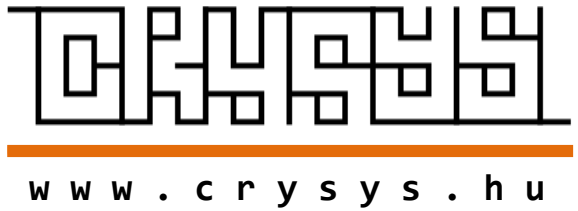

Malware Protection for IoT Devices

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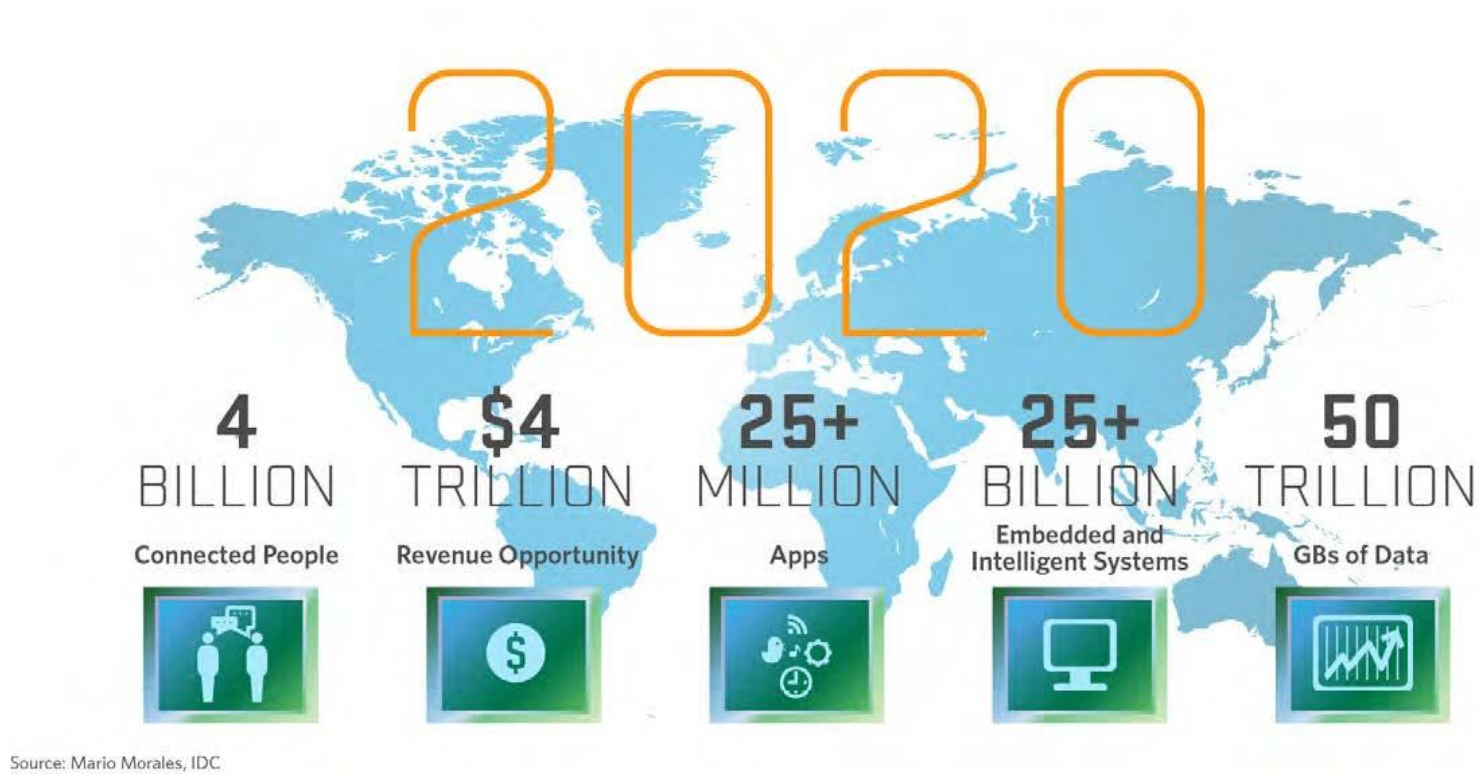
Internet of Things

- On-going evolution of the Internet
- More connected devices than connected people

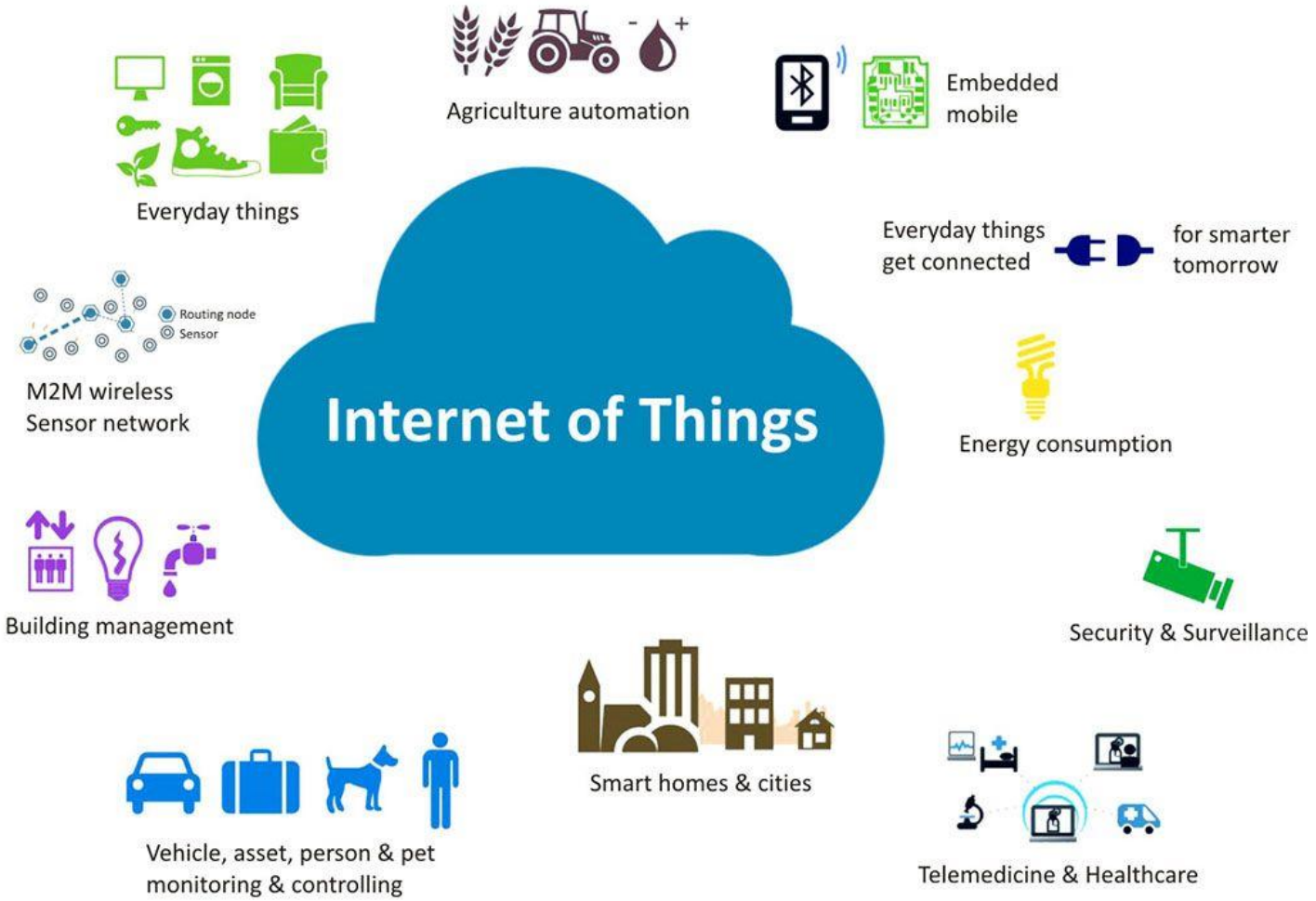


IoT ”smart” devices

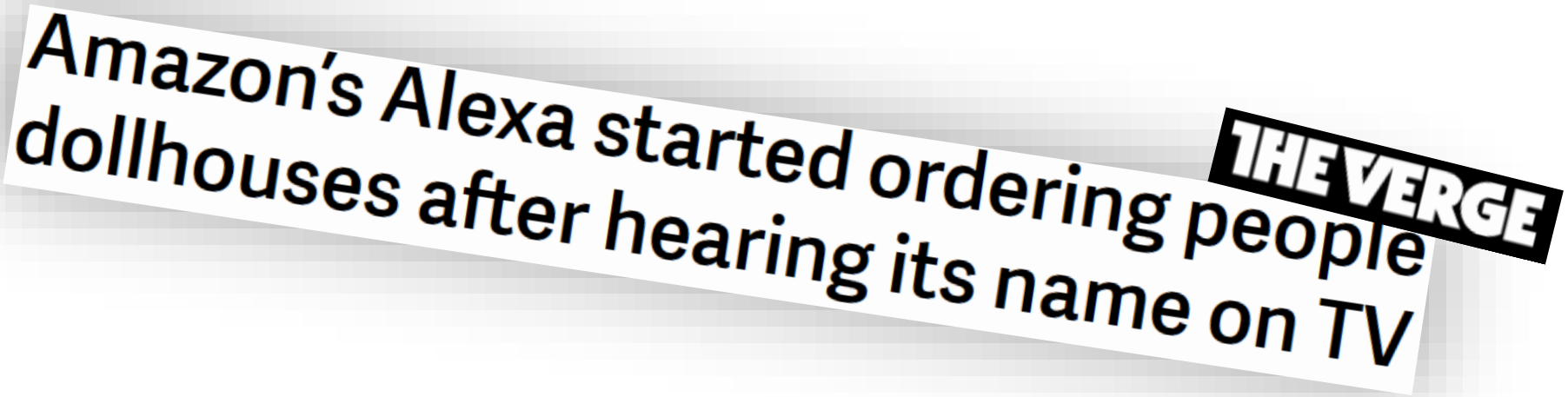
- Internet connection
- Embedded device: developed to perform a specific task
  - Sensors, actuators

- → Machine-to-machine interaction
- → Monitoring, Automation and control

IoT applications



”Smart” devices can be tricked



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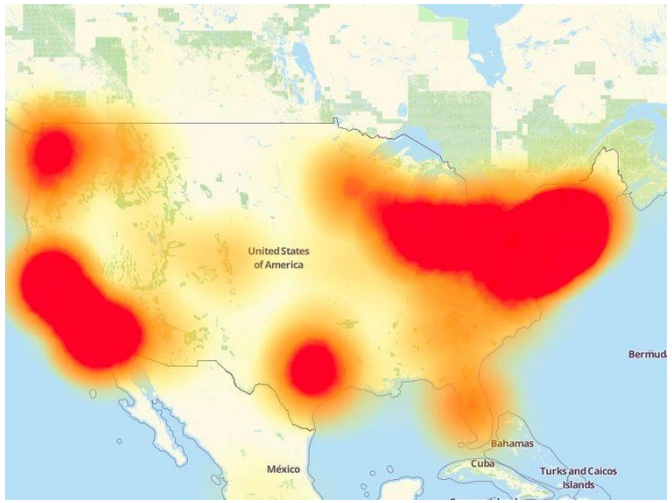
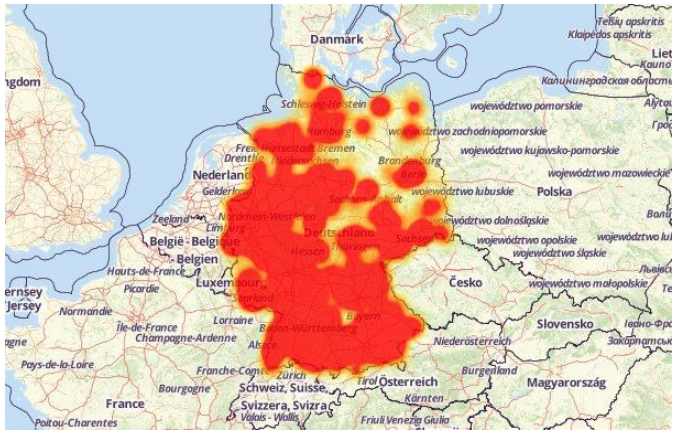
IoT targeted by malware

- Malware = **mal**icious soft**ware**
  - Generic term, encompasses viruses, worms, trojans, etc.
  - Installed without user consent
  - Performs unintended operations

- Example: Mirai botnet (2016)
  - DDoS attack against DNS servers
    → Many websites unreachable
  - Magnitude: 1.2 Tbps





Security issues of IoT devices

- Insecure open ports for communication
  - No authentication necessary for privileged access
- Weak passwords
  - Default passwords can be collected in dictionaries
  - Hard-coded passwords can be found in firmware images
  - Guessable passwords
- Vulnerable software
  - Vulnerabilities in the firmware/OS and the applications
    → Infection, privilege escalation
  - Exploitation may begin before patch is available

Protection is challenging

- Traditional protection: antivirus scanners
  - Scan individual files for signs of malware, called signatures
  - Signatures are stored in the signature database (GBs of RAM/HDD)

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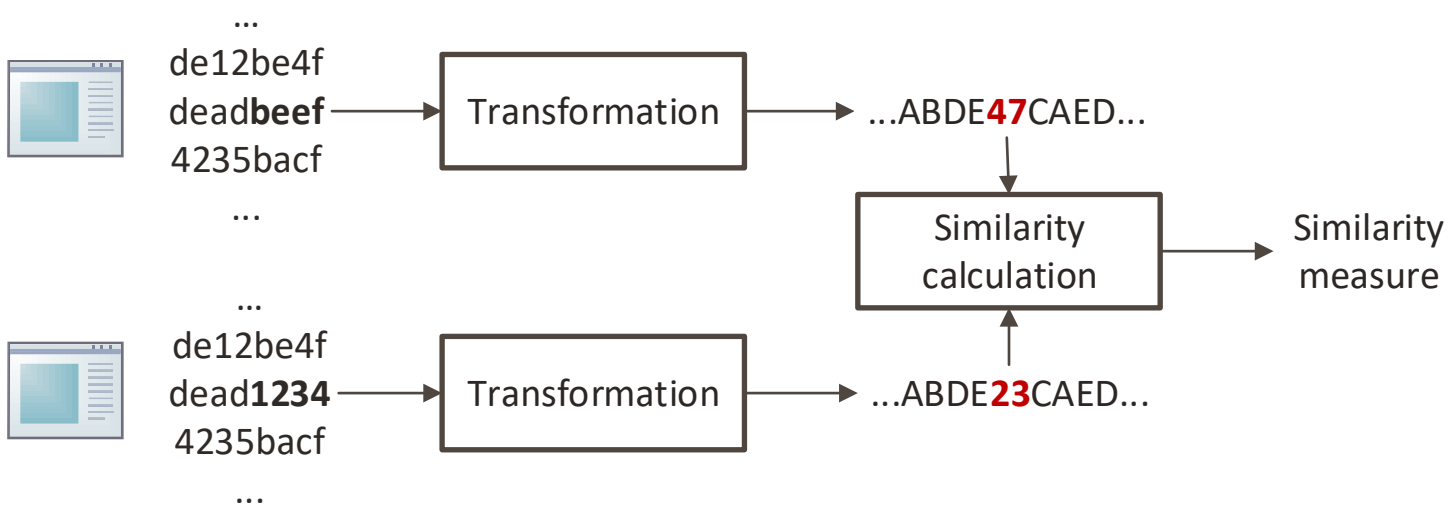
  - Scan individual files for signs of malware, called signatures
  - Signatures are stored in the signature database (GBs of RAM/HDD)

- IoT devices are resource constrained
  - Less computing power
  - Less memory
  - Less storage
  - In many cases, battery-powered
- → IoT devices cannot handle existing signature databases!

Antivirus scanner for IoT devices

- Goal: create a smaller signature database

- Binary similarity measure

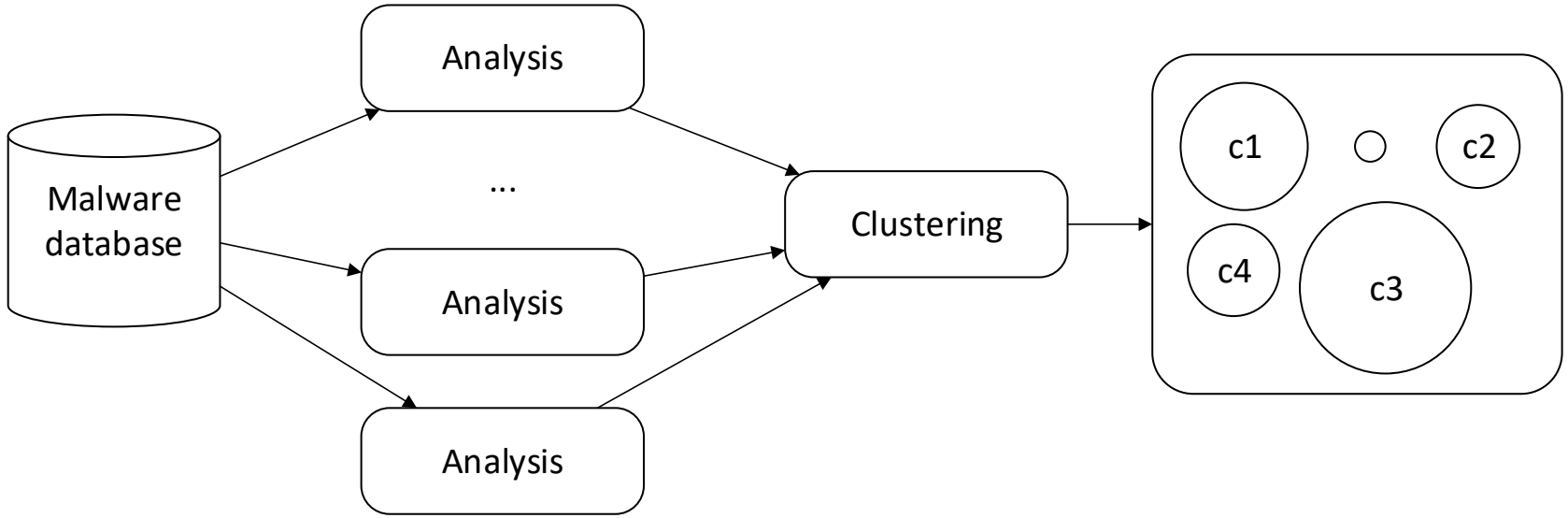


  - Transformation and similarity calculation is fast (milliseconds)
  - Result of transformation is tens of bytes

Antivirus scanner for IoT devices

- Goal: create a smaller signature database

- Binary similarity measure
- Malware clustering



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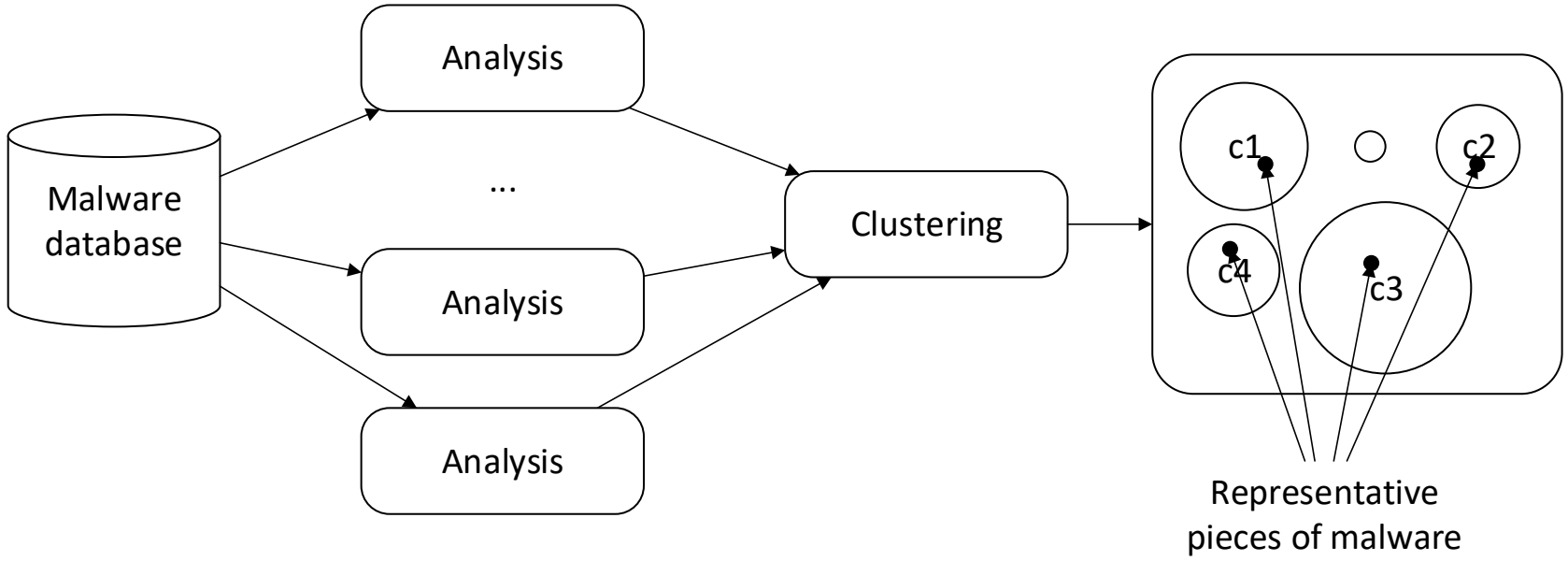

Takeaway messages

- Internet of Things enables new and innovative applications but devices face many threats
- Traditional security measures are hard to apply due to resource constraints
- CrySyS Lab and Ukatemi developed new, innovative antivirus scanner for IoT devices
  - Orders of magnitude smaller signature database
  - Computation tailored for resource-constrained embedded devices

Acknowledgement

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