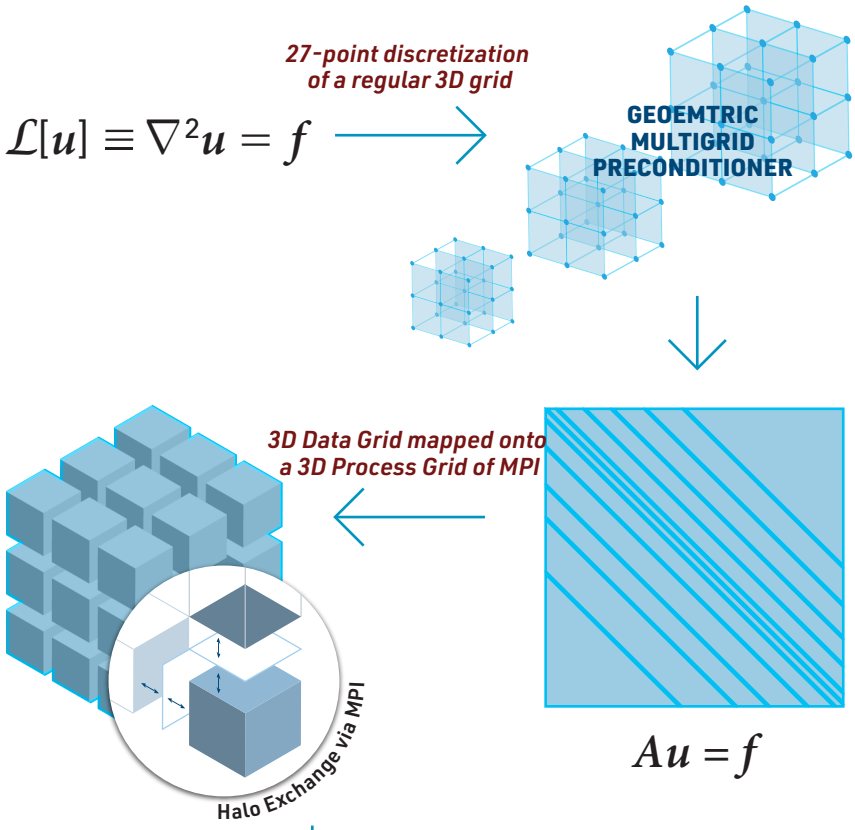
HPCG

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

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, and yet challenging, patterns of execution, memory access, and global communication.

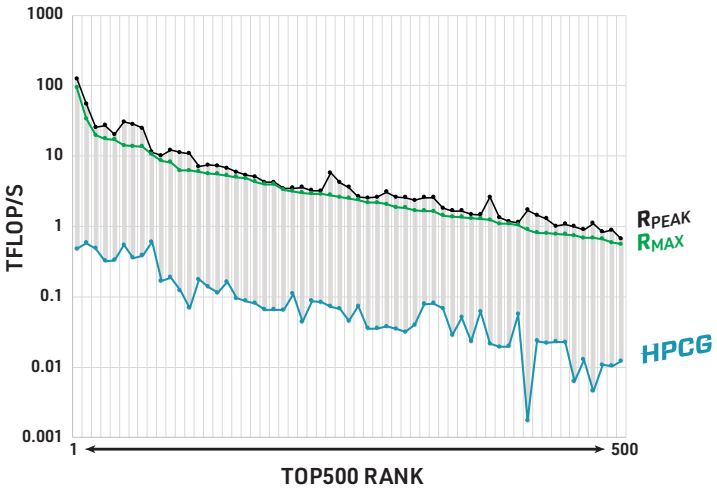
The PCG implementation uses a regular 27-point stencil discretization in 3 dimensions of an elliptic Partial Differential Equation (PDE). The 3D domain is scaled to fill a 3D virtual process grid of all available MPI process ranks. The CG iteration includes a local and symmetric Gauss-Seidel preconditioner, 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

$p_0 \leftarrow x_0$, $r_0 \leftarrow b - Ap_0$
for $i = 1, 2,$ to max_iterations **do**
  $z_i \leftarrow M^{-1} r_{i-1}$
  if $i = 1$ **then**
    $p_i \leftarrow z_i$
    $\alpha_i \leftarrow$ dot_prod(r_{i-1}, z_i)
  else
    $\alpha_i \leftarrow$ dot_prod(r_{i-1}, z_i)
    $\beta_i \leftarrow \alpha_i / \alpha_{i-1}$
    $p_i \leftarrow \beta_i p_{i-1} + z_i$
  end if
  $\alpha_i \leftarrow$ dot_prod(r_{i-1}, z_i)/dot_prod(p_i, Ap_i)
  $x_{i+1} \leftarrow x_i + \alpha_i p_i$
  $r_i \leftarrow r_{i-1} - \alpha_i Ap_i$
  if $\|r_i\|_2 <$ tolerance **then**
    STOP
  end if
end for

SAMPLE RESULTS



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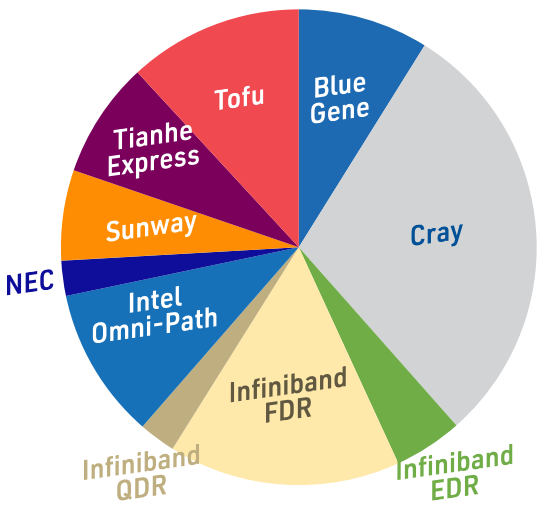
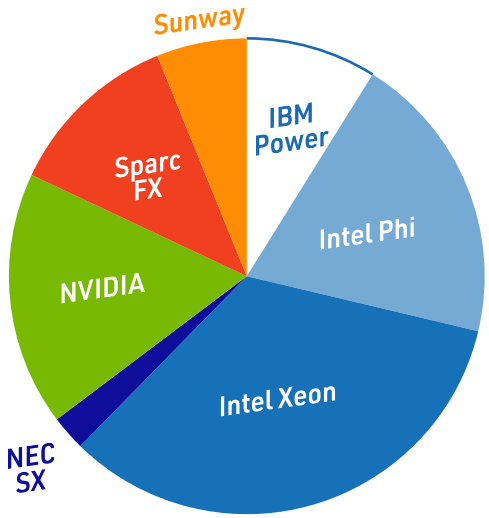
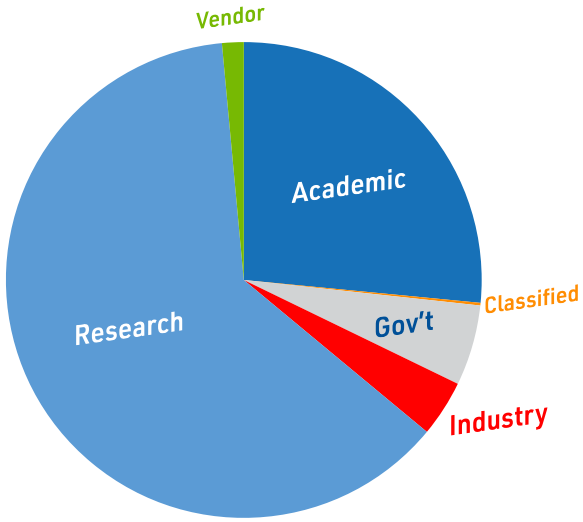
HPCG PERFORMANCE BY NETWORK TYPE/VENDOR



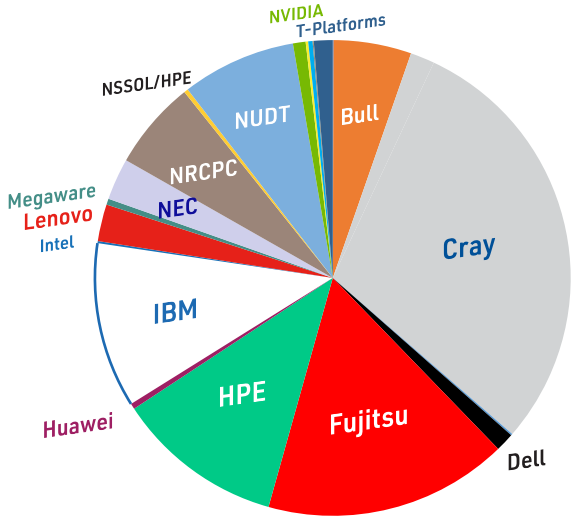
HPCG PERFORMANCE BY PROCESSOR TYPE/VENDOR



HPCG PERFORMANCE BY SEGMENT



HPCG PERFORMANCE BY SYSTEM INTEGRATOR



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