



# FUTURE OF COMMUNICATIONS

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JUNIPER  
NETWORKS

Engineering  
Simplicity





# AGENDA

## Artificial Intelligence



Sergey Lebedev. Creator of the first stored program computer in continental Europe

# At the beginning ... a little quiz

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DEEP BLUE



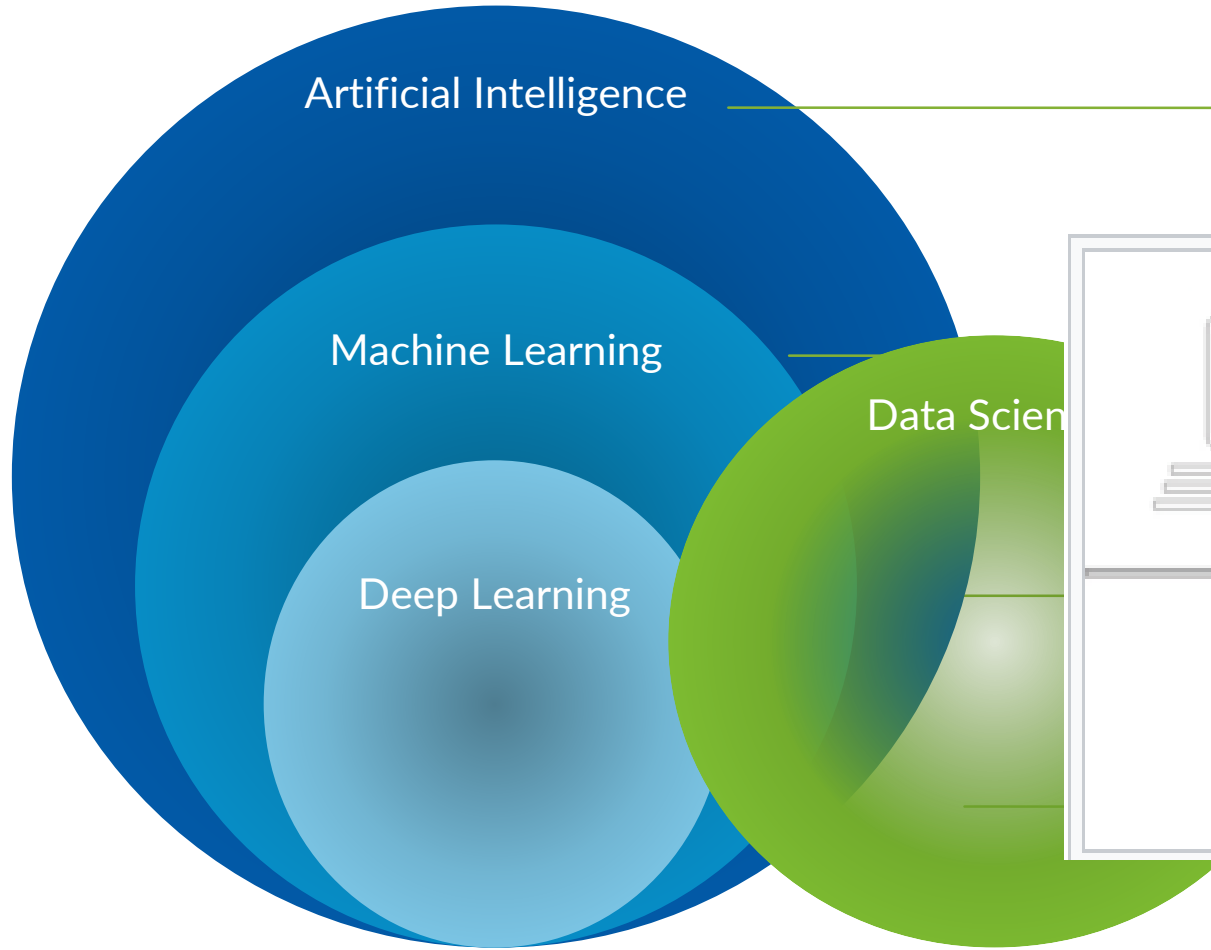
ALPHAGO



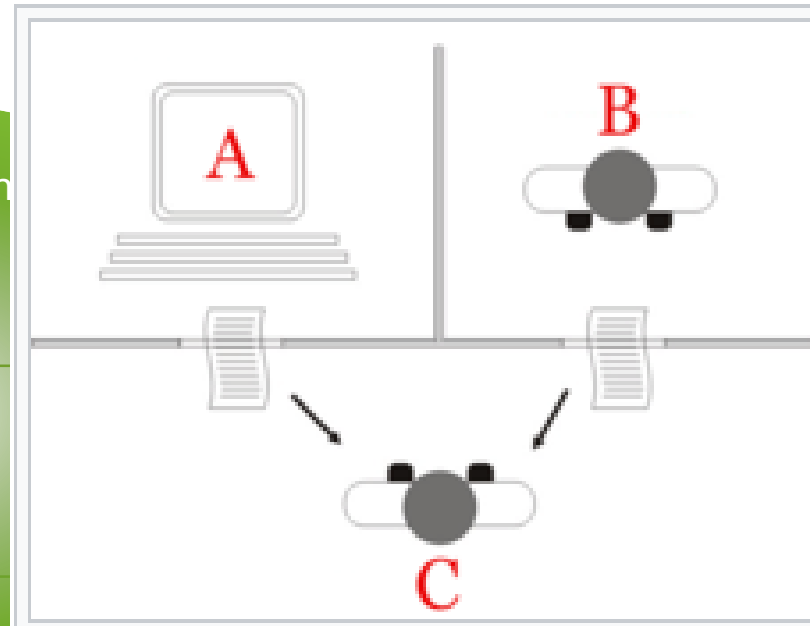
WATSON



# AI, Machine Learning, Deep Learning, Data Science – Definition



“...the theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.”



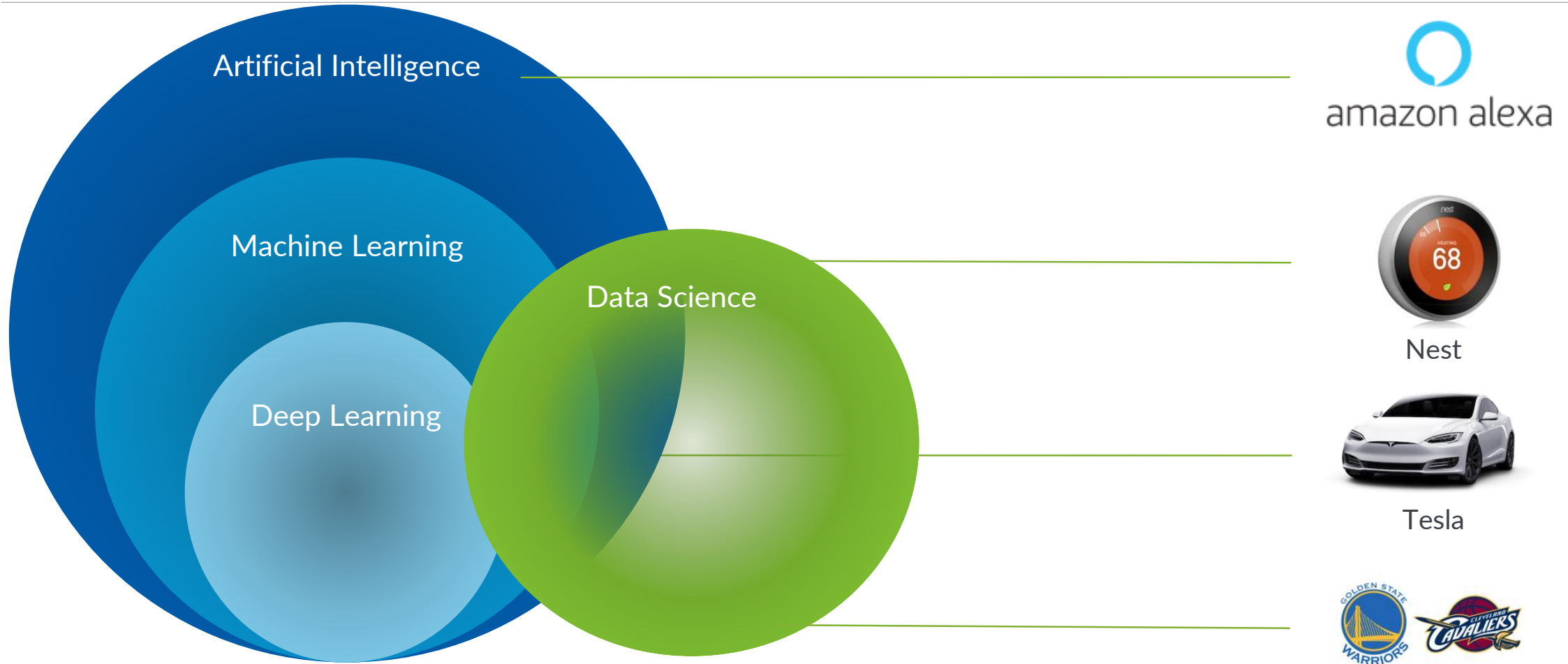
the field of computer science that often uses the ability to "learn" (i.e., progressively <) with data, without being explicitly

deep neural networks and recurrent neural including computer vision, speech recognition l games..etc, where they have produced results prior to human experts.”

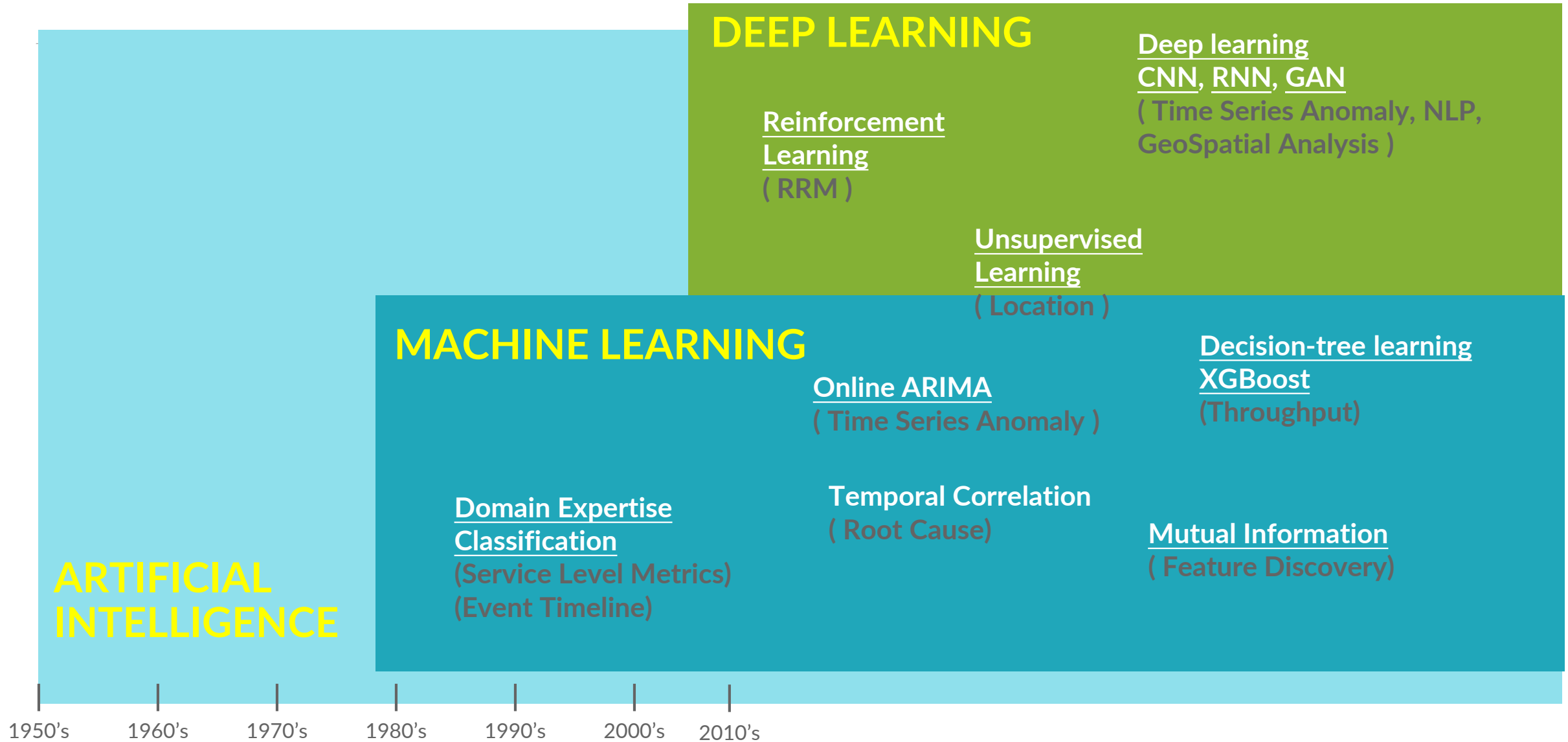
scientific methods, processes, algorithms and ghts from data in various forms, both data mining.”



# Examples – just to be precise



# AIOps REQUIRES A WELL STOCKED DATA SCIENCE TOOLBOX



# Reinforcement Learning – example RRM



## Action

- Channel
- Power
- Channel bandwidth

## State

- SLE capacity utilization
- SLE coverage anomaly
- SLE AP uptime
- Radar events

## Reward

- User Experience (SLE Metrics)
  - Client data rate symmetry
  - Roaming

## What is New?

Long term vs. short term reward

Optimize user experience vs. just interference

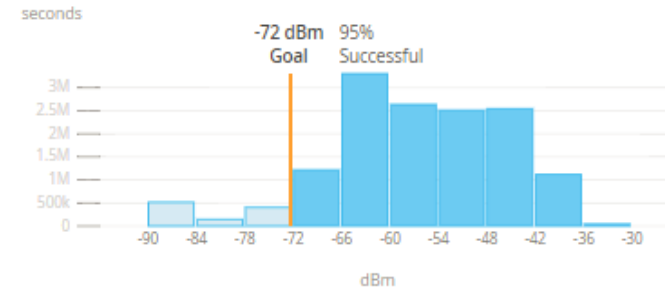
Global and Local optimization

# It is All About Data



Synchronous  
AP Stats

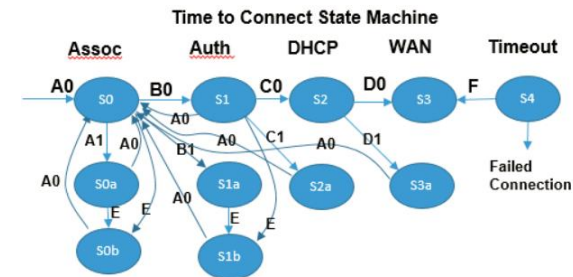
Distribution



Coverage



Asynchronous  
User State  
Events



Dynamic Packet Capture

Data comes from client perspective



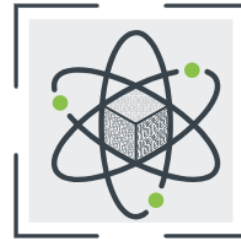
# AI is a continuous Journey



Data



AI Primitives

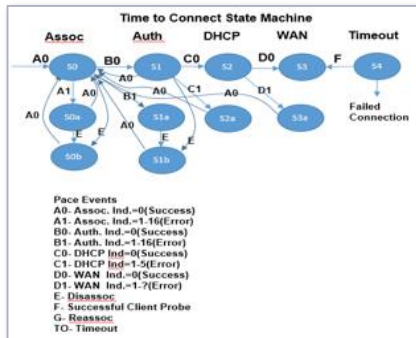


Data Science Toolbox

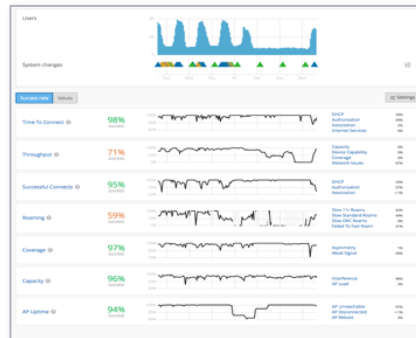


Virtual Assistant

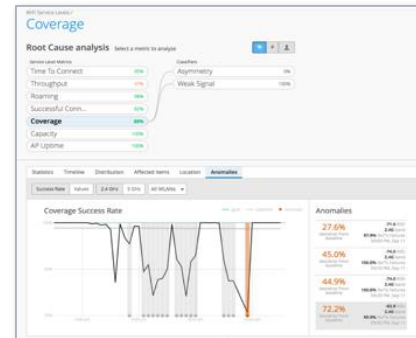
Self Driving



2015



2016



2017



2018



..and beyond

Real time, Inline, Distributed (Micro-Services) Software Architecture

# Networking Evolution

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Static Hardware

CLI-based Operations



Simple

Automated procedures  
(API driven)



Self-Learning

Self-driven network



# AGENDA

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## Automation



Victor Glushkov. Institute of Cybernetics Founder



# Automation and AI: It's changing life around us

## HOMES



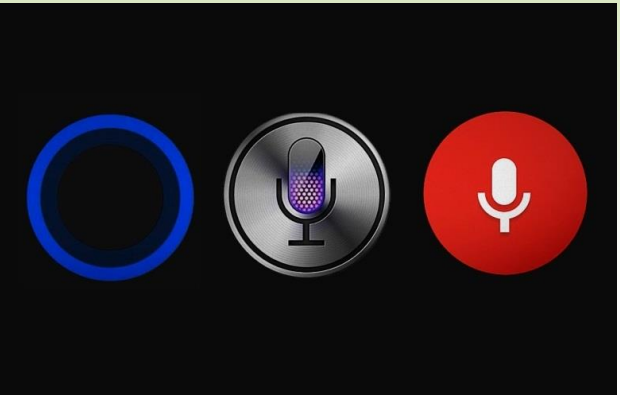
## CARS



## SHOPPING



## ASSISTANTS



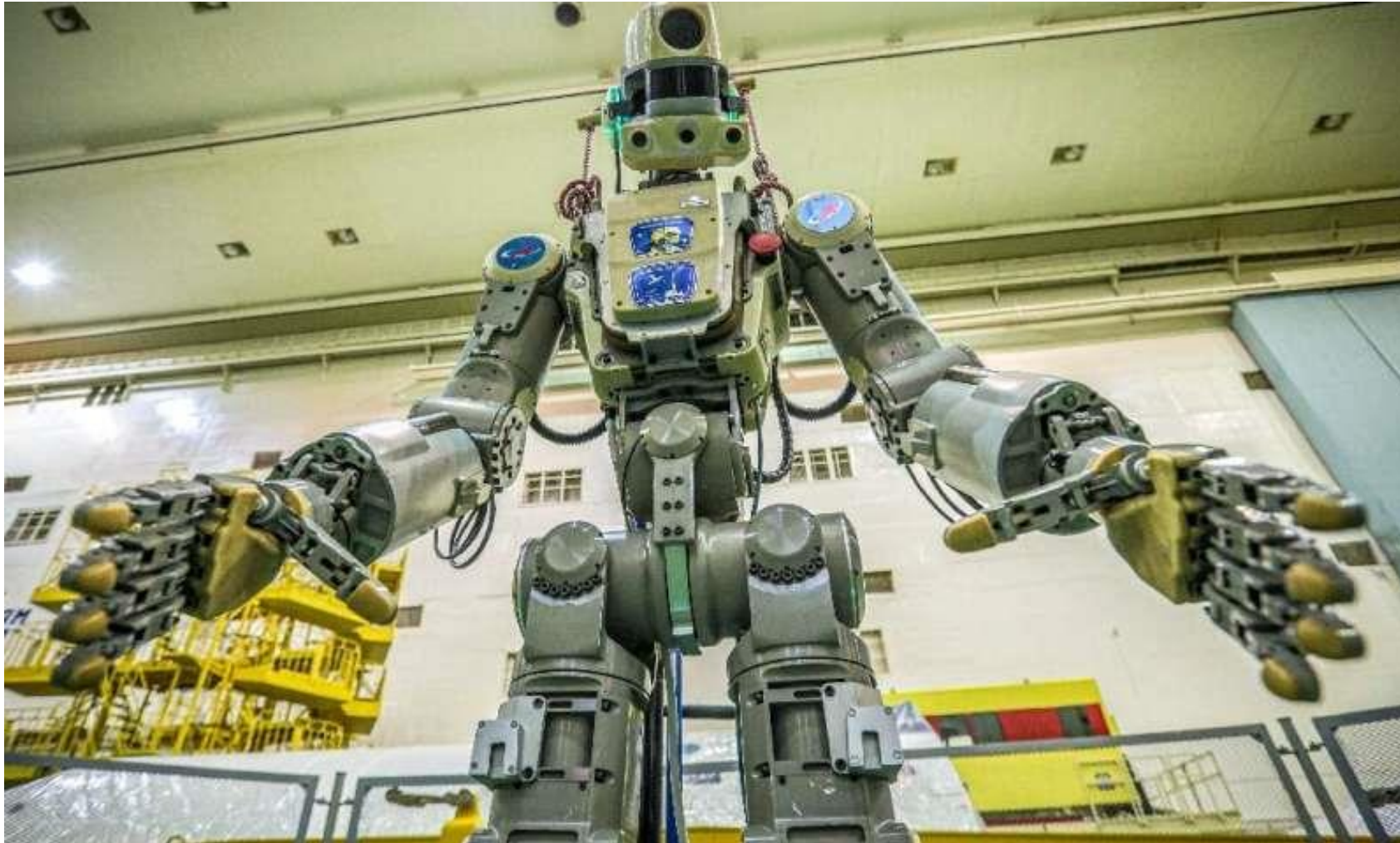
## LANGUAGE



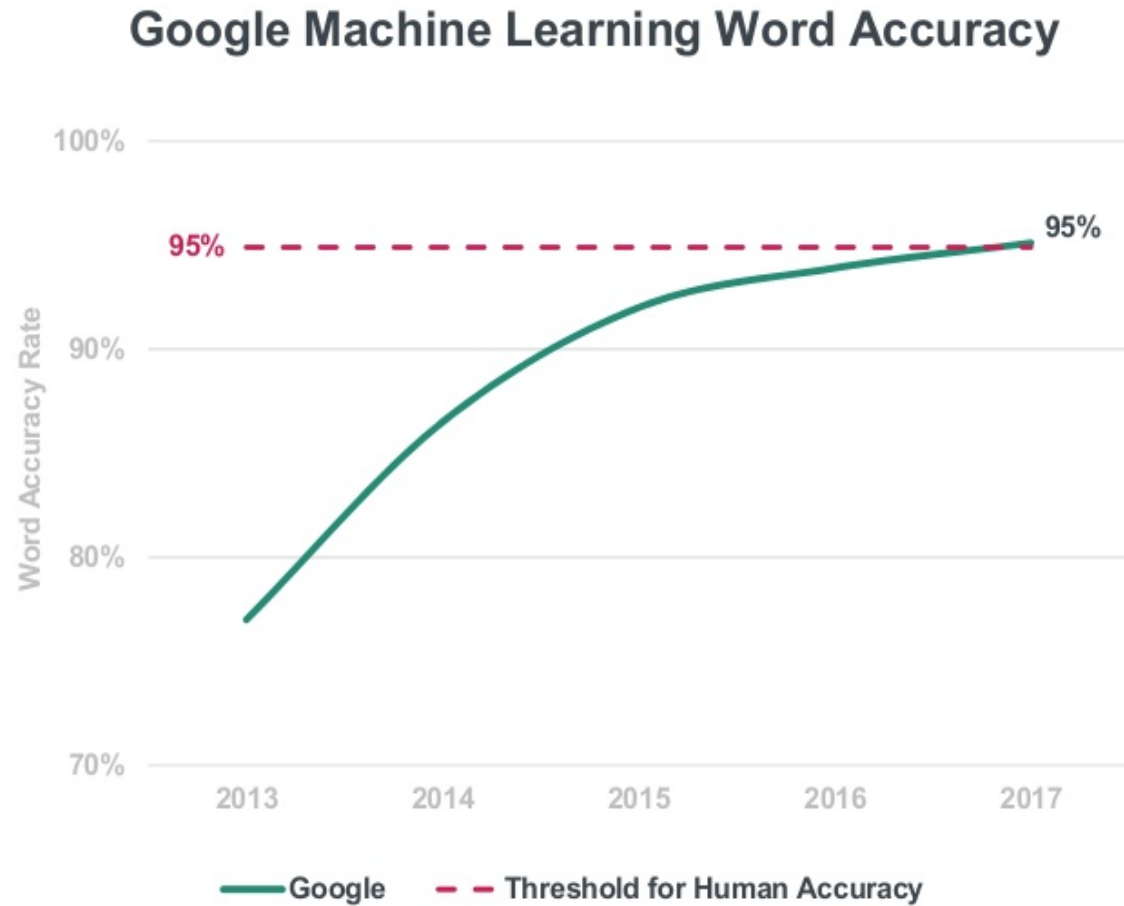
## GAMES



It's changing life around us .. Even here !



# Automation: Getting it right





# Automation : Setting the context

WHAT?

**“Using machines  
to run machines”**

**Peter F Drucker 1955**

WHY?

**Agility! Delivering  
outcomes fast.  
Dealing with  
scale. Reacting to  
change.**

HOW?

**Technology,  
Culture, and  
Process**



# AGENDA

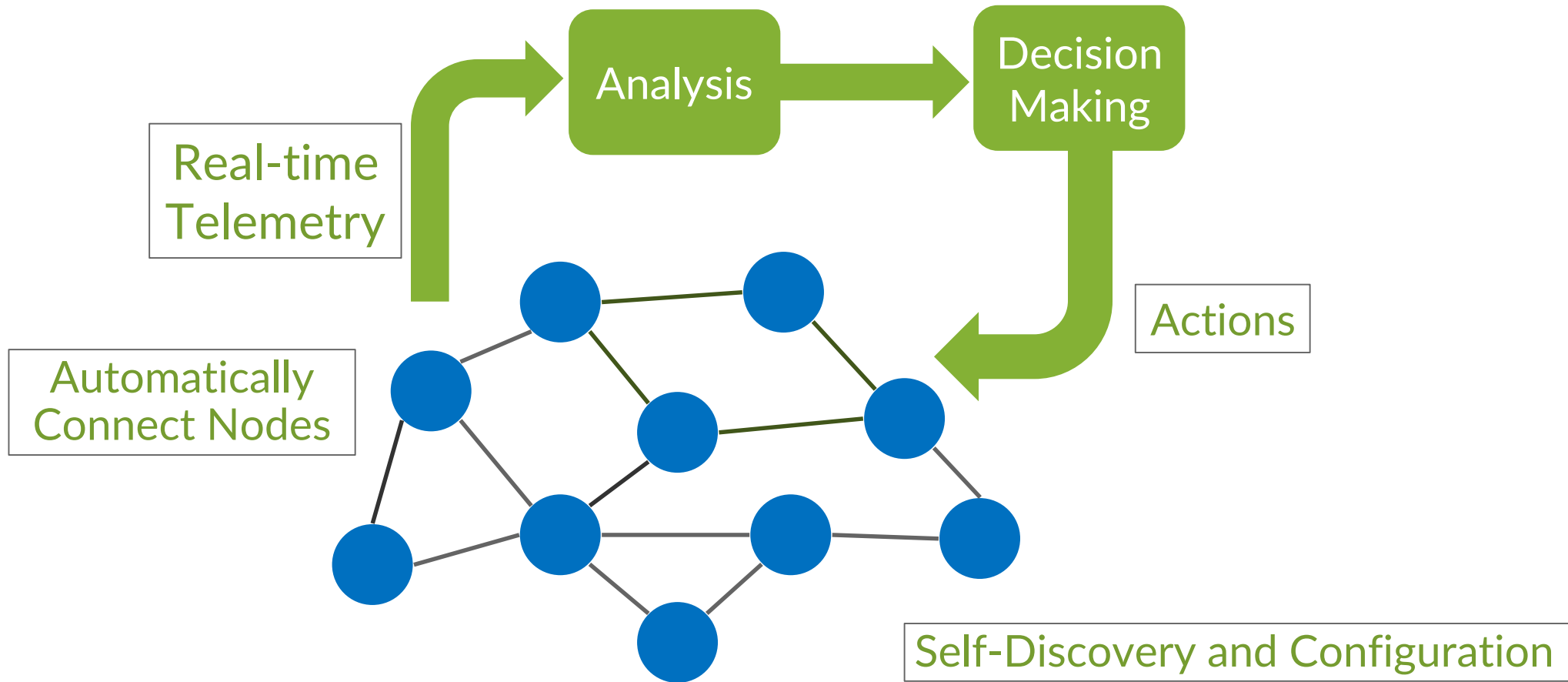
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## Self Driving Network



Dmitry Pospelov.  
Russian Artificial Intelligence Association Founder

# Schematic of a Self-Driving Network





# The Self-Driving Network - Activities

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## A self-driving network does....

- **Accept “guidance”** from a network operator
  - **Self-discover** its constituent parts
  - **Self**-configure
  - **Automatically** connect nodes
  - **Self** monitor using probes and other techniques
- **Automatically** monitor and update services and SLAs
  - **Auto**-detect and **auto**-enable new customers or users
  - **Self**-analyze using machine learning
  - **Self**-report to humans

# Why Do We Need AI & The Self-Driving Network?

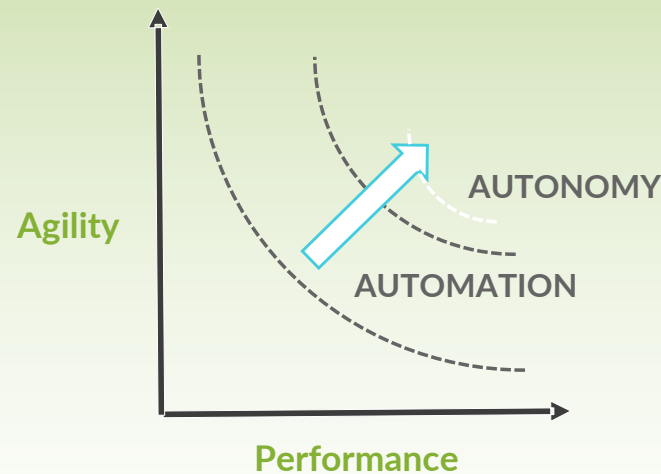
## 1 Economics



Reduce net management complexity and costs

Satisfy increasingly demanding customers

## 2 Agility



“Push out” the Performance / Agility tradeoff curves

## 3 Security



Baseline of normal activity

Detect anomalies

Automatically remediate

# Do I really need that fancy automatic stuff - Seriously..?

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- EMOTET Infection at the 25th September
- All PCs taken offline only 2 days later
- Result: Works since 27th September 2019 in „paper-only mode“



# Your Journey with AI to the Self-Driving Network™

## The Self-Driving Network

### Human-Driven Automation



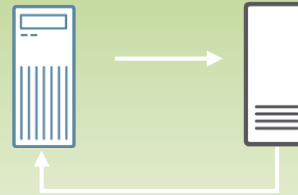
- Standard-based network interfaces and data models
- Automate network provisioning and management
- Simplify network operations

### Event-driven Automation



- Telemetry for Actionable Information
- Integration with Full IT infrastructure (Orchestration, etc)
- Rule-based Actions driven by events

### Machine-Driven Automation



- Use sophisticated algorithms (statistics)
- Pre-programmed machines makes decisions and drives network change
- Humans make decisions where machines cannot

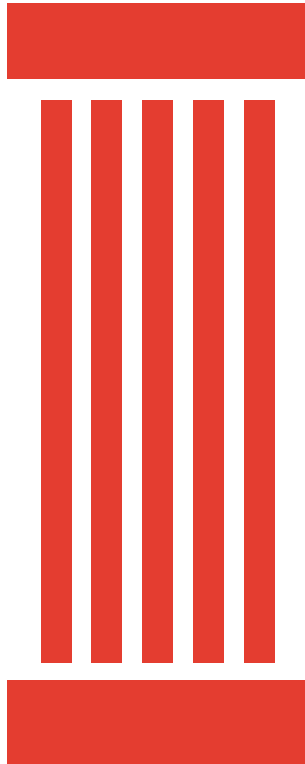
### Autonomy



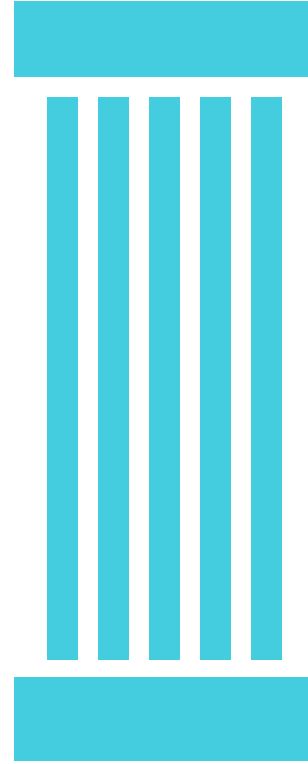
- Integrated machine-learning algorithms into the system
- Adaptive machine decisions drive network change
- Human supervision, no active intervention

# The Three Pillars of Success

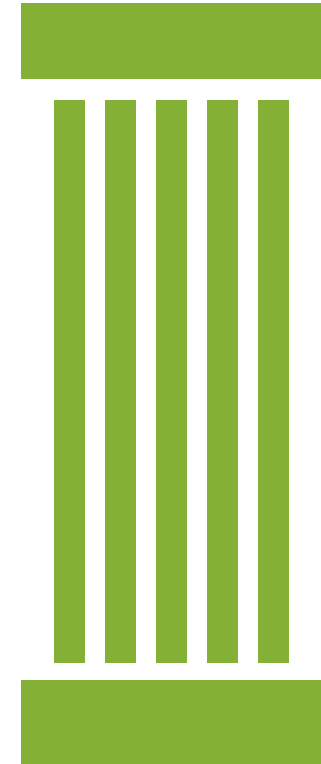
CULTURE



PROCESS



TECHNOLOGY



# The Three Pillars of Success

## CULTURE

- Lead the change from CLI to software mentality
- Create cross-functional teams
- Encourage and reward skills development
- Fail fast, fix fast, scale fast

## PROCESS

- Build an Agile-DevOps environment
- Train up staff
- Follow the processes
- Don't allow exceptions
- Leverage, engage and contribute to the community

## TECHNOLOGY

- Identify focus areas
- Start small, iterate often
- Leverage tools across the infrastructure
- Embrace & encourage open-source
- Five key technologies



# FIVE TECHNOLOGIES to be used...

**1** AUTOMATION

**2** TELEMETRY

**3** MULTIDIMENSIONAL VIEWS

**4** DECLARATIVE INTENT

**5** DECISION MAKING



# You can start today

## The Self-Driving Network

### Human-Driven Automation



Data models – NetConf, Yang

Config templates network and security

Puppet, Ansible, Chef, OpenConfig JSNAPy/PyEZ

### Event-driven Automation



Juniper Event-Driven Infrastructure (JEDI)  
Contrail Svc Orchestration  
Network Director  
Security Director  
Juniper Extension Toolkit  
Juniper Telemetry I/F  
NITA  
SaltStack  
Python

### Machine-Driven Automation



Software Defined Secure Networks

AppFormix

Contrail

NorthStar

### Autonomy



Certain features eg. Auto-Bandwidth

# Summary: Self-Driving Networks

More than a vision , becoming meaningful and realizable reality

- **Economic imperative:** attack the biggest cost in networking – operations
- **Efficiency imperative:** spin up resources as needed and optimize their use
- **Agility imperative:** bring up new services quickly; predict, anticipate and adapt
- **Security imperative:** quickly detect, diagnose, isolate, and mitigate threats



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„We can only see  
a short distance ahead,  
but we can see plenty  
there that needs to be  
done.“

Alan Turing





СПАСИБО!

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NETWORKS | Simplicity