



Updated February 2011

Intel® Xeon® Processor 5600 Series

What's new about the Intel® Xeon® Processor 5600 Series (*formerly codenamed Westmere-EP*)?

- **True Six-Core Dual-Socket Servers**

The new Intel Xeon Processor 5600 offers true six-core CPUs with up to 12 threads and up to 12MB cache. Quad-core processors with up to 8 threads and 12MB of cache are also available in the 5600 series.

- **32nm Process Technology**

Based on Nehalem architecture, the 5600 Series is built on the 32nm high-k metal gate process.

- **Intel® Intelligent Power Technology**

IPT automatically shifts the CPU and memory into the lowest available power state, reducing energy costs.

- **Intel® Turbo Boost Technology**

Turbo Boost delivers additional performance automatically when needed by taking advantage of the processor's power and thermal headroom. This enables increased performance of both multi-threaded and single-threaded workloads.

- **Intel® Hyper-Threading Technology**

Hyper-Threading allows thread-level parallelism on each processor, resulting in more efficient use of processor resources. With higher processing throughput, you enjoy substantially improved performance.

- **DDR3 Memory**

The move to DDR3 memory offers increased performance due to higher memory speeds, and reduced power consumption compared to FB-DDR2 memory operating at the same speed.

Dramatically Increased Performance

Dramatically Decreased Energy Consumption

Expert included.



Intel® Xeon® Processor 5600 Series

Expert included.

Process	TDP ¹	CPU Number	Frequency	Cores / Threads	Cache	Link Speed	Max Mem Speed	Turbo Boost ²	HT
32nm	130W	X5690	3.46	6 / 12		6.4 GT/s	1333 MHz		
		X5687	3.60	4 / 8	12MB	6.4 GT/s	1333 MHz	+2	Yes
		X5647	2.93	4 / 8		5.86 GT/s	1066 MHz		
	95W	X5675	3.06	6 / 12					
		X5672	3.20	4 / 8					
		X5660	2.80	6 / 12	12MB	6.4 GT/s	1333 MHz	+3	Yes
		X5650	2.66	6 / 12					
	80W	E5649	2.53	6 / 12			1333 MHz		
		E5645	2.40	6 / 12	12MB	5.86 GT/s	1333 MHz	+2	Yes
		E5620	2.40	4 / 8			1066 MHz		
		E5607	2.26	4 / 4	8 MB		1066 MHz		
		E5606	2.13	4 / 4	8 MB	4.8 GT/s	1066 MHz	No	No
		E5603	1.60	4 / 4	4 MB		1066 MHz		
	LOW POWER	L5640	2.26	6 / 12		5.86 GT/s	1333 MHz	+4	Yes
		L5630	2.13	4 / 8	12MB	5.86 GT/s	1066 MHz	+2	Yes
		L5609	1.86	4 / 4		4.8 GT/s	1066 MHz	No	No

¹ TDP is Thermal Design Power

² Max Turbo Boost frequency based on number of 133-MHz increments above base frequency (+2 = 0.266 GHz, +3 = 0.400 GHz). See pages 4 and 5 for information about interpreting the Turbo Boost specification.



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The processors listed below continue to be available in the event that you need one of these specific models. You may, however, be able to achieve improved price performance by selecting from the CPUs listed on the previous page.

Process	TDP ¹	CPU Number	Frequency	Cores / Threads	Cache	Link Speed	Max Mem Speed	Turbo Boost ²	HT
32nm	130W	X5680	3.33 GHz	6 / 12	12MB	6.4 GT/s	1333 MHz	1 / 1 / 1 / 1 / 2 / 2	Yes
		X5677	3.46 GHz	4 / 8				1 / 1 / 2 / 2	
	95W	X5670	2.93 GHz	6 / 12	12MB	6.4 GT/s	1333 MHz	2 / 2 / 2 / 2 / 3 / 3	Yes
		X5667	3.06 GHz	4 / 8				2 / 2 / 3 / 3	
	80W	E5640	2.26 GHz	4 / 8	12MB	5.86 GT/s	1066 MHz	1 / 1 / 2 / 2	Yes
		E5630	2.53 GHz						
45nm	80W	E5507	2.26 GHz	4 / 4	4MB	4.8 GT/s	800 MHz	No	No
		E5506	2.13 GHz	4 / 2					
		E5503	2.00 GHz	2 / 2					

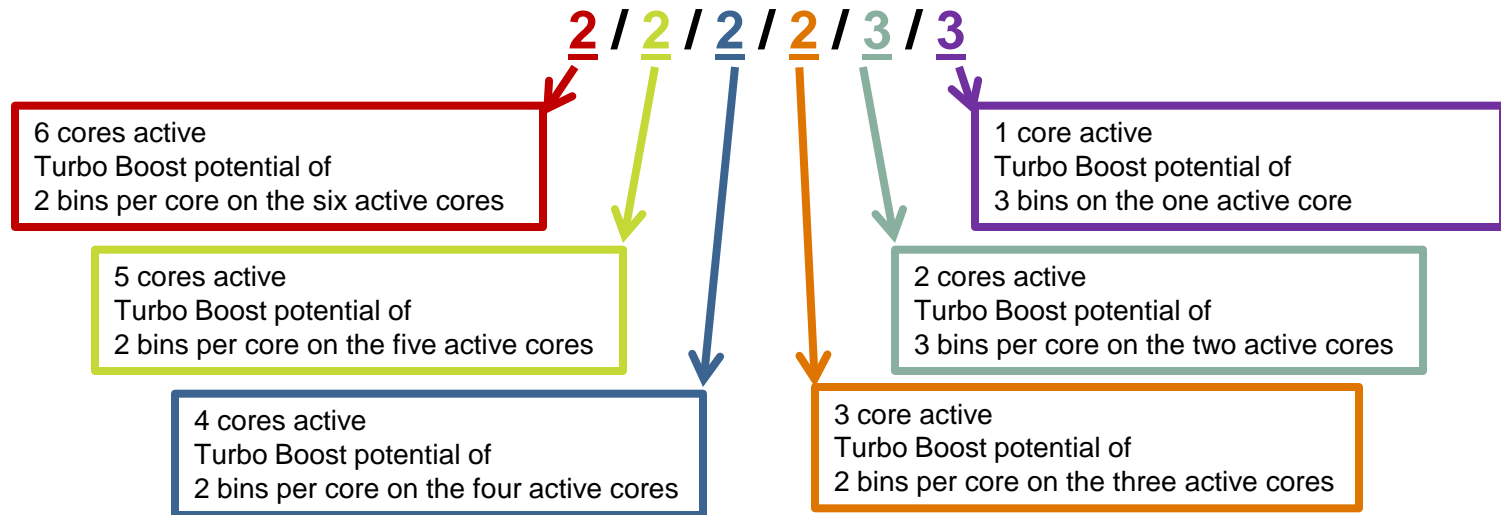
¹ TDP is Thermal Design Power

² Max Turbo Boost frequency based on number of 133-MHz increments above base frequency (+2 = 0.266 GHz, +3 = 0.400 GHz). See pages 4 and 5 for information about interpreting the Turbo Boost specification.

Expert included.

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Interpreting the Turbo Boost Specification



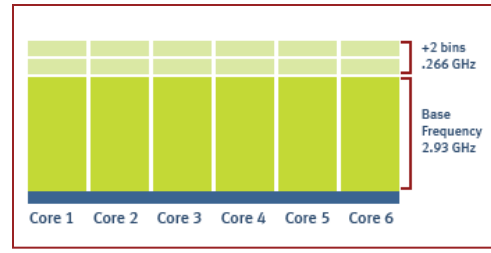
- This example is based on the Intel Xeon processor 5670: 6 cores, 2.93 GHz, with a Turbo Boost specification of 2 / 2 / 2 / 2 / 3 / 3.
- When thermal headroom exists or a core is idle, Turbo Boost increases the base frequency of the cores.
- The frequency increases take place in increments ("bins") of 133 MHz (.133 GHz).
- The first number corresponds to the boost potential of 2 bins per core when all six cores are active. The second number refers to the boost potential of 2 bins per core when five cores are active. The third number refers the boost potential of 2 bins per core when four cores are active. The fourth number refers to the boost potential of 2 bins per core when three cores are active. The fifth number refers to the boost potential of 3 bins per core when two cores are active. The sixth number refers to the boost potential of 3 bins when one core is active.

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Interpreting the Turbo Boost Specification

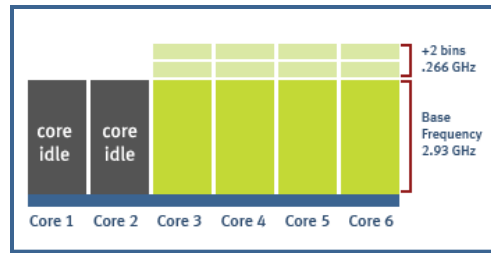
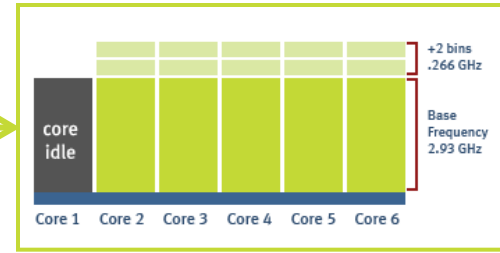
2 / 2 / 2 / 2 / 3 / 3

Base Frequency: 2.93 GHz
Incremental Increase: .133 GHz



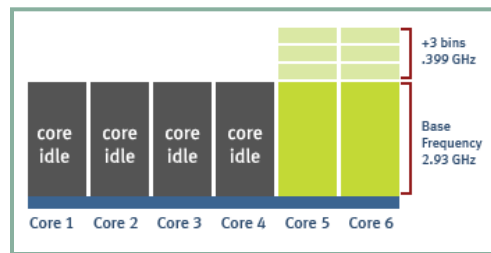
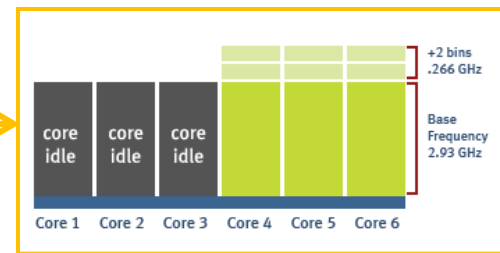
In Use: 6 cores
Turbo Boost: 2 bins
Boosted Frequency: 3.2 GHz

In Use: 5 cores
Turbo Boost: 2 bins
Boosted Frequency: 3.2 GHz



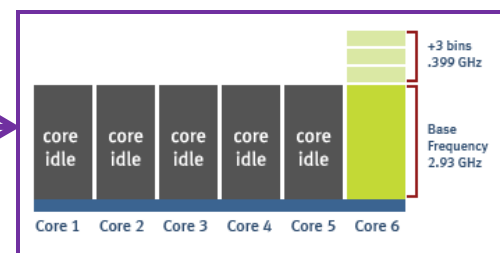
In Use: 4 cores
Turbo Boost: 2 bins
Boosted Frequency: 3.2 GHz

In Use: 3 cores
Turbo Boost: 2 bins
Boosted Frequency: 3.2 GHz



In Use: 2 cores
Turbo Boost: 3 bins
Boosted Frequency: 3.3 GHz

In Use: 1 core
Turbo Boost: 3 bins
Boosted Frequency: 3.3 GHz

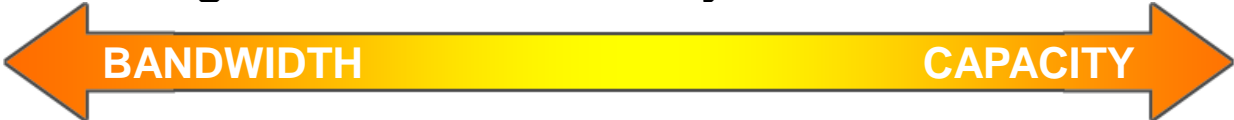


Expert included.



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Matching Processor to Memory: Selection Guidance



Memory Technology	DDR3 1333 10.6 GB/s 96MB			DDR3 1066 8.5 GB/s 96MB			DDR3 800 6.4 GB/s 144 MB		
Assumes use of 8GB DIMMs									
Valid for single- or dual-rank DIMMs									
CPU Features									
12 MB Cache 6.4 GT/s QPI Turbo Boost HyperTransport	130W	X5690	6 cores, 3.46 GHz	130W	X5690	6 cores, 3.46 GHz	130W	X5690	6 cores, 3.46 GHz
		X5687	4 cores, 3.60 GHz		X5687	4 cores, 3.60 GHz		X5687	4 cores, 3.60 GHz
	95W	X5675	6 cores, 3.06 GHz	95W	X5675	6 cores, 3.06 GHz	95W	X5675	6 cores, 3.06 GHz
		X5672	4 cores, 3.20 GHz		X5672	4 cores, 3.20 GHz		X5672	4 cores, 3.20 GHz
		X5660	6 cores, 2.80 GHz		X5660	6 cores, 2.80 GHz		X5660	6 cores, 2.80 GHz
		X5650	6 cores, 2.66 GHz		X5650	6 cores, 2.66 GHz		X5650	6 cores, 2.66 GHz
12 MB Cache 5.86 GT/s QPI TurboBoost HyperTransport	130W	X5647	4 cores, 2.93 GHz				130W	X5647	4 cores, 2.93 GHz
	60W	L5640	6 cores, 2.26 GHz				60W	L5640	6 cores, 2.26 GHz
12 MB Cache 4.8 GT/s QPI				80W	E5649	6 cores, 2.53 GHz		E5649	6 cores, 2.53 GHz
					E5645	6 cores, 2.40 GHz	80W	E5645	6 cores, 2.40 GHz
					E5620	4 cores, 2.40 GHz		E5620	4 cores, 2.40 GHz
4 MB Cache 4.8 GT/s QPI				40W	L5630	4 cores, 2.13 GHz	40W	L5630	4 cores, 2.13 GHz
				40W	L5609	4 cores, 1.86 GHz	40W	L5609	4 cores, 1.86 GHz
							80W	E5607	4 cores, 2.26 GHz
								E5606	4 cores, 2.13 GHz
								E5603	4 cores, 1.60 GHz

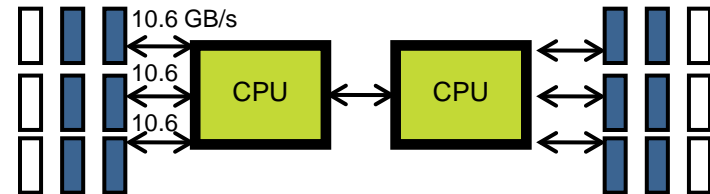
Expert included.

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Memory Population Scenarios

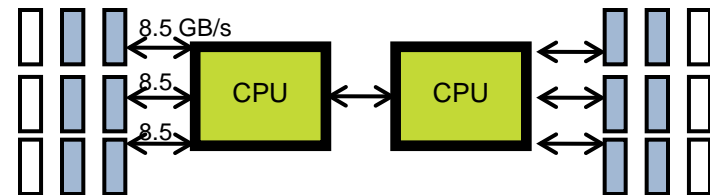
Maximum Bandwidth:

- DDR3 1333 across 3 channels per CPU
- 1 or 2 DIMMs per channel (up to 12 DIMMs)
- DDR3 1333 memory performance requires one of the following processors: X5690, X5687, X5675, X5672, X5660, L5640



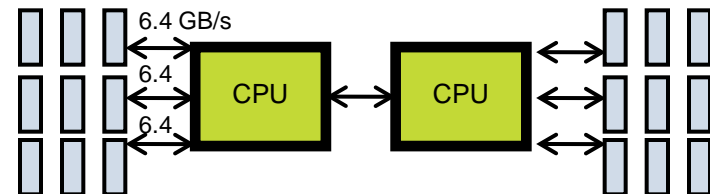
Price / Performance Balance:

- DDR3 1066 across 3 channels per CPU
- 1 or 2 DIMMs per channel (up to 12 DIMMs)
- DDR3 1066 memory performance requires one of the following processors: X5647, E5620, L5630, L5609, E5607, E5606, E5603



Maximum Capacity:

- DDR3 800 across 3 channels per CPU
- Up to 3 DIMMs per channel (18 DIMMs)
(18 DIMMs available only on selected mainboards.)



For maximum bandwidth, you want the fastest memory speed, which requires one of the more advanced CPU SKUs. Since 1333MHz memory performance is only supported at up to 2 DIMMs per channel, depending on CPU frequency, the maximum installation with 2 CPUs would be 12 DIMMs.

For maximum capacity, you want to be able to install as many DIMMs as possible. Populating 3 DIMMs per channel will result in the memory running at a maximum of 800MHz, meaning you can choose any of the Xeon 5600 SKUs, since they all support 800MHz or higher, and will clock down memory speed, if necessary, to support 3 DIMMs per channel.

Using any quad-rank DIMMS:

Configurations with 1 DIMM per channel will operate at 1066 MHz.

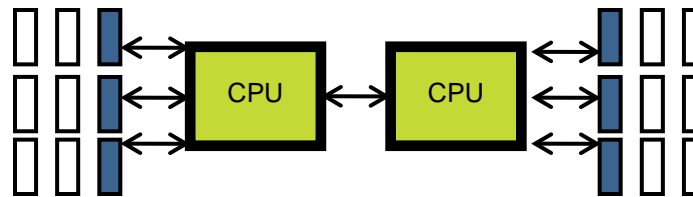
Configurations with 2 or 3 DIMMs/channel will make all DIMMs operate at 800 MHz.

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Balanced vs. Unbalanced Memory Population Considerations

Recommended: Balanced Memory Population

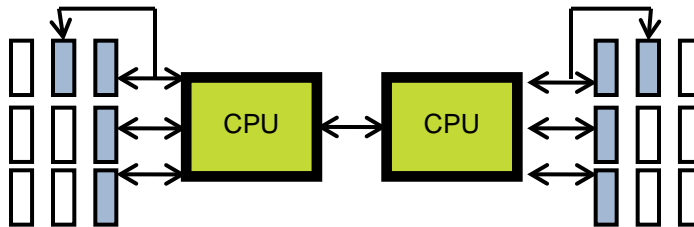
- Use a “balanced” platform configuration: populate the same number of DIMMs for each channel and each socket.
- Use identical DIMM types throughout the platform: same size, speed, and number of ranks.



Balanced 1-1-1 Memory Population

Alternatives: Unbalanced Memory Population “2-1-1” (not recommended)

Option 1



Population Scenario

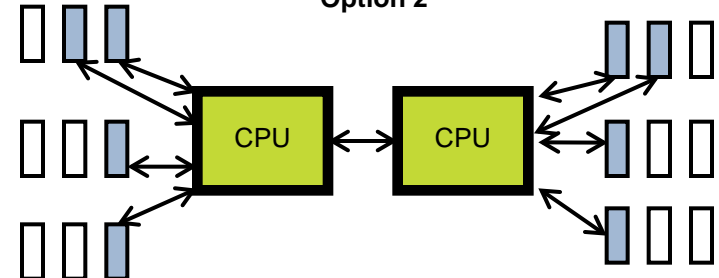
Interleave the first 3 DIMMs equally across the 3 channels and add the 4th DIMM to the first channel.

Performance Consideration: Unpredictable Performance

If your application uses only the first three DIMMs, your results will be the same as in a balanced 1-1-1 memory population scenario.

If the 4th DIMM is used, your performance will be reduced to the equivalent of a single channel.

Option 2



Population Scenario

Interleave across all four DIMMs equally.

Performance Consideration: Bandwidth Bottleneck

For every memory request the application makes to channels 2 and 3, channel 1 will need to handle two requests.

The doubled number of requests to channel 1 will result in a bottleneck of your bandwidth.



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Silicon Mechanics Products with Intel® Xeon® Processor 5600 Series CPUs

Rackmount Servers

1U Servers

- [Rackform iServ R304](#)
- [Rackform iServ R308](#)
- [Rackform iServ R331](#)
- [Rackform iServ R335](#)
- [Rackform iServ R350](#)

2U Servers

- [Rackform iServ R346](#)
- [Rackform iServ R348](#)

3U Server

- [Rackform iServ R362](#)

High-Density 1U and 2U Twins

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- [Rackform iServ R4210-IB](#)
- [Rackform iServ R4410](#)
- [Rackform iServ R4410-IB](#)

Storage Servers

- [Storform iServ R513](#)
- [Storform iServ R515](#)
- [Storform iServ R516](#)
- [Storform iServ R518](#)

GPU Workstation

- [Hyperform HPCg R2504](#)

Expert included.



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Contact Silicon Mechanics

**For answers regarding processor selection,
memory matching, or other questions you may have,
contact one of the Experts at Silicon Mechanics:**

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Toll Free: 866.352.1173

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Expert included.