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Přednáška 11

Trendy a budoucnost IT

CORE013 Vývoj softwarových systémů: od myšlenky k funkčnímu řešení

11. Trendy a budoucnost IT

- Trendy a budoucnost, příležitosti a hrozby
- Automatizace
- Robotika a IoT
- Big data and BI
- AI and bots

Domácí práce a příprava na dnešní přednášku

- Najďete a nasdílejte inspirativní článek k tématu do diskuzního fóra
  https://is.muni.cz/auth/discussion/predmetove/fi/podzim2022/CORE013/trendy_a_budoucnost_it/

DIGITALIZACE PROMĚŇUJE SVĚT

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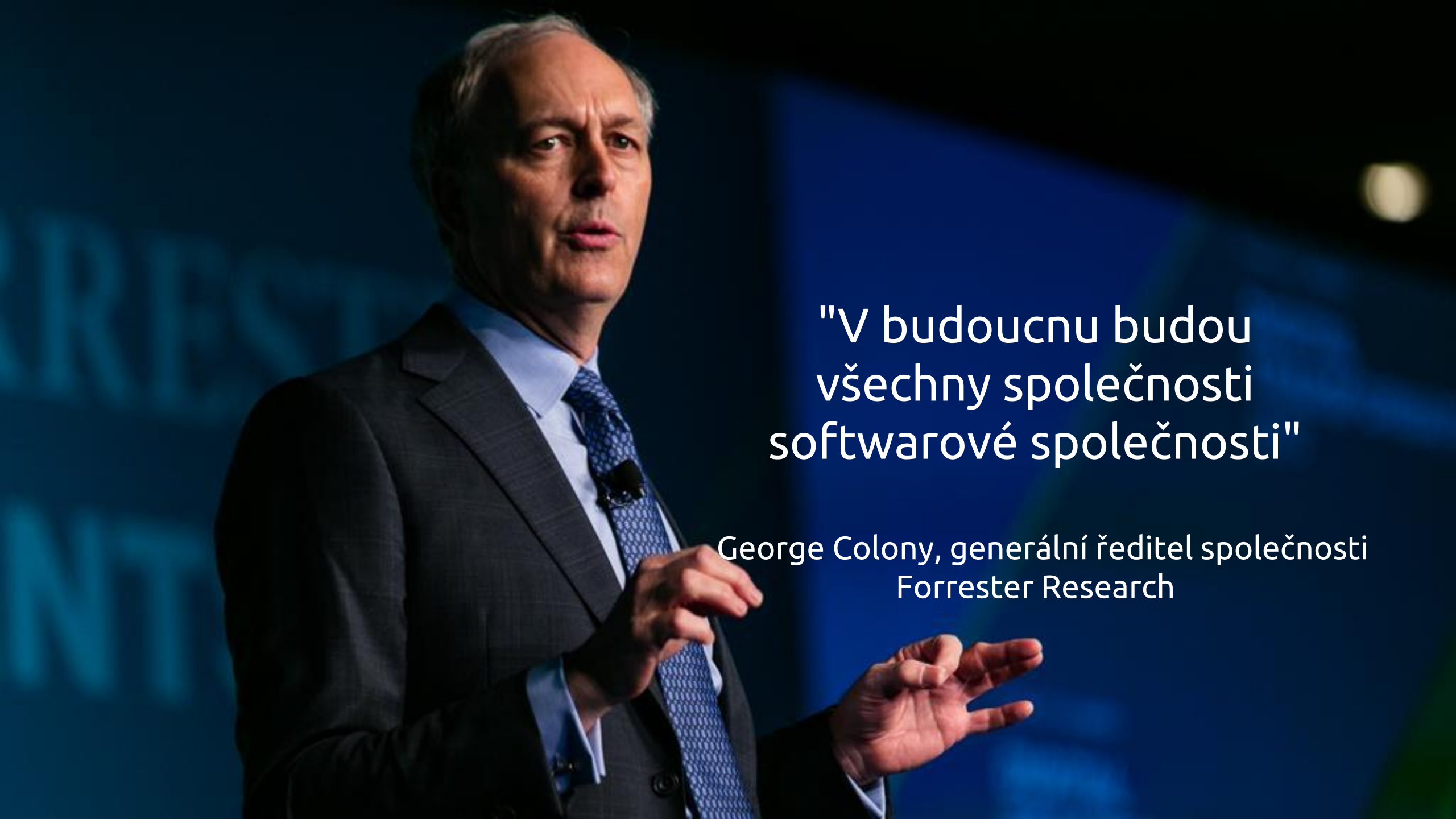

"V budoucnu budou
všechny společnosti
softwarové společnosti"
George Colony, generální ředitel společnosti
Forrester Research

Digitalizace jako cesta k inovacím

- **Inovace** - všechny velké společnosti se vyvíjejí prostřednictvím digitalizace (nebo zaniknou).
- **Udržitelnost** - inteligentní využívání zdrojů (např. doprava, energetické sítě, budovy).
- **Reakce na globální problémy**
  - **Růst populace v rozvojových zemích** (přístup k potravinám, vodě, vzdělání, bydlení, lékařské péči)
  - **Stárnutí populace ve vyspělých zemích** (zdravotní péče, podpora, sociální začlenění)
  - **Kvalita životního prostředí** (změna klimatu, znečištění, obnovitelné zdroje energie).
  - **Organizovaný zločin** (terorismus, náboženské/etnické/rasové konflikty, dezinformace, kyberkriminalita).

LOOKING AHEAD AT DIGITAL TRANSFORMATION & THE GROWTH OF IOT

Digital Supply Chains...
reduce process costs by 50%, reduce procurement costs by 20% and **increase revenue by 10%.**

Source: "Digital Supply Chains: A Formula For..." The Center for Global Enterprise

Companies with 50% or more of their revenues from **digital ecosystems achieve 32% higher revenue growth** and 27% higher profit margins.

Source: Source: MIT Sloan Management Review: Thriving in an Increasingly Digital Ecosystem

The volume of data captured by IoT **will exceed 1.6 zettabytes** by 2020.

Source: Edge Analytics in IoT: All Research

By 2018, **60% of enterprise IT will be off-premise** and **in the cloud.**

Source: "IDC FutureScape: Worldwide IT Industry 2017 Predictions" IDC Research, Inc.

Only 5% of organizations feel that they have mastered digital to a point of differentiation from their competitors.

Source: Source: "Digital Transformation in the Age of the Customer" Accenture

Only 9% of companies have access to real-time data for financial analysis and planning.

Source: "AFP 2016 Benchmarking Survey" Association for Financial Professionals

70% of utilities executives said their companies **want to be digital leaders** in the sector.

Source: PWC

Industrial companies are planning to **invest 5% of their revenues** annually to **digitally transform their enterprise**, with 55% of their investments expecting a payback in two years or less.

Source: "Industry 4.0: Building the Digital Enterprise" PwC

IoT could be worth $19 trillion over the next decade thanks to cost savings and profits for business and increased revenues for the public sector.

Source: "The Internet of Everything is closer than you think" EY

By 2019, **40% of local & regional governments will use IoT** to turn infrastructure into assets instead of liabilities.

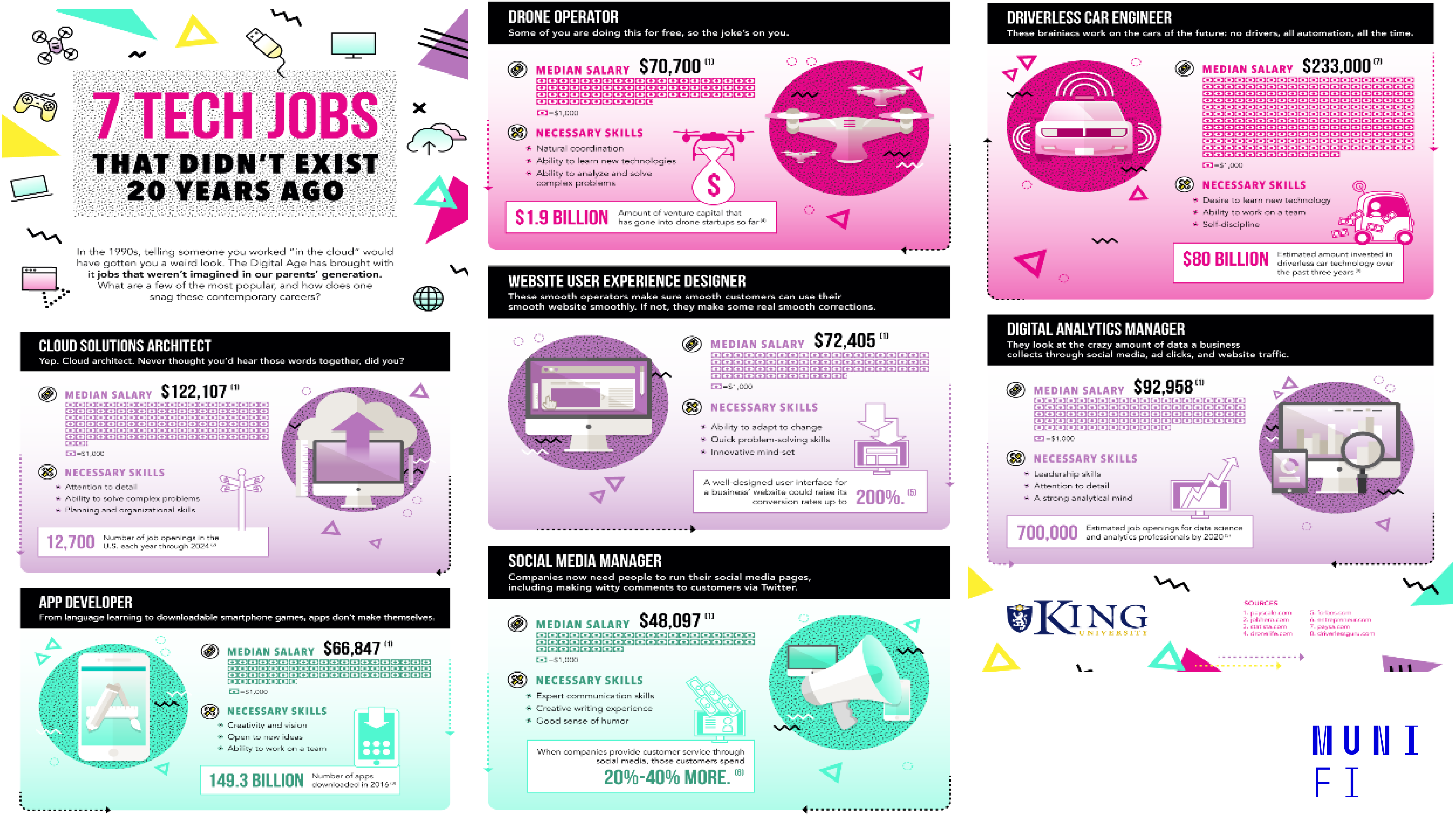
Source: IDC FutureScape: Worldwide IT Industry 2017 Predictions IDC Research Inc.

The **volume of data expenditure** on data analytics **will grow from $700 million in 2012 to $3.8 billion in 2020**

Source: GTM Research

In 2016, **93% of energy and utilities companies increased the number of IoT projects** they were involved in.

Source: "ENERGY INDUSTRY IOT LESSONS LEARNED - DESIGN FIRST, TECHNOLOGY SECOND" Indigo Advisory


7 TECH JOBS
THAT DIDN'T EXIST 20 YEARS AGO
In the 1990s, telling someone you worked "in the cloud" would have gotten you a weird look. The Digital Age has brought with it jobs that weren't imagined in our parents' generation. What are a few of the most popular, and how does one snag these contemporary careers?
CLOUD SOLUTIONS ARCHITECT
Yep. Cloud architect. Never thought you'd hear those words together, did you?
MEDIAN SALARY $122,107 (1)
=$1,000
NECESSARY SKILLS
Attention to detail
Ability to solve complex problems
Planning and organizational skills
12,700 Number of job openings in the U.S. each year through 2024
APP DEVELOPER
From language learning to downloadable smartphone games, apps don't make themselves.
MEDIAN SALARY $66,847 (1)
=$1,000
NECESSARY SKILLS
Creativity and vision
Open to new ideas
Ability to work on a team
149.3 BILLION Number of apps downloaded in 2016
DRONE OPERATOR
Some of you are doing this for free, so the joke's on you.
MEDIAN SALARY $70,700 (1)
=$1,000
NECESSARY SKILLS
Natural coordination
Ability to learn new technologies
Ability to analyze and solve complex problems
$1.9 BILLION Amount of venture capital that has gone into drone startups so far
WEBSITE USER EXPERIENCE DESIGNER
These smooth operators make sure smooth customers can use their smooth website smoothly. If not, they make some real smooth corrections.
MEDIAN SALARY $72,405 (1)
=$1,000
NECESSARY SKILLS
Ability to adapt to change
Quick problem-solving skills
Innovative mind set
A well designed user interface for a business' website could raise its conversion rates up to 200%. (5)
SOCIAL MEDIA MANAGER
Companies now need people to run their social media pages, including making witty comments to customers via Twitter.
MEDIAN SALARY $48,097 (1)
=$1,000
NECESSARY SKILLS
Expert communication skills
Creative writing experience
Good sense of humor
When companies provide customer service through social media, those customers spend 20%-40% MORE. (6)
DRIVERLESS CAR ENGINEER
These brainiacs work on the cars of the future: no drivers, all automation, all the time.
MEDIAN SALARY $233,000 (7)
=$1,000
NECESSARY SKILLS
Desire to learn new technology
Ability to work on a team
Self-discipline
$80 BILLION Estimated amount invested in driverless car technology over the past three years
DIGITAL ANALYTICS MANAGER
They look at the crazy amount of data a business collects through social media, ad clicks, and website traffic.
MEDIAN SALARY $92,958 (1)
=$1,000
NECESSARY SKILLS
Leadership skills
Attention to detail
A strong analytical mind
700,000 Estimated job openings for data science and analytics professionals by 2020
KING UNIVERSITY
SOURCES

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Zmíněné technologické trendy

- Distribuované systémy
- Mobilní vývoj
- Cloudové aplikace
- Autonomní vozidla a drony

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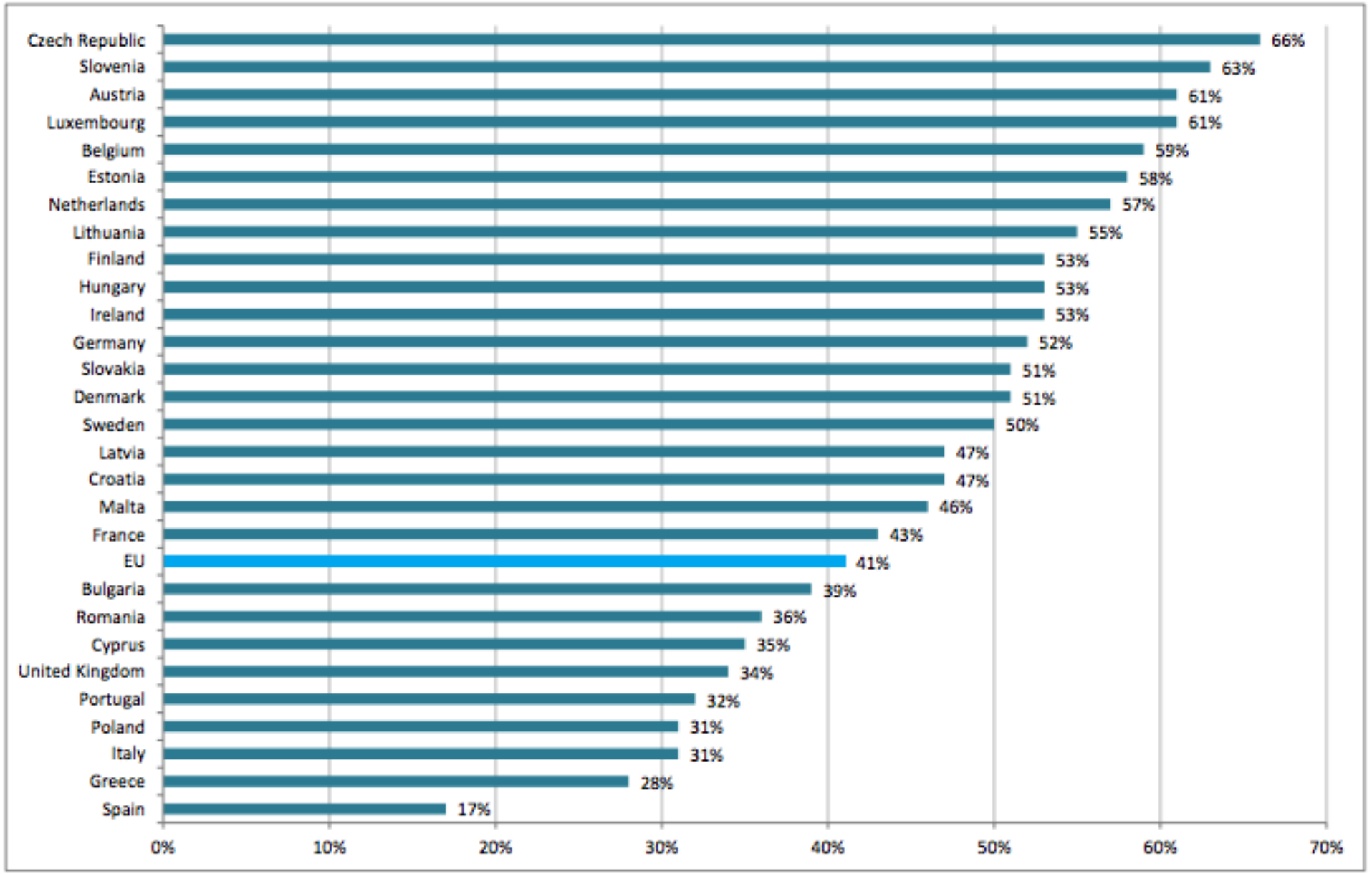
Share of enterprises which had hard-to-fill vacancies for ICT specialists, 2016

(as % of enterprises which recruited / tried to recruit ICT specialists)



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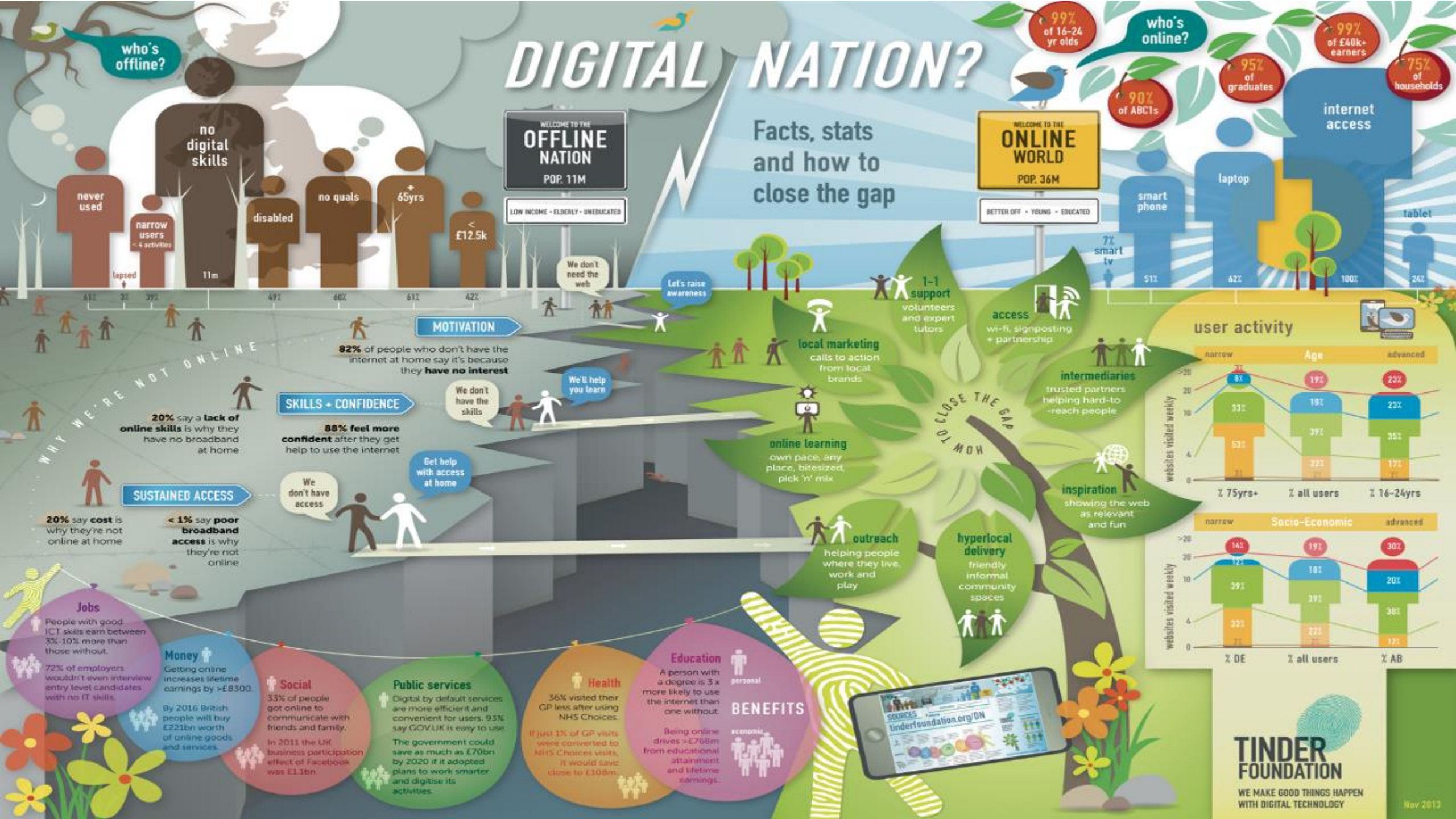
DIGITAL NATION?
Facts, stats and how to close the gap
who's offline?
no digital skills
never used
narrow users
< 4 activities
lapsed
disabled
no quals
65yrs
< £12.5k
11m
WELCOME TO THE OFFLINE NATION
POP. 11M
LOW INCOME + ELDERLY + UNEDUCATED
WELCOME TO THE ONLINE WORLD
POP. 36M
BETTER OFF + YOUNG + EDUCATED
who's online?
99% of 16-24 yr olds
90% of ABC1s
95% of graduates
99% of £40k+ earners
75% of households
internet access
laptop
smart phone
7% smart tv
tablet
51%
62%
100%
24%
WHY WE'RE NOT ONLINE
MOTIVATION
82% of people who don't have the internet at home say it's because they have no interest
We don't need the web
Let's raise awareness
We'll help you learn
SKILLS + CONFIDENCE
20% say a lack of online skills is why they have no broadband at home
88% feel more confident after they get help to use the internet
We don't have the skills
Get help with access at home
SUSTAINED ACCESS
20% say cost is why they're not online at home
< 1% say poor broadband access is why they're not online
We don't have access
HOW TO CLOSE THE GAP
1-1 support
volunteers and expert tutors
local marketing
calls to action from local brands
access
wi-fi, signposting + partnership
intermediaries
trusted partners helping hard-to-reach people
online learning
own pace, any place, bitesized, pick 'n' mix
inspiration
showing the web as relevant and fun
outreach
helping people where they live, work and play
hyperlocal delivery
friendly informal community spaces
user activity
narrow
Age
advanced
websites visited weekly
% 75yrs+
% all users
% 16-24yrs
narrow
Socio-Economic
advanced
% DE
% all users
% AB
BENEFITS
personal
economic
Jobs
People with good ICT skills earn between 3%-10% more than those without.
72% of employers wouldn't even interview entry level candidates with no IT skills.
Money
Getting online increases lifetime earnings by >£8300.
By 2016 British people will buy £221bn worth of online goods and services.
Social
33% of people got online to communicate with friends and family.
In 2011 the UK business participation effect of Facebook was £1.1bn.
Public services
Digital by default services are more efficient and convenient for users. 93% say GOV.UK is easy to use.
The government could save as much as £70bn by 2020 if it adopted plans to work smarter and digitise its activities.
Health
36% visited their GP less after using NHS Choices.
If just 1% of GP visits were converted to NHS Choices visits, it would save close to £108m.
Education
A person with a degree is 3 x more likely to use the internet than one without.
Being online drives >£768m from educational attainment and lifetime earnings.
SOURCES
tinderfoundation.org/DN
TINDER FOUNDATION
WE MAKE GOOD THINGS HAPPEN WITH DIGITAL TECHNOLOGY
Nov 2013

Další hlavní technologické trendy

- Technologické trendy současnosti
  - Internet věcí a robotika
  - Velká data a BI
  - Umělá inteligence a roboti/asistenti
  - Automatizace a kybernetická bezpečnost
- Očekávané průlomové změny
  - Rozšířená realita
  - Blockchain
  - Sítě 5G/6G
  - Kvantová výpočetní technika

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INTERNET OF THINGS

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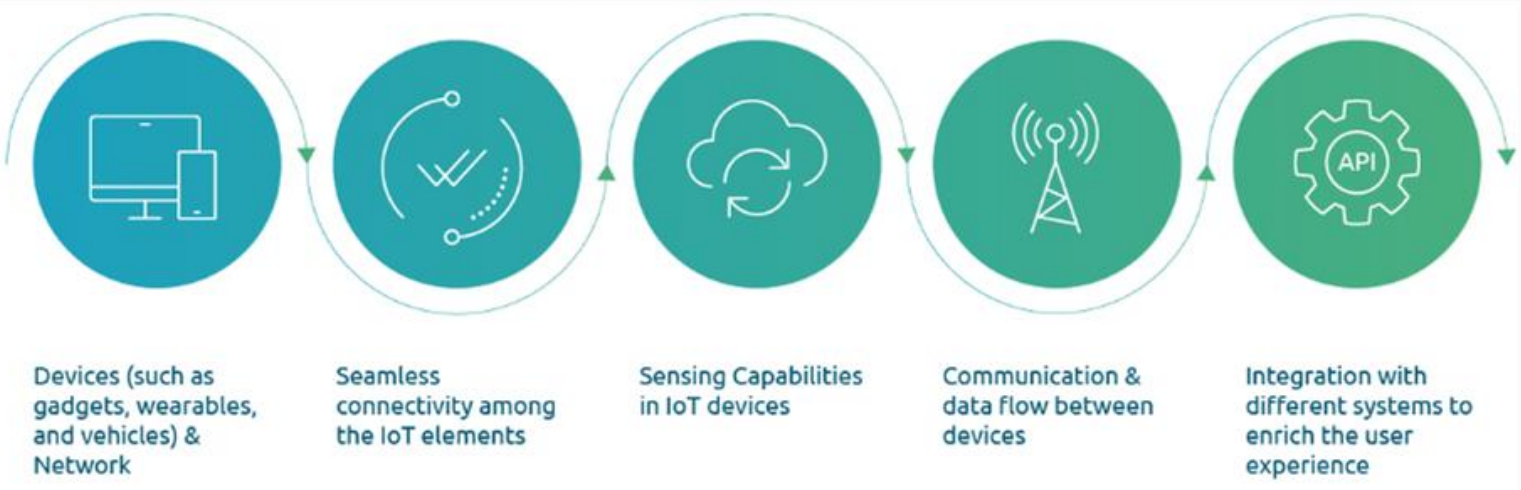
Internet of Things

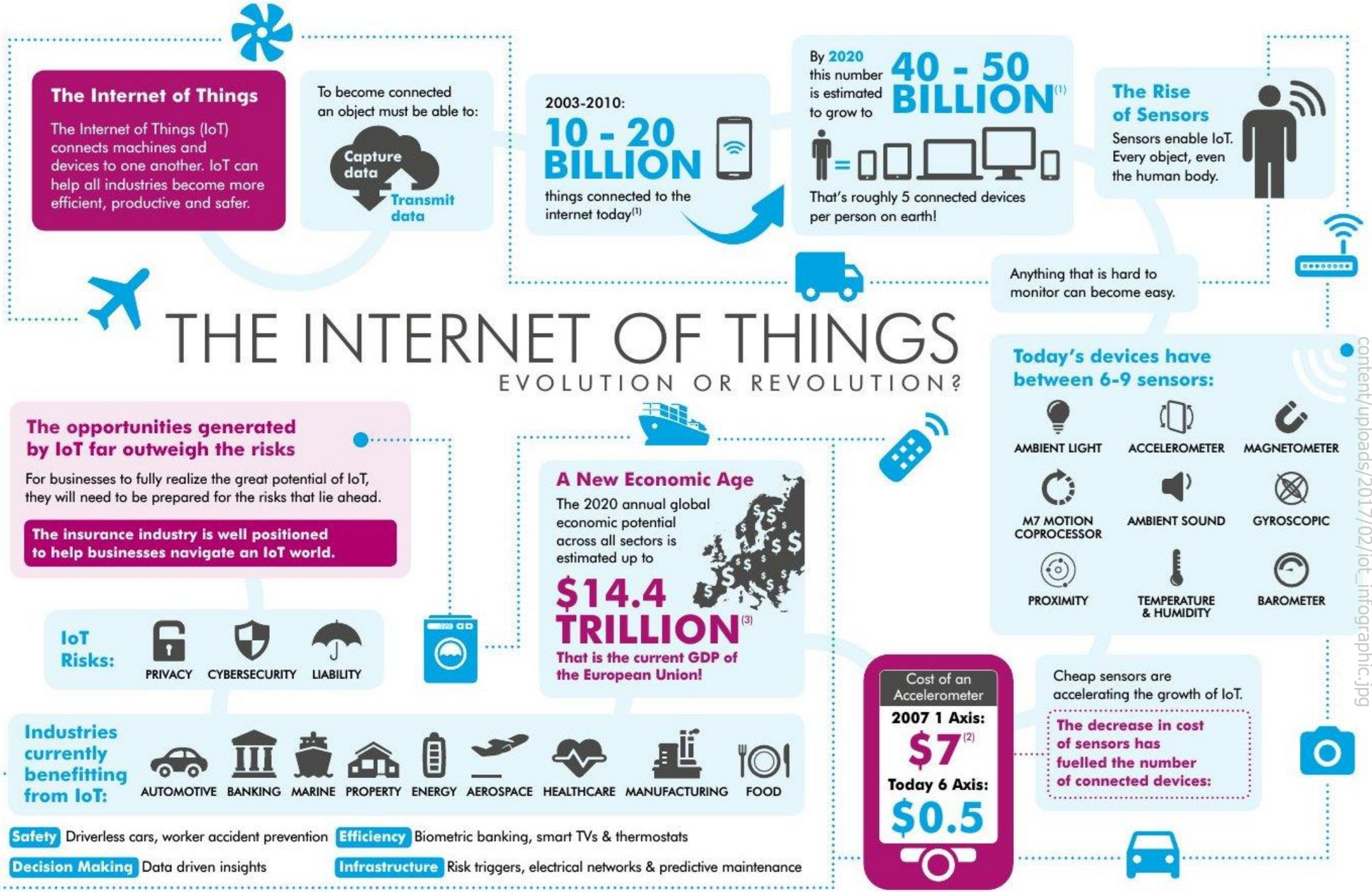
- Internet věcí je systém fyzických zařízení, která jsou propojená pomocí sítě a mohou tak spolu komunikovat.
- Každé ze zařízení sbírá data za pomocí senzorů a díky sdílení těchto dat systém umožňuje např. dálkové monitorování, efektivnější plánování, flexibilní rea



https://www.pinterest.com/pin/667025394810714993/

Oblasti využití

- Doprava
- Průmyslová výroba
- Zdravotnictví
- Energetika
- Potravinářství
- Chytré domácnosti


The Internet of Things
The Internet of Things (IoT) connects machines and devices to one another. IoT can help all industries become more efficient, productive and safer.
To become connected an object must be able to:
Capture data
Transmit data
2003-2010:
10 - 20 BILLION
things connected to the internet today(1)
By 2020 this number is estimated to grow to
40 - 50 BILLION(1)
That's roughly 5 connected devices per person on earth!
The Rise of Sensors
Sensors enable IoT. Every object, even the human body.
Anything that is hard to monitor can become easy.
THE INTERNET OF THINGS
EVOLUTION OR REVOLUTION?
Today's devices have between 6-9 sensors:
AMBIENT LIGHT
ACCELEROMETER
MAGNETOMETER
M7 MOTION COPROCESSOR
AMBIENT SOUND
GYROSCOPIC
PROXIMITY
TEMPERATURE & HUMIDITY
BAROMETER
The opportunities generated by IoT far outweigh the risks
For businesses to fully realize the great potential of IoT, they will need to be prepared for the risks that lie ahead.
The insurance industry is well positioned to help businesses navigate an IoT world.
A New Economic Age
The 2020 annual global economic potential across all sectors is estimated up to
$14.4 TRILLION(3)
That is the current GDP of the European Union!
IoT Risks:
PRIVACY
CYBERSECURITY
LIABILITY
Industries currently benefitting from IoT:
AUTOMOTIVE
BANKING
MARINE
PROPERTY
ENERGY
AEROSPACE
HEALTHCARE
MANUFACTURING
FOOD
Safety Driverless cars, worker accident prevention
Efficiency Biometric banking, smart TVs & thermostats
Decision Making Data driven insights
Infrastructure Risk triggers, electrical networks & predictive maintenance
Cost of an Accelerometer
2007 1 Axis:
$7(2)
Today 6 Axis:
$0.5
Cheap sensors are accelerating the growth of IoT.
The decrease in cost of sensors has fuelled the number of connected devices:
https://iotnews.asia/wp-content/uploads/2017/02/iot_infographic.jpg

BIG DATA AND BUSINESS INTELLIGENCE

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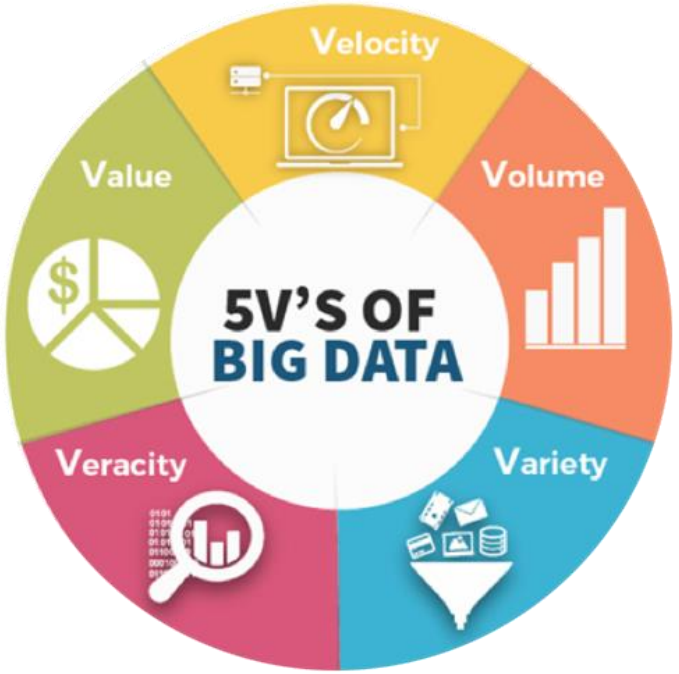
Velká data - 7. přednáška

- Charakteristika - 5 V's:
  - **Objem** - velikost dat je obrovská
  - **Rozmanitost** - různé zdroje a formát dat
  - **Variabilita** - údaje mohou být nekonzistentní a nepředvídatelné
  - **Rychlost** - data jsou generována velmi rychle
  - **Věrohodnost** - data jsou ověřena a validována.
- Zpracování dat:
  - Čištění
  - Analýza
  - Vizualizace
  - Zabezpečení



https://img.techentice.com/media/2019/04/5_V_Big_data-1.png

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A Minute on the Internet in 2019

Estimated data created on the internet in one minute

@StatistaCharts Sources: Lori Lewis & Officially Chad via Visual Capitalist

statista

https://www.opusinteractive.com/unlocking-the-secrets-of-the-hybrid-cloud/chartoftheday_17518_internet_use_one_minute_n/

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Business Intelligence

- Business Intelligence je analýza trhu a velký plánuje další směřování systému/podnikání
- Zahrnuje zpracování a vizualizace dat, jejich organizace umožňuje rychlejší rozhodování budoucím vývoji.

http://kreyonsystems.com/BusinessIntelligence.aspx

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Oblasti využití

- Vláda a vzdělávání
- Finance
- Zdravotnictví
- Energetika
- Potravinářství
- Podnikání

UMĚLÁ INTELIGENCE

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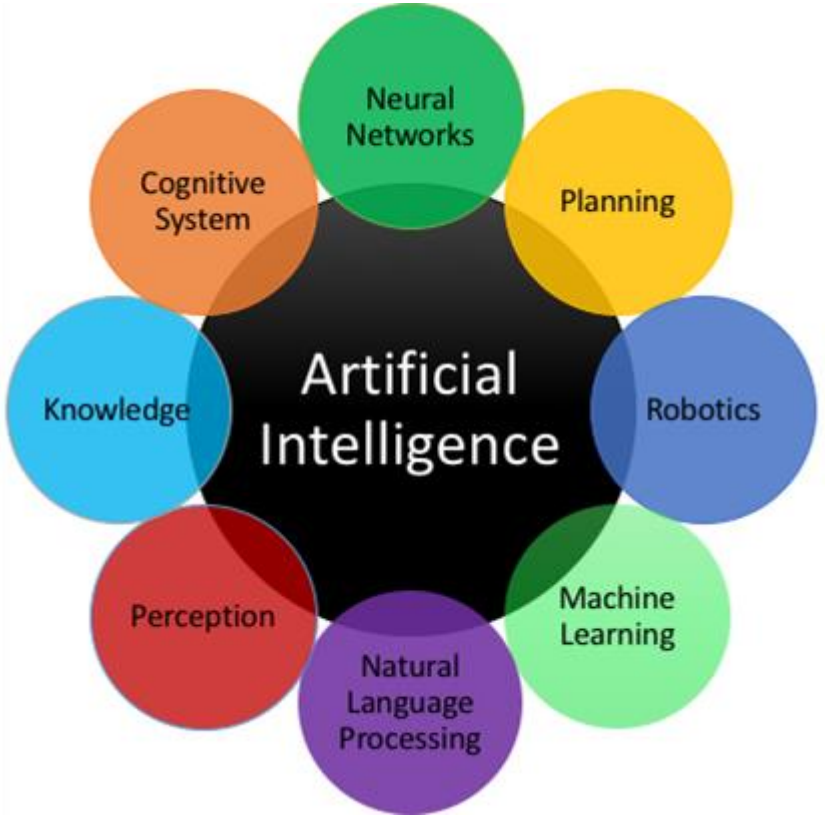
Umělá inteligence

- Umělá inteligence je systém (program) napodobující lidské myšlení.
- Základní schopnosti UI:
  - Komunikace s okolím
  - Samostatné rozhodování
  - Schopnost poučit se
  - Plnění úkolů bez explicitních instrukcí



https://www.besttechguru.com/future-technology-explained-what-is-artificial-intelligence/

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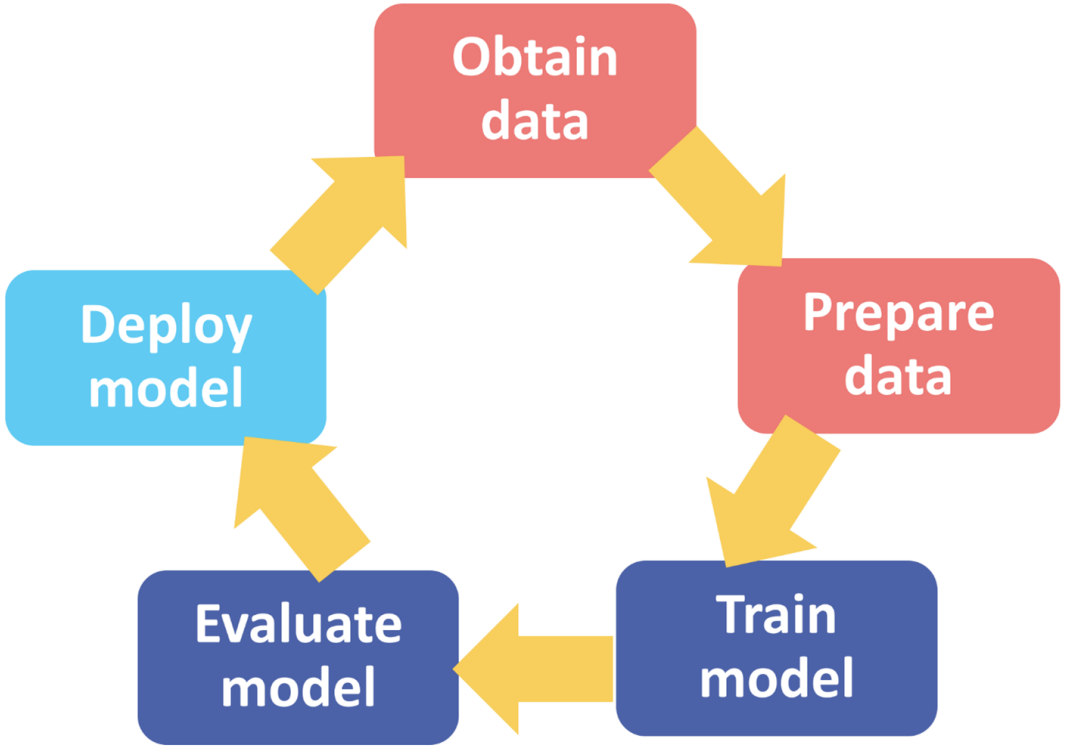
Strojové učení

- Strojové učení je návrh a vývoj programu, který má schopnost se samostatně učit a získávat zkušenosti.
- Během učení program obdrží data, na základě kterých si vytváří vzory, které se pak snaží hledat v neznámých situacích.



https://acloudguru.com/blog/engineering/prepare-your-dataset-for-machine-learning

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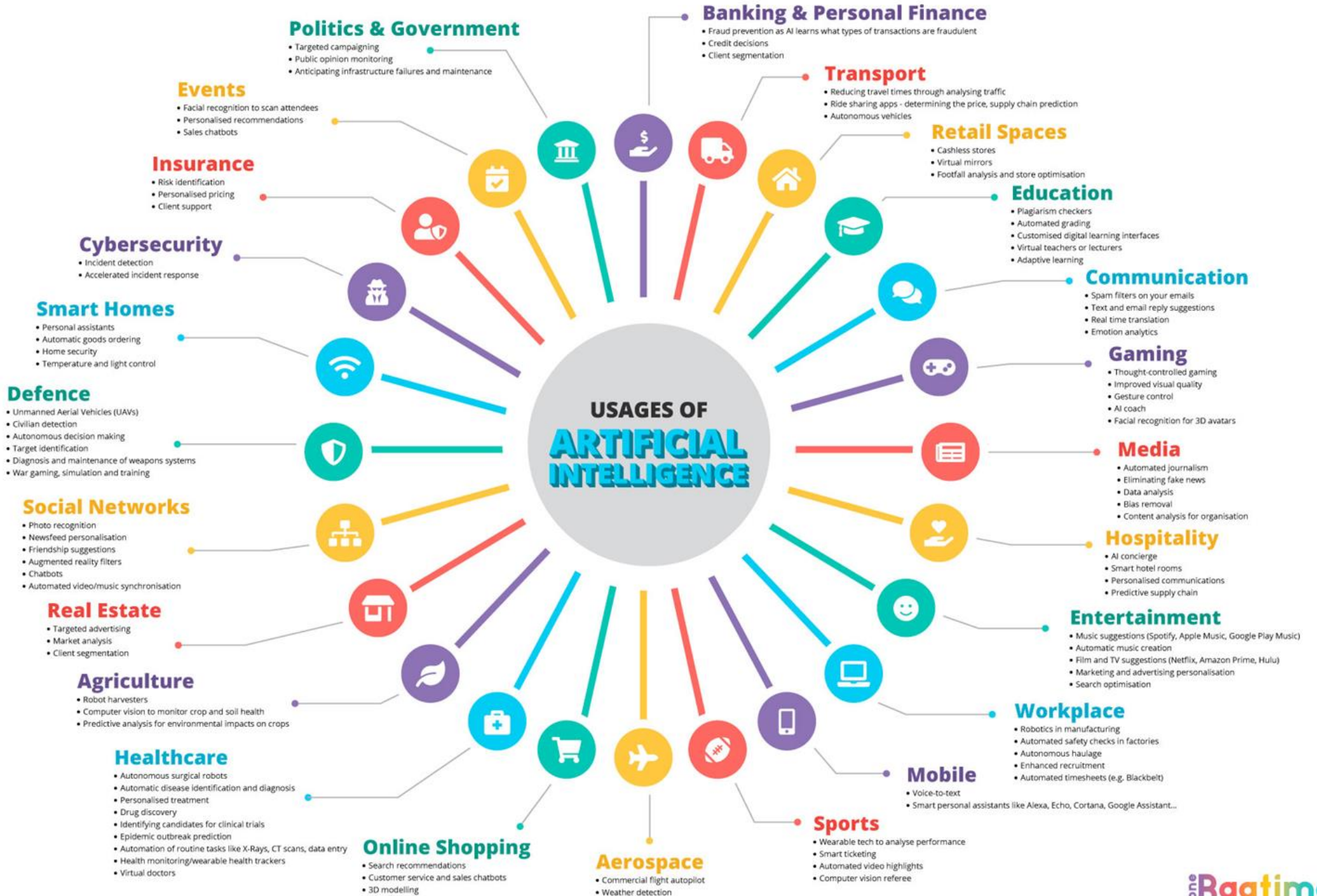
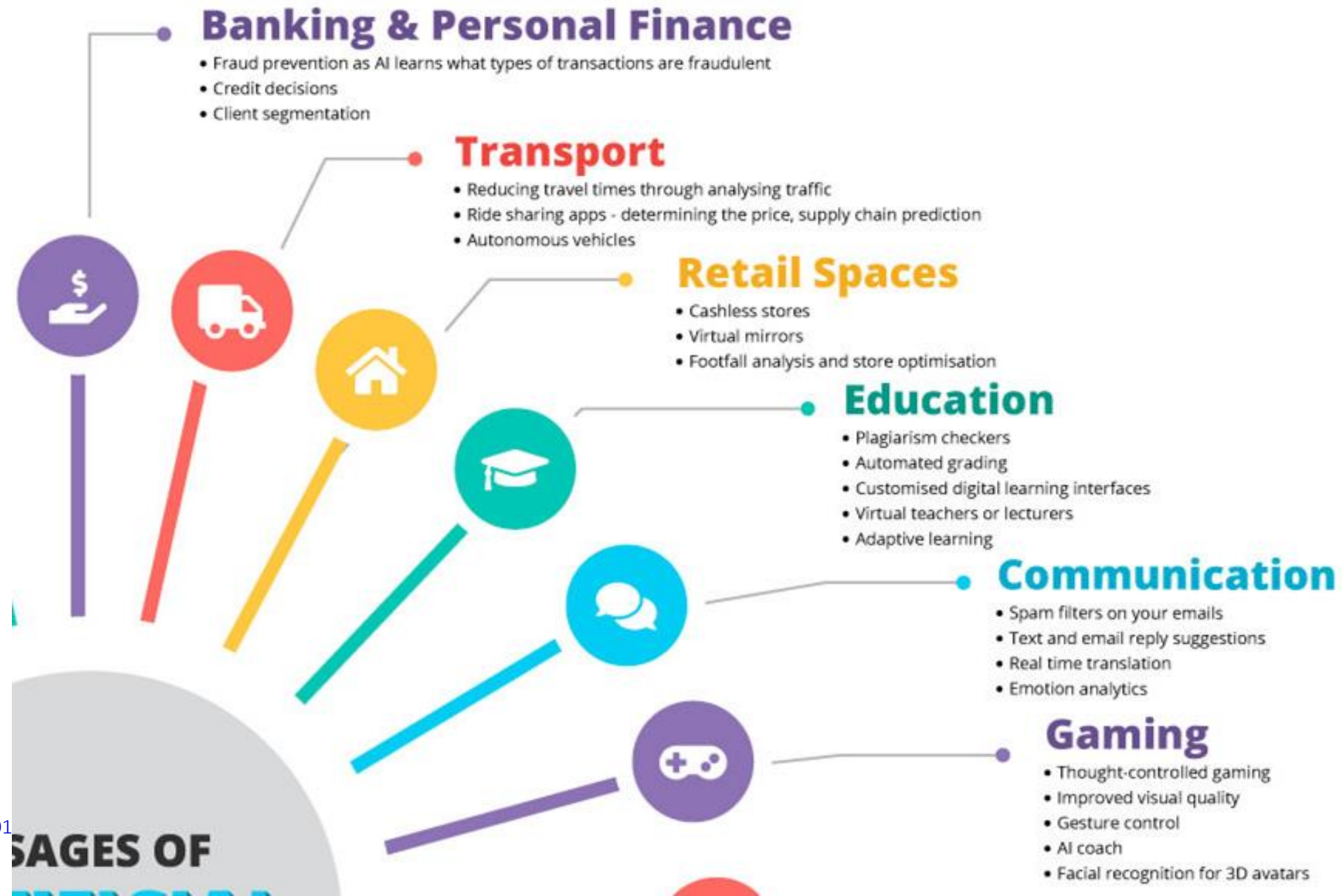
Oblasti využití

- Počítačové hry
- Zpracování přirozeného jazyka
  - Siri, Alexa, ...
- Rozpoznávání mluvené řeči nebo rukopisu
  - Hlasové psaní zpráv, psaní matematických rovnic v MS Word
- Zpracování obrazu
  - vojenství - rozpoznávání cílů na mapě
  - zdravotnictví - hledání nádorů a jiných útvarů na snímcích
  - bezpečnost - rozpoznávání obličejů a SPZ kamerou



https://img.oneragtime.com/uploads/2018/08/infographic_wheel_v2.jpg



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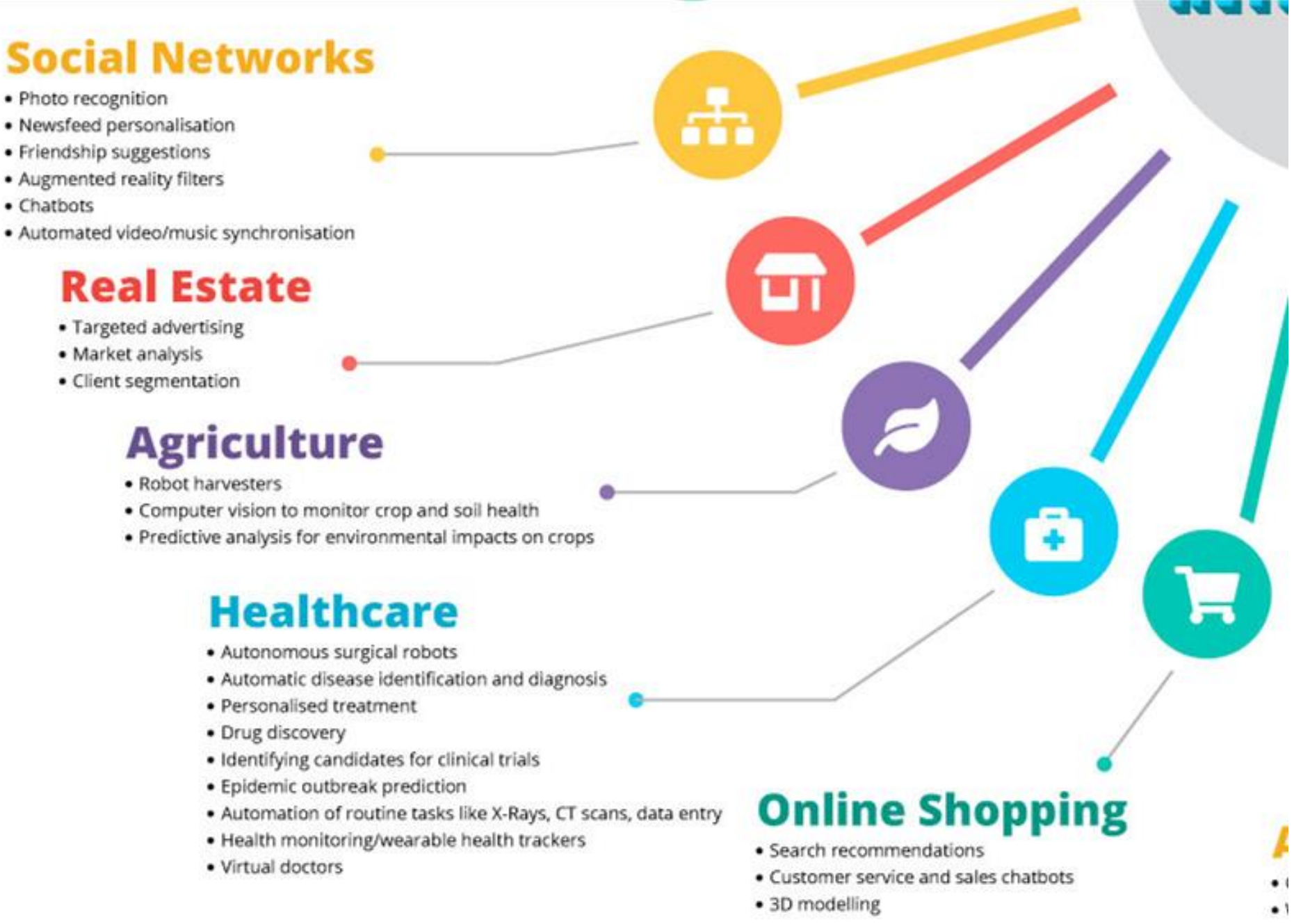

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https://img.oneragtime.com/uploads/2018/08/infographic_wheel_v2.jpg

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ROBOTIKA

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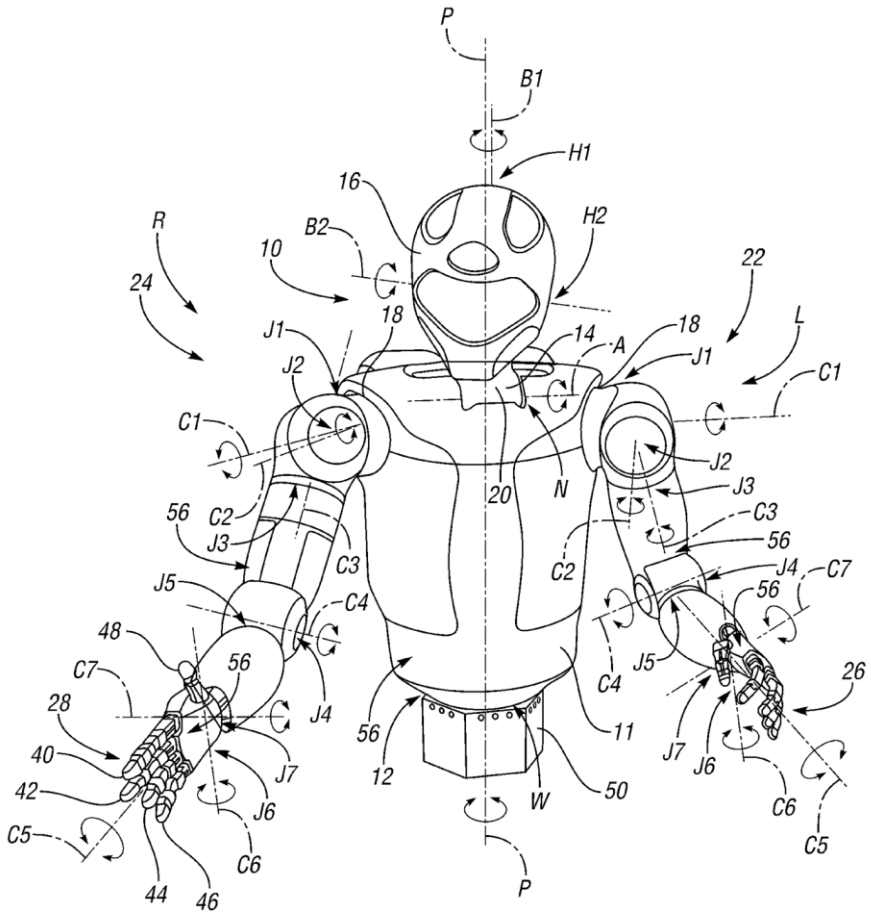
Robotika

- Jaká rozdíl je mezi robotem a umělou intelig
- Představte si, že stavíte robotického člověka robot skládat?
- Jakým způsobem mohou roboti lidem usnac



https://patents.google.com/patent/US8511964

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The rise of **Robotics and AI**

Fueled by advances in computing power and connectivity, the fields of robotics and artificial intelligence have grown rapidly

1921
The term **robot** is first used by Czech writer Karel Capek

1939
Elektro, a humanoid robot, debuts at the World's Fair, smoking cigarettes and blowing up balloons

1941
Isaac Asimov formulates the **Three Laws of Robotics:**

A robot may not injure a human being or, through inaction, allow a human being to be harmed

A robot must obey orders given it by human beings except where such orders would conflict with the First Law

A robot must protect its own existence as long as such protection does not conflict with the First or Second Law

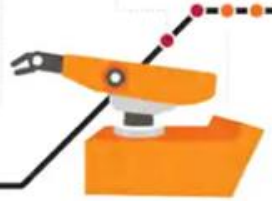
1948
William Grey Walter creates **the first autonomous robot with complex behavior**

1950
Alan Turing publishes paper about the possibility of machines that think, develops idea known as the **Turing's Test.**

It tests a machine's ability to "think" by answering a series of questions. In essence, **the tester must think the machine's answers are coming from a human**

1951
Marvin Minsky builds the first neurocomputer, **SNARC**

1954
George Devol invents the first digitally operated and programmable robot



1956
Field of AI research founded at a conference at Dartmouth

1960
Frank Rosenblatt constructs **Mark I Perceptron,** a computer that learned new skills by trial and error

1961
GM installs Unimate robot to lift and stack hot pieces of metal

1968
Mobile robot "Shakey" is introduced. It's controlled by a computer the size of a room

1972
Stanford researcher develops PARRY, designed to simulate a paranoid schizophrenic.

1974
Intel produces its second-generation 8080 general-purpose chips

1956 IBM 305, the first hard disk drive **5MB**

1970 IBM 1330 **100MB** per pack

1985 IBM 0665, a 5.25" disk with **20-40MB**

Minimize and maximize

Shrinking disk sizes and exponentially growing capacity help fuel robotics and AI

1984
Doug Lenat and his team start **Cyc,** to codify millions of pieces knowledge that compose human common sense

1984
The RB5X, developed by General Robotics Corp., includes software enabling it to learn from its environment

1985
Jaron Lanier's VPL Research, Inc., sells first VR glasses and gloves; Lanier coins the phrase **virtual reality**

1986
Honda creates the E0, the first of a series of humanoid robots that walk on two feet

1988
Researchers launch Jabberwacky, an AI chatbot designed to learn through conversation

Nope, I'm human.

1988
The first HelpMate service robot begins work at Danbury Hospital

pwc

Robotics and AI
charging forward

With technologies advancing at breakneck speeds, robotics and artificial intelligence are finding new applications in factories, businesses, and homes

1997
Deep Blue defeats Garry Kasparov in a game of chess

1997
NASA's Pathfinder lands on Mars

1990
Tom Caudell coins the phrase **augmented reality**

1990
iRobot® Corporation is founded, producing domestic and military robots

1998
Dr. Cynthia Breazeal creates **Kismet,** a robot that interacts emotionally with humans

2000
The UN estimates there are **742,500 industrial robots in use worldwide**

2005
Stanford robot **Stanley** drives autonomously for 131 miles

2006
IBM introduces Watson, a question-answering computer system that later defeated a Jeopardy! champion

2007
Fanuc develops an industrial **robot arm that can grab 120 items per minute**

2010
Google launches **a 3D version of its Street View**

2011
Siri is introduced

2012
Google introduces its Siri response: **Google Now,** which already has been rendered obsolete by Google Assistant

2012
An estimated **8.7 billion devices** are connected to the internet

2012
Baxter, created by Rodney Brooks, can do light repetitive tasks

2013
Google launches **Google Glass,** augmented reality glasses

2015
Amazon launches **Alexa,** a "virtual assistant" that helps communicate with connected devices in the home

2016
Amazon makes first drone delivery in UK

2020
By 2020, the drone industry could be worth **$127 billion**

The FAA expects **7 million drones to ship in the US, including 2.7 million commercial drones**

2016
Sony PlayStation launches **PlayStation VR**

2016
Uber begins testing driverless cars in California and Arizona

2016
Companies utilize an estimated **1.8 million industrial robots**

2004
Seagate ST1, 1" disk
2.5-5GB

2015
Seagate Thin HDD, 2.5", 7mm thick
2 TB

2025
Even smaller
100+ TB?

Growing capacities
As disk size has shrunk, capacity has grown exponentially since 2000

Industrial robots: looking forward
A common fixture in the factory, the industrial robot has reshaped the manufacturing landscape through the years by performing duties unsuitable for humans

2005: Fewer than 1 million
2016: 1.8 million
2019: 2.6 million

Robotics and other computerization could replace **47 percent of U.S. jobs,** according to a 2013 University of Oxford study

2034

https://graphicspedia.net/the-birth-growth-and-fame-of-robotics-and-ai-a-timeline-infographic/

AUTOMATIZACE

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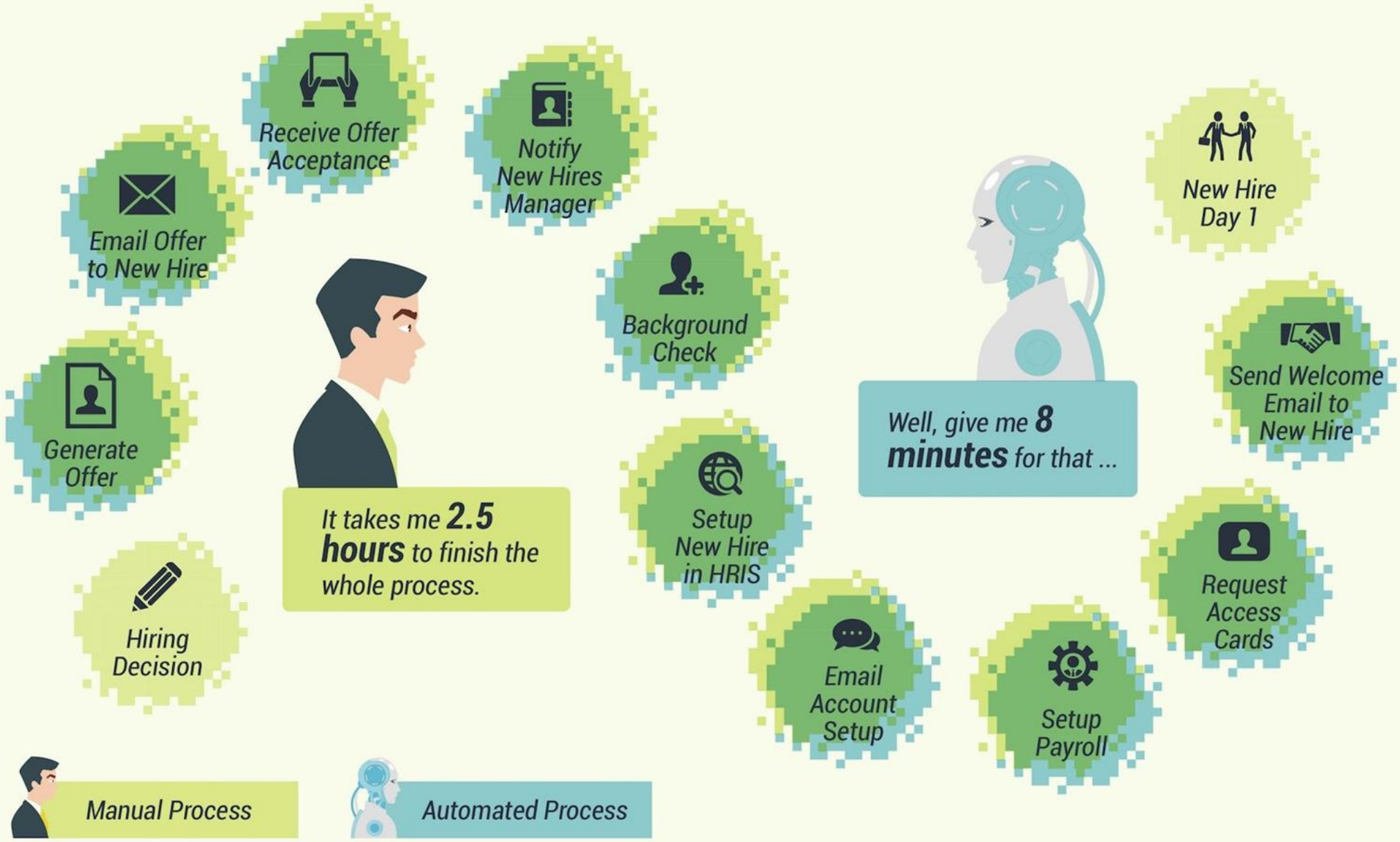
Automatizace

- Jaké výhody nám přináší automatizace?
- Ve kterých oblastech je vhodné automatizovat a kde naopak ne?
- Jaké etické problémy se mohou vázat k automatizaci?



https://www.pinterest.com/pin/640707484463772017/

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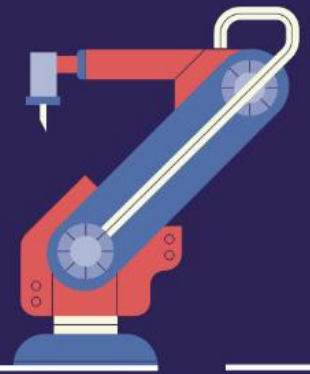
AGE OF AUTOMATION

THE OUTLOOK FOR MANUFACTURING JOBS AND AUTOMATION IN SEVEN CHARTS

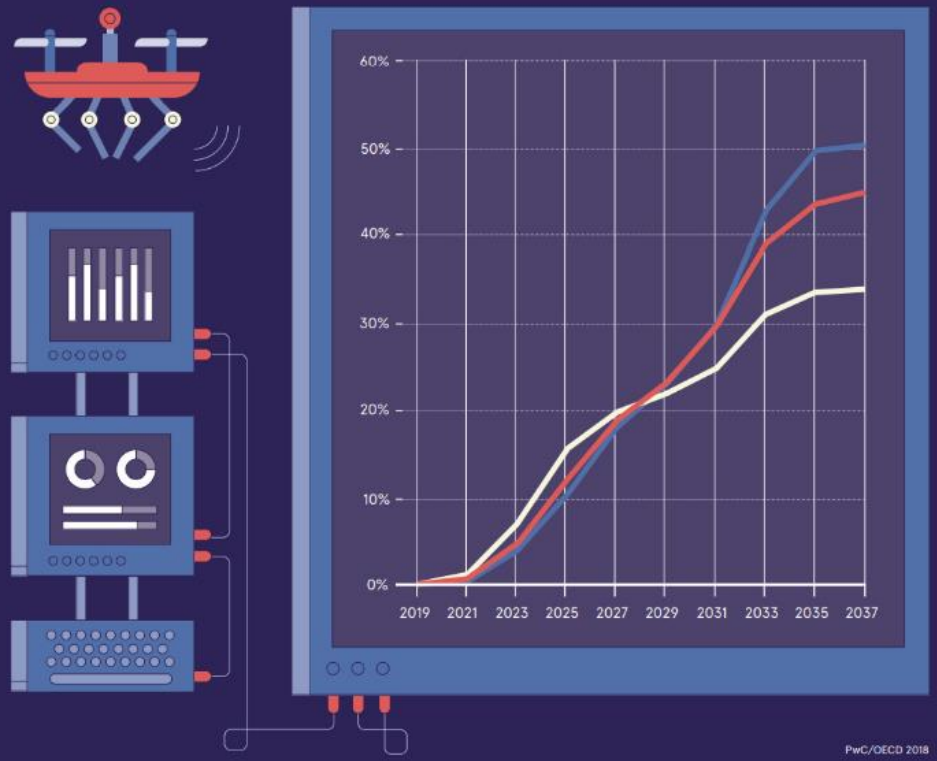


Advances in artificial intelligence and remote communication will arguably impact manufacturing more than any other sector, given that half of all roles within the industry involve manual and routine work. And yet, despite a large portion of jobs being at high risk of automation, job losses may not be as severe as feared as manufacturers upskill workers to adapt for a new technological future

01 AUTOMATION'S IMPACT ON THE JOBS MARKET WILL START TO BE FELT FROM THE MID-2020S

Share of jobs with a high potential of automation

Transportation and storage · Manufacturing · Wholesale and retail trade

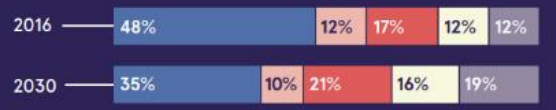


PwC/OECD 2018

02 UPSKILLING NEEDED AS ROUTINE AND MANUAL JOBS MAKE UP HALF OF WORKFORCE

Composition of current skills needed for current and future manufacturing jobs

Physical and manual · Social and emotional · Basic cognitive · Technological · Higher cognitive

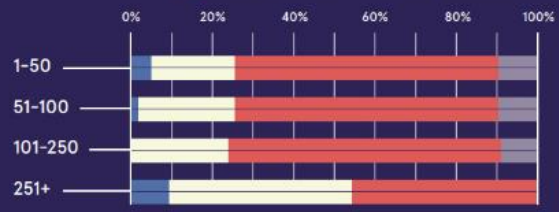


McKinsey 2018

03 AUTOMATION ADOPTION VARIES WITH COMPANY SIZE

Percentage of manufacturers investing to automate processes by number of employees

All of the processes · Most of our processes · Some of our processes · None of our processes



Make UK 2018

https://www.visualcapitalist.com/automation-manufacturing-jobs-7-charts/automation-

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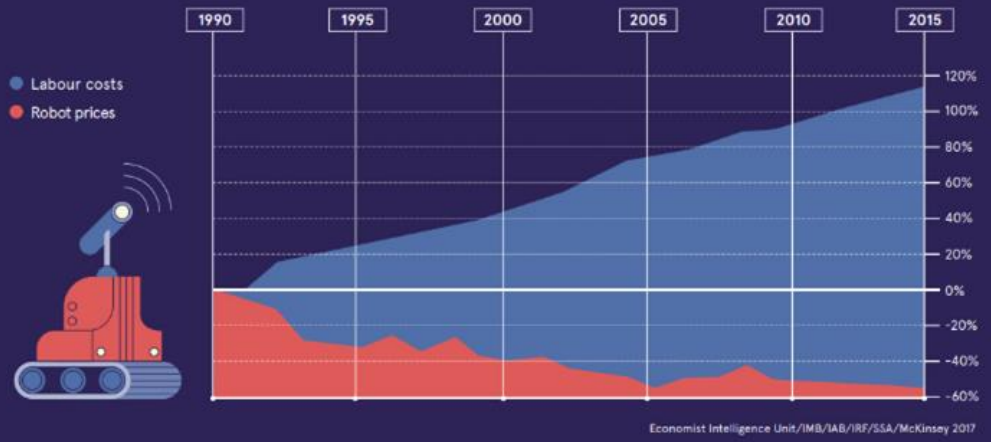
04 DECLINING ROBOT PRICES COULD ENCOURAGE MORE INVESTMENT AS LABOUR COSTS CREEP HIGHER

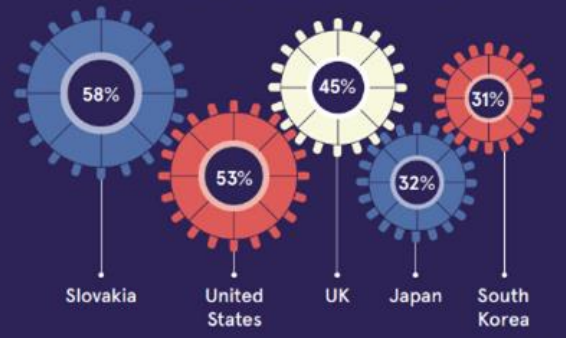
Example shown is for average robot prices and labour compensation in US manufacturing (1990 = 0%)



Economist Intelligence Unit/IMB/IAB/IRF/SSA/McKinsey 2017

05 OVER-RELIANCES ON MANUAL WORK MEAN AUTOMATION IMPACT IS WORSE IN SOME REGIONS

Percentage of manufacturing jobs with a high potential of automation



PwC 2018

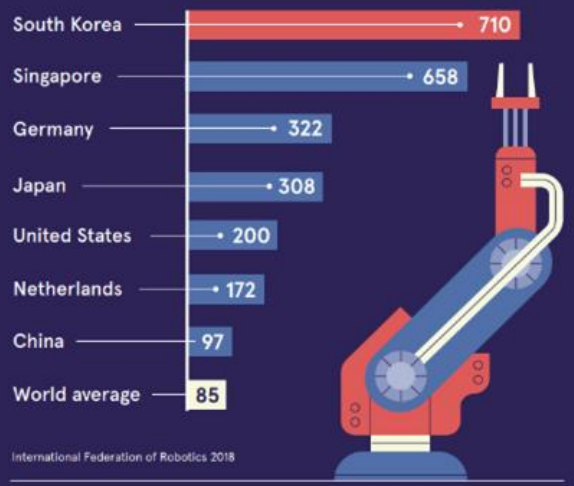
06 LOWER EDUCATED HARDEST HIT AS MANUAL TASKS PHASED OUT

Share of jobs with a high potential of automation by education level

PwC/OECD 2018

07 SOUTH KOREA IS MILES AHEAD WHEN IT COMES TO ROBOT ADOPTION

Number of installed industrial robots per 10,000 manufacturing employees, selected countries



International Federation of Robotics 2018

RACONTEUR

https://www.visualcapitalist.com/automation-manufacturing-jobs-7-charts/automation-infographic/

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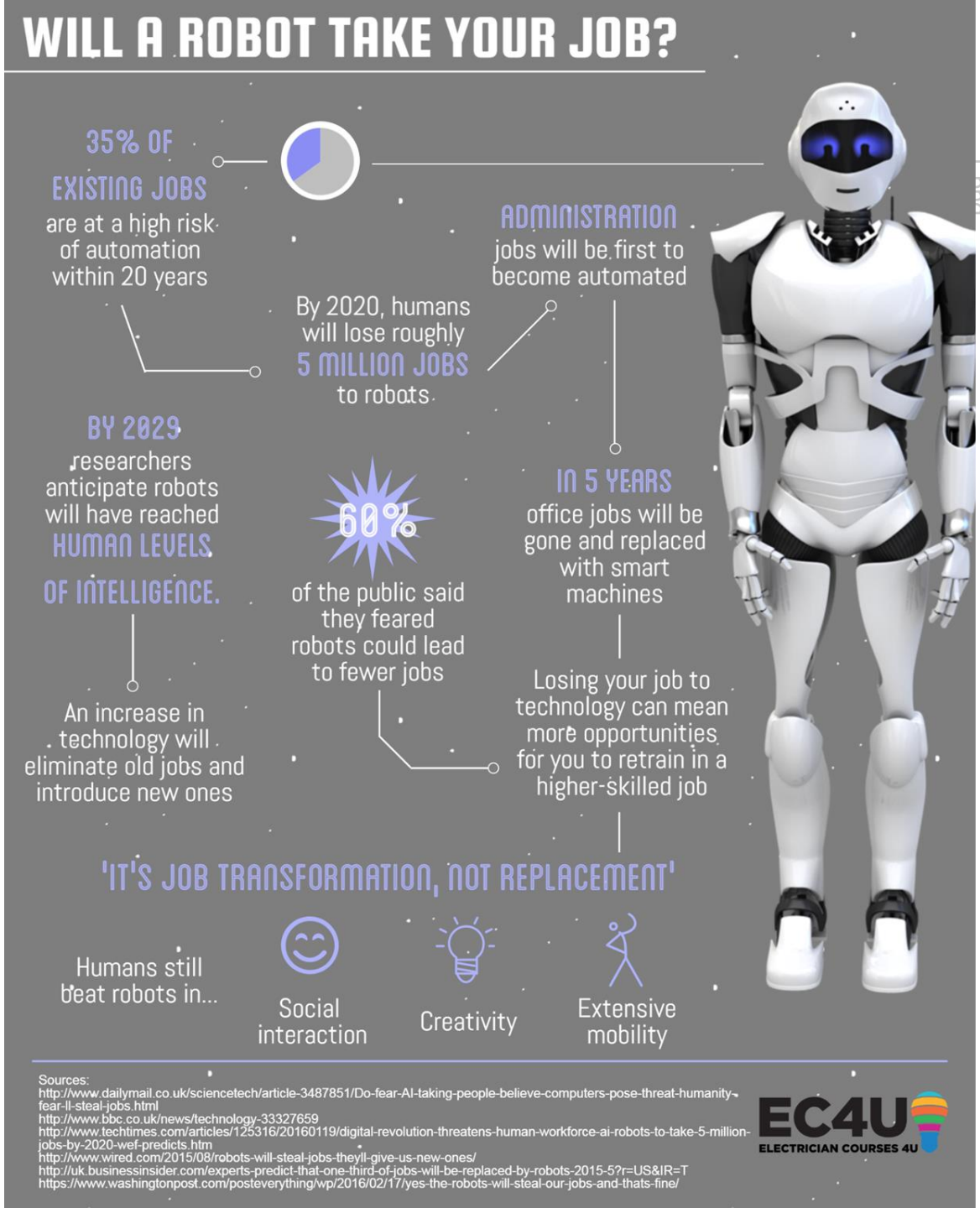
Mýty a obavy o automatizaci a umělé inteligenci

- Automatizace znamená zavedení umělé inteligence.
- Roboti nás časem nahradí ve všech profesích.
- UI funguje jako lidský mozek.
- UI je pokročilá technologie, kterou si můžou dovolit používat jen velké a bohaté společnosti.
- UI nemá předsudky a je nestranná.



https://www.electriciancourses4u.co.uk/wp-content/uploads/robot-technology-infographic-1.png

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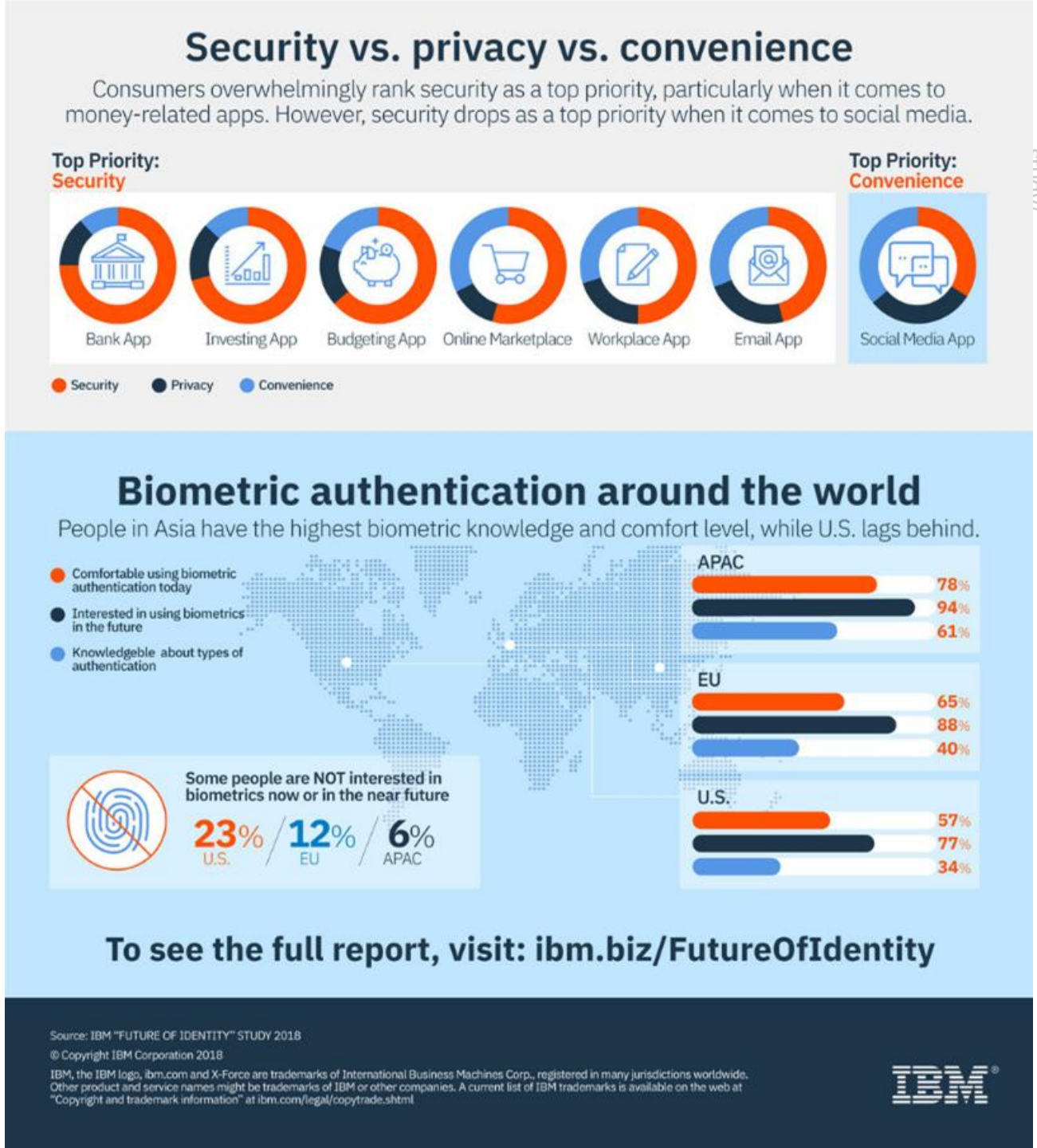
BEZPEČNOST

http://www.enacommweb.net/blog/2018/02/02/infographic-ibm-security-future-of-identity-study/



http://www.enacommweb.net/blog/2018/02/02/infographic-ibm-security-future-of-identity-study/

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OČEKÁVANÉ PRŮLOMOVÉ ZMĚNY

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Hlavní technologické trendy

- Technologické trendy současnosti
  - Internet věcí a robotika
  - Velká data a BI
  - Umělá inteligence a asistenti/bots
  - Automatizace a kybernetická bezpečnost
- Očekávané průlomové změny
  - Virtuální a rozšířená realita
  - Blockchain
  - Sítě 5G/6G
  - Kvantová výpočetní technika

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CO NÁS ČEKÁ PŘÍŠTĚ

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12. Přesahy IT do dalších oborů

- Zdravotnictní
- Energetika
- Doprava
- Budovy
- Chytrá města
- Životní prostředí
- Průmysl
- Obrana
- eGovernment
- Finance

Domácí práce a příprava na příští přednášku

- Pročtěte si a okomentujte 2-3 články vložené do diskuzního fóra
  https://is.muni.cz/auth/discussion/predmetove/fi/podzim2022/CORE013/trendy_a_budoucnost_it/