

# Co je kvalita

ISO 250xx

# Kvalita

- Kvalita nějaké entity je hodnocena pomocí fuzzy metriky vztahující se ke (skrytým) potřebám, postojům hodnotitele
- Neurčitost hodnocení je možné zkvalitnit tím, že se využijí explicitnější vlastnosti hodnocené entity (dimenze, charakteristiky, aspekty), které jsou „objektivnější“, dají se lépe měřit
- Zpravidla se využije soubor aspektů, např. přesnost a důvěryhodnost

# Zaměříme se na popis aspektů kvality

- Dat
- SW systémů
- Ukážeme že některé požadavky na kvalitu mohou být konfliktní neboť aspekty je třeba rozumně vyvažovat

Kvalita dat ISO 25012

# Dvoudimensionální pohled

- **Inherent Data Quality:** Inherent data quality refers to the degree to which quality characteristics of data have the intrinsic potential to satisfy stated and implied needs when data is used under specified conditions. From the inherent point of view, data quality refers to data itself, in particular to:
  - data domain values and possible restrictions (e.g. business rules governing the quality required for the characteristic in a given application);
  - relationships of data values (e.g. consistency);
  - metadata.
- **System-Dependent Data Quality:** System dependent data quality refers to the degree to which data quality is reached and preserved within a computer system when data is used under specified conditions.
- From this point of view data quality depends on the technological domain in which data are used; it is achieved by the capabilities of computer systems' components such as: hardware devices (e.g. to make data available or to obtain the required precision), computer system software (e.g. backup software to achieve recoverability), and other software (e.g. migration tools to achieve portability).

# Dvoudimensionální pohled2

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# Inherent Data Quality

- **Accuracy**
- The degree to which data has attributes that correctly represent the true value of the intended attribute of a concept or event in a specific context of use.  
It has two main aspects:
- **Syntactic Accuracy:** Syntactic accuracy is defined as the closeness of the data values to a set of values defined in a domain considered syntactically correct.
- **Semantic Accuracy:** Semantic accuracy is defined as the closeness of the data values to a set of values defined in a domain considered semantically correct.
- **Completeness**
- The degree to which subject data associated with an entity has values for all expected attributes and related entity instances in a specific context of use.
- **Consistency**
- The degree to which data has attributes that are free from contradiction and are coherent with other data in a specific context of use. It can be either or both among data regarding one entity and across similar data for comparable entities.
- **Credibility**
- The degree to which data has attributes that are regarded as true and believable by users in a specific context of use. Credibility includes the concept of authenticity (the truthfulness of origins, attributions, commitments).
- **Currentness**
- The degree to which data has attributes that are of the right age in a specific context of use



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# Inherent and System-Dependent Data

## Quality

- **Accessibility**
- The degree to which data can be accessed in a specific context of use, particularly by people who need supporting technology or special configuration because of some disability.
- **Compliance**
- The degree to which data has attributes that adhere to standards, conventions or regulations in force and similar rules relating to data quality in a specific context of use.
- **Confidentiality**
- The degree to which data has attributes that ensure that it is only accessible and interpretable by authorized users in a specific context of use. Confidentiality is an aspect of information security (together with availability, integrity) as defined in ISO/IEC 13335-1:2004.
- **Efficiency**
- The degree to which data has attributes that can be processed and provide the expected levels of performance by using the appropriate amounts and types of resources in a specific context of use.
- **Precision**
- The degree to which data has attributes that are exact or that provide discrimination in a specific context of use.
- **Traceability**
- The degree to which data has attributes that provide an audit trail of access to the data and of any changes made to the data in a specific context of use.
- **Understandability**
- The degree to which data has attributes that enable it to be read and interpreted by users, and are expressed in appropriate languages, symbols and units in a specific context of use.  
Some information about data understandability are provided by metadata.

# Inherent and System-Dependent Data

## Quality 2

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# Inherent and System-Dependent Data

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# System-Dependent Data Quality

- **Availability**
- The degree to which data has attributes that enable it to be retrieved by authorized users and/or applications in a specific context of use.
- **Portability**
- The degree to which data has attributes that enable it to be installed, replaced or moved from one system to another preserving the existing quality in a specific context of use.
- **Recoverability**
- The degree to which data has attributes that enable it to maintain and preserve a specified level of operations and quality, even in the event of failure, in a specific context of use

# Charakteristiky kvality SW

Pohled na celý systém

# ISO 25010

<b>(Sub)Characteristic</b>	<b>Reliability</b>
<b>Functional suitability</b>	Maturity
Functional completeness	Availability
Functional correctness	Fault tolerance
Functional appropriateness	Recoverability
<b>Performance efficiency</b>	<b>Security</b>
Time behaviour	Confidentiality
Resource utilization	Integrity
Capacity	Non-repudiation (nepopiratelnost)
<b>Compatibility</b>	Accountability
Co-existence	Authenticity
Interoperability	<b>Maintainability</b>
<b>Usability</b>	Modularity
Appropriateness recognizability	Reusability
Learnability	Analysability
Operability	Modifiability
User error protection	Testability
User interface aesthetics	<b>Portability</b>
Accessibility	Adaptability
	Installability
	Replaceability



# ISO 25010 SW Quality Characteristics

## **Functional suitability**

Functional completeness

Functional correctness

Functional appropriateness

## **Performance efficiency**

Time behaviour

Resource utilization

Capacity

# ISO 25010 SW Quality Characteristics

## **Reliability**

Maturity

Availability

Fault tolerance

Recoverability

## **Security**

Confidentiality

Integrity

Non-repudiation

Accountability

Authenticity

# ISO 25010 SW Quality Characteristics

## **Compatibility**

Co-existence

Interoperability

## **Usability**

Appropriateness

recognizability

Learnability

Operability

User error protection

User interface aesthetics

Accessibility

# ISO 25010 SW Quality Characteristics

## **Maintainability**

Modularity

Reusability

Analysability

Modifiability

Testability

## **Portability**

Adaptability

Installability

Replaceability

# **maintainability**

degree of effectiveness and efficiency with which a product or system can be modified by the intended maintainers

Modifications can include corrections, improvements or adaptation of the software to changes in environment, and in requirements and functional specifications. Modifications include those carried out by specialized support staff, and those carried out by business or operational staff, or end users.

Maintainability includes installation of updates and upgrades.

Maintainability can be interpreted as either an inherent capability of the product or system to facilitate maintenance activities, or the quality in use experienced by the maintainers for the goal of maintaining the product or system

## **modularity**

degree to which a system or computer program is composed of discrete components such that a change to one component has minimal impact on other components

[SOURCE: ISO/IEC/IEEE 24765]

## **reusability**

degree to which an asset can be used in more than one system, or in building other assets

## **analysability**

degree of effectiveness and efficiency with which it is possible to assess the impact on a product or system of an intended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified

Implementation can include providing mechanisms for the product or system to analyse its own faults and provide reports prior to a failure or other event.

## **modifiability**

degree to which a product or system can be effectively and efficiently modified without introducing defects or degrading existing product quality

Implementation includes coding, designing, documenting and verifying changes.

[Modularity](#) (and [analysability](#) can influence modifiability

Modifiability is a combination of changeability and stability.

## **testability**

degree of effectiveness and efficiency with which test criteria can be established for a system, product or component and tests can be performed to determine whether those criteria have been met

maintainability

degree of effectiveness and efficiency with which a product or system can be modified by the intended maintainers

Note 1 to entry: Modifications can include corrections, improvements or adaptation of the software to changes in environment, and in requirements and functional specifications. Modifications include those carried out by specialized support staff, and those carried out by business or operational staff, or end users.

Note 2 to entry: Maintainability includes installation of updates and upgrades.

Note 3 to entry: Maintainability can be interpreted as either an inherent capability of the product or system to facilitate maintenance activities, or the quality in use experienced by the maintainers for the goal of maintaining the product or system.

4.2.7.1

modularity

degree to which a system or computer program is composed of discrete components such that a change to one component has minimal impact on other components

[SOURCE: ISO/IEC/IEEE 24765]

4.2.7.2

reusability

degree to which an asset can be used in more than one system, or in building other assets

Note 1 to entry: Adapted from IEEE 1517-2004.

4.2.7.3

analysability

degree of effectiveness and efficiency with which it is possible to assess the impact on a product or system of an intended change to one or more of its parts, or to diagnose a product for deficiencies or causes of failures, or to identify parts to be modified

Note 1 to entry: Implementation can include providing mechanisms for the product or system



## 4.2.1 functional suitability

degree to which a product or system provides functions that meet stated and implied needs when used under specified conditions

Note 1 to entry: Functional suitability is only concerned with whether the functions meet stated and implied needs, not the functional specification.

### 4.2.1.1 functional completeness

degree to which the set of functions covers all the specified tasks and user objectives

### 4.2.1.2 functional correctness

degree to which a product or system provides the correct results with the needed degree of precision

### 4.2.1.3 functional appropriateness

degree to which the functions facilitate the accomplishment of specified tasks and objectives

**Na SOA to moc nepasuje (úplnosť?)**

# ISO 25010 kvalita pro užívání

## **Effectiveness**

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## **Efficiency**

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## **Satisfaction**

Usefulness

Trust

Pleasure

Comfort

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## **Freedom from risk**

Economic risk mitigation

Health and safety risk mitigation

Environmental risk mitigation

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## **Context coverage**

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Context completeness

Flexibility

# Některé aspekty silně závisí na architektuře

- SOA
- SOA a dokumentová orientace
- cloud

# IT a legislativa

## Př. problém ochrany osobních dat

Jak se za cenu velkých ztrát a nežádoucích efektů dosáhne opaku deklarovaného cíle

# Takzvaná ochrana osobních dat jako příklad ztráty kvality dat a chybného řešení

1. Pravidlo: Osobní data se smí shromažďovat, udržovat a používat jen k tomu účelu, ke kterému byla pořízena
2. „Řešení“: Vymazat data, pokud není 1 splněno.
  - Příklad zrušení dat o vydaných receptech
  - Ztrta kvality dat – dostupnosti dat

Výzva: Chrání to skutečně životní zájmy jednotlivých občanů?

Zamlčený předpoklad: Tím se podstaně zlepší ochrana osobních dat z hlediska občana

# Main failure of public information systems

Should provide crucial services, e.g. access to any important publishable information, and assure personal data security and ***also*** other basic human rights

The systems, however, provide  
neither personal data security , neither access to publishable  
info

nor the quality of crucial services

Moreover, it threatens some human rights

# Brute data security rules implied by laws

1. Personal data can be collected and used for the purposes only they were created
2. Any information computed from sensitive (personal) data must be treated as sensitive.
  - Such information is not open irrespective of its content that could/should be open
3. Any collection of personal data not satisfying previous points must be erased

# Limits of brute rules

- Reasons for the rules
  - (Mis)interpretation of Universal Declaration of Human Rights
  - Prejudices of public especially the Big Brother hysteria
    - State has too much information on me
  - Lobby interests
- Undesirable effects of the rules
  - The rules to some degree protect some rights but threaten others
  - They increase the threats of Big Godfathers
  - They in principle cannot assure personal data security



# Brute rules in action 1

System for the prevention of the production of the narcotic Pervitin

- Principle:
- On line control of the cases, when anyone has purchased too many drugs containing pseudoefedrin (needed for the production of the narcotic Pervitin) lately all over the Czech Republic
  - Personal ID's had to be used in a database of all drug purchases. The data disclose health information.

# Brute rules in action 2

System for the prevention of the production of the narcotic Pervitin

- **Results:**

- A very effective use of SOA, effective implementation
- The production of Pervitin was substantially reduced after the system had started
- Potential opportunities
  - On-line prevention of improper medication, it could save a lot of lives (hundreds, maybe thousands in Czech Rep.) and prevent hundreds of thousands health damages (estimations for USA 50000 and 1.2 milions a year respectively)
  - Evaluation of health institution (hospitals)
  - Optimization of health expenses
  - Epidemic prevention and control
  - Support of medical research and the on line control of the drug use effectiveness, Etc

# Brute data security rules in action 3

- Pity end of the system: The system was forbidden as its database did not comply with the brute rules
- Consequences
  - *The production of Pervitin was resumed*
    - Tragedies of drug consumers and their families
    - Growing power of criminal structures
  - *The opportunities were lost*
    - Lost lives due to a wrong cure (not too small number of cases, comparable with the number of deaths in traffic incidents)

# Brute data security rules in action 4

- Hidden consequences:
  - The analysis of the huge amount of data collected by health assurance institution and health institutions is blocked,
    - The above opportunities are missed
    - The physicians and health institutions are not properly informed on patients health and medications and their effects
    - People are induced to apply improper security disciplines (not to use info critical for patients)
    - Many cure procedures are needlessly repeated

# Summary of brute rules effects

- The effects of the rules are the negations of declared goals as they threaten some rights
  - The effects jeopardized lives or health of patients
    - It threatens the right for live
  - Some open information is not available although it should be used to evaluate/access
    - Aspects of the health care quality
    - Epidemic information
    - Etc.
  - People must invest into health more than necessary
  - Personal data leakage prevention is not substantially enhanced by the current data security regulations as there are many data leakage channels. People and majorities are not aware of it.

# Multiple data leakage channels

- Open data state institutions (land or enterprise registers, ....), data leakages from state institutions
- Financial institutions, e-commerce, etc
- Social software and generally Internet if somebody is not careful enough,
  - It is often very difficult to be careful enough
  - Dangerous habits
- Mobile phones
  - Can be tapped or monitored, even from satellites (positions, the communication can be decoded, ...)
  - Log files at the operators of mobiles
- Servers are not fully immune against hacker attacks,
- etc.

# Great financial data leakage, German government must act against crime

- German government has bought and will again buy disks with financial data of Swiss banks to prevent tax evasions of German citizens

# Data security and education

Issues and effects similar to those discussed above,

- especially important in post-communistic countries,
- Obama and others complain on U.S. education quality
- What schools and study profiles should be preferred
  - Measure: What schools have the most successful graduates/alumni according to the criteria of individual evaluators.
  - What education profiles are the most successful ones
- Problem of STEM (science, technology, engineering, mathematics) education
  - falling popularity,
  - what are the STEM job perspectives



# Data security rules threaten basic human rights in education

- It is difficult for people to decide properly, it is dangerous to the prosperity of whole society
  - Lack of needed professions, decay of basic education services, fall of the quality of education
  - International competition issues
- The investments into education are not optimal, attempts to introduce school-fees
- Lost talents (i.e. it is in fact equal to the vasting of a limited natural resource)
- Danger of social instability

# Other consequences of improper data security procedures

- Macroeconomic data
  - Monopoly of analytical firms, the firms, however, have failed to forecast coming crisis
  - State organizations have failed as well
- Copyright practices
  - Monopoly of large editors
  - Copyright transfers from people to companies

# The brute rules threaten whole IT

- The brute data security rules reduce in fact substantially the data quality,
- It seems to be the bottleneck of many crucial IT projects
  - The effects of the projects cannot be bettered unless the rules are changed
  - Many aims of IT cannot be then achieved irrespective massive investments
- It is a danger for the whole IT (informatics)

# Takzvaná ochrana osobních dat 2

## Skartace zdravotních dat

V daném případě:

- Mohou chybět data o právě prováděných medikacích a pak může být fatální průšvih
  - Stává se omylem lékaře nebo tím, že je nějaký incident jako dopravní nehoda
  - Pacient na léky, které užívá, neupozorní
  - Ohrožuje to životní zájmy lidí, stovky, spíše tisíce úmrtí, kterým nemuselo dojít, statisíce poškození zdraví (v USA 1.2 milionu ročně)
- Blokuje se optimalizace výdeje léků
  - Mnohamiliardové ztráty
- Uvolňuje se prostor pro produkci drog, příběh pervitinu
- Zhoršují se podmínky zdravotnického výzkumu
- Klíčová osobní data se stejně neochrání
- Naprostá většina informací, které jsou pro občany zajímavá, jako je kvalita škol, by měla být zpřístupnitelná ze zákona, jsou často jsou blokována

# Takzvaná ochrana osobních dat 3

## Analýza efektivnosti vzdělávání

### Hrozba

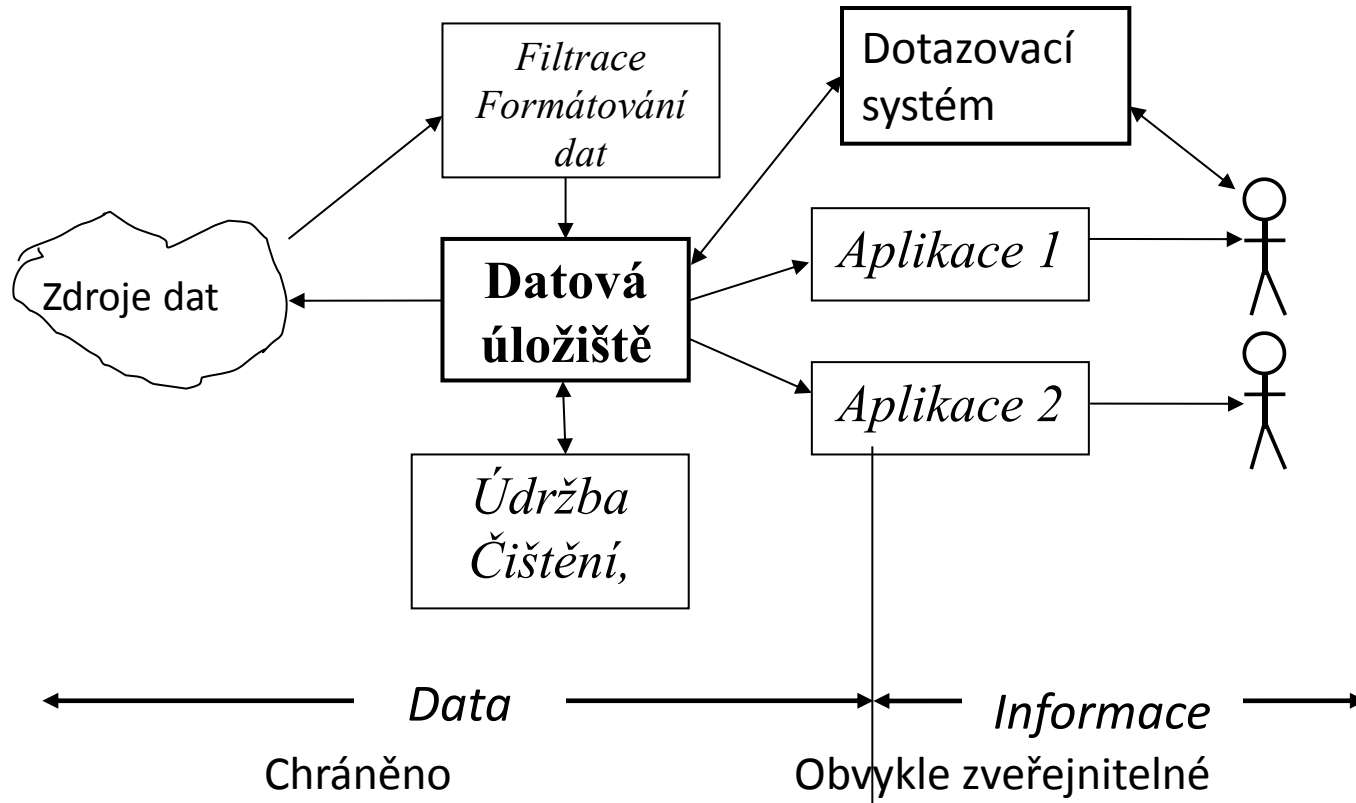
- Dostí rozšířený a asi správný pocit, že se naše školství vyvíjí špatným směrem
  - Opomíjení STEM, To pocítujeme i u nás, je problém v podnicích (průzkum Manpower)
  - Opomíjení tréninku dovedností. Včetně trivia a cizích jazyků, pologramotnost
  - Nerovnoprávné postavení učitelů
    - Za stížnosti žáků je trestán učitel, za nedodržení osnov fakticky nikoliv, příklad Zborovská, Evropská, náznaky i na MFF
  - Administrativní náročnost chodu škol
    - Ekonomická samostatnost – inspekce sledují účty a ne výuku
    - IT by mohlo sledovat úspěšnost všech zařízení podle úspěšnosti absolventů
- Jistou pomocí by mohlo být sledování úspěšnosti absolventů
  - Není o to zájem, nedalo by se tunelovat, rodiče by se museli o ratolesti více starat
  - Naráží to na problém ochrany dat
  - Je to lepší než nic
  - Ohrožuje to i informatiku, nebudou odborníci

# Takzvaná ochrana osobních dat 4

## Informatický výzkum, kvalita IS

- Nelze plně využít výsledky informatického výzkumu, poněvadž přístup k datům není „hladký“
  - Sémantický web
  - Použití metod umělé inteligence
  - Možnosti jednotného pohledu a hladkého přístupu ke všem dostupným datům

# Chráněná data a otevřené informace



Informace je zde to, co je výstupem příslušné aplikace (pro uživatele)

# Takzvaná ochrana osobních dat 4

## Analýza efektivnosti datové skartace

Virtuální skartace je v principu neúčinná, neboť nemůže zásadně omezit únik dat (vlastně těch nejdůležitějších)

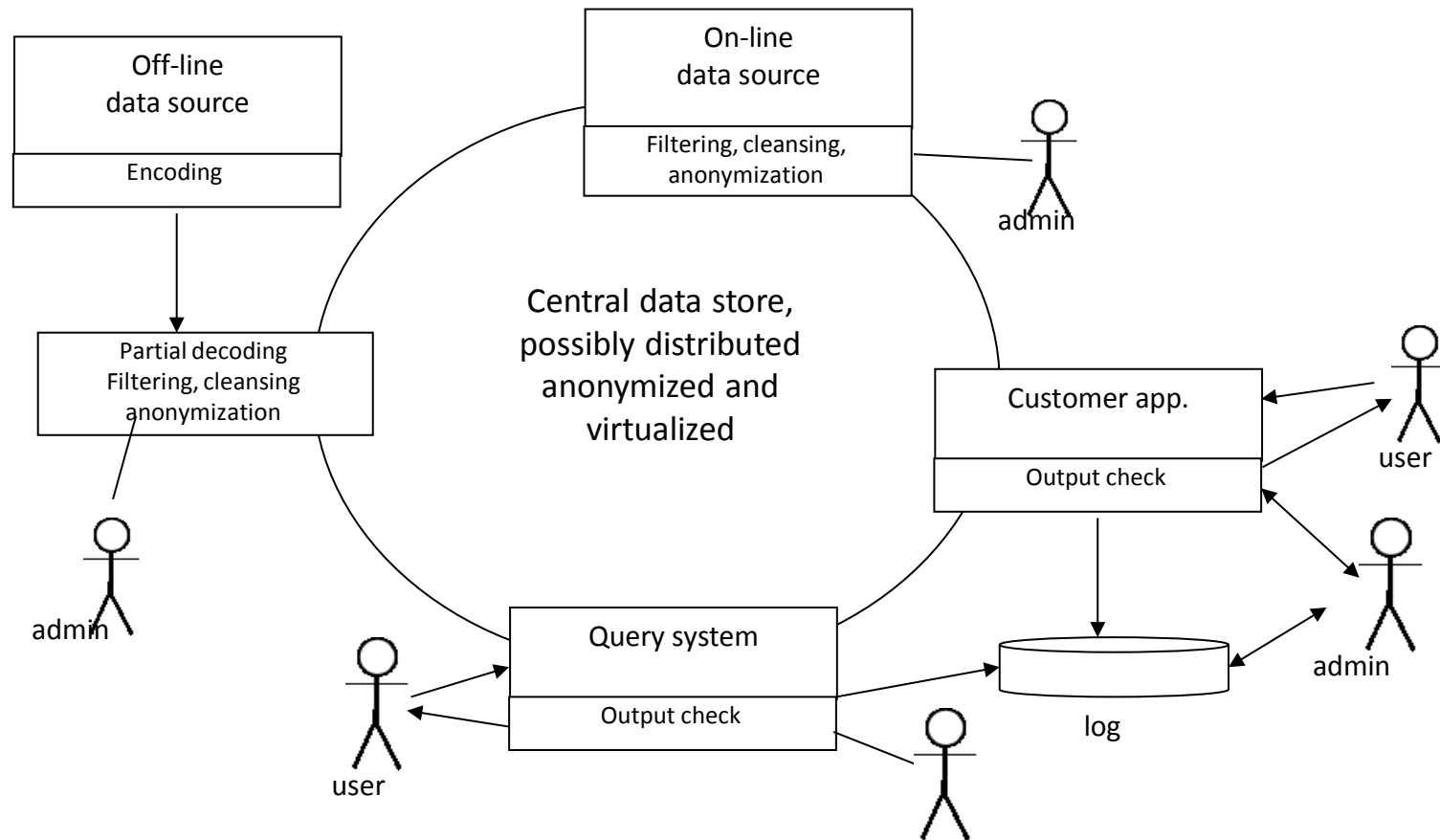
- Pro mnohé je nesmyslná, proto ji nepodporují, a tudíž není úplná a včasná
- Osobní data se shromažďují za různými účely a mohou tedy unikat - a také unikají - mnoha dalšími cestami, legálními i nelegálními
  - Sociální sítě
    - To je výzva i pro nás, jak to zlepšit
  - Různé rejstříky (obchodní, katastry, ...)
  - Finanční instituce
  - Mobily, ty může sledovat i družice
  - Webové služby
    - a-maily, e-komerce
    - Různé procedury zpřístupňující otevřené dokumenty na webu
  - Imigrační a cestovní procedury, např. USA



# Výpočet otevřených informací s použitím osobních dat

- Data se shromažďují u důvěryhodné instituce
  - instituce data a soukromí chrání
    - Organizačně s použitím známých technik
    - Částečným zakódováním (identifikátorů subjektů)
    - Kontrolou výstupů výpočtů, zda se z informací nedá odvodit, ke komu se vztahují
  - Instituce poskytuje základní dotazovací systém a umožňuje po prověření nezávadností aplikací vyvinutých uživateli integraci a používání těchto aplikací

# System chránící data a zpřístupňující otevřené informace



# Co chybí při ochraně osobních dat

- ÚOOÚ by měl prokazovat, že je skartace skutečně nezbytná,
  - měl by doporučovat opatření (důvěryhodnost instituce, anonymizace dat, ..), opatření by měl navrhnout sám, nebo si je dát navrhnout od expertů s cílem vyhnout se skartaci
  - Měl by mít povinnost vyhodnocovat ztráty vyvolané skartací a to i na podnět občanů a institucí
- Ale to je legislativní změna!

# Od dostupnosti k nedosažitelnosti

## Zavalí nás informační odpadky?

- Stále větší množství smetí, přes které se musím probojovávat k tomu, co potřebuji, leccos nakonec nenajdu
- I užitečných/relevantních informací je stále více a pro menší skupiny je příliš nákladné všechny využívat
  - Některé informace jsou jen v knihách a reportech, jiné v dokumentaci SW artefaktů
  - Je obtížné se k některým dokumentům prokousat
- Informační prostor stále více vyplňují velcí vydavatelé a vnucují ostatním svoje pravidla hry

# Jiné hrozby

- Finanční operace v milisekundách a finanční bubliny, nedostupnost základních ekonomických info
- Sobecké zájmy velkých hráčů
  - Obdoba starověkých nomádů ničících staré civilizace?
- Obrovská koncentrace na trhu SW
- Globální aktivity bez globálního dohledu
  - I zde hraje roli IT
- Přesun kódování do mzdových rájů
- Specifikace požadavků bude asi muset zahrnout i specifikaci požadavků na změnu prostředí

# Neřeší se problém kvality dat

- Aktualizace
  - povinnost aktualizovat
- Věrohodnost
- Konsistence
- Odpovědnost
- Postih za zničení dat

# Hlavní výzvy pro ajťáky

- Zdá se, že klíčový problém IT (bottleneck) je spojen s pravidly (ne)dostupnosti dat a nekompetentností uživatelů
  - Jak na věc\_
  - ?
- Úspěch SW závisí na tom, zda se podaří ovlivnit legislativní prostředí,
- Budování informačních systémů a SW systémů obecně je stále více mezioborový a společenský problém a IT se rychle mění
  - Jak to zohlednit ve vzdělávání, jak upravit studium (i to celoživotní), jak se sám vzdělávat
  - IS pro kontrolu kvality vzdělávacích institucí (samo o sobě nestačí), asi bychom se měli více zajímat o zkušenosti dřívějších absolventů
- Jak se prosadit v malých firmách proti velkým hráčům
- Potřeba kontaktů na praktické problémy a spolupráce s firmami

# Hlavní výzvy pro ajťáky

- Využití dat je možné jen, jsou-li dostupné a jinak kvalitní, to není zdaleka splněno
  - Změna vyžaduje zásah do společenského prostředí
    - Předsudky veřejnosti
    - Legislativa
- Kombinace oborů
  - Kombinace měkkých a tvrdých znalostí



# Hlavní výzvy pro ajťáky

## Teorie není jen pro akademiky

- Využívání dat je možné jen s použitím matematické statistiky
- Mnohé inženýrské vlastnosti jsou důsledkem abstraktní matematiky
- Ajťáci matematice moc nedají
- Roste význam statistiky a ta je ajťákům protivná
  - Je nutná v business intelligence
  - Specifikace často spojena se statistickou analýzou
  - Způsob myšlení
- Abstrakce jen když je vhodná a v případě IS jí uživatelé musí rozumět

# Kdy se nevyplatí vyrobit úplně dokonalý SW produkt

- Systém má být použitelný, ale musí se upravovat (i z důvodů změn prostředí), co je pak dokonalý systém
- Uživatel je pak obvykle na dodavateli závislý a nemůže jednoduše přejít k jinému
  - Opravovat musí stále stejný dodavatel
- Úplatky, o přechod není zájem.
  - Nedokonalosti se za úplatu odstraňují a systém se „zdokonaluje“ i když to nemusí být potřeba
- Legitimní důvod: Bylo by to příliš drahé nebo příliš pozdě, někdy ani nelze (, není jasné co, faktor času, reorg cycle – v době kdy předávám je to už zastaralé)

Neakceptuje je, že tvorba SW je  
inženýrský obor  
SW entity jsou průmyslové výrobky

Shody jejich vlastností s vlastnostmi  
klasickými pokročilými výrobky

# Inženýr a řemeslník

- Pohrdání řemeslníků (kodérů) analytiky
- Analytici nemají porozumění pro nuance řemesla (možnosti, cena, ...)
- Obojí spolu se zadavateli nemají zažité přístupy hodnocení plánovaných či existujících SW artefaktů, týká se to i vývojových nástrojů
- Nejsou dostatečně rozvinuté postupy hodnocení a kontroly projektů