LHC Computing Review Recommendations

http://lhc-computing-review-public.web.cern.ch

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7th LHCb Software Week

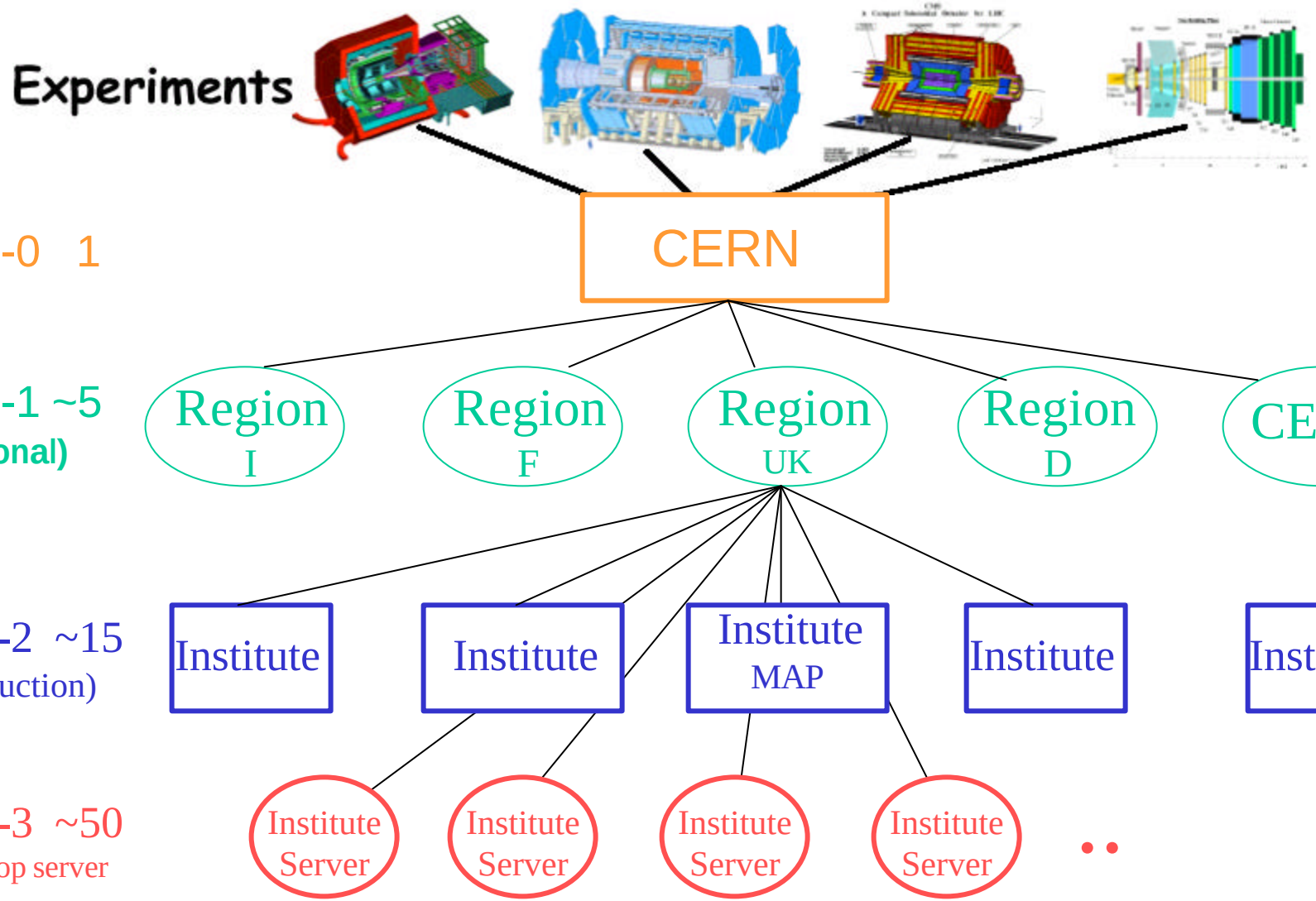
Major conclusions and recommendations 1

- Scale of resource requirements assessed and accepted
- Multi-tier hierarchical model + Grid endorsed
  - Expected ~1/3 at CERN
- Need affordable research network @ 1.5 Gbps for each experiment by 2006
- Joint software efforts encouraged between experiments and IT
- Data challenges encouraged to test infrastructure and software
- Areas of concern in software (support of simulation & analysis)
- Missing manpower for Core Software teams, CERN/IT

Major conclusions and recommendations 2

- Total hardware costs (240 MCHF, LHCb ~27 MCHF i.e. ~11%)
  - Investment spread over '05, '06, '07 in approx. equal portions
  - M&O – rolling replacement every 3 years
- Joint prototype reaching ~50% of 1 facility for '03/'04
- LHC Software & Computing Steering Committee (SC2)+TAGs to oversee deployment of entire computing structure
- MoU describing funding of and responsibility for hardware and software
- Interim MoU to be signed prior to MoU (software, prototype)

Multi-Tier Hierarchical Model



Rates and Installed Capacities

	ALICE	ATLAS	CMS	LHCb	Total
Event size (MB)	25	2	1	0.125	
Raw data/year (PB)	2.7	8.1	1.7	0.25	13.0
MC data/year (PB)	0.2	1.5	1.2	0.36	3.3
Tape at CERN (TB)	3200	8959	1540	912	14611
Disk at CERN (TB)	534	410	1143	330	2417
CPU at CERN (kSI95)	824	690	820	225	2559
Tape worldwide (TB)	4700	19800	10500	2800	37900
Disk worldwide (TB)	1600	2570	5900	1100	11070
CPU worldwide (kSI95)	1758	1944	2907	925	7535
WAN Tier0/Tier1 (Mb)	1500	1500	1500	310	4810

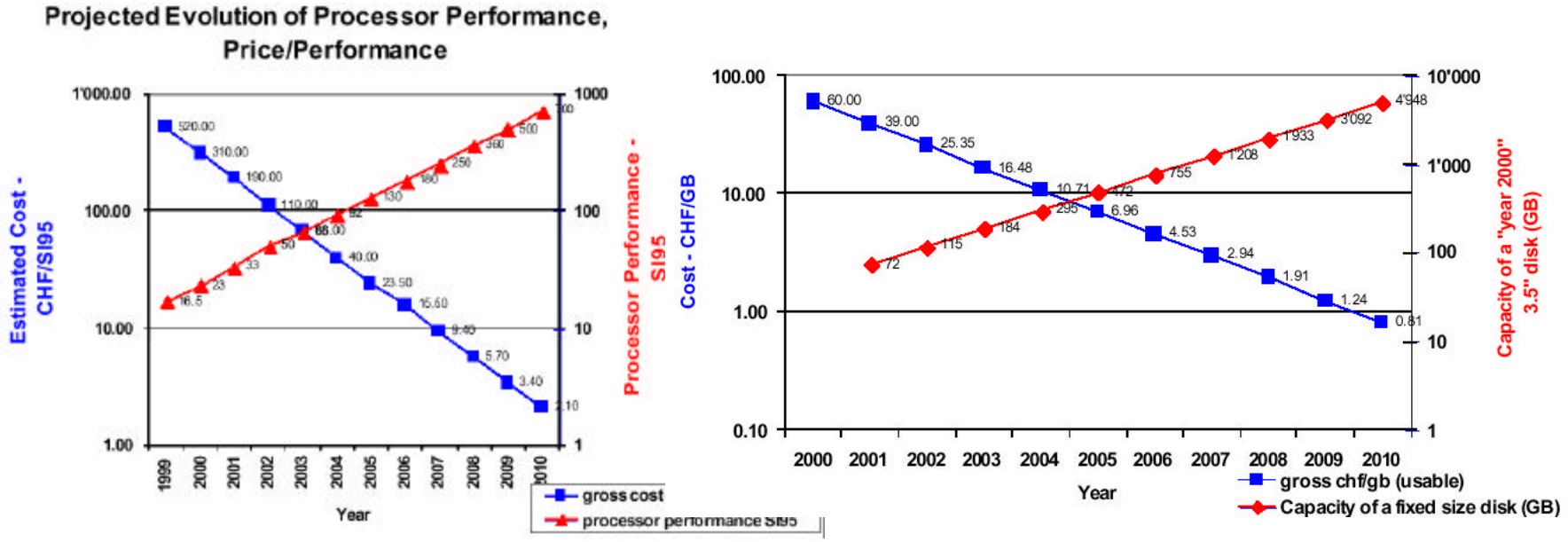
Manpower (FTEs) for CORE Software

	2000 Have (miss)	2001	2002	2003	2004	2005
ALICE	12(5)	17.5	16.5	17	17.5	16.5
ATLAS	23(8)	36	35	30	28	29
CMS	15(10)	27	31	33	33	33
LHCb	14(5)	25	24	23	22	21
Total	64(28)	105.5	106.5	103	100.5	99.5

Only computing professionals counted

CERN/IT - current staff complement	187
- minimum required to run centre	157
- predicted complement in 2006	137

Hardware costs of CERN Computing '05-'07



Units kCHF	ALICE	ATLAS	CMS	LHCb
CPU	11069	10667	12667	3479
Disk	2188	1907	5314	1535
Robotic Tape	3200	9407	1617	958
Shelf Tape	0	0	1816	214
Total Cost	18073	23692	23135	7040

Costs spread over '05 (30%) '06 (30%) '07 (40%) LHCb Tier-1's 20152 kSFr (74%)

Joint Prototype

- Use testbed to test at realistic scales:
  - Fabric management
  - Data Challenges with realistic rates
  - Scalability tests of CPU and I/O performance
  - New technologies - Copper gigabit; New tapes, IA-64
  - Data Grid functionality
- LHCb Data Challenges
  - July '02 : Functional OO software
  - July '02 : DC 1 - 10^6 events in ~2 weeks
  - Dec '02 : Computing TDR
  - July '03 : DC 2 - 10^7 events in ~2 weeks (DataGrid milestone)
  - Dec '04 : Software Production Readiness Review
  - July '05 : DC3 - 10^7 events (full test of software & infrastructure)

CERN Testbed Plans

	4Q. 00	4Q. 01	4Q. 02
Number of systems (dual CPU systems)	200 ✍ 300	500 (April 140)	1'200
Disk capacity (TB)	16	55	180
Tape capacity (PB)	0.2	0.4	1.0
Disk I/O rate (GB/s)	5	15	50
Tape I/O rate (GB/s)	0.25	0.5	1
WAN links (Mbps)	40	60	150

Observations and conclusions

- Waiting for response from CERN management
  - guidelines on construction and cost sharing of prototype
  - timescale for Computing TDR and MoU
  - allocation of additional new effort to IT and experiments
  - role and composition of SC2 and timescale for launch
    - Data management project already in preparation
- Communication with funding agencies
  - Discussions at LHCC, RRBs - preparation of IMoU
  - Responsibilities for core software (sharing policy)
  - Advance notice of long term computing plan (cost sharing)
  - Policy of access to centres outside CERN
- Preparation of distributed computing infrastructure
  - Development of analysis model – physics use-cases
  - Development of grid services – integration in GAUDI
  - Preparation of data challenges

Projects

- Event Filter Farm (Computing)
  - Control and management of farm, installation, scalability
  - specialisation of GAUDI to filter farm environment
- Software Framework (GAUDI)
  - Event model – development and optimisation
  - Detector description – development and optimisation of geometry
  - Scripting component to allow interactive analysis based on PYTHON
  - Grid services
  - Data management (event data, conditions data, bookkeeping)
- Physics frameworks
  - Simulation framework using GEANT4 – coordination
  - Analysis framework – coordination
  - High level trigger framework – coordination
- Tools/utilities
  - software and data quality monitoring
  - Documentation, workbooks
- ….