It’s all about the money, money, money…

ISC 2017

21 June 2017

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Who are we?

Why do we feel qualified to talk about this?

- Founded in 2004, Red Oak has a substantial customer base in government, industry, research and academia
  - Combined HPC industry experience in excess of 80 yrs
- Red Oak Consulting are uniquely placed in the sector as the only pure play, client side HPC consulting organisation in the UK
- Worked on 30+ HPC installations in last 10 years
  - Ranging from $100k to $100m (incl. Top 500)

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What do we do?

Advise on all aspects of the HPC lifecycle

- Some of the services we provide:
  - Strategic and business analysis
  - Change and programme management
  - Targeted technical advice and solutions
  - Benchmarking, system integration and tuning
  - Procurement support through to system acceptance
  - Highly experienced HPC project management
  - Business case creation and benefits realisation
  - Service transition and decommissioning
- HPC and its application are Red Oak's core expertise

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Why are we here?

Not just AWS Certified Consulting Partners

- Red Oak is the ***only*** decision support HPC consultancy working with AWS in the UK
- A business built on knowledge, loyalty, and reputation with outstanding longevity in our customer relationships and partnerships
- Red Oak recognises that conventional on-premise HPC deployment are not necessarily a panacea

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HPC: Why bother?

Only one answer

- Because it provides value

Alternative, slightly better answer

- Because it provides *more* value *than it costs*

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Where is your HPC tomorrow?

The traditional answer …

- The same place as it was yesterday
- "IT is a truth universally acknowledged …"
  - That an organisation in possession of a large fortune must be in want of an on premise HPC system appologies to Austen
- Until recently it's certainly been difficult to challenge this accepted truth
  - Though certain classes of problem (esp capacity vs capability etc.) have mapped well onto public cloud
- However there are lots of confounding factors

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Where is your HPC tomorrow?

The “heretical” answer …

- In a public cloud environment such as AWS
- So can we can build a model that allows us to challenge the accepted orthodoxies of HPC and the Cloud Computing
  - Caveat: Assuming workflow which perform well on AWS
- **Observation**: Traditional TCO models do not account for the future
  - When this is factored into TCO models, the answers become … interesting

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Where is your HPC tomorrow?

The caveat

- Measuring ‘value’ is a complex topic with many different treatments available
- We’ll show in the next few slides that the ‘value for money’ argument isn’t always as clear cut as perhaps the traditional view suggests
- In particular, allowing for Moore’s Law and using Internal Rate of Return (IRR) models, public cloud starts to look more competitive with traditional HPC on a cost basis

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HPC exceptionalism

Where IT gets interesting

- HPC is special
- Pace of technological change is (very) high
- Performance of hardware increases rapidly and exponentially over time – “Moore’s Law”
  - Not just gate density and historical Dennard scaling
  - Also improvements in the peripheral areas such as networking, storage, memory, manufacturing, …
  - There are more innovative and disruptive technologies coming now than for a number of years …

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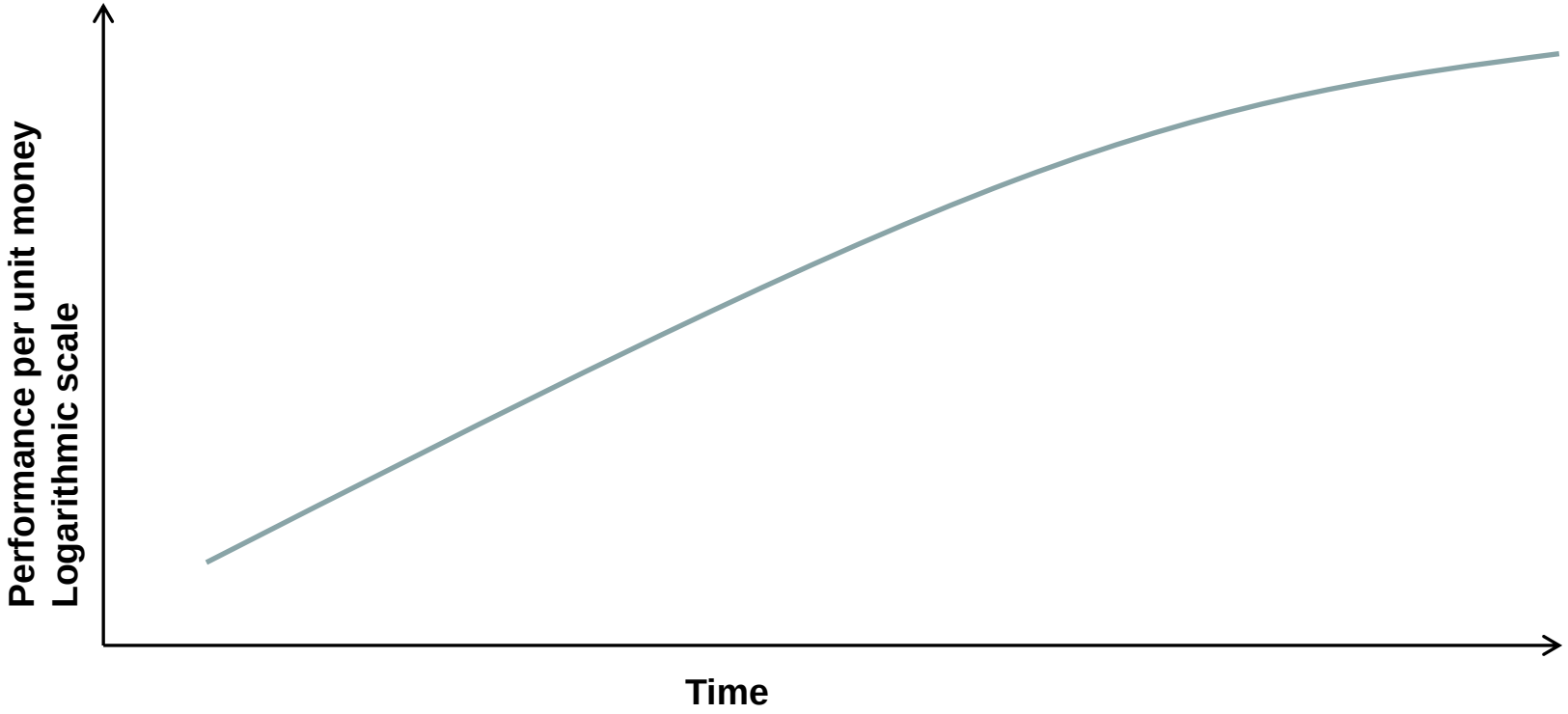
So about Moore's Law…

Is it dead?



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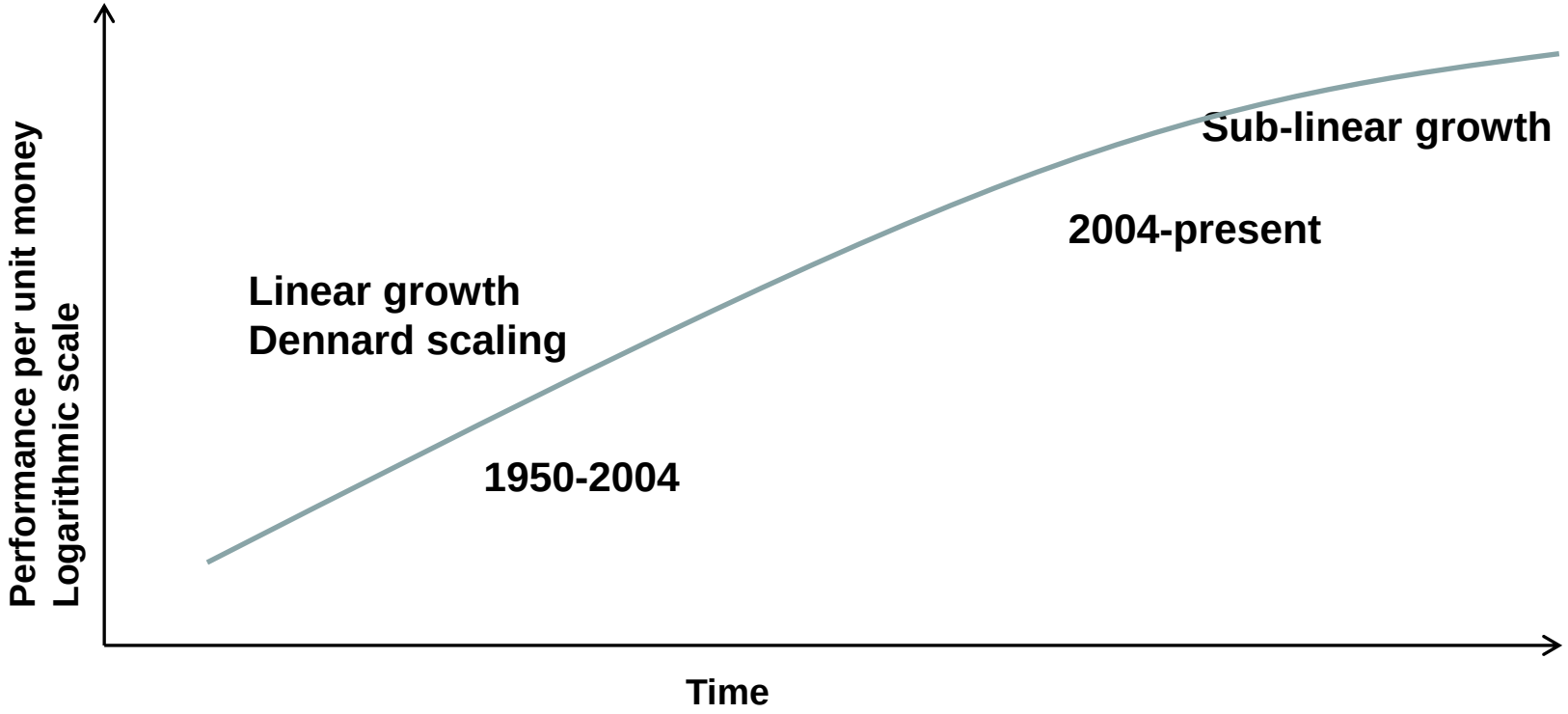
So about Moore's Law …

Is it dead?



Moore's Law

Observations

- No – it's not dead yet
  - Though it is becoming much harder to maintain
- Headline version focuses on the CPU, but equivalent curves also apply to networking, storage and others
  - Though exponential terms are different
- One of the interesting aspects of public cloud is that as it is exponentially growing the pricing more or less tracks Moore's Law

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The ‘value’ of money

Internal Rate of Return (IRR) in TCO models

- IRR is a metric used in budgeting to calculate the return on investments into projects
  - You can operate on the assumption that any project will have at least an IRR of 20% (otherwise why are you spending the money?)
- What does this mean in practice?
- If you can delay your spend (on HPC) until next year then you can use the same spend for something else this year, make a profit of that, and still spend it (on HPC) next year

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A simple TCO spreadsheet

Vastly over-simplified but illustrates the point

- Start with a traditional simplified TCO model and compare value for money with public cloud

- **Spoiler alert:**
  - Spend the whole day discussing TCO models at SC17
  - Discusses all the assumptions used here and many more besides

- The purpose of the following slides is to thought provoking, a conversational opener rather than to try and be a definitive answer

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State the assumptions

Really simple TCO model for On Prem vs AWS

Purchase price per core (2017)		£185	Based on recent 5000 core procurement
Size of system for examples		2000	Cores
Manufacturer support & maintenance		5.00%	**Come see our TCO Workshop at SC17**
Procurement overhead		10.00%	
Installation facilities costs		10%	
Electricity cost		9%	Based on 10p per kWhr
PUE		2	Not an unerasonable average for many older DCs
Data centre costs		18%	
Internal support team		2.00	FTE
FTE cost		£100,000	per annum
Effective utilisation		70%	
Moore's Law per year		71%	
Discount rate (IRR)		20%	
Dollar rate	$	1.28	USD/GBP
Hours per year		8760	

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AWS Costs

AWS price per core (June 2017)					Using c4.8xlarge pricing
18 cores of c4.8xlarge per hour	£	1.48	$	1.90	On demand
	£	1.01	$	1.29	Spot reserved 6hr
	£	0.97	$	1.24	Reserved
	£	0.82	$	1.05	Spot reserved 1hr
	£	0.20	$	0.25	Spot
Per core hour	£	0.06	$	0.08	On demand
	£	0.04	$	0.06	Spot reserved 6hr
	£	0.04	$	0.05	Reserved
	£	0.04	$	0.05	Spot reserved 1hr
	£	0.01	$	0.01	Spot

- We have some controls to use in the calculations
- Including recurring costs such as support and maintenance, electricity, cooling, data centre costs, internal support, utilisation factors
- But also Moore's Law and Internal Rate of Return

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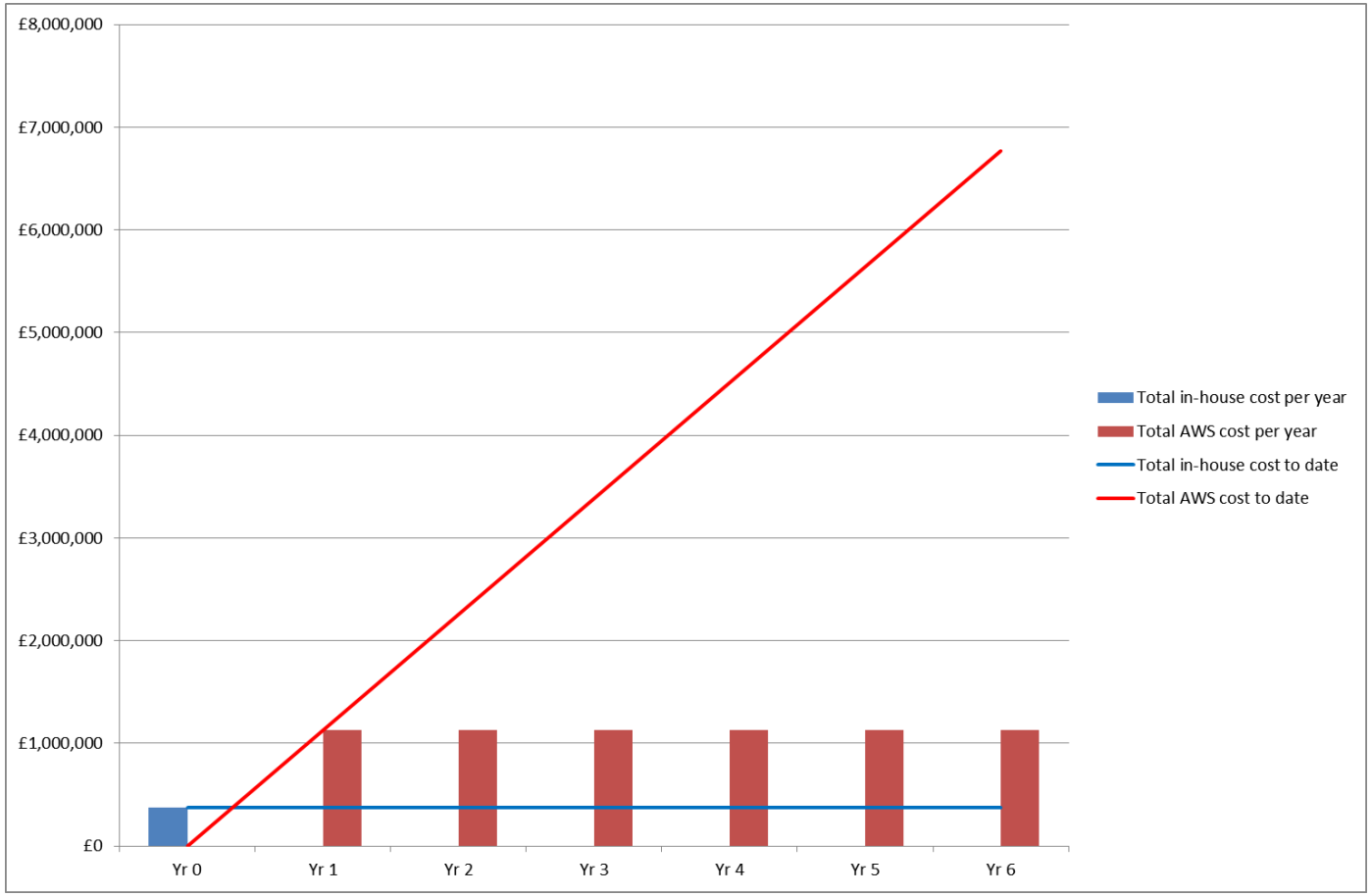
The really simple treatment



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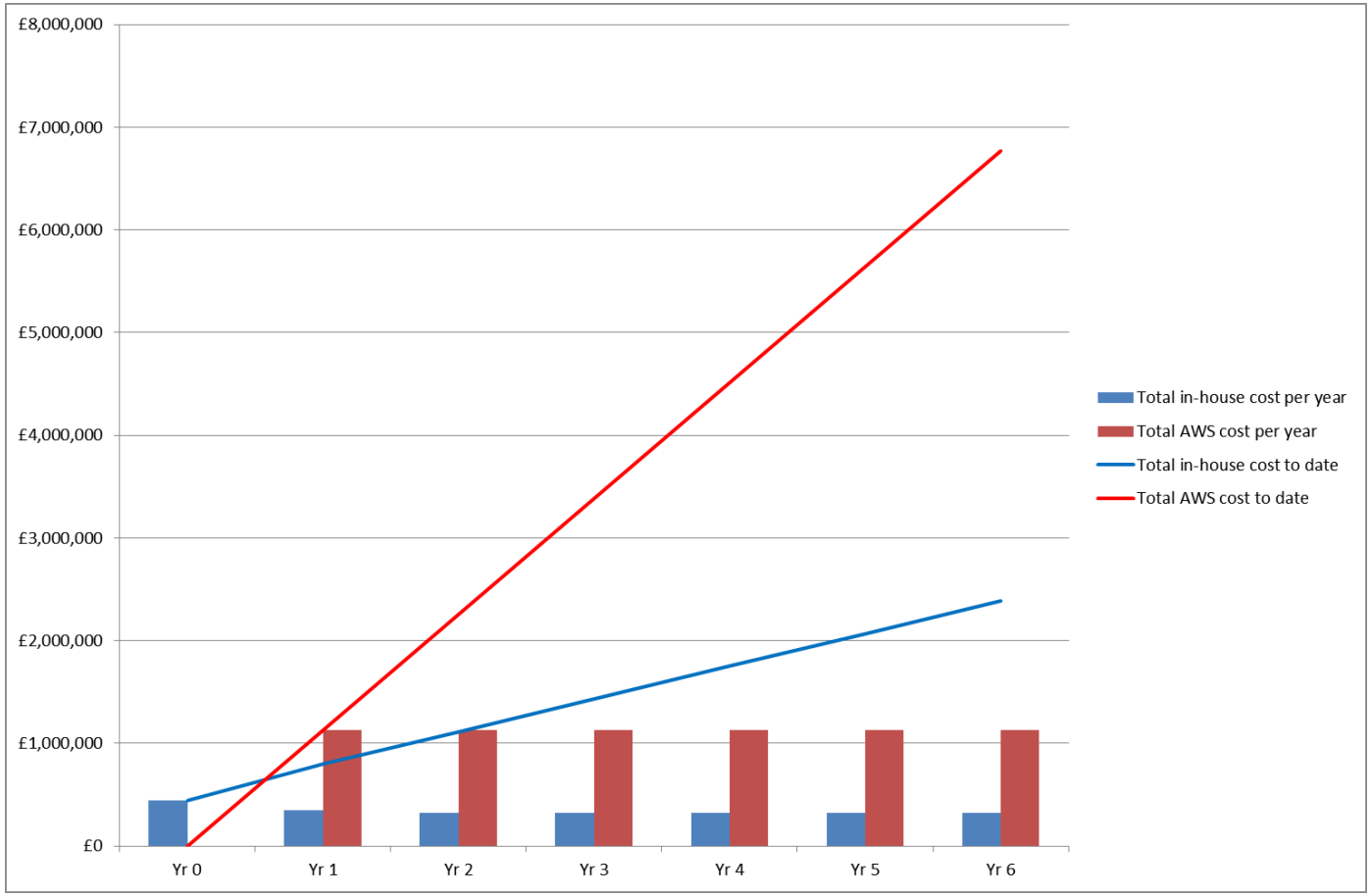
Bit more realistic for on-premise



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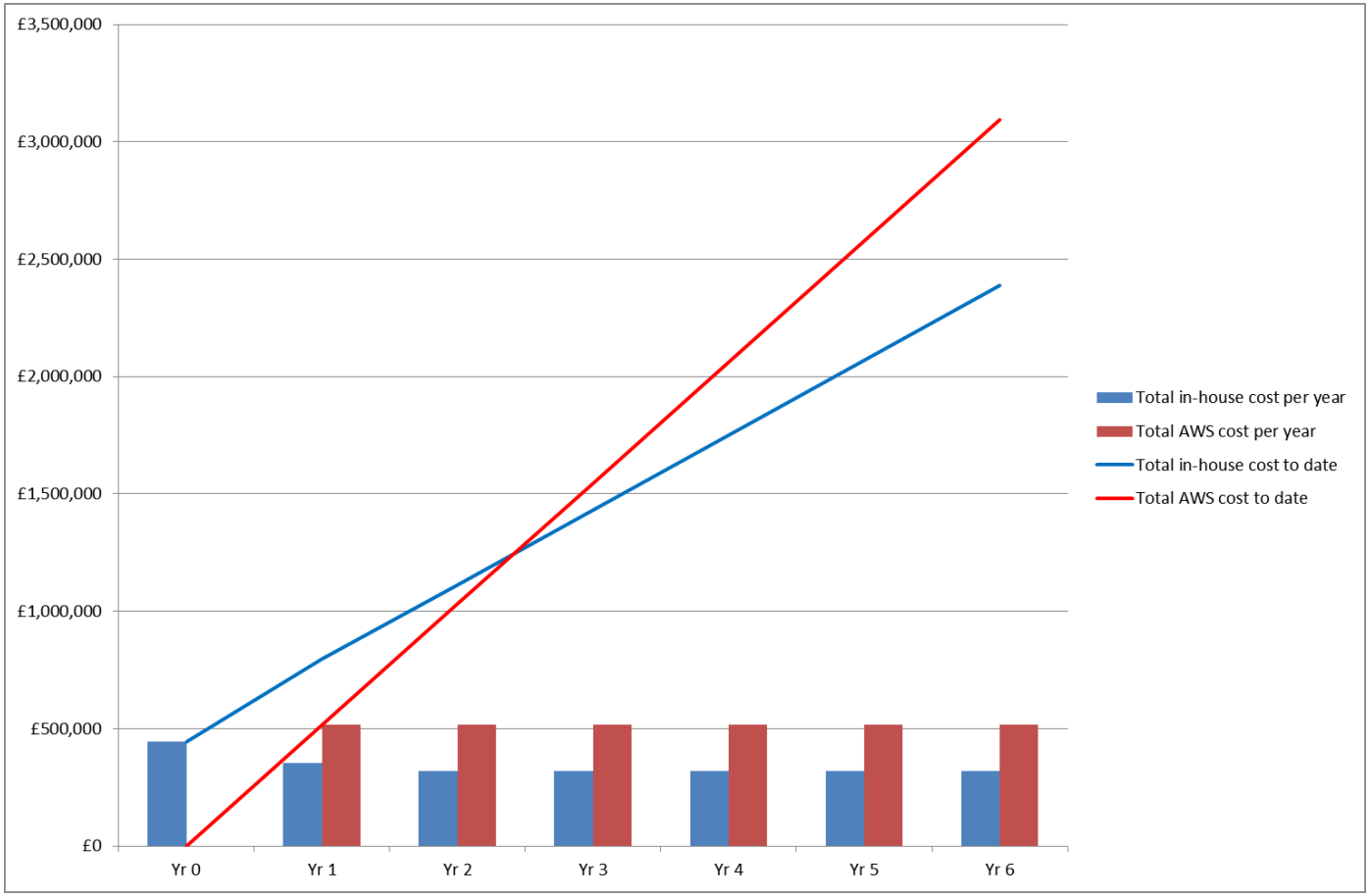
More realistic AWS pricing (res.)



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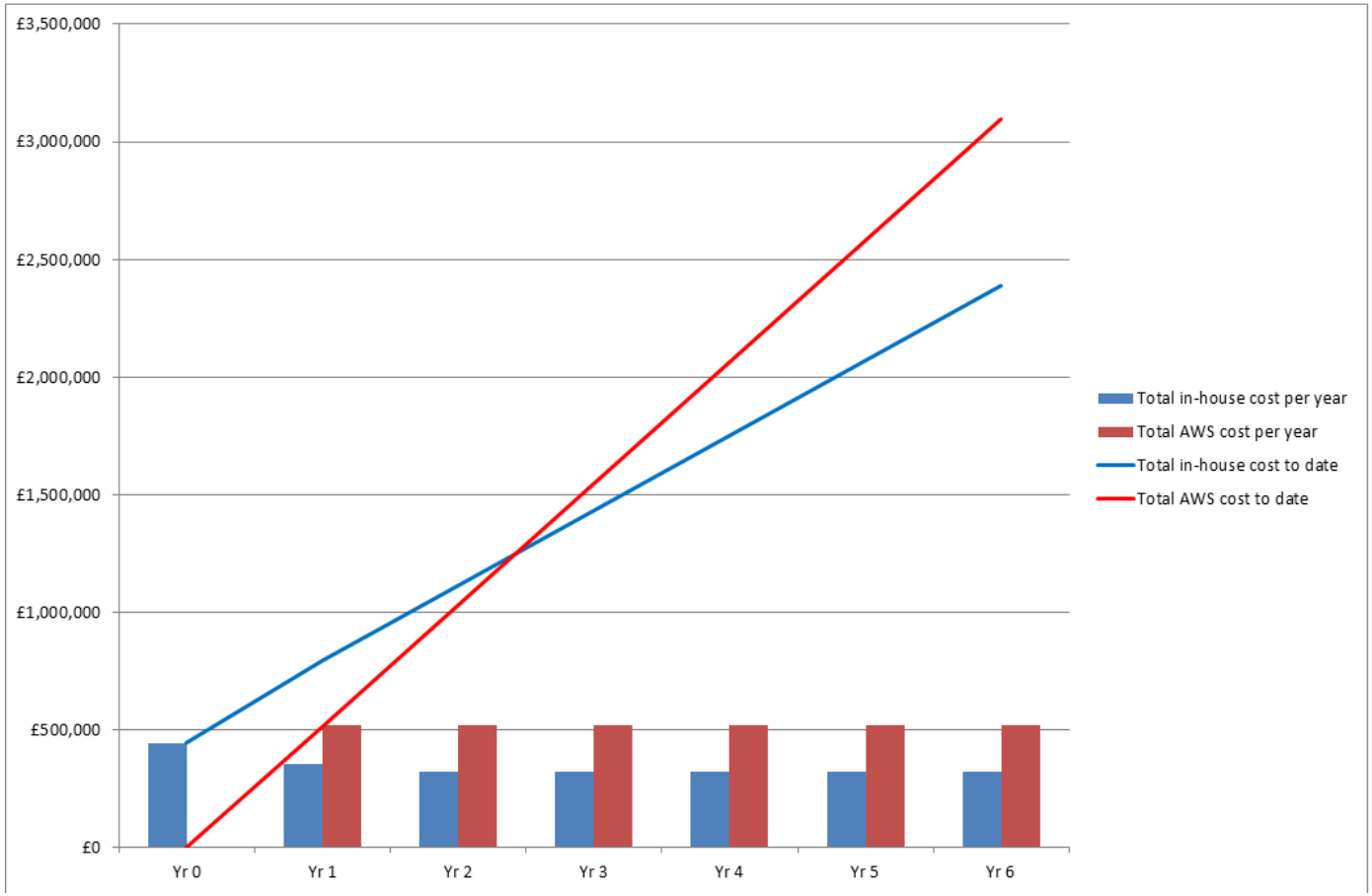
What about utilisation?



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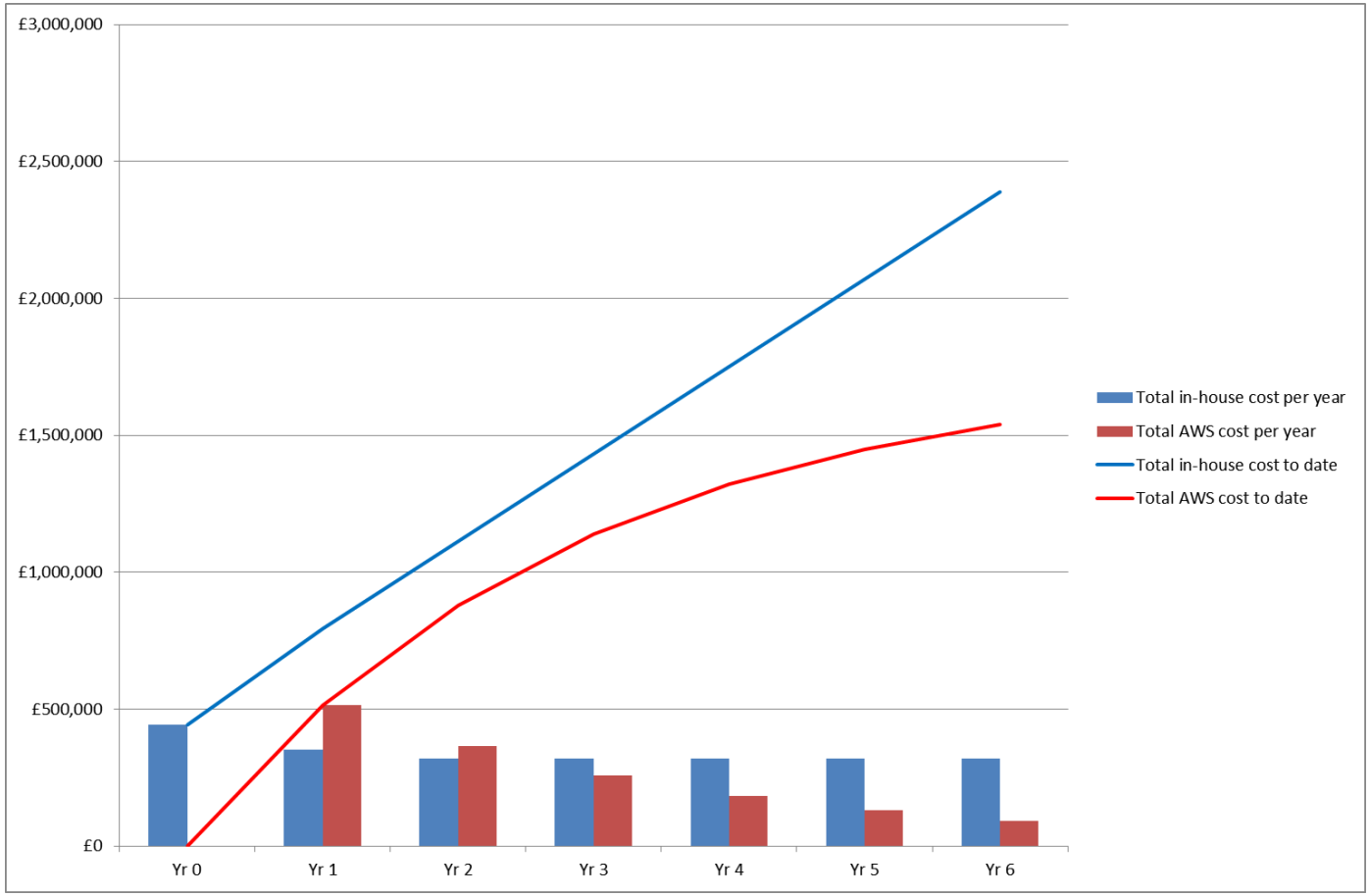
But what about Moore's Law



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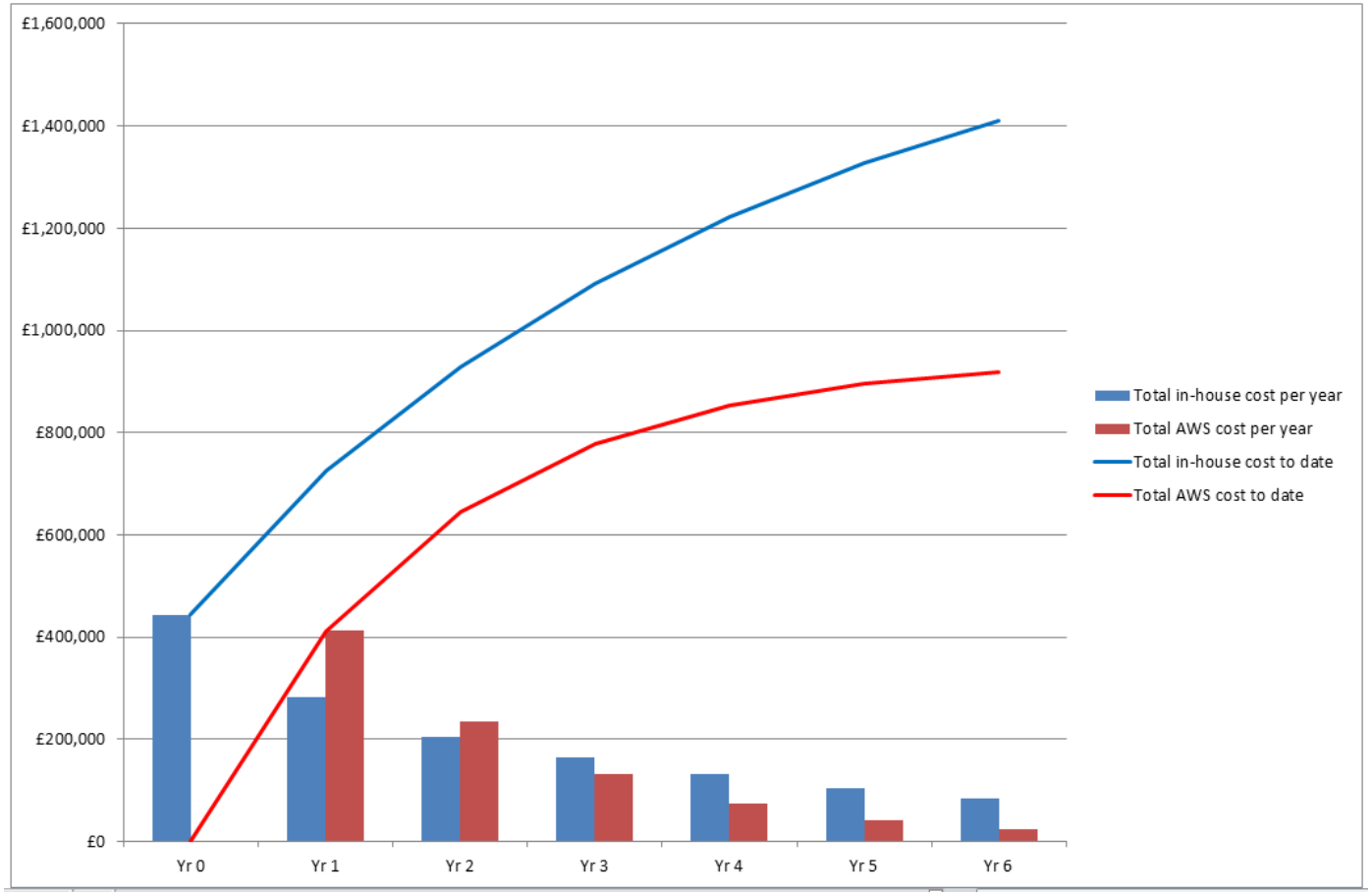
And Internal Rate of Return



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A diversion: Value

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What is value?

The value of value

- Value and benefit poorly understood terms
  - Lots of confusion , misconception and misrepresentation
- Human nature to overvalue benefit, and downplay risk and cost
  - Lots of double counting
  - Confusion between necessary and sufficient
- Broadly two types of benefit/value
  - Direct organisational (or personal)
  - Socio-economic
- Implications for funding route

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What is value?

Counting value

- Generally if it can't be measured it doesn't exist
  - Gold standard: £
  - Other metrics are available – but need to be applied carefully
- Generally easier to metricate value than is assumed
  - Change in profit/loss
  - What would you pay
  - What would you pay to find out
  - …
- *Detailed* measurement can be hard though

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What is value?

Show me the money

- Timeliness is often ignored in business cases
  - “Too hard” to account for
  - (In contrast to “time”)
- Generally a mistake
  - Time is the most precious commodity we have

- Accepted accounting technique for understanding this: NPV
  - Then becomes an argument re discount rates
  - Not as straightforward as may be assumed
  - LIBOR: 0.5%, Wonga APR: 1,500%

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A diversion: Cost

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Cost

The price of everything …

- Not as straightforward as assumed
  - Too often just focused on “cash out of the door”

- Example “cash costs” tracked carefully
  - Cost of the supercomputer (purchase and support)
  - Software costs (purchase and support)
  - Cost of installation and changes to the data centre
  - Electricity (and cooling)
  - Training, travel and subsistence!
  - Contractor costs

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Cost

But that comes out of a different budget …

- Other costs often ignored
  - Project staff costs
  - “Overhead” function costs
  - Data centre costs
  - Cost of money
  - Electricity (!)
  - Complexity of internal support (hardware and software)
  - Lost or delayed benefit
    - Not just NPV related
- Your project management may not “care” but your FD does

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Conclusions

Don’t loose sight of the real goals

- To deliver value (however you choose to measure it) at a reasonable cost
- More traditional HPC in the cloud is still viewed as hard but for some classes of HPC problem there are undoubtedly good reasons to look at the economics
- Accounting for effects such as Moore’s Law and IRR in TCO calculations can significantly change the balance point for a move to a cloud strategy

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