Selective and early threat detection in large networked systems

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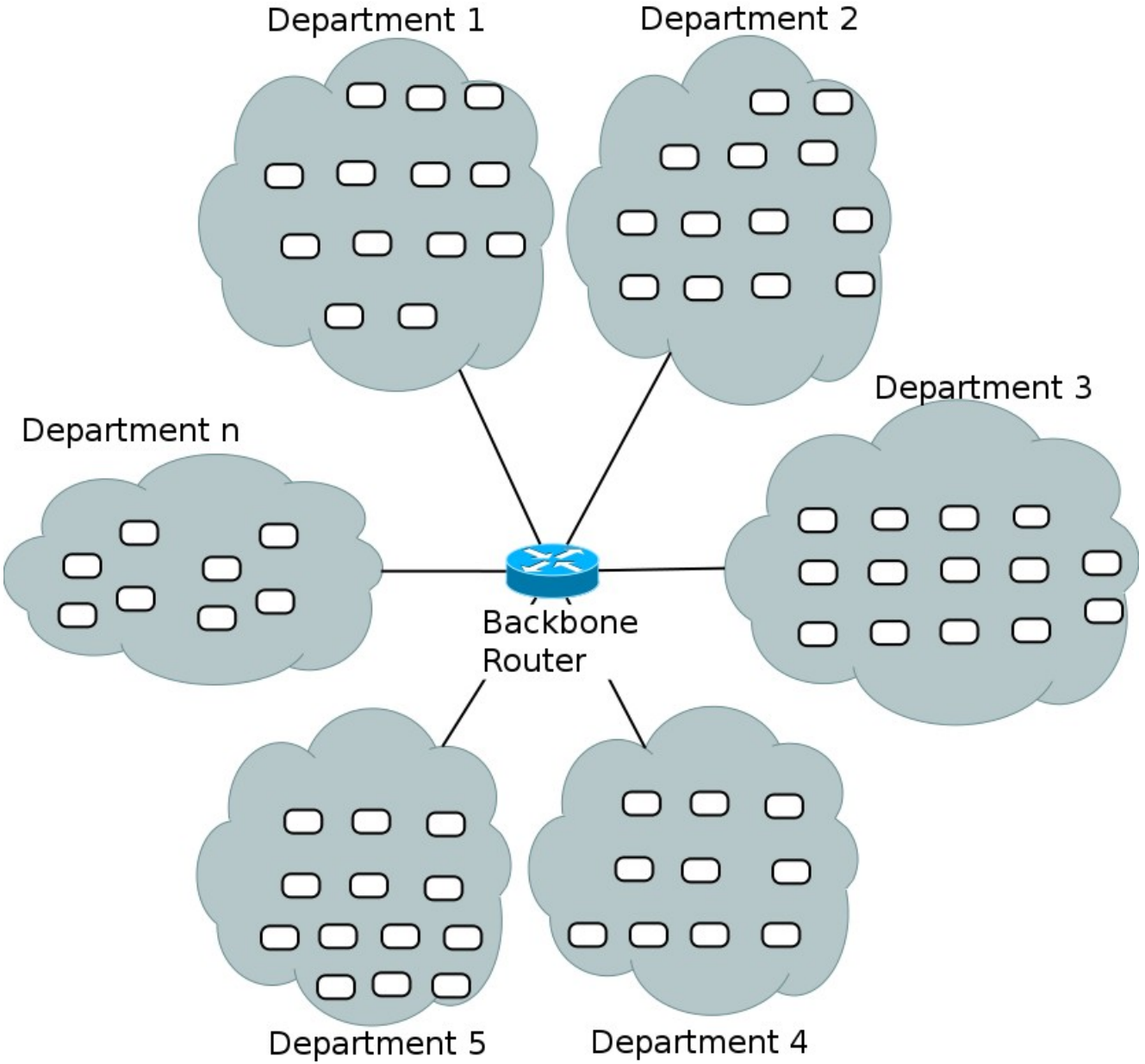
Defense scenarios



Goals

Avoid common drawbacks of Centralized and Hierarchical architectures.

- Single point(s) of failure
- Load unbalance
- Poor or no scalability

We propose:

- Hybrid communication scheme
  - Hierarchical at intra-department level
  - Peer-to-peer at inter-department level
- Distributed alert ranking scheme

Goals

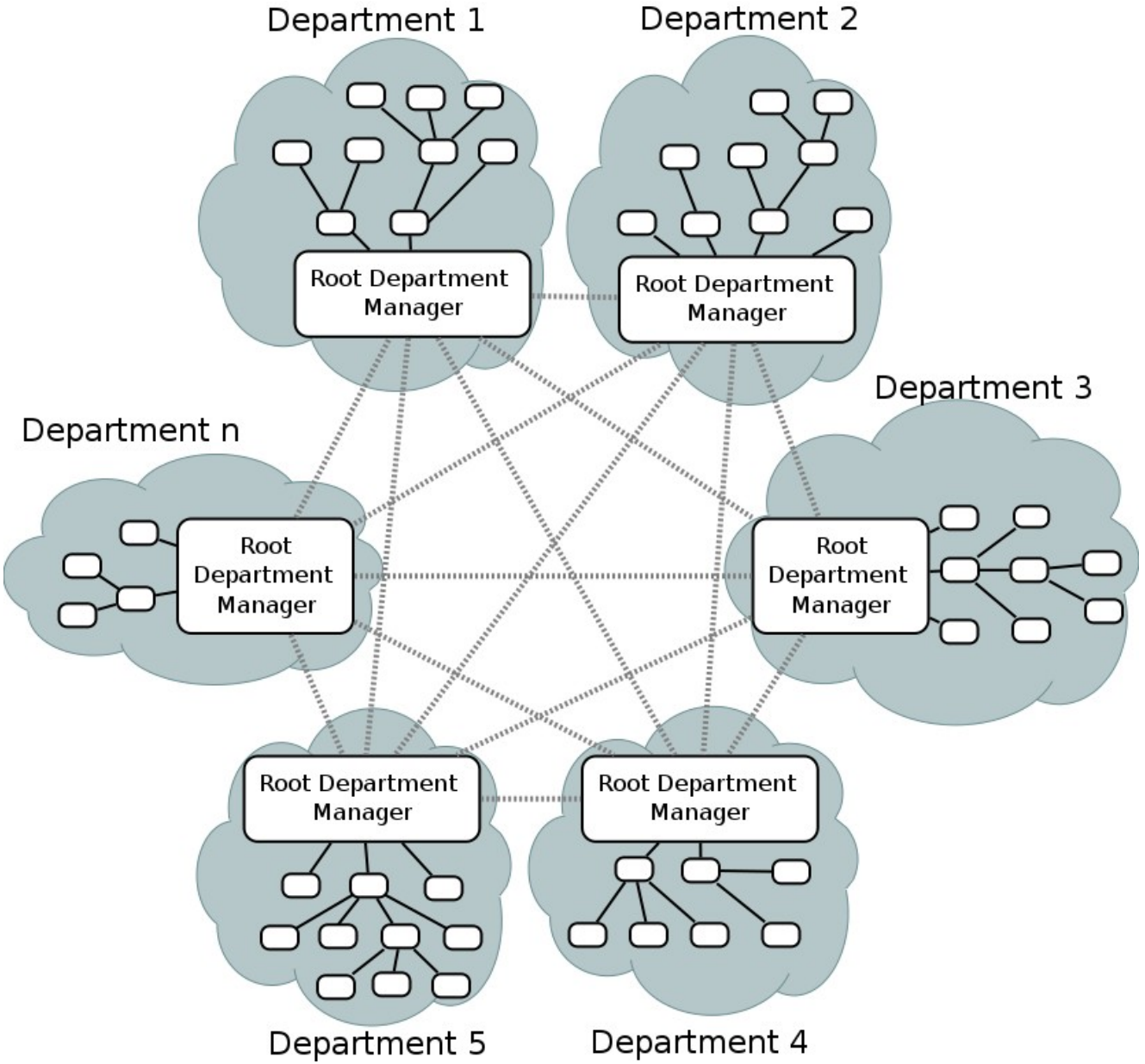
Avoid common drawbacks of pure P2P architectures.

- Complex algorithms
- Sharing/disclosure of sensitive data

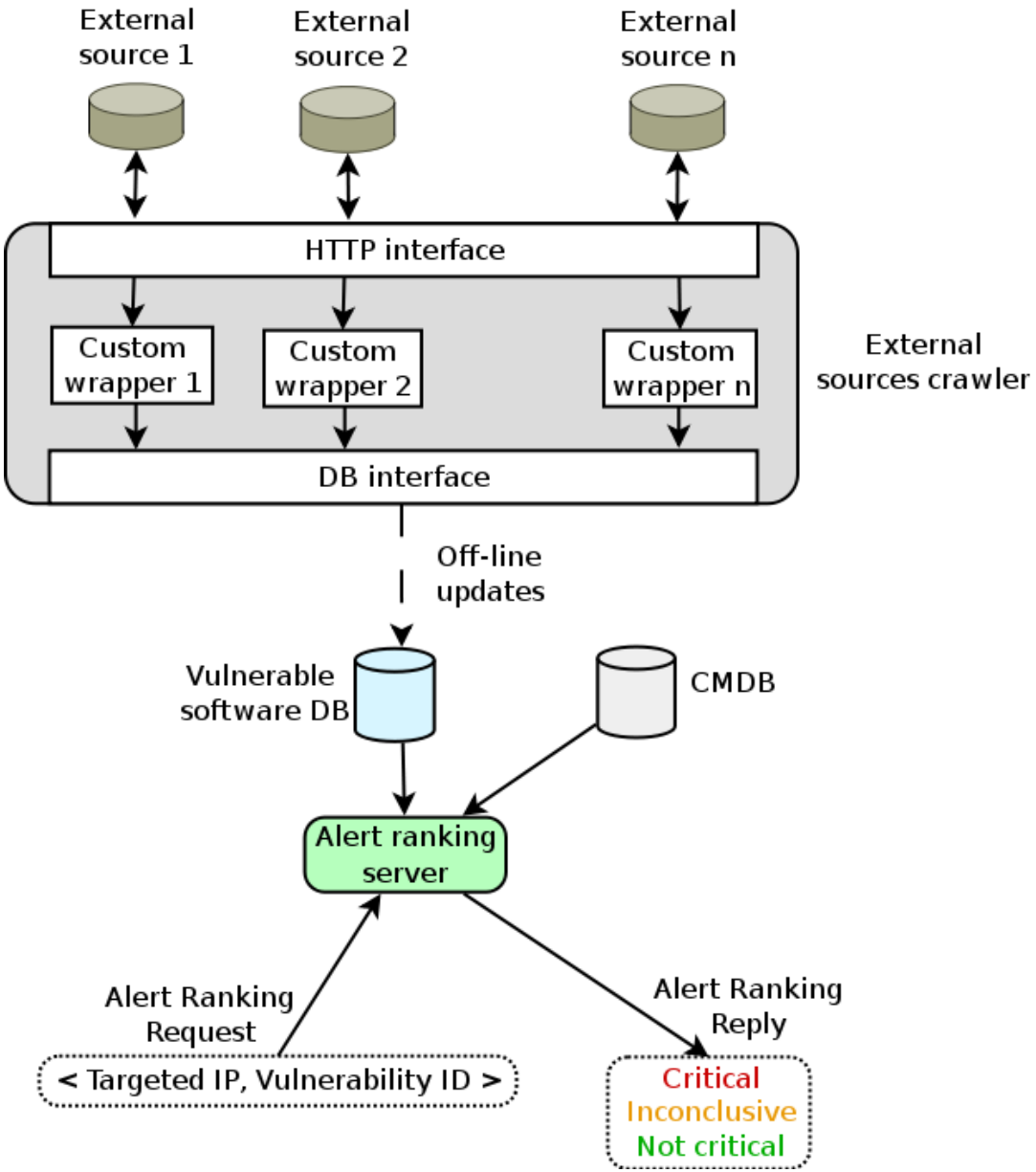
We propose:

- Hybrid communication scheme
  - Hierarchical at intra-department level
  - Peer-to-peer at inter-department level
- Selective alert sharing service

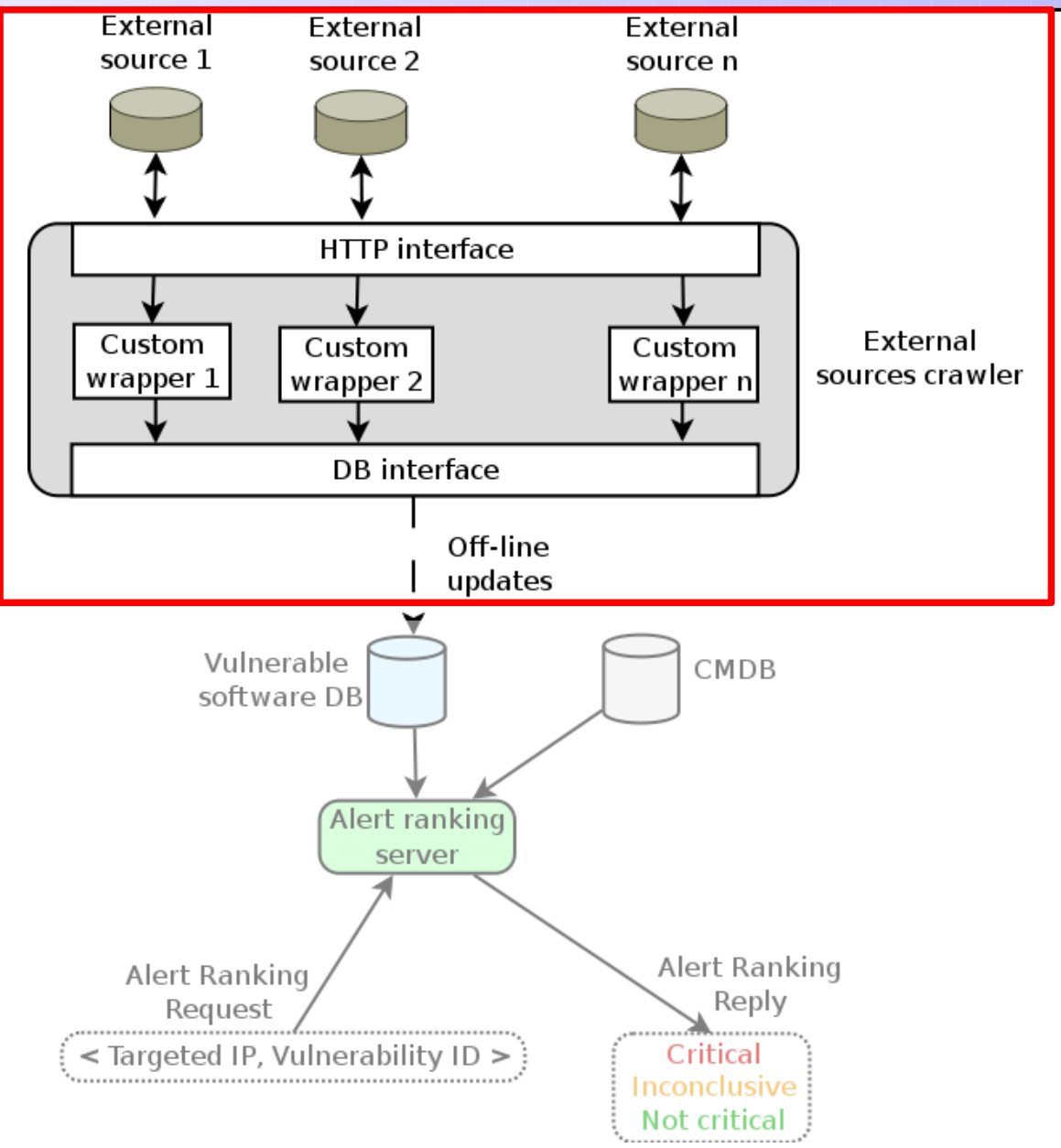
Distributed IDS with hybrid architecture



Alert ranking system



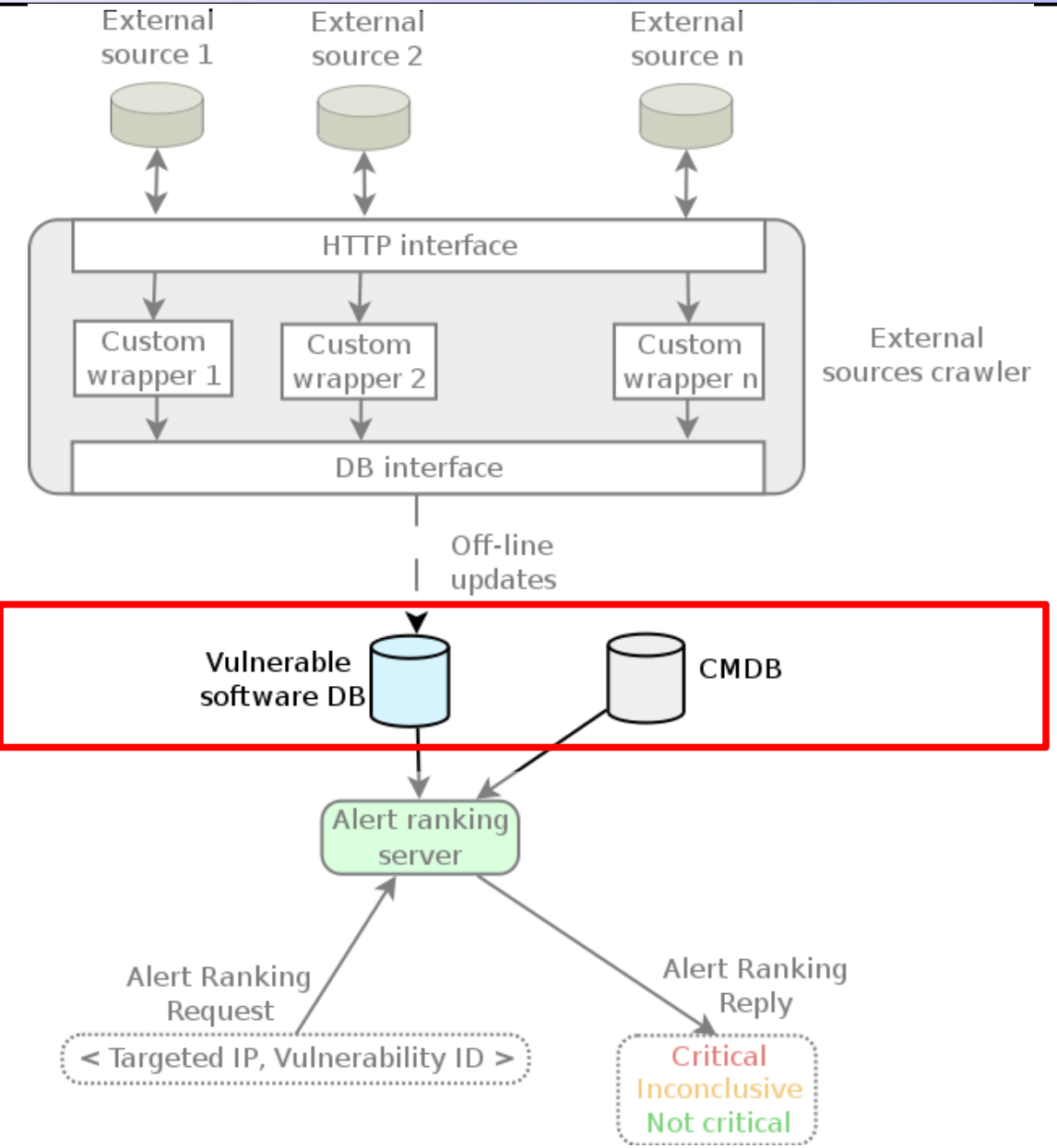
Alert ranking components



External source crawler:

- Gathers vulnerability updates from external sources
- Normalizes data

Alert ranking components



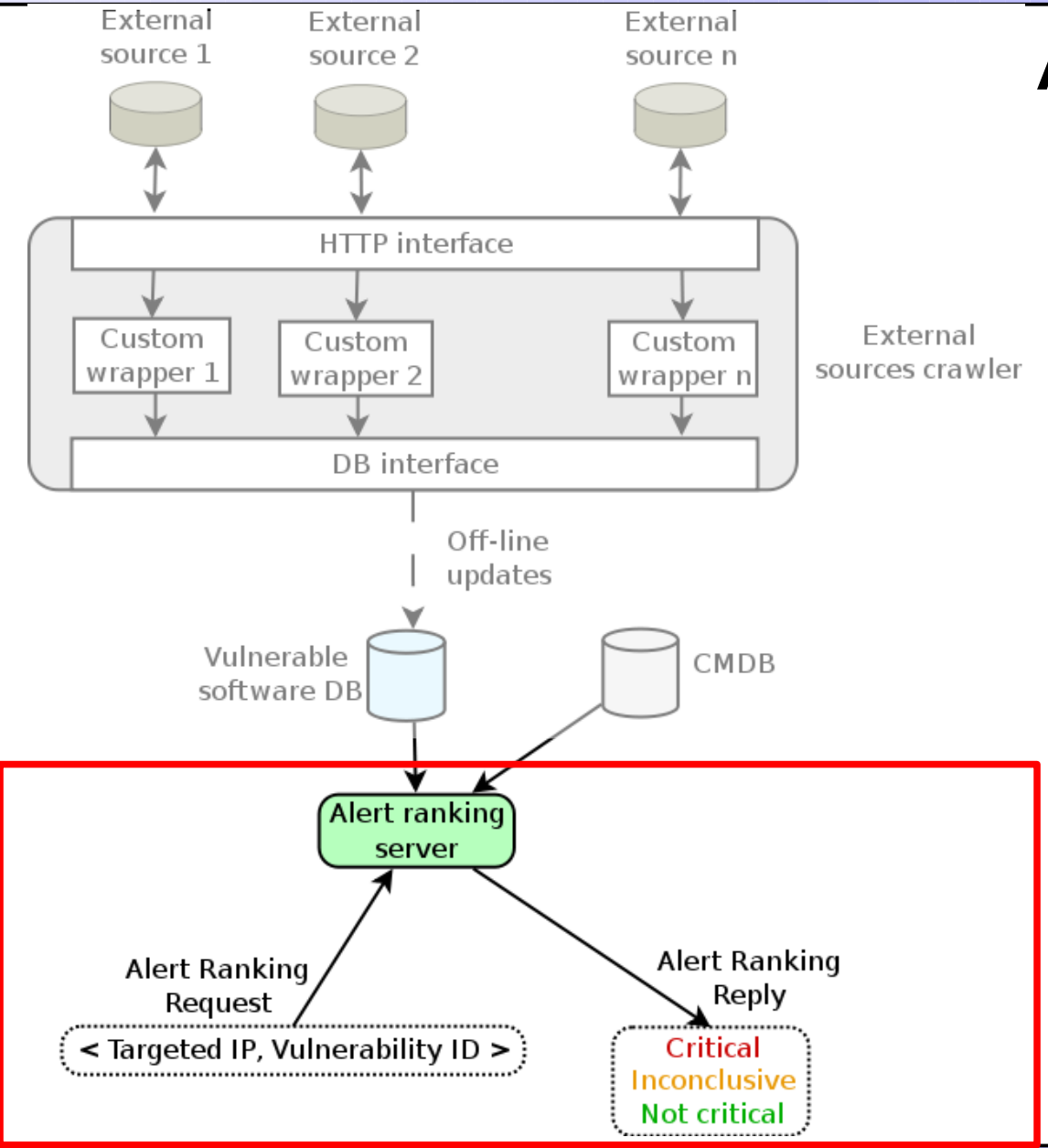
Vulnerable software DB:

- Provide fast access to vulnerable software

Configuration Management Database (CMDB):

- Authoritative information on devices, software and services
- Complete information of all IT infrastructure
- Directly managed by the administrator

Alert ranking components



Alert ranking server:

- Searches software vulnerable to the received NIDS alert
- Retrieves list of software installed on the targeted machine
- Compares results and ranks the alert:
  - Match → Critical
  - No Match → No Critical
  - Insufficient information → Inconclusive

Distributed ranking scheme

Root Department Manager:

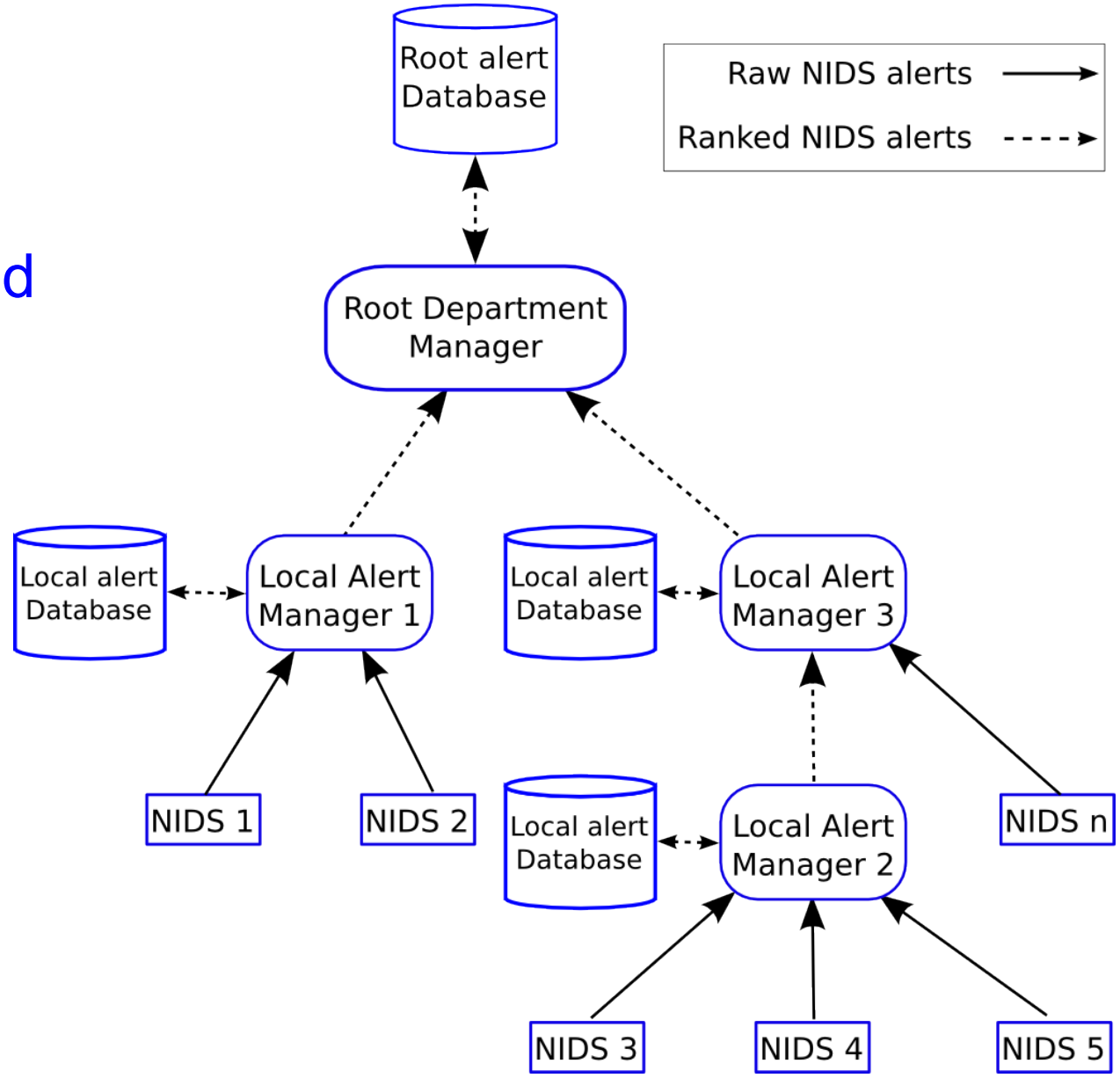
- receives already ranked alerts

Local alert managers:

- Receive and process raw alerts
- Forward ranked alerts

Distributed NIDS:

- Monitor all network segments



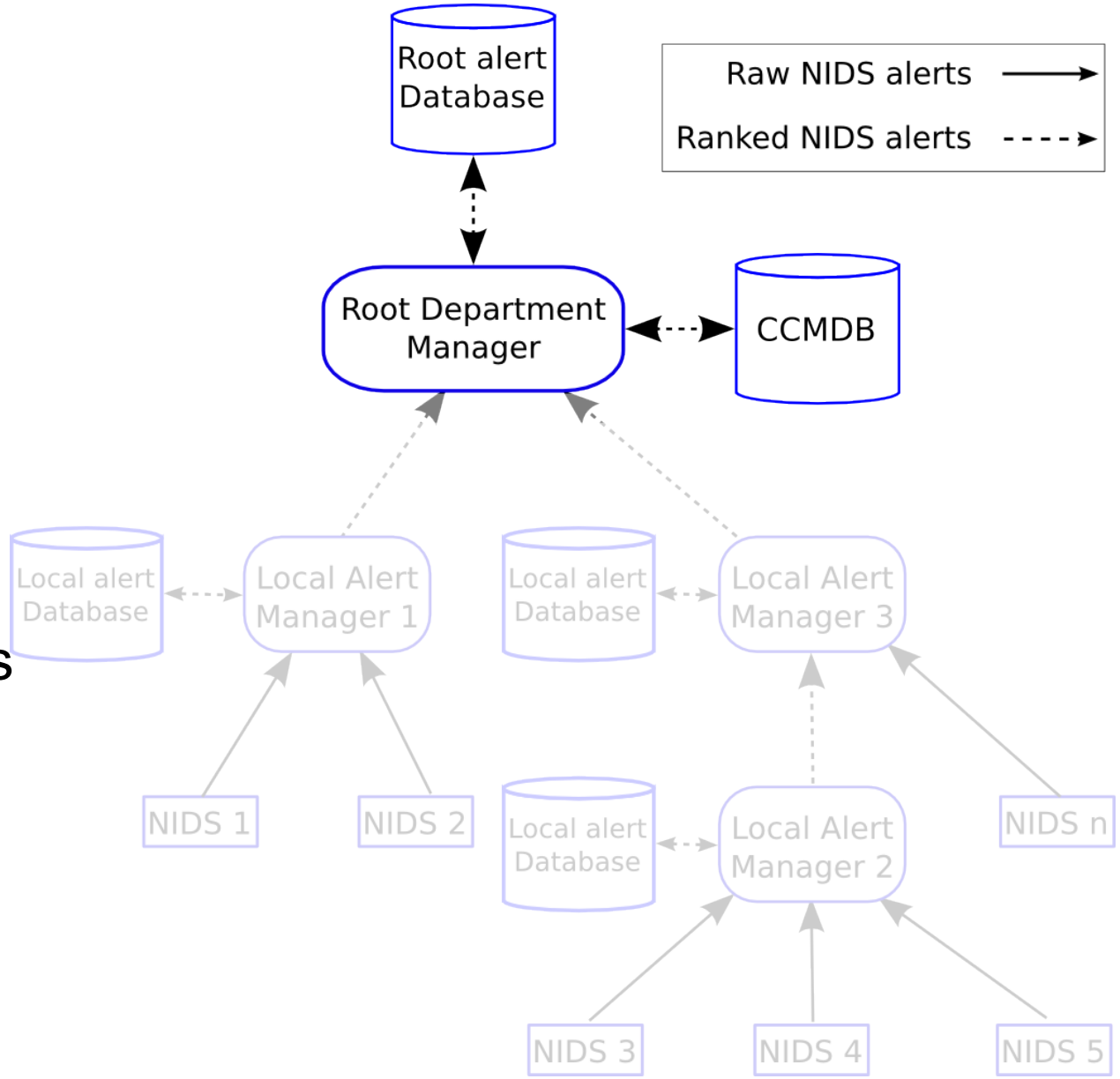
Selective alert sharing

Critical CMDB (CCMDB):

- Small subset of critical machines belonging to the IT infrastructure
- Populated on a voluntary base

Root Department Manager:

- Processes received alerts using CCMDB
- Forwards to others Departments only Critical alerts



Prototype
Present features

- Supported *External sources*:
  - CVE and Snort's SID
- *Alert ranking server* written in Python
- *Local alert manager* based on Prelude:
  - Simple implementation of hierarchical architecture
  - *Correlator module* modified to invoke the *alert ranking server*
- *Root department manager:*
  - Similar to Local alert manager
  - Implements a publish/subscribe module based on Scribe (Pastry routing scheme)
  - Graphical front-end based on Prewikka

Conclusions and future work

Conclusions

- Innovative architecture
- Fit to realistic information systems
- Provide distributed alert ranking
- Enable selective alert sharing

Future works

- Automatic populating of the CMDB
- Increase supported external sources