Architect of an Open World™

The RWTH Aachen Supercomputer Architecture and Design

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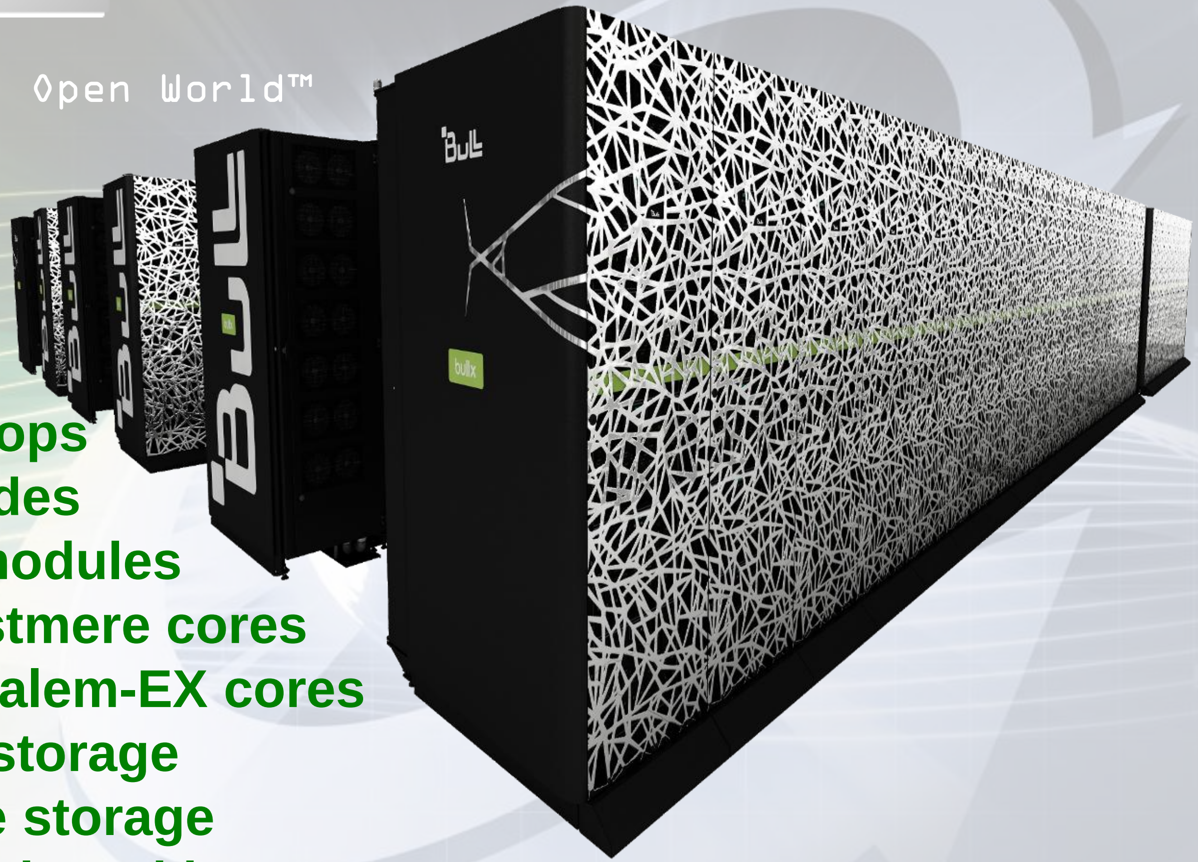
PPCES – March 21st 2011

The RWTH Aachen Supercomputer at a glance

RWTH AACHEN UNIVERSITY

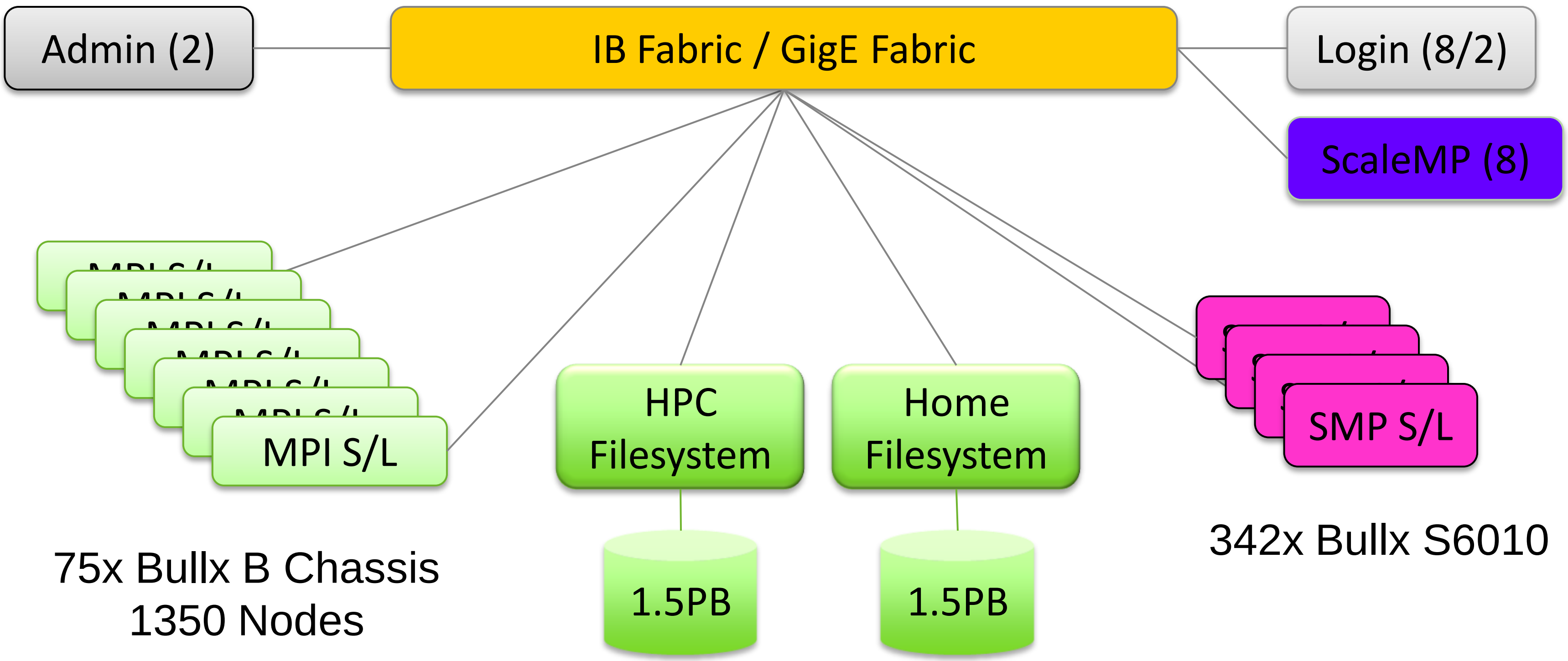
Architect of an Open World™



292	Peak TFlops
1 350	bullx blades
362	bullx S modules
16 200	Intel Westmere cores
11 500	Intel Nehalem-EX cores
1 500	TB HPC storage
1 500	TB Home storage
	QDR InfiniBand interconnect

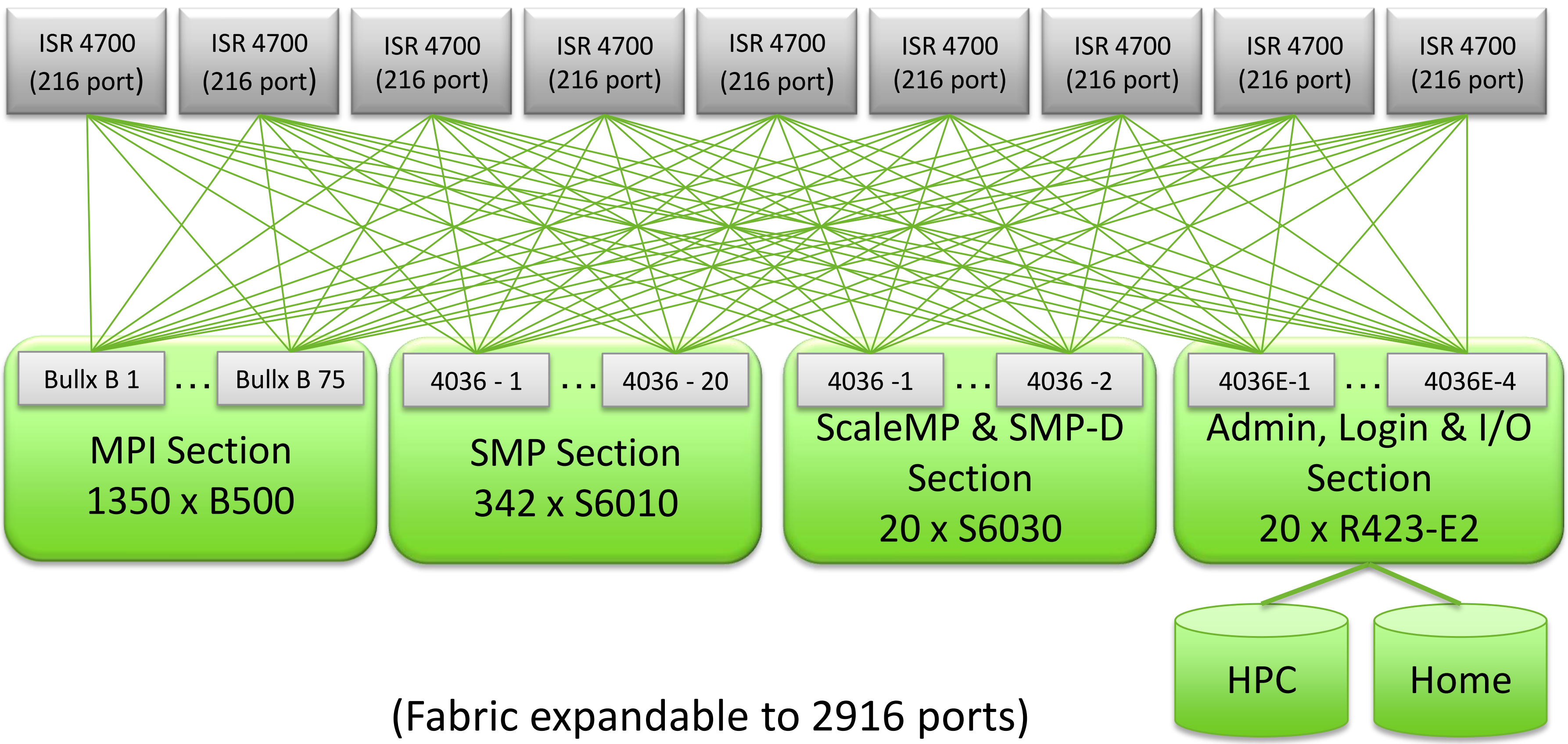
Soon operational ……

RWTH Aachen – System Architecture



Infiniband Fabric – Full Fat Tree

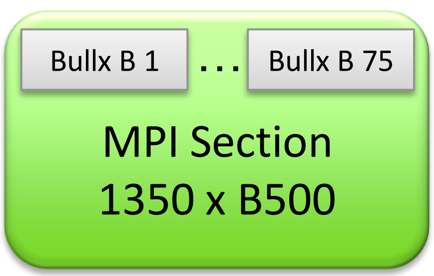
9x 216port TopLevel Switches - 1944 ports total

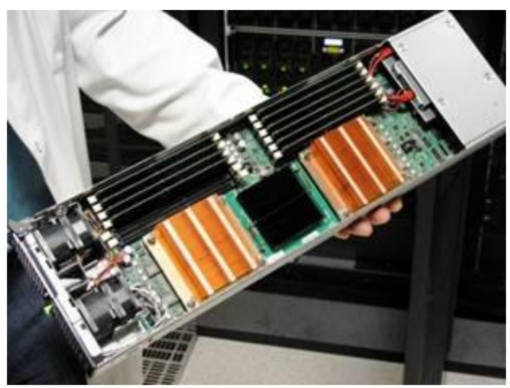


(Fabric expandable to 2916 ports)

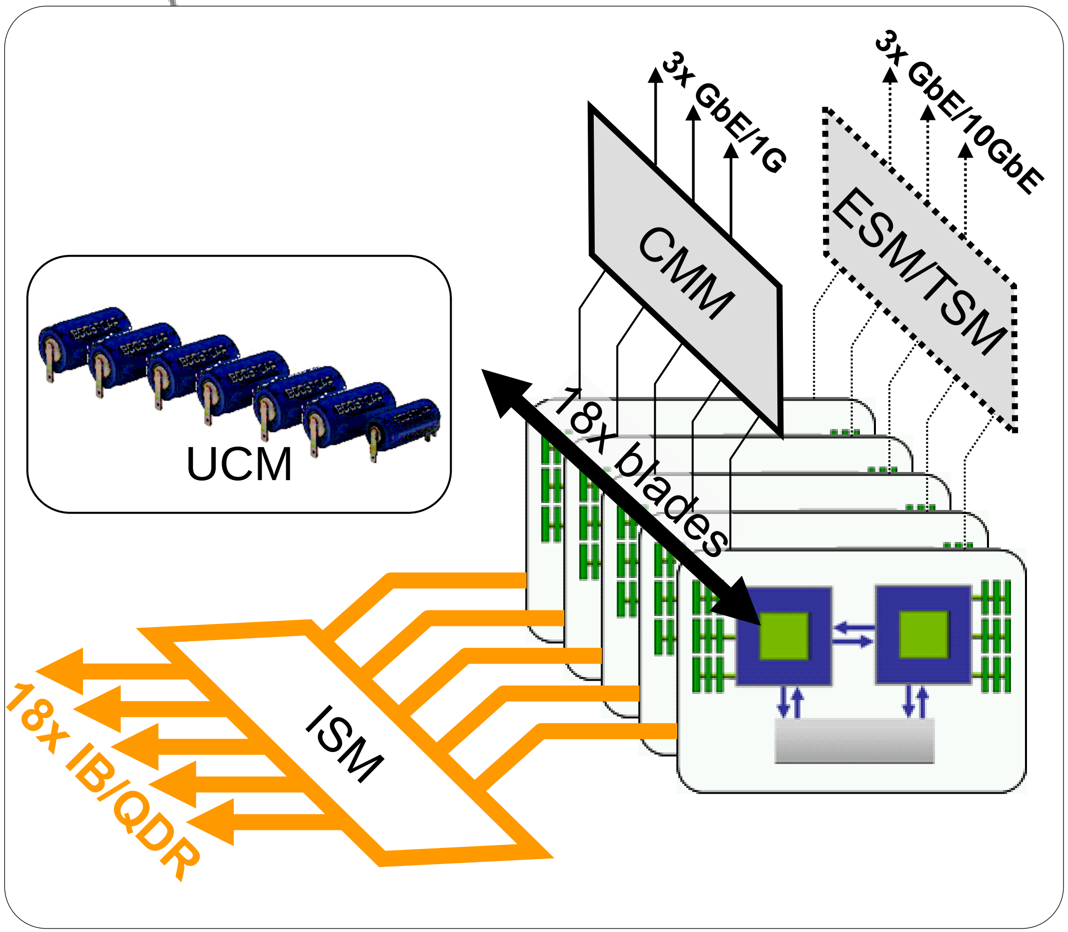
MPI Section: Bullx B500 Blade Series

- 75x Bullx Blade Chassis
- 1350x Bullx B500 Compute Node
  - 1098 Nodes with 24 GB Memory
  - 252 Nodes with 96 GB Memory
- Intel Westmere X5675 CPU (3,06GHz)
- Local SSD Disk (60GB)
- QDR Infiniband





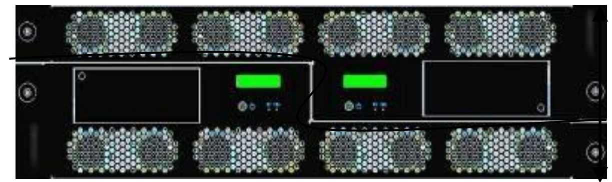
Bullx blade system – Block Diagram



- 18x compute blades
  - 2x Westmere-EP sockets
  - 12x memory DDR3 DIMMs (12x 8GB= 96GB)
  - 1x SATA HDD/SSD slot
  - 1x IB ConnectX/QDR chip
- 1x InfiniBand Switch Module (**ISM**) for cluster interconnect
  - 36 ports QDR IB switch
  - 18x internal connections
  - 18x external connections
- 1x Chassis Management Module (**CMM**)
  - OPMA board
  - 24 ports GbE switch
  - 18x internal ports to Blades
  - 3x external ports
- 1x optional Ethernet Switch Module (**ESM**)
  - 24ports GbE switch
  - 18x internal ports to Blades
  - 3x external ports
- 1x optional Ethernet Switch Module (**TSM**)
  - GigE Switch with 10GigE Uplinks
- 1x optional Ultra Capacitor Module (**UCM**)

SMP Section: Bull S6010 Supernode

- 342x Bullx S6010 Compute Node
  - 270 Modules with 64 GB Memory
  - 72 Modules with 256 GB Memory



- Intel Nehalem-EX X7550 CPU (2 Ghz)
- Local Sata Disk (500GB)
- QDR Infiniband

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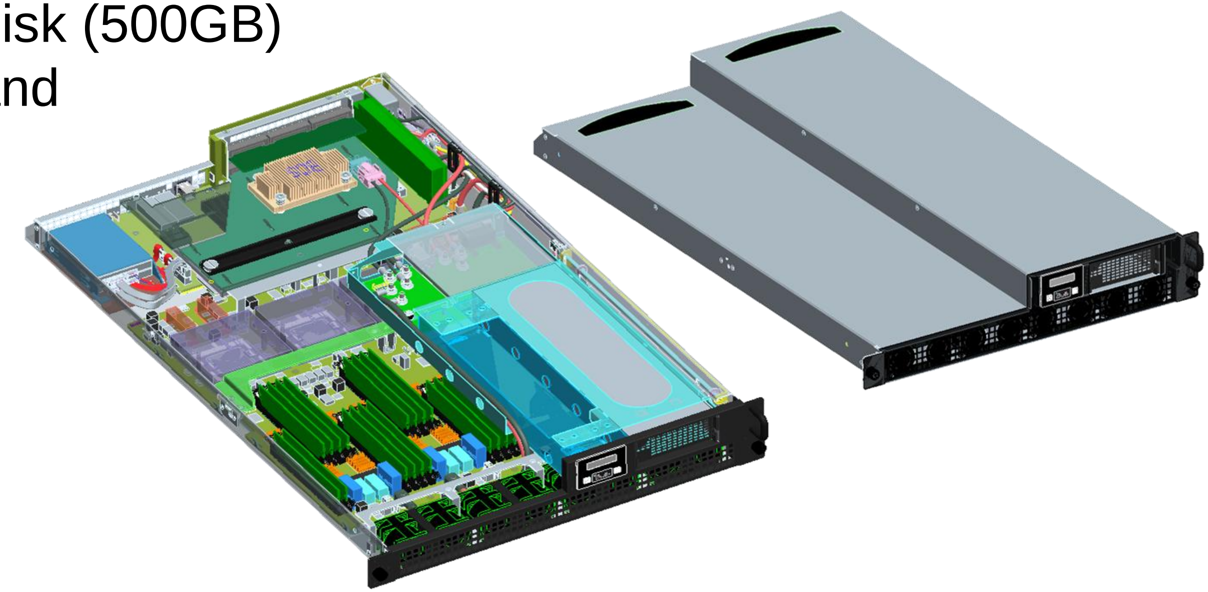
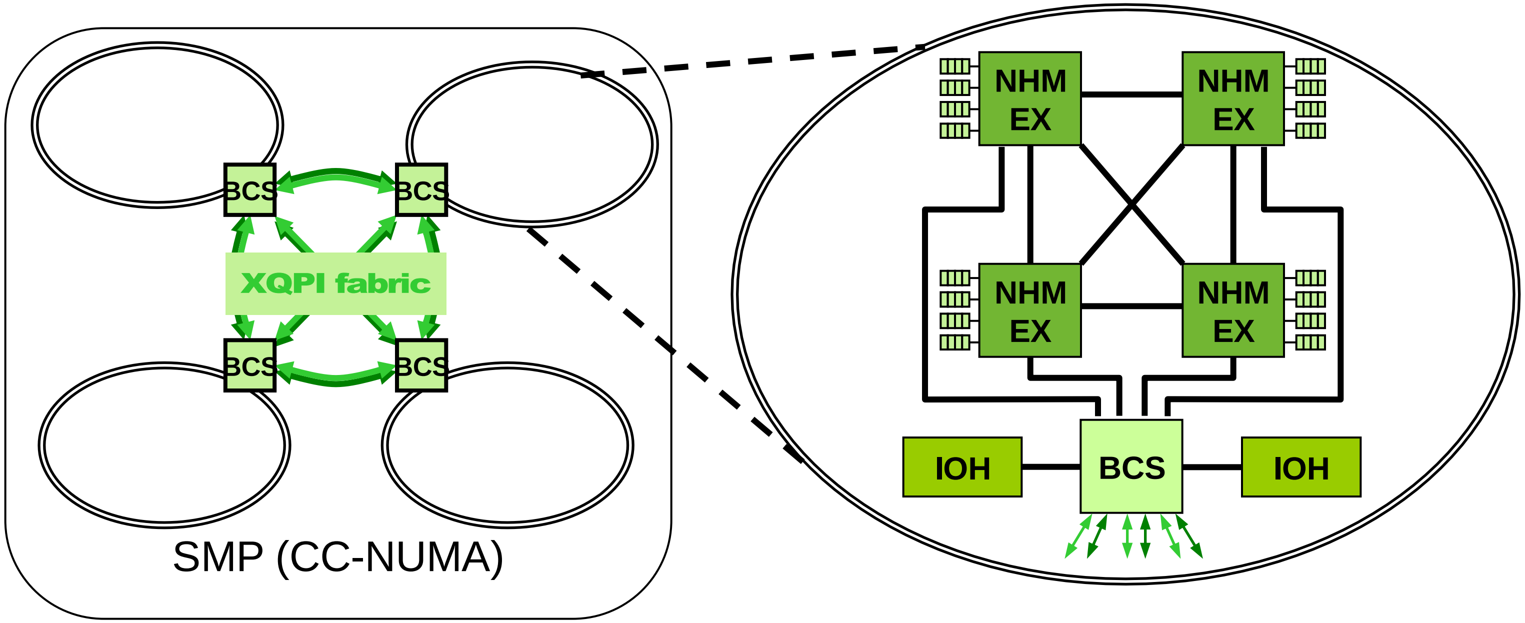
SMP Section
342 x S6010



Bullx S60x0 – CC-NUMA server



Node maximum configuration :

- 4 modules
- 16 sockets
- 128 cores (Nehalem-EX)
- 128 memory slots (2TB)

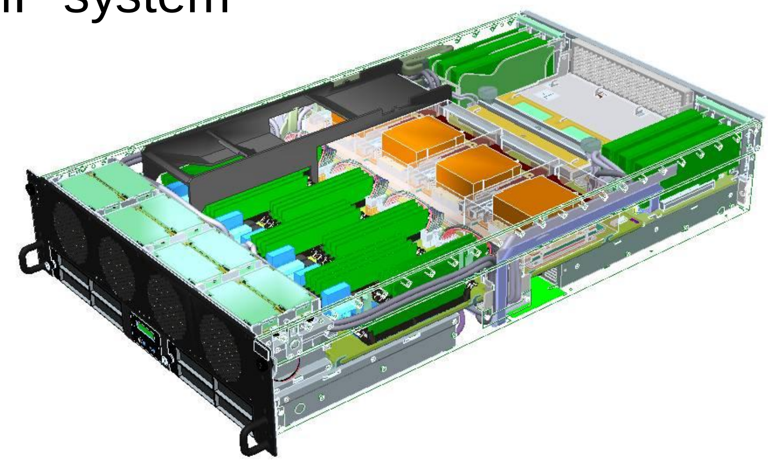
Large nodes :

- Large shared memory (pre/post-processing)
- Many more cores (SMP)
- Fewer nodes
- Simpler system administration
- Multi Level Parallelism (MPI/OpenMP)

ScaleMP Section: Bullx S6030 Supernode

- 16x Bullx S6030 Compute Node
  - 256 GB Memory
  - Intel Nehalem-EX X7550 CPU (2 Ghz)
  - 3x 300GB SAS Disk
  - QDR Infiniband
  - 10GigE

- To be coupled to a single vSMP system



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ScaleMP Section
16 x S6030

Service and Admin Section: Bullx R423-E2

- 8x MPI-D: R423-E2
  - Intel Westmere X5675, 96GB Memory
    5x300 GB SAS Disk, QDR-IB
- 4x SMP-D: S6030
  - Intel Nehalem-EX X7550, 128GB Memory
    3x300GB SAS Disk, QDR-IB
- 2x Admin: R423-E2
  - Intel Westmere X5675, 48GB Memory
    4x600 GB SAS Disk, QDR-IB
- 8x OSS: R423-E2
  - Intel Westmere X5675, 48GB Memory
    2x300 GB SAS Disk, 3x QDR-IB
- 2x MDS: R423-E2
  - Intel Westmere X5675, 48GB Memory
    2x300 GB SAS Disk, QDR-IB, 2x FC8

HPC & Home Filesystem: DDN & BlueArc

- HPC Filesystem:
  - 2x DDN SFA10k
  - 940x 2TB SATA Disk
  - 1x DDN 6620 (as MDS)
  - 40x 600GB SAS Disk 15krpm

- Home Filesystem
  - 4x BlueArc Titan 3210 NAS Filer
  - DDN SFA10k
  - 960x 2TB SATA Disk

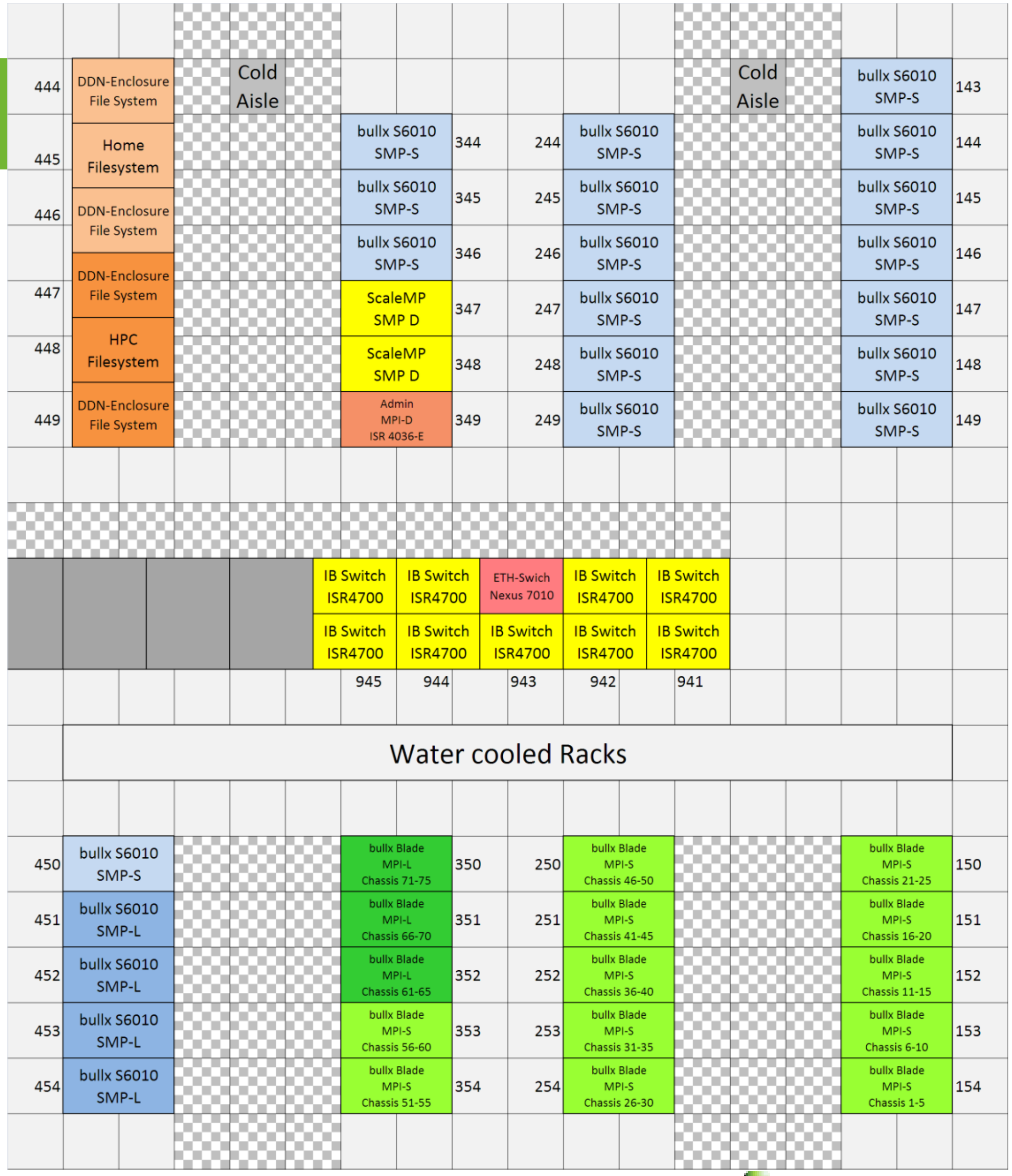
System Summary

Section	Component / CPU	#Nodes/#Modules	TFLOP
MPI-S	B500 / X5675	1098	161
MPI-L	B500 / X5675	252	37
MPI-D	R423-E2 / X5675	8	1
SMP-S	S6010 / X7550	270	69
SMP-L	S6010 / X7550	72	18
SMP-D	S6030 / X7550	4	1
ScaleMP	S6030 / X7550	16	4
		$\sum = 1712$	$\sum = 292$ TFlop
Home-Filesystem	DDN / BlueArc	1.500 TB	
HPC-Filesystem	DDN	1.500 TB	
Infiniband	Voltaire	Full Fat-Tree	2000 ports

Floorplan

- 50 Racks
- 9 Rows

- 11,6m x 9,6m
- 109,4 m²



Top 100 Entries - Germany (Top500 - Nov 2010)

Rank	Site	Cores	Rmax	Rpeak
9	FZ Jülich	294.912	825,5	1.002,7
22	University of Frankfurt	15.120	285,2	469,7
23	FZ Jülich	26.304	274,8	308,3
	RWTH Aachen	**27.700**		**292,0**
58	DKRZ	8.064	115,9	151,6
63	HLRN – Hannover	10.240	107,1	120,7
64	HLRN – ZIB	10.240	107,1	120,7
73	MPG	6.848	98,4	128,7
78	IT Service Provider	10.240	94,7	122,8
89	RRZK Cologne	9.376	85,9	100,2

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Thank you

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