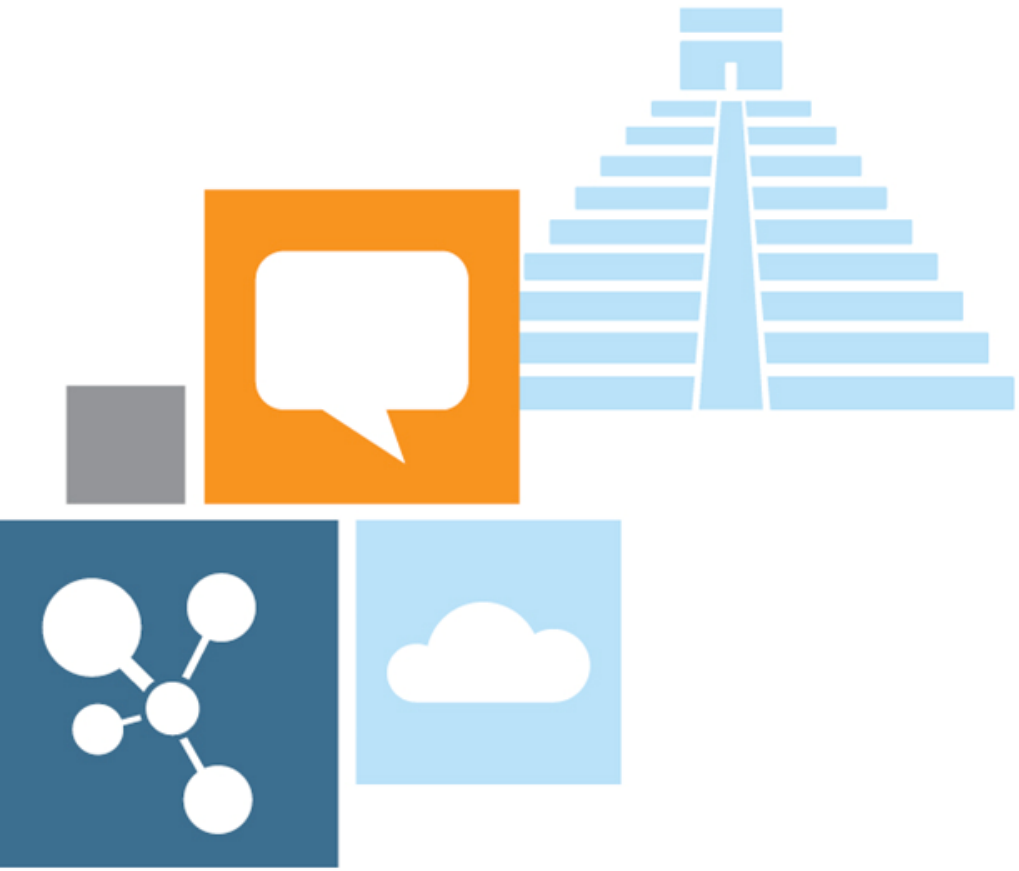
Microsoft



Microsoft® Research

Faculty Summit 2012

Riviera Maya, Mexico | May 23-25 | In partnership with CONACYT

Microsoft Research

From Research to Innovation

Peter Lee
Corporate Vice President

May 23, 2012

Discrete Mathematics 27 (1979) 47–57.
© North-Holland Publishing Company

BOUNDS FOR SORTING BY PREFIX REVERSAL

William H. GATES

Microsoft, Albuquerque, New Mexico

Christos H. PAPADIMITRIOU*†

Department of Electrical Engineering, University of California, Berkeley, CA 94720, U.S.A.

Received 18 January 1978
Revised 28 August 1978

For a permutation σ of the integers from 1 to n, let $f(\sigma)$ be the smallest number of prefix reversals that will transform σ to the identity permutation, and let $f(n)$ be the largest such $f(\sigma)$ for all σ in (the symmetric group) S_n. We show that $f(n) \leqslant (5n+5)/3$, and that $f(n) \geqslant 17n/16$ for n a multiple of 16. If, furthermore, each integer is required to participate in an even number of reversed prefixes, the corresponding function $g(n)$ is shown to obey $3n/2-1 \leqslant g(n) \leqslant 2n+3$.

"Things like even software verification, this has been the Holy Grail of computer science for decades but now in some very key areas, for example, driver verification we're building ***tools that can do actual proof about the software*** and how it works in order to guarantee the reliability."

_ *Bill Gates, April 18, 2002*

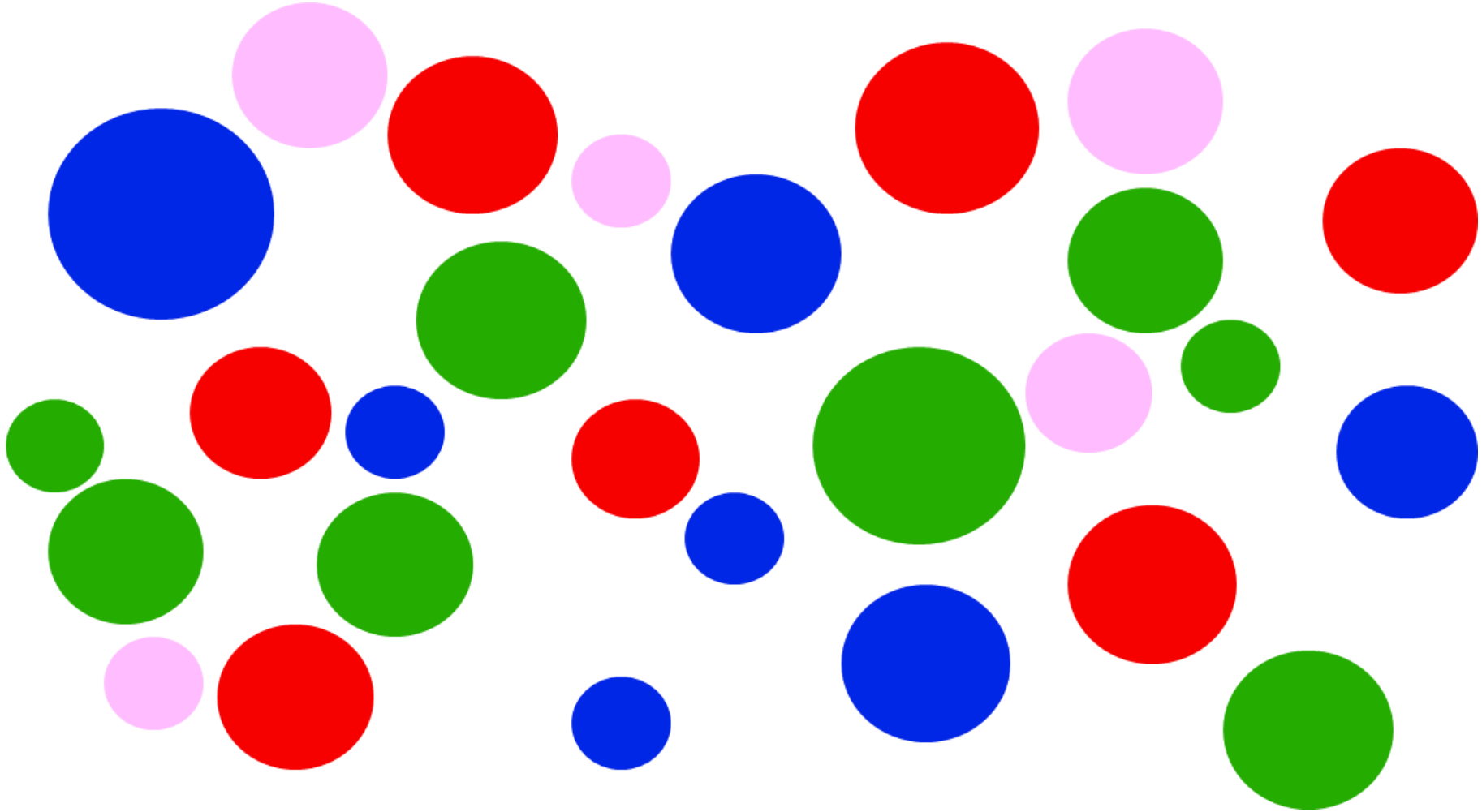
Our Mission

Advance the field in the areas we do research

Transfer our research results into products

Ensure the future for the company and its products

A Simple Test



How many **blue** dots?

Microsoft Research Worldwide

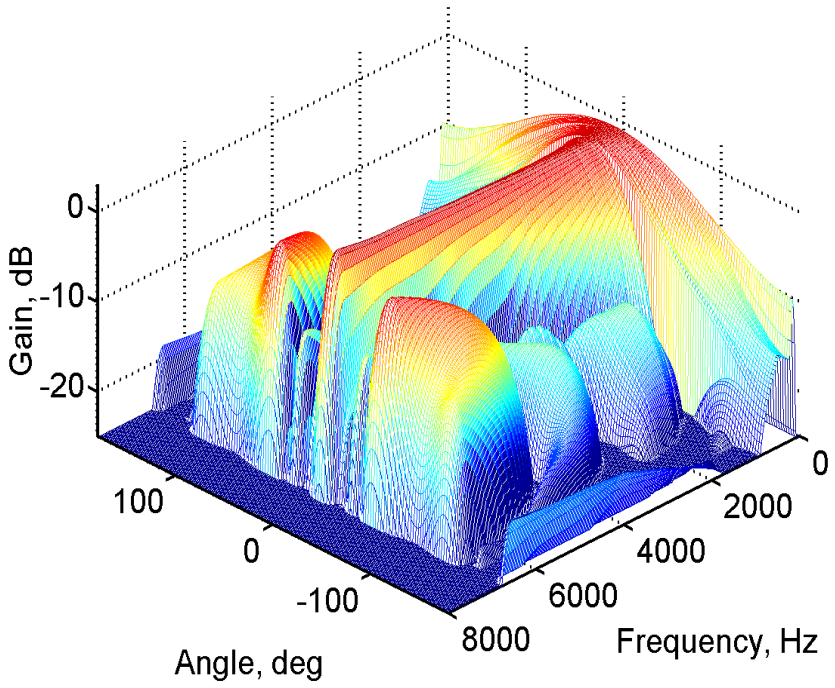
Guiding Principles

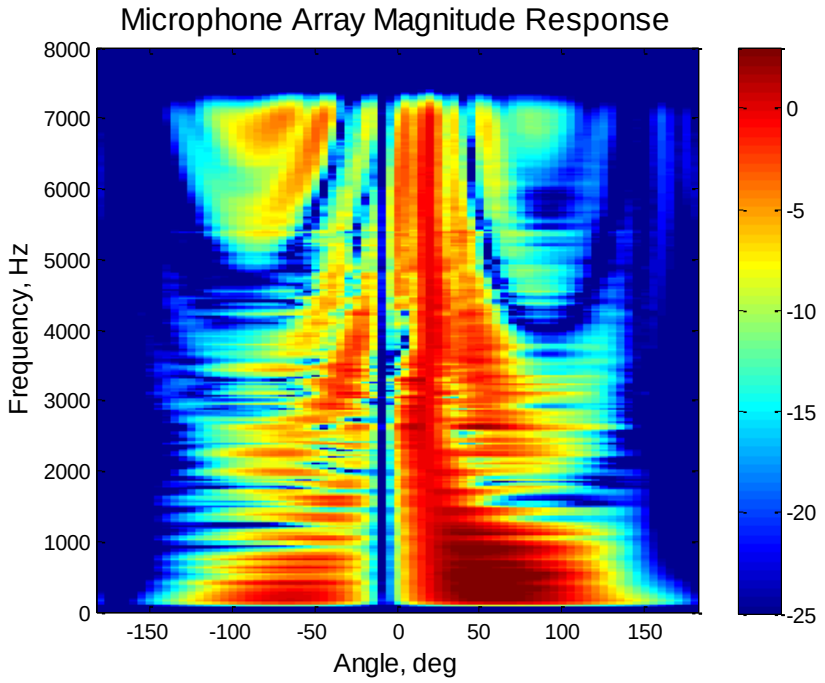
Hire great people (and stay out of the way)

Engage with academia and publish openly

Embrace diversity in research

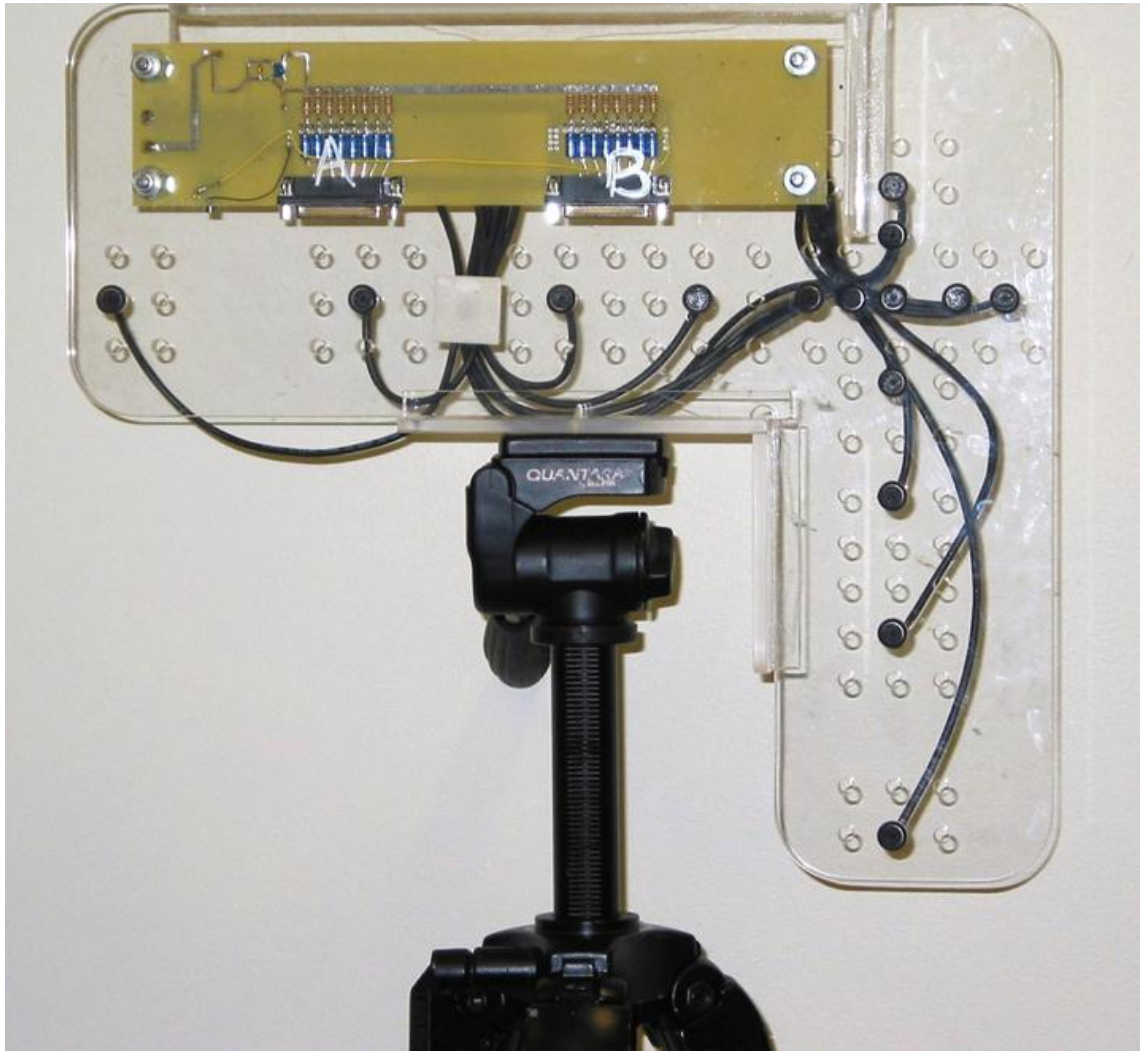
MVDR Adaptive Beamformer



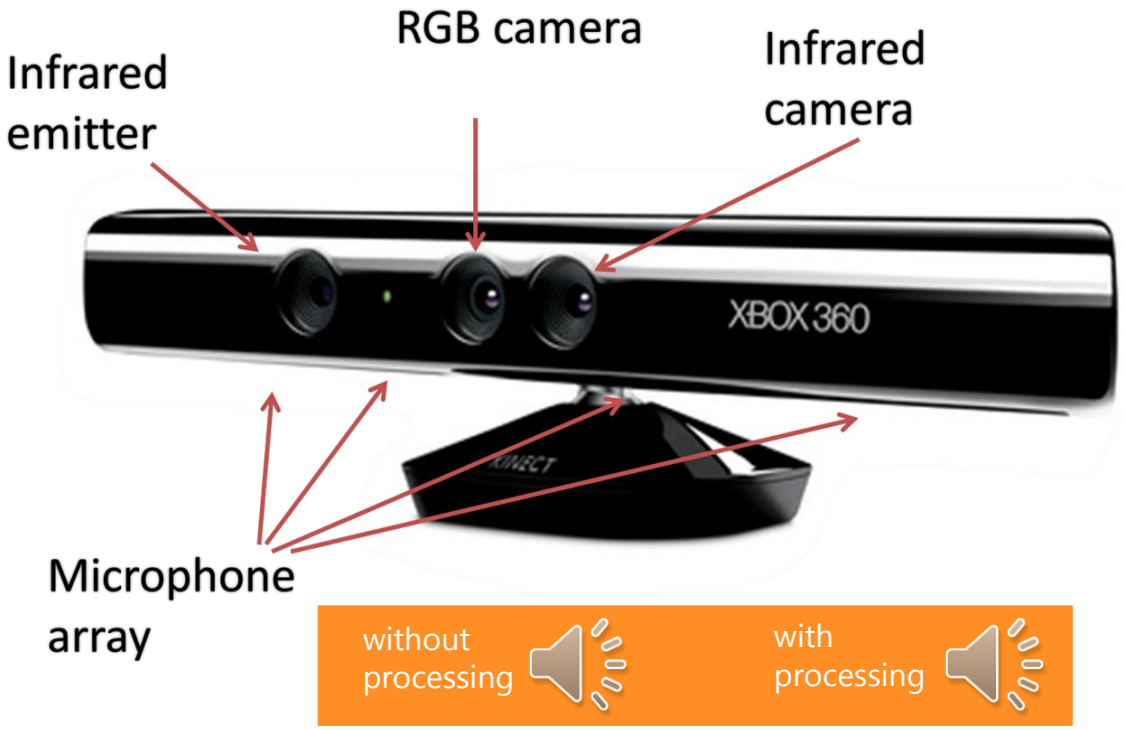


$$\mathbf{W}_{MVDR}(f) = \frac{\mathbf{D}_c^H(f)\boldsymbol{\Phi}_{NN}^{-1}(f)}{\mathbf{D}_c^H(f)\boldsymbol{\Phi}_{NN}^{-1}(f)\mathbf{D}_c(f)}$$

Test Rig



Kinect


Infrared emitter
RGB camera
Infrared camera
XBOX 360
KINECT
Microphone array
without processing
with processing

10 March 2011 Last updated at 11:09 GMT

Microsoft Kinect 'fastest-selling device on record'

Microsoft has sold more than 10 million Kinect sensor systems since launch on 4 November, and - according to Guinness World Records - is the fastest-selling consumer electronics device on record.

The popularity of the Kinect has helped to boost sales of games, Microsoft says

The sales figures outstrip those of both Apple's iPhone and iPad when launched, Guinness said.

Kinect is an infrared camera add-on for Microsoft's Xbox 360 games console that allows it to track body movements.

The success of Kinect has also helped to drive games sales, Microsoft said.

Related Stories

Xbox to welcome

MULTICHANNEL ACOUSTIC ECHO CANCELLATION FOR STEREO AND SURROUND SOUND

Ivan Tashev[1)], *Nilesh Madhu*[2)], *Alex Acero*[1)]

[1)]Microsoft Research, One Microsoft Way, Redmond, WA 98052, USA
[2)]Ruhr-Universität Bochum, Universitätsstraße 150, 44801 Bochum, Germany
{ivantash, alexac}@microsoft.com, Nilesh.Madhu@ruhr-uni-bochum.de

REJECTED

ABSTRACT

In this paper we propose a novel approach and architecture for solving the problem of stereo and multichannel acoustic echo cancellation. The proposed structure consists of one fixed filter for each loudspeaker channel and one adaptive filter structure being the sum of the fixed filters from the microphone signal. We prove that if the fixed filters contain the valid set of the transfer functions, then the single adaptive filter can handle the changes in the echo paths in reasonable limits. We propose to obtain the first correct solution by playing short chirps at the beginning of the communications session. The proposed multichannel echo canceller is illustrated with stereo signal; however it should not be a problem using it with surround sound since it scales up well with an increasing number of loudspeaker channels and microphones.

Index Terms — Echo cancellation, stereo echo cancellation, multichannel echo cancellation.

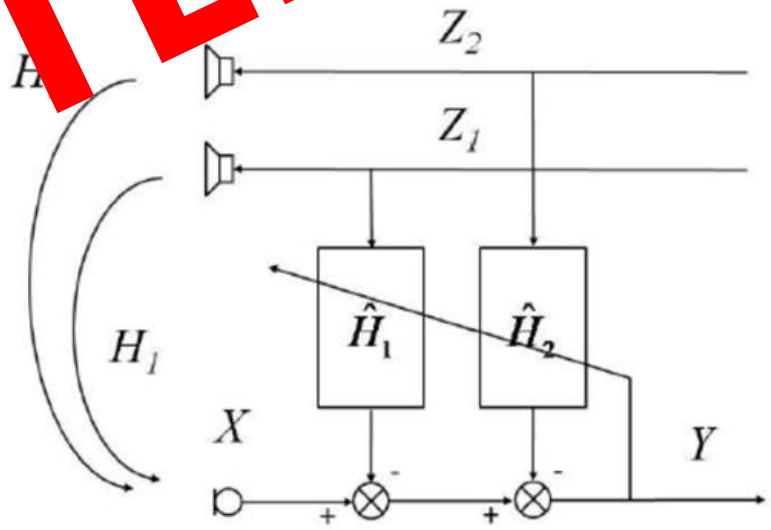


Figure 1. Stereo AEC with chained adaptive filters.

If the estimation of the transfer path is correct $\left(H_k^{(n)} - \hat{H}_k^{(n)} = 0\right)$ then the captured loudspeaker signal is

Comments from the Reviewers

"The solution proposed by the authors **does not obviously solve the** … **problem at all**."

"In fact this… **does not afford a real stereo echo cancellation**…"

"In the practical problem, pre-training **makes no improvement**… This principle is basic and understood, and on these grounds I find I cannot recommend this paper."

"This paper comes up with an idea which… has some **serious drawbacks for realistic scenarios**."

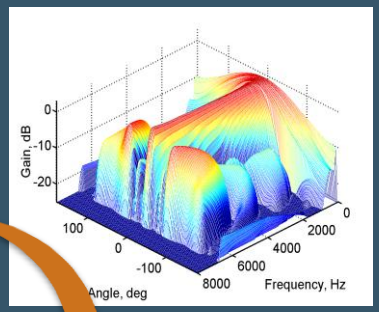
Magic

There is a **thin line** between a **visionary product** and **science fiction**.

Sensible researchers will often avoid trying to do science fiction.

Magic can happen when visionary product development and world-class research work **hand-in-hand**.

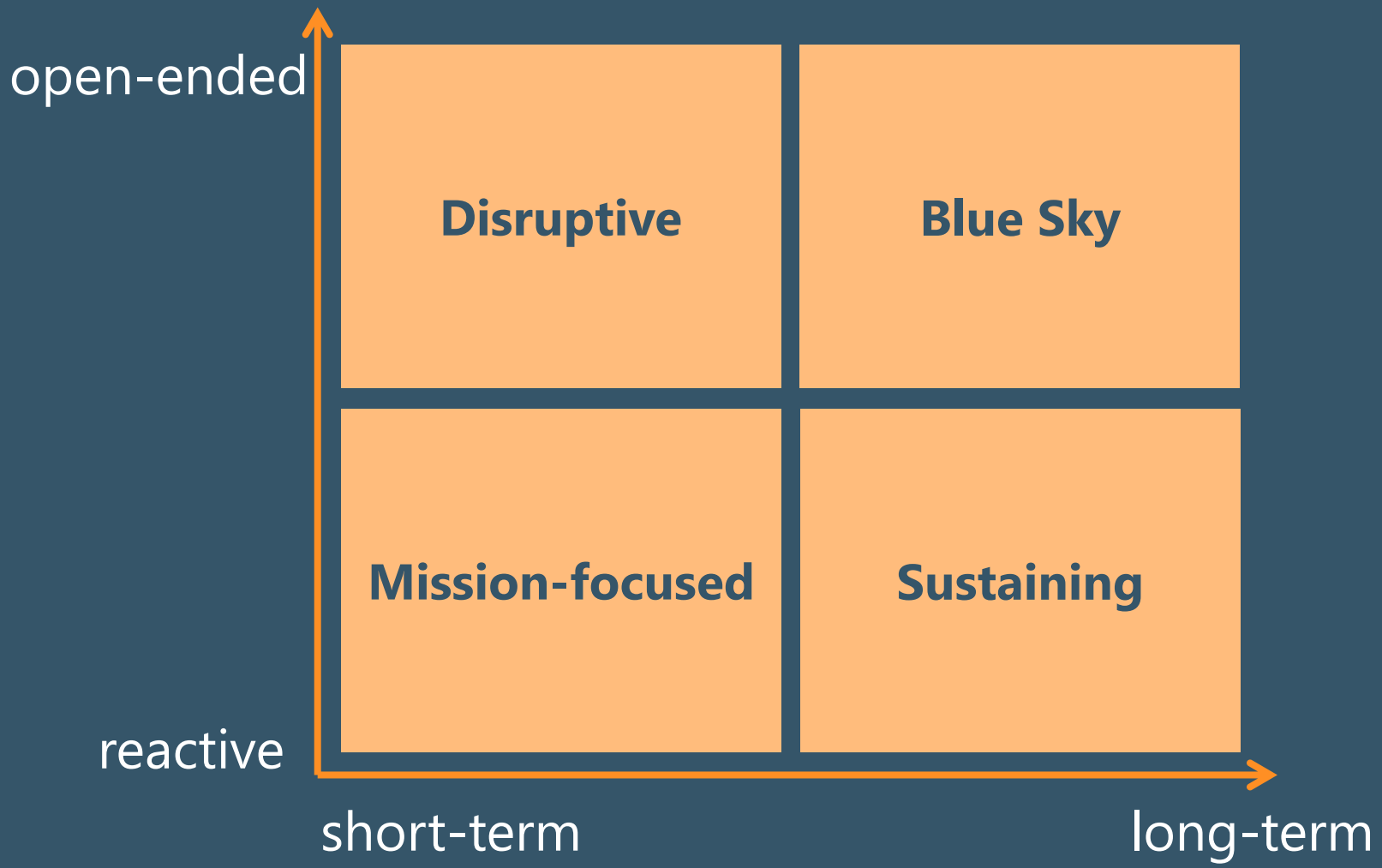
open-ended



reactive

short-term

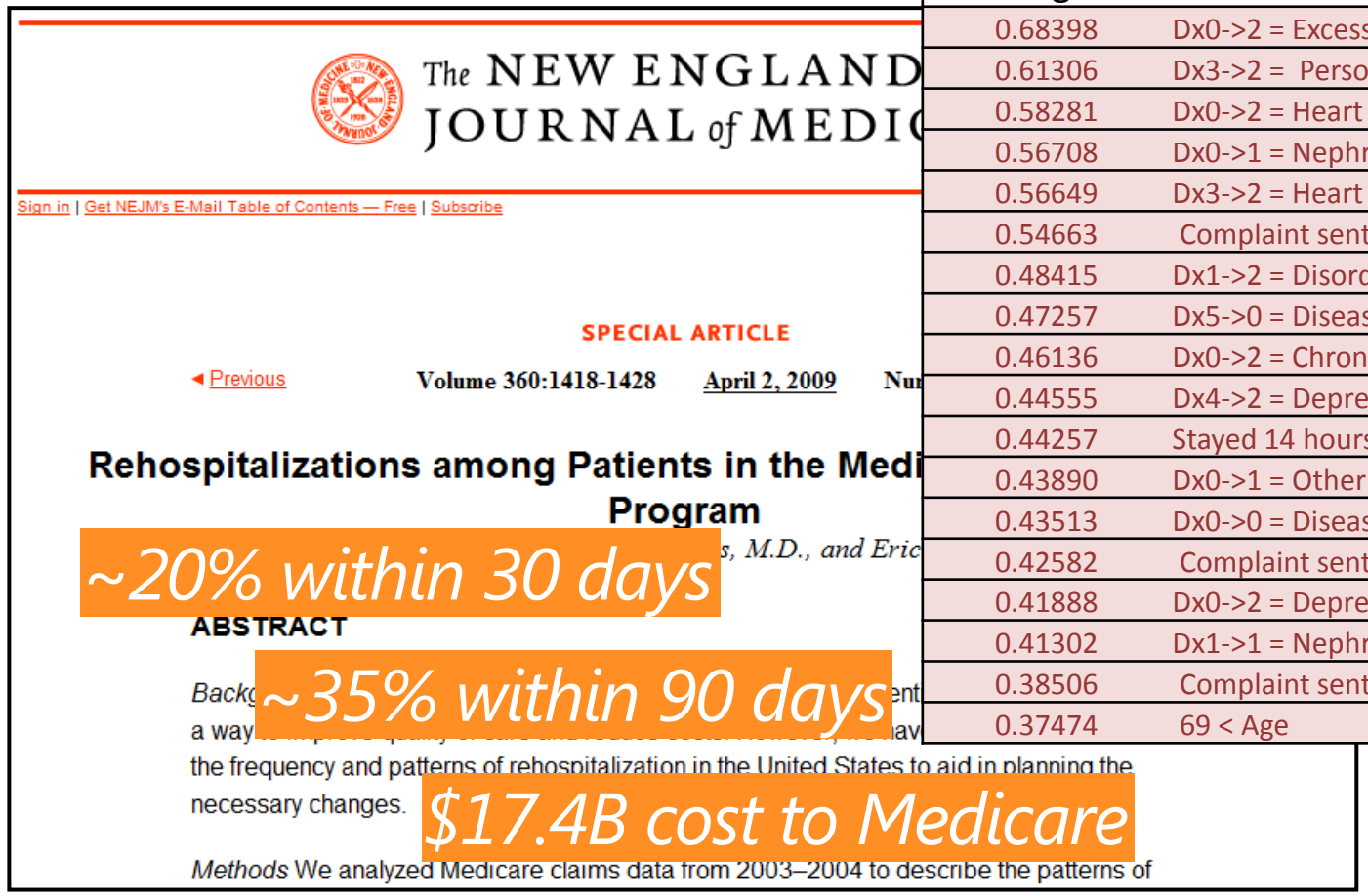
long-term


open-ended
Disruptive
Blue Sky
Mission-focused
Sustaining
reactive
short-term
long-term

Microsoft®

© 2012 Microsoft Corporation. All rights reserved. Microsoft, Windows, and other product names are or may be registered trademarks and/or trademarks in the U.S. and/or other countries.
The information herein is for informational purposes only and represents the current view of Microsoft Corporation as of the date of this presentation. Because Microsoft must respond to changing market conditions, it should not be interpreted to be a commitment on the part of Microsoft, and Microsoft cannot guarantee the accuracy of any information provided after the date of this presentation. MICROSOFT MAKES NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, AS TO THE INFORMATION IN THIS PRESENTATION.

Machine Learning and Predictive Analytics



The NEW ENGLAND JOURNAL of MEDI

Sign in | Get NEJM's E-Mail Table of Contents — Free | Subscribe

SPECIAL ARTICLE

◂ Previous Volume 360:1418-1428 April 2, 2009 Nu

Rehospitalizations among Patients in the Medi Program

s, M.D., and Eric

ABSTRACT

Backg ent
a way av
the frequency and patterns of rehospitalization in the United States to aid in planning the necessary changes.

Methods We analyzed Medicare claims data from 2003–2004 to describe the patterns of

~20% within 30 days

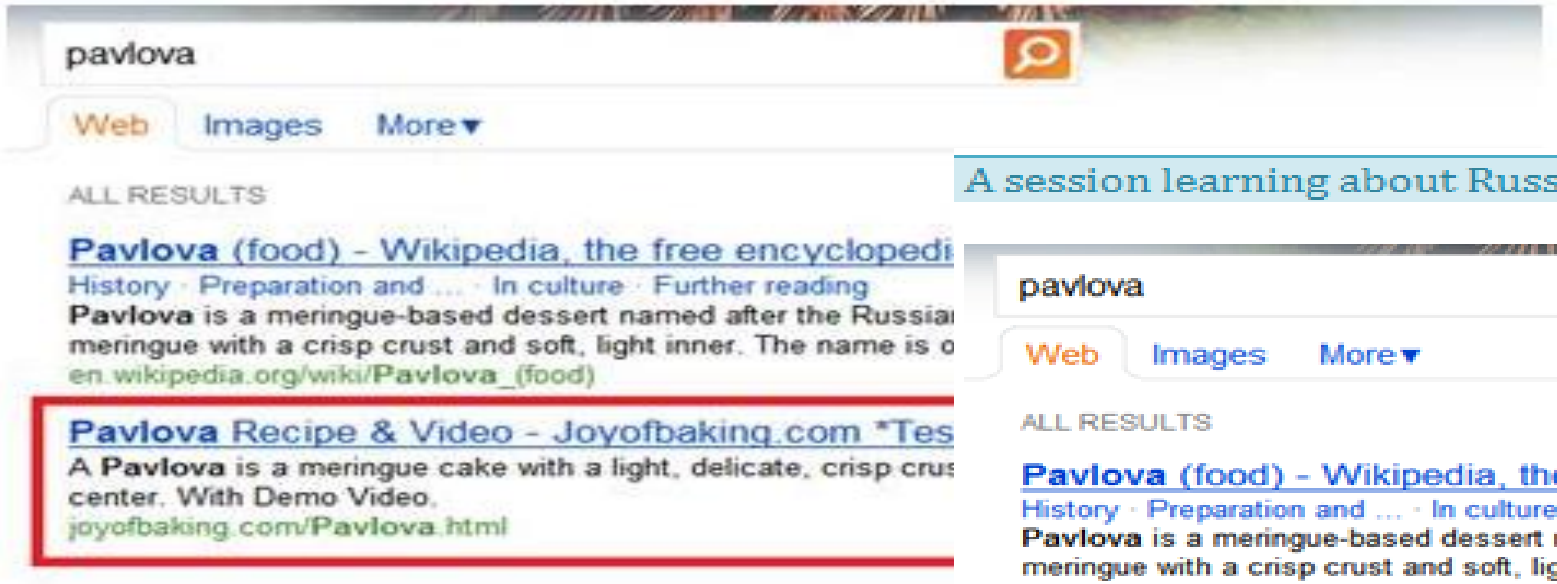
~35% within 90 days

$17.4B cost to Medicare

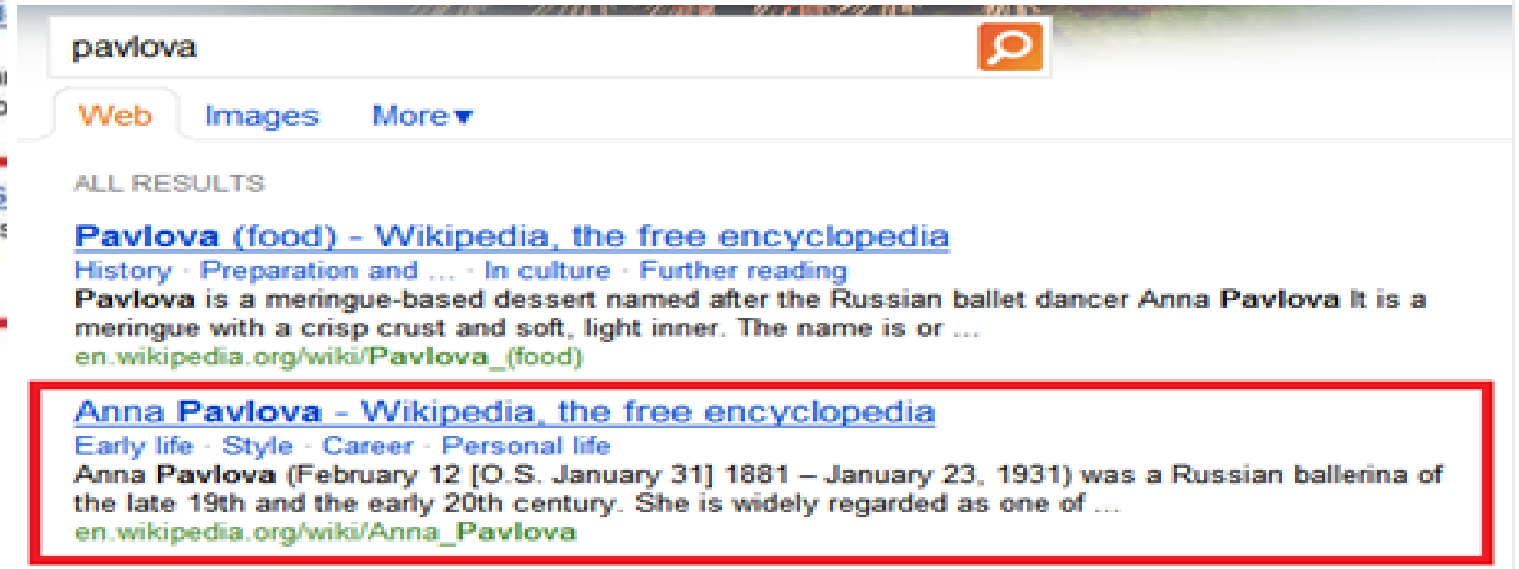
Weight	Feature description	Frequency
0.68398	Dx0->2 = Excessive vomiting in pregnancy	0.31%
0.61306	Dx3->2 = Personal history of malignant neoplasm	0.28%
0.58281	Dx0->2 = Heart failure	0.30%
0.56708	Dx0->1 = Nephritis, nephrotic syndrome, and nephrosis	0.09%
0.56649	Dx3->2 = Heart failure	0.28%
0.54663	Complaint sentence contains ''suicidal''	0.17%
0.48415	Dx1->2 = Disorders of function of stomach	0.07%
0.47257	Dx5->0 = Diseases Of The Genitourinary System	0.15%
0.46136	Dx0->2 = Chronic airway obstruction, not elsewhere classified	0.10%
0.44555	Dx4->2 = Depressive disorder, not elsewhere classified	0.10%
0.44257	Stayed 14 hours in the ER	0.10%
0.43890	Dx0->1 = Other psychoses	0.32%
0.43513	Dx0->0 = Diseases Of The Blood And Blood-Forming Organs	0.46%
0.42582	Complaint sentence contains ''dialysis''	0.19%
0.41888	Dx0->2 = Depressive disorder, not elsewhere classified	0.27%
0.41302	Dx1->1 = Nephritis, nephrotic syndrome, and nephrosis	0.29%
0.38506	Complaint sentence contains ''fluid''	0.10%
0.37474	69 < Age	9.22%

Search Technologies

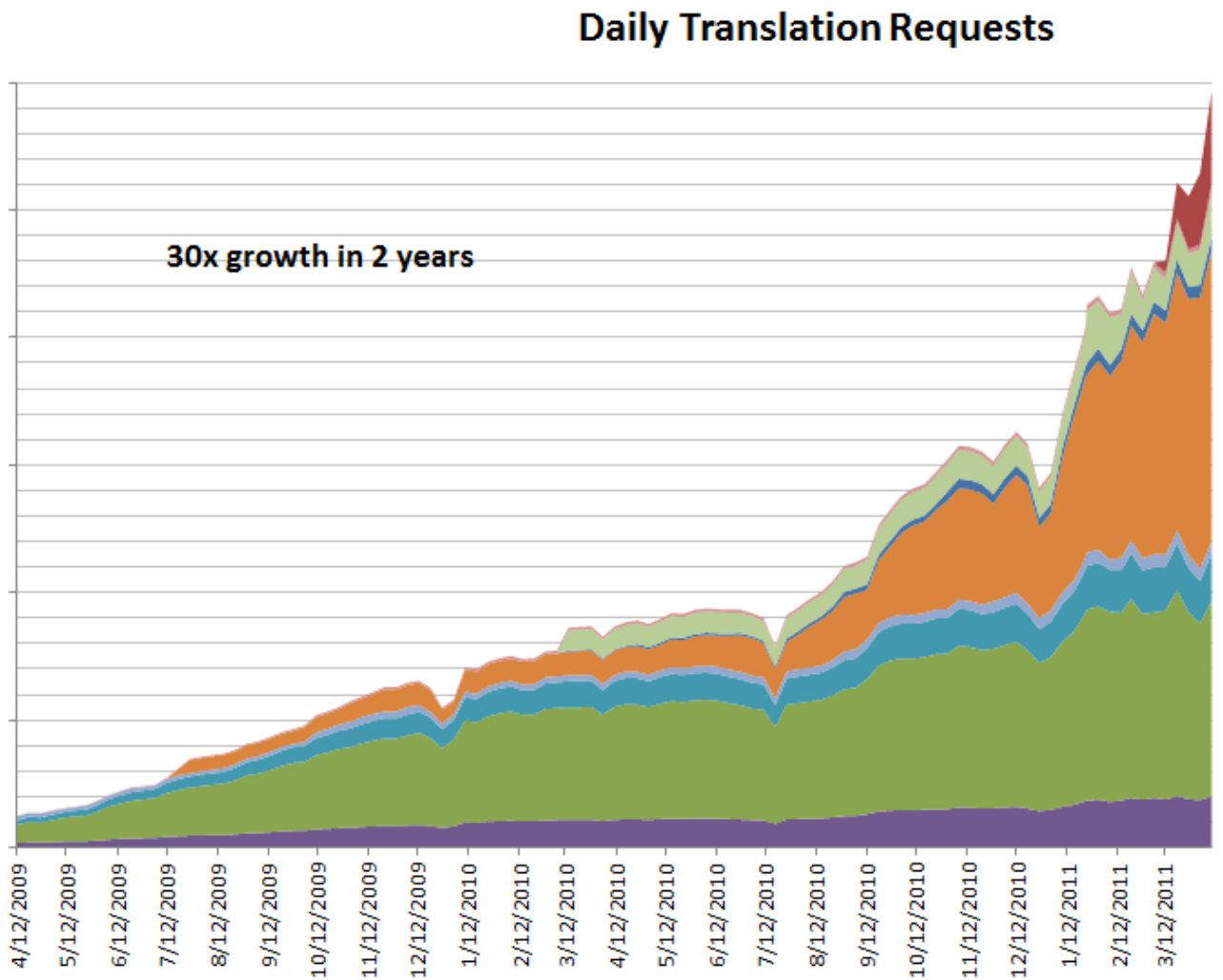
A session looking for dessert recipes…



A session learning about Russian ballet…



Language Technologies



Machine Translation

Software Engineering and Tools

Hundreds of file formats supported in Windows, Office, etc.

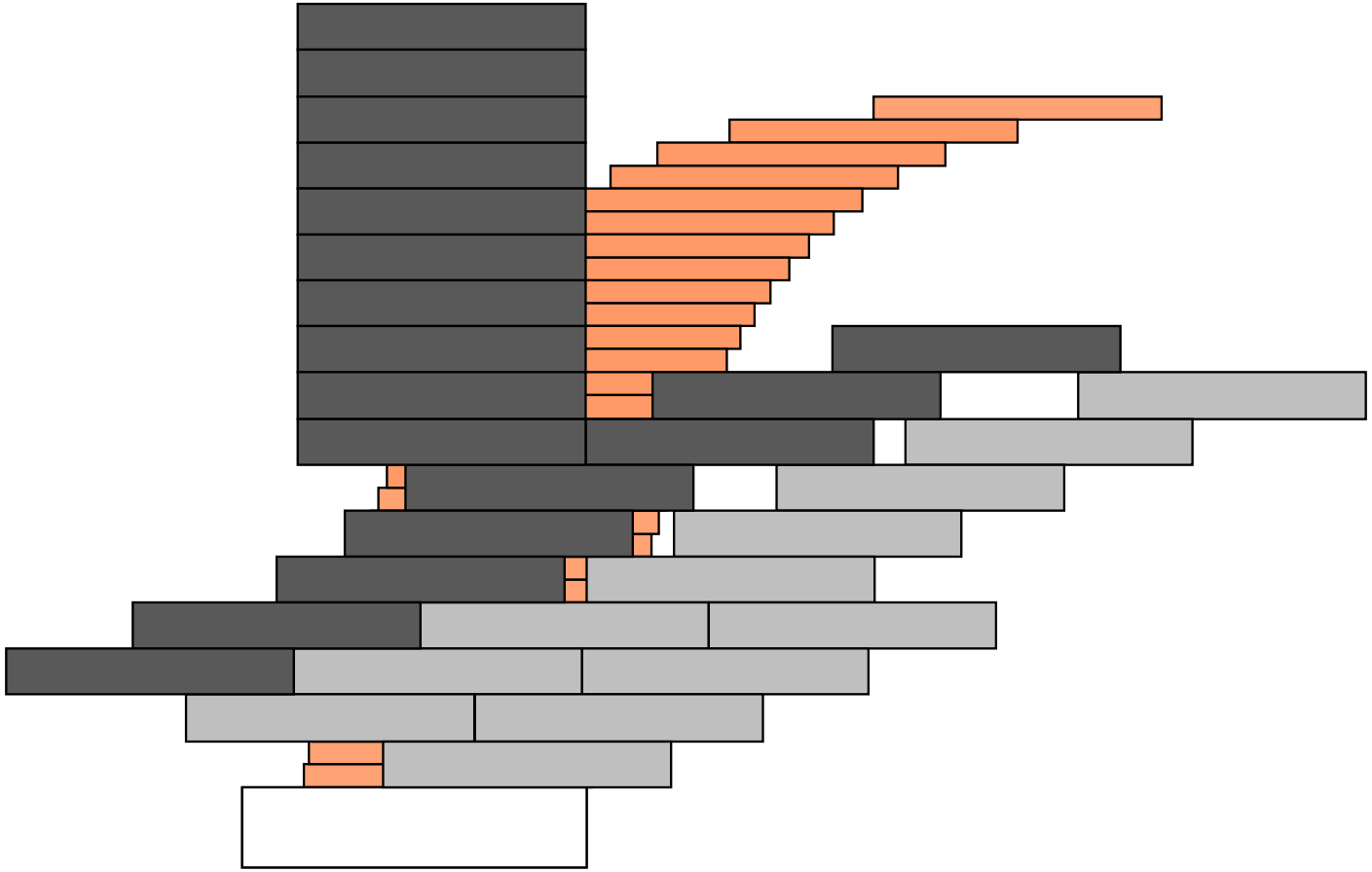
All groups do "fuzz testing," mandated by the Security Development Lifecycle.

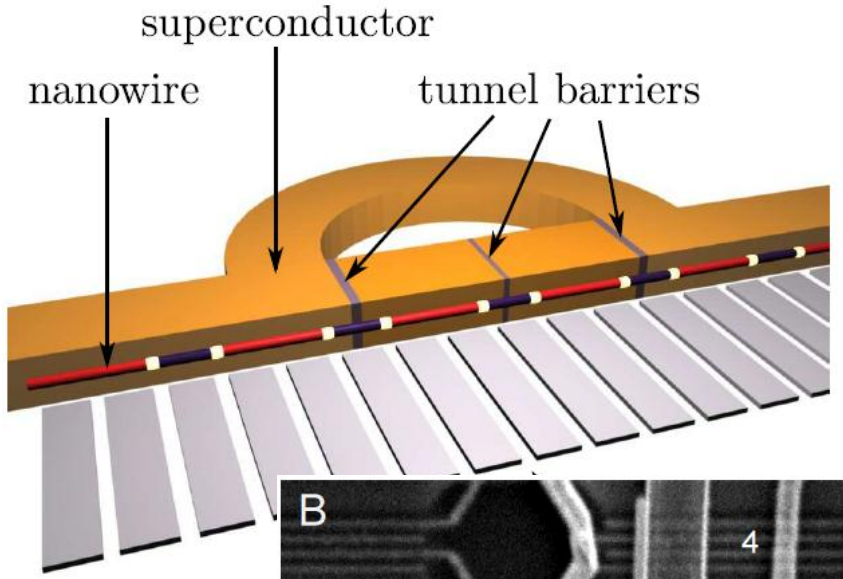
Every security patch costs Microsoft alone **one million dollars.**

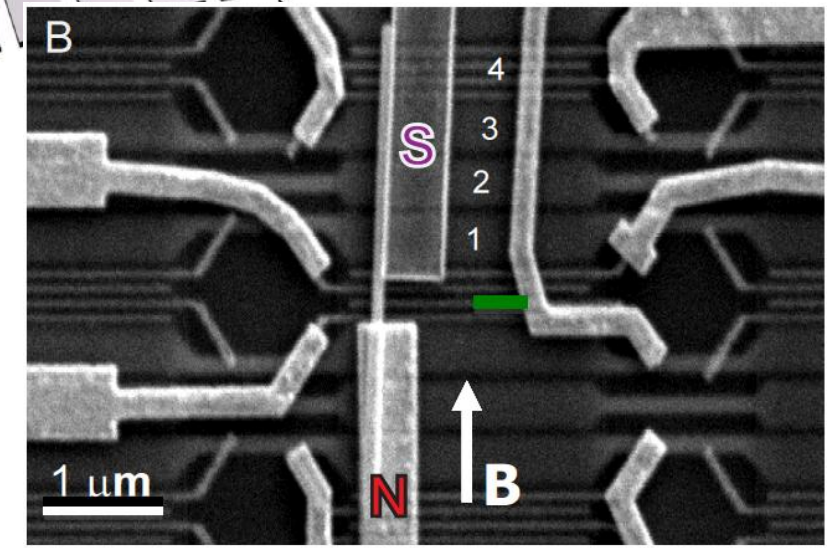
Traditional random fuzz testing **can't catch this bug**:

```
int obscure(int x, int y) {
  if (x==hash(y)) error();
  return 0;
}
```

Theoretical Computer Science and Physical Sciences

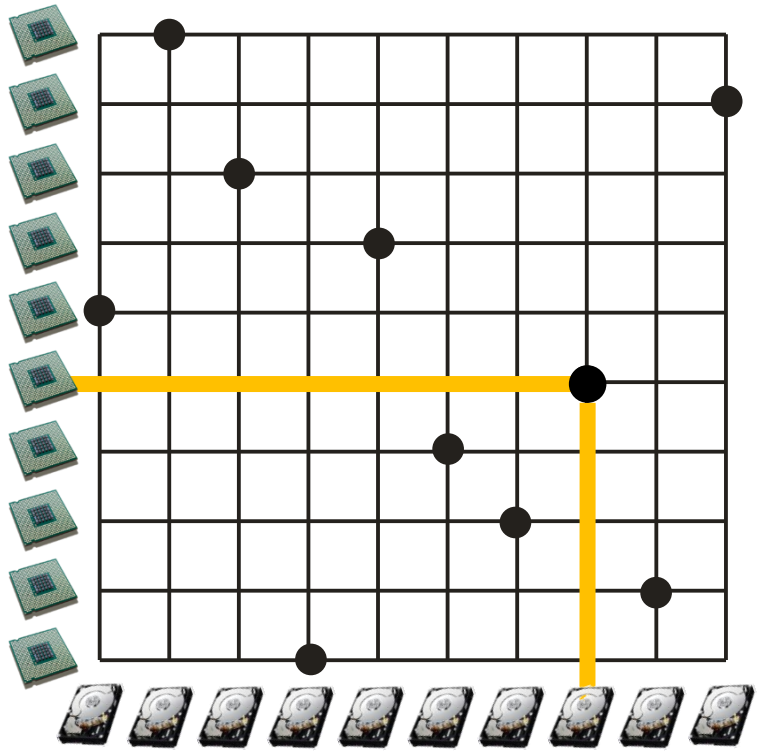




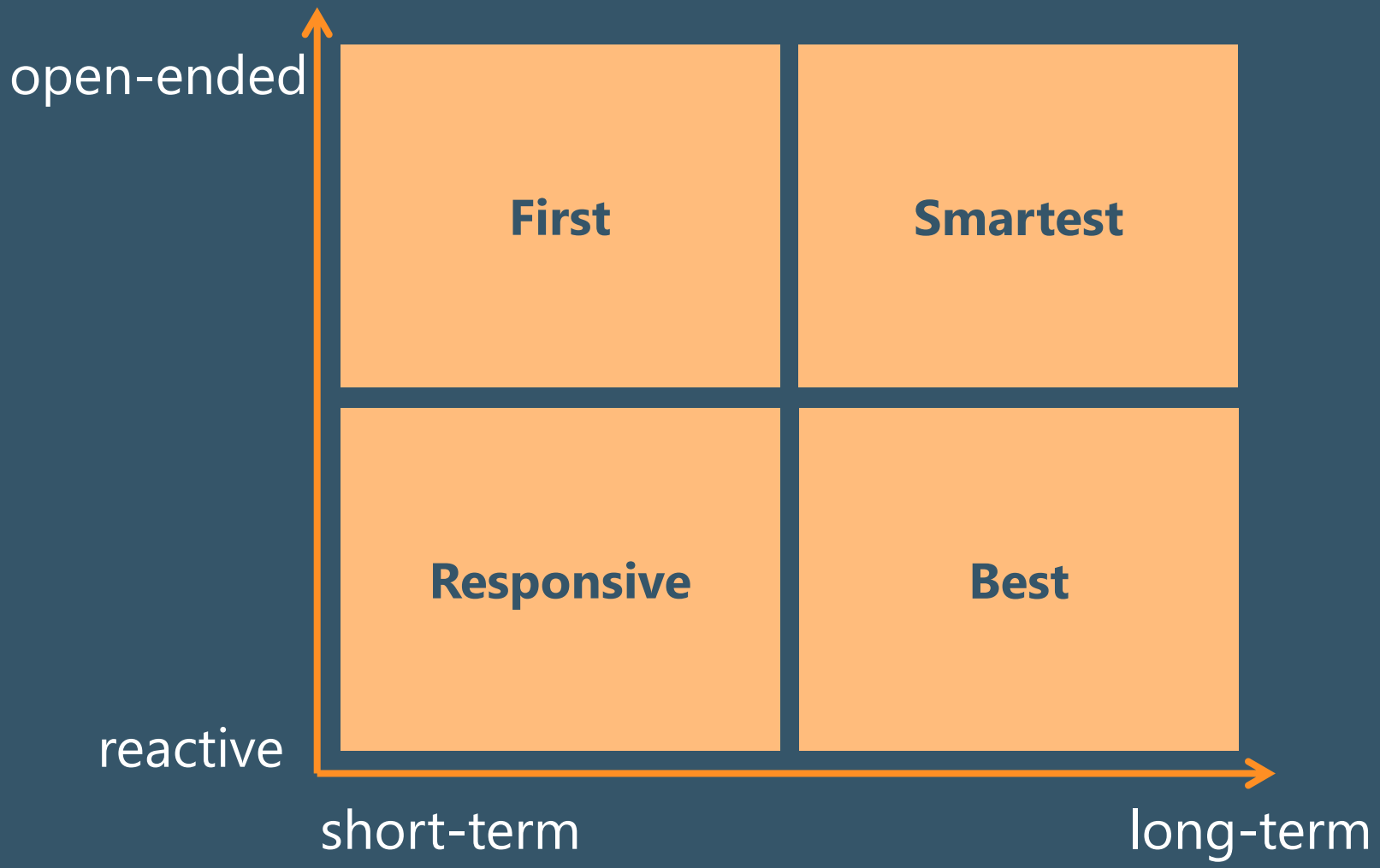


Natural User Interaction

Cloud Technologies: FDS



- Flat Datacenter System enables any processor to access any disk with the throughput of a local disk
- Dramatically increases throughput and failure recovery
- Winner of the Indy and Daytona sorting records


open-ended
First
Smartest
Responsive
Best
reactive
short-term
long-term

Microsoft®

© 2012 Microsoft Corporation. All rights reserved. Microsoft, Windows, and other product names are or may be registered trademarks and/or trademarks in the U.S. and/or other countries.
The information herein is for informational purposes only and represents the current view of Microsoft Corporation as of the date of this presentation. Because Microsoft must respond to changing market conditions, it should not be interpreted to be a commitment on the part of Microsoft, and Microsoft cannot guarantee the accuracy of any information provided after the date of this presentation. MICROSOFT MAKES NO WARRANTIES, EXPRESS, IMPLIED OR STATUTORY, AS TO THE INFORMATION IN THIS PRESENTATION.