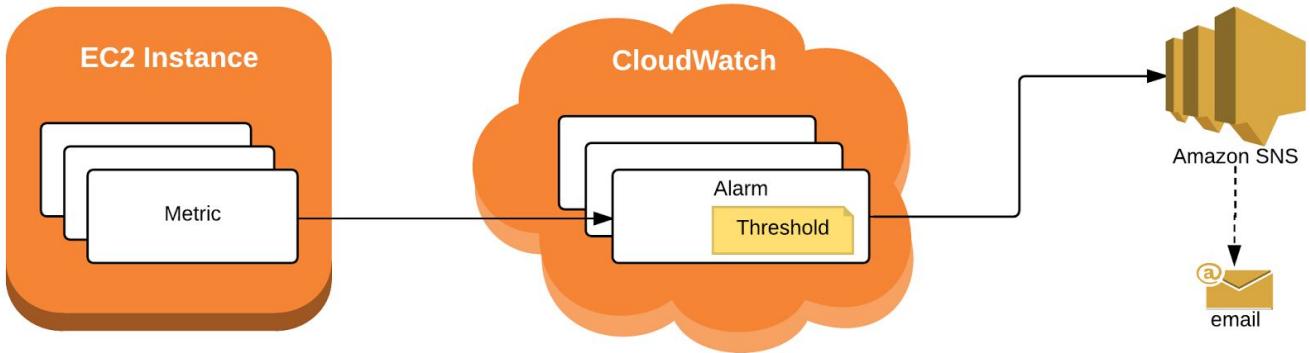


MODULE 6 – LAB EXERCISES

The lab exercises described below will help you to get practice in both Amazon CloudWatch and Amazon Simple Notification Service in performance monitoring and alarm alerting for your computing instances.

During the hands-on exercises we will use the scheme below as a reference model:



1. Create a new SNS Topic

A quite comfortable way for our case is to start our configuration "from the tail" therefore let begin at e-mail notification part.

Please open AWS Management Console and then navigate to SNS main page:

The screenshot shows the AWS SNS dashboard. On the left sidebar, the 'Topics' item is circled in red. The main content area is titled 'SNS dashboard' and contains several sections: 'Common actions' with icons for 'Create topic', 'Create platform application', 'Create subscription', and 'Publish message'; 'Resources' showing resource counts (Topic: 0, Subscriptions: 0, Applications: 0, Endpoints: 0) for the eu-central-1 region; and 'More info' with links to 'Getting started', 'Documentation', 'API reference', 'Forums', and 'Service health'. At the bottom, there are 'Feedback', 'English (US)', and copyright information.

 If nothing was created before in Amazon SNS under your account, you will see a welcome page with some brief explanations, just click on “Get started” button.

Click on “Topic” item on left-side menu (refer to previous screenshot) to open Topics page and then click on “Create new topic” button:

The screenshot shows the 'Topics' page. The left sidebar has 'Topics' selected. The top navigation bar includes 'Publish to topic', 'Create new topic' (which is highlighted with a red box), and 'Actions'. Below is a 'Filter' input field and a table with columns 'Name' and 'ARN'. The table is currently empty.

Specify the name and (optionally) displayed name for new topic, then click on “Create topic” button:

Create new topic

A topic name will be used to create a permanent unique identifier called an Amazon Resource Name (ARN).

Topic name: My_topic

Display name: Enter topic display name. Required for topics with SMS subscriptions.

Cancel Create topic

On the next page select your topic in the list then perform “Actions” → “Subscribe to topic” command from Topics top menu:

SNS dashboard

Topics

Applications

Subscriptions

Topics

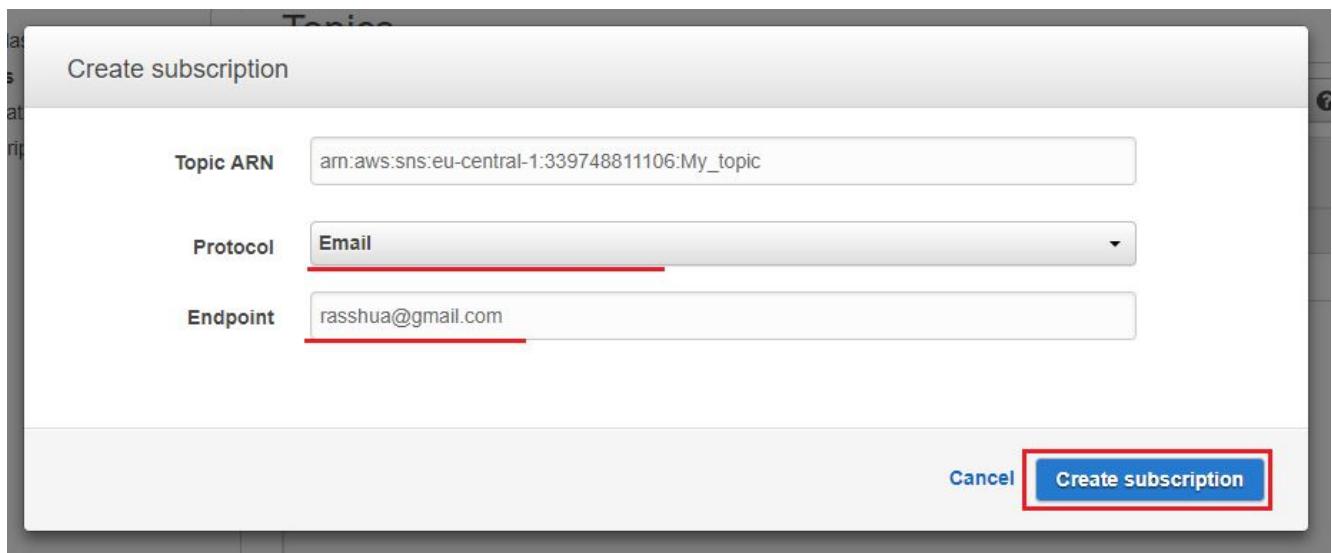
Topics

Actions ▾

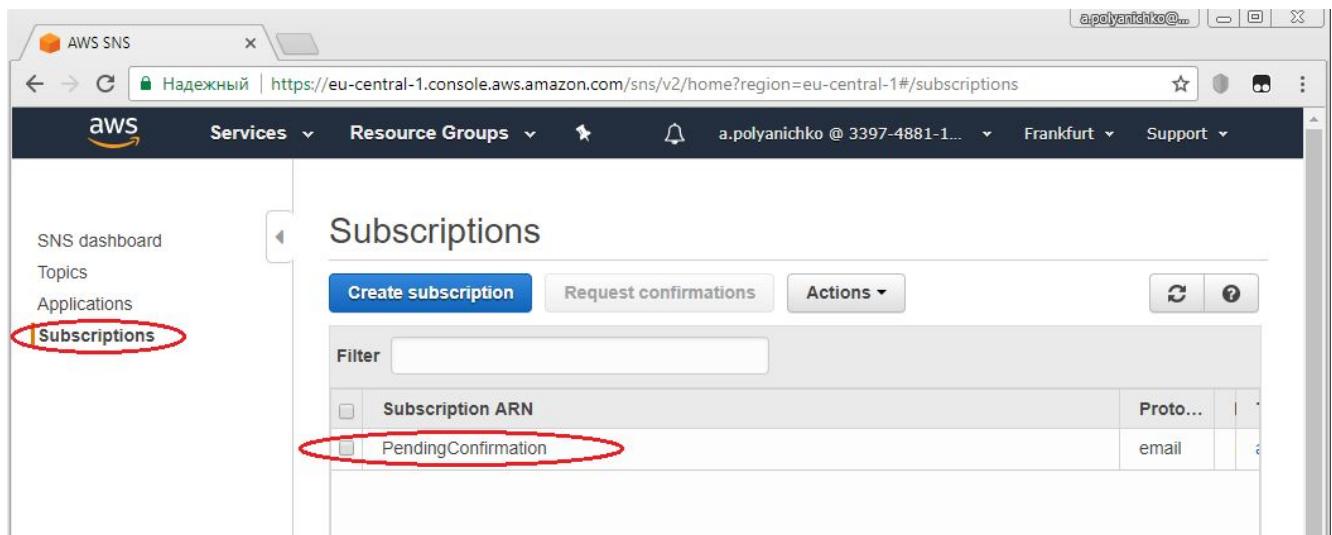
Subscribe to topic

Name	ARN
My_topic	arn:aws:sns:eu-central-1:33974881106:My_topic

Please select Email protocol and then type the valid e-mail address as endpoint for the subscription:



Click on “Create subscription” button and find your subscription on Subscriptions page as shown below:



At this stage the subscription is waiting for confirmation by e-mail. Please check the mailbox that you have put as endpoint, find the message from AWS Notifications and confirm using of e-mail address. After that your subscription is being active:

The screenshot shows the AWS SNS Subscriptions page. The left sidebar has 'Subscriptions' selected. The main area is titled 'Subscriptions' with buttons for 'Create subscription', 'Request confirmations', and 'Actions'. A table lists one subscription:

Subscription ARN	Protocol	Endpoint
arn:aws:sns:eu-central-1:339748811106:My_topic:4da7d584-4b66-4e28-a075-1f29da51d83b	email	a.polyanichko@...

To check that everything is ok with your SNS you may test your topic manually. Select desired topic in the list as shown below and click on “Publish to topic” button:

The screenshot shows the AWS SNS Topics page. The left sidebar has 'Topics' selected. The main area is titled 'Topics' with buttons for 'Publish to topic', 'Create new topic', and 'Actions'. A table lists one topic:

Name	ARN
My_topic	arn:aws:sns:eu-central-1:339748811106:My_topic

On the next page select “Raw” as message format, type a piece of text in Message textbox and finally click on “Publish message” button at the bottom:

The screenshot shows the AWS SNS 'Publish a message' interface. On the left, there's a sidebar with 'Topics' selected, showing 'arn:aws:sns:eu-central-1:339748811106:My_topic' as the Topic ARN. The main area has a heading 'Publish a message' and a sub-instruction: 'Amazon SNS enables you to publish notifications to all subscriptions associated with a topic as well as to an individual endpoint associated with a platform application.' Below this, there's a 'Topic ARN' input field containing the same ARN, and a 'Subject' input field which is empty. Under 'Message format', there are two radio buttons: 'Raw' (which is selected and highlighted with a red circle) and 'JSON'. In the 'Message' input field, the word 'Hello!' is typed. At the bottom right, there are 'Cancel' and 'Publish message' buttons, with the latter being highlighted by a red box.

You will receive the message on the address that you've specified in the subscription.

2. Starting CloudWatch monitoring on the existing EC2 Instance



In the exercise we will use Amazon Linux AMI on EC2 instance which was created in our previous practice. We assume that your EC2 instance exists and is in running state:

The screenshot shows the AWS Management Console EC2 Instances page. On the left sidebar, under the 'INSTANCES' section, the 'Instances' tab is selected. In the main content area, there is a table with one row. The row contains the following information:

Name	Instance ID	Instance Type	Availability Zone	Instance State
EC2 Test	i-0dae70a513b55bcae	t2.micro	eu-central-1b	running

A red arrow points to the 'Launch Instance' button at the top of the page, and another red arrow points to the 'running' status indicator for the instance.

Otherwise please create EC2 instance from scratch as was described in MODULE 3 Lab classwork.

On AWS Management Console please find and click on CloudWatch link:

On CloudWatch main page let start from Dashboard menu item:

Metric Summary

Amazon CloudWatch monitors operational and performance metrics for your AWS cloud resources and applications. You currently have 58 CloudWatch metrics available in the EU (Frankfurt) region.

Browse or search your metrics to get started graphing data and creating alarms.

Alarm Summary

Note: You may have AutoScaling alarms that are currently hidden.

You do not have any alarms created in the EU (Frankfurt) region. Alarms allow you to send

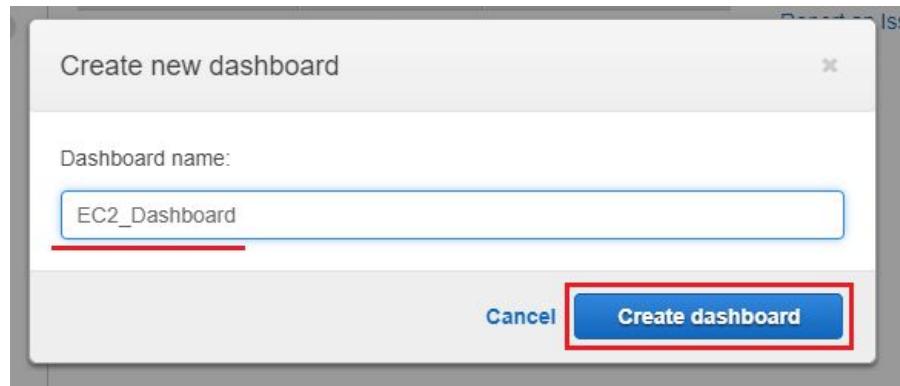
Please click on “Create dashboard” button on the next page:

Name	Favorite	Last updated (UTC)
My_Dashboard	☆	2017-12-07 06:55

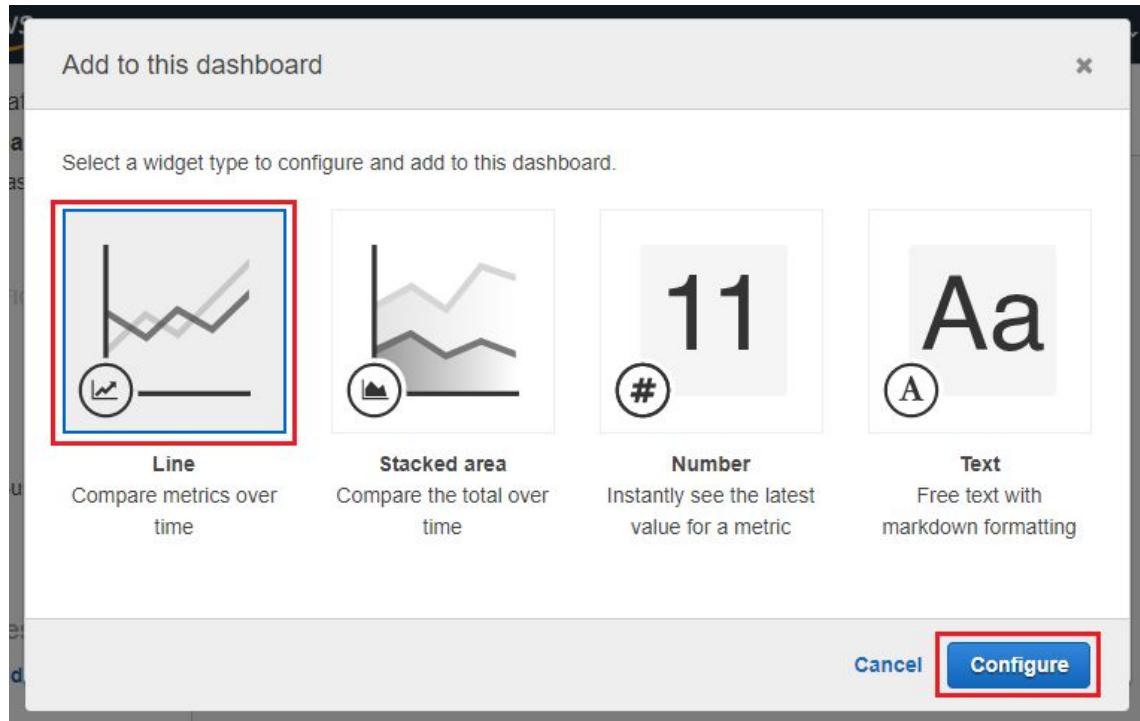


Frankly speaking, the creation of a dashboard is not mandatory for objectives of this exercise. We will pass this step because the dashboard is comfortable tool for metric observation and alarm configuration.

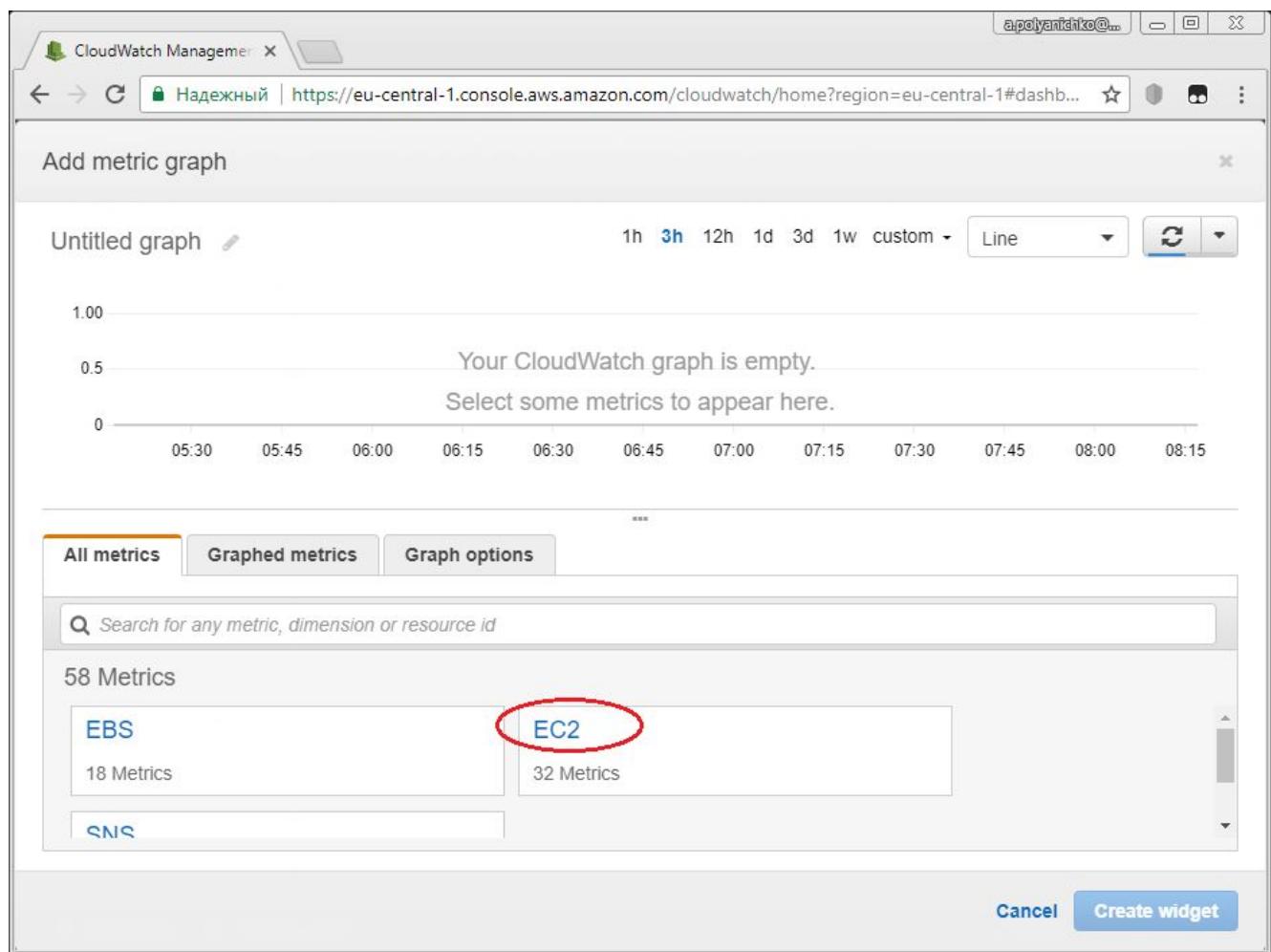
Specify the name for dashboard and then click on “Create dashboard” button below:



Select a type of widget which will be added on the dashboard and then click “Configure” button:

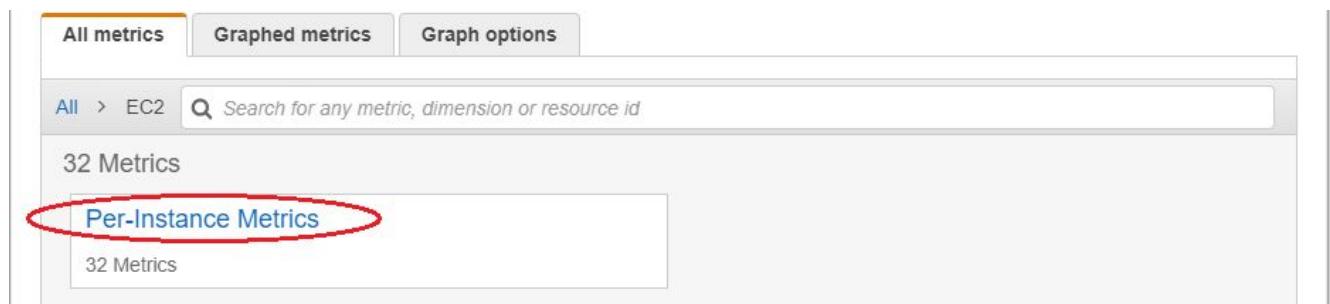


On the next page you must select the metric (-s) which will be displayed on the widget:

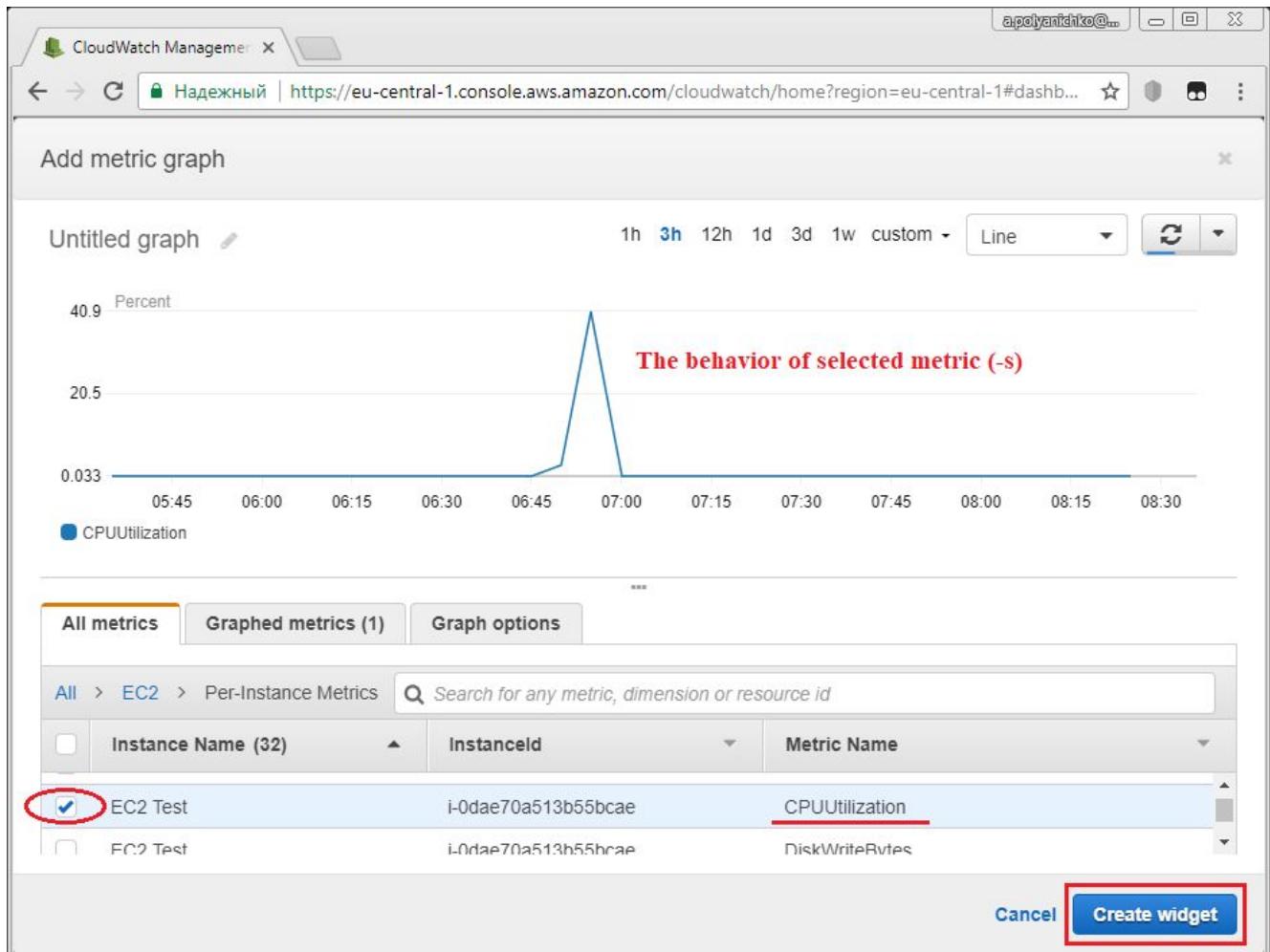


 We are using CPUUtilization metric from our active EC2 for training purpose.

Please click on “EC2” link (shown above) than on “Per-Instance Metric” link:



and find and select CPUUtilization metric for your desired EC2:



Finally click on “Create widget” button as shown above and ensure that your dashboard displays desired metric:

The screenshot shows the AWS CloudWatch Metrics Dashboard titled "EC2_Dashboard". On the left sidebar, under "Dashboards", the "EC2_Dashboard" is selected and highlighted with a red circle. The main area displays a line chart titled "CPUUtilization" in "Percent" over time from 06:00 to 08:30. The chart shows a sharp peak reaching approximately 40.9% at around 06:55. Below the chart, a red text overlay says "Drag the right-bottom corner to resize widget". At the bottom of the dashboard, there are links for "Feedback", "English (US)", "© 2008 - 2017, Amazon Web Services, Inc. or its affiliates. All rights reserved.", "Privacy Policy", and "Terms of Use".



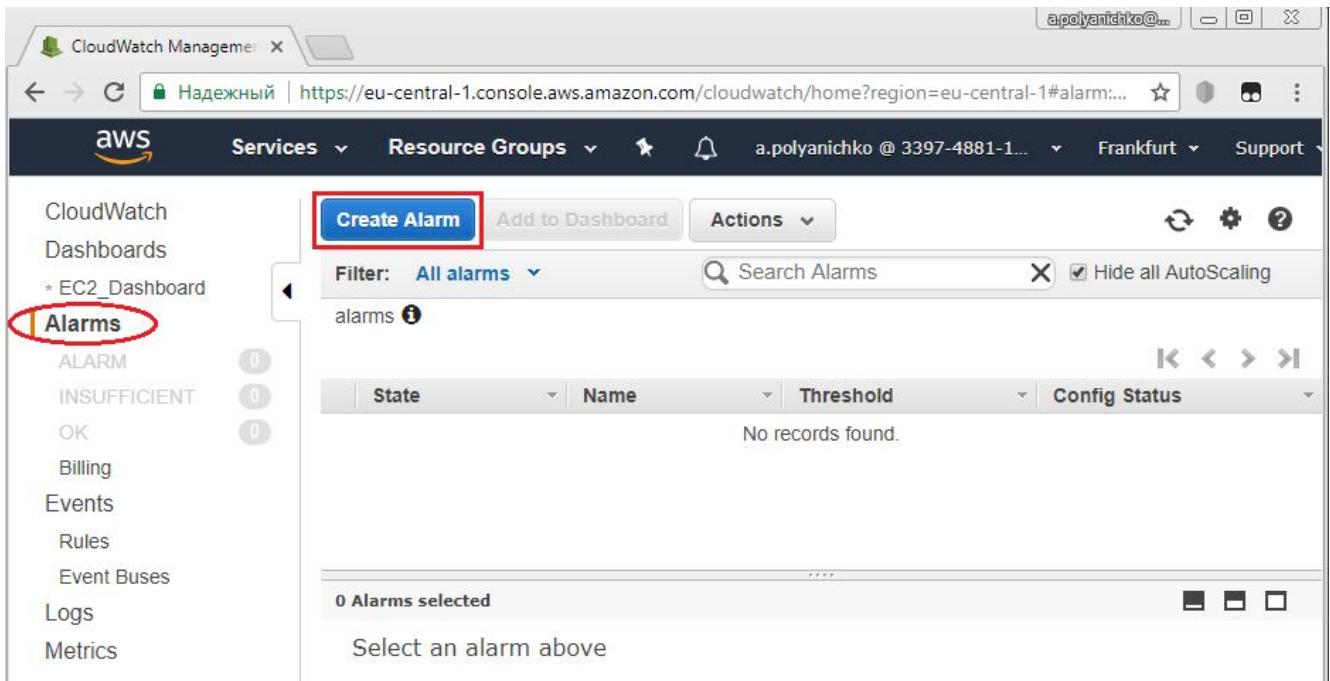
Please take in account that the time on X-Axis is displayed in UTC format by default.

So your dashboard is ready for use and now you may start to create alarm in CloudWatch.



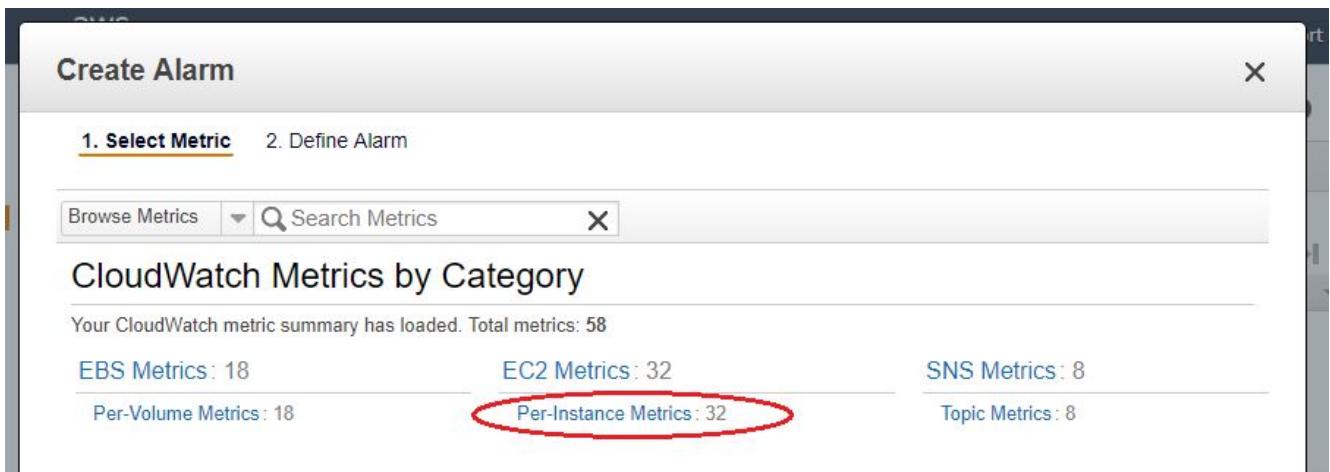
At this point please note average maximal value for CPU utilization using your dashboard and widget. CPU utilization in “idle” mode will be necessary when you will configure alarm threshold. In our testing lazy CPU utilization values were less than 5%.

Switch to “Alarm” item on the left-side menu and click on “Create alarm” button:



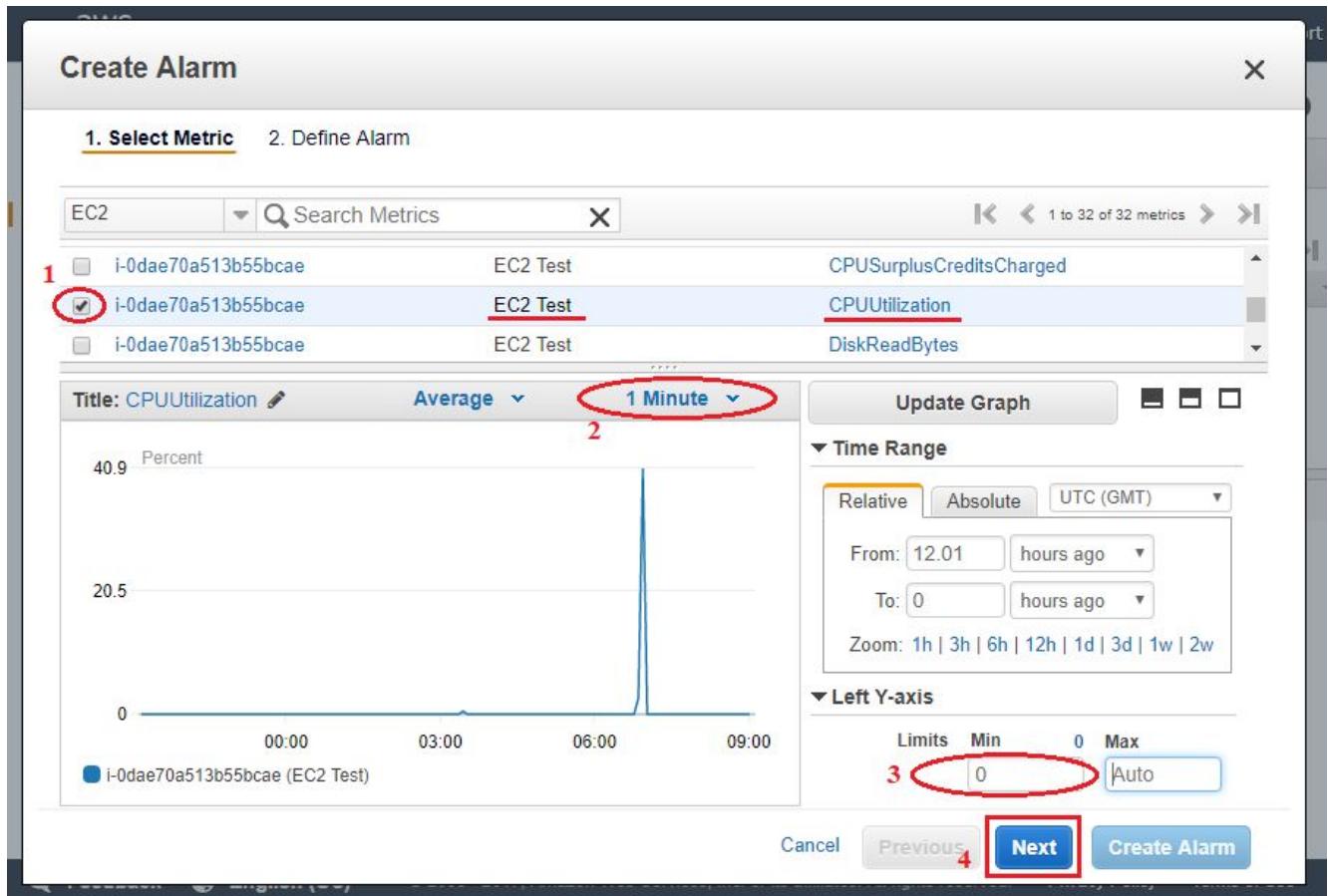
The screenshot shows the AWS CloudWatch Metrics console. On the left, there's a sidebar with various CloudWatch services: Dashboards, EC2_Dashboard, Alarms (which is selected and circled in red), ALARM, INSUFFICIENT, OK, Billing, Events, Rules, Event Buses, Logs, and Metrics. The main area has a 'Create Alarm' button at the top, which is also highlighted with a red box. Below it, there's a search bar and a table header with columns: State, Name, Threshold, and Config Status. A message says 'No records found.' At the bottom, it says '0 Alarms selected' and 'Select an alarm above'.

On the next page select desired metric group:



The screenshot shows the 'Create Alarm' wizard, step 1: Select Metric. It has two tabs: '1. Select Metric' (which is active) and '2. Define Alarm'. There's a search bar labeled 'Search Metrics'. Below it, there's a section titled 'CloudWatch Metrics by Category' with a summary: 'Your CloudWatch metric summary has loaded. Total metrics: 58'. It lists several categories with their counts: EBS Metrics: 18, EC2 Metrics: 32, SNS Metrics: 8, Per-Volume Metrics: 18, Per-Instance Metrics: 32 (which is circled in red), and Topic Metrics: 8.

then select desired metric (1), define measurement interval (2) and optionally minimal limit for Y-axis (3), and finally click on “Next” button (4):



On the next step you must specify alarm threshold (name and value) as shown in example below:

Create Alarm

1. Select Metric 2. Define Alarm

Alarm Threshold

Provide the details and threshold for your alarm. Use the graph on the right to help set the appropriate threshold.

Name: CPU Overload

Description:

Whenever: CPUUtilization

is: \geq 20

for: 1 out of 5 datapoints ⓘ

Additional settings

Provide additional configuration for your alarm.

Treat missing data as: missing ⓘ

And finally you specify consecutive actions for the alarm state as shown below:

The screenshot shows the 'Create Alarm' wizard at step 2, 'Define Alarm'. It displays two notification rules. Each rule has a red circle around the 'Whenever this alarm:' dropdown. The first rule is set to 'State is ALARM' and the second to 'State is OK'. Both rules have 'Send notification to:' set to 'My_topic' and 'Email list:' set to 'pol.andre456@gmail.com'. At the bottom, there are buttons for '+ Notification', '+ AutoScaling Action', and '+ EC2 Action'. The '+ Notification' button is highlighted with a red box. The 'Create Alarm' button is also highlighted with a red box.



You must set the name of your SNS topic which was created before as the target to send notifications to.



Use “+Notification” button to add one more notification to the list (by default there is only one string there).

Finally click on “Create alarm” button (shown above) to create and activate alarm and watch Alarm section:

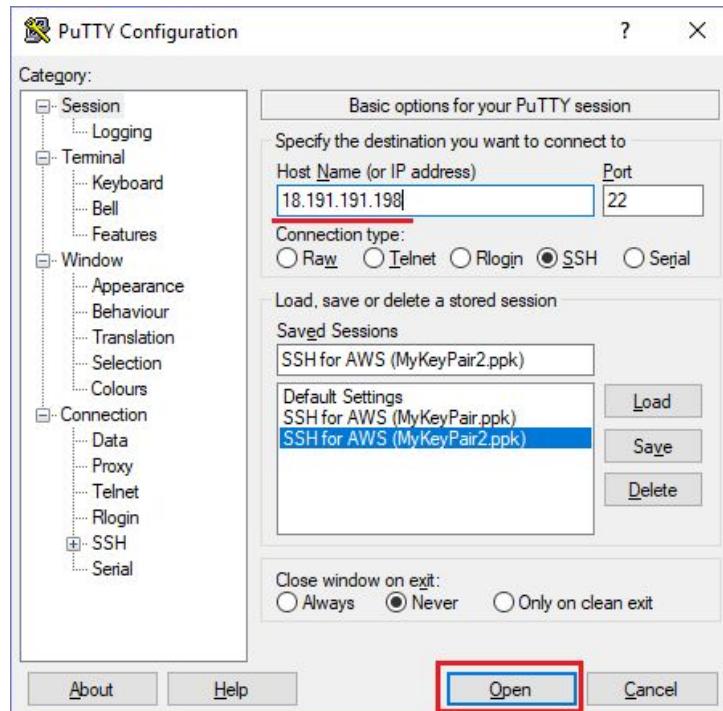
If everything is ok with your SNS topic, you will receive “OK” notification on e-mail address which was specified in SNS subscription.



“INSUFFICIENT” value may be displayed for your alarm as intermediate state in short time just after creation. It will not be notified on e-mail.

Now let increase the computing load for our EC2 by calculating the number "pi" with an accuracy greater than 1000 decimal places.

Connect to your EC2 instance from PuTTY via SSH using public IP address as was described in MODULE 3 hands-on exercises:



```
R1
login as: ec2-user
Authenticating with public key "imported-ssh-key"
Last login: Thu Dec  7 06:56:21 2017 from 31.13.22.89

      _\|_(_\|_) /  Amazon Linux AMI
      __|\_\_|__|_

https://aws.amazon.com/amazon-linux-ami/2017.09-release-notes/
No packages needed for security; 1 packages available
Run "sudo yum update" to apply all updates.
[ec2-user@ip-172-31-43-55 ~]$ 
[ec2-user@ip-172-31-43-55 ~]$ 
[ec2-user@ip-172-31-43-55 ~]$ 
```

and run the following command sequence:

\$>	[ec2-user@ip-172-31-43-55 ~]\$ bc -lq scale=1000 4*a(1)
-----	--

The output example is shown below:

```
[ec2-user@ip-172-31-43-55 ~]$  
[ec2-user@ip-172-31-43-55 ~]$  
[ec2-user@ip-172-31-43-55 ~]$ bc -lq  
scale=1000  
4*a(1)  
3.141592653589793238462643383279502884197169399375105820974944592307\  
81640628620899862803482534211706798214808651328230664709384460955058\  
22317253594081284811174502841027019385211055596446229489549303819644\  
28810975665933446128475648233786783165271201909145648566923460348610\  
45432664821339360726024914127372458700660631558817488152092096282925\  
40917153643678925903600113305305488204665213841469519415116094330572\  
70365759591953092186117381932611793105118548074462379962749567351885\  
75272489122793818301194912983367336244065664308602139494639522473719\  
07021798609437027705392171762931767523846748184676694051320005681271\  
45263560827785771342757789609173637178721468440901224953430146549585\  
37105079227968925892354201995611212902196086403441815981362977477130\  
99605187072113499999983729780499510597317328160963185950244594553469\  
08302642522308253344685035261931188171010003137838752886587533208381\  
42061717766914730359825349042875546873115956286388235378759375195778\  
18577805321712268066130019278766111959092164201988  
  
quit  
[ec2-user@ip-172-31-43-55 ~]$  
[ec2-user@ip-172-31-43-55 ~]$
```

Repeat the sequence of commands, replacing the value of Scale by 10000:

\$>	[ec2-user@ip-172-31-43-55 ~]\$ [ec2-user@ip-172-31-43-55 ~]\$ bc -lq scale=10000 4*a(1)
-----	--



The computing will take longer time comparing to previous example. You may interrupt the process by <Ctrl>+<C> combination.

After a few minutes you will receive ALARM notification on e-mail address and the status of alarm will be changed similar to example below:

The screenshot shows the AWS CloudWatch Metrics Alarms console. On the left sidebar, under the 'CloudWatch' section, the 'Alarms' item is selected and highlighted with a red box. A red circle with the number '1' is placed over the 'ALARM' category. In the main content area, there is one alarm listed: 'CPU Overload'. The alarm details show it is currently 'OK'. Below the alarm table, a message states '1 Alarm selected' and 'Alarm: CPU Overload'. The 'Details' tab is selected, showing state changes and a description. The description includes a threshold graph for CPU utilization. The graph shows a constant baseline at 20, with a sharp spike reaching above 50 around 10:00 on December 7, 2017. A red arrow points to the threshold line on the graph.



You may examine your dashboard to see exactly values of CPU utilization in the time

If you will be doing nothing during a few minutes and, of course, computing in EC2 was completed or interrupted, shortly you will receive OK notification on e-mail address and the status of alarm will be changed back to "green" state:

The screenshot shows the AWS CloudWatch Metrics console interface. On the left sidebar, under the 'CloudWatch' section, the 'Alarms' item is selected and highlighted with a red box. A red arrow points from this box to the 'OK' status entry in the main list. The main area displays a single alarm named 'CPU Overload' with the following details:

State	Name	Threshold
OK	CPU Overload	CPUUtilization >= 20 for 1 datapoints within 5 minutes

Below the table, it says '1 Alarm selected' and shows the alarm name 'Alarm:CPU Overload'. The 'Details' tab is active, displaying the following information:

State Details: State changed to OK at 2017/12/07. Reason: Threshold Crossed: 1 out of the last 5 datapoints [0.033333333333303 (07/12/17 10:02:00)] was not greater than or equal to the threshold (20.0) (minimum 5 datapoints for ALARM -> OK transition).

Description: Threshold: CPUUtilization >= 20 for 1

To the right, a graph titled 'CPU Overload' shows CPUUtilization over time. A red horizontal line at 20 represents the threshold. A blue line shows the actual metric value, which remains below the threshold until approximately 10:00, where it spikes sharply above 20.