Online Monitoring and filtering on Alice GDCs

C.Cheshkov

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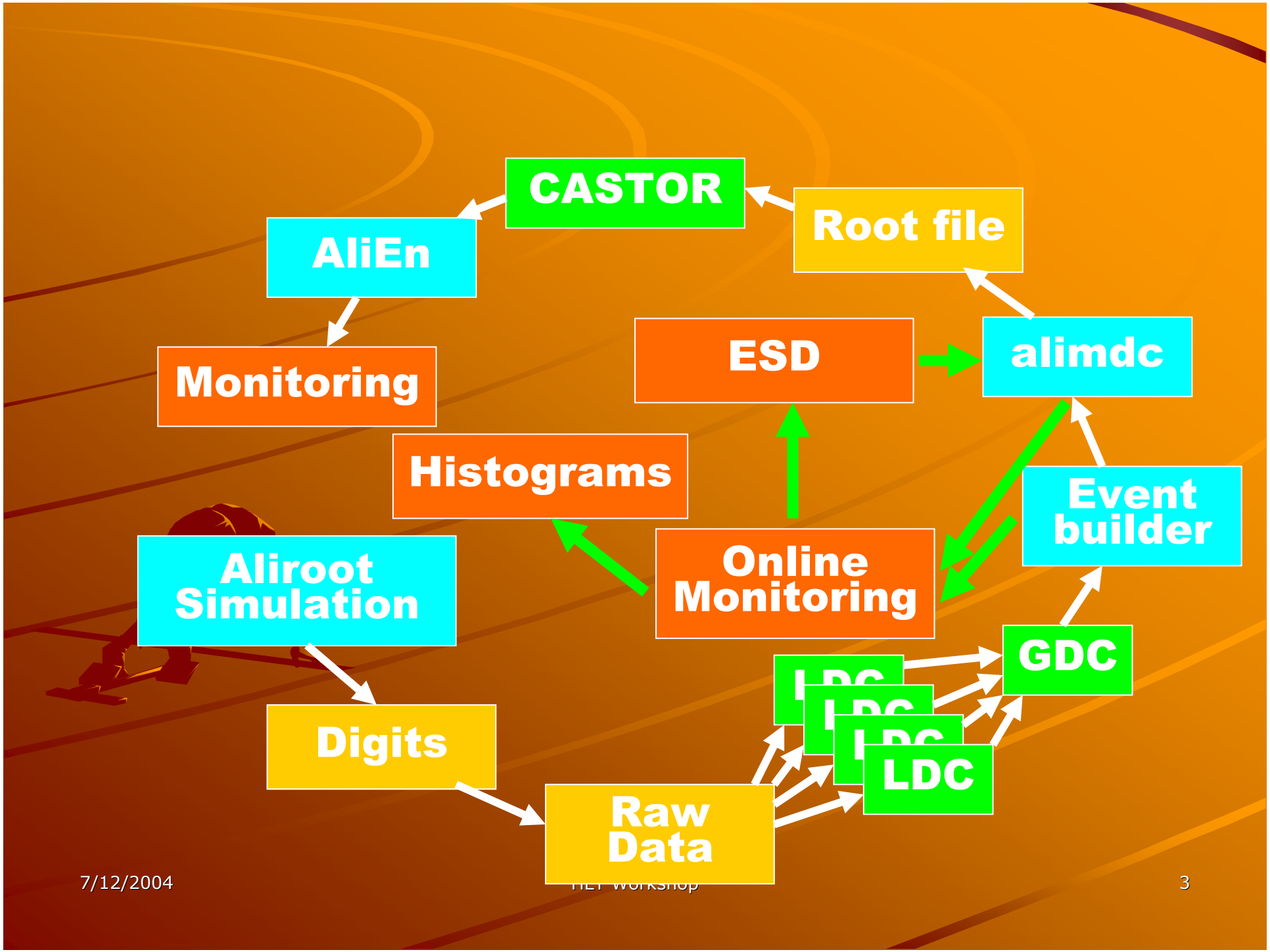

CASTOR
AliEn
Root file
Monitoring
ESD
alimdc
Histograms
Event builder
Aliroot Simulation
Online Monitoring
GDC
LDC
Digits
Raw Data

Online Monitoring: Description

- Fast reconstruction code which is running on the GDCs (Alice DAQ EventBuilders)
- Takes the raw-data either just after event building (through DATE monitoring interface) or within AliMDC before sending the event to the CDR
- Presumably based on HLT algorithms
- The output can be both monitoring histograms, ESD and why not trigger decision

Online Monitoring: Objectives

- Almost instantaneous feedback and check of:
  - Raw-data consistency
  - "Raw" detector performance: digit maps, raw signals, dead regions and etc.
  - General detector performance: number of tracks, spectra, invariant mass resolutions, global event parameters and etc.
- Reconstruction, analysis and why not filtering of the incoming events

Online monitoring: Status

- Algorithms:
  - So far HLT algorithms only for TPC and ITS (hope TRD and MUON are coming)
  - The online monitoring reconstruction for TPC is based on the Hough Transform tracker
  - As ITS tracking the version presented yesterday is used
- Framework:
  - Thomas already prepared a stand-alone GDC executable which catches the events from DATE and provides an interface to raw-data payload
  - The algorithms are already implemented in both the GDC executable and ALIMDC

Improvements in the raw-data processing

- So far we showed the time performance of the HT itself, assuming that we have TPC data nicely prepared and sorted in arrays
- However, in the real life the TPC raw data will come compressed by ALTRO

$\Rightarrow$ Obvious need in optimization of the raw data reading and decoding

Improvements in the raw-data processing

- The reading and decompressing of an event with dN/dy~8000 (~70Mb) typically was taking about 100s on the GDCs
- We've used Intel's VTune profiling tool to identify and correct most of the "hot spots"
- Most of the problems were solved "easily"
- Significant improvement also by using partially LUTs in the addressing of Huffman decoding tree and processing the input raw-data on byte-by-byte basis
- At the moment the speed of the raw-data processing is limited by the Huffman decompression algorithm (which now seems quite optimized)

Improvements in the raw-data processing

- After the improvements the raw-data I/O and decompression were speeded up by a factor of >10
- The time needed to process the raw-data is roughly equal to that for reconstruction

Monitoring in threads

- Since the Alice GDCs are dual CPU machines and data traffic takes only a few % of the CPU

  $\Rightarrow$ we studed and impemented the possibility to run the Hough tracker in a multi-threaded fashion (basically in 2 threads)
- As Fons proposed we used the Root TThread class
- As expected, we got a solid factor of 2 in the computing time

Demo

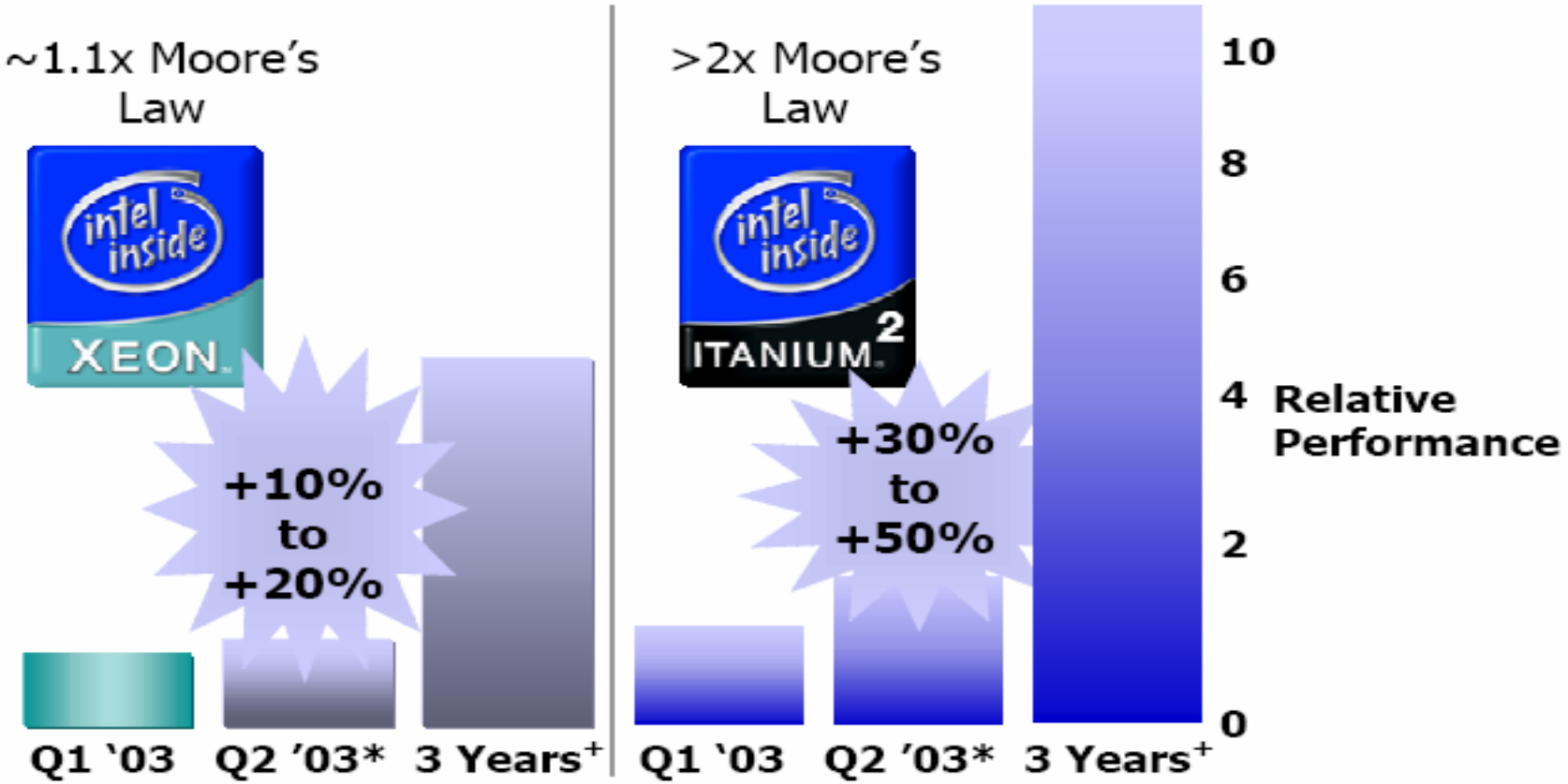
- HIJINGparam event: dN/dy=4000, 0.5T
- The whole reconstruction chain of TPC HT + ITS
- At the end of the reconstruction we fill the ESD and store it together with the raw data in the output file

Conclusions and Outlook

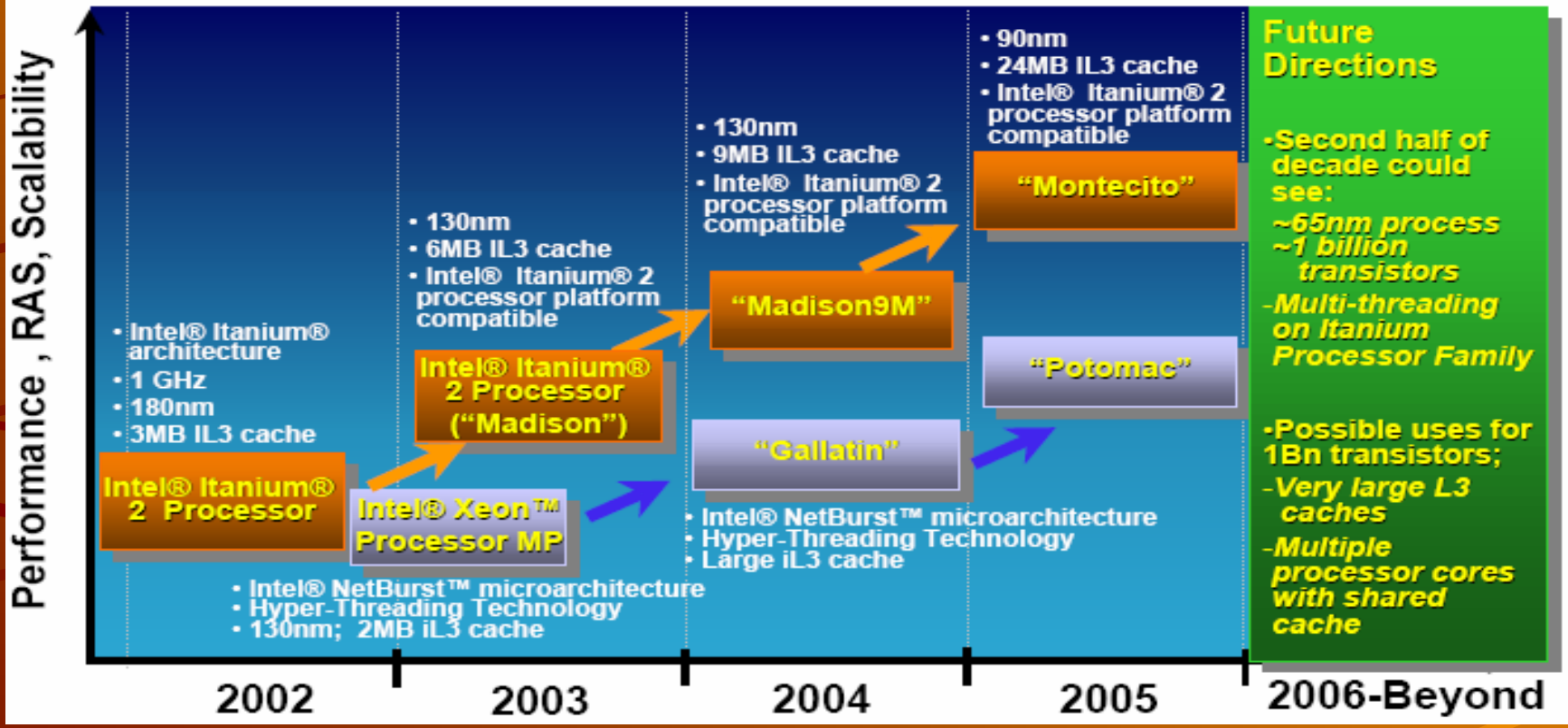
- Lets assume that in PbPb collision runs we get a rate of 200Hz of central events with average multiplicity about dN/dy~4000
- Then in order to cope with the rate and using the present hardware we would need about 200Hz * 8s = 1600 GDCs
- Of course, these are needs to run only TPC + ITS reconstruction
- On the other hand, one can extrapolate the present status to 2007 (according to Moore's Law and promises given by Intel)

- **Conclusion: Since the presented approach seems very promising in both effectiveness and needed computing resources, it is really worth to continue the work on the online monitoring in parallel with standard HLT architecture.**

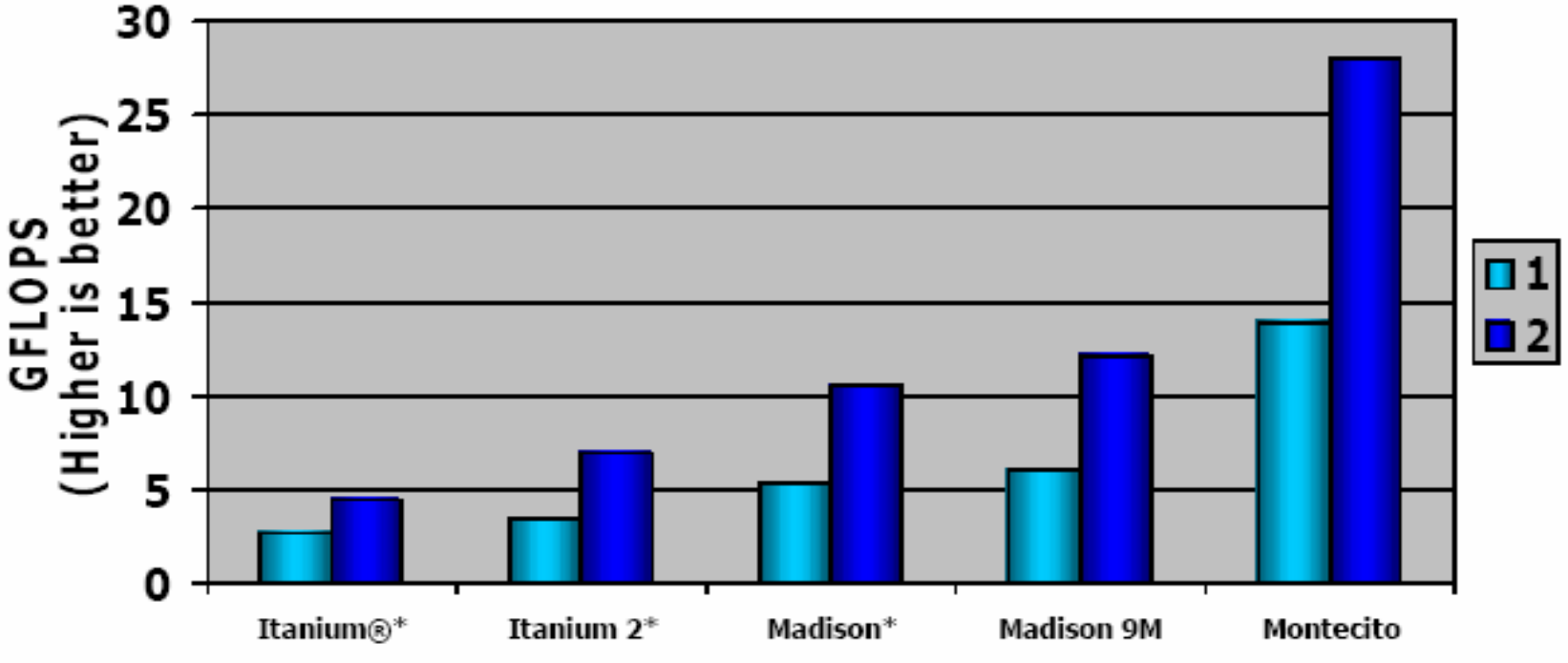
Moore's Law


~1.1x Moore's Law
intel inside
XEON
+10% to +20%
Q1 '03
Q2 '03*
3 Years+
>2x Moore's Law
intel inside
ITANIUM 2
+30% to +50%
Q1 '03
Q2 '03*
3 Years+
10
8
6
4
2
0
Relative Performance

Intel® Architecture MP Server Processor Roadmap



Linpack Projections



*Actual data

All projections based on Intel estimates.

Note: Madison 9M and Montecito roughly use Itanium 2 processor efficiency and scaling values, with some extrapolation for bandwidths