A Framework for Distributed Intrusion Detection using Interest-Driven Cooperating Agents

Rajeev Gopalakrishna

and

Eugene H. Spafford

Distributed IDS

“a system where the analysis of the data is performed on a number of locations proportional to the number of hosts that are being monitored” – Spafford and Zamboni

Distributed Communication Models

Event-based model

- Any entity may produce, any entity may consume events
- Symmetric roles
- Loosely connected
- Higher scalability
- Event advertisement, interest specification and event notification

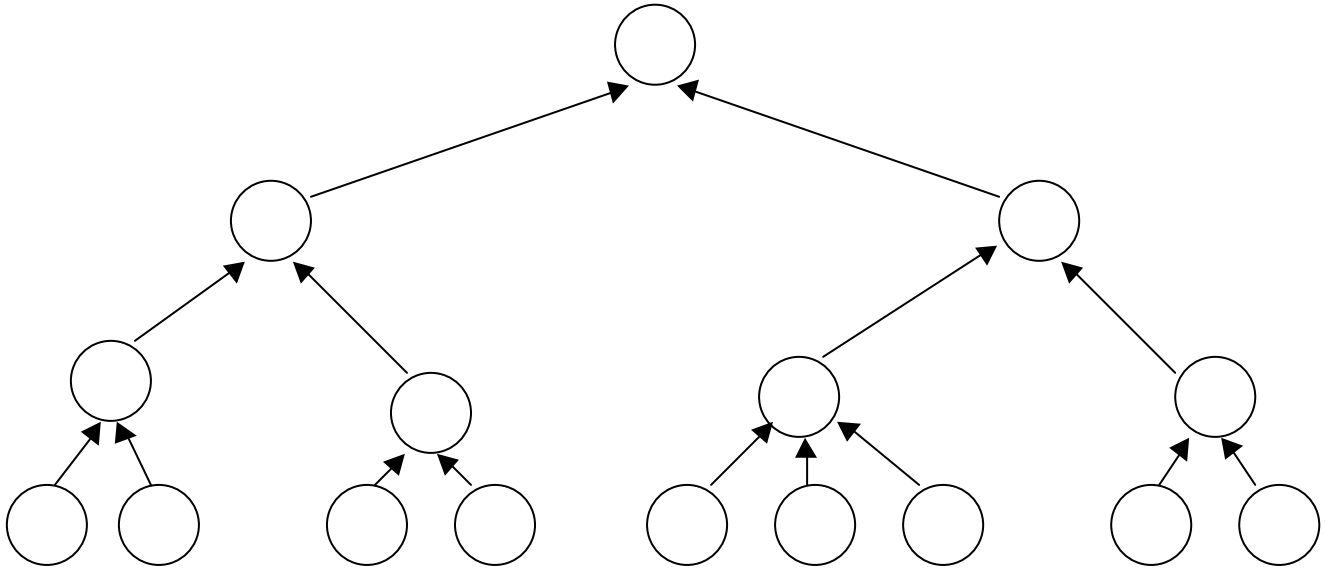
Push-based model

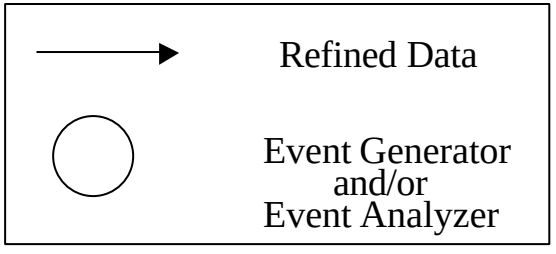
- Specific producers and consumers
- Asymmetric roles
- Logical channels
- Tighter coupling
- Less scalable

Motivation

- Concept of agents to perform intrusion detection
- Event-based communication model
- Concept of interest propagation

Generic Hierarchical Intrusion Detection Systems





Examples

- DIDS
- GrIDS
- EMERALD
- AAFID

Drawbacks

- Analysis hierarchy
- Data refinement
- Bulky modules at all levels of hierarchy
- Passive interaction

Related Work

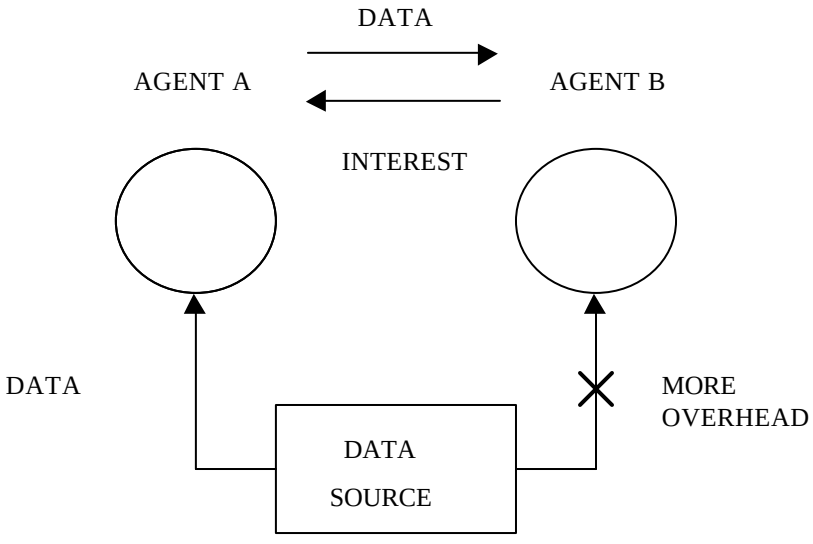
- Crosbie and Spafford
- Barrus and Rowe
- Ingram
- Mell and McLarnon
- CARDS

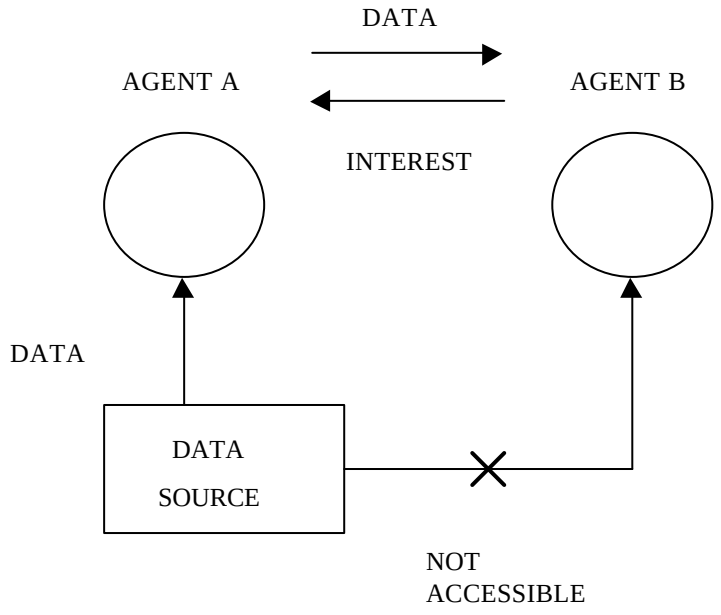
Our Approach

- Agents
- No analysis hierarchy
- Intelligent cooperation using the concept of interests
- Interest propagation
- Active communication
- Lightweight modules at all levels of hierarchy

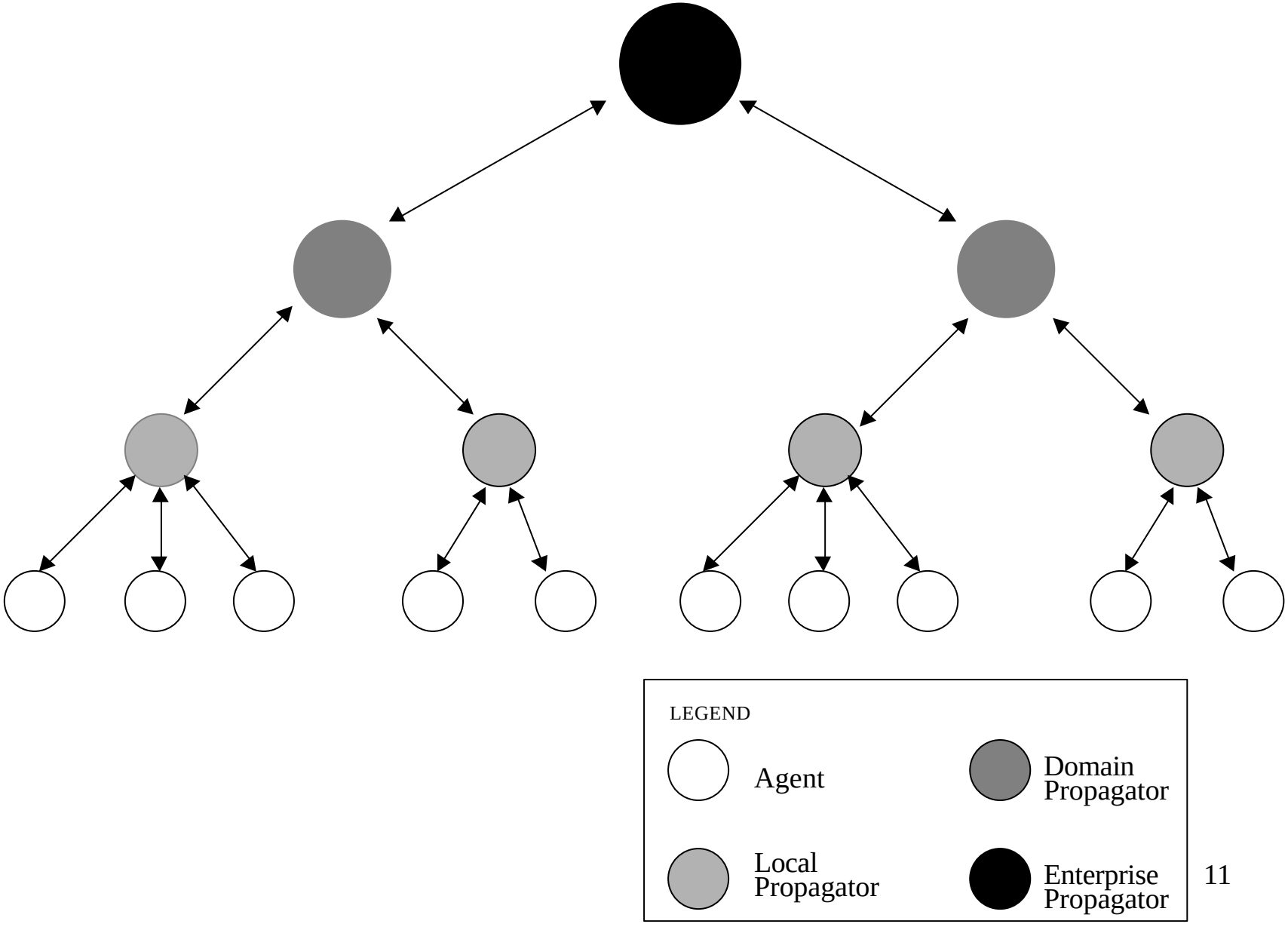
Interest

"a specification of data that an agent is interested in, but is not available to the agent because of the locality of data collection or because the agent was not primarily intended to observe those data"





Interest Propagation



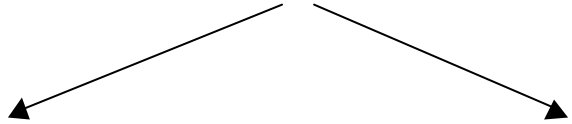
Types of Interests

- Directed or Propagated Interests
- Local, Domain or Enterprise Level Interests
- Permanent or Temporal Interests

Granularity of Interests

- *Event* vs. *Alert*
- *Curiosity level*
- Adds dynamism to agents
- Reduces overhead

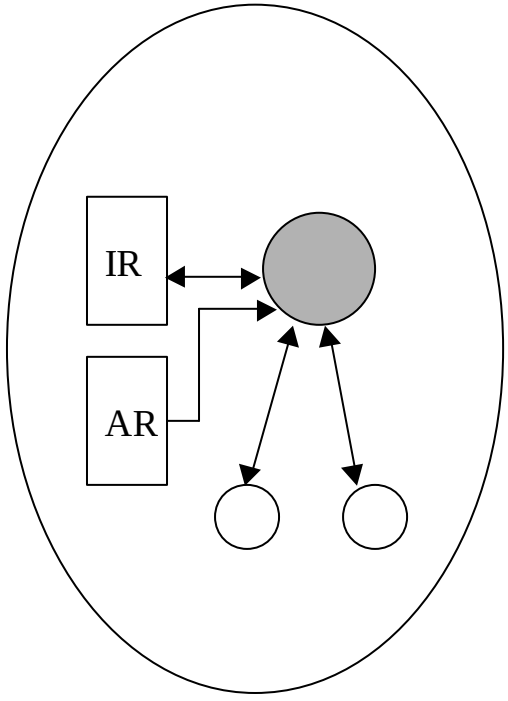
Data Delivery



Hierarchical delivery **Direct delivery**

- Failure of modules
- Scalability
- Data Coalescing

Host



IR - Interest Registry

AR - Agent Registry

Other Considerations

- Security of Agents
- Clock Synchronization
- Redundancy of Propagators

Future Work

- Implementation of the framework
- Explore alternatives for implementing the interest mechanism
- Impact on size of agents and on host and network performance