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IHEPCCC/HEPiX Benchmarking WG Status Update

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LCG Management Board

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Progress since end March (1)

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- Just an update to my presentation on 25-Mar-2008
- Benchmarking cluster at CERN: Now 8 permanent machines (added 2.33 GHz Harpertown), 3 temporary ones
- Other sites: Desy: Harpertown 2.83 GHz; Padova: Harpertown 2.33 GHz, Barcelona 2.1 GHz; all actively used
- All experiments have run a variety of benchmarks on most benchmarking nodes
- Most experiments are moving towards freezing their benchmarking applications, and packaging them for easy distribution and running by non-experts
- Ran SPECcpu with perfmon (low-level CPU performance counters)

Progress since end March (2)

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- Perfmon analysis of SPECcpu
  - SI2000 is 1% FP (SI2006: 0.1%)
  - Average bus utilisation low, but Bus Not Ready at percent level
  - L2 cache misses 2x higher on SI2006 than on SI2000
  - SPEC2006 C++: About 10…14% FP
- Perfmon requires a new kernel
  - Can't run on SLC4 2.6.9-xx kernel
  - Even with perfmon enabled, systems running 2.6.24-xx are ~ 10% faster than with 2.6.9-xx …!

Progress since end March (3)

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- Interim report at HEPiX at CERN last week
  http://indico.cern.ch/sessionDisplay.py?sessionId=11&confId=27391
  - Status report (Helge Meinhard)
  - CERN benchmarking cluster, including SPECcpu (Alex Iribarren)
  - Atlas (Franco Brasolin)
  - CMS (Gabriele Benelli)
  - Alice (Peter Hristov)
  - LHCb (Hubert Degaudenzi)
  - CPU-level performance monitoring (Andreas Hirstius)

Methodology

- Full least-squares fit awaiting consistent estimation of measurement errors
- Meanwhile, assumed linear dependency and checked Pearson's correlation coefficient

$$r = \frac{1}{n-1} \sum \left(\frac{X_i - \bar{X}}{s_X} \right) \left(\frac{Y_i - \bar{Y}}{s_Y} \right)$$

- For SPECint2006 vs SPECint2000, SPECfp2006 vs SPECint2000: see Alex' talk

Alice results (preliminary)

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Exp. Results versus …

Benchmark	Test	SPECint2000	SPECint2006	SPECfp2006
pp MinBias	GEN+SIM	0.974	0.981	0.980
	DIGI	0.949	0.959	0.979
	RECO	0.956	0.966	0.989
	TOTAL(SUM)	0.965	0.974	0.983
PbPb per2	GEN+SIM	0.976	0.983	0.982
8.6 - 11.2fm	DIGI	0.754	0.752	0.682
	RECO	0.942	0.949	0.943
	TOTAL(SUM)	0.976	0.983	0.983

CMS results (preliminary) (1)

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		Exp. Result versus…		
Benchmark	**Test**	**SPECint2000**	**SPECint2006**	**SPECfp2006**
HiggsZZ4LM190	GEN+SIM	0.983	0.988	0.986
	DIGI	0.971	0.977	0.974
	RECO	0.979	0.985	0.983
	TOTAL(SUM)	0.982	0.988	0.986
MinBias	GEN+SIM	0.982	0.988	0.986
	DIGI	0.972	0.978	0.973
	RECO	0.970	0.976	0.970
	TOTAL(SUM)	0.981	0.987	0.984

CMS results (preliminary) (2)

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QCD_80_120	GEN+SIM	0.980	0.986	0.984
	DIGI	0.973	0.980	0.976
	RECO	0.975	0.981	0.977
	TOTAL(SUM)	0.980	0.986	0.983
SingleElectron E1000	GEN+SIM	0.983	0.989	0.988
	DIGI	0.970	0.976	0.974
	RECO	0.962	0.968	0.960
	TOTAL(SUM)	0.983	0.989	0.987

CMS results (preliminary) (3)

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QCD_80_120	GEN+SIM	0.980	0.986	0.984
	DIGI	0.973	0.980	0.976
	RECO	0.975	0.981	0.977
	TOTAL(SUM)	0.980	0.986	0.983
SingleElectronE1000	GEN+SIM	0.983	0.989	0.988
	DIGI	0.970	0.976	0.974
	RECO	0.962	0.968	0.960
	TOTAL(SUM)	0.983	0.989	0.987

CMS results (preliminary) (4)

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TTbar	GEN+SIM	0.982	0.987	0.985
	DIGI	0.974	0.980	0.975
	RECO	0.902	0.908	0.891
	TOTAL(SUM)	0.977	0.982	0.978
	Total Total	0.969	0.975	0.970

Atlas results (preliminary)

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Machine	ATLAS Generation	ATLAS Simulation	ATLAS Digitization	ATLAS Reconstruction	ATLAS Total
lxbench01	5.291	0.001	0.048	0.055	0.001
lxbench02	5.236	0.001	0.052	0.053	0.001
lxbench03	6.579	0.002	0.076	0.063	0.002
lxbench04	9.434	0.002	0.088	0.109	0.002
lxbench05	10.537	0.003	0.115	0.093	0.003
lxbench06	7.692	0.002	0.088	0.070	0.002
lxbench07	8.333	0.002	0.089	0.099	0.002
SPECint2000	**0.645**	**0.679**	**0.726**	**0.691**	**0.685**
SPECint2006	**0.651**	**0.686**	**0.729**	**0.706**	**0.692**
SPECfp2006	**0.693**	**0.737**	**0.760**	**0.752**	**0.743**

LHCb status

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- First results received for performance of minimum bias pp on CERN's benchmarking machines
- Fits being verified

Error handling

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- First chi-squares fit only take account of spread of multiple runs on the same machine
  - As expected, error clearly underestimated
- Being considered:
  - Runs on different HW of supposedly same configuration
  - Runs on different HW of “similar” configuration
  - Runs with different seeds
  - Spread between cores running SPEC cpu base in parallel
  - Multiple runs on the same machine

Conclusions, next steps

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- Preliminary results indicate that standard benchmarks are adequate
- Rather poor Atlas correlation to be understood
- Treatment of errors to be understood
- Run experiments' code with perfmon (CPU performance/event counters)