

# .NET & AZURE MEETUP ŠTAJERSKA

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THURSDAY, OCTOBER 16 · 18:30 – 21 CEST

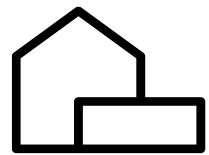
TEHNOLOŠKI PARK PTUJ  
Vičava 1, 2250 Ptuj

# Monitor your IoT Asset with Azure Free Services

NICOLA PARO

# Special thanks to

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TEHNOLOŠKI PARK PTUJ

# A Real Life Story...

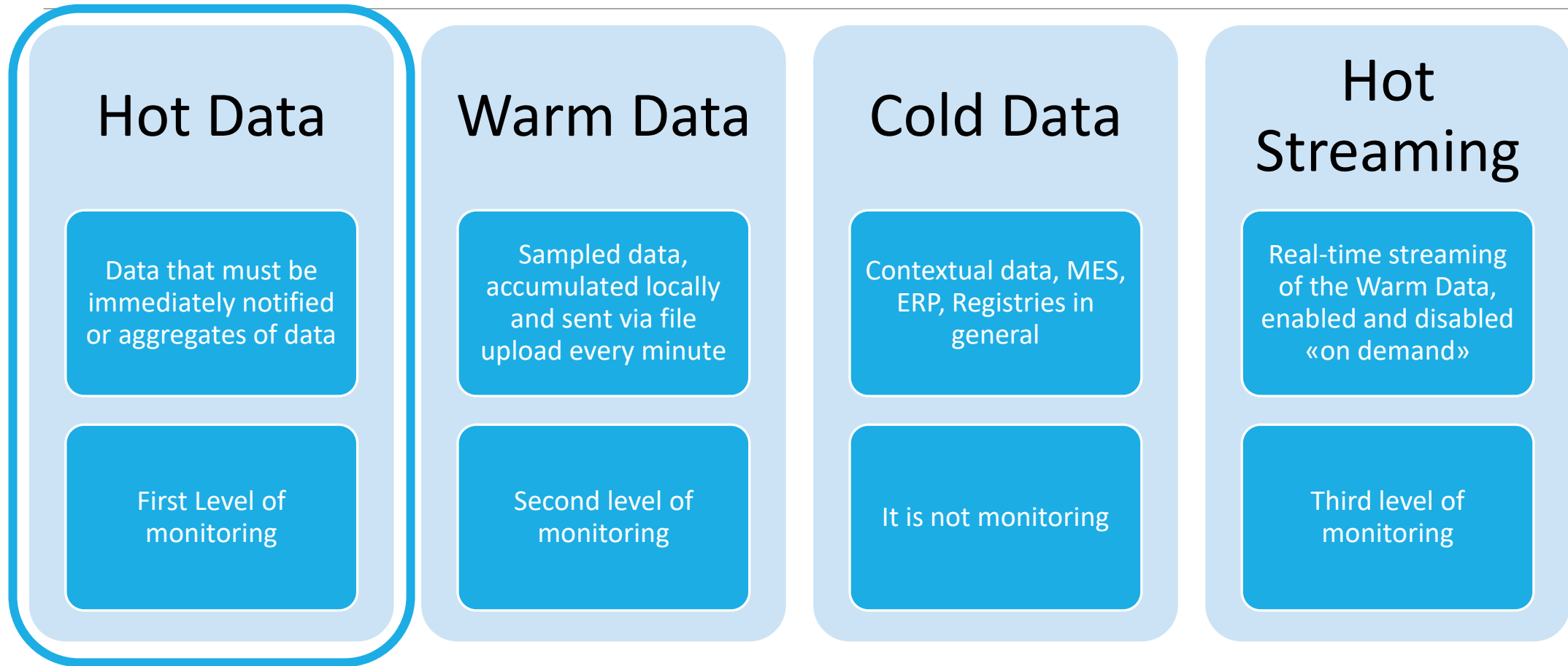
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My IoT device works, but not really that well...

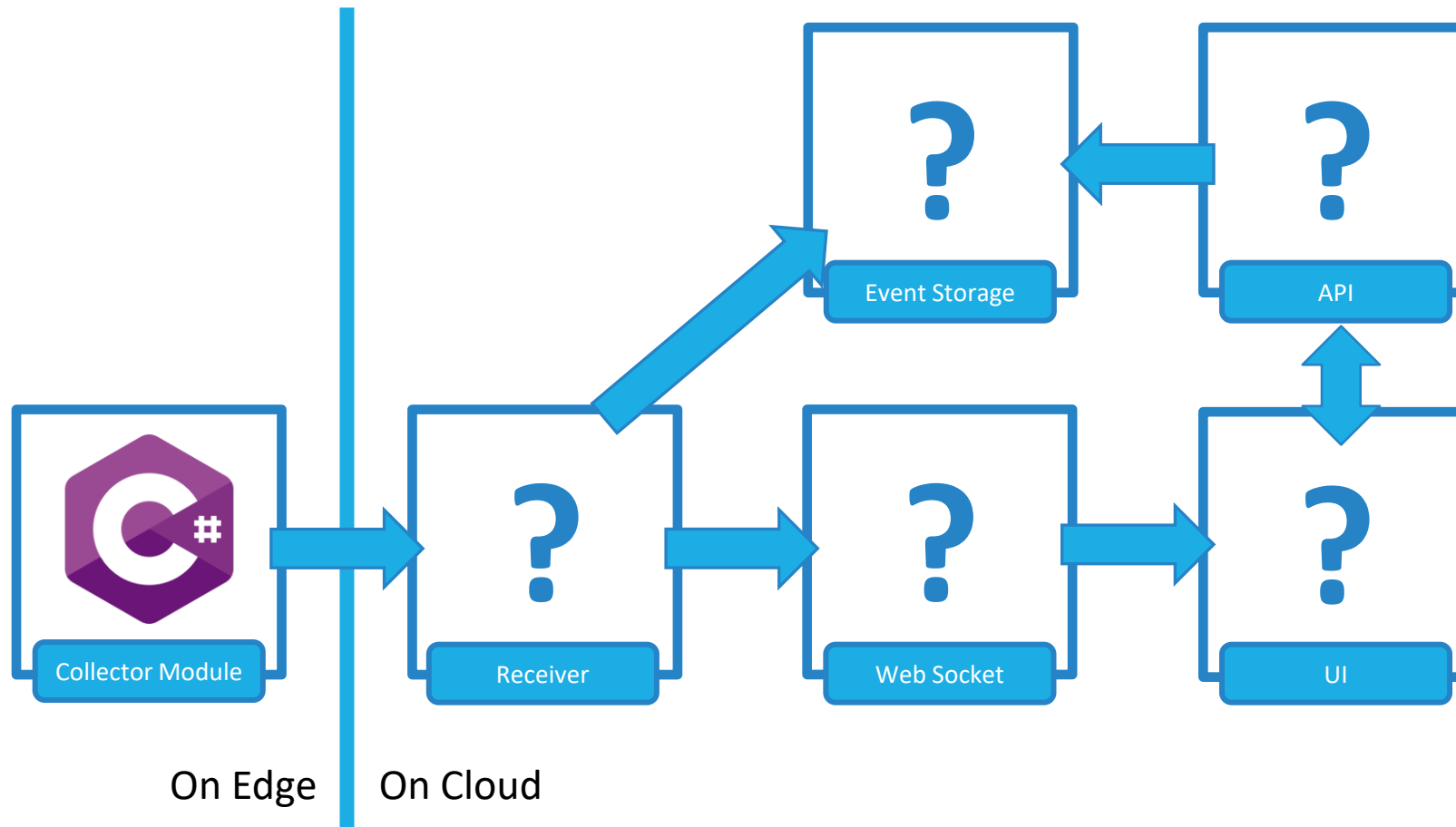
If only I would have a monitoring system, I could understand when things are not working properly...

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»



# Monitoring Platform Overview





# Azure Free Services



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

# Monitoring Platform – Event Storage

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

It must allow analytics in a simple way.





# Cosmos DB

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Managed Database either relationation 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

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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 ov

Free Tie

- You c
- Or els



#### Cost summary

##### General Purpose (GP\_Gen5\_2)

Cost per <b>vCore</b> (in EUR) <sup>1</sup>	114.41
<b>vCores</b> selected	x 2

Cost per <b>GB</b> (in EUR)	0.13
<b>Max storage</b> selected (in GB)	x 41.6

<b>ESTIMATED COST / MONTH</b>	234.16 EUR
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#### NOTES

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



#### Cost summary

##### General Purpose (GP\_S\_Gen5\_2)

Cost per <b>GB</b> (in EUR)	0.00
<b>Max storage</b> selected (in GB)	x 41.6

- 💜 First 32 GB storage free
- 💜 First 100,000 vCore seconds free

Overage billing <sup>1</sup>	Disabled
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<b>ESTIMATED STORAGE COST / MONTH</b>	0.00 EUR
<b>COMPUTE COST / VCORE SECOND <sup>2</sup></b>	0.000000 EUR

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

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

\* vCore and  
limits are rea  
only for the e

orever

# Monitoring Platform – Event Storage

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Cosmos or SQL ?



# Monitoring Platform – Event Storage

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Cosmos or SQL ?



# Monitoring Platform – Web Socket

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



# Azure SignalR & Web PubSub

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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

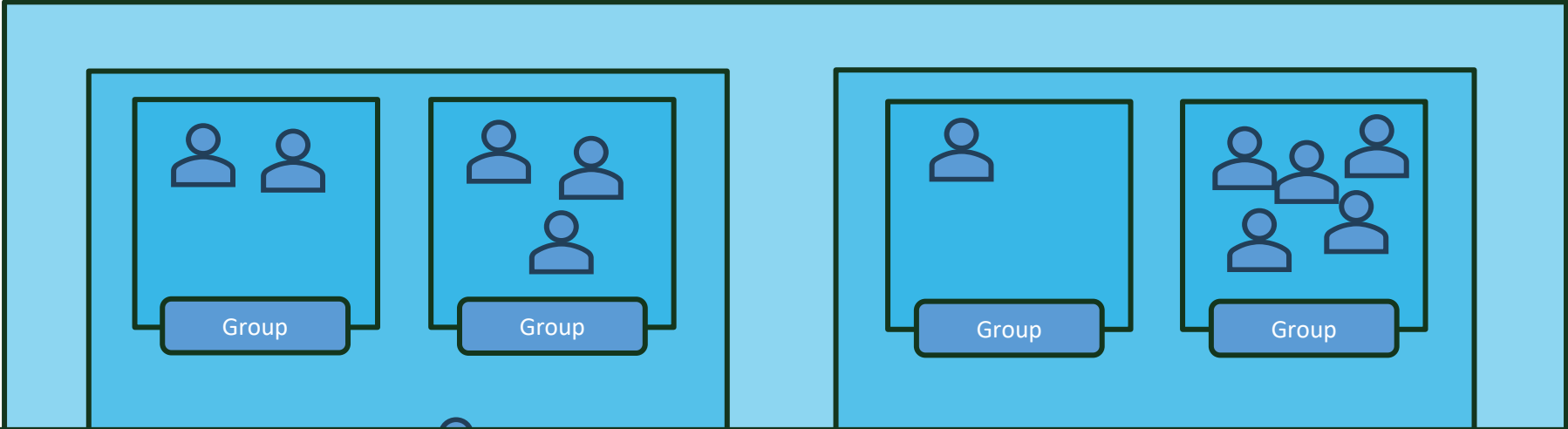
You need to transport another custom protocol over WebSocket

- MQTT over WebSocket
- AMQP over WebSocket

A «lite» infrastructure is enough for your application



# Inside Azure Web PubSub



The diagram illustrates the Azure Web PubSub architecture. It shows two main containers, each representing a Hub. Inside each Hub, there are two smaller containers representing Groups. Each Group contains user icons (represented by blue circles with person silhouettes) and a label 'Group'. The first Hub on the left contains two Groups, each with two users. The second Hub on the right contains two Groups, one with one user and the other with four users.

Client URL Generator

Hub \*  
Hub

User ID  
User ID

Token Lifetime (Minutes) \*  
60

Select Sign Key  
Primary Secondary

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  
[wss://xmasdev-events.webpubsub.azure.com/client/hubs/Hub?access\\_token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJhdWQiOiJ3c3M6Ly94bWZzZGV2LWV2ZW50cy53ZWJwdWJzdWlu...](wss://xmasdev-events.webpubsub.azure.com/client/hubs/Hub?access_token=eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJhdWQiOiJ3c3M6Ly94bWZzZGV2LWV2ZW50cy53ZWJwdWJzdWlu...)

# Sending Data with Azure Web PubSub

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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 ⓘ	-	-	✓
 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

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Web Pub Sub o SignalR?



# Monitoring Platform – Web Socket

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Web Pub Sub o SignalR?



# Monitoring Platform - Receiver

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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

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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

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Azure Functions o Azure Functions ?





# Monitoring Platform - Receiver

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Azure Functions o Azure Functions ?



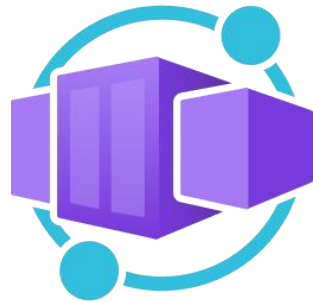
# Monitoring Platform - API

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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

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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

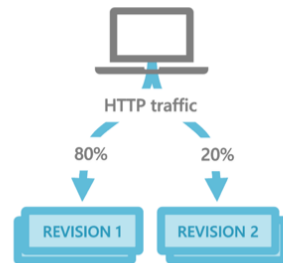
Serverless platform for the execution of containerized applications

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

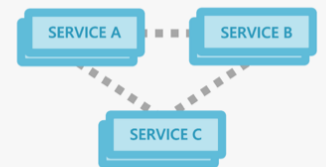


A queue reader application that processes messages as they arrive in a queue.

#### 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

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Each month you get for free:

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

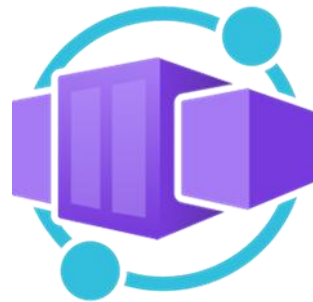
Other tricks to ~~not to pay them~~ pay them less

- 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

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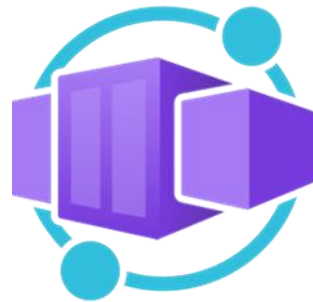
Container Apps o Web Apps?



# Monitoring Platform - API

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Container Apps o Web Apps?



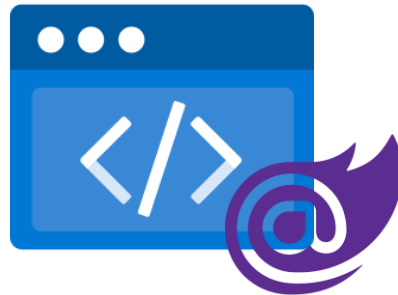


# Monitoring Platform - UI

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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

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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

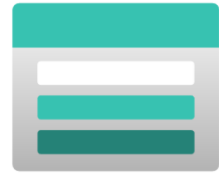
Globally  
distributed static  
content

Free SSL certificate

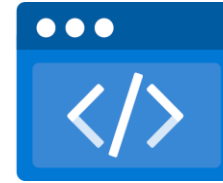
Staging  
environment  
management

# Azure Blob Static Website vs Azure Static WebApp

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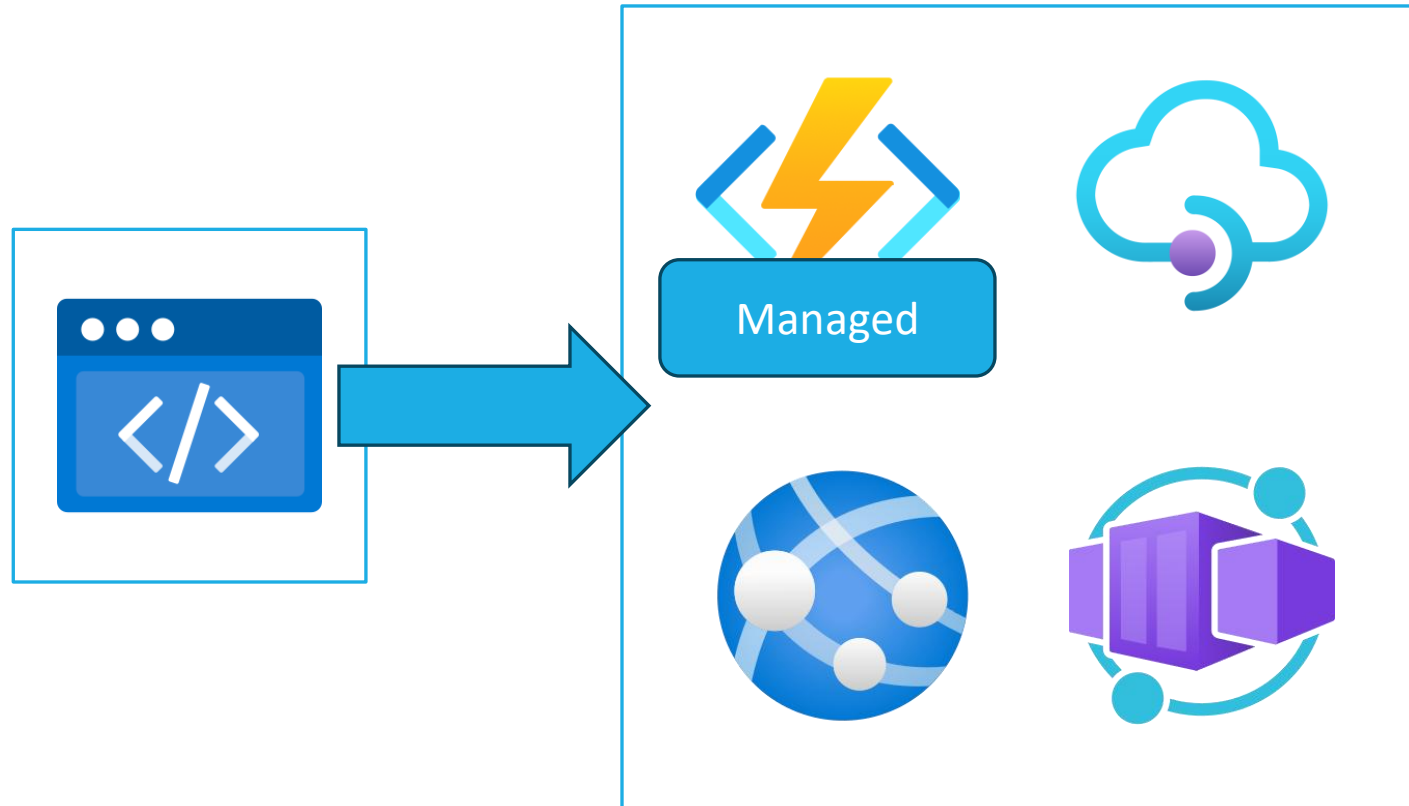
- ✓ SSL
- 😞 CI/CD do it yourself
- ✗ No Multiregion
- ✓ Custom Domain
- ✗ No HTTPS with Custom Domains



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

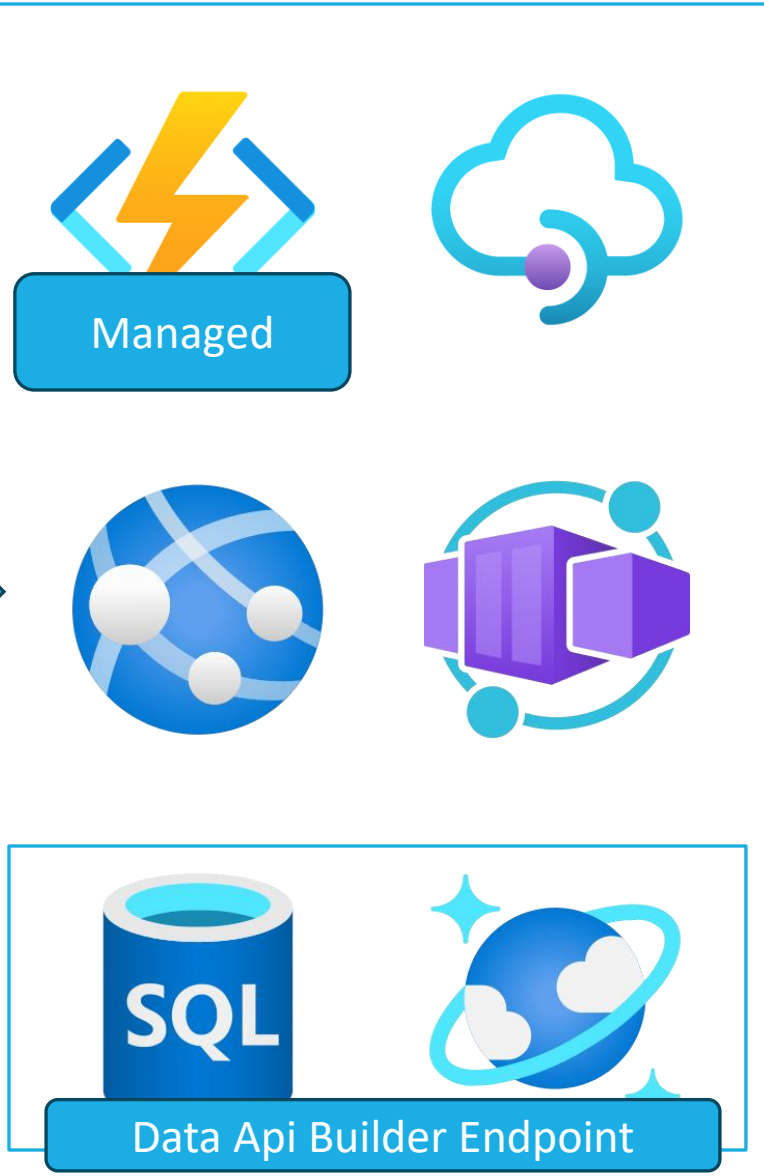
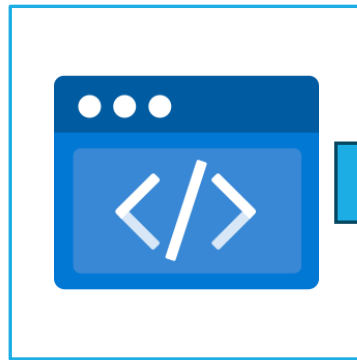
# Azure Static WebApp... But the backend?

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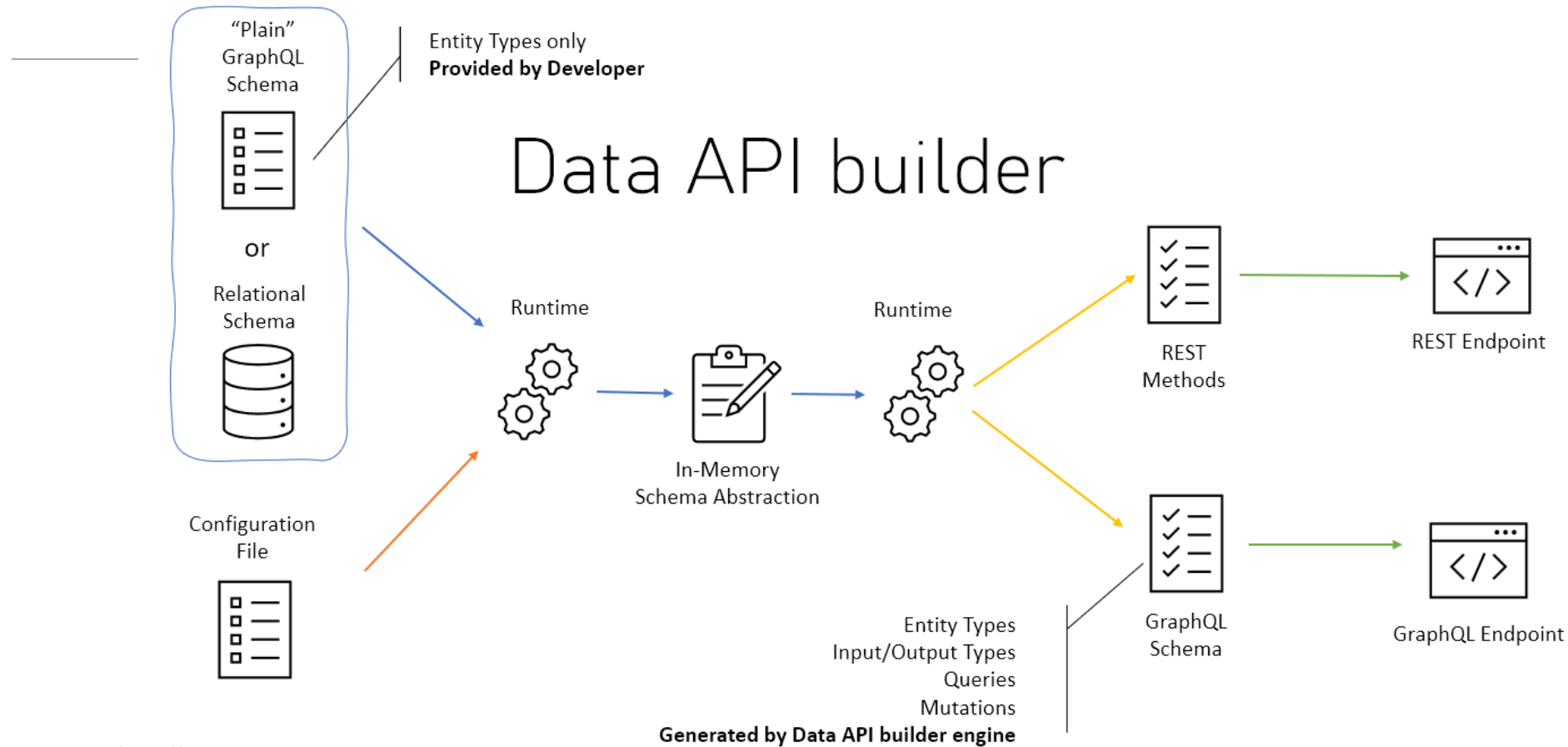


# Azure Static WebA

# ckend?



# Data API Builder?



To use DAB locally

```
dotnet tool install Microsoft.DataApiBuilder
```

# Azure Static WebApp Pricing

Plan/Features	<input checked="" type="radio"/> <b>Free</b> For hobby or personal projects	<input type="radio"/> <b>Standard</b> 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

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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

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Static Web Apps or Static Web Apps



# Monitoring Platform - UI

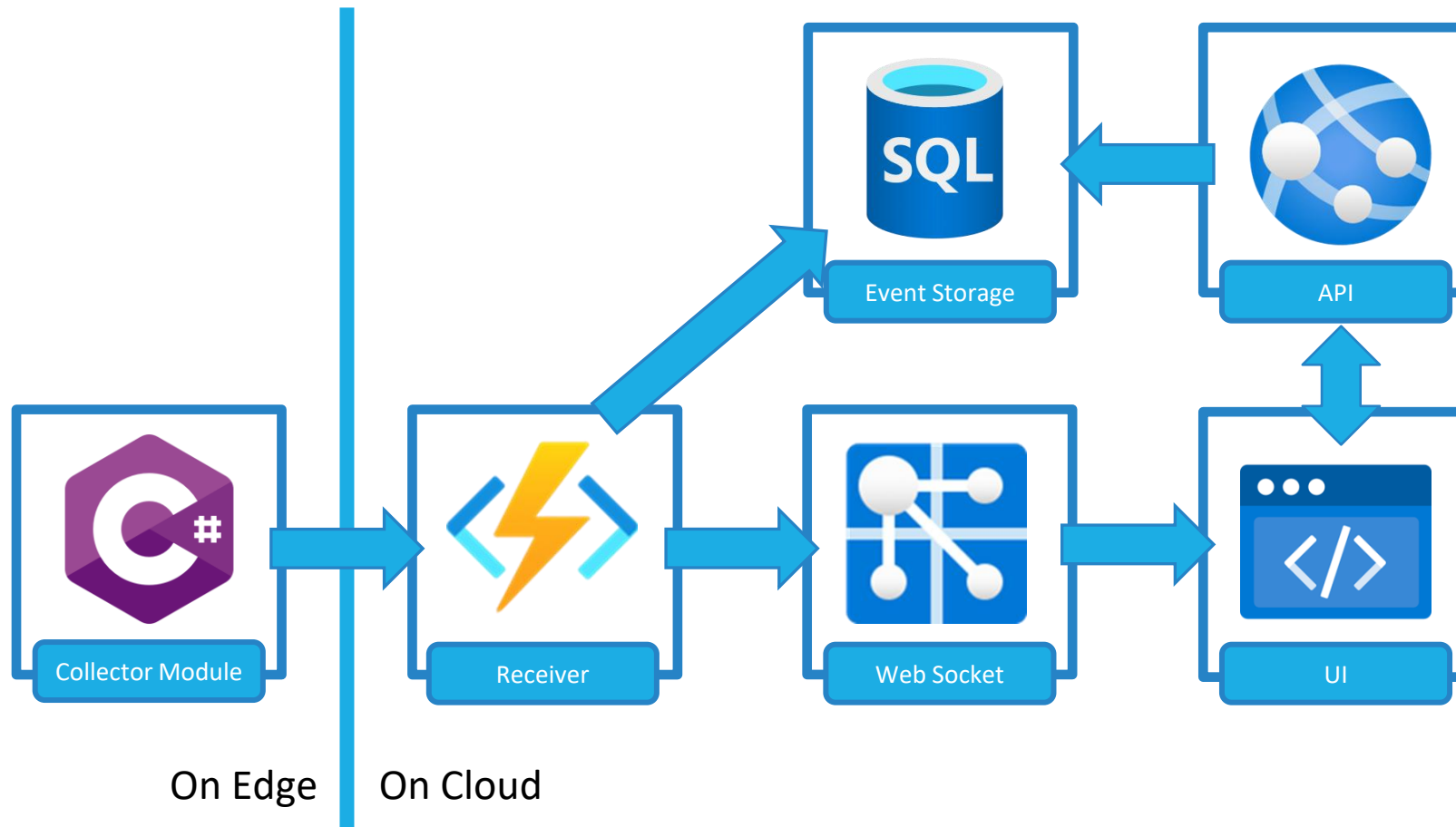
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Static Web Apps or Static Web Apps

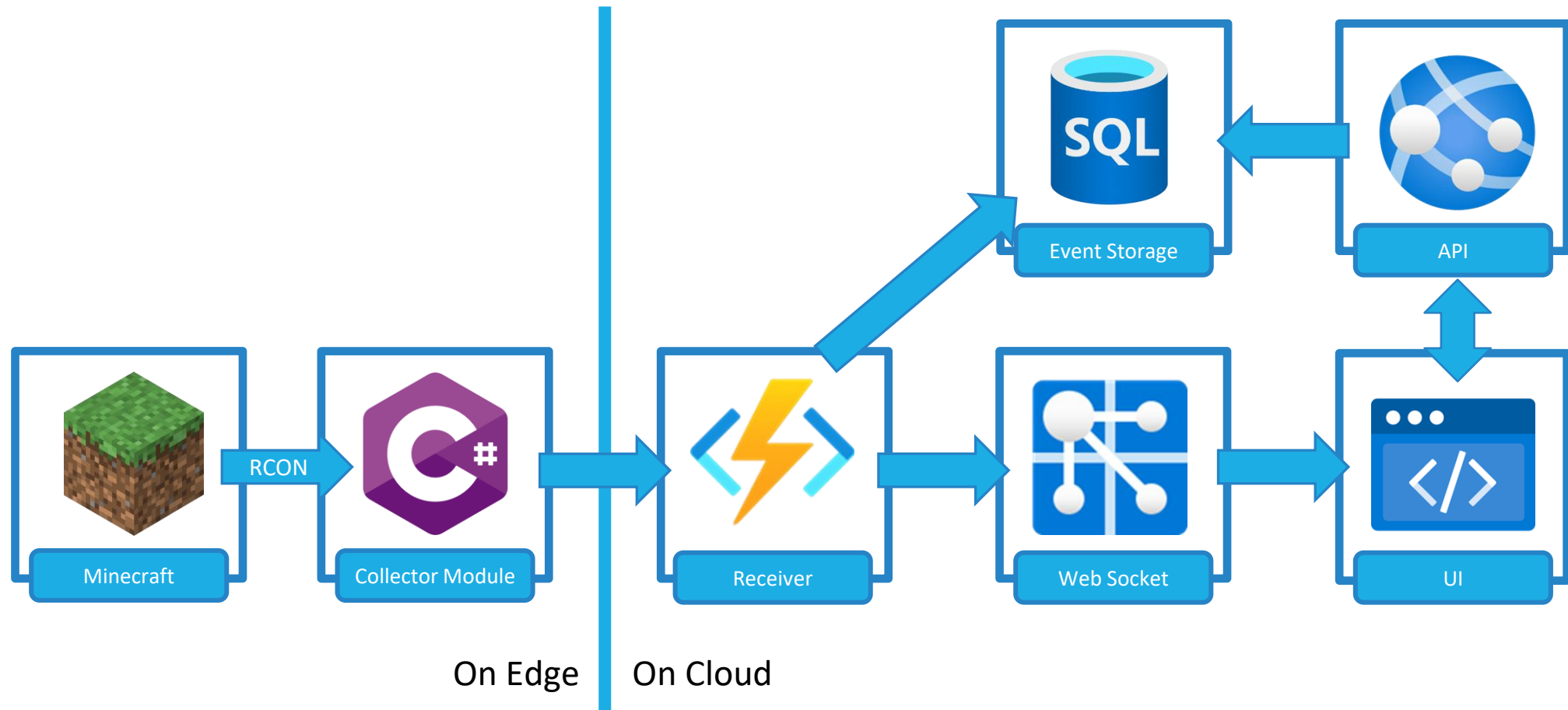


# Monitoring Platform Overview

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# Monitoring Platform Overview



Demo

# Let's get in touch!

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## Nicola Paro

Solution Architect | Microsoft MVP



[linkedin.com/in/nicolaparo](https://linkedin.com/in/nicolaparo)



[github.com/nicolaparo](https://github.com/nicolaparo)



# WE LIKE CI/CD

Continuous Improvement – Continuous Discussions

Share your feedback, opinions, suggestions with us!

# WE ARE ON DISCORD!



<https://discord.gg/K6F7pdP4xq>





**GREMO NA PIVO?**

Hvala!