CS 535 Large Scale Data Analysis

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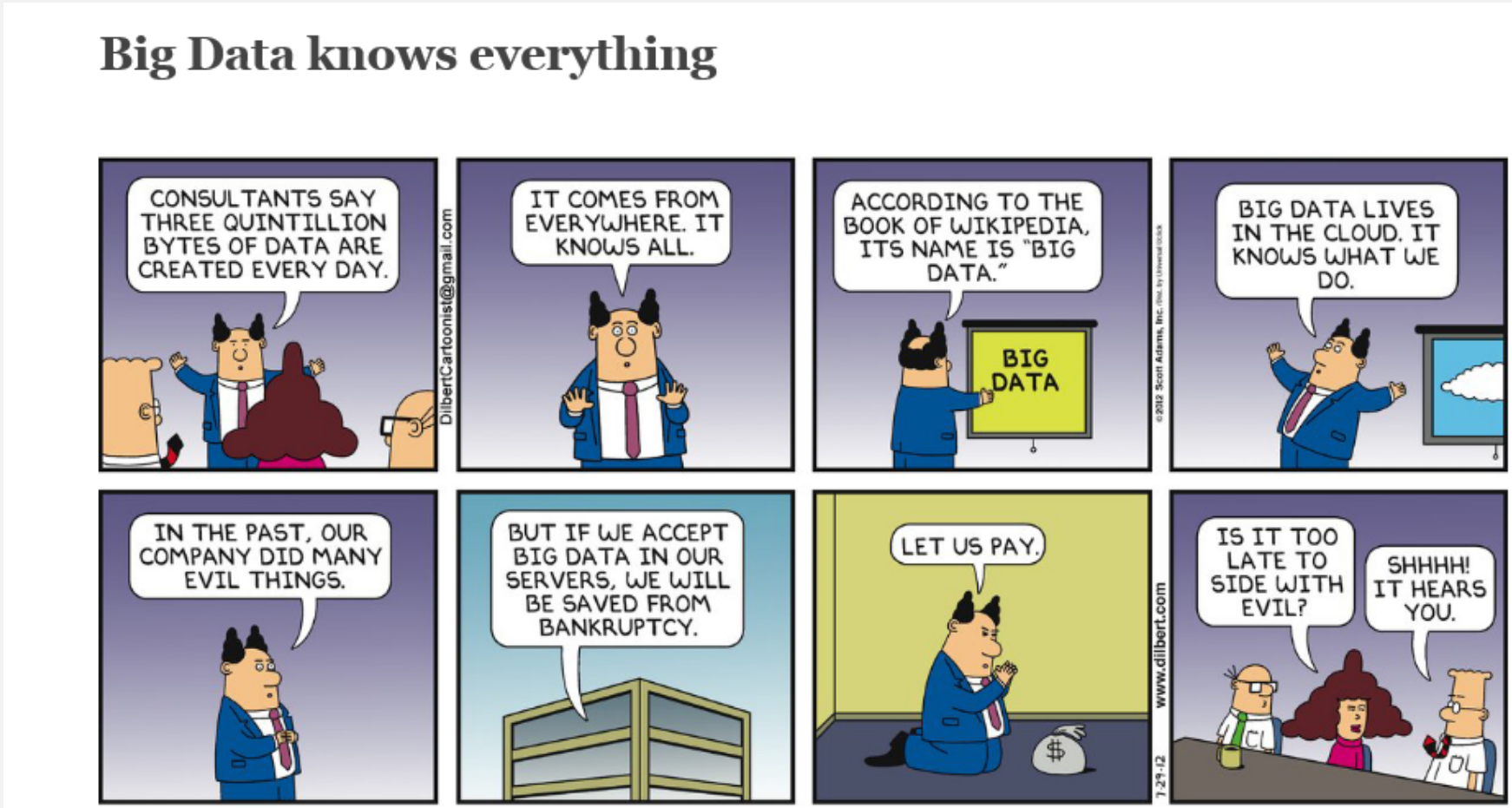
Big Data, Big Disks, Cheap Computers

- *"In pioneer days they used oxen for heavy pulling, and when one ox couldn't budge a log, they didn't try to grow a larger ox. We shouldn't be trying for bigger computers, but for more systems of computers."* Rear Admiral Grace Hopper.
- *"More data usually beats better algorithms."* Anand Rajaraman.
- *"The good news is that Big Data is here. The bad news is that we are struggling to store and analyze it."* Tom White.

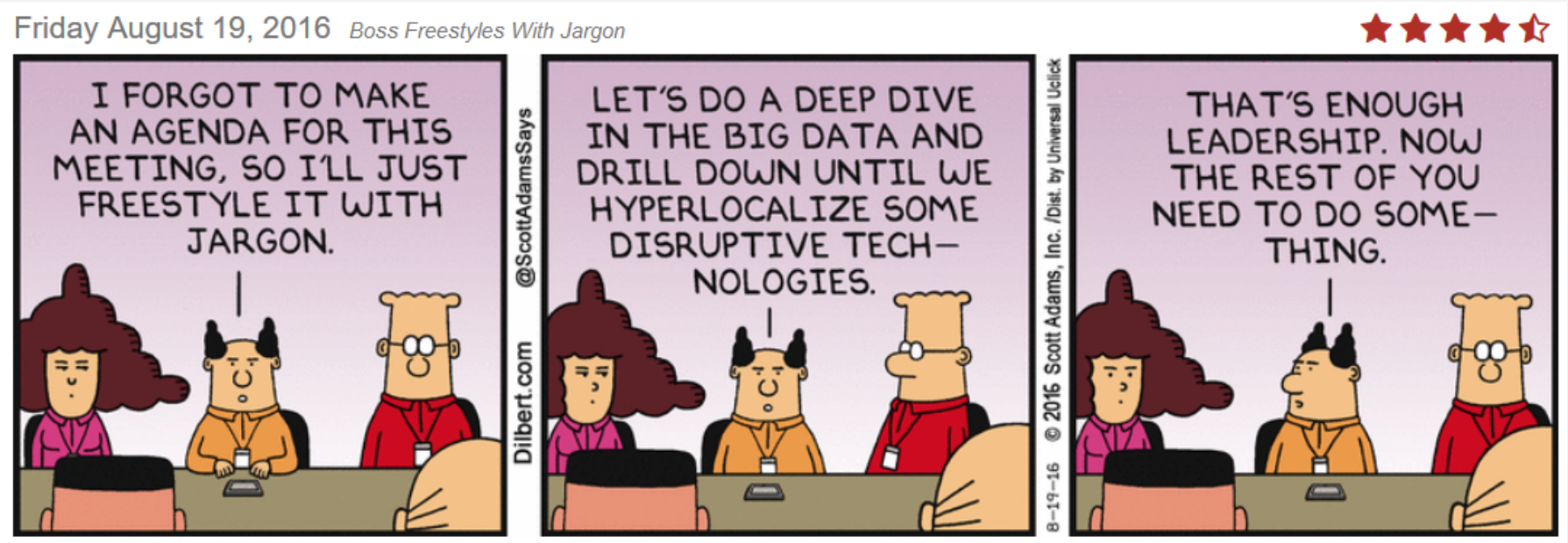
Units and Units

Check out http://en.wikipedia.org/wiki /Petabyte

Big Data


Big Data knows everything
CONSULTANTS SAY THREE QUINTILLION BYTES OF DATA ARE CREATED EVERY DAY.
DilbertCartoonist@gmail.com
IT COMES FROM EVERYWHERE. IT KNOWS ALL.
ACCORDING TO THE BOOK OF WIKIPEDIA, ITS NAME IS "BIG DATA."
BIG DATA
BIG DATA LIVES IN THE CLOUD. IT KNOWS WHAT WE DO.
IN THE PAST, OUR COMPANY DID MANY EVIL THINGS.
BUT IF WE ACCEPT BIG DATA IN OUR SERVERS, WE WILL BE SAVED FROM BANKRUPTCY.
LET US PAY.
www.dilbert.com
7-29-12
IS IT TOO LATE TO SIDE WITH EVIL?
SHHHH! IT HEARS YOU.

Big Data


Friday August 19, 2016 Boss Freestyles With Jargon
I FORGOT TO MAKE AN AGENDA FOR THIS MEETING, SO I'LL JUST FREESTYLE IT WITH JARGON.
LET'S DO A DEEP DIVE IN THE BIG DATA AND DRILL DOWN UNTIL WE HYPERLOCALIZE SOME DISRUPTIVE TECH-NOLOGIES.
THAT'S ENOUGH LEADERSHIP. NOW THE REST OF YOU NEED TO DO SOME-THING.
Dilbert.com @ScottAdamsSays
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Big Data


DO WE HAVE ANY ACTIONABLE ANALYTICS FROM OUR BIG DATA IN THE CLOUD?
YES, THE DATA SHOWS THAT MY PRODUCTIVITY PLUNGES WHENEVER YOU LEARN NEW JARGON.
MAYBE IN-MEMORY COMPUTING WILL ACCEL-ERATE YOUR APPLICA-TIONS.
PLUNGE, PLUNGE, PLUNGE.
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Word-count: Hello World of Big Data

Problem: Given a collection of text files, find the frequency of each word. For example:

File1.txt	File2.txt	File3.txt
large	data	huge
big	data	big
large	data	small
big	data	deluge

Result:

```
large 2
big 3
data 4
small 1
deluge 1
huge 1
```

Questions: Do we want the output sorted by frequency? Sorted by word? How would you solve this problem?

Large Scale Word-Count (1)

- What if the the number of files is in millions and will not fit in one server?
- What if the total size of the files is in Petabytes and will not fit in one server?
- How do you modify your solution from before? Assume that you have a cluster of n servers available with the files distributed across the servers.
- But how do we create a cluster and get the files on it?

Large Scale Word-Count (2)

- What if some of the servers fail while running your program?
- What if some of the server disks fail or get corrupted while your program is running?
- What if the some system administrator reboots some of your servers for software/hardware updates without letting you know?

Data Scientist versus Data Engineer

Data Science tasks:

- Goal is to answer a question or discovering insights.
- Often uses interactive shells for adhoc analysis
- Typically uses Python, R, Matlab (and Spark now)

Data engineer tasks:

- Builds and maintains a production application (that may use hardened versions of the original data science work)
- Use principles of software engineering like encapsulation, object-oriented design and interface design
- They have to deal with parallelization, complexity of distributed systems, fault tolerance etc
- Typical languages would be Java (with Hadoop and/or Spark), Scala, Python (at smaller scales)