Berkeley NOW Project

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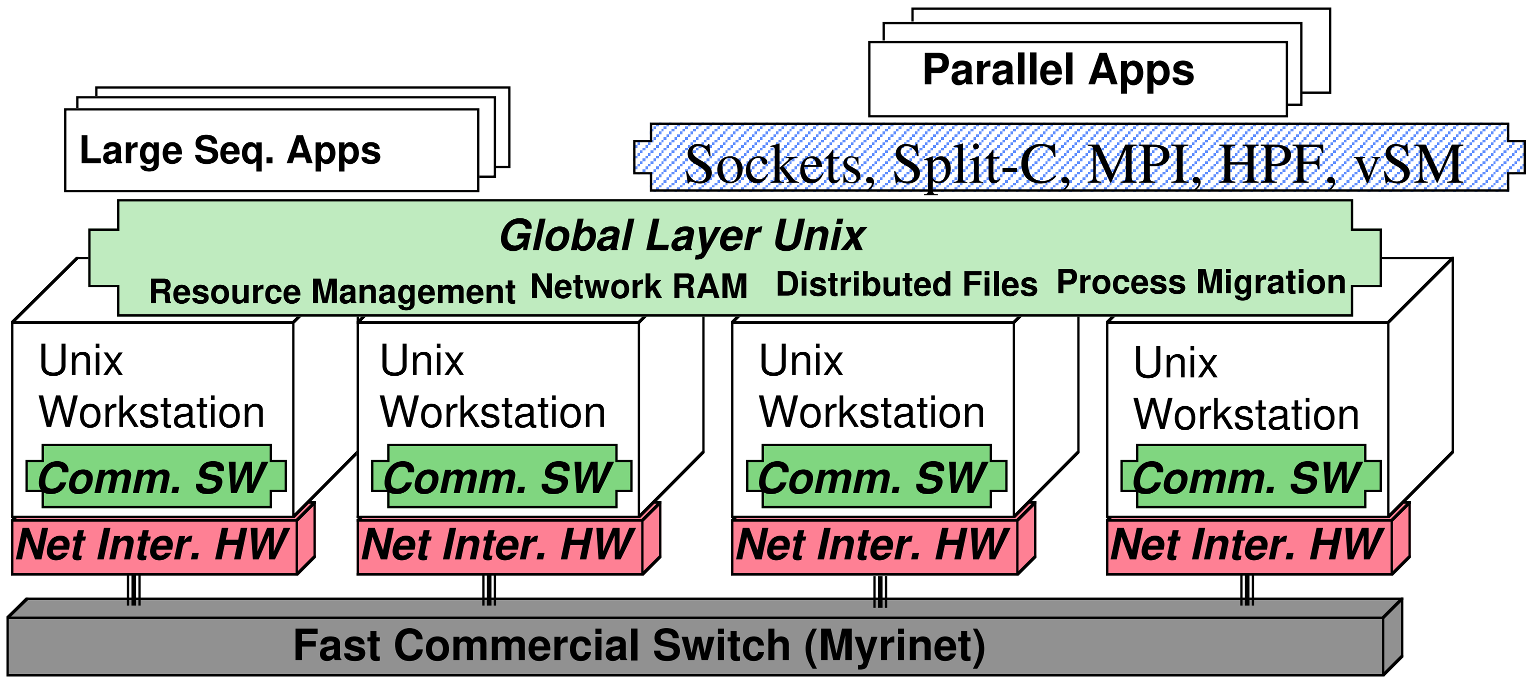
Goals of the Research

- Fundamental change in how we design large-scale computing systems
  - snap together commodity components
  - self-managing, self-tuning, highly available
- Make the “killer network” real
  - realize the potential of emerging hardware technology
  - and push its effect through the rest of the system
- Integrated system on a building-wide scale
  - pool of resources (proc, disk mem)
  - remote processor and memory closer than local disk
  - federation of systems with local and global role
- The right way to build internet services

NOW System Architecture

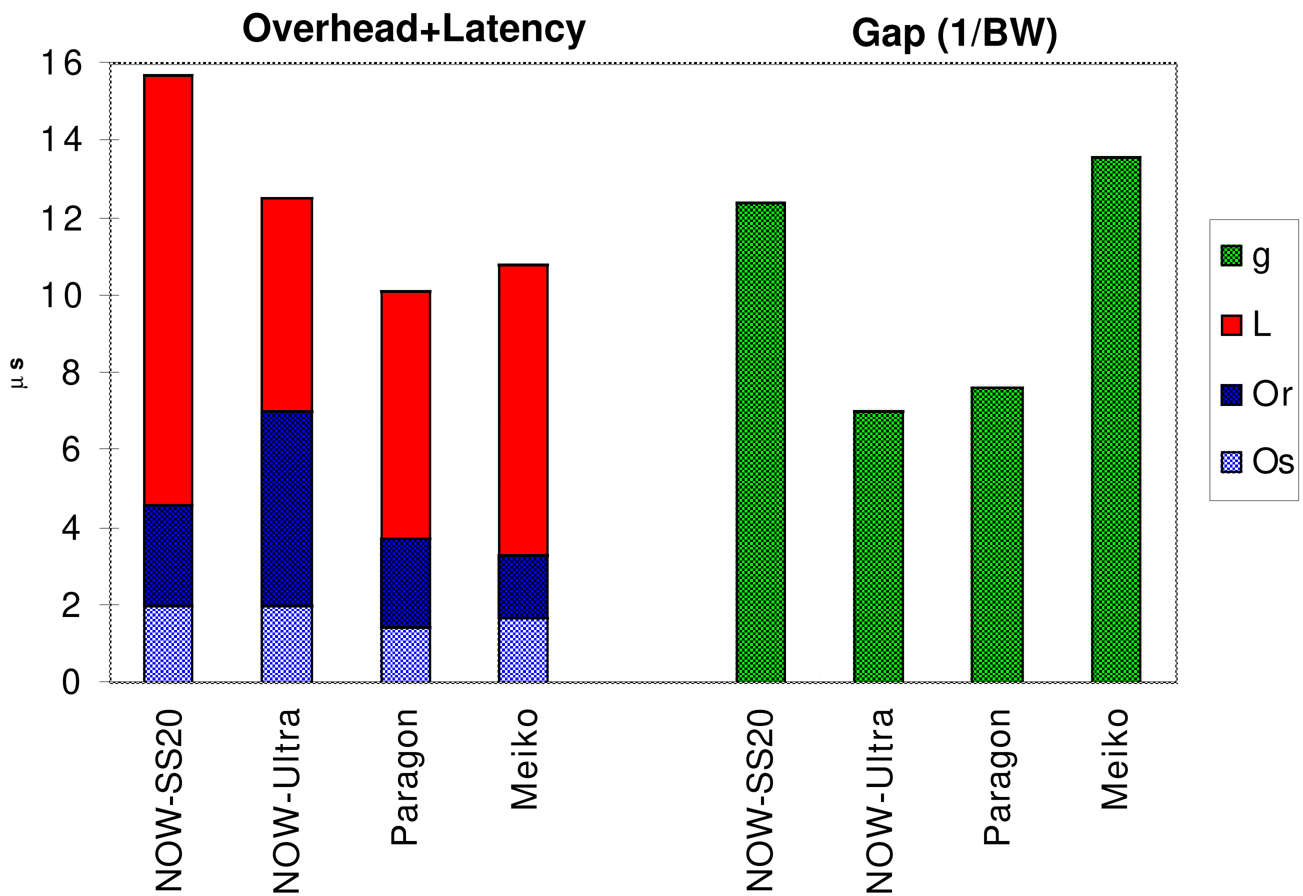


Status

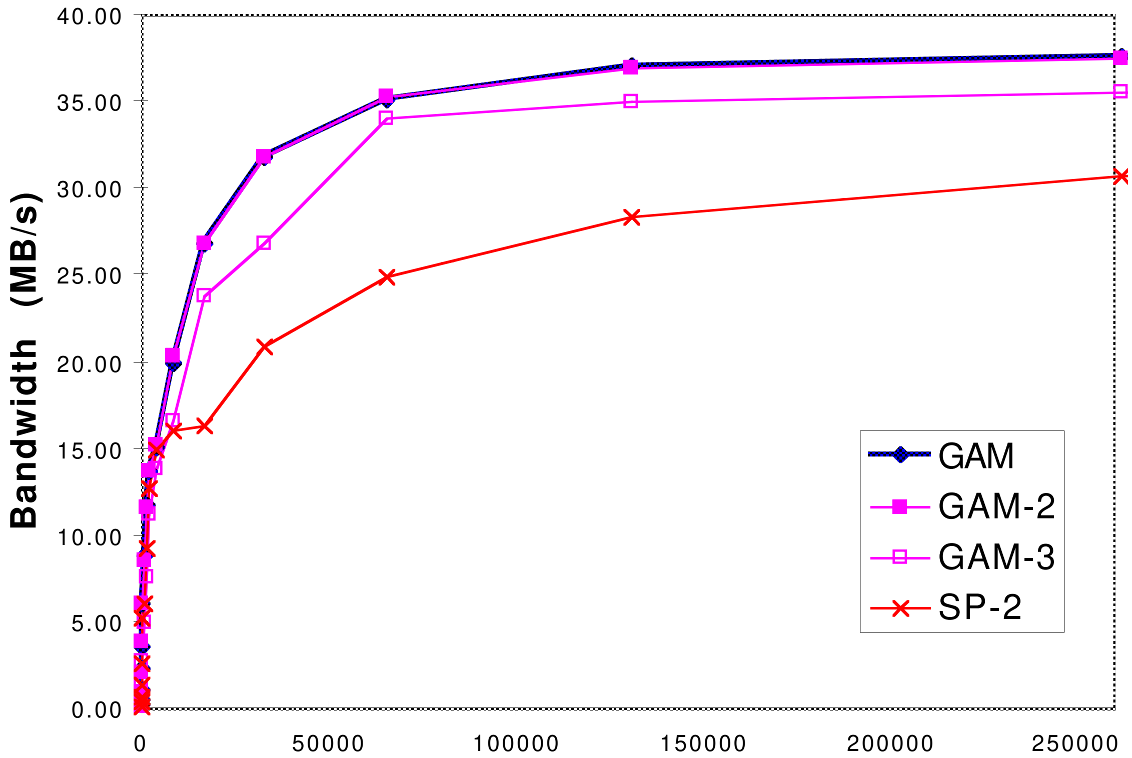
- Large cluster operational
  - 100 nodes under glunix before Supercomputing96
- Generic Active Messages Released
- Evaluation against range of uses
- xFS scalability demonstrated
- network virtual memory demonstrated
- AM 2 with virtual networks operational
- Technology Transfer to inktomi (HotBot)
- World Record disk-to-disk sort
- Supporting scientific applications
- Growing into the web

Recent Highlights

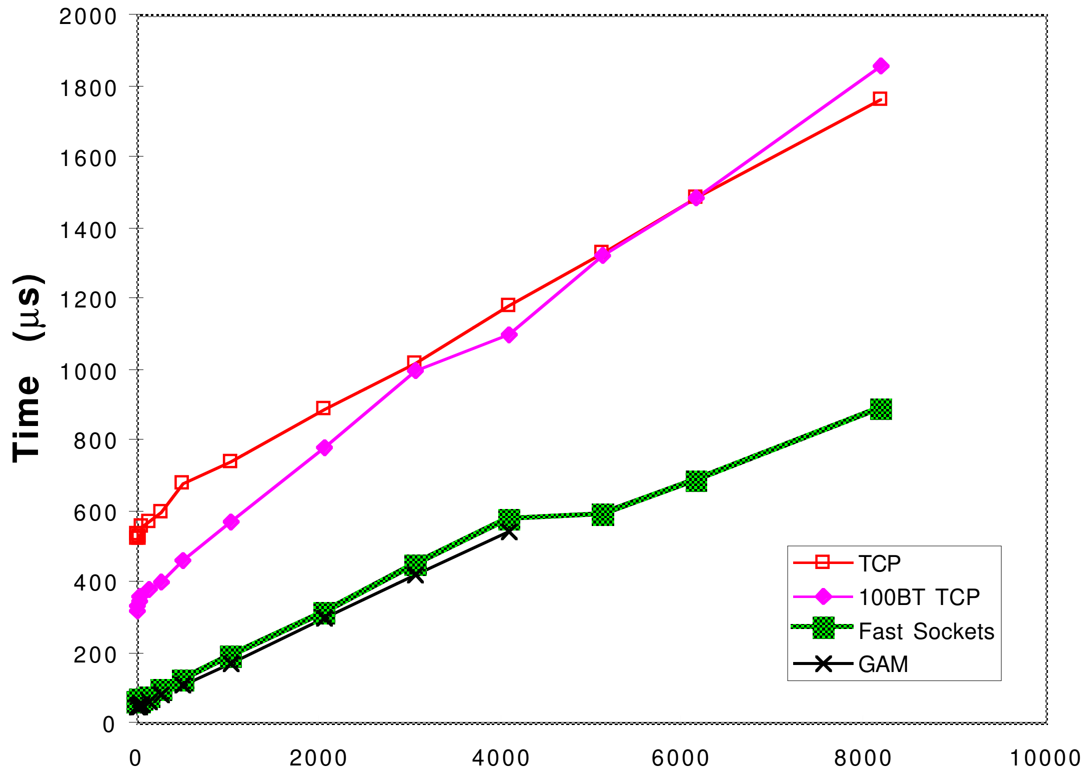
AM: Fast, Portable Communication



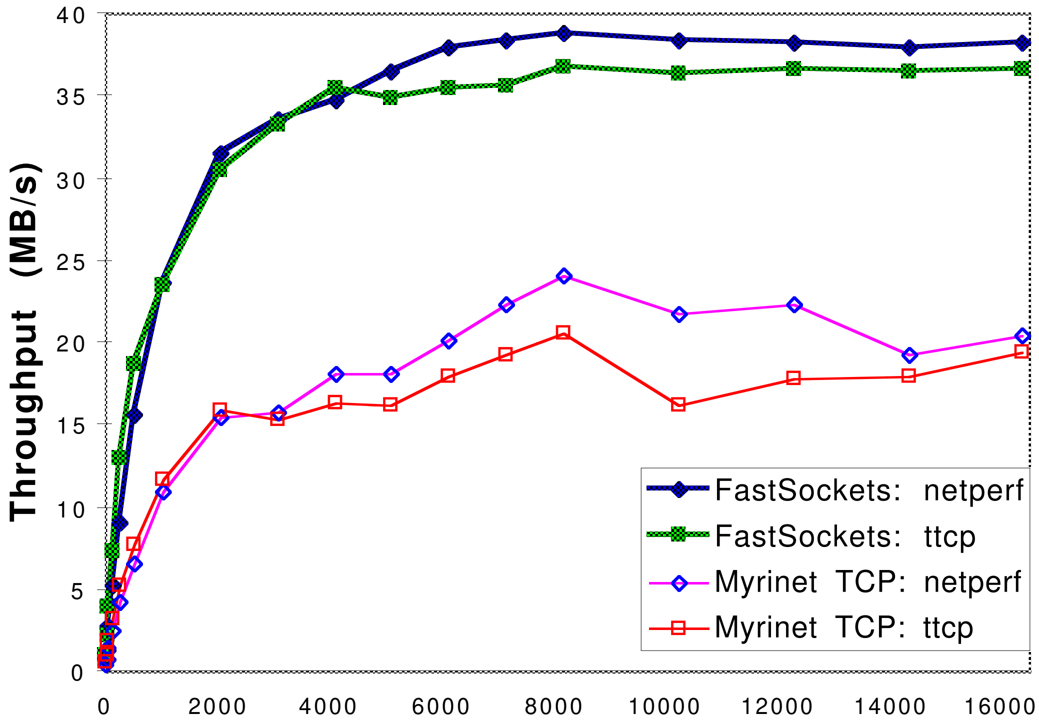
MPI on Active Messages



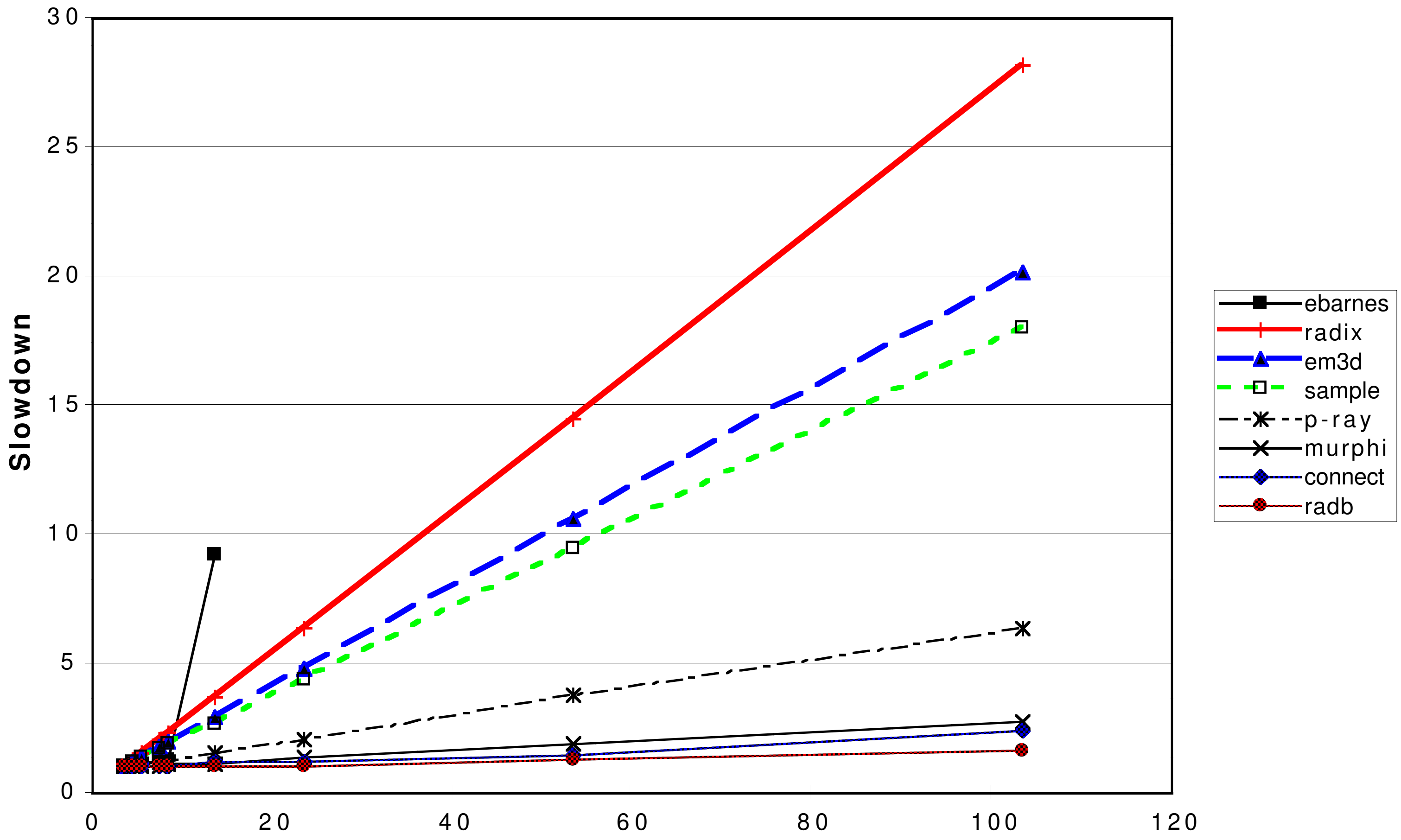
Sockets over AM: Latency



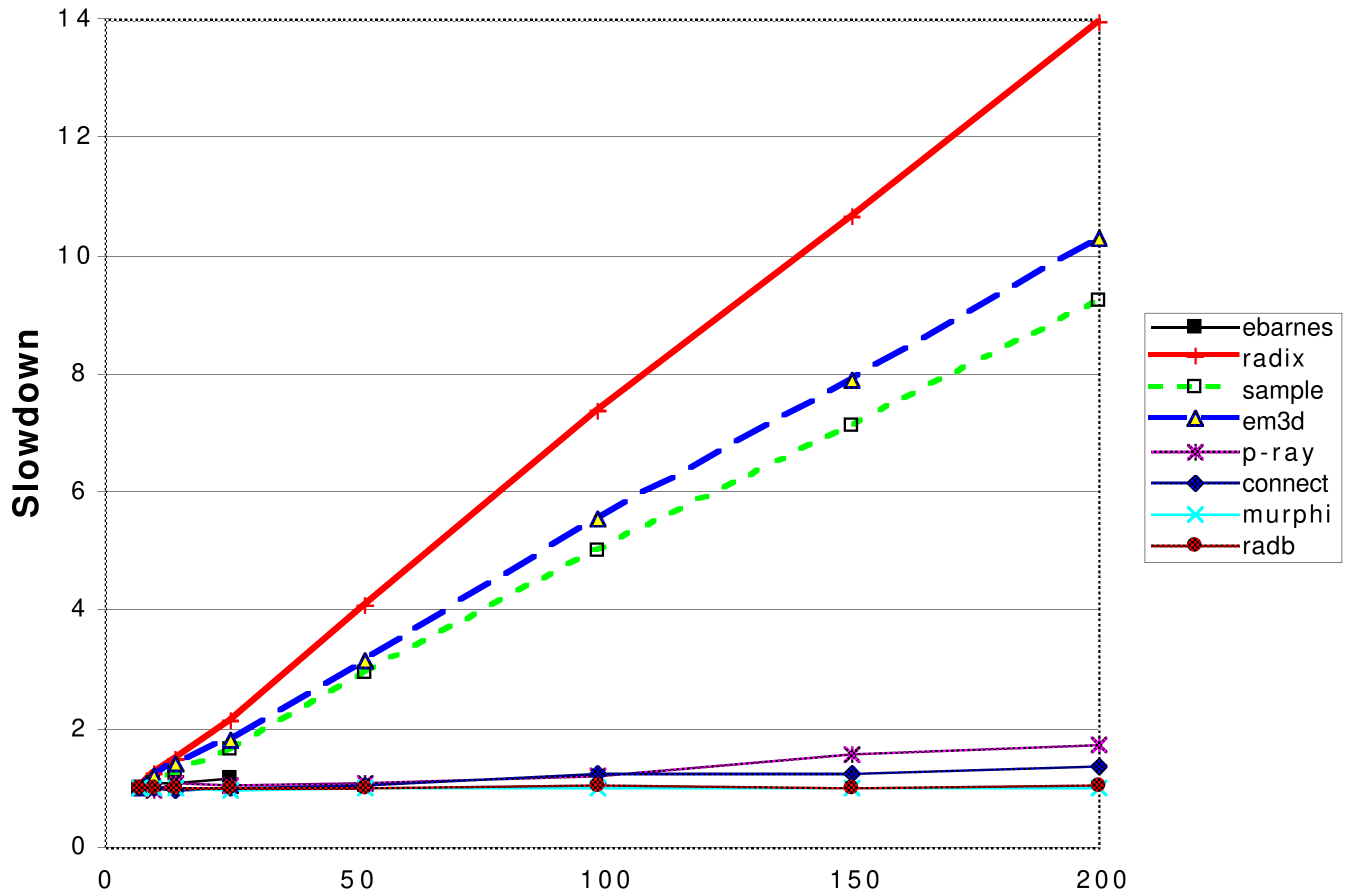
netperf, ttcp bandwidth



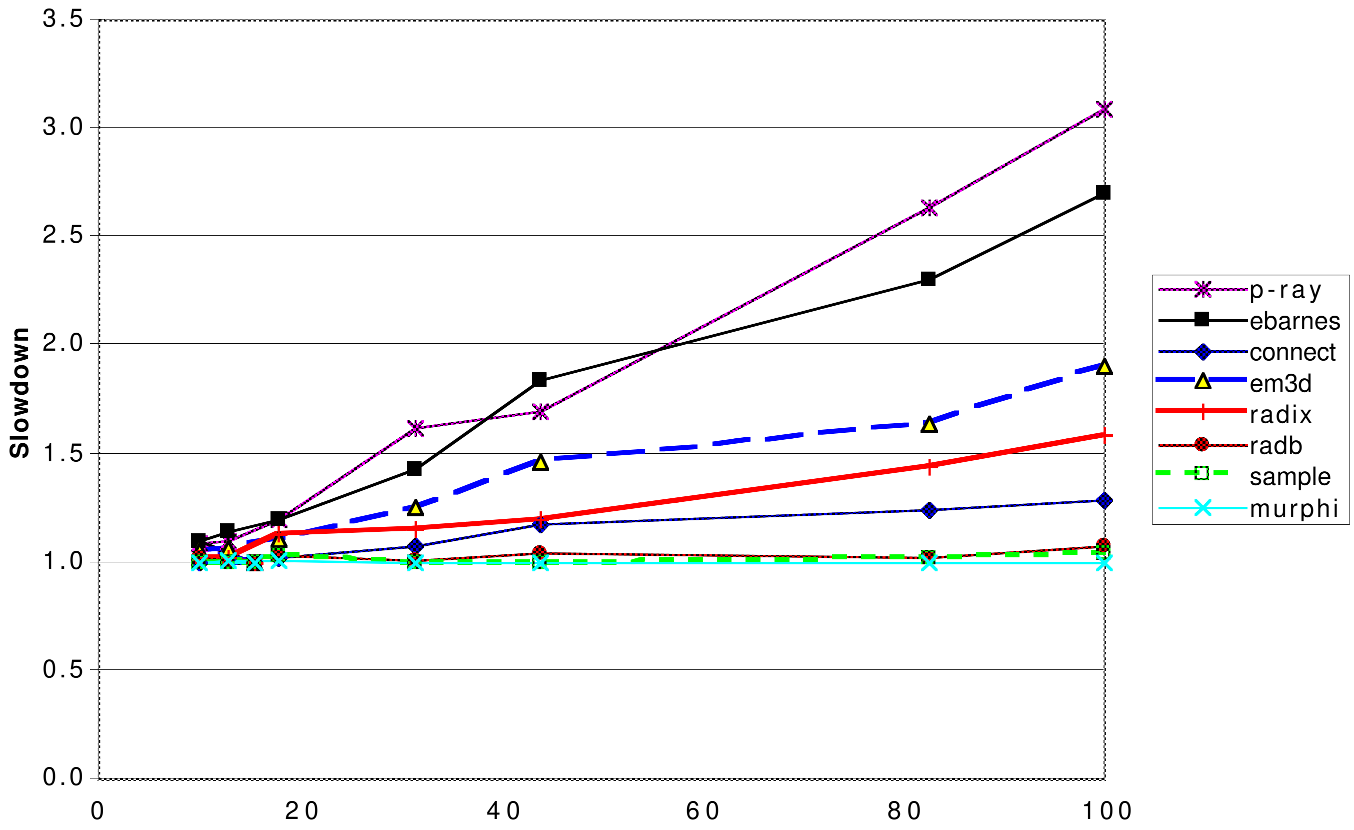
Application Sensitivity to Overhead



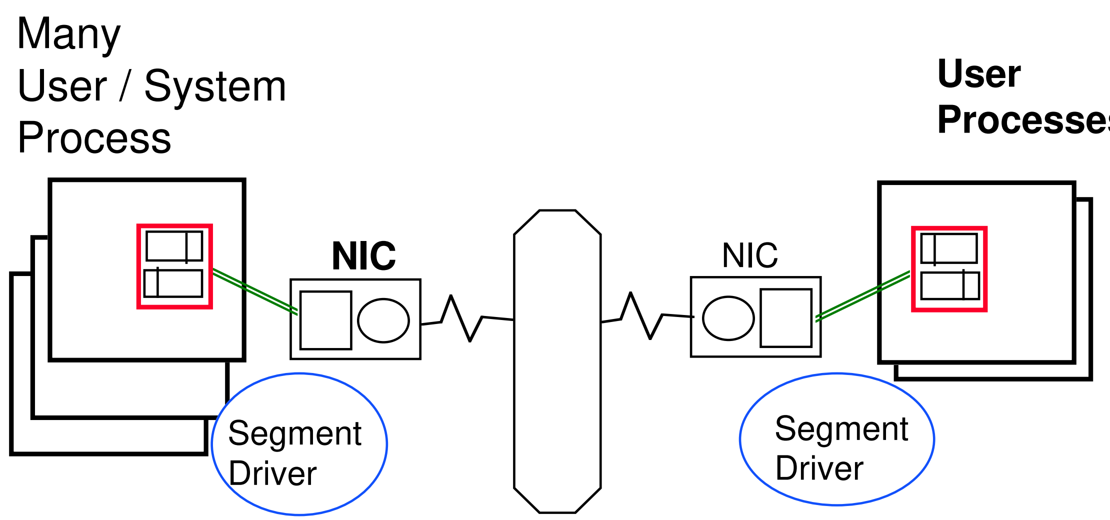
Sensitivity to gap (1/msg rate)



Sensitivity to Latency

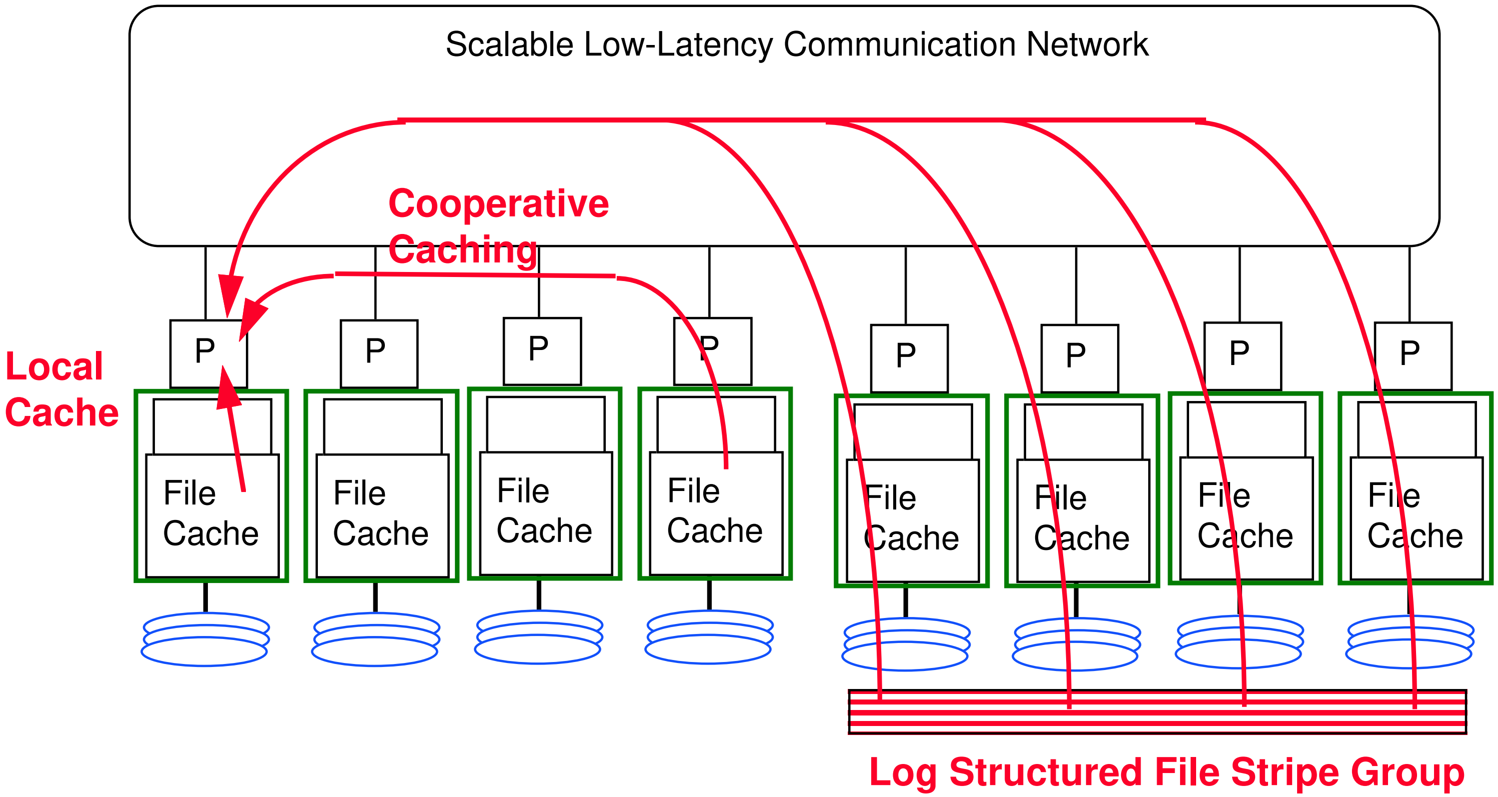


General Purpose, fault-tolerant "Virtual Networks"



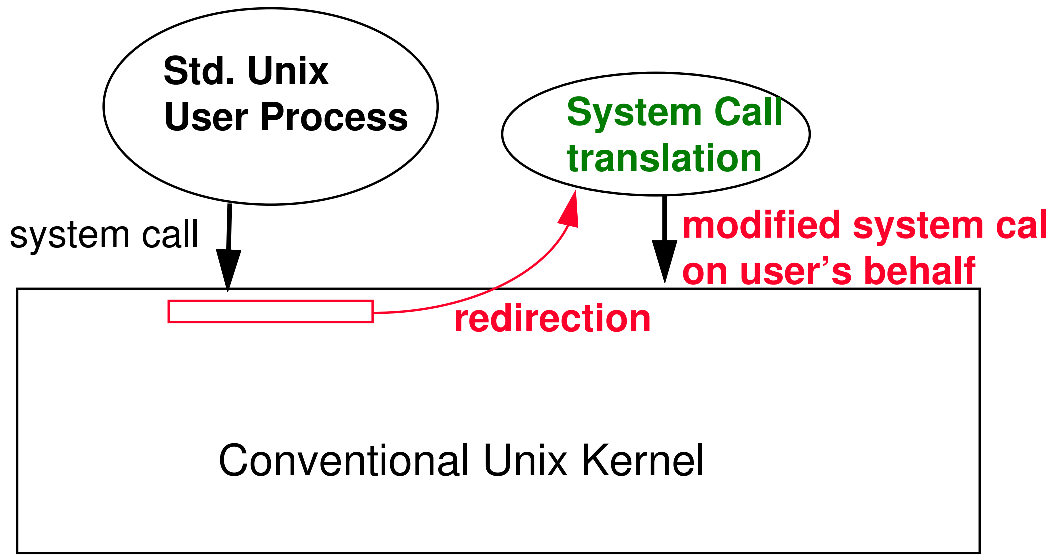
- **Dynamic binding of multiple "virtual" network end-points directly to physical NIC resources**
- **Deep integration with VM and threads**
- **Smart NIC mux-demux, errors, and flow-control**

Truely Distibuted File System – XFS



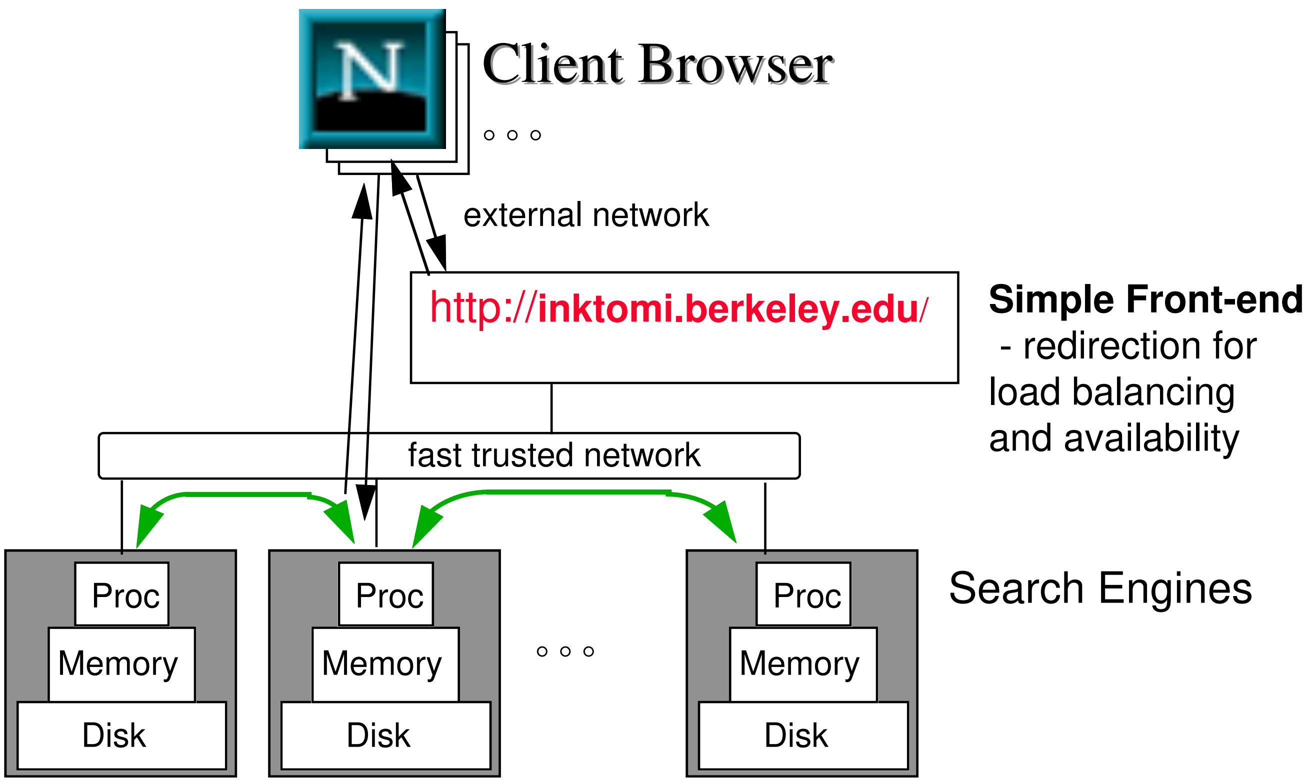
G = Node Comm BW / Disk BW

Virtualization of O.S. Services



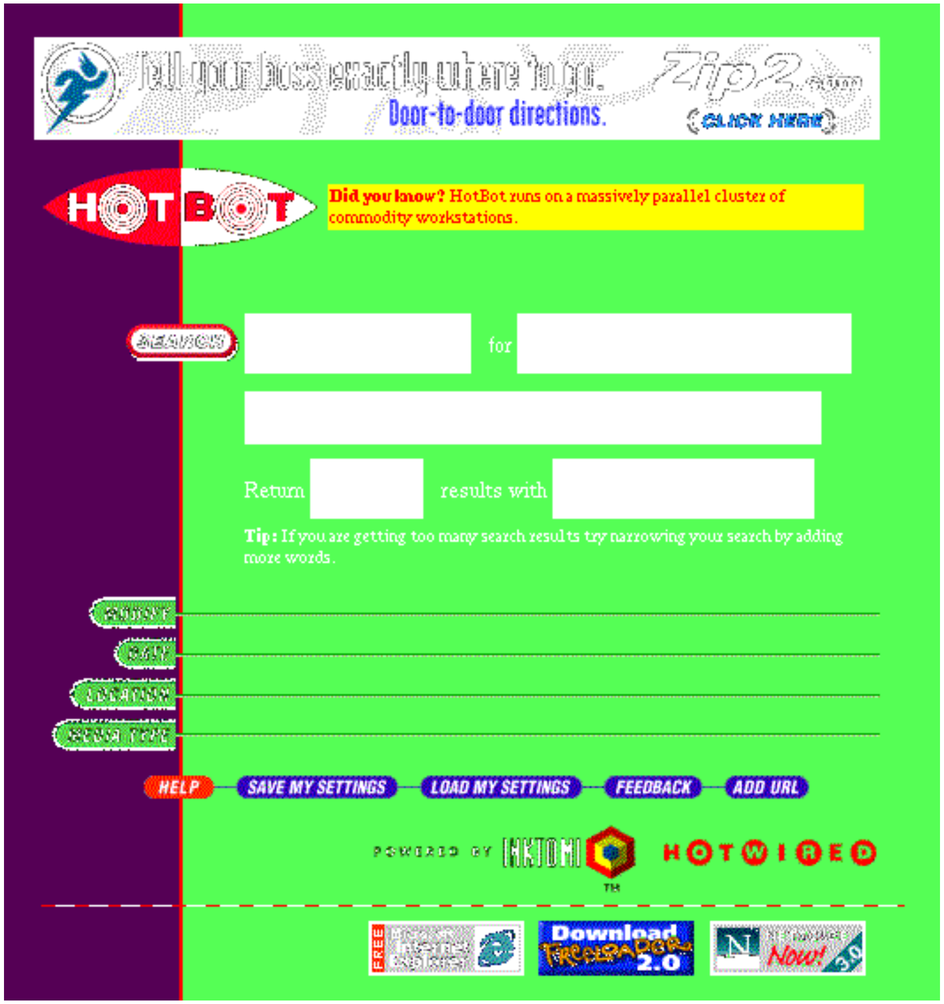
- **Small kernel insertion provides redirection to user-level translation facilty**
- **Translation provide global-local mapping of system functions for std. binaries**

Scalable, Available WEB Services



- **Fastest large web index & crawler**
  - **production service in oct. -> commercial in may**
- **Also commerical, scientific, and social appl'ns**

Scalable Internet Services



World-Record Disk-to-Disk Sort