Cplant Applications and Experiences

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Outline

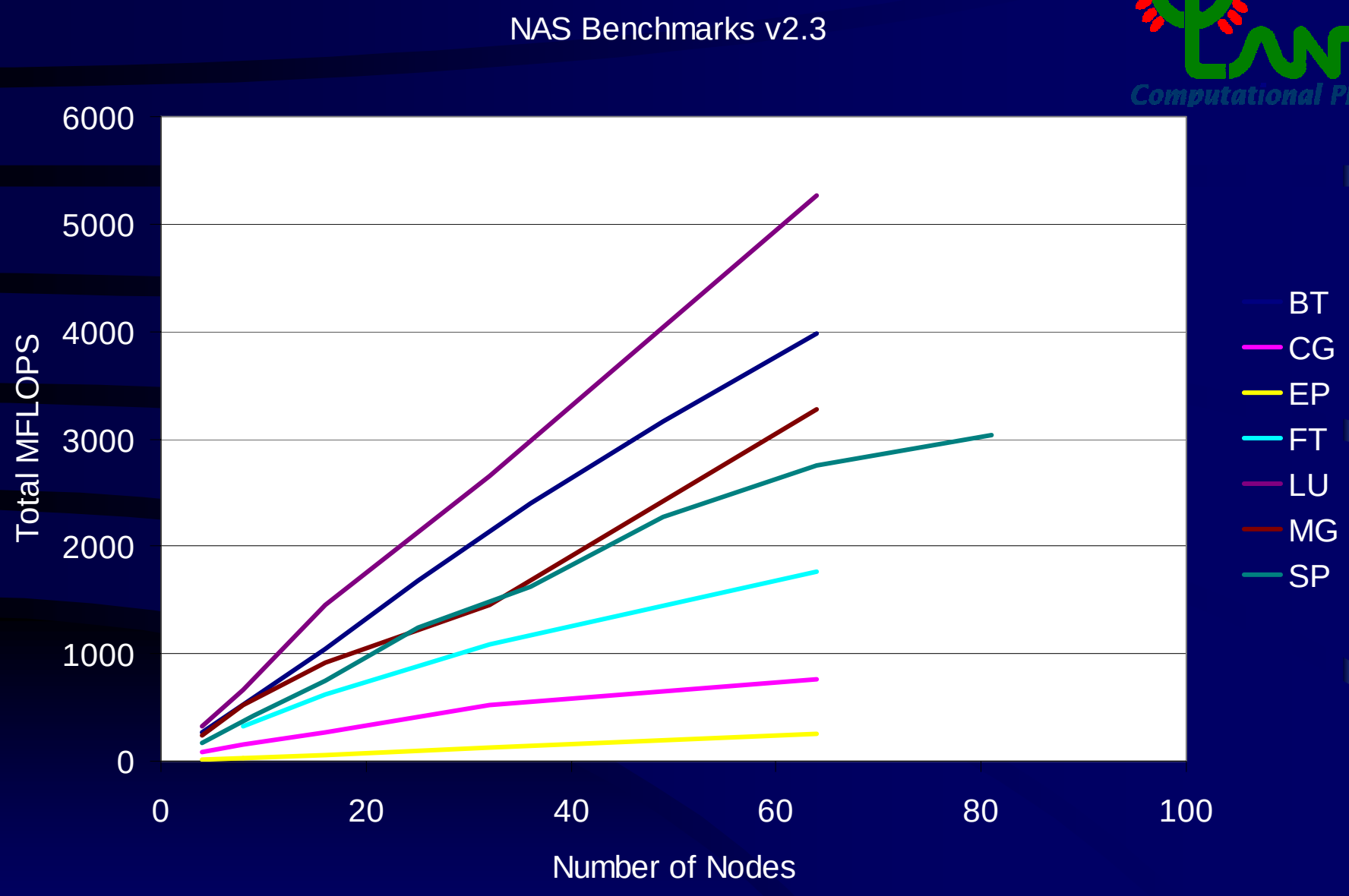
- Compile Environment
- Application Launcher
- NAS Benchmark performance
- MPLinpack performance
- Applications

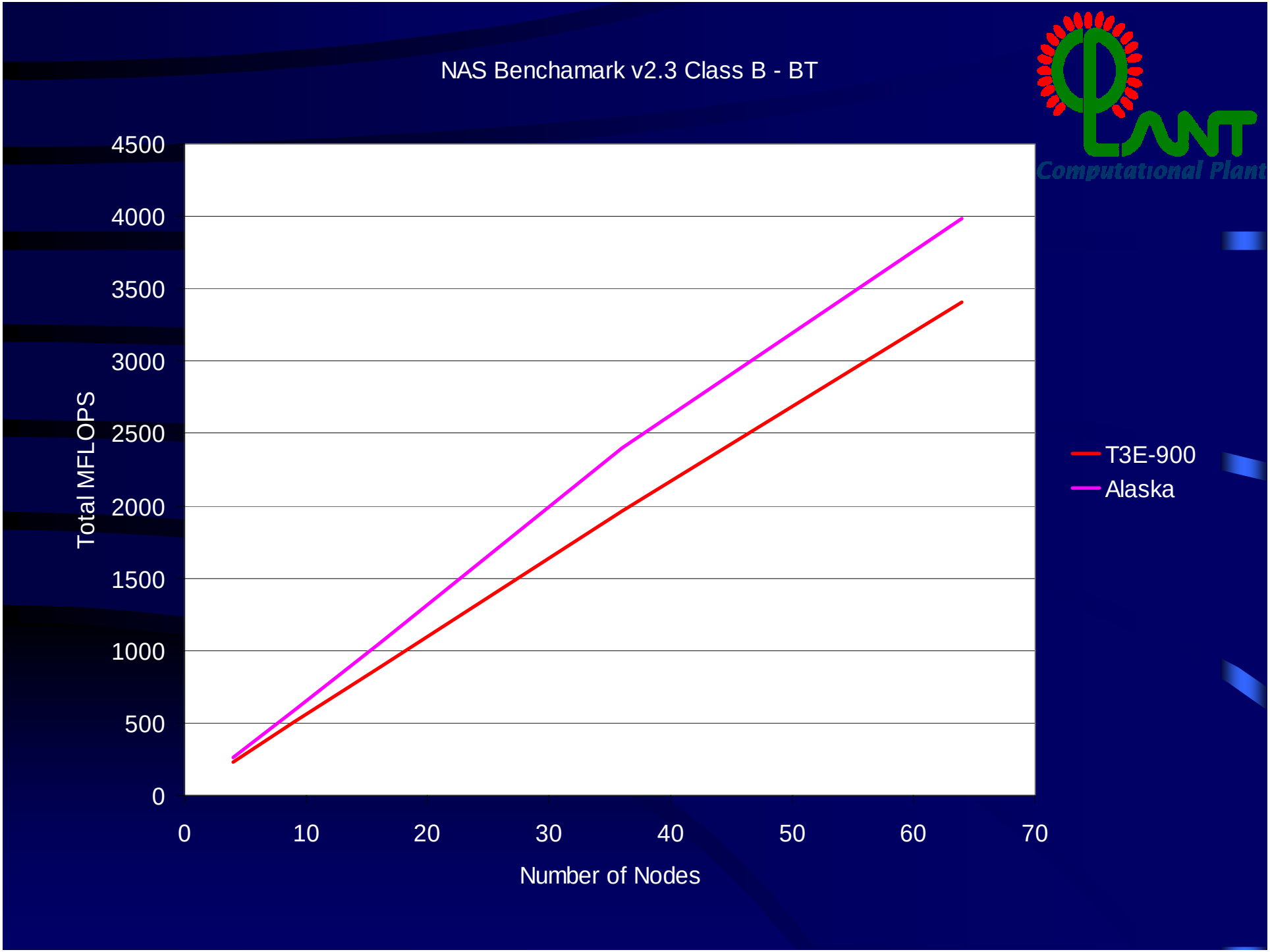
Compile Environment

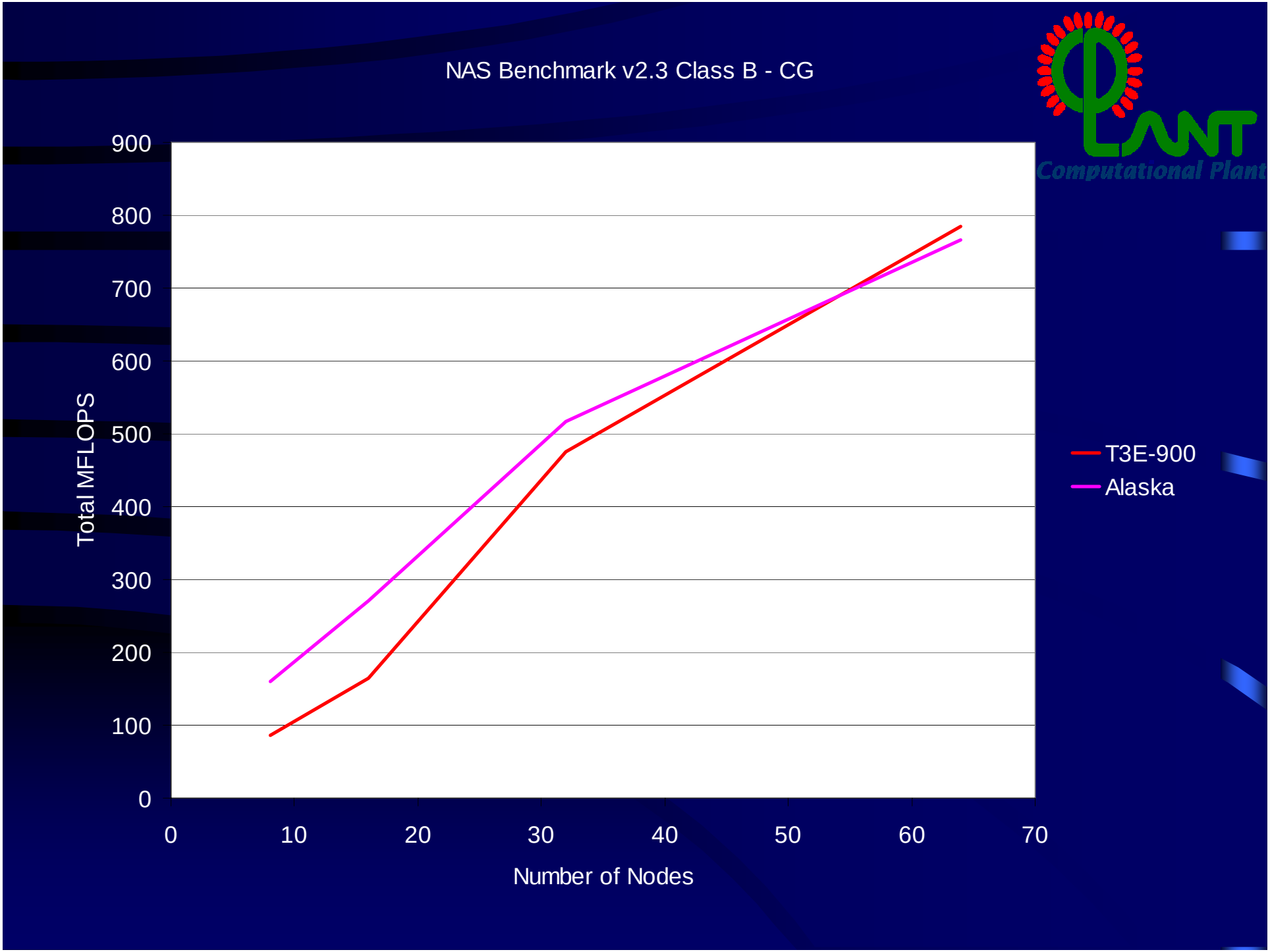
- use shell scripts that call Digital UNIX compilers
- support libraries - startup module, PUMA library, redirected I/O and C libraries, TFLOPS MPI library
- centrally located for any DU machine
- dedicated DU machine
- can be tar'd up and moved to any DU machine
- avoids Linux-specific configurations and immature GNU FORTRAN compiler

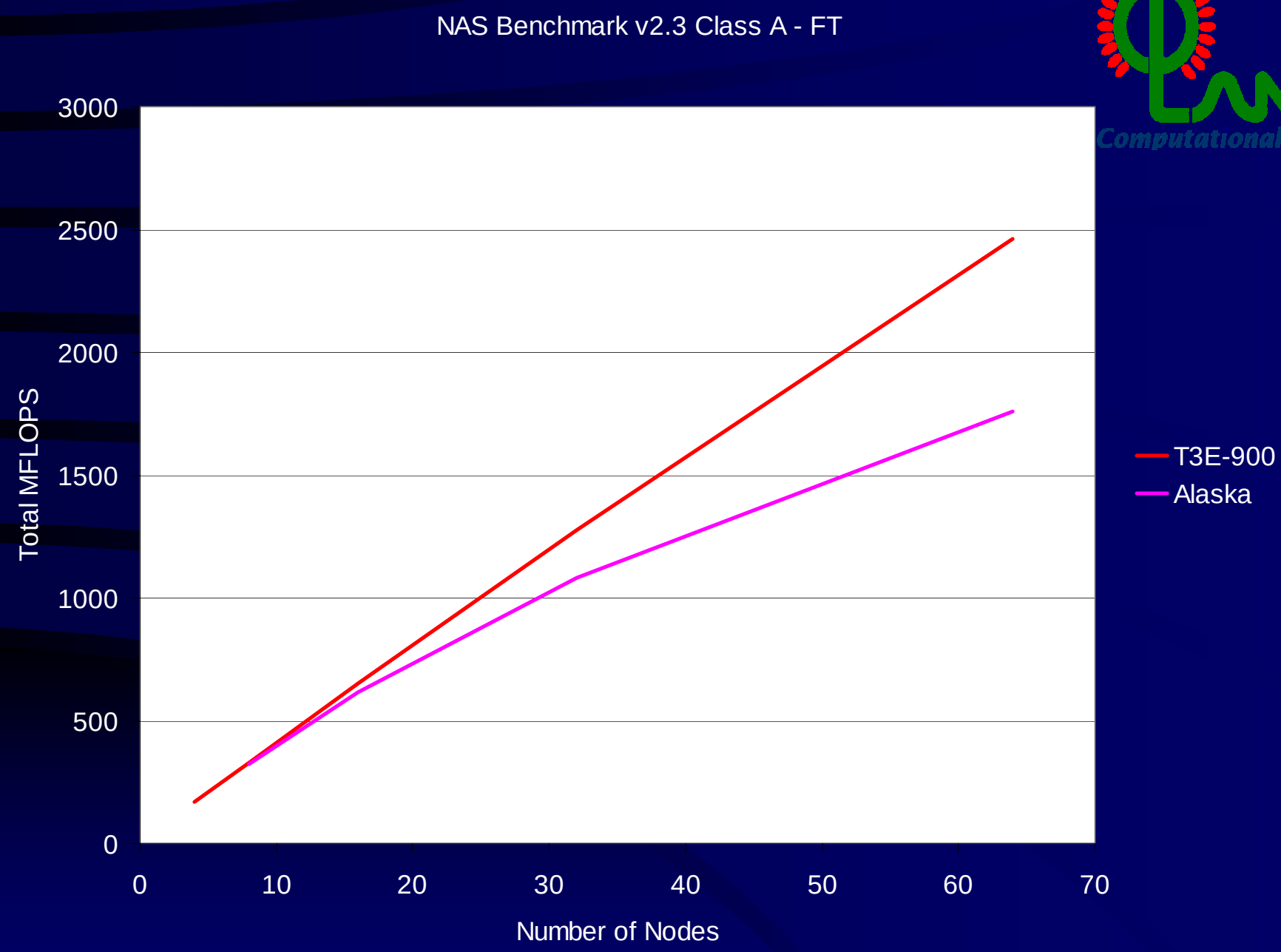
Application Launcher

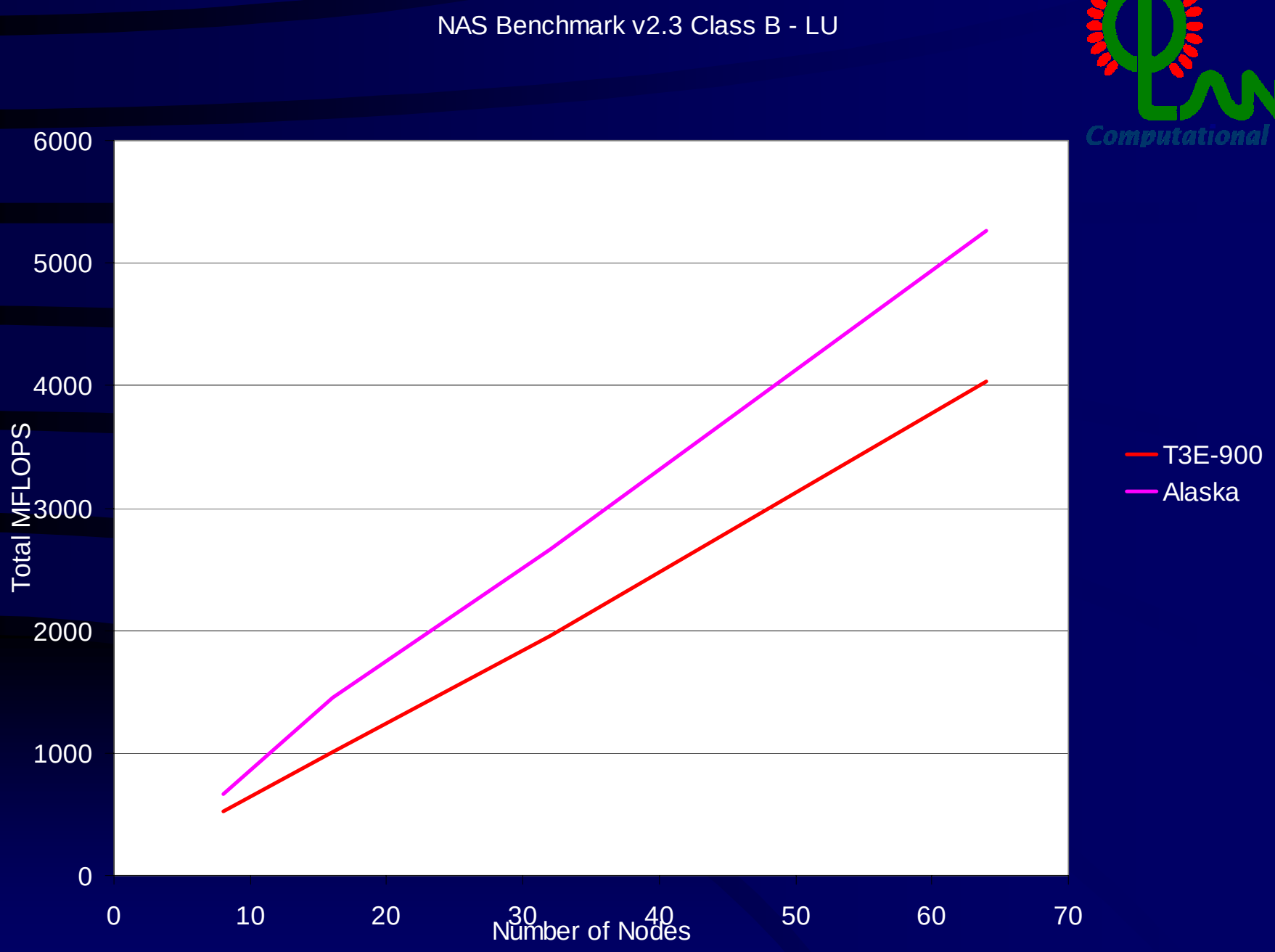
- Yod provides the following services:
  - contacts compute node allocator
  - launches the application into the compute partition
  - redirects all application I/O (stdio, file I/O)
  - makes any filesystem visible in the service partition visible to the application
  - redirects any UNIX signals to compute node processes
  - allows user to choose specific compute nodes
  - can launch multiple (up to 5) different binaries

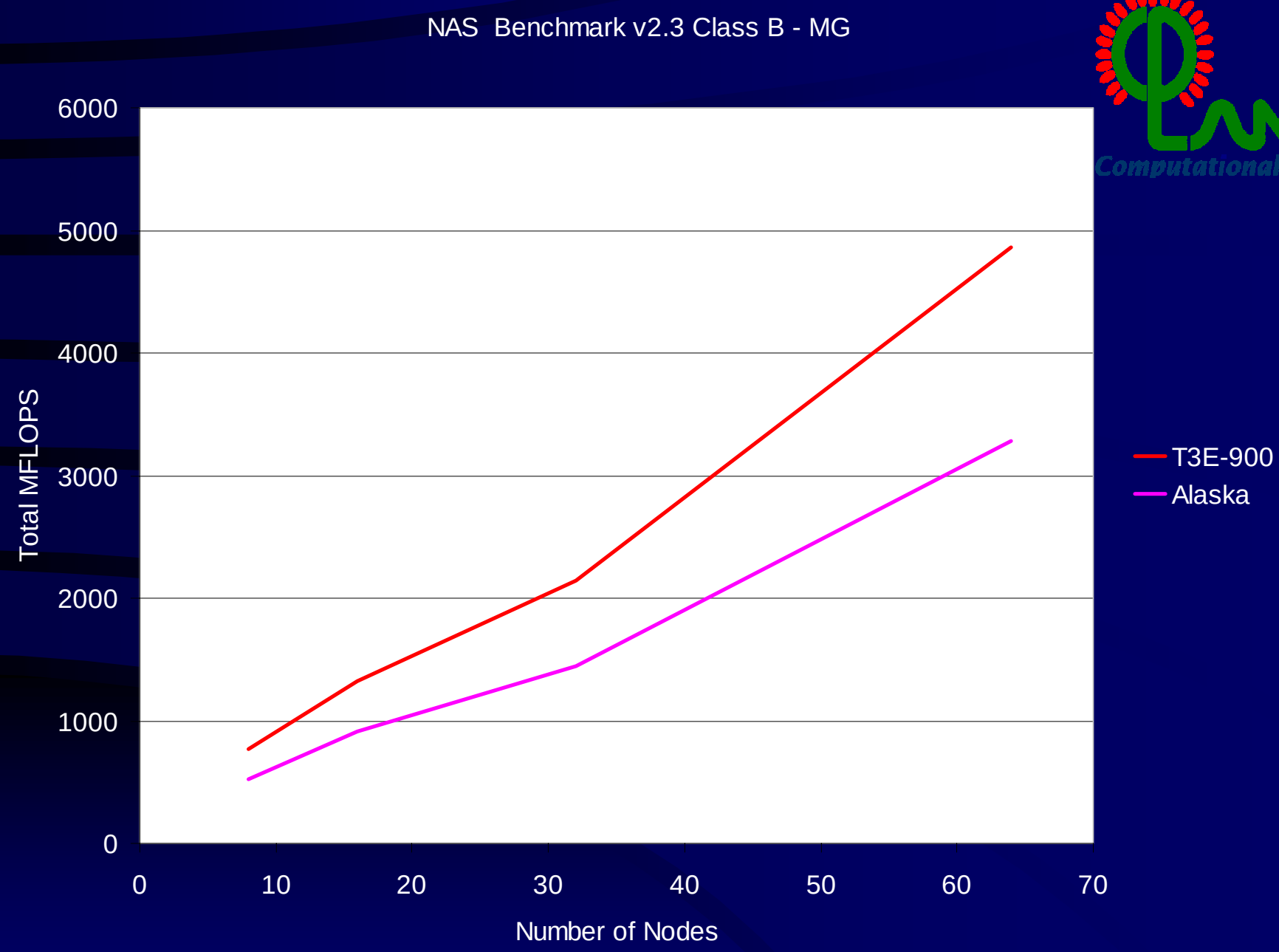

NAS Benchmarks v2.3
Total MFLOPS
6000
5000
4000
3000
2000
1000
0
0
20
40
60
80
100
Number of Nodes
BT
CG
EP
FT
LU
MG
SP

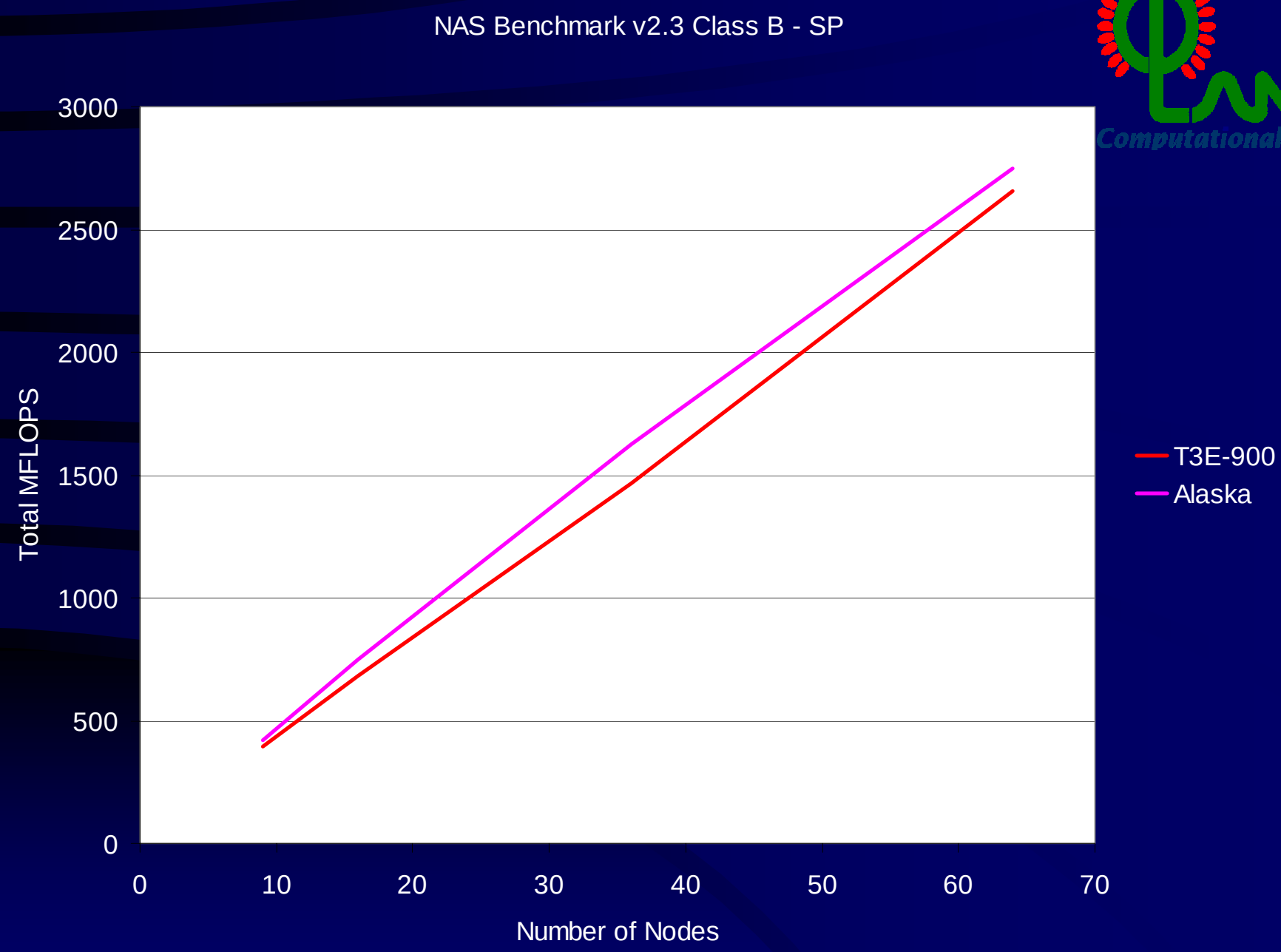

NAS Benchamark v2.3 Class B - BT
Total MFLOPS
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
Number of Nodes
T3E-900
Alaska
Computational Plant

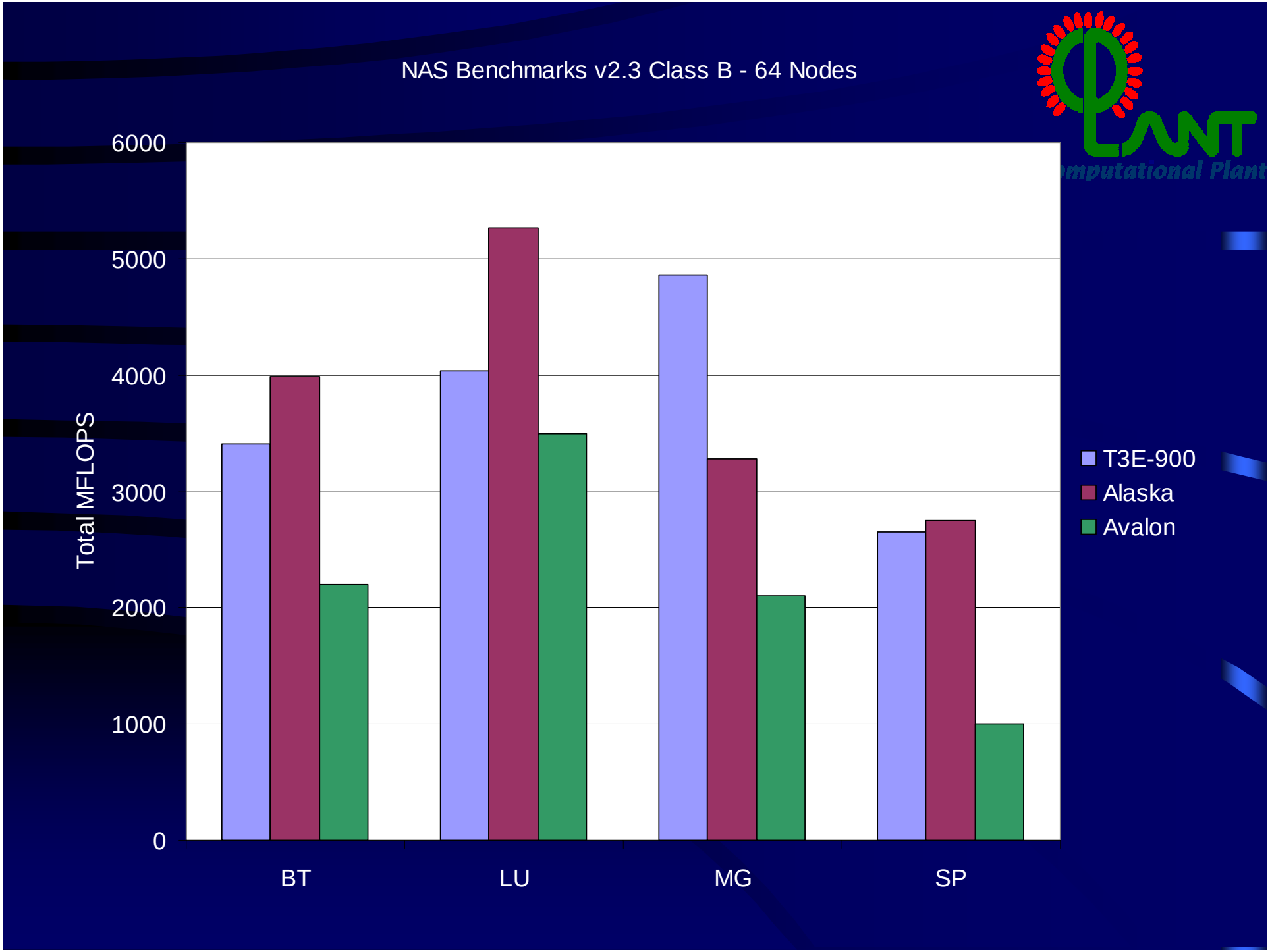

NAS Benchmark v2.3 Class B - CG
Total MFLOPS
900
800
700
600
500
400
300
200
100
0
0
10
20
30
40
50
60
70
Number of Nodes
T3E-900
Alaska
Computational Plant

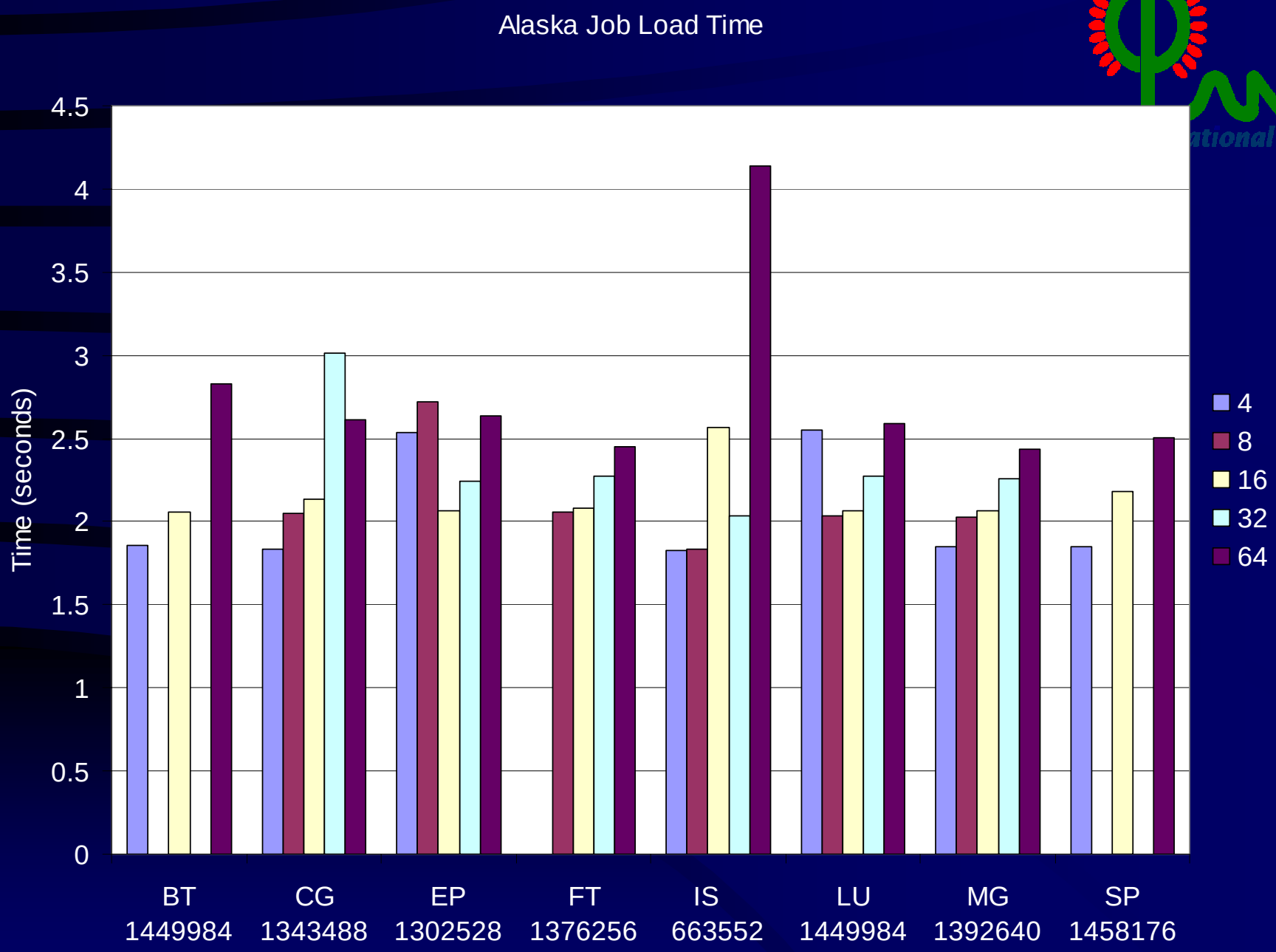

NAS Benchmark v2.3 Class A - FT
Total MFLOPS
3000
2500
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
Number of Nodes
T3E-900
Alaska


NAS Benchmark v2.3 Class B - LU
Total MFLOPS
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
Number of Nodes
T3E-900
Alaska

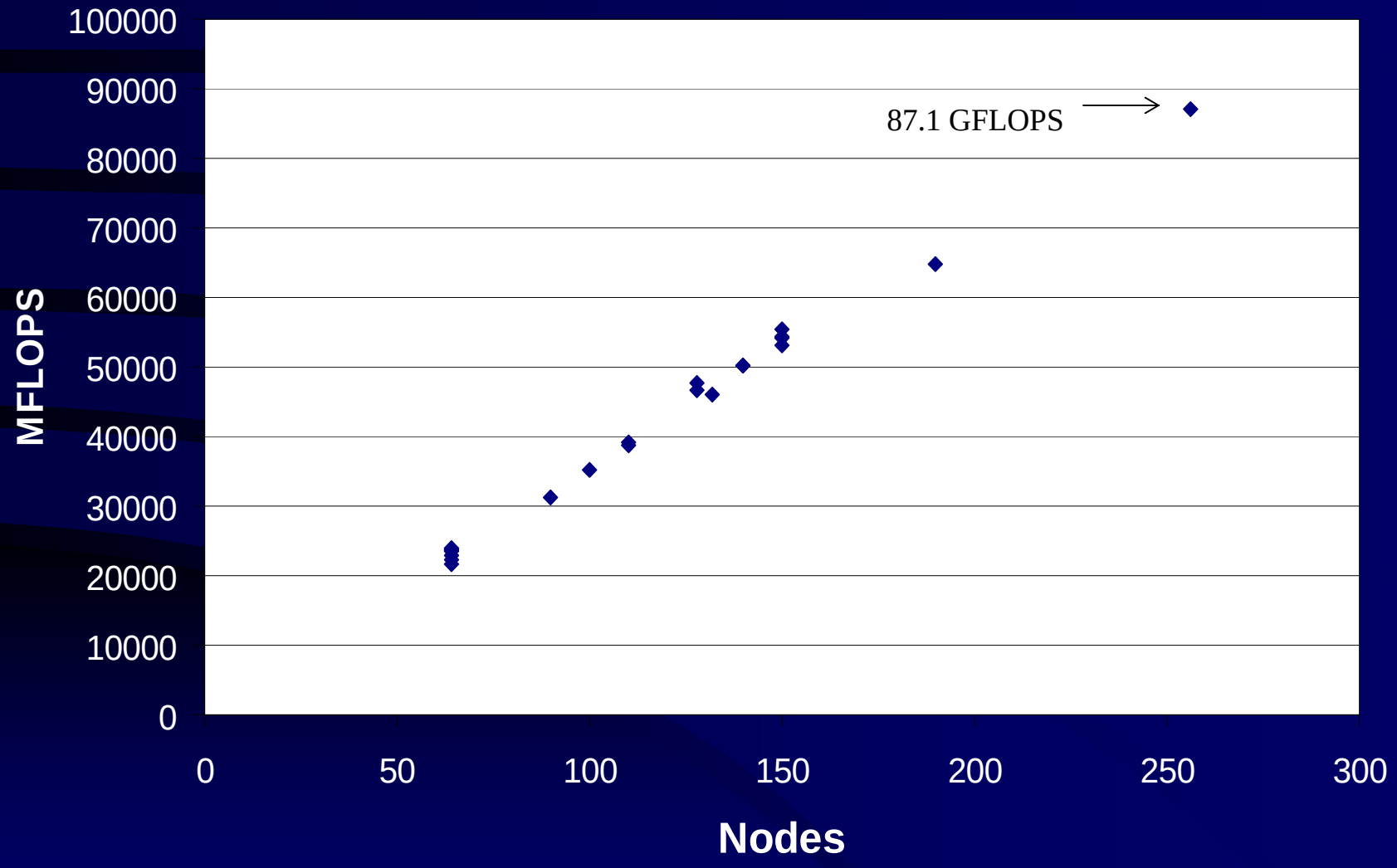

NAS Benchmark v2.3 Class B - MG
Total MFLOPS
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
Number of Nodes
T3E-900
Alaska


NAS Benchmark v2.3 Class B - SP
Total MFLOPS
3000
2500
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
Number of Nodes
T3E-900
Alaska


NAS Benchmarks v2.3 Class B - 64 Nodes
Total MFLOPS
6000
5000
4000
3000
2000
1000
0
BT
LU
MG
SP
T3E-900
Alaska
Avalon

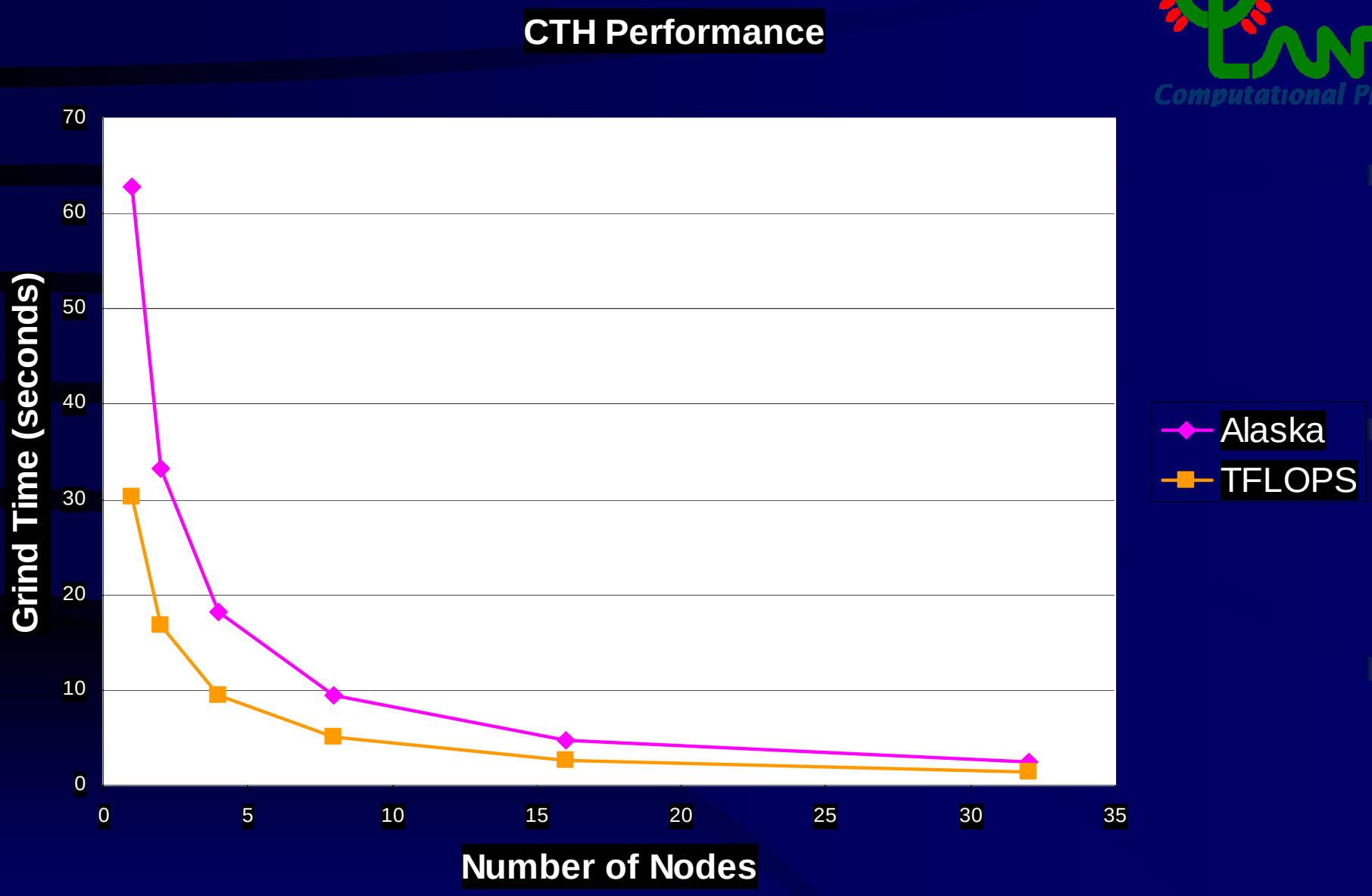

Alaska Job Load Time
Time (seconds)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
BT 1449984
CG 1343488
EP 1302528
FT 1376256
IS 663552
LU 1449984
MG 1392640
SP 1458176
4
8
16
32
64

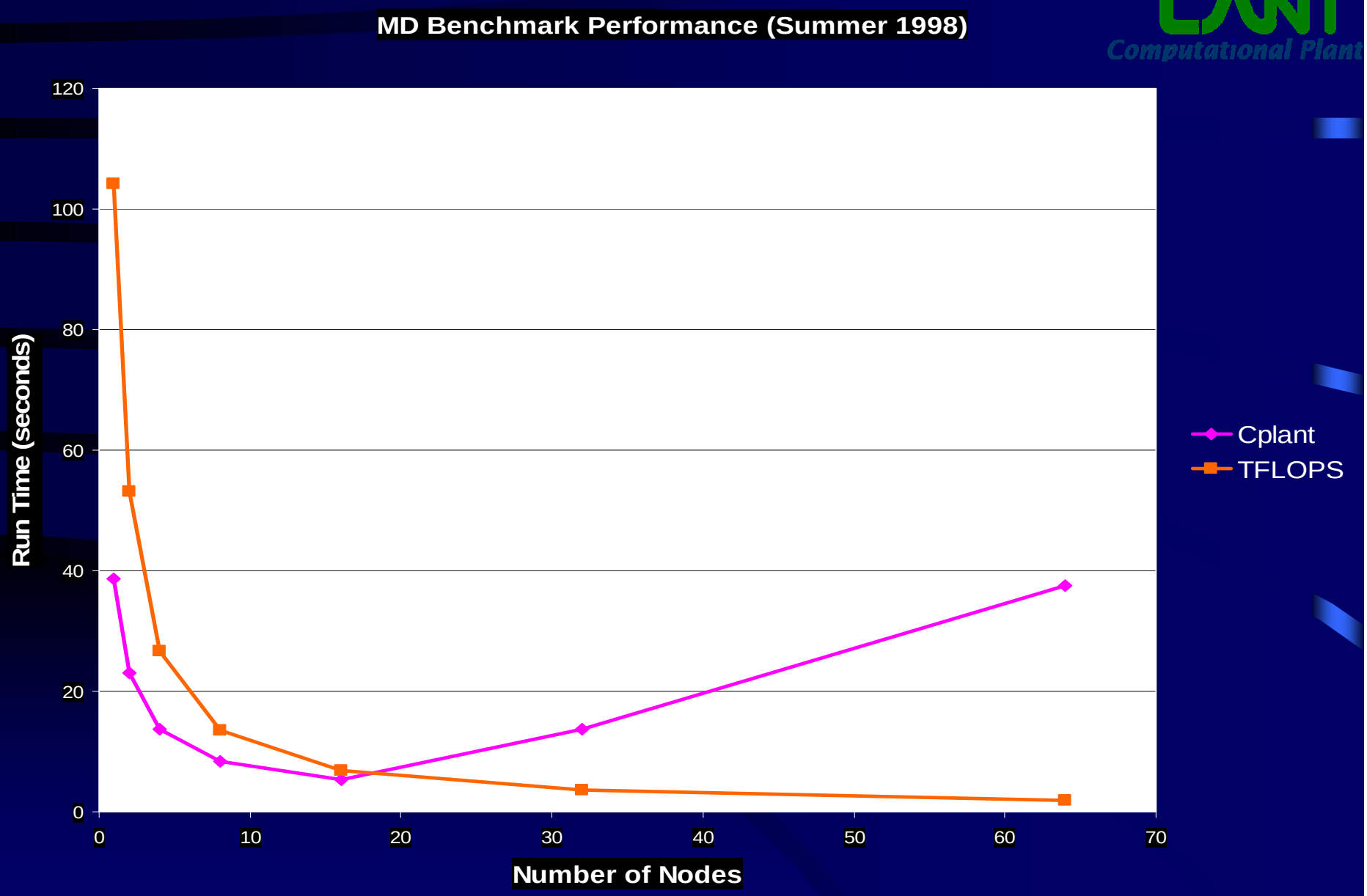
MPLinpack Results

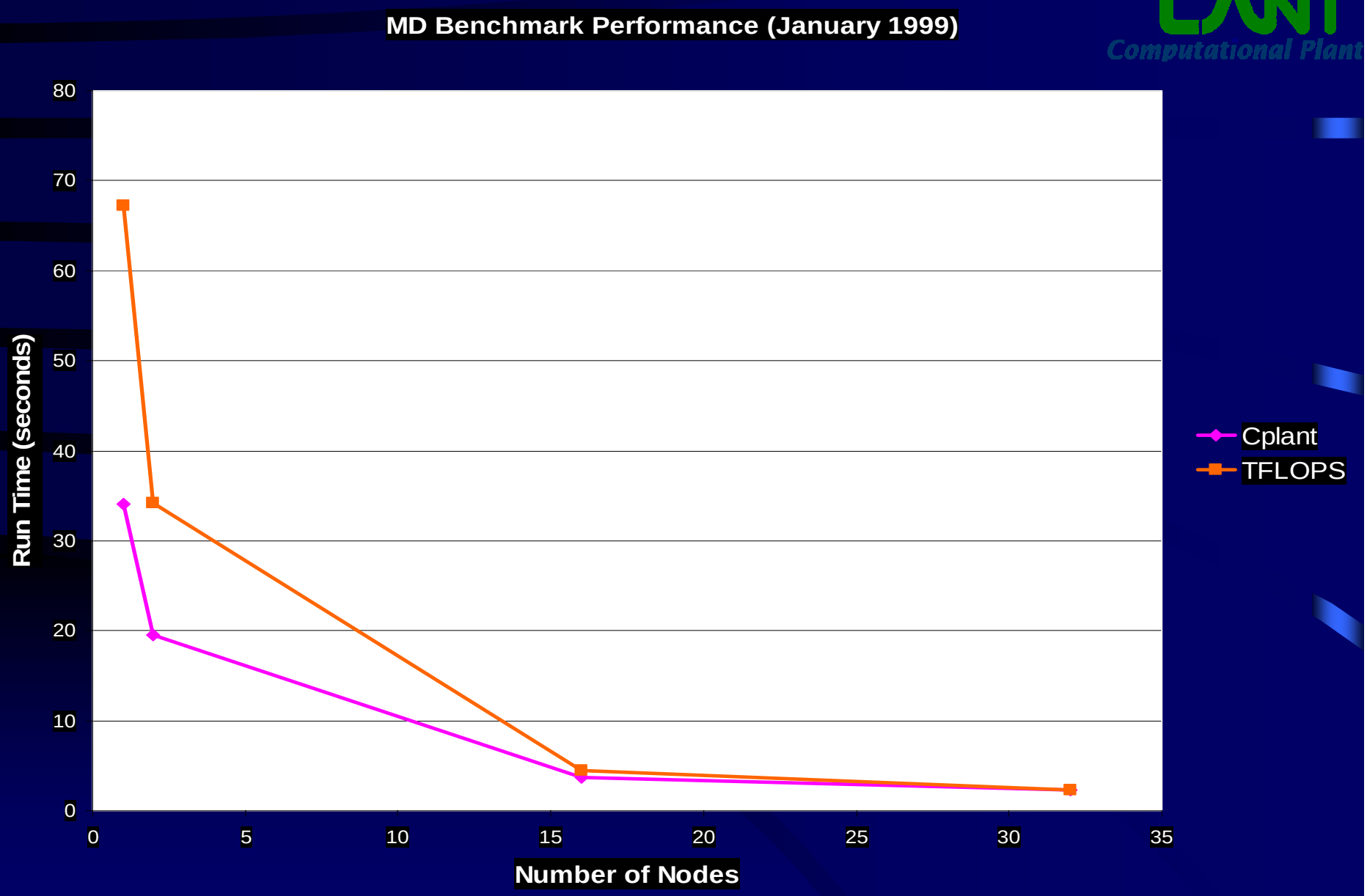


Applications

- CTH
- ALEGRA
- GILA
- MPQuest
- SALVO
- Parallel MESA
- Xpatch
- RSM/TEMPRA
- MD Benchmark
- ITS


CTH Performance
Grind Time (seconds)
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
Number of Nodes
Alaska
TFLOPS


MD Benchmark Performance (Summer 1998)
Run Time (seconds)
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
Number of Nodes
Cplant
TFLOPS


MD Benchmark Performance (January 1999)
Run Time (seconds)
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
Number of Nodes
Cplant
TFLOPS

Weapons Safety Codes Being Implemented on C-Plant

- RSM uncertainty analysis code
  - Used with any “black box” computer code to assess uncertainty in time-dependent output
- SEARCH Weapons Vulnerability Identification Code
  - SEARCH / TEMPRA
  - SEARCH / COYOTE

W76 C-Plant/SGI comparison

- SGI R10000 chip
- Single processor
- Serial execution
- 49 minutes (53 sec/run)

- C-Plant (Dec Alpha)
- 55 Processors
- Parallel execution
- 2 minutes (2.2 sec/run)

Factor of 25 Improvement in Execution Time

B61 C-Plant/SGI/Sun Tempra comparison

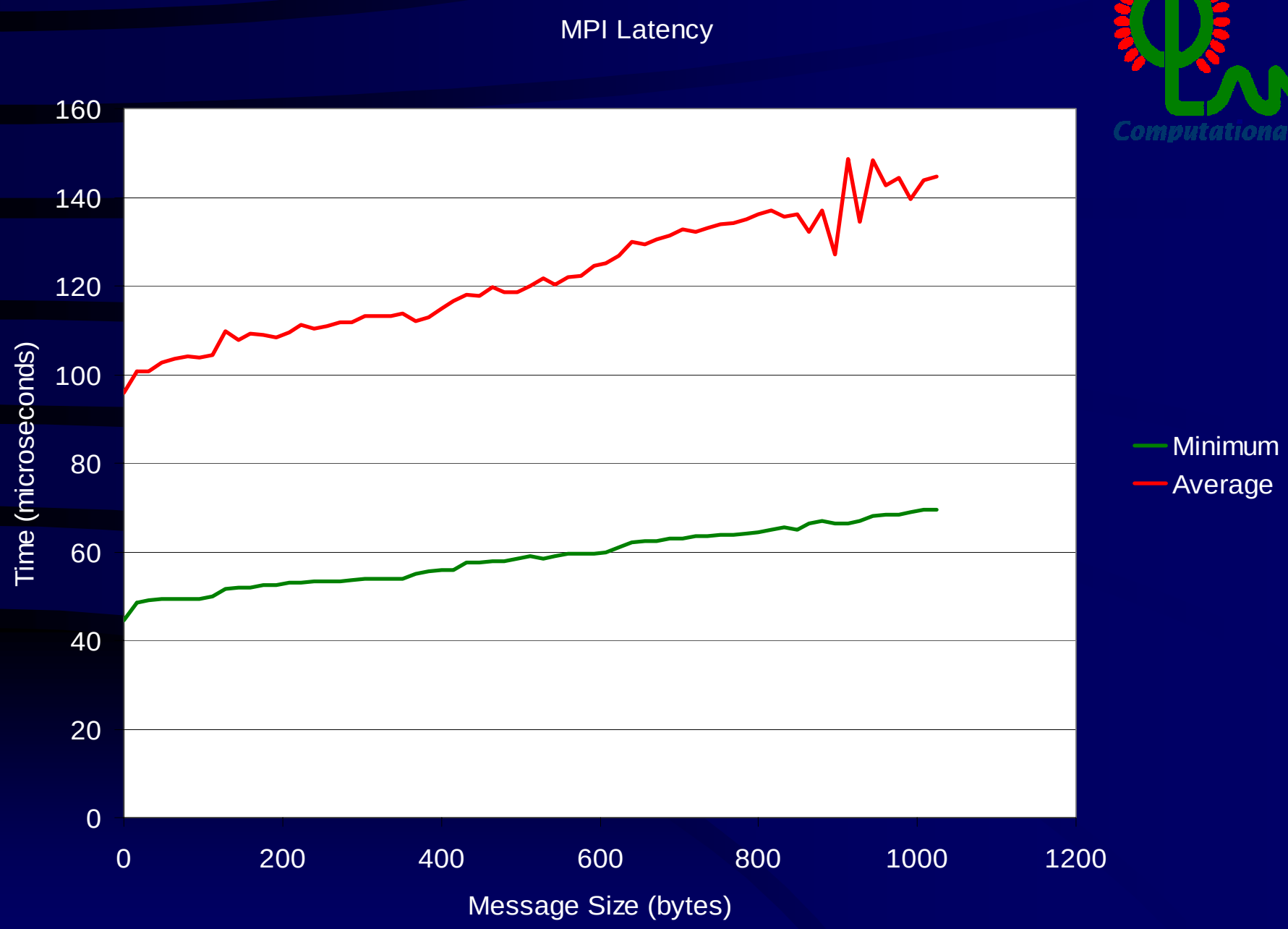
Single case, 1400F @ 240 min. duration

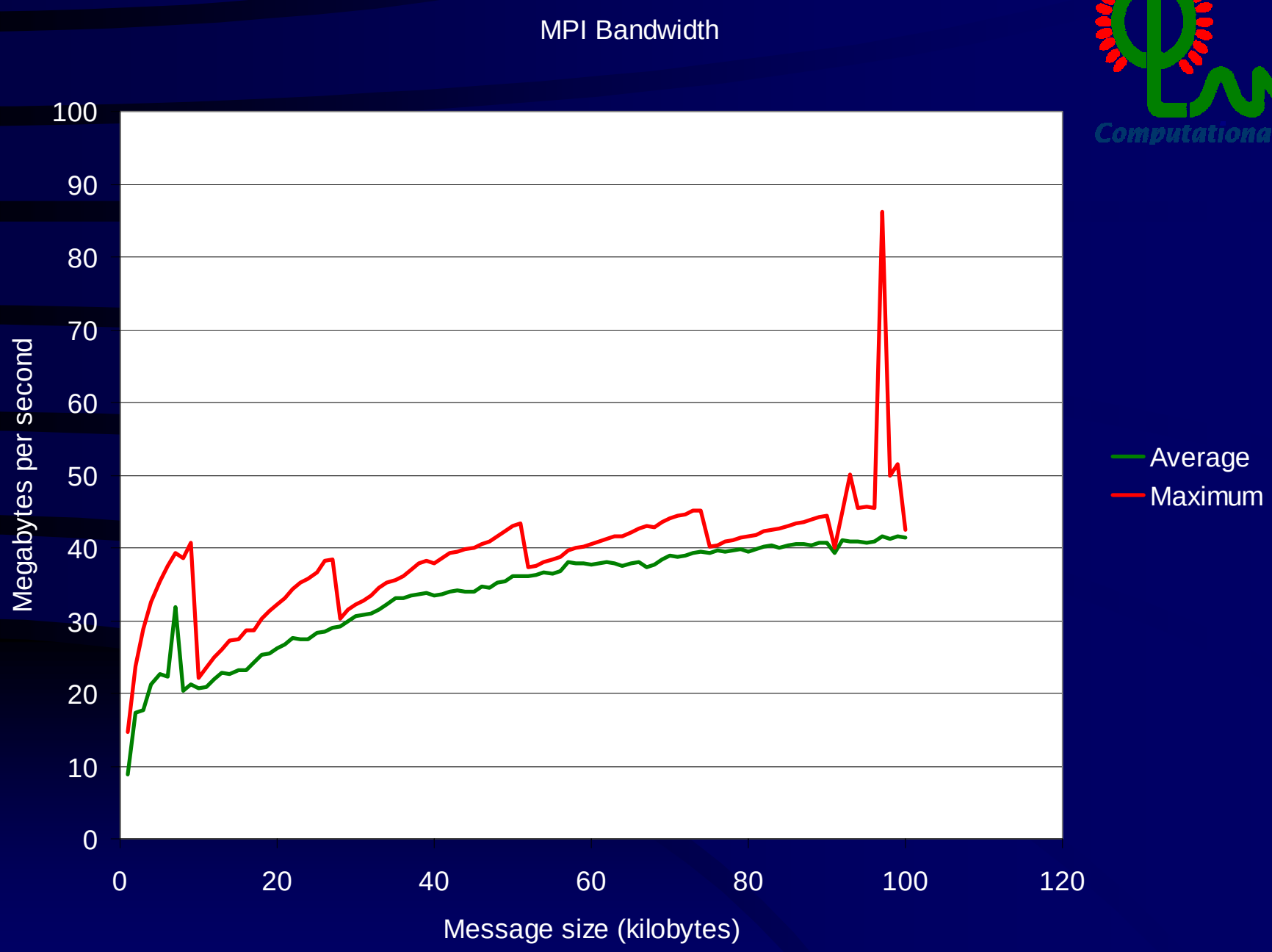
Nominal Run

- SGI/Sun - 300 Mhz
- Single processor
- 12 hours

- C-Plant (Dec Alpha)
- Added MPI routines
- Single Processor
- 20 minutes

Factor of 36 Improvement in Execution Speed


MPI Latency
Time (microseconds)
160
140
120
100
80
60
40
20
0
0
200
400
600
800
1000
1200
Message Size (bytes)
Minimum
Average


MPI Bandwidth
Megabytes per second
100
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
Message size (kilobytes)
Average
Maximum