

Cloud Computing Applications and Services

(Aplicações e Serviços de Computação em Nuvem)

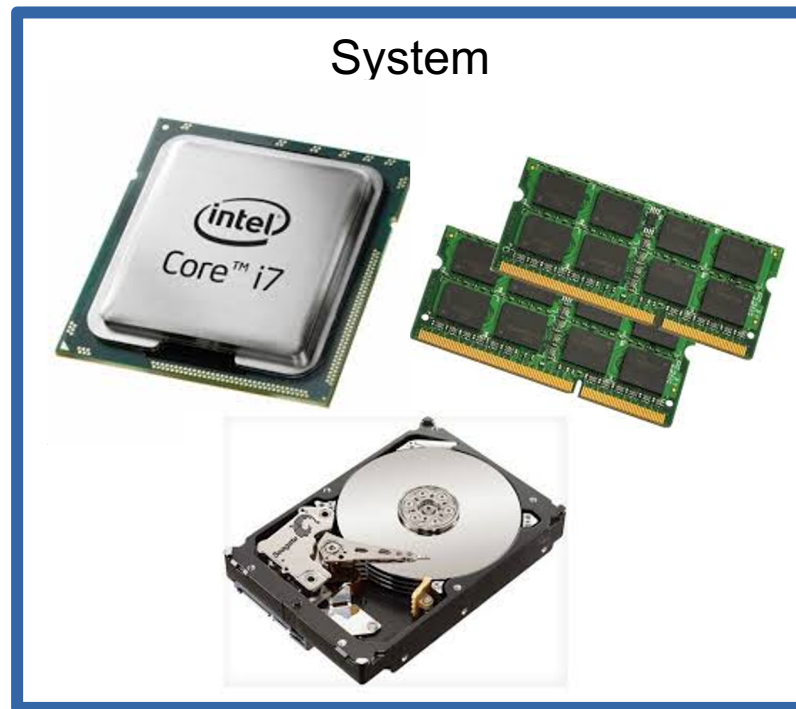
Monitoring

University of Minho
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Monitoring

- A monitor observes the activity of a system

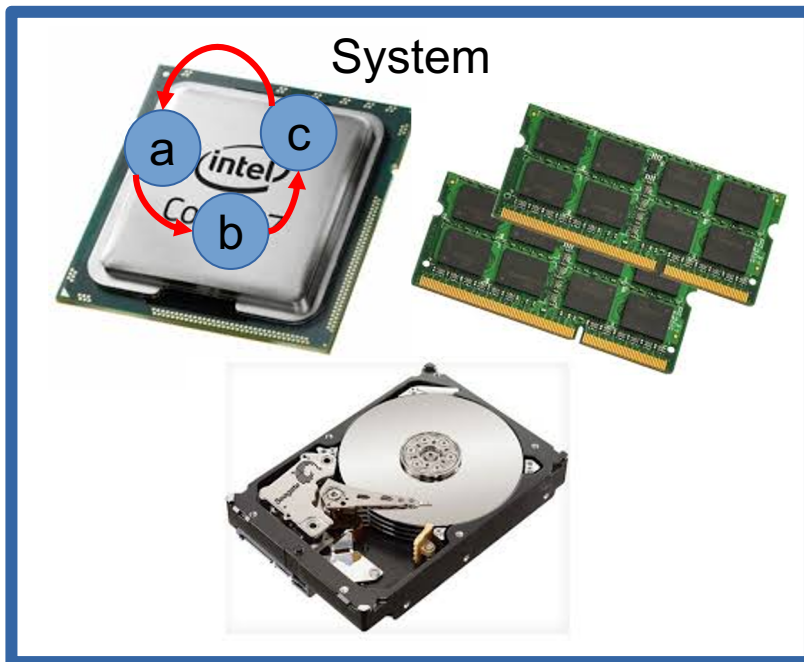


Monitor



Monitoring concepts

- A system contains physical and logical resources with state
- State changes as events
- Trace is log of events:
 - Time stamp, variable detail...



Monitor



Trace

10:00 – $a > b$
10:01 – $b > c$
...

Monitoring concepts

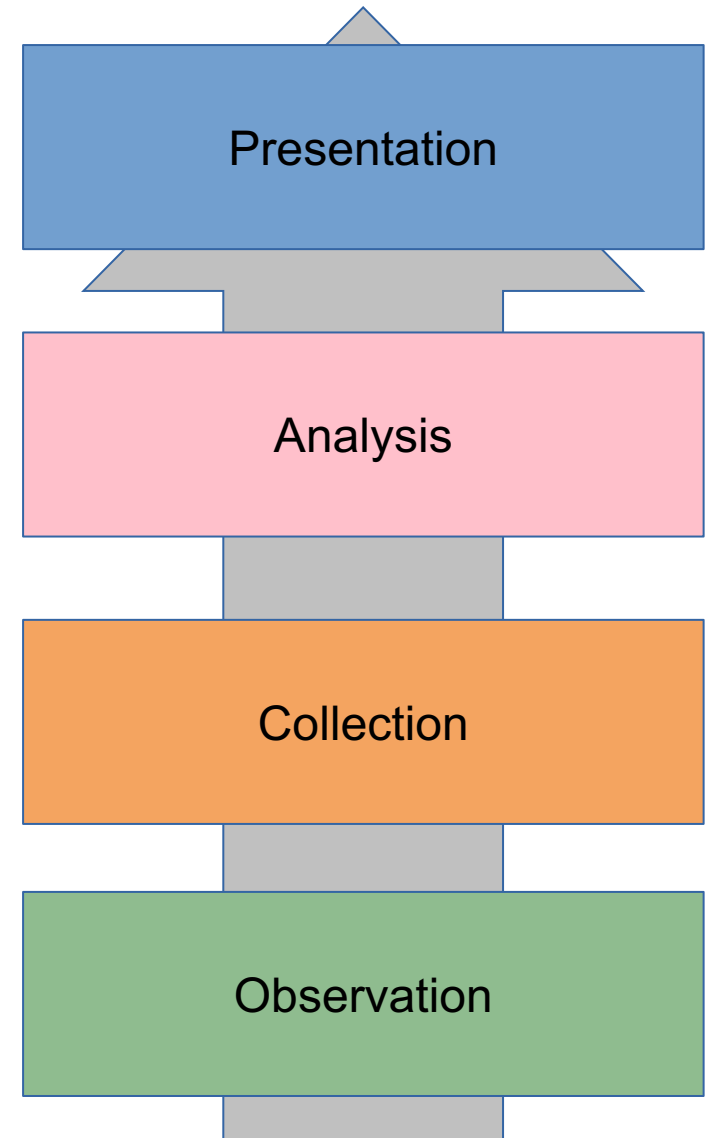
- Domain is the set of activities observed
- The detail varies:
 - In time according to the input rate
 - In scape, according to the resolution
- A monitor imposes overhead, changing the observed activity

Monitor classification

- Event-driven vs sampling: what triggers observation
- On-line vs batch: when observation is available
- Hardware vs software
- Centralized vs distributed

Monitor architecture

- Presentation produces reports, alarms, ...
- Analysis layer filters, relates and summarizes data
- Collection and normalization of data
- Observation of raw events in systems

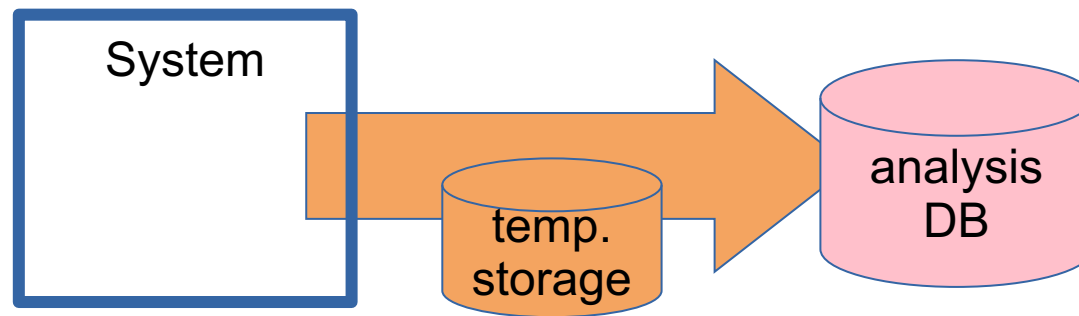


Observation

- Passive observation or spying:
 - Network sniffer
- Instrumentation:
 - Counters built in the system (hardware and OS)
 - Log generation
- Probing with additional requests:
 - Ping
- Examples:
 - beats

Collection

- Push data vs pull data:
 - Depends on configuration, legacy systems, ...
- Reliability and persistence



- Time synchronization in distributed systems
- Examples:
 - collectd, logstash

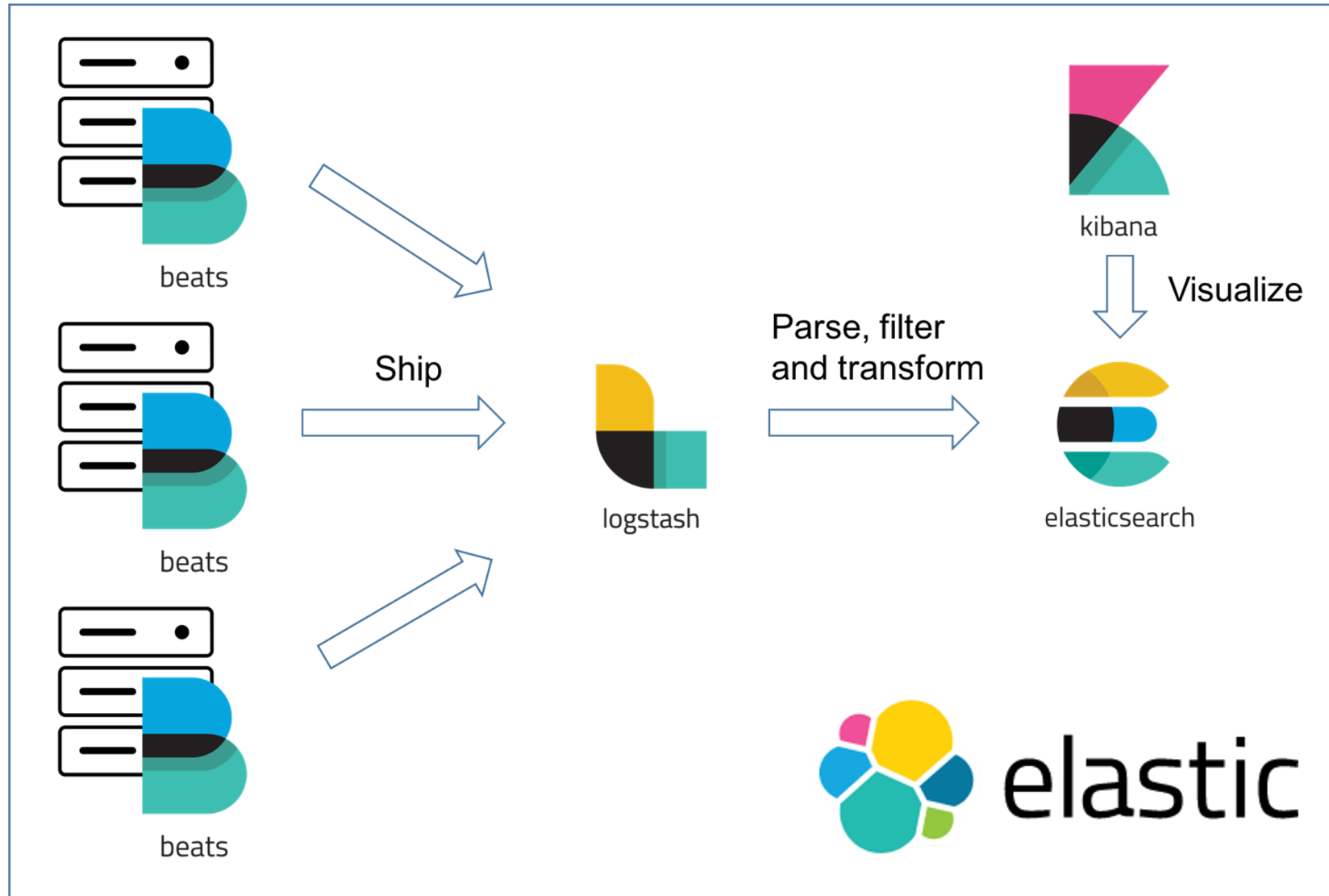
Analysis

- Data processing task:
 - Time series
 - Searching
- “Big data” in large infrastructures
- Examples:
 - Elasticsearch, Graphite

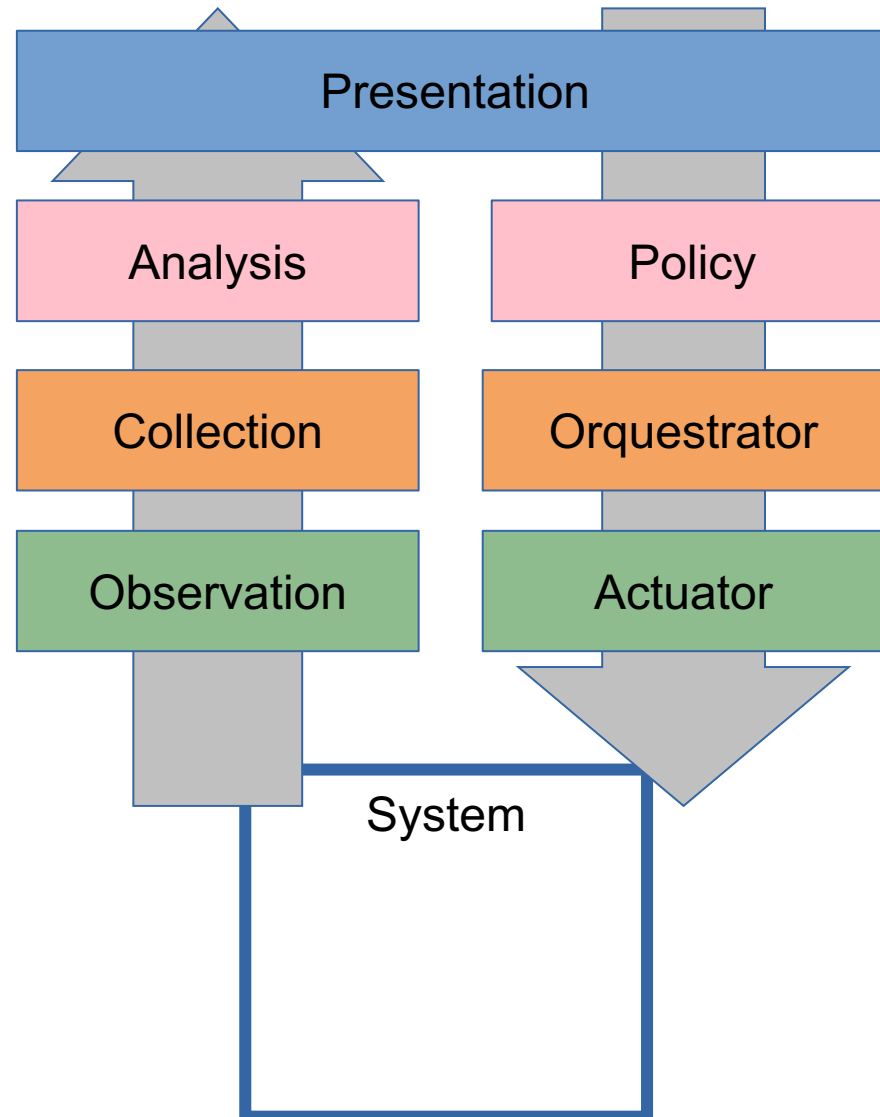
Presentation

- Goals:
 - Performance metrics
 - Error detection
 - Configuration tracking
- Results:
 - Alert generation
 - Graphical presentation
- Examples:
 - Kibana, Grafana

Case study: ELK



Monitoring and Management



More...

- R. Jain, *“The Art of Computer Systems Performance Analysis.”* Wiley, 1991.
 - Chapters 7 and 8
- Esteves T, Neves F, Oliveira R, Paulo J. 2021. CaT: Content-aware Tracing and Analysis for Distributed Systems. ACM/IFIP Middleware conference (Middleware).
- Neves F, Machado N, Pereira J. 2018. Falcon: A Practical Log-based Analysis Tool for Distributed Systems. IEEE/IFIP International Conference on Dependable Systems and Networks (DSN18).

Questions?