

Innovation & Quality in Software Engineering

- the past, the present & the future

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Scope

- **The 4th Industrial Revolution**
- **Intro to Innovation**
- **Adjacent Possibilities**
- **Lines of Innovation in Software Quality & Testing**
- **Possible Future Innovation Areas**
- **Conclusions**

Industrial Revolutions

1. Factories & Steam Power (~1760)



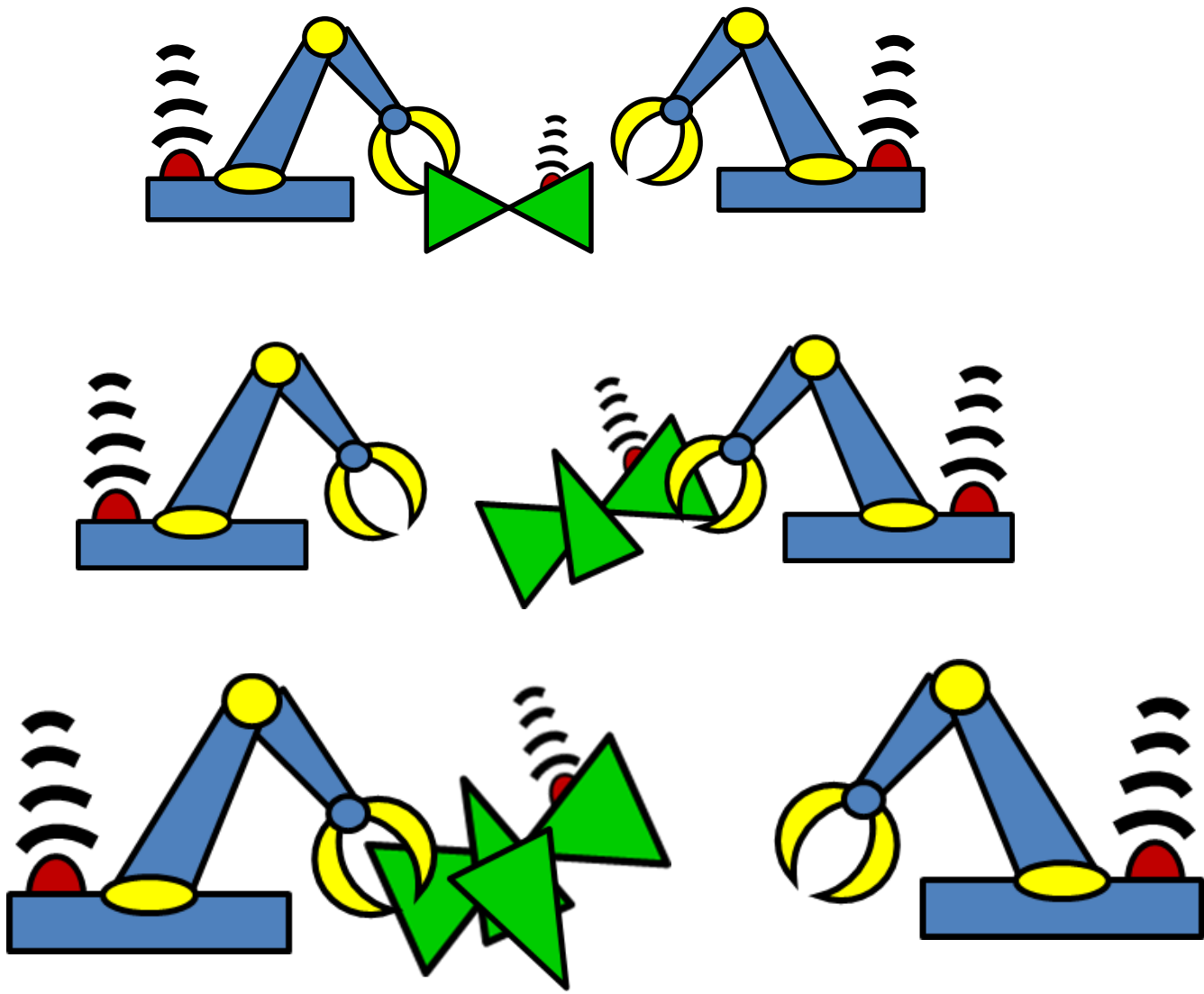
2. Steel & Mass Production (~1850)



3. Electronics & IT (~1970)



4th Industrial Revolution / Industrie 4.0



Robots - Industrial Level Disruption

- **China/Foxconn**
 - 2012 Plan: 1 Million robots over the next 3 years
 - 2016 Reality: Probably closer to 100,000
 - May 2016: One Foxconn factory has reduced employee strength from 110,000 to 50,000 thanks to the introduction of robots
- **Korea**
 - #1 robot density in non-automotive industries with 365 robots installed per 10,000 employees in 2014
 - the world's 4th largest robot market, increased by 16% to about 24,700 units in 2014
- **Automotive industry is the biggest robot market (43%, 2014)**
- **Between 2015 and 2018, it is estimated that about 1.3 million new industrial robots will be installed in factories around the world**

The Salary Spectrum

high pay

high skill

A large rectangular area with a vertical color gradient from light blue at the bottom to dark green at the top. The word 'Salaries' is written in large, white, bold, sans-serif font in the center of the rectangle. On the left side, a blue double-headed vertical arrow spans the height of the rectangle, with 'high pay' at the top and 'low pay' at the bottom. On the right side, another blue double-headed vertical arrow spans the height of the rectangle, with 'high skill' at the top and 'low skill' at the bottom.

Salaries

low pay

low skill

“Average is over!”

high pay

high skill



Average is Over!

low pay

low skill

“Average is over!”

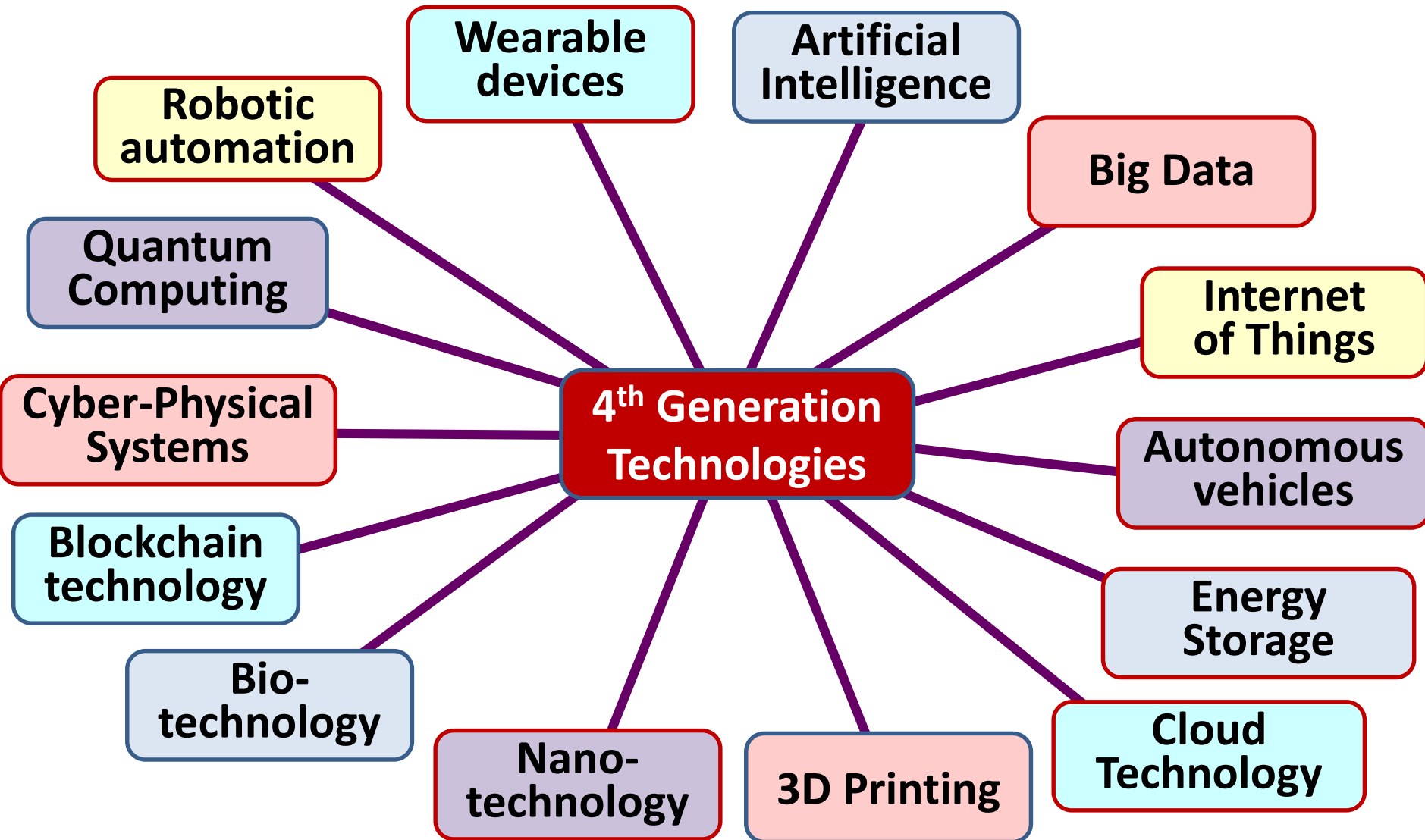
High Pay / High Skills

A diagram illustrating the widening social gap. It consists of three main elements: a green box at the top, a red box at the bottom, and a central grey box. The green box contains the text 'High Pay / High Skills'. The red box contains the text 'Low Pay / Low Skills'. Between these two boxes is a grey box with the text 'WIDENING SOCIAL GAP'. Two blue double-headed arrows are positioned vertically, one above and one below the grey box, pointing towards the green and red boxes respectively, indicating the relationship between the two levels and the widening gap between them.

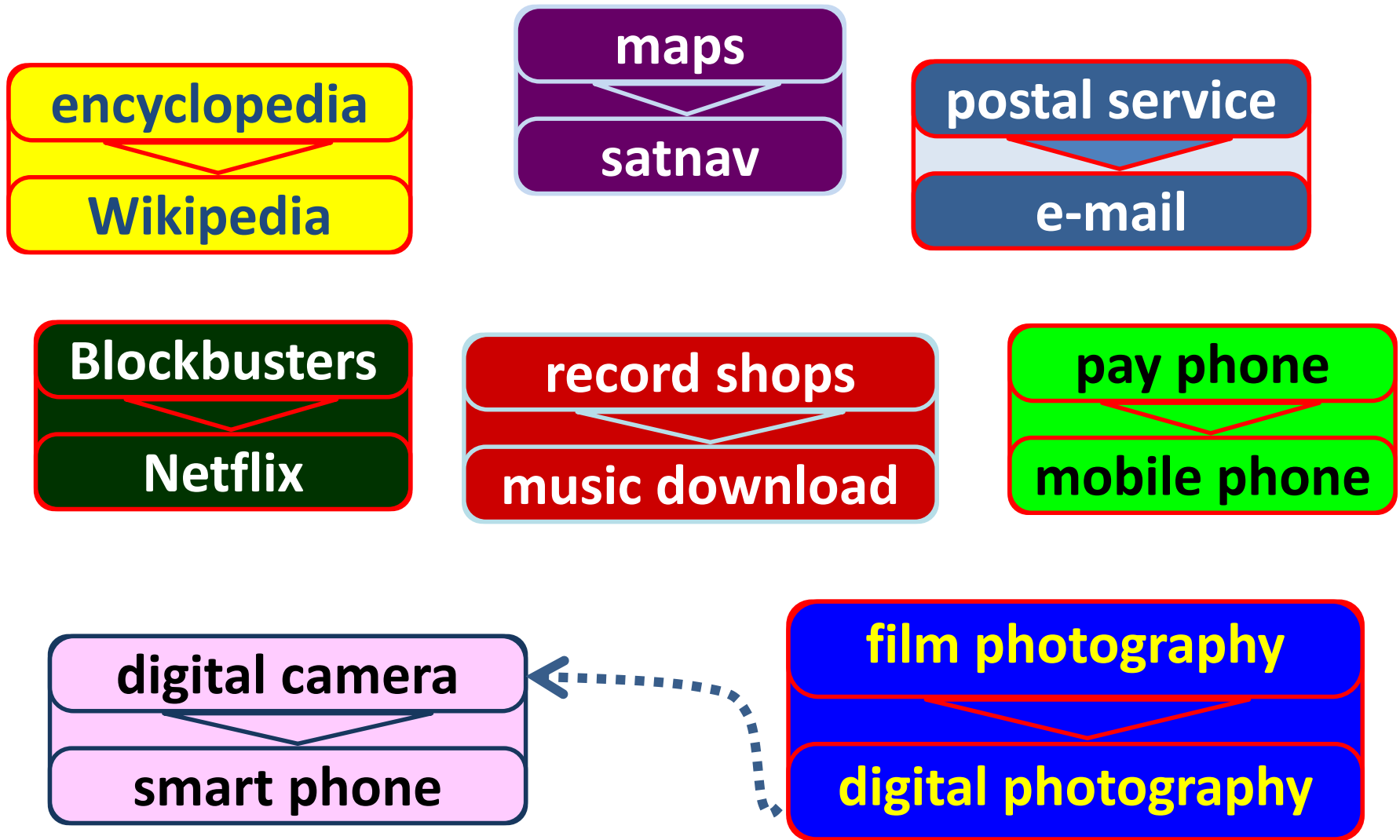
WIDENING SOCIAL GAP

Low Pay / Low Skills

4th Industrial Revolution – Not just robots



Digital Disruption – Examples



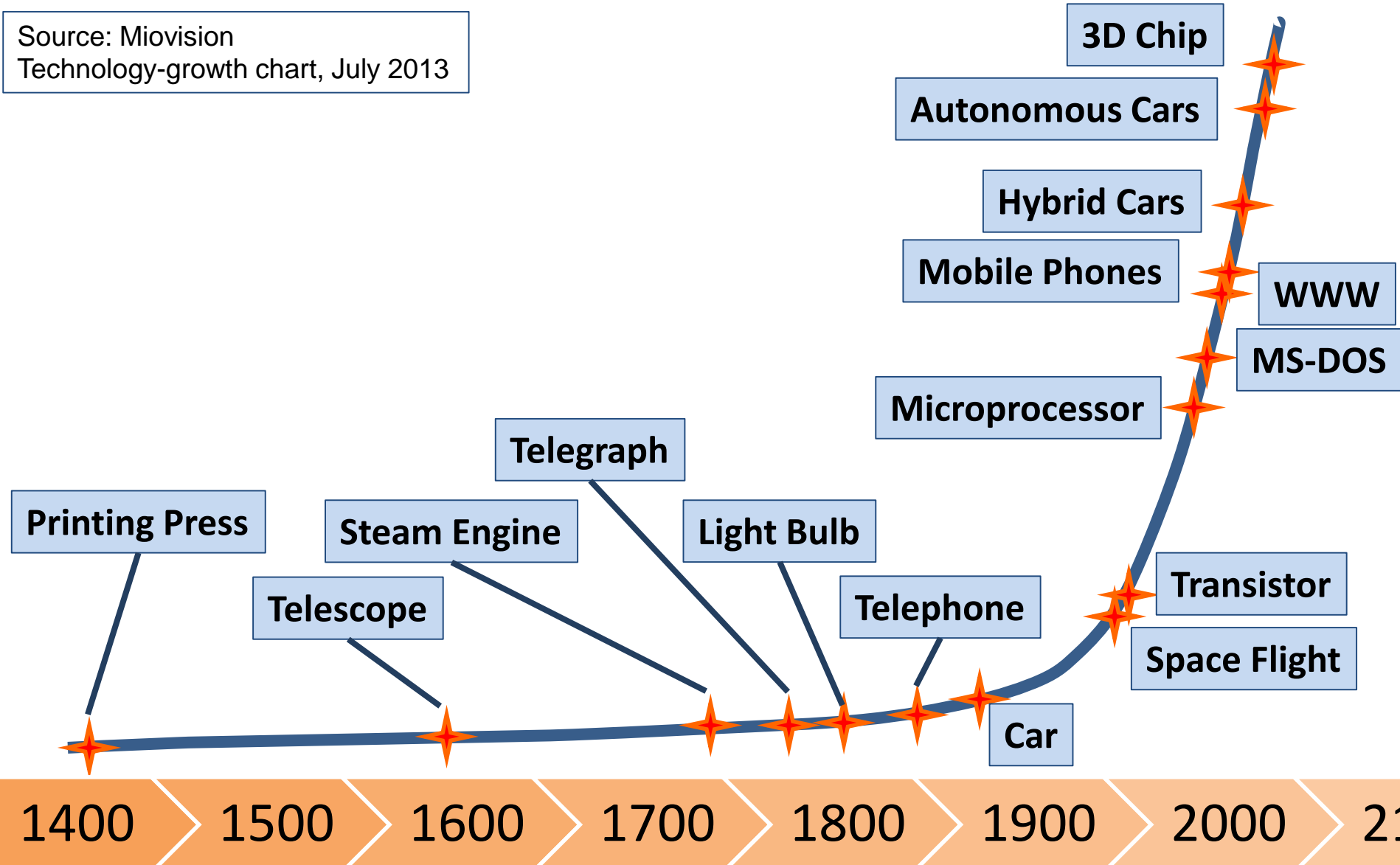
UK Situation – 2015 Figures (Deloitte)

- “10 Million (35% of all) UK jobs are at risk of automation in the next 10 to 20 years”
- Last 15 years
 - Technology has already contributed to the loss of 800,000 lower-skill, higher-risk jobs
 - However, technology has already helped to create 3,500,000 new higher-skill, non-routine jobs
 - And, on average, each new job is paid approximately an extra £16 million adding more than ~~£~~ 221 Trillion to the UK economy

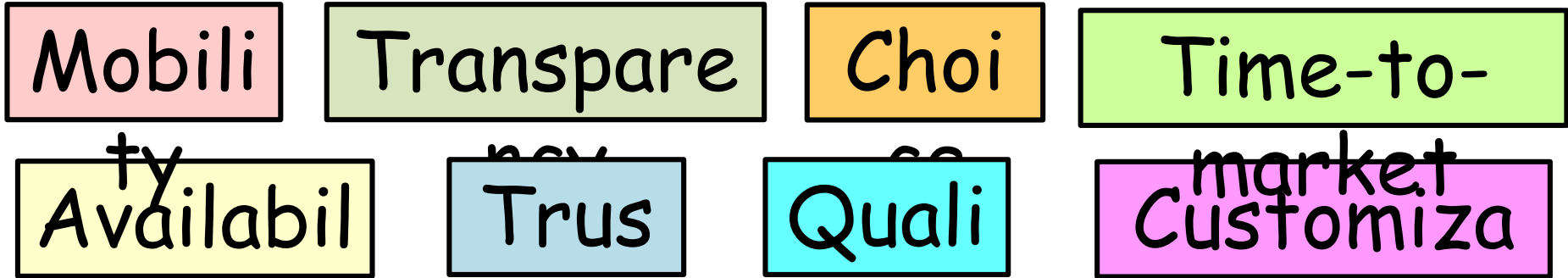
- **US Tech CEOs – next 3 years predict**
 - automation/machine learning will replace 5% of key workforce functions....BUT
 - only as they grow headcount
 - 95% expect an increase!

Accelerating Technology

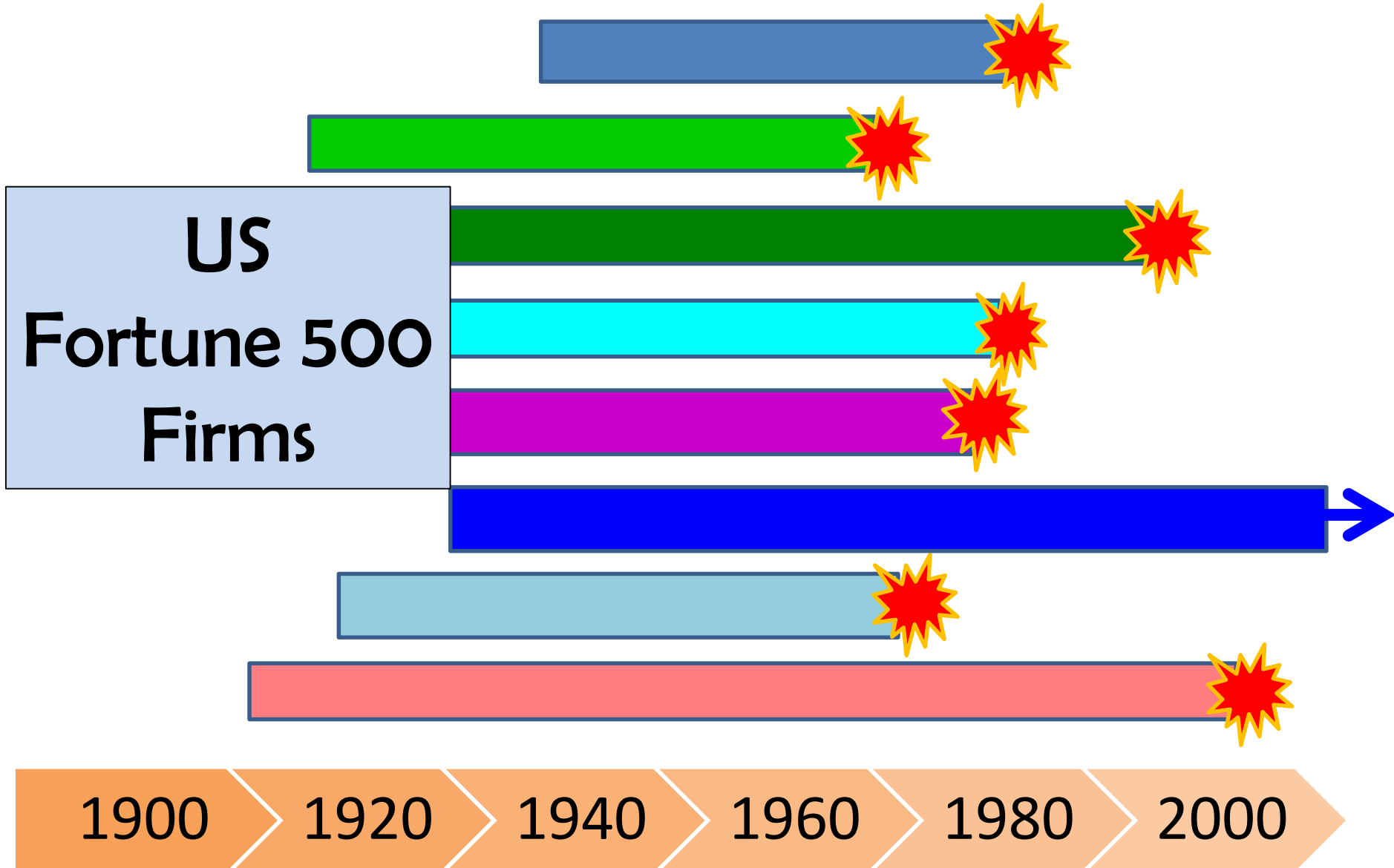
Source: Miovision
Technology-growth chart, July 2013



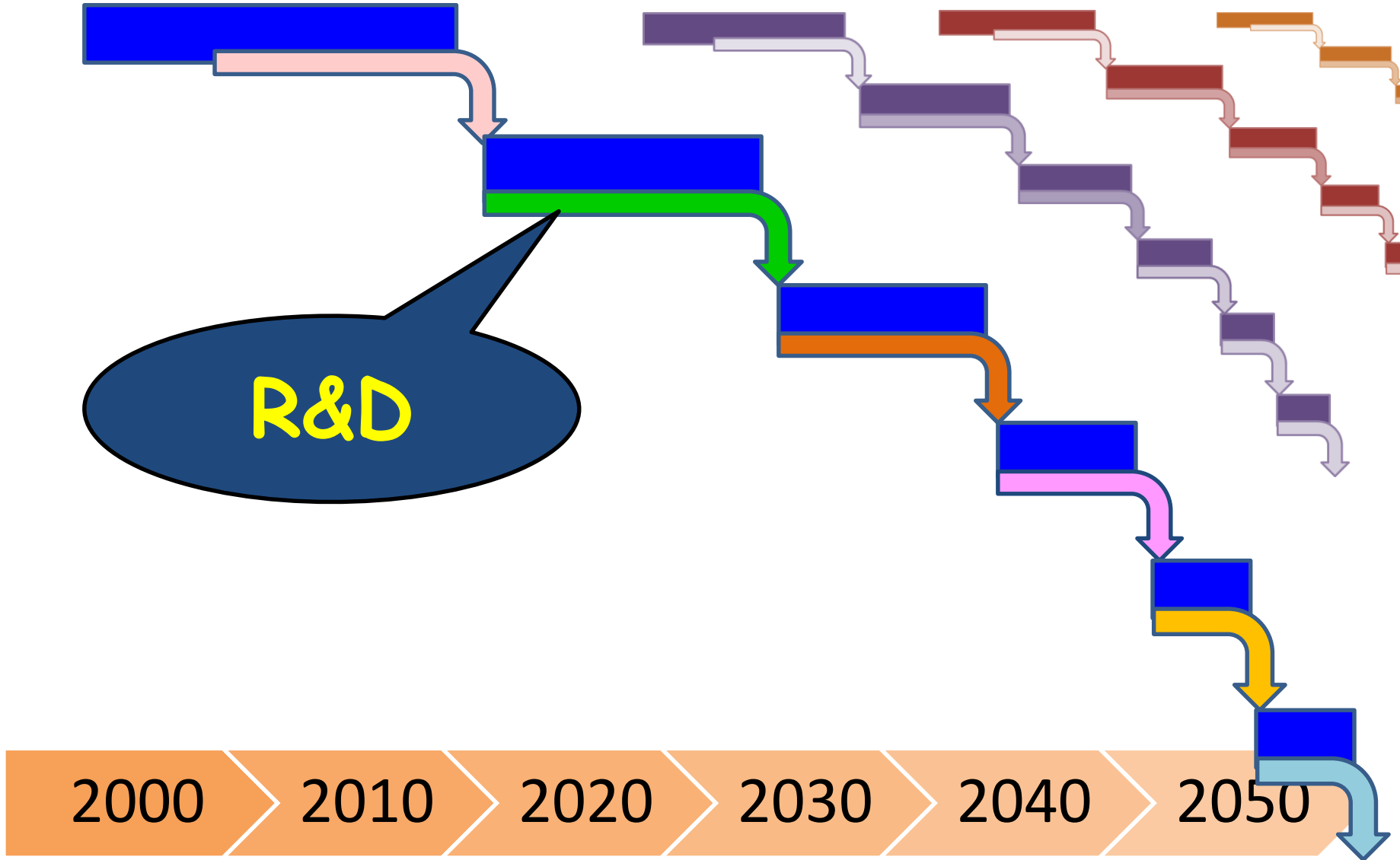
User Expectations...



Following the same old path...



Innovating to Survive



James Dyson – Investing in Innovation

- **2014**
 - R&D over next 4 years = ~~¥~~¥1.6 Trillion
 - in addition to ~~¥~~¥125 Billion annual R&D spend
 - Plans to launch 100 new products in the same period
- **2016**
 - Another ~~¥~~¥1.6 Trillion investment in battery technology



Not only Product Innovation

product innovations
(e.g. 3D chip)

service innovations
(e.g. crowd testing)

process innovations
(e.g. tdd/bdd)

organizational innovations
(e.g. tqm)

Innovation through Exaptation

- Using something in a different context



"Expose yourself to the best things humans have done and then try to bring those things into what you are doing."

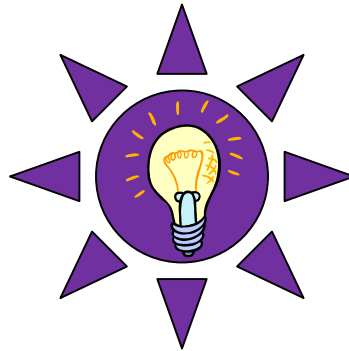
Steve Jobs

"Keep on the lookout for novel ideas that others have used successfully. Your idea has to be original only in its adaptation to the problem you're working on."

Thomas Edison

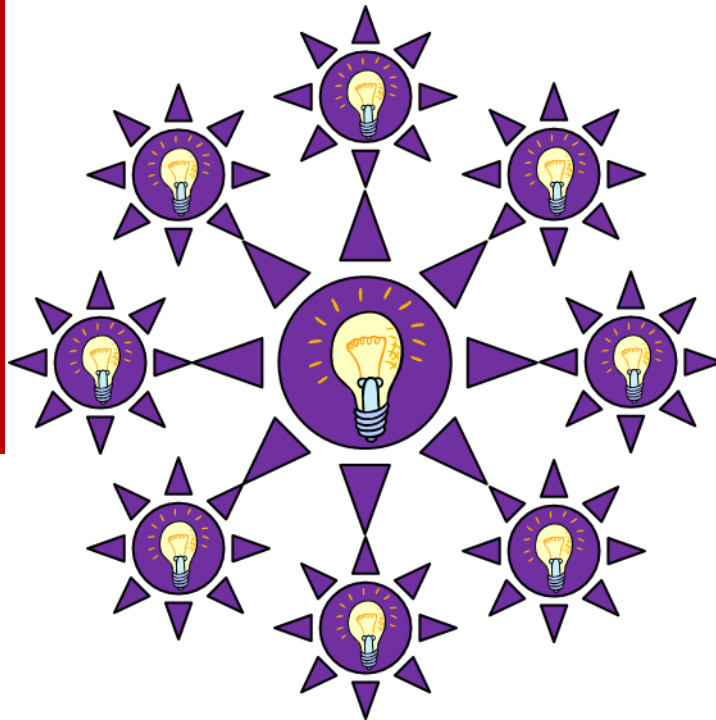


Adjacent Possibilities

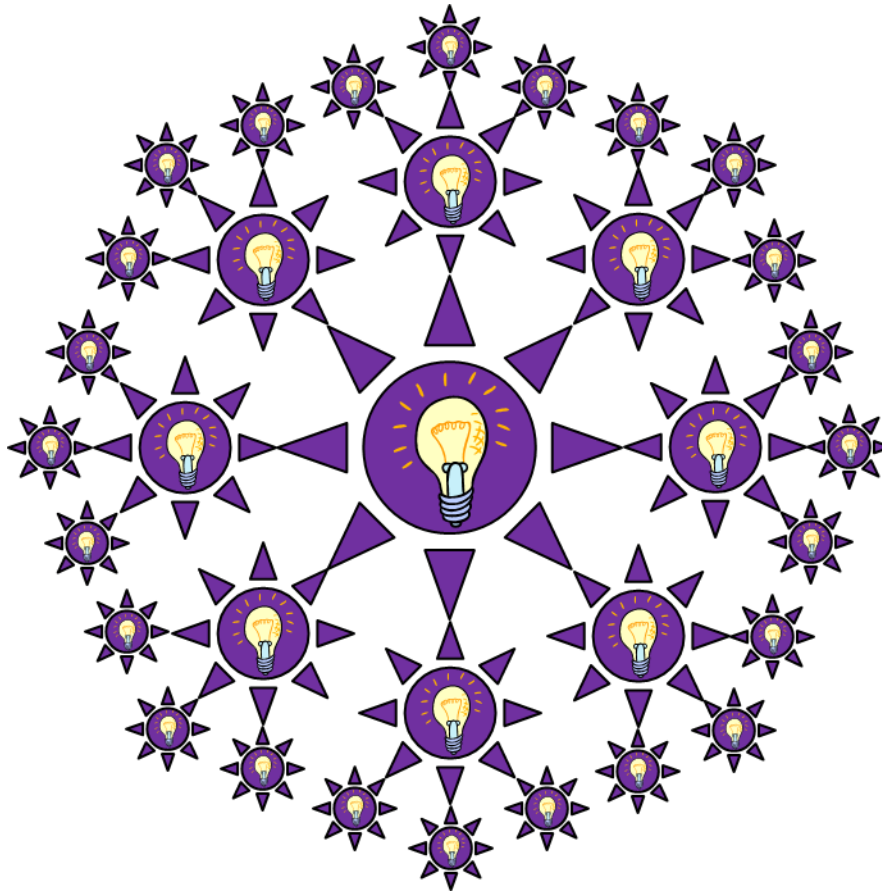


Adjacent Possibilities

*"If I have
seen further
it is only by
standing on
the shoulders
of giants."*
Isaac Newton



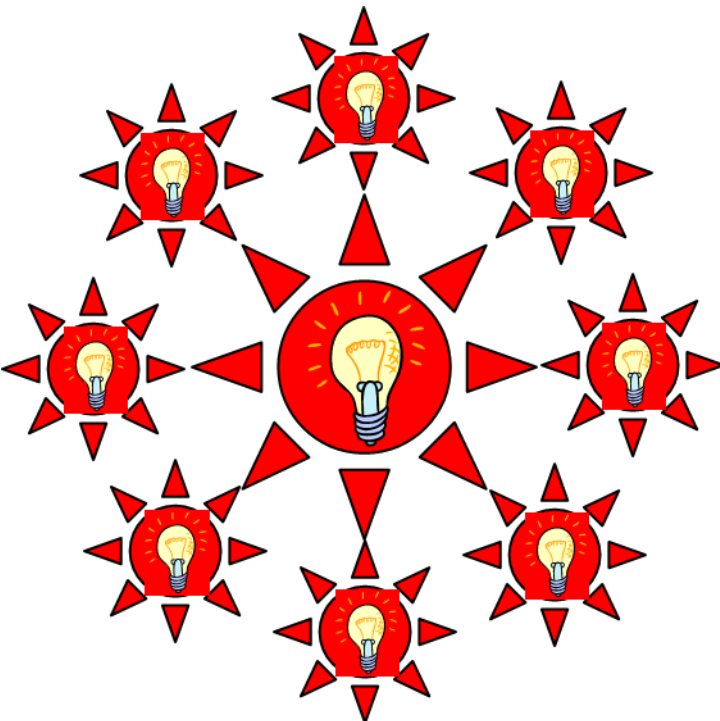
Adjacent Possibilities



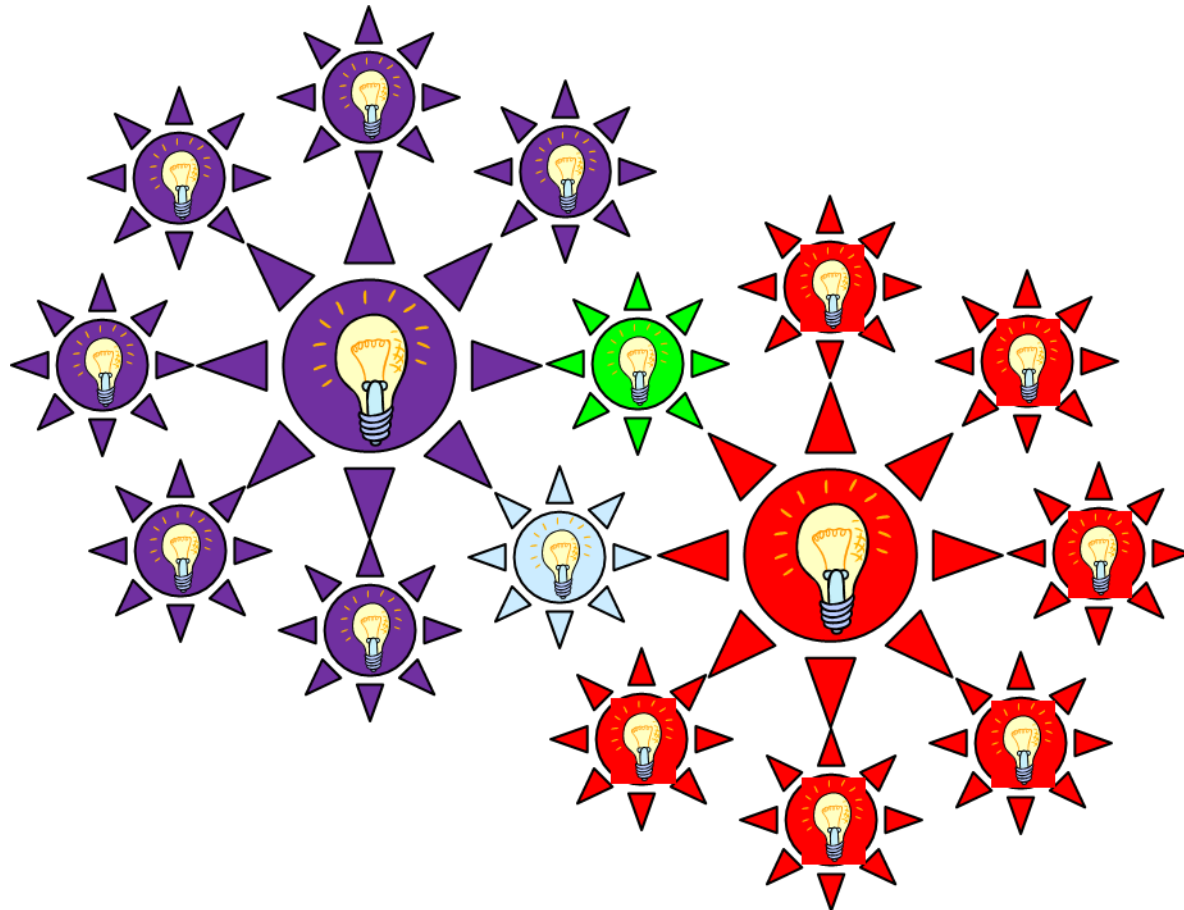
"Too often we forget that genius, too, depends upon the data within its reach, that even Archimedes could not have devised Edison's inventions."

Ernest Dimnet

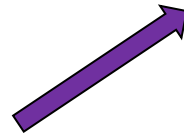
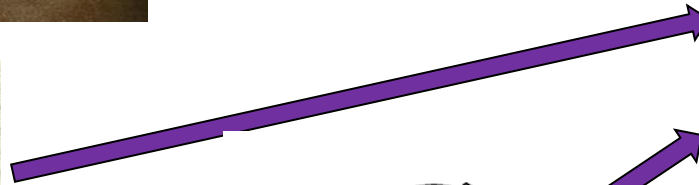
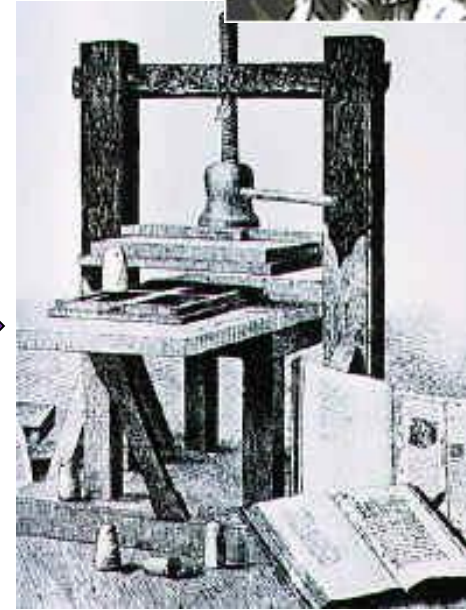
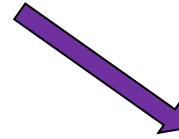
Adjacent Possibilities



Adjacent Possibilities

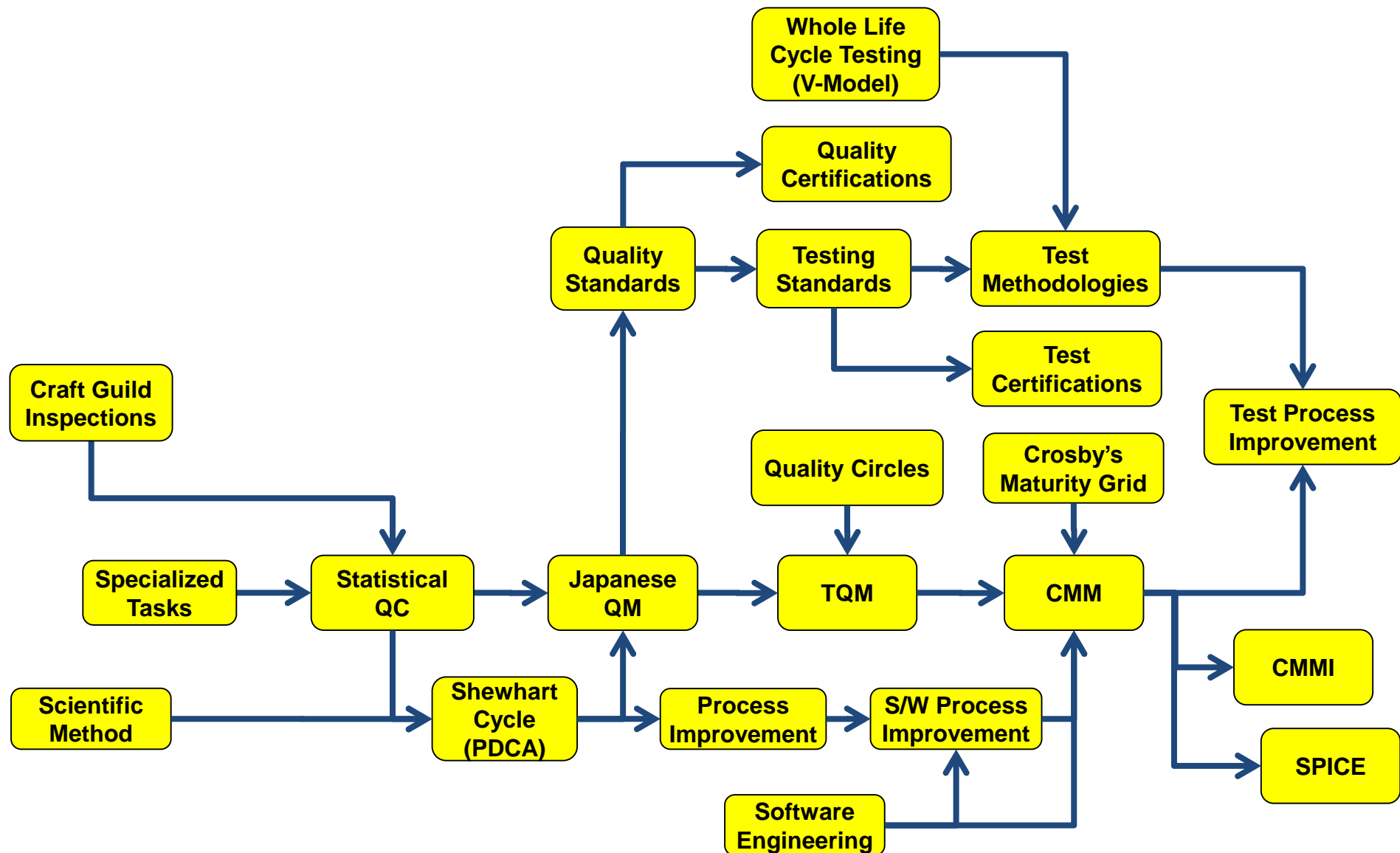


Gutenberg Press-Adjacent Possibilities

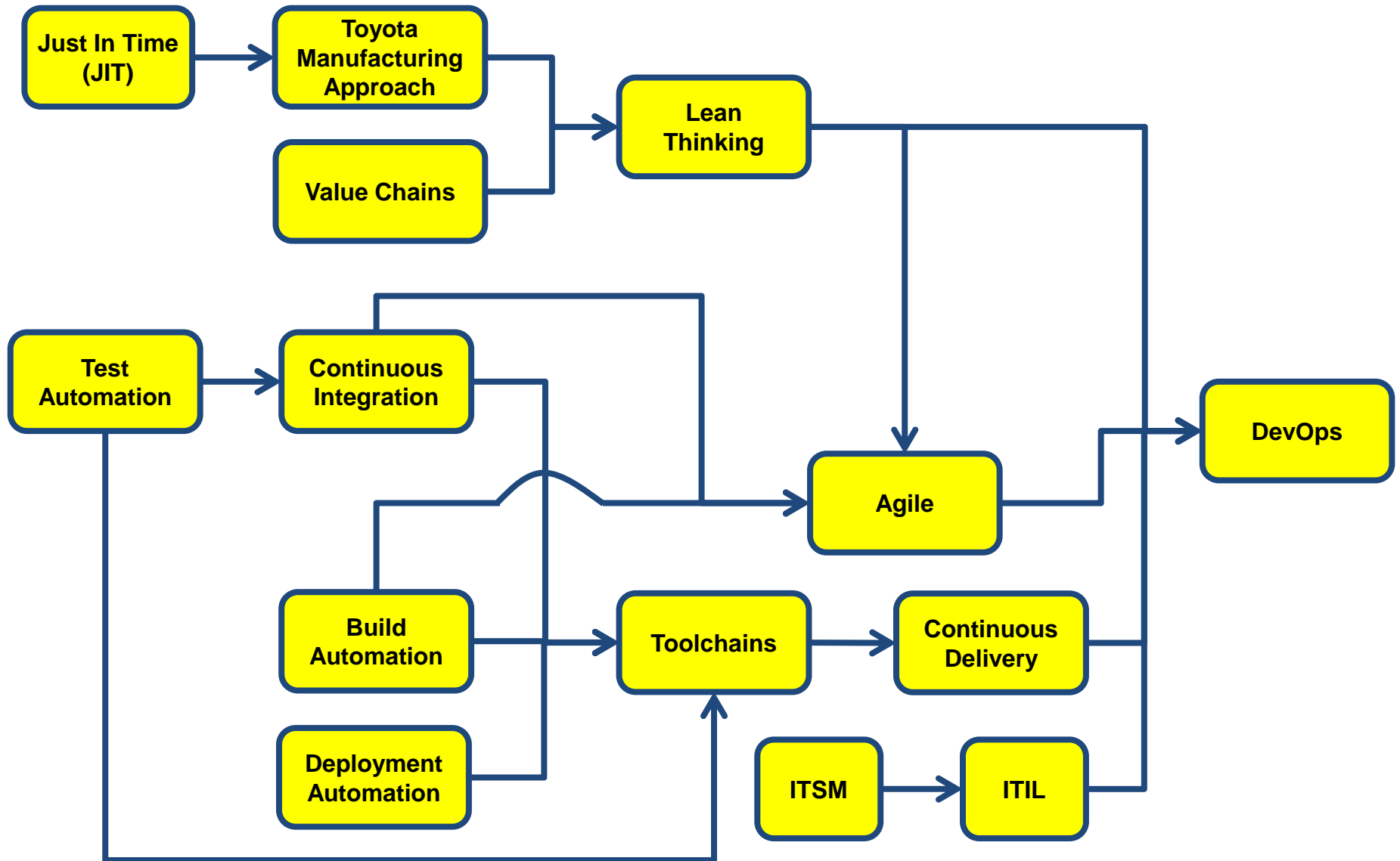


Lines of Innovation -

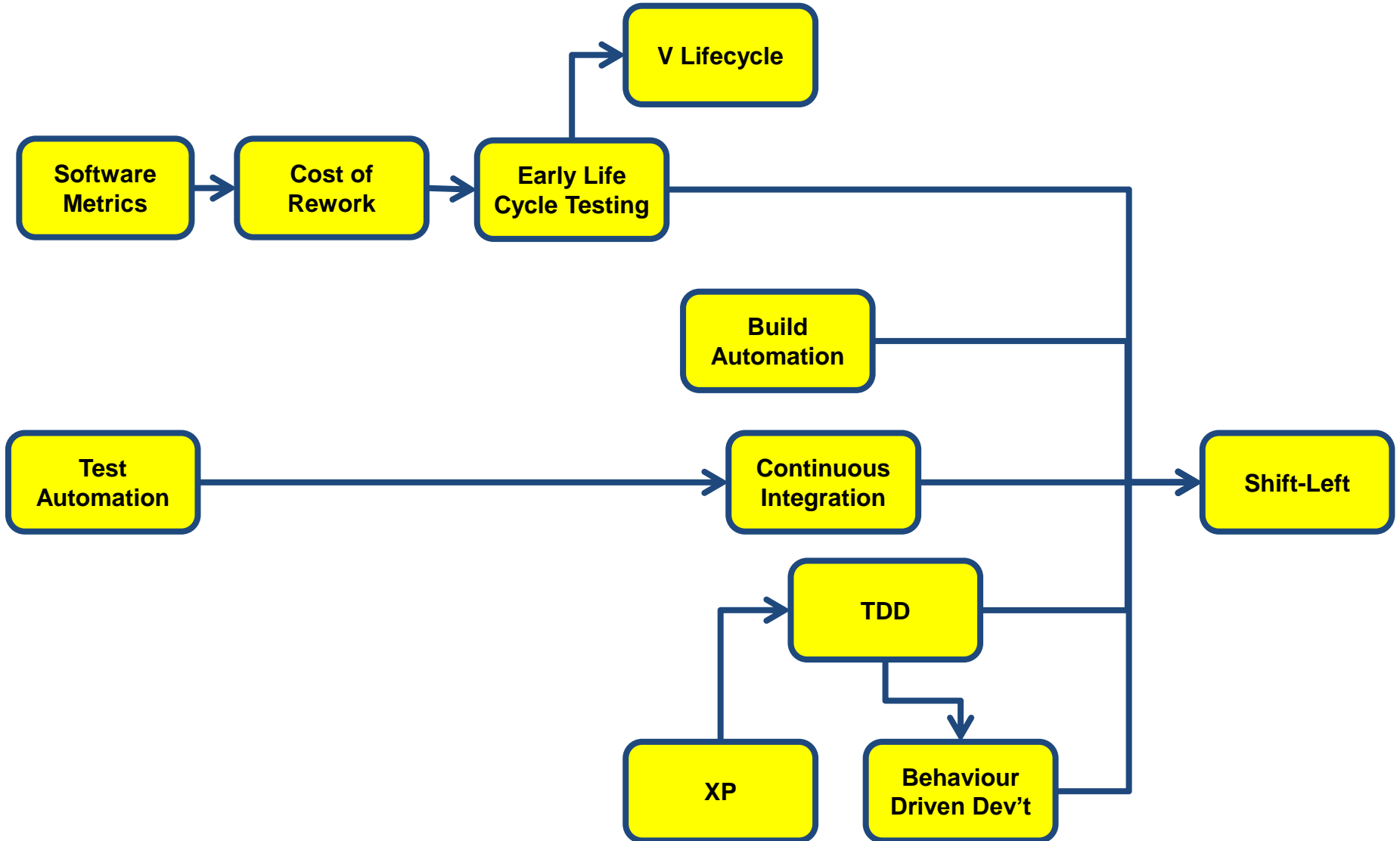
Quality, Standards & Process Improvement



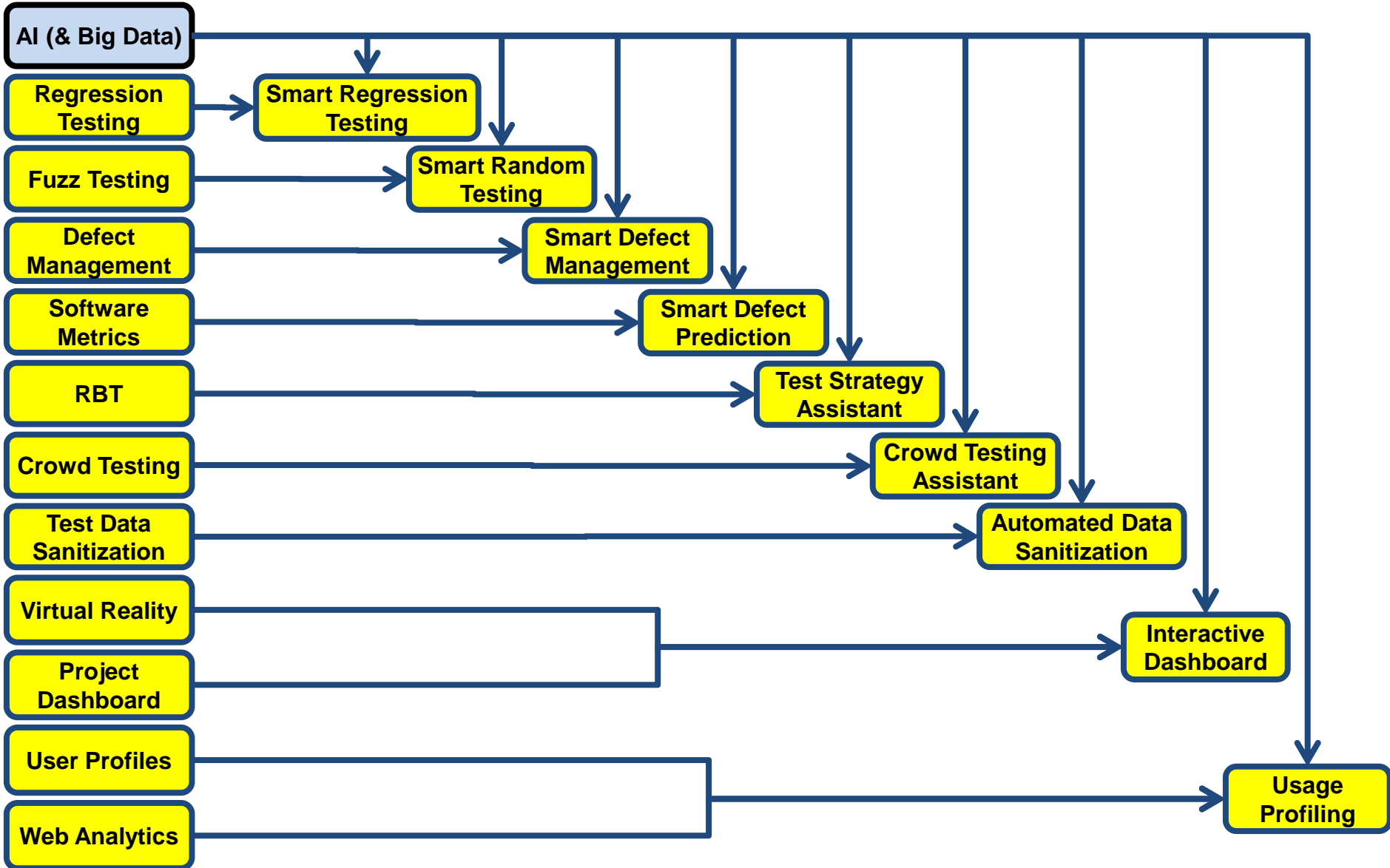
DevOps



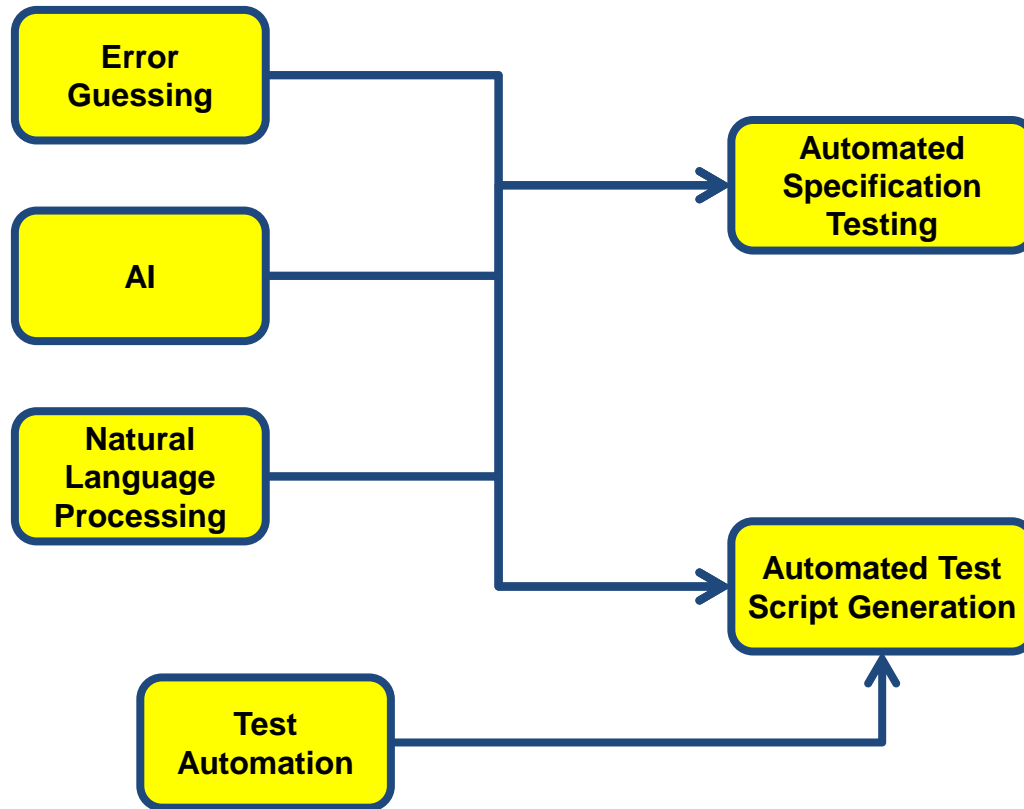
Shift-Left



AI, Big Data & Testing Opportunities



Natural Language Processing



Conclusions

- **The 4th Industrial Revolution**
- **Innovation is a necessity for survival**
- **Lines of Innovation**
 - to understand the current situation
 - to provide a platform for further innovation
- **Possible Future Innovation Areas**
 - People Testing
 - AI, Big Data and various Testing Areas
 - Natural Language Processing of Specifications
 - Your Insights? Please send them to me 😊

Thank you for listening 😊

Any Questions?