

Keynote

# Current Trends in Software Engineering and the Implications of their Convergence

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ICSEA 2020



*Aalen University*



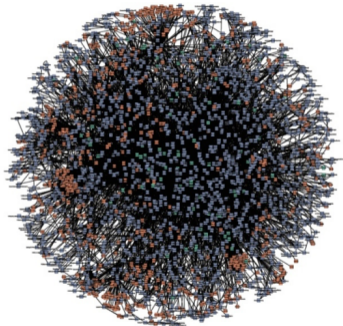
# IT Trends

# Today & Future Challenges to IT Operations

“IT operations is challenged by the rapid growth in data volumes generated by IT infrastructure and applications that must be captured, analyzed and acted on”

- Padraig Byrne, Senior Director Analyst at Gartner

# A crazy IT deployment landscape



Amazon Microservices



Netflix Microservices



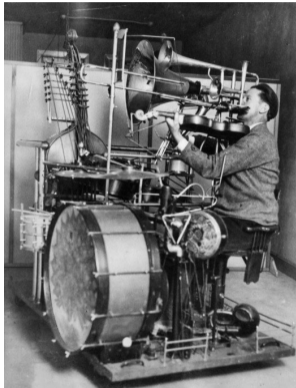
# The complex IT reality today

57% of enterprises  
use between  
1000-5000  
business applications

# Age of the IT Versatilist

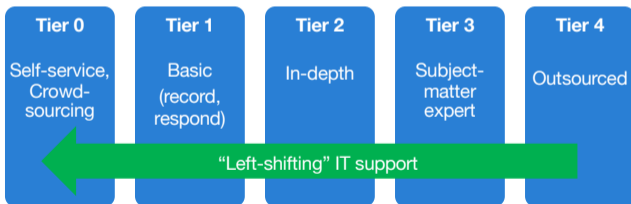
40% of IT Staff will be versatilists by 2021, holding multiple roles, most of which will be business-related rather than tech-related.

- Gartner



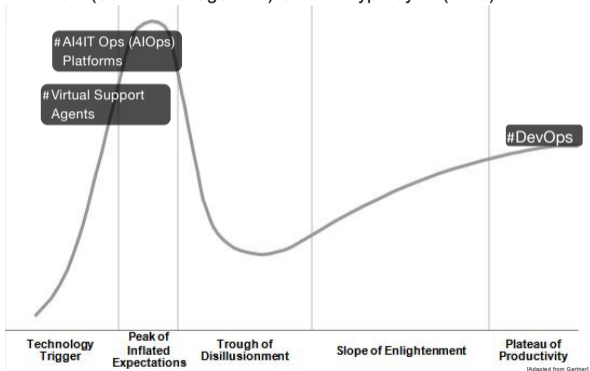
# DIY IT Self-Service Trend

83% of IT organizations enable/support self-service tools for end users [BMC]



# AI and Virtual Agents to the rescue

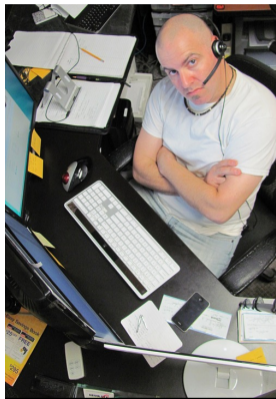
ITSM (Service Management) Gartner Hype Cycle (2020)



# Towards NoOps: Virtual Support Agents

25% of customer service and support Ops will integrate virtual customer assistant (VCA) or chatbot tech by 2020 across engagement channels, up from <2% in 2017.

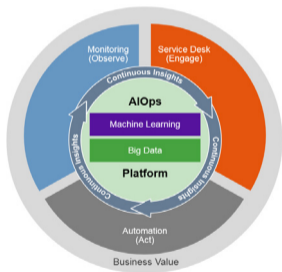
- Gartner




# NoOps via AIOps: Artificial Intelligence

- 40% of large enterprises using AIOps by 2022 to support and partially replace IT Ops activities (up from 5% today)
- Large enterprise exclusive use of AIOps and digital experience monitoring tools will increase from 5% (2018) to 30% in 2023
- AIOps will have a long-term transformative impact on IT operations

- Padraig Byrne, Senior Director Analyst at Gartner



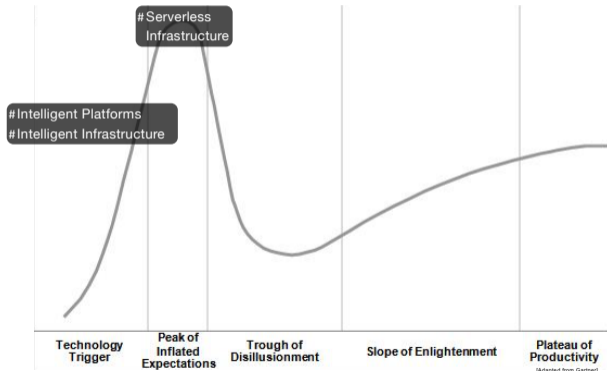
# Towards NoOps: Serverless



Over 50% of AWS users are using the serverless AWS Lambda Function as a Service (FaaS)

# Towards NoOps: Serverless & Intelligent Infrastructure

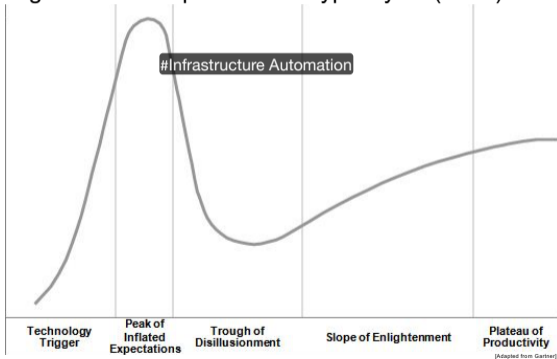
Gartner Hype Cycle Infrastructure Strategies (2020) - Selection





# Towards NoOps: Infrastructure Automation

Agile and DevOps Gartner Hype Cycle (2020) – Selection



IT

#Self-service  
#AIOps  
#Virtual Support Agents  
#Intelligent Platforms  
#Intelligent Infrastructure  
#Serverless Infrastructure  
#Infrastructure Automation

#NoOps

IT

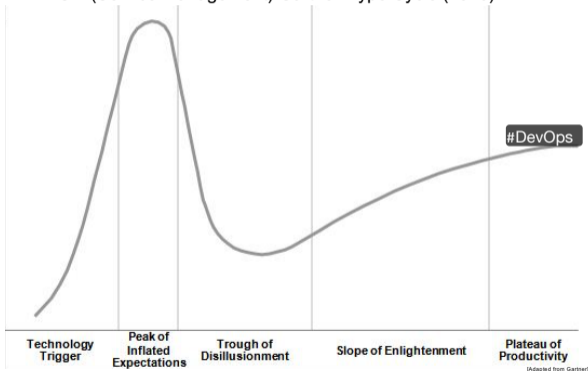
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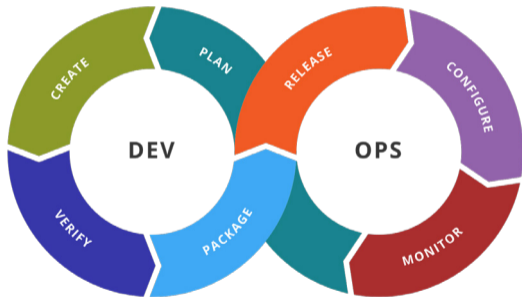
Development  
Trends

# DevOps: What are the implications?

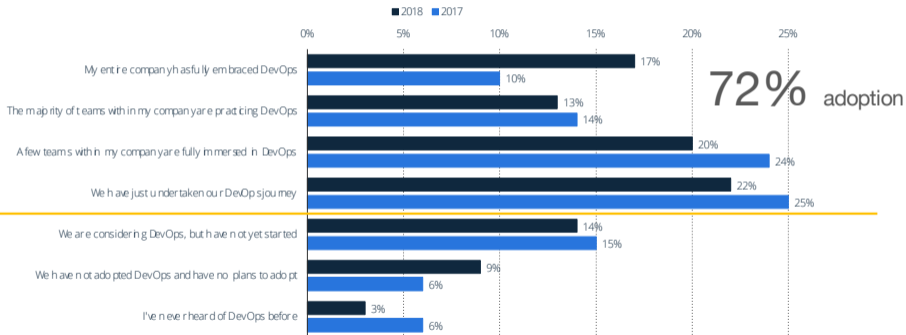
ITSM (Service Management) Gartner Hype Cycle (2020)



# DevOps



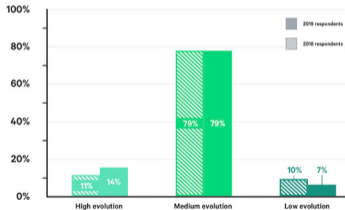
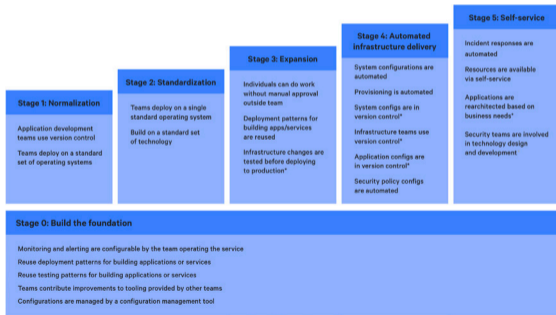
# DevOps: SW Developer adoption



**Note:** Worldwide; 2016 to 2018; 1091 Respondents; technology professionals responsible for development and quality of web and mobile applications  
**Source(s):** Sauce Labs; Dimensional Research

# DevOps: 5 Stage Evolution Model

[Puppet, CircleCI & Splunk]



# DevOps: Potential

High  
performing  
DevOps  
organizations

46X more code deployments

440X faster commit → deploy

96X faster recovery from downtime

Changes 20% less likely to fail

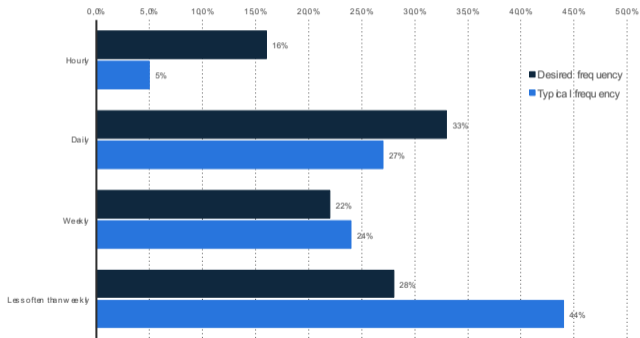
21% less time on unplanned (re)work

44% more time on new work


[2017 Puppet State of DevOps Report]



# DevOps: Build Deployment Frequency (2018)



Source: Sauce Labs; Dimensional Research, 2018



136,000 deployments  
per day.

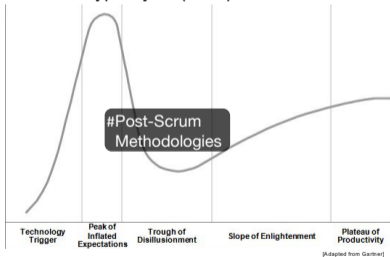
Ken Exner  
Amazon Director of Development Productivity

# Towards Instant Development & Deployment

Deployment frequency has come a long way since 2012



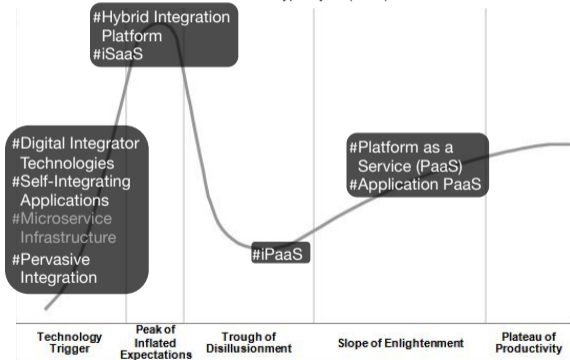
Application Development and Delivery  
Gartner Hype Cycle (2018)



# Towards Instant Pervasive Integration

## Application Infrastructure & Integration

Gartner Hype Cycle (2017)



[Adapted from Gartner]

# Integrate Anything: x-PaaS (Platform-as-a-Service)

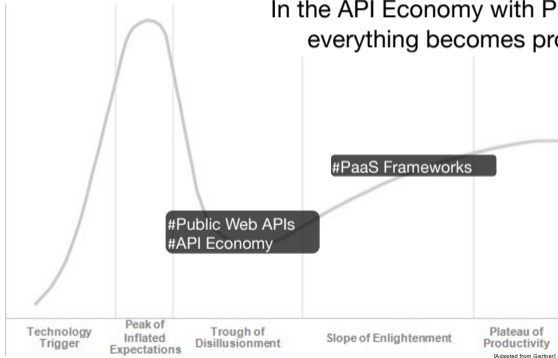
|                       |                       |           |
|-----------------------|-----------------------|-----------|
| Application Dev       | Platform Services     | (adPaaS)  |
| Application           | Platform Services     | (aPaaS)   |
| High-productivity app | Platform Services     | (hpaPaaS) |
| Business Analytics    | Platform Services     | (baPaaS)  |
| Business Process      | Management Services   | (bpmPaaS) |
| Business Rule         | Platform Services     | (brPaaS)  |
| Citizen Integrator    | Software as a Service | (iSaaS)   |
| Integration           | Platform Services     | (iPaaS)   |
| Communications        | Platform Services     | (cPaaS)   |
| Database              | Platform Services     | (dbPaaS)  |
| Data Broker           | Platform Services     | (dbrPaaS) |
| Event-Processing      | Platform Services     | (epPaaS)  |
| Function              | Platform Services     | (fPaaS)   |

# Towards Complete Software Infrastructure

## Application Development and Delivery

Gartner Hype Cycle (2018) - Selection

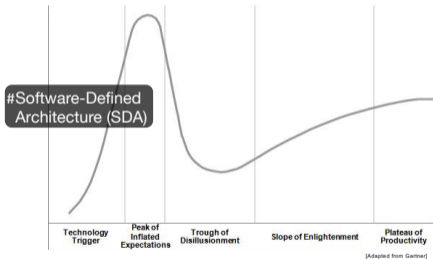
In the API Economy with Public Web APIs,  
everything becomes programmable



# Towards Software-Defined Architecture (SDA)

- SDA creates a virtualization layer over the software APIs by providing an API gateway.
- Enables reconfiguring the software application infrastructure without necessarily needing a software architect or developers.
- As the availability of Public Web APIs increase, SDA will enable applications to be quickly reconfigured or redefined based on changing circumstances.

Gartner Hype Cycle Enterprise Architecture (2017)



# Towards AI-empowered Developers: Augmented SW Development and the Virtual Developer

At least 40% of new  
Application Development projects will have  
an AI-powered 'virtual developer'  
on their team by 2022.

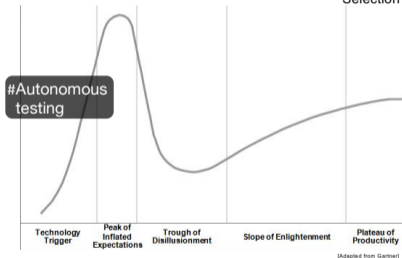
- Gartner (2018)



# Towards Autonomous Testing

- Leverages AI & ML to reduce the amount of manual labor associated with creating test code
- Enables Citizen Developers to have their code tested without necessarily requiring additional develop/tester resources

Agile and DevOps Gartner Hype Cycle (2020) Selection



# Democratization of Software Development

The rise of the Citizen Developer  
in a tech-savvy population

“We’re all developers now”  
- Gartner (2012)

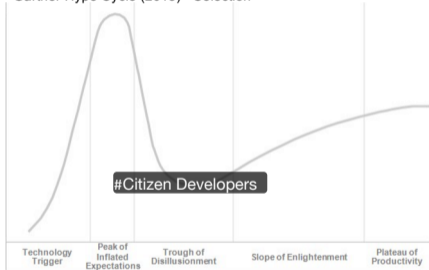
# NoCode: Citizen Developer & Low/No-Code

Low-code platforms will be used in more than 65% of software development projects by 2024  
- Gartner



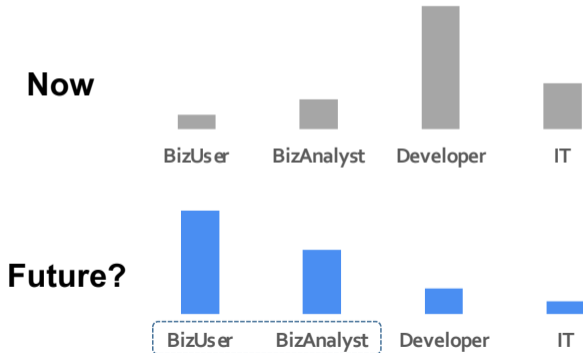
## Application Development and Delivery

Gartner Hype Cycle (2018) - Selection



[Adapted from Gartner]

# NoDevs?: Left-Shifting Engagement Trend



# Towards NoDevs: AI may eventually replace (some subset of) developers

- Various ongoing or completed projects are addressing AI-based code generation:
  - BAYOU
  - Deep TabNine – autocompleter trained on 2M GitHub repos
  - OpenAI code generation example via GPT2
- By 2040, ML and NLP technologies are expected to be capable of writing better software code faster than the best human developers. [Billings et al.: "Will humans even write code in 2040 and what would that mean for extreme heterogeneity in computing?", 2017]

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Development

#x-PaaS, Public Web APIs  
#Self-Integrating Applications  
#Pervasive Integration  
#SDA  
#DevOps, Post-Scrum  
#Citizen Developers  
#Virtual Developers  
#LowCode

#NoOps

#NoCode

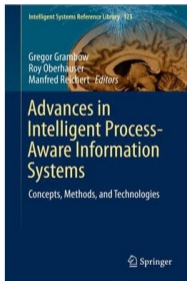


#NoBugs

#NoProblem?

# At least currently serious challenges remain for AI/ML assisted SW development

- We still have a way to go, even for automatically detecting known software design patterns.
  - E.g., refer to the ICSEA 2020 paper:
    - “A Machine Learning Approach Towards Automatic Software Design Pattern Recognition Across Multiple Programming Languages”
- We still face various challenges for creating intelligent autonomic process-aware information systems – refer to book

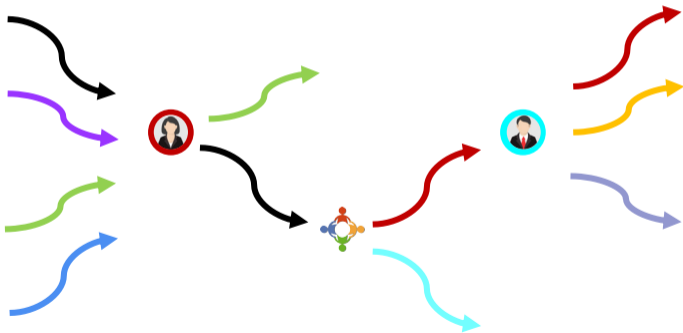


# Keep hoping for **No Silver Bullet?** Will Software's Essential Difficulties Remain?

Or can/will Augmented/Virtual Developers and No-Code Platforms do away with the essential difficulties of software development as elucidated by Frederick P. Brooks, Jr. :

- Complexity
- Conformity
- Changeability
- Invisibility

# Finding A Value Stream for Software Developers



# Perhaps a remaining hope for SW Developers: Eliciting Requirements

“The hardest single part of building a software system  
is deciding precisely what to build.

No other part of the conceptual work is as difficult as establishing  
the detailed technical requirements, including  
all the interfaces to people, to machines, and to other software systems.  
No other part of the work so cripples the resulting system if done wrong.  
No other part is more difficult to rectify later.

Therefore, the most important function  
that the software builder performs for the client  
is the iterative extraction and refinement  
of the product requirements.”

-- Frederick P. Brooks, Jr.

# Perhaps a remaining hope for SW Developers: Eliciting Requirements



Perhaps identifying stakeholders and getting stakeholder agreement and buy-in on explicit and implicit requirements, needs, and expectations may be the most challenging problem for AI to address



# Convergence

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Thank you!