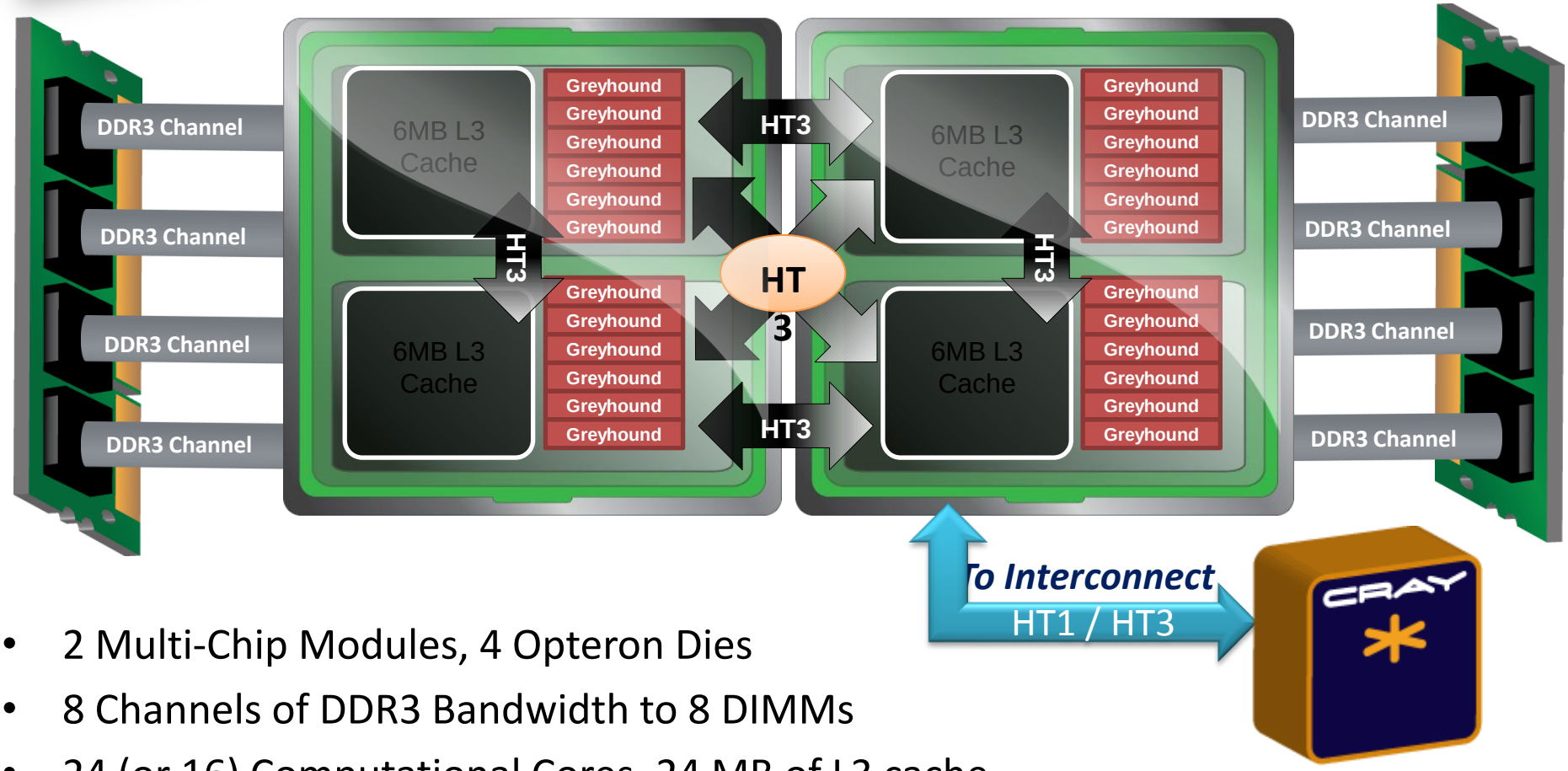
Extreme Scaling on Petascale-class Systems

Cray XE/XT Architecture, System Software, and Scientific Libraries

CRAY XE/XT SYSTEM ARCHITECTURE

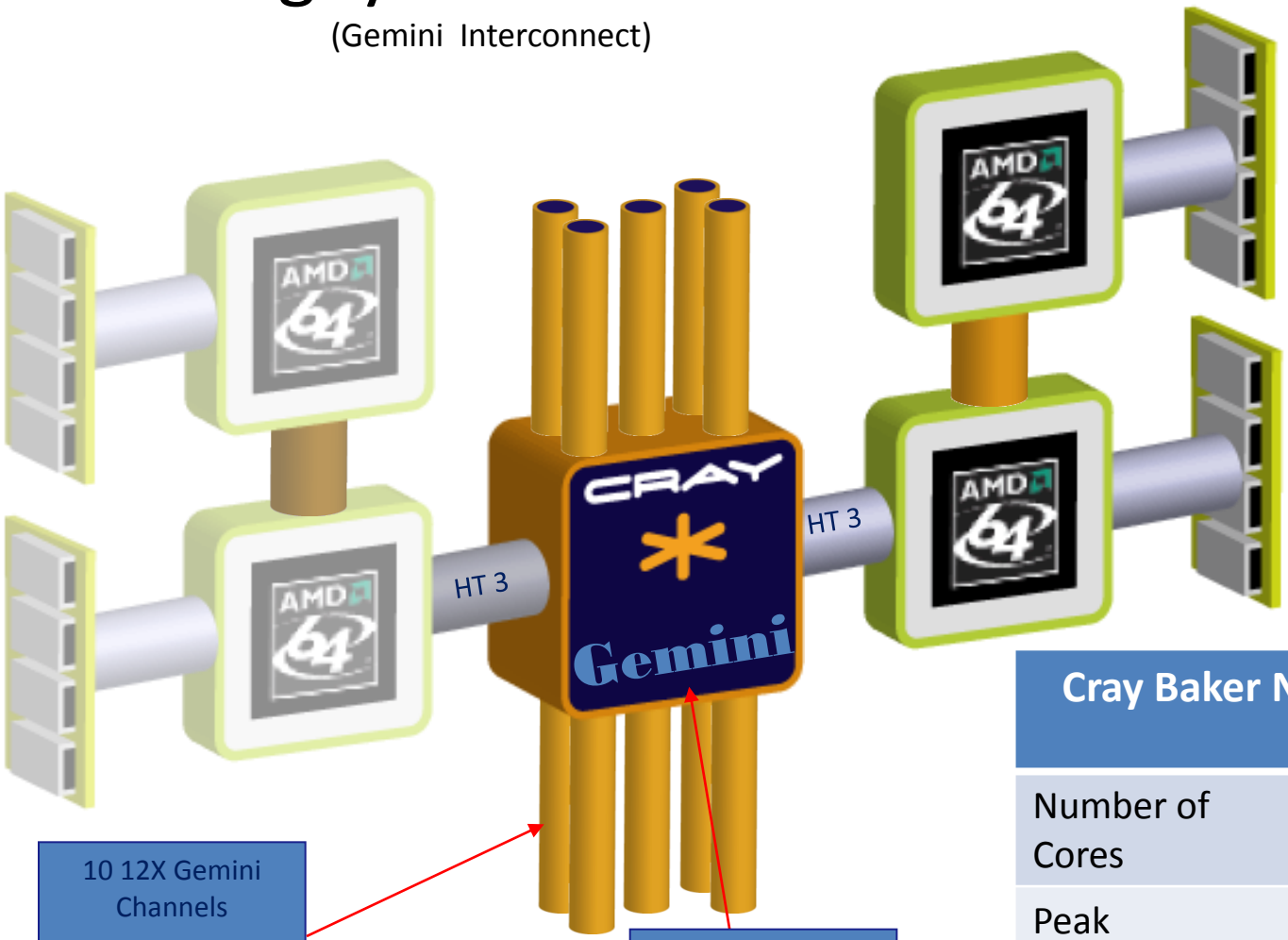
XE6 Node Details:
24-core Magny Cours



- 2 Multi-Chip Modules, 4 Opteron Dies
- 8 Channels of DDR3 Bandwidth to 8 DIMMs
- 24 (or 16) Computational Cores, 24 MB of L3 cache
- Dies are fully connected with HT3
- Snoop Filter Feature Allows 4 Die SMP to scale well

Two Magny Cours XE6 Nodes

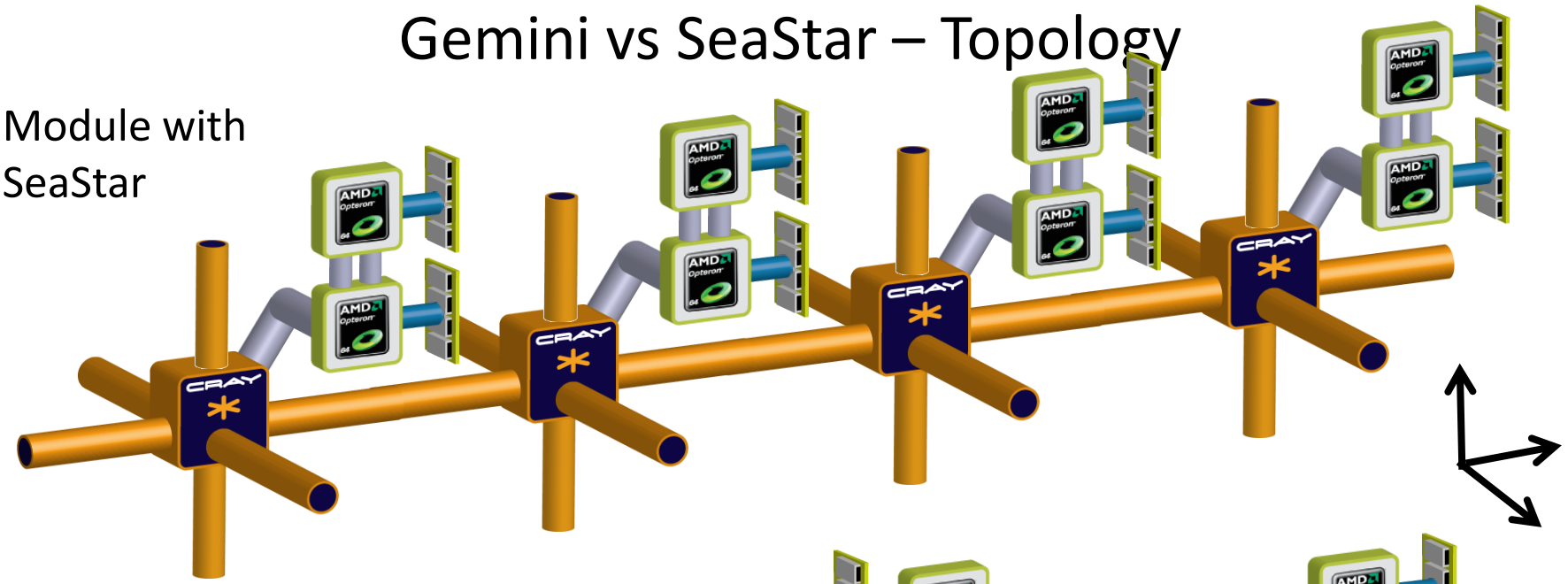
(Gemini Interconnect)

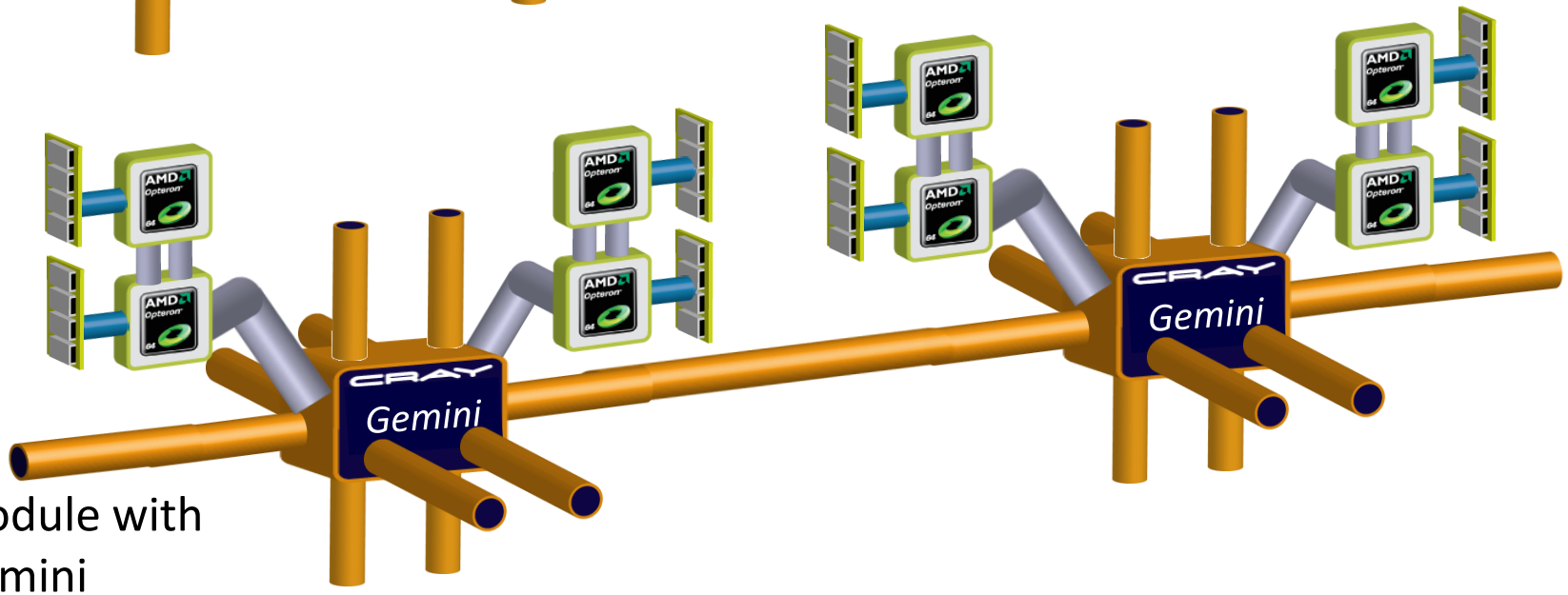


Cray Baker Node Characteristics	
Number of Cores	16 or 24
Peak Performance	140 or 210 Gflops/s
Memory Size	32 or 64 GB per node
Memory Bandwidth	85 GB/sec

Gemini vs SeaStar – Topology

Module with SeaStar

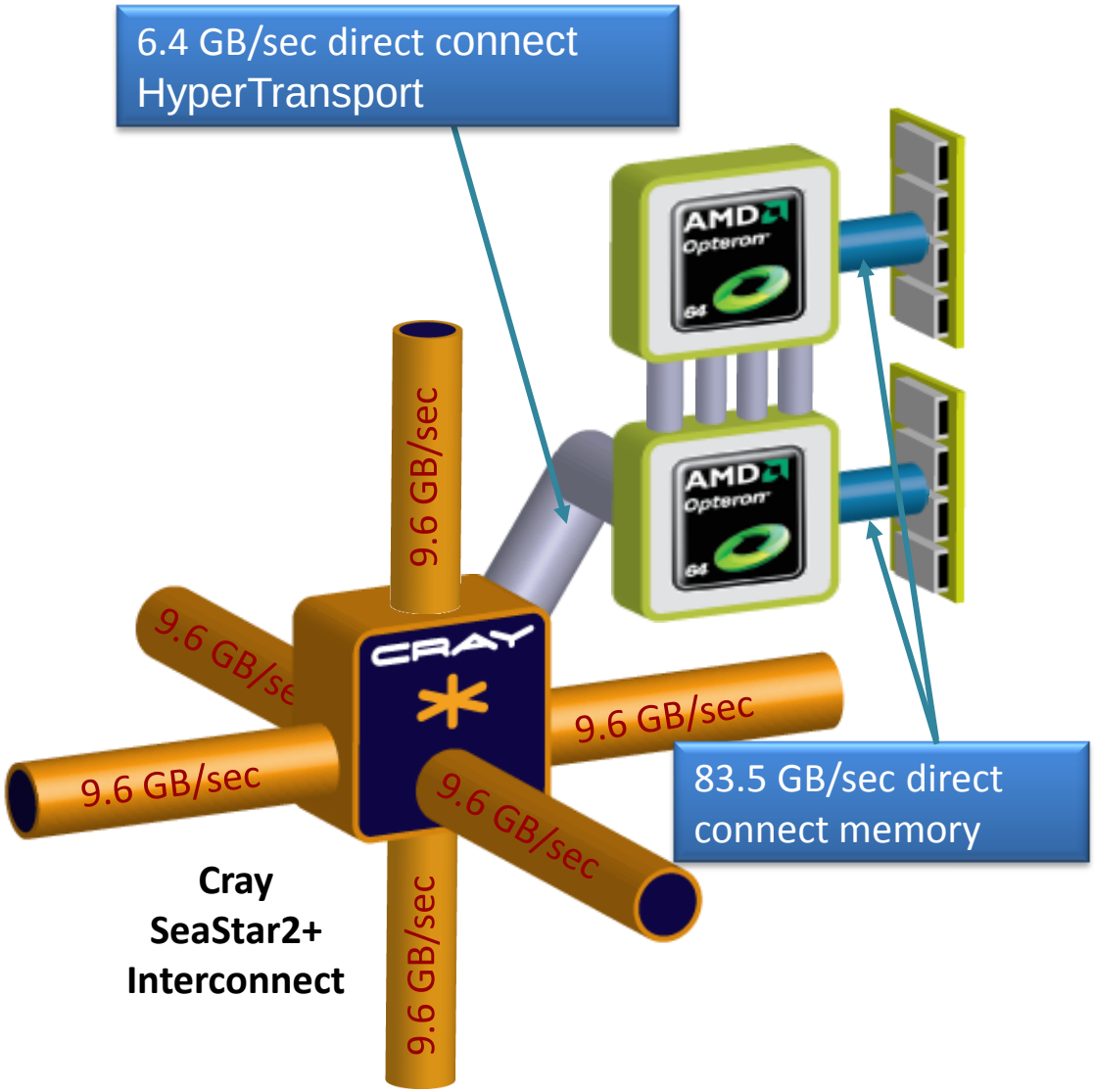




Module with Gemini

Cray XT6 (Or XT6m) Node

Characteristics	
Number of Cores	16 or 24 (MC) 32 (IL)
Peak Performance MC-8 (2.4)	153 Gflops/sec
Peak Performance MC-12 (2.2)	211 Gflops/sec
Memory Size	32 or 64 GB per node
Memory Bandwidth	83.5 GB/sec



CRAY SYSTEM SOFTWARE

Cray Linux Enviroment (CLE)

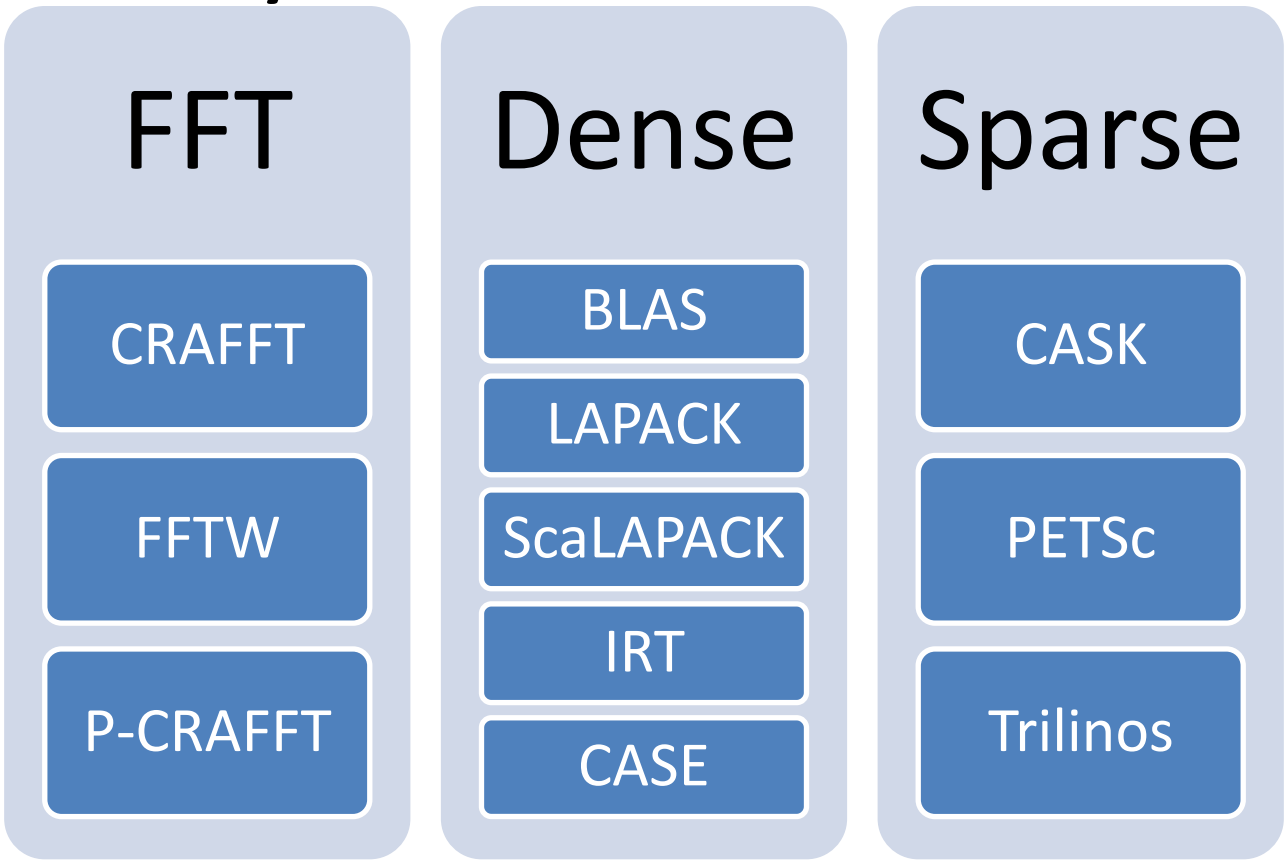
- Login nodes are a full Linux environment plus additional Cray support packages
- Extreme Scalability Mode
  - Linux-based microkernel on compute nodes
  - Minimal compute-node interrupts for very high scaling
- Cluster Compatibility Mode
  - Restores services removed in ESM for supporting a wider range of applications
  - Mainly aimed at ISV applications

CRAY PROGRAMMING ENVIRONMENT

Cray PE Features

- Compilers
  - Cray Compiler Environment, Portland Group, GNU, Pathscale, Intel
- Communication
  - Cray-tuned MPICH2
  - Co-array Fortran, UPC, Shmem, Global Arrays
    - Performance Tuned for Gemini on XE6
    - Functional on SeaStar (XT) Machines
- Performance Analysis/Tuning
  - CrayPAT, Cray Apprentice^2
- Scientific Libraries

Cray Scientific Libraries



IRT – Iterative Refinement Toolkit
CASK – Cray Adaptive Sparse Kernels
CRAFFT – Cray Adaptive FFT
CASE – Cray Adaptive Simple Eigensolver

Packages within LibSci

- BLAS
- LAPACK
- SCALAPACK
- BLACS
- PBLAS
- ACML
- FFTW 2&3
- PETSC
- TRILINOS
- IRT*
- MUMPS
- ParMetis
- SuperLU
- SuperLU_dist
- Hypre
- Scotch
- Sundials
- CASK*
- CRAFFT*
- CASE*