Big Data and Cyber Security
A bibliometric study

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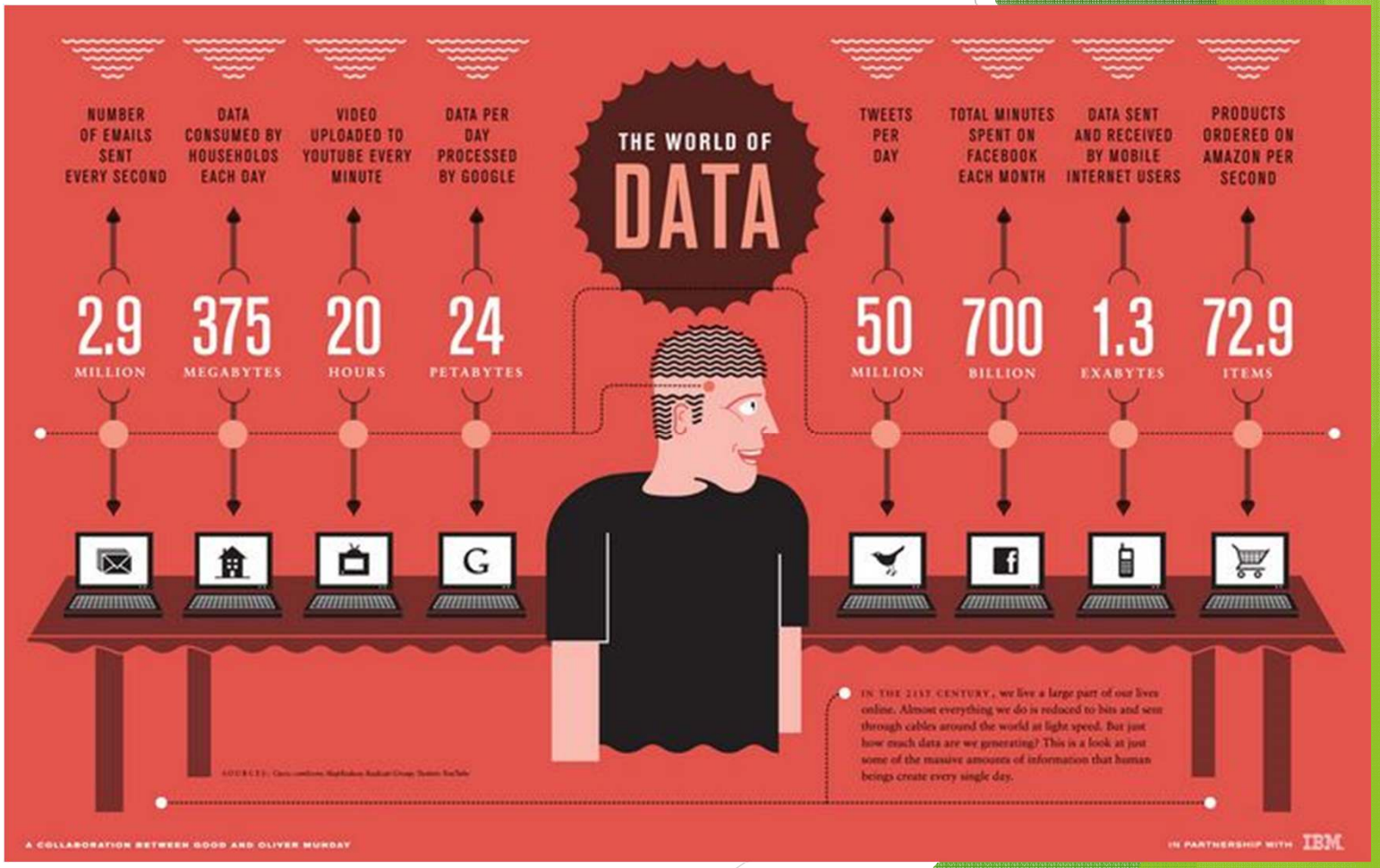
Workshop SCBC - 2015 (ER 2015)

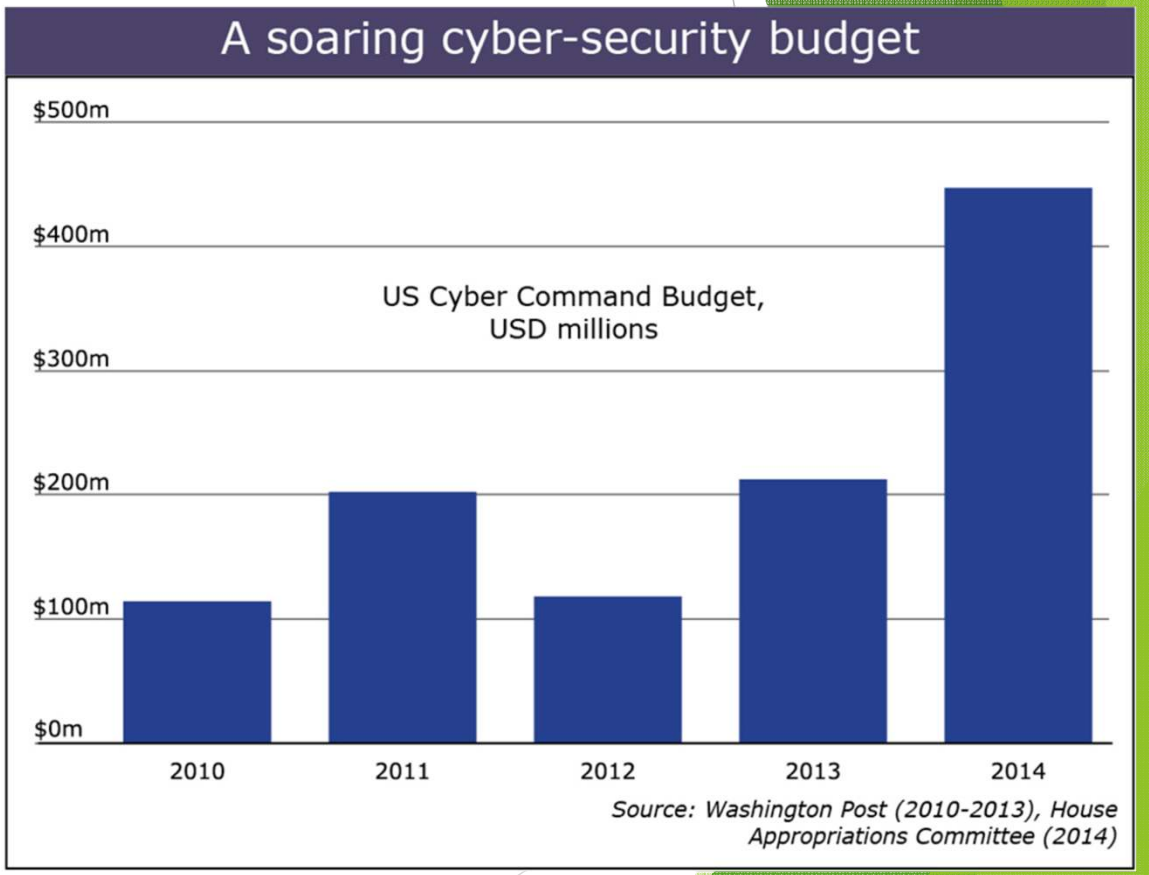
Big Data

- a new generation of technologies and architectures, designed to economically extract value from very large volumes of a wide variety of data, by enabling the high-velocity capture, discovery, and/or analysis (Gantz)

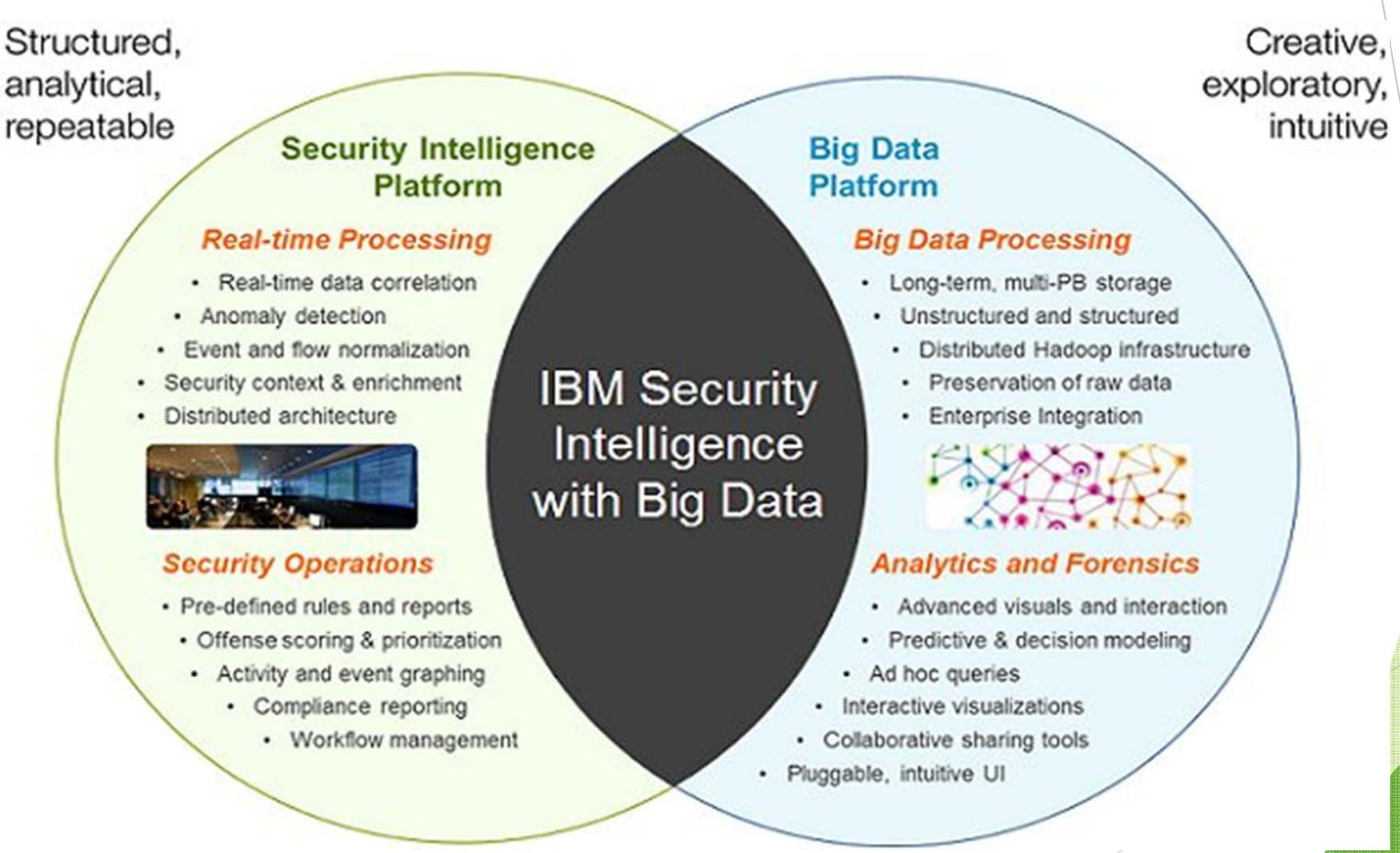


Cyber-security

- Cybersecurity refers to the techniques, processes and methodologies concerned with thwarting illegal or dishonest cyber attacks in order to protect one or more computers on any type of network from any type of damage.



Cybersecurity and Big Data



Examples of cyber attacks

- **Spamming:** sending unsolicited bulk messages to multiple recipients
  - By 2015, the spam volume is 95% of all email traffic
- **Search Poisoning:** dishonest use of Search Engine Optimization techniques to falsely improving the ranking of a webpage.
- **Botnets:** networks of malware-infected compromised computers managed by an adversary.
- **Denial of Service (DoS):** makes a system or any other network resource inaccessible to its intended users
- **Phishing:** fraudulently acquires confidential user data by mimicking e-communication, mainly through email and web spoofing
- **Malware**: software programmed to perform and propagate malicious activities
- **Website Threats:** attackers exploiting vulnerabilities in legitimate website, infecting them and indirectly attacking visitors

Our research approach

- Objective: a bibliometric study on research combining big data and cybersecurity
- Main steps:
  - Find the number of research articles using the terms Big Data and Cybersecurity in the abstract, and/or in the title, and/or in the keywords
  - Focus degrees of papers on the big data and cybersecurity issues (abstract, keywords, title)
  - Comparing number of publications by researchers and by professionals
  - Analyze the publications according to different perspectives:
    - Security component (threat, asset, vulnerability, control, security requirement, security treatment, event, risk, impact)
    - IT artifact (language, metamodel, system design, ontology, taxonomy, framework, architecture, methodology, guideline, algorithm, method fragment, metric, prototype)
    - Application domain (military, healthcare, education, public sector, banking, tourism, marketing)
    - Objective (traceability, integrity, confidentiality, availability, privacy, reliability, scalability, performance, usability, quality, security)
    - Intervention level (network security, software security, information system security, security audit, security policy

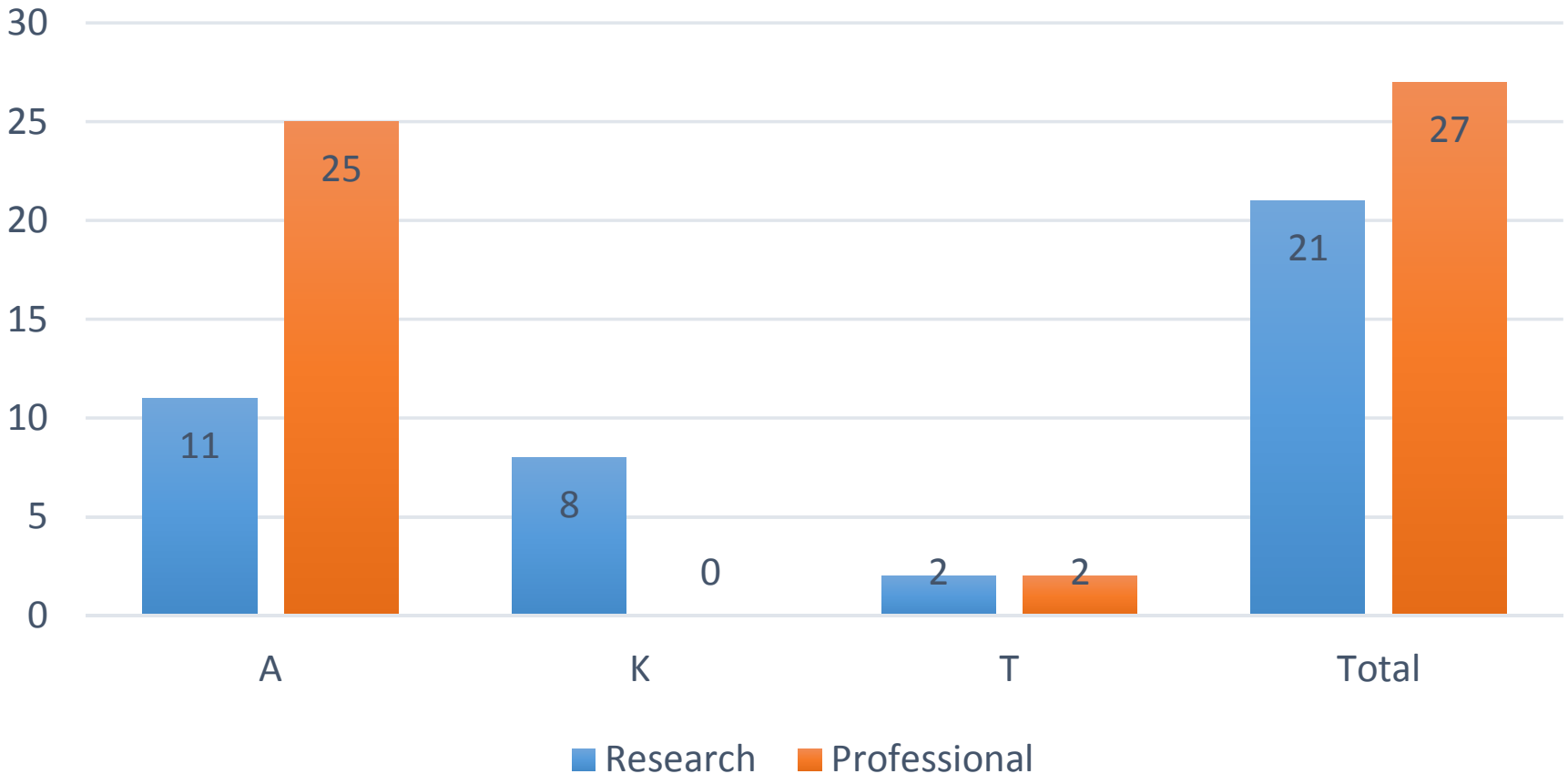
Results: Research papers vs. periodicals

Nb of papers / Perspectives	with chain in A	with chain in K	with chain in T	With chain in AKT
Bigdata & cybersecurity	11	8	2	21
Security Component	4	1	2	7
Artifact	2	0	0	2
Usage	4	0	0	4
Objective	4	1	1	6
Intervention level	0	0	0	0

Nb of papers / Perspectives	with chain in A	with chain in K	with chain in T	with chain in AKT
Bigdata & cybersecurity	25	0	2	27
Security Component	12	0	0	12
Artifact	0	0	0	0
Usage	7	0	0	7
Objective	12	0	0	12
Intervention level	0	0	0	0

Examples of periodical: Business Intelligence Journal, Channel Insider, etc.

Research vs professional publications



Main findings

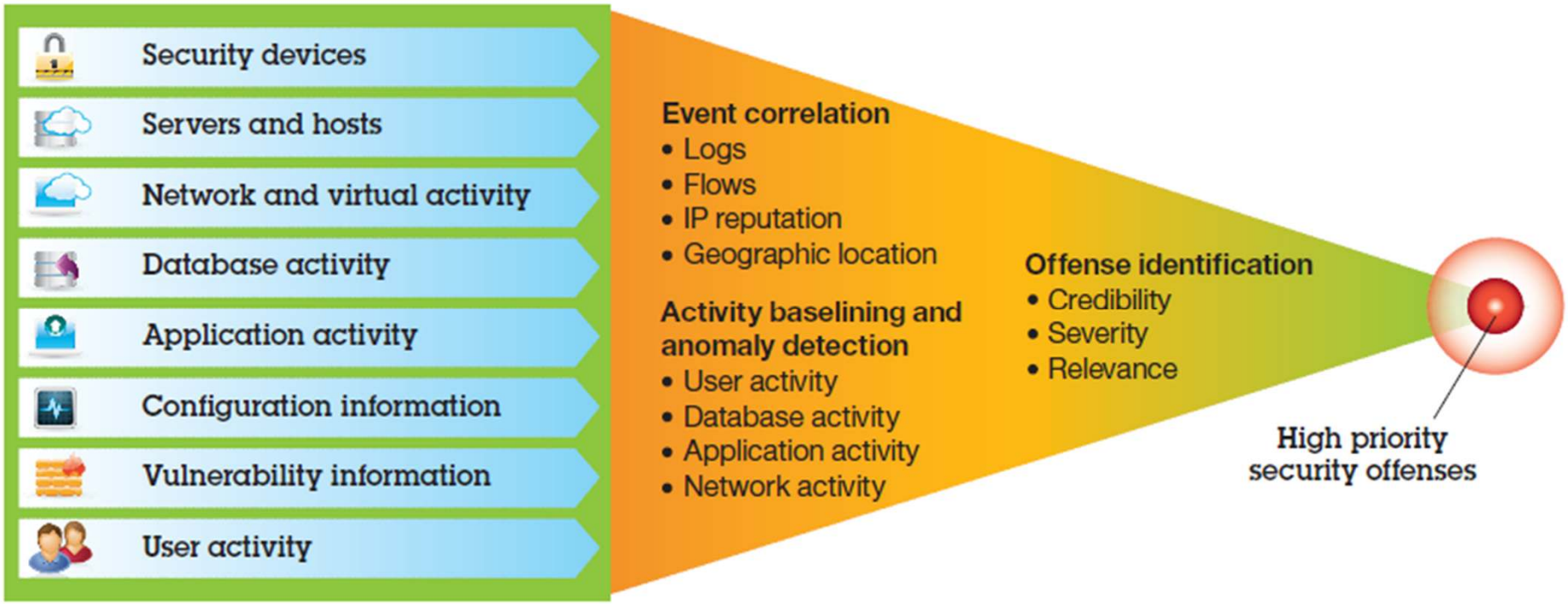
- Very few research publications on both topics (big data and cybersecurity)
- Security components addressed:
  - Risk, threat, vulnerability, event, control
- Quality objectives mentioned:
  - Security, privacy, performance, usability
- Artifacts produced:
  - Methodology, framework, algorithm, prototype
- Application domains addressed:
  - Healthcare
- Nothing on intervention level (audit, policy, requirements, etc.)

- That means large research opportunities!

Big data and cybersecurity: Characterizing the intersection

- *Cybersecurity for Big Data*
  - *Data in the cloud*
    - *Data leakage*
  - *Data analytics*
    - *Secure Hadoop and Map-Reduce (privacy): avoid record linkage*
- *Big Data for Cybersecurity*
  - *Social network analysis*
  - *Mobile data analysis*
  - *Security analytics*
    - *Detect anomalous behaviours in near real-time*
    - Obtain clusters for typical malicious behaviors
    - *Go back in time from security events to root causes*
    - *Discover suspicious applications*

Big data for security: an example (IBM)



Other stakeholders: Accenture, HP, Invensys, EADS, CISCO, Unisys, etc.

Security for big data
Top ten challenges (Cloud security alliance)