Manufacturing and Scaling Big Data

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Advancing Data-Driven Manufacturing

What Is Big Data?

- Big Data is like **teenage sex:**
  - Everyone **talks** about it
  - Nobody really knows **how** to do it
  - So, everybody claims they ***ARE*** doing it

The Future Is Not What It Used To Be

- "Dave, I need to know what Sun will be selling 10 years from now, can you tell me?"
- "Yes, I can. Just one question for you, what are the game-changing technologies that will be invented in the next 10 years?

Laws

Mike O'Dell's Laws

- Scaling is ALWAYS THE problem
- If you're not afraid, you simply do NOT understand

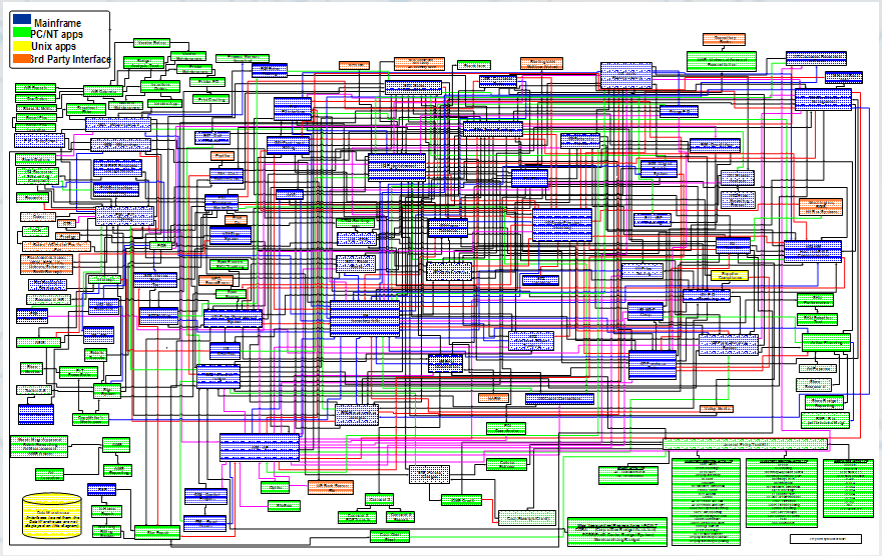


Image above is from John Meyer's 2013 keynote

Cramming More Components onto Integrated Circuits

- Published in *Electronics* magazine on April 19, 1965
- This article has turned into the moral equivalent of Moses coming down from the mountaintop carrying the Ten Commandments of Electronics
- The author basically stated the number of circuits on a chip would double every two years
- **Dr. Carver Mead at Caltech coined the term "Moore's Law" after his friend Dr. Gordon E. Moore of Intel**

100,000 Libraries of Congress

- The amount of printed material at the Library of Congress is 10TB
  - A petabyte is 1,000 TB
- An exabyte (EB)
  - The prefix *exa* means one billion billion, or one quintillion
  - **1,152,921,504,606,846,976 bytes**
  - 1,000 petabytes, or a million TBs or a billion gigabytes
  - 67 million iPhones of data
- It is rumored that NSA has 3 to 12 Exabytes at their new facility in Bluffdale, Utah
- New large data set tools, like hadoop, have replaced yesterday's tools, and new tools will be created to deal with tomorrow's even larger data sets

340,282,366,920,938,463,463,374, 607,431,768,211,456

- That's 340 ***undecillion***
- aka IPv6 addressing – 128 bit addresses
- If we took every single atom on planet Earth, we would be able to give each and ***every*** atom 100 IPv6 addresses
- IPv4 was too small at 4,294,967,296
    - That's 4 billion
    - That's 32 bits
- IPv6 is the foundation for manufacturing and scaling big data

Neil Groundwater's Law

- /* You are not expected to understand this */
- Everything you know is wrong
- How do the little electrons know?
  - Monster cables versus Home Depot wire
- Do the math
  - Sun Net Manager's Two Questions
- Can be summarized as, ***"stop, and think <u>through</u> this problem."***

Metcalfe's Law

- The value of any network is the number of nodes squared

- N^2

Edstrom's MTConnect Law

- The value of any manufacturing network is the number of MTConnect enabled systems ***plus*** the number of software systems that are ***integrated*** with that MTConnect data **squared**
- **[MTConnect + Integrated Software]^2**

John Meyer's 2013 Keynote

Businesses are "dying of thirst in an ocean of data"

90%
of the world's data was created in the last two years

80%
of the world's data today is unstructured

1 Trillion
connected devices generate 2.5 quintillion bytes data / day

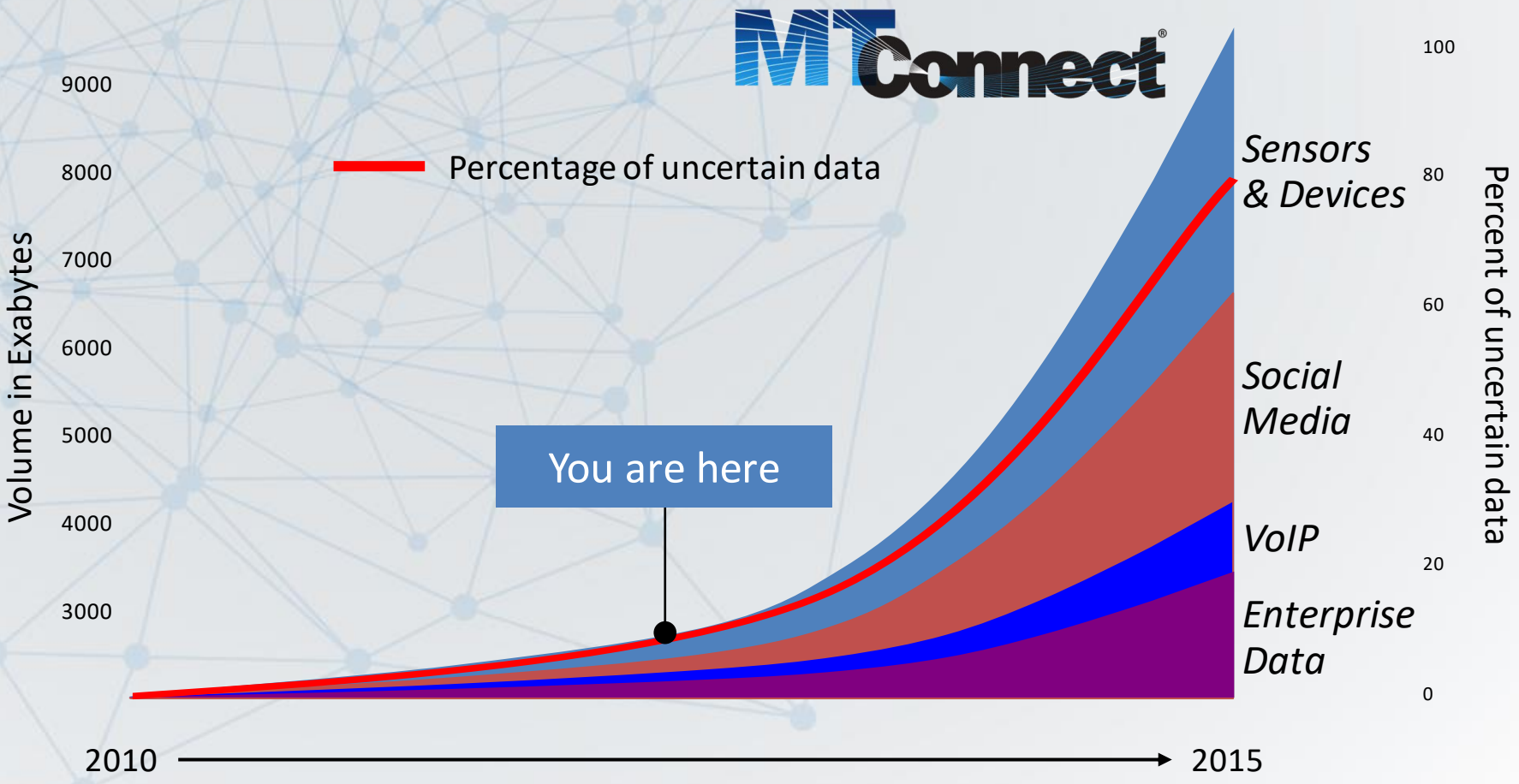
1 in 2
business leaders don't have access to data they need

83%
of CIOs cited BI and analytics as part of their visionary plan

2.2X
more likely that top performers use business analytics

[MC]²

Big Data – Seas of Manufacturing Sensors



Source: *John Meyer's [MC]2 2013 Keynote*
IBM Global Technology Outlook - 2012

[MC]2

2025 Manufacturing and Scaling Big Data

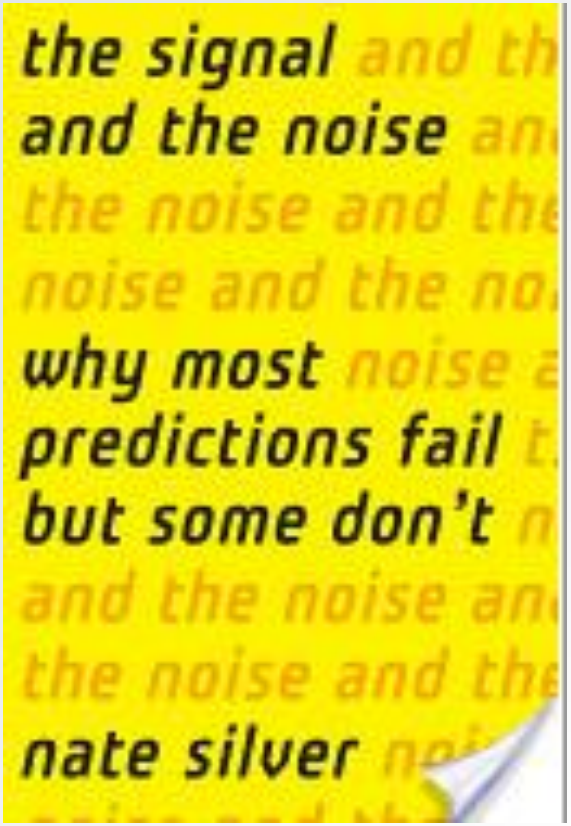
- 256 exabytes of data will be created in the year 2025
  - A large percent of that data will be sensor data
- 300 zettabytes – 300,000 exabytes of total storage around the globe
- You will be carrying the equivalent of 64 of today's iPhones in your pocket
  - A 4***TB*** iPhone 16S will sell for $199

It Begs The Obvious Question…..

So what?

Karl versus Nate

Just increasing the size of your haystack does not help you find the needle



Moneyball's Billy Beane

- Who saw the movie with Brad Pitt and Jonah Hill?
- Groundwater's Law – **Everything You Know is Wrong**
  - Scouts have been drowning in baseball's Sea of Statistics for over a hundred years
  - Predicting **how well a player will perform in the future** is very different than measuring how well he has done in the past
  - **On Base Percentage** is **MUCH** more of an indicator for scoring runs and winning games than a player's batting average
- **What matters the <u>absolute most</u> to predict the <u>future success</u> of a baseball player?**
  - Preparedness and work ethic
  - Concentration and Focus
  - Competiveness and Self-Confidence
  - Stress Management and Humility
  - Adaptiveness and Learning Ability

What Do The Following Have In Common?

- National Security Agency
- Doug Woods
- Dr. Dean Bartles
- **An appreciation of metadata?**
  - **First, what is metadata? Data about data**
    - NSA example phone records example
- **YES,** all three have an appreciation of metadata AND separating the signals from all the noise

Edstrom Issues D² MTCorrect Challenge

- How do you build **D**oug Woods and Dr. **D**ean Bartles **MTCorrect app**?
  - Answers the question, "What is the ***best*** way to build this part using the ***right*** material with the equipment and the people that I have?"
- This is the suggestion I have made to every single machine tool builder since 2006
  - Sun's maintenance program – **anonymized metadata**
  - **Absolutely priceless for not only knowing how your systems are being used, but what your future systems should concentrate on**
- AMT's USMTO survey model
  - You have to share to play
- It's NOT about capturing ALL the machine tool data, it's about **determining, creating, capturing and analyzing the right metadata from a variety of systems**

Manufacturing and Scaling Big Data

- Manufacturing means accessing and creating the RIGHT data ***and the right metadata***
- Scaling means using the right metrics and algorithms to **separate the signals from all the noise**
- It's **not the size** of your data, it's **what you do with it.**

Thanks!

- Thanks to MTConnect Community
- Thanks to MTConnect Technical Advisory Group (MTCTAG)
- Thanks to MTConnect Board of Directors
- Thanks to AMT
- Thanks to Doug Woods