

## Research for the NSF 426 Task Groups - Environmental Leadership Standard for Servers

<b>Contracted by:</b>	International Sustainable Development Foundation (ISDF) in cooperation with the Green Electronics Council (GEC)
<b>Research Conducted by:</b>	Hansheng Ltd. ( <a href="mailto:anson.wu@hansheng.co.uk">anson.wu@hansheng.co.uk</a> ) and Sea Green Tree ( <a href="mailto:catriona.mcalister@seagreentree.com">catriona.mcalister@seagreentree.com</a> )
<b>Task:</b>	#2 - Understanding the Servers Supply Chain
<b>Research Question:</b>	<p>Task Group 13 (Corporate Responsibility) would like a better understanding of the server supply chain. Such as:</p> <ul style="list-style-type: none"> <li>• What are the tiers for design and manufacturing?</li> <li>• Are the Brands (e.g. HP, Dell, IBM, etc.) doing manufacturing and/or assembly?</li> <li>• Are the Brands doing design, or is it contracted?</li> <li>• Are there just a handful of firms doing the work at any tier level, or is it many?</li> <li>• Who are they (e.g., size) and where are they located?</li> <li>• The top 5 companies account for more than 80% of the revenue, but do they also account for 80% of the servers sold (by units)?</li> </ul>

# Research Response:

## Definitions:

OEM: Original Equipment Manufacturer - refers to the company that originally manufactured the product.

ODM: Original Design Manufacturer - a company that produces, designs and manufactures products which are specified and branded by another firm.

EMS: Electronic Manufacturing Service – a company that manufactures products from another firms design.

## Summary

This task seeks to provide a high level overview of the server supply chain and market. Historically the market was dominated by the 'Big Four' (HP, IBM, Dell and Sun) but this is changing as the market develops and diversifies with manufacturers crossing multiple tiers. In particular it seeks to provide answers to the following questions:

### ***What are the tiers for design and manufacturing?***

There are two main tiers for design and manufacturing, the OEMs and ODMs. However, this is starting to blur for the hyperscale market where ODMs are selling directly to large internet companies such as Google, Facebook and Microsoft.

### ***Are the Brands (e.g. HP, Dell, IBM, etc.) doing manufacturing and/or assembly?***

There is now very limited manufacturing/final assembly by the main OEM brands. The vast majority is contracted manufacturing with ODM/EMS. Hon hai (Foxconn) in particular have stated they manufactured two thirds of all servers produced in 2012. Most server components are standardised including CPUs, RAM, storage, and PSUs. The supply chain is common to other computer products and are sourced around the world, but mainly in Asia, and China in particular.

### ***Are the Brands doing design, or is it contracted?***

No definitive information could be found but the research suggests that the design work is a mixture of contracted, collaborative and in house. The stricter technical requirements for reliability, efficiency and cooling, as well as the higher value of servers compared to other electronics suggest more in-house design occurs, especially for higher value servers.

### ***Are there just a handful of firms doing the work at any tier level, or is it many?***

There are only a handful of firms at any tier level, less than 10 OEMs and ODMs, however the tier levels are starting to blur.

### ***Who are they (e.g., size) and where are they located?***

The biggest OEMs are Dell, HP, and IBM, all based in USA but with very large global networks. The biggest ODMs tend to be based in Taiwan, but also have globally distributed manufacturing locations – main names include Hon Hai (Foxconn), Quanta, Compal, Wistron and Inventec. Hon Hai is by far the largest, accounting for approximately two thirds of all servers manufactured. Quanta reported it manufactured 1.2 million servers in

2012. Based on Gartner 2012 sales of just under 10 million, they accounted for 12.4% of all servers manufactured.

*The top 5 companies account for more than 80% of the revenue, but do they also account for 80% of the servers sold (by units)?*

The top 5 companies account for just around 57% of the global market by units sold (2013). This is likely to drop due to continued growth in smaller companies, such as Cisco and Chinese manufacturers primarily serving the Chinese market such as Huawei and Inspur. In addition, the ODMs are likely to take a greater market share as direct sales to hyperscale companies continue to increase. Lastly, the sale of the server manufacturing from IBM to Lenovo will split the high revenue and very small volume IBM mainframe servers from Lenovo's lower revenue high volume sales.

A different mix of companies make up the top 5 in terms of revenue, accounting for 76% of total global revenue.

## Structure of the Server Market

The server market and supply chain is currently diversifying and this can be best understood by dividing the market into three:

1. **The OEM x86 server market:** These form the bulk of the market, with server OEMs (Dell, HP, IBM, Fujitsu) and Intel CPUs dominant. This market serves customers of all sizes and can be broken down into various other niches and business models which are not described in this report.
2. **The Hyperscale server market:** This refers the very large-scale server operations such as Facebook, Google, Microsoft, Rackspace and Amazon. Because they purchase servers in very high volumes more recently they have been custom designing their own 'vanity-free' or 'white-box' servers, which are purchased directly from ODMs rather than through OEMs. This market is more difficult to estimate since the manufacturer and volumes are often not disclosed, and may not be accounted for as accurately in market research, e.g. Gartner or IDC. For example, Google has been reported to be the fifth largest Intel customer for server CPUs but is not identified in any market research data.
3. **The high-end, mainframe market:** This is dominated by IBM. This is a very small fraction of the market by volume but with an average server price over \$600,000 USD, it accounts for \$1.3bn per quarter around 10% of server sales by revenue<sup>12</sup>

## All Markets - Servers Share

This analysis is based on Gartner data from 4Q 2011 to 3Q 2013. The complete dataset including revenue in USD and sales volume units can be found in Attachment A. IDC market share by revenue is also included.

The server market as a whole is dominated by HP, Dell and IBM who account for 67% of servers by revenue or 54.1% by shipments based on Gartner data (See Figure 1 and Figure 2). While IBM only accounts for 8% of shipments, they dominate the high-value high-end mainframe market, which greatly increases their market share by revenue.

The smaller manufacturers include Oracle, Fujitsu, Cisco, Huawei and Inspur electronics who each have approximately 2-3% of the market. Because Gartner data only names the top five manufacturers, these

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<sup>1</sup> <http://slashdot.org/topic/datacenter/mainframes-no-names-hyperscale-blades-show-shift-in-market-for-servers/>

<sup>2</sup> [http://www.channelregister.co.uk/2013/05/28/gartner\\_q1\\_2013\\_server\\_numbers/](http://www.channelregister.co.uk/2013/05/28/gartner_q1_2013_server_numbers/)

manufacturers do not all appear in the chart, but seem to be trading places quarter over quarter (see accompanying spreadsheet). Huawei and Inspur Electronics are relatively unique as they primarily serve the Chinese market, which is now growing so rapidly that these manufacturers are becoming globally significant.

The other vendors in the Gartner data include smaller manufacturers such as SuperMicro, but also the ODMs who are engaging in direct sales to large customers. These account for a very large proportion of the market, approximately 40% of the total shipments by volume.

### Gartner server revenue 3Q 2013

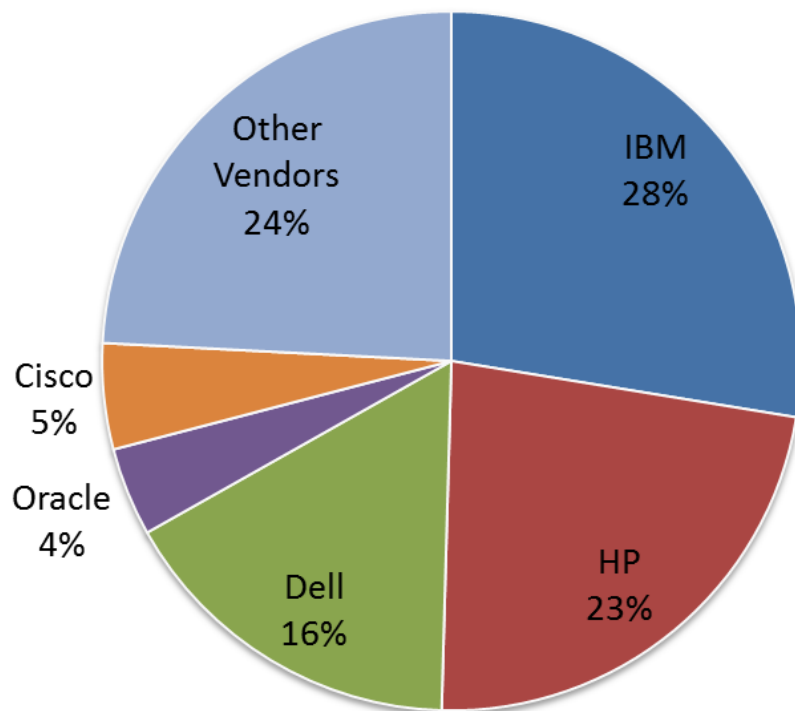


Figure 1 Server market share by revenue (Source: Gartner)

## Gartner server shipment 3Q 2013

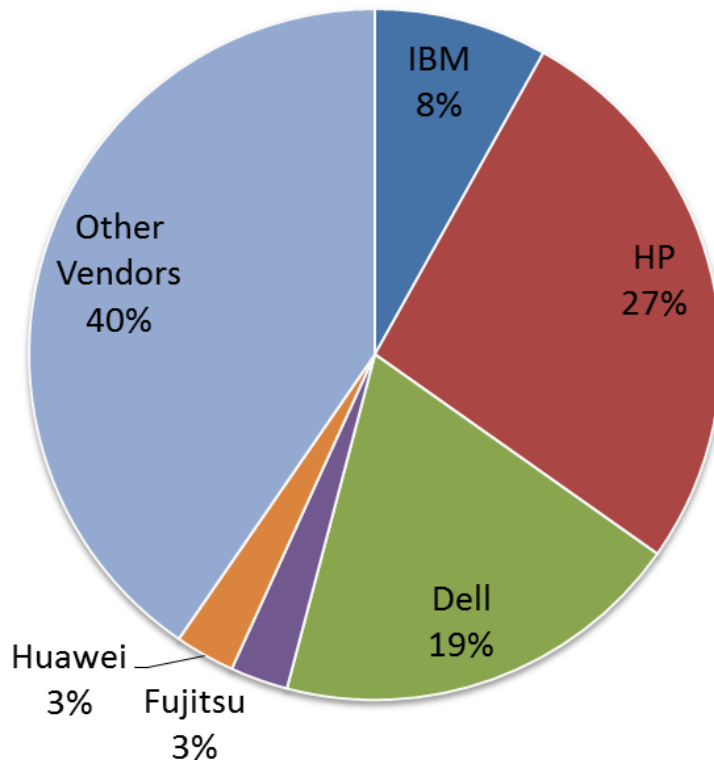


Figure 2 Server market share by sales volume (Source: Gartner)

OEM x86 supply chain HP is the largest manufacturer by volume and also publishes its supplier list<sup>3</sup>. It identifies server final assembly plants in Czech Republic, China, Mexico, Australia and USA. These are all contract manufacturing, meaning that the actual assembly is provided by an ODM/EMS.

The other manufacturers all have a similar structure contracted assembly which is globally distributed. However, some limited in house manufacturing and assembly also occurs in some companies, such as Fujitsu.

Although IBM contracts server manufacture, Lenovo has purchased their volume x86 server business. Based on the success of its PC business model, it is expected that Lenovo will be vertically integrated with design, manufacture and distribution all performed in-house.

## Hyperscale Server Market Supply Chain

For large scale cloud computing, companies have been designing their own servers and contracting manufacturing directly from the ODMs. This is referred to as ODM direct sales. The advantage of this is cost savings as well as enabling purpose built custom designs. In addition, such designs are being open sourced through the Open Compute Project, which means this route may become more accessible for smaller customers otherwise unable to design servers.

Direct sales account for 7.2% of server sales by volume in 3Q 2013<sup>4</sup>. Direct sales contracts sometimes require confidentiality agreements regarding the client and sales volume. As a result the market size is harder to

<sup>3</sup> <http://h20195.www2.hp.com/V2/GetPDF.aspx/co3728062.pdf>

estimate. Reports based on contracts publicly announced and ODM server R&D and design capabilities suggests that Quanta is the largest direct sales ODM and Wiywynn (a subsidiary of Wistron) and Inventec as the next largest.

This market is expected to grow as more cloud providers grow in scale and the ODMs develop greater R&D and customer facing capabilities to serve smaller markets and customers. However, there is mixed information about the rate and scale of growth. While hyperscale has been estimated to occupy 50% of the market by 2014<sup>5</sup>, it is more likely a larger proportion of the server customers, whose core business is not directly related to data centres and IT, will still require additional support, software and services. This means that the x86 OEM server manufacturers, who are increasingly moving to a hardware and services business model will still make up the larger market share.

## Mainframe Market

The mainframe market is less than 0.1% of the total market by volume. It is dominated by IBM. The most significant impact of this market will occur when IBM sells its x86 server business to Lenovo. IBM will retain the mainframes business' high revenue market share, but will lose the high volume market share.

### List of Significant OEMs

- HP
- IBM/Lenovo
- Dell
- Fujitsu
- Oracle
- Cisco
- Huawei
- Inspur Electronics
- Supermicro
- Gigabyte

### List of Significant ODMs

- Hon Hai (Foxconn)
- Quanta
- Inventec
- Wistron/Wiywynn
- Compal
- Synnex Hyve
- MiTAC

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<sup>4</sup> <http://www.businesscloudnews.com/2013/12/16/branded-servers-decline-but-white-box-servers-rise-on-cloud-adoption/>

<sup>5</sup> <https://www.ventureoutsource.com/contract-manufacturing/focus-odm-quanta-it-shift-cloud-infrastructure-leaving-dell-hp-traditional>

## Attachment A - Gartner Worldwide Server Market Data

### Worldwide: Server Vendor Revenue Estimates, 4Q11 - 3Q13 (U.S. Dollars)

Company	4Q11 Revenue	1Q12 Revenue	2Q12 Revenue	3Q12 Revenue	4Q12 Revenue	1Q13 Revenue	2Q13 Revenue	3Q13 Revenue
IBM	4,682,403,526	3,490,477,200	3,496,145,346	3,330,804,391	5,097,759,610	3,016,060,031	156,584,672	3,404,811,159
HP	3,744,672,591	3,455,759,513	3,747,482,751	3,479,454,267	3,620,601,066	2,959,030,197	089,886,031	2,821,114,540
Dell	2,060,795,399	1,857,578,951	1,979,115,827	2,099,469,317	2,084,634,094	2,124,462,397	190,643,700	2,025,411,030
Oracle	735,403,237	739,825,931	772,760,548	592,040,000	603,030,654	538,542,499	716,749,999	500,438,000
Fujitsu	498,052,547	626,721,932			541,010,171	583,238,840		
Cisco			376,320,000	419,900,000			539,172,000	599,300,000
Other Vendor	2,192,866,804	2,273,724,071	2,462,309,786	2,684,112,837	2,673,589,171	2,604,390,348	657,795,360	2,989,616,696
<b>Total</b>	<b>13,914,194,104</b>	<b>12,444,087,599</b>	<b>12,834,134,257</b>	<b>12,605,780,812</b>	<b>14,620,624,767</b>	<b>11,825,724,312</b>	<b>50,831,762</b>	<b>12,340,691,425</b>

### Worldwide: Server Vendor Revenue Estimates, 4Q11 - 3Q13 (% share)

Company	4Q11	1Q12	2Q12	3Q12	4Q12	1Q13	2Q13	3Q13
IBM	33.7	28	27.2	26.4	34.9	25.5	25.6	27.6
HP	26.9	27.8	29.2	27.6	24.8	25	25	22.9
Dell	14.8	14.9	15.4	16.7	14.3	18	17.7	16.4
Oracle	5.3	5.9	6	4.7	4.1	4.6	5.8	4.1
Fujitsu	3.6	5			3.7	4.9		
Cisco			2.9	3.3			4.4	4.9
Other Vendor	15.8	18.3	19.2	21.3	18.3	22	21.5	24.2
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

<b>Worldwide: Server Vendor Shipments Estimates, 4Q11 - 3Q13 (Units)</b>								
<b>Company</b>	<b>4Q11</b>	<b>1Q12</b>	<b>2Q12</b>	<b>3Q12</b>	<b>4Q12</b>	<b>1Q13</b>	<b>2Q13</b>	<b>3Q13</b>
HP	704,853	685,015	678,963	634,793	663,598	580,563	586,857	669,103
Dell	573,125	503,450	541,693	564,475	532,890	516,355	551,000	484,607
IBM	329,232	267,556	228,138	280,424	291,328	230,446	209,833	201,777
Fujitsu	69,918	86,360		76,128	69,853	73,375		68,424
Cisco	44,942	40,498	49,054		63,342	53,873	77,729	
Inspur Electronics			20,960				65,350	
Huawei				23,027				69,573
Other Vendor	783,833	763,205	847,671	879,742	879,711	874,396	969,342	1,012,739
<b>Total</b>	<b>2,505,904</b>	<b>2,346,083</b>	<b>2,366,479</b>	<b>2,458,589</b>	<b>2,500,722</b>	<b>2,329,009</b>	<b>2,460,111</b>	<b>2,506,223</b>

<b>Worldwide: Server Vendor Shipments Estimates, 4Q11 - 3Q13 (% Share)</b>								
	<b>4Q11</b>	<b>1Q12</b>	<b>2Q12</b>	<b>3Q12</b>	<b>4Q12</b>	<b>1Q13</b>	<b>2Q13</b>	<b>3Q13</b>
HP	28.1	29.2	28.7	25.8	26.5	24.9	23.9	26.7
Dell	22.9	21.5	22.9	23	21.3	22.2	22.4	19.3
IBM	13.1	11.4	9.6	11.4	11.6	9.9	8.5	8.1
Fujitsu	2.8	3.7		3.1	2.8	3.2		2.7
Cisco	1.8	1.7	2.1		2.5	2.3	3.2	
Inspur Electronics			0.9				2.7	
Huawei				0.9				2.8
Other Vendor	31.3	32.5	35.8	35.8	35.2	37.5	39.4	40.4
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>



## Attachment B - General Overview of Supply Chain Tiers

