SSD in Enterprise Storage

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SAMSUNG

Samsung Storage...at the speed of imagination

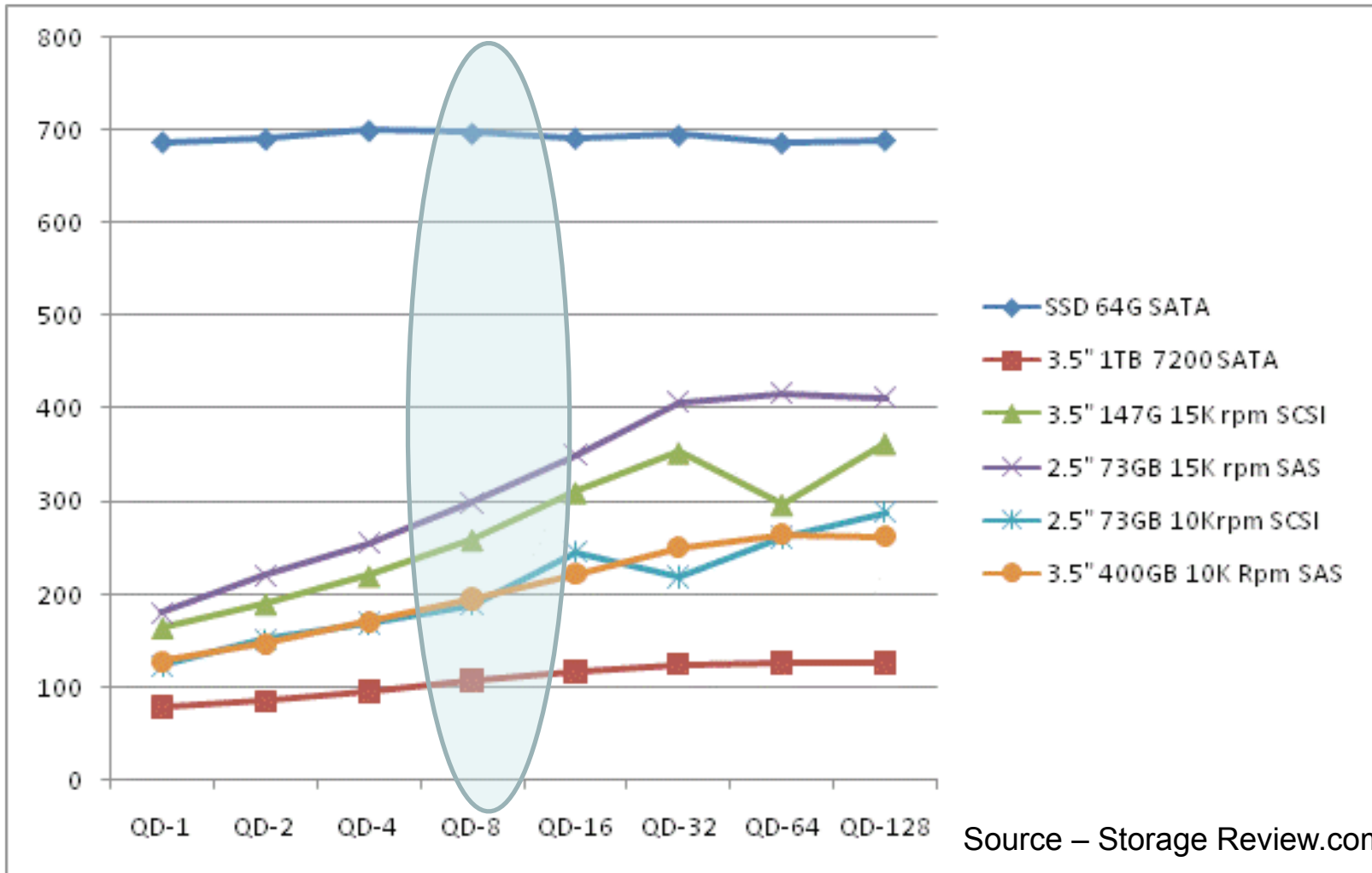# New Dynamics in the Storage World A.k.a. – What problem are we trying to solve?

Creating Content – Finding/Storing Content – Buying/Consuming Content
What Matters ? … BOTH Storage _Performance_ and Storage _Capacity_

SAMSUNG

Samsung Storage…at the speed of imagination
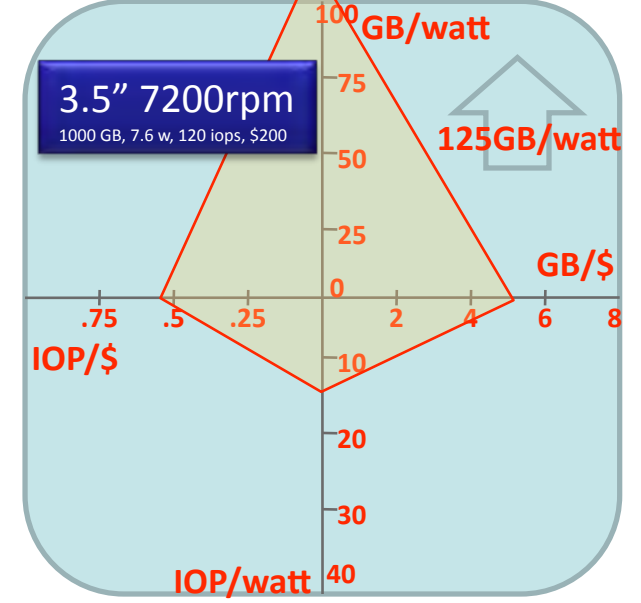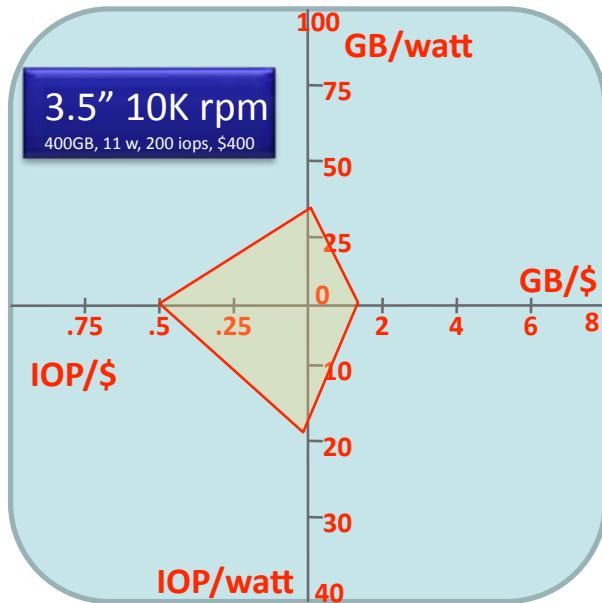
Storage Performance (IOmeter FileSerever)
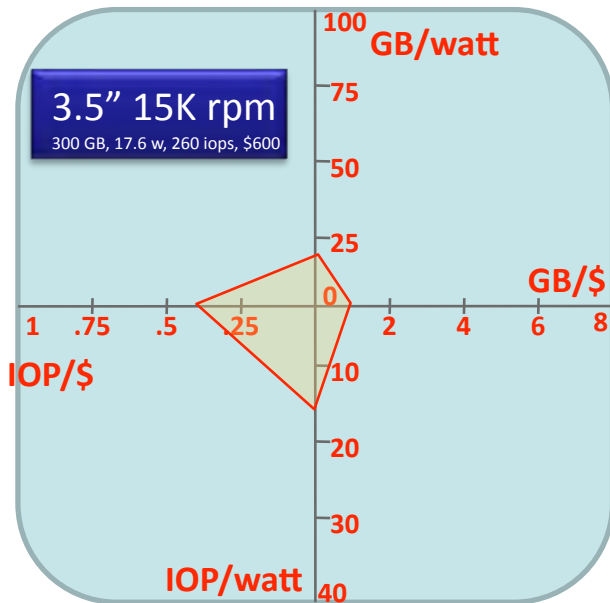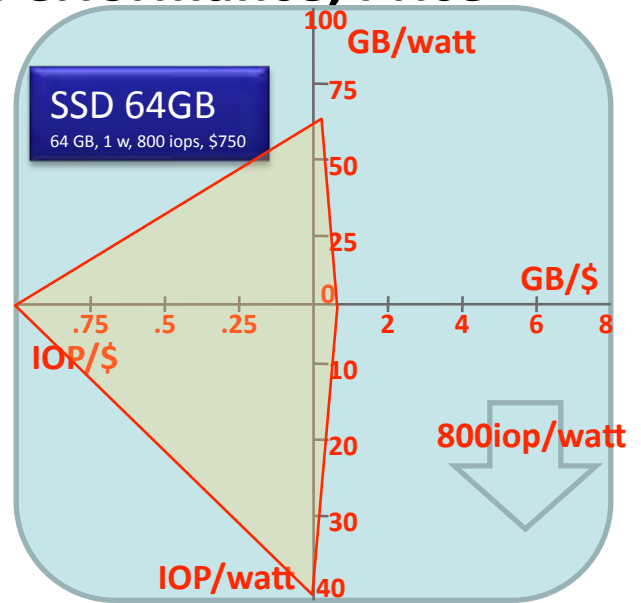

Source – Storage Review.com

Clear, real-world Storage Performance
Our customers deserve clarity

SAMSUNG   *Samsung Storage...at the speed of imagination*

Squeeze the Balloon – Capacity, Power, Performance, Price

2.5" 15K rpm
76 GB, 8 w, 275 iops, $400

2.5" 10K rpm
146 GB, 9 w, 200 iops, $220

SSD 64GB
64 GB, 1 w, 800 iops, $750

800iop/watt

3.5" 15K rpm
300 GB, 17.6 w, 260 iops, $600

3.5" 10K rpm
400GB, 11 w, 200 iops, $400

3.5" 7200rpm
1000 GB, 7.6 w, 120 iops, $200

125GB/watt

GB/watt · GB/$ · IOP/$ · IOP/watt

Samsung Storage...at the speed of imagination

Enterprise Storage: IOP/$ and GB/$

IO/$

800iops/$750

SSD (64G)

64GB/$750

320iops/$350

280iops/$300

220iops/$250

3.5" 15Krpm

2.5" 10Krpm

3.5" 10K

400GB/$250

380iops/$420

300GB/$350

144GB/$300

2.5" 15Krpm

144GB/$420

120iops/$200

3.5" 7200 rpm (1TB)

1000GB/$200

GB/$

Enterprise Storage: IOP/watt and GB/watt

800iops/1 watt

SSD

64GB/1 watt

380iops/7watts

2.5" 15Krpm

144GB/7watts

IO/Watt

280iops/6 watts

320iops/16watts

2.5" 10K rpm

3.5" 15K rpm

450GB/6watts

300GB/16watts

220iops/11watts

120iops/8watts

3.5" 10K rpm

3.5" 7200rpm (1TB)

600/11

1000GB/8watts

GB/Watt
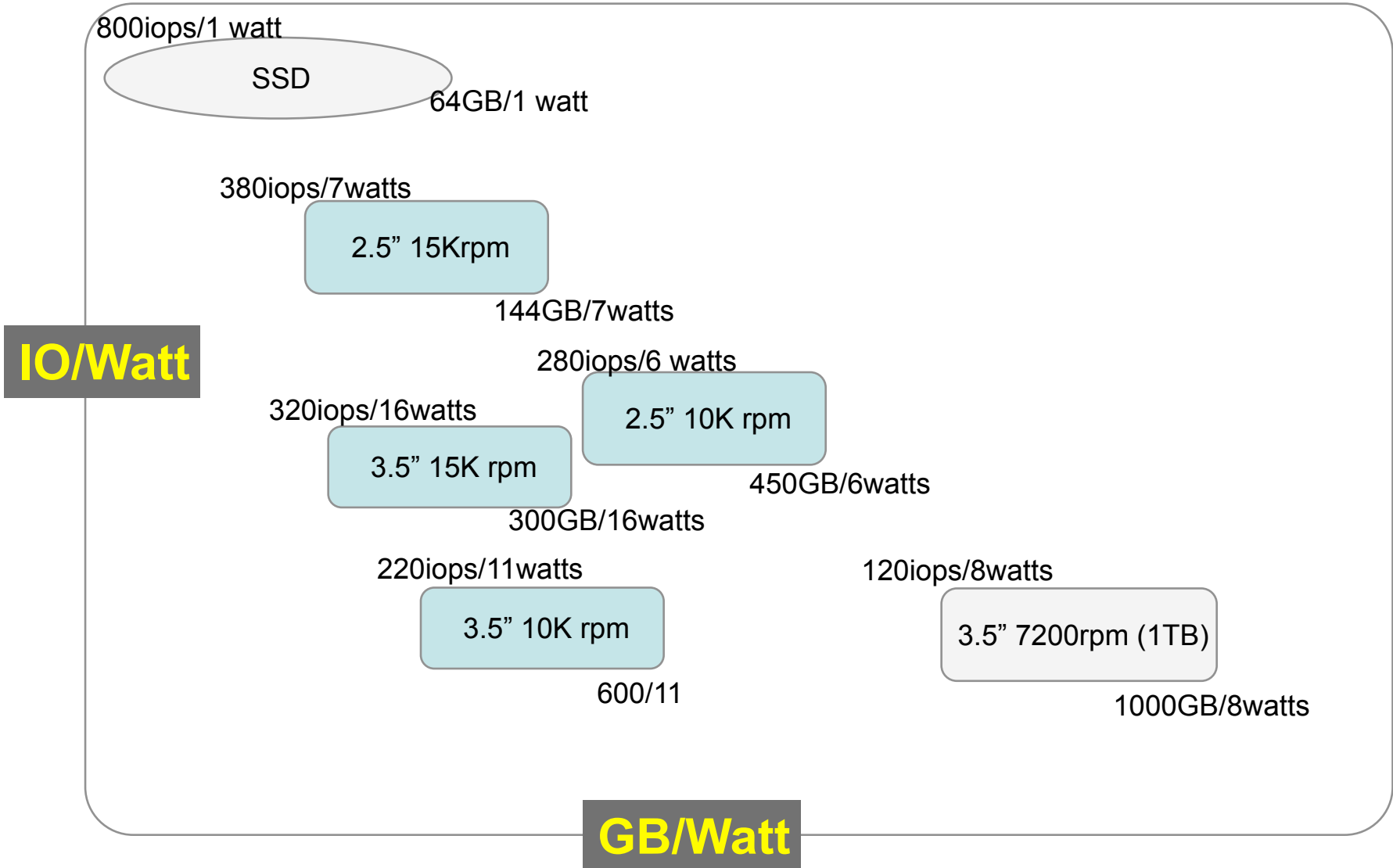
Case Study

- Internet Service Provider - medical office software (real)

- Workload is mostly database – scheduling, billing, insurance claim processing. Very limited scanned documents

- 3,000 to 5,000 simultaneous users

- Capacity: **8.6 TB** - 60 drives – 15,000 rpm

- Storage Performance: **12,000** IOPs at typical Queue depth of 8

15K rpm (PO)		
IOP/watt	15.1	bad
IOP/$	0.29	bad
GB/watt	8.7	bad
GB/$	0.16	bad

TCO		
initial cost $	52,257	bad
power $	4,892.43	bad

SSD (PO)		
IOP/watt	376.0	very good indeed
IOP/$	1.00	very good indeed
GB/watt	38.5	good
GB/$	0.10	bad

TCO		
initial cost $	83,984	not so good
power $	1,100.80	good

SSD + 7200 1TB (PO + CO)		
IOP/watt	28.4	good, 2x 15Krpm
IOP/$	0.31	OK, same as 15Krpm
GB/watt	83.5	very good indeed
GB/$	0.91	very good indeed

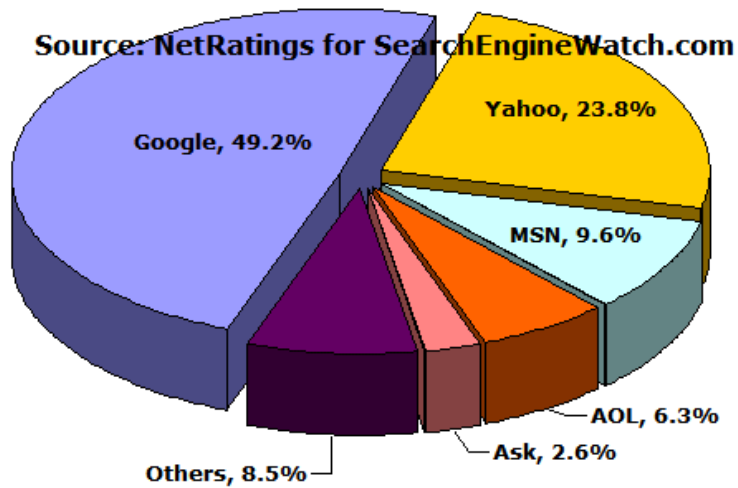| TCO		
initial cost $	38,824	good
power $	2,081.72	good

(PO) = Performance Optimized
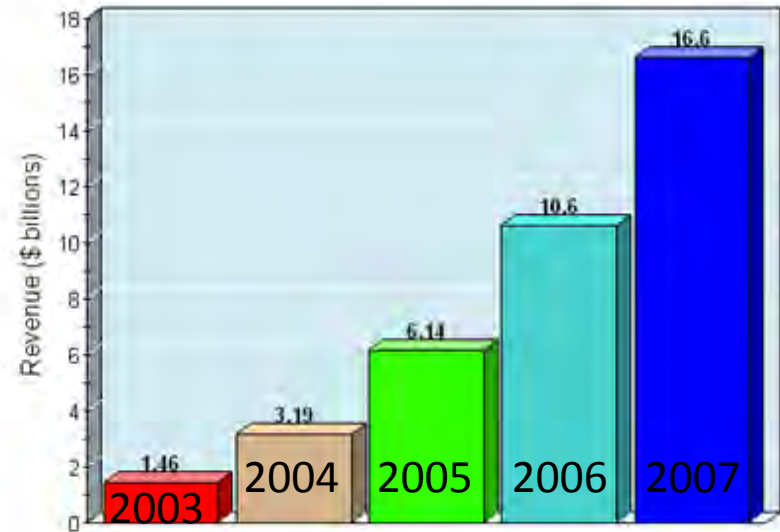(CO) = Capacity Optimized

Conclusion

- Enterprise SSD Drivers –
  - User experience – business need to capture users (ad based), good user experience drives market share
  - Economics – the business need to deliver affordable performance <u>and</u> affordable capacity <u>and</u> low power

- Enterprise SSD Enablers –
  - PO/CO – performance optimized and capacity optimized storage with logic or processes to manage the hot data and cold data
  - SATA Enterprise adoption was the dress rehearsal for SSD adoption

- Call to action –
  - Be good to our customers through consistent use of KPC: IOP/$, IOP/watt, GB/$, GB/watt and simpler storage performance

SSD adoption drivers – User Experience, Economics and PO/CO
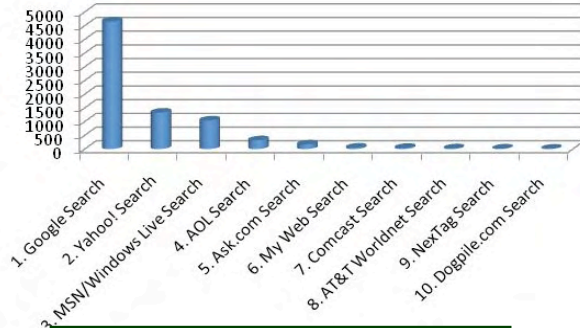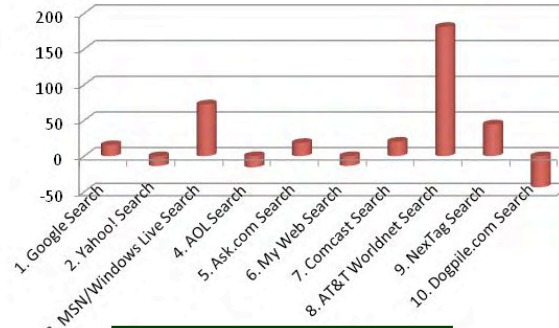**SSD(PO) adoption requires a bookend: 1TB 7200rpm (CO)**

Web Advert Market

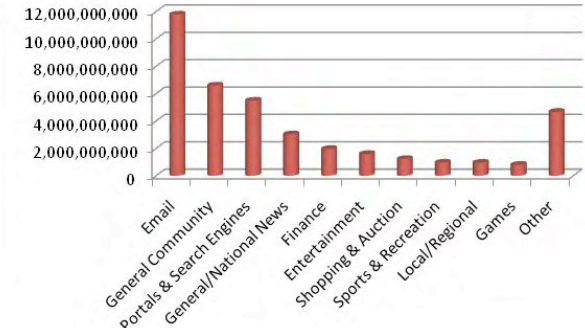Google Sales Revenue - $16.6B in 2007

Source: NetRatings for SearchEngineWatch.com

Google, 49.2%

Yahoo, 23.8%

MSN, 9.6%

AOL, 6.3%

Ask, 2.6%

Others, 8.5%

Revenue ($ billions)

18
16.6
16
14
12
10.6
10
8
6.14
6
4
3.19
2
1.46
0
2003   2004   2005   2006   2007

Source – Google annual report 2007

5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0

1. Google Search
2. Yahoo! Search
3. MSN/Windows Live Search
4. AOL Search
5. Ask.com Search
6. My Web Search
7. Comcast Search
8. AT&T Worldnet Search
9. NexTag Search
10. Dogpile.com Search

Search MSS (000,000 per month)

200
150
100
50
0
-50

1. Google Search
2. Yahoo! Search
3. MSN/Windows Live Search
4. AOL Search
5. Ask.com Search
6. My Web Search
7. Comcast Search
8. AT&T Worldnet Search
9. NexTag Search
10. Dogpile.com Search

Search MSS Growth (%)

Neilsen On-Line ad relevance June23-Jun29 2008

12,000,000,000
10,000,000,000
8,000,000,000
6,000,000,000
4,000,000,000
2,000,000,000
0

Email
General Community
Portals & Search Engines
General/National News
Finance
Entertainment
Shopping & Auction
Sports & Recreation
Local/Regional
Games
Other

Ad Imprints per week (39B)