

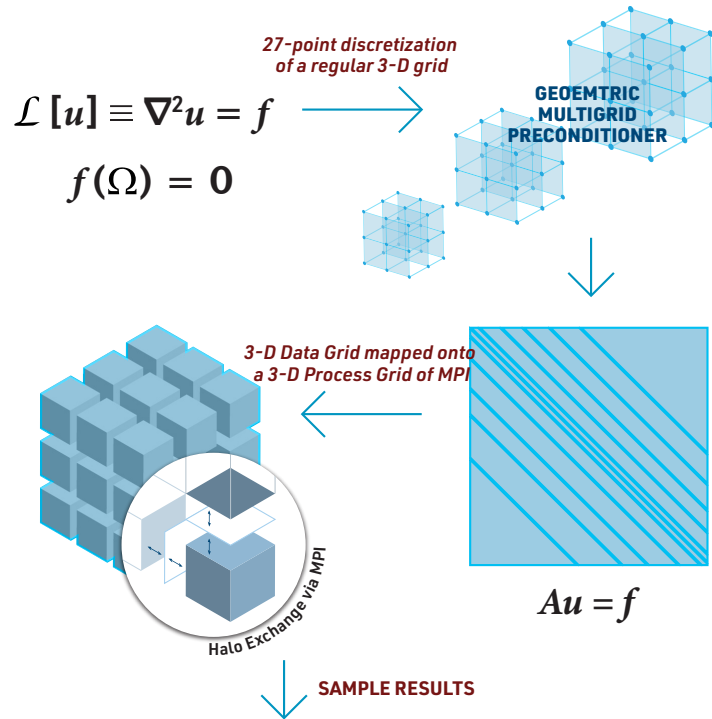
HPCG

JUNE 2025 TOP 5

		SITE	COUNTRY	ACHIEVED
1	El Capitan	DOE/NNSA/LLNL	USA	17.4 Pflop/s
2	Fugaku	RIKEN R-CCS	Japan	16 Pflop/s
3	Frontier	DOE/SC/ORNL	USA	14 Pflop/s
4	Aurora	DOE/SC/ANL	USA	5.6 Pflop/s
5	LUMI	EuroHPC/CSC	Finland	4.6 Pflop/s

The HPC Conjugate Gradient (HPCG) benchmark uses a preconditioned conjugate gradient (PCG) algorithm to measure the performance of HPC platforms with respect to frequently observed, yet challenging, patterns of execution, memory access, and global communication.

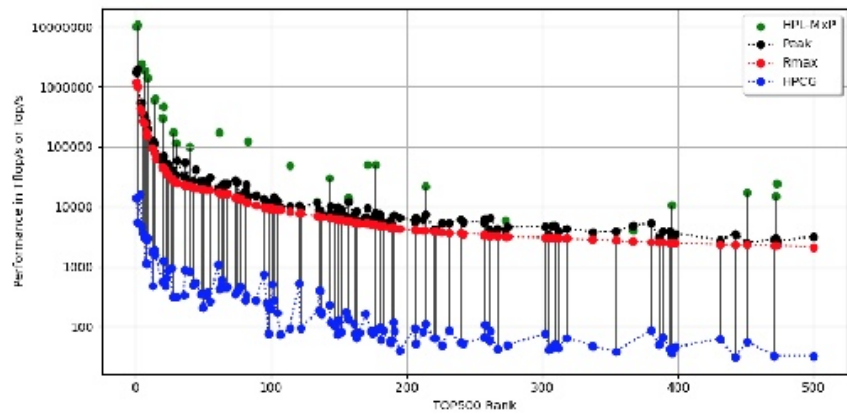
The PCG implementation uses a regular 27-point stencil discretization in 3 dimensions of an elliptic partial differential equation (PDE) with zero Dirichlet boundary condition. The 3-D domain is scaled to fill a 3-D virtual process grid of all available MPI process ranks. The CG iteration includes a local and symmetric Gauss-Seidel preconditioner, which computes a forward and a back solve with a triangular matrix. All of these features combined allow HPCG to deliver a more accurate performance metric for modern HPC hardware architectures.



PRECONDITIONED CONJUGATE GRADIENT SOLVER

```

p0 ← x0, r0 ← b - Ap0
for i = 1, 2, to max_iterations do
  zi ← M⁻¹ri-1
  if i = 1 then
    pi ← zi
    αi ← dot_prod(ri-1, zi)
  else
    αi ← dot_prod(ri-1, zi)
    βi ← αi/αi-1
    pi ← βipi-1 + zi
  end if
  αi ← dot_prod(ri-1, zi)/dot_prod(pi, Api)
  xi+1 ← xi + αipi
  ri ← ri-1 - αiApi
  if ||ri||₂ < tolerance then
    STOP
  end if
end for
  
```



FIND OUT MORE AT
<http://www.hpcg-benchmark.org/>

