Mapové zdroje
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OBSAH PŘEDNÁŠKY

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1. Nové přístupy – Velká data (Big Data) a malá data (Small Data)

Introduction
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BD in Cartographical aspect

BIG DATA - Contents

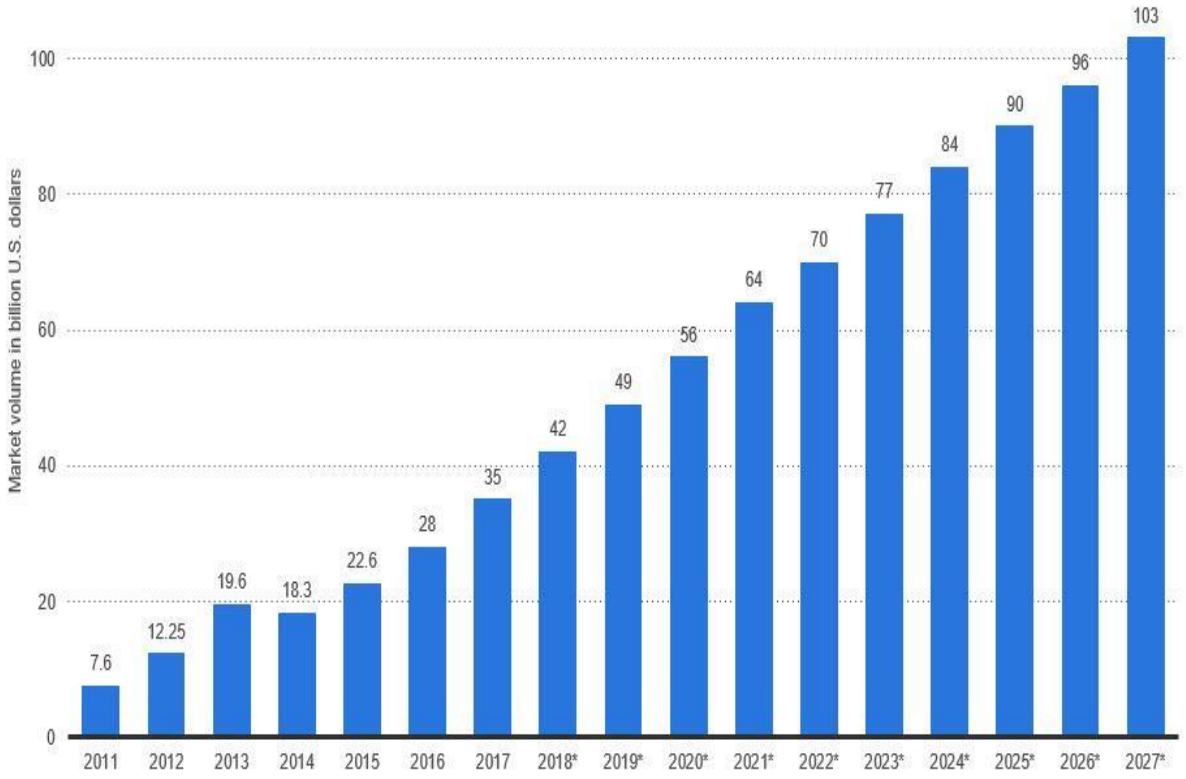
2. Ekonomická síla Big Data

Worldwide Big Data market revenues for software and services are projected to increase from $42B in 2018 to $103B in 2027, attaining a Compound Annual Growth Rate (CAGR) of 10.48%. As part of this forecast, Wikibon estimates the worldwide Big Data market is growing at an 11.4% CAGR between 2017 and 2027, growing from $35B to $103B.

Source: Wikibon and reported by Statista.

Forecast Revenue Big Data Market Worldwide 2011-2027

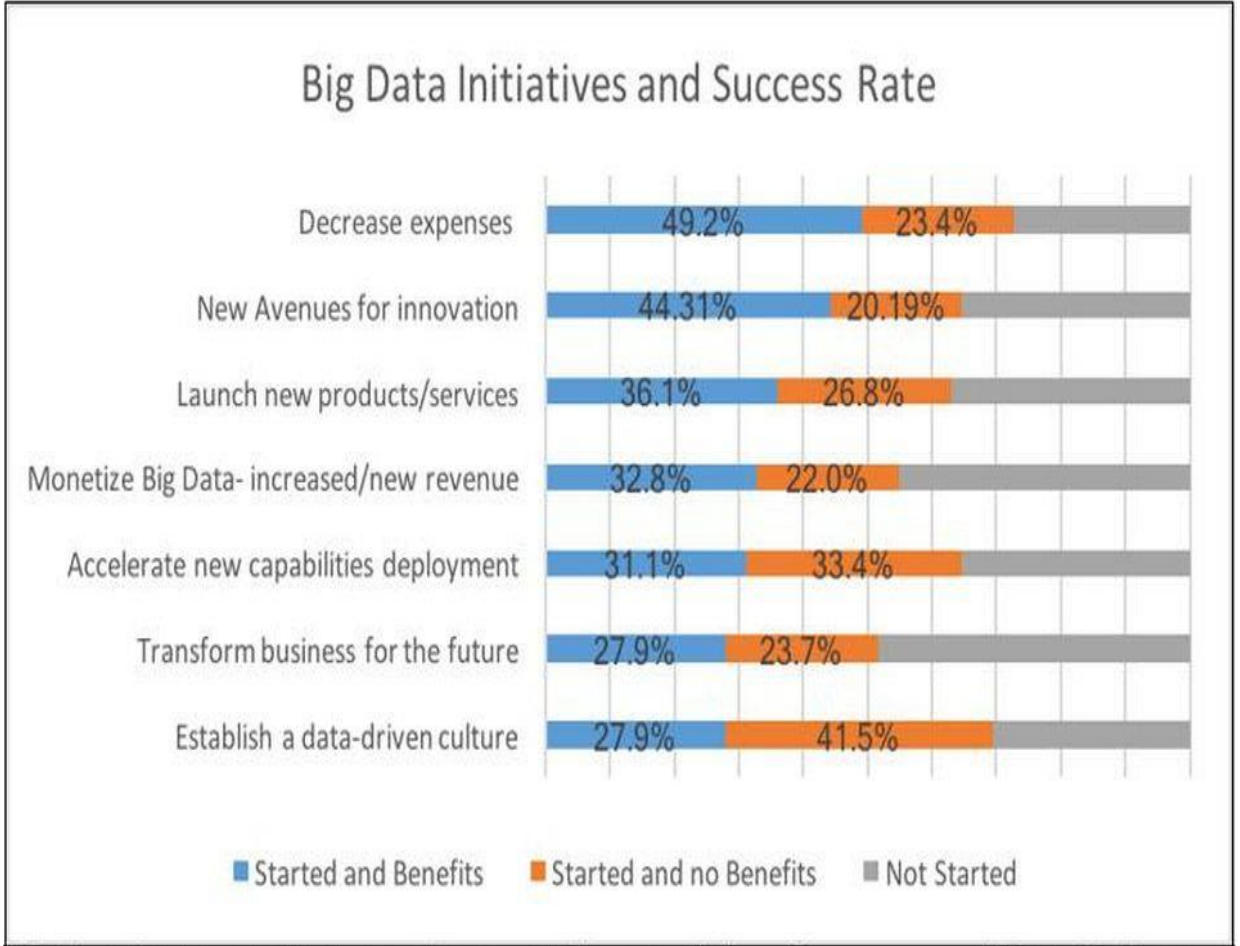
Big Data Market Size Revenue Forecast Worldwide From 2011 To 2027 (in billion U.S. dollars)



Compound annual growth rate (*CAGR*)

https://www.forbes.com/sites/louiscolumbus/2018/05/23/10-charts-that-will-change-your-perspective-of-big-datas-

According to New Vantage Venture Partners, Big Data is delivering the most value to enterprises by decreasing expenses (49.2%) and creating new avenues for innovation and disruption (44.3%).

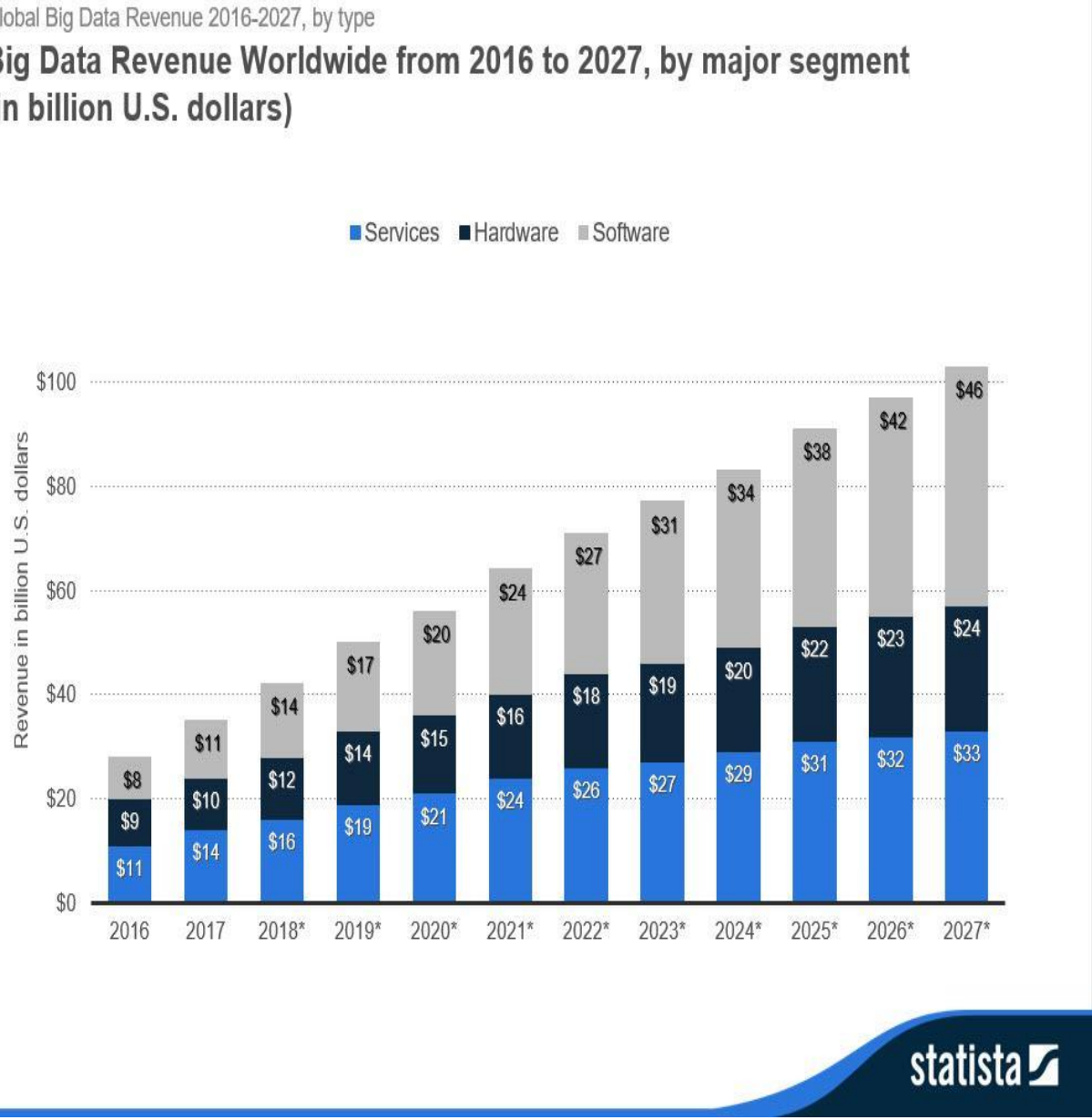


Big Data business initiatives underway; with successful results.	Started	Success
Decrease expenses through operational cost efficiencies	72.6%	49.2%
Establish a data-driven culture	69.4%	27.9%
Create new avenues for innovation and disruption	64.5%	44.3%
Accelerate the speed with which new capabilities and services are deployed	64.5%	31.1%
Launch new product and service offerings	62.9%	36.1%
Monetize Big Data through increased revenues and new revenue sources	54.8%	32.8%
Transform and reposition your business for the future	51.6%	27.9%

https://www.forbes.com/sites/louiscolumbus/2018/05/23/10-charts-that-will-change-your-perspective-of-big-datas-growth/#3d5c76752926

Comparing the worldwide demand for advanced analytics and Big Data-related hardware, services and software, the latter category's dominance becomes clear. The software segment is projected to increase the fastest of all categories, increasing from $14B in 2018 to $46B in 2027 attaining a CAGR of 12.6%.

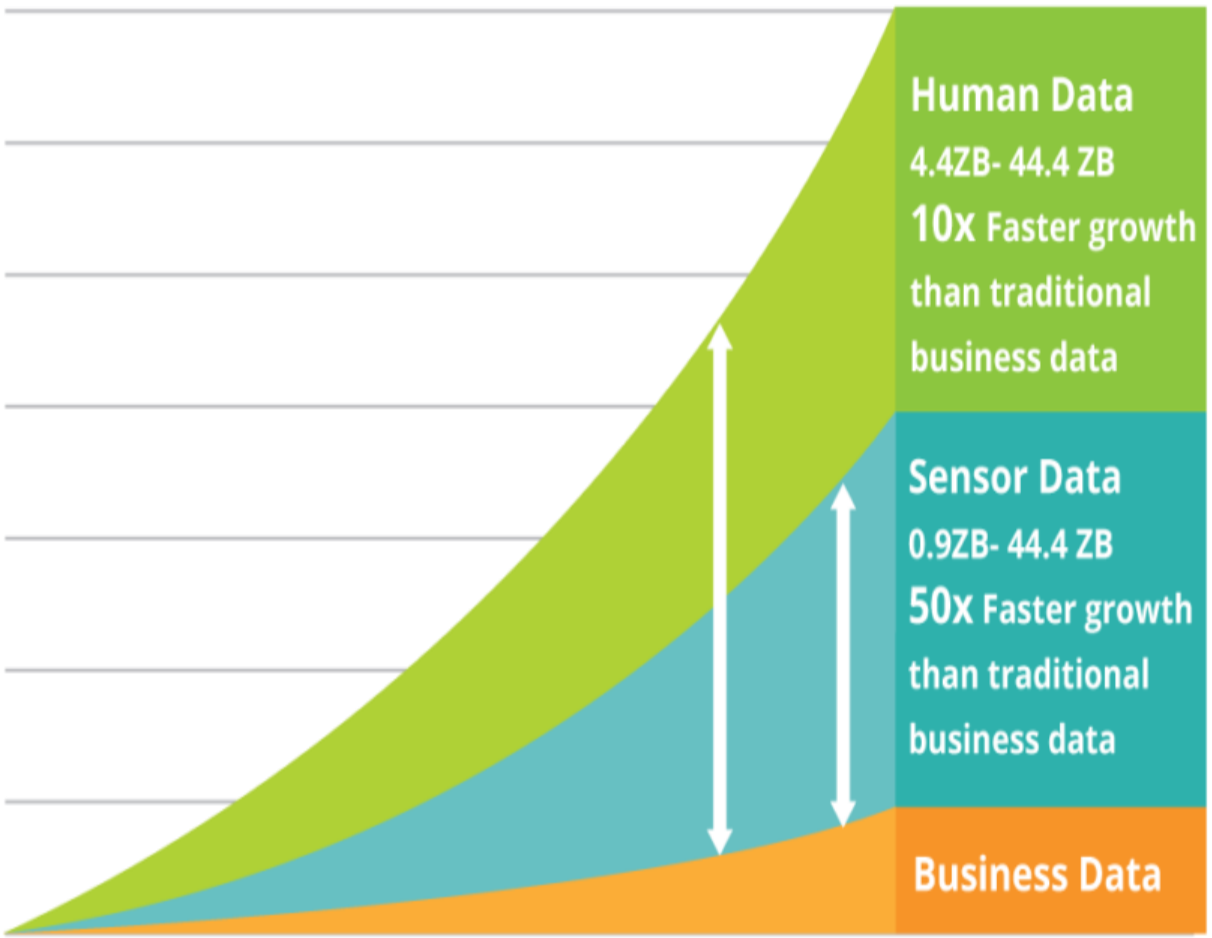
Sources: Wikibon; SiliconANGLE; Statista estimates and reported by Statista.



https://www.forbes.com/sites/louiscolumbus/2018/05/23/10-charts-that-will-change-your-perspective-of-big-datas-growth/#3d5c76752926

The growth of human and machine-generated data

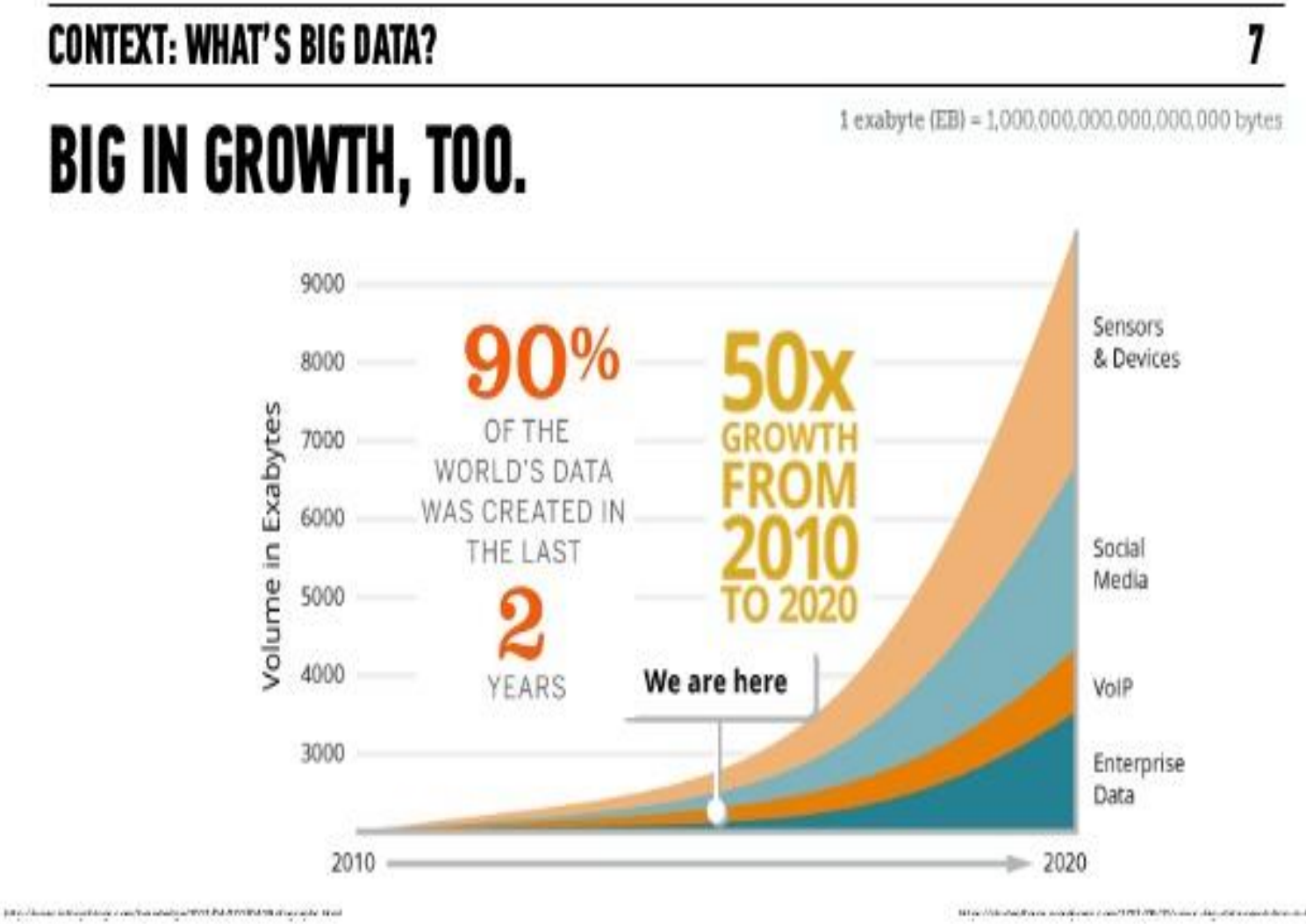
Human- and machine-generated data is experiencing an overall 10x faster growth rate than traditional business data, and machine data is increasing even more rapidly at 50x that growth rate.



Source: Inside big data

https://www.business2community.com/big-data/iot-big-data-ai-new-superpowers-digital-universe-01926411

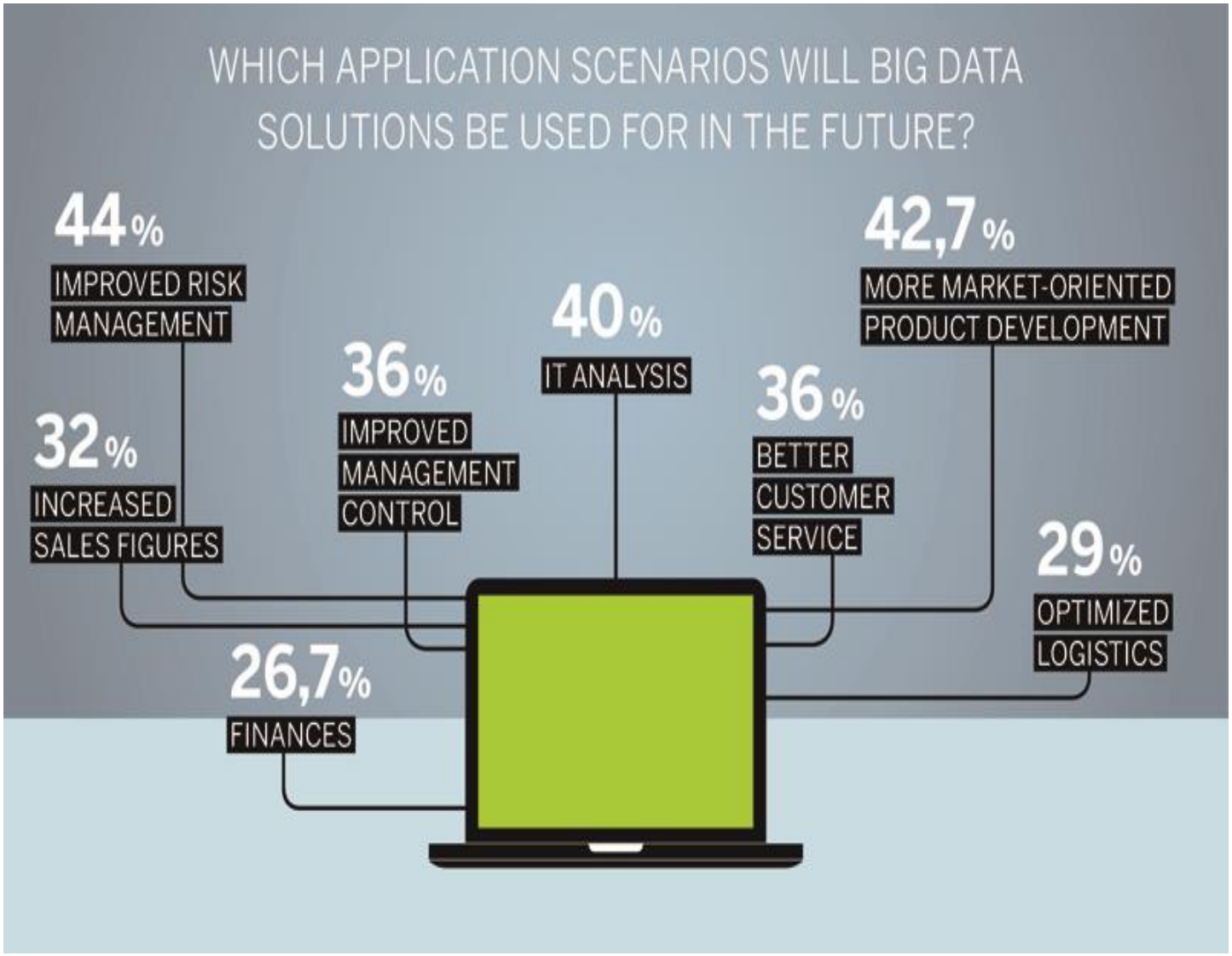
Today when we say Big Data, it primarily means the process of performing analyses on very large data sets (read exabytes) via computers with higher processing capability to unveil insights that might not be normally visible.



VOIP - Voice Over Internet Protocol, or phone service over the Internet.

https://www.promptcloud.com/blog/want-to-ensure-business-growth-via-big-data-augment-enterprise-data-with-web-data/

Medida	Simbologia	Equivalencia	Equivalente en Bytes
byte	b	8 bits	1 byte
kilobyte	Kb	1024 bytes	1 024 bytes
megabyte	MB	1024 KB	1 048 576 bytes
gigabyte	GB	1024 MB	1 073 741 824 bytes
terabyte	TB	1024 GB	1 099 511 627 776 bytes
Petabyte	PB	1024 TB	1 125 899 906 842 624 bytes
Exabyte	EB	1024 PB	1 152 921 504 606 846 976 bytes
Zetabyte	ZB	1024 EB	1 180 591 620 717 411 303 424 bytes
Yottabyte	YB	1024 ZB	1 208 925 819 614 629 174 706 176 bytes
Brontobyte	BB	1024 YB	1 237 940 039 285 380 274 899 124 224 bytes
Geopbyte	GB	1024 BB	1 267 650 600 228 229 401 496 703 205 376 bytes



http://www.thesnapplab.com/big-data-entenderla-para-mejorar-tu-negocio/

This trend leads to new challenges also in GI science and cartography while dealing with gathering, storage, analysis and visualization of spatial information and data.

Cartography is one of the few visualization disciplines to have always used and correctly analyzed a huge amount of data, and represented it on different levels of preciseness according to the needs of potential users.

DEFINITION OF BD

It is difficult to find BD definition which is appropriate for every science, every person and the society.

Zucker defines BD as "a popular term used to describe the exponential growth and availability of data, both **structured and unstructured".**

European Union Project tries to define BD as an emerging field "where innovative technology offers alternatives to resolve the inherent problems that appear when working with huge amounts of data, providing new ways to reuse and extract value from information".

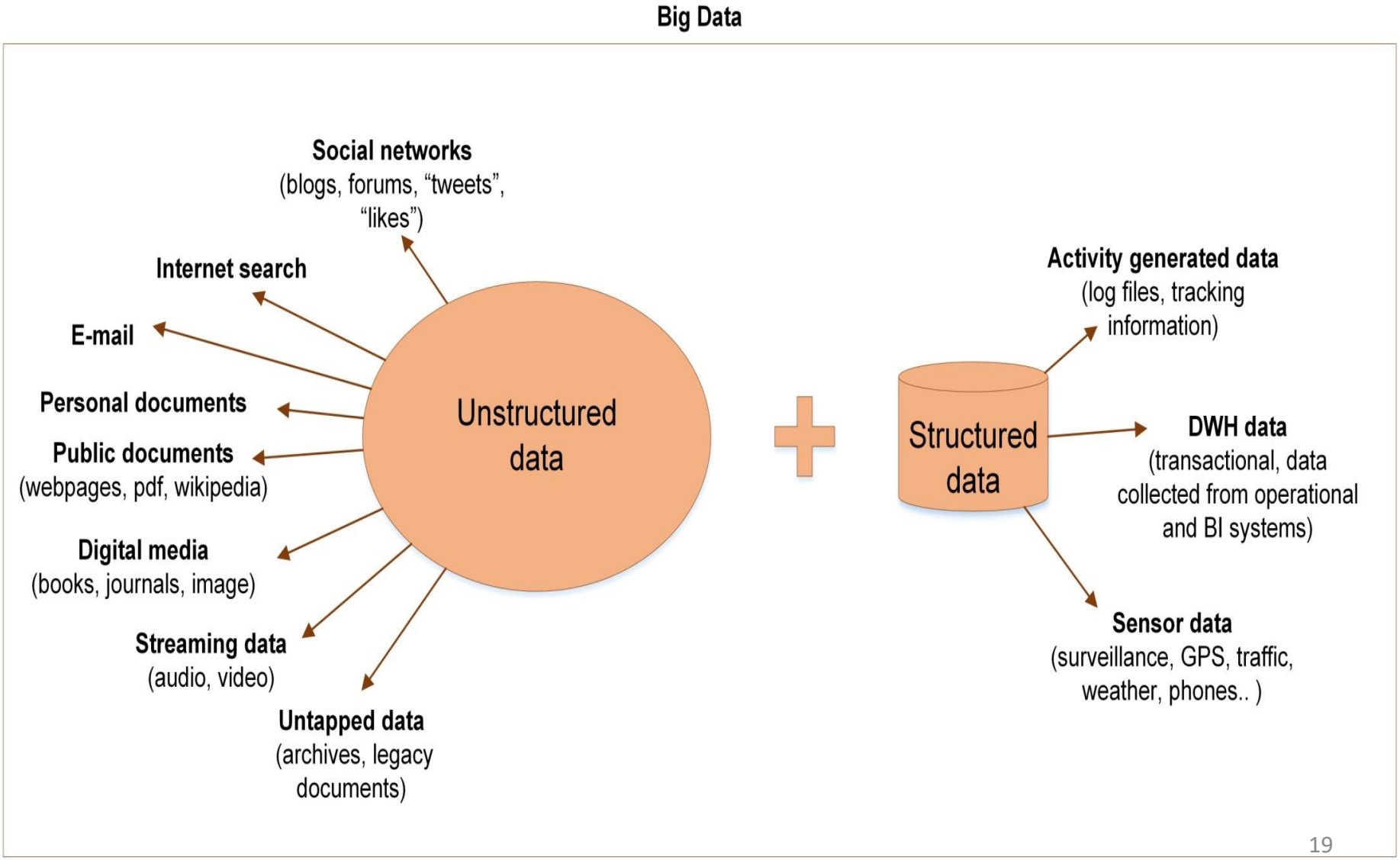
DEFINITION OF BD

One of the most general definitions was given by Uganes :

„Big data is one of the most promising – and hyped – trends in technology today… If a traditional database is a collection of data, then **big data is a collection of collections of data".**

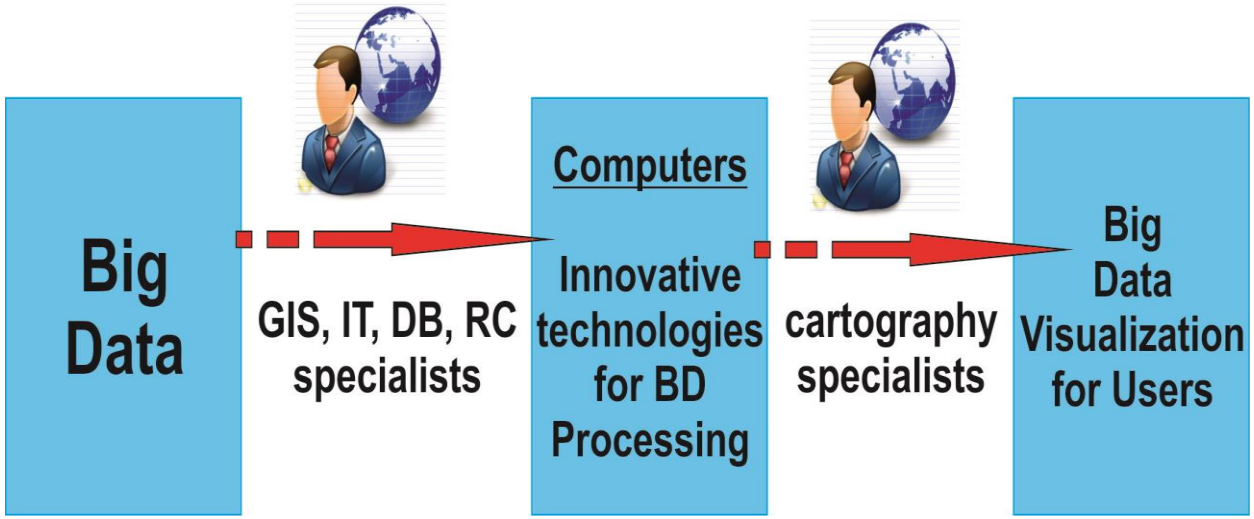
From cartographic point of view we consider BD as a mix of structured and unstructured data that existing GIS technologies are not able to process because of variety in terms of formats, increasingly big amount of volume and complexity of knowledge.

BIG DATA ENVIRONMENT POTENTIALS FOR CARTOGRAPHY



Experts from different fields are needed in order to find methods, paradigms and ways for BD effective processing.

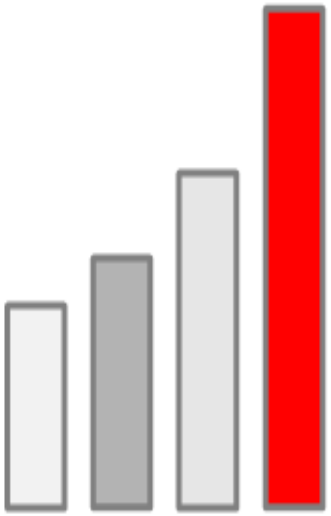
After that, processed data shall be visualized and delivered in readable form for different kind of users with different sort of purposes. This is the place where cartographers shall be involved.



Next-generation GIS are required to store, process and visualize many structured, unstructured and semi-structured data in different formats: vector, raster, video, audio, text, etc. However, the more interesting question is about user involvement into data collection and GIS development.

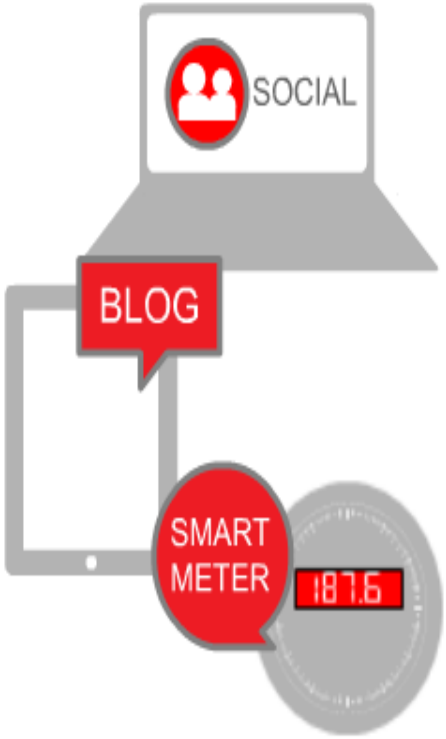
The idea of virtual GIS is considered in this regard. Virtual GIS development is encouraged by the idea of virtual geographic environment which may have enormous potential in BD usage and manipulation.

What Makes it Big Data?



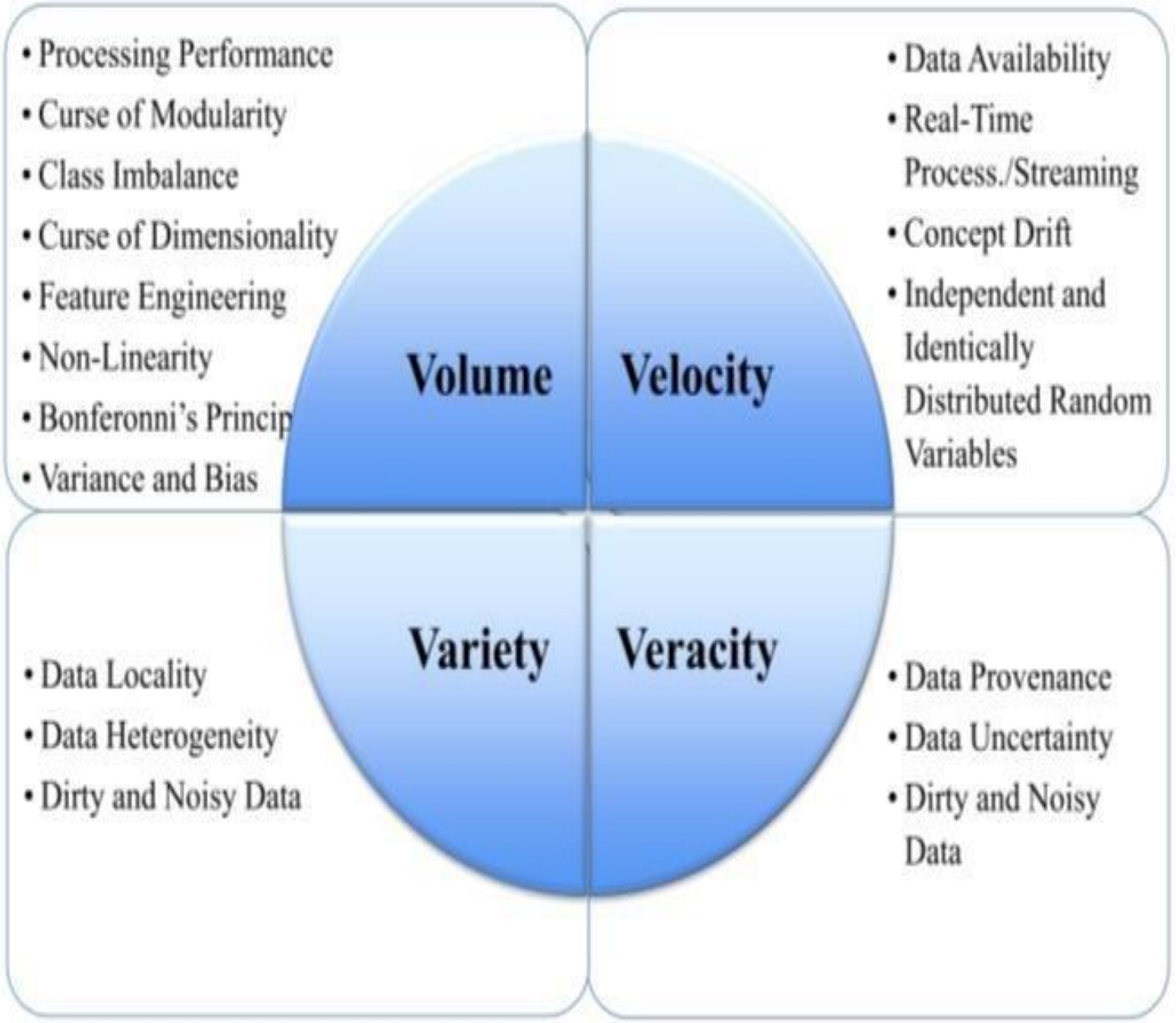
VOLUME

VELOCITY



VARIETY

VALUE



Katarina Grolinger
The University of Western Ontario

VOLUME

Huge amount of data

VERACITY

Inconsistencies and uncertainty in data

VARIETY

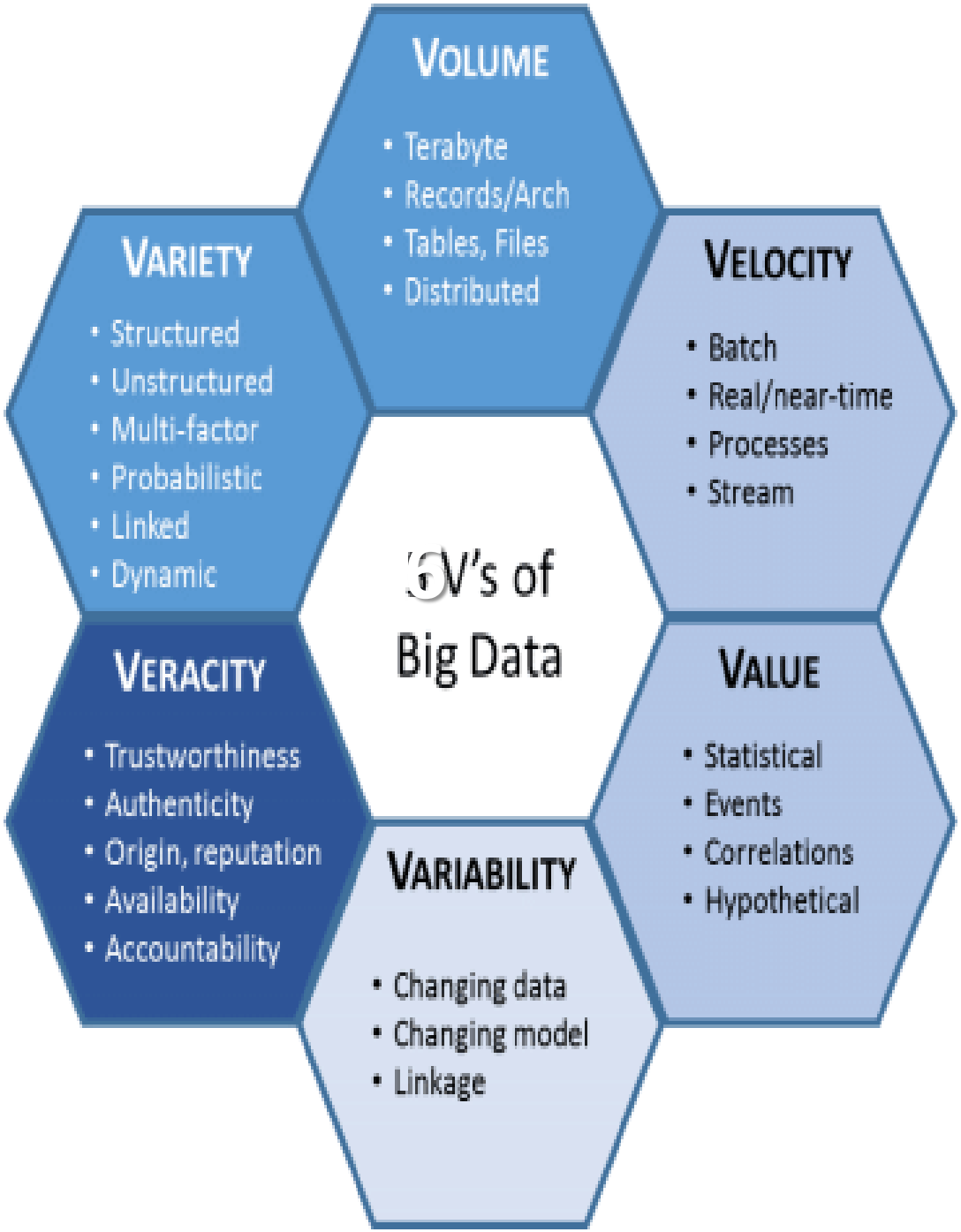
Different formats of data from various sources

VELOCITY

High speed of accumulation of data

VALUE

Extract useful data



Characteristics
Validity
Value
Variability
Variety
Velocity
Veracity
Viability
Virality
Viscosity
Visualization
Volatility
Volume

Facebook (Lister, 2017; "The Top 20 Valuable Facebook Statistics," 2017)	• 22% of the world's total population uses Facebook • Every day, 100 million hours of video content are watched • 300 million photos are updated per day • Every 60 seconds, 510,000 comments are posted, and 293,000 statuses are updated, • Every second, five new profiles are created
YouTube (Donchev, 2017)	• YouTube has 1,300,000,000 users • Every minute, 300 hours of video are uploaded • Every day, almost 5 billion videos are watched • YouTube has 30 million visitors per day
LinkedIn (Aslam, 2017b)	• LinkedIn has 467 million users • On a weekly basis, 3 million users share content • Over 19.7 million slide share presentations have been uploaded
Twitter (Aslam, 2017c)	• Twitter has 317 million users • 500 million tweets are tweeted per day
Instagram (Aslam, 2017a)	• 95 million photos are uploaded per day • 40 billion photos are shared per day • So far more than 40 billion photos have been uploaded to Instagram
Snapchat (Lister, 2017)	• 400 million snaps are shared on Snapchat per day, • 9,000 photos are shared every second

www.semanticscholar.org/paper/Characteristics-of-big-data

WHAT IS SMALL DATA?

DO YOU AGREE WITH THIS TERM?

The nature of Small Data is less obvious, and this is reflected in the lack of agreement on its definition.

Allen Bonde, one of the earliest users of the term around the late 2000s, defines Small Data as "…connecting people with timely, meaningful insights (derived from Big Data and/or 'local' sources), organized and packaged (often visually) to be accessible, understandable, and actionable for everyday tasks".

Whereas branding expert Martin Lindstrom defines it as "The tiny clues that uncover huge trends", which he generally collects through observational data. Perhaps the most commonly used broad definition is "Data that is small enough in size for human comprehension" (original source unknown).

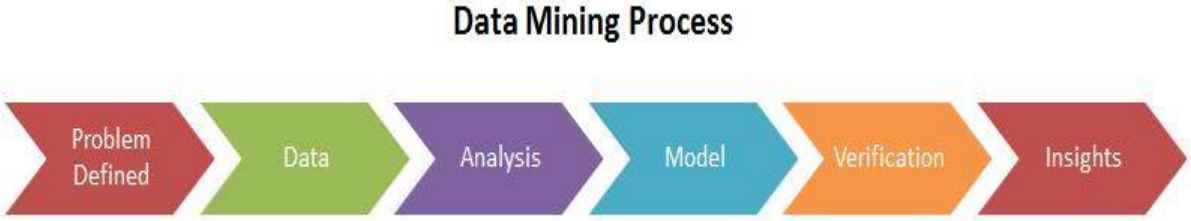
https://www.focusvision.com/resources/it-takes-two-understanding-customers-through-big-and-small-data/

WHAT IS SMALL DATA?

This idea of it being 'small enough for human comprehension' is key.???

In comparison to Big Data, Small Data's volume is more manageable and is measured in megabytes and gigabytes. It can be stored and processed on a single computer, using established techniques developed in the 1950s onwards as the first commercial mainframe computers became available. The speed of the data is slower**?**, being collected over days and weeks.**?** Finally, it consists entirely of known detail, the data is either structured (i.e. numeric) and/or unstructured (i.e. text, images, video).**?**

https://www.focusvision.com/resources/it-takes-two-understanding-customers-through-big-and-small-data/



Data mining is a time consuming. The data should be generalized and made ready for analysis. Then, a valid model should be created from the data. The model should be verified, analyzed and used for some purpose.

	Big Data	Small Data
Data Condition	Always unstructured, not ready for analysis, many relational database tables that need merged	Ready for analysis, flat file, no need for merging tables.
Location	Cloud, Offshore, SQL Server, etc.	Database, local PC
Data Size	Over 50K Variables, over 50K individuals, random samples, unstructured	File that is in a spreadsheet, that can be viewed on a few sheets of paper
Data Purpose	No intended purpose	Intended purpose for Data Collection

http://www.312analytics.com/what-is-the-difference-between-big-and-

Will you use the term “small data”?

Small data is collected with an intended purpose for analysis. It is a sample size that is determined by the data scientist that is collected to answers the problem at hand. With Small Data, there is control of the data. It is ready and conditioned for analysis once the data is collected.

Big Data, does not have an intended purpose other than data mining. For this reason, the data takes a long time to clean and processed by the machine learning algorithms. The data scientist lets the machine do all the work to come up with relationships in the data structures. Then uses different algorithms to verify the findings.

http://www.312analytics.com/what-is-the-difference-between-big-and-small-data/

CHARACTERISTICS OF BD - VVVVC

Volume of BD means the quantity of data;

Velocity of BD means the speed of data generation.

Variety of BD means different category of data in different formats and purpose of analyzing and using:

sensors, digitalization, mobile applications, Web, data bases, photos, videos, audios, sms, automations and others.

Variability of BD means the time of generating the data.

Complexity of BD means multiple sources generating data.

"Big Data is high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enables enhanced insight, decision making, and process automation."

https://www.focusvision.com/resources/it-takes-two-understanding-customers-through-big-and-small-data/

3. Velká data – výzvy pro geoinformatiku a kartografii

CHARACTERISTICS OF BD - ADIQ
FROM CARTOGRAPHY

Accuracy means the degree of correct information and data which can be projected or referred to a coordinate system;

Dimensionality means a measure of spatial, time and characteristics extent of the information represented to the map: 2D, 3D, 4D to multi-dimensional map;

Interactivity means the level of allowance of user activity;

Quality means a high level of value of the gathered information and data.

MAP DEFINITION IN BD ERA

In the BD era, the definition of the map must retain the basic features of the map that distinguish it from other earth images and representations. Therefore, here a definition is suggested, which states: **“the map is a mathematically defined multi-scaled, multi-layers geolocated, generalized drawing, representing the earth (or other planets) surface, objects and phenomena by symbol system.”** Additional drawing, images, audio, video, animation, and other attributes, giving quantitative, qualitative or other information, could be geolocated and attached to the main map content. (Bandrova T., Pashova L.,2020)

https://iccgis2020.cartography-gis.com/proceedings-vol-1/

PERCEPTION OF GEOSPATIAL ABSTRACTIONS

Different level of abstractions may distinguish: conceptual, geometric, semantic, graphic, visual, and cognitive.

A specific problem is the degree of abstraction with changing the scales of maps when the same content is visualized.

For example, if different aspects of the abstraction are ignored, it may be difficult to perceive the map content when navigating through the web geoportals changing its scale.

https://iccgis2020.cartography-gis.com/proceedings-vol-1/

MAP DESIGN

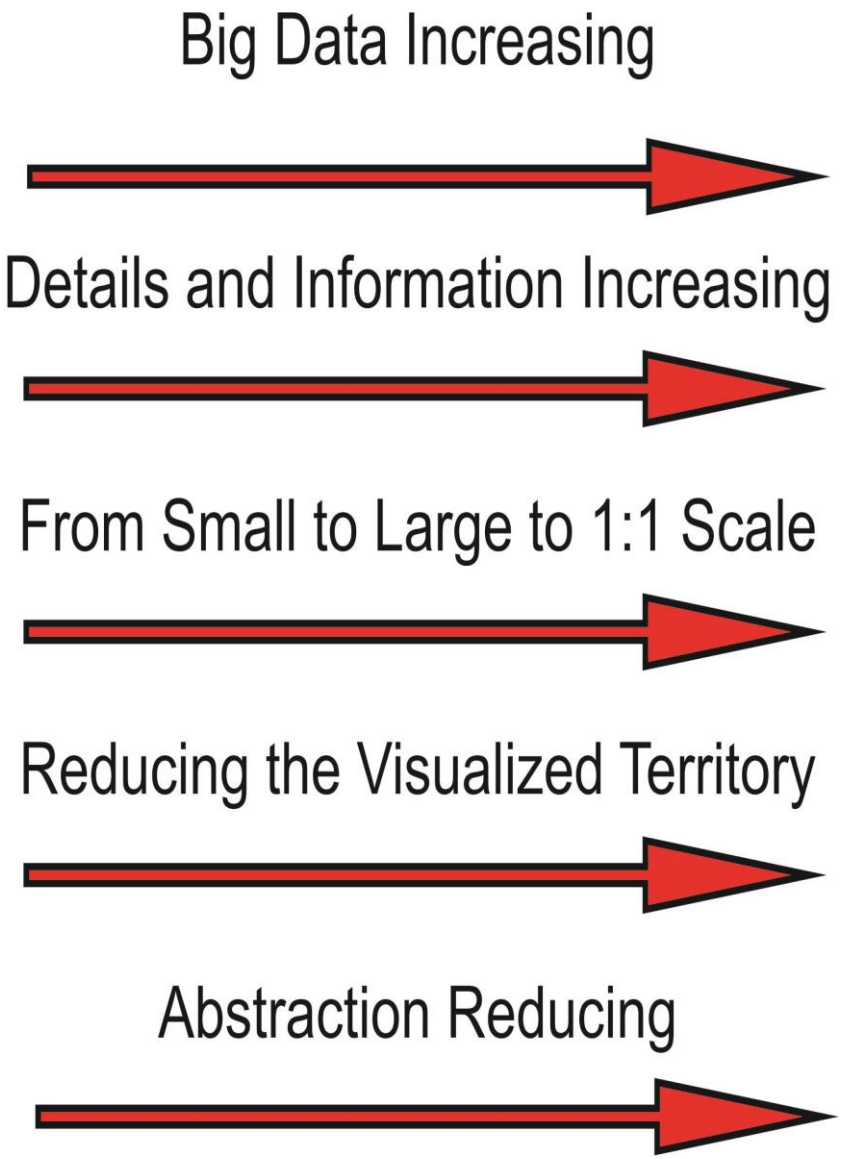
In traditional cartography, the map design still exists. With the widely available and easy-to-manage GIS, many maps have emerged, most of which are drawings or graphics rather than maps.

Maps should attract user attention, and they should like them, and not only provide a possibility to read and understand. In this case, the maps will become more and more popular to any type of users.

Colours and labelling are essential elements in the map design, and they are chosen during the process of map creation.

https://iccgis2020.cartography-gis.com/proceedings-vol-1/

BD AND MAP SCALE

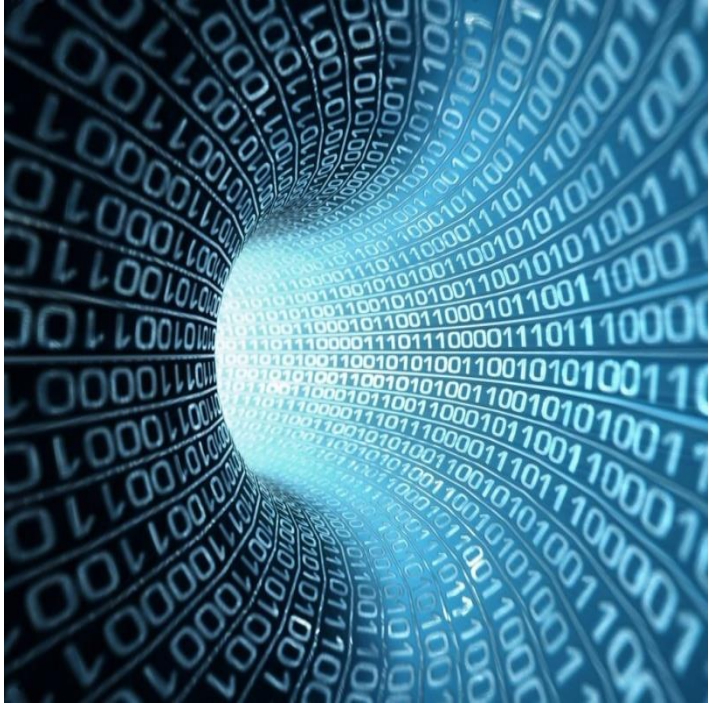


MULTI-SCALE MAP

Every map has to have a clearly defined scale/s, which is/are shown, and users can make the necessary measurements. The scale means a relation between any line on the map and its real size on the earth surface. It can be represented on a map by three different ways: bar-scale or graphical, verbal and representative fraction.

Web platforms usually represent differently scaled maps in the same territory. It means that the map is a multi-scaled model. Degree of resolution is defined as a scale in the cartographical context of BD. The same approach is used for web mapping, e.g. changing of the scale means changing the degree of resolution and the level of details. It can be represented in different dimensional map representation: 2D, 2.5D, 3D, 4D, etc.

BD AND MAP DIMENSIONALITY



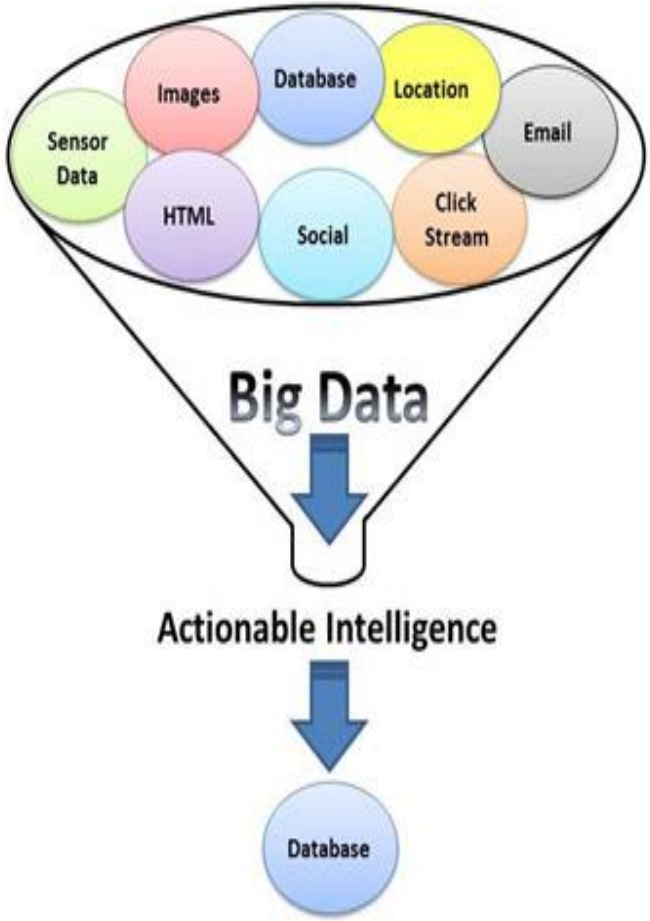
We need to visualize our 3D or 4D world on 2D map. The solution - 3D or 4D cartographic representation or multi-dimensional maps in virtual environment.

Gourley (2013) defines the map as a **multi-dimensional rendering of any type of information,** representing the relationships of objects. He adds that Google Map now invest 20 Petabytes of information every week from 1 300 different data sources into its mapping software.

“Generally, the big data process begins with “cleaning” data sets and joining them together to make them useable” (Uganes).

In case of BD generalization rules will be big challenge for all GI specialists.

A possible solution is not to try to adapt current principles to new situations but to create new ones according to the needs of the new data environment.



http://www.scaledb.com/big-data.php

To make maps using BD sources does not mean that cartographers will not use cartographical symbol systems. In many GIS applications and web map platform, examples with and without symbol system can be found (see Fig. 1 without a legend, Fig. 2 with a legend).

The symbol system is the language of the map, and it is needed to perceive by the map's content from the users.

The symbol system should be well defined and to give the necessary qualitative and quantitative information about objects and phenomena depicted on the map. In the case of BD representation on a web map, the visualization should be done in a separate window, easily accessed for the users.

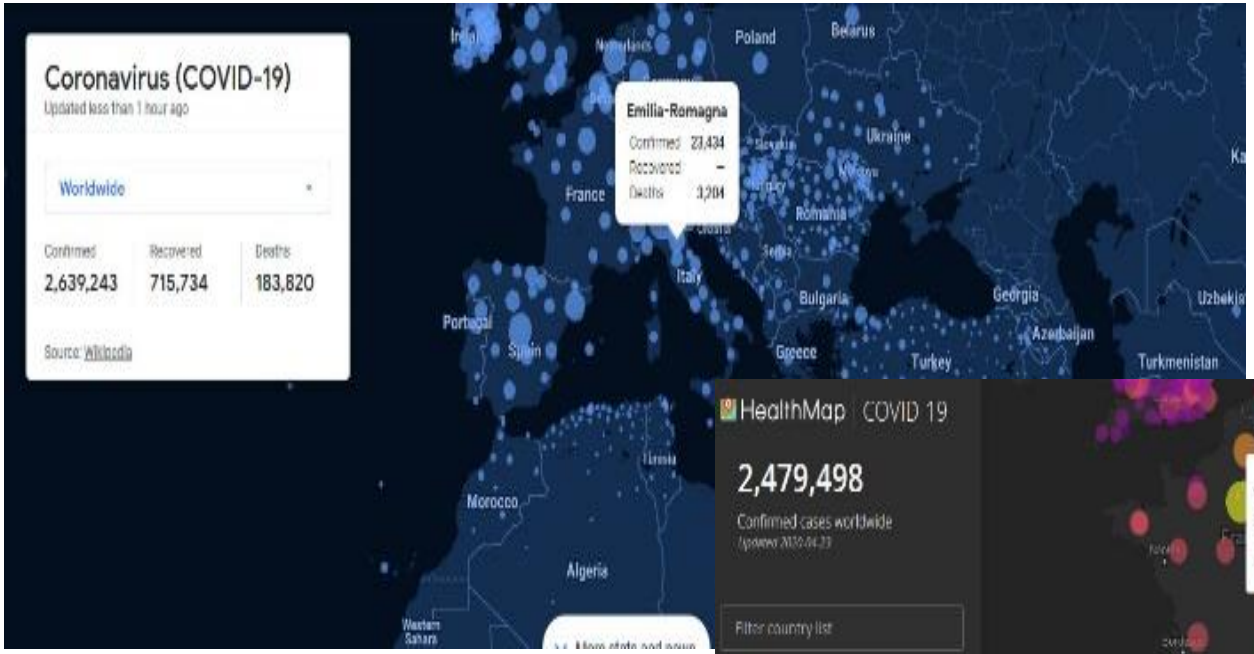


Fig. 1 Web map without a legend

(Source: https://news.google.com/covid19/ map?hl=en-US&gl=US&ceid=US:en)

Fig. 2 Web map with a legend

(Source: https://www.healthmap.org/covid-19/)

Cartography cannot deal with all kinds of data of the BD environment and cannot provide all the solutions of BD processing and management.

Cartography can handle only a part of the data and extract valuable information from it.

- Data must be spatially distributed: The power of cartography is in its capacity of describing quality and quantity characteristics of objects, their positioning and relations.

CONCLUSIONS

- Data must be classified. The majority of BD is semi- or non-classified. To map the data, we need clear classification first.

- Data must have quality and / or quantity characteristics. Cartography visualizes objects' and phenomena's characteristics and provides to readers their distribution. Modern cartography capabilities like multidimensional representation and animation allow us to represent much more data characteristics than before.

- Data of interest must be generalized. Many data in semi- or non- classified format can represent an interest for cartography.

PERSPECTIVES

Big data is watching, by Heloukee, on Flickr

To look from the BD perspective we see that cartography will continue its development in some kind of **equilibrium between sciences, technology and art.**

This equilibrium is more valid than before, because combination of new scientific approaches based on ICT in cartography provides many possibilities for map creation and inclusion of art not only make maps attractive but also enables new and imaginative forms in which maps could be shown and naturally understood.

In the era of BD, it is very important for cartography to take advantage of the development of the ICT.

The distance between cartographers and the world's leading information providers like Google, Open Streat Maps, Facebook and Twitter have to be reduced through clear involvement of cartography roles and rules in solution delivery.

As experts, we are happy of the new possibilities presented by ICT, but still we cannot hide the fact that much chaotically transmitted information is not correct and can lead to misinterpretation by the users.

4. TECHNOLOGIE 5G

Bandwith – šířka pásma, širokopásmový

Agile - agilní

Enhanced reliability – zvýšená spolehlivost

Latency – latentnost, „dlouhodobost“

KONVERZE:

Zdarma zdroje dat GIS ve vaší zemi

Kde?

Jaký druh?

Zdarma nebo ne?

Kdo je uživatel?

Formáty?

Integrace dat?

Co si myslíte o Big Data?

Jak a kdy 5G ovlivní globální ekonomiku?

5G je hnací silou globálního růstu.

- 13,2 bilionů dolarů světové ekonomické produkce
- 22,3 milionů vytvořených nových pracovních míst
- 2,1 bilionů dolarů růstu HDP

Pozitiva a negativa?

Charakteristiky 5G

5G je pátou generací nejnovější mobilní technologie, která byla vyvinuta za účelem zvýšení rychlosti bezdrátových sítí.

Jednou z důležitých funkcí technologie 5G je, že dokáže zpracovávat tisíce přenosů více, než dnešní sítě; je 10krát rychlejší než 4G.

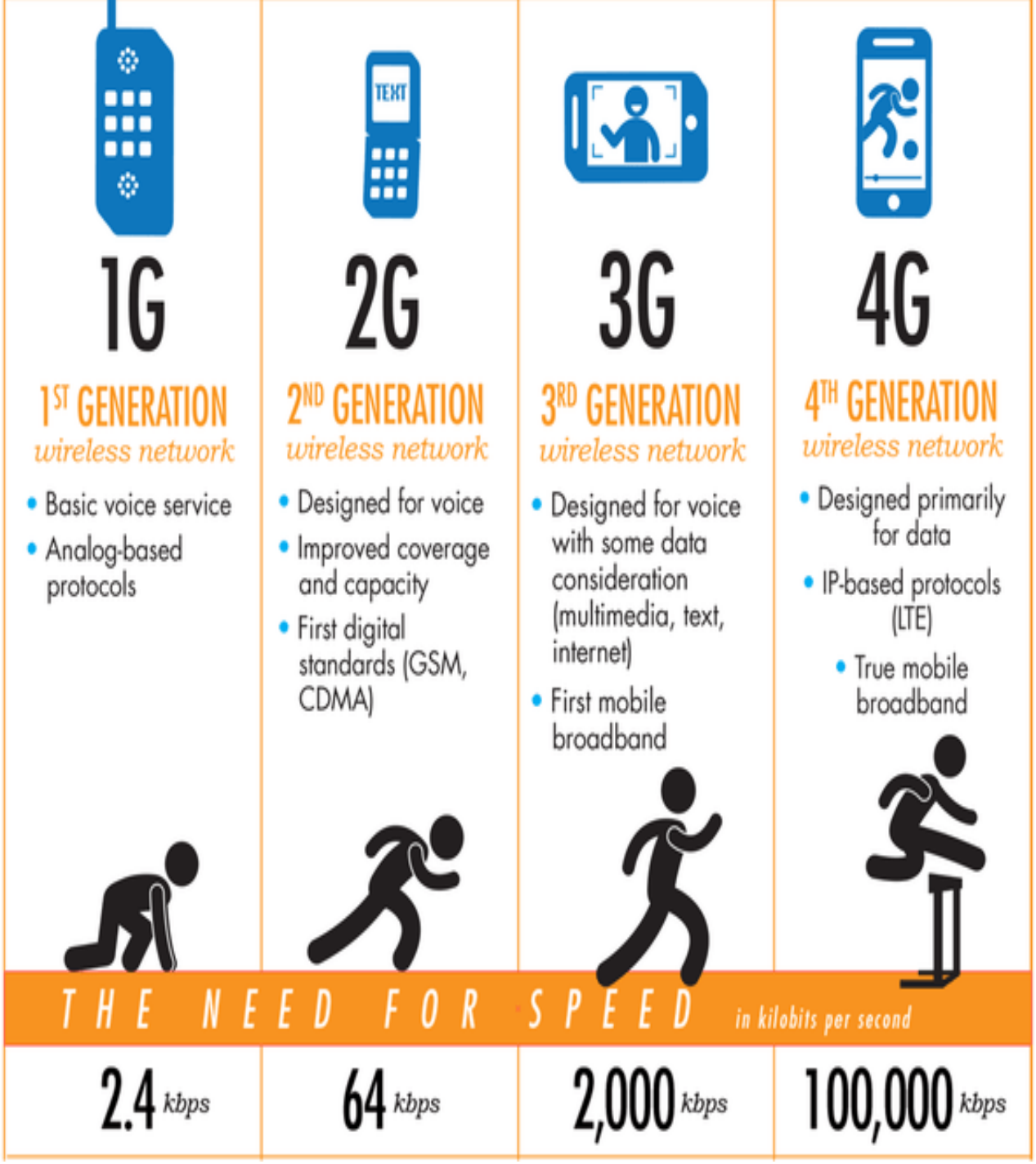
Představte si, že můžete stahovat videa, mediální soubory během několika sekund. 5G je mezitím základem virtuální reality a internetu věcí.

Každý pokrok v technologickém světě přinesl významný vývoj v oblasti mobilní komunikace s novými generacemi sítí, z nichž každá nová byla lepší než předchozí.

Začalo to mobilní sítí první generace **(1G),** která uživateli umožňovala pouze telefonovat.

Tato technologie pokračovala, dokud ji v roce 1991 nenahradila mobilní síť druhé generace **(2G).**

Podobně **3G** sítě, **4G** sítě a nyní **5G** přišly spolu s technologií internetu a způsobily revoluci ve schopnostech mobilních telefonů.



Pokud vidíme, že osoba běží ve 4G připojení, osoba v 5G připojení jako by letěla raketou.

The Landscape of 5G

5G will differentiate itself by delivering various improvements:

10x

Decrease in latency:
Delivering latency as low as 1 ms.

10x

Connection density:
Enabling more efficient signaling for IoT connectivity.

10x

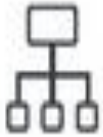
Experienced throughput:
Bringing more uniform, multi-Gbps peak rates.

3x

Spectrum efficiency:
Achieving even more bits per Hz with advanced antenna techniques.

100x

Traffic capacity:
Driving network hyper-densification with more small cells everywhere.



100x

Network efficiency:
Optimizing network energy consumption with more efficient processing.

PROS & CONS OF
5G TECHNOLOGY

PROS	CONS
1. Greater Transmission Speed.	1. Cost of Establishment.
2. Lower Latency.	2. Lack of Information.
3. Increased Connectivity.	3. Limited Coverage.
4. Energy Efficiency Plans.	4. Overcrowded Radio Frequency.
5. Efficient Business Processes.	5. Security and Privacy Issue.

Výhoda 1. Vyšší přenosová rychlost

Očekává se, že tato síť využívající vysoké spektrum spárovaná s pokročilou rádiovou technologií bude stokrát rychlejší než sítě čtvrté generace (4G) s přenosovou rychlostí až 10 Gb / s.

To nevyhnutelně vede k rychlejšímu přenosu obrázků a videí.

Výhoda 2. Nižší latence

Latence označuje časový interval mezi přijetím pokynu a provedenou danou instrukcí.

V technologii 5G je doba zpoždění přibližně 4 až 5 milisekund (ms) a lze ji snížit na 1 ms, tj. 10krát méně než latence technologie 4G. To nám umožňuje bez přerušení sledovat vysokorychlostní videa z virtuální reality.

Výhoda 3. Zvýšená konektivita

Vzhledem k tomu, že síť 5G využívá širší spektrum, umožňuje přesnější připojení s větším počtem zařízení, stokrát vyšší dopravní kapacitu. To umožňuje více lidem a více zařízením komunikovat současně.

To zvyšuje šance na založení inteligentních měst, která se regulují pomocí různých připojení senzorů.

Výhoda 4. Plány energetické účinnosti

Šířily se obávy, že výrazné zvýšení rychlosti dat a konektivity přinese stejně velkou spotřebu energie. Cílem sítě 5G je však snížit spotřebu energie o 10 procent ve srovnání se současnými běžnými sítěmi 4G.

Výhoda 5. Efektivní obchodní procesy

Jeho vyšší přenosová rychlost, nižší latence a široká konektivita mají ve světě obchodních podniků co nabídnout.

Díky schopnosti podporovat až jeden milion zařízení na kilometr čtvereční umožňuje technologie 5G podnikům koordinovat všechna zařízení pod jejich kontrolou s nekonečnou účinností.

Za druhé, vyšší rychlost dat poskytovaná sítěmi 5G může být revoluční, což umožňuje rychlejší dosažení všech vzdálených prací, které vyžadují datové připojení.

Nevýhoda 1. Náklady na založení

Zavedení 5G technologie ve světě vyžaduje nahrazení stávajících mobilních infrastruktur, které nejsou kompatibilní s 5G technologií. To nevyhnutelně vede ke zvýšené spotřebě času a peněz. Vzhledem ke své složité povaze vyžaduje velké množství kvalifikovaných pracovníků k udržení správného spojení, což zvyšuje nákladový faktor.

Nevýhoda 2. Nedostatek informací

Technologie 5G je stále ve fázi vývoje a zbývá ještě mnoho objevit. Stejně jako vyřezávání mramoru do podoby detailních soch, vyžaduje i technologie 5G ještě odborníky, aby na jejích vlastnostech pracovali, než bude vytvořen naleštěný a „vymakaný“ plán.

Nevýhoda 3. Omezené pokrytí

V důsledku zvýšení šířky pásma v sítích 5G se celkové pokrytí poskytované každou buňkou snížilo. Proto buněčné systémy využívané technologií 5G cestují na kratší vzdálenost než technologie využívané technologií 4G, což nakonec zmenšuje plochu pokrytou jednotlivým vysílačem buněk 5G.
Rovněž milimetrové vlny mají obecně velmi nízkou penetrační sílu a nemohou procházet budovami, stromy, zdmi nebo jinými překážkami bez narušení signálu.
Vzhledem k tomu, že sítě 5G používají milimetrové vlny spolu s dalšími rozsahy, je vysoce pravděpodobné, že tato vlastnost milimetrových vln naruší 5G připojení.

Nevýhoda 4. Přeplněná rádiová frekvence

Rádiové spektrum již přeplněné v důsledku přítomnosti buněk 3G a 4G se přidáním buněk 5G ještě více zahltí.
Rozšířený rozsah frekvence sítě 5G je také 6 GHz, což je již plné jiných signálů. To naznačuje problém, který může nastat v důsledku přetížené rádiové frekvence.

Nevýhoda 5. Problém se zabezpečením a ochranou soukromí

Výzkumný tým z University of Lorraine a University of Dundee provedl studii o ověřování 5G a dospěl k závěru, že zvyšuje bezpečnostní hrozby. Je to hlavně díky jeho vlastnosti umožňující přenos vysoce kvalitních dat a přítomnosti více vstupních bodů pro útočníky.
Ve světě, který se stává mobilním, se ohrožení integrity sítě nakonec stane otázkou národního zájmu.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Závěr

Vezmeme-li v úvahu všechny výše uvedené body, je zcela jasné, že technologie 5G se stále rozvíjí, překonává překážky, zdokonaluje se a vylepšuje se tak, aby vyhovovala lidským požadavkům, a formuluje lepší plány pro její zavedení a využití.

Ačkoli má v současné době má podíl na výhodách a nevýhodách, očekává se, že výhody v nadcházející budoucnosti převáží nad nevýhodami.

https://honestproscons.com/pros-and-cons-of-5g-technology/

References:
https://arxiv.org/abs/1806.10360
https://www.ericsson.com/en/blog/2020/2/mobile-devices-and-energy-efficiency

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ĎAKUJEM ZA POZORNOSŤ