Component interaction

This cookbook contains recipes for common component communication scenarios in which two or more components share information.

See the live example / download example.

Pass data from parent to child with input binding

`HeroChildComponent` has two ***input properties***, typically adorned with @Input decorations.

component-interaction/src/app/hero-child.component.ts

```
import { Component, Input } from '@angular/core';

import { Hero } from './hero';

@Component({
  selector: 'app-hero-child',
  template: `
    <h3>{{hero.name}} says:</h3>
    <p>I, {{hero.name}}, am at your service, {{masterName}}.</p>
  `
})
export class HeroChildComponent {
  @Input() hero: Hero;
  @Input('master') masterName: string;
}
```

The second `@Input` aliases the child component property name `masterName` as `'master'`.

The `HeroParentComponent` nests the child `HeroChildComponent` inside an `*ngFor` repeater, binding its `master` string property to the child's `master` alias, and each iteration's `hero` instance to the child's `hero` property.

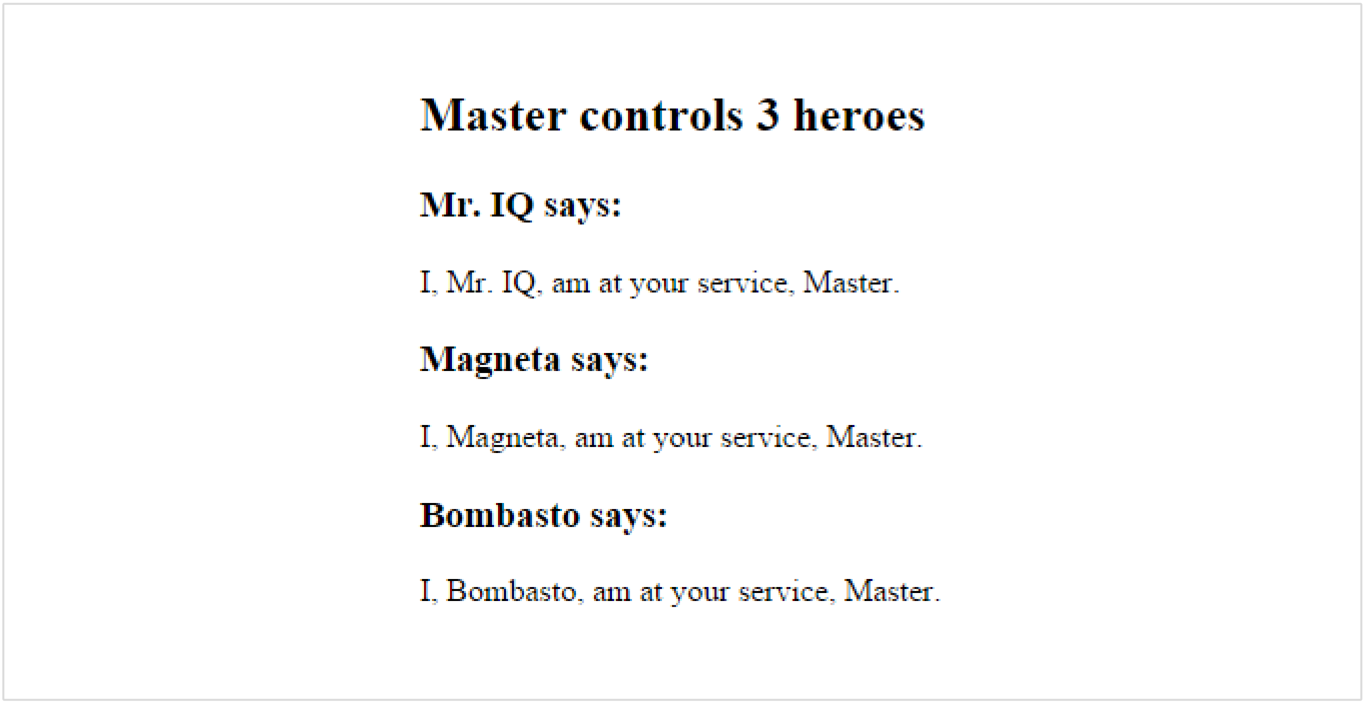
component-interaction/src/app/hero-parent.component.ts

```
import { Component } from '@angular/core';

import { HEROES } from './hero';

@Component({
  selector: 'app-hero-parent',
  template: `
    <h2>{{master}} controls {{heroes.length}} heroes</h2>
    <app-hero-child *ngFor="let hero of heroes"
      [hero]="hero"
      [master]="master">
    </app-hero-child>
  `
})
export class HeroParentComponent {
  heroes = HEROES;
  master = 'Master';
}
```

The running application displays three heroes:



```
Master controls 3 heroes

Mr. IQ says:

I, Mr. IQ, am at your service, Master.

Magneta says:

I, Magneta, am at your service, Master.

Bombasto says:

I, Bombasto, am at your service, Master.
```

Test it

E2E test that all children were instantiated and displayed as expected:

component-interaction/e2e/src/app.e2e-spec.ts

```
// ...
let _heroNames = ['Dr IQ', 'Magneta', 'Bombasto'];
let _masterName = 'Master';

it('should pass properties to children properly', function () {
  let parent = element.all(by.tagName('app-hero-parent')).get(0);
  let heroes = parent.all(by.tagName('app-hero-child'));

  for (let i = 0; i < _heroNames.length; i++) {
    let childTitle = heroes.get(i).element(by.tagName('h3')).getText();
    let childDetail = heroes.get(i).element(by.tagName('p')).getText();
    expect(childTitle).toEqual(_heroNames[i] + ' says:');
    expect(childDetail).toContain(_masterName);
  }
});
// ...
```

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Intercept input property changes with a setter

Use an input property setter to intercept and act upon a value from the parent.

The setter of the `name` input property in the child `NameChildComponent` trims the whitespace from a name and replaces an empty value with default text.

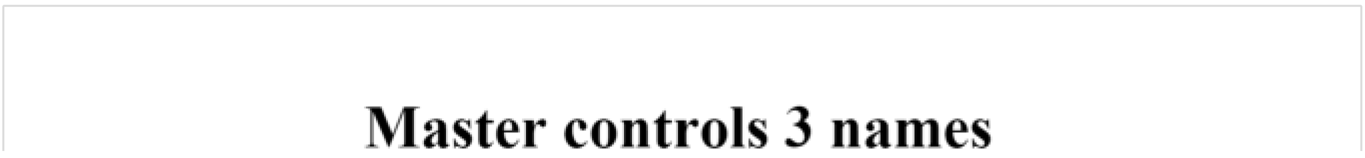
component-interaction/src/app/name-child.component.ts

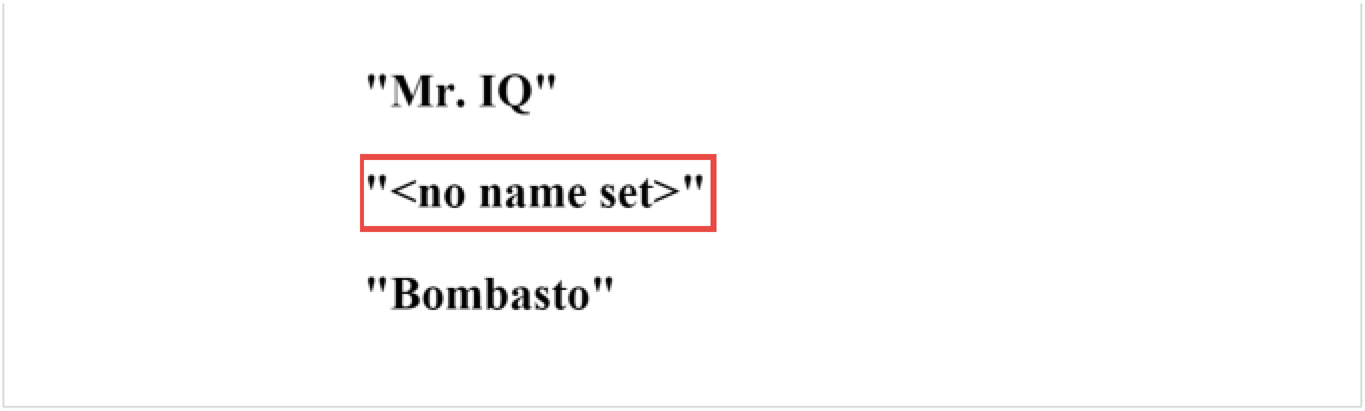
```
import { Component, Input } from '@angular/core';

@Component({
  selector: 'app-name-child',
  template: '<h3>"{{name}}"</h3>'
})
export class NameChildComponent {
  private _name = '';

  @Input()
  set name(name: string) {
    this._name = (name && name.trim()) || '<no name set>';
  }

  get name(): string { return this._name; }
}
```

Here's the `NameParentComponent` demonstrating name variations including a name with all spaces:

component-interaction/src/app/name-parent.component.ts

```
import { Component } from '@angular/core';

@Component({
  selector: 'app-name-parent',
  template: `
  <h2>Master controls {{names.length}} names</h2>
  <app-name-child *ngFor="let name of names" [name]="name"></app-name-child>
  `
})
export class NameParentComponent {
  // Displays 'Dr IQ', '<no name set>', 'Bombasto'
  names = ['Dr IQ', '   ', '  Bombasto  '];
}
```


Master controls 3 names


"Mr. IQ"

"<no name set>"

"Bombasto"

Test it

E2E tests of input property setter with empty and non-empty names:

component-interaction/e2e/src/app.e2e-spec.ts

```
// ...
it('should display trimmed, non-empty names', function () {
  let _nonEmptyNameIndex = 0;
  let _nonEmptyName = '"Dr IQ"';
  let parent = element.all(by.tagName('app-name-parent')).get(0);
  let hero = parent.all(by.tagName('app-name-child')).get(_nonEmptyNameIndex);

  let displayName = hero.element(by.tagName('h3')).getText();
  expect(displayName).toEqual(_nonEmptyName);
});

it('should replace empty name with default name', function () {
  let _emptyNameIndex = 1;
  let _defaultName = '"<no name set>"';
  let parent = element.all(by.tagName('app-name-parent')).get(0);
  let hero = parent.all(by.tagName('app-name-child')).get(_emptyNameIndex);

  let displayName = hero.element(by.tagName('h3')).getText();
  expect(displayName).toEqual(_defaultName);
});
// ...
```

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Intercept input property changes with *ngOnChanges()*

Detect and act upon changes to input property values with the `ngOnChanges()` method of the `OnChanges` lifecycle hook interface.

> You may prefer this approach to the property setter when watching multiple, interacting input properties.
>
> Learn about `ngOnChanges()` in the Lifecycle Hooks chapter.

This `VersionChildComponent` detects changes to the `major` and `minor` input properties and composes a log message reporting these changes:

component-interaction/src/app/version-child.component.ts

```
import { Component, Input, OnChanges, SimpleChange } from '@angular/core';

@Component({
  selector: 'app-version-child',
  template: `
    <h3>Version {{major}}.{{minor}}</h3>
    <h4>Change log:</h4>
    <ul>
      <li *ngFor="let change of changeLog">{{change}}</li>
    </ul>
  `
})
export class VersionChildComponent implements OnChanges {
  @Input() major: number;
  @Input() minor: number;
  changeLog: string[] = [];

  ngOnChanges(changes: {[propKey: string]: SimpleChange}) {
    let log: string[] = [];
    for (let propName in changes) {
      let changedProp = changes[propName];
      let to = JSON.stringify(changedProp.currentValue);
      if (changedProp.isFirstChange()) {
        log.push(`Initial value of ${propName} set to ${to}`);
      } else {
        let from = JSON.stringify(changedProp.previousValue);
        log.push(`${propName} changed from ${from} to ${to}`);
      }
    }
    this.changeLog.push(log.join(', '));
  }
}
```

The `VersionParentComponent` supplies the `minor` and `major` values and binds buttons to methods that change them.

component-interaction/src/app/version-parent.component.ts

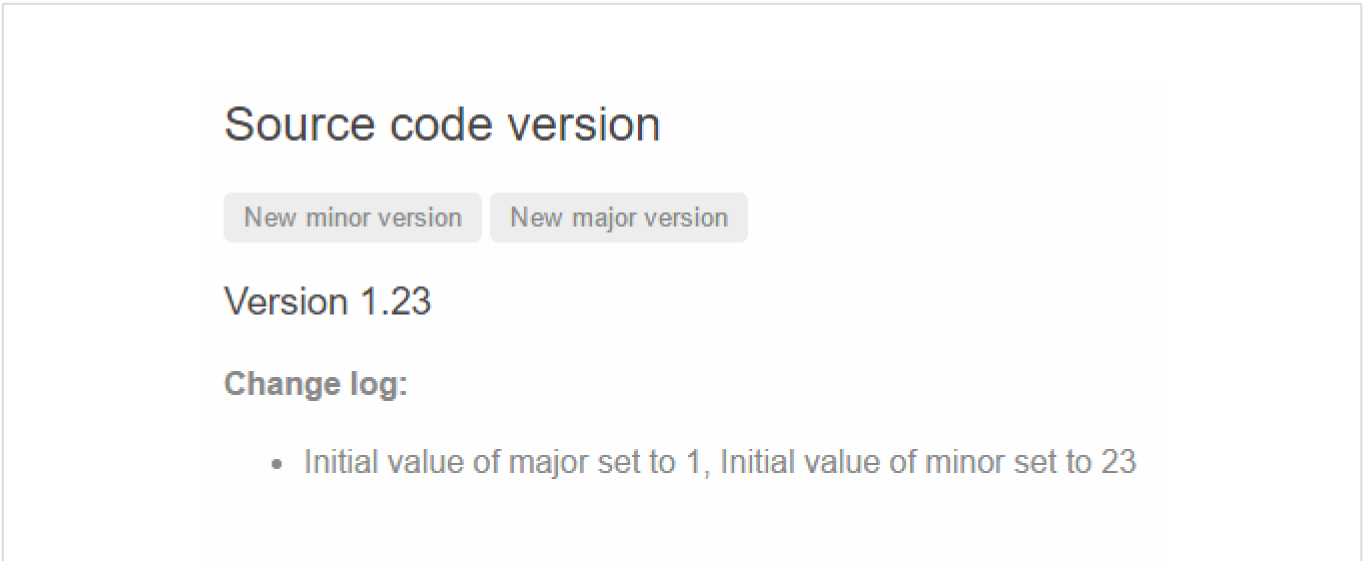
```
import { Component } from '@angular/core';

@Component({
  selector: 'app-version-parent',
  template: `
    <h2>Source code version</h2>
    <button (click)="newMinor()">New minor version</button>
    <button (click)="newMajor()">New major version</button>
    <app-version-child [major]="major" [minor]="minor"></app-version-child>
  `
})
export class VersionParentComponent {
  major = 1;
  minor = 23;

  newMinor() {
    this.minor++;
  }

  newMajor() {
    this.major++;
    this.minor = 0;
  }
}
```

Here's the output of a button-pushing sequence:



Source code version

Version 1.23

Change log:

- Initial value of major set to 1, Initial value of minor set to 23

Test it

Test that ***both*** input properties are set initially and that button clicks trigger the expected `ngOnChanges` calls and values:

component-interaction/e2e/src/app.e2e-spec.ts

```
// ...
// Test must all execute in this exact order
it('should set expected initial values', function () {
  let actual = getActual();

  let initialLabel = 'Version 1.23';
  let initialLog = 'Initial value of major set to 1, Initial value of minor set to
23';

  expect(actual.label).toBe(initialLabel);
  expect(actual.count).toBe(1);
  expect(actual.logs.get(0).getText()).toBe(initialLog);
});

it('should set expected values after clicking \'Minor\' twice', function () {
  let repoTag = element(by.tagName('app-version-parent'));
  let newMinorButton = repoTag.all(by.tagName('button')).get(0);

  newMinorButton.click().then(function() {
    newMinorButton.click().then(function() {
      let actual = getActual();

      let labelAfter2Minor = 'Version 1.25';
      let logAfter2Minor = 'minor changed from 24 to 25';

      expect(actual.label).toBe(labelAfter2Minor);
      expect(actual.count).toBe(3);
      expect(actual.logs.get(2).getText()).toBe(logAfter2Minor);
    });
  });
});

it('should set expected values after clicking \'Major\' once', function () {
  let repoTag = element(by.tagName('app-version-parent'));
  let newMajorButton = repoTag.all(by.tagName('button')).get(1);

  newMajorButton.click().then(function() {
    let actual = getActual();
```

```
      let labelAfterMajor = 'Version 2.0';
      let logAfterMajor = 'major changed from 1 to 2, minor changed from 25 to 0';

      expect(actual.label).toBe(labelAfterMajor);
      expect(actual.count).toBe(4);
      expect(actual.logs.get(3).getText()).toBe(logAfterMajor);
    });
  });

  function getActual() {
    let versionTag = element(by.tagName('app-version-child'));
    let label = versionTag.element(by.tagName('h3')).getText();
    let ul = versionTag.element((by.tagName('ul')));
    let logs = ul.all(by.tagName('li'));

    return {
      label: label,
      logs: logs,
      count: logs.count()
    };
  }
  // ...
```

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Parent listens for child event

The child component exposes an `EventEmitter` property with which it `emits` events when something happens. The parent binds to that event property and reacts to those events.

The child's `EventEmitter` property is an ***output property***, typically adorned with an @Output decoration as seen in this `VoterComponent`:

component-interaction/src/app/voter.component.ts

```
import { Component, EventEmitter, Input, Output } from '@angular/core';

@Component({
  selector: 'app-voter',
  template: `
    <h4>{{name}}</h4>
    <button (click)="vote(true)"  [disabled]="didVote">Agree</button>
    <button (click)="vote(false)" [disabled]="didVote">Disagree</button>
  `
})
export class VoterComponent {
  @Input()  name: string;
  @Output() voted = new EventEmitter<boolean>();
  didVote = false;

  vote(agreed: boolean) {
    this.voted.emit(agreed);
    this.didVote = true;
  }
}
```

Clicking a button triggers emission of a `true` or `false`, the boolean *payload*.

The parent `VoteTakerComponent` binds an event handler called `onVoted()` that responds to the child event payload `$event` and updates a counter.

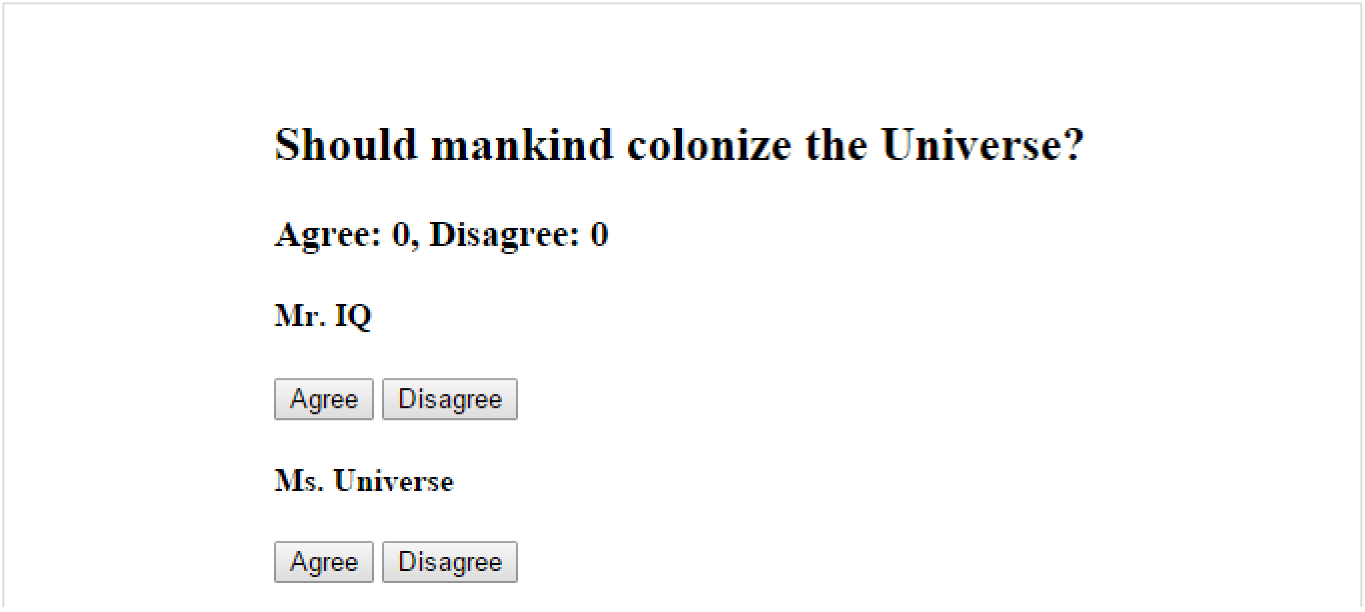
component-interaction/src/app/votetaker.component.ts

```
import { Component }      from '@angular/core';

@Component({
  selector: 'app-vote-taker',
  template: `
    <h2>Should mankind colonize the Universe?</h2>
    <h3>Agree: {{agreed}}, Disagree: {{disagreed}}</h3>
    <app-voter *ngFor="let voter of voters"
      [name]="voter"
      (voted)="onVoted($event)">
    </app-voter>
  `
})
export class VoteTakerComponent {
  agreed = 0;
  disagreed = 0;
  voters = ['Narco', 'Celeritas', 'Bombasto'];

  onVoted(agreed: boolean) {
    agreed ? this.agreed++ : this.disagreed++;
  }
}
```

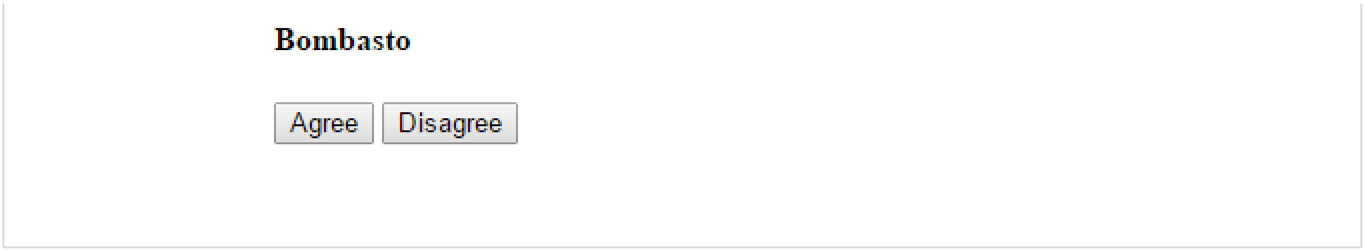
The framework passes the event argument—represented by `$event`—to the handler method, and the method processes it:


Should mankind colonize the Universe?

Agree: 0, Disagree: 0

Mr. IQ

Ms. Universe



Test it

Test that clicking the *Agree* and *Disagree* buttons update the appropriate counters:

component-interaction/e2e/src/app.e2e-spec.ts

```
// ...
it('should not emit the event initially', function () {
  let voteLabel = element(by.tagName('app-vote-taker'))
    .element(by.tagName('h3')).getText();
  expect(voteLabel).toBe('Agree: 0, Disagree: 0');
});

it('should process Agree vote', function () {
  let agreeButton1 = element.all(by.tagName('app-voter')).get(0)
    .all(by.tagName('button')).get(0);
  agreeButton1.click().then(function() {
    let voteLabel = element(by.tagName('app-vote-taker'))
      .element(by.tagName('h3')).getText();
    expect(voteLabel).toBe('Agree: 1, Disagree: 0');
  });
});

it('should process Disagree vote', function () {
  let agreeButton1 = element.all(by.tagName('app-voter')).get(1)
    .all(by.tagName('button')).get(1);
  agreeButton1.click().then(function() {
    let voteLabel = element(by.tagName('app-vote-taker'))
      .element(by.tagName('h3')).getText();
    expect(voteLabel).toBe('Agree: 1, Disagree: 1');
  });
});
// ...
```

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Parent interacts with child via *local variable*

A parent component cannot use data binding to read child properties or invoke child methods. You can do both by creating a template reference variable for the child element and then reference that variable *within the parent template* as seen in the following example.

The following is a child `CountdownTimerComponent` that repeatedly counts down to zero and launches a rocket. It has `start` and `stop` methods that control the clock and it displays a countdown status message in its own template.

component-interaction/src/app/countdown-timer.component.ts

```
import { Component, OnDestroy, OnInit } from '@angular/core';

@Component({
  selector: 'app-countdown-timer',
  template: '<p>{{message}}</p>'
})
export class CountdownTimerComponent implements OnInit, OnDestroy {

  intervalId = 0;
  message = '';
  seconds = 11;

  clearTimer() { clearInterval(this.intervalId); }

  ngOnInit()    { this.start(); }
  ngOnDestroy() { this.clearTimer(); }

  start() { this.countDown(); }
  stop()  {
    this.clearTimer();
    this.message = `Holding at T-${this.seconds} seconds`;
  }

  private countDown() {
    this.clearTimer();
    this.intervalId = window.setInterval(() => {
      this.seconds -= 1;
      if (this.seconds === 0) {
        this.message = 'Blast off!';
      } else {
        if (this.seconds < 0) { this.seconds = 10; } // reset
        this.message = `T-${this.seconds} seconds and counting`;
      }
    }, 1000);
  }
}
```

The `CountdownLocalVarParentComponent` that hosts the timer component is as follows:

component-interaction/src/app/countdown-parent.component.ts

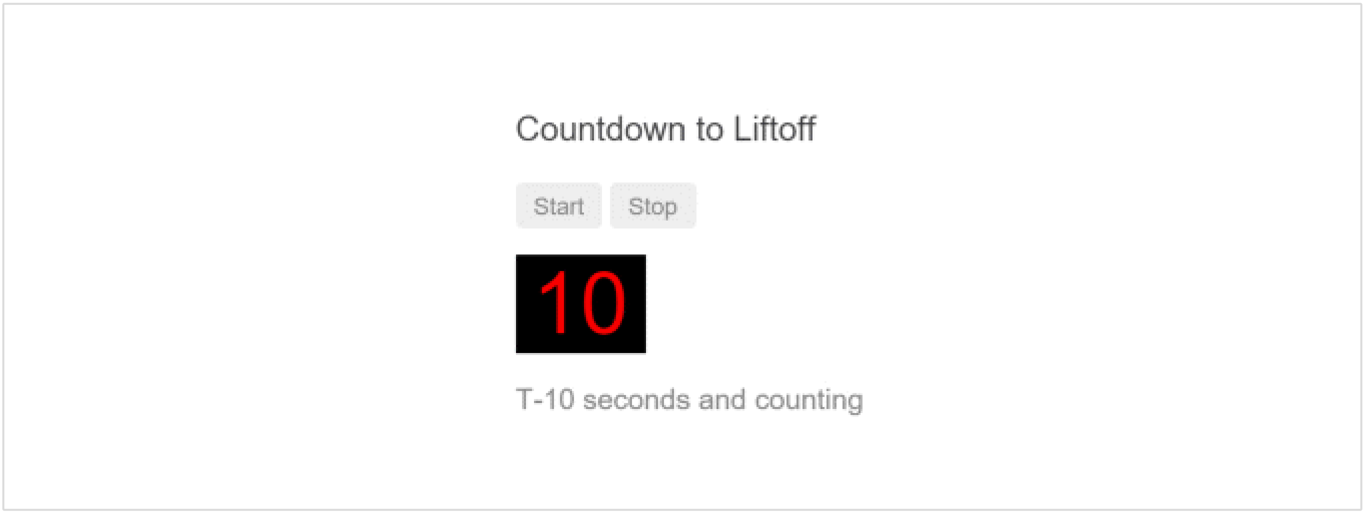
```
import { Component }                from '@angular/core';
import { CountdownTimerComponent }  from './countdown-timer.component';

@Component({
  selector: 'app-countdown-parent-lv',
  template: `
  <h3>Countdown to Liftoff (via local variable)</h3>
  <button (click)="timer.start()">Start</button>
  <button (click)="timer.stop()">Stop</button>
  <div class="seconds">{{timer.seconds}}</div>
  <app-countdown-timer #timer></app-countdown-timer>
  `,
  styleUrls: ['../assets/demo.css']
})
export class CountdownLocalVarParentComponent { }
```

The parent component cannot data bind to the child's `start` and `stop` methods nor to its `seconds` property.

You can place a local variable, `#timer`, on the tag `<countdown-timer>` representing the child component. That gives you a reference to the child component and the ability to access *any of its properties or methods* from within the parent template.

This example wires parent buttons to the child's `start` and `stop` and uses interpolation to display the child's `seconds` property.

Here we see the parent and child working together.



Test it

Test that the seconds displayed in the parent template match the seconds displayed in the child's status message. Test also that clicking the *Stop* button pauses the countdown timer:

component-interaction/e2e/src/app.e2e-spec.ts

```
// ...
it('timer and parent seconds should match', function () {
  let parent = element(by.tagName(parentTag));
  let message = parent.element(by.tagName('app-countdown-timer')).getText();
  browser.sleep(10); // give `seconds` a chance to catchup with `message`
  let seconds = parent.element(by.className('seconds')).getText();
  expect(message).toContain(seconds);
});

it('should stop the countdown', function () {
  let parent = element(by.tagName(parentTag));
  let stopButton = parent.all(by.tagName('button')).get(1);

  stopButton.click().then(function() {
    let message = parent.element(by.tagName('app-countdown-timer')).getText();
    expect(message).toContain('Holding');
  });
});
// ...
```

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Parent calls an *@ViewChild()*

The *local variable* approach is simple and easy. But it is limited because the parent-child wiring must be done entirely within the parent template. The parent component *itself* has no access to the child.

You can't use the *local variable* technique if an instance of the parent component *class* must read or write child component values or must call child component methods.

When the parent component *class* requires that kind of access, ***inject*** the child component into the parent as a *ViewChild*.

The following example illustrates this technique with the same Countdown Timer example. Neither its appearance nor its behavior will change. The child CountdownTimerComponent is the same as well.

> The switch from the *local variable* to the *ViewChild* technique is solely for the purpose of demonstration.

Here is the parent, `CountdownViewChildParentComponent`:

component-interaction/src/app/countdown-parent.component.ts

```
import { AfterViewInit, ViewChild } from '@angular/core';
import { Component }                from '@angular/core';
import { CountdownTimerComponent }  from './countdown-timer.component';

@Component({
  selector: 'app-countdown-parent-vc',
  template: `
  <h3>Countdown to Liftoff (via ViewChild)</h3>
  <button (click)="start()">Start</button>
  <button (click)="stop()">Stop</button>
  <div class="seconds">{{ seconds() }}</div>
  <app-countdown-timer></app-countdown-timer>
  `,
  styleUrls: ['../assets/demo.css']
})
export class CountdownViewChildParentComponent implements AfterViewInit {

  @ViewChild(CountdownTimerComponent)
  private timerComponent: CountdownTimerComponent;

  seconds() { return 0; }

  ngAfterViewInit() {
    // Redefine `seconds()` to get from the `CountdownTimerComponent.seconds` ...
    // but wait a tick first to avoid one-time devMode
    // unidirectional-data-flow-violation error
    setTimeout(() => this.seconds = () => this.timerComponent.seconds, 0);
  }

  start() { this.timerComponent.start(); }
  stop() { this.timerComponent.stop(); }
}
```

It takes a bit more work to get the child view into the parent component *class*.

First, you have to import references to the `ViewChild` decorator and the `AfterViewInit` lifecycle hook.

Next, inject the child `CountdownTimerComponent` into the private `timerComponent` property via the `@ViewChild` property decoration.

The `#timer` local variable is gone from the component metadata. Instead, bind the buttons to the parent component's own `start` and `stop` methods and present the ticking seconds in an interpolation around the parent component's `seconds` method.

These methods access the injected timer component directly.

The `ngAfterViewInit()` lifecycle hook is an important wrinkle. The timer component isn't available until *after* Angular displays the parent view. So it displays `0` seconds initially.

Then Angular calls the `ngAfterViewInit` lifecycle hook at which time it is *too late* to update the parent view's display of the countdown seconds. Angular's unidirectional data flow rule prevents updating the parent view's in the same cycle. The app has to *wait one turn* before it can display the seconds.

Use `setTimeout()` to wait one tick and then revise the `seconds()` method so that it takes future values from the timer component.

Test it

Use the same countdown timer tests as before.

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Parent and children communicate via a service

A parent component and its children share a service whose interface enables bi-directional communication *within the family*.

The scope of the service instance is the parent component and its children. Components outside this component subtree have no access to the service or their communications.

This `MissionService` connects the `MissionControlComponent` to multiple `AstronautComponent` children.

component-interaction/src/app/mission.service.ts

```
import { Injectable } from '@angular/core';
import { Subject }    from 'rxjs';

@Injectable()
export class MissionService {

  // Observable string sources
  private missionAnnouncedSource = new Subject<string>();
  private missionConfirmedSource = new Subject<string>();

  // Observable string streams
  missionAnnounced$ = this.missionAnnouncedSource.asObservable();
  missionConfirmed$ = this.missionConfirmedSource.asObservable();

  // Service message commands
  announceMission(mission: string) {
    this.missionAnnouncedSource.next(mission);
  }

  confirmMission(astronaut: string) {
    this.missionConfirmedSource.next(astronaut);
  }
}
```

The `MissionControlComponent` both provides the instance of the service that it shares with its children (through the `providers` metadata array) and injects that instance into itself through its constructor:

component-interaction/src/app/missioncontrol.component.ts

```
import { Component }          from '@angular/core';

import { MissionService }     from './mission.service';

@Component({
  selector: 'app-mission-control',
  template: `
    <h2>Mission Control</h2>
    <button (click)="announce()">Announce mission</button>
    <app-astronaut *ngFor="let astronaut of astronauts"
      [astronaut]="astronaut">
    </app-astronaut>
    <h3>History</h3>
    <ul>
      <li *ngFor="let event of history">{{event}}</li>
    </ul>
  `,
  providers: [MissionService]
})
export class MissionControlComponent {
  astronauts = ['Lovell', 'Swigert', 'Haise'];
  history: string[] = [];
  missions = ['Fly to the moon!',
              'Fly to mars!',
              'Fly to Vegas!'];
  nextMission = 0;

  constructor(private missionService: MissionService) {
    missionService.missionConfirmed$.subscribe(
      astronaut => {
        this.history.push(`${astronaut} confirmed the mission`);
      });
  }

  announce() {
    let mission = this.missions[this.nextMission++];
    this.missionService.announceMission(mission);
    this.history.push(`Mission "${mission}" announced`);
```

```
      if (this.nextMission >= this.missions.length) { this.nextMission = 0; }
    }
  }
```

The `AstronautComponent` also injects the service in its constructor. Each `AstronautComponent` is a child of the `MissionControlComponent` and therefore receives its parent's service instance:

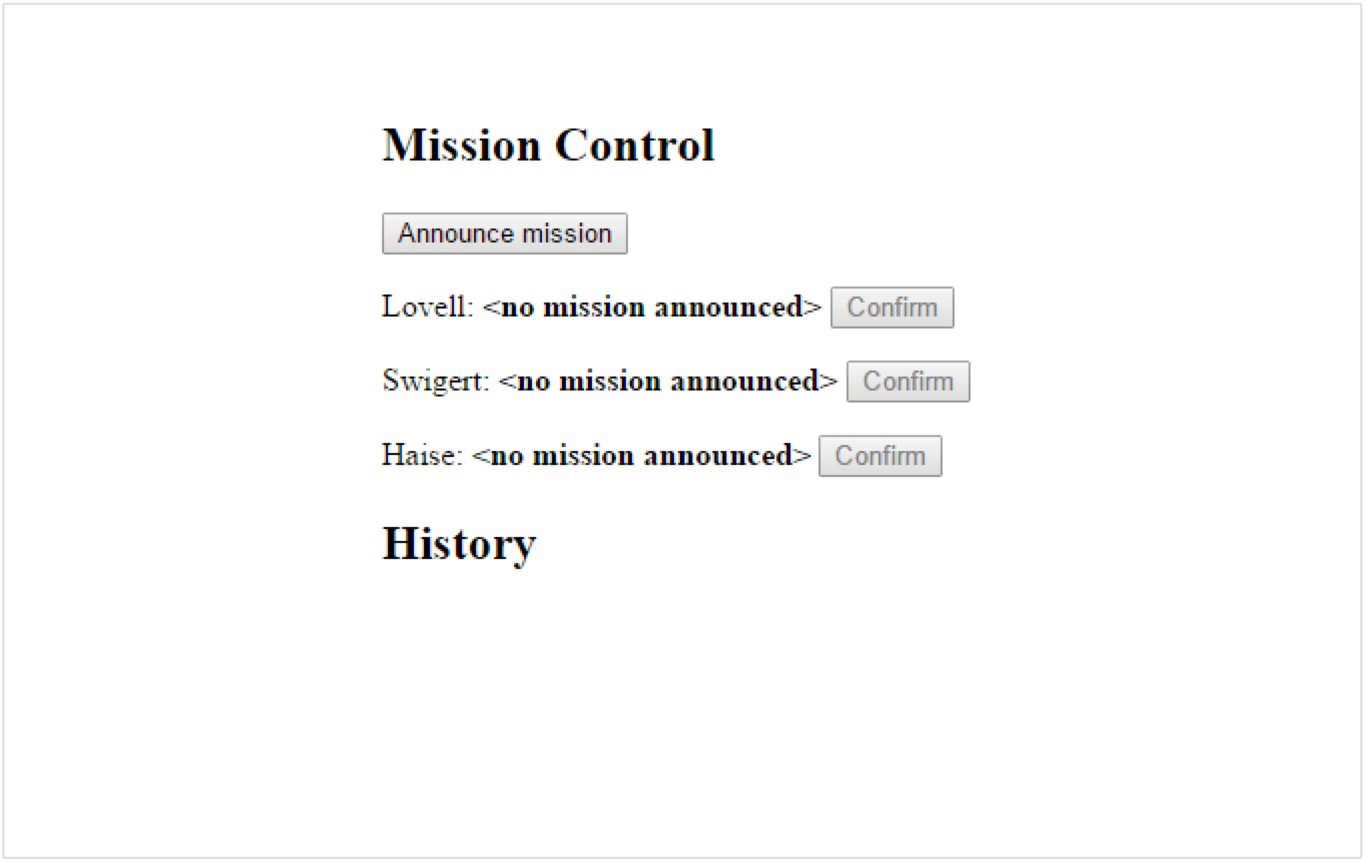
component-interaction/src/app/astronaut.component.ts

```
import { Component, Input, OnDestroy } from '@angular/core';

import { MissionService } from './mission.service';
import { Subscription }   from 'rxjs';

@Component({
  selector: 'app-astronaut',
  template: `
    <p>
      {{astronaut}}: <strong>{{mission}}</strong>
      <button
        (click)="confirm()"
        [disabled]="!announced || confirmed">
        Confirm
      </button>
    </p>
  `
})
export class AstronautComponent implements OnDestroy {
  @Input() astronaut: string;
  mission = '<no mission announced>';
  confirmed = false;
  announced = false;
  subscription: Subscription;

  constructor(private missionService: MissionService) {
    this.subscription = missionService.missionAnnounced$.subscribe(
      mission => {
        this.mission = mission;
        this.announced = true;
        this.confirmed = false;
    });
  }

  confirm() {
    this.confirmed = true;
    this.missionService.confirmMission(this.astronaut);
  }
  ngOnDestroy() {
    // prevent memory leak when component destroyed
    this.subscription.unsubscribe();
  }
}
```

Notice that this example captures the `subscription` and `unsubscribe()` when the `AstronautComponent` is destroyed. This is a memory-leak guard step. There is no actual risk in this app because the lifetime of a `AstronautComponent` is the same as the lifetime of the app itself. That *would not* always be true in a more complex application.

You don't add this guard to the `MissionControlComponent` because, as the parent, it controls the lifetime of the `MissionService`.

The *History* log demonstrates that messages travel in both directions between the parent `MissionControlComponent` and the `AstronautComponent` children, facilitated by the service:


Mission Control
Announce mission
Lovell: <no mission announced>
Confirm
Swigert: <no mission announced>
Confirm
Haise: <no mission announced>
Confirm
History

Test it

Tests click buttons of both the parent `MissionControlComponent` and the `AstronautComponent` children and verify that the history meets expectations:

component-interaction/e2e/src/app.e2e-spec.ts

```
// ...
it('should announce a mission', function () {
  let missionControl = element(by.tagName('app-mission-control'));
  let announceButton = missionControl.all(by.tagName('button')).get(0);
  announceButton.click().then(function () {
    let history = missionControl.all(by.tagName('li'));
    expect(history.count()).toBe(1);
    expect(history.get(0).getText()).toMatch(/Mission.* announced/);
  });
});

it('should confirm the mission by Lovell', function () {
  testConfirmMission(1, 2, 'Lovell');
});

it('should confirm the mission by Haise', function () {
  testConfirmMission(3, 3, 'Haise');
});

it('should confirm the mission by Swigert', function () {
  testConfirmMission(2, 4, 'Swigert');
});

function testConfirmMission(buttonIndex: number, expectedLogCount: number,
astronaut: string) {
  let _confirmedLog = ' confirmed the mission';
  let missionControl = element(by.tagName('app-mission-control'));
  let confirmButton = missionControl.all(by.tagName('button')).get(buttonIndex);
  confirmButton.click().then(function () {
    let history = missionControl.all(by.tagName('li'));
    expect(history.count()).toBe(expectedLogCount);
    expect(history.get(expectedLogCount - 1).getText()).toBe(astronaut +
_confirmedLog);
  });
}
// ...
```

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