

Microsoft Azure Certified Data & AI Track

# Vendée Globe Business Case

August 2022

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## Vendée Globe – Business Case

# Foreword

The Vendée Globe is a solo non-stop round the world sailboat race founded by Philippe Jeantot in 1989. The race takes place every four years and is considered an extreme quest of individual endurance and the ultimate test in ocean racing.

The 9th edition of the Vendee Globe was held in 2020-2021 and was won by French sailor Yannick Bestaven who took slightly over 80 days to sail non-stop around the globe.

During the race, spectators could follow the action live on an online racing dashboard. The technology for tracking the boats live was provided by Nokia.



## Vendée Globe – Business Case

# Your Challenge

What will you need to do during this business case? Find out during this section of the guide!

# Vendee Globe - Sailing Race

Learn more about your challenge during this business case.

## The Challenge

In this business case, you will assume the role of Nokia. You will build a cloud-based Lambda Architecture to process the telemetry data from the sailing boats. Your architecture should run in Azure and contain a real-time path for processing sailing boat data in real-time, and a batch-processing path for collecting sailing boat data in batches and performing calculations on those batches.

## Lambda Architecture

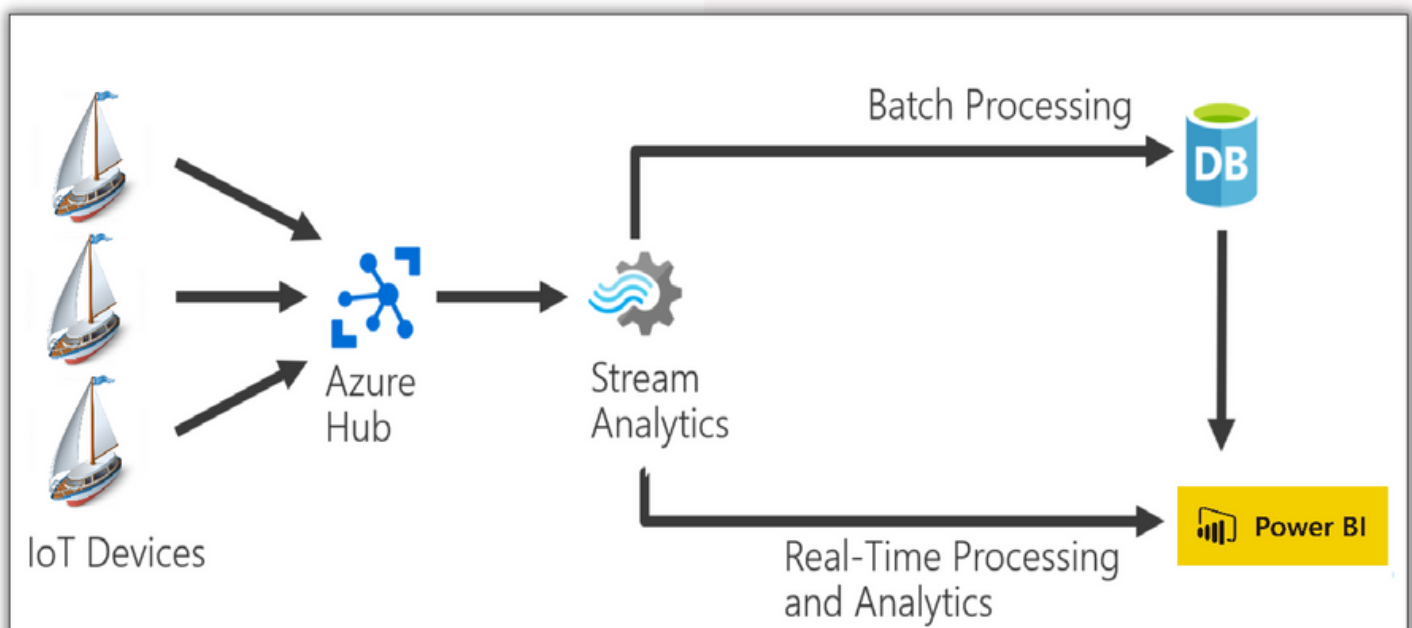
The Lambda Architecture should send all boat data to a PowerBI dashboard. The dashboard should display a world map with the current position of each boat, and a table with a ranking of racing teams. The ranking table should be sorted by who is currently in the lead.

We are currently between races, so unfortunately we cannot use the actual data from the boats participating in the race. Instead, you are going to use a Python application that will simulate boat telemetry data from a fleet of 10 race participants.

## To complete the business case...

- Create a Lambda Architecture in Azure with a real-time path and a batch-processing path. Your architecture should include an Event Hub, a Stream Analytics Job, and an output to PowerBI. Your batch-processing path can use any data storage service you prefer: a Data Lake, a SQL Database, a Cosmos database, or a Synapse Analytics Workspace.
- Create a PowerBI dashboard that displays a world map with the current location of each racing team, and a table with the teams ranked by position in the race.
- Download the Python race simulation app to your local computer. Configure the app to send data to your EventHub.
- Start the Python app. Every 60 seconds, the telemetry of the simulated racing boats will be sent to your Azure cloud.

**You will have completed the business case if your PowerBI dashboard correctly shows the position and ranking of each sailing team in the race.**





## Vendée Globe – Business Case

# Getting Started

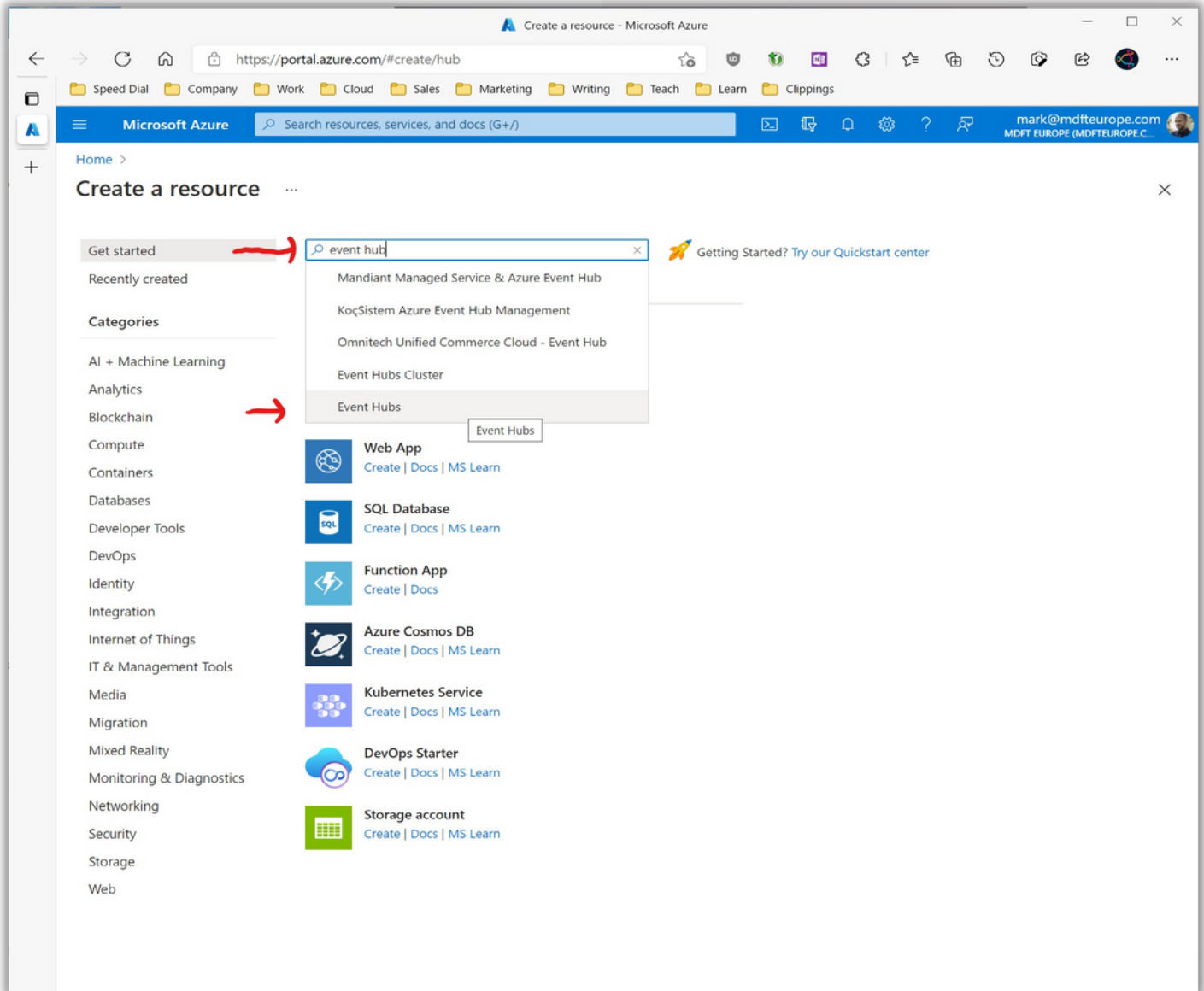
To help you get started, here are guided instructions to build the first piece of the Lambda Architecture and get the Python sailing simulator up and running.

# How to create the Event Hub

## Getting Started with the Vendée Globe Business Case

### Step One:

The first thing you need to do is create an Event Hub Namespace in your Azure Tenant:



# How to create the Event Hub

## Getting Started with the Vendée Globe Business Case

### Step Two:

Then configure the Event Hub Namespace as follows:

- Subscription: select your Azure Pass Sponsorship
- Resource group: create a new resource group to hold all the resources of your Lambda Architecture.
- Namespace name: choose a name for your namespace
- Location: select the region that's closest to your current location. This will be 'West Europe' if you're in the Netherlands.
- Pricing tier: set this to 'Basic'.
- Throughput Units: set this to 1.

Click the blue 'Review + Create' button at the bottom of the page, and then click the blue 'Create' button to create your Event Hub Namespace.

The screenshot shows the 'Create Namespace' page in the Microsoft Azure portal. The page is titled 'Create Namespace - Microsoft Azure' and the URL is 'https://portal.azure.com/#create/Microsoft.EventHub'. The breadcrumb navigation is 'Home > Create a resource > Event Hubs >'. The page has a blue header with the Microsoft Azure logo and a search bar. The main content area is titled 'Create Namespace' and has a sub-header 'Event Hubs'. There are three tabs: 'Basics', 'Tags', and 'Review + create'. The 'Basics' tab is selected. Under 'PROJECT DETAILS', there is a description: 'Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.' Below this are two dropdown menus: 'Subscription' (set to 'Enterprise') and 'Resource group' (set to '(New) techionista-vgcase'). Under 'INSTANCE DETAILS', there is a description: 'Enter required settings for this namespace, including a price tier and configuring the number of units (capacity)'. Below this are four fields: 'Namespace name' (set to 'techionista-vgcase-ehns'), 'Location' (set to 'West Europe'), 'Pricing tier' (set to 'Basic (1 Consumer group, 100 Brokered connections)'), and 'Throughput Units' (set to '1'). At the bottom of the page, there are three buttons: 'Review + create', '< Previous', and 'Next: Tags >'. Red arrows point to the 'Enterprise' subscription, '(New) techionista-vgcase' resource group, 'techionista-vgcase-ehns' namespace name, 'West Europe' location, 'Basic' pricing tier, and '1' throughput unit.



# How to create the Event Hub

## Getting Started with the Vendée Globe Business Case

### Step Three:

Once the Event Hub Namespace has been created, click on the blue 'Go to resource' button to access the Event Hub Namespace overview page.

From there, click on the '+ Event Hub' button to add a new Event Hub to the Event Hub Namespace:

The screenshot displays the Microsoft Azure portal interface for the 'techionista-vgcase-ehns' Event Hubs Namespace. The page is titled 'techionista-vgcase-ehns' and 'Event Hubs Namespace'. A search bar is present with the text 'Search (Ctrl+/)'. Below the search bar, there is a '+ Event Hub' button, which is circled in red, indicating the next step in the process. To the right of the '+ Event Hub' button are 'Delete' and 'Refresh' buttons. The page shows various details about the namespace, including 'Resource group (change) techionista-vgcase', 'Status Active', 'Location West Europe', 'Subscription (change) Enterprise', 'Subscription ID 4bcd930f-f9d2-4e88-a62f-78b28aaede89', 'Host name techionista-vgcase-ehns.servicebus.windows.net', 'Tags (change) Click here to add tags', 'Created Saturday, July 31, 2021, 12:17:54 GMT+2', 'Updated Saturday, July 31, 2021, 12:18:40 GMT+2', 'Zone Redundancy Enabled', 'Pricing tier Basic', 'Throughput Units 1 unit', and 'Auto-inflate throughput units Not Supported'. Below these details, there are three sections: 'NAMESPACE CONTENTS' showing '0 EVENT HUBS', 'KAFKA SURFACE' showing 'NOT SUPPORTED', and 'ZONE REDUNDANCY' showing 'ENABLED'. At the bottom, there are three charts: 'Requests', 'Messages', and 'Throughput', each showing a line graph and a table of data for the last 1 hour.

# How to create the Event Hub

## Getting Started with the Vendée Globe Business Case

### Step Four:

Configure the Event Hub as follows:

- Name: choose a name for your Event Hub.

**Store the Event Hub name in notepad.** You will need it in an upcoming installation step.

You can leave all other fields at their default value. Click the blue 'Create' button at the bottom of the page to create the Event Hub.

The screenshot shows the 'Create Event Hub' page in the Microsoft Azure portal. The browser address bar shows the URL: <https://portal.azure.com/#@mdfteurope.com/resource/subscriptions...>. The page title is 'Create Event Hub - Microsoft Azure'. The breadcrumb navigation is 'Home > techionista-vgcase-ehns > techionista-vgcase-ehns > Create Event Hub'. The 'Name' field is highlighted with a red arrow and contains the text 'techionista-vgcase-eh'. Below it, the 'Partition Count' is set to 2, 'Message Retention' is set to 1, and the 'Capture' toggle is set to 'On'. At the bottom of the page, a red arrow points to the 'Create' button.

# How to get the Event Hub Namespace Connection String

## Getting Started with the Vendée Globe Business Case

### Step Five:

Next, you will need to create a Shared Access Policy that will allow the Python sailing simulator to send data to this Event Hub Namespace.

The Shared Access Policy will contain a connection string that the Python code will use to connect to the Event Hub and upload data to the Azure cloud.

First, make sure that you are on the Event Hub Namespace overview page, and then click the Shared Access Policies menu item.

The screenshot shows the Microsoft Azure portal interface for the Event Hub Namespace 'techionista-vgcase-ehns'. The left-hand navigation pane is visible, with the 'Settings' section highlighted and the 'Shared access policies' option selected. The main content area displays the 'Essentials' tab, showing details such as the resource group 'techionista-vgcase', status 'Active', location 'West Europe', and subscription 'Enterprise'. Below this, there are three status indicators: 'NAMESPACE CONTENTS' (1 EVENT HUB), 'KAFKA SURFACE' (NOT SUPPORTED), and 'ZONE REDUNDANCY' (ENABLED). At the bottom, there are three charts: 'Requests' (showing a peak at 12 PM), 'Messages' (showing 0 incoming and outgoing messages), and 'Throughput' (showing 0B incoming and outgoing bytes). The charts are for the last 1 hour.

# How to get the Event Hub Namespace Connection String

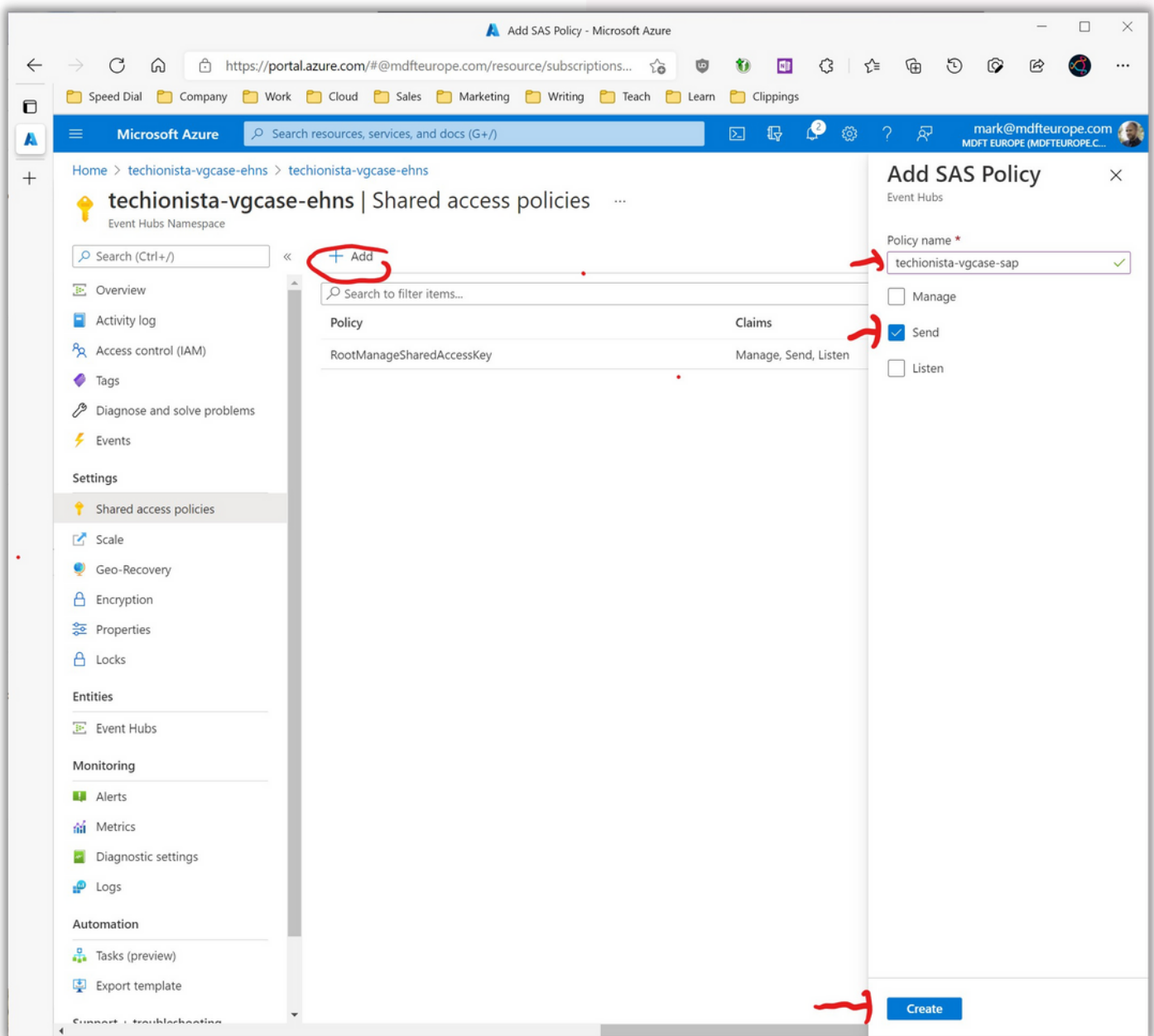
## Getting Started with the Vendée Globe Business Case

### Step Six:

Now click the 'Add' button to add a new Shared Access Policy and provide the following information:

- Name: choose a name for your Shared Access Policy
- Send: check this box to allow sending new data to the Event Hub Namespace.

Leave the other options unchecked, and click the blue 'Create' button at the bottom of the page.



Once the Shared Access Policy has been created, select it from the list. Then use the copy button to copy the 'Connection String-Primary Key' value to your clipboard.

**Store the connection string in notepad.** You will need it in an upcoming installation step.

# Download and configure the Python Sailing Simulator

## Getting Started with the Vendée Globe Business Case

### Step Seven:

We do not have access to the real boat telemetry data from the Vendée Globe participants, so instead, we are going to use a Python application that will simulate boat telemetry data from a fleet of 10 race participants.

First, make sure that **Python** is installed on your computer. You can use either Windows, OS/X or Linux to run the sailing simulator.

Now download the **Python Sailing Simulator** and store it somewhere on your computer. We suggest you save the file in your Documents folder. Make sure you save the file as **race\_simulator.py**.

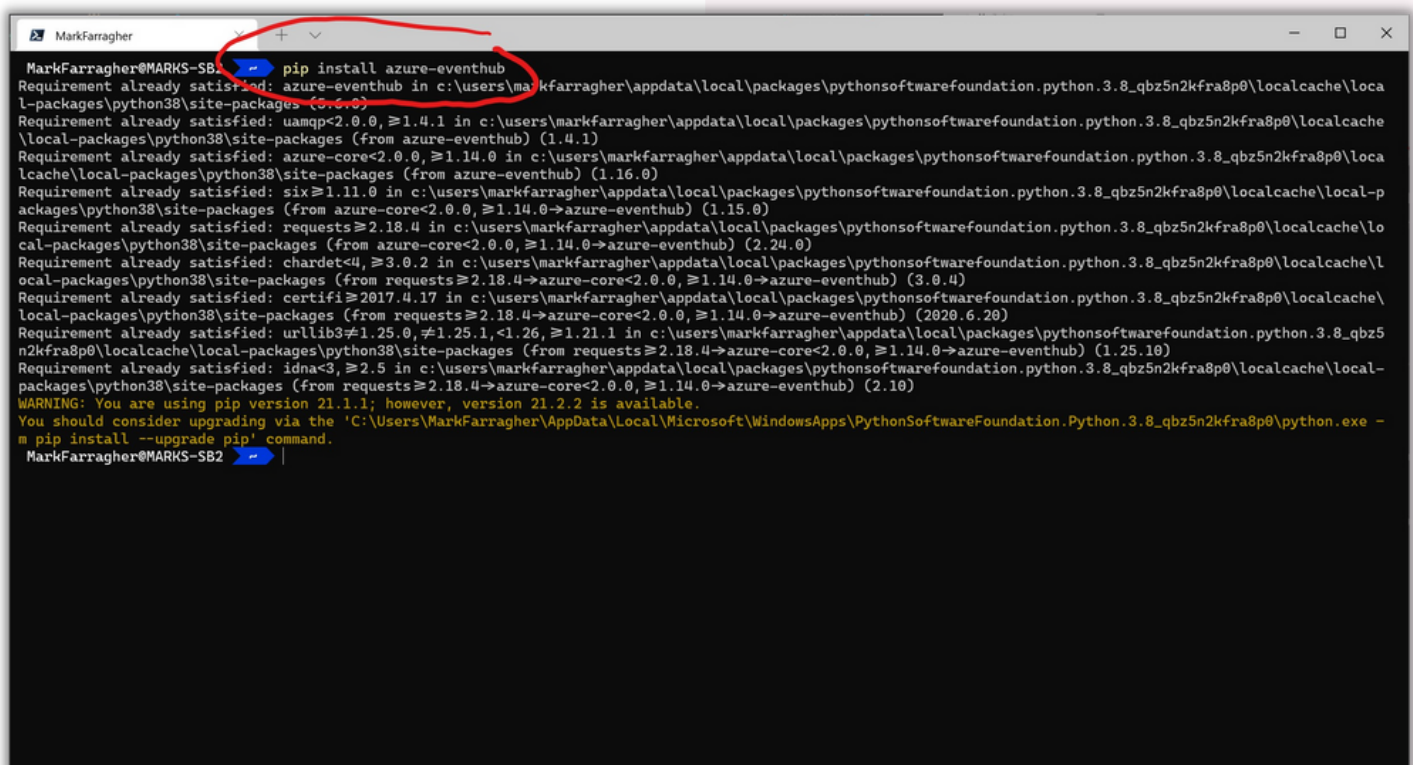
Next, open a Powershell window (or a Terminal window if you're using OS/X or Linux) and run the following command:

```
cd ~/Documents
```

This will change the current directory to the Documents folder where you have saved the racing simulator. Now you need to install the Python library for Azure Event Hubs. Run the following command:

```
pip install azure-eventhub
```

This will install the Azure Event Hub library for Python on your computer.



```
MarkFarragher@MARKS-SB2: ~$ pip install azure-eventhub
Requirement already satisfied: azure-eventhub in c:\users\markfarragher\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5n2kfra8p0\localcache\loca
l-packages\python38\site-packages (5.0.0)
Requirement already satisfied: uamqp<2.0.0,>=1.4.1 in c:\users\markfarragher\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5n2kfra8p0\localcache
\local-packages\python38\site-packages (from azure-eventhub) (1.4.1)
Requirement already satisfied: azure-core<2.0.0,>=1.14.0 in c:\users\markfarragher\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5n2kfra8p0\loca
l-cache\local-packages\python38\site-packages (from azure-eventhub) (1.16.0)
Requirement already satisfied: six>=1.11.0 in c:\users\markfarragher\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5n2kfra8p0\localcache\local-p
ackages\python38\site-packages (from azure-core<2.0.0,>=1.14.0->azure-eventhub) (1.15.0)
Requirement already satisfied: requests>=2.18.4 in c:\users\markfarragher\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5n2kfra8p0\localcache\loca
l-packages\python38\site-packages (from azure-core<2.0.0,>=1.14.0->azure-eventhub) (2.24.0)
Requirement already satisfied: chardet<4,>=3.0.2 in c:\users\markfarragher\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5n2kfra8p0\localcache\loca
l-packages\python38\site-packages (from requests>=2.18.4->azure-core<2.0.0,>=1.14.0->azure-eventhub) (3.0.4)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\markfarragher\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5n2kfra8p0\localcache\loca
l-packages\python38\site-packages (from requests>=2.18.4->azure-core<2.0.0,>=1.14.0->azure-eventhub) (2020.6.20)
Requirement already satisfied: urllib3!=1.25.0,!=1.25.1,<1.26,>=1.21.1 in c:\users\markfarragher\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5
n2kfra8p0\localcache\local-packages\python38\site-packages (from requests>=2.18.4->azure-core<2.0.0,>=1.14.0->azure-eventhub) (1.25.10)
Requirement already satisfied: idna<3,>=2.5 in c:\users\markfarragher\appdata\local\packages\pythonsoftwarefoundation.python.3.8_qbz5n2kfra8p0\localcache\local-
packages\python38\site-packages (from requests>=2.18.4->azure-core<2.0.0,>=1.14.0->azure-eventhub) (2.10)
WARNING: You are using pip version 21.1.1; however, version 21.2.2 is available.
You should consider upgrading via the 'C:\Users\MarkFarragher\AppData\Local\Microsoft\WindowsApps\PythonSoftwareFoundation.Python.3.8_qbz5n2kfra8p0\python.exe -
m pip install --upgrade pip' command.
MarkFarragher@MARKS-SB2: ~$
```

The racing simulator is just a single file named **race\_simulator.py**. Open this file with your favorite text editor and take a look at lines 33 and 34.

# Download and configure the Python Sailing Simulator

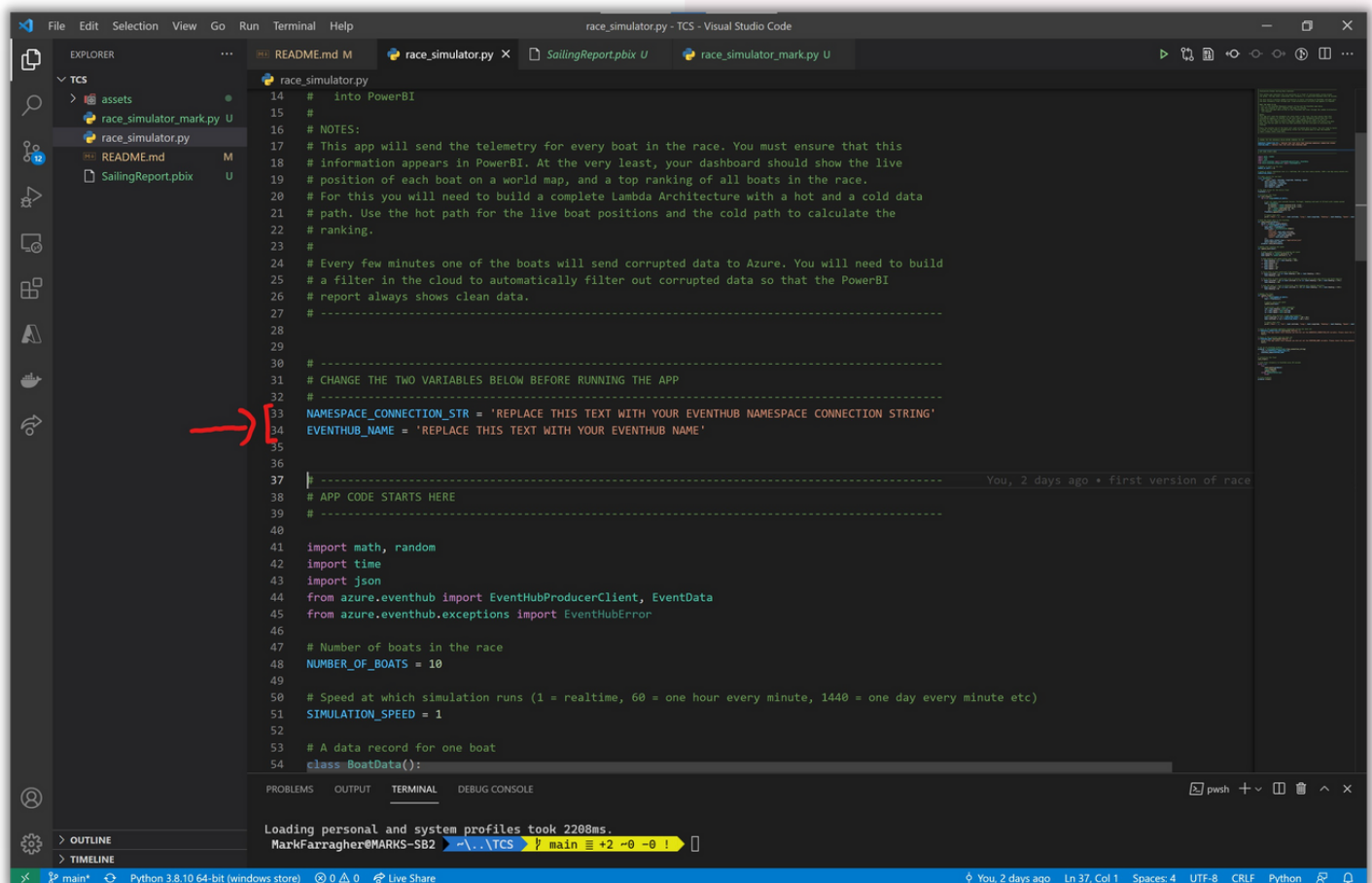
## Getting Started with the Vendée Globe Business Case

### Step Eight:

You must do the following:

- Replace the value of line 33 with the Connection String-Primary Key of your Event Hub Namespace. You saved this value in notepad earlier.
- Replace the value of line 34 with the name of your Event Hub. You saved this value in notepad earlier.

After you have made these replacements, your file should now look like this (keep in mind that the screenshot shows my specific configuration values, your values will be different):



```
File Edit Selection View Go Run Terminal Help
race_simulator.py - TCS - Visual Studio Code

EXPLORER
TCS
  assets
  race_simulator_mark.py U
  race_simulator.py
  README.md M
  SailingReport.pbix U

race_simulator.py
14 # into PowerBI
15 #
16 # NOTES:
17 # This app will send the telemetry for every boat in the race. You must ensure that this
18 # information appears in PowerBI. At the very least, your dashboard should show the live
19 # position of each boat on a world map, and a top ranking of all boats in the race.
20 # For this you will need to build a complete Lambda Architecture with a hot and a cold data
21 # path. Use the hot path for the live boat positions and the cold path to calculate the
22 # ranking.
23 #
24 # Every few minutes one of the boats will send corrupted data to Azure. You will need to build
25 # a filter in the cloud to automatically filter out corrupted data so that the PowerBI
26 # report always shows clean data.
27 # -----
28 #
29 #
30 # -----
31 # CHANGE THE TWO VARIABLES BELOW BEFORE RUNNING THE APP
32 # -----
33 NAMESPACE_CONNECTION_STR = 'REPLACE THIS TEXT WITH YOUR EVENTHUB NAMESPACE CONNECTION STRING'
34 EVENTHUB_NAME = 'REPLACE THIS TEXT WITH YOUR EVENTHUB NAME'
35
36
37 # ----- You, 2 days ago • first version of race
38 # APP CODE STARTS HERE
39 # -----
40
41 import math, random
42 import time
43 import json
44 from azure.eventhub import EventHubProducerClient, EventData
45 from azure.eventhub.exceptions import EventHubError
46
47 # Number of boats in the race
48 NUMBER_OF_BOATS = 10
49
50 # Speed at which simulation runs (1 = realtime, 60 = one hour every minute, 1440 = one day every minute etc)
51 SIMULATION_SPEED = 1
52
53 # A data record for one boat
54 class BoatData():
55
56
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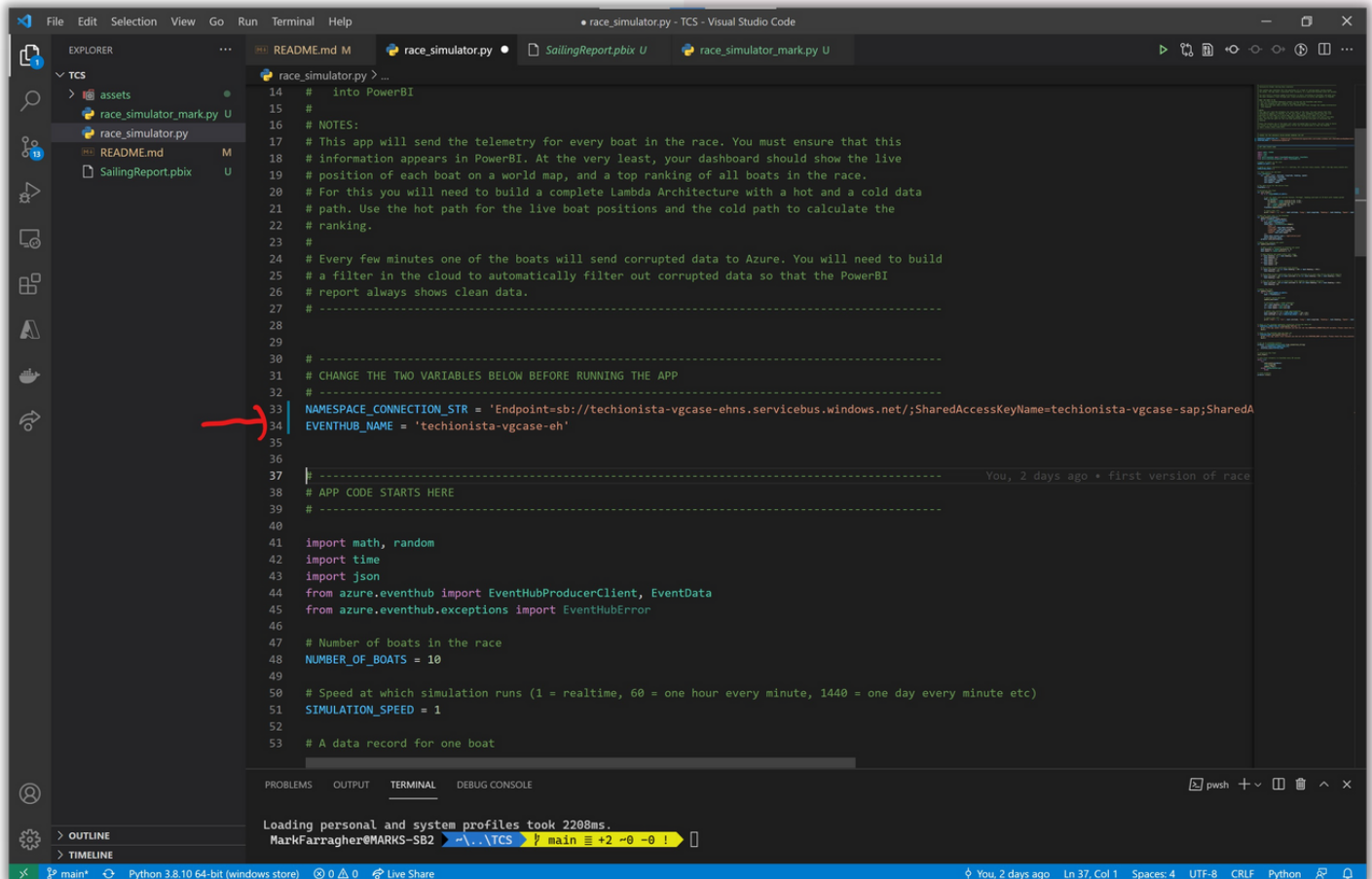


# Download and configure the Python Sailing Simulator

Getting Started with the Vendée Globe Business Case

## Step Nine:

Save the file. You are now ready to run the simulator.



```
14 # into PowerBI
15 #
16 # NOTES:
17 # This app will send the telemetry for every boat in the race. You must ensure that this
18 # information appears in PowerBI. At the very least, your dashboard should show the live
19 # position of each boat on a world map, and a top ranking of all boats in the race.
20 # For this you will need to build a complete Lambda Architecture with a hot and a cold data
21 # path. Use the hot path for the live boat positions and the cold path to calculate the
22 # ranking.
23 #
24 # Every few minutes one of the boats will send corrupted data to Azure. You will need to build
25 # a filter in the cloud to automatically filter out corrupted data so that the PowerBI
26 # report always shows clean data.
27 # -----
28 #
29 # -----
30 #
31 # CHANGE THE TWO VARIABLES BELOW BEFORE RUNNING THE APP
32 # -----
33 NAMESPACE_CONNECTION_STR = 'Endpoint=sb://techionista-vgcase-ehns.servicebus.windows.net;/SharedAccessKeyName=techionista-vgcase-sap;SharedAccessKey=...'
34 EVENTHUB_NAME = 'techionista-vgcase-eh'
35
36
37 |----- You, 2 days ago • first version of race
38 # APP CODE STARTS HERE
39 # -----
40
41 import math, random
42 import time
43 import json
44 from azure.eventhub import EventHubProducerClient, EventData
45 from azure.eventhub.exceptions import EventHubError
46
47 # Number of boats in the race
48 NUMBER_OF_BOATS = 10
49
50 # Speed at which simulation runs (1 = realtime, 60 = one hour every minute, 1440 = one day every minute etc)
51 SIMULATION_SPEED = 1
52
53 # A data record for one boat
```

PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE

Loading personal and system profiles took 2208ms.  
MarkFarragher@MARKS-SB2 ➤ ~\..\TCS ➤ main +2 -0 -0 !

main\* Python 3.8.10 64-bit (windows store) 0 0 0 Live Share You, 2 days ago Ln 37, Col 1 Spaces: 4 UTF-8 CRLF Python

# Run the Python Sailing Simulator

## Getting Started with the Vendée Globe Business Case

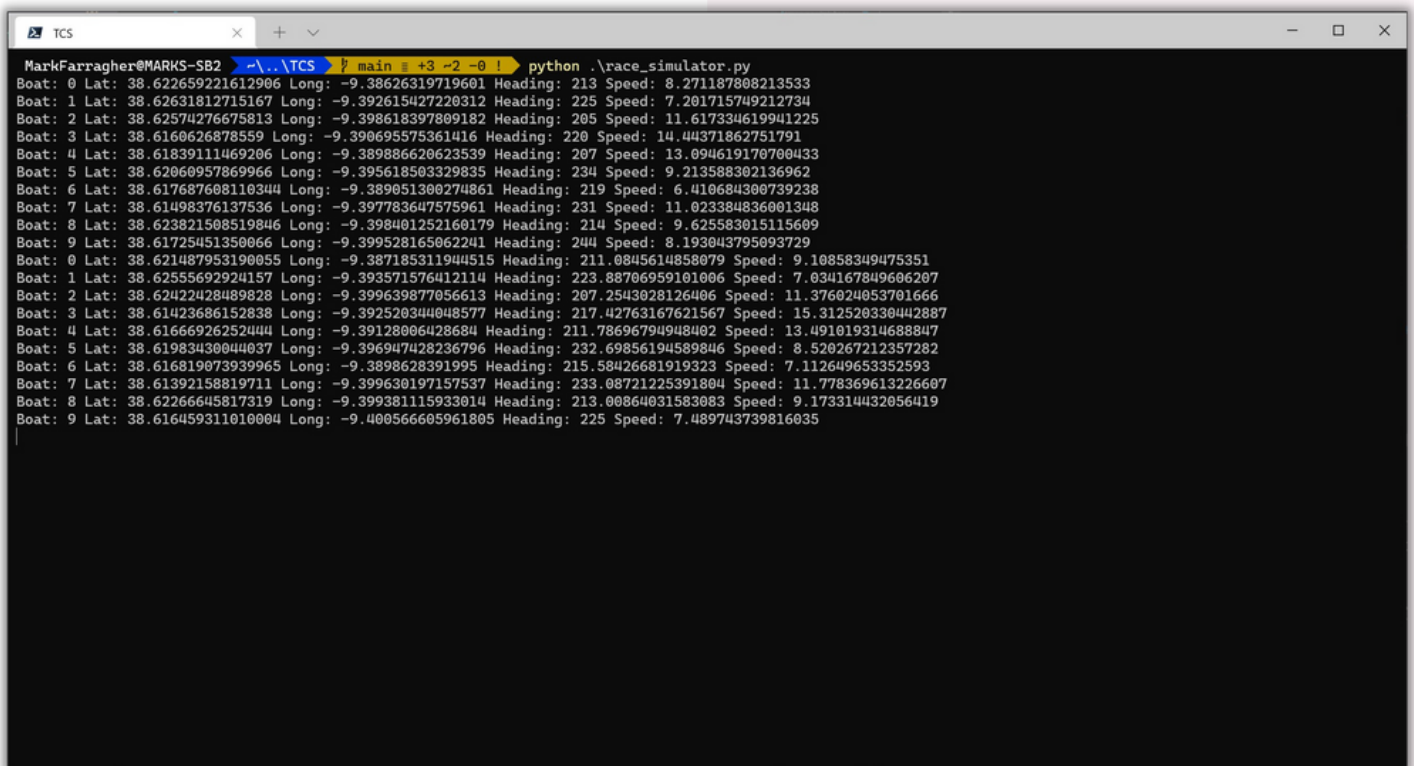
### Step Ten:

Open a command-line window and run the following command:

```
python .\race_simulator.py
```

This will run the Python sailing simulator. The app will simulate a fleet of 10 sailing boats that start the race near the port of Cascais in Portugal and proceed south along the coast of Africa and then east towards Australia.

While the app is running, it will display simulated boat telemetry data every 60 seconds:



```
MarkFarragher@MARKS-SB2 ~\TCS$ python .\race_simulator.py
Boat: 0 Lat: 38.622659221612906 Long: -9.38626319719601 Heading: 213 Speed: 8.271187808213533
Boat: 1 Lat: 38.62631812715167 Long: -9.392615427220312 Heading: 225 Speed: 7.201715749212734
Boat: 2 Lat: 38.62574276675813 Long: -9.398618397809182 Heading: 205 Speed: 11.617334619941225
Boat: 3 Lat: 38.6160626878559 Long: -9.390695575361416 Heading: 220 Speed: 14.44371862751791
Boat: 4 Lat: 38.61839111469206 Long: -9.389886620623539 Heading: 207 Speed: 13.094619170700433
Boat: 5 Lat: 38.62060957869966 Long: -9.395618503329835 Heading: 234 Speed: 9.213588302136962
Boat: 6 Lat: 38.617687608110344 Long: -9.389051300274861 Heading: 219 Speed: 6.410684300739238
Boat: 7 Lat: 38.61498376137536 Long: -9.397783647575961 Heading: 231 Speed: 11.023384836001348
Boat: 8 Lat: 38.623821508519846 Long: -9.398401252160179 Heading: 214 Speed: 9.625583015115609
Boat: 9 Lat: 38.61725451350066 Long: -9.399528165062241 Heading: 244 Speed: 8.193043795093729
Boat: 0 Lat: 38.621487953190055 Long: -9.387185311944515 Heading: 211.0845614858079 Speed: 9.10858349475351
Boat: 1 Lat: 38.62555692924157 Long: -9.393571576412114 Heading: 223.88706959101006 Speed: 7.034167849606207
Boat: 2 Lat: 38.62422428489828 Long: -9.399639877056613 Heading: 207.2543028126406 Speed: 11.376024053701666
Boat: 3 Lat: 38.61423686152838 Long: -9.392520344048577 Heading: 217.42763167621567 Speed: 15.312520330442887
Boat: 4 Lat: 38.61666926252444 Long: -9.39128006428684 Heading: 211.78696794948402 Speed: 13.491019314688847
Boat: 5 Lat: 38.61983430044037 Long: -9.396947428236796 Heading: 232.69856194589846 Speed: 8.520267212357282
Boat: 6 Lat: 38.616819073939965 Long: -9.3898628391995 Heading: 215.58426681919323 Speed: 7.112649653352593
Boat: 7 Lat: 38.61392158819711 Long: -9.399630197157537 Heading: 233.08721225391804 Speed: 11.778369613226607
Boat: 8 Lat: 38.62266645817319 Long: -9.399381115933014 Heading: 213.00864031583083 Speed: 9.173314432056419
Boat: 9 Lat: 38.616459311010004 Long: -9.400566605961805 Heading: 225 Speed: 7.489743739816035
```

The race will continue for as long as you keep the app running. If you stop and restart the app, all sailing boats will reset back to their starting position in Portugal.

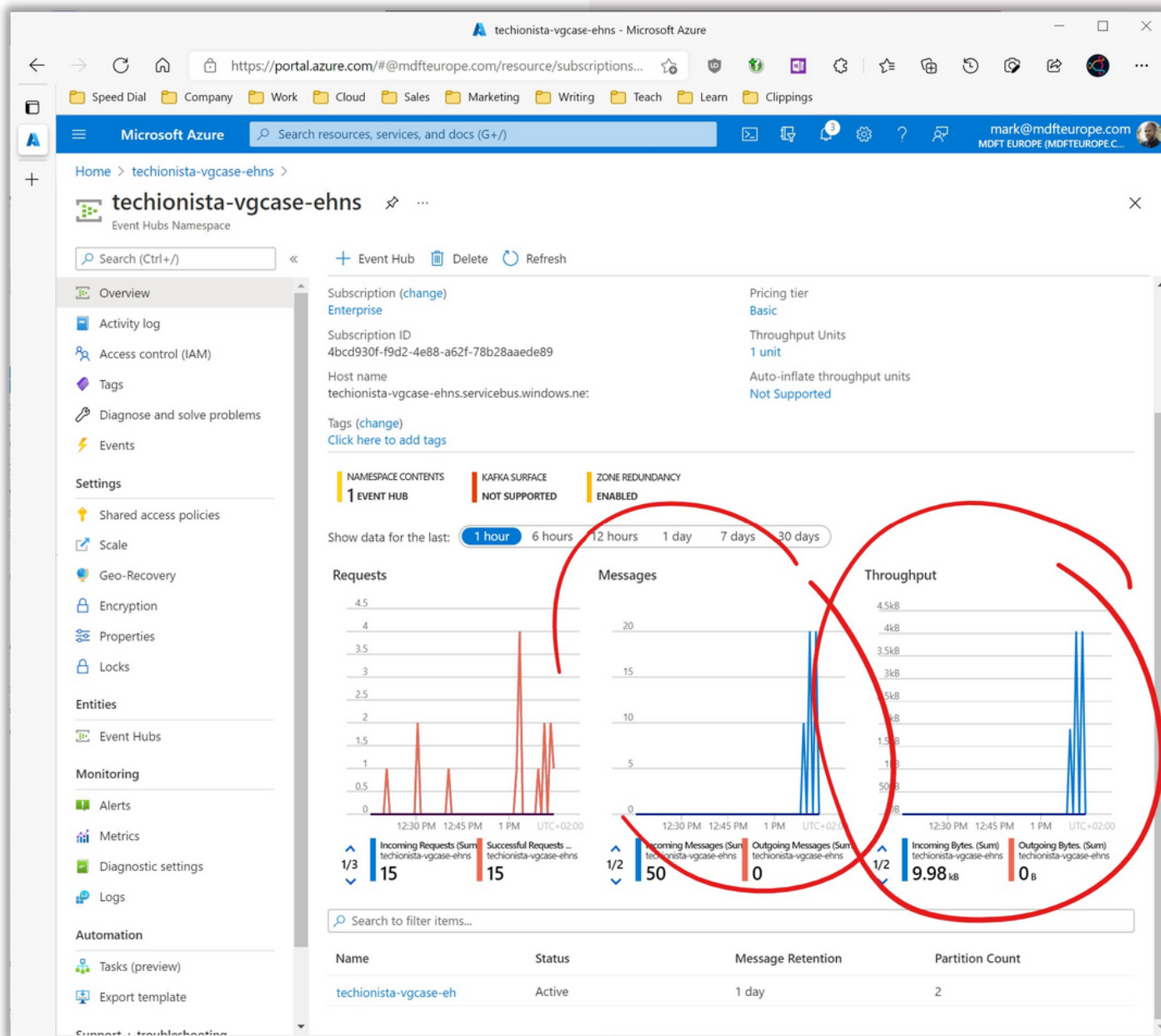


# Run the Python Sailing Simulator

## Getting Started with the Vendée Globe Business Case

### Step Eleven:

Keep the app running and check your Event Hub Namespace overview page. After approximately 5 minutes, the first data should appear in the monitoring graphs:



**Congratulations!** Your app is now working correctly and sending simulated race data to your Azure cloud.

# Next Steps

## Getting Started with the Vendée Globe Business Case

### Next Steps

To complete the business case, here's what you need to add:

- The remaining pieces of the Lambda Architecture: a Stream Analytics Job, an output to PowerBI, and a second output to a data storage service of your choice.
- A data storage service of your choice to store batch data: a Data Lake, a SQL Database, a Cosmos database, or a Synapse Analytics Workspace.
- A view or stored procedure or Synapse notebook to calculate the table of teams ranked by position in the race.
- A PowerBI dashboard that displays a world map with the current location of each racing team, and a table with the teams ranked by position in the race.

You will have completed the business case when your PowerBI dashboard correctly shows the position and ranking of each sailing team in the race.

### Challenges

During the business case, you will need to address several challenges:

- The Python app occasionally produces garbled data. How are you going to ensure that only clean data arrives in the PowerBI dashboard?
- How are you going to calculate the ranked list of sailing teams? How will you calculate who is ahead in the race?
- Which data service are you going to use for the batch-processing path in the Lambda Architecture?
- How will you present your data in the PowerBI dashboard?

There are multiple solutions for each challenge.