.NET & AZURE MEETUP ŠTAJERSKA

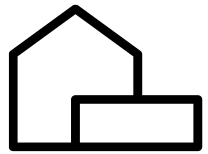
THURSDAY, OCTOBER 16 · 18:30 – 21 CEST

TEHNOLOŠKI PARK PTUJ
Vičava 1, 2250 Ptuj

Monitor your IoT Asset with Azure Free Services

NICOLA PARO

Special thanks to



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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

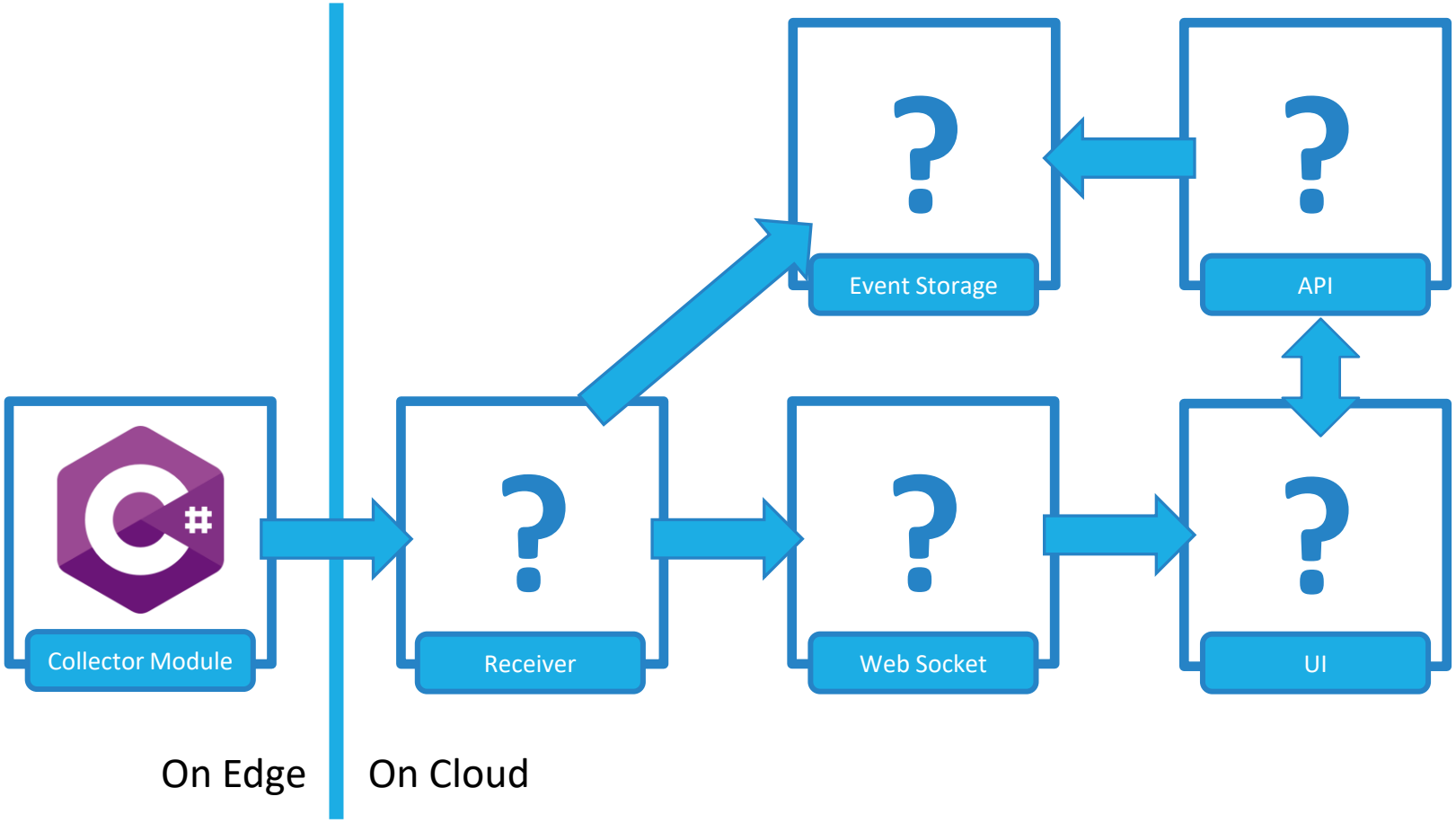
It is not monitoring

Hot Streaming

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

Third level of monitoring

Monitoring Platform Overview



Azure Free Services

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 relationation and NoSQL

Globally distributed, highly responsive and always online

You can use the API you prefer

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

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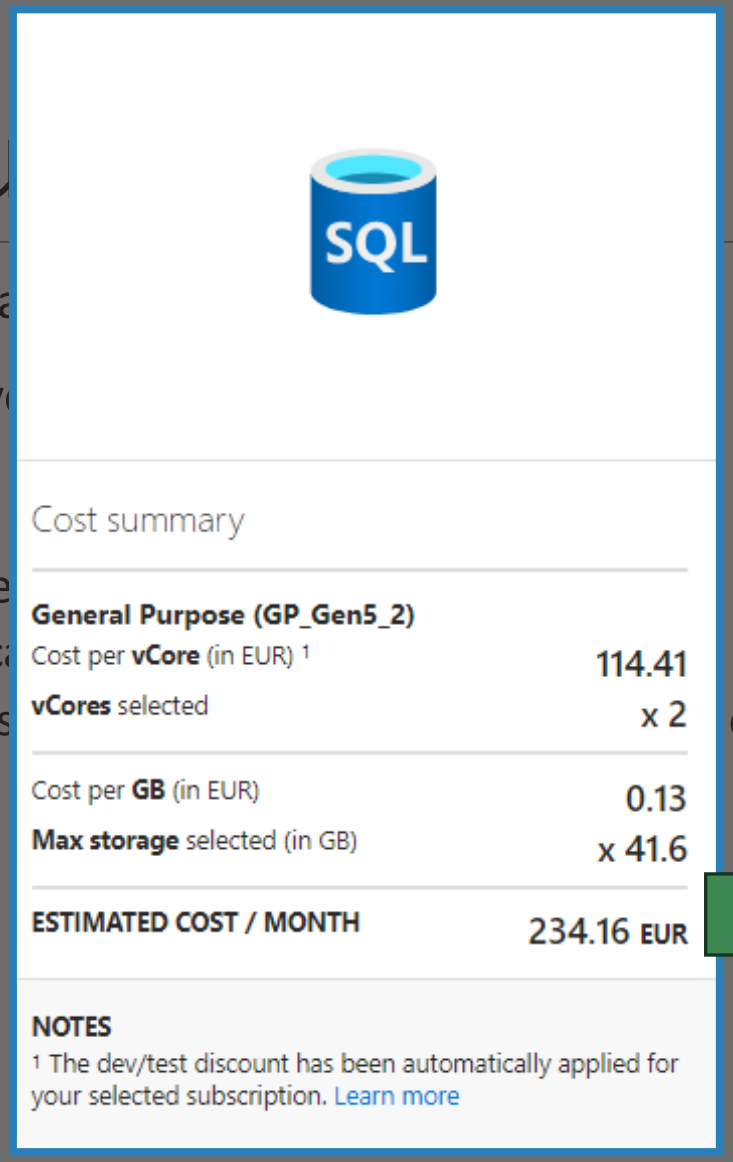
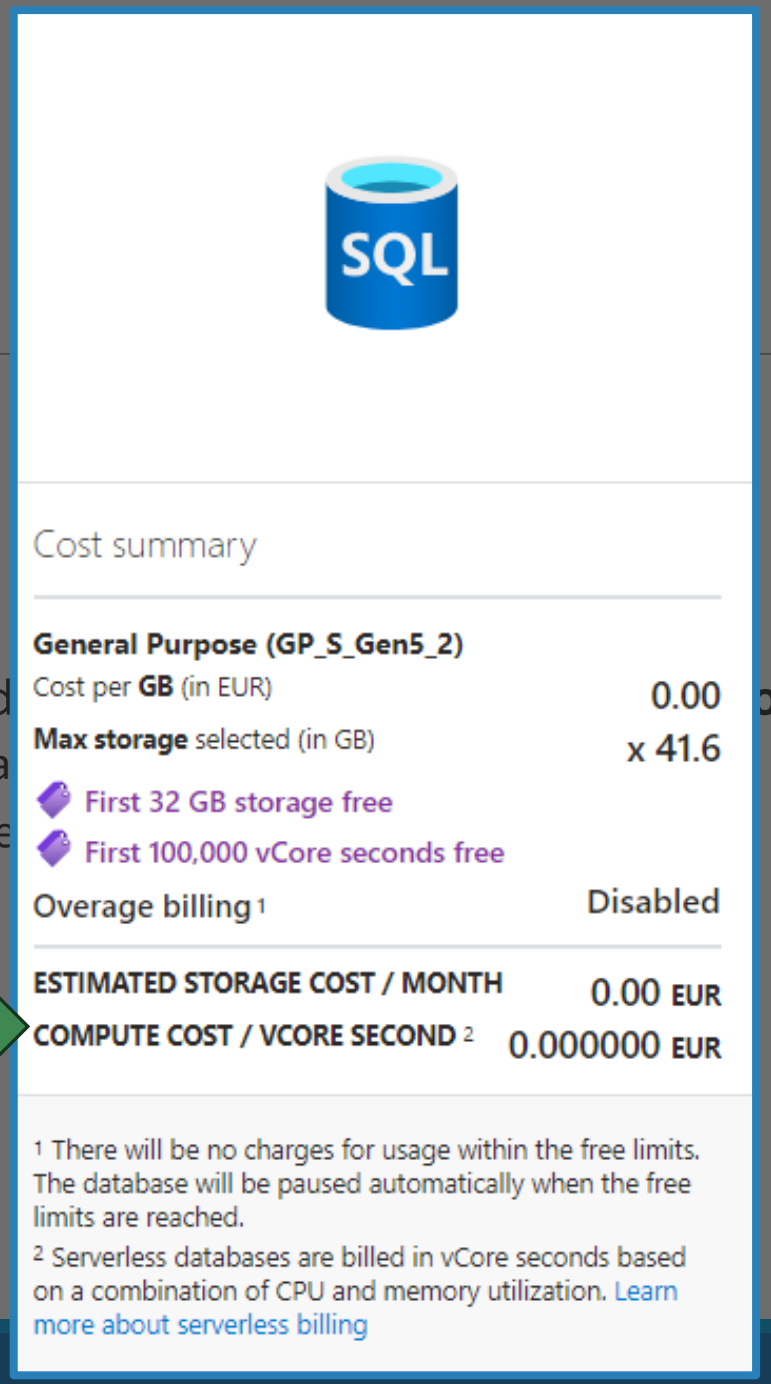
Free Tie * vCore and **orever**

- You c limits are rea
- Or els only for the e





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:

You really need multiple transport protocols

- WebSocket
- Server sent events
- Long polling

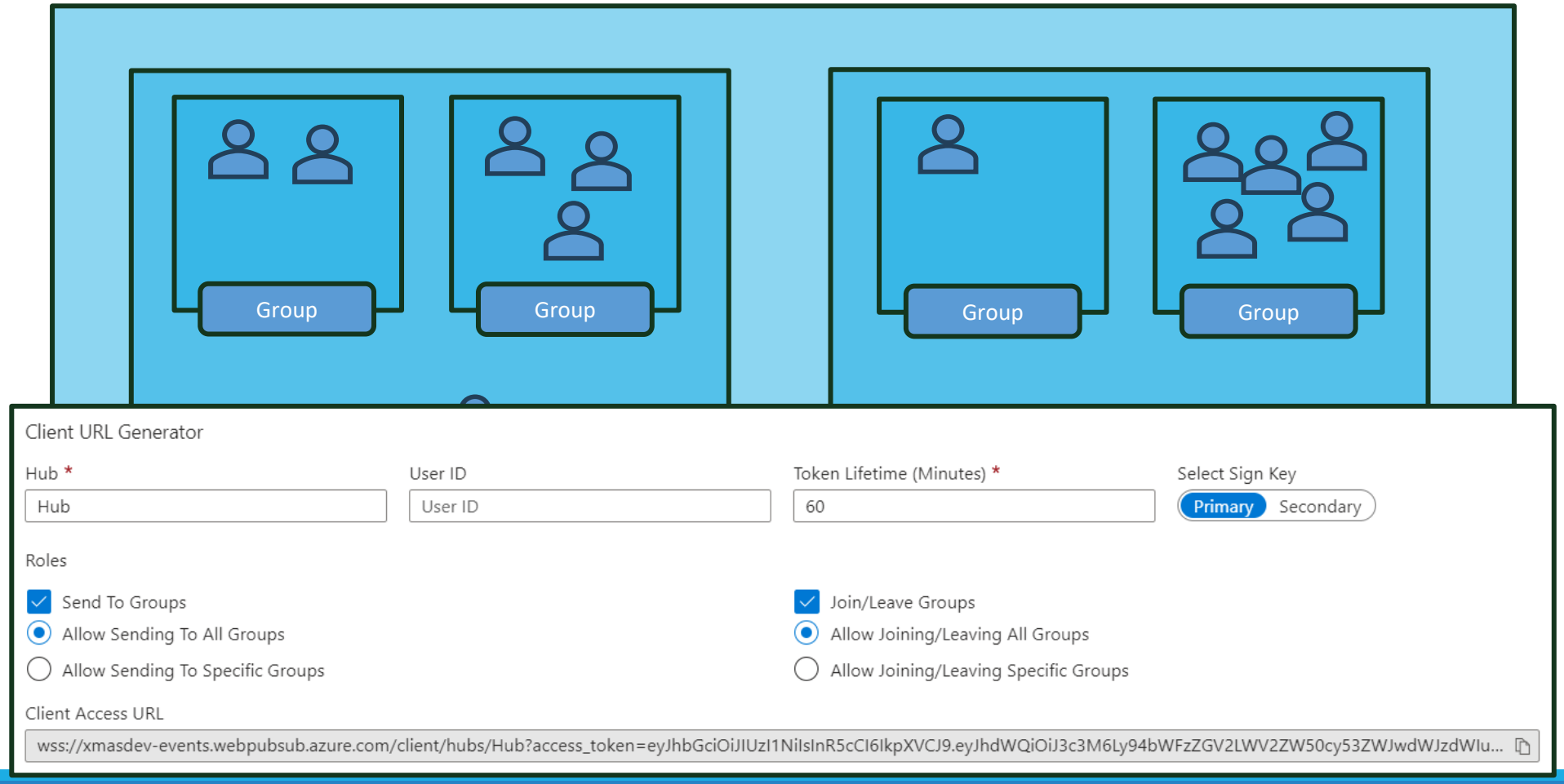
WebSockets are good enough for your use case

You need to transport another custom protocol over WebSocket

- MQTT over WebSocket
- AMQP over WebSocket

A «lite» infrastructure is enough for your application

Inside Azure Web PubSub



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	Free For individual dev/test	Standard For production workloads	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 ⓘ	-	-	✓
Availability Zone ⓘ	-	-	✓ (In supported regions)
Custom Domains	-	-	✓
Pricing			
Estimated Price	-	41.41 EUR/Month/Unit	51.44 EUR/Month/Unit
Additional Message Costs ⓘ	-	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

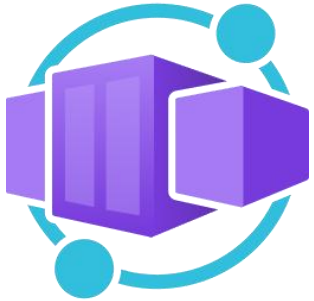
Azure Functions o Azure Functions ?

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

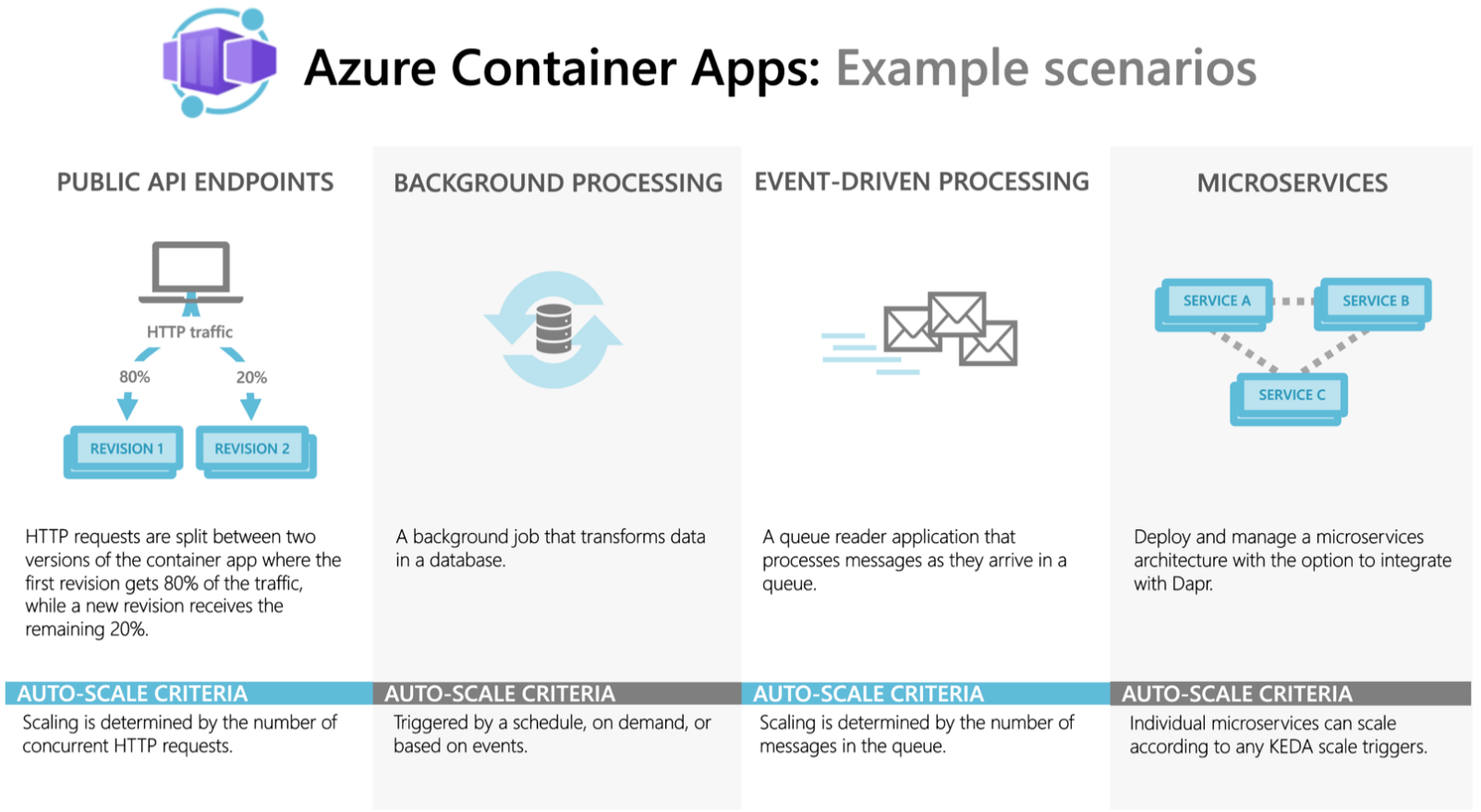
I can have only a single App Service Plan Free instance per subscription

	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 Free Grant

Each month you get for free:

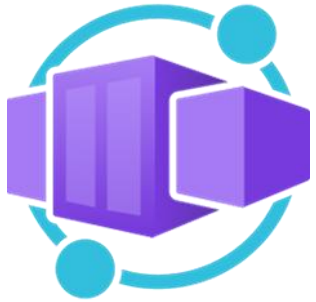
- Up to 180,000 vCPU-seconds
- 360,000 GiB-seconds
- 2 million requests

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

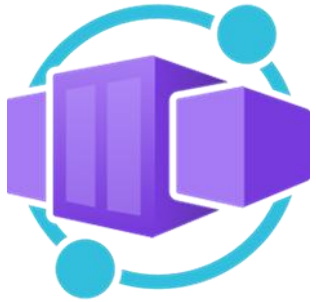
Monitoring Platform - API

Container Apps o Web Apps?



Monitoring Platform - API

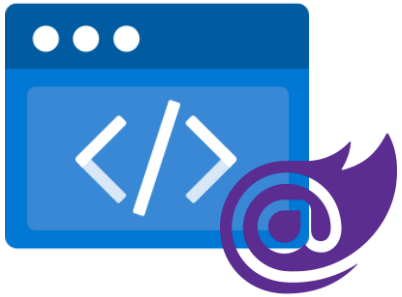
Container Apps o Web Apps?



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.



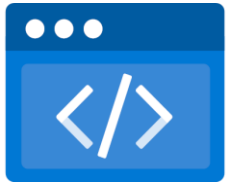
Azure Static WebApp

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

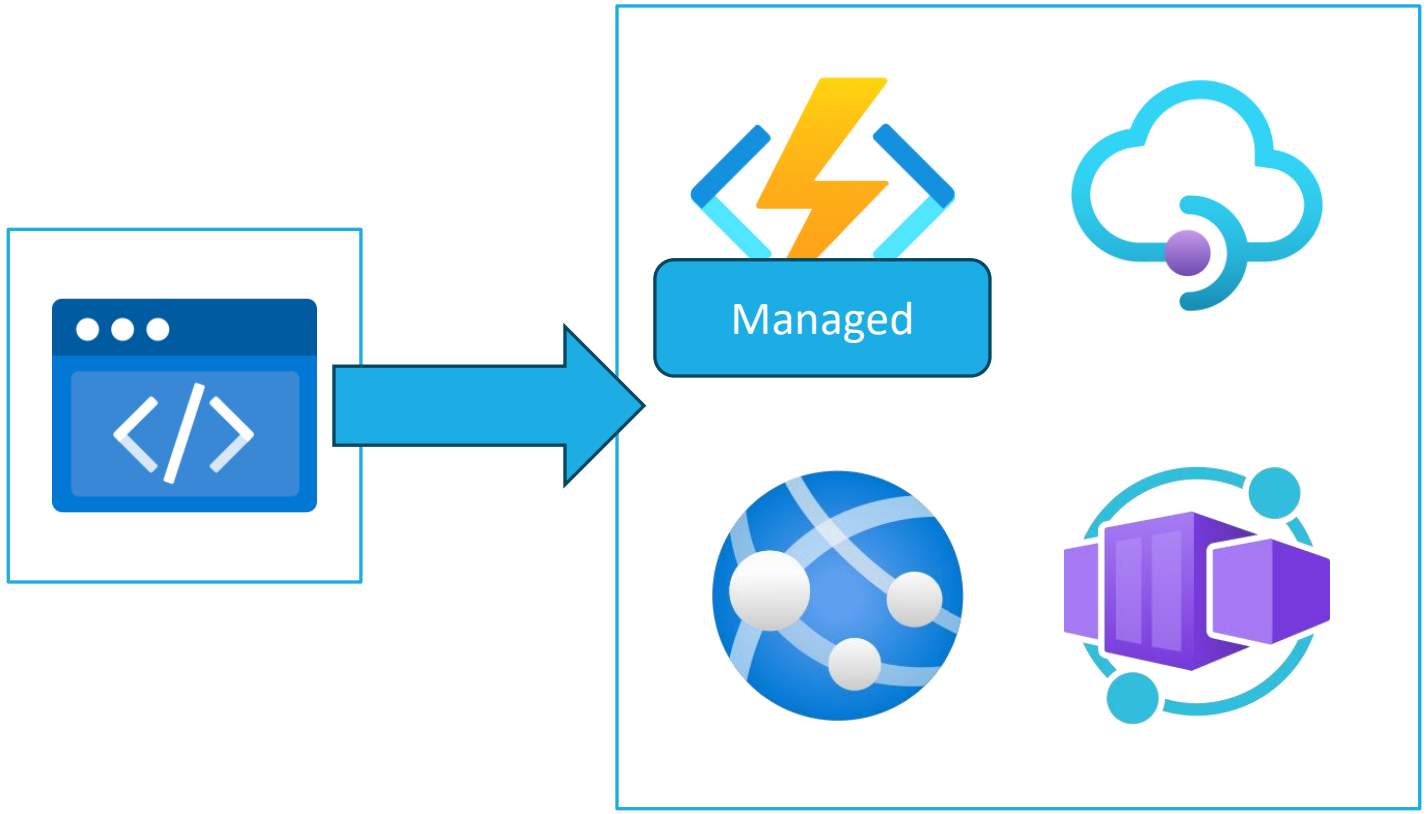
Azure Blob Static Website vs Azure Static WebApp

- ✔️ SSL
- 😟 CI/CD do it yourself
- ❌ No Multiregion
- ✔️ Custom Domain
- ❌ No HTTPS with Custom Domains

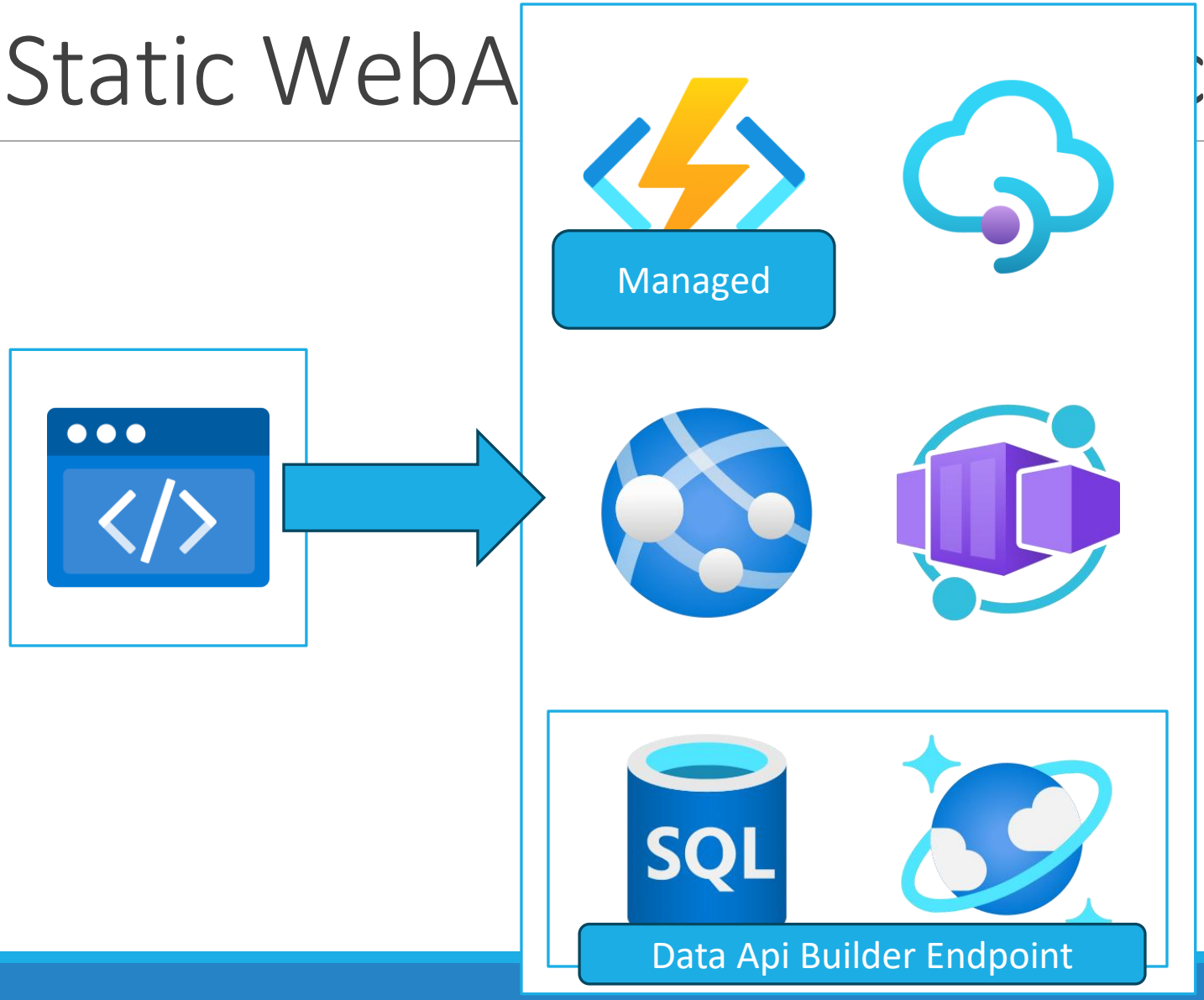


- ✔️ SSL
- ✔️ CI/CD integrate
- ✔️ Globally distributed
- ✔️ Custom Domain
- ✔️ HTTPS with Custom Domain

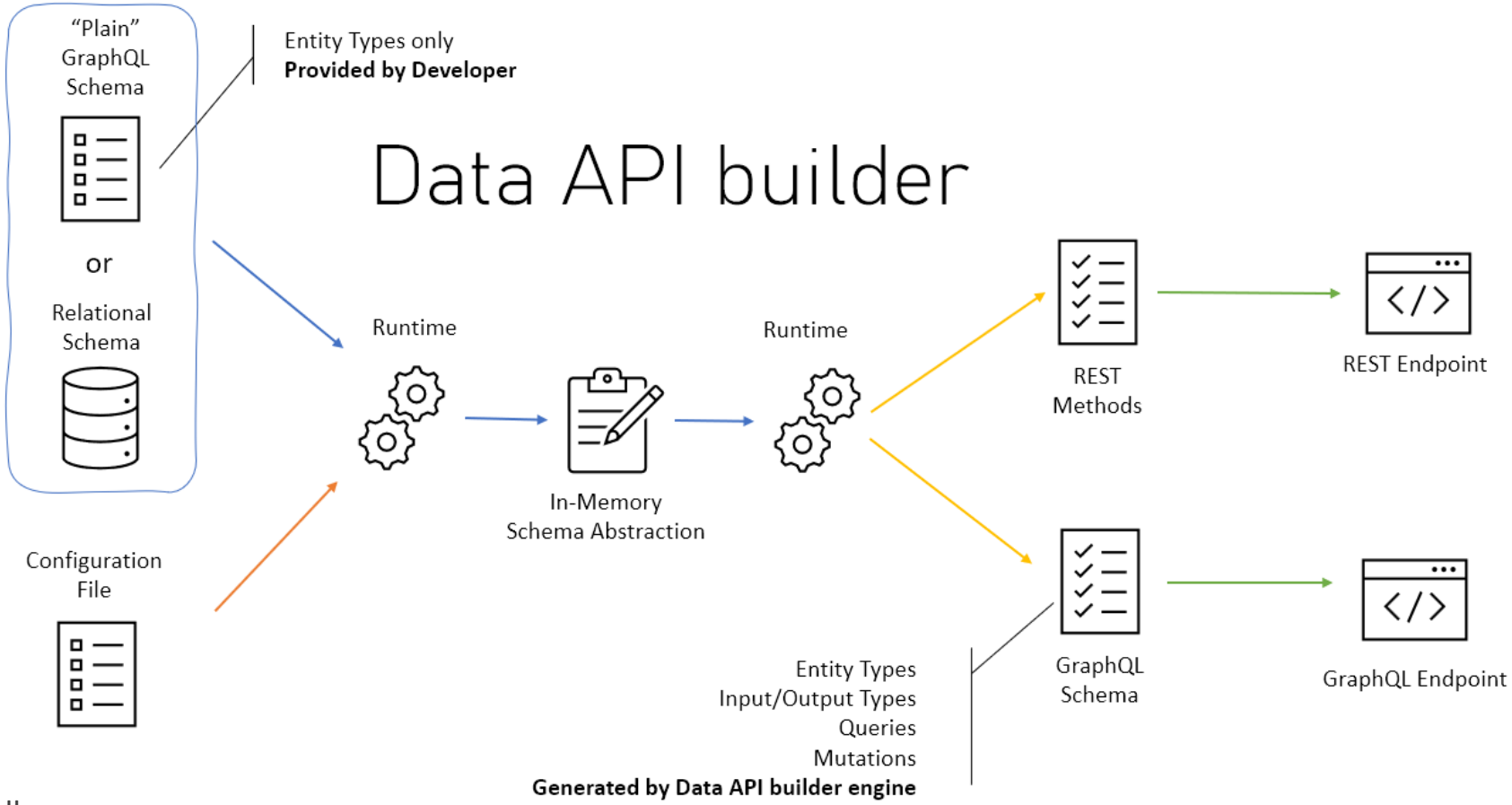
Azure Static WebApp… But the backend?



Azure Static WebA ckend?



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/

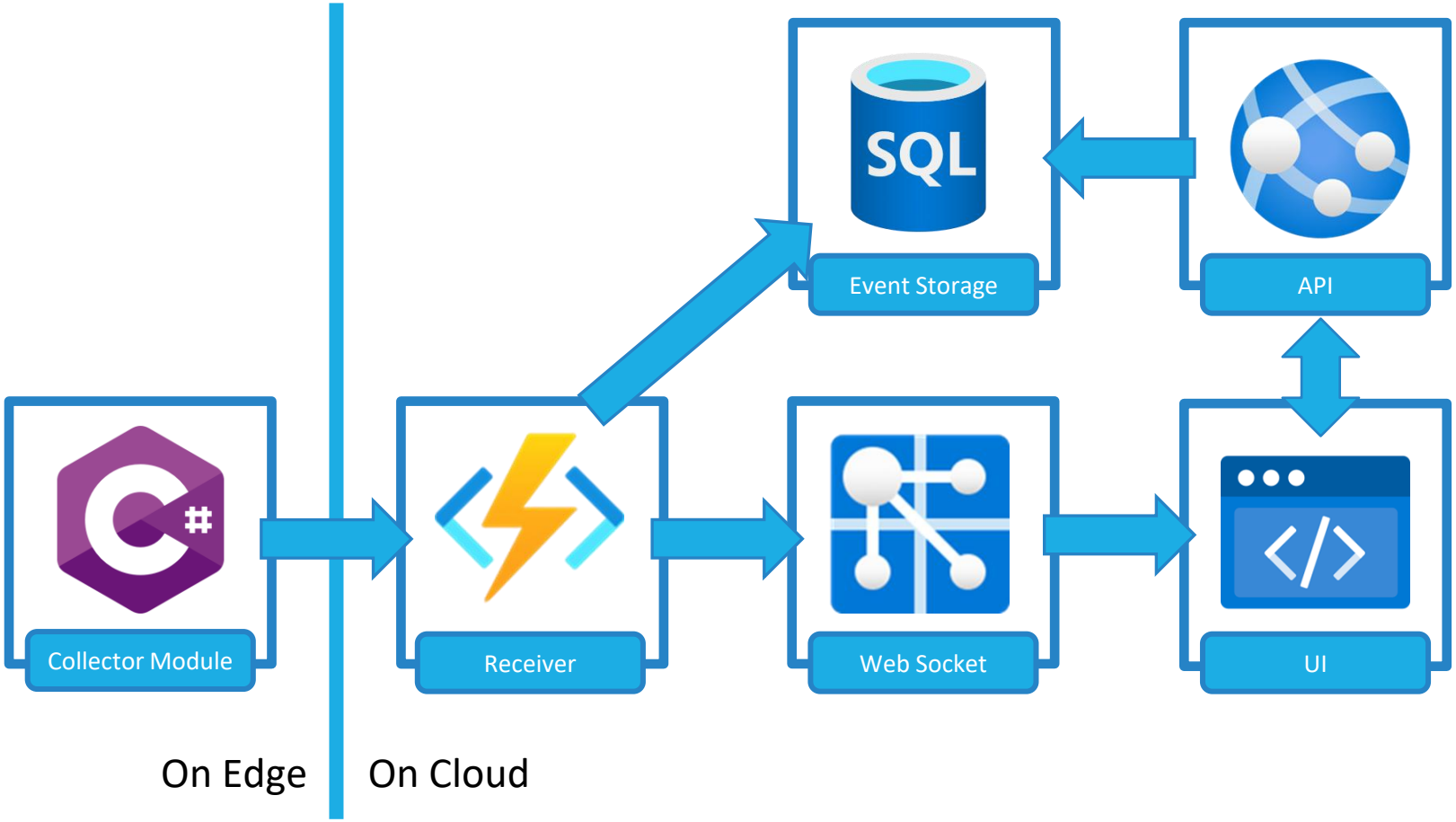
Monitoring Platform - UI

Static Web Apps or Static Web Apps

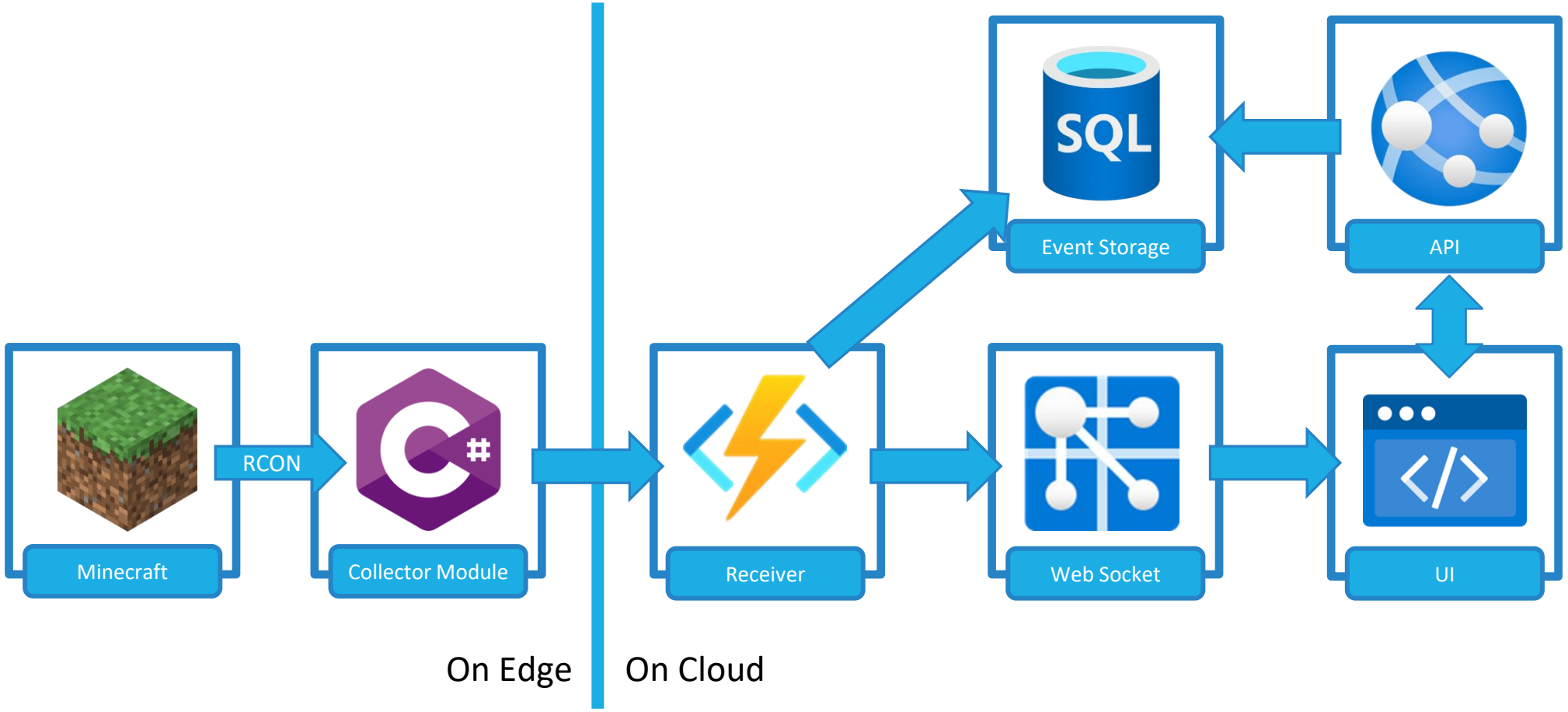
Monitoring Platform - UI

Static Web Apps or Static Web Apps

Monitoring Platform Overview



Monitoring Platform Overview



Demo

Let’s get in touch!

Nicola Paro

Solution Architect | Microsoft MVP

linkedin.com/in/nicolaparo

github.com/nicolaparo

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GREMO NA PIVO?

Hvala!