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U Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google C

Large CPU comparison versus various Amazon EC2 cloud public on-demand instance types. Tests being worked on by Michael Larabel for a future article.

Automated Executive Summary

EC2 c5.18xlarge had the most wins, coming in first place for 47% of the tests.

Based on the geometric mean of all complete results, the fastest (2 x Xeon Gold 6138) was 16.416x the speed of the slowest (EC2 m5.large).

The results with the greatest spread from best to worst included:

NAS Parallel Benchmarks (Performance / Cost - Test / Class: EP.C) at 232.308x
POV-Ray (Performance / Cost - Trace Time) at 95.66x
Rodinia (Performance / Cost - Test: OpenMP LavaMD) at 85.095x
OpenSSL (RSA 4096-bit Performance) at 53.216x
C-Ray (Total Time) at 48.43x
Parboil (Test: OpenMP CUTCP) at 41.732x
NAS Parallel Benchmarks (Test / Class: EP.C) at 41.2x
John The Ripper (Test: Blowfish) at 38.608x
Java JMH (Throughput) at 38.335x

Rodinia (Test: OpenMP LavaMD) at 36.406x.

Test Systems:

Ryzen 3 1200

Processor: AMD Ryzen 3 1200 @ 3.10GHz (4 Cores), Motherboard: MSI B350M GAMING PRO (MS-7A39) v1.0 (2.90 BIOS), Chipset: AMD Device 1450, Memory: 8192MB, Disk: 525GB SABRENT + 120GB ADATA SU700, Graphics: AMD FirePro V3800 512MB, Audio: AMD Redwood HDMI Audio, Monitor: DELL S2409W, Network: Realtek RTL8111/8168/8411

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Server: Wayland, Display Driver: modesetting 1.19.5, OpenGL: 3.3 Mesa 17.2.4 (LLVM 5.0.0), Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: acpi-cpufreq ondemand
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: __user pointer sanitization + Full AMD retpoline Protection

Ryzen 3 1300X

Processor: AMD Ryzen 3 1300X @ 3.50GHz (4 Cores), Motherboard: ASRock AB350 Pro4 (P3.20 BIOS), Chipset: AMD Device 1450, Memory: 8192MB, Disk: 525GB SABRENT + 128GB ADATA SU800, Graphics: Sapphire AMD Radeon R7 260X/360 2048MB, Audio: AMD Tobago HDMI Audio, Monitor: VE228, Network: Realtek RTL8111/8168/8411

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Server: Wayland, Display Driver: modesetting 1.19.5, OpenGL: 4.5 Mesa 17.2.4 (LLVM 5.0.0), Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: acpi-cpufreq ondemand
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: __user pointer sanitization + Full AMD retpoline Protection

Ryzen 3 2200G

Processor: AMD Ryzen 3 2200G @ 3.50GHz (4 Cores), Motherboard: MSI X370 XPOWER GAMING TITANIUM (MS-7A31) v1.0 (1.C0 BIOS), Chipset: AMD Device 15d0, Memory: 14336MB, Disk: 525GB SABRENT + 525GB Crucial_CT525MX3 + 120GB Force MP500, Graphics: llvmpipe 14080MB, Audio: AMD Device 15de, Network: Intel I211 Gigabit Connection

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Driver: modesetting

1.19.5, OpenGL: 3.3 Mesa 18.1.0-devel- padoka PPA (LLVM 7.0 128 bits), Vulkan: 1.0.61, Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: acpi-cpufreq ondemand
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: __user pointer sanitization + Full AMD retpoline IBPB Protection

Ryzen 5 2400G

Processor: AMD Ryzen 5 2400G @ 3.60GHz (4 Cores / 8 Threads), Motherboard: MSI X370 XPOWER GAMING TITANIUM (MS-7A31) v1.0 (1.C0 BIOS), Chipset: AMD Device 15d0, Memory: 14336MB, Disk: 525GB SABRENT + 525GB Crucial_CT525MX3 + 120GB Force MP500, Graphics: llvmpipe 14080MB, Audio: AMD Device 15de, Network: Intel I211 Gigabit Connection

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Driver: modesetting 1.19.5, OpenGL: 3.3 Mesa 18.1.0-devel- padoka PPA (LLVM 7.0 128 bits), Vulkan: 1.0.61, Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: acpi-cpufreq ondemand
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: __user pointer sanitization + Full AMD retpoline IBPB Protection

Ryzen 7 1700

Processor: AMD Ryzen 7 1700 Eight-Core @ 3.00GHz (8 Cores / 16 Threads), Motherboard: MSI B350 TOMAHAWK (MS-7A34) v1.0 (1.90 BIOS), Chipset: AMD Device 1450, Memory: 16384MB, Disk: 525GB SABRENT + 120GB Samsung SSD 840, Graphics: llvmpipe 16128MB, Audio: AMD Cape Verde/Pitcairn, Network: Realtek RTL8111/8168/8411

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Driver: modesetting 1.19.5, OpenGL: 3.3 Mesa 17.2.4 (LLVM 5.0 128 bits), Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 1280x1024

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: acpi-cpufreq ondemand
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: __user pointer sanitization + Full AMD retpoline Protection

Ryzen 7 1800X

Processor: AMD Ryzen 7 1800X Eight-Core @ 3.60GHz (8 Cores / 16 Threads), Motherboard: MSI X370 XPOWER GAMING TITANIUM (MS-7A31) v1.0 (1.90 BIOS), Chipset: AMD Device 1450, Memory: 16384MB, Disk: 525GB SABRENT, Graphics: NV134 8192MB, Audio: NVIDIA GP104 HD Audio, Monitor: DELL P2415Q, Network: Intel I211 Gigabit Connection

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Server: Wayland, Display Driver: modesetting 1.19.5, OpenGL: 4.3 Mesa 17.2.4, Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: acpi-cpufreq ondemand
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: __user pointer sanitization + Full AMD retpoline Protection

Threadripper 1950X

Processor: AMD Ryzen Threadripper 1950X 16-Core @ 3.40GHz (16 Cores / 32 Threads), Motherboard: Gigabyte X399 AORUS Gaming 7 (F3g BIOS), Chipset: AMD Device 1450, Memory: 16384MB, Disk: 525GB SABRENT + 120GB Force MP500, Graphics: MSI AMD Radeon R7 370 / R9 270/370 OEM 4096MB, Audio: Realtek ALC1220, Monitor: VE228, Network: Qualcomm Atheros Device e0b1 + Intel Wireless 8265 / 8275

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Server: Wayland, Display Driver: modesetting 1.19.5, OpenGL: 4.5 Mesa 17.2.4 (LLVM 5.0.0), Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: acpi-cpufreq ondemand
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: __user pointer sanitization + Full AMD retpoline Protection

EPYC 7601

Processor: AMD EPYC 7601 32-Core @ 2.20GHz (32 Cores / 64 Threads), Motherboard: TYAN B8026T70AE24HR (V0.05.B10 BIOS), Chipset: AMD Device 1450, Memory: 129024MB, Disk: 525GB SABRENT + 280GB INTEL SSDPE21D280GA, Graphics: ASPEED ASPEED Family, Monitor: VE228, Network: Broadcom Limited NetXtreme BCM5720 Gigabit PCIe

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Driver: modesetting 1.19.5, Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: acpi-cpufreq ondemand
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: __user pointer sanitization + Full AMD retpoline Protection

Core i3 8100

Processor: Intel Core i3-8100 @ 3.60GHz (4 Cores), Motherboard: ASRock Z370M-ITX/ac (P1.20 BIOS), Chipset: Intel Device 3e1f, Memory: 8192MB, Disk: 525GB SABRENT + 60GB DREVO X1 SSD, Graphics: Intel HD 3072MB (1100MHz), Audio: Realtek ALC892, Monitor: DELL S2409W, Network: Intel Connection + Intel Device 24fb

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Server: Wayland,

Display Driver: modesetting 1.19.5, OpenGL: 4.5 Mesa 17.2.4, Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: KPTI + __user pointer sanitization + Full generic retpoline Protection

Core i5 8400

Processor: Intel Core i5-8400 @ 4.00GHz (6 Cores), Motherboard: MSI Z370M MORTAR (MS-7B54) v1.0 (1.10 BIOS), Chipset: Intel Device 3ec2, Memory: 8192MB, Disk: 525GB SABRENT + 128GB ADATA SX6000NP, Graphics: Intel HD 3072MB (1050MHz), Audio: Realtek ALC892, Monitor: DELL S2409W, Network: Intel Connection

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Server: Wayland, Display Driver: modesetting 1.19.5, OpenGL: 4.5 Mesa 17.2.4, Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: KPTI + __user pointer sanitization + Full generic retpoline Protection

Core i7 7740X

Processor: Intel Core i7-7740K @ 4.50GHz (4 Cores / 8 Threads), Motherboard: Gigabyte X299 AORUS Gaming-CF (F2d BIOS), Chipset: Intel Device 591f, Memory: 8192MB, Disk: 525GB SABRENT + 120GB Force MP500, Graphics: llvmpipe 7936MB, Audio: Realtek ALC1220, Monitor: VE228, Network: Intel Connection

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Server: Wayland, Display Driver: modesetting 1.19.5, OpenGL: 3.3 Mesa 17.2.4 (LLVM 5.0 256 bits), Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: KPTI + __user pointer sanitization + Full generic retpoline Protection

Core i7 8700K

Processor: Intel Core i7-8700K @ 4.70GHz (6 Cores / 12 Threads), Motherboard: ASUS PRIME Z370-A (0606 BIOS), Chipset: Intel Device 3ec2, Memory: 16384MB, Disk: 525GB SABRENT + 525GB Crucial_CT525MX3 + Samsung SSD 950 PRO 256GB, Graphics: MSI AMD Radeon RX 580 8192MB, Audio: Realtek ALC1220, Monitor: DELL P2415Q, Network: Intel Connection

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Server: Wayland, OpenGL: 4.5 Mesa 17.2.4 (LLVM 5.0.0), Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: KPTI + __user pointer sanitization + Full generic retpoline Protection

Core i9 7980XE

Processor: Intel Core i9-7980XE @ 4.40GHz (18 Cores / 36 Threads), Motherboard: ASUS PRIME X299-A (1004 BIOS), Chipset: Intel Device 2020, Memory: 16384MB, Disk: 525GB SABRENT + 256GB INTEL SSDPEKKW256G8, Graphics: NV117 1024MB, Audio: Realtek ALC1220, Monitor: Acer B286HK, Network: Intel Connection

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Server: Wayland, OpenGL: 4.3 Mesa 17.2.4, Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 3840x2160

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: KPTI + __user pointer sanitization + Full generic retpoline Protection

Xeon Silver 4108

Processor: Intel Xeon Silver 4108 @ 3.00GHz (8 Cores / 16 Threads), Motherboard: TYAN S7100AG2NR (V3.00 BIOS), Chipset: Intel Device 2020, Memory: 23552MB, Disk: 525GB SABRENT + 240GB Force MP500, Graphics: ASPEED ASPEED Family, Audio: Realtek ALC892, Monitor: VE228, Network: Intel I350 Gigabit Connection

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Driver: modesetting 1.19.5, Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: KPTI + __user pointer sanitization + Full generic retpoline Protection

2 x Xeon Gold 6138

Processor: 2 x Intel Xeon Gold 6138 @ 3.70GHz (40 Cores / 80 Threads), Motherboard: TYAN S7106 (V1.00 BIOS), Chipset: Intel Device 2020, Memory: 96256MB, Disk: 525GB SABRENT + 256GB Samsung SSD 850 + 2000GB Seagate ST2000DM006-2DM1 + 2 x 120GB TOSHIBA-TR150, Graphics: ASPEED ASPEED Family, Monitor: VE228, Network: Intel I210 Gigabit Connection

OS: Ubuntu 17.10, Kernel: 4.15.2-041502-generic (x86_64), Desktop: GNOME Shell 3.26.2, Display Driver: modesetting 1.19.5, Compiler: GCC 7.2.0, File-System: ext4, Screen Resolution: 1920x1080

Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib --with-tune=generic --without-cuda-driver -v
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.14 + Python 3.6.3
Security Notes: KPTI + __user pointer sanitization + Full generic retpoline Protection

EC2 t2.2xlarge

Processor: Intel Xeon E5-2676 v3 @ 2.39GHz (8 Cores), Motherboard: Xen HVM domU (4.2.amazon BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 32768MB, Disk: 28GB, Graphics: Cirrus Logic GD 5446

OS: Ubuntu 16.04, Kernel: 4.4.0-1050-aws (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: Xen HVM domU 4.2.amazon

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

EC2 m5.4xlarge

Processor: Intel Xeon Platinum 8175M @ 2.50GHz (8 Cores / 16 Threads), Motherboard: Amazon EC2 m5.4xlarge (1.0 BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 63488MB, Disk: 30GB Amazon Elastic Block Store, Network: Device 1d0f:ec20

OS: Ubuntu 16.04, Kernel: 4.4.0-1050-aws (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: KVM

Kernel Notes: nvme.io_timeout=4294967295
Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

EC2 m5.12xlarge

Processor: Intel Xeon Platinum 8175M @ 2.50GHz (24 Cores / 48 Threads), Motherboard: Amazon EC2 m5.12xlarge (1.0 BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 189440MB, Disk: 30GB Amazon Elastic Block Store, Network: Device 1d0f:ec20

OS: Ubuntu 16.04, Kernel: 4.4.0-1050-aws (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: KVM

Kernel Notes: nvme.io_timeout=4294967295
Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

EC2 c5.9xlarge

Processor: Intel Xeon Platinum 8124M @ 3.00GHz (18 Cores / 36 Threads), Motherboard: Amazon EC2 c5.9xlarge (1.0 BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 70656MB, Disk: 30GB Amazon Elastic Block Store, Network: Device 1d0f:ec20

OS: Ubuntu 16.04, Kernel: 4.4.0-1050-aws (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: KVM

Kernel Notes: nvme.io_timeout=4294967295
Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

EC2 c5.18xlarge

Processor: 2 x Intel Xeon Platinum 8124M @ 3.00GHz (36 Cores / 72 Threads), Motherboard: Amazon EC2 c5.18xlarge (1.0 BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 141312MB, Disk: 30GB Amazon Elastic Block Store, Network: Device 1d0f:ec20

OS: Ubuntu 16.04, Kernel: 4.4.0-1050-aws (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: KVM

Kernel Notes: nvme.io_timeout=4294967295
Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

EC2 m4.16xlarge

Processor: 2 x Intel Xeon E5-2686 v4 @ 3.00GHz (32 Cores / 64 Threads), Motherboard: Xen HVM domU (4.2.amazon BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 258048MB, Disk: 28GB, Graphics: Cirrus Logic GD 5446, Network: Device 1d0f:ec20

OS: Ubuntu 16.04, Kernel: 4.4.0-1050-aws (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: Xen HVM domU 4.2.amazon

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

EC2 m5.large

Processor: Intel Xeon Platinum 8175M @ 2.50GHz (1 Core / 2 Threads), Motherboard: Amazon EC2 m5.large (1.0 BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 8192MB, Disk: 30GB Amazon Elastic Block Store, Network: Device 1d0f:ec20

OS: Ubuntu 16.04, Kernel: 4.4.0-1050-aws (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: KVM

Kernel Notes: nvme.io_timeout=4294967295
Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

EC2 c4.8xlarge

Processor: 2 x Intel Xeon E5-2666 v3 @ 3.50GHz (18 Cores / 36 Threads), Motherboard: Xen HVM domU (4.2.amazon BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 60416MB, Disk: 28GB, Graphics: Cirrus Logic GD 5446, Network: Intel 82599 Virtual Function

OS: Ubuntu 16.04, Kernel: 4.4.0-1050-aws (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: Xen HVM domU 4.2.amazon

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

EC2 m4.10xlarge

Processor: 2 x Intel Xeon E5-2676 v3 @ 3.00GHz (20 Cores / 40 Threads), Motherboard: Xen HVM domU (4.2.amazon BIOS), Chipset: Intel 440FX- 82441FX PMC, Memory: 161792MB, Disk: 28GB, Graphics: Cirrus Logic GD 5446, Network: Intel 82599 Virtual Function

OS: Ubuntu 16.04, Kernel: 4.4.0-1050-aws (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: Xen HVM domU 4.2.amazon

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Processor Notes: Scaling Governor: intel_pstate powersave
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

Microsoft Azure D4s v3

Processor: Intel Xeon E5-2673 v3 @ 2.39GHz (2 Cores / 4 Threads), Motherboard: Microsoft Virtual Machine v7.0 (090007 BIOS), Chipset: Intel 440BX/ZX/DX, Memory: 16384MB, Disk: 32GB Virtual Disk + 34GB Virtual Disk, Graphics: Microsoft Hyper-V virtual VGA

OS: Ubuntu 16.04, Kernel: 4.13.0-1009-azure (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, Screen Resolution: 1152x864, System Layer: Microsoft Hyper-V Server

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

Microsoft Azure E4s v3

Processor: Intel Xeon E5-2673 v4 @ 2.29GHz (2 Cores / 4 Threads), Motherboard: Microsoft Virtual Machine v7.0 (090007 BIOS), Chipset: Intel 440BX/ZX/DX, Memory: 32768MB, Disk: 32GB Virtual Disk + 69GB Virtual Disk, Graphics: Microsoft Hyper-V virtual VGA

OS: Ubuntu 16.04, Kernel: 4.13.0-1009-azure (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, Screen

Resolution: 1152x864, System Layer: Microsoft Hyper-V Server

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

Microsoft Azure D8s v3

Processor: Intel Xeon E5-2673 v3 @ 2.39GHz (4 Cores / 8 Threads), Motherboard: Microsoft Virtual Machine v7.0 (090007 BIOS), Chipset: Intel 440BX/ZX/DX, Memory: 32768MB, Disk: 32GB Virtual Disk + 69GB Virtual Disk, Graphics: Microsoft Hyper-V virtual VGA

OS: Ubuntu 16.04, Kernel: 4.13.0-1009-azure (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, Screen Resolution: 1152x864, System Layer: Microsoft Hyper-V Server

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

Google n1-standard-8

Processor: Intel Xeon @ 2.30GHz (4 Cores / 8 Threads), Motherboard: Google Compute Engine, Chipset: Intel 440FX-82441FX PMC, Memory: 30720MB, Disk: 32GB PersistentDisk, Network: Red Hat Virtio device

OS: Ubuntu 16.04, Kernel: 4.13.0-1008-gcp (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: KVM

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

Google n1-highcpu-8

Processor: Intel Xeon @ 2.30GHz (4 Cores / 8 Threads), Motherboard: Google Compute Engine, Chipset: Intel 440FX-82441FX PMC, Memory: 8192MB, Disk: 32GB PersistentDisk, Network: Red Hat Virtio device

OS: Ubuntu 16.04, Kernel: 4.13.0-1008-gcp (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: KVM

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

Google n1-standard-16

Processor: Intel Xeon @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Google Compute Engine, Chipset: Intel 440FX-82441FX PMC, Memory: 60416MB, Disk: 11GB PersistentDisk, Network: Red Hat Virtio device

OS: Ubuntu 16.04, Kernel: 4.13.0-1008-gcp (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: KVM

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

Google n1-highcpu-16

Processor: Intel Xeon @ 2.30GHz (8 Cores / 16 Threads), Motherboard: Google Compute Engine, Chipset: Intel 440FX-82441FX PMC, Memory: 15360MB, Disk: 32GB PersistentDisk, Network: Red Hat Virtio device

OS: Ubuntu 16.04, Kernel: 4.13.0-1008-gcp (x86_64), Compiler: GCC 5.4.0 20160609, File-System: ext4, System Layer: KVM

Compiler Notes: --build=x86_64-linux-gnu --disable-browser-plugin --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-gnu-unique-object --enable-gtk-cairo --enable-java-awt=gtk --enable-java-home --enable-languages=c,ada,c++,java,go,d,fortran,objc,obj-c++ --enable-libmpx --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-arch-directory=amd64 --with-default-libstdcxx-abi=new --with-multilib-list=m32,m64,mx32 --with-tune=generic -v
Python Notes: Python 2.7.12 + Python 3.5.2
Security Notes: KPTI Protection

Contabo VPS S SSD

Processor: AMD EPYC 7282 16-Core (4 Cores), Motherboard: QEMU Standard PC (i440FX + PIIX 1996) (rel-1.14.0-0-g155821a1990b-prebuilt.qemu.org BIOS), Chipset: Intel 440FX 82441FX PMC, Memory: 1 x 8192 MB RAM QEMU, Disk: 215GB QEMU HDD, Graphics: VMware SVGA II, Network: Red Hat Virtio device

OS: Ubuntu 20.04, Kernel: 5.4.0-62-generic (x86_64), Compiler: GCC 9.3.0, File-System: ext4, System Layer: KVM VMware

Kernel Notes: Transparent Huge Pages: madvise
Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++,gm2 --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-9-HskZEa/gcc-9-9.3.0/debian/tmp-nvptx/usr,hsa --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib=auto --with-tune=generic --without-cuda-driver -v
Processor Notes: CPU Microcode: 0x1000065
Java Notes: OpenJDK Runtime Environment (build 11.0.11+9-Ubuntu-0ubuntu2.20.04)
Python Notes: Python 3.8.10
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Full AMD retpoline IBPB: conditional STIBP: disabled RSB filling + srbds: Not affected + tsx_async_abort: Not affected

	Ryzen 3 1200	Ryzen 3 1300X	Ryzen 3 2200G	Ryzen 5 2400G	Ryzen 7 1700	Ryzen 7 1800X	Threadripper 1950X	EPYC 7601	Core i3 8100	Core i5 8400	Core i7 7740X	Core i7 8700K	Core i9 7980XE	Xeon Silver 4108	2 x Xeon Gold 6138	EC2 t2.2xlarge	EC2 m5.4xlarge	EC2 m5.12xlarge	EC2 c5.9xlarge	EC2 c5.18xlarge	EC2 m4.16xlarge	EC2 m5.large	EC2 c4.8xlarge	EC2 m4.10xlarge	Microsoft Azure D4s v3	Microsoft Azure E4s v3	Microsoft Azure D8s v3	Google n1-standard-8	Google n1-highcpu-8	Google n1-standard-16	Google n1-highcpu-16	C t V P S S S D
NAS Parallel Benchmarks - EP.C (Mop/s)	122.00	141.62	144.02	293.90	489.65	571.10	1090	1623	202.48	321.50	394.63	577.05	1268	319.97	1999	146.20	459.35	1385	1256	**2513**	1035	**609.99**	673.14	627.62	64.00	64.90	125.37	233.87	235.75	477.95	464.55	1 8 6
Normalized	4.86%	5.64%	5.73%	11.97%	19.49%	22.73%	43.39%	64.58%	8.06%	12.79%	15.96%	22.45%	50.73%	12.73%	79.55%	5.82%	18.28%	55.14%	49.99%	100%	41.19%	2.43%	26.79%	24.98%	2.55%	2.58%	4.99%	9.31%	9.38%	19.02%	18.49%	6 1
Standard Deviation	0.5%	0.1%	0.3%	1%	2.5%	0.4%	0.5%	0.6%	0.3%	0.1%	1.1%	0.6%	0.9%	0.4%	1.1%	0.1%	0.4%	0.2%	2.7%	2%	0.2%	8.6%	0.9%	0.3%	0.6%	0.2%	0.7%	1%	1.5%	1.4%	6.4%	0 %
Parboil - OpenMP CUTCP (sec)	17.36	15.03	15.64	11.34	6.49	5.58	3.24	2.63	14.95	9.47	10.13	7.08	3.28	10.99	**2.35**	11.46	16.11	5.80	6.17	3.75	3.18	**98.07**	4.39	4.63	37.92	37.25	19.56	27.54	27.80	14.16	14.16	
Normalized	13.54%	15.64%	15.03%	20.72%	36.21%	42.11%	72.53%	89.35%	15.72%	24.82%	23.2%	33.19%	71.65%	21.38%	100%	20.51%	14.59%	40.52%	38.09%	62.67%	73.9%	2.4%	53.53%	50.76%	6.2%	6.31%	12.01%	8.53%	8.45%	16.6%	16.6%	
Standard Deviation	0.4%	0.1%	0.7%	0.6%	0.7%	0.4%	0.4%	1%	0%	0.1%	1.7%	0.3%	0.4%	0.3%	1.1%	0%	0.4%	1.2%	0.4%	2.2%	3.1%	0.8%	1.7%	1.5%	0.7%	0.4%	0.2%	0.3%	0.5%	0.1%	0.1%	

Rodinia - OpenMP LavaMD (sec)	258.67	223.34	217.13	160.28	95.15	82.39	45.95	31.58	22.21	14.15	15.42	10.19	46.64	17.83	28.52	21.70	11.20	39.53	44.56	22.67	34.10	82.97	52.79	56.59	55.02	52.89	27.78	24.74	24.30	12.24	12.90
Normalized	8.8%	10.2%	10.49%	14.21%	23.93%	27.64%	49.55%	72.1%	10.07%	15.91%	14.75%	21.24%	48.82%	13.33%	79.84%	10.66%	19.77%	57.6%	51.1%	10.0%	66.77%	2.75%	43.13%	40.24%	4.14%	4.3%	8.14%	9.27%	9.24%	18.48%	18.53%
Standard Deviation	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	2.1%	1.5%	0%	0.1%	0.9%	0.1%	0.3%	0.6%	1.9%	0%	3.3%	3.5%	1.3%	1.2%	0.2%	1.6%	0.4%	0.1%	0.5%	0.7%	0%	0.6%	0.4%	0.3%	0.7%
Timed MAFFT Alignment - M.S.A (sec)	7.25	5.99	6.27	5.73	4.26	3.65	3.13	4.69	5.71	3.68	3.97		3.04	5.46	10.15	4.26	4.35	3.18	2.72	4.23	8.84	20.00	4.42	5.78	11.89	11.86	6.61	7.30	7.44	4.96	4.91
Normalized	37.52%	45.41%	43.38%	47.47%	63.85%	74.52%	86.9%	58%	47.64%	73.91%	68.51%		89.47%	49.82%	26.8%	63.85%	62.53%	85.53%	10.0%	64.3%	30.77%	13.6%	61.54%	47.06%	22.88%	22.93%	41.15%	37.26%	36.56%	54.84%	55.4%
Standard Deviation	0.4%	4.8%	5%	4.3%	3.1%	0.9%	4%	4.1%	6.4%	4.7%	8.7%			3.8%	3.3%	0.6%	9.6%	7.2%	3.5%	8.6%	1.5%	0.6%	5.7%	17.5%	3.8%	8.2%	0.6%	9.7%	3.7%	1.2%	3.4%
John The Ripper - Blowfish (Real C/S)	37111	43933	45401	60022	10431	12445	23001	23552	44110	69980	88075	12758	30104	82750	50248	60670	12094	37069	30593	60305	39091	15621	25341	23632	23232	24192	46211	53110	52560	10649	10501
Normalized	6.15%	7.28%	7.53%	9.99%	17.3%	20.64%	38.14%	39.05%	7.31%	11.6%	14.73%	21.16%	49.92%	13.72%	83.32%	10.06%	20.05%	61.47%	50.73%	10.0%	64.82%	2.59%	42.02%	39.19%	3.85%	4.01%	7.66%	8.81%	8.72%	17.66%	17.41%
Standard Deviation	0.8%	0.3%	0.2%	3.9%	0.8%	0.1%	2%	0.5%	0.2%				0%		1.9%		0.3%	0.2%	0.1%	0.1%	0.9%	2.6%	0.3%	0.1%	2.3%	0.2%	0.9%	0.2%	0.3%	0.4%	0.4%

Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

OpenFMM Nero2D - Total Time (sec)	10	94	92	90	57	50	30	26	92	61	76	54	27	86	**21**	87	11	48	60	32	26	**53**	36	41	39	35	17	19	19	12	13
	9.59	.3	.0	.5	.4	.1	.1	.1	.6	.0	.3	.9	.9	.8	**.4**	.0	5.	.7	.1	.1	.1	**4.08**	.9	.1	1.	1.	7.	3.	8.	6.	0.
		9	9	6	8	5	6	5	1	4	6	8	9	4	**4**	4	44	8	5	9	3		1	8	21	83	01	69	33	67	21
Normalized	19.56%	22.71%	23.28%	23.67%	37.3%	42.75%	71.09%	81.99%	23.15%	35.12%	28.08%	39%	76.6%	24.69%	10.0%	24.63%	18.57%	43.95%	35.64%	66.6%	82.05%	4.0%	58.09%	52.06%	5.48%	6.09%	12.11%	11.07%	10.81%	16.93%	16.47%
Standard Deviation	0.3%	0.1%	0.3%	1%	0.5%	1.1%	3.3%	3%	0.7%	1.2%	0.5%	1%	0.6%	0.4%	4.1%	0.8%	7.5%	28.1%	2.8%	26%	0.9%	2.9%	0.6%	3.4%	0.2%	0.4%	0.9%	0.8%	0.5%	1.8%	8.6%
TTSIO D 3D Renderer - P.R.W.S.S.M (FPS)	12	13	17	21	27	31	46	44	16	26	27	39	69	21	**73**	23	18	50	46	33	46	**26**	41	39	74	75	14	12	12	23	23	9
	2.95	4.	8.	1.	4.	2.	6.	7.	8.	3.	7.	1.	0.	0.	**3.58**	1.	4.	4.	0.	6.	5.	**.8**	9.	4.	.6	.1	2.	9.	4.	8.	4.	.
		97	17	60	64	22	13	71	27	63	43	67	00	84	**58**	07	83	82	27	76	90	**8**	30	52	4	4	43	81	66	88	96	7
Normalized	16.76%	18.4%	24.29%	28.84%	37.44%	42.56%	63.54%	61.03%	22.94%	35.94%	37.82%	53.39%	94.06%	28.74%	10.0%	31.5%	25.2%	68.82%	62.74%	45.91%	63.51%	3.6%	57.16%	53.78%	10.17%	10.24%	19.42%	17.7%	16.99%	32.56%	32.03%	1
Standard Deviation	0.7%	0.2%	0.8%	1.4%	0.1%	0.2%	0.2%	0.2%	0.6%	0.1%	1.8%	0.3%	0.8%	0.4%	3.2%	0.3%	0.5%	1.6%	1.6%	6.4%	7.7%	14.8%	1.3%	1.4%	0.4%	0.2%	0.5%	0.7%	0.5%	1.4%	1.6%	0
x264 - H.2.V.E (FPS)	23	27	27	34	60	71	12	10	30	56	49	72	12	32	10	38	55	12	13	**17**	11	**11**	10	97	13	12	26	26	25	52	52	
	.4	.3	.6	.7	.9	.4	7.	8.	.4	.1	.9	.9	5.	.7	7.	.4	.4	9.	4.	**6.03**	5.	**.02**	7.	.4	.9	.0	.8	.9	.9	.0	.4	
	7	3	0	5	0	6	00	07	2	1	5	6	28	5	89	3	6	66	10	**34**	2		99	3	5	8	2	3	2	7	1	
Normalized	13.33	15.53	15.68	19.74	34.6%	40.6%	72.15	61.39	17.28	31.88	28.38	41.45	71.17	18.6%	61.29	21.83	31.51	73.66	76.18	10.0%	65.52	6.2%	61.35	55.35	7.2%	6.6%	15.24	15.3%	14.72	29.58	29.77	
Standard Deviation	3.4%	0.2%	0.1%	3.3%	3.3%	0.5%	0.6%	0.7%	3.3%	0.2%	0.6%	0.5%	0.4%	0.7%	2.5%	0.1%	1.7%	0.4%	0.6%	1.4%	1.9%	0.3%	0.5%	0.3%	0.7%	0.1%	0.4%	0.3%	1%	0.8%	0.4%	
7-Zip Compression - C.S.T (MIPS)	12	15	15	17	30	33	71	95	17	27	28	39	91	27	13	23	36	11	91	**16**	11	**50**	78	75	91	87	17	16	14	30	30	1
	60	88	74	72	62	02	59	06	22	02	95	03	13	88	97	91	64	26	93	**08**	55	**90**	08	76	44	08	01	13	99	22	25	4
	1	0	4	9	7	2	2	2	1	8	2	9	8	8	07	7	2	99	3	**22**	98		7	2			5	6	6	9	3	7
Normalized	7.84%	9.87%	9.79%	11.02%	19.04%	20.53%	44.52%	59.11%	10.71%	16.81%	18.%	24.27%	56.67%	17.34%	86.87%	14.87%	22.78%	70.08%	57.16%	10.0%	71.88%	3.1%	48.55%	47.11%	5.6%	5.4%	10.58%	10.03%	9.3%	18.8%	18.81%	8

Standard Deviation		1.8%	0.5%	3.3%	0.6%	1.5%	0.2%	0.6%	0.2%	0.2%	2.9%	1%	0.5%	1.5%	2.6%	0.6%	1.3%	0.7%	0.4%	0.3%	0.7%	1%	0.8%	0.6%	1.7%	0.3%	0.9%	0.8%	0.2%	0.7%	0.8%	2
Timed Linux Kernel Compilation - Time To Compile	48 4. 57	45 8. 00	20 1. 48	15 3. 49	95 .1 7	85 .2 2	48 .4 8	38 .3 9	16 7. 81	10 8. 02	10 6. 97	79 .1 0	39 .7 0	12 7. 47	30 .4 1	10 6. 83	85 .7 7	35 .6 1	37 .9 9	**24 .4 8**	33 .9 0	**64 1. 51**	43 .5 1	45 .9 1	38 1. 97	38 6. 80	19 2. 60	15 5. 50	16 4. 16	84 .1 7	83 .2 3	
Normalized	5.05%	5.34%	12.15%	15.95%	25.72%	28.73%	50.5%	63.77%	14.59%	22.66%	22.88%	30.95%	61.66%	19.2%	80.5%	22.91%	28.54%	68.74%	64.44%	10.0%	72.21%	3.8%	56.26%	53.32%	6.41%	6.3%	12.71%	15.74%	14.91%	29.08%	29.41%	
Standard Deviation	0.2%	0.3%	1%	1.2%	2.2%	2%	3.2%	4.5%	1%	1.7%	1%	7%	6.9%	2.3%	6.2%	1.3%	2.8%	7.6%	7.2%	10.4%	5.8%	12.6%	4.2%	4.4%	6.6%	6%	1.6%	1.5%	2.3%	2.2%	2.5%	
C-Ray - Total Time (sec)	24 .9 5	21 .5 0	21 .0 7	19 .4 8	11 .2 3	9. 70	5. 16	3. 47	24 .6 5	15 .5 7	18 .6 9	12 .7 8	5. 46	19 .6 9	**3. 14**	16 .5 2	29 .4 8	9. 94	11 .0 0	5. 72	4. 16	**15 2. 07**	6. 09	6. 46	63 .0 5	63 .9 5	31 .9 7	39 .7 7	40 .0 8	20 .7 6	20 .8 4	1
Normalized	12.59%	14.6%	14.9%	16.12%	27.96%	32.37%	60.85%	90.49%	12.74%	20.17%	16.8%	24.57%	57.51%	15.95%	10.0%	19.01%	10.65%	31.59%	28.55%	54.9%	75.48%	2.0%	51.56%	48.61%	4.98%	4.91%	9.82%	7.92%	7.83%	15.13%	15.07%	1
Standard Deviation	0.1%	0%	0.7%	1.4%	0%	0.1%	0.1%	0.7%	0.1%	0.1%	1.5%	0.1%	0.3%	0.1%	0.2%	0%	0.2%	0.2%	0.1%	0.2%	0.2%	6.5%	0.2%	0.4%	0.4%	0.3%	0.1%	0.1%	0%	0.3%	0.6%	0
POV-Ray - Trace Time (sec)	18 1. 19	15 6. 29	15 3. 63	10 7. 39	64 .4 0	56 .2 1	30 .3 0	21 .9 7	13 9. 02	87 .9 4	87 .9 4	60 .9 6	32 .7 5	19 5. 83	25 .7 0	56 3. 33	87 .1 0	29 .8 7	32 .3 5	**17 .7 4**	24 .1 2	**61 7. 28**	35 .0 8	37 .4 4	34 6. 10	37 8. 52	17 2. 17	15 0. 53	15 2. 93	75 .9 2	75 .8 7	1 2 5
Normalized	9.7%	11.35%	11.55%	16.52%	27.55%	31.56%	58.55%	80.75%	12.76%	20.17%	20.17%	29.1%	54.17%	9.06%	69.03%	3.15%	20.37%	59.39%	54.84%	10.0%	73.55%	2.87%	50.57%	47.38%	5.13%	4.69%	10.3%	11.79%	11.6%	23.37%	23.38%	1
Standard Deviation	0.1%	0.2%	0.4%	0.3%	0%	0.1%	0.3%	0.6%	0.1%	0.1%	0.1%	0.2%	0.6%	0.4%	17.3%	9%	0.3%	0.2%	0.9%	1.3%	0.5%	11.4%	0.7%	0.1%	0.1%	0.1%	0%	0.4%	0%	0.6%	0.2%	0

LAME MP3 Encoding - WAV To MP3 (sec)	39.8	35.8	37.13	35.19	36.59	33.50	33.75	42.77	33.30	30.01	27.50	**26.07**	28.50	39.90	32.33	42.12	43.90	43.57	35.53	35.62	45.22	41.09	37.62	45.51	**46.62**	46.44	45.77	44.72	45.41	44.85	45.56	3
Normalized	65.7%	72.86	70.21	74.08	71.25	77.82	77.24	60.95	78.29	86.87	94.8%	100%	91.47	65.34	80.64	61.89	59.38	59.83	73.17	73.19	57.65	63.45	69.3%	57.28	55.92	56.14	56.96	58.3%	56.91	58.13	57.22	7
Standard Deviation	0.1%	0.3%	0.2%	0.1%	0%	0.8%	0.9%	0%	0%	0%	0.8%	1.3%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0%	0.7%	7.2%	0.2%	0.3%	0.1%	0.4%	0.1%	0.4%	1.4%	0%	0.2%	0
OpenSSL - R.4.b.P (Signs/sec)		71 0.53	73 4.20	79 3.80	13 80	15 93	30 21	45 67	10 43	16 71	13 13	19 80	46 95	12 85	78 58	**17 4.83**	18 61	56 69	46 72	**93 04**	39 63	24 2.00	25 80	24 11	24 2.10	37 6.40	47 8.40	55 4.97	54 0.70	10 92	10 79	
Normalized		7.64%	7.89%	8.53%	14.83	17.12	32.47	49.09	11.21	17.96	14.11	21.28	50.47	13.82	84.46	1.88%	20 %	60.93	50.21	10 0%	42.59	2.6 %	27.73	25.91	2.6 %	4.05%	5.14%	5.97%	5.81%	11.73	11.6%	
Standard Deviation		6.4%	1.1%	2.1%	0.1%	0.1%	0.2%	0.9%	2.2%	0%	2.7%	0.1%	0.2%	0.3%	0.6%	1.4%	0.2%	0.4%	0%	0.4%	0.2%	0.7%	0.2%	0.1%	2%	0.2%	0.1%	10.7%	6.7%	7.9%	6%	
Java JMH - Throughput (Ops/s)	61 74 07 80 43	71 69 11 09 74	73 85 10 71 72	74 05 45 34 45	12 78 36 88 16 7	14 78 08 54 84 1	27 82 59 81 93 1	41 83 06 58 06 4	14 38 23 33 76 5	22 77 54 63 20 1	17 92 08 02 34 4	25 75 62 00 60 8	61 04 24 10 55 6	16 74 16 24 53 1	10 52 30 02 79 22	42 17 43 10 39	24 44 74 43 00 4	74 08 63 33 55 4	60 94 08 89 04 6	**12 18 29 91 11 81**	84 00 23 23 90 3	**31 78 03 61 99**	56 60 34 26 11 0	52 82 13 81 65 2	52 67 51 10 05	51 47 33 46 33	10 47 48 90 15 0	10 67 60 70 77 4	10 64 24 22 18 7	21 38 17 85 01 1	21 34 92 96 89 9	
Normalized	5.07%	5.89%	6.06%	6.08%	10.49	12.13	22.84	34.34	11.81	18.69	14.71	21.14	50.1%	13.74	86.37	3.46%	20.07	60.81	50.02	10 0%	68.95	2.6 %	46.46	43.36	4.3 %	4.23%	8.63%	8.7%	8.7%	17.55	17.52	
PyBench - T.F.A.T.T (Milliseconds)	16 55	14 98	15 47	14 58	15 18	13 95	14 20	17 81	13 40	12 09	10 75	**10 31**	11 50	16 15	13 07	18 37	16 37	16 04	14 59	14 53	**19 92**	15 59	16 43	19 87	19 65	19 59	19 54	18 46	18 75	18 58	18 76	
Normalized	62.3%	68.83	66.65	70.71	67.92	73.91	72.61	57.89	76.94	85.28	95.91	100%	89.65	63.84	78.88	56.12	62.98	64.28	70.66	70.96	51.76	66.13	62.75	51.89	52.47	52.63	52.76	55.85	54.99	55.49	54.96	
Standard Deviation	0.1%	0.3%	0.9%	0.2%	0.2%	0.4%	1.3%		0.1%	0.4%	0.1%	0.2%	0.1%		0.3%	0.5%	0.9%	1.2%	0.5%	0.9%	0.5%	0.2%	0.6%			1.3%	0.8%	1%	0.5%		0.1%	

Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

NGINX Benchmark - S.W.P.S (Reqs/sec)	29 14 5	32 63 3	33 62 1	33 45 0	29 82 0	32 96 4	31 19 8	24 02 0	36 31 1	40 53 3	45 47 6	44 91 6	42 84 1	31 67 0	30 95 9	18 17 5	20 16 1	25 55 5	29 99 9	24 61 9	21 41 1	12 13 3	23 09 1	21 57 9	14 32 9	15 48 1	15 43 2	25 25 6	21 20 3	26 55 6	24 00 5	1 2 0
Normalized	64.09%	71.76%	73.93%	73.55%	65.57%	72.49%	68.6%	52.82%	79.85%	89.13%	100%	98.77%	94.21%	69.64%	68.08%	39.97%	44.33%	56.2%	65.97%	54.14%	47.08%	26.68%	50.78%	47.45%	31.51%	34.04%	33.93%	55.54%	46.62%	58.4%	52.79%	4 4
Standard Deviation	1.7%	0.2%			1.2%	0.1%	0.5%	0.8%	0.6%	0.5%	1.1%	3.3%	2%	0.3%	0.9%	7.6%	0.8%	1%	0.3%	0.6%	2.3%	2.7%	3.4%	0.8%	0%	1.6%	0.3%	0.7%	2.8%	0.5%	0.7%	0 %
NAS Parallel Benchmarks - Performance / Cost - EP.C (Mop/s/Doll																73 10	45 93 5	69 27 5	12 56 19	25 12 81	34 49 8	60 99	33 65 7	20 92 1	32 00	10 82	62 69	23 38 7	23 57 5	47 79 5	46 45 5	
Normalized																2.91%	18.28%	27.57%	49.99%	100%	13.73%	2.43%	13.39%	8.33%	1.27%	0.43%	2.49%	9.31%	9.38%	19.02%	18.49%	

Rodinia - Performance / Cost - OpenMP LavaMD (sec x Dollar	14.96	8.06	3.16	2.67	**1.37**	3.41	58.03	3.70	5.66	49.50	**116.58**	25.18	14.74	9.85	7.39	4.92
Normalized	9.16%	17%	43.35%	51.31%	100%	40.18%	2.36%	37.03%	24.2%	2.77%	1.18%	5.44%	9.29%	13.91%	18.54%	27.85%
John The Ripper - Performance / Cost - Blowfish (Real C/S/Dollar)	30333350	30233350	28513346	33992250	35473535	21713572	15622800	28156700	21483636	23233600	**80633**	23105050	**53110000**	52560000	35496700	52505050
Normalized	57.12%	56.93%	53.69%	64%	66.79%	40.89%	29.41%	53.02%	40.45%	43.74%	15.18%	43.5%	100%	98.96%	66.84%	98.86%

Open FMM Nero2D - Performance / Cost - Total Time (sec x	2.61	8.08	4.88	4.81	2.90	**1.83**	21.36	1.85	2.88	23.47	**52.77**	10.62	7.75	5.95	7.60	5.21
Normalized	70.11%	22.65%	37.05%	38.05%	63.10%	100%	8.57%	98.92%	63.54%	7.8%	3.47%	17.23%	23.61%	30.76%	24.08%	35.12%
TTSIOD 3D Renderer - Performance / Cost - P.R.W.S.S.M (FPS/ Dollar	23107	9242	16827	23014	56013	93018	**13344**	13977	13151	74064	25005	14243	12981	12466	**23888**	23496
Normalized	96.73%	38.69%	70.44%	96.34%	23.5%	39.01%	5.63%	58.51%	55.05%	31.25%	10.49%	59.62%	54.34%	52.19%	10.0%	98.36%
x264 - Performance / Cost - H.2.V.E (FPS/ Dollar	3843	5546	12966	13410	**17603**	57067		10799	97143	13395	**60 4.00**	26082	26093		5207	
Normalized	21.83%	31.51%	73.66%	76.18%	10.0%	32.76%		61.35%	55.35%	7.92%	3.43%	15.24%	15.3%		29.58%	

7-Zip Compression - Performance / Cost - C.S.T (MIPS/Dollar	23911	18322	16098	22985	14621	**77061**		15614	10823	91440	87080	17015	16013	14996	15110	**30250**
	70100	10006	98325	32018	01053			74040	31400	00000	00500	60000	60000	45000	**30000**
Normalized	79.06%	60.56%	53.22%	75.97%	48.33%	25.47%		51.62%	35.78%	30.23%	28.78%	56.24%	53.34%	49.57%	49.96%	10%
Timed Linux Kernel Compilation - Performance / Cost - Time To Compile (sec	4.27	5.15	2.85	2.28	**1.96**	3.73	32.08	3.05	4.13	22.92	**61.89**	11.56	6.22	4.92	3.37	2.50
Normalized	45.9%	38.06%	68.77%	85.96%	100%	52.55%	6.1%	64.26%	47.46%	8.5%	3.1%	16.96%	31.51%	39.84%	58.16%	78.4%
C-Ray - Performance / Cost - Total Time (sec x	0.17	0.59	0.20	0.22	0.11	0.08	1.52	**0.06**	**0.06**	0.63	**1.92**	0.32	0.40	0.40	0.21	0.21
Normalized	35.29%	10.17%	30%	27.27%	54.55%	75%	3.9%	10%	10%	9.5%	3.1%	18.75%	15%	15%	28.57%	28.57%

POV-Ray - Performance / Cost - Trace Time (sec x Dollar	10.140	5.23	2.09	1.62	1.06	1.93	30.86	1.75	2.62	20.67	60.56	10.33	4.52	4.59	3.04	2.28
Normalized	1.05%	20.27%	50.72%	65.43%	100%	54.92%	3.43%	60.57%	40.46%	5.1%	1.75%	10.26%	23.45%	23.09%	34.87%	46.49%
LAME MP3 Encoding - Performance / Cost - WAV To MP3 (sec x	0.42	1.32	3.92	1.78	3.21	5.43		1.88	3.64	0.47	0.93	0.92	0.45	0.46	0.90	0.91
Normalized	10 0%	31.82%	10.71%	23.6%	13.08%	7.73%		22.34%	11.54%	89.36%	45.16%	45.65%	93.33%	91.3%	46.67%	46.15%
Open SSL - Performance / Cost - R.4.b.P (Signs /sec/Dollar)	17.483	18.60	14.17	15.57	15.50	66.04		85.98	60.26		37.64	47.84			10.91	10.78
Normalized	9.39%	10 0%	76.16%	83.68%	83.32%	35.49%		46.21%	32.38%		20.23%	25.71%			58.67%	57.97%

Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

Java JMH - Performance / Cost - Throughput (Ops/s /Dollar)	10	27	27	33	33	22	31	31	22	26	**85**	26	35	**53**	35	42
	54	16	43	85	84	10	78	44	96	33	**78**	18	58	**21**	63	69
	35	38	93	60	16	58	03	63	58	75	**89**	72	69	**21**	63	85
	77	25	82	49	41	74	61	47	18	55	**10**	25	02	**10**	08	93
	59	55	79	47	99	71	99	83	10	02	**54**	37	58	**93**	35	79
	68	99	78	00	47	13	44	86	96	29	**2**	61	06	**72**	12	74
Normalized	19.81%	51.05%	51.57%	63.62%	63.6%	41.54%	59.72%	59.1%	43.16%	49.5%	16.12%	49.21%	66.88%	10 0%	66.97%	80.24%
PyBench - Performance / Cost - T.F.A.T.T (Milliseconds x Dollar	**18.37**	32.74	11 2.28	58.36	13 0.77	**23 9.04**		82.15	15 8.96	19.65	39.18	19.54	18.46	18.75	37.16	18.76
Normalized	10 0%	56.11 %	16.36 %	31.48 %	14.05 %	7.68%		22.36 %	11.56 %	93.49 %	46.89 %	94.01 %	99.51 %	97.97 %	49.43 %	97.92 %

NGINX Benchmark - Performance / Cost - S.W.P.S (Reqs/sec/Dollar)	45,280,151,133,117,937,981,020,222,068,**792,938,**125,231,237,242,112,369,271,642,538,042,571,**123,**795,604,**125,**801,578															
Normalized	35.98%	22.81%	12.65%	26.4%	8.86%	6.28%	96.08%	15.24%	10.05%	56.73%	20.43%	30.55%	10.0%	83.95%	52.57%	63.37%
PyBench - T.F.A.T.T (Milliseconds)	20,144	17,992	17,977	16,907	16,909	**22,139**	17,921	18,219	22,025	21,991	21,971	21,993	20,935	20,969	20,936	20,963	1
Normalized	60.23%	68.69%	69.27%	76.6%	76.51%	54.98%	71.53%	67.33%	55.18%	56.7%	56.13%	56.49%	59.5%	60.46%	59.67%	0
Standard Deviation	0%	0.4%	0.4%	0.4%	0.4%	0.2%	1.5%	0.8%	0.3%	0.1%	0.9%	1%	0.4%	0.1%	0.4%	0.2%	0

Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

PyBench - Performance / Cost - T.F.A.T (Milliseconds x Dollar	20.4	53.7	14.2	80.3	16.0	**31.3**		10.9	20.0	21.9	43.4	43.8	**20.3**	20.6	40.7	41.2
Normalized	99.56%	37.85%	14.31%	25.33%	12.65%	6.49%		18.65%	10.16%	92.88%	46.87%	46.4%	10.0%	98.36%	49.98%	49.32%
Scikit-Learn (sec)	179.03	21.86	20.55	19.08	19.52	18.92	21.77	**16.09**	19.67	19.96	18.80	19.66	26.15	**27.74**	25.14	26.88
Normalized	91.66%	77.45%	80.22%	86.33%	86.13%	89.71%	76.4%	100%	85.61%	83.31%	87.37%	85.17%	63.08%	60.16%	65.08%	61.95%
Standard Deviation	0.1%	0.1%	0%	0%	0.2%	0.1%	8%	0.6%	1.3%	0.3%	1.6%	0.5%	0.4%	0.5%	0.3%	0.5%
Scikit-Learn - Performance / Cost - (sec x Dollar	10.74	29.66	79.72	45.62	**93.35**	89.63	**4.30**	36.10	61.33	5.91	15.02	11.56	15.61	13.64	27.74	23.84
Normalized	40.04%	14.5%	5.39%	9.43%	4.61%	4.81%	100%	11.91%	7.01%	72.76%	28.63%	37.52%	27.55%	31.52%	15.5%	18.04%
AOBench - 2048 x 2048 - Total Time (sec)	62.18	65.48	66.21	58.70	58.42	64.56	65.51	55.39	67.24	68.45	65.32	67.22	73.65	**74.7**	72.76	74.2	**4**
Normalized	69.55%	66.04%	65.32%	73.67%	74.03%	66.99%	66.01%	78.08%	64.32%	62.81%	66.21%	64.14%	58.72%	57.84%	59.35%	58.27%	1

Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

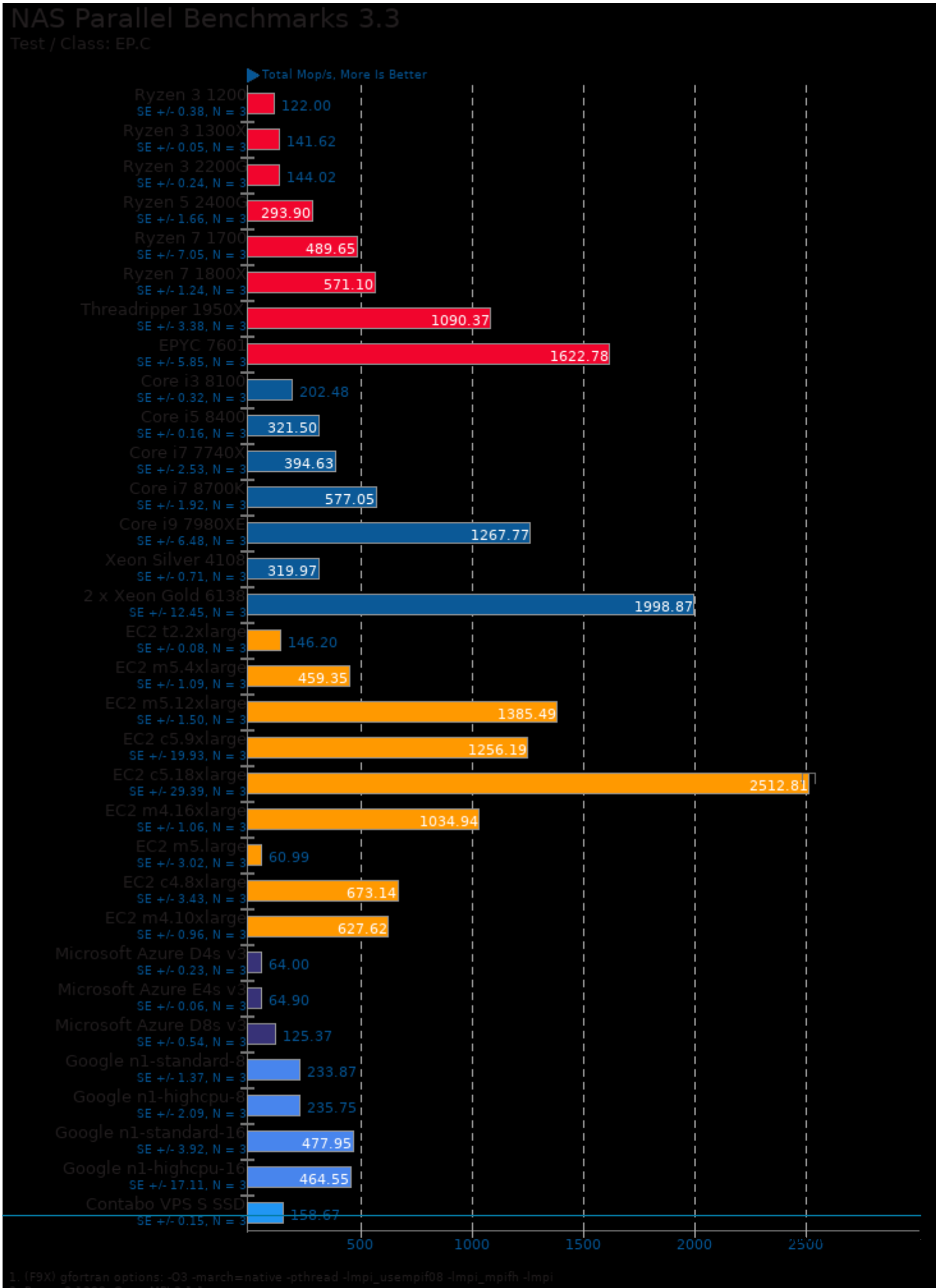
Standard Deviation	0.1%	0.4%	2.8%	1.1%	0.3%	2.8%	1.3%	0.4%	0.5%	0.6%	1.4%	0.2%	0.3%	0.3%	0.1%	0.2%	0
AOBench - Performance / Cost - 2048 x 2048 - Total Time (sec x	1.24	2.62	8.61	4.70	8.76	11.62	0.66	4.43	7.40	0.69	1.96	1.35	1.47	0.75	2.19	2.23	
Normalized	53.23%	25.19%	7.6%	14.04%	7.53%	5.68%	10%	14.9%	8.92%	95.65%	33.67%	48.89%	44.9%	88%	30.14%	29.6%	
Crafty - Elapsed Time (Node	5824047	6023992	6372596	6980161	6974942	5378062	5691579	6480104	5369651	5106188	5042299	5201406	5040950	4839203	5268737	4989328	6
Normalized	83.5%	86.37%	91.36%	99.91%	10%	77.11%	81.6%	92.91%	76.98%	73.21%	72.29%	74.57%	72.27%	69.38%	75.32%	70.72%	8
Standard Deviation	0.1%	0.2%	0.1%	0.2%	0.2%	0.5%	2.7%	0.6%	0.8%	0.8%	1.2%	1%	0.3%	0.7%	1.1%	0.1%	0

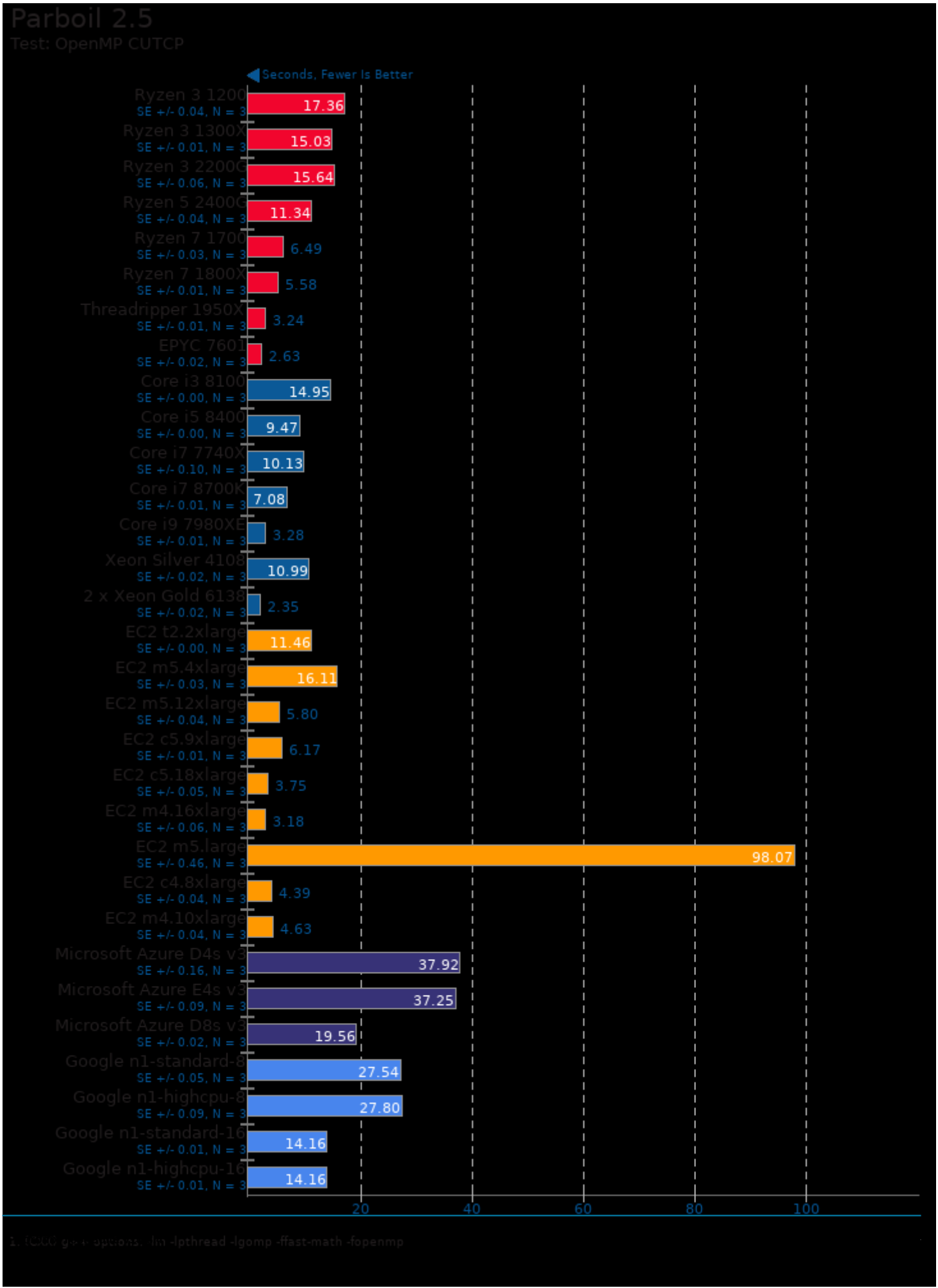
Crafty - Performance / Cost - Elapsed Time (Nodes/s/Do	58	30	10	17	87	53		16	89	51	25	52	50	48	26	49
	24	11	62	42	18	78		20	49	06	21	01	40	39	26	32
	04	99	09	20	67	06		02	41	43	21	50	95	20	84	89
	50	60	93	02	75	20		60	83	80	45	60	90	30	35	80
	0	0	3	5				0		0	0	0	0	0	0	0
Normalized	10 0%	51. 72 %	18. 24 %	29. 91 %	14. 97 %	9.2 3%		27. 82 %	15. 37 %	87. 68 %	43. 29 %	89. 31 %	86. 55 %	83. 09 %	45. 1%	84. 7%
Parboil - Performance / Cost - Open MP CUTCP (sec x Dollar		0. 16	0. 06	0. 06	0. 04	0. 03	0. 98	0. 04	0. 05	0. 38	0. 75	0. 20	0. 28		0. 14	0. 14
Normalized		18. 75 %	50 %	50 %	75 %	10 0%	3.0 6%	75 %	60 %	7.8 9%	4%	15 %	10. 71 %		21. 43 %	21. 43 %
Cost To Run Tests - C.P.P.H (Cost / Price/		0. 89	2. 00	1. 28	2. 43	2. 81	0. 34	1. 35	1. 86	0. 47	1. 20	0. 61	0. 41	0. 32	0. 63	0. 48
Normalized		35. 96 %	16 %	25 %	13. 17 %	11. 39 %	94. 12 %	23. 7%	17. 2%	68. 09 %	26. 67 %	52. 46 %	78. 05 %	10 0%	50. 79 %	66. 67 %

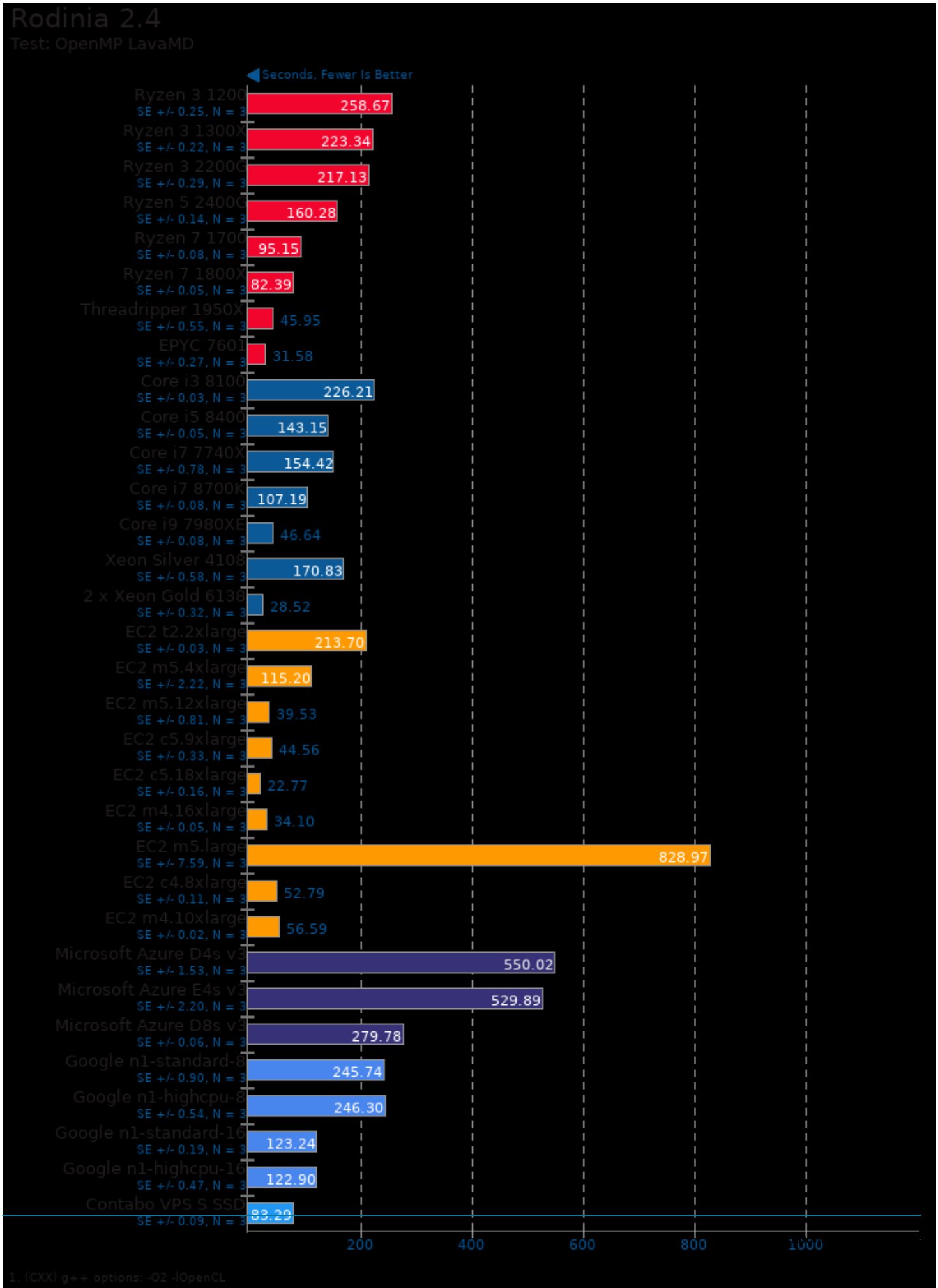
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

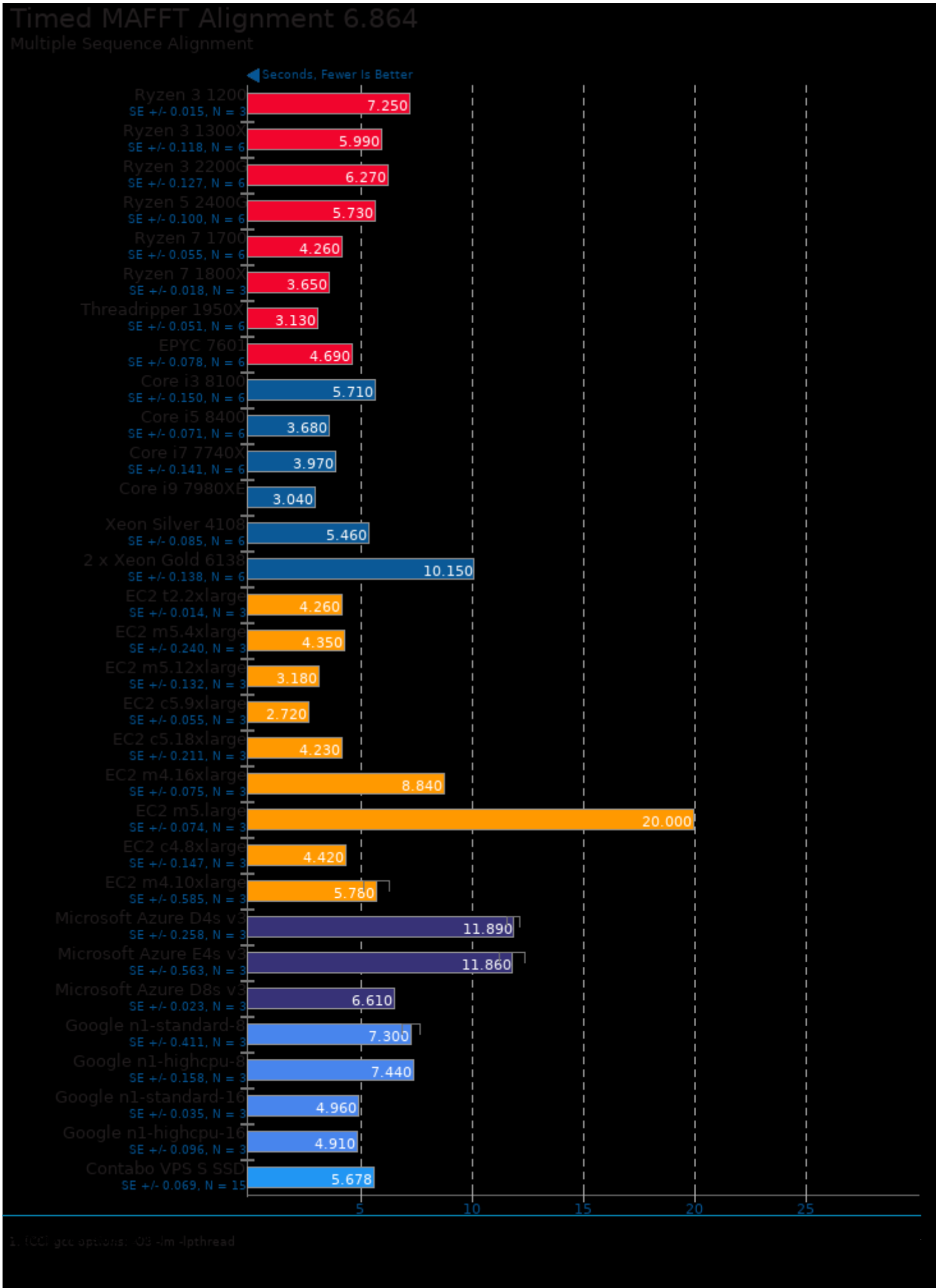
Timed MAFFT Alignment - Performance / Cost - M.S.A (sec x Dollar	**0.03**	**0.03**	0.04	**0.27**	0.04	0.06	0.12
Normalized	100%	100%	75%	11.11%	75%	50%	25%

Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

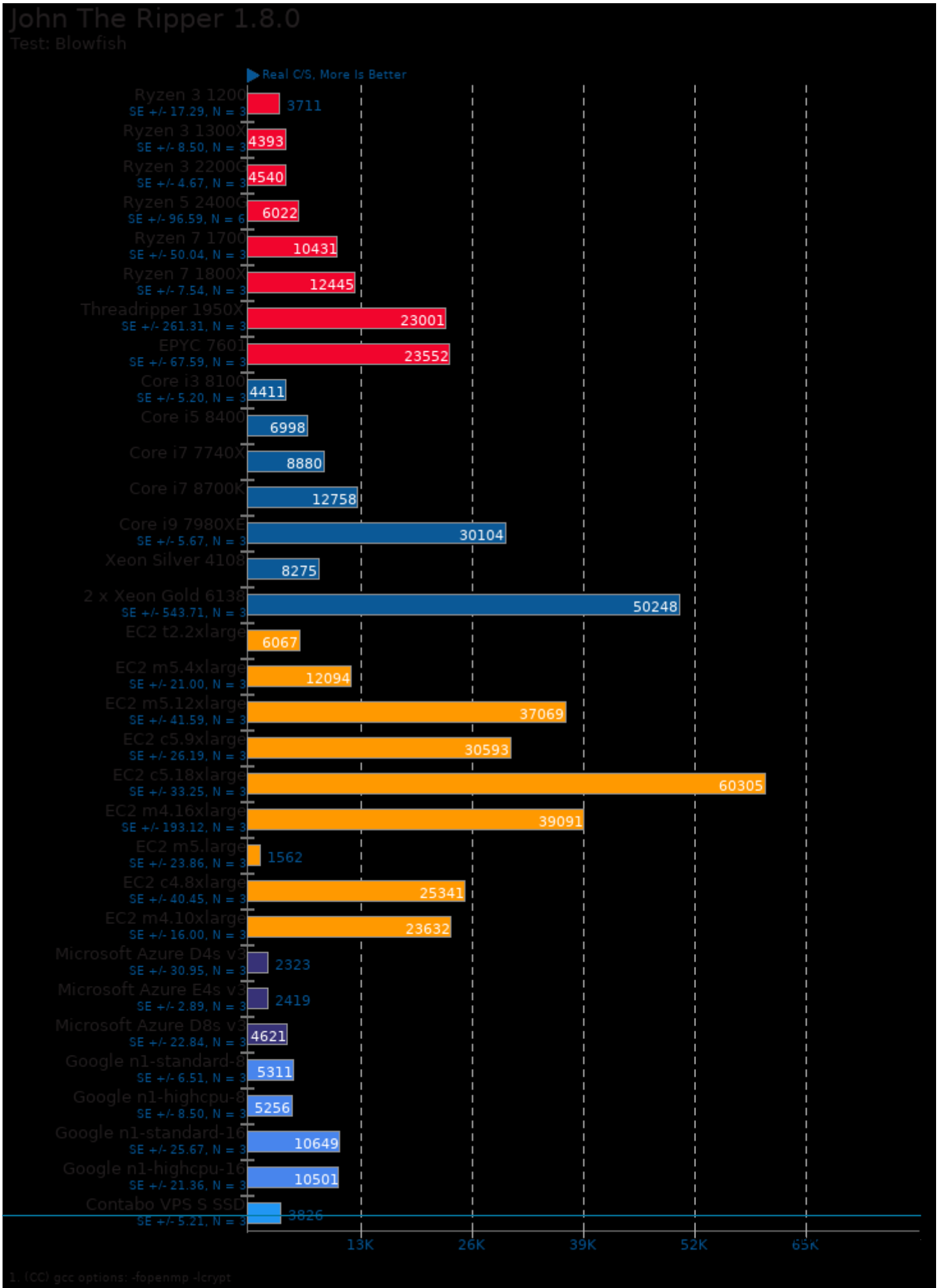

NAS Parallel Benchmarks 3.3
Test / Class: EP.C
Total Mop/s, More Is Better
Ryzen 3 1200
SE +/- 0.38, N = 3
122.00
Ryzen 3 1300X
SE +/- 0.05, N = 3
141.62
Ryzen 3 2200G
SE +/- 0.24, N = 3
144.02
Ryzen 5 2400G
SE +/- 1.66, N = 3
293.90
Ryzen 7 1700
SE +/- 7.05, N = 3
489.65
Ryzen 7 1800X
SE +/- 1.24, N = 3
571.10
Threadripper 1950X
SE +/- 3.38, N = 3
1090.37
EPYC 7601
SE +/- 5.85, N = 3
1622.78
Core i3 8100
SE +/- 0.32, N = 3
202.48
Core i5 8400
SE +/- 0.16, N = 3
321.50
Core i7 7740X
SE +/- 2.53, N = 3
394.63
Core i7 8700K
SE +/- 1.92, N = 3
577.05
Core i9 7980XE
SE +/- 6.48, N = 3
1267.77
Xeon Silver 4108
SE +/- 0.71, N = 3
319.97
2 x Xeon Gold 6138
SE +/- 12.45, N = 3
1998.87
EC2 t2.2xlarge
SE +/- 0.08, N = 3
146.20
EC2 m5.4xlarge
SE +/- 1.09, N = 3
459.35
EC2 m5.12xlarge
SE +/- 1.50, N = 3
1385.49
EC2 c5.9xlarge
SE +/- 19.93, N = 3
1256.19
EC2 c5.18xlarge
SE +/- 29.39, N = 3
2512.81
EC2 m4.16xlarge
SE +/- 1.06, N = 3
1034.94
EC2 m5.large
SE +/- 3.02, N = 3
60.99
EC2 c4.8xlarge
SE +/- 3.43, N = 3
673.14
EC2 m4.10xlarge
SE +/- 0.96, N = 3
627.62
Microsoft Azure D4s v3
SE +/- 0.23, N = 3
64.00
Microsoft Azure E4s v3
SE +/- 0.06, N = 3
64.90
Microsoft Azure D8s v3
SE +/- 0.54, N = 3
125.37
Google n1-standard-8
SE +/- 1.37, N = 3
233.87
Google n1-highcpu-8
SE +/- 2.09, N = 3
235.75
Google n1-standard-16
SE +/- 3.92, N = 3
477.95
Google n1-highcpu-16
SE +/- 17.11, N = 3
464.55
Contabo VPS S SSD
SE +/- 0.15, N = 3
158.67
500
1000
1500
2000
2500
1. (F9X) gfortran options: -O3 -march=native -pthread -lmpi_usempif08 -lmpi_mpifh -lmpi

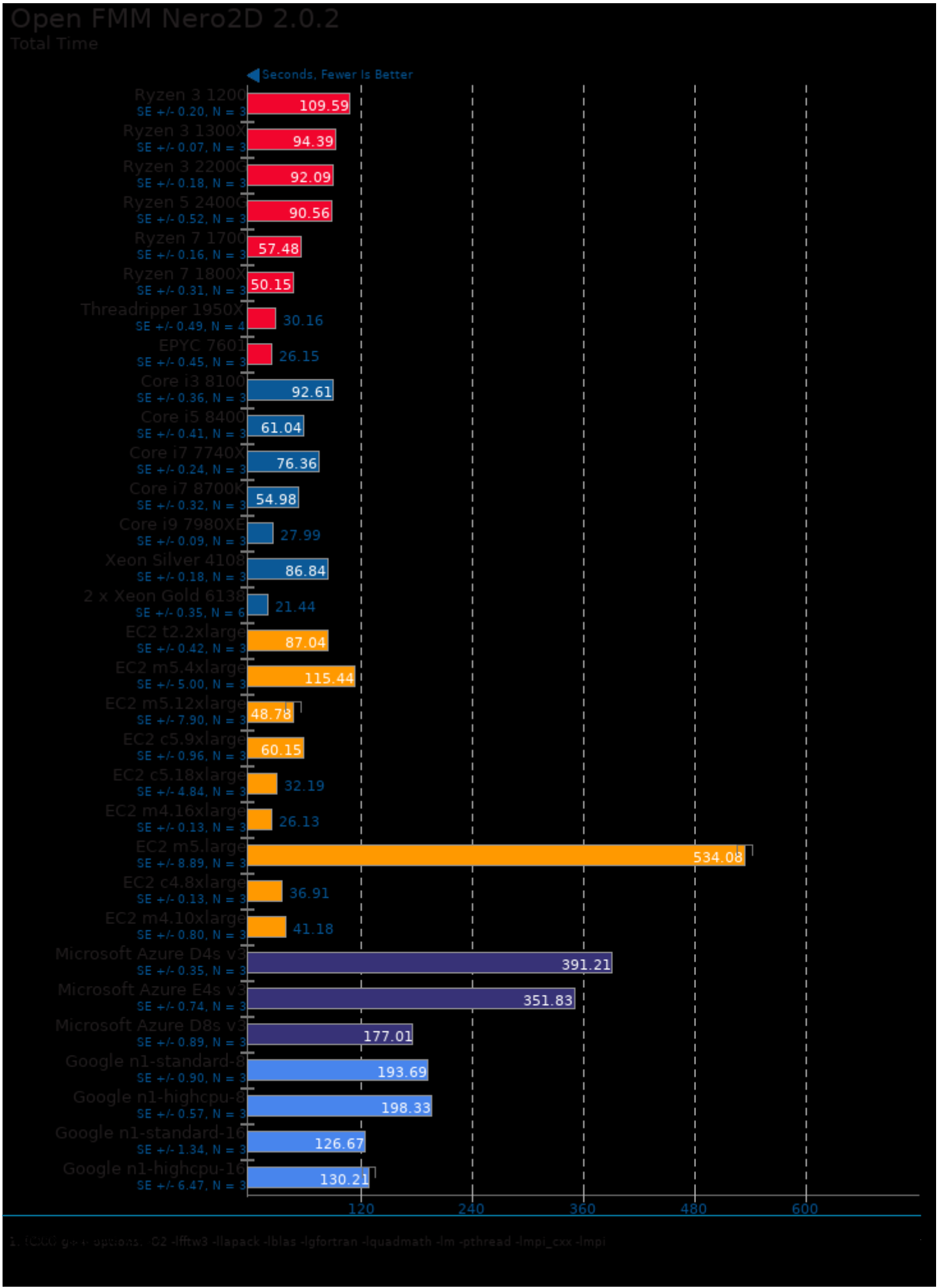

Parboil 2.5
Test: OpenMP CUTCP
Seconds, Fewer Is Better
Ryzen 3 1200
SE +/- 0.04, N = 3
17.36
Ryzen 3 1300X
SE +/- 0.01, N = 3
15.03
Ryzen 3 2200G
SE +/- 0.06, N = 3
15.64
Ryzen 5 2400G
SE +/- 0.04, N = 3
11.34
Ryzen 7 1700
SE +/- 0.03, N = 3
6.49
Ryzen 7 1800X
SE +/- 0.01, N = 3
5.58
Threadripper 1950X
SE +/- 0.01, N = 3
3.24
EPYC 7601
SE +/- 0.02, N = 3
2.63
Core i3 8100
SE +/- 0.00, N = 3
14.95
Core i5 8400
SE +/- 0.00, N = 3
9.47
Core i7 7740X
SE +/- 0.10, N = 3
10.13
Core i7 8700K
SE +/- 0.01, N = 3
7.08
Core i9 7980XE
SE +/- 0.01, N = 3
3.28
Xeon Silver 4108
SE +/- 0.02, N = 3
10.99
2 x Xeon Gold 6138
SE +/- 0.02, N = 3
2.35
EC2 t2.2xlarge
SE +/- 0.00, N = 3
11.46
EC2 m5.4xlarge
SE +/- 0.03, N = 3
16.11
EC2 m5.12xlarge
SE +/- 0.04, N = 3
5.80
EC2 c5.9xlarge
SE +/- 0.01, N = 3
6.17
EC2 c5.18xlarge
SE +/- 0.05, N = 3
3.75
EC2 m4.16xlarge
SE +/- 0.06, N = 3
3.18
EC2 m5.large
SE +/- 0.46, N = 3
98.07
EC2 c4.8xlarge
SE +/- 0.04, N = 3
4.39
EC2 m4.10xlarge
SE +/- 0.04, N = 3
4.63
Microsoft Azure D4s v3
SE +/- 0.16, N = 3
37.92
Microsoft Azure E4s v3
SE +/- 0.09, N = 3
37.25
Microsoft Azure D8s v3
SE +/- 0.02, N = 3
19.56
Google n1-standard-8
SE +/- 0.05, N = 3
27.54
Google n1-highcpu-8
SE +/- 0.09, N = 3
27.80
Google n1-standard-16
SE +/- 0.01, N = 3
14.16
Google n1-highcpu-16
SE +/- 0.01, N = 3
14.16
20
40
60
80
100
1. (CXX) g++ options: -lm -lpthread -lgomp -ffast-math -fopenmp

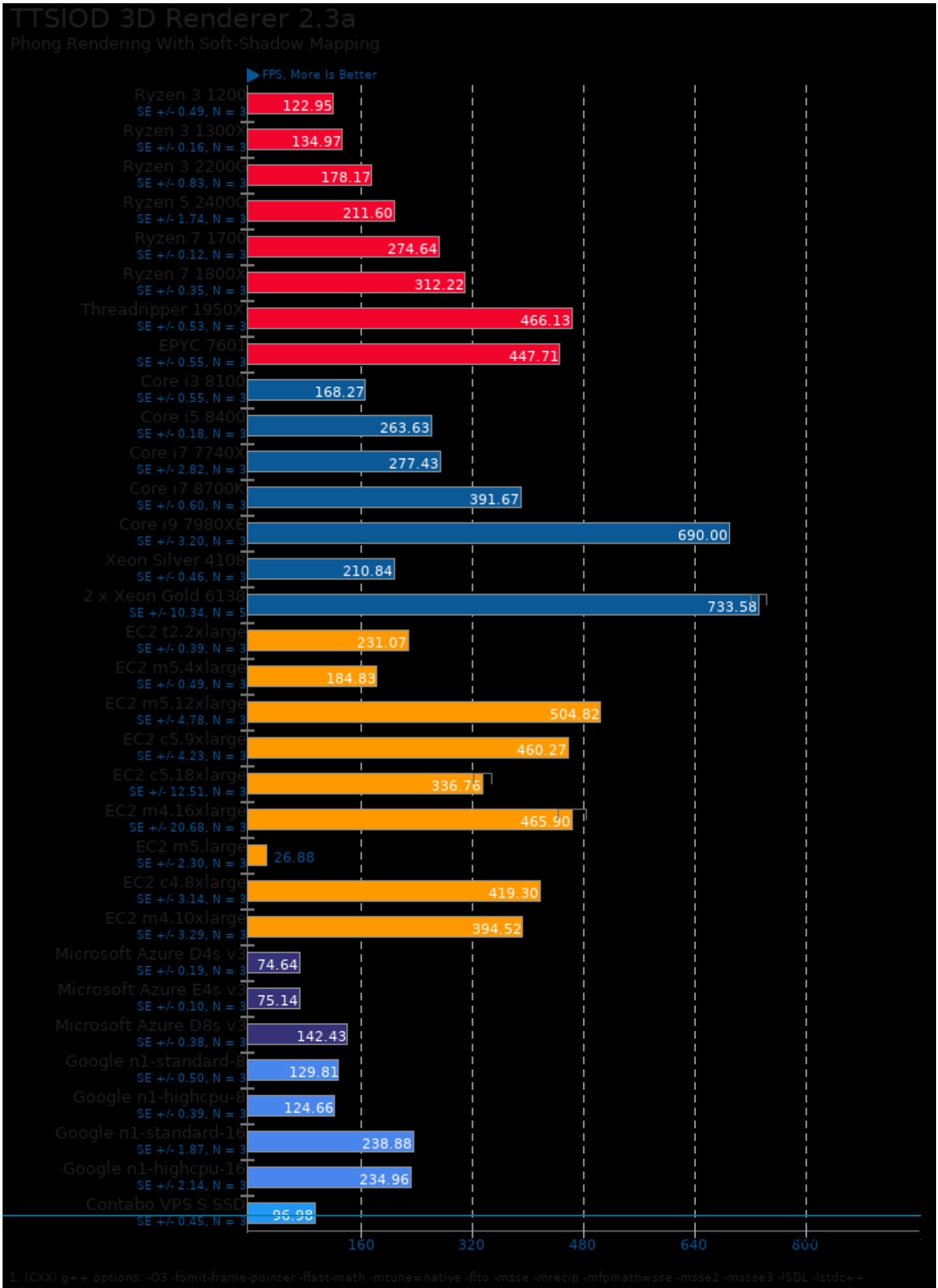

Rodinia 2.4
Test: OpenMP LavaMD
Seconds, Fewer Is Better
Ryzen 3 1200
SE +/- 0.25, N = 3
258.67
Ryzen 3 1300X
SE +/- 0.22, N = 3
223.34
Ryzen 3 2200G
SE +/- 0.29, N = 3
217.13
Ryzen 5 2400G
SE +/- 0.14, N = 3
160.28
Ryzen 7 1700
SE +/- 0.08, N = 3
95.15
Ryzen 7 1800X
SE +/- 0.05, N = 3
82.39
Threadripper 1950X
SE +/- 0.55, N = 3
45.95
EPYC 7601
SE +/- 0.27, N = 3
31.58
Core i3 8100
SE +/- 0.03, N = 3
226.21
Core i5 8400
SE +/- 0.05, N = 3
143.15
Core i7 7740X
SE +/- 0.78, N = 3
154.42
Core i7 8700K
SE +/- 0.08, N = 3
107.19
Core i9 7980XE
SE +/- 0.08, N = 3
46.64
Xeon Silver 4108
SE +/- 0.58, N = 3
170.83
2 x Xeon Gold 6138
SE +/- 0.32, N = 3
28.52
EC2 t2.2xlarge
SE +/- 0.03, N = 3
213.70
EC2 m5.4xlarge
SE +/- 2.22, N = 3
115.20
EC2 m5.12xlarge
SE +/- 0.81, N = 3
39.53
EC2 c5.9xlarge
SE +/- 0.33, N = 3
44.56
EC2 c5.18xlarge
SE +/- 0.16, N = 3
22.77
EC2 m4.16xlarge
SE +/- 0.05, N = 3
34.10
EC2 m5.large
SE +/- 7.59, N = 3
828.97
EC2 c4.8xlarge
SE +/- 0.11, N = 3
52.79
EC2 m4.10xlarge
SE +/- 0.02, N = 3
56.59
Microsoft Azure D4s v3
SE +/- 1.53, N = 3
550.02
Microsoft Azure E4s v3
SE +/- 2.20, N = 3
529.89
Microsoft Azure D8s v3
SE +/- 0.06, N = 3
279.78
Google n1-standard-8
SE +/- 0.90, N = 3
245.74
Google n1-highcpu-8
SE +/- 0.54, N = 3
246.30
Google n1-standard-16
SE +/- 0.19, N = 3
123.24
Google n1-highcpu-16
SE +/- 0.47, N = 3
122.90
Contabo VPS S SSD
SE +/- 0.09, N = 3
83.29
200
400
600
800
1000
1. (CXX) g++ options: -O2 -lOpenCL

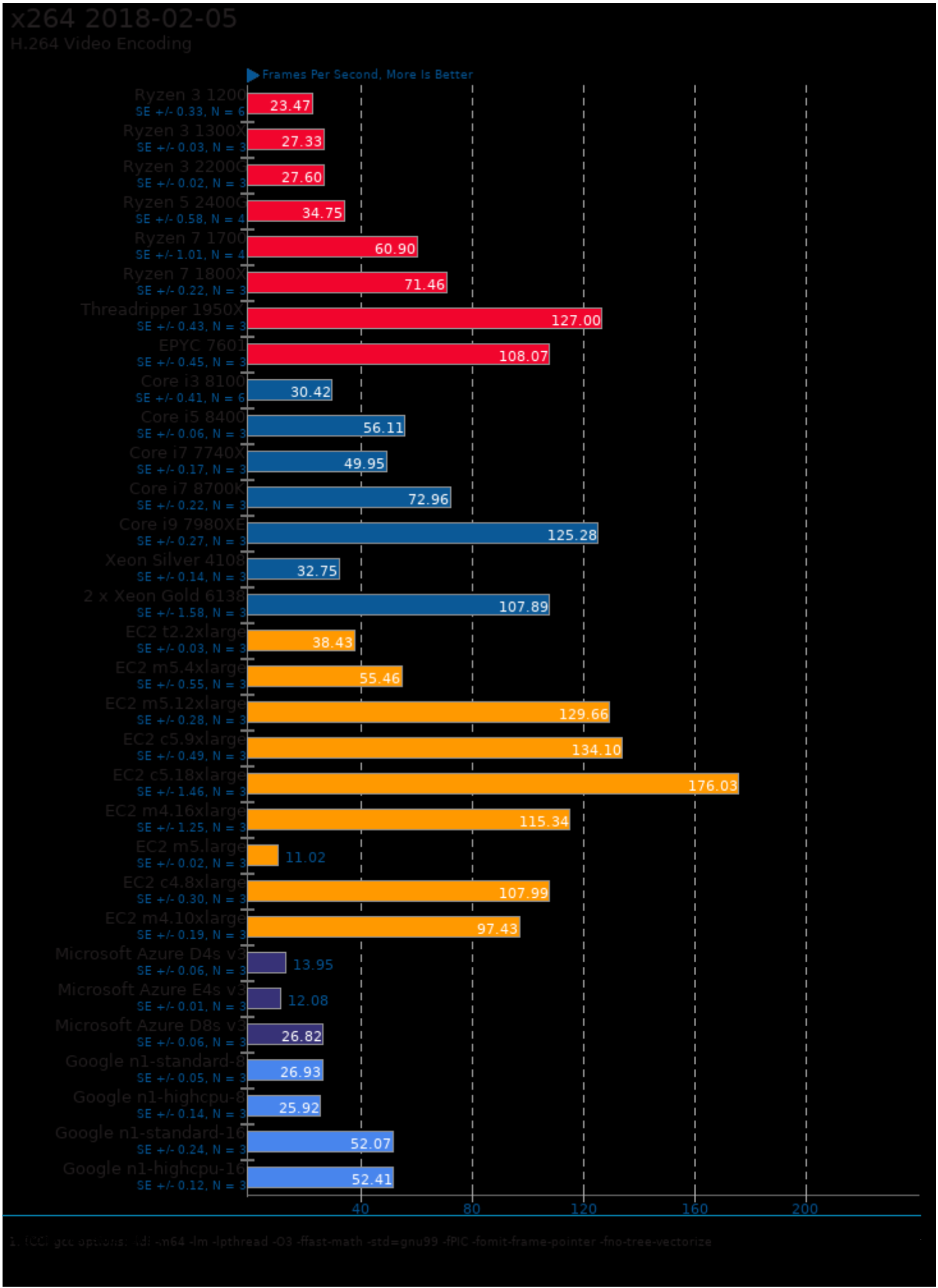

Timed MAFFT Alignment 6.864
Multiple Sequence Alignment
Seconds, Fewer Is Better
Ryzen 3 1200
SE +/- 0.015, N = 3
7.250
Ryzen 3 1300X
SE +/- 0.118, N = 6
5.990
Ryzen 3 2200G
SE +/- 0.127, N = 6
6.270
Ryzen 5 2400G
SE +/- 0.100, N = 6
5.730
Ryzen 7 1700
SE +/- 0.055, N = 6
4.260
Ryzen 7 1800X
SE +/- 0.018, N = 3
3.650
Threadripper 1950X
SE +/- 0.051, N = 6
3.130
EPYC 7601
SE +/- 0.078, N = 6
4.690
Core i3 8100
SE +/- 0.150, N = 6
5.710
Core i5 8400
SE +/- 0.071, N = 6
3.680
Core i7 7740X
SE +/- 0.141, N = 6
3.970
Core i9 7980XE
3.040
Xeon Silver 4108
SE +/- 0.085, N = 6
5.460
2 x Xeon Gold 6138
SE +/- 0.138, N = 6
10.150
EC2 t2.2xlarge
SE +/- 0.014, N = 3
4.260
EC2 m5.4xlarge
SE +/- 0.240, N = 3
4.350
EC2 m5.12xlarge
SE +/- 0.132, N = 3
3.180
EC2 c5.9xlarge
SE +/- 0.055, N = 3
2.720
EC2 c5.18xlarge
SE +/- 0.211, N = 3
4.230
EC2 m4.16xlarge
SE +/- 0.075, N = 3
8.840
EC2 m5.large
SE +/- 0.074, N = 3
20.000
EC2 c4.8xlarge
SE +/- 0.147, N = 3
4.420
EC2 m4.10xlarge
SE +/- 0.585, N = 3
5.760
Microsoft Azure D4s v3
SE +/- 0.258, N = 3
11.890
Microsoft Azure E4s v3
SE +/- 0.563, N = 3
11.860
Microsoft Azure D8s v3
SE +/- 0.023, N = 3
6.610
Google n1-standard-8
SE +/- 0.411, N = 3
7.300
Google n1-highcpu-8
SE +/- 0.158, N = 3
7.440
Google n1-standard-16
SE +/- 0.035, N = 3
4.960
Google n1-highcpu-16
SE +/- 0.096, N = 3
4.910
Contabo VPS S SSD
SE +/- 0.069, N = 15
5.678
5
10
15
20
25
1. (CC) gcc options: -O3 -lm -lpthread

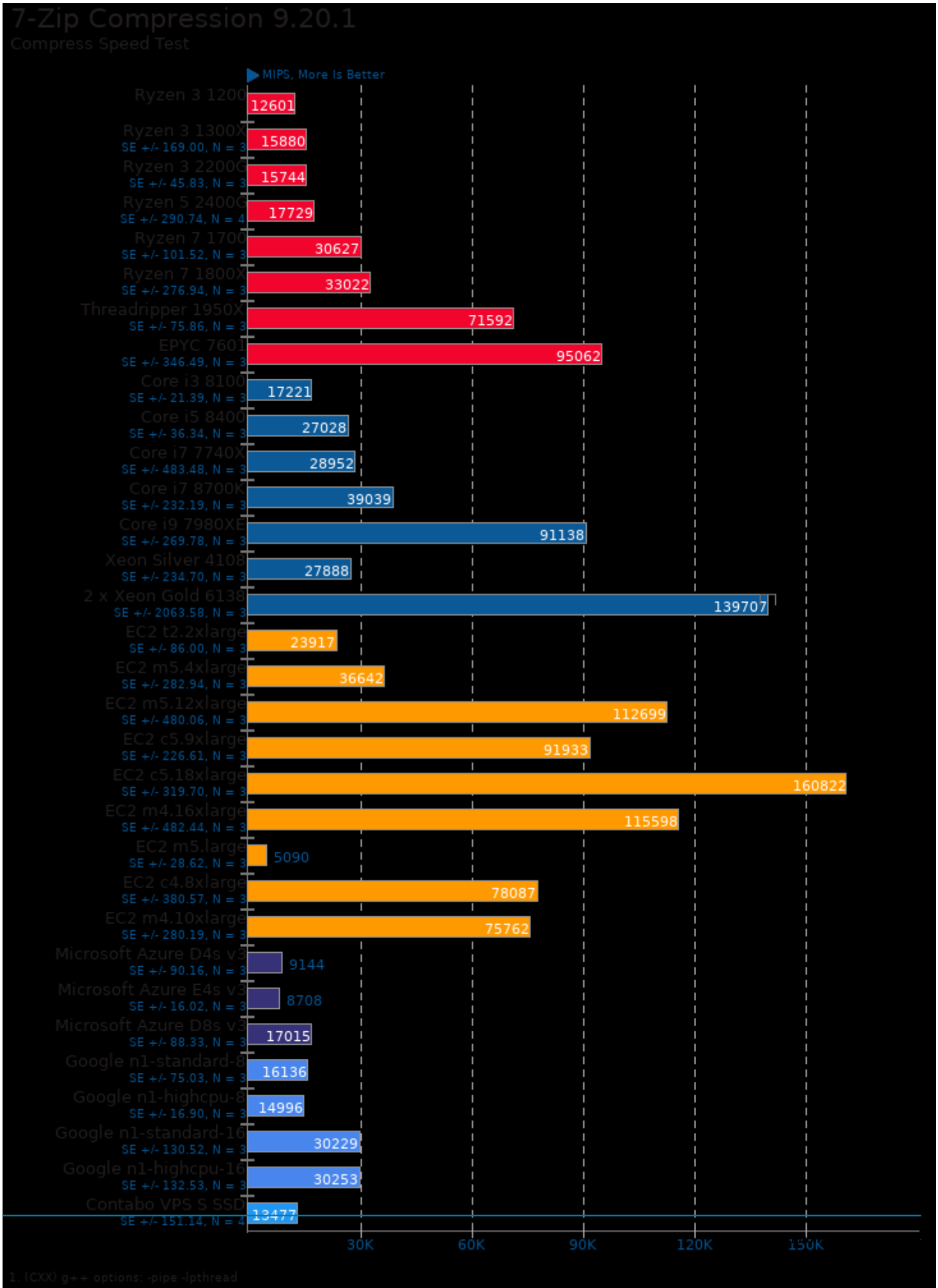
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

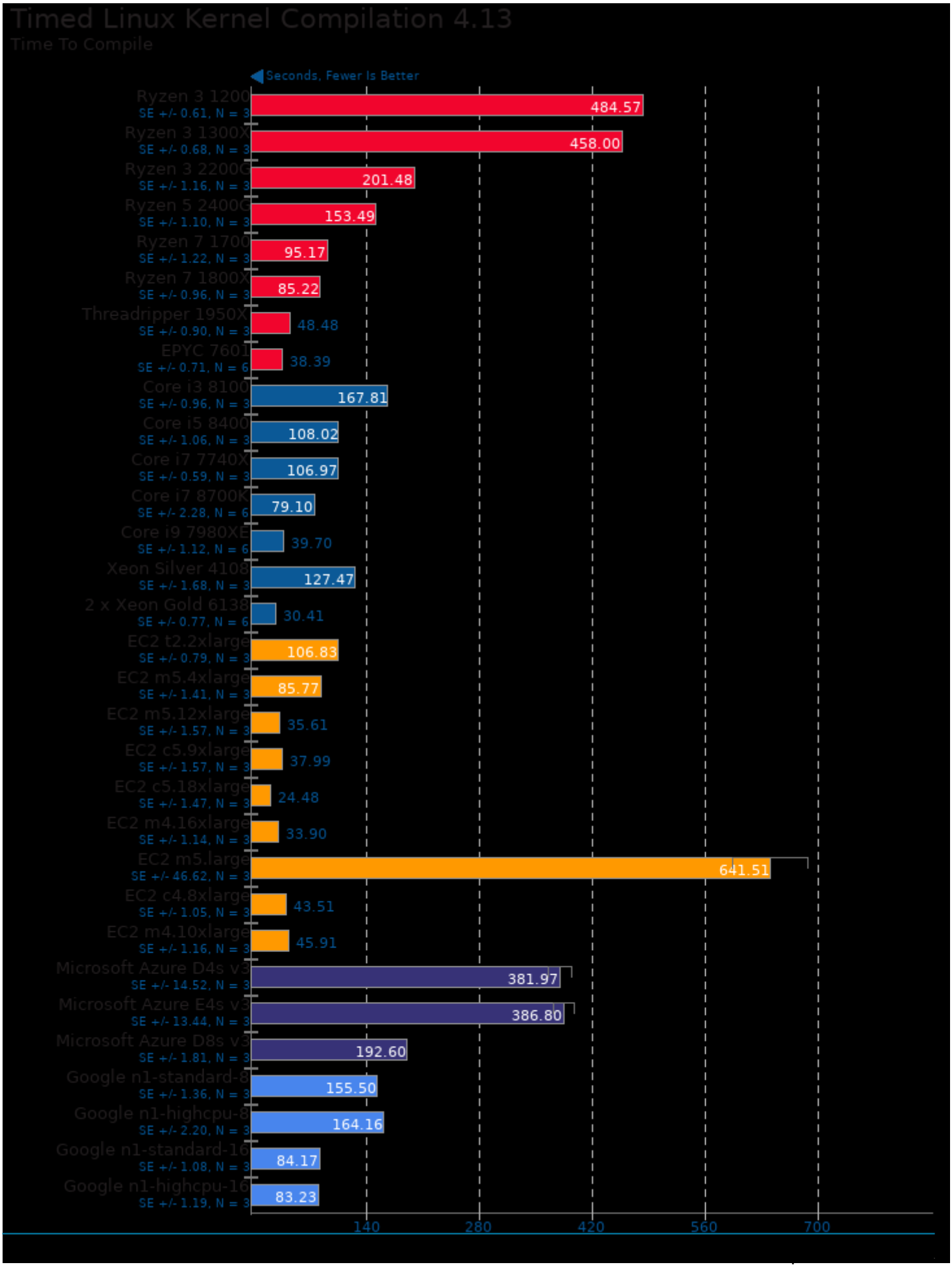


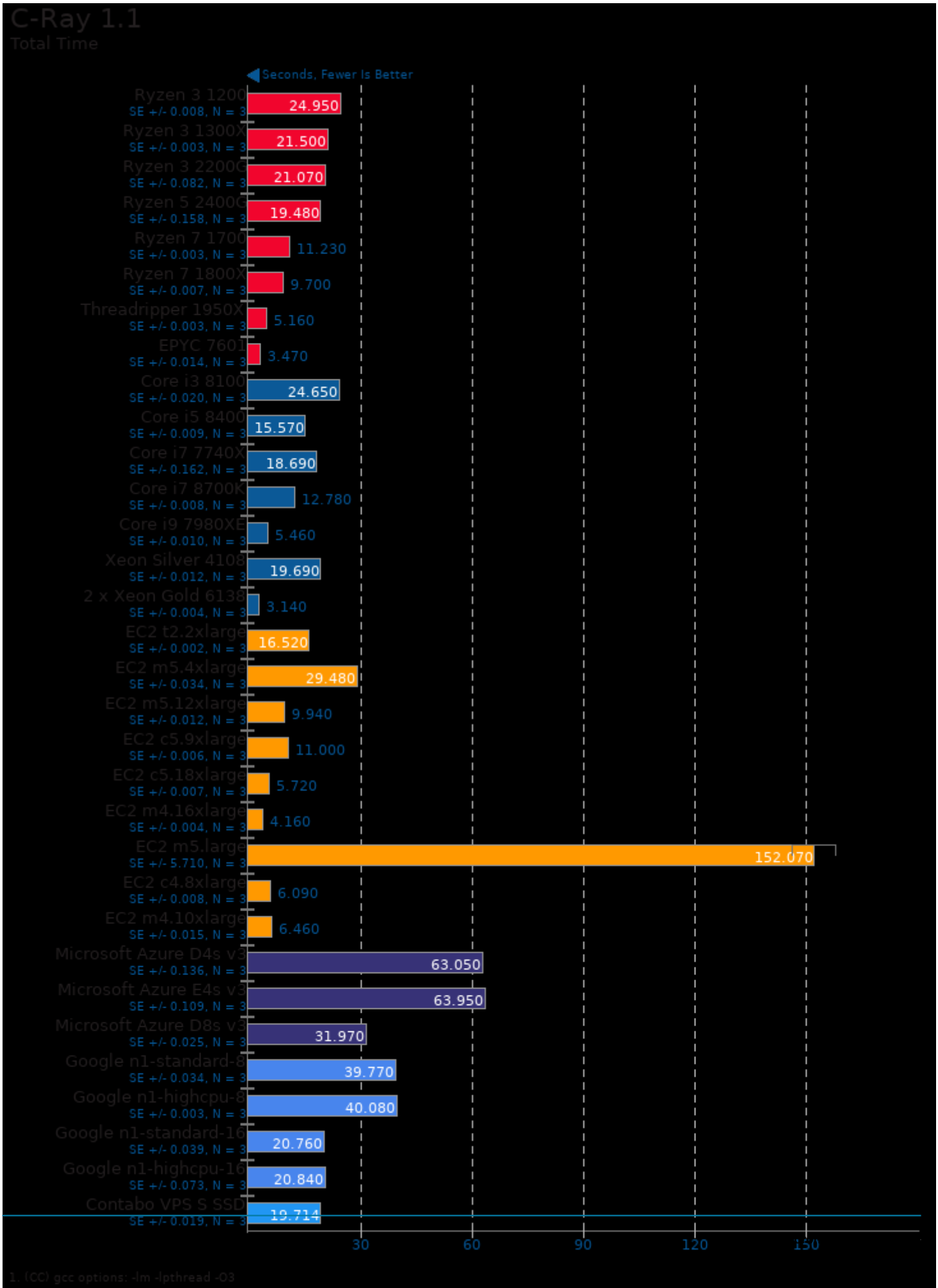

Open FMM Nero2D 2.0.2
Total Time
Seconds, Fewer Is Better
Ryzen 3 1200
SE +/- 0.20, N = 3
109.59
Ryzen 3 1300X
SE +/- 0.07, N = 3
94.39
Ryzen 3 2200G
SE +/- 0.18, N = 3
92.09
Ryzen 5 2400G
SE +/- 0.52, N = 3
90.56
Ryzen 7 1700
SE +/- 0.16, N = 3
57.48
Ryzen 7 1800X
SE +/- 0.31, N = 3
50.15
Threadripper 1950X
SE +/- 0.49, N = 4
30.16
EPYC 7601
SE +/- 0.45, N = 3
26.15
Core i3 8100
SE +/- 0.36, N = 3
92.61
Core i5 8400
SE +/- 0.41, N = 3
61.04
Core i7 7740X
SE +/- 0.24, N = 3
76.36
Core i7 8700K
SE +/- 0.32, N = 3
54.98
Core i9 7980XE
SE +/- 0.09, N = 3
27.99
Xeon Silver 4108
SE +/- 0.18, N = 3
86.84
2 x Xeon Gold 6138
SE +/- 0.35, N = 6
21.44
EC2 t2.2xlarge
SE +/- 0.42, N = 3
87.04
EC2 m5.4xlarge
SE +/- 5.00, N = 3
115.44
EC2 m5.12xlarge
SE +/- 7.90, N = 3
48.78
EC2 c5.9xlarge
SE +/- 0.96, N = 3
60.15
EC2 c5.18xlarge
SE +/- 4.84, N = 3
32.19
EC2 m4.16xlarge
SE +/- 0.13, N = 3
26.13
EC2 m5.large
SE +/- 8.89, N = 3
534.08
EC2 c4.8xlarge
SE +/- 0.13, N = 3
36.91
EC2 m4.10xlarge
SE +/- 0.80, N = 3
41.18
Microsoft Azure D4s v3
SE +/- 0.35, N = 3
391.21
Microsoft Azure E4s v3
SE +/- 0.74, N = 3
351.83
Microsoft Azure D8s v3
SE +/- 0.89, N = 3
177.01
Google n1-standard-8
SE +/- 0.90, N = 3
193.69
Google n1-highcpu-8
SE +/- 0.57, N = 3
198.33
Google n1-standard-16
SE +/- 1.34, N = 3
126.67
Google n1-highcpu-16
SE +/- 6.47, N = 3
130.21
120
240
360
480
600
1. (CXX) g++ options: -O2 -lfftw3 -llapack -lblas -lgfortran -lquadmath -lm -pthread -lmpi_cxx -lmpi

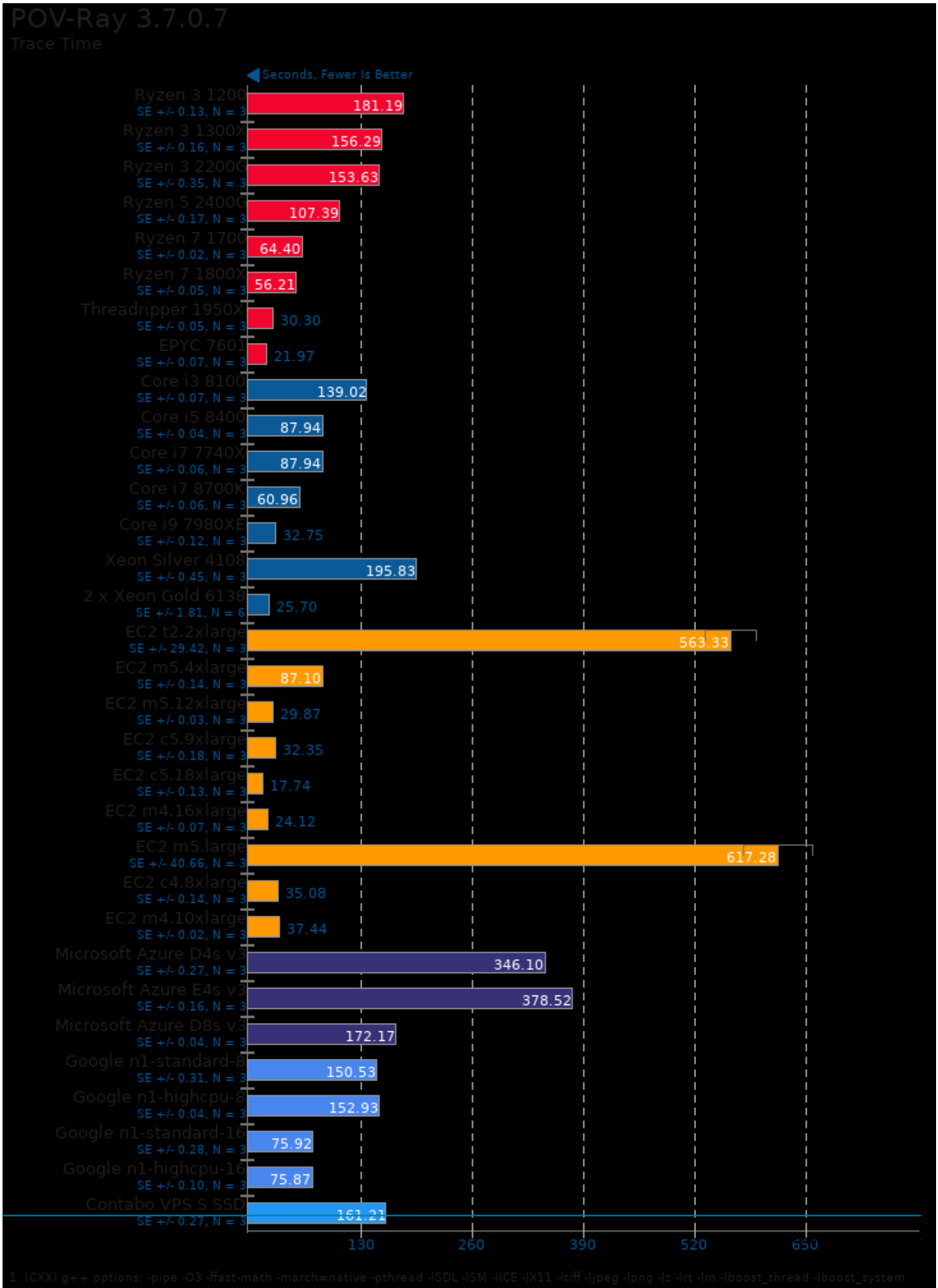

TTSIOD 3D Renderer 2.3a
Phong Rendering With Soft-Shadow Mapping
FPS, More Is Better
Ryzen 3 1200
SE +/- 0.49, N = 3
122.95
Ryzen 3 1300X
SE +/- 0.16, N = 3
134.97
Ryzen 3 2200G
SE +/- 0.83, N = 3
178.17
Ryzen 5 2400G
SE +/- 1.74, N = 3
211.60
Ryzen 7 1700
SE +/- 0.12, N = 3
274.64
Ryzen 7 1800X
SE +/- 0.35, N = 3
312.22
Threadripper 1950X
SE +/- 0.53, N = 3
466.13
EPYC 7601
SE +/- 0.55, N = 3
447.71
Core i3 8100
SE +/- 0.55, N = 3
168.27
Core i5 8400
SE +/- 0.18, N = 3
263.63
Core i7 7740X
SE +/- 2.82, N = 3
277.43
Core i7 8700K
SE +/- 0.60, N = 3
391.67
Core i9 7980XE
SE +/- 3.20, N = 3
690.00
Xeon Silver 4108
SE +/- 0.46, N = 3
210.84
2 x Xeon Gold 6138
SE +/- 10.34, N = 5
733.58
EC2 t2.2xlarge
SE +/- 0.39, N = 3
231.07
EC2 m5.4xlarge
SE +/- 0.49, N = 3
184.83
EC2 m5.12xlarge
SE +/- 4.78, N = 3
504.82
EC2 c5.9xlarge
SE +/- 4.23, N = 3
460.27
EC2 c5.18xlarge
SE +/- 12.51, N = 3
336.76
EC2 m4.16xlarge
SE +/- 20.68, N = 3
465.90
EC2 m5.large
SE +/- 2.30, N = 3
26.88
EC2 c4.8xlarge
SE +/- 3.14, N = 3
419.30
EC2 m4.10xlarge
SE +/- 3.29, N = 3
394.52
Microsoft Azure D4s v3
SE +/- 0.19, N = 3
74.64
Microsoft Azure E4s v3
SE +/- 0.10, N = 3
75.14
Microsoft Azure D8s v3
SE +/- 0.38, N = 3
142.43
Google n1-standard-8
SE +/- 0.50, N = 3
129.81
Google n1-highcpu-8
SE +/- 0.39, N = 3
124.66
Google n1-standard-16
SE +/- 1.87, N = 3
238.88
Google n1-highcpu-16
SE +/- 2.14, N = 3
234.96
Contabo VPS S SSD
SE +/- 0.45, N = 3
96.98
160
320
480
640
800
1. (CXX) g++ options: -O3 -fomit-frame-pointer -ffast-math -mtune=native -flto -msse -mrecip -mfpmath=sse -msse2 -mssse3 -lSDL -lstdc++

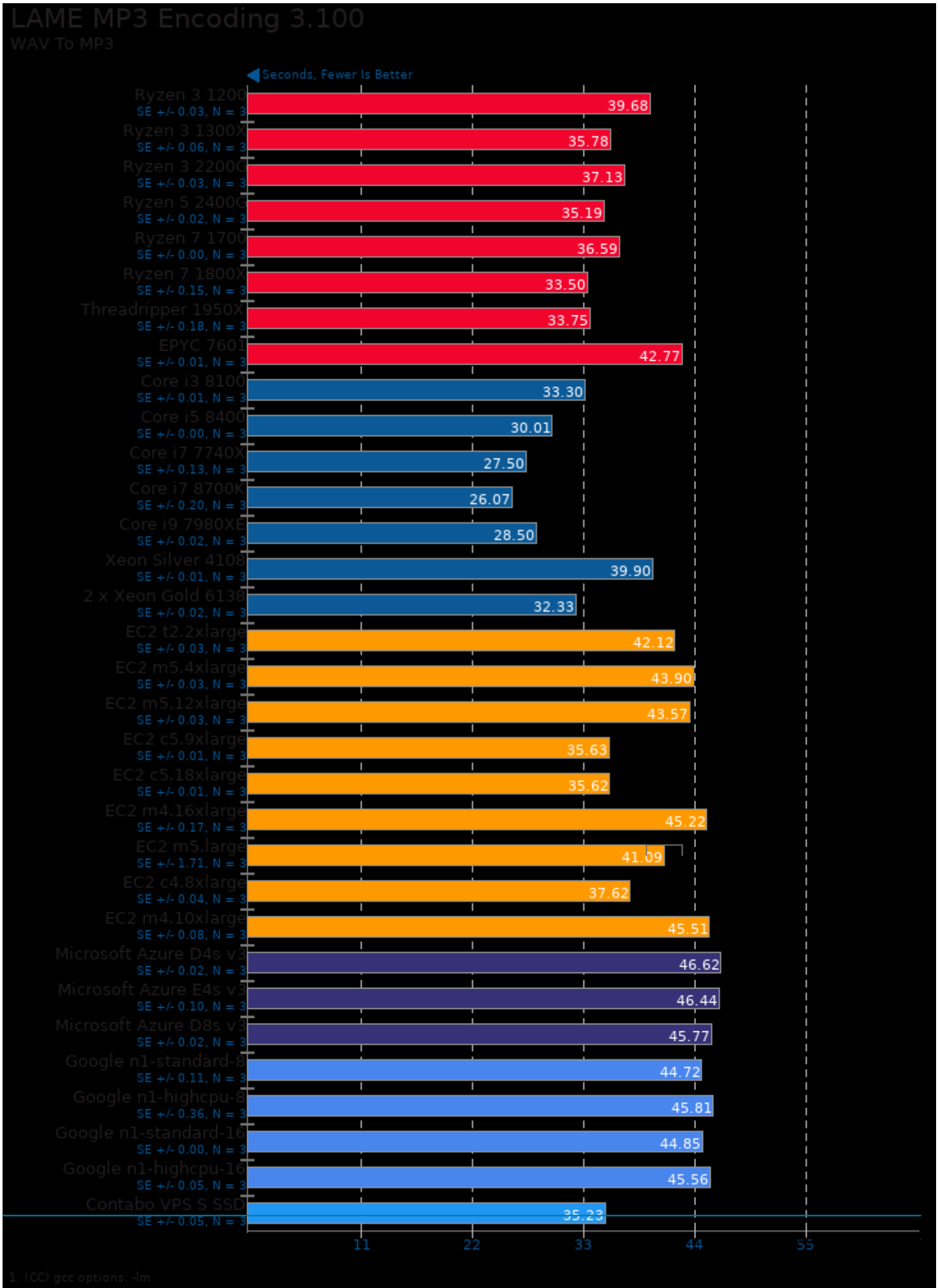

x264 2018-02-05
H.264 Video Encoding
Frames Per Second, More Is Better
Ryzen 3 1200
SE +/- 0.33, N = 6
23.47
Ryzen 3 1300X
SE +/- 0.03, N = 3
27.33
Ryzen 3 2200G
SE +/- 0.02, N = 3
27.60
Ryzen 5 2400G
SE +/- 0.58, N = 4
34.75
Ryzen 7 1700
SE +/- 1.01, N = 4
60.90
Ryzen 7 1800X
SE +/- 0.22, N = 3
71.46
Threadripper 1950X
SE +/- 0.43, N = 3
127.00
EPYC 7601
SE +/- 0.45, N = 3
108.07
Core i3 8100
SE +/- 0.41, N = 6
30.42
Core i5 8400
SE +/- 0.06, N = 3
56.11
Core i7 7740X
SE +/- 0.17, N = 3
49.95
Core i7 8700K
SE +/- 0.22, N = 3
72.96
Core i9 7980XE
SE +/- 0.27, N = 3
125.28
Xeon Silver 4108
SE +/- 0.14, N = 3
32.75
2 x Xeon Gold 6138
SE +/- 1.58, N = 3
107.89
EC2 t2.2xlarge
SE +/- 0.03, N = 3
38.43
EC2 m5.4xlarge
SE +/- 0.55, N = 3
55.46
EC2 m5.12xlarge
SE +/- 0.28, N = 3
129.66
EC2 c5.9xlarge
SE +/- 0.49, N = 3
134.10
EC2 c5.18xlarge
SE +/- 1.46, N = 3
176.03
EC2 m4.16xlarge
SE +/- 1.25, N = 3
115.34
EC2 m5.large
SE +/- 0.02, N = 3
11.02
EC2 c4.8xlarge
SE +/- 0.30, N = 3
107.99
EC2 m4.10xlarge
SE +/- 0.19, N = 3
97.43
Microsoft Azure D4s v3
SE +/- 0.06, N = 3
13.95
Microsoft Azure E4s v3
SE +/- 0.01, N = 3
12.08
Microsoft Azure D8s v3
SE +/- 0.06, N = 3
26.82
Google n1-standard-8
SE +/- 0.05, N = 3
26.93
Google n1-highcpu-8
SE +/- 0.14, N = 3
25.92
Google n1-standard-16
SE +/- 0.24, N = 3
52.07
Google n1-highcpu-16
SE +/- 0.12, N = 3
52.41
40
80
120
160
200
1. (CC) gcc options: -m64 -lm -lpthread -O3 -ffast-math -std=gnu99 -fPIC -fomit-frame-pointer -fno-tree-vectorize

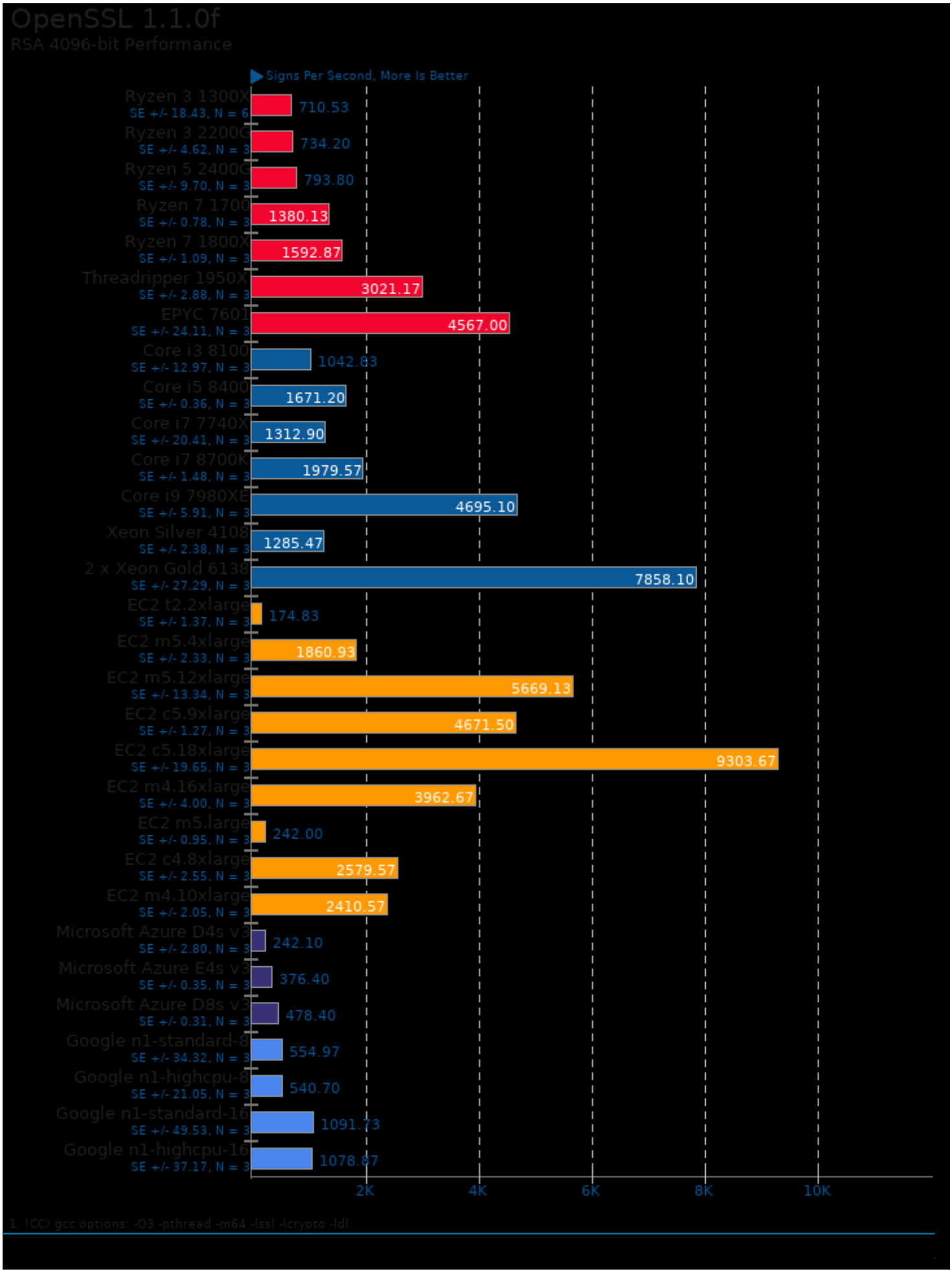

7-Zip Compression 9.20.1
Compress Speed Test
MIPS, More Is Better
Ryzen 3 1200
12601
Ryzen 3 1300X
SE +/- 169.00, N = 3
15880
Ryzen 3 2200G
SE +/- 45.83, N = 3
15744
Ryzen 5 2400G
SE +/- 290.74, N = 4
17729
Ryzen 7 1700
SE +/- 101.52, N = 3
30627
Ryzen 7 1800X
SE +/- 276.94, N = 3
33022
Threadripper 1950X
SE +/- 75.86, N = 3
71592
EPYC 7601
SE +/- 346.49, N = 3
95062
Core i3 8100
SE +/- 21.39, N = 3
17221
Core i5 8400
SE +/- 36.34, N = 3
27028
Core i7 7740X
SE +/- 483.48, N = 3
28952
Core i7 8700K
SE +/- 232.19, N = 3
39039
Core i9 7980XE
SE +/- 269.78, N = 3
91138
Xeon Silver 4108
SE +/- 234.70, N = 3
27888
2 x Xeon Gold 6138
SE +/- 2063.58, N = 3
139707
EC2 t2.2xlarge
SE +/- 86.00, N = 3
23917
EC2 m5.4xlarge
SE +/- 282.94, N = 3
36642
EC2 m5.12xlarge
SE +/- 480.06, N = 3
112699
EC2 c5.9xlarge
SE +/- 226.61, N = 3
91933
EC2 c5.18xlarge
SE +/- 319.70, N = 3
160822
EC2 m4.16xlarge
SE +/- 482.44, N = 3
115598
EC2 m5.large
SE +/- 28.62, N = 3
5090
EC2 c4.8xlarge
SE +/- 380.57, N = 3
78087
EC2 m4.10xlarge
SE +/- 280.19, N = 3
75762
Microsoft Azure D4s v3
SE +/- 90.16, N = 3
9144
Microsoft Azure E4s v3
SE +/- 16.02, N = 3
8708
Microsoft Azure D8s v3
SE +/- 88.33, N = 3
17015
Google n1-standard-8
SE +/- 75.03, N = 3
16136
Google n1-highcpu-8
SE +/- 16.90, N = 3
14996
Google n1-standard-16
SE +/- 130.52, N = 3
30229
Google n1-highcpu-16
SE +/- 132.53, N = 3
30253
Contabo VPS S SSD
SE +/- 151.14, N = 4
13477
30K
60K
90K
120K
150K
1. (CXX) g++ options: -pipe -lpthread

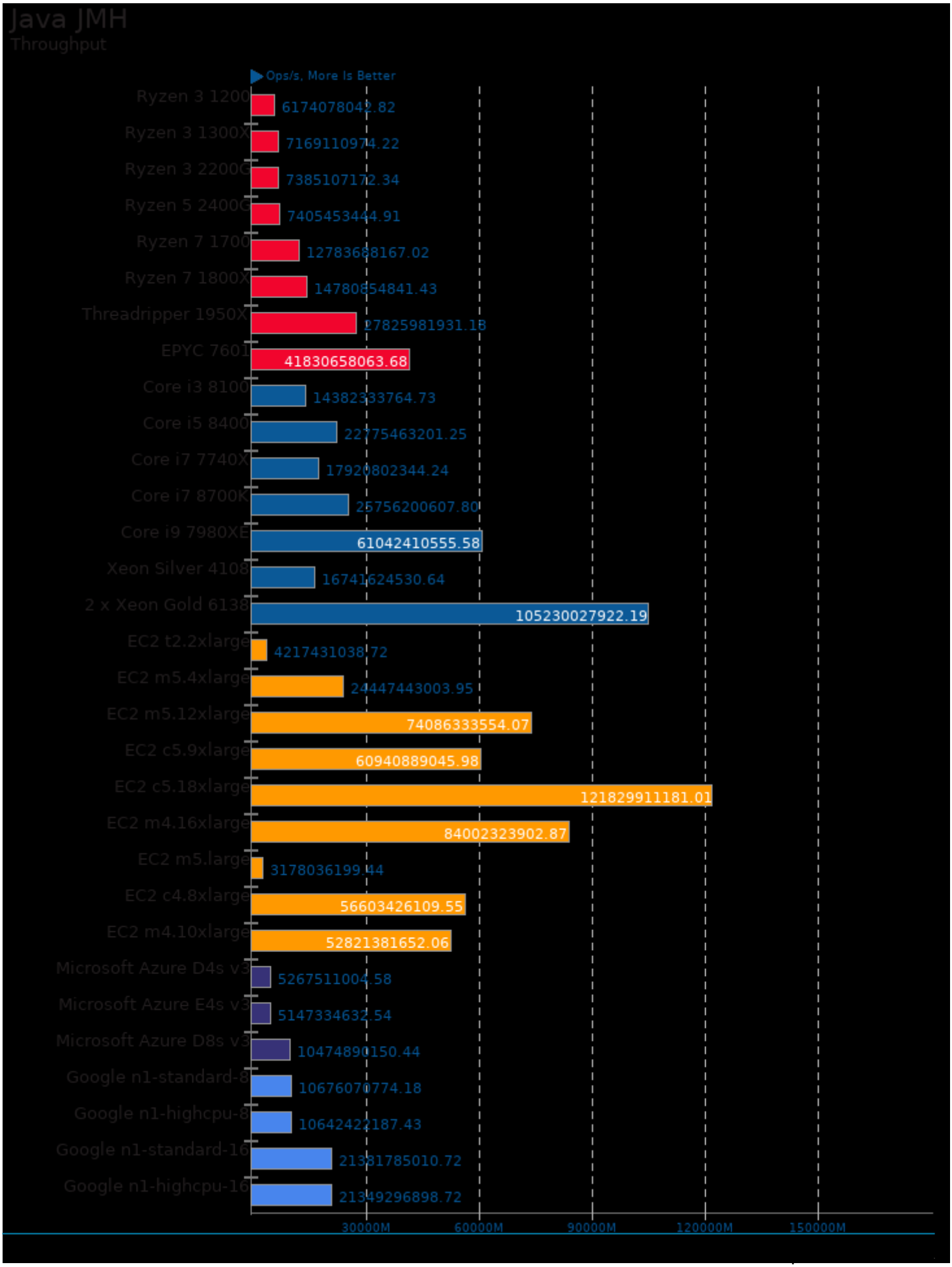

Timed Linux Kernel Compilation 4.13
Time To Compile
Seconds, Fewer Is Better
Ryzen 3 1200
SE +/- 0.61, N = 3
484.57
Ryzen 3 1300X
SE +/- 0.68, N = 3
458.00
Ryzen 3 2200G
SE +/- 1.16, N = 3
201.48
Ryzen 5 2400G
SE +/- 1.10, N = 3
153.49
Ryzen 7 1700
SE +/- 1.22, N = 3
95.17
Ryzen 7 1800X
SE +/- 0.96, N = 3
85.22
Threadripper 1950X
SE +/- 0.90, N = 3
48.48
EPYC 7601
SE +/- 0.71, N = 6
38.39
Core i3 8100
SE +/- 0.96, N = 3
167.81
Core i5 8400
SE +/- 1.06, N = 3
108.02
Core i7 7740X
SE +/- 0.59, N = 3
106.97
Core i7 8700K
SE +/- 2.28, N = 6
79.10
Core i9 7980XE
SE +/- 1.12, N = 6
39.70
Xeon Silver 4108
SE +/- 1.68, N = 3
127.47
2 x Xeon Gold 6138
SE +/- 0.77, N = 6
30.41
EC2 t2.2xlarge
SE +/- 0.79, N = 3
106.83
EC2 m5.4xlarge
SE +/- 1.41, N = 3
85.77
EC2 m5.12xlarge
SE +/- 1.57, N = 3
35.61
EC2 c5.9xlarge
SE +/- 1.57, N = 3
37.99
EC2 c5.18xlarge
SE +/- 1.47, N = 3
24.48
EC2 m4.16xlarge
SE +/- 1.14, N = 3
33.90
EC2 m5.large
SE +/- 46.62, N = 3
641.51
EC2 c4.8xlarge
SE +/- 1.05, N = 3
43.51
EC2 m4.10xlarge
SE +/- 1.16, N = 3
45.91
Microsoft Azure D4s v3
SE +/- 14.52, N = 3
381.97
Microsoft Azure E4s v3
SE +/- 13.44, N = 3
386.80
Microsoft Azure D8s v3
SE +/- 1.81, N = 3
192.60
Google n1-standard-8
SE +/- 1.36, N = 3
155.50
Google n1-highcpu-8
SE +/- 2.20, N = 3
164.16
Google n1-standard-16
SE +/- 1.08, N = 3
84.17
Google n1-highcpu-16
SE +/- 1.19, N = 3
83.23
140
280
420
560
700

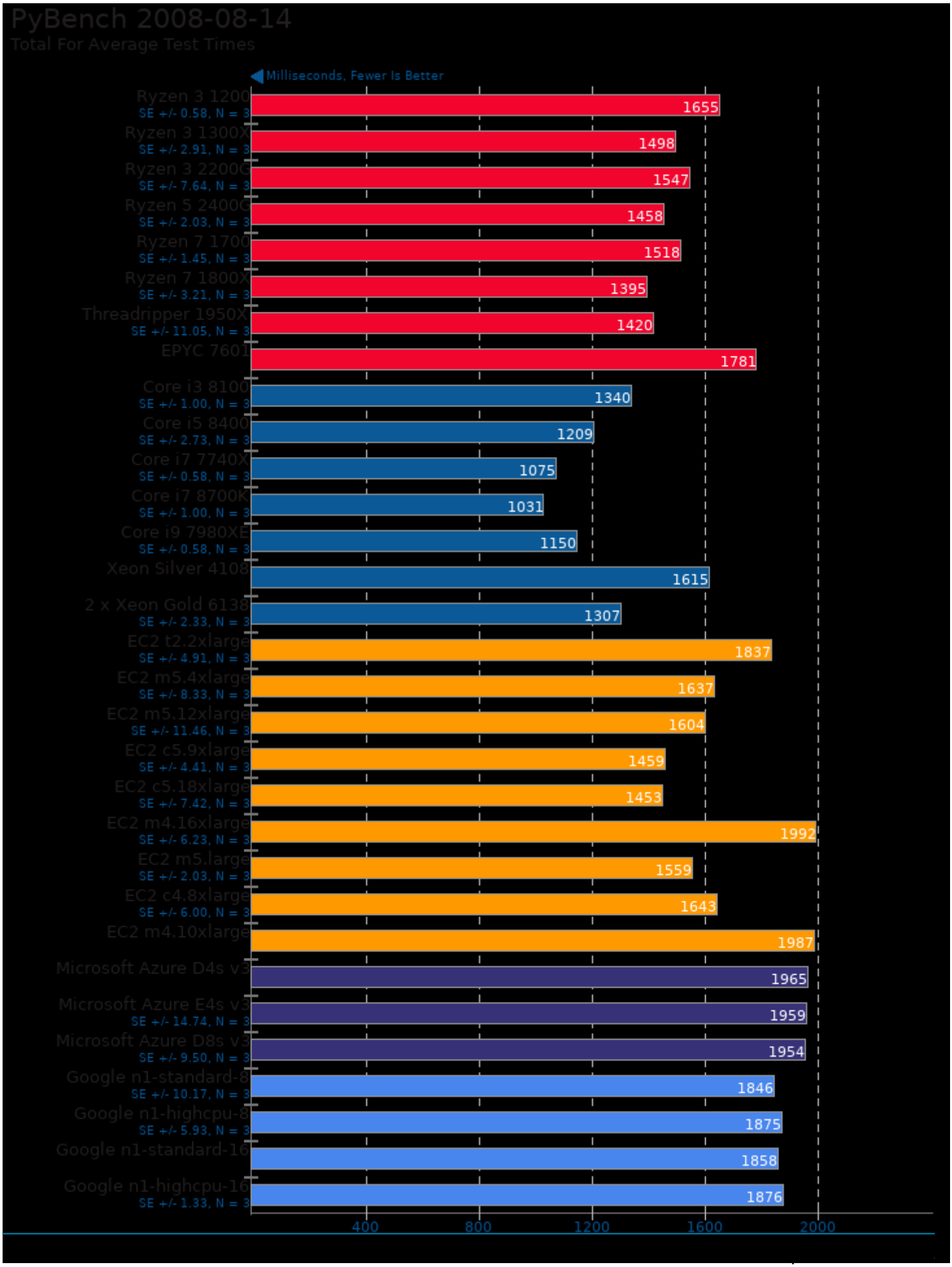

C-Ray 1.1
Total Time
Seconds, Fewer Is Better
Ryzen 3 1200
SE +/- 0.008, N = 3
24.950
Ryzen 3 1300X
SE +/- 0.003, N = 3
21.500
Ryzen 3 2200G
SE +/- 0.082, N = 3
21.070
Ryzen 5 2400G
SE +/- 0.158, N = 3
19.480
Ryzen 7 1700
SE +/- 0.003, N = 3
11.230
Ryzen 7 1800X
SE +/- 0.007, N = 3
9.700
Threadripper 1950X
SE +/- 0.003, N = 3
5.160
EPYC 7601
SE +/- 0.014, N = 3
3.470
Core i3 8100
SE +/- 0.020, N = 3
24.650
Core i5 8400
SE +/- 0.009, N = 3
15.570
Core i7 7740X
SE +/- 0.162, N = 3
18.690
Core i7 8700K
SE +/- 0.008, N = 3
12.780
Core i9 7980XE
SE +/- 0.010, N = 3
5.460
Xeon Silver 4108
SE +/- 0.012, N = 3
19.690
2 x Xeon Gold 6138
SE +/- 0.004, N = 3
3.140
EC2 t2.2xlarge
SE +/- 0.002, N = 3
16.520
EC2 m5.4xlarge
SE +/- 0.034, N = 3
29.480
EC2 m5.12xlarge
SE +/- 0.012, N = 3
9.940
EC2 c5.9xlarge
SE +/- 0.006, N = 3
11.000
EC2 c5.18xlarge
SE +/- 0.007, N = 3
5.720
EC2 m4.16xlarge
SE +/- 0.004, N = 3
4.160
EC2 m5.large
SE +/- 5.710, N = 3
152.070
EC2 c4.8xlarge
SE +/- 0.008, N = 3
6.090
EC2 m4.10xlarge
SE +/- 0.015, N = 3
6.460
Microsoft Azure D4s v3
SE +/- 0.136, N = 3
63.050
Microsoft Azure E4s v3
SE +/- 0.109, N = 3
63.950
Microsoft Azure D8s v3
SE +/- 0.025, N = 3
31.970
Google n1-standard-8
SE +/- 0.034, N = 3
39.770
Google n1-highcpu-8
SE +/- 0.003, N = 3
40.080
Google n1-standard-16
SE +/- 0.039, N = 3
20.760
Google n1-highcpu-16
SE +/- 0.073, N = 3
20.840
Contabo VPS S SSD
SE +/- 0.019, N = 3
19.714
30
60
90
120
150
1. (CC) gcc options: -lm -lpthread -O3

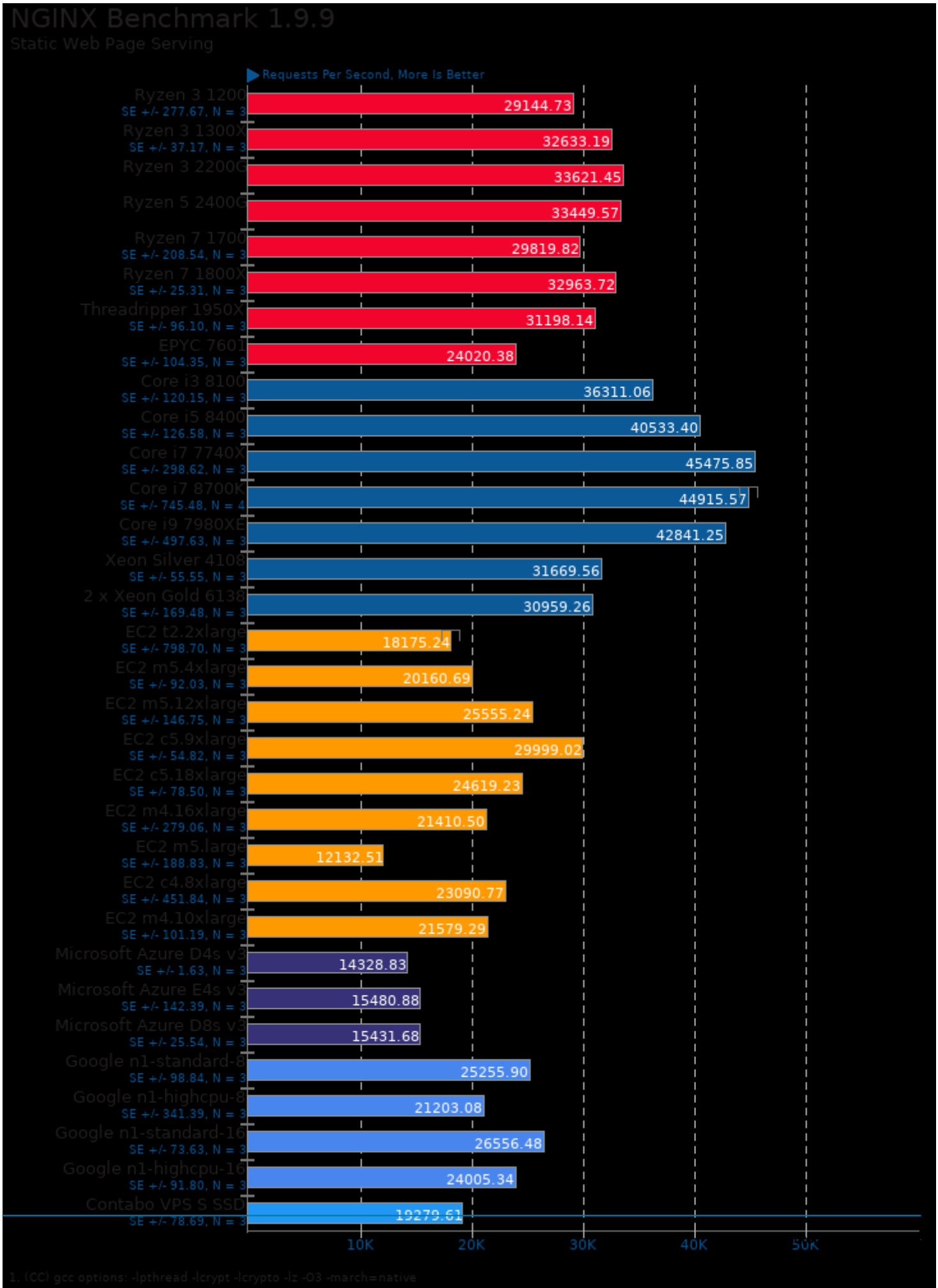

POV-Ray 3.7.0.7
Trace Time
Seconds, Fewer Is Better
Ryzen 3 1200
SE +/- 0.13, N = 3
181.19
Ryzen 3 1300X
SE +/- 0.16, N = 3
156.29
Ryzen 3 2200G
SE +/- 0.35, N = 3
153.63
Ryzen 5 2400G
SE +/- 0.17, N = 3
107.39
Ryzen 7 1700
SE +/- 0.02, N = 3
64.40
Ryzen 7 1800X
SE +/- 0.05, N = 3
56.21
Threadripper 1950X
SE +/- 0.05, N = 3
30.30
EPYC 7601
SE +/- 0.07, N = 3
21.97
Core i3 8100
SE +/- 0.07, N = 3
139.02
Core i5 8400
SE +/- 0.04, N = 3
87.94
Core i7 7740X
SE +/- 0.06, N = 3
87.94
Core i7 8700K
SE +/- 0.06, N = 3
60.96
Core i9 7980XE
SE +/- 0.12, N = 3
32.75
Xeon Silver 4108
SE +/- 0.45, N = 3
195.83
2 x Xeon Gold 6138
SE +/- 1.81, N = 6
25.70
EC2 t2.2xlarge
SE +/- 29.42, N = 3
563.33
EC2 m5.4xlarge
SE +/- 0.14, N = 3
87.10
EC2 m5.12xlarge
SE +/- 0.03, N = 3
29.87
EC2 c5.9xlarge
SE +/- 0.18, N = 3
32.35
EC2 c5.18xlarge
SE +/- 0.13, N = 3
17.74
EC2 m4.16xlarge
SE +/- 0.07, N = 3
24.12
EC2 m5.large
SE +/- 40.66, N = 3
617.28
EC2 c4.8xlarge
SE +/- 0.14, N = 3
35.08
EC2 m4.10xlarge
SE +/- 0.02, N = 3
37.44
Microsoft Azure D4s v3
SE +/- 0.27, N = 3
346.10
Microsoft Azure E4s v3
SE +/- 0.16, N = 3
378.52
Microsoft Azure D8s v3
SE +/- 0.04, N = 3
172.17
Google n1-standard-8
SE +/- 0.31, N = 3
150.53
Google n1-highcpu-8
SE +/- 0.04, N = 3
152.93
Google n1-standard-16
SE +/- 0.28, N = 3
75.92
Google n1-highcpu-16
SE +/- 0.10, N = 3
75.87
Contabo VPS S SSD
SE +/- 0.27, N = 3
161.21
130
260
390
520
650
1. (CXX) g++ options: -pipe -O3 -ffast-math -march=native -pthread -lSDL -lSM -lICE -lX11 -ltiff -ljpeg -lpng -lz -lrt -lm -lboost_thread -lboost_system

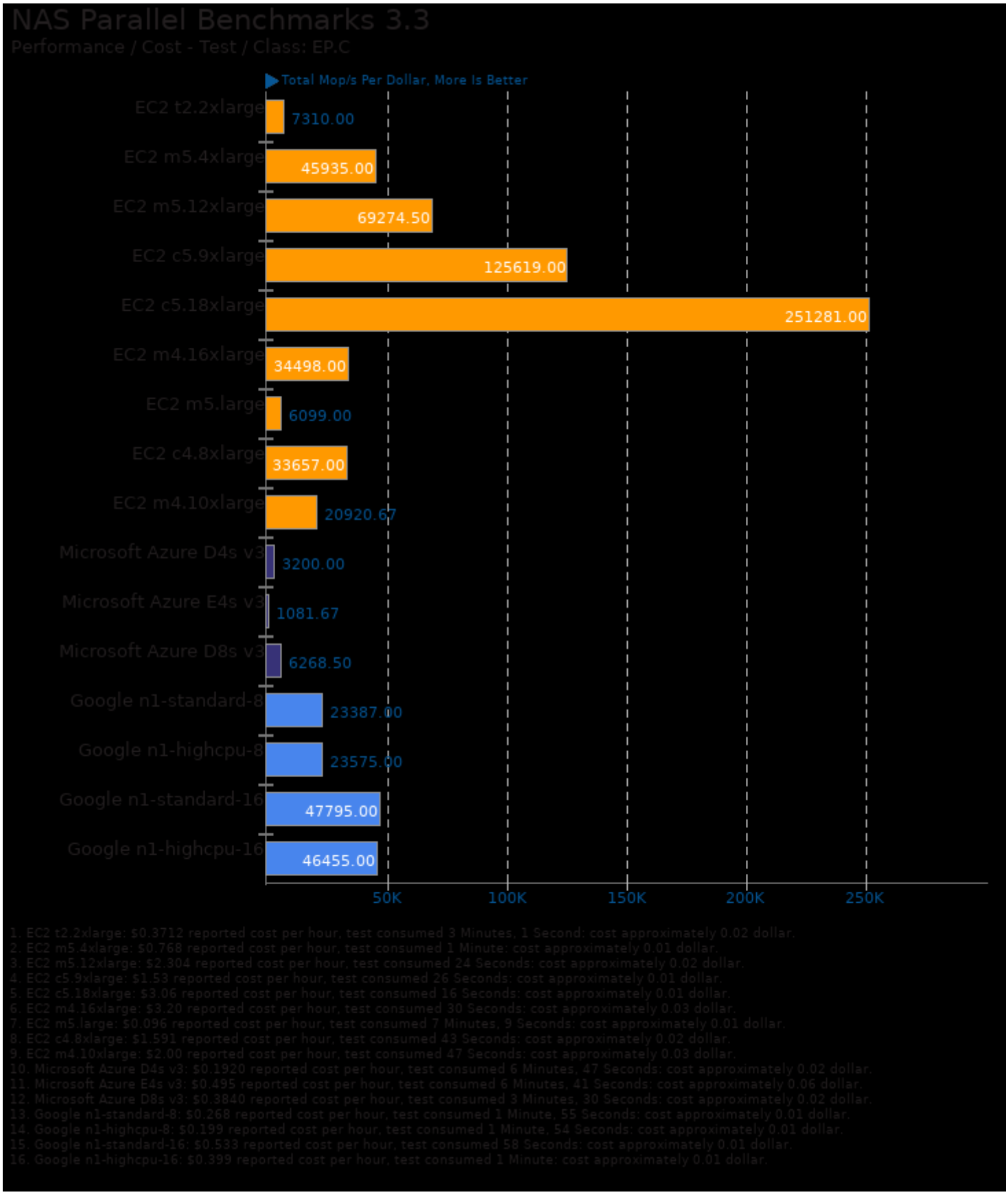

LAME MP3 Encoding 3.100
WAV To MP3
Seconds, Fewer Is Better
Ryzen 3 1200
SE +/- 0.03, N = 3
39.68
Ryzen 3 1300X
SE +/- 0.06, N = 3
35.78
Ryzen 3 2200G
SE +/- 0.03, N = 3
37.13
Ryzen 5 2400G
SE +/- 0.02, N = 3
35.19
Ryzen 7 1700
SE +/- 0.00, N = 3
36.59
Ryzen 7 1800X
SE +/- 0.15, N = 3
33.50
Threadripper 1950X
SE +/- 0.18, N = 3
33.75
EPYC 7601
SE +/- 0.01, N = 3
42.77
Core i3 8100
SE +/- 0.01, N = 3
33.30
Core i5 8400
SE +/- 0.00, N = 3
30.01
Core i7 7740X
SE +/- 0.13, N = 3
27.50
Core i7 8700K
SE +/- 0.20, N = 3
26.07
Core i9 7980XE
SE +/- 0.02, N = 3
28.50
Xeon Silver 4108
SE +/- 0.01, N = 3
39.90
2 x Xeon Gold 6138
SE +/- 0.02, N = 3
32.33
EC2 t2.2xlarge
SE +/- 0.03, N = 3
42.12
EC2 m5.4xlarge
SE +/- 0.03, N = 3
43.90
EC2 m5.12xlarge
SE +/- 0.03, N = 3
43.57
EC2 c5.9xlarge
SE +/- 0.01, N = 3
35.63
EC2 c5.18xlarge
SE +/- 0.01, N = 3
35.62
EC2 m4.16xlarge
SE +/- 0.17, N = 3
45.22
EC2 m5.large
SE +/- 1.71, N = 3
41.09
EC2 c4.8xlarge
SE +/- 0.04, N = 3
37.62
EC2 m4.10xlarge
SE +/- 0.08, N = 3
45.51
Microsoft Azure D4s v3
SE +/- 0.02, N = 3
46.62
Microsoft Azure E4s v3
SE +/- 0.10, N = 3
46.44
Microsoft Azure D8s v3
SE +/- 0.02, N = 3
45.77
Google n1-standard-8
SE +/- 0.11, N = 3
44.72
Google n1-highcpu-8
SE +/- 0.36, N = 3
45.81
Google n1-standard-16
SE +/- 0.00, N = 3
44.85
Google n1-highcpu-16
SE +/- 0.05, N = 3
45.56
Contabo VPS S SSD
SE +/- 0.05, N = 3
35.23
11
22
33
44
55
1. (CC) gcc options: -lm

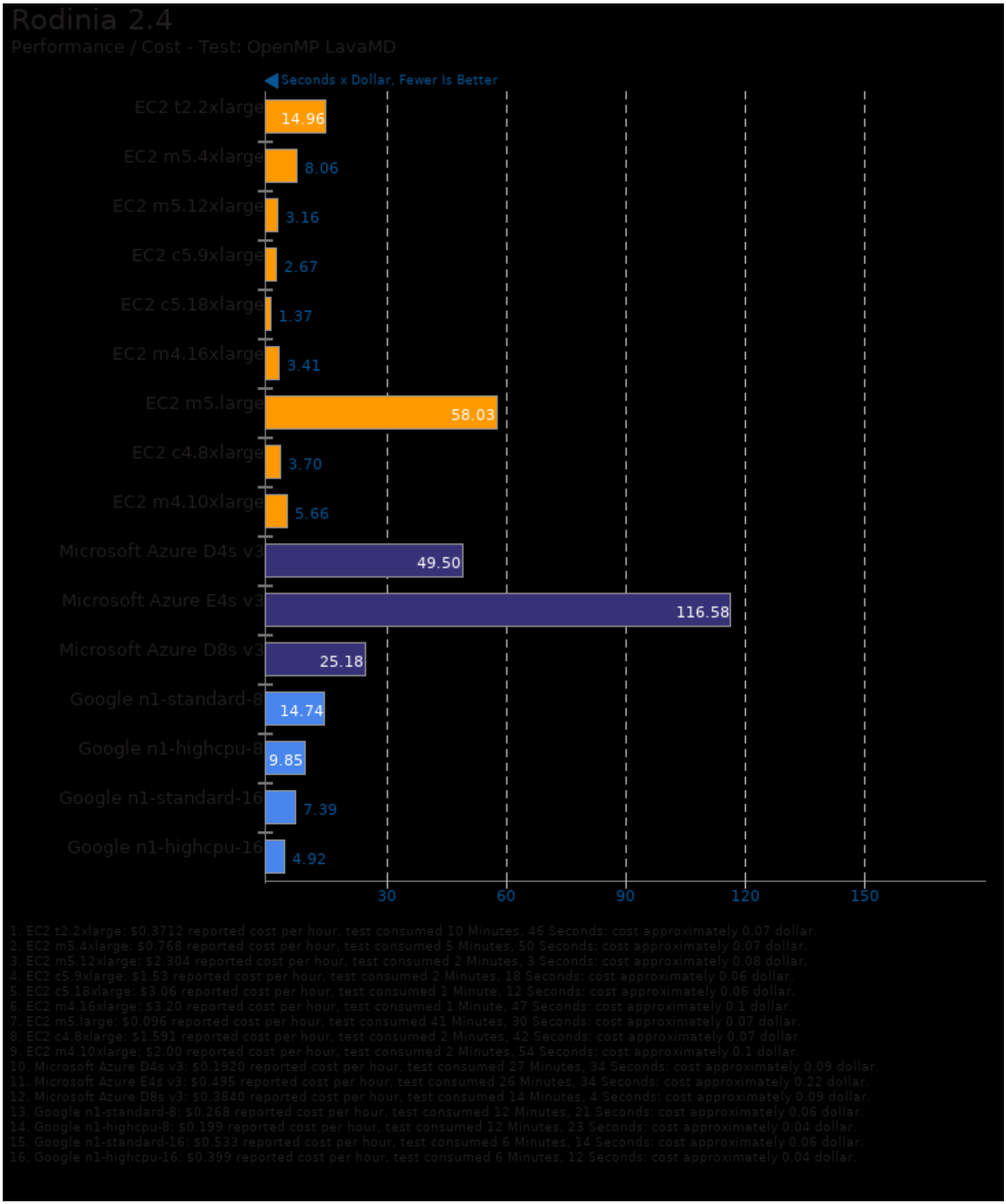

OpenSSL 1.1.0f
RSA 4096-bit Performance
Signs Per Second, More Is Better
Ryzen 3 1300X
SE +/- 18.43, N = 6
710.53
Ryzen 3 2200G
SE +/- 4.62, N = 3
734.20
Ryzen 5 2400G
SE +/- 9.70, N = 3
793.80
Ryzen 7 1700
SE +/- 0.78, N = 3
1380.13
Ryzen 7 1800X
SE +/- 1.09, N = 3
1592.87
Threadripper 1950X
SE +/- 2.88, N = 3
3021.17
EPYC 7601
SE +/- 24.11, N = 3
4567.00
Core i3 8100
SE +/- 12.97, N = 3
1042.83
Core i5 8400
SE +/- 0.36, N = 3
1671.20
Core i7 7740X
SE +/- 20.41, N = 3
1312.90
Core i7 8700K
SE +/- 1.48, N = 3
1979.57
Core i9 7980XE
SE +/- 5.91, N = 3
4695.10
Xeon Silver 4108
SE +/- 2.38, N = 3
1285.47
2 x Xeon Gold 6138
SE +/- 27.29, N = 3
7858.10
EC2 t2.2xlarge
SE +/- 1.37, N = 3
174.83
EC2 m5.4xlarge
SE +/- 2.33, N = 3
1860.93
EC2 m5.12xlarge
SE +/- 13.34, N = 3
5669.13
EC2 c5.9xlarge
SE +/- 1.27, N = 3
4671.50
EC2 c5.18xlarge
SE +/- 19.65, N = 3
9303.67
EC2 m4.16xlarge
SE +/- 4.00, N = 3
3962.67
EC2 m5.large
SE +/- 0.95, N = 3
242.00
EC2 c4.8xlarge
SE +/- 2.55, N = 3
2579.57
EC2 m4.10xlarge
SE +/- 2.05, N = 3
2410.57
Microsoft Azure D4s v3
SE +/- 2.80, N = 3
242.10
Microsoft Azure E4s v3
SE +/- 0.35, N = 3
376.40
Microsoft Azure D8s v3
SE +/- 0.31, N = 3
478.40
Google n1-standard-8
SE +/- 34.32, N = 3
554.97
Google n1-highcpu-8
SE +/- 21.05, N = 3
540.70
Google n1-standard-16
SE +/- 49.53, N = 3
1091.73
Google n1-highcpu-16
SE +/- 37.17, N = 3
1078.87
2K
4K
6K
8K
10K
1. (CC) gcc options: -O3 -pthread -m64 -lssl -lcrypto -ldl


Java JMH
Throughput
Ops/s, More Is Better
Ryzen 3 1200
Ryzen 3 1300X
Ryzen 3 2200G
Ryzen 5 2400G
Ryzen 7 1700
Ryzen 7 1800X
Threadripper 1950X
EPYC 7601
Core i3 8100
Core i5 8400
Core i7 7740X
Core i7 8700K
Core i9 7980XE
Xeon Silver 4108
2 x Xeon Gold 6138
EC2 t2.2xlarge
EC2 m5.4xlarge
EC2 m5.12xlarge
EC2 c5.9xlarge
EC2 c5.18xlarge
EC2 m4.16xlarge
EC2 m5.large
EC2 c4.8xlarge
EC2 m4.10xlarge
Microsoft Azure D4s v3
Microsoft Azure E4s v3
Microsoft Azure D8s v3
Google n1-standard-8
Google n1-highcpu-8
Google n1-standard-16
Google n1-highcpu-16
41830658063.68
61042410555.58
105230027922.19
74086333554.07
60940889045.98
121829911181.01
84002323902.87
56603426109.55
52821381652.06
30000M
60000M
90000M
120000M
150000M

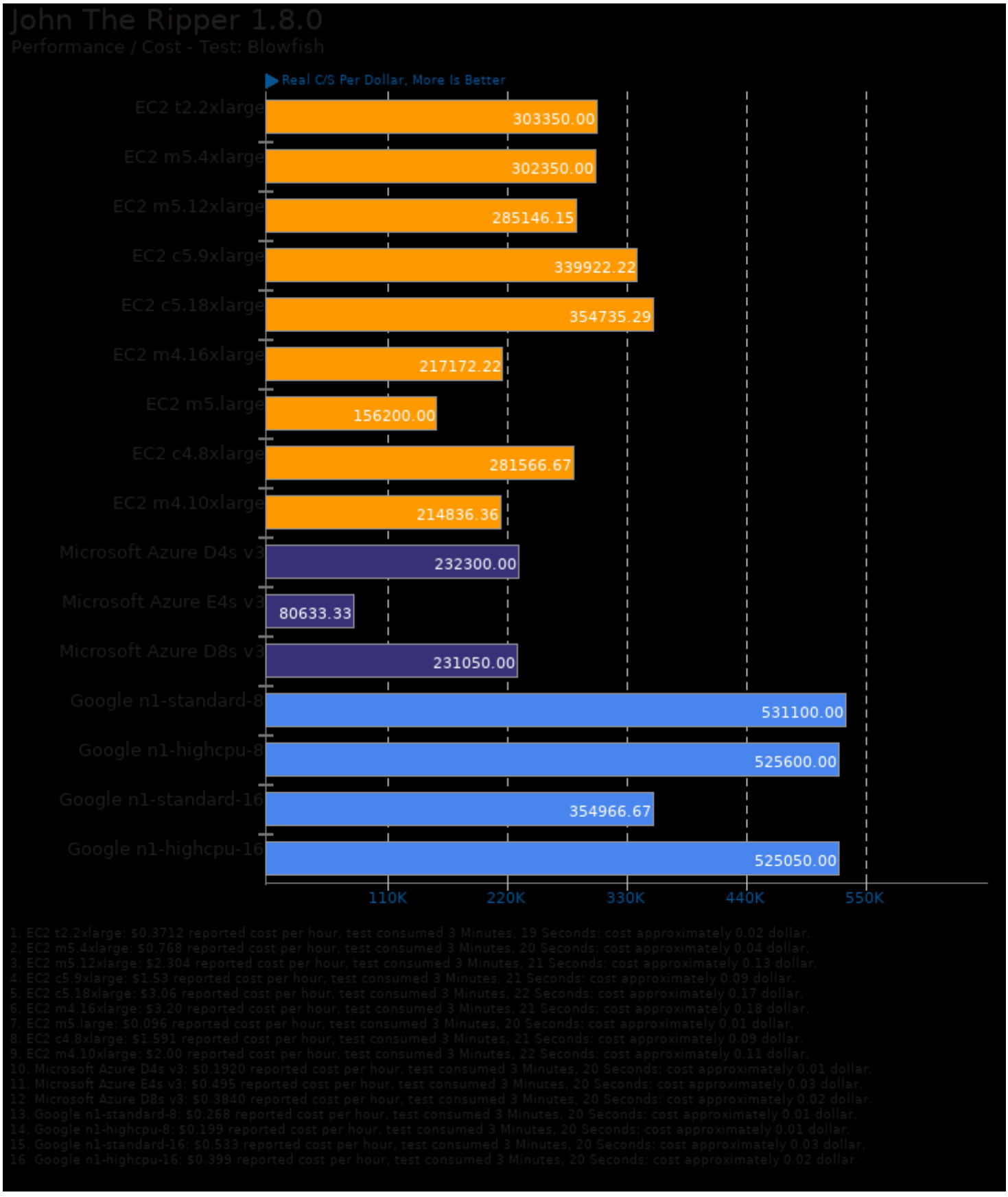

PyBench 2008-08-14
Total For Average Test Times
Milliseconds, Fewer Is Better
Ryzen 3 1200
SE +/- 0.58, N = 3
1655
Ryzen 3 1300X
SE +/- 2.91, N = 3
1498
Ryzen 3 2200G
SE +/- 7.64, N = 3
1547
Ryzen 5 2400G
SE +/- 2.03, N = 3
1458
Ryzen 7 1700
SE +/- 1.45, N = 3
1518
Ryzen 7 1800X
SE +/- 3.21, N = 3
1395
Threadripper 1950X
SE +/- 11.05, N = 3
1420
EPYC 7601
1781
Core i3 8100
SE +/- 1.00, N = 3
1340
Core i5 8400
SE +/- 2.73, N = 3
1209
Core i7 7740X
SE +/- 0.58, N = 3
1075
Core i7 8700K
SE +/- 1.00, N = 3
1031
Core i9 7980XE
SE +/- 0.58, N = 3
1150
Xeon Silver 4108
1615
2 x Xeon Gold 6138
SE +/- 2.33, N = 3
1307
EC2 t2.2xlarge
SE +/- 4.91, N = 3
1837
EC2 m5.4xlarge
SE +/- 8.33, N = 3
1637
EC2 m5.12xlarge
SE +/- 11.46, N = 3
1604
EC2 c5.9xlarge
SE +/- 4.41, N = 3
1459
EC2 c5.18xlarge
SE +/- 7.42, N = 3
1453
EC2 m4.16xlarge
SE +/- 6.23, N = 3
1992
EC2 m5.large
SE +/- 2.03, N = 3
1559
EC2 c4.8xlarge
SE +/- 6.00, N = 3
1643
EC2 m4.10xlarge
1987
Microsoft Azure D4s v3
1965
Microsoft Azure E4s v3
SE +/- 14.74, N = 3
1959
Microsoft Azure D8s v3
SE +/- 9.50, N = 3
1954
Google n1-standard-8
SE +/- 10.17, N = 3
1846
Google n1-highcpu-8
SE +/- 5.93, N = 3
1875
Google n1-standard-16
1858
Google n1-highcpu-16
SE +/- 1.33, N = 3
1876
400
800
1200
1600
2000

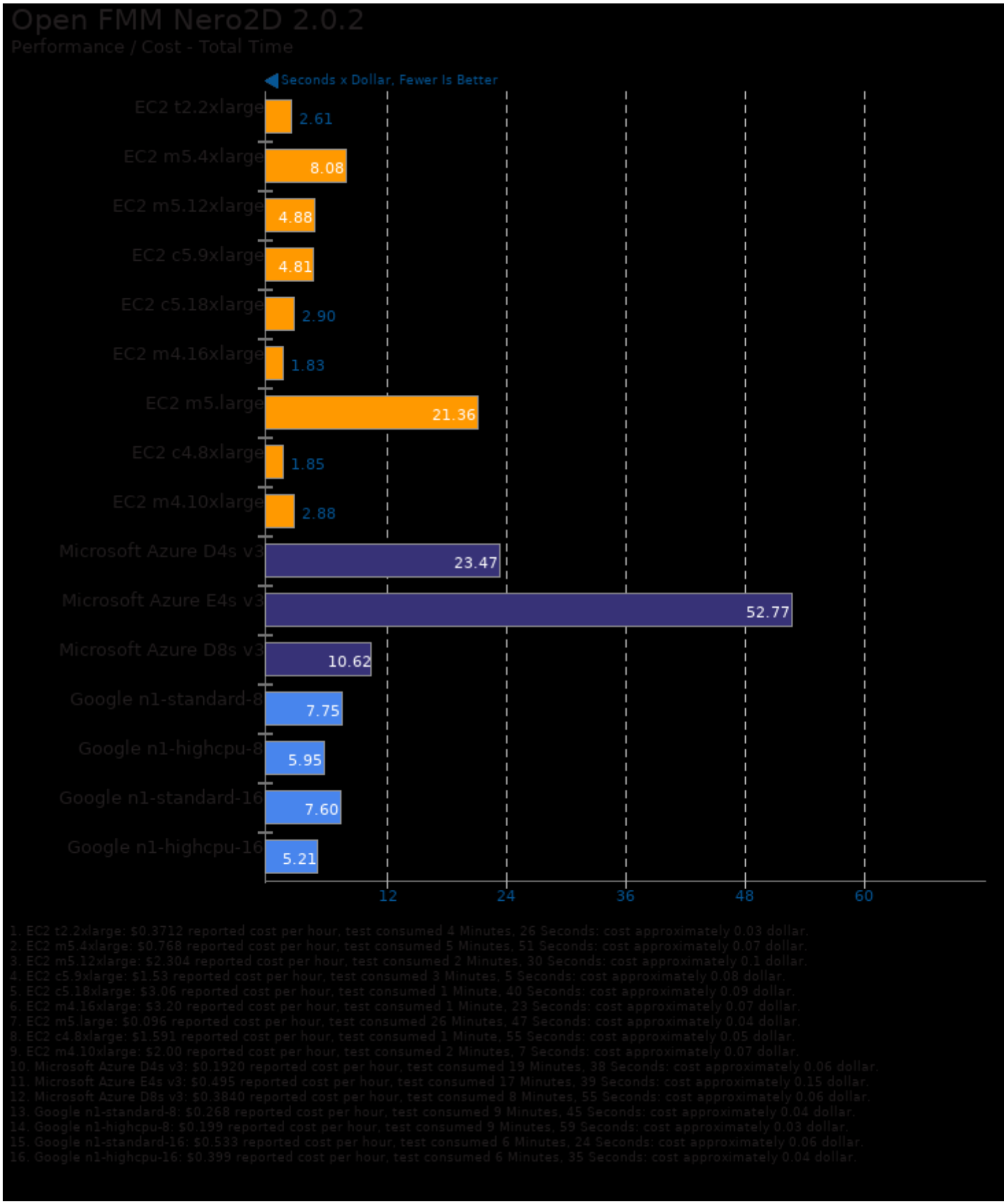

NGINX Benchmark 1.9.9
Static Web Page Serving
Requests Per Second, More Is Better
Ryzen 3 1200
SE +/- 277.67, N = 3
29144.73
Ryzen 3 1300X
SE +/- 37.17, N = 3
32633.19
Ryzen 3 2200G
33621.45
Ryzen 5 2400G
33449.57
Ryzen 7 1700
SE +/- 208.54, N = 3
29819.82
Ryzen 7 1800X
SE +/- 25.31, N = 3
32963.72
Threadripper 1950X
SE +/- 96.10, N = 3
31198.14
EPYC 7601
SE +/- 104.35, N = 3
24020.38
Core i3 8100
SE +/- 120.15, N = 3
36311.06
Core i5 8400
SE +/- 126.58, N = 3
40533.40
Core i7 7740X
SE +/- 298.62, N = 3
45475.85
Core i7 8700K
SE +/- 745.48, N = 4
44915.57
Core i9 7980XE
SE +/- 497.63, N = 3
42841.25
Xeon Silver 4108
SE +/- 55.55, N = 3
31669.56
2 x Xeon Gold 6138
SE +/- 169.48, N = 3
30959.26
EC2 t2.2xlarge
SE +/- 798.70, N = 3
18175.24
EC2 m5.4xlarge
SE +/- 92.03, N = 3
20160.69
EC2 m5.12xlarge
SE +/- 146.75, N = 3
25555.24
EC2 c5.9xlarge
SE +/- 54.82, N = 3
29999.02
EC2 c5.18xlarge
SE +/- 78.50, N = 3
24619.23
EC2 m4.16xlarge
SE +/- 279.06, N = 3
21410.50
EC2 m5.large
SE +/- 188.83, N = 3
12132.51
EC2 c4.8xlarge
SE +/- 451.84, N = 3
23090.77
EC2 m4.10xlarge
SE +/- 101.19, N = 3
21579.29
Microsoft Azure D4s v3
SE +/- 1.63, N = 3
14328.83
Microsoft Azure E4s v3
SE +/- 142.39, N = 3
15480.88
Microsoft Azure D8s v3
SE +/- 25.54, N = 3
15431.68
Google n1-standard-8
SE +/- 98.84, N = 3
25255.90
Google n1-highcpu-8
SE +/- 341.39, N = 3
21203.08
Google n1-standard-16
SE +/- 73.63, N = 3
26556.48
Google n1-highcpu-16
SE +/- 91.80, N = 3
24005.34
Contabo VPS S SSD
SE +/- 78.69, N = 3
10K
20K
30K
40K
50K
1. (CC) gcc options: -lpthread -lcrypt -lcrypto -lz -O3 -march=native

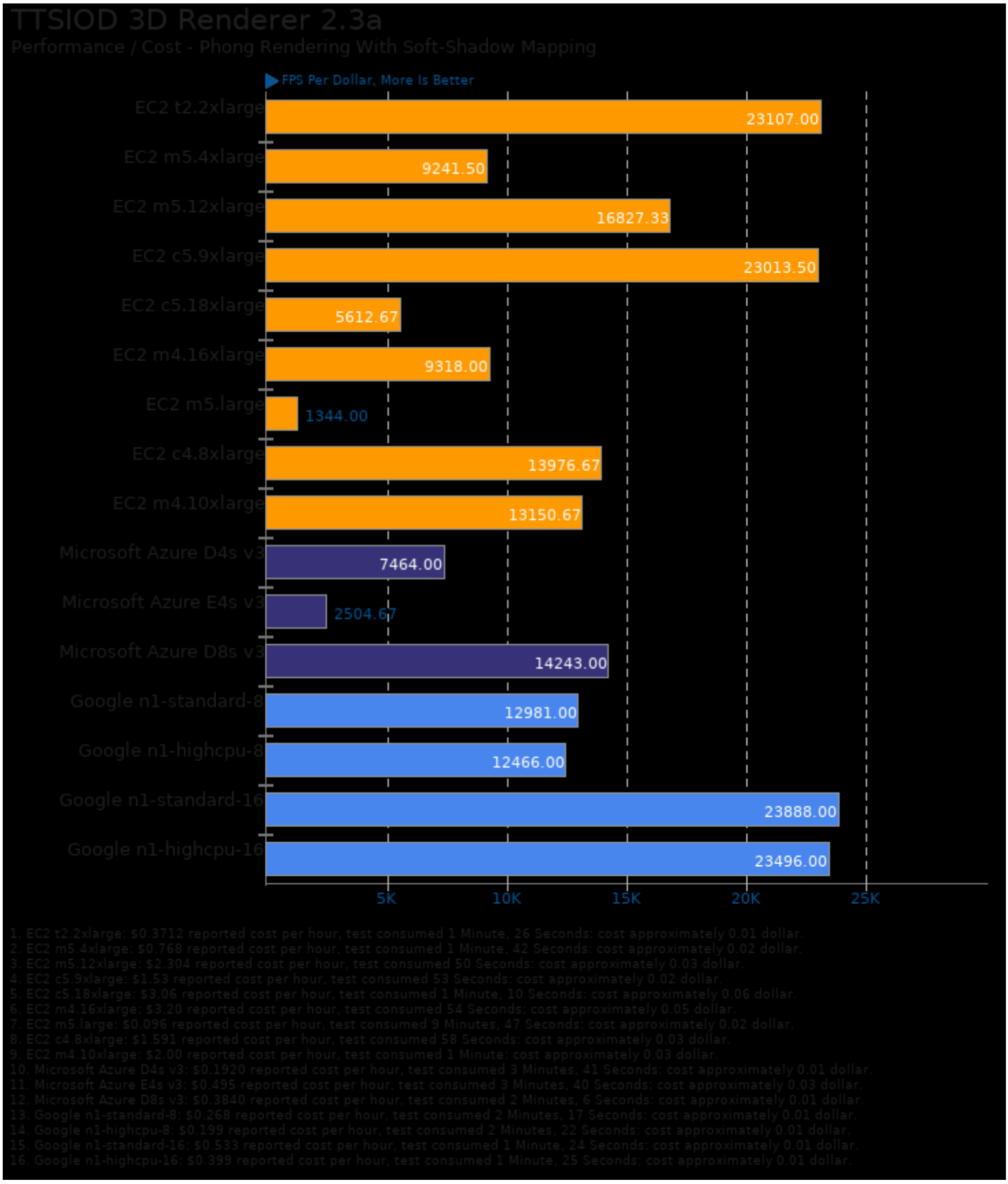

NAS Parallel Benchmarks 3.3
Performance / Cost - Test / Class: EP.C
Total Mop/s Per Dollar, More Is Better
EC2 t2.2xlarge
7310.00
EC2 m5.4xlarge
45935.00
EC2 m5.12xlarge
69274.50
EC2 c5.9xlarge
125619.00
EC2 c5.18xlarge
251281.00
EC2 m4.16xlarge
34498.00
EC2 m5.large
6099.00
EC2 c4.8xlarge
33657.00
EC2 m4.10xlarge
20920.67
Microsoft Azure D4s v3
3200.00
Microsoft Azure E4s v3
1081.67
Microsoft Azure D8s v3
6268.50
Google n1-standard-8
23387.00
Google n1-highcpu-8
23575.00
Google n1-standard-16
47795.00
Google n1-highcpu-16
46455.00
50K
100K
150K
200K
250K
1. EC2 t2.2xlarge: $0.3712 reported cost per hour, test consumed 3 Minutes, 1 Second: cost approximately 0.02 dollar.
2. EC2 m5.4xlarge: $0.768 reported cost per hour, test consumed 1 Minute: cost approximately 0.01 dollar.
3. EC2 m5.12xlarge: $2.304 reported cost per hour, test consumed 24 Seconds: cost approximately 0.02 dollar.
4. EC2 c5.9xlarge: $1.53 reported cost per hour, test consumed 26 Seconds: cost approximately 0.01 dollar.
5. EC2 c5.18xlarge: $3.06 reported cost per hour, test consumed 16 Seconds: cost approximately 0.01 dollar.
6. EC2 m4.16xlarge: $3.20 reported cost per hour, test consumed 30 Seconds: cost approximately 0.03 dollar.
7. EC2 m5.large: $0.096 reported cost per hour, test consumed 7 Minutes, 9 Seconds: cost approximately 0.01 dollar.
8. EC2 c4.8xlarge: $1.591 reported cost per hour, test consumed 43 Seconds: cost approximately 0.02 dollar.
9. EC2 m4.10xlarge: $2.00 reported cost per hour, test consumed 47 Seconds: cost approximately 0.03 dollar.
10. Microsoft Azure D4s v3: $0.1920 reported cost per hour, test consumed 6 Minutes, 47 Seconds: cost approximately 0.02 dollar.
11. Microsoft Azure E4s v3: $0.495 reported cost per hour, test consumed 6 Minutes, 41 Seconds: cost approximately 0.06 dollar.
12. Microsoft Azure D8s v3: $0.3840 reported cost per hour, test consumed 3 Minutes, 30 Seconds: cost approximately 0.02 dollar.
13. Google n1-standard-8: $0.268 reported cost per hour, test consumed 1 Minute, 55 Seconds: cost approximately 0.01 dollar.
14. Google n1-highcpu-8: $0.199 reported cost per hour, test consumed 1 Minute, 54 Seconds: cost approximately 0.01 dollar.
15. Google n1-standard-16: $0.533 reported cost per hour, test consumed 58 Seconds: cost approximately 0.01 dollar.
16. Google n1-highcpu-16: $0.399 reported cost per hour, test consumed 1 Minute: cost approximately 0.01 dollar.

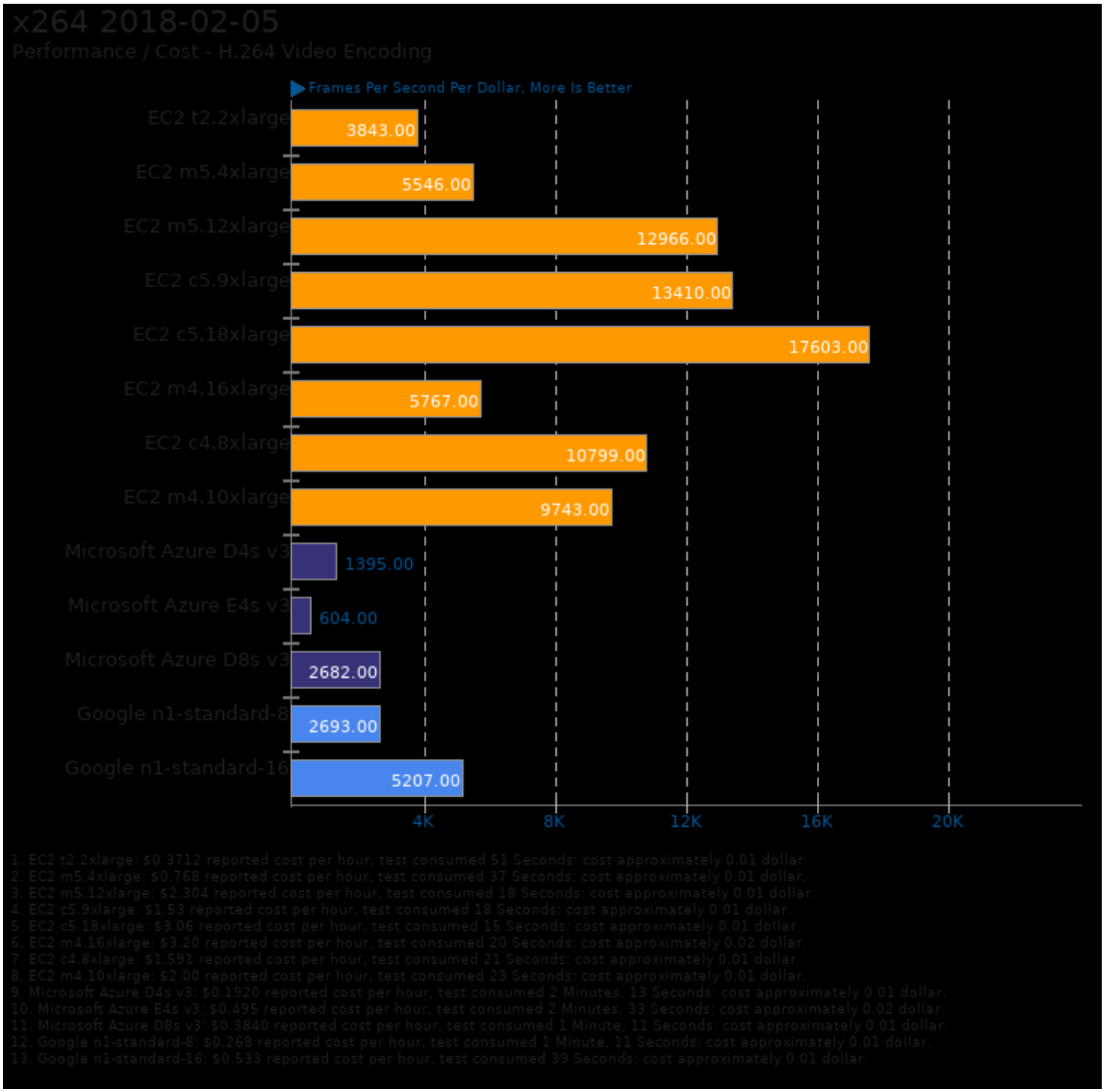

Rodinia 2.4
Performance / Cost - Test: OpenMP LavaMD
Seconds x Dollar, Fewer Is Better
EC2 t2.2xlarge
14.96
EC2 m5.4xlarge
8.06
EC2 m5.12xlarge
3.16
EC2 c5.9xlarge
2.67
EC2 c5.18xlarge
1.37
EC2 m4.16xlarge
3.41
EC2 m5.large
58.03
EC2 c4.8xlarge
3.70
EC2 m4.10xlarge
5.66
Microsoft Azure D4s v3
49.50
Microsoft Azure E4s v3
116.58
Microsoft Azure D8s v3
25.18
Google n1-standard-8
14.74
Google n1-highcpu-8
9.85
Google n1-standard-16
7.39
Google n1-highcpu-16
4.92
30
60
90
120
150
1. EC2 t2.2xlarge: $0.3712 reported cost per hour, test consumed 10 Minutes, 46 Seconds: cost approximately 0.07 dollar.
2. EC2 m5.4xlarge: $0.768 reported cost per hour, test consumed 5 Minutes, 50 Seconds: cost approximately 0.07 dollar.
3. EC2 m5.12xlarge: $2.304 reported cost per hour, test consumed 2 Minutes, 3 Seconds: cost approximately 0.08 dollar.
4. EC2 c5.9xlarge: $1.53 reported cost per hour, test consumed 2 Minutes, 18 Seconds: cost approximately 0.06 dollar.
5. EC2 c5.18xlarge: $3.06 reported cost per hour, test consumed 1 Minute, 12 Seconds: cost approximately 0.06 dollar.
6. EC2 m4.16xlarge: $3.20 reported cost per hour, test consumed 1 Minute, 47 Seconds: cost approximately 0.1 dollar.
7. EC2 m5.large: $0.096 reported cost per hour, test consumed 41 Minutes, 30 Seconds: cost approximately 0.07 dollar.
8. EC2 c4.8xlarge: $1.591 reported cost per hour, test consumed 2 Minutes, 42 Seconds: cost approximately 0.07 dollar.
9. EC2 m4.10xlarge: $2.00 reported cost per hour, test consumed 2 Minutes, 54 Seconds: cost approximately 0.1 dollar.
10. Microsoft Azure D4s v3: $0.1920 reported cost per hour, test consumed 27 Minutes, 34 Seconds: cost approximately 0.09 dollar.
11. Microsoft Azure E4s v3: $0.495 reported cost per hour, test consumed 26 Minutes, 34 Seconds: cost approximately 0.22 dollar.
12. Microsoft Azure D8s v3: $0.3840 reported cost per hour, test consumed 14 Minutes, 4 Seconds: cost approximately 0.09 dollar.
13. Google n1-standard-8: $0.268 reported cost per hour, test consumed 12 Minutes, 21 Seconds: cost approximately 0.06 dollar.
14. Google n1-highcpu-8: $0.199 reported cost per hour, test consumed 12 Minutes, 23 Seconds: cost approximately 0.04 dollar.
15. Google n1-standard-16: $0.533 reported cost per hour, test consumed 6 Minutes, 14 Seconds: cost approximately 0.06 dollar.
16. Google n1-highcpu-16: $0.399 reported cost per hour, test consumed 6 Minutes, 12 Seconds: cost approximately 0.04 dollar.

Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

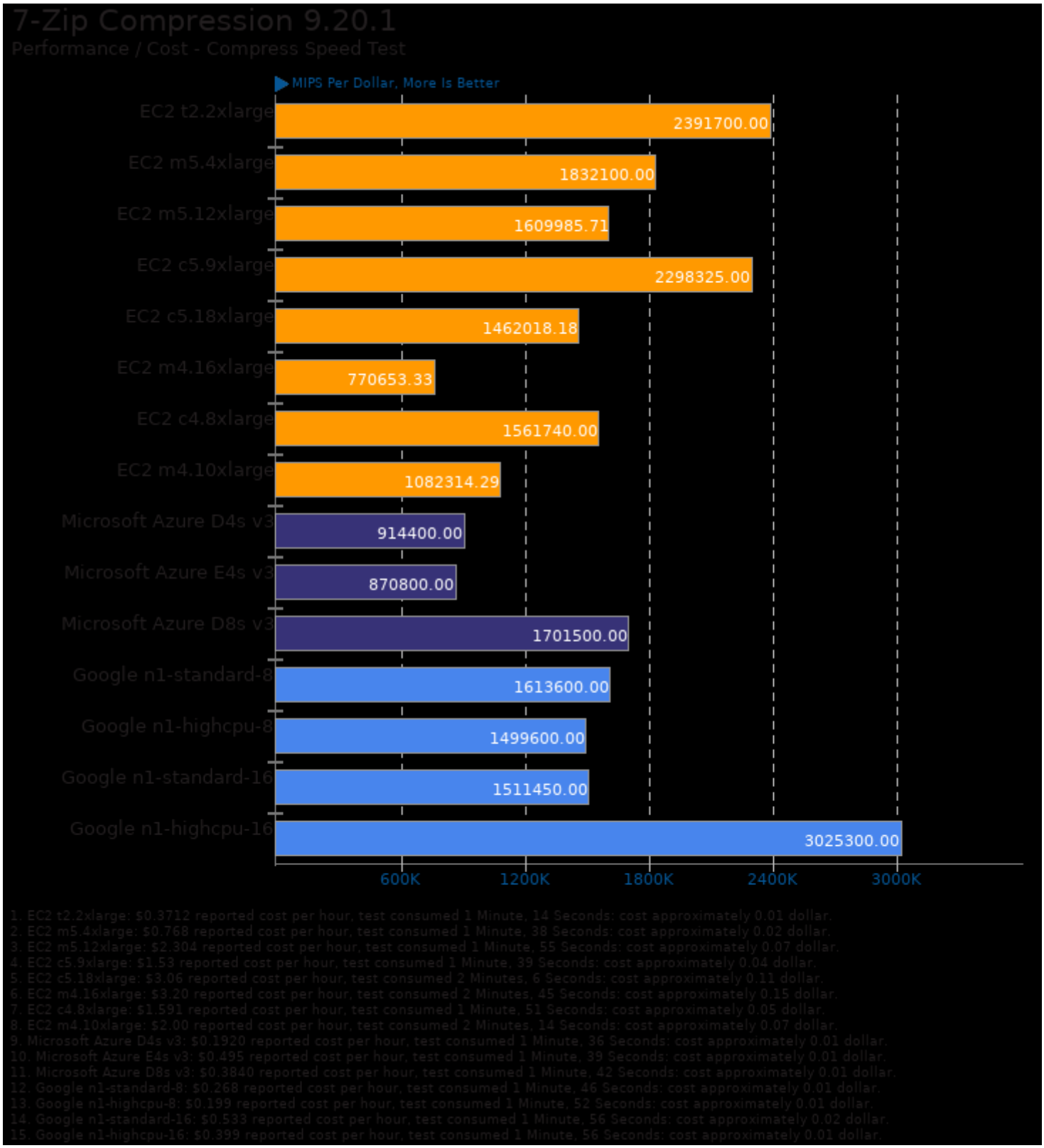



Open FMM Nero2D 2.0.2
Performance / Cost - Total Time
Seconds x Dollar, Fewer Is Better
EC2 t2.2xlarge
2.61
EC2 m5.4xlarge
8.08
EC2 m5.12xlarge
4.88
EC2 c5.9xlarge
4.81
EC2 c5.18xlarge
2.90
EC2 m4.16xlarge
1.83
EC2 m5.large
21.36
EC2 c4.8xlarge
1.85
EC2 m4.10xlarge
2.88
Microsoft Azure D4s v3
23.47
Microsoft Azure E4s v3
52.77
Microsoft Azure D8s v3
10.62
Google n1-standard-8
7.75
Google n1-highcpu-8
5.95
Google n1-standard-16
7.60
Google n1-highcpu-16
5.21
12
24
36
48
60
1. EC2 t2.2xlarge: $0.3712 reported cost per hour, test consumed 4 Minutes, 26 Seconds: cost approximately 0.03 dollar.
2. EC2 m5.4xlarge: $0.768 reported cost per hour, test consumed 5 Minutes, 51 Seconds: cost approximately 0.07 dollar.
3. EC2 m5.12xlarge: $2.304 reported cost per hour, test consumed 2 Minutes, 30 Seconds: cost approximately 0.1 dollar.
4. EC2 c5.9xlarge: $1.53 reported cost per hour, test consumed 3 Minutes, 5 Seconds: cost approximately 0.08 dollar.
5. EC2 c5.18xlarge: $3.06 reported cost per hour, test consumed 1 Minute, 40 Seconds: cost approximately 0.09 dollar.
6. EC2 m4.16xlarge: $3.20 reported cost per hour, test consumed 1 Minute, 23 Seconds: cost approximately 0.07 dollar.
7. EC2 m5.large: $0.096 reported cost per hour, test consumed 26 Minutes, 47 Seconds: cost approximately 0.04 dollar.
8. EC2 c4.8xlarge: $1.591 reported cost per hour, test consumed 1 Minute, 55 Seconds: cost approximately 0.05 dollar.
9. EC2 m4.10xlarge: $2.00 reported cost per hour, test consumed 2 Minutes, 7 Seconds: cost approximately 0.07 dollar.
10. Microsoft Azure D4s v3: $0.1920 reported cost per hour, test consumed 19 Minutes, 38 Seconds: cost approximately 0.06 dollar.
11. Microsoft Azure E4s v3: $0.495 reported cost per hour, test consumed 17 Minutes, 39 Seconds: cost approximately 0.15 dollar.
12. Microsoft Azure D8s v3: $0.3840 reported cost per hour, test consumed 8 Minutes, 55 Seconds: cost approximately 0.06 dollar.
13. Google n1-standard-8: $0.268 reported cost per hour, test consumed 9 Minutes, 45 Seconds: cost approximately 0.04 dollar.
14. Google n1-highcpu-8: $0.199 reported cost per hour, test consumed 9 Minutes, 59 Seconds: cost approximately 0.03 dollar.
15. Google n1-standard-16: $0.533 reported cost per hour, test consumed 6 Minutes, 24 Seconds: cost approximately 0.06 dollar.
16. Google n1-highcpu-16: $0.399 reported cost per hour, test consumed 6 Minutes, 35 Seconds: cost approximately 0.04 dollar.

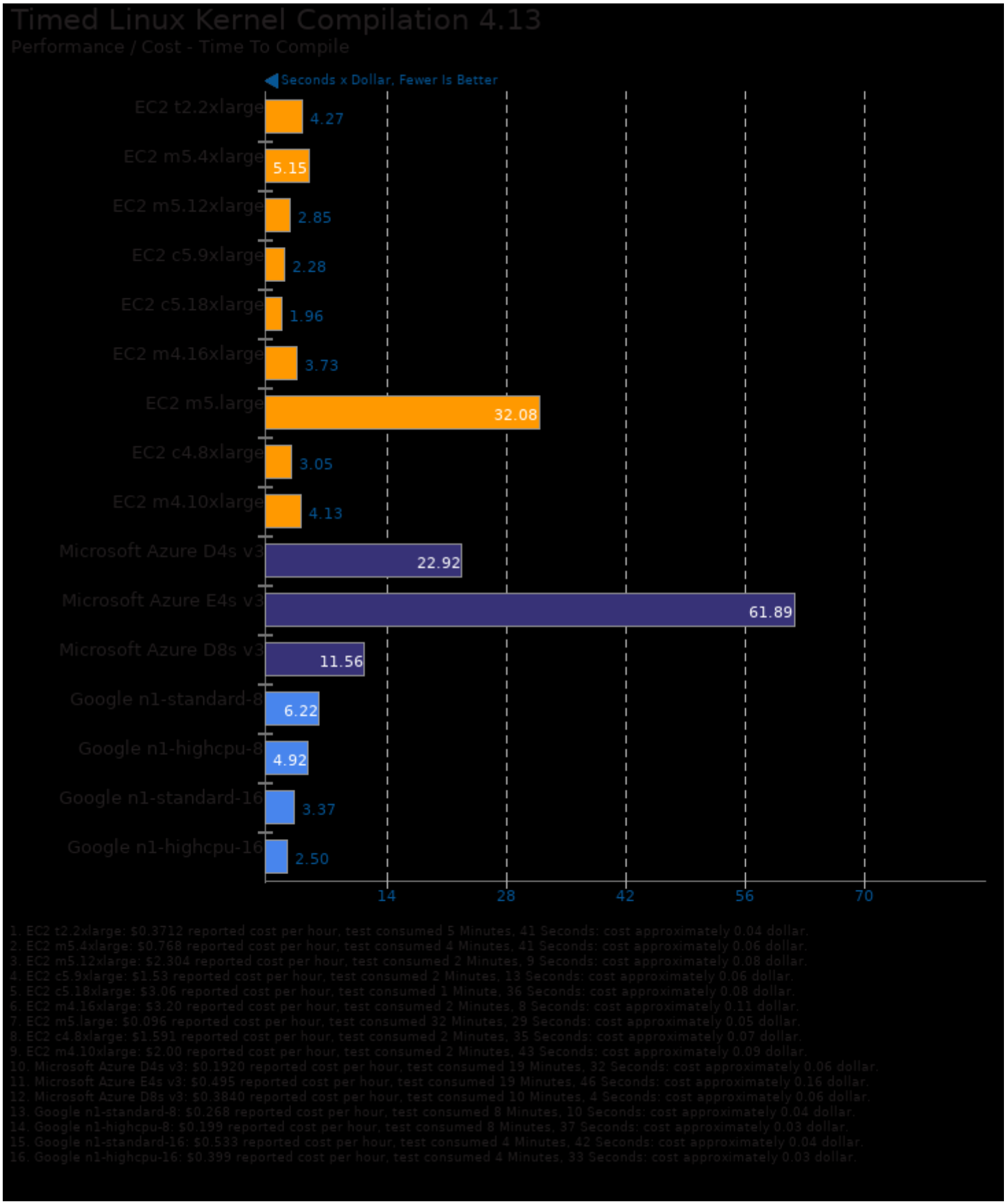

TTSIOD 3D Renderer 2.3a
Performance / Cost - Phong Rendering With Soft-Shadow Mapping
FPS Per Dollar, More Is Better
EC2 t2.2xlarge
23107.00
EC2 m5.4xlarge
9241.50
EC2 m5.12xlarge
16827.33
EC2 c5.9xlarge
23013.50
EC2 c5.18xlarge
5612.67
EC2 m4.16xlarge
9318.00
EC2 m5.large
1344.00
EC2 c4.8xlarge
13976.67
EC2 m4.10xlarge
13150.67
Microsoft Azure D4s v3
7464.00
Microsoft Azure E4s v3
2504.67
Microsoft Azure D8s v3
14243.00
Google n1-standard-8
12981.00
Google n1-highcpu-8
12466.00
Google n1-standard-16
23888.00
Google n1-highcpu-16
23496.00
5K
10K
15K
20K
25K
1. EC2 t2.2xlarge: $0.3712 reported cost per hour, test consumed 1 Minute, 26 Seconds: cost approximately 0.01 dollar.
2. EC2 m5.4xlarge: $0.768 reported cost per hour, test consumed 1 Minute, 42 Seconds: cost approximately 0.02 dollar.
3. EC2 m5.12xlarge: $2.304 reported cost per hour, test consumed 50 Seconds: cost approximately 0.03 dollar.
4. EC2 c5.9xlarge: $1.53 reported cost per hour, test consumed 53 Seconds: cost approximately 0.02 dollar.
5. EC2 c5.18xlarge: $3.06 reported cost per hour, test consumed 1 Minute, 10 Seconds: cost approximately 0.06 dollar.
6. EC2 m4.16xlarge: $3.20 reported cost per hour, test consumed 54 Seconds: cost approximately 0.05 dollar.
7. EC2 m5.large: $0.096 reported cost per hour, test consumed 9 Minutes, 47 Seconds: cost approximately 0.02 dollar.
8. EC2 c4.8xlarge: $1.591 reported cost per hour, test consumed 58 Seconds: cost approximately 0.03 dollar.
9. EC2 m4.10xlarge: $2.00 reported cost per hour, test consumed 1 Minute: cost approximately 0.03 dollar.
10. Microsoft Azure D4s v3: $0.1920 reported cost per hour, test consumed 3 Minutes, 41 Seconds: cost approximately 0.01 dollar.
11. Microsoft Azure E4s v3: $0.495 reported cost per hour, test consumed 3 Minutes, 40 Seconds: cost approximately 0.03 dollar.
12. Microsoft Azure D8s v3: $0.3840 reported cost per hour, test consumed 2 Minutes, 6 Seconds: cost approximately 0.01 dollar.
13. Google n1-standard-8: $0.268 reported cost per hour, test consumed 2 Minutes, 17 Seconds: cost approximately 0.01 dollar.
14. Google n1-highcpu-8: $0.199 reported cost per hour, test consumed 2 Minutes, 22 Seconds: cost approximately 0.01 dollar.
15. Google n1-standard-16: $0.533 reported cost per hour, test consumed 1 Minute, 24 Seconds: cost approximately 0.01 dollar.
16. Google n1-highcpu-16: $0.399 reported cost per hour, test consumed 1 Minute, 25 Seconds: cost approximately 0.01 dollar.


x264 2018-02-05
Performance / Cost - H.264 Video Encoding
Frames Per Second Per Dollar, More Is Better
EC2 t2.2xlarge
3843.00
EC2 m5.4xlarge
5546.00
EC2 m5.12xlarge
12966.00
EC2 c5.9xlarge
13410.00
EC2 c5.18xlarge
17603.00
EC2 m4.16xlarge
5767.00
EC2 c4.8xlarge
10799.00
EC2 m4.10xlarge
9743.00
Microsoft Azure D4s v3
1395.00
Microsoft Azure E4s v3
604.00
Microsoft Azure D8s v3
2682.00
Google n1-standard-8
2693.00
Google n1-standard-16
5207.00
4K
8K
12K
16K
20K
1. EC2 t2.2xlarge: $0.3712 reported cost per hour, test consumed 51 Seconds: cost approximately 0.01 dollar.
2. EC2 m5.4xlarge: $0.768 reported cost per hour, test consumed 37 Seconds: cost approximately 0.01 dollar.
3. EC2 m5.12xlarge: $2.304 reported cost per hour, test consumed 18 Seconds: cost approximately 0.01 dollar.
4. EC2 c5.9xlarge: $1.53 reported cost per hour, test consumed 18 Seconds: cost approximately 0.01 dollar.
5. EC2 c5.18xlarge: $3.06 reported cost per hour, test consumed 15 Seconds: cost approximately 0.01 dollar.
6. EC2 m4.16xlarge: $3.20 reported cost per hour, test consumed 20 Seconds: cost approximately 0.02 dollar.
7. EC2 c4.8xlarge: $1.591 reported cost per hour, test consumed 21 Seconds: cost approximately 0.01 dollar.
8. EC2 m4.10xlarge: $2.00 reported cost per hour, test consumed 23 Seconds: cost approximately 0.01 dollar.
9. Microsoft Azure D4s v3: $0.1920 reported cost per hour, test consumed 2 Minutes, 13 Seconds: cost approximately 0.01 dollar.
10. Microsoft Azure E4s v3: $0.495 reported cost per hour, test consumed 2 Minutes, 33 Seconds: cost approximately 0.02 dollar.
11. Microsoft Azure D8s v3: $0.3840 reported cost per hour, test consumed 1 Minute, 11 Seconds: cost approximately 0.01 dollar.
12. Google n1-standard-8: $0.268 reported cost per hour, test consumed 1 Minute, 11 Seconds: cost approximately 0.01 dollar.
13. Google n1-standard-16: $0.533 reported cost per hour, test consumed 39 Seconds: cost approximately 0.01 dollar.

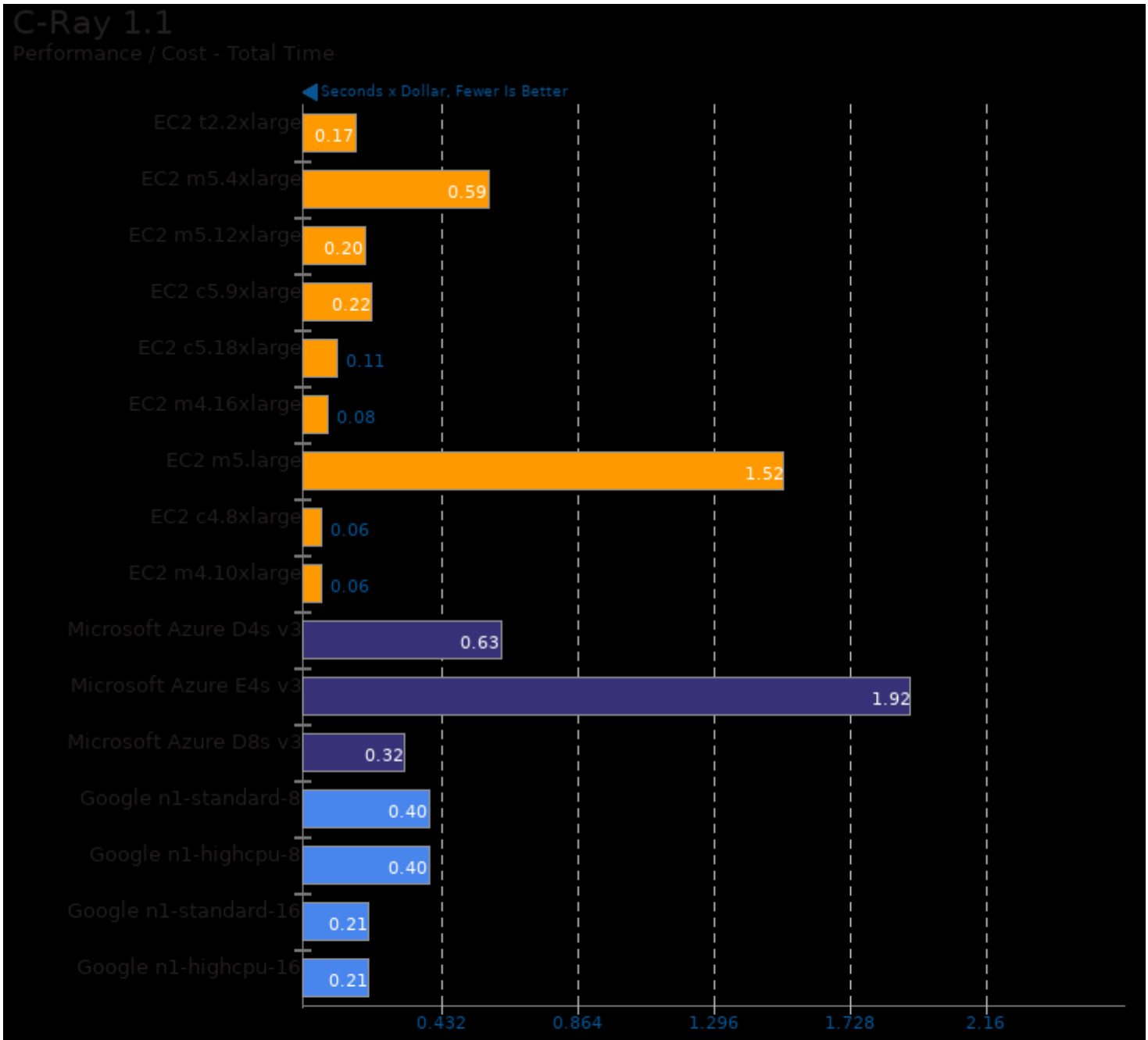
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine



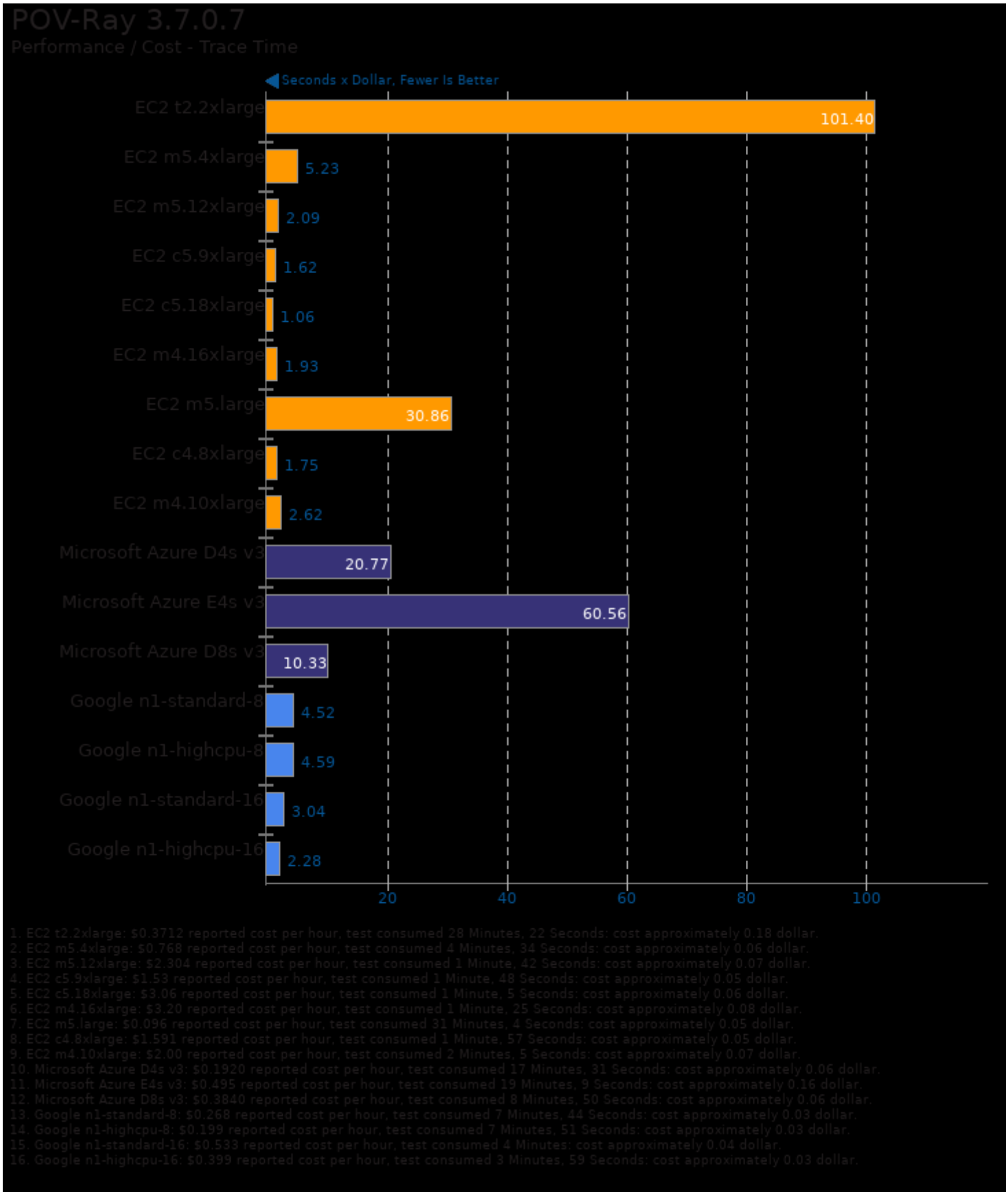
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine



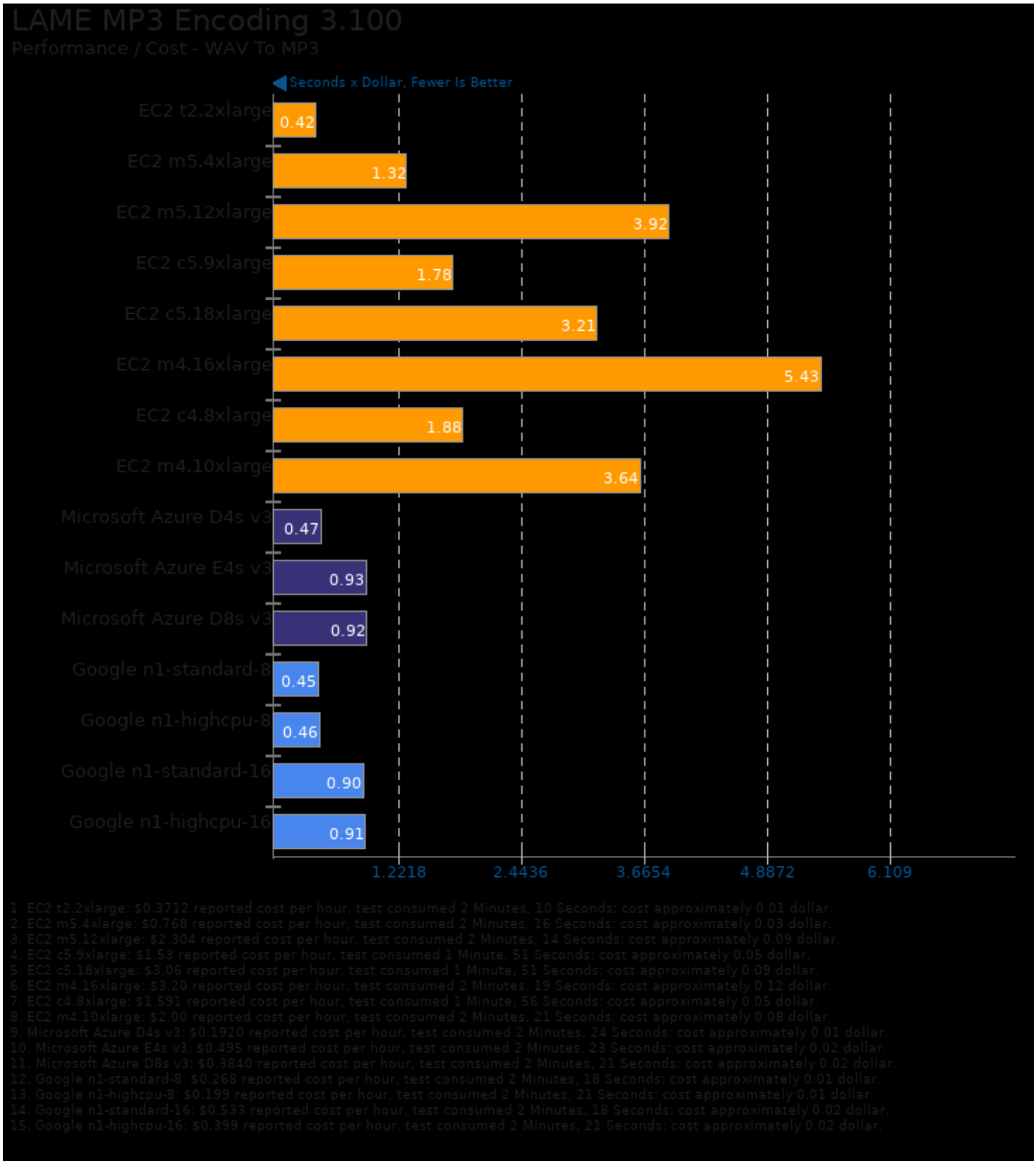
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine



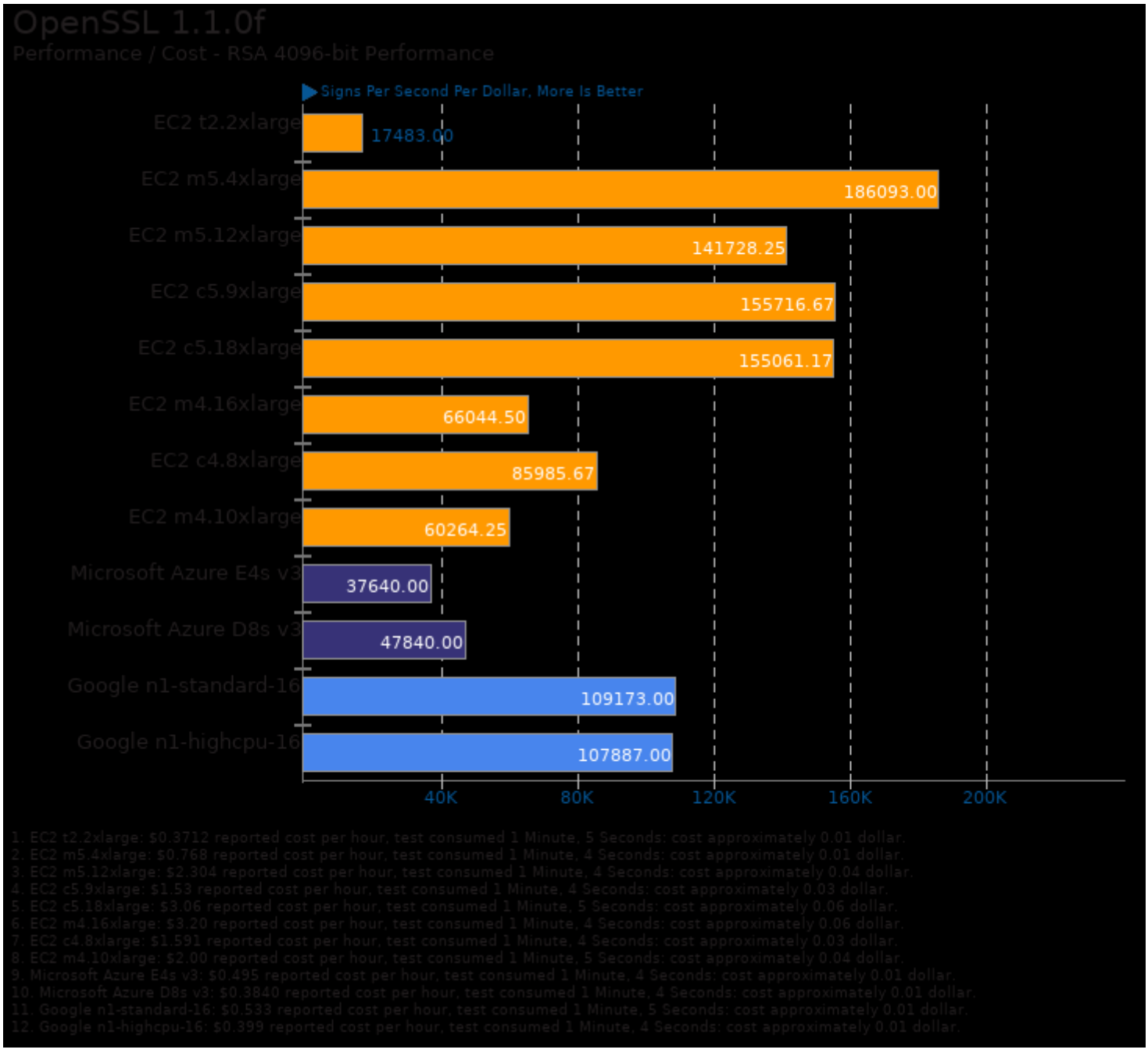
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine



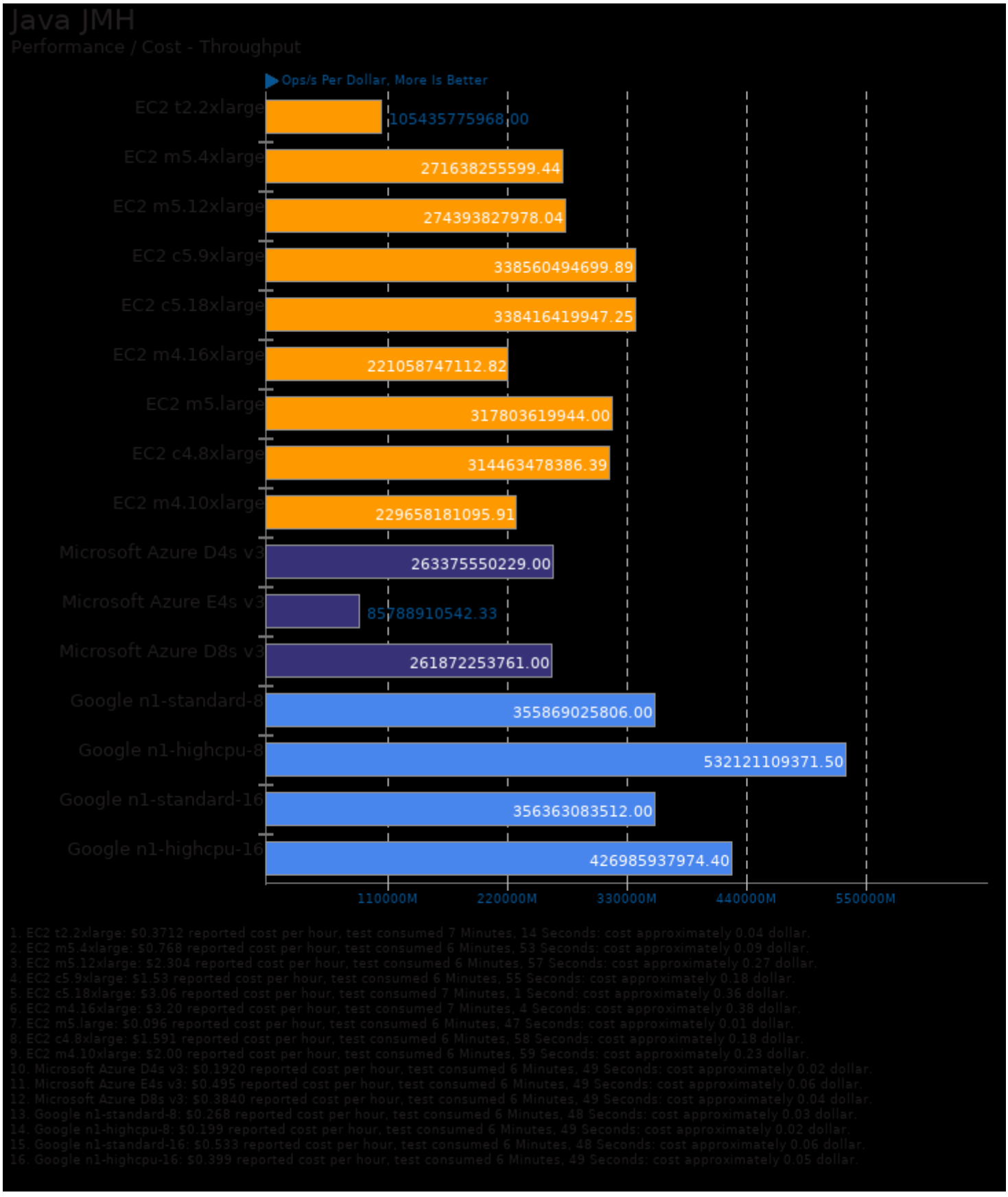
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine



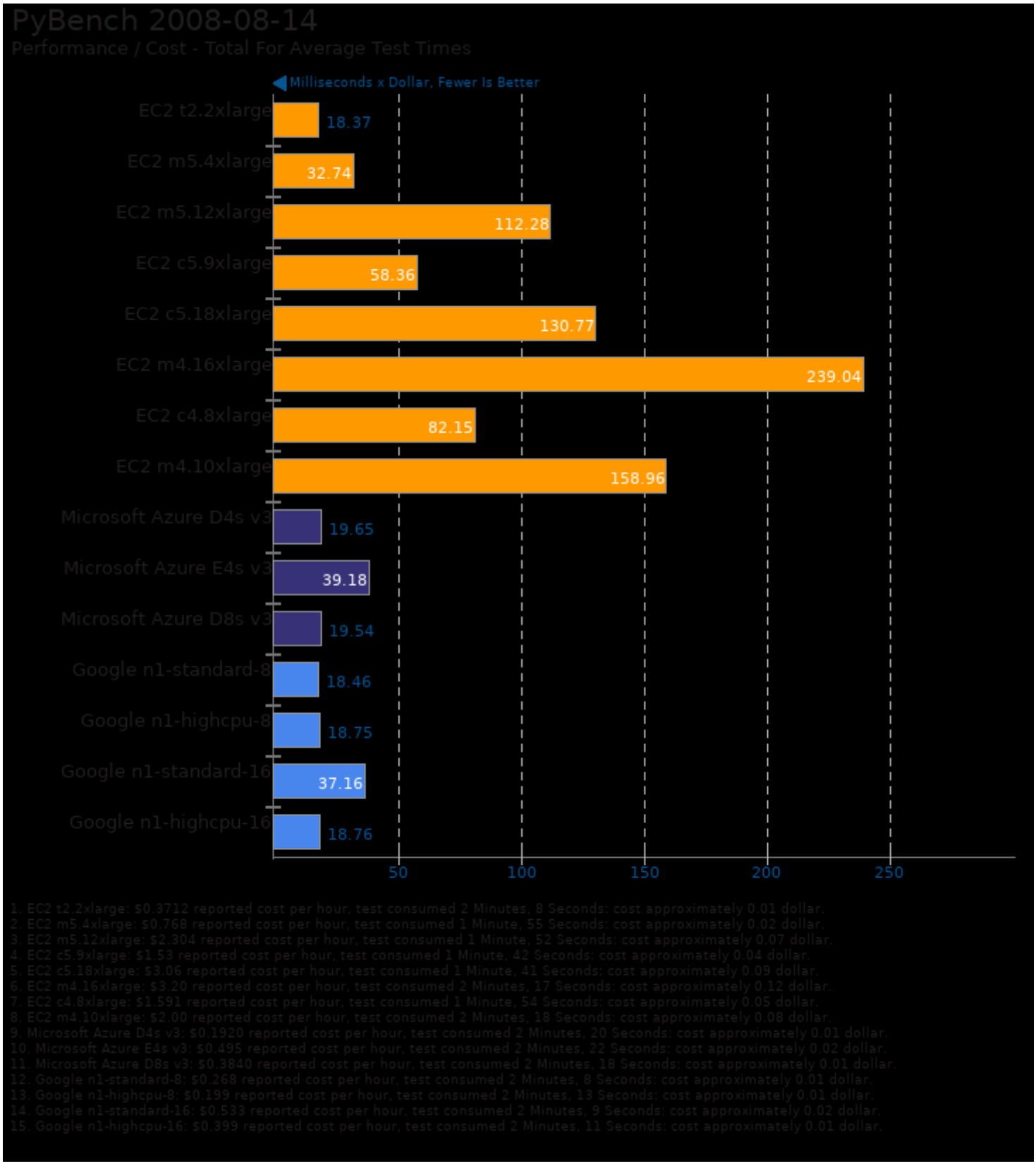
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine



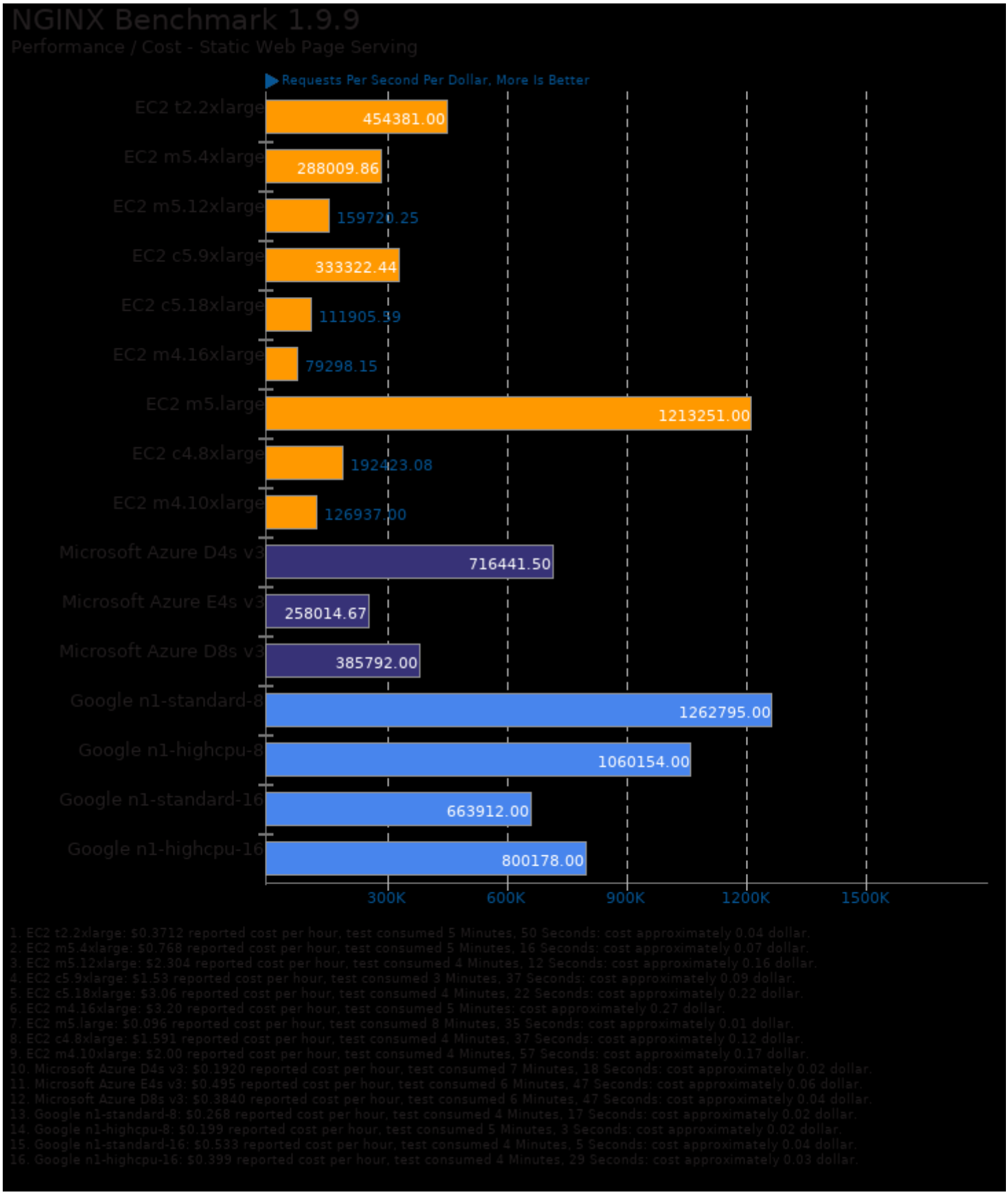
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

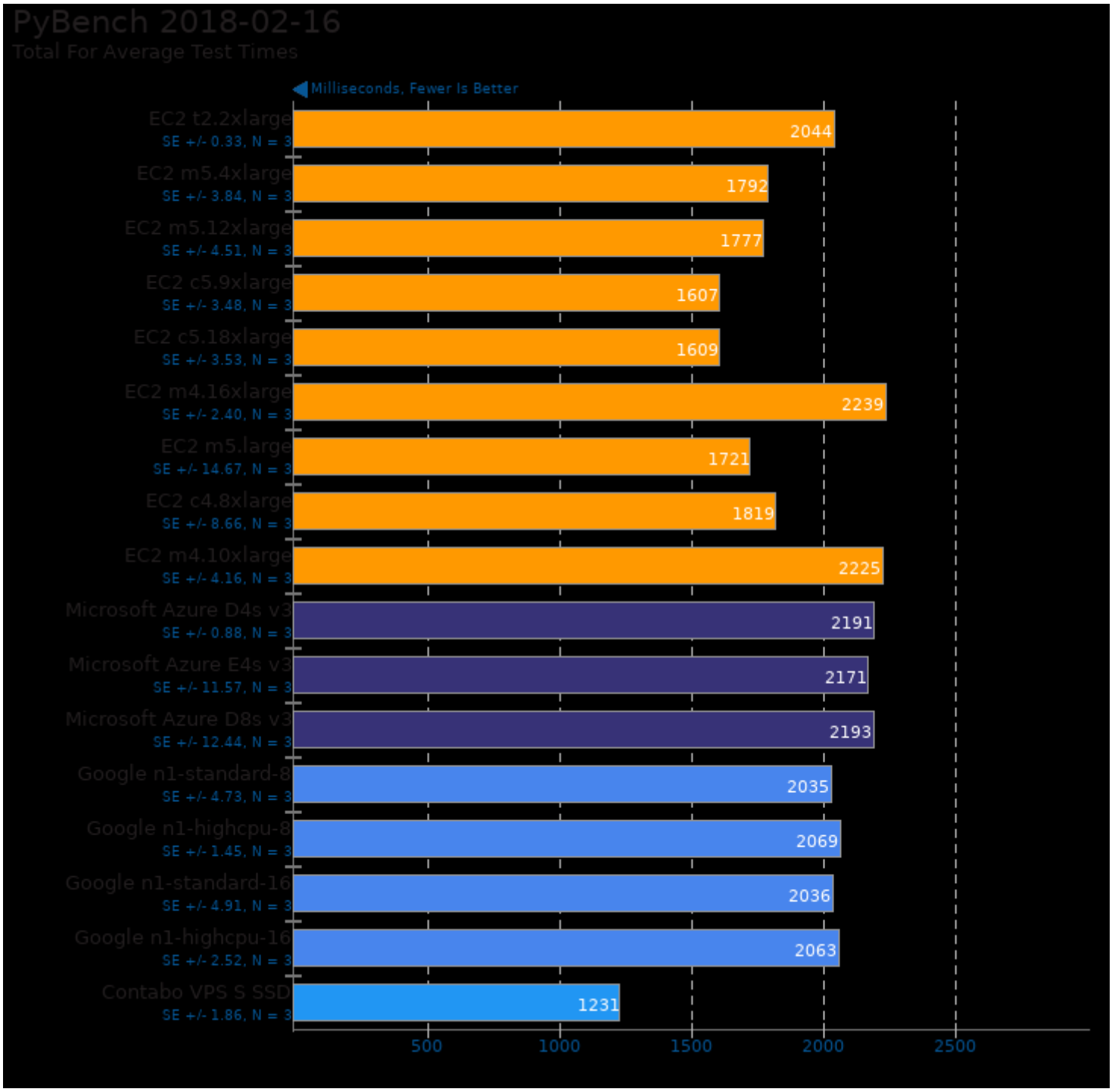


Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

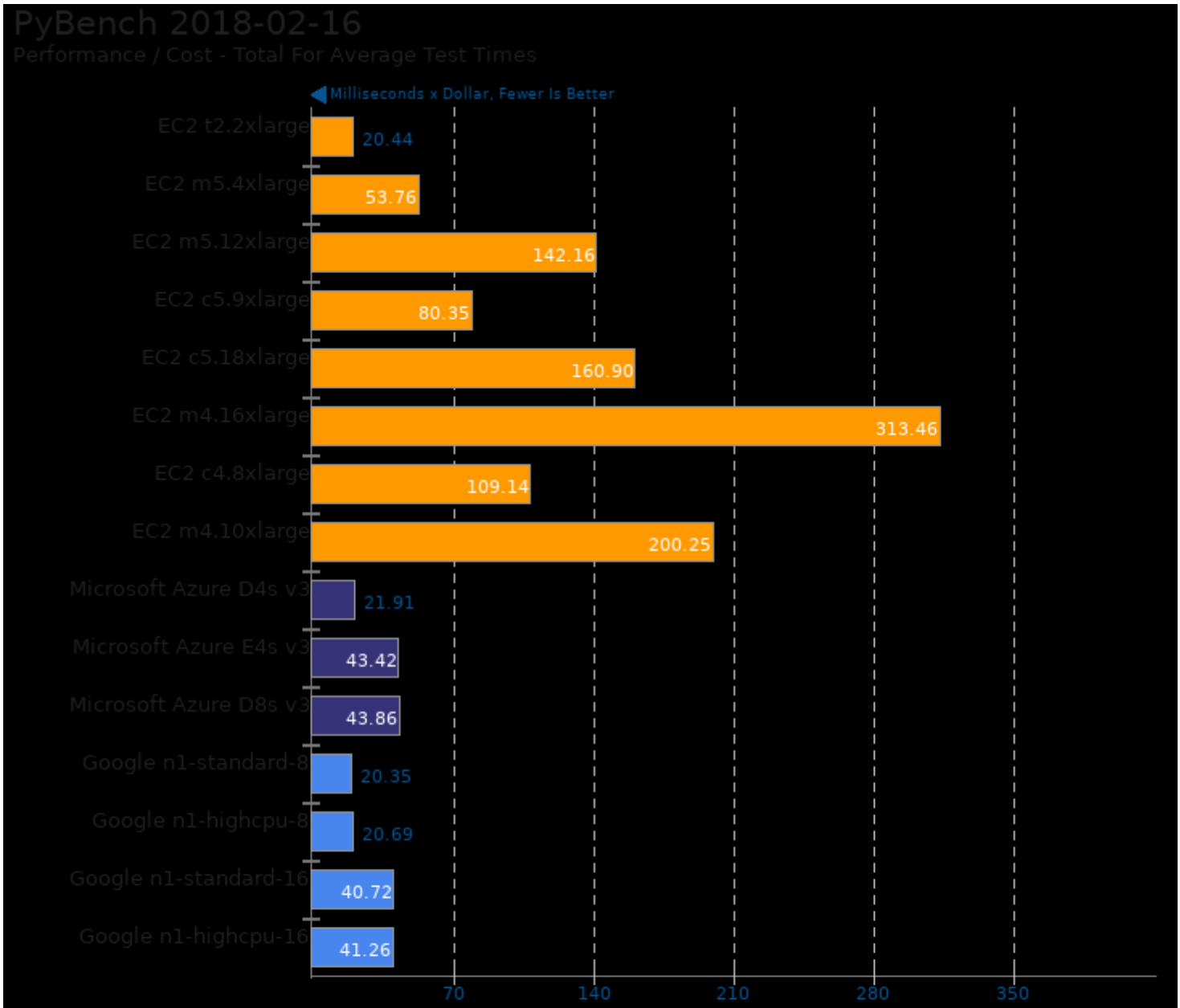


Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

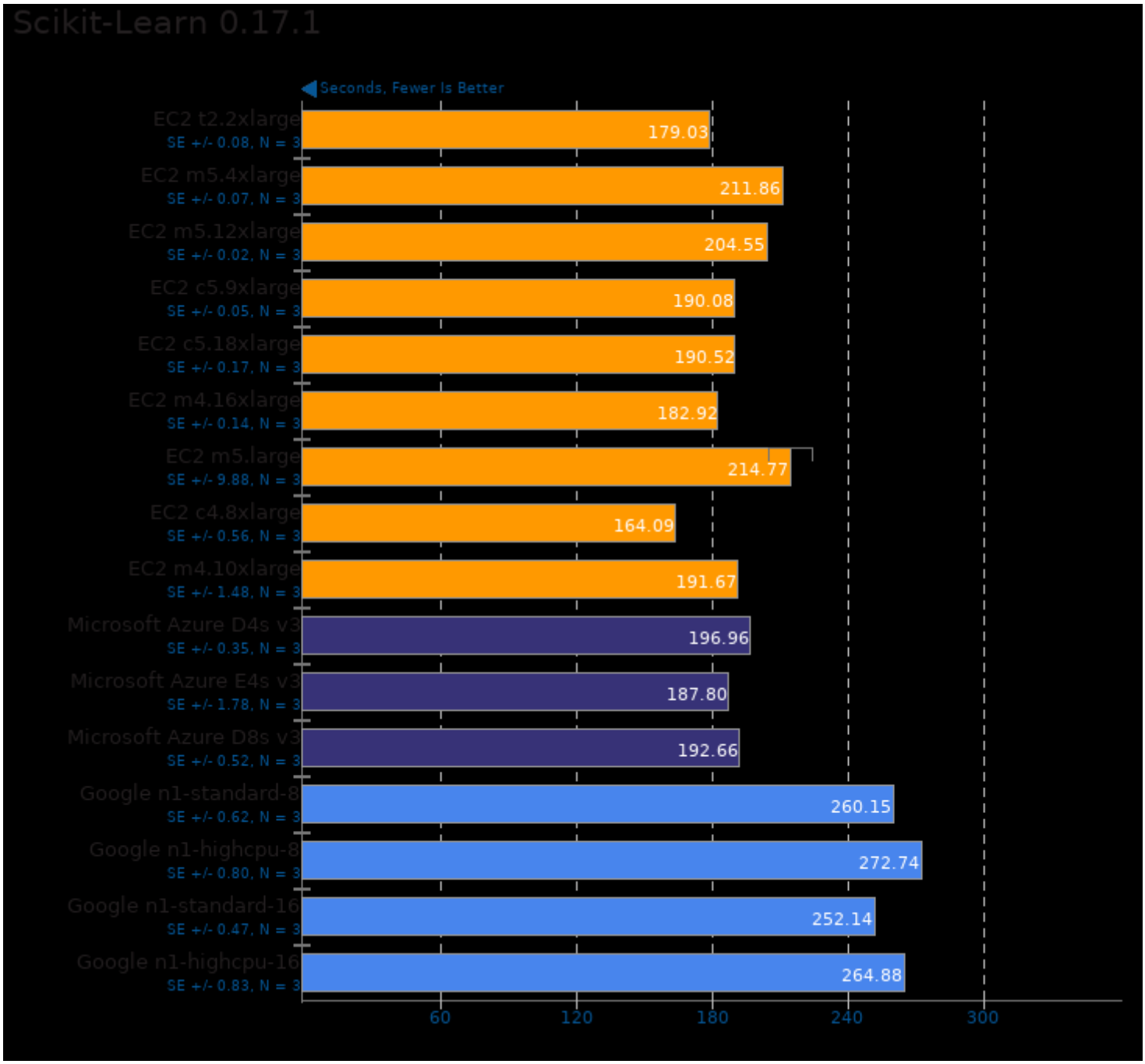


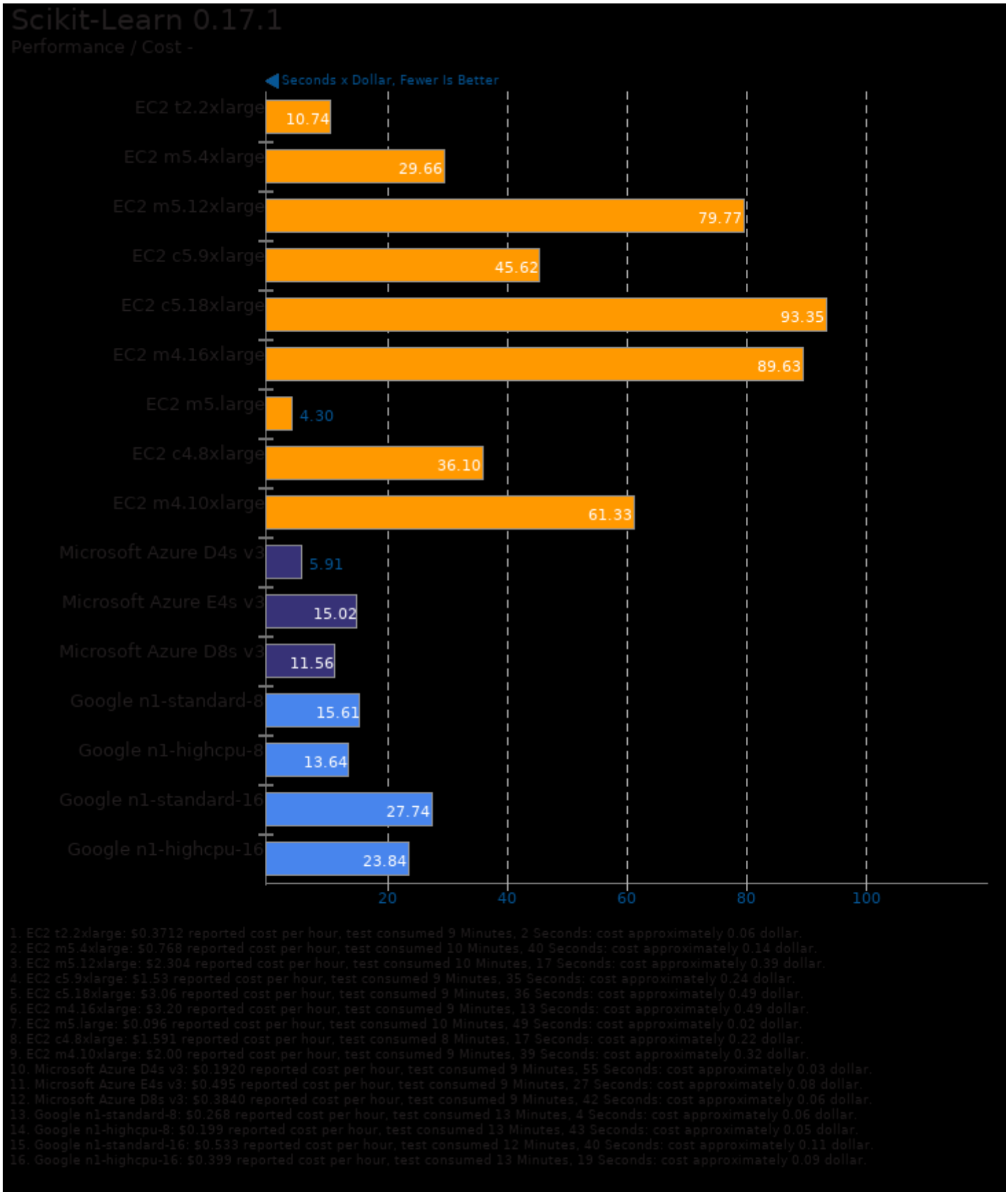

PyBench 2018-02-16
Total For Average Test Times
Milliseconds, Fewer Is Better
EC2 t2.2xlarge
SE +/- 0.33, N = 3
2044
EC2 m5.4xlarge
SE +/- 3.84, N = 3
1792
EC2 m5.12xlarge
SE +/- 4.51, N = 3
1777
EC2 c5.9xlarge
SE +/- 3.48, N = 3
1607
EC2 c5.18xlarge
SE +/- 3.53, N = 3
1609
EC2 m4.16xlarge
SE +/- 2.40, N = 3
2239
EC2 m5.large
SE +/- 14.67, N = 3
1721
EC2 c4.8xlarge
SE +/- 8.66, N = 3
1819
EC2 m4.10xlarge
SE +/- 4.16, N = 3
2225
Microsoft Azure D4s v3
SE +/- 0.88, N = 3
2191
Microsoft Azure E4s v3
SE +/- 11.57, N = 3
2171
Microsoft Azure D8s v3
SE +/- 12.44, N = 3
2193
Google n1-standard-8
SE +/- 4.73, N = 3
2035
Google n1-highcpu-8
SE +/- 1.45, N = 3
2069
Google n1-standard-16
SE +/- 4.91, N = 3
2036
Google n1-highcpu-16
SE +/- 2.52, N = 3
2063
Contabo VPS S SSD
SE +/- 1.86, N = 3
1231
500
1000
1500
2000
2500

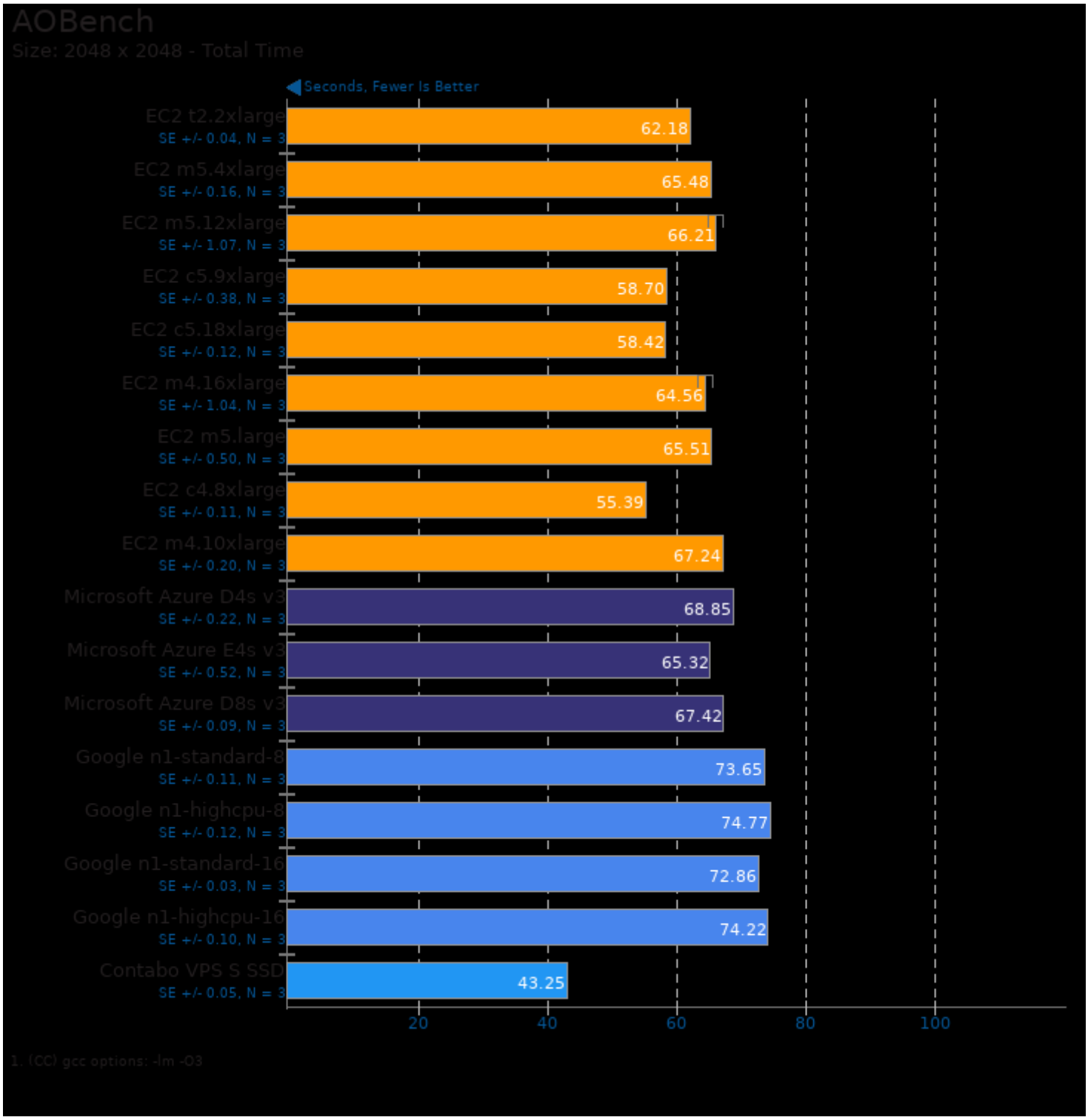
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine



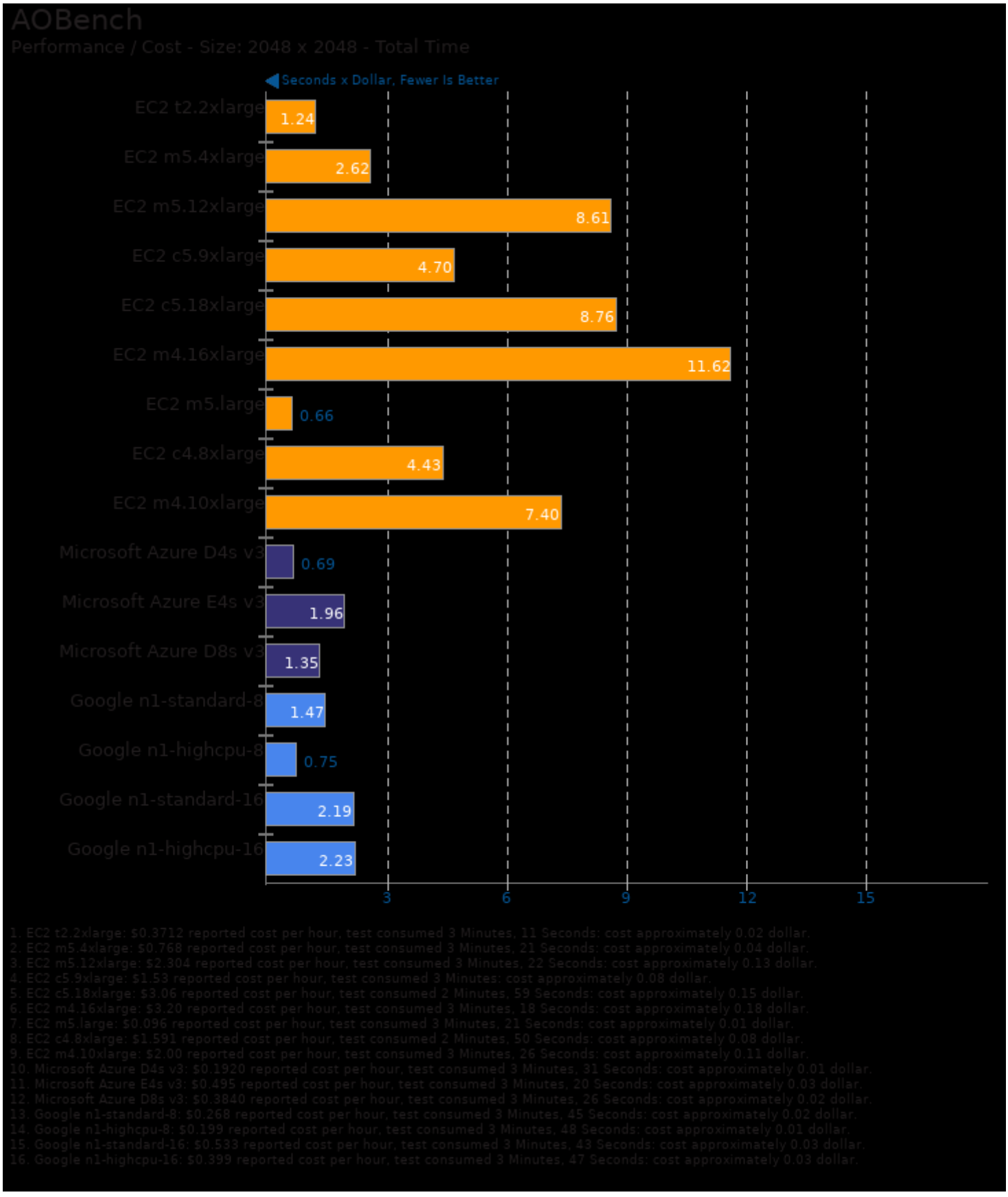
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

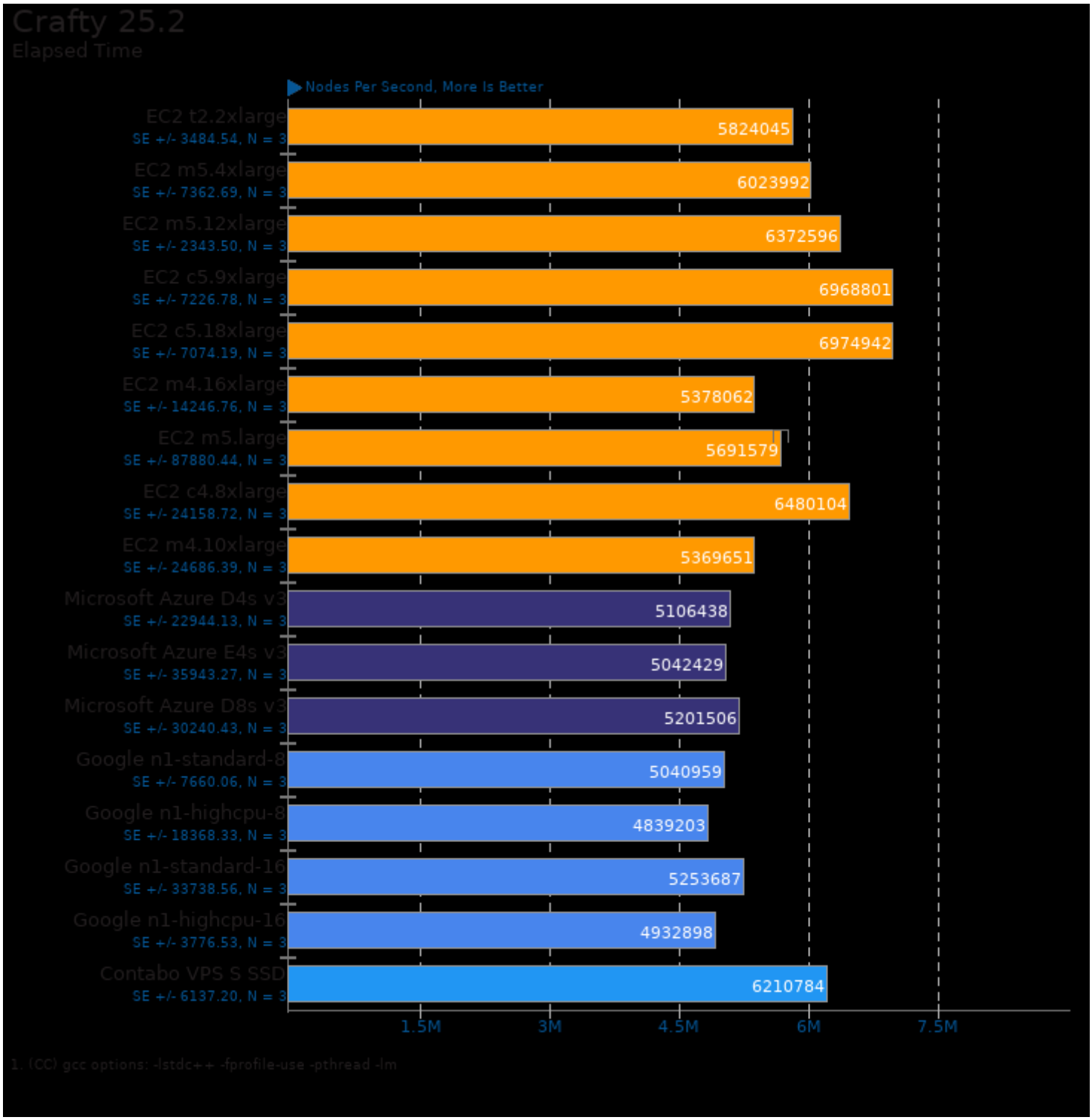



Scikit-Learn 0.17.1
Performance / Cost -
Seconds x Dollar, Fewer Is Better
EC2 t2.2xlarge
10.74
EC2 m5.4xlarge
29.66
EC2 m5.12xlarge
79.77
EC2 c5.9xlarge
45.62
EC2 c5.18xlarge
93.35
EC2 m4.16xlarge
89.63
EC2 m5.large
4.30
EC2 c4.8xlarge
36.10
EC2 m4.10xlarge
61.33
Microsoft Azure D4s v3
5.91
Microsoft Azure E4s v3
15.02
Microsoft Azure D8s v3
11.56
Google n1-standard-8
15.61
Google n1-highcpu-8
13.64
Google n1-standard-16
27.74
Google n1-highcpu-16
23.84
20
40
60
80
100
1. EC2 t2.2xlarge: $0.3712 reported cost per hour, test consumed 9 Minutes, 2 Seconds: cost approximately 0.06 dollar.
2. EC2 m5.4xlarge: $0.768 reported cost per hour, test consumed 10 Minutes, 40 Seconds: cost approximately 0.14 dollar.
3. EC2 m5.12xlarge: $2.304 reported cost per hour, test consumed 10 Minutes, 17 Seconds: cost approximately 0.39 dollar.
4. EC2 c5.9xlarge: $1.53 reported cost per hour, test consumed 9 Minutes, 35 Seconds: cost approximately 0.24 dollar.
5. EC2 c5.18xlarge: $3.06 reported cost per hour, test consumed 9 Minutes, 36 Seconds: cost approximately 0.49 dollar.
6. EC2 m4.16xlarge: $3.20 reported cost per hour, test consumed 9 Minutes, 13 Seconds: cost approximately 0.49 dollar.
7. EC2 m5.large: $0.096 reported cost per hour, test consumed 10 Minutes, 49 Seconds: cost approximately 0.02 dollar.
8. EC2 c4.8xlarge: $1.591 reported cost per hour, test consumed 8 Minutes, 17 Seconds: cost approximately 0.22 dollar.
9. EC2 m4.10xlarge: $2.00 reported cost per hour, test consumed 9 Minutes, 39 Seconds: cost approximately 0.32 dollar.
10. Microsoft Azure D4s v3: $0.1920 reported cost per hour, test consumed 9 Minutes, 55 Seconds: cost approximately 0.03 dollar.
11. Microsoft Azure E4s v3: $0.495 reported cost per hour, test consumed 9 Minutes, 27 Seconds: cost approximately 0.08 dollar.
12. Microsoft Azure D8s v3: $0.3840 reported cost per hour, test consumed 9 Minutes, 42 Seconds: cost approximately 0.06 dollar.
13. Google n1-standard-8: $0.268 reported cost per hour, test consumed 13 Minutes, 4 Seconds: cost approximately 0.06 dollar.
14. Google n1-highcpu-8: $0.199 reported cost per hour, test consumed 13 Minutes, 43 Seconds: cost approximately 0.05 dollar.
15. Google n1-standard-16: $0.533 reported cost per hour, test consumed 12 Minutes, 40 Seconds: cost approximately 0.11 dollar.
16. Google n1-highcpu-16: $0.399 reported cost per hour, test consumed 13 Minutes, 19 Seconds: cost approximately 0.09 dollar.

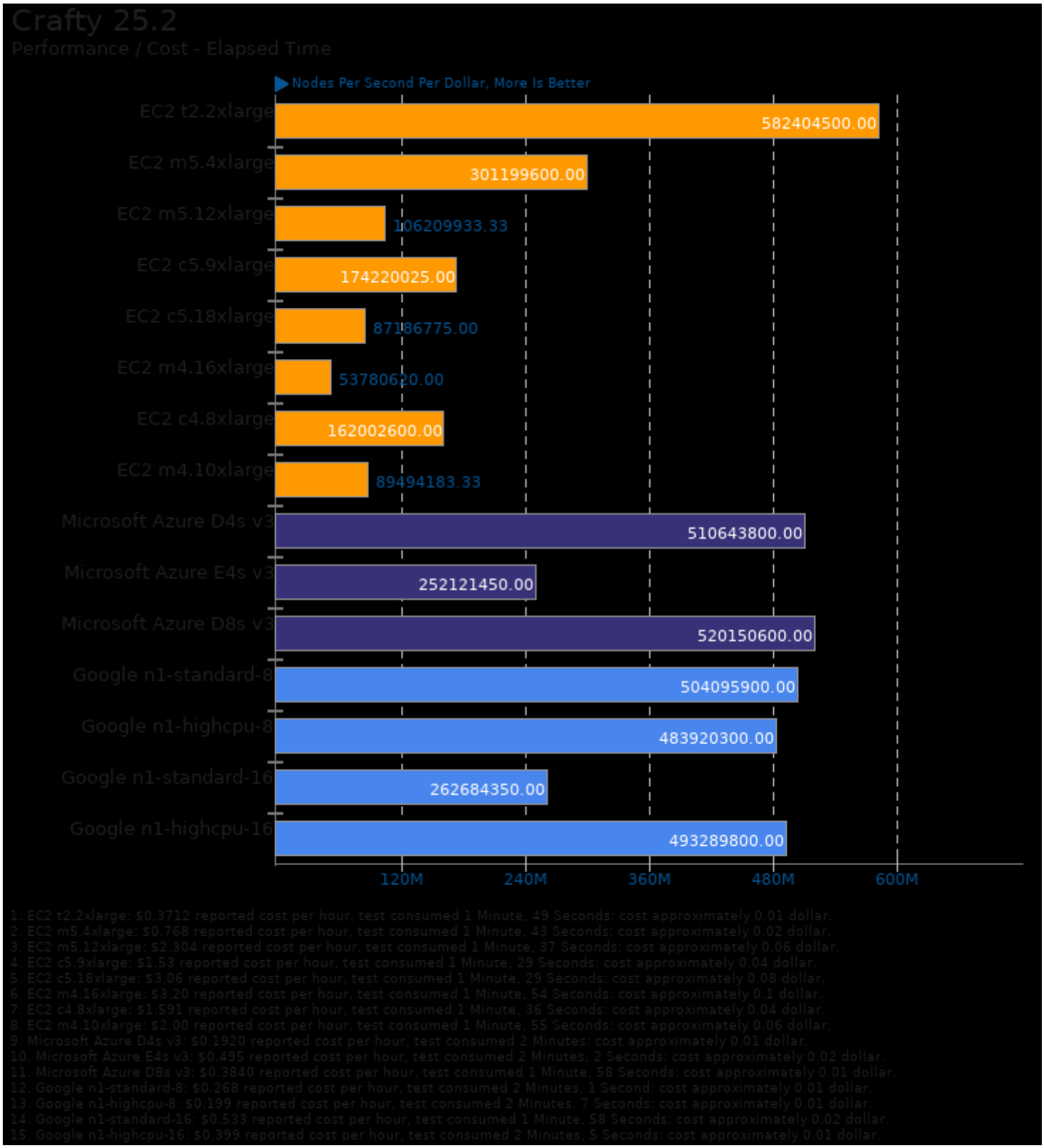

AOBench
Size: 2048 x 2048 - Total Time
Seconds, Fewer Is Better
EC2 t2.2xlarge
SE +/- 0.04, N = 3
62.18
EC2 m5.4xlarge
SE +/- 0.16, N = 3
65.48
EC2 m5.12xlarge
SE +/- 1.07, N = 3
66.21
EC2 c5.9xlarge
SE +/- 0.38, N = 3
58.70
EC2 c5.18xlarge
SE +/- 0.12, N = 3
58.42
EC2 m4.16xlarge
SE +/- 1.04, N = 3
64.56
EC2 m5.large
SE +/- 0.50, N = 3
65.51
EC2 c4.8xlarge
SE +/- 0.11, N = 3
55.39
EC2 m4.10xlarge
SE +/- 0.20, N = 3
67.24
Microsoft Azure D4s v3
SE +/- 0.22, N = 3
68.85
Microsoft Azure E4s v3
SE +/- 0.52, N = 3
65.32
Microsoft Azure D8s v3
SE +/- 0.09, N = 3
67.42
Google n1-standard-8
SE +/- 0.11, N = 3
73.65
Google n1-highcpu-8
SE +/- 0.12, N = 3
74.77
Google n1-standard-16
SE +/- 0.03, N = 3
72.86
Google n1-highcpu-16
SE +/- 0.10, N = 3
74.22
Contabo VPS S SSD
SE +/- 0.05, N = 3
43.25
20
40
60
80
100
1. (CC) gcc options: -lm -O3

Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine

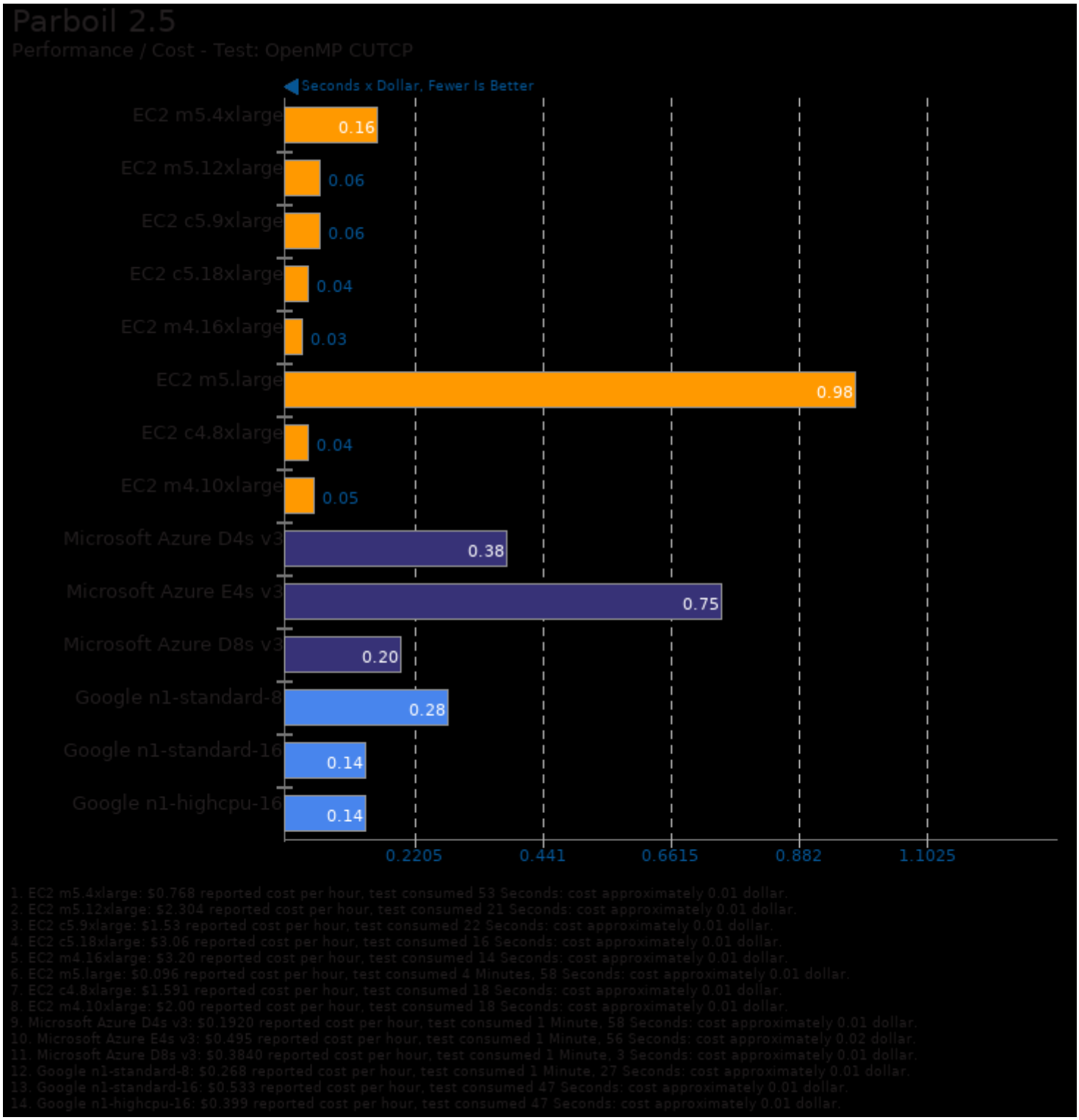



Crafty 25.2
Elapsed Time
Nodes Per Second, More Is Better
EC2 t2.2xlarge
SE +/- 3484.54, N = 3
5824045
EC2 m5.4xlarge
SE +/- 7362.69, N = 3
6023992
EC2 m5.12xlarge
SE +/- 2343.50, N = 3
6372596
EC2 c5.9xlarge
SE +/- 7226.78, N = 3
6968801
EC2 c5.18xlarge
SE +/- 7074.19, N = 3
6974942
EC2 m4.16xlarge
SE +/- 14246.76, N = 3
5378062
EC2 m5.large
SE +/- 87880.44, N = 3
5691579
EC2 c4.8xlarge
SE +/- 24158.72, N = 3
6480104
EC2 m4.10xlarge
SE +/- 24686.39, N = 3
5369651
Microsoft Azure D4s v3
SE +/- 22944.13, N = 3
5106438
Microsoft Azure E4s v3
SE +/- 35943.27, N = 3
5042429
Microsoft Azure D8s v3
SE +/- 30240.43, N = 3
5201506
Google n1-standard-8
SE +/- 7660.06, N = 3
5040959
Google n1-highcpu-8
SE +/- 18368.33, N = 3
4839203
Google n1-standard-16
SE +/- 33738.56, N = 3
5253687
Google n1-highcpu-16
SE +/- 3776.53, N = 3
4932898
Contabo VPS S SSD
SE +/- 6137.20, N = 3
6210784
1.5M
3M
4.5M
6M
7.5M
1. (CC) gcc options: -lstdc++ -fprofile-use -pthread -lm

Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine



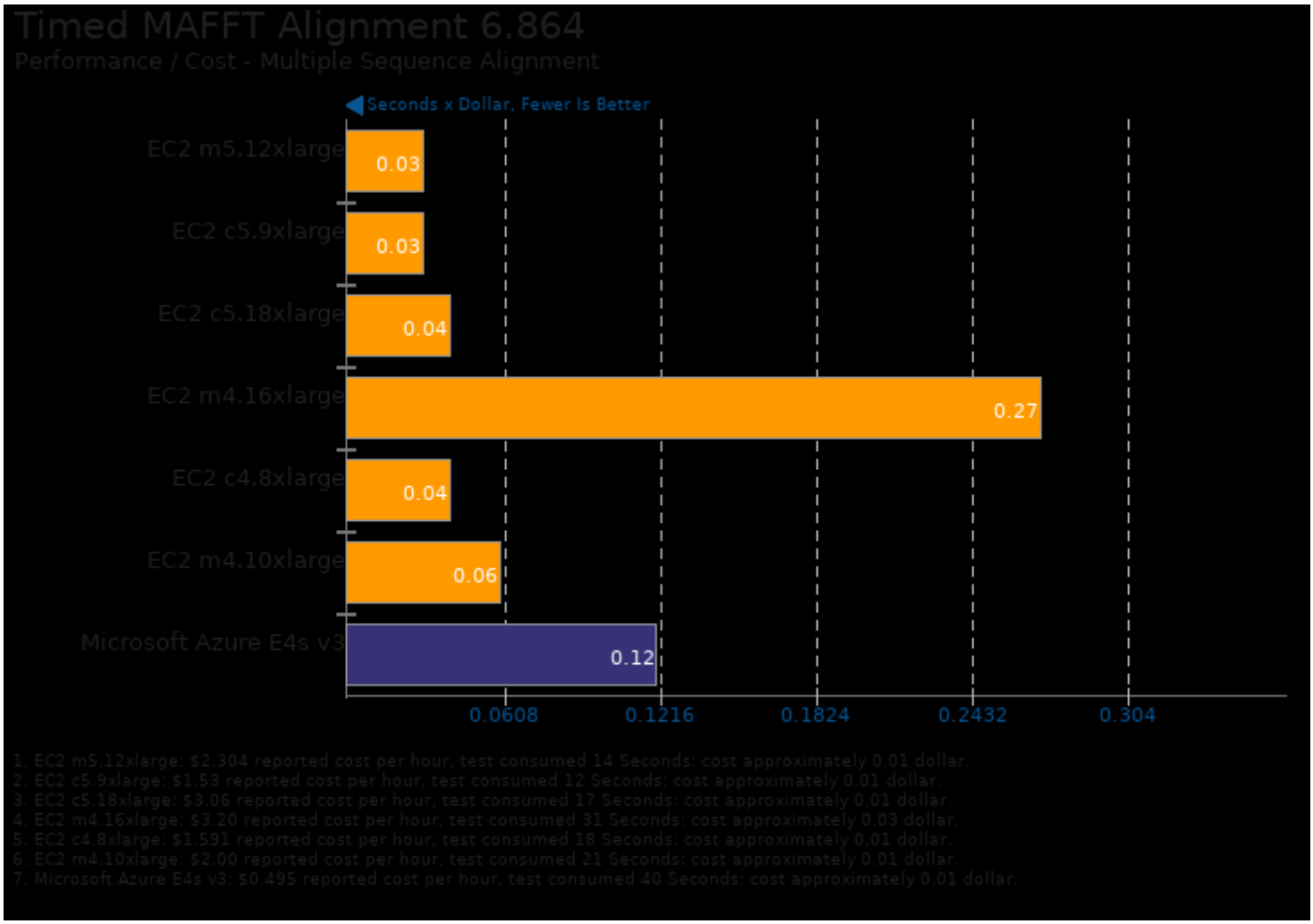
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine



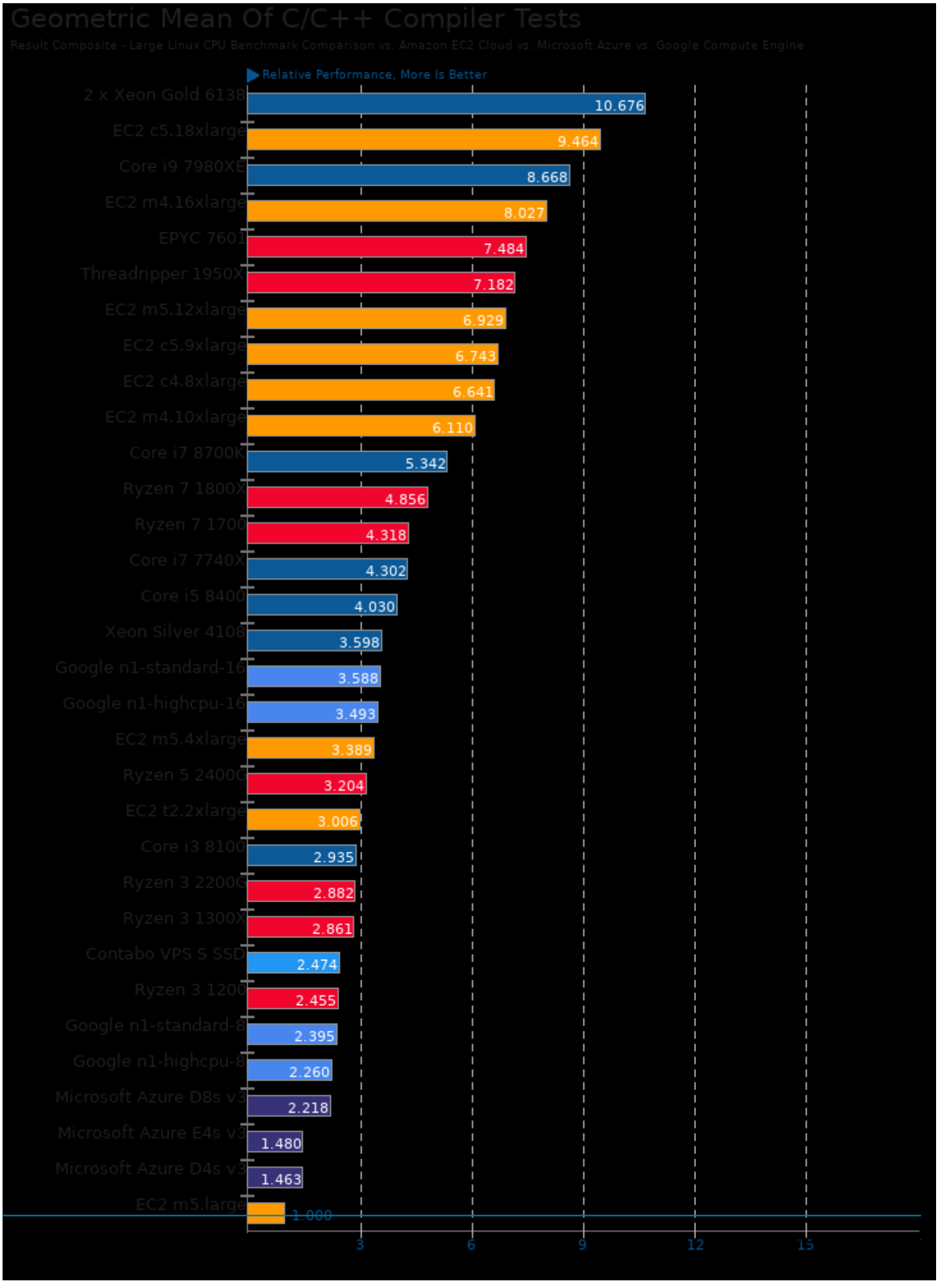
Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine



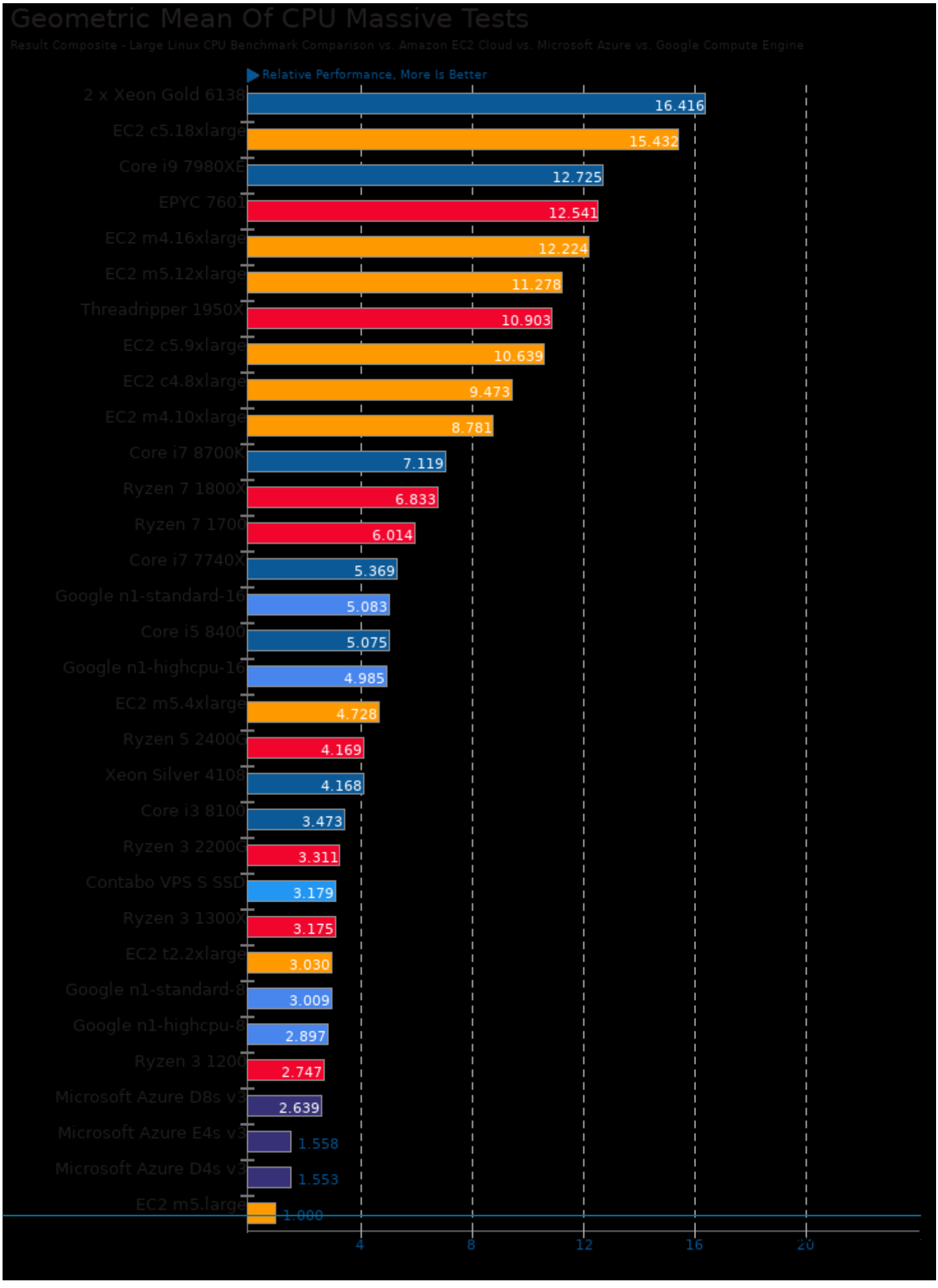
1. EC2 m5.4xlarge: $0.768 reported cost per hour, running tests consumed 1 Hour, 9 Minutes, 15 Seconds: cost approximately 0.89 dollar.
2. EC2 m5.12xlarge: $2.304 reported cost per hour, running tests consumed 52 Minutes, 9 Seconds: cost approximately 2 dollar.
3. EC2 c5.9xlarge: $1.53 reported cost per hour, running tests consumed 50 Minutes, 21 Seconds: cost approximately 1.28 dollar.
4. EC2 c5.18xlarge: $3.06 reported cost per hour, running tests consumed 47 Minutes, 35 Seconds: cost approximately 2.43 dollar.
5. EC2 m4.16xlarge: $3.20 reported cost per hour, running tests consumed 52 Minutes, 42 Seconds: cost approximately 2.81 dollar.
6. EC2 m5.large: $0.096 reported cost per hour, running tests consumed 3 Hours, 30 Minutes, 28 Seconds: cost approximately 0.34 dollar.
7. EC2 c4.8xlarge: $1.591 reported cost per hour, running tests consumed 50 Minutes, 46 Seconds: cost approximately 1.35 dollar.
8. EC2 m4.10xlarge: $2.00 reported cost per hour, running tests consumed 55 Minutes, 55 Seconds: cost approximately 1.86 dollar.
9. Microsoft Azure D4s v3: $0.1920 reported cost per hour, running tests consumed 2 Hours, 27 Minutes, 44 Seconds: cost approximately 0.47 dollar.
10. Microsoft Azure E4s v3: $0.495 reported cost per hour, running tests consumed 2 Hours, 25 Minutes, 51 Seconds: cost approximately 1.2 dollar.
11. Microsoft Azure D8s v3: $0.3840 reported cost per hour, running tests consumed 1 Hour, 35 Minutes, 54 Seconds: cost approximately 0.61 dollar.
12. Google n1-standard-8: $0.268 reported cost per hour, running tests consumed 1 Hour, 32 Minutes, 18 Seconds: cost approximately 0.41 dollar.
13. Google n1-highcpu-8: $0.199 reported cost per hour, running tests consumed 1 Hour, 35 Minutes, 11 Seconds: cost approximately 0.32 dollar.
14. Google n1-standard-16: $0.533 reported cost per hour, running tests consumed 1 Hour, 11 Minutes, 1 Second: cost approximately 0.63 dollar.
15. Google n1-highcpu-16: $0.399 reported cost per hour, running tests consumed 1 Hour, 12 Minutes, 24 Seconds: cost approximately 0.48 dollar.


Timed MAFFT Alignment 6.864
Performance / Cost - Multiple Sequence Alignment
Seconds x Dollar, Fewer Is Better
EC2 m5.12xlarge
0.03
EC2 c5.9xlarge
0.03
EC2 c5.18xlarge
0.04
EC2 m4.16xlarge
0.27
EC2 c4.8xlarge
0.04
EC2 m4.10xlarge
0.06
Microsoft Azure E4s v3
0.12
0.0608
0.1216
0.1824
0.2432
0.304
1. EC2 m5.12xlarge: $2.304 reported cost per hour, test consumed 14 Seconds: cost approximately 0.01 dollar.
2. EC2 c5.9xlarge: $1.53 reported cost per hour, test consumed 12 Seconds: cost approximately 0.01 dollar.
3. EC2 c5.18xlarge: $3.06 reported cost per hour, test consumed 17 Seconds: cost approximately 0.01 dollar.
4. EC2 m4.16xlarge: $3.20 reported cost per hour, test consumed 31 Seconds: cost approximately 0.03 dollar.
5. EC2 c4.8xlarge: $1.591 reported cost per hour, test consumed 18 Seconds: cost approximately 0.01 dollar.
6. EC2 m4.10xlarge: $2.00 reported cost per hour, test consumed 21 Seconds: cost approximately 0.01 dollar.
7. Microsoft Azure E4s v3: $0.495 reported cost per hour, test consumed 40 Seconds: cost approximately 0.01 dollar.

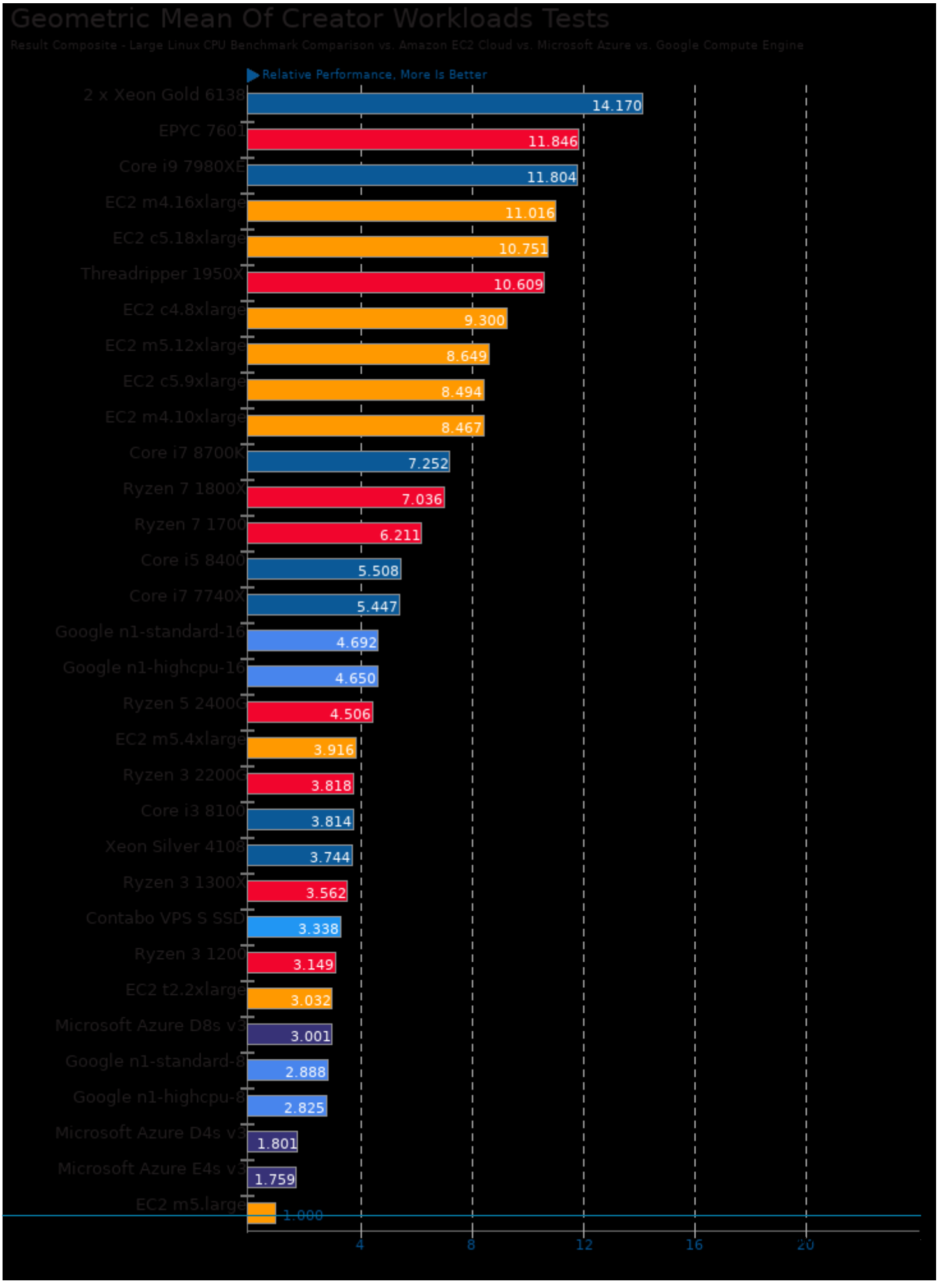
These geometric means are based upon test groupings / test suites for this result file.


Geometric Mean Of C/C++ Compiler Tests
Result Composite - Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine
Relative Performance, More Is Better
2 x Xeon Gold 6138 10.676
EC2 c5.18xlarge 9.464
Core i9 7980XE 8.668
EC2 m4.16xlarge 8.027
EPYC 7601 7.484
Threadripper 1950X 7.182
EC2 m5.12xlarge 6.929
EC2 c5.9xlarge 6.743
EC2 c4.8xlarge 6.641
EC2 m4.10xlarge 6.110
Core i7 8700K 5.342
Ryzen 7 1800X 4.856
Ryzen 7 1700 4.318
Core i7 7740X 4.302
Core i5 8400 4.030
Xeon Silver 4108 3.598
Google n1-standard-16 3.588
Google n1-highcpu-16 3.493
EC2 m5.4xlarge 3.389
Ryzen 5 2400G 3.204
EC2 t2.2xlarge 3.006
Core i3 8100 2.935
Ryzen 3 2200G 2.882
Ryzen 3 1300X 2.861
Contabo VPS S SSD 2.474
Ryzen 3 1200 2.455
Google n1-standard-8 2.395
Google n1-highcpu-8 2.260
Microsoft Azure D8s v3 2.218
Microsoft Azure E4s v3 1.480
Microsoft Azure D4s v3 1.463
EC2 m5.large 1.000
3
6
9
12
15

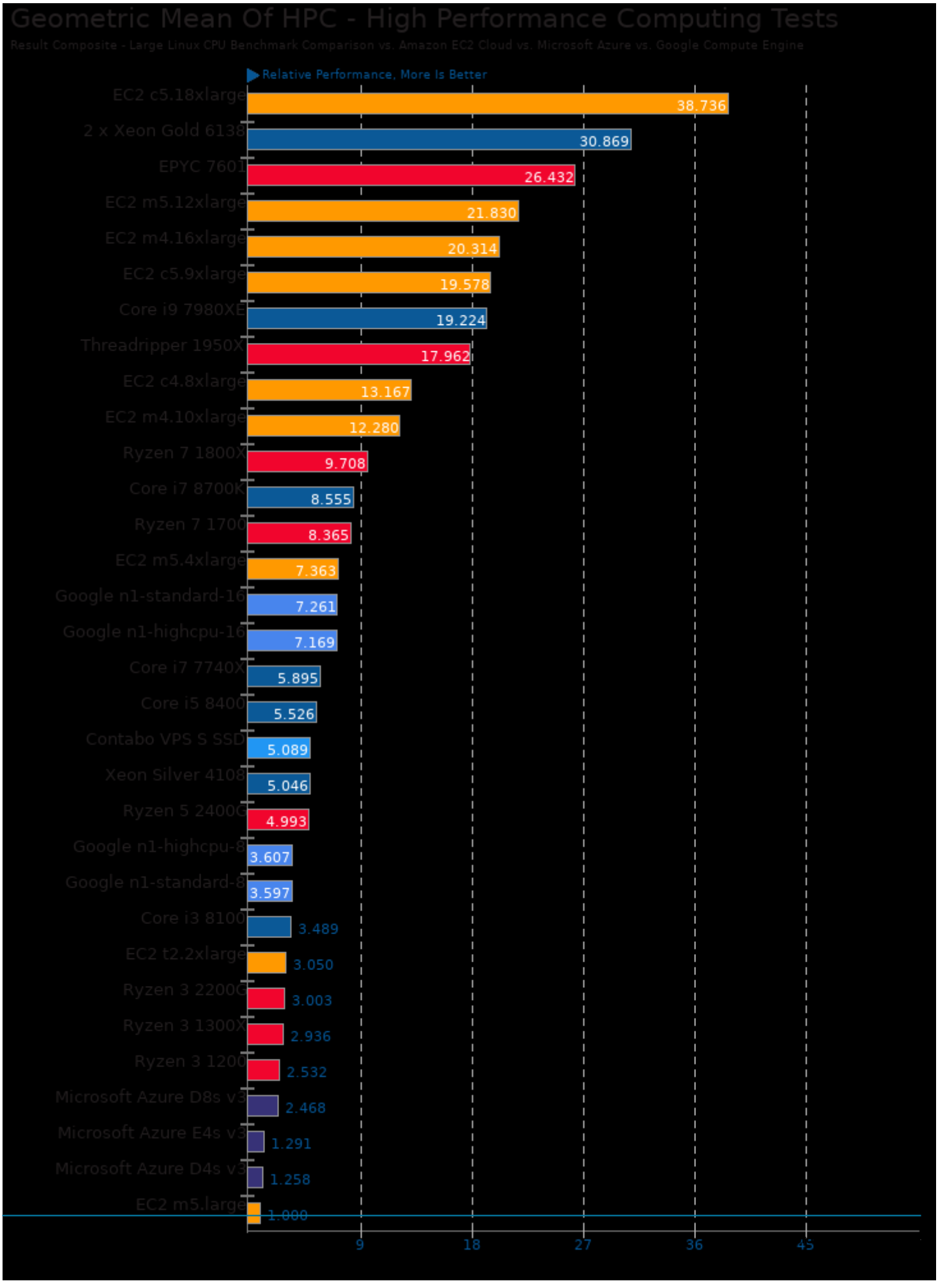
Geometric mean based upon tests: pts/mafft, pts/aobench, pts/c-ray, pts/compress-7zip, pts/encode-mp3, pts/john-the-ripper, pts/x264, pts/openssl and pts/nginx


Geometric Mean Of CPU Massive Tests
Result Composite - Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine
Relative Performance, More Is Better
2 x Xeon Gold 6138
16.416
EC2 c5.18xlarge
15.432
Core i9 7980XE
12.725
EPYC 7601
12.541
EC2 m4.16xlarge
12.224
EC2 m5.12xlarge
11.278
Threadripper 1950X
10.903
EC2 c5.9xlarge
10.639
EC2 c4.8xlarge
9.473
EC2 m4.10xlarge
8.781
Core i7 8700K
7.119
Ryzen 7 1800X
6.833
Ryzen 7 1700
6.014
Core i7 7740X
5.369
Google n1-standard-16
5.083
Core i5 8400
5.075
Google n1-highcpu-16
4.985
EC2 m5.4xlarge
4.728
Ryzen 5 2400G
4.169
Xeon Silver 4108
4.168
Core i3 8100
3.473
Ryzen 3 2200G
3.311
Contabo VPS S SSD
3.179
Ryzen 3 1300X
3.175
EC2 t2.2xlarge
3.030
Google n1-standard-8
3.009
Google n1-highcpu-8
2.897
Ryzen 3 1200
2.747
Microsoft Azure D8s v3
2.639
Microsoft Azure E4s v3
1.558
Microsoft Azure D4s v3
1.553
EC2 m5.large
1.000
4
8
12
16
20

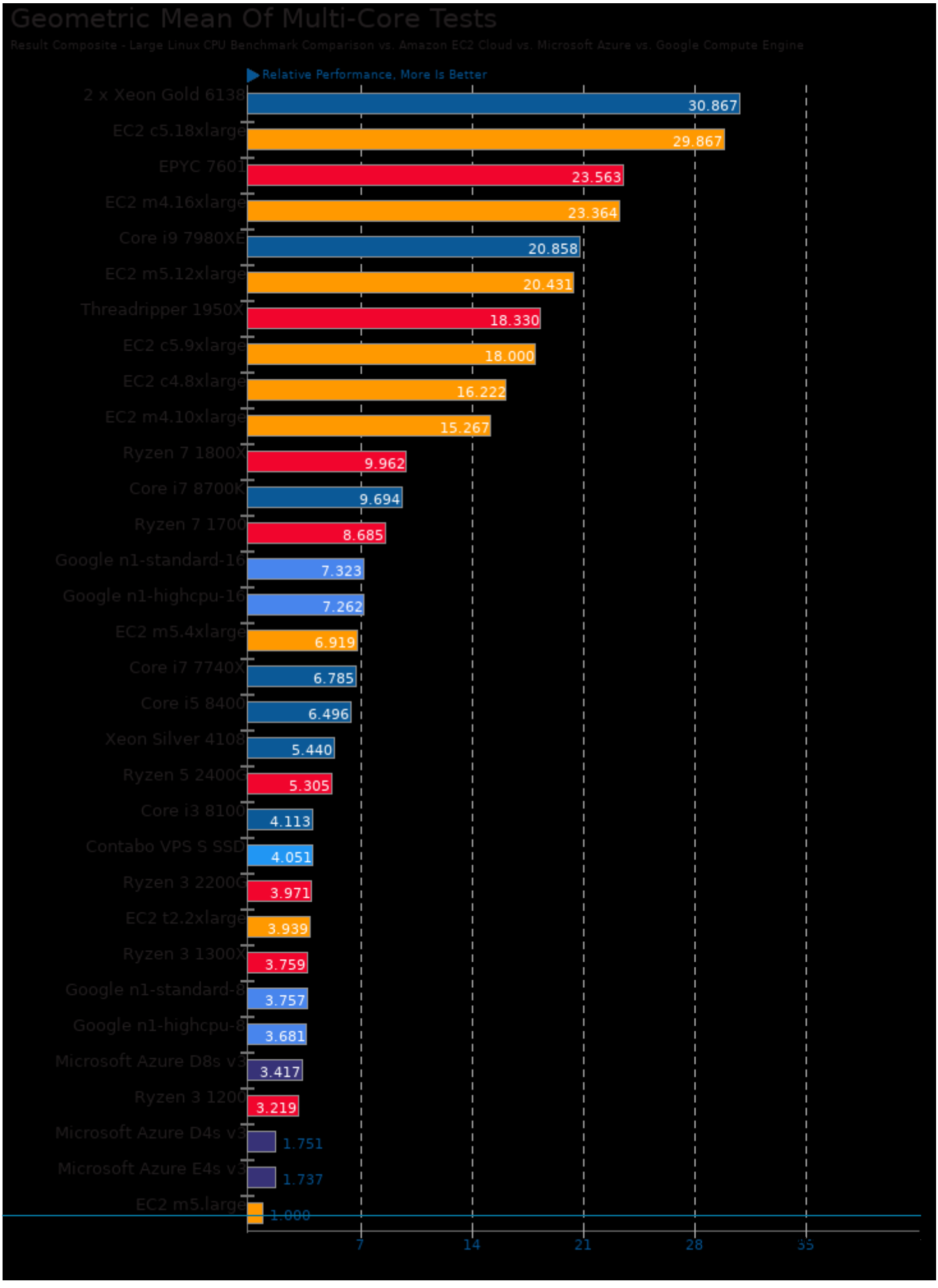
Geometric mean based upon tests: pts/build-linux-kernel, pts/c-ray, pts/compress-7zip, pts/crafty, pts/x264, pts/encode-mp3, pts/john-the-ripper, pts/openssl, pts/mafft, pts/nero2d, pts/nginx, pts/npb, pts/parboil, pts/povray, pts/rodinia, pts/scikit-learn and pts/ttsiod-renderer


Geometric Mean Of Creator Workloads Tests
Result Composite - Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine
Relative Performance, More Is Better
2 x Xeon Gold 6138
14.170
EPYC 7601
11.846
Core i9 7980XE
11.804
EC2 m4.16xlarge
11.016
EC2 c5.18xlarge
10.751
Threadripper 1950X
10.609
EC2 c4.8xlarge
9.300
EC2 m5.12xlarge
8.649
EC2 c5.9xlarge
8.494
EC2 m4.10xlarge
8.467
Core i7 8700K
7.252
Ryzen 7 1800X
7.036
Ryzen 7 1700
6.211
Core i5 8400
5.508
Core i7 7740X
5.447
Google n1-standard-16
4.692
Google n1-highcpu-16
4.650
Ryzen 5 2400G
4.506
EC2 m5.4xlarge
3.916
Ryzen 3 2200G
3.818
Core i3 8100
3.814
Xeon Silver 4108
3.744
Ryzen 3 1300X
3.562
Contabo VPS S SSD
3.338
Ryzen 3 1200
3.149
EC2 t2.2xlarge
3.032
Microsoft Azure D8s v3
3.001
Google n1-standard-8
2.888
Google n1-highcpu-8
2.825
Microsoft Azure D4s v3
1.801
Microsoft Azure E4s v3
1.759
EC2 m5.large
1.000
4
8
12
16
20

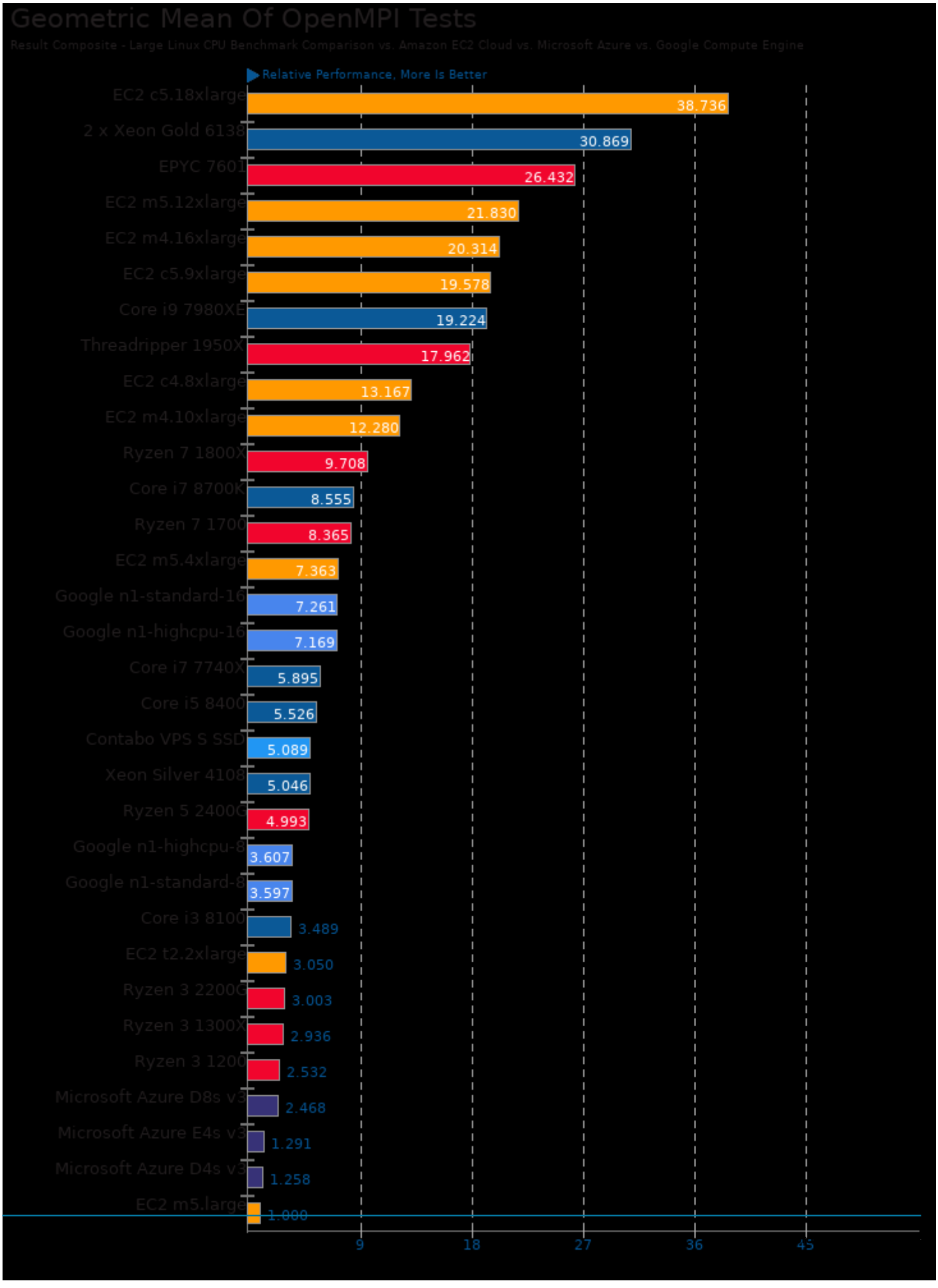
Geometric mean based upon tests: pts/c-ray, pts/povray, pts/aobench, pts/ttsiod-renderer, pts/x264 and pts/encode-mp3


Geometric Mean Of HPC - High Performance Computing Tests
Result Composite - Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine
Relative Performance, More Is Better
EC2 c5.18xlarge
38.736
2 x Xeon Gold 6138
30.869
EPYC 7601
26.432
EC2 m5.12xlarge
21.830
EC2 m4.16xlarge
20.314
EC2 c5.9xlarge
19.578
Core i9 7980XE
19.224
Threadripper 1950X
17.962
EC2 c4.8xlarge
13.167
EC2 m4.10xlarge
12.280
Ryzen 7 1800X
9.708
Core i7 8700K
8.555
Ryzen 7 1700
8.365
EC2 m5.4xlarge
7.363
Google n1-standard-16
7.261
Google n1-highcpu-16
7.169
Core i7 7740X
5.895
Core i5 8400
5.526
Contabo VPS S SSD
5.089
Xeon Silver 4108
5.046
Ryzen 5 2400G
4.993
Google n1-highcpu-8
3.607
Google n1-standard-8
3.597
Core i3 8100
3.489
EC2 t2.2xlarge
3.050
Ryzen 3 2200G
3.003
Ryzen 3 1300X
2.936
Ryzen 3 1200
2.532
Microsoft Azure D8s v3
2.468
Microsoft Azure E4s v3
1.291
Microsoft Azure D4s v3
1.258
EC2 m5.large
1.000
9
18
27
36
45

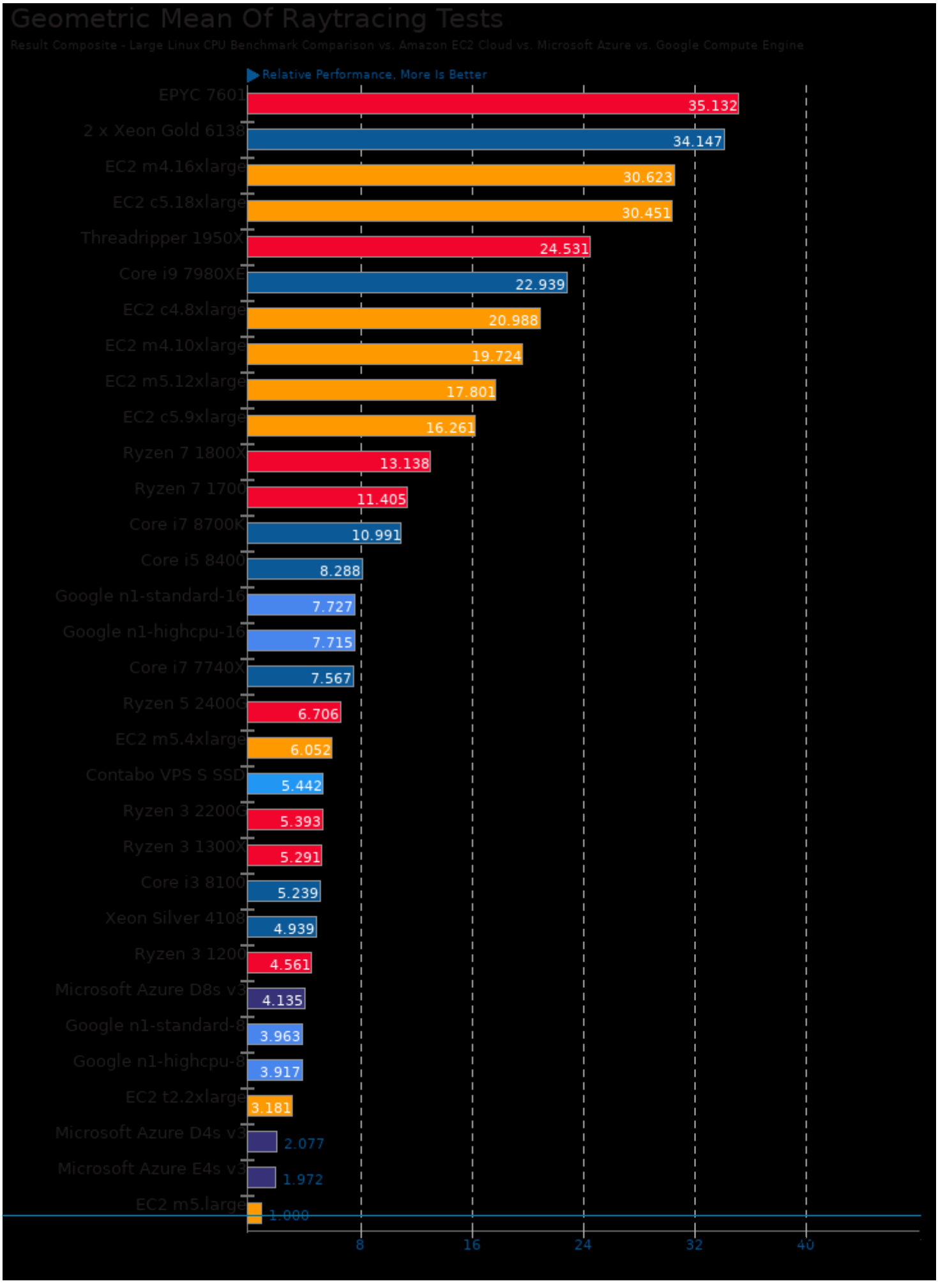
Geometric mean based upon tests: pts/npb, pts/rodinia, pts/parboil, pts/mafft and pts/scikit-learn


Geometric Mean Of Multi-Core Tests
Result Composite - Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine
Relative Performance, More Is Better
2 x Xeon Gold 6138
30.867
EC2 c5.18xlarge
29.867
EPYC 7601
23.563
EC2 m4.16xlarge
23.364
Core i9 7980XE
20.858
EC2 m5.12xlarge
20.431
Threadripper 1950X
18.330
EC2 c5.9xlarge
18.000
EC2 c4.8xlarge
16.222
EC2 m4.10xlarge
15.267
Ryzen 7 1800X
9.962
Core i7 8700K
9.694
Ryzen 7 1700
8.685
Google n1-standard-16
7.323
Google n1-highcpu-16
7.262
EC2 m5.4xlarge
6.919
Core i7 7740X
6.785
Core i5 8400
6.496
Xeon Silver 4108
5.440
Ryzen 5 2400G
5.305
Core i3 8100
4.113
Contabo VPS S SSD
4.051
Ryzen 3 2200G
3.971
EC2 t2.2xlarge
3.939
Ryzen 3 1300X
3.759
Google n1-standard-8
3.757
Google n1-highcpu-8
3.681
Microsoft Azure D8s v3
3.417
Ryzen 3 1200
3.219
Microsoft Azure D4s v3
1.751
Microsoft Azure E4s v3
1.737
EC2 m5.large
1.000
7
14
21
28
35

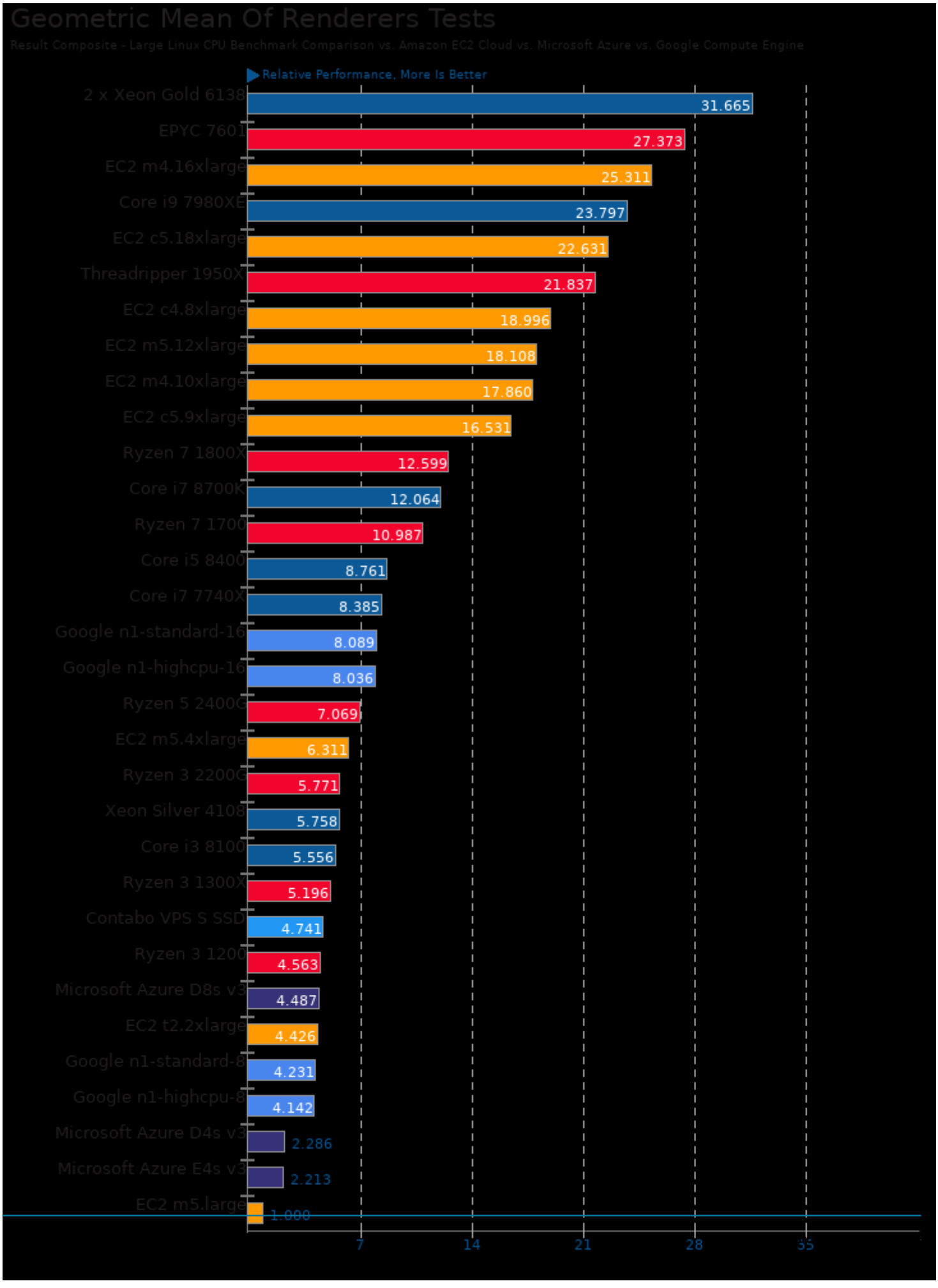
Geometric mean based upon tests: pts/c-ray, pts/povray, pts/x264, pts/rodinia, pts/parboil, pts/npb, pts/john-the-ripper, pts/nero2d, pts/compress-7zip, pts/build-linux-kernel, pts/aobench and pts/ttsiod-renderer


Geometric Mean Of OpenMPI Tests
Result Composite - Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine
Relative Performance, More Is Better
EC2 c5.18xlarge
38.736
2 x Xeon Gold 6138
30.869
EPYC 7601
26.432
EC2 m5.12xlarge
21.830
EC2 m4.16xlarge
20.314
EC2 c5.9xlarge
19.578
Core i9 7980XE
19.224
Threadripper 1950X
17.962
EC2 c4.8xlarge
13.167
EC2 m4.10xlarge
12.280
Ryzen 7 1800X
9.708
Core i7 8700K
8.555
Ryzen 7 1700
8.365
EC2 m5.4xlarge
7.363
Google n1-standard-16
7.261
Google n1-highcpu-16
7.169
Core i7 7740X
5.895
Core i5 8400
5.526
Contabo VPS S SSD
5.089
Xeon Silver 4108
5.046
Ryzen 5 2400G
4.993
Google n1-highcpu-8
3.607
Google n1-standard-8
3.597
Core i3 8100
3.489
EC2 t2.2xlarge
3.050
Ryzen 3 2200G
3.003
Ryzen 3 1300X
2.936
Ryzen 3 1200
2.532
Microsoft Azure D8s v3
2.468
Microsoft Azure E4s v3
1.291
Microsoft Azure D4s v3
1.258
EC2 m5.large
1.000
9
18
27
36
45

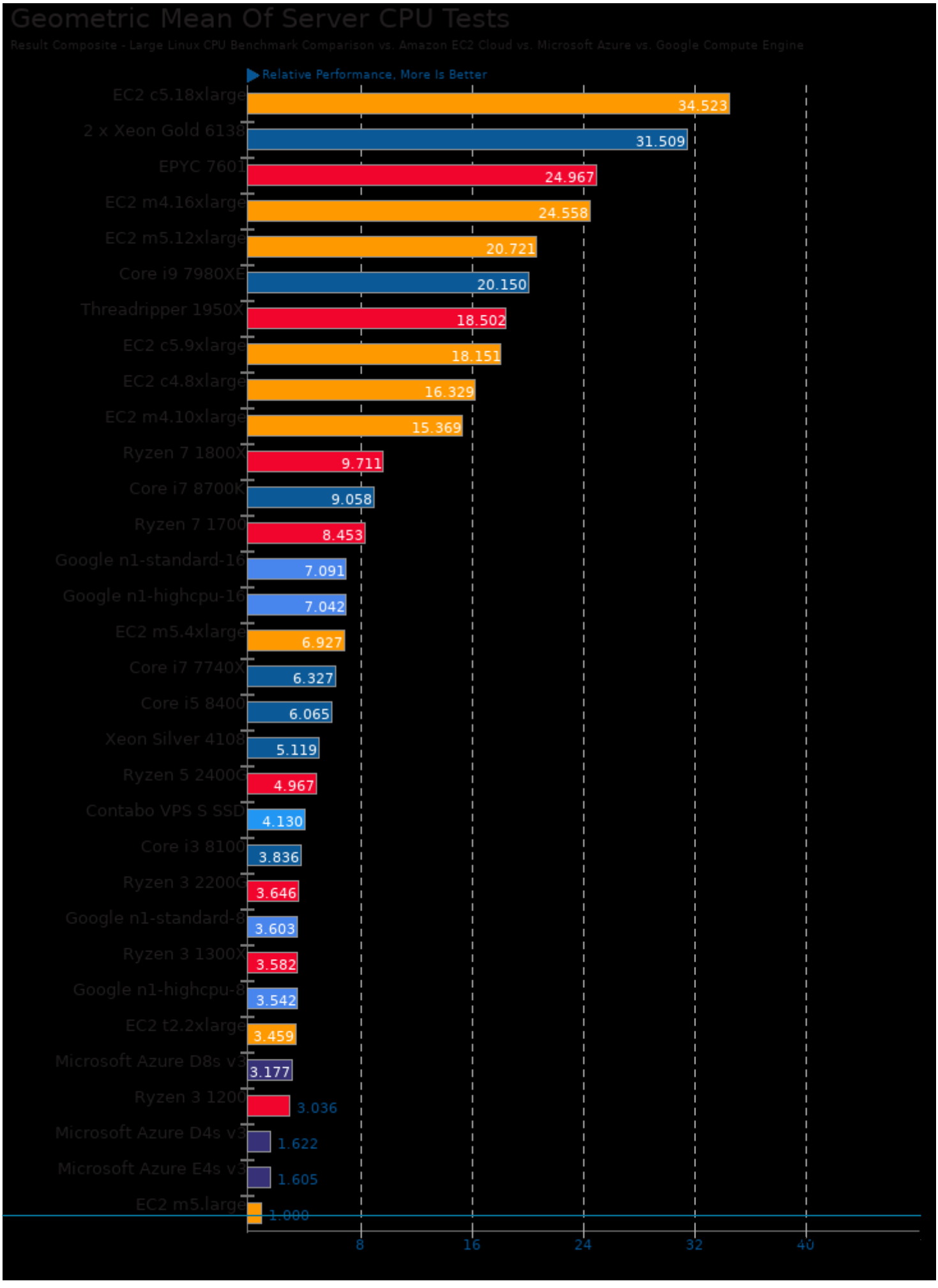
Geometric mean based upon tests: pts/npb, pts/rodinia and pts/nero2d


Geometric Mean Of Raytracing Tests
Result Composite - Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine
Relative Performance, More Is Better
EPYC 7601
35.132
2 x Xeon Gold 6138
34.147
EC2 m4.16xlarge
30.623
EC2 c5.18xlarge
30.451
Threadripper 1950X
24.531
Core i9 7980XE
22.939
EC2 c4.8xlarge
20.988
EC2 m4.10xlarge
19.724
EC2 m5.12xlarge
17.801
EC2 c5.9xlarge
16.261
Ryzen 7 1800X
13.138
Ryzen 7 1700
11.405
Core i7 8700K
10.991
Core i5 8400
8.288
Google n1-standard-16
7.727
Google n1-highcpu-16
7.715
Core i7 7740X
7.567
Ryzen 5 2400G
6.706
EC2 m5.4xlarge
6.052
Contabo VPS S SSD
5.442
Ryzen 3 2200G
5.393
Ryzen 3 1300X
5.291
Core i3 8100
5.239
Xeon Silver 4108
4.939
Ryzen 3 1200
4.561
Microsoft Azure D8s v3
4.135
Google n1-standard-8
3.963
Google n1-highcpu-8
3.917
EC2 t2.2xlarge
3.181
Microsoft Azure D4s v3
2.077
Microsoft Azure E4s v3
1.972
EC2 m5.large
1.000
8
16
24
32
40

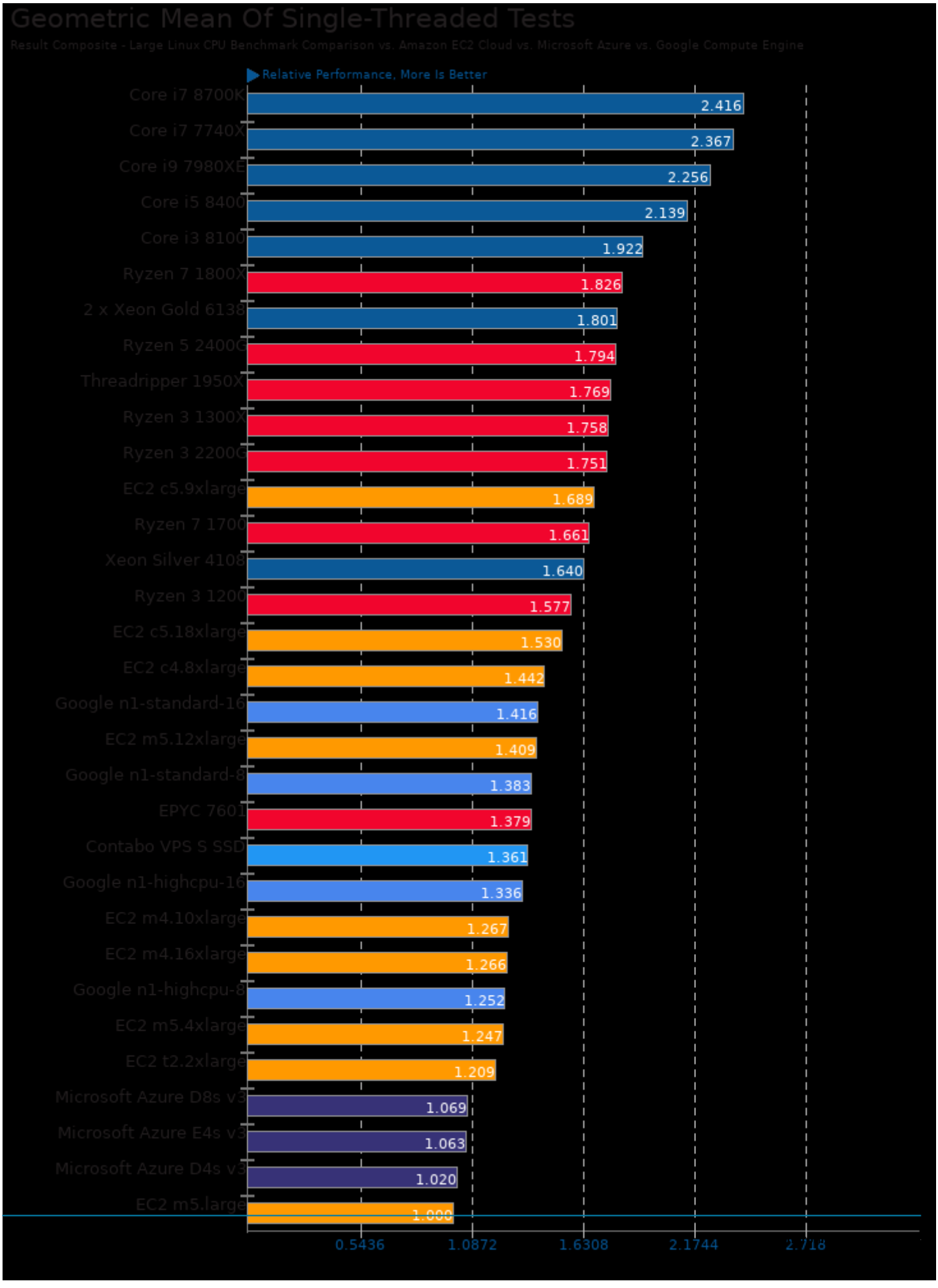
Geometric mean based upon tests: pts/c-ray and pts/povray


Geometric Mean Of Renderers Tests
Result Composite - Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine
Relative Performance, More Is Better
2 x Xeon Gold 6138
31.665
EPYC 7601
27.373
EC2 m4.16xlarge
25.311
Core i9 7980XE
23.797
EC2 c5.18xlarge
22.631
Threadripper 1950X
21.837
EC2 c4.8xlarge
18.996
EC2 m5.12xlarge
18.108
EC2 m4.10xlarge
17.860
EC2 c5.9xlarge
16.531
Ryzen 7 1800X
12.599
Core i7 8700K
12.064
Ryzen 7 1700
10.987
Core i5 8400
8.761
Core i7 7740X
8.385
Google n1-standard-16
8.089
Google n1-highcpu-16
8.036
Ryzen 5 2400G
7.069
EC2 m5.4xlarge
6.311
Ryzen 3 2200G
5.771
Xeon Silver 4108
5.758
Core i3 8100
5.556
Ryzen 3 1300X
5.196
Contabo VPS S SSD
4.741
Ryzen 3 1200
4.563
Microsoft Azure D8s v3
4.487
EC2 t2.2xlarge
4.426
Google n1-standard-8
4.231
Google n1-highcpu-8
4.142
Microsoft Azure D4s v3
2.286
Microsoft Azure E4s v3
2.213
EC2 m5.large
1.000
7
14
21
28
35

Geometric mean based upon tests: pts/c-ray, pts/povray, pts/aobench and pts/ttsiod-renderer


Geometric Mean Of Server CPU Tests
Result Composite - Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine
Relative Performance, More Is Better
EC2 c5.18xlarge
34.523
2 x Xeon Gold 6138
31.509
EPYC 7601
24.967
EC2 m4.16xlarge
24.558
EC2 m5.12xlarge
20.721
Core i9 7980XE
20.150
Threadripper 1950X
18.502
EC2 c5.9xlarge
18.151
EC2 c4.8xlarge
16.329
EC2 m4.10xlarge
15.369
Ryzen 7 1800X
9.711
Core i7 8700K
9.058
Ryzen 7 1700
8.453
Google n1-standard-16
7.091
Google n1-highcpu-16
7.042
EC2 m5.4xlarge
6.927
Core i7 7740X
6.327
Core i5 8400
6.065
Xeon Silver 4108
5.119
Ryzen 5 2400G
4.967
Contabo VPS S SSD
4.130
Core i3 8100
3.836
Ryzen 3 2200G
3.646
Google n1-standard-8
3.603
Ryzen 3 1300X
3.582
Google n1-highcpu-8
3.542
EC2 t2.2xlarge
3.459
Microsoft Azure D8s v3
3.177
Ryzen 3 1200
3.036
Microsoft Azure D4s v3
1.622
Microsoft Azure E4s v3
1.605
EC2 m5.large
1.000
8
16
24
32
40

Geometric mean based upon tests: pts/npb, pts/rodinia, pts/john-the-ripper, pts/x264, pts/compress-7zip, pts/build-linux-kernel, pts/c-ray, pts/povray, pts/openssl, pts/pybench and pts/scikit-learn


Geometric Mean Of Single-Threaded Tests
Result Composite - Large Linux CPU Benchmark Comparison vs. Amazon EC2 Cloud vs. Microsoft Azure vs. Google Compute Engine
Relative Performance, More Is Better
Core i7 8700K 2.416
Core i7 7740X 2.367
Core i9 7980XE 2.256
Core i5 8400 2.139
Core i3 8100 1.922
Ryzen 7 1800X 1.826
2 x Xeon Gold 6138 1.801
Ryzen 5 2400G 1.794
Threadripper 1950X 1.769
Ryzen 3 1300X 1.758
Ryzen 3 2200G 1.751
EC2 c5.9xlarge 1.689
Ryzen 7 1700 1.661
Xeon Silver 4108 1.640
Ryzen 3 1200 1.577
EC2 c5.18xlarge 1.530
EC2 c4.8xlarge 1.442
Google n1-standard-16 1.416
EC2 m5.12xlarge 1.409
Google n1-standard-8 1.383
EPYC 7601 1.379
Contabo VPS S SSD 1.361
Google n1-highcpu-16 1.336
EC2 m4.10xlarge 1.267
EC2 m4.16xlarge 1.266
Google n1-highcpu-8 1.252
EC2 m5.4xlarge 1.247
EC2 t2.2xlarge 1.209
Microsoft Azure D8s v3 1.069
Microsoft Azure E4s v3 1.063
Microsoft Azure D4s v3 1.020
EC2 m5.large 1.000
0.5436
1.0872
1.6308
2.1744
2.718

Geometric mean based upon tests: pts/encode-mp3, pts/pybench and pts/nginx

This file was automatically generated via the Phoronix Test Suite benchmarking software on Thursday, 28 March 2024 13:41.