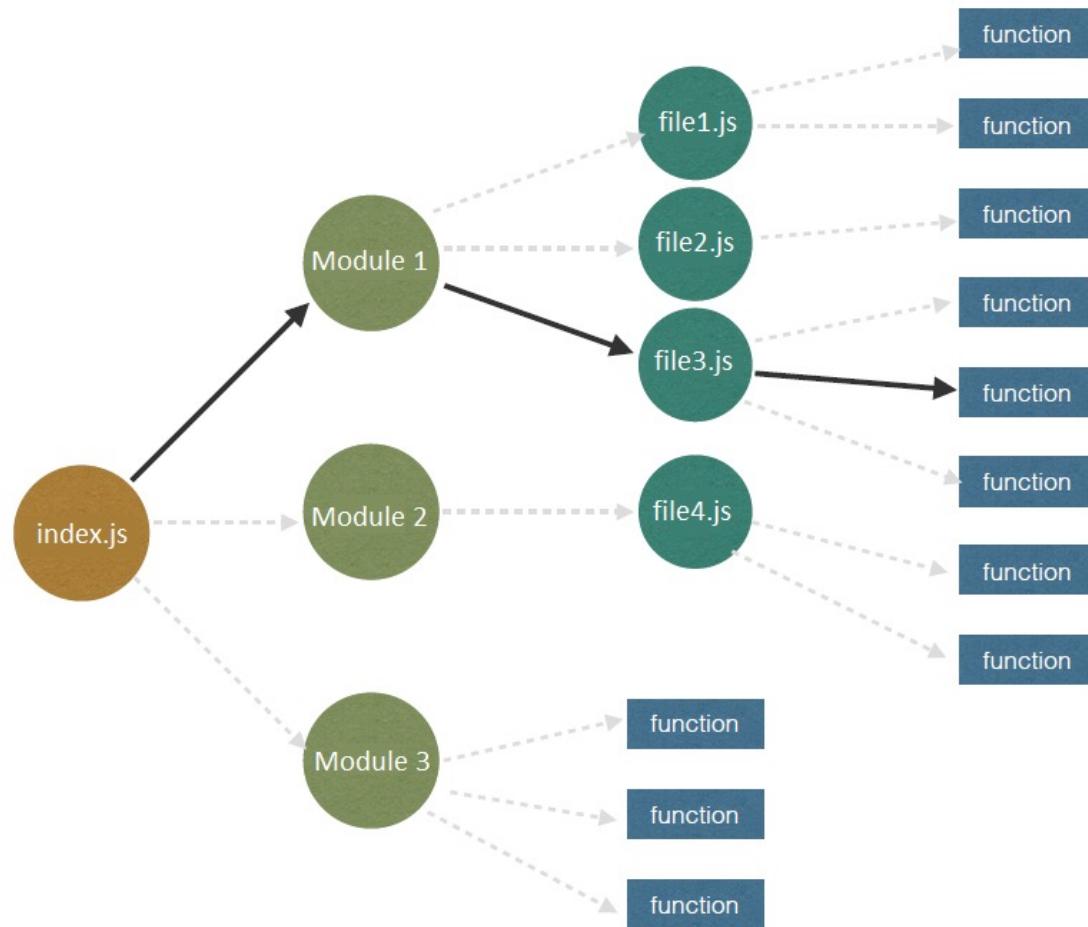


Ivy makes AOT the default 😊

- Ivy also does a lot of under the hood optimization
- No breaking changes, nothing to do from our side 😊
- Angular ViewEngine itself was not tree-shakable
- Angular Ivy is tree-shakable 😊
- Default since NG 10, for libs default since NG 12

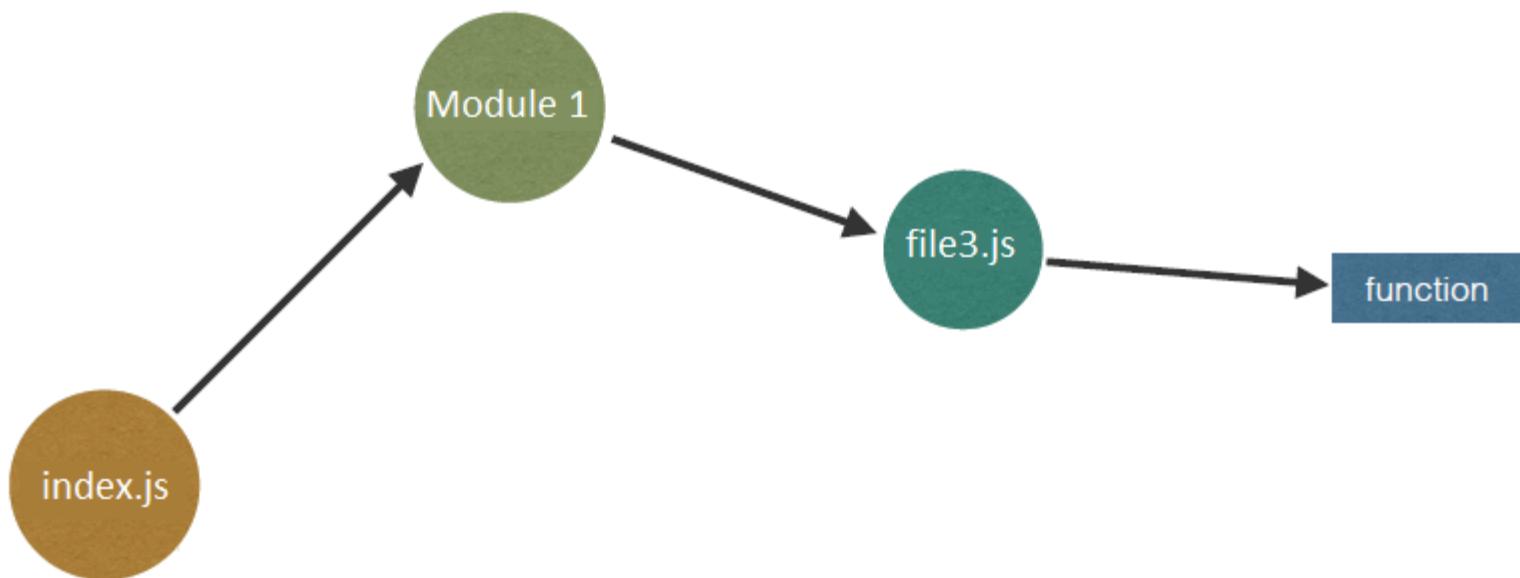
Tree Shaking

Before Tree Shaking



Tree Shaking

After Tree Shaking



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Webpack Bundle Analyzer

Bundles without AOT and Tree Shaking

vendor.978ac3ef762178ef4aa8.bundle.js

node_modules

JIT Compiler

@angular

platform-browser-dynamic

esm5

platform-browser-dynamic.js
+ 1 modulescore
esm5

core.js

router.js +
23 modules

common.js http.js

common
esm5forms
esm5forms.js +
2 modulesplatform-browser
esm5http
esm5

platform-browser.js http.js

rxjs

_esm5

main.ts
+ 68
modules

polyfills.7c4efb87d4ba5dbbc58c.bundle.js

node_modules

zone.js

dist

zone.js

core.js

modules



Demo

Conclusion

Quick Wins

Lazy Loading
and
Preloading

OnPush w/
Immutables and
Observables

AOT and Tree
Shaking



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For performance deep dive

Watch this (starting at 8:30):

https://drive.google.com/file/d/15fmyedJPYSOIv_0YvFtg26XGS8tZpZ03/view

Repo: <https://github.com/jeffbcross/victor-videos/>