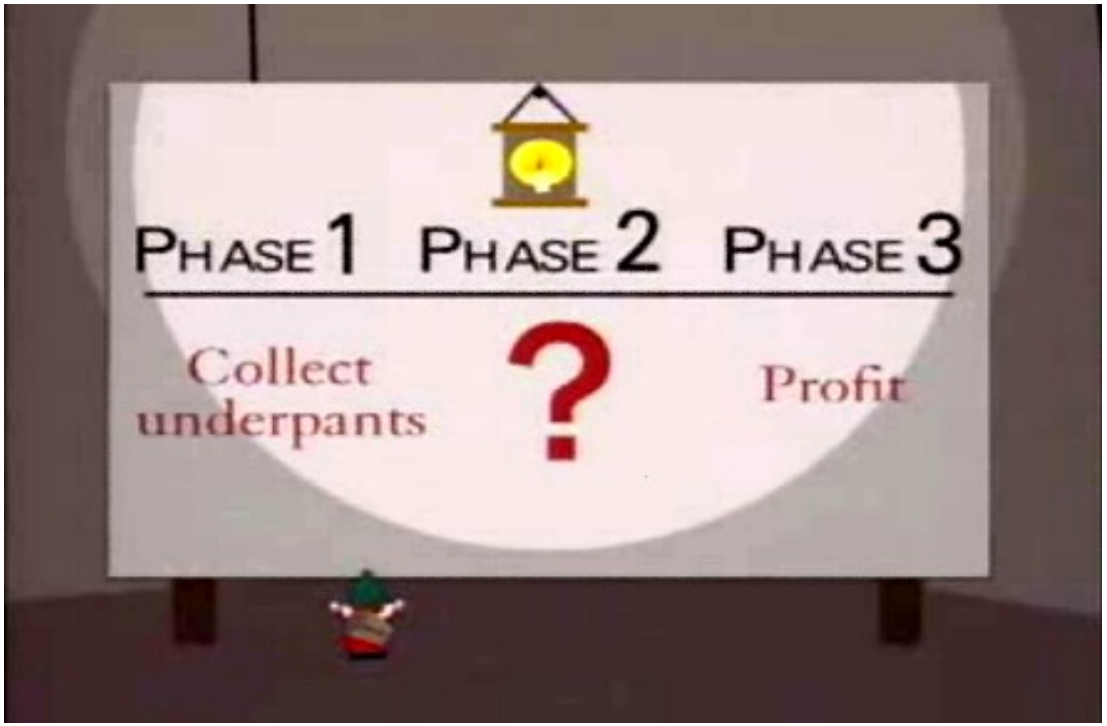
Re-architecting for the 'green' cloud and lower costs ***Justin Cormack***

1. build a cloud from lots of ~~underpants~~ mobile phone CPUs

2. ?

3. Profit



What would change the status quo?

Slower processors more power efficient

But require many more of them

Much more parallelism, hard

Some numbers

	RAM	power	cost	SHA1 speed
dual core 1GHz ARM	1 GB	4 W	$50	120 MB/s
dual core Pentium	8 GB	40 W	$500	720 MB/s
12 core Xeon	64 GB	400 W	$5000	3000 MB/s

Almost linear performance, not compelling. Amdahl's Law.

RAM based world

The applications we are building are very RAM hungry.

RAM based data storage: Memcache, Redis, Membase, VoltDB, Gigaspaces, TimesTen ...

EC2 offers 68GB high memory instances. Intel releasing machines that can take 1TB RAM.

ARM servers are 32 bit. 4GB is enough for anybody?

Why are we so RAM obsessed?

Reads per second

L1 cache reference	2,000,000,000
Branch mispredict	200,000,000
L2 cache reference	140,000,000
Mutex lock/unlock	10,000,000
RAM reference	10,000,000
datacentre round trip	2000
hard drive seek	100
Intercontinental round trip	10

Hold on, something happened...

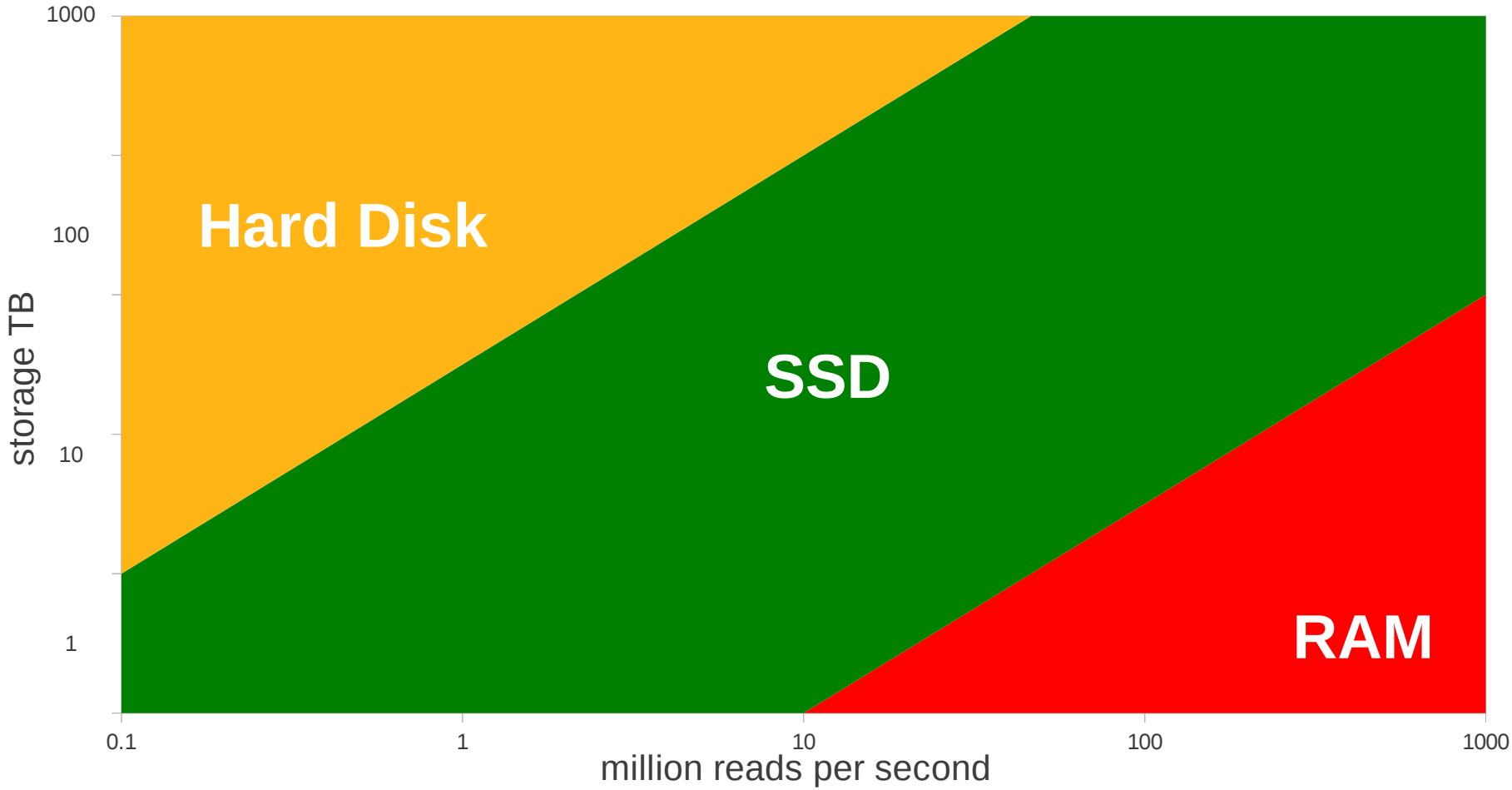
Reads per second

L1 cache reference	2,000,000,000
Branch mispredict	200,000,000
L2 cache reference	140,000,000
Mutex lock/unlock	10,000,000
RAM reference	10,000,000
SLC flash SSD, PCIe	180,000
MLC flash SSD, SATA	35,000
datacentre round trip	2000
hard drive seek	100
Intercontinental round trip	10

Marriage made in heaven?

RAM	$75 / GB	250 W / TB
SSD	$2 / GB	2 W / TB

Cheapest Space / Transactions



Which workloads?

- Middle ground of performance
- Read dominated
- Up to 1k requests per second per CPU
- Medium latency 10–100ms per request

eg web serving SAAS, 1GB data per customer

12 core xeon	64 GB RAM	$5,000	64 customers	$78 each	400 W
2 core ARM	512 GB SSD	$1,000	512 customers	$2 each	4 W

Business case for low power cloud?

- Not just more slower processors
- Not a replacement for all workloads
- low cost commodity middle ground
- Use SSD not RAM or hard drive
- Needs optimised software

Upside is potentially 10-100x cheaper

Questions?

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