

FROM 'GRID' TO 'CLOUD'

Economic Model Evolution & Policy Implications

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ABOUT ME...

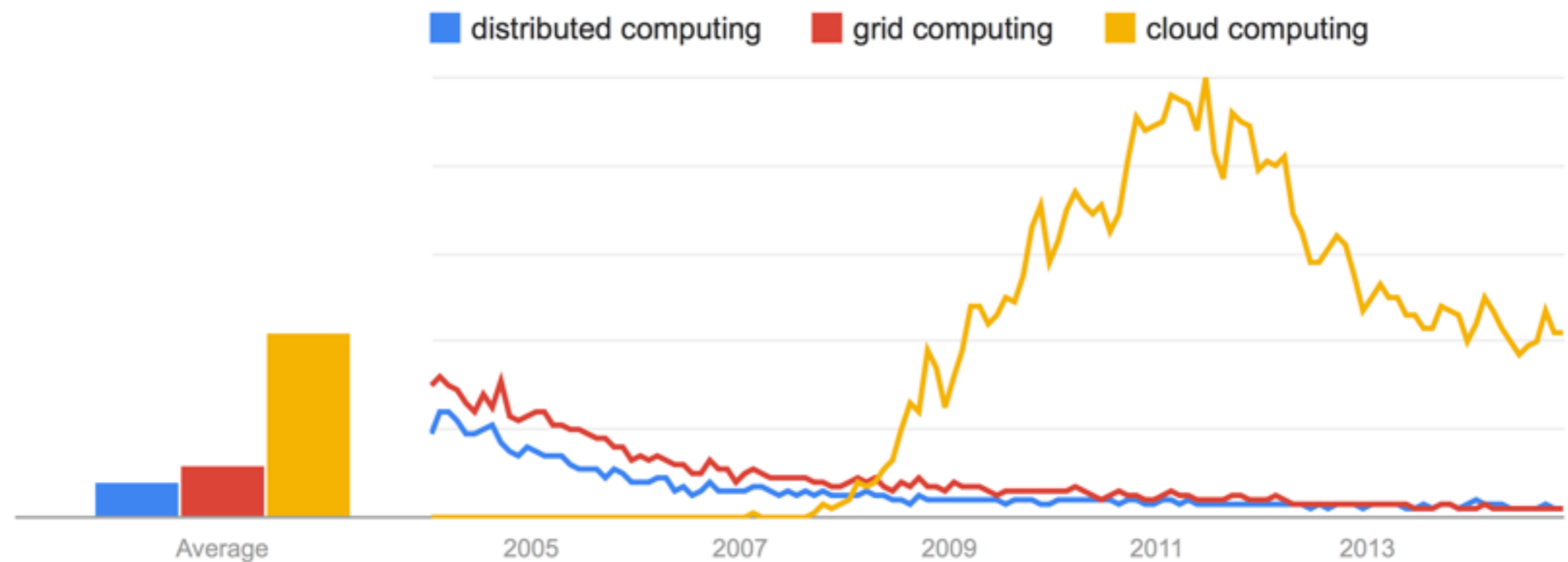
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- *Affiliate Professor*, Imperial College London
 - Internet Centre (Social Computing Group)
- *Associate Editor*, Int. J. of Manufacturing Technology & Management



UNDERSTANDING THE PAST
OF CLOUD COMPUTING TO
HELP UNDERSTAND ITS FUTURE



Interest over time. Web Search. Worldwide, 2004 - present.



GRID VS CLOUD





GRIDECON



- “Grid Economics & Business Models”
- European Framework Programme 6
- € 2,300,000
- July 2006 – April 2009



Imperial College
London



ΟΙΚΟΝΟΜΙΚΟ
ΠΑΝΕΠΙΣΤΗΜΙΟ
ΑΘΗΝΩΝ



ATHENS UNIVERSITY
OF ECONOMICS
AND BUSINESS

the 451 group



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WHAT IS “GRID”?



WHAT IS “GRID”?

A network of PCs?

A network of supercomputers?

Centralised providers

WHAT IS “GRID”?

A network of PCs?	–
A network of supercomputers?	Scenario 1
Centralised providers	Scenario 2

SCENARIOS

- Scenario 1: Grid Commodity Market
- Scenario 2: Differentiated market



SCENARIO I

GRID COMMODITY MARKET



COMPUTER GRID

- Inspired by electricity grid:
 - market for trading computing resources
 - mix of large and small providers
 - commoditised product
 - market mechanisms

A MARKET FOR GRID RESOURCES

- A few centralised market places (aiming at global market)
- ‘bid-ask’ mechanism
- Forwards, options, swaps
- Brokers and other planning and aggregating agents



≠



COMPUTING OBSTACLES

- Computing resources multidimensional (speed, memory, storage)
- Challenges to distribute computer processes
 - ‘Freezing’ processes
 - Scheduling jobs (interdependencies)
 - Failed jobs

SCENARIO 2

DIFFERENTIATED MARKET



DIFFERENTIATED MARKET

- Providers of computing power and capacity of various sizes
- Non-commoditisation
- Market segmentation
- Relatively few intermediaries (vertical integration)



HOW THINGS ACTUALLY LOOKED





HOW GRID/CLOUD LOOKED LIKE





CLOUD COMPUTING C. 1996

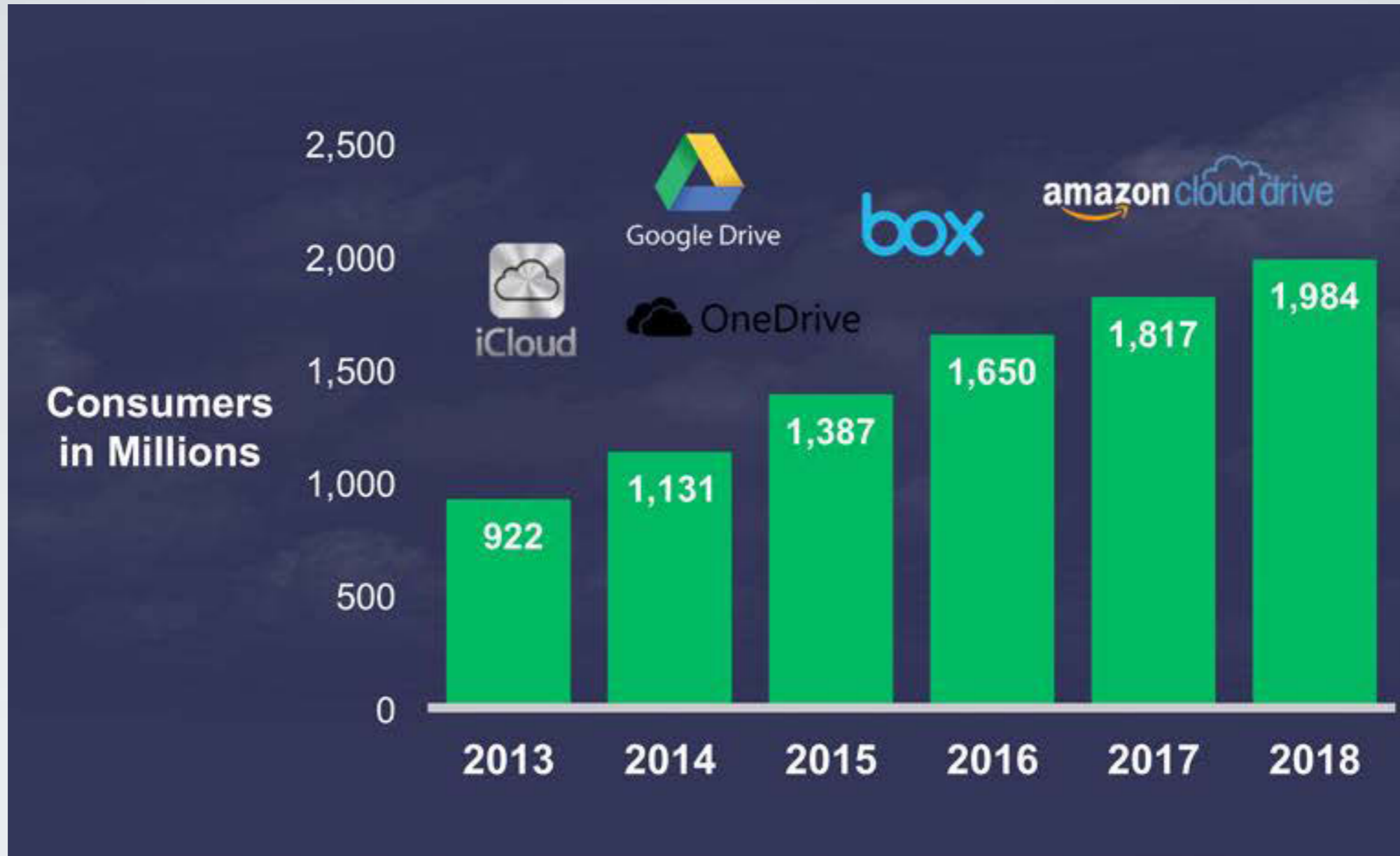


INDUSTRY OBSTACLES

- Economic model based on idleness and redundancy
 - Planned obsolescence
 - Little rationale for remote storage
 - Slow network
 - No point of not storing locally

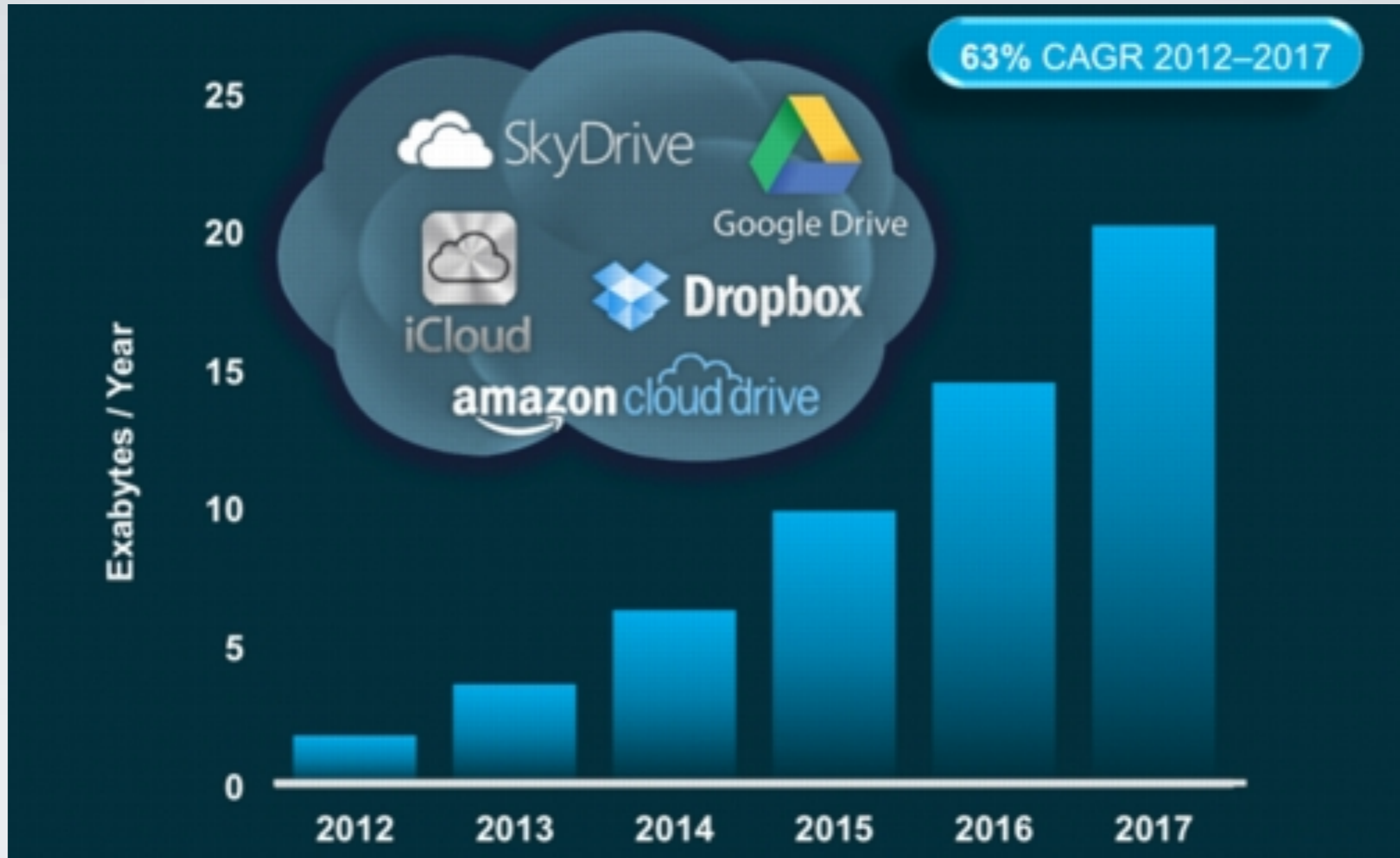
YET, IT HAPPENED!





MORE CONSUMERS

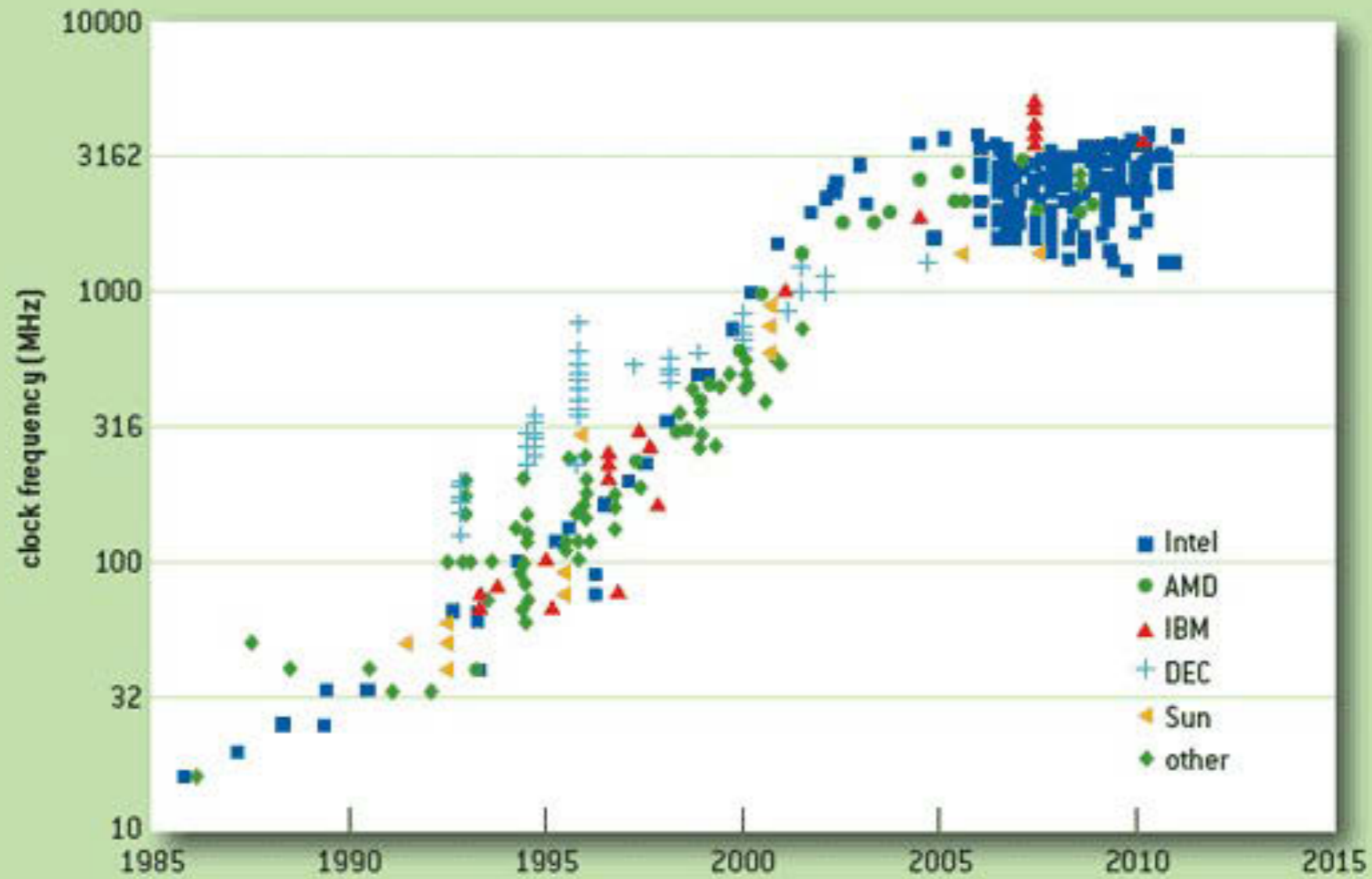




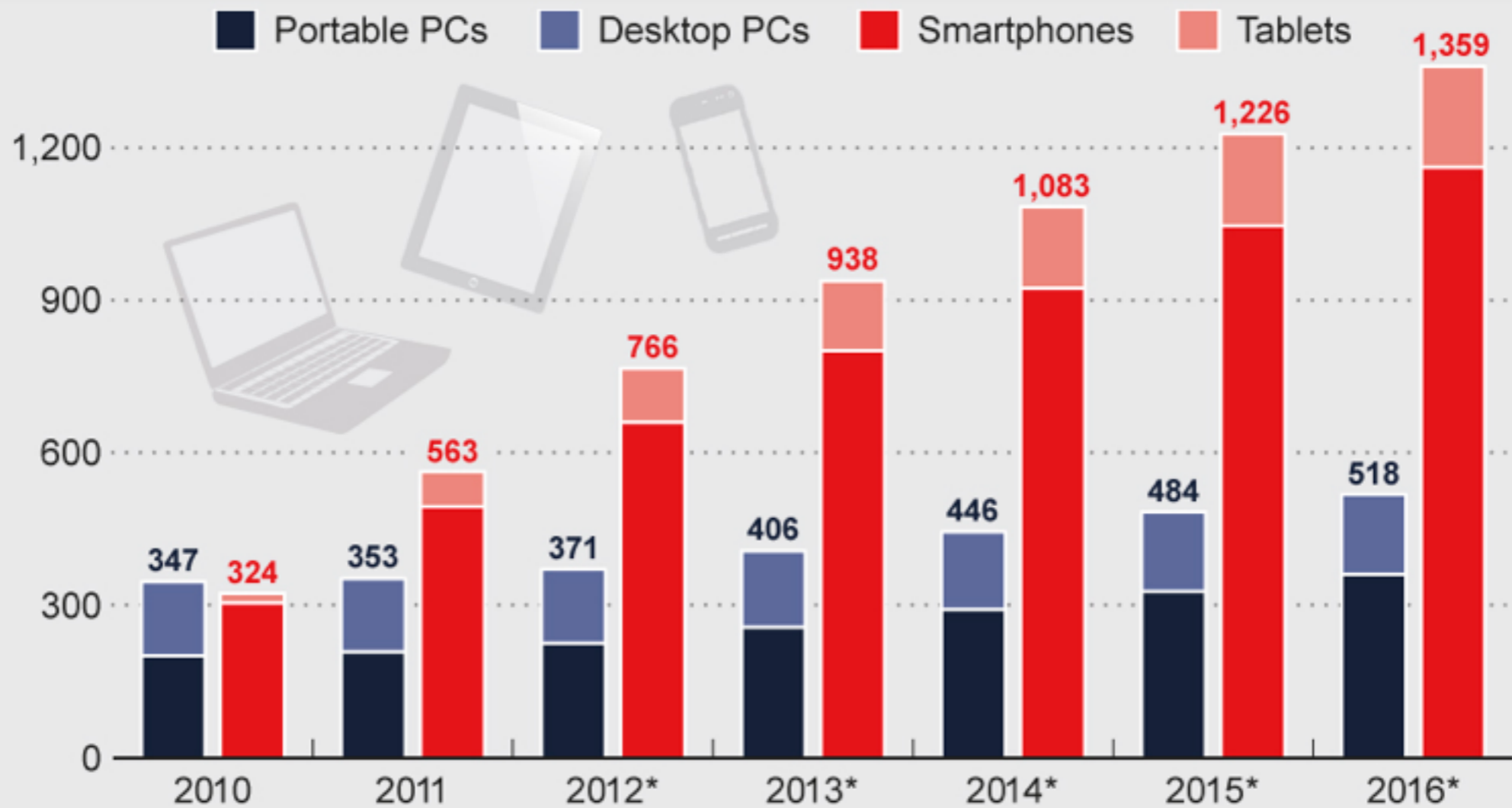
MORE CONSUMPTION

SO WHAT HAS CHANGED?





MOORE HITS A WALL



statista The Statistics Portal

cc creative commons

* Forecast data

Source: IDC

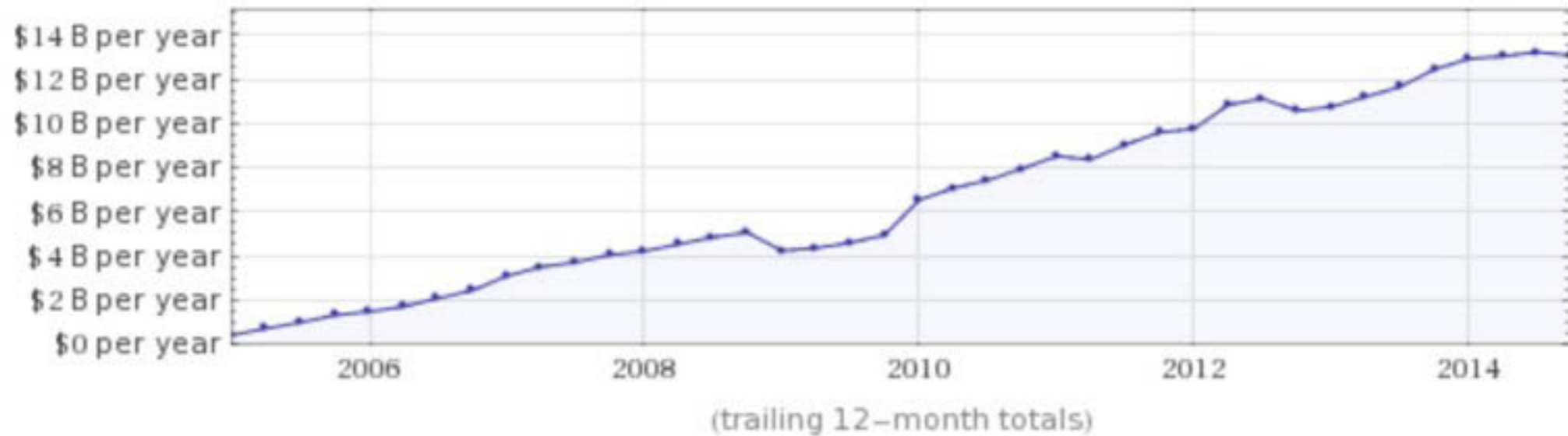
THE PC BECOMES OBSOLETE



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History:

All data ▼



(from Dec 2004 to Sep 2014)

minimum	average	maximum
\$399.1 M per year	\$6.669 B per year	\$13.22 B per year
(quarter ending Dec 31, 2004)		(quarter ending Jun 30, 2014)

Google net income

DATA BECOMES VALUABLE

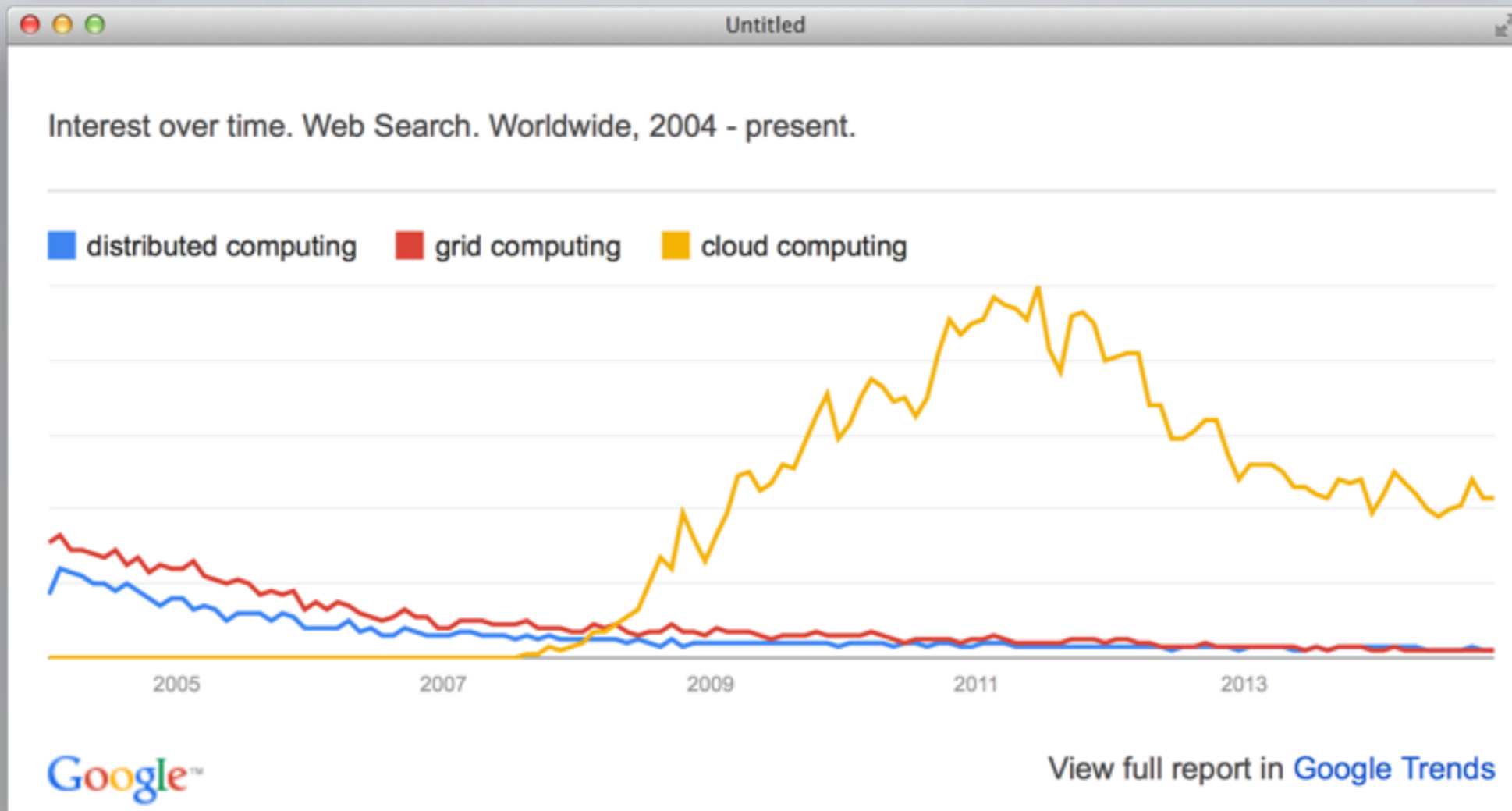


SO WHAT CAN WE LEARN
FROM GRID?



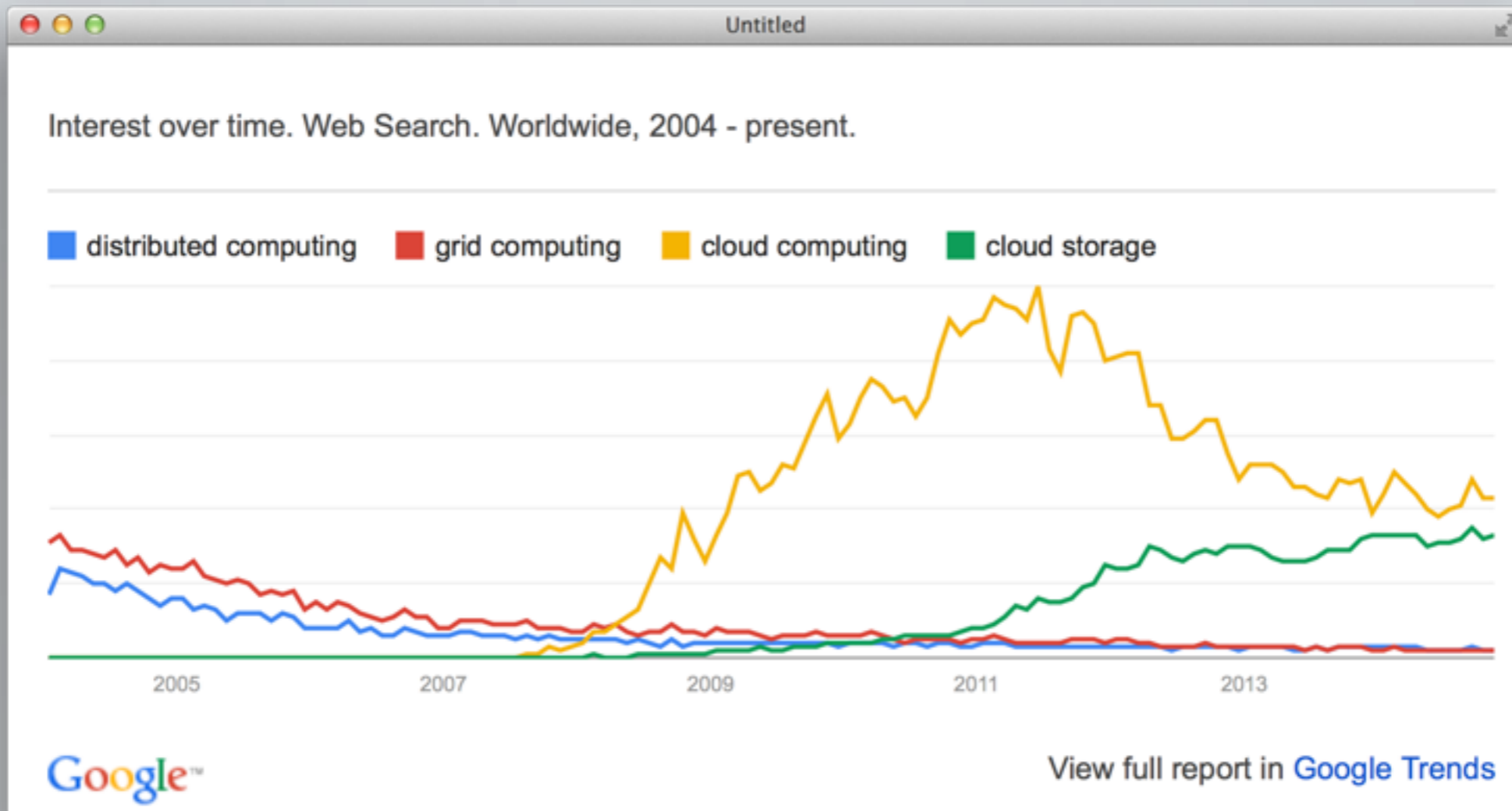
A PARADOXE





IT IS CLOUD...





... BUT IS IT COMPUTING?



TOP 5 GAMING PHONES

BASEMARK X

SHARE:    FILTER:

#	OEM	Device	GPU CPU	Score
1	Samsung	Galaxy S5 LTE-A SM-G901F	Adreno 420 Qualcomm Snapdragon 805 Quad-core 2.5 GHz Krait 450	32684.88
2	Apple	iPhone 6 Plus	Apple A8 GPU Apple A8 dual-core 1.4 GHz Cyclone	32608.39
3	Motorola	XT1254	Adreno 420 Qualcomm Snapdragon 805 Quad-core 2.65 GHz Krait 450	32098.67
4	Samsung	SM-G906K	Adreno 420 Qualcomm Snapdragon 805 Quad-core 2.5 GHz Krait 450	31592.72
5	Apple	iPhone 6	Apple A8 GPU Apple A8 dual-core 1.4 GHz Cyclone	31259.83

ANDROID

IOS

WINDOWS PHONE

ALL

THIS IS (MOBILE) COMPUTING



THE CLOUD PARADOXE

- What made Scenario 1 challenging and Scenario 2 vertically concentrated was the use of computing power
- A large part of cloud computing nowadays relate to storage, not computing power
 - Storage IS a commodity!

CURRENT ISSUES WITH CLOUD

- Often mentioned are:
 - Security
 - Privacy
 - Regulatory compliance
 - Integration
 - Provider transparency
 - Ability to customise
 - Reliability
 - Viability of provider
 - Lock-in
 - Cross-border restriction



UNLOCKING THE CLOUD

- A significant number of concerns and adoption barriers relate to vertical integration and *ex-post* incompatibilities
- While not all types of cloud resources can be traded in an open market, some can
- Little rationale from an economic perspective to keep a closed system

WHICH POLICIES FOR CLOUD?

- Little/no rationale for such vertical integration
 - Creates/reinforces giants (artificially)
 - Hinders adoption
 - Creates regulation nightmares
 - Causes security issues
- Need to promote (existing) open standards and uncouple software/storage



SPECIAL ISSUE: “LEVERAGING TECHNOLOGICAL CHANGE: THE ROLE OF BUSINESS MODELS AND ECOSYSTEMS”

- Prof. P.-J. Benghozi (X/CNRS), Prof. T. Rayna (Novancia), Dr E. Salvador (École Polytechnique), Dr L. Striukova (UCL)
- Int. J. of Technology Management
- Cat. 3 (2*) FNEGE/CNRS
- Deadline: ~~31 Oct. 2014~~
30 Nov. 2014



QUESTIONS?

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