GVP HSG Pages

MP3 16 kbps Bit Rate with Encryption

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We tested the MP3 16 kbps bit rate with encryption, using the dest2 physical server and Vitual Machine (VM) environments, which compares with results of non-encryption from MP3 16 kbps Bit Rate without Encryption. The OS remained Windows 2008 R2 x64.

Physical Server on Single Hex Core

These tests were performed on Hardware Profile 1: a physical server on a single hex core of Dell R410. The three graphs below compare system CPU usage and audio quality-related metrics, max jitter and max delta.

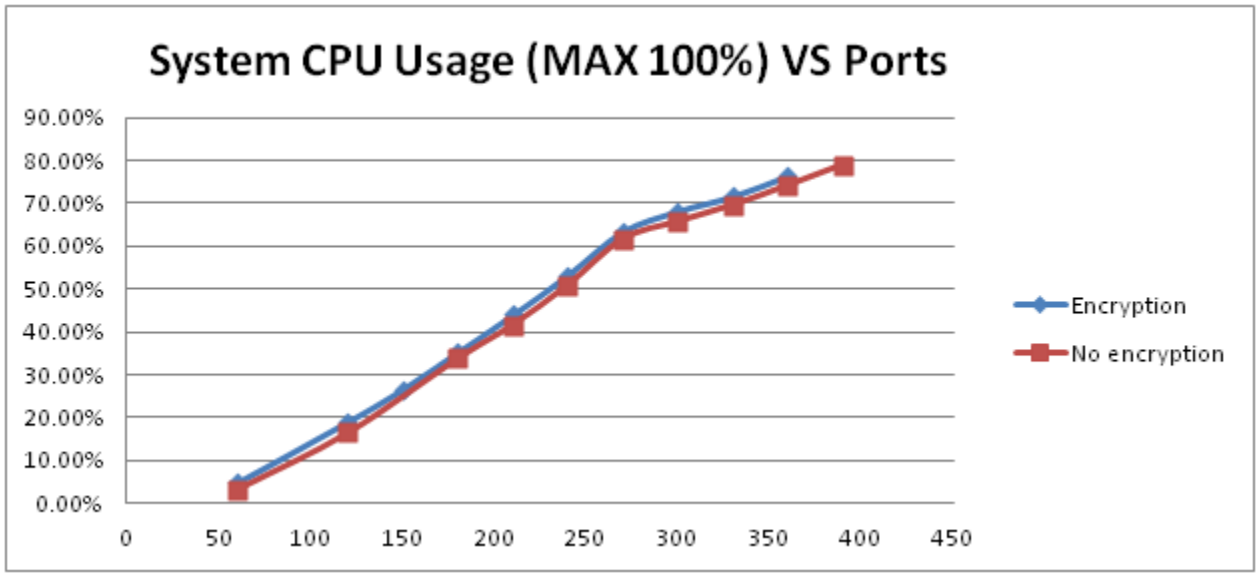

Figure 57: Comparison of Physical Server System CPU Usage of MP3 16kbps encryption vs non-encryption

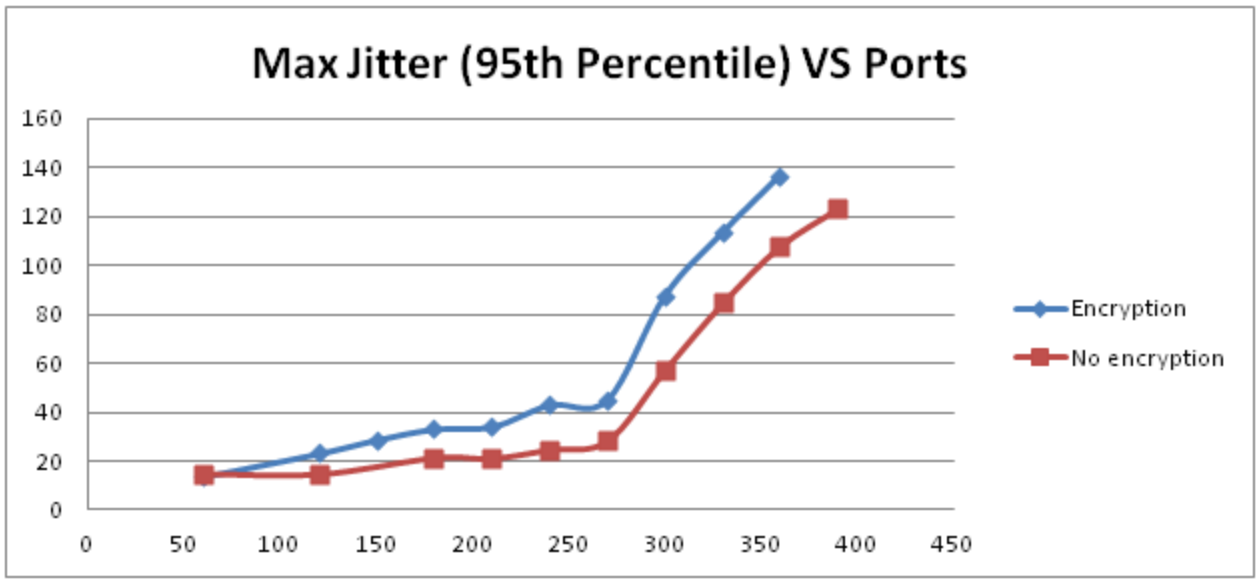

Figure 58: Comparison of Physical Server Max Jitter of MP3 16kbps encryption vs non-encryption

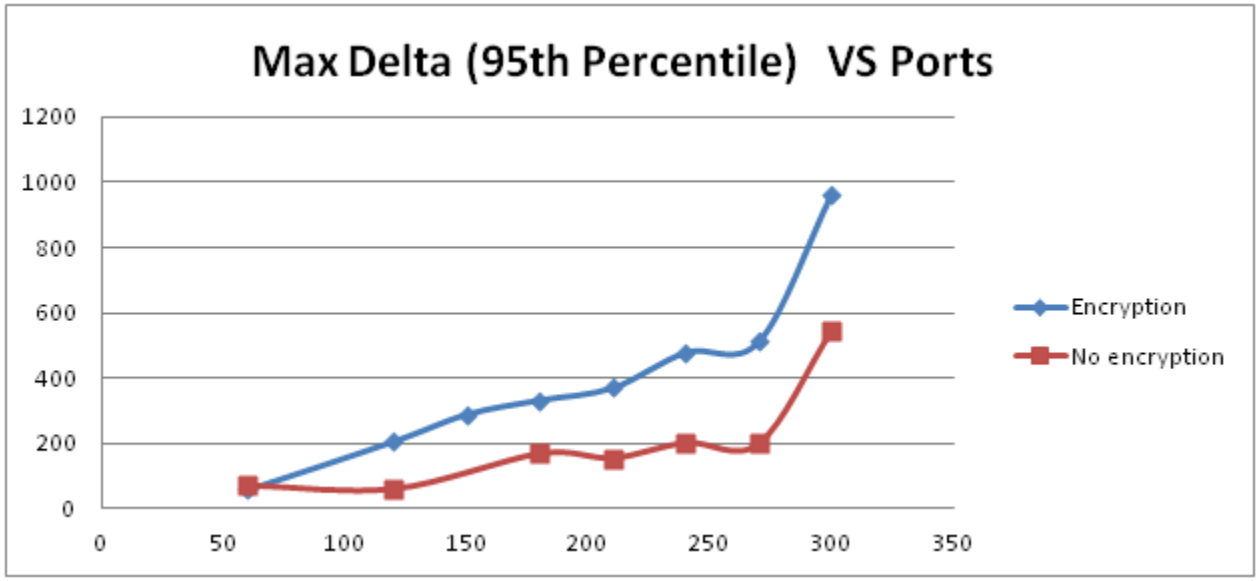

Figure 59: Comparison of Physical Server Max Delta of MP3 16kbps encryption vs non-encryption

In the graphs above, encryption consumes slightly higher system CPU than does non-encryption. Max Jitter and Max Delta consume much more CPU with encryption, than without. If a slightly higher delay due to latency introduced by encryption is acceptable, then recommended and preferred port capacity would be 210 ports—only a 12.5% reduction from the peak capacity of 240 ports offered by non-encryption. If the audio quality strictly applies, then the recommended port capacity can be as low as 120 ports. Peak port capacity could be the same 270 ports as non-encryption, if the delay is acceptable.

The table below lists system disk IOPS:

Figure 60: IOPS on physical server of single hex core, MP3 only, 16 Kbps, encryption

Ports	Physical Server Disk IOPS		
Total	Reads	Writes	
60	14.66	0.036	14.62
120	24.00	0.041	23.95
180	33.42	0.029	33.39
210	37.65	0.030	37.62
240	42.21	0.029	42.18
270	47.18	0.036	47.14
300	51.44	0.011	51.43
330	55.81	0.006	55.81
360	60.99	0.002	60.99
390	67.12	0.003	67.11

The graph below compares system disk IOPS on a physical server IOPS with non-encryption:

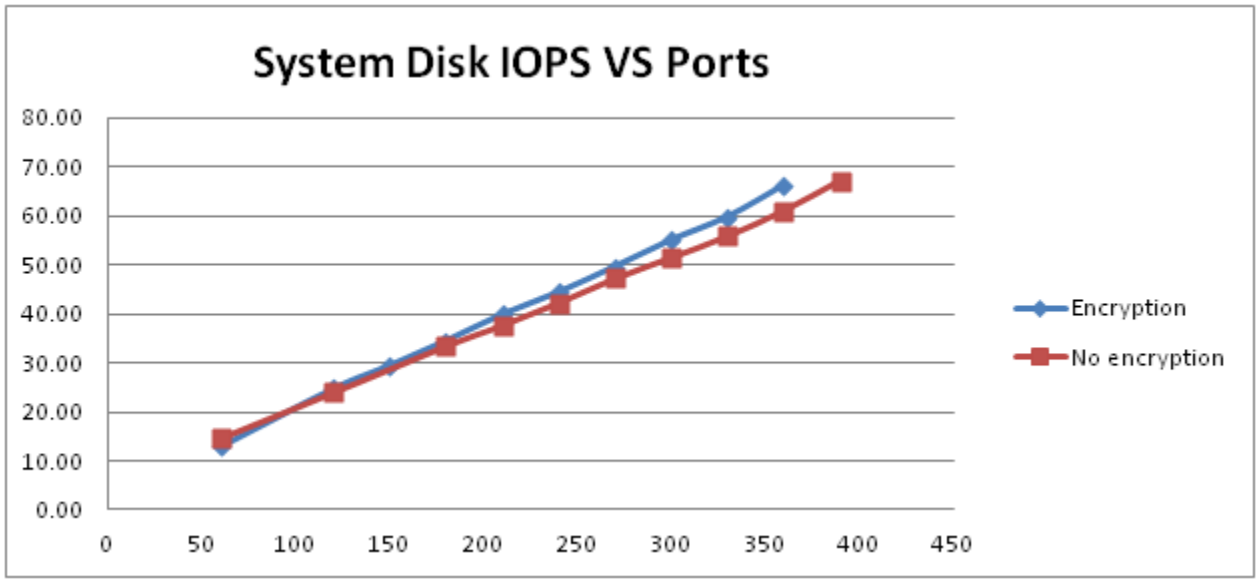

Figure 61: Comparison of System Disk IOPS on Single Hex Core Physical Server, MP3 16kbps encryption vs non-encryption

System disk IOPS is nearly the same for encryption and non-encryption; both increase slightly at a higher port capacity. Some of that can be attributed by other disk IO operations, such as encryption key files.

The table below lists MCP IOPS:

Figure 62: MCP IOPS on physical server of single hex core, MP3 only, 16 Kbps, encryption

Ports	Physical Server MCP IOPS		
Total	Reads	Writes	
60	16.53	8.88	7.65
120	32.59	17.69	14.91
150	40.40	21.96	18.44
180	48.46	26.46	22.01
210	56.35	30.83	25.52
240	64.32	35.24	29.08
270	72.28	39.64	32.64
300	80.06	43.95	36.11
330	88.61	48.53	40.07
360	100.48	52.91	47.57

The graph below compares total MCP IOPS between encryption and non-encryption:

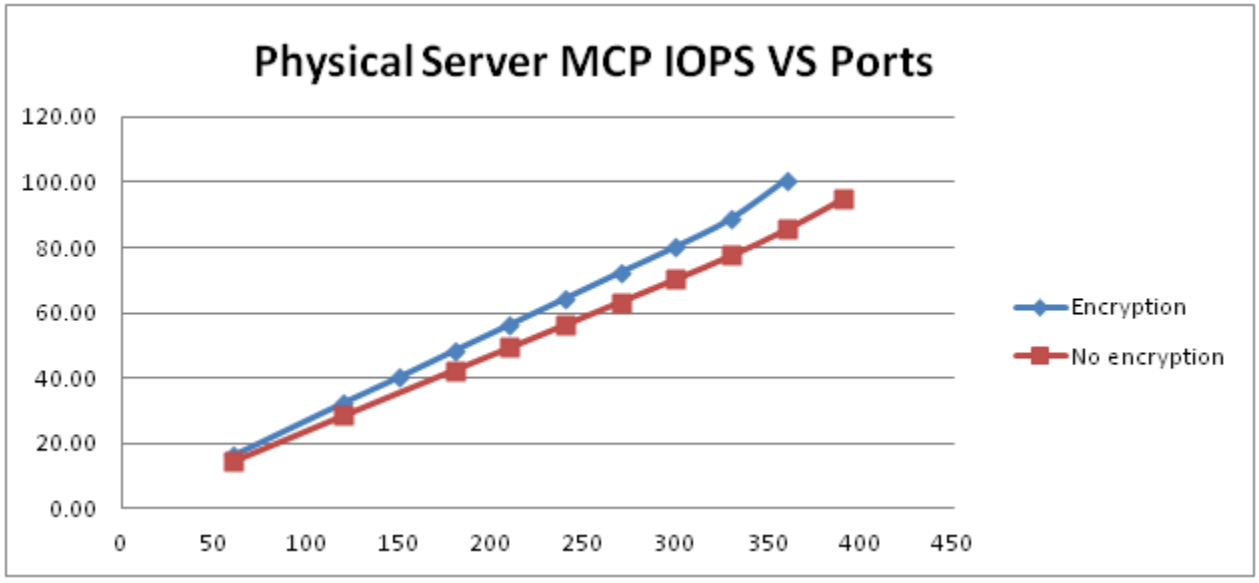

Figure 63: MCP IOPS on Single Hex Core Physical Server, MP3 16Kbps encryption vs non-encryption

MCP IOPS for encryption increases when port capacity increases. As seen in Figure: Comparison of System Disk IOPS on Single Hex Core Physical Server, MP3 16kbps encryption vs non-encryption, increase for disk IOPS is much smaller for encryption, so here the increase should be attributed to network IOs.

VMs on Dual Hex Cores Server

The testing for MP3 16kbps with encryption was conducted on the VM Profile 4 based on Hardware Profile 4 of a dual hex cores server, same as non-encryption in the 16knps tests VMs on Dual Hex Cores Server. Six VMs were configured while only one MCP was installed on each Windows VM. Below

are three graphs comparing overall CPU usage, audio quality related max jitter and max delta for MP3 16kbps encryption vs non-encryption:

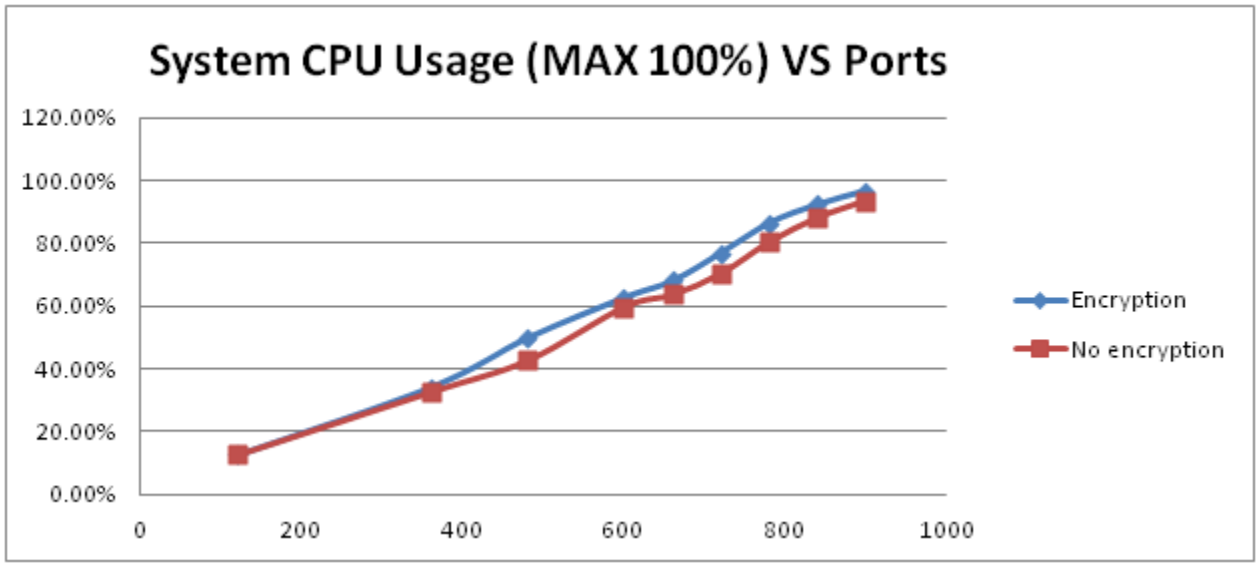

Figure 64: Comparison of Overall VMs CPU Usage of MP3 16kbps encryption vs non-encryption

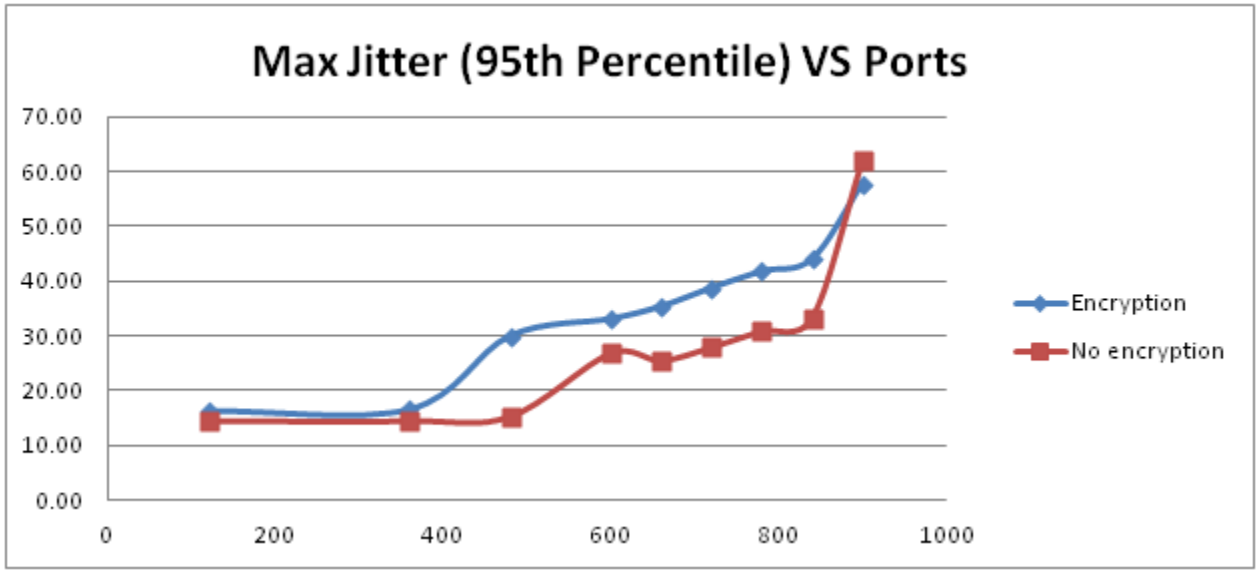

Figure 65: Comparison of Overall VMs Max Jitter of MP3 16kbps encryption vs non-encryption

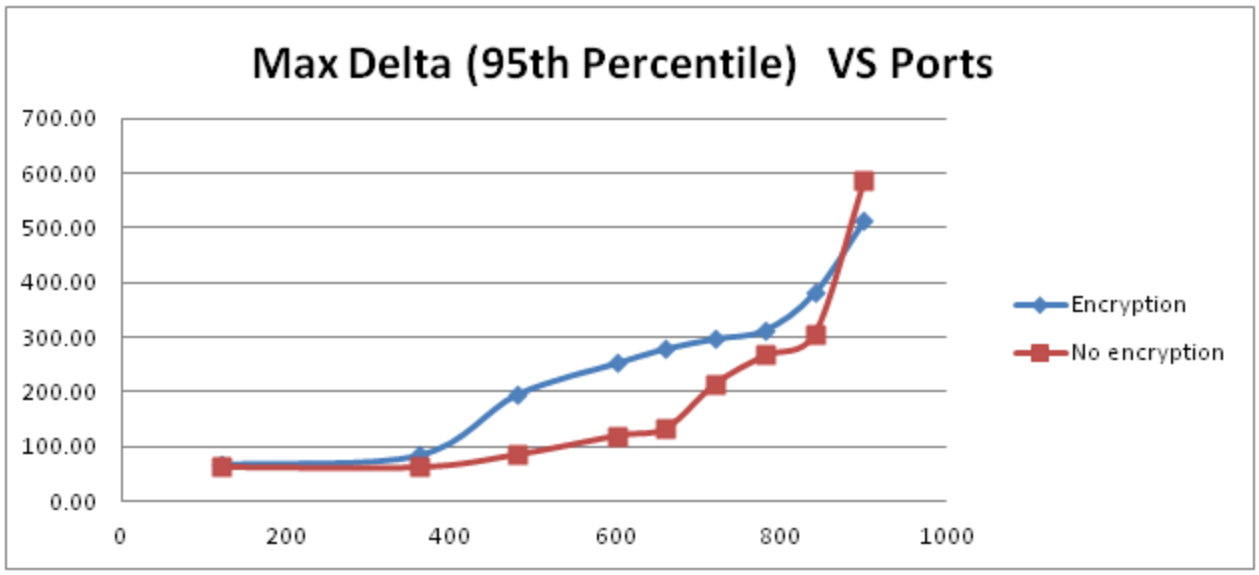

Figure 66: Comparison of Overall VMs Max Delta of MP3 16kbps encryption vs non-encryption

The VM environment exhibits a similar trend: slightly overall CPU usage for the encryption profile, and much higher for max jitter and max delta. Applying the same criteria from the physical server results, if a slightly higher delay (due to latency introduced by encryption) is acceptable, then the recommended and preferred port capacity could be 600 ports—only a 16.7% reduction of the peak 720 ports with non-encryption. If audio quality strictly applies, the recommended ports can be as low as 480 ports. And if some delay is acceptable, then the peak port capacity can be the same 840 ports as non-encryption.

The overall system disk IOPS for all 6 VMs is listed below:

Figure 67: Overall Disk IOPS on all 6 VMs of dual hex cores, MP3 only, 16 Kbps, encryption

Ports	Overall 6 VMs Disk IOPS			SSD Drive Disk IOPS		
Total	Reads	Writes	Total	Reads	Writes	
120	28.70	0.004	28.69	21.881	0.000	21.881
360	67.46	0.004	67.46	56.238	0.000	56.238
480	87.56	0.026	87.54	74.903	0.000	74.903
600	108.01	0.015	107.99	93.647	0.000	93.647
660	119.49	0.005	119.48	104.304	0.000	104.304
720	128.76	0.020	128.74	114.441	0.000	114.441
780	137.68	0.015	137.66	123.210	0.002	123.209
840	146.99	0.009	146.98	132.646	0.002	132.644
900	154.68	0.025	154.66	140.145	0.002	140.143

The graph below compares system disk IOPS with encryption and with non-encryption, on the same VM environment:

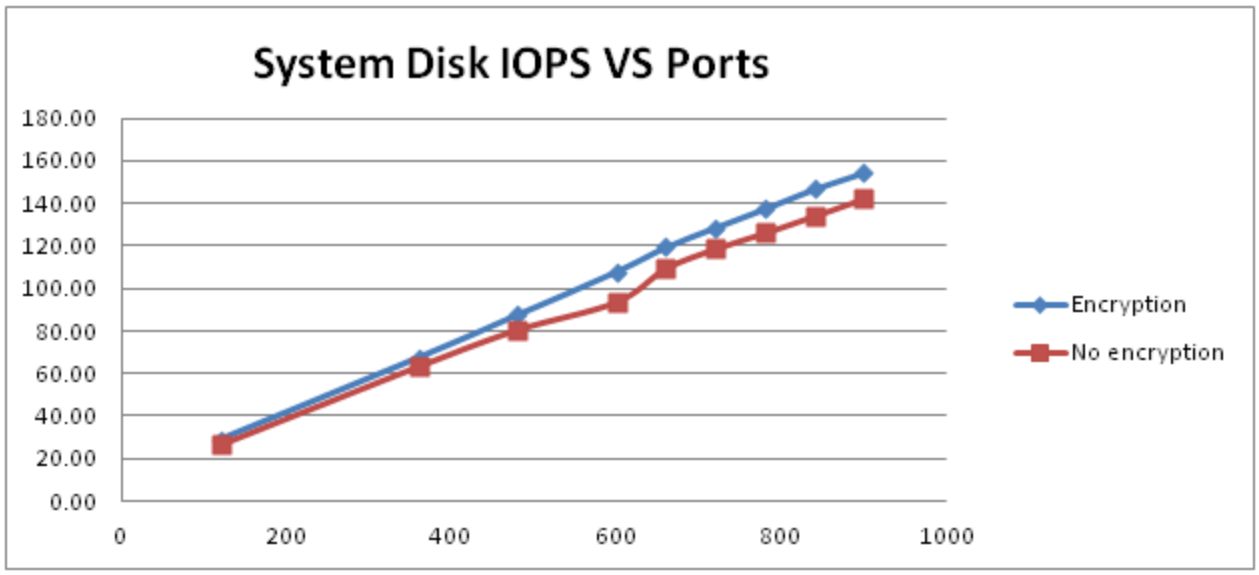

Figure 68: Comparison of Overall 6 VMs Disk IOPS MP3 16 kbps encryption vs non-encryption

As with the physical server tests, encryption increases as port capacity increases. Also as with the physical server tests, some of that can be attributed to extra disk IO operations.

The table below lists Data throughputs for encryption:

Figure 69: Data Throughputs for MP3 only, 16 kbps, encryption

Ports	Overall Disk KB/sec			SSD Drive Disk KB/sec		
Total	Reads	Writes	Total	Reads	Writes	
120	387.99	0.02	387.97	304.229	0.000	304.229
360	1096.82	22.54	1074.28	876.599	0.000	876.599
480	1344.60	107.95	1236.65	1191.403	0.006	1191.397
600	2187.50	348.40	1839.09	1532.171	0.000	1532.171
660	2024.16	35.09	1989.07	1652.232	0.000	1652.232
720	1955.33	99.81	1855.51	1803.207	0.006	1803.201
780	2572.79	205.15	2367.64	1982.733	0.024	1982.709
840	2534.97	28.65	2506.32	2097.871	0.043	2097.829
900	2851.85	119.47	2732.38	2297.264	0.007	2297.257

Using Formula 1...

```
MP3 bitrate * Ports / 8 = KB/sec
Or 16kbps * Ports / 8 =KB/sec if MP3 is 16kbps
```

...take two samples (120 & 720) from the above table above, and apply them to Formula 1:

```
16 kpbs * 120 / 8 = 240 kb close to 304 in the table (in SSD)
```

```
16 kpbs * 720 / 8 = 14400 kb close to 1803 in the table (in SSD)
```

The measurements from real testing for MP3 16kbps encryption are slightly higher than these calculations predict, due to other file, such as metadata and JSON files, being saved on the same cache folder.

The graph below compares overall data throughputs with no encryption:

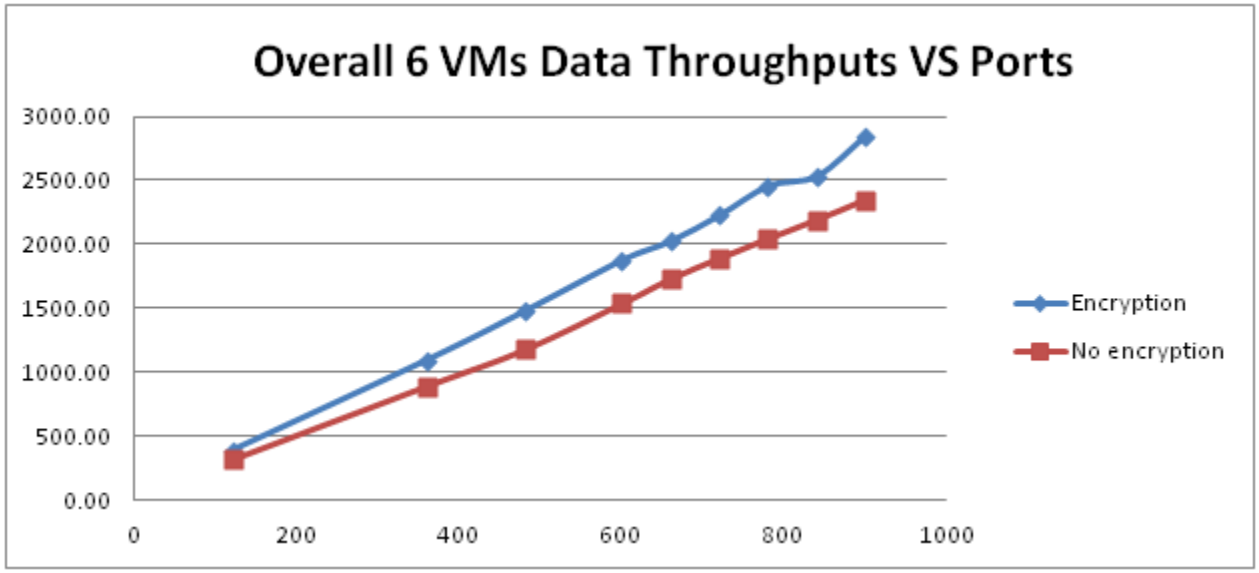

Figure 70: Comparison of Overall 6 VMs Data Throughputs MP3 16 kbps encryption vs non-encryption

The data throughputs for encryption increase slightly when port capacity increases, matching a similar trend with system disk IOPS.

The table below lists overall MCP IOPS from all 6 VMs:

Figure 71: Overall MCP IOPS from 6 VMs of dual hex core, MP3 only, 16kbps, encryption

Ports	Overall 6 VMs MCP IOPS		
Total	Reads	Writes	
120	34.874	17.638	17.236
360	102.624	52.900	49.724
480	130.285	70.377	59.909
600	168.849	87.766	81.083
660	186.175	96.882	89.293
720	193.248	105.171	88.077
780	219.395	114.398	104.997
840	235.730	123.009	112.720
900	252.198	131.682	120.516

The graph below compares performance of the same configuration, except with non-encryption:

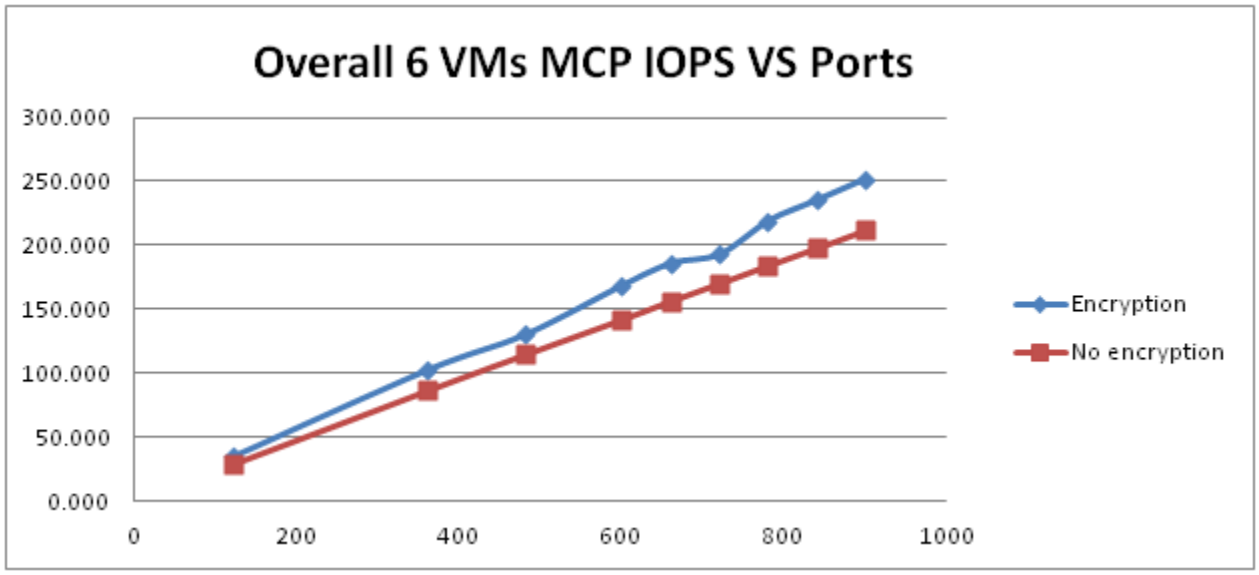

Figure 72: MCP IOPS from 6 VMs of dual hex core, MP3 only, 16kbps, encryption vs non-encryption

MCP IOPS performance is affected slightly by encryption, similar to the trend expressed in the physical server results.