



distributed application runtime

an intro

<https://dapr.io/>



TL ; DR ;

- “ Dapr is a **portable, event-driven runtime** that makes it easy for any developer to build resilient, stateless and stateful applications that run on the **cloud and edge** and **embraces the diversity of languages and developer frameworks**.
- “ Dapr codifies the **best practices for building microservice applications** into open, independent, **building blocks** that enable you to build portable applications with the language and framework of your choice.

<https://docs.dapr.io/concepts/overview/>

READ THE DOCS

<https://dapr.io>
DISTRIBUTED APP RUNTIME

- OVERVIEW
- BUILDING BLOCKS
- COMPONENTS
- CONFIGURATION
- MIDDLEWARE PIPELINES
- OBSERVABILITY
- SECURITY

SO YOU'RE AN APP DEVELOPER: "Hello!"

OVERVIEW

DAPR IS A PORTABLE
EVENT-DRIVEN RUNTIME

- Make it EASY for devs to build RESILIENT stateful and stateless apps that RUN ON CLOUD and support DIVERSE languages and dev frameworks!

BUILD MICROSERVICES ON CLOUD OR EDGE

INTRODUCTION TO DAPR

GOAL: BUILD RESILIENT APPS USING MICROSERVICES

HELP! CHALLENGES

STATE RECOVERY AFTER FAILURE

MANAGE SECRETS

DISCOVER + INVOKE OTHER MICROSERVICES SECURELY

YOU'LL BE RIGHT BESIDE YOU

WHAT'S YOUR DEV FRAM. PREFERENCE?

GO, JAVA, JET NODE, .NET, PYTHON, C++

AMAZON, AUKU, GCP, KUBERNETES

API LEVEL

ABSTRACTION

API

GO

PYTHON

ANY FRAMEWORK LANGUAGE WHERE

SIDECAR ARCHITECTURE

MICROSERVICES BUILDING BLOCKS

GO

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ANY FRAMEWORK LANGUAGE WHERE

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ANY FRAMEWORK LANGUAGE WHERE

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MICROSERVICES BUILDING BLOCKS

GO

PYTHON

SIDECAR ARCHITECTURE

USE ANY LANGUAGE OR FWK

DAPR RUNS IN ITS OWN CONTAINER

USE ALL BLOCKS OR JUST ONE

RUN IT ALONGSIDE YOUR APP CONTAINER AND BENEFIT FROM CLOUD SCALABILITY

READY FOR USE WITH EXISTING APPS

docs.dapr.io

github.com/dapr@daprdev

GET YOUR APP UP AND RUNNING!

ABSTRACT AWAY COMPLEXITY. Keep your app clean!

GO

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ANY FRAMEWORK LANGUAGE WHERE

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DAPR CODIFIES BEST PRACTICES FOR BUILDING MICROSERVICES

INTO OPEN, INDEPENDENT "BUILDING BLOCKS"

APPLICATION

API

HTTP

GRPC

3-TIER ARCH

Client, Service, Database

BUT

NOT WITH A MICROSERVICE ARCHITECTURE

AZURE AWS GCP ALIBABA

DEVS TODAY ARE COMFORTABLE WITH CLASSIC 3-TIER ARCH

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BUT

API - EXPOSED EITHER AS A PROCESS OR AS A CONTAINER

APPS DO NOT NEED TO ADD DAPR RUNTIME INTO THAT CORE!

EASY INTEGRATION

CLEAN SEPARATION

"BUILDING BLOCKS"

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DAPR 1.0 IS HERE!

- aka.ms/dapr-v1.0

DAPR IS NOW PRODUCTION READY

Join a fast growing and engaged community

GREAT ECOSYSTEM AROUND DAPR

75+ components and growing daily

WIDE RANGE OF SDKS (Go, Java, .NET, JS, Python, PHP, Node...)

IS LANGUAGE AGNOSTIC

OR USE API OVER HTTP OR gRPC

Run on local dev machine (Self Host)

Run in KUBERNETES MODE (cluster, cloud)

Run in KUBERNETES MODE (cluster, cloud)

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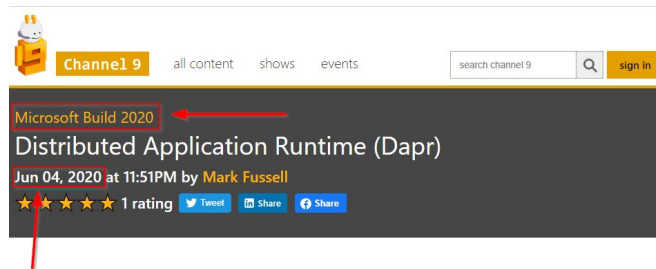
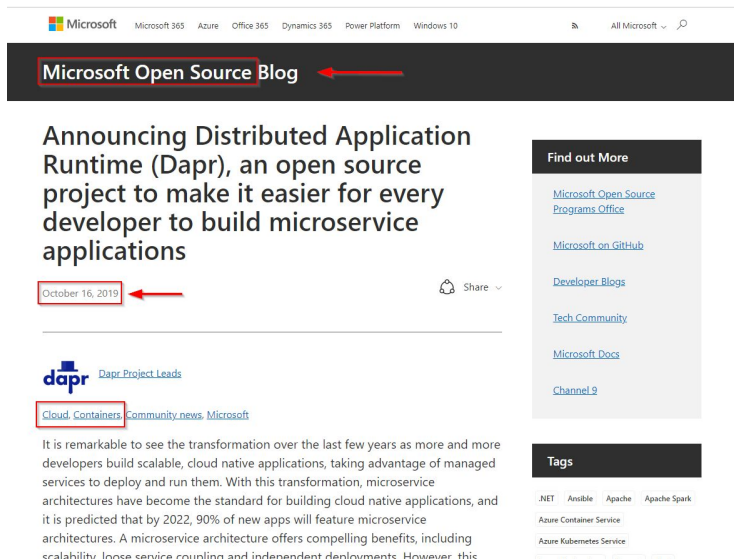
OR USE API OVER HTTP OR gRPC

Run on local dev machine (Self Host)

Run in KUBERNETES MODE (cluster, cloud)

History

- originated within Microsoft
 - IMHO: possibly because nobody wanted to use [Service Fabric](#)?
- announced **2019**, broader audience **Microsoft Build 2020**



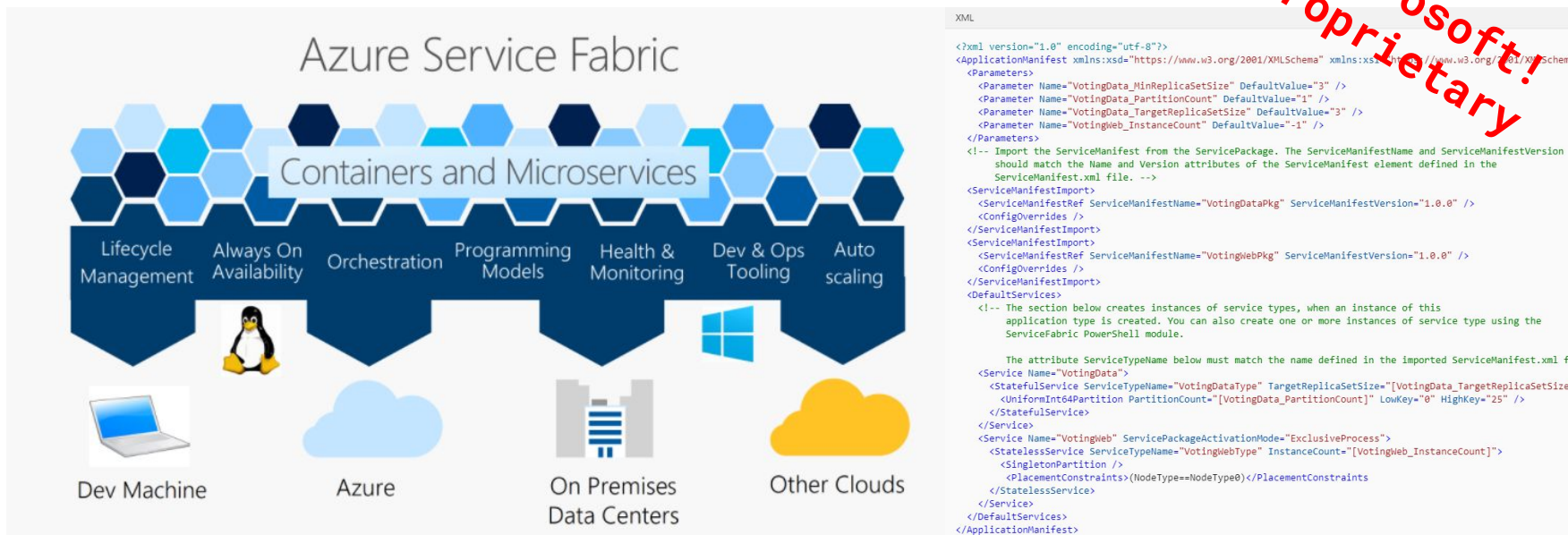
What is holding back microservice development?



(detour) Service Fabric

- Microsoft-specific technology not really widely used

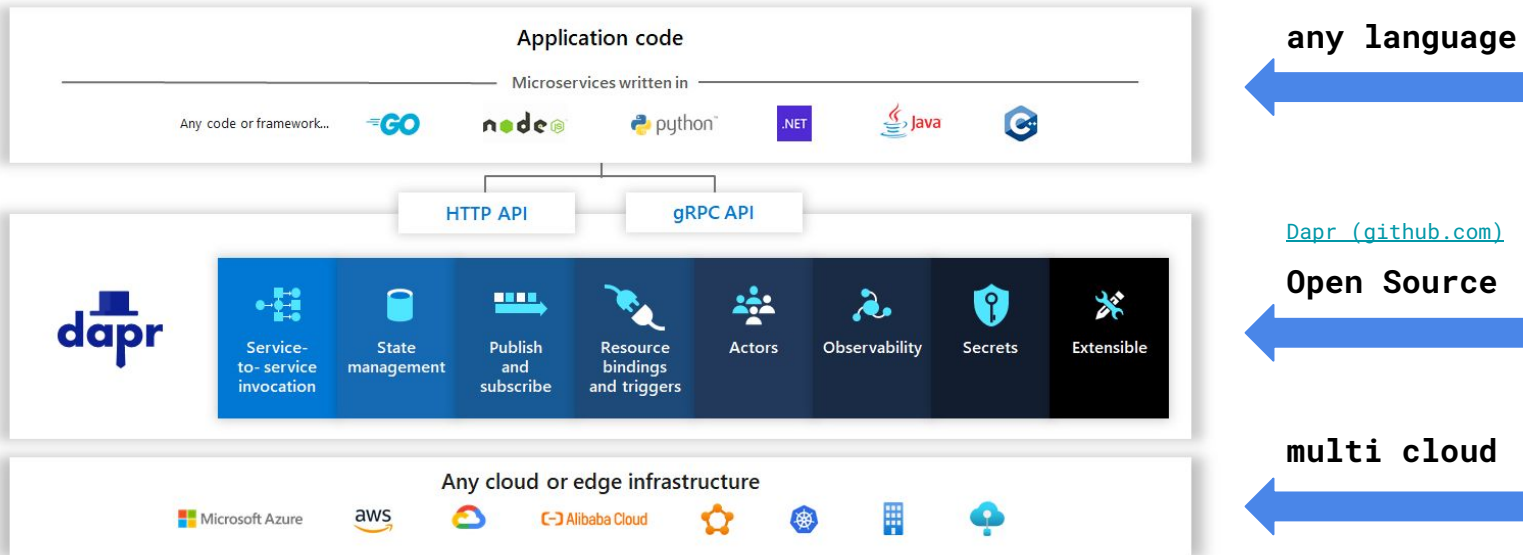
 **old Microsoft!**
proprietary



<https://docs.microsoft.com/en-us/azure/service-fabric/>

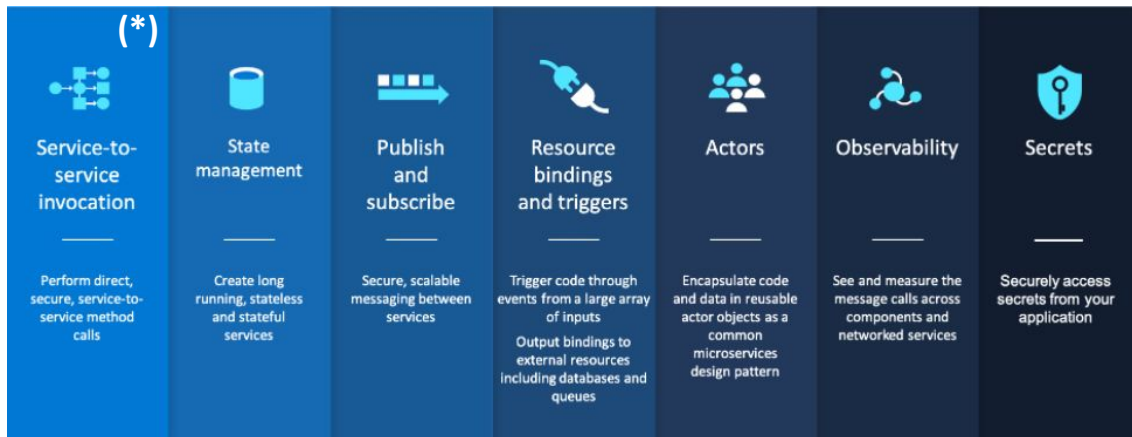
Overview

- **Building-Blocks** to somehow standardize/simplify cloud development
- Can be used with **any language** and with **multiple environments** (systems/cloud providers)



Building Blocks

- Typical **components/services** needed for app development
 - cannot hide Microsoft Background (Azure components GA)
- **Simple** use/integration because of **HTTP/gRPC** -> **any language**
- **Abstract** cloud platform-/technology-details -> **multi cloud**



<https://docs.dapr.io/concepts/building-blocks-concept/>

(*) [Dapr is not a service mesh](#)

State Stores

Amazon Web Services (AWS)

| Name | CRUD | Transactional | ETag | Actors | Status | Component version | Since |
|--------------|------|---------------|------|--------|--------|-------------------|-------|
| AWS DynamoDB | ✓ | ✗ | ✗ | ✗ | Alpha | v1 | 1.0 |

Google Cloud Platform (GCP)

| Name | CRUD | Transactional | ETag | Actors | Status | Component version | Since |
|---------------|------|---------------|------|--------|--------|-------------------|-------|
| GCP Firestore | ✓ | ✗ | ✗ | ✗ | Alpha | v1 | 1.0 |

Microsoft Azure

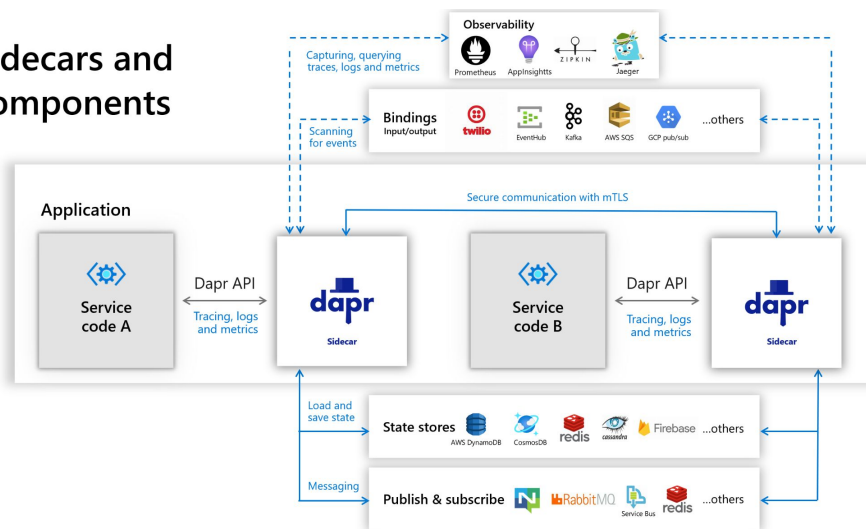
| Name | CRUD | Transactional | ETag | Actors | Status | Component version | Since |
|---------------------|------|---------------|------|--------|--------|-------------------|-------|
| Azure Blob Storage | ✓ | ✗ | ✓ | ✗ | GA | v1 | 1.0 |
| Azure CosmosDB | ✓ | ✓ | ✓ | ✓ | GA | v1 | 1.0 |
| Azure SQL Server | ✓ | ✓ | ✓ | ✓ | Alpha | v1 | 1.0 |
| Azure Table Storage | ✓ | ✗ | ✓ | ✗ | Alpha | v1 | 1.0 |

<https://docs.dapr.io/reference/components-reference/>

Implementation

- Development **in the open** <https://github.com/dapr/dapr> / [Community Calls - YouTube](#)
- [v1.2.0](#) current, [MIT License](#), **golang based** (♥)
- Dapr logic/building-blocks **implemented as sidecars**
- Expose **HTTP/gRPC API** for invocation ([dapr API](#) / [dapr GRPC](#))
- Support for **microservice patterns**

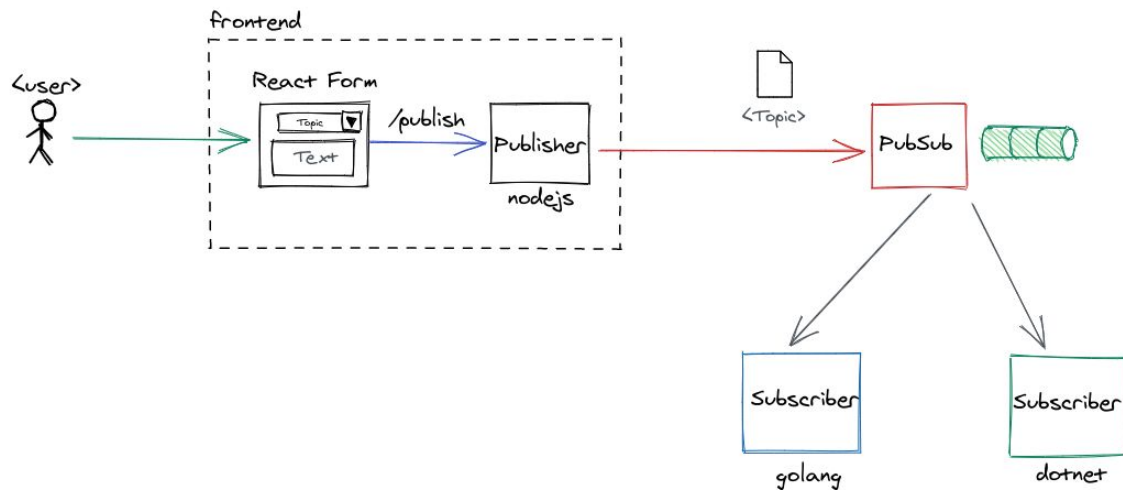
Sidecars and components



| Building Block | Endpoint |
|-------------------------------|----------------------------------|
| Service-to-service invocation | /v1.0/invoke |
| State management | /v1.0/state |
| Publish and subscribe | /v1.0/publish /v1.0/subscribe |
| Resource bindings | /v1.0/bindings |
| Actors | /v1.0/actors |
| Observability | N/A |
| Secrets | /v1.0/secrets |

DEMO

- Dev example with simple **pubsub logic**
- dapr CLI
- k8s with dapr (use redis)
- k8s with dapr (use azure service-bus)



Dev example - PupSub

- expressjs -> simple POST to http://localhost:3500/v1.0/publish/pubsubname/<TOPIC>

```
const daprPort = process.env.DAPR_HTTP_PORT || 3500;
const daprUrl = `http://localhost:${daprPort}/v1.0`;
const port = 8080;
const pubsubName = 'pubsub';

app.post('/publish', (req, res) => {
  console.log("Publishing: ", req.body);
  const publishUrl = `${daprUrl}/publish/${pubsubName}/${req.body.messageType}`;
  request( { uri: publishUrl, method: 'POST', json: req.body } );
  res.sendStatus(200);
});
```

nodejs

- subscribers

```
[HttpPost("/receive_all")]
0 references
public IActionResult GetSubscriptionResultA([FromBody]Message msg)
{
  _logger.LogInformation($"📩 message '{msg.Data.Message}' via '/receive_all'");
  return Ok(new Result {
    Success = true
  });
}
```

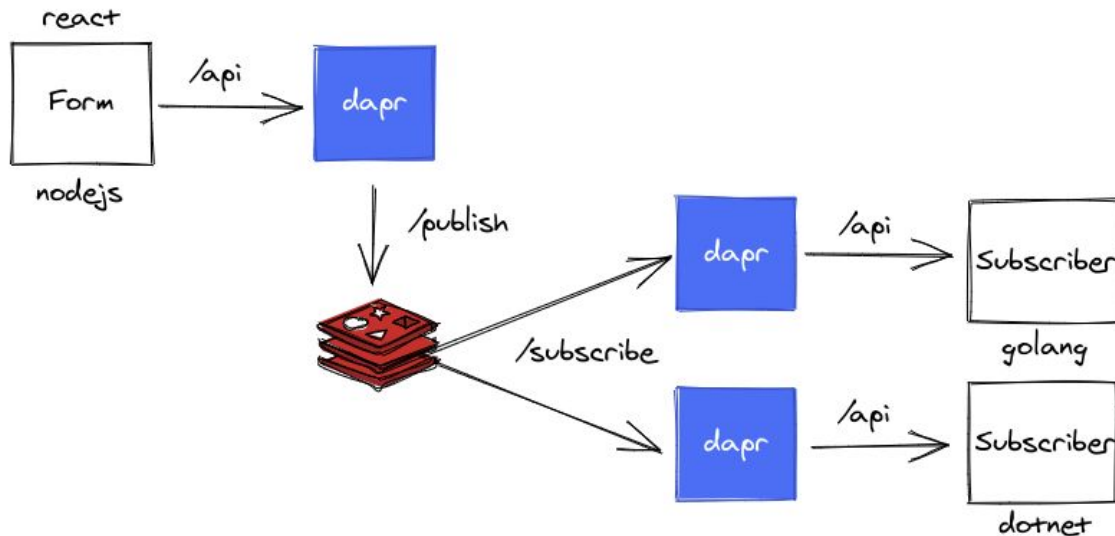
dotnet

```
func procMessage(route string) http.HandlerFunc {
  return func(w http.ResponseWriter, r *http.Request) {
    msg, err := getMessage(r.Body)
    defer r.Body.Close()
    if err != nil {
      http.Error(w, err.Error(), 500)
      return
    }
    log.Printf("📩 via '%s', for '%s' with message '%s'", route, msg.Topic, msg.Data.Message)
    w.WriteHeader(http.StatusOK)
  }
}
```

golang

Dev example - PupSub

- `dapr run --app-id golang-subscriber --app-port 3000 ./golang-subscriber`
- `dapr run --app-id dotnet-subscriber --app-port 5000 ./output/dotnet-subscriber`
- `dapr run --app-id react-form --app-port 8080 npm run start`



```
make dap-run
workstation scope=dapr.runtime.actor type=log ver=1.1.2
== APP == info: Microsoft.Hosting.Lifetime[0]
== APP == Now listening on: http://localhost:5000
== APP == info: Microsoft.Hosting.Lifetime[0]
== APP == Now listening on: https://localhost:5001
== APP == info: Microsoft.Hosting.Lifetime[0]
== APP == Application started. Press Ctrl+C to shut down.
== APP == info: Microsoft.Hosting.Lifetime[0]
== APP == Hosting environment: Production
== APP == info: Microsoft.Hosting.Lifetime[0]
== APP == Content root path: /home/henrik/Development/dapr/pub-sub/dotnet-subscriber
INFO[0000] app is subscribed to the following topics: [Topic2 ALL] through pubsub=pubsub app_id=dotnet-subscriber instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] dapr initialized. Status: Running. Init Elapsed 285.870498ms app_id=dotnet-subscriber instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] placement tables updated, version: 0 app_id=dotnet-subscriber instance=henrik-workstation scope=dapr.runtime.actor.internal.placement type=log ver=1.1.2
[+] Updating metadata for app command: ./output/dotnet-subscriber
[+] You're up and running! Both Dapr and your app logs will appear here.
== APP == info: dotnet_subscriber.Controllers.PubSubController[0]
== APP == message 'hello, dapr world!' via '/receive_all' for 'ALL'
```

React App

localhost:8080

Pub-Sub Sample

Select Message Type

ALL

Enter message

hello, dapr world!

Submit

```
make dap-run
rpc.internal type=log ver=1.1.2
INFO[0000] enabled gRPC metrics middleware app_id=golang-subscriber instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
rpc.internal type=log ver=1.1.2
INFO[0000] internal gRPC server is running on port 39695 app_id=golang-subscriber instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] application protocol: http. waiting on port 3000. This will block until the app is listening on that port. app_id=golang-subscriber instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] application discovered on port 3000 app_id=golang-subscriber instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
== APP == 2021/05/29 14:31:24 "GET http://127.0.0.1:3000/dapr/config HTTP/1.1" from 127.0.0.1:47190 - 404 198 in 7.171µs
INFO[0000] application configuration loaded app_id=golang-subscriber instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] actor runtime started. actor idle timeout: 1h0m0s. actor scan interval: 30s app_id=golang-subscriber instance=henrik-workstation scope=dapr.runtime.actor type=log ver=1.1.2
== APP == 2021/05/29 14:31:24 "GET http://127.0.0.1:3000/dapr/subscribe HTTP/1.1" from 127.0.0.1:47190 - 200 122B in 41.13µs
INFO[0000] app is subscribed to the following topics: [Topic1 ALL] through pubsub=pubsub app_id=golang-subscriber instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] dapr initialized. Status: Running. Init Elapsed 3.983924ms app_id=golang-subscriber instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] placement tables updated, version: 0 app_id=golang-subscriber instance=henrik-workstation scope=dapr.runtime.actor.internal.placement type=log ver=1.1.2
[+] Updating metadata for app command: ./golang-subscriber
[+] You're up and running! Both Dapr and your app logs will appear here.
== APP == 2021/05/29 14:32:48 via '/receive_all', for 'ALL' with message 'hello, dapr world!'
== APP == 2021/05/29 14:32:48 "POST http://127.0.0.1:3000/receive_all HTTP/1.1" from 127.0.0.1:47358 - 200 0B in 112.072µs
```

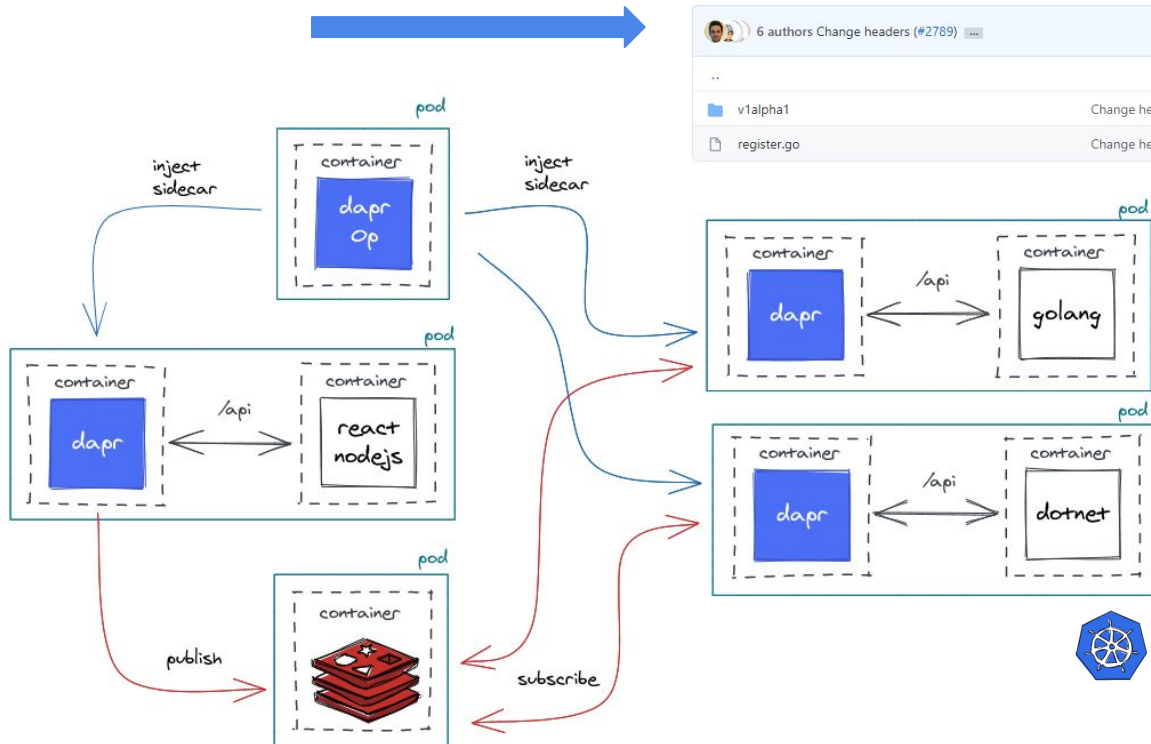
```
make dap-run
ime.grpc.internal type=log ver=1.1.2
INFO[0000] internal gRPC Server is running on port 41865 app_id=react-form instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] application protocol: http. waiting on port 8080. This will block until the app is listening on that port. app_id=react-form instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
== APP ==
== APP == > react-form@1.0.0 start /home/henrik/Development/dapr/pub-sub/react-form
== APP == > node server.js
== APP == Listening on port 8080!
INFO[0000] application discovered on port 8080 app_id=react-form instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] actor runtime started. actor idle timeout: 1h0m0s. actor scan interval: 30s app_id=react-form instance=henrik-workstation scope=dapr.runtime.actor type=log ver=1.1.2
ERROR[0000] error getting topics from app: invalid character '<' looking for beginning of value app_id=react-form instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] dapr initialized. Status: Running. Init Elapsed 212.186236ms app_id=react-form instance=henrik-workstation scope=dapr.runtime type=log ver=1.1.2
INFO[0000] placement tables updated, version: 0 app_id=react-form instance=henrik-workstation scope=dapr.runtime.actor.internal.placement type=log ver=1.1.2
[+] Updating metadata for app command: npm run start
[+] You're up and running! Both Dapr and your app logs will appear here.
== APP == Publishing: { messageType: 'ALL', message: 'hello, dapr world!' }
```

Dev example - PupSub @ k8s

```

1  apiVersion: dapr.io/v1alpha1
2  kind: Component
3  metadata:
4    name: pubsub
5  spec:
6    type: pubsub.redis
7    version: v1
8    metadata:
9      - name: redisHost
10        value: redis-master:6379
11      - name: redisPassword
12        secretKeyRef:
13          name: redis
14          key: redis-password
15  auth:
16    secretStore: kubernetes

```



release-1.2 dapr / pkg / apis / components /

This branch is 29 commits ahead, 25 commits behind master.

6 authors Change headers (#2789) ...

v1alpha1 Change headers (#2789)

register.go Change headers (#2789)


```
kubectl logs -f --selector app=dotnet-subscriber -c dotnet-subscriber

> kubectl logs -f --selector app=dotnet-subscriber -c dotnet-subscriber
info: Microsoft.Hosting.Lifetime[0]
  Now listening on: http://[::]:5000
info: Microsoft.Hosting.Lifetime[0]
  Application started. Press Ctrl+C to shut down.
info: Microsoft.Hosting.Lifetime[0]
  Hosting environment: Production
info: Microsoft.Hosting.Lifetime[0]
  Content root path: /opt/dotnet-subscriber
info: dotnet_subscriber.Controllers.PubSubController[0]
  message 'hello, dapr world!' via '/receive_all' for 'ALL'
info: dotnet_subscriber.Controllers.PubSubController[0]
  message 'hello, dapr world!' via '/receive_all' for 'ALL'
```

React App

Not secure | 192.168.49.2:31638

Apps News Blogs PALFINGER Development Read-Later E-Banking Private WhatsApp

Pub-Sub Sample

Select Message Type

ALL

Enter message

hello, dapr world!

Submit

```
kubectl logs -f --selector app=golang-subscriber -c golang-subscriber

> kubectl logs -f --selector app=golang-subscriber -c golang-subscriber
up and running @ :3000
2021/05/29 14:37:07 "GET http://127.0.0.1:3000/dapr/config HTTP/1.1" from 127.0.0.1:46106 - 404 198 in 7.15µs
2021/05/29 14:37:07 "GET http://127.0.0.1:3000/dapr/subscribe HTTP/1.1" from 127.0.0.1:46106 - 200 122B in 77.291µs
2021/05/29 14:44:15 via '/receive_all', for 'ALL' with message 'hello, dapr world!'
2021/05/29 14:44:15 "POST http://127.0.0.1:3000/receive_all HTTP/1.1" from 127.0.0.1:54246 - 200 0B in 124.671µs
2021/05/29 14:49:25 via '/receive_all', for 'ALL' with message 'hello, dapr world!'
2021/05/29 14:49:25 "POST http://127.0.0.1:3000/receive_all HTTP/1.1" from 127.0.0.1:60356 - 200 0B in 71.481µs
```

```
kubectl logs -f --selector app=react-form -c react-form

> kubectl logs -f --selector app=react-form -c react-form
> react-form@1.0.0 server
> node server.js

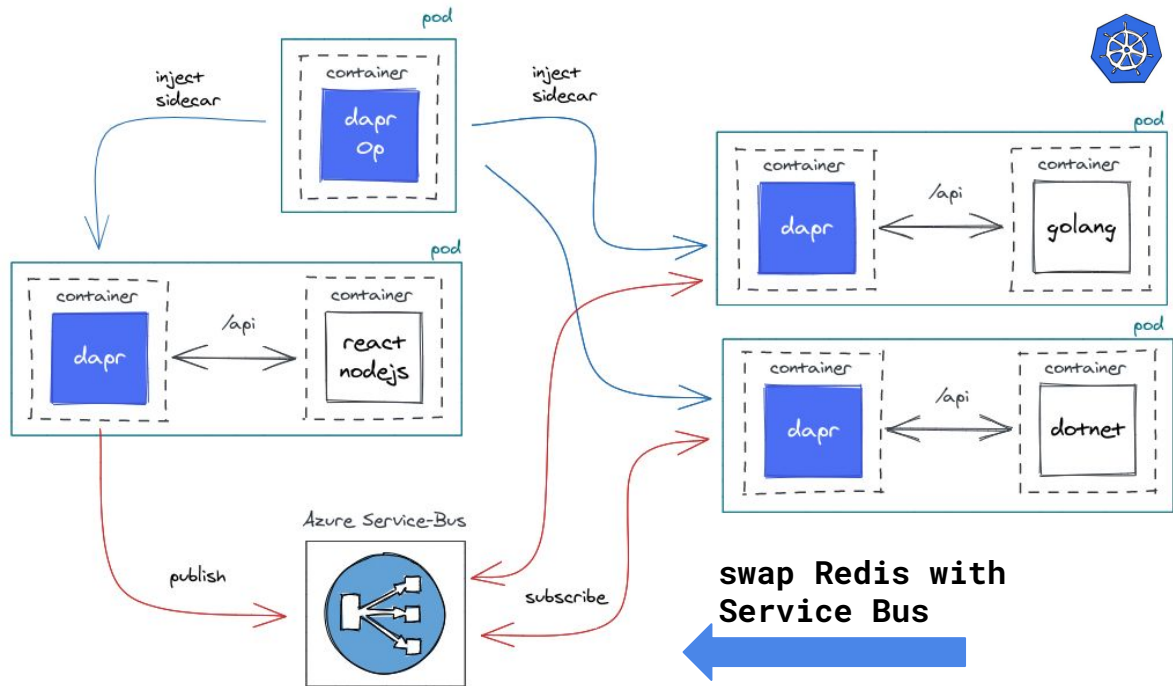
[nodemon] 2.0.7
[nodemon] to restart at any time, enter 'rs'
[nodemon] watching path(s): *.*
[nodemon] watching extensions: js,mjs,json
[nodemon] starting 'node server.js'
Listening on port 8080!
Publishing: { messageType: 'ALL', message: 'hello, dapr world!' }
Publishing: { messageType: 'ALL', message: 'hello, dapr world!' }
```

Dev example - PupSub @ k8s

```

1  apiVersion: dapr.io/v1alpha1
2  kind: Component
3  metadata:
4    name: pubsub
5  spec:
6    type: pubsub.azure.servicebus
7    version: v1
8    metadata:
9      - name: connectionString # Required
10      secretKeyRef:
11        name: az-sb
12        key: connstr
13  auth:
14    secretStore: kubernetes

```



Howto subscriptions with dapr

- **Programmatic**

- provide endpoint `/dapr/subscribe` serving application/json
- on dapr startup endpoints queried → subscription created

- **Declarative**

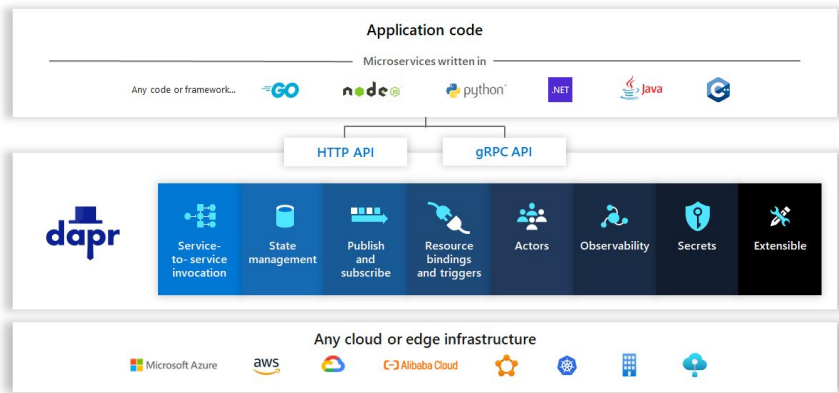
- configure subscription via **dapr CRD**
- deployed alongside components

```
1  apiVersion: dapr.io/v1alpha1
2  kind: Subscription
3  metadata:
4    name: golang-subscription-all
5  spec:
6    topic: ALL
7    route: /receive_all
8    pubsubname: pubsub
9  scopes:
10 - golang-subscriber
```

```
1  [
2    {
3      "pubsubname": "pubsub",
4      "topic": "ALL",
5      "route": "receive_all"
6    },
7    {
8      "pubsubname": "pubsub",
9      "topic": "Topic2",
10     "route": "receive_c"
11   }
12 ]
```

Summary

- ✓ **Building-Blocks** to somehow standardize/simplify cloud development
- ✓ Support for **microservice patterns**
- ✓ Can be used with **any language** and with **multiple environments**
 - ✓ Easy **HTTP/gRPC API** for invocation
 - ~ Different maturity levels of integrations (GA, Beta, Alpha, ..)
- ✓ Development **in the open** <https://github.com/dapr/dapr>
- ✓ Abstraction layer
- ~ Abstraction layer



Links

- <https://docs.dapr.io/getting-started/>
- <https://github.com/dapr/quickstarts/tree/master/pub-sub>
- <https://docs.dapr.io/developing-applications/building-blocks/pubsub/pubsub-overview/>
- <https://docs.dapr.io/reference/components-reference/supported-pubsub/setup-azure-servicebus/>
- PubSub with Azure Service Bus: <https://www.youtube.com/watch?v=umrU1frZqKk>
- <https://blog.dapr.io/posts/2021/03/02/a-visual-guide-to-dapr/>
- Example src: <https://github.com/bihe/dapr-intro>

Dapr examples / use-cases

- [How Alibaba is using Dapr | Dapr Blog](#)
- [Running Dapr in production at Roadwork | Dapr Blog](#)
- [Microsoft Customer Story-ZEISS accelerates cloud-first development on Azure and streamlines order processing](#)
- [Microsoft Customer Story-Ignition Group speeds development and payment processing using Dapr and Azure](#)