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Prometheus Monitoring : The Definitive Guide

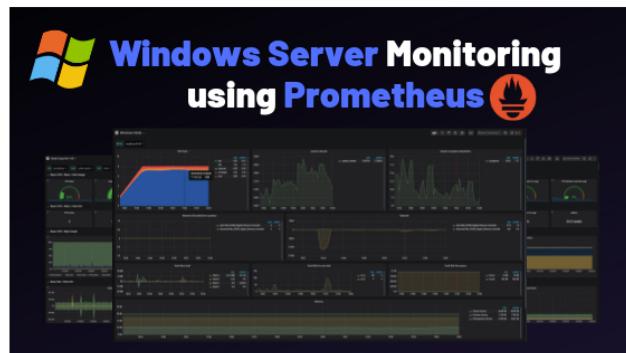
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Grafana • Monitoring • Prometheus

Windows Server Monitoring using Prometheus and WMI Exporter

written by Schkn


 Opsgenie

Notify the right people at the right time and never miss a critical alert

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If you are a **Windows system administrator**, or a **site reliability engineer**, you spend a lot of time monitoring your Windows servers.

Sometimes, your servers are down, but you can't know why easily.

Is it because of a **high CPU usage** on one of the processes?

Is the server having some **memory issues**? Is the **RAM** used too much on my Windows server?

Today, after understanding how to do [Linux system monitoring](#), we are taking a look at how to configure your Windows Server monitoring properly.



For this tutorial, we are going to use **Prometheus**, a modern time series database and monitoring platform.

If you are not familiar with [Prometheus monitoring](#), you can have a look at one of the guides we crafted for you.

Ready to monitor your Windows servers?

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 - 5.548. bb - Adding a file group
 - 5.549. cc - Configuring the file group
 - 5.550. dd - Adding a file group
 - 5.551. ee - Configuring the file group
 - 5.552. ff - Adding a file group
 - 5.553. gg - Configuring the file group
 - 5.554. hh - Adding a file group
 - 5.555. ii - Configuring the file group
 - 5.556. jj - Adding a file group
 - 5.557. kk - Configuring the file group
 - 5.558. ll - Adding a file group
 - 5.559. mm -

I – What You Will Learn

If you follow this tutorial until the end, here are the key concepts you are going to learn about.

- How to **install and configure Prometheus** on your Linux servers;
- How to **download and install the WMI exporter** for Windows servers;
- How to bind Prometheus to your WMI exporter;
- How to **build an awesome Grafana dashboard** to visualize your metrics.

Quite a long program, let's jump into it.

II – Windows Server Monitoring Architecture

Before installing the WMI exporter, let's have a quick look at what our final architecture looks like.



ezoic report th



As a reminder, Prometheus is constantly scraping **targets**.

Targets are nodes that are exposing metrics on a given URL, accessible by Prometheus.

Such targets are equipped with "**exporters**" : exporters are binaries running on a target and responsible for getting and aggregating metrics about the host itself.

If you were to monitor a Linux system, you would run a "**Node Exporter**", that would be responsible for gathering metrics about the CPU usage or the disk I/O currently in use.

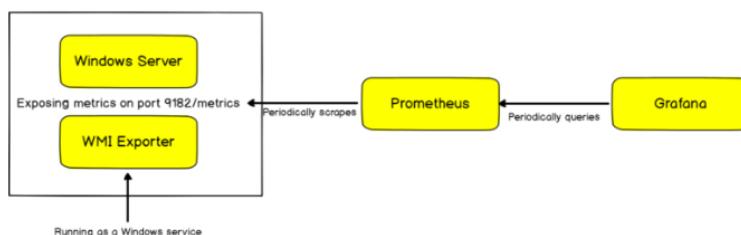


For Windows hosts, you are going to use the **WMI exporter**.

The WMI exporter will run as a Windows service and it will be responsible for gathering metrics about your system.

In short, here is the final architecture that you are going to build.

Windows Server Monitoring Architecture



III – Installing Prometheus

The complete [Prometheus installation for Linux](#) was already covered in one of our previous article.

Make sure to read it extensively to have your Prometheus instance up and running.

To verify it, head over to <http://localhost:9090> (9090 being the default Prometheus port).

You should see a Web Interface similar to this one.

If this is the case, it means that your Prometheus installation was successful.

Prometheus Time Series Collection and Processing Server - Mozilla Firefox

Prometheus Time Series × +

https://localhost:1234/graph

Prometheus Alerts Graph Status Help

Enable query history

Expression (press Shift+Enter for newlines)

Execute - insert metric at cursor -

Graph Console

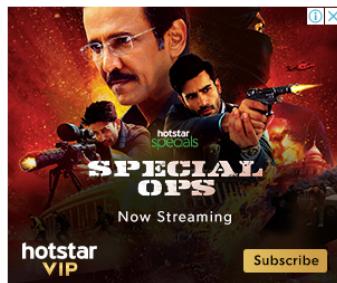
Moment

Element	Value
no data	

Remove Graph

Add Graph

Great!



Now that your Prometheus is running, let's install the WMI exporter on your Windows Server.

IV – Installing the WMI Exporter

The WMI exporter is an awesome exporter for Windows Servers.

It will export metrics such as the **CPU usage, the memory and the disk I/O usage**.

The WMI exporter can also be used to monitor IIS sites and applications, the network interfaces, the services and even the local temperature!

If you want a complete look of everything that the WMI exporter offers, have a look at [all the collectors available](#).

In order to install the WMI exporter, head over to the [WMI releases page](#) on GitHub.

a – Downloading the WMI Exporter MSI

As of August 2019, the latest version of the WMI exporter is 0.8.1.

Latest release

v0.8.1

carlpett released this 18 days ago · 12 commits to master since this release

Verified

Bug fixes

- Fix resource leak leading to slow increase in memory usage over time ([#376](#))

Assets

sha256sums.txt	396 Bytes
wmi_exporter-0.8.1-386.exe	12.7 MB

wmi_exporter-0.8.1-386.msi	6.78 MB
wmi_exporter-0.8.1-amd64.exe	14.2 MB
wmi_exporter-0.8.1-amd64.msi	7.01 MB
Source code (zip)	
Source code (tar.gz)	

On the releases page, download the MSI file corresponding to your CPU architecture.

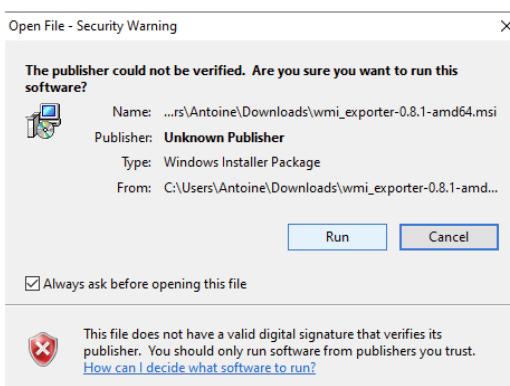


In my case, I am going to download the [wmi_exporter-0.8.1-amd64.msi](#) file.

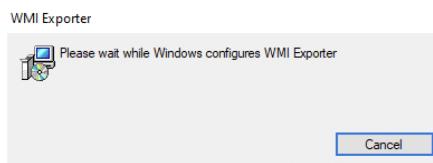
b – Running the WMI installer

When the download is done, simply click on the MSI file and start running the installer.

This is what you should see on your screen.



Windows should now start configuring your WMI exporter.



You should be prompted with a firewall exception. Make sure to accept it for the WMI exporter to run properly.



The MSI installation should exit without any confirmation box. However, the WMI exporter should now run as a **Windows service on your host**.

To verify it, head over to the **Services panel** of Windows (by typing Services in the Windows search menu).

In the Services panel, search for the "**WMI exporter**" entry in the list. Make sure that your service is running properly.

Name	Description	Status	Startup Type	Log On As
Windows Module...	Enables installation, modification, and removal of...	Running	Manual	Local System
Windows Percepti...	Enables spatial perception, spatial input, and holo...	Running	Manual (Trig...	Local Service
Windows Percepti...	Enables spatial perception simulation, virtual cam...	Running	Manual	Local System

Description: Exports Prometheus metrics from WMI queries	Windows Present... Windows Push N... Windows Push N... Windows PushToL... Windows Remote ... Windows Search Windows Security... Windows Time Windows Update Windows Update ... WinHTTP Web Pr... Wired AutoConfig WLAN AutoConfig WMI exporter WMI Performance...	Optimizes performance of Windows Presentation... This service runs in session 0 and hosts the notific... This service hosts Windows notification platform ... Provides infrastructure support for Microsoft ... Windows Remote Management (WinRM) service ... Provides content indexing, property caching, and... Windows Security Service handles unified device ... Maintains date and time synchronization on all cl... Enables the detection, download, and installation... Enables remediation and protection of Windows ... WinHTTP implements the client HTTP stack and p... The Wired AutoConfig (DOTSVC) service is respons... The WLMNSVC service provides the logic required... Exports Prometheus metrics from WMI queries Provides performance library information from W...	Manual Running Running Manual (Trig... Manual Running Automatic (D... Manual Running Manual (Trig... Manual Manual Manual Manual Manual Manual Running Automatic Manual	Local Service Local System Local System Local System Network Service Local System Local System Local Service Local System Local System Local System Local System Local System Local System Local System Local System
--	---	---	---	---

c – Observing Windows Server metrics

Now that your exporter is running, it should start exposing metrics on <http://localhost:9182/metrics>

Open your web browser and navigate to the WMI exporter URL. This is what you should see in your web browser.



Some metrics are very general and exported by all the exporters, but some of the metrics are very specific to your Windows host (like the `wmi_cpu_core_frequency_mhz` metric for example)

```
← → ⌂ ⓘ localhost:9182/metrics

# HELP go_gc_duration_seconds A summary of the GC invocation durations.
# TYPE go_gc_duration_seconds summary
go_gc_duration_seconds{quantile="0"} 0
go_gc_duration_seconds{quantile="0.25"} 0
go_gc_duration_seconds{quantile="0.5"} 0
go_gc_duration_seconds{quantile="0.75"} 0
go_gc_duration_seconds{quantile="1"} 0.0009755
go_gc_duration_seconds_sum 0.0009755
go_gc_duration_seconds_count 21
# HELP go_goroutines Number of goroutines that currently exist.
# TYPE go_goroutines gauge
go_goroutines 12
# HELP go_memstats_alloc_bytes Number of bytes allocated and still in use.
# TYPE go_memstats_alloc_bytes gauge
go_memstats_alloc_bytes 2.46544e+06
# HELP go_memstats_alloc_bytes_total Total number of bytes allocated, even if freed.
# TYPE go_memstats_alloc_bytes_total counter
go_memstats_alloc_bytes_total 5.436184e+07
# HELP go_memstats_buck_hash_sys_bytes Number of bytes used by the profiling bucket hash table.
# TYPE go_memstats_buck_hash_sys_bytes gauge
go_memstats_buck_hash_sys_bytes 1.454435e+06
# HELP go_memstats_frees_total Total number of frees.
# TYPE go_memstats_frees_total counter
```

Great!

Windows Server monitoring is now active using the WMI exporter.

If you remember correctly, Prometheus scrapes targets.

As a consequence, we have to configure our Windows Server as a Prometheus target.



This is done in Prometheus configuration file.

d – Binding Prometheus to the WMI exporter

As you probably saw from your web browser request, the WMI exporter exports a lot of metrics.

As a consequence, there is a chance that the scrape request times out when trying to get the metrics.

This is why we are going to set a high scrape timeout in our configuration file.

If you want to keep a low scrape timeout, make sure to configure the WMI exporter to export less metrics (by specifying just a few collectors for example).



Head over to your configuration file (mine is located at `/etc/prometheus/prometheus.yml`) and edit the following changes to your file.

```
scrape_configs:
  # The job name is added as a label `job=<job_name>` to any timeseries scraped from
  # this config.
  - job_name: 'prometheus'

    # Careful, the scrape timeout has to be lower than the scrape interval.
    scrape_interval: 6s
    scrape_timeout: 5s
    static_configs:
      - targets: ['localhost:9090', 'localhost:9216']
```

Save your file, and restart your Prometheus service.

```
$ sudo systemctl restart prometheus
$ sudo systemctl status prometheus
```

Head back to the Prometheus UI, and select the "Targets" tab to make sure that Prometheus is correctly connected to the WMI exporter.

The screenshot shows the Prometheus UI with the "Targets" tab selected. There is one target listed: "prometheus (1/1 up)". The table details the target's state as "UP" and its labels as "instance='localhost:9182'" and "job='prometheus'".

Endpoint	State	Labels	Last Scrape	Scrape Duration	Error
http://localhost:9182/metrics	UP	instance="localhost:9182" job="prometheus"	4.785s ago	0.215s	

If you are getting the following error, "context deadline exceeded", make sure that the scrape timeout is set in your configuration file.

Great! Our Windows Server monitoring is almost ready.

Now it is time for us to start building an awesome Grafana dashboard to monitor our Windows Server.

V – Building an Awesome Grafana Dashboard

The [Prometheus & Grafana installation](#) was already covered in our previous guides. Make sure to configure your Grafana properly before moving to the next section.



If you are looking to [install Grafana](#) on Windows, here is another guide for it.

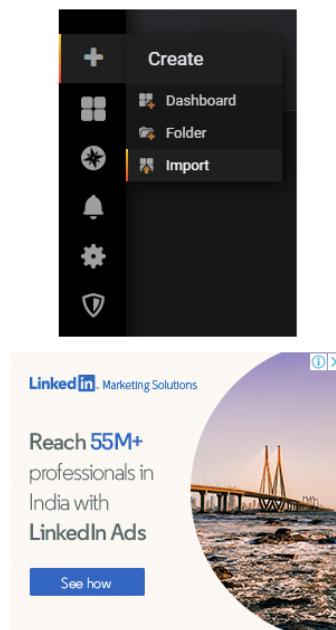
Prometheus should be configured as a Grafana target, and accessible through your reverse proxy.

a – Importing a Grafana dashboard

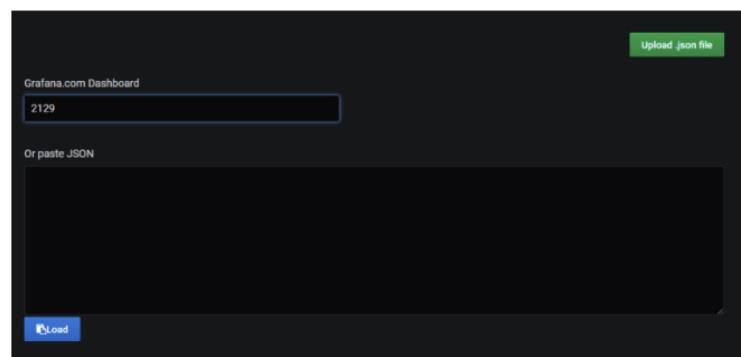
In Grafana, you can either create your own dashboards or you can use pre-existing ones that contributors already crafted for you.

In our case, we are going to use the [Windows Node](#) dashboard, accessible via the **2129 ID**.

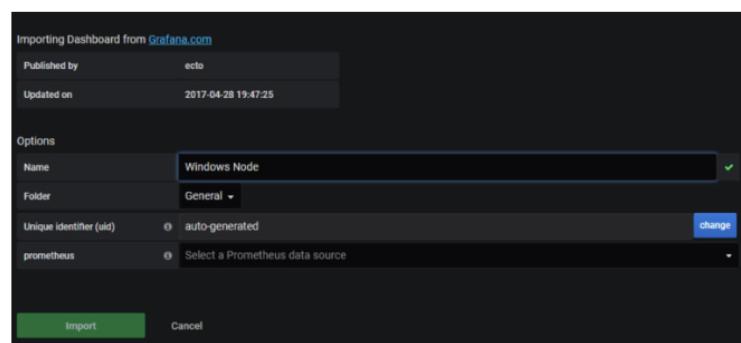
Head over to the main page of Grafana (located at <http://localhost:3000> by default), and click on the **Import option in the left menu**.



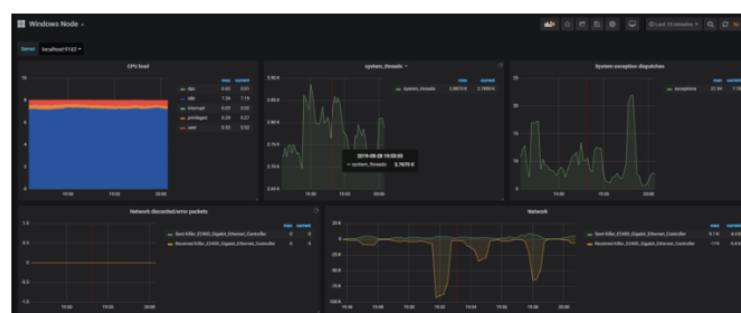
In the next window, simply insert the dashboard ID in the corresponding text field.



From there, Grafana should **automatically detect your dashboard as the Windows Node dashboard**. This is what you should see.



Select your Prometheus datasource in the "Prometheus" dropdown, and click on "Import" for the dashboard to be imported.

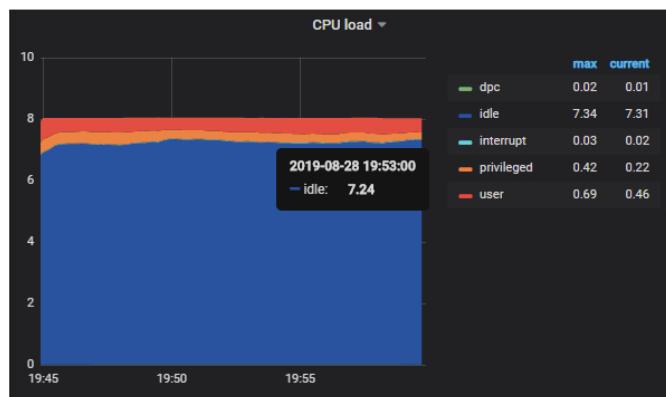


Awesome!

An entire dashboard displaying **Windows metrics** was created for us in just one click.

As you can see, the dashboard is pretty exhaustive.

You can monitor the **current CPU load**, but also the **number of threads** created by the system, and even the number of system exceptions dispatched.



On the second line, you have access to metrics related to the network monitoring. You can for example have a look at the number of packets sent versus the number of packets received by your network card.

It can be useful to track anomalies on your network, in case of TCP flood attacks on your servers for example.



On the third line, you have metrics related to the disk I/O usage on your computer.

Those metrics can be very useful when you are trying to debug applications (for example ASP.NET applications). Using those metrics, you are able to see if your application consume too much memory or too much disk.



Finally, one of the greatest panels has to be the memory monitoring. RAM has a very big influence on the overall system performance.



As a consequence, it has to be monitored properly, and this is exactly what the fourth line of the dashboard does.



That's an awesome dashboard, but what if we want to be alerted whenever the CPU usage is too high for example?

wouldn't it be useful for our DevOps teams to know about it in order to see what's causing the outage on the machine?

This is what we are going to do in the next section.

VI – Raising alerts in Grafana on high CPU usage

As discussed in the previous section, you want alerts to be raised when the CPU usage is too high.

Grafana is equipped with an alerting system, meaning that whenever a panel raises an alert it will propagate the alert to “**notification channels**”.

Notification channels are Slack, your internal mailing system of PagerDuty for example.

In this case, we are going to use **Slack** as it is a pretty common team productivity tool used in companies.

a – Creating a Slack webhook

For those who are not familiar with Slack, you can create webhooks which are essentially addresses for external sources to reach Slack.



As a consequence, Grafana is going to post the alert to the Webhook address, and it will be displayed in your Slack channel.

To create a Slack webhook, head over to your [Slack apps page](#).

A screenshot of the Slack 'Your Apps' page. The page has a header with 'Your Apps' and a 'Create New App' button. Below is a search bar with placeholder text 'Filter apps by name or workspace'. A table lists one app: 'devconnected' (App Name), 'devconnected' (Workspace), and 'Not distributed' (Distribution Status). At the bottom, there is a message: 'Don't see an app you're looking for? Sign in to another workspace.'

Click on the name of your app (“devconnected” here). On the left menu, click on “Incoming Webhooks”.

A screenshot of the Slack app settings for 'devconnected'. The top navigation shows the app icon and name. The 'Basic Information' tab is selected. Below it are sections for 'Features' (with 'Incoming Webhooks' highlighted in blue) and 'Slack'. The 'Incoming Webhooks' section contains links for 'Interactive Components', 'Slash Commands', 'OAuth & Permissions', 'Event Subscriptions', 'Bot Users', and 'User ID Translation'. The 'Slack' section contains links for 'Slack ❤️', 'Help', and 'Contact'.

On the next page, simply click on "Add New Webhook to Workspace".

Webhook URLs for Your Workspace

To dispatch messages with your webhook URL, send your message in JSON as the body of an `application/json` POST request.

Add this webhook to your workspace below to activate this curl example.

Sample curl request to post to a channel:

```
curl -X POST -H 'Content-type: application/json' --data '{"text":"Hello, World!"}'  
https://hooks.slack.com/services/TJ5EWB8LD/B35EYTwCV/SivNmcmBjbquDcM74ywX7eA
```

[Copy](#)

Webhook URL	Channel	Added By
https://hooks.slack.com/services/TJ5EWB8LD/B35EYTwCV/SivNmcmBjbquDcM74ywX7eA	#devconnecteds-blog	solnichkin.antoine Apr 24, 2019
Add New Webhook to Workspace		



ezoic

report it



ezoic

report it

On the next screen, choose where you want your alert messages to be sent. In this case, I will choose the main channel of my Slack account.



Dans l'équipe devconnected, devconnected
voudrait :

Confirmer votre identité sur devconnected

Publier dans [#devconnecteds-blog](#)

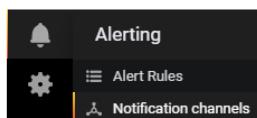
[Annuler](#) [Permettre](#)

Click on "Allow". From there, your Slack Webhook URL should be created.

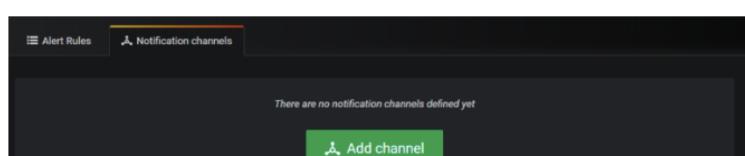
Webhook URL	Channel	Added By
https://117E/5KNLJokOnezdj3w756E	#devconnecteds-blog	solnichkin.antoine Aug 28, 2019

b – Set Slack as a Grafana notification channel

Copy the Webhook URL and head over to the Notifications Channels window of Grafana. This option is located in the left menu.



Click on the option, and you should be redirected to the following window.



A screenshot of the Grafana alert configuration interface. At the top, there's a ProTip message: "ProTip: You can include images in your alert notifications. [Learn more](#)". Below it, a section says "Click on ‘Add channel’". The main area shows a "New Notification Channel" configuration for a "Slack notification". It includes fields for "Name" (Slack notification), "Type" (Slack), and several toggle switches for "Default (send on all alerts)", "Include image", "Disable Resolve Message", and "Send reminders". Below this is a "Slack settings" section with fields for "Url" (https://hooks.slack.com/services/TJ5EWB8LD/B...), "Recipient", "Username" (Grafana), and "Token". At the bottom are "Save", "Send Test", and "Back" buttons.

Click on “Add channel”. You should be redirected to the notification channel configuration page.

Copy the following configuration, and change the webhook URL with the one you were provided with in the last step.

The "Slack settings" section of the notification channel configuration. It contains the following fields:

Url	https://hooks.slack.com/services/TJ5EWB8LD/B...
Recipient	
Username	Grafana
Icon emoji	
Icon URL	
Mention	
Token	

At the bottom are three buttons: "Save" (green), "Send Test" (blue), and "Back" (grey).

When your configuration is done, simply click on “Send Test” to send a test notification to your Slack channel.



Great! Your notification channel is working properly.

Let's create a PromQL query to monitor our CPU usage.

c – Building a PromQL query

If you are not familiar with PromQL, there is a section dedicated to this language in my [Prometheus monitoring tutorial](#).

When talking a look at our [CPU usage panel](#), this is the PromQL query used to display the CPU graph.

A screenshot of the Grafana Metrics panel. The query is:

```
Metrics sum by (mode) (rate(wmi_cpu_time_total{instance=~"$server"}[5m]))
```

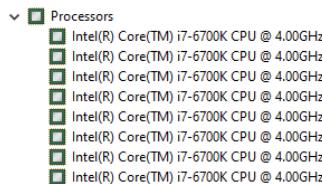
The panel includes a "Legend" section with a dropdown for "({mode})", "Min step" and "Resolution" both set to "1/1", and a "Format" dropdown set to "Time series". There are also "Instant" and "Prometheus" buttons.

Please note that the results will be the mode with the longest duration. Then the average.

First, the query splits the results by the mode (idle, user, interrupt, etc, privileged). Then, the query computes the average CPU usage for a five minutes period, for every single mode.

In the end, the modes are displayed with aggregated sums.

In my case, my CPU has 8 cores, so the overall usage sums up to 8 in the graph.



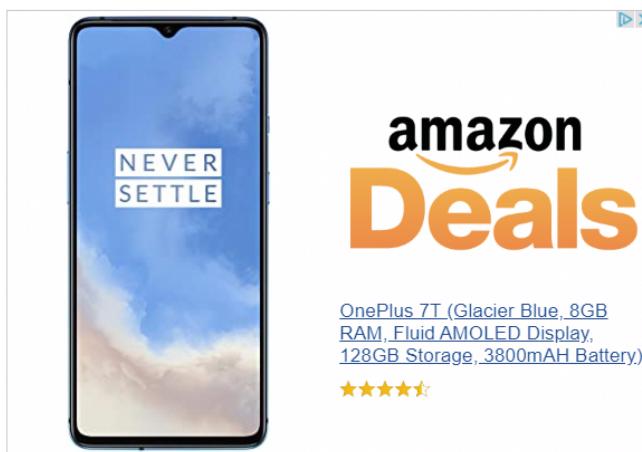
If I want to be notified when my CPU usage peaks at 50%, you essentially want to trigger an alert when the idle state goes below 4 (as 4 cores are going to be fully used).

To monitor our CPU usage, we are going to use this query

```
sum by (mode) (rate(wmi_cpu_time_total{instance=~"localhost:9182", mode="idle"})[5m])
```

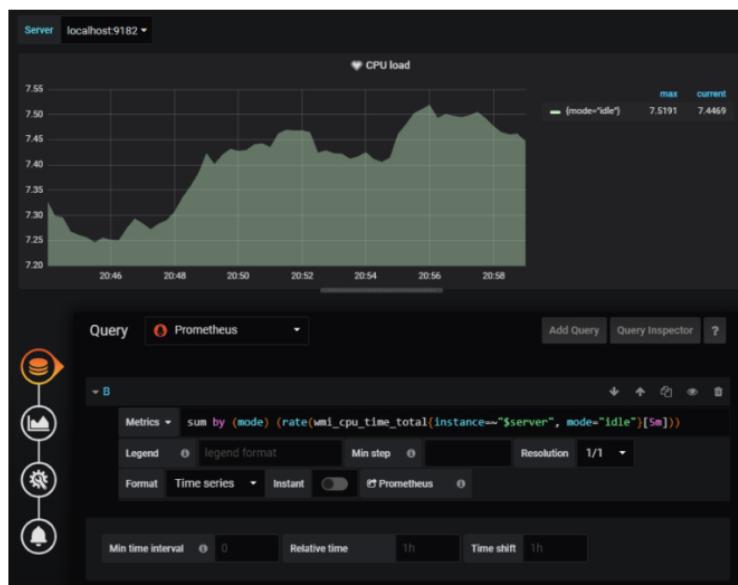
I am not using a template variable here for the instance as they are not supported by Grafana for the moment.

This query is very similar to the one already implemented in the panel, but it specifies that we specifically want to target the "idle" mode of our CPU.



Replace the existing query with the query we just wrote.

This is what you should now have in your dashboard.



Now that your query is all set, let's build an alert for it.

d – Creating a Grafana alert

In order to create a Grafana alert, click on the bell icon located right under the query panel.



In the rule panel, you are going to configure the following alert.

Every 10 seconds, Grafana will check if the average CPU usage for the last 10 seconds was below 4 (i.e. using more than 50% of our CPU).

If it is the case, an alert will be sent to Slack, otherwise nothing happens.

Finally, right below this rule panel, you are going to configure the Slack notification channel.

Now let's try to bump the CPU usage on our instance.



As the CPU usage goes below the 4 threshold, it should set the panel state to "Alerting" (or "Pending" if you specified a "For" option that is too long).

From there, you should receive an alert in Slack.



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Grafana v6.3.3 | Aujourd'hui à 23 h 12

As you can see, there is even an indication of the CPU usage (73% in this case).

Great! Now our DevOps is aware that there is an issue on this server and they can investigate on what's happening exactly.

VII – Conclusion

As you can see, monitoring Windows servers can easily be done using Prometheus and Grafana.

With this tutorial, you had a quick overview of what's possible with the WMI exporter. So what's next?

From there, you can create your own visualizations, your own dashboards and your own alerts.

Our monitoring section contains a lot of examples of what's possible and you can definitely take some inspiration from some of the dashboards.

On the same subject, make sure to check our Windows services monitoring using Telegraf and InfluxDB.

Until then, have fun, as always.

[EXPORTER](#) [PROMETHEUS](#) [PROMETHEUS MONITORING](#) [WINDOWS](#) [WINDOWS MONITORING](#)

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