

What's Our Job When The Machines Do Testing?

2 May 2018

Geoff Meyer, Test Architect

geoff_meyer@dell.com

DELL EMC





FORRESTER
How AI Will Change Software Development And Applications
November 2, 2016
3/1/2016



The Era

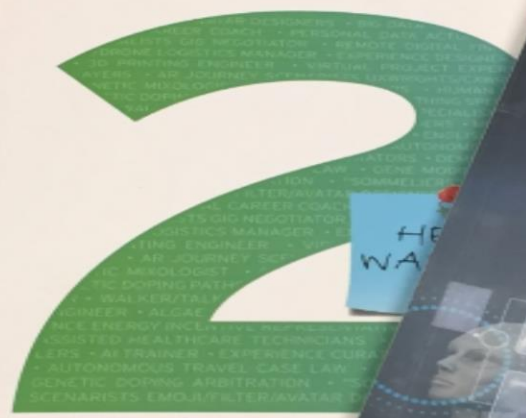


Testing

The state
develop
play th
QA m
The g

<https://www.mabl.com/blog/the-era-of-intelligent-testing>

Cognizant



JOBS ON
A GUIDE TO
EMPLOYED

Capgemini
CONSULTING TECHNOLOGY OUTSOURCING

Hewlett Packard
Enterprise

SOGETI

WORLD QUALITY REPORT

2016-17

EIGHTH EDITION





Hope, Hype and Realization

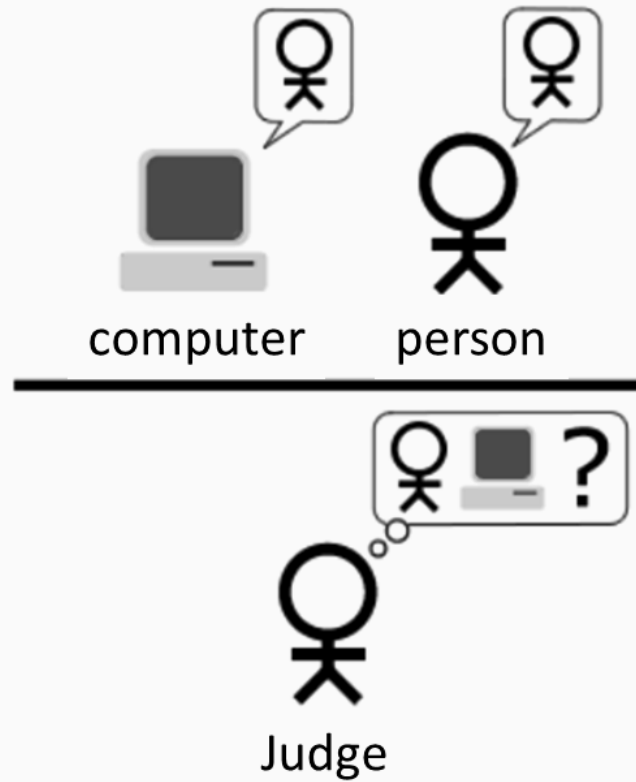
Navigating the Age of the Machine

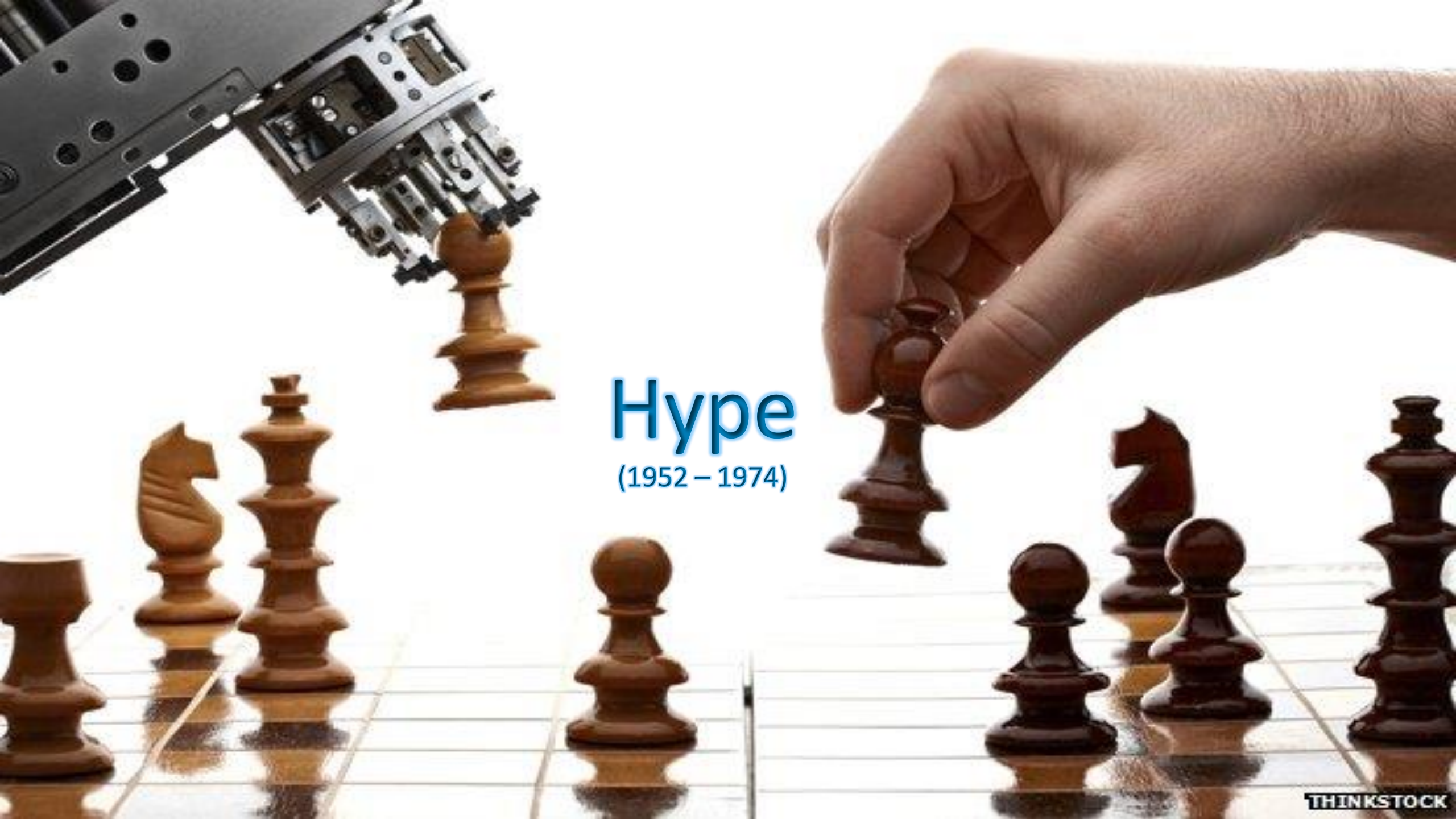
Machine Partnerships in Test

What's our job?

Hope


(1945 – 1951)





Hype

(1952 – 1974)


A person with a red backpack is walking up a steep, snow-covered mountain slope. The person is seen from behind, leaving a trail of footprints in the snow. The landscape is vast and desolate, with snow-covered peaks and ridges under a clear sky. The lighting suggests a bright day, with long shadows cast on the snow.

“Optimistic predictions embarrassed
the nascent AI field” ~ *Ray Kurzweil*

Winter

(1974 – 1993)

Dystopian



Ex Machina
Minority Report
Transcendence
Bladerunner 2049

Beware!

When Will AI Exceed Human Performance? Evidence from AI Experts

Katja Grace^{1,2}, John Salvatier², Allan Dafoe^{1,3}, Baobao Zhang³, and Owain Evans¹

¹Future of Humanity Institute, Oxford University
²AI Impacts
³Department of Political Science, Yale University

Abstract

Advances in artificial intelligence (AI) will transform modern life by reshaping transportation, health, science, finance, and the military [1, 2, 3]. To adapt public policy, we need to better anticipate these advances [4, 5]. Here we report the results from a large survey of machine learning researchers on their beliefs about progress in AI. Researchers predict AI will outperform humans in many activities in the next ten years, such as translating languages (by 2024), writing high-school essays (by 2026), driving a truck (by 2027), working in retail (by 2031), writing a best-selling book (by 2031), and making a successful business deal (by 2031).

LIFE 3.0

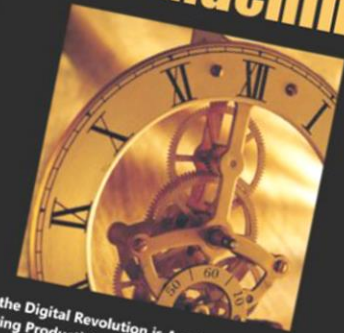
BEING HUMAN IN THE AGE OF
ARTIFICIAL INTELLIGENCE

MAX TEGMARK



NEW YORK TIMES BEST SELLER

Erik Brynjolfsson Andrew McAfee **Race Against The Machine**



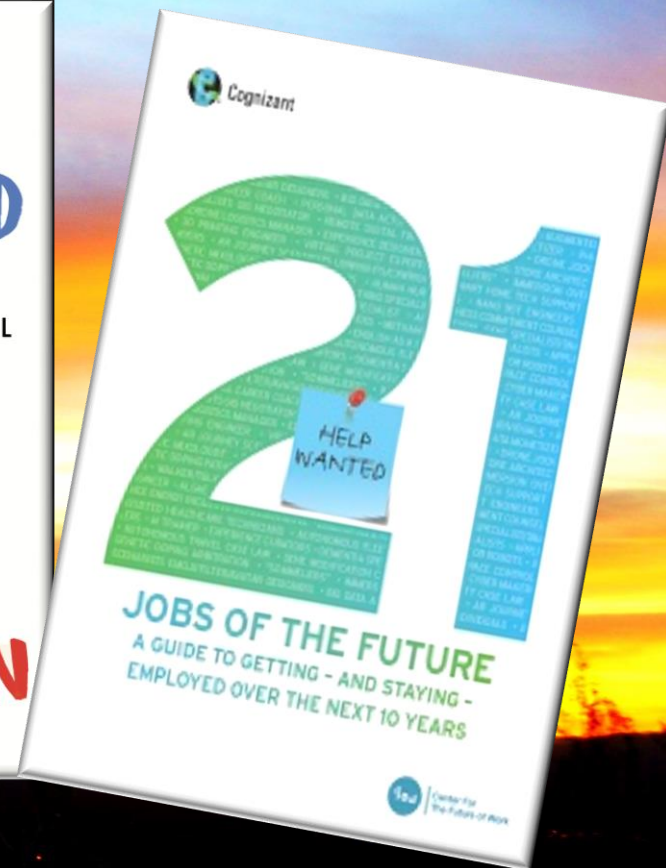
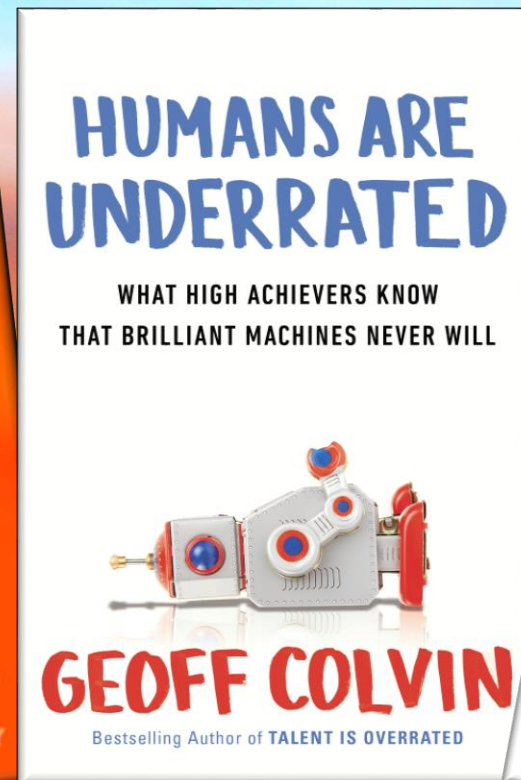
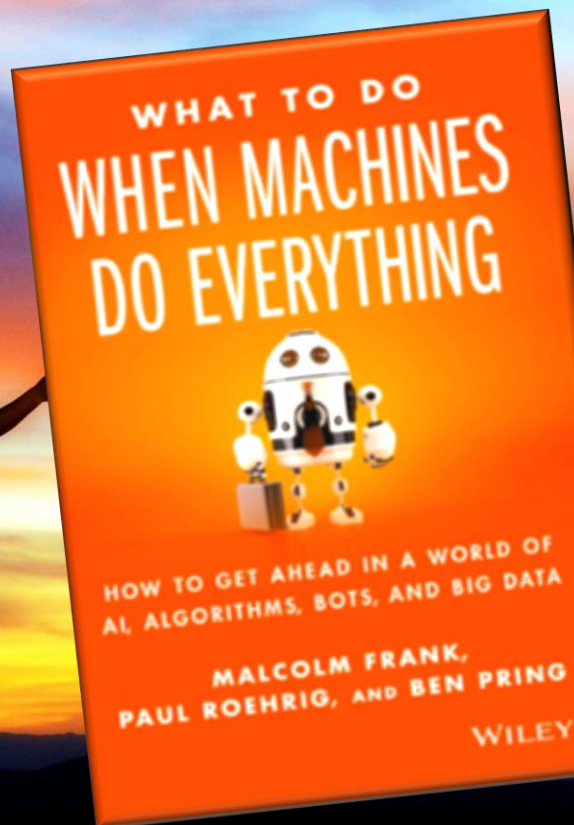
How the Digital Revolution is Accelerating Innovation,
Driving Productivity, and Irreversibly Transforming
Employment and the Economy

Utopian

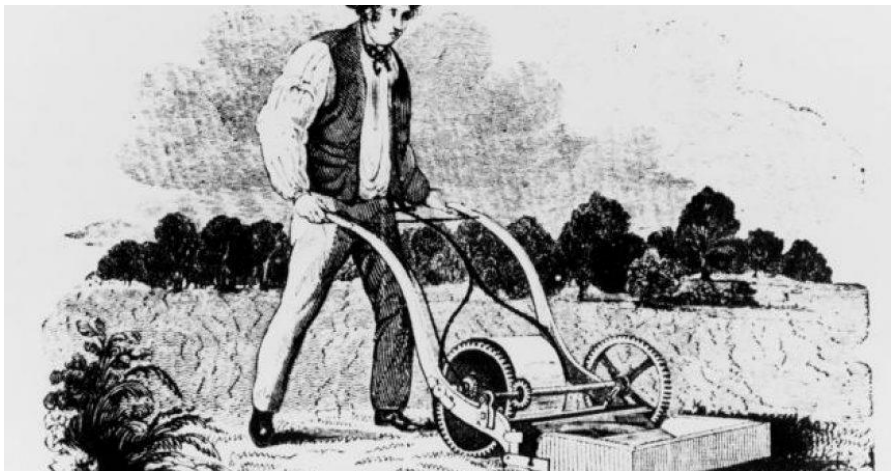


DELL

A NEW DAY



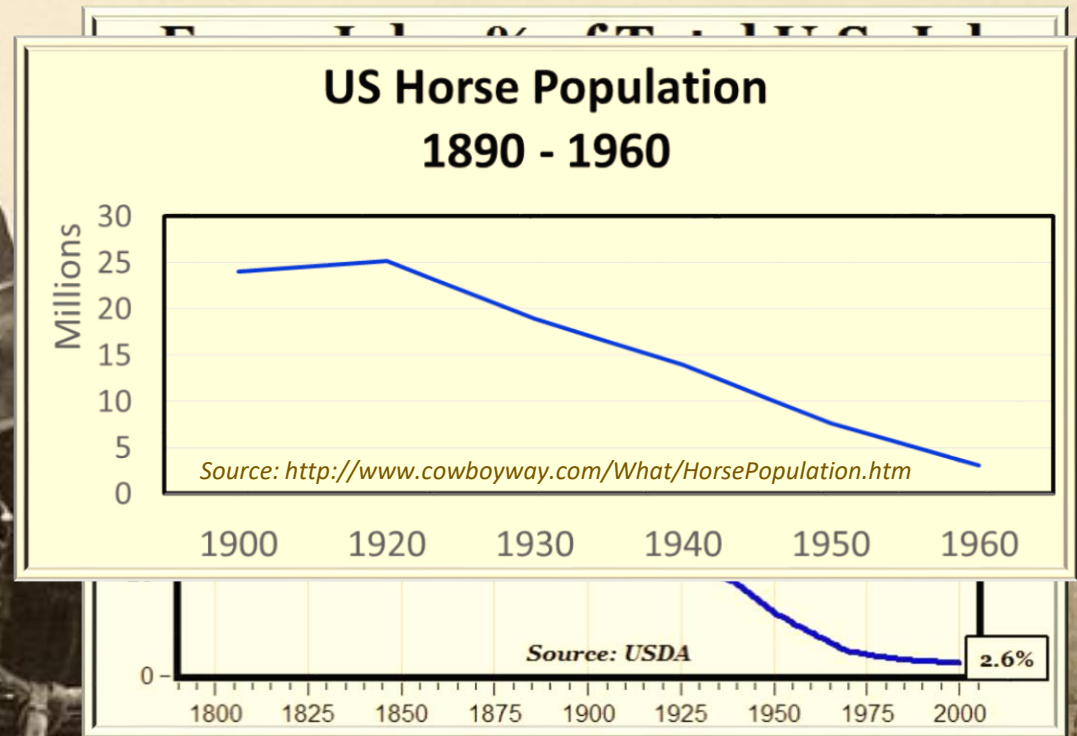
Budding Effect



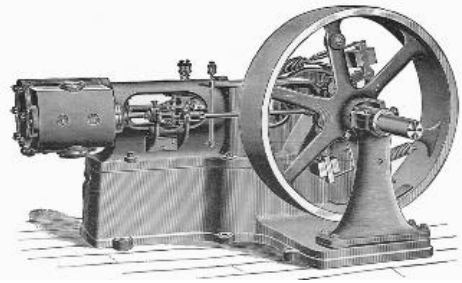
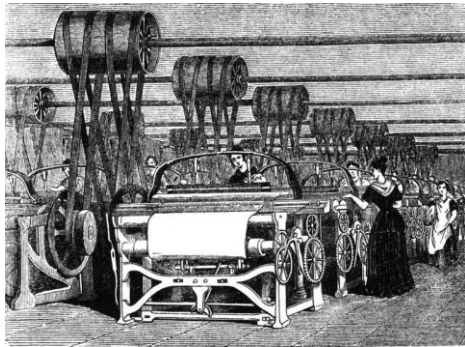
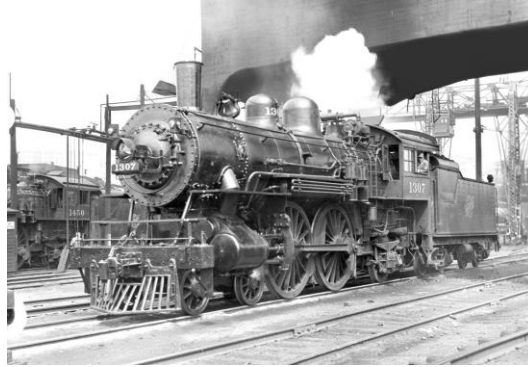
Convenience



Abundance



Industrial Revolutions are not new



◆ 1st Industrial Revolution → ◆ 2nd IR → ◆ 3rd IR → ◆ 4th IR →

1800

1900

2000

2018

This time feels different

2005

Market Cap

Employees

ExxonMobil

\$\$\$\$\$



\$\$\$\$



Microsoft

\$\$\$\$



citigroup

\$\$\$



Bank of America

\$\$\$



~\$1.9T

~930K employees

2017

Market Cap

Employees



\$\$\$\$\$\$\$\$



Alphabet

\$\$\$\$\$\$\$\$



Microsoft

\$\$\$\$\$\$\$\$



amazon

\$\$\$\$\$



\$\$\$\$\$



~\$3.2T

~910K employees

\$ = \$100B 👤 = 10,000

Analytics and AI in Business



Human Resources



Legal Discovery



Global Audit



Global Services & Support



Financial Services



Sales & Pricing



Marketing Analytics

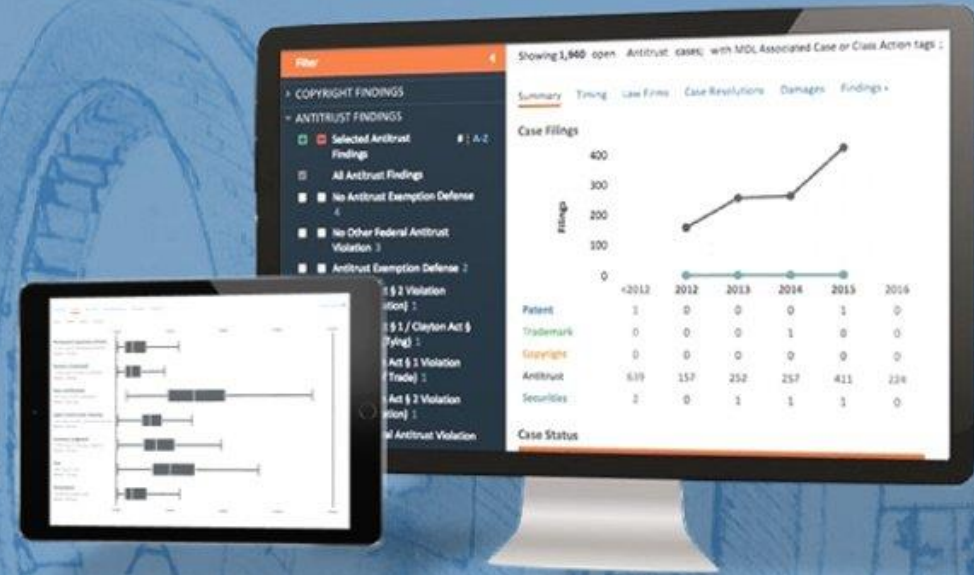


Operations

...Identify what doesn't work well in a process, service or product and make it go away ~ *Malcolm Frank, Cognizant Future of Work*

Legal Analytics® for Winning Litigators

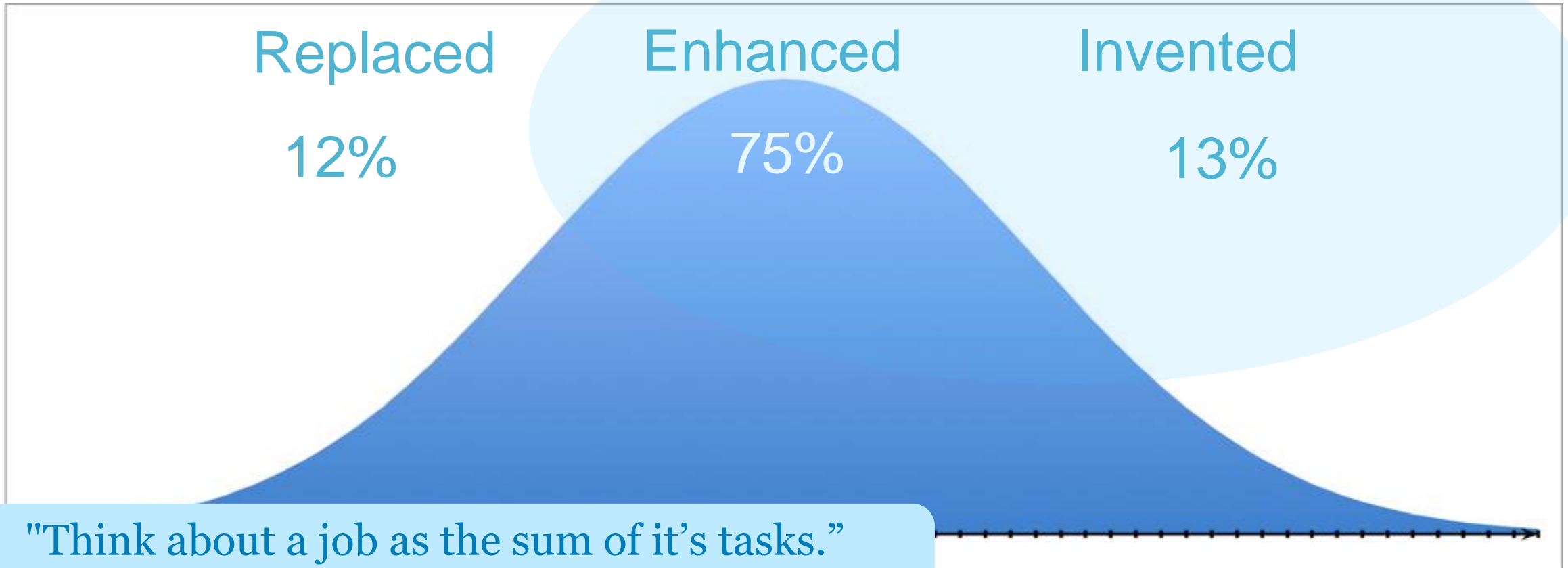
 Lex Machina



“What’s happening to lawyers is a model for any occupation involving analysis, subtle interpretation, strategizing, and persuasion” ~ *Geoff Colvin, Author*

But it's OK

Almost 90%!



"Think about a job as the sum of it's tasks."
~ *What to do when Machines do everything*



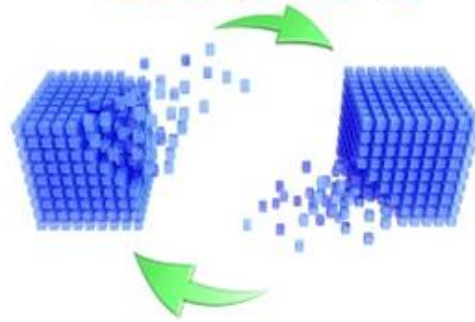


It's all about the data

Data
Sources



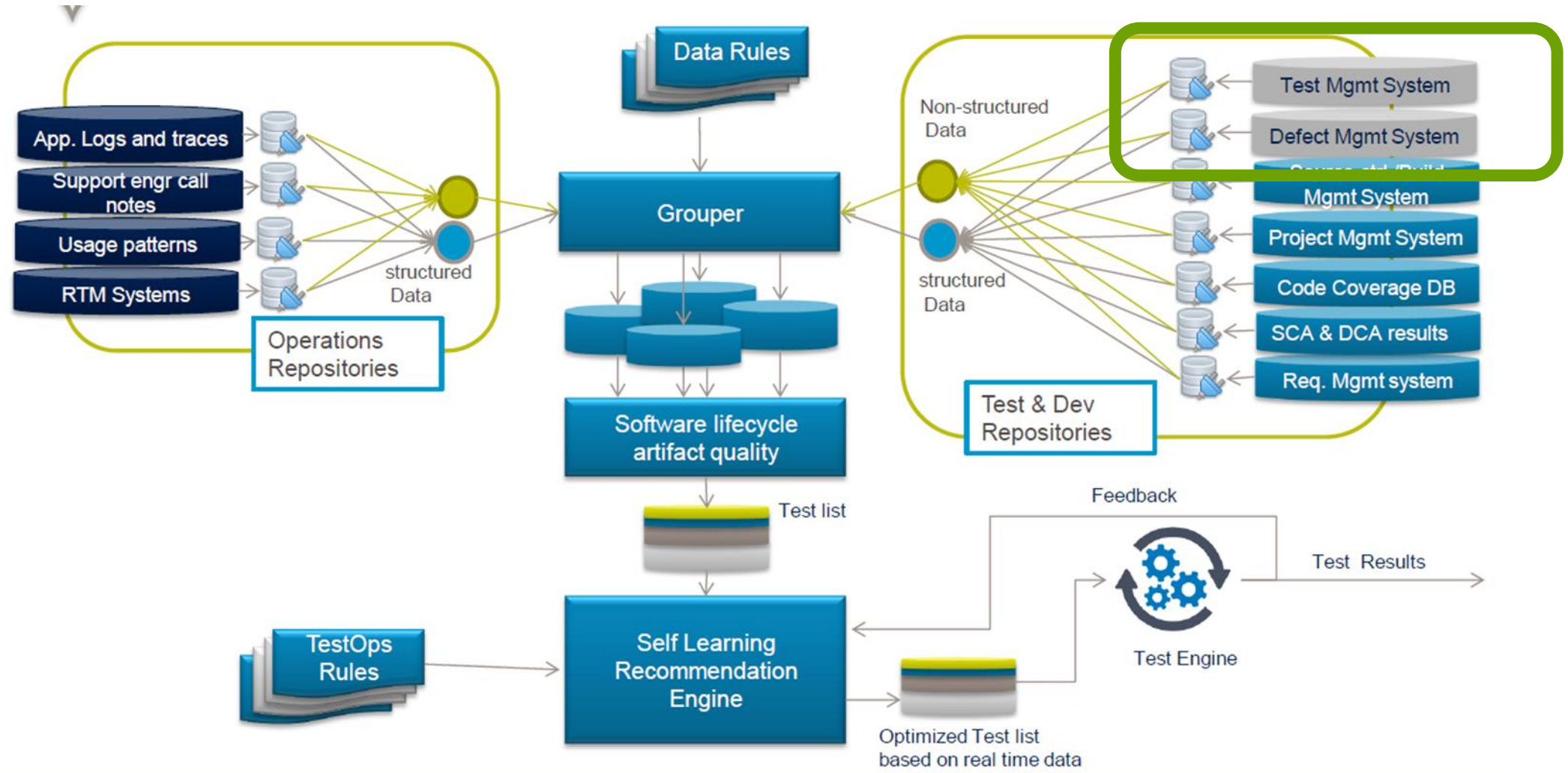
Data
Cleanse



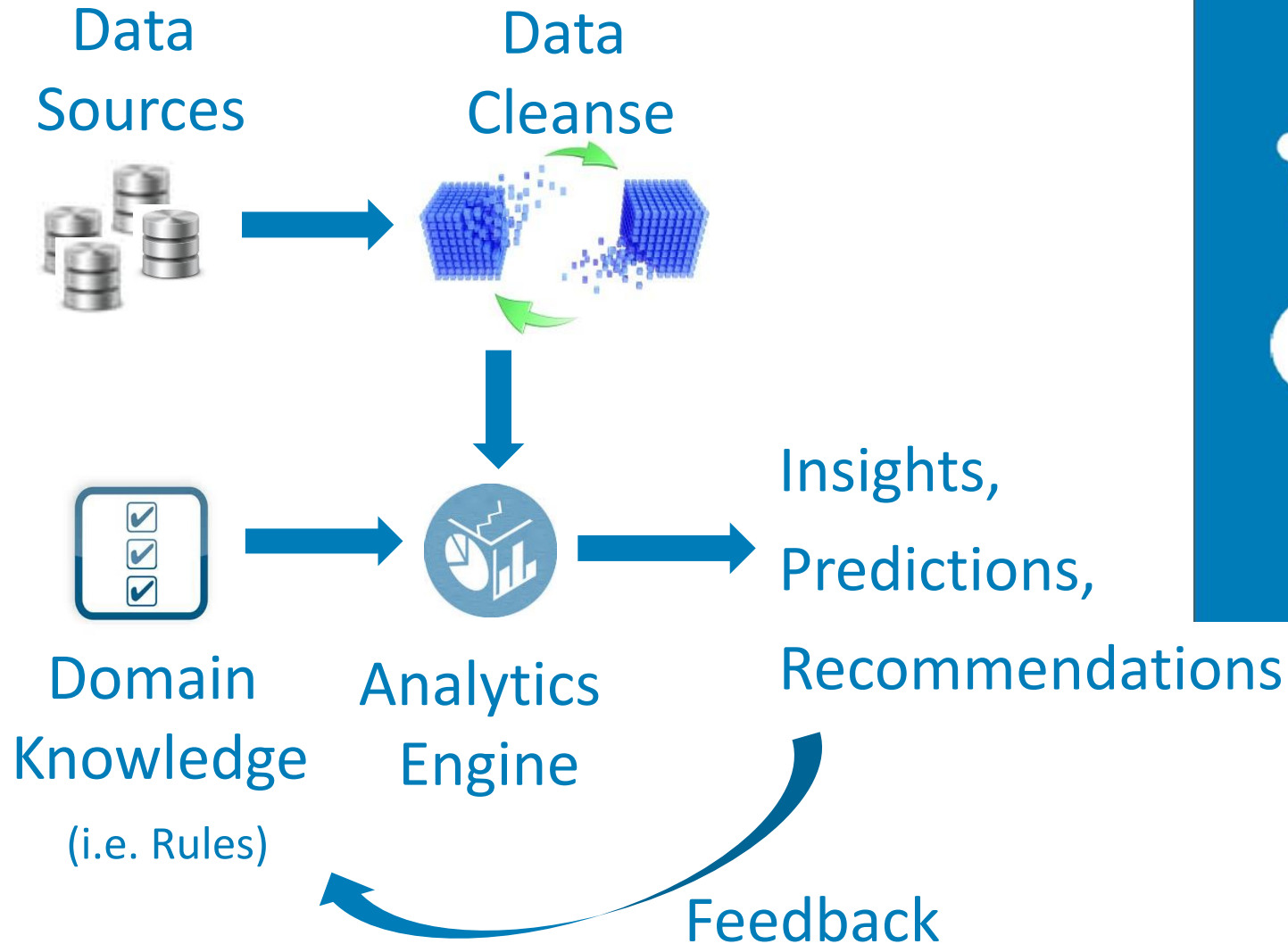
“Nobody really goes out of their way to point out the importance of data...”

~ *Brian Sletten, Bosatsu Consulting*

Data Sources - Product Engineering



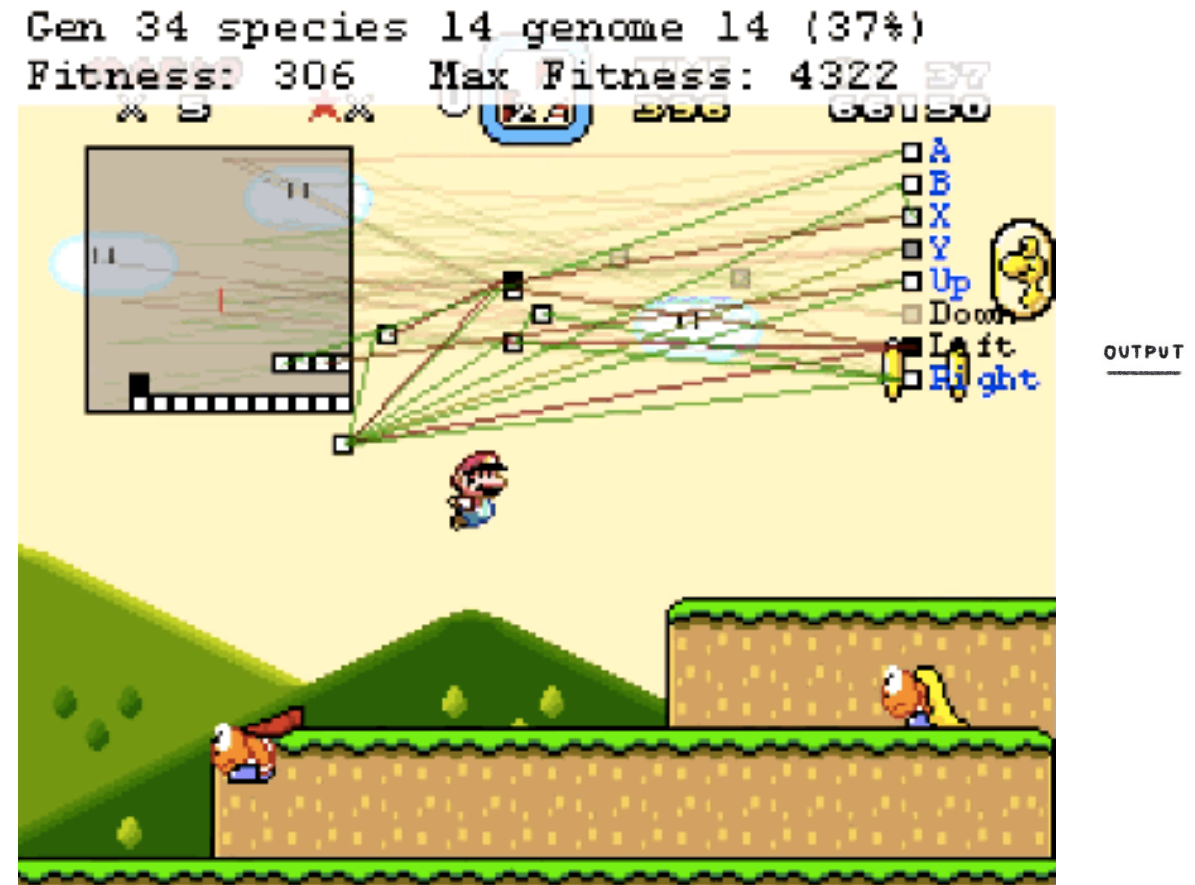
Data Analytics Modeling



Machine Learning

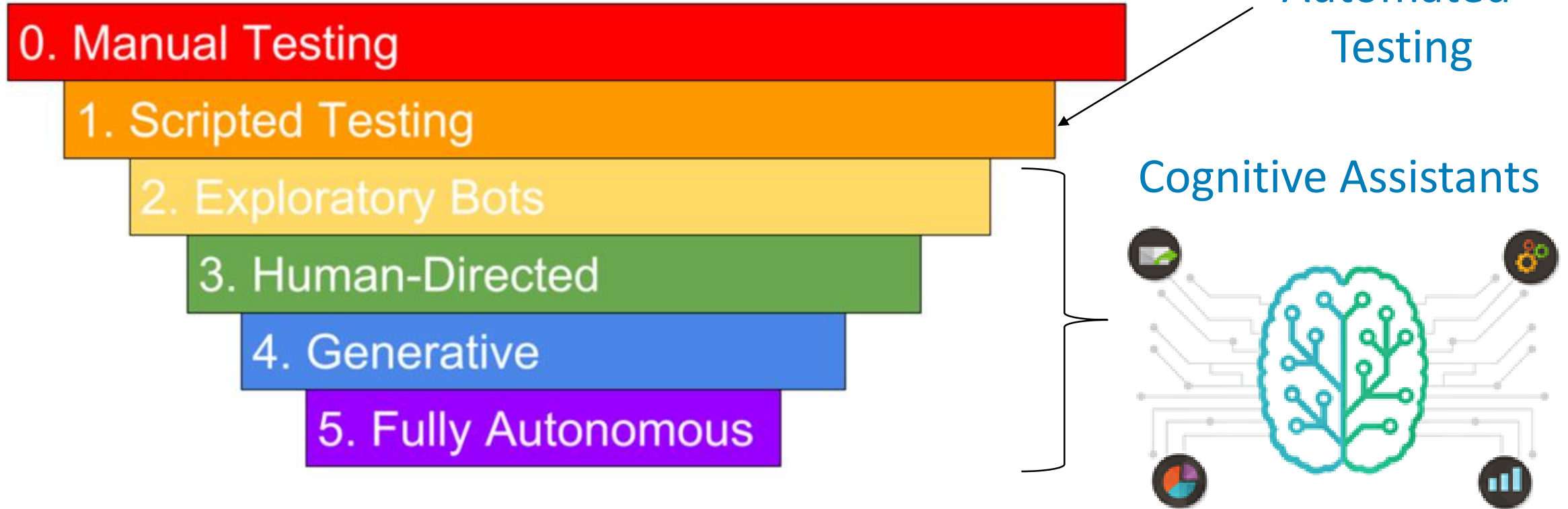
Getting Computers to learn without being explicitly programmed

- Supervised Learning
- Unsupervised Learning
- Reinforcement Learning



MarI/O - <https://www.youtube.com/watch?v=qv6UVOQ0F44>

Test Autonomy Levels



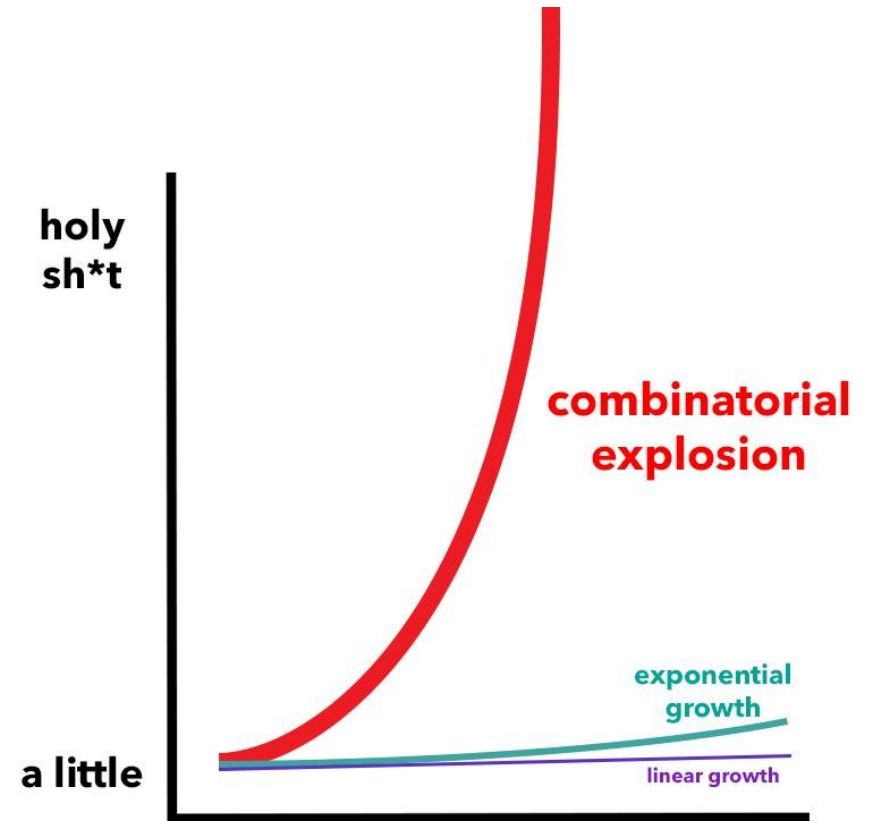
Context at DellEMC Servers



Server Configuration Elements

- Chassis
- Processor
- Memory DIMM
- Memory Configuration
- Hard Disk Drive (HDD)
- Non-Volatile Memory (NVM)
- Embedded Systems Management
- Power Management BIOS
- Power Supply
- Bezel
- Network Daughter Card
- RAID Controller
- Network Interface Card (NIC)
- Host Bus Adapter (HBA)
- Additional PCIe Cards
- Cooling

465 Trillion
Test Configurations!!



The Smart Assistant

What are the high-value SUT configurations?

What is the release risk given the testing that's been completed?

What test scripts should be retired rather than be re-factored?

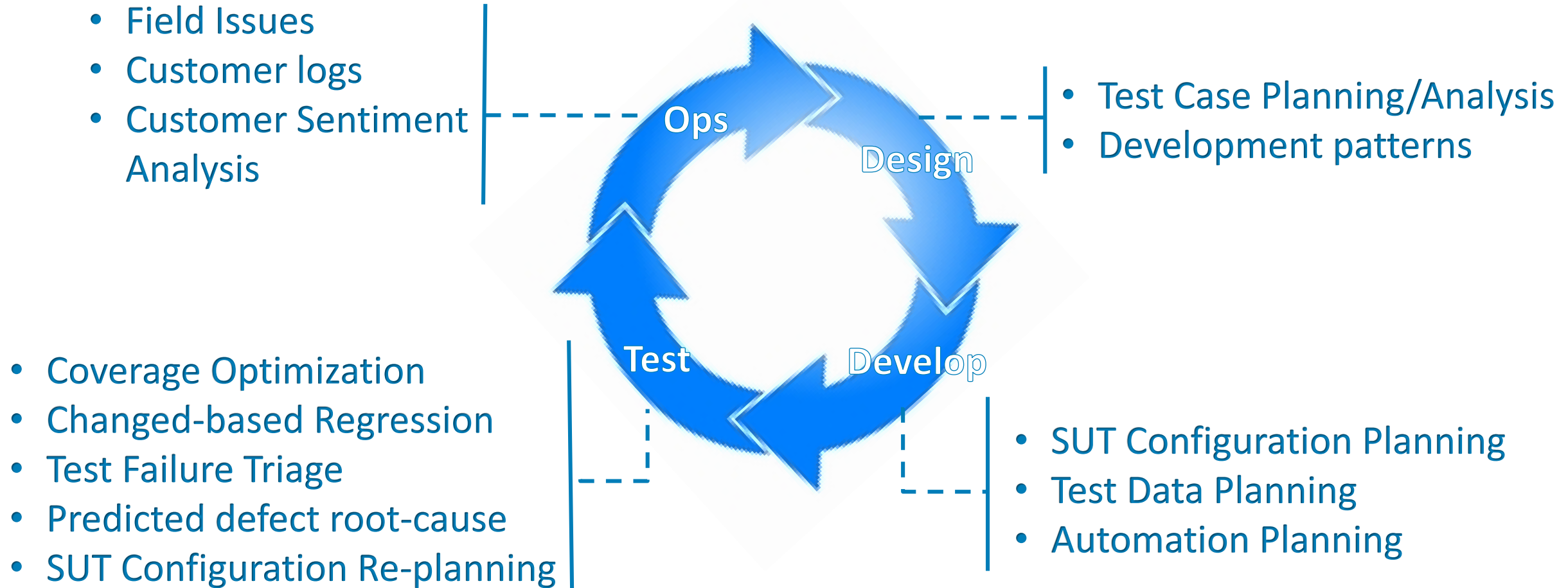
What tests can detect the maximum number of defects given the changes in the current build

What's the optimal coverage for this build/test cycle?

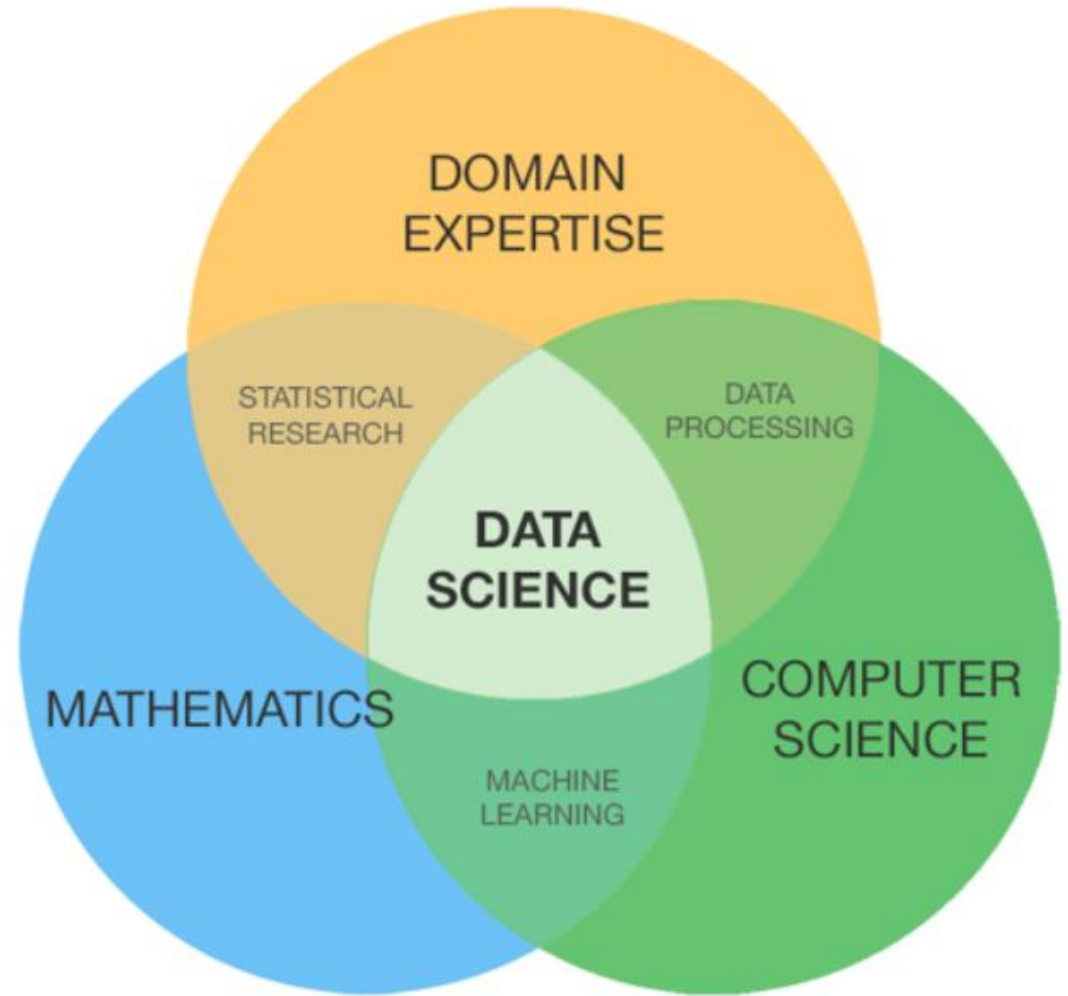
What automated test failures appear to be duplicates?



Human | Machine Opportunities in the SDLC



What about Data Science skills?



*Source: Palmer, Shelly. Data Science for the C-Suite.
New York: Digital Living Press, 2015. Print.*

SUT Configuration Model

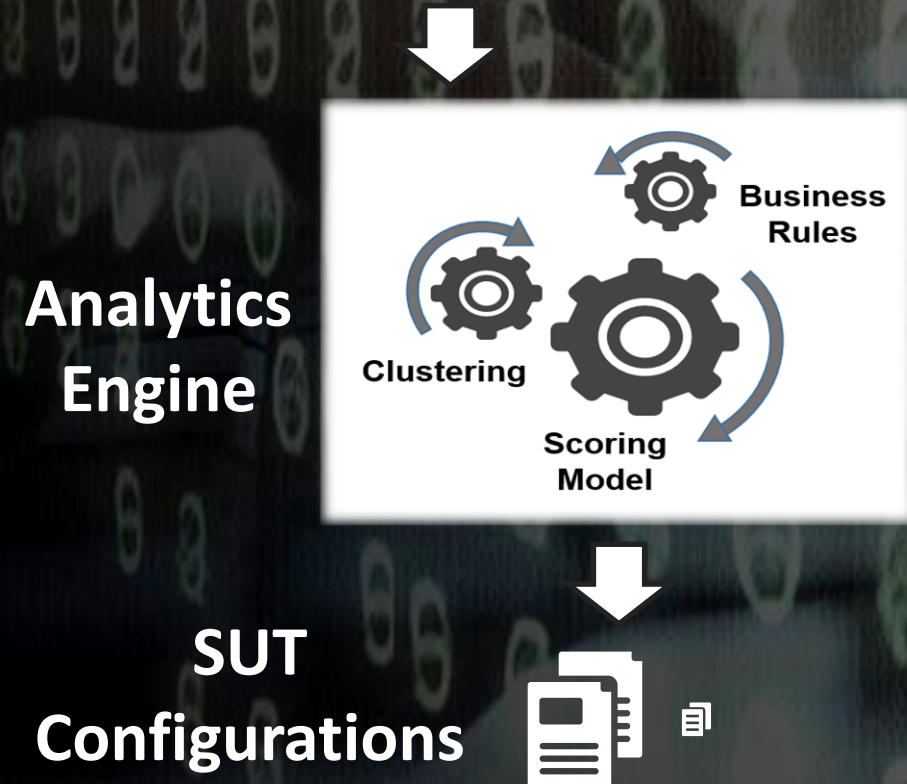
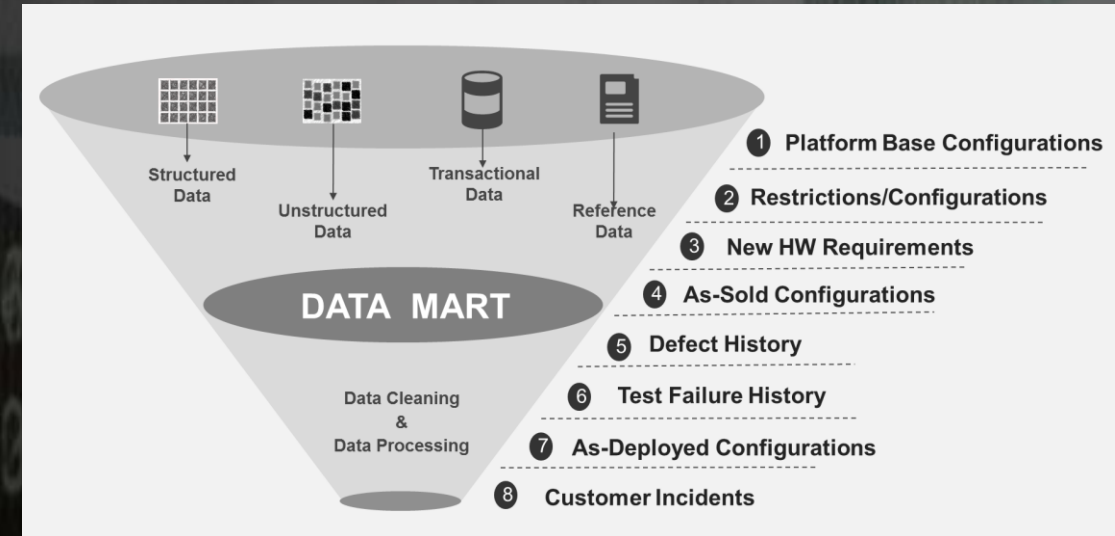
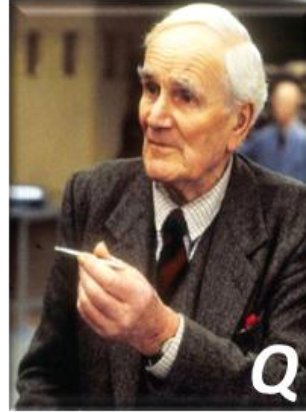
“Q” - System Under Test

Objective

- **Quickly** predict “best-available” SUT configurations during planning and test execution phases

Methodology

- High-Value is defined by **primary** metrics:
 - New HW Requirements
 - Restrictions/Configurations
 - Quantity of As-Sold configuration
 - Historical Test Failures



Test Suite Model

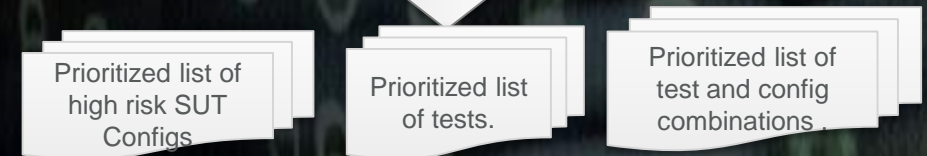
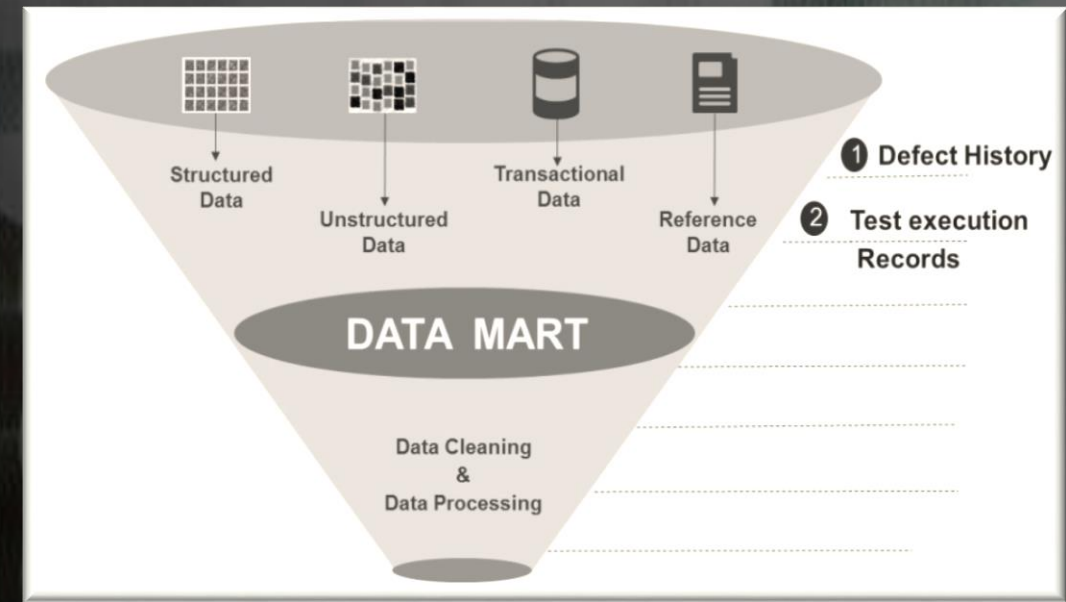
“JARVIS”

Objective

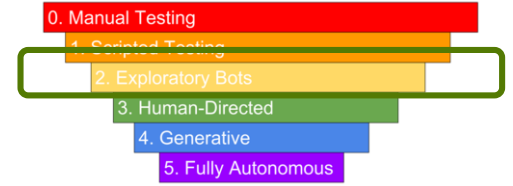
- Learn from historical data to identify the high-value tests that we should run, re-factor or retire

Methodology

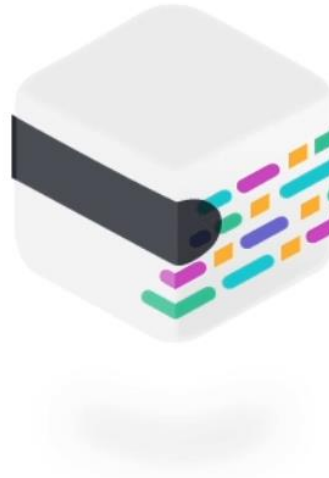
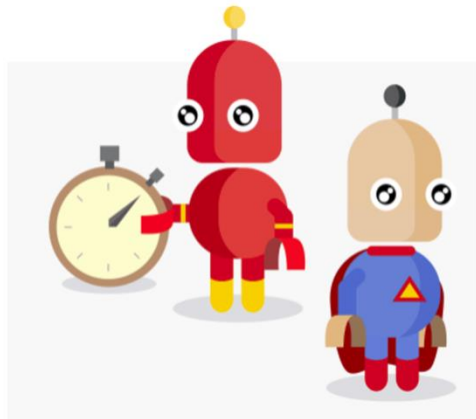
- “High-Value” Rules:
 - Fail Frequency Score (Config/Test)
 - Most Recent Failures (Config/Test)
 - Failures resulted in a code change
 - Most Failed Config/Test Combinations
- Identify and Close Data Quality Gaps



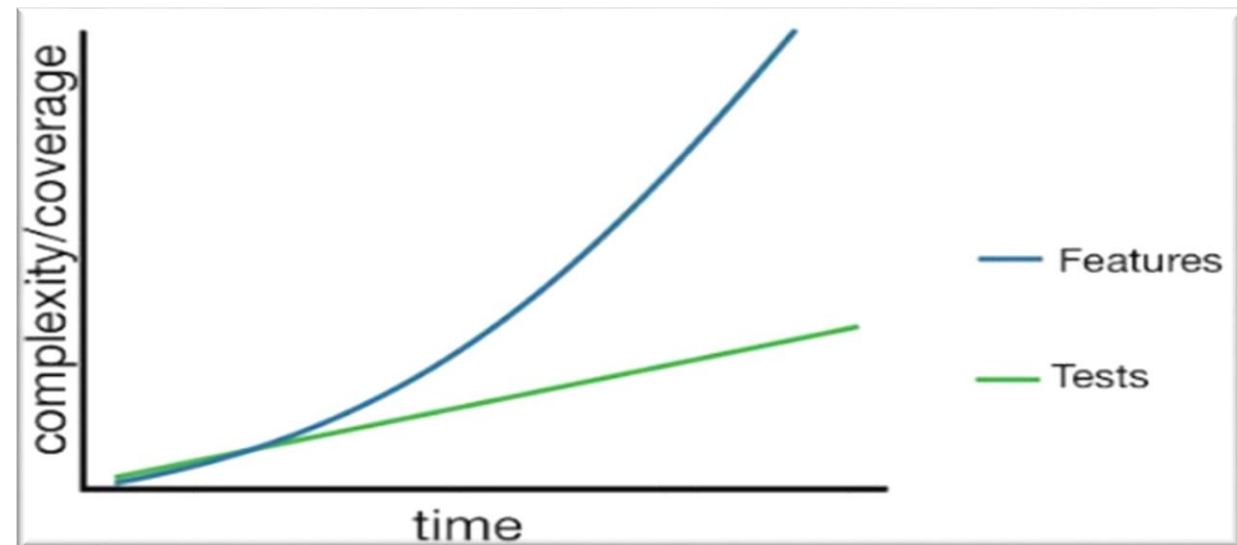
Testbots are here



Meet your
newest testers.

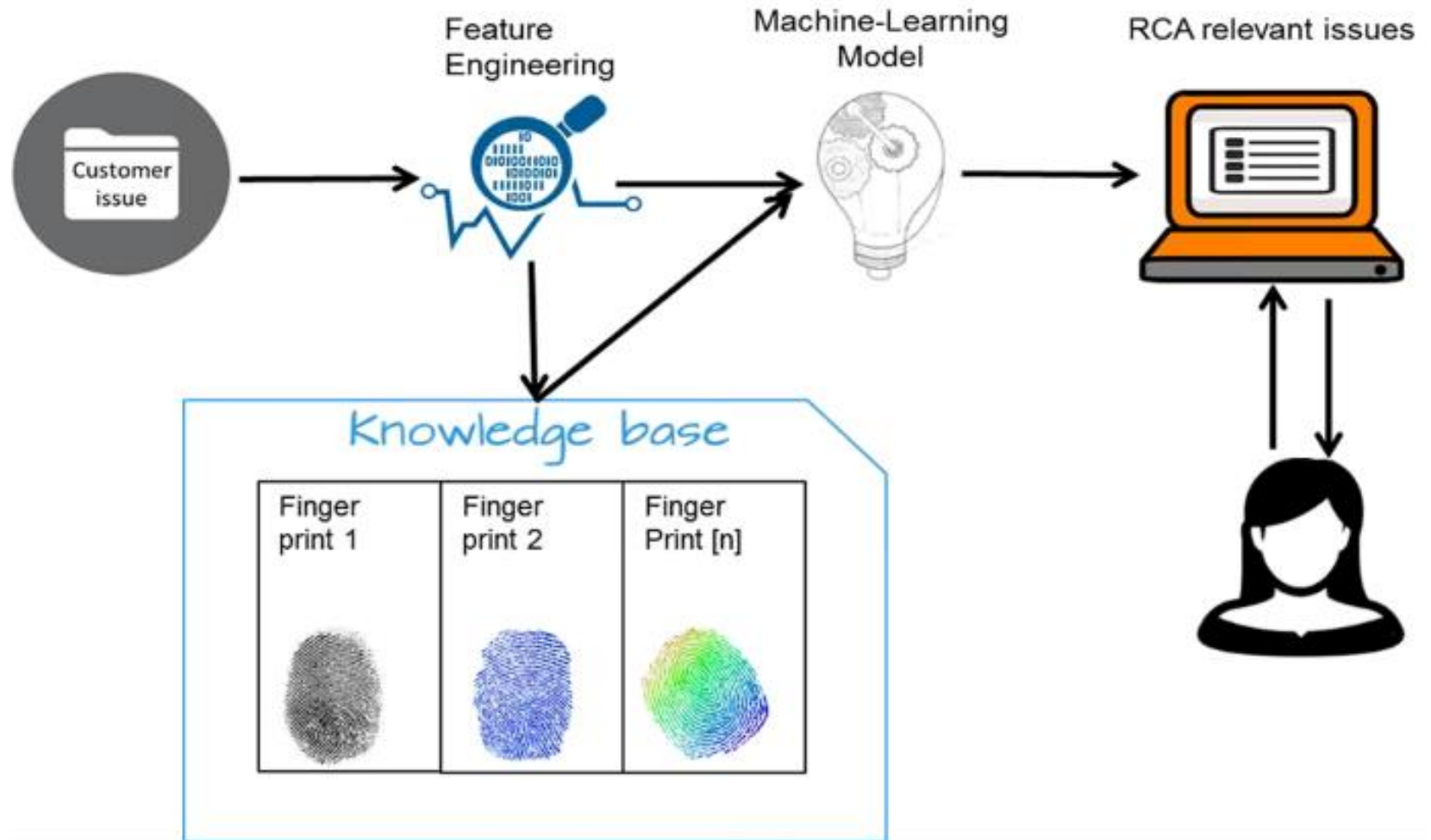


hi, I'm mabl. I make testing easier.

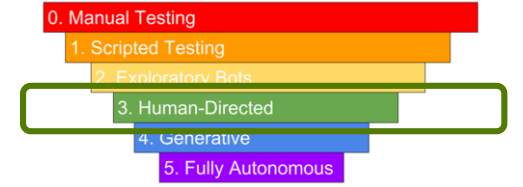


Duplicate Defect Prediction

Dell EMC XtremIO



Human-Directed bots



PERCEIVE

“What can we interact with?”



ACT

Neural network determines what action to take



LEARN

Each action contributes to training brain

What's our job?



A photograph of three people in a collaborative meeting. A man in a blue shirt is leaning forward, gesturing with his hand while speaking to a woman with glasses and a white polka-dot shirt. Another man with curly hair is sitting to the right, looking on. The background is a blurred office or public space.

The rise of the Relationship Worker

Don't ask what Computers can't do...

Identify tasks that the machine can do for us

Become a Better Human

Key Skills/Attributes of a Tester

Janet Gregory



Skills

1. Communication
2. Technical
3. Domain knowledge
4. Programming
5. Be aware of good tools
6. Ask questions
7. Give feedback
8. Problem solving
9. Test design

Attributes

- | | |
|----------------------------------|----------------------|
| 1. Structured thinker | 13. Flexible |
| 2. Detail oriented | 14. Big-picture view |
| 3. Curious | 15. Proactive |
| 4. Collaborative / team player | 16. Assertive |
| 5. Critical thinking/ analytical | 17. Responsible |
| 6. Creative / out of the box | 18. Versatile |
| 7. Open-minded | 19. Positive |
| 8. Fast learner | 20. Polite |
| 9. Extravert | 21. Mean |
| 10. Self-confident | 22. Stubborn |
| 11. Patience | 23. Honest |
| 12. Self-organizer | 24. Helpful |
| | 25. Logical |



@janetgregoryca



What can Humans do Better?

- Creative, Collaborative, Problem Solving
- Contextualized Intelligence
- Empathy
- Storytelling



We insist some things be performed by humans

- We want to hold individuals accountable for important decisions
- We prefer
 - Generals to lead our armies
 - Judgements come from judges
 - Diagnosis come from a doctor
- We keep changing our conception of the problem
- We want to work with other people in solving problems

Even if aided by technology

But... We're headed in the wrong direction

Digital Distractions are
stunting the development
of vital social skills



“There should be no cell phones allowed
in conference rooms” ~ Simon Sinek

Simon Sinek



So... How do we become a better human?

- Put your phone down
- Practice your social skills
- Embrace life-long learning

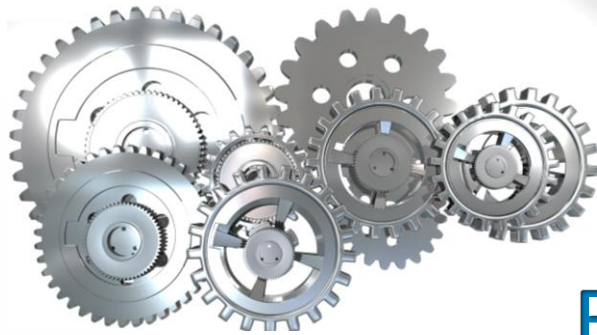
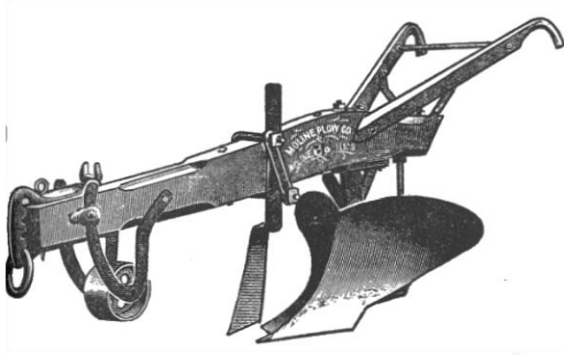
“The Machines are learning, are you?” ~ Paul Merrill

Our Job

Capture your data



Pinpoint **your** pain points



Experiment with the Machine

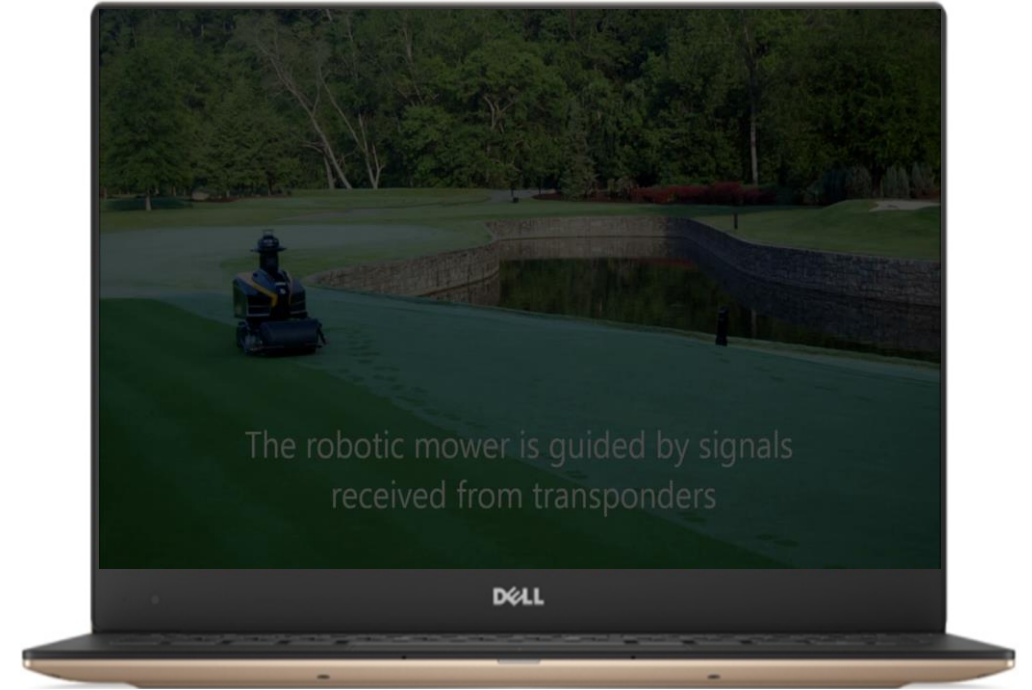
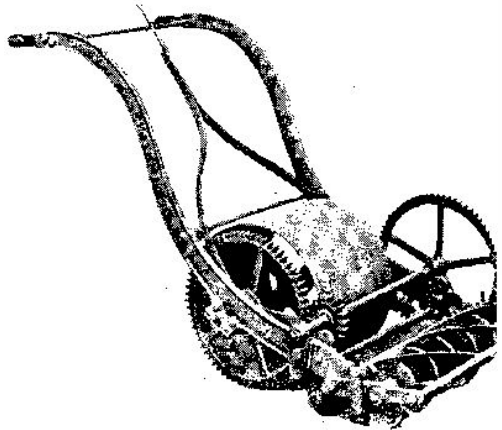


Be a Better Human

Thank you



And the other thing that Budding started...



Resources

Books

- **Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die:** https://www.amazon.com/dp/B019HR9X4U/ref=dp-kindle-redirect?_encoding=UTF8&btkr=1
- **What To Do When Machines Do Everything:** <http://www.whenmachinesdoeverything.com/>
- **Weapons of Math Destruction:** <https://weaponsofmathdestructionbook.com/>
- **Race against the Machine:** https://books.google.com/books/about/Race_Against_the_Machine.html?id=IhArMwEACAAJ
- **Super Freakonomics:** <http://freakonomics.com/books/>
- **Humans are underrated:** <http://geoffcolvin.com/books/humans-are-underrated/>
- **Life 3.0: Being Human in the Age of Artificial Intelligence:** <https://www.amazon.com/Life-3-0-Being-Artificial-Intelligence/dp/1101946598>
- **Horses at Work: Harnessing Power in Industrial America:** <https://www.amazon.com/Horses-Work-Harnessing-Industrial-America/dp/0674031296>
- **The Four:** <http://www.thefourbook.com/>

Research

- **When will AI Exceed Human Performance:** <https://arxiv.org/pdf/1705.08807.pdf>
- **World Quality Report 2016-17 (Capgemini):** <https://www.capgemini.com/thought-leadership/world-quality-report-2016-17>
- **World Quality Report 2017-18 (Capgemini):** <https://www.capgemini.com/thought-leadership/world-quality-report-2017-18>
- **The next era of Human|Machine Partnerships:** <https://www.delltechnologies.com/en-us/perspectives/realizing-2030.htm>
- **Towards a Reskilling Revolution: A Future of Jobs for All:** http://www3.weforum.org/docs/WEF_FOW_Reskilling_Revolution.pdf
- **Special report: Tech and the future of transportation:** http://b2b.cbsimg.net/downloads/Gilbert/SF_feb2018_transport.pdf
- **How AI will Change Software Development:** <https://www.slideshare.net/WillyDevNET/how-ai-will-change-software-development-and-applications>
- **21 Jobs of the future:** <https://www.cognizant.com/whitepapers/21-jobs-of-the-future-a-guide-to-getting-and-staying-employed-over-the-next-10-years-codex3049.pdf>
- **The Future of Jobs:** http://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf
- **Wait but why: Artificial Intelligence Revolution Part 1:** <https://waitbutwhy.com/2015/01/artificial-intelligence-revolution-1.html>
- **Wait but why: Artificial Intelligence Revolution Part 2:** <https://waitbutwhy.com/2015/01/artificial-intelligence-revolution-2.html>
- **What's Next | Artificial Intelligence Part 1:** <https://www.youtube.com/watch?v=2br8yji-rcM>
- **What's Next | Artificial Intelligence Part 2:** https://www.youtube.com/watch?v=_WKyiGBYFrU
- **TensorFlow by Brian Sletten:** <https://www.youtube.com/watch?v=RlrBKYehcNg>
- **Has the Turing Test been Passed:** <http://isturingtestpassed.github.io/>
- **How can AI improve how we work:** <https://hbr.org/ideacast/2018/04/how-ai-can-improve-how-we-work>

Movie clips

- Ex Machina
- Bladerunner 2049
- Transcendence
- Minority Report

Resources

Articles

- **Every study we could find on what automation will do to jobs:** https://www.technologyreview.com/s/610005/every-study-we-could-find-on-what-automation-will-do-to-jobs-in-one-chart/?utm_campaign=add_this&utm_source=email&utm_medium=post
- **This Technology Will Upend the Entire Automotive Industry:** <https://moneywise411.com/new-automotive-technology/?ppc=743242>
- **5 ways AI will change software testing** - <https://techbeacon.com/5-ways-ai-will-change-software-testing>
- **What's Everybody So Afraid of:** <http://www.popularmechanics.com/technology/robots/news/a28645/googles-alphabet-astro-teller-ai/>
- **Robots Are Coming for Jobs of as Many as 800 Million Worldwide:** <https://www.bloomberg.com/news/articles/2017-11-29/robots-are-coming-for-jobs-of-as-many-as-800-million-worldwide>
- **Self-Driving Cars Could Save 300,000 Lives:** <https://www.theatlantic.com/technology/archive/2015/09/self-driving-cars-could-save-300000-lives-per-decade-in-america/407956/>
- **The 10 Biggest AI Failures of 2017:** <https://www.techrepublic.com/article/the-10-biggest-ai-failures-of-2017/?ftag=TRE684d531&bhid=24345184115902224026945549370599>
- **Technology has created more jobs than it has destroyed:** <https://www.theguardian.com/business/2015/aug/17/technology-created-more-jobs-than-destroyed-140-years-data-census>
- **Life 3.0 by Max Tegmark review – we are ignoring the AI apocalypse:** <https://www.theguardian.com/books/2017/sep/22/life-30-max-tegmark-review>
- **The Big Shift Last Time: From Horse Dung to Car Smog:** <http://www.resilience.org/stories/2013-03-15/the-big-shift-last-time-from-horse-dung-to-car-smog/>
- **AlphaZero Is the New Chess Champion:** <https://www.extremetech.com/extreme/260215-alphazero-new-chess-champion-harbinger-brave-new-world-ai>
- **The tech industry needs one million workers now:** <https://www.yahoo.com/finance/news/tech-industry-needs-one-million-workers-now-130452775.html>
- **Only 4% of CIOs have deployed AI:** <https://cio.economictimes.indiatimes.com/news/business-analytics/only-4-pc-of-cios-have-deployed-ai-despite-huge-interest-levels-in-ai-technologies/62900459>
- **Towers Watson & Oxford Economics: Global Talent 2021:** <https://www.oxfordeconomics.com/my-oxford/projects/128942>
- **Meet the 13-year-old prodigy taking IBM and AI by storm:** <http://www.abc.net.au/news/2017-07-26/meet-the-teen-taking-ibm-and-artificial-intelligence-by-storm/8743880?pfmredir=sm>
- **Millennials in the Workplace:** <https://www.youtube.com/watch?v=hER0Qp6QJNU>
- **Humans Need Not Apply:** <https://www.youtube.com/watch?v=7Pq-S557XQU&feature=youtu.be>
- **Humans are under rated:** <http://fortune.com/2015/07/23/humans-are-underrated/>
- **Testing and Management Efficiency:** <http://www.developsense.com/blog/2018/02/Efficiency/>
- **How Smartphones are Killing Conversation:** https://greatergood.berkeley.edu/article/item/how_smartphones_are_killing_conversation
- **How Safe is Safe Enough:** https://www.washingtonpost.com/local/trafficandcommuting/how-safe-is-safe-enough-to-put-driverless-cars-on-the-nations-roadways/2017/12/10/9a1aa348-d519-11e7-b62d-d9345ced896d_story.html?utm_term=.f9c191557789
- **How reinventing software testing can transform your business:** https://techcrunch.com/2018/03/13/how-reinventing-software-testing-can-transform-your-business-and-change-the-world/?utm_content=68756890&utm_medium=social&utm_source=linkedin
- **Are you ready for Data Science:** https://www.huffingtonpost.com/shelly-palmer/are-you-ready-for-data-sc_b_6844032.html
- **The Fourth Industrial Revolution:** <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond>
- **Vera the robot:** <http://www.dailyherald.com/business/20180428/want-to-work-for-ikea-your-interview-could-be-conducted-by-russian-robot>

Abstract

Title: What's our job when the Machine does Testing?

Description: After its hyped introduction decades ago, followed by a quiet "winter", Artificial Intelligence (AI) has slowly crept back into our 21st century consciousness. While our Siri and Alexa assistants entertain us, Machine Learning (ML) has also brought convenience into our lives with solutions such as Nest and Netflix. Today, AI brings society to the tantalizing brink of the autonomous vehicle and the sea change of this 4th Industrial revolution has already started to disrupt industry after industry. The emerging chapters of these fascinating Machines demands our attention as AI starts to be applied in ways that directly affect the workplace, one in which the Test community won't be immune.

Geoff explores industry-wide applications of Analytics and Machine Learning and provides a view into how this next generation of automation is being used to optimize Test operations. He identifies opportunities across the Engineering and Test landscape for the application of AI, ranging from the identification of high-value Test Cases and Test Configurations which streamlines regression testing to dynamically generating change-based regression test suites when time is not on your side. Most importantly, Geoff provides tips to prepare yourself in skillset and mindset so that you willingly embrace the application of Analytics in your Test operations.

Geoff Meyer

A Test Architect in the Dell EMC Infrastructure Solutions Group, Geoff has 30+ years of industry experience as a software developer, manager, program manager, and director.

He drives the Test Strategy and Architecture for 400+ SW and HW Testers across India, Taiwan, and the United States. His initiatives include Agile Testing, Continuous Testing, Infrastructure as a Service(IaaS), and Predictive Analytics

Geoff is a member of the Agile Austin community and is a speaker at Agile, STAR, and related Software conferences. He is an active mentor to Veterans participating in the Vets4Quality.Org program, which provides them an on-ramp to a career in software quality assurance.

DELLEMC geoff_meyer@dell.com



<https://www.linkedin.com/in/geoff-meyer-02b1aa3/>



https://twitter.com/geoffrey_meyer

