

.NET & AZURE MEETUP ŠTAJERSKA

THURSDAY, OCTOBER 16 · 18:30 – 21 CEST

TEHNOLOŠKI PARK PTUJ
Vičava 1, 2250 Ptuj

Monitor your IoT Asset with Azure Free Services

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Special thanks to



TEHNOLOŠKI PARK PTUJ

A Real Life Story...

My IoT device works, but not really that well...

If only I would have a monitoring system, I could understand when things are not working properly...

I'm low on budget, so I need to create a cheap infrastructure that «does the job», even better if I don't have to pull out any money...

IoT is not always «RealTime»

Hot Data

Data that must be immediately notified or aggregates of data

First Level of monitoring

Warm Data

Sampled data, accumulated locally and sent via file upload every minute

Second level of monitoring

Cold Data

Contextual data, MES, ERP, Registries in general

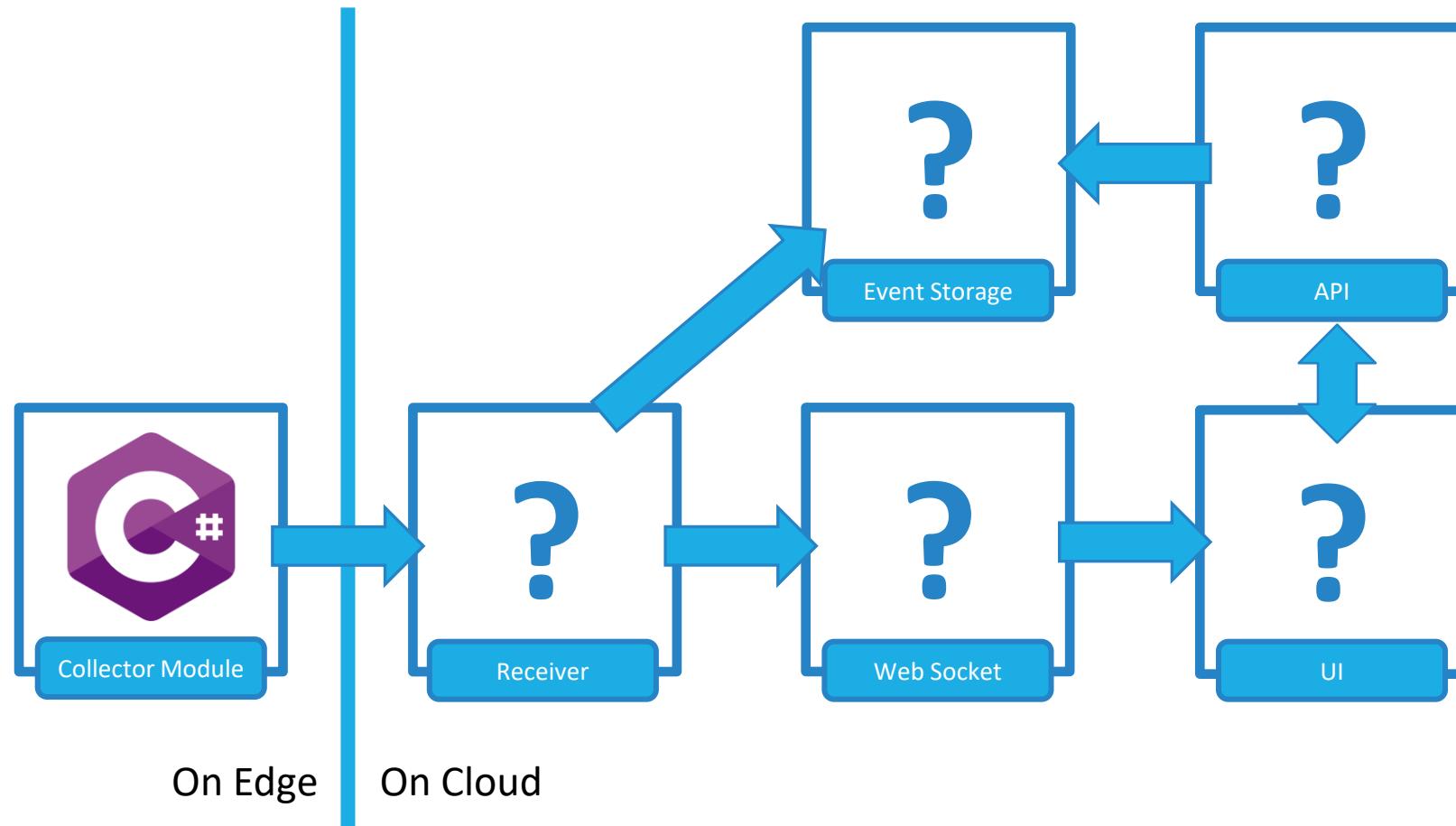
It is not monitoring

Hot Streaming

Real-time streaming of the Warm Data, enabled and disabled «on demand»

Third level of monitoring

Monitoring Platform Overview





Azure Free Services

<https://azure.microsoft.com/en-us/pricing/free-services>

Monitoring Platform – Event Storage

It must persist the events in order to query them later.

It must allow analytics in a simple way.



Cosmos DB

Managed Database either relational and NoSQL

Globally distributed, highly responsive and always online

You can use the API you prefer

NoSQL

MongoDB

Apache
Cassandra

Apache
Gremlin

Table

PostgreSQL

Free Tier: Max throughput 1000 RU/s + 25 GB storage, available to “provisioned throughput accounts” (must opt-in when creating the account)

Azure SQL

Fully managed relational database

Built over the same engine of SQL Server

Free Tier available with 100,000 seconds * vCore and 32GB of storage limit per month **forever**

- You can choose to auto-pause it when the limits are reached
- Or else you can continue to use it and pay only for the extra usage

Azu

Fully ma

Built over

Free Tier

- You can
- Or else



Cost summary

General Purpose (GP_Gen5_2)

Cost per vCore (in EUR)¹ 114.41

vCores selected x 2

Cost per GB (in EUR) 0.13

Max storage selected (in GB) x 41.6

ESTIMATED COST / MONTH 234.16 EUR

NOTES

1 The dev/test discount has been automatically applied for your selected subscription. [Learn more](#)

* vCore and storage limits are reached only for the estimated cost.



Cost summary

General Purpose (GP_S_Gen5_2)

Cost per GB (in EUR) 0.00

Max storage selected (in GB) x 41.6

First 32 GB storage free

First 100,000 vCore seconds free

Overage billing¹ Disabled

ESTIMATED STORAGE COST / MONTH 0.00 EUR

COMPUTE COST / VCORE SECOND² 0.000000 EUR

1 There will be no charges for usage within the free limits. The database will be paused automatically when the free limits are reached.

2 Serverless databases are billed in vCore seconds based on a combination of CPU and memory utilization. [Learn more about serverless billing](#)

Monitoring Platform – Event Storage

Cosmos or SQL ?



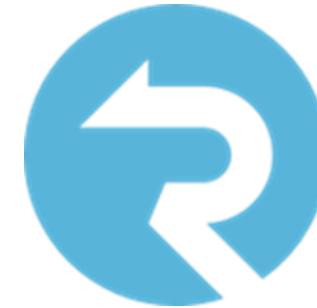
Monitoring Platform – Event Storage

Cosmos or SQL ?



Monitoring Platform – Web Socket

Must notify the events to the frontend to ensure a quick human intervention



Azure SignalR & Web PubSub

Thought for applications that require real-time data

High frequency updates

Live dashboards e monitoring

Cross-platform live chat

Real-time location on map

Real-time targeted ads

Collaborative apps

Push notifications

Real-time broadcasting

IoT

Automation

Azure SignalR vs Web PubSub



When you are already using SignalR

There is an available SignalR client in your language

- MS officially supported Clients:



WebSockets are good enough for your use case

You need to transport another custom protocol over WebSocket

- MQTT over WebSocket
- AMQP over WebSocket

A «lite» infrastructure is enough for your application

You really need multiple transport protocols

- WebSocket
- Server sent events
- Long polling

Inside Azure Web PubSub

The diagram illustrates the internal structure of Azure Web PubSub. It shows two separate groups of users, each represented by a blue rounded rectangle containing three user icons. Below each group is a blue rectangular box labeled "Group". The entire structure is contained within a larger blue rectangular area.

The screenshot of the "Client URL Generator" interface includes the following fields:

- Hub ***: A text input field containing "Hub".
- User ID**: A text input field containing "User ID".
- Token Lifetime (Minutes) ***: A text input field containing "60".
- Select Sign Key**: A button group with "Primary" selected and "Secondary" as an option.
- Roles**:
 - Send To Groups
 - Allow Sending To All Groups
 - Allow Sending To Specific Groups
 - Join/Leave Groups
 - Allow Joining/Leaving All Groups
 - Allow Joining/Leaving Specific Groups
- Client Access URL**: A text input field containing the URL "wss://xmasdev-events.webpubsub.azure.com/client/hubs/Hub?access_token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJhdWQiOiJ3c3M6Ly94bWFzZGV2LWV2ZW50cy53ZWJwdWJzdWIu...".

Sending Data with Azure Web PubSub

ServiceClient C#
Azure.Messaging.WebPubSub

AzFunction Bindings
Microsoft.Azure.WebJobs.Extensions.WebPubSub

```
[FunctionName(nameof(EventNotifier))]
public static async Task NotifyEventAsync(
    [ServiceBusTrigger("%TopicName%", "%SubscriptionName%", Connection = "ServiceBusConnectionString")] string rawpayload
    , [WebPubSub(Hub = "alarms", Connection = "WebPubSubConnectionString")] IAsyncCollector<WebPubSubAction> alarms
    , ILogger log
)
{
    var payload = Payloads.DeserializePayload(rawpayload);

    if (payload is null)
        return;

    if (payload is AlarmPayload)
    {
        await alarms.AddAsync(WebPubSubAction.CreateSendToAllAction(rawpayload));
        await alarms.FlushAsync();
    }
}
```

Azure SignalR & Web PubSub Pricing

Pricing tier	<input checked="" type="radio"/> Free For individual dev/test	<input type="radio"/> Standard For production workloads	<input type="radio"/> Premium(Preview) For production workloads with more supported features
Features			
 Connections	Up to 20 connections	1,000 connections/unit	1,000 connections/unit
 Included Messages	20,000/Day	1,000,000/Unit/Day	1,000,000/Unit/Day
 Additional Messages	-	Unlimited	Unlimited
 SLA	-	99.9%	99.95%
 SSL	✓	✓	✓
 Autoscale <small> ⓘ</small>	-	-	✓
 Availability Zone <small> ⓘ</small>	-	-	✓ <small>(In supported regions) ↗</small>
 Custom Domains	-	-	✓
Pricing			
Estimated Price	-	41.41 EUR/Month/Unit	51.44 EUR/Month/Unit
Additional Message Costs <small> ⓘ</small>	-	0.84 EUR per million messages	0.84 EUR per million messages

Monitoring Platform – Web Socket

Web Pub Sub o SignalR?



Monitoring Platform – Web Socket

Web Pub Sub o SignalR?



Monitoring Platform - Receiver

Must receive “occasional” events from the IoT device

Must store these events in the Event Storage

Must notify via WebSocket each event

```
[FunctionName("ReceiverFunction")]
public static async Task<IActionResult> Run(
    [HttpTrigger(AuthorizationLevel.Function, "post", Route = null)] HttpRequest req,
    [WebPubSub(Hub = "CookieFactoryEvents", Connection = "WebPubSubConnectionString")] IAsyncCollector<WebPubSubAction> pubsub,
    [Sql("CookieFactoryEvents", "SqlConnectionString")] IAsyncCollector<CookieFactoryEvent> database,
    ILogger log)
{
    string requestBody = await new StreamReader(req.Body).ReadToEndAsync();
    var cloudEvent = JsonSerializer.Deserialize<CloudEvent>(requestBody);
    await pubsub.AddAsync(WebPubSubAction.CreateSendToAllAction(requestBody));
    await pubsub.FlushAsync();

    var cookieFactoryEvent = cloudEvent.Data.Deserialize<CookieFactoryEvent>();
    await database.AddAsync(cookieFactoryEvent);
    await database.FlushAsync();

    return new OkResult();
}
```

Azure Functions Free grant

Only in **Consumption Plan** on **Pay As You Go** subscriptions

Up to 400.000 GBs and 1 million invocations

Or I can host them in a free AppServicePlan

Despite the free grant, Azure Functions always require a **Storage Account** in order to work properly (it is cheap, but is not given for free)

Monitoring Platform - Receiver

Azure Functions o Azure Functions ?



Monitoring Platform - Receiver

Azure Functions o Azure Functions ?

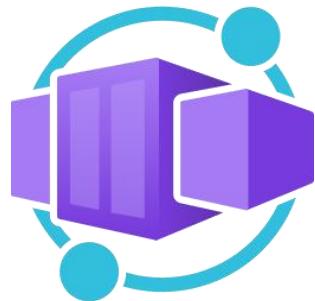


Monitoring Platform - API

Must read the events from the Event Storage

Must perform small aggregates

Must expose the contents via REST to make them available for the UI



Azure App Service Web Apps

Managed services to host web apps and REST APIs

Wide choice of supported programming languages

Supports Docker containers

Managed updates and security patches

Authentication support without modifying application code

Built-in CORS management

Azure App Service Plan Free Tier

I can have only a single App Service Plan Free instance per subscription

Name	ACU/vCPU	vCPU	Memory (GB)	Remote Storage (GB)	Scale (instance)	Cost per hour (instance)	Cost per month (instance)
▼ Dev/Test (For less demanding workloads)							
Free F1	60 minutes/day...	N/A	1	1	N/A	Free	Free
Basic B1	100	1	1.75	10	3	0.017 EUR	12.30 EUR
Basic B2	100	2	3.5	10	3	0.034 EUR	24.60 EUR
Basic B3	100	4	7	10	3	0.066 EUR	48.516 EUR
▼ Production (For most production workloads)							
Premium v3 P0V3	195*	1	4	250	30	0.079 EUR	57.809 EUR
Premium v3 P1V3	195	2	8	250	30	0.127 EUR	92.932 EUR
Premium v3 P2V3	195	4	16	250	30	0.255 EUR	185.864 EUR
Premium v3 P3V3	195	8	32	250	30	0.509 EUR	371.728 EUR
Standard S1	100	1	1.75	50	10	0.089 EUR	64.915 EUR

Azure Container Apps

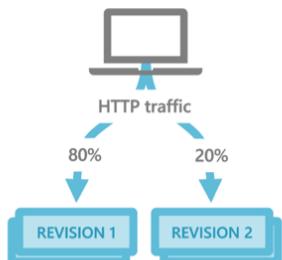
Serverless platform for the execution of containerized applications

Basically, Kubernetes pods as PaaS: you pay for what you use.



Azure Container Apps: Example scenarios

PUBLIC API ENDPOINTS



HTTP requests are split between two versions of the container app where the first revision gets 80% of the traffic, while a new revision receives the remaining 20%.

AUTO-SCALE CRITERIA

Scaling is determined by the number of concurrent HTTP requests.

BACKGROUND PROCESSING



A background job that transforms data in a database.

AUTO-SCALE CRITERIA

Triggered by a schedule, on demand, or based on events.

EVENT-DRIVEN PROCESSING

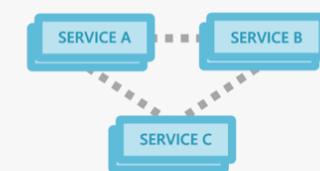


A queue reader application that processes messages as they arrive in a queue.

AUTO-SCALE CRITERIA

Scaling is determined by the number of messages in the queue.

MICROSERVICES



Deploy and manage a microservices architecture with the option to integrate with Dapr.

AUTO-SCALE CRITERIA

Individual microservices can scale according to any KEDA scale triggers.

Azure Container Apps Free Grant

Each month you get for free:

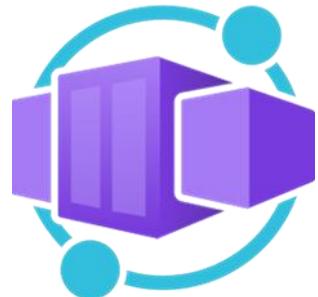
- Up to 180,000 vCPU-seconds
- 360,000 GiB-seconds
- 2 million requests

Other tricks to ~~not to pay them~~ pay them less

- Scale the replicas down to 0
- When there are no incoming HTTP requests and the replica count is at its minimum, you are going to pay a reduced price

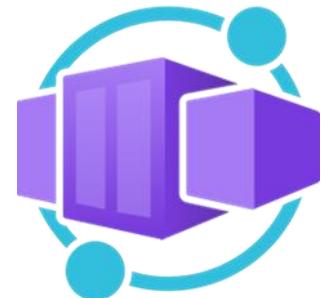
Monitoring Platform - API

Container Apps o Web Apps?



Monitoring Platform - API

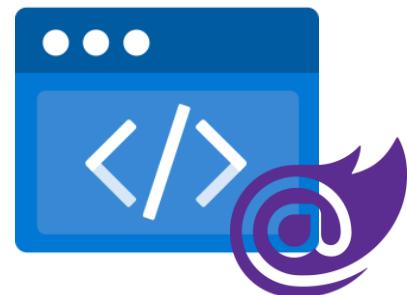
Container Apps o Web Apps?



Monitoring Platform - UI

App for exploring the historical data and for receiving the IoT notifications

It doesn't really need a full backend, as it can consume the APIs we just implemented.



Azure Static WebApp

Service that allows the hosting of static web applications.

Static content publishing with HTML, CSS, and JavaScript

API support

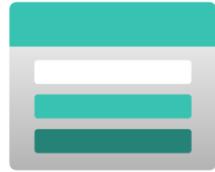
CI/CD with GitHub and Azure DevOps

Globally distributed static content

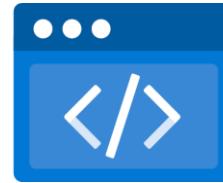
Free SSL certificate

Staging environment management

Azure Blob Static Website vs Azure Static WebApp

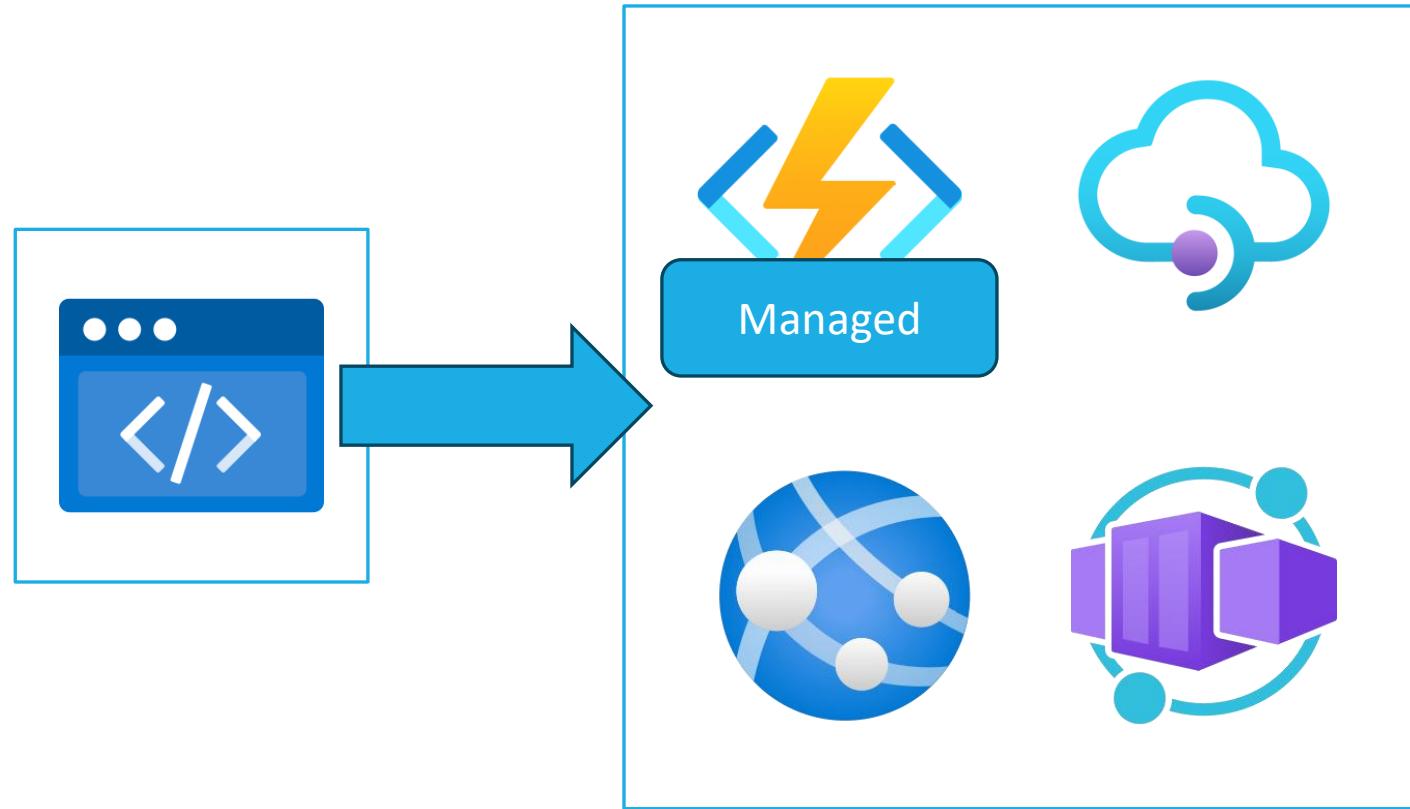


- ✓ SSL
- 😞 CI/CD do it yourself
- ✗ No Multiregion
- ✓ Custom Domain
- ✗ No HTTPS with Custom Domains

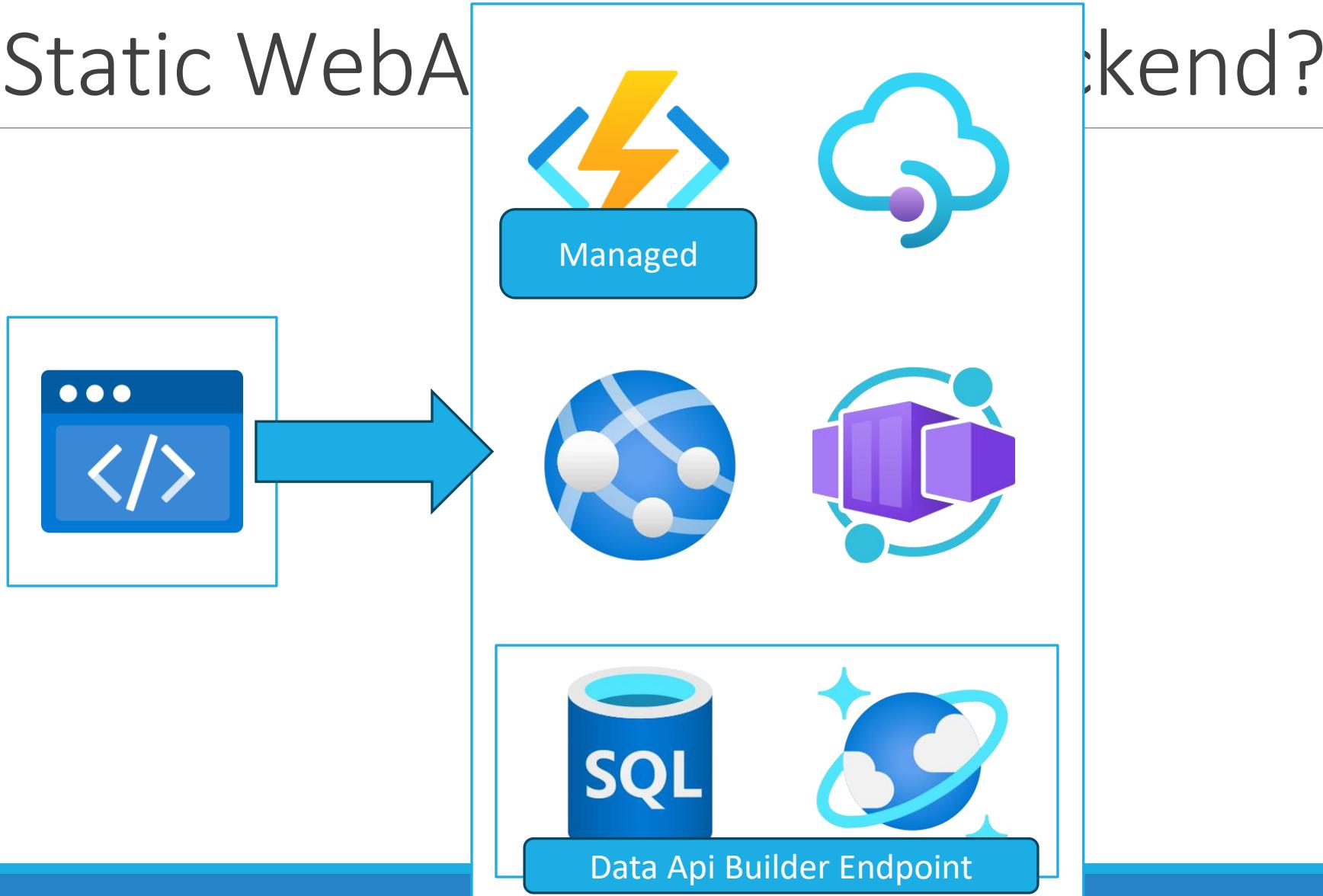


- ✓ SSL
- ✓ CI/CD integrate
- ✓ Globally distributed
- ✓ Custom Domain
- ✓ HTTPS with Custom Domain

Azure Static WebApp... But the backend?

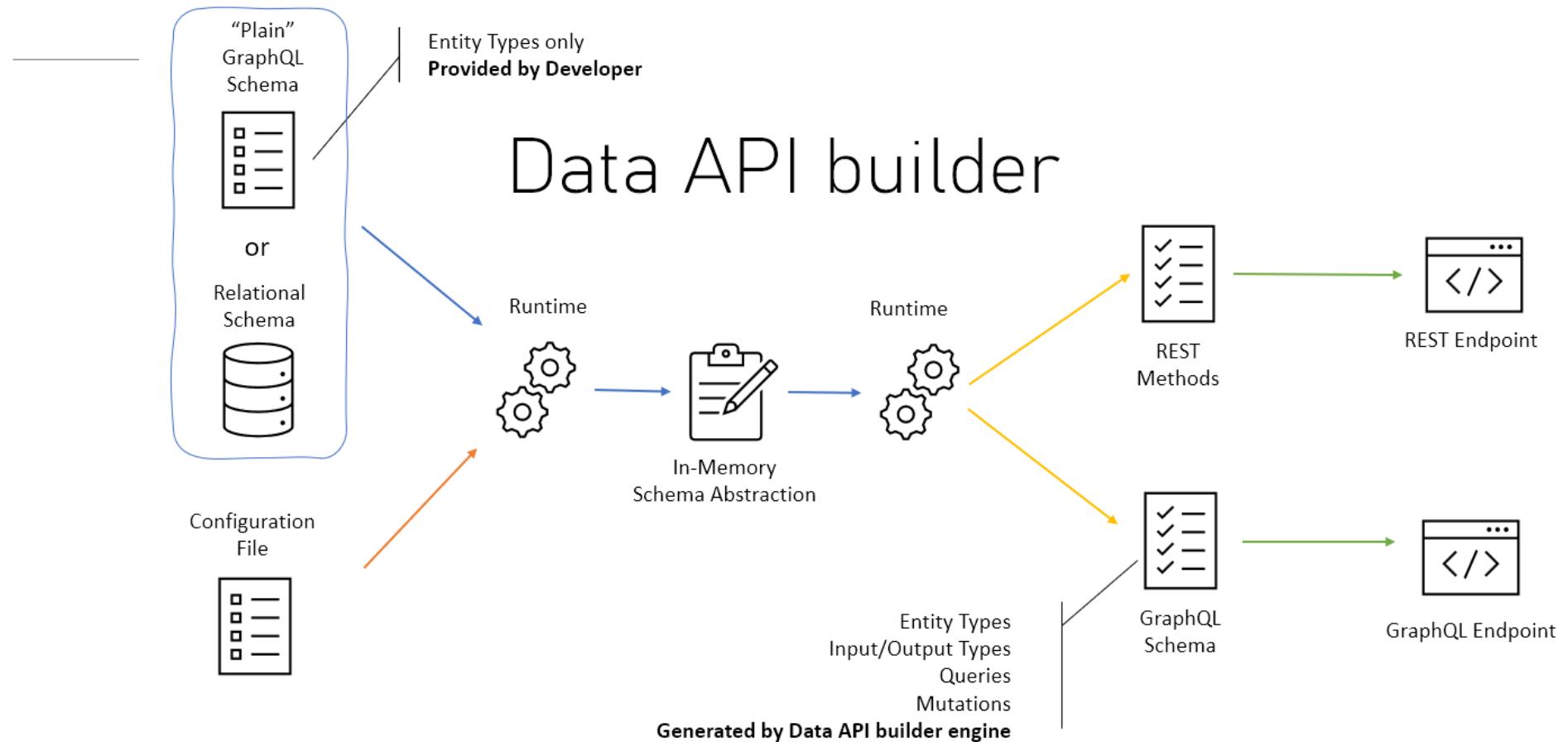


Azure Static WebA



kend?

Data API Builder?



To use DAB locally

`dotnet tool install Microsoft.DataApiBuilder`

Azure Static WebApp Pricing

Plan/Features	Free For hobby or personal projects	Standard For general purpose production apps
Price	Free	8.42 EUR per app per month
Included bandwidth	100 GB per subscription	100 GB per subscription
Bandwidth overage	Free	0.19 EUR per GB per subscription
Custom domains	2 per app	5 per app
SSL certificates	Free	Free
Custom authentication	-	✓
Private endpoints	-	✓
Max app size	250 MB	500 MB
Staging environments	3	10
Azure functions	Managed	Managed or Bring your own
Enterprise-grade edge	-	16.40 EUR per app per month

Required Tools to work with this technology

Static Web App Command line tool (swa)

```
npm install -g @azure/static-web-apps-cli
```

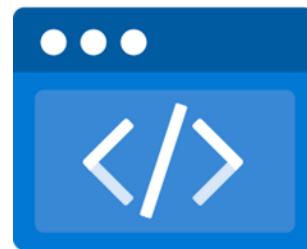
Wasm tools to output Blazor wasm

```
dotnet workload install -g wasm-tools-net6
```

<https://azure.github.io/static-web-apps-cli/docs/use/install/>

Monitoring Platform - UI

Static Web Apps or Static Web Apps

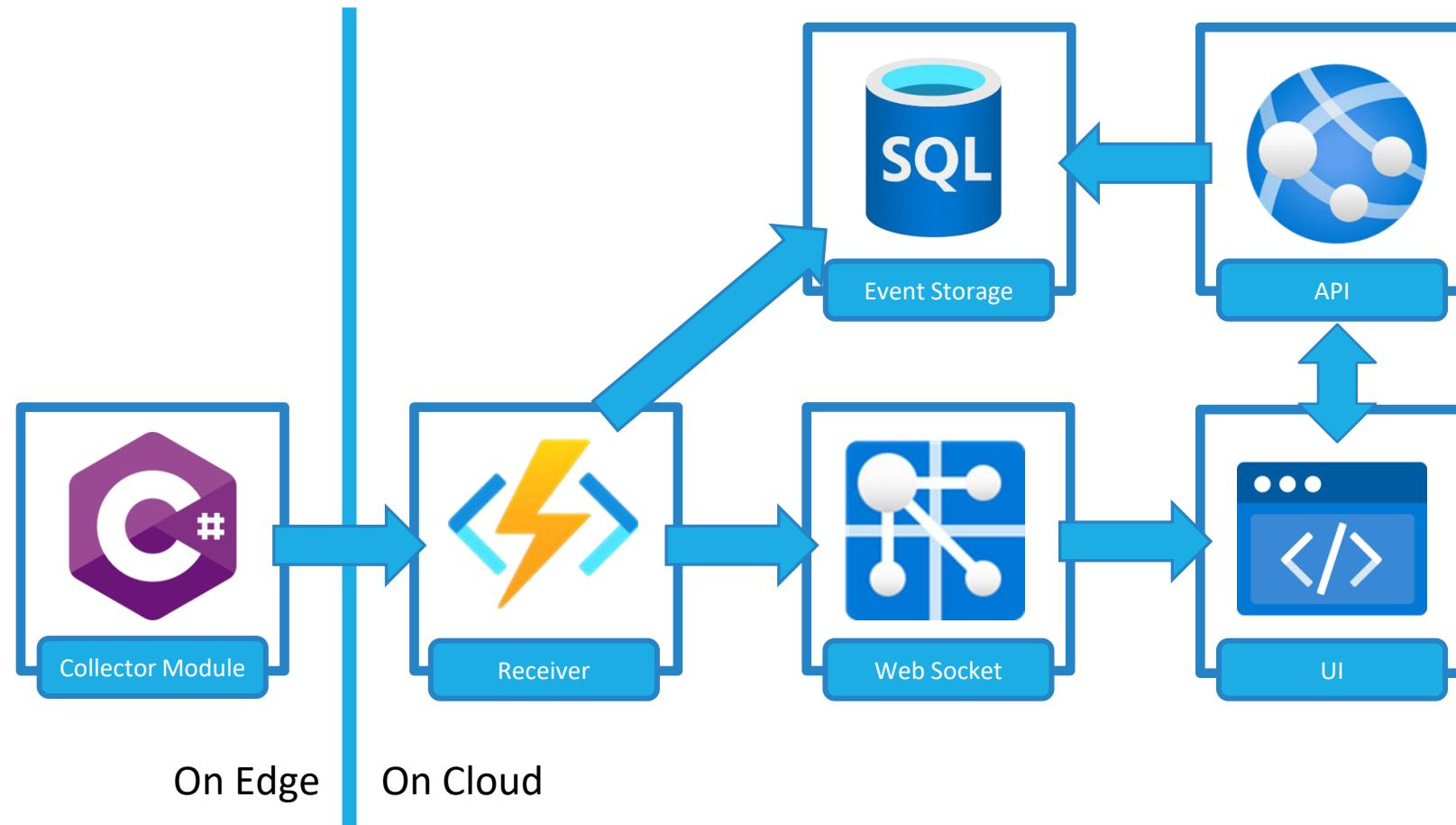


Monitoring Platform - UI

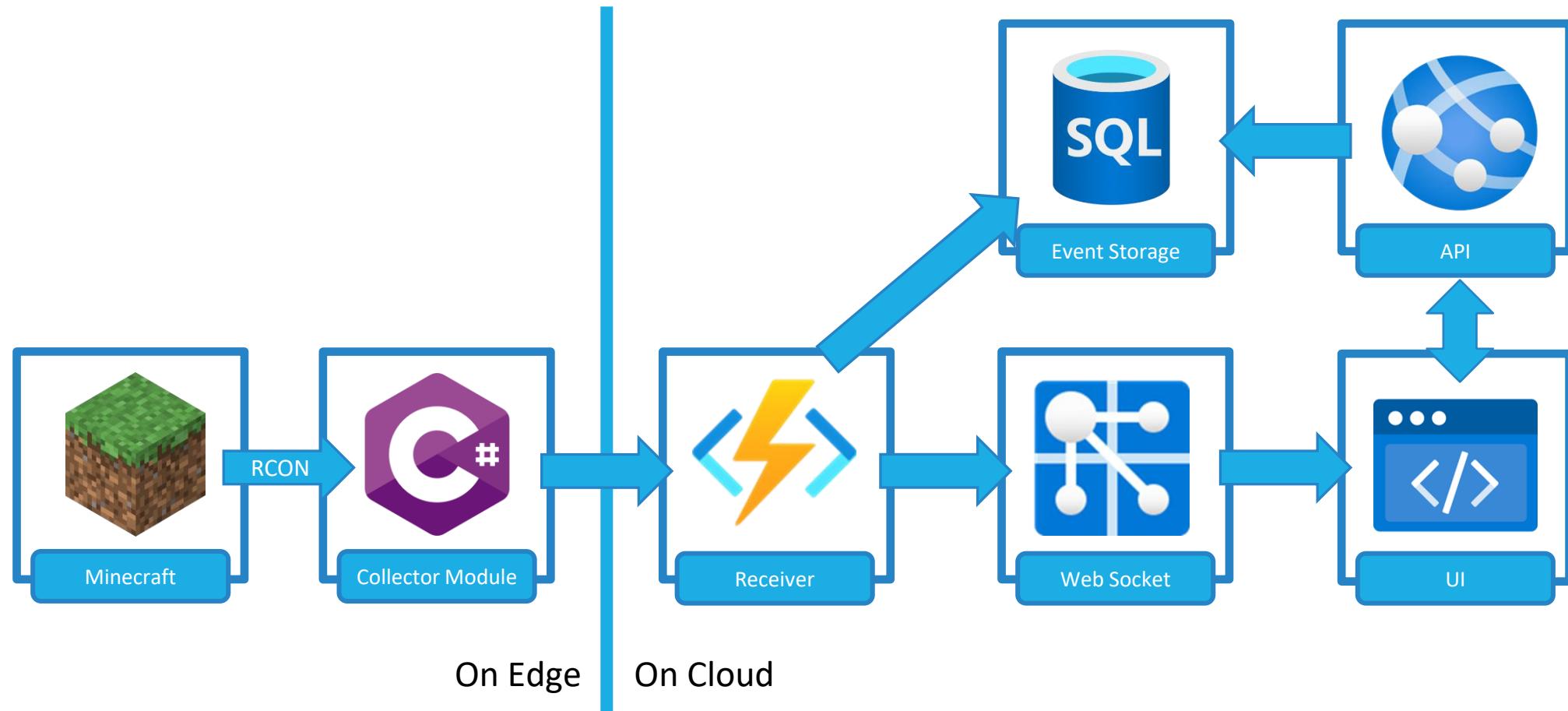
Static Web Apps or Static Web Apps



Monitoring Platform Overview



Monitoring Platform Overview



Demo

Let's get in touch!



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WE LIKE CI/CD

Continuous Improvement – Continuous Discussions

Share your feedback, opinions, suggestions with us!

WE ARE ON DISCORD!



<https://discord.gg/K6F7pdP4xq>

A close-up photograph of a cold, frothy mug of beer. The glass is covered in condensation droplets, and a thick, white head of foam sits atop the golden-brown beer. The mug has a handle on the right side. The background is blurred, showing warm, bokeh-style lights.

GREMO NA PIVO?

Hvala!