

# CPU Performance Comparison Report

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## Overview

This report analyzes CPU performance across four different environments:

- 1. **Cloud t2.micro No Credits**
- 2. **Cloud t2.micro with Credits**
- 3. **Virtual Machine**
- 4. **Physical Machine**

Each test measured CPU computation times from the file results:

- `cpu_results_no_credits.txt`
- `cpu_results_with_credits.txt`
- `cpu_results_VM.txt`
- `cpu_results.txt`

The data represents time in **seconds** vs. computation step.

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## 1. Experimental Setup

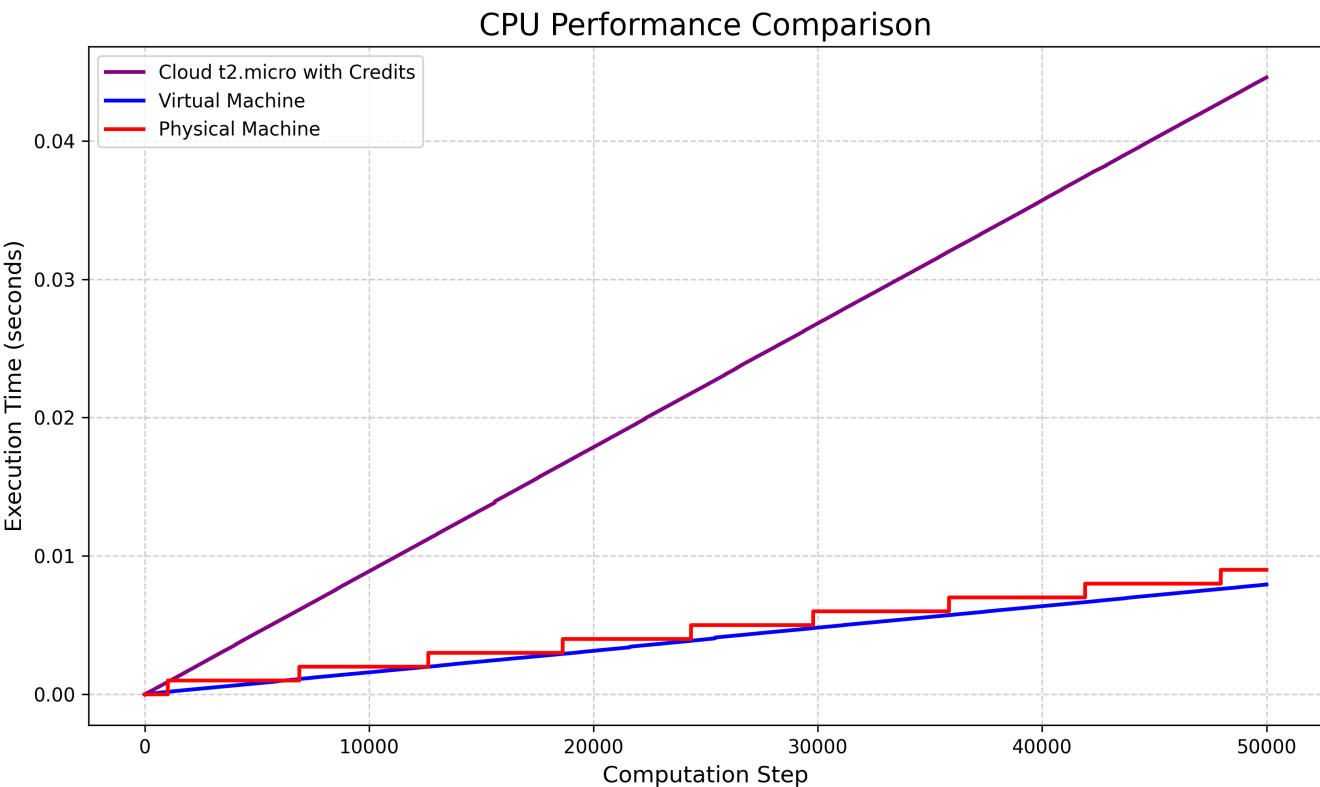
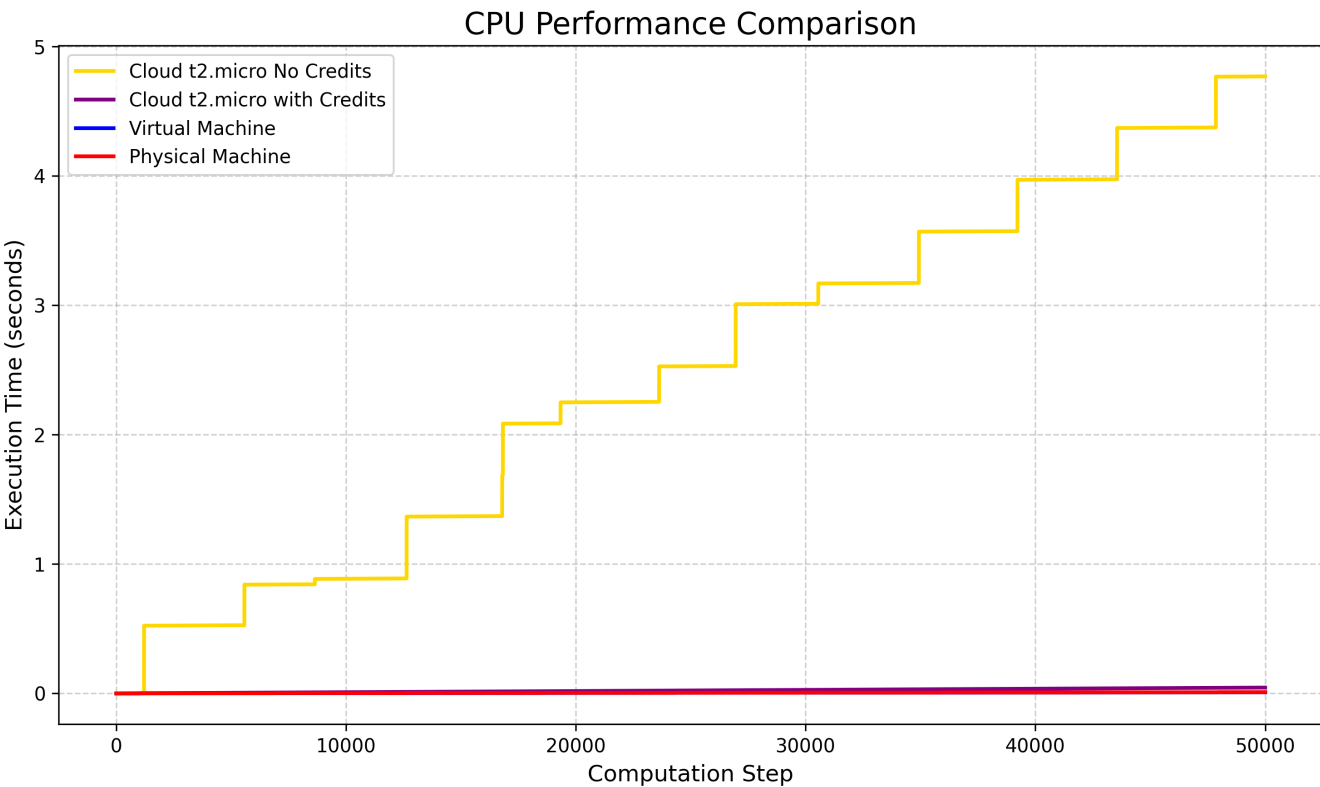
Scenario	CPU Speed (GHz)	Time to Run (s)
Cloud t2.micro No Credits	2.4	4.76723289
Cloud t2.micro with Credits	2.4	0.04370307
Virtual Machine	3.6	0.00778150
Physical Machine	3.6	0.01073980

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## 2. Plot: CPU Performance Comparison

Below is a comparative graph showing runtime behavior for each scenario.

Generated using the accompanying Python script in this project.



### 3. Analysis

#### 3.1 What is a CPU Credit in AWS?

A **CPU Credit** is a performance unit that allows EC2 instances to burst above baseline CPU utilization. When utilization is below baseline, credits accumulate; when it exceeds baseline, credits are consumed.

#### 3.2 Benefits

Perspective	Benefit
Cloud User	Can burst CPU performance during high-demand periods without constant cost.
Cloud Provider	Can overcommit CPUs by sharing idle compute among users, increasing efficiency.

4. Discussion

- **Scenario 1 (No Credits)** took the longest runtime (>4.5s).
- **Scenario 2 (With Credits)** completed the task in <0.05s.
- Both **VM** and **Physical Machine** (3.6 GHz) outperformed cloud instances.

From the plot:

- The **purple line (t2.micro with Credits)** performs similarly to **blue (VM)** and **red (Physical)**, while **gold (No Credits)** is significantly slower.

4.1 Local vs Cloud

Yes, the **local notebook** is faster than the **t2.micro instance**, since:

- It has a higher CPU speed (3.6 GHz vs. 2.4 GHz).
- It has dedicated cores, unlike the shared vCPU on the cloud.

4.2 VM vs Physical Machine

The **VM** slightly outperforms the **Physical Machine**, likely due to fewer background processes and a leaner operating system (Debian VM vs. Windows host).

5. Conclusion

- **CPU Credits** significantly impact burstable cloud instance performance.
- **Local environments** remain superior for short, CPU-intensive tasks.
- **Virtualization overhead** can be minimal or even beneficial depending on the OS and resource allocation.