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Composition of a DIDS by Integrating Heterogeneous IDSs on Grids

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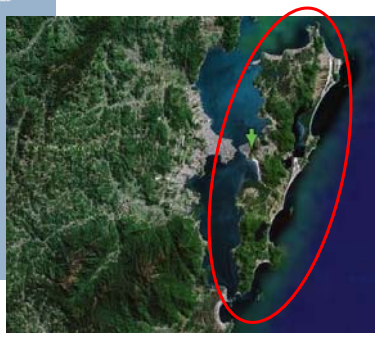

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Outline

- Introduction
  - Integration of Intrusion Detection Systems
  - Distributed Intrusion Detection Systems
- The proposed model
- Implementation
- Experiments
- Conclusions and future work

Intrusion Detection Systems

- Intrusion Detection Systems (IDSs) aim at identifying misuse or anomalous behavior of computer systems
  - Network IDS
  - Protocol-based IDS
  - Application Protocol-based IDS
  - Host-based IDS

Integration of IDSs

- Several IDSs are available in the market
  - Each system has advantages and weaknesses
- Distributed intrusions and attacks
  - Coordinated distributed attacks
  - Information from multiple networks is needed to detect these types of attacks
- The interoperability/integration of different IDS components would improve the time to market of IDSs

Distributed Intrusion Detection Systems (DIDS)

- Allow the correlation of intrusion information from multiple hosts, networks and/or administrative domains
- Help in identifying coordinated attacks
- Can enable a detailed examination of how these attacks progress
- Require a high degree of coordination

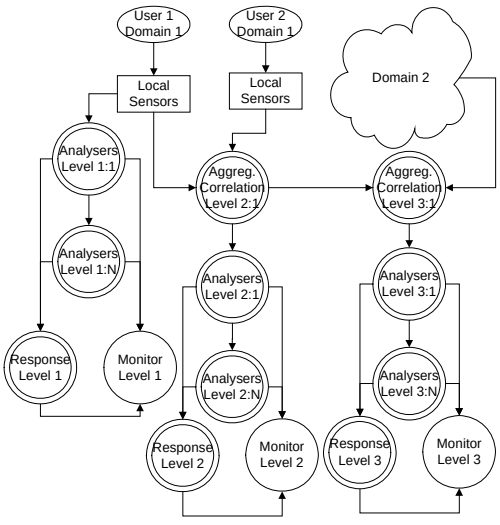
Grid Computing

- Allows the aggregation and sharing of resources spanning multiple administrative domains
- Supports the development of distributed applications and coordination in distributed environments
- Enables the encapsulation of existing IDSs as resources to compose an DIDS

Proposed Model: DIDSoG

- Distributed Intrusion Detection System on Grid
  - A model for integrating heterogeneous IDSs
  - Use of Grid computing for such an integration

DIDSoG: Architecture



- DIDSoG presents a hierarchy of intrusion detection services
- It is organized in several levels of "Scope:Complexity"

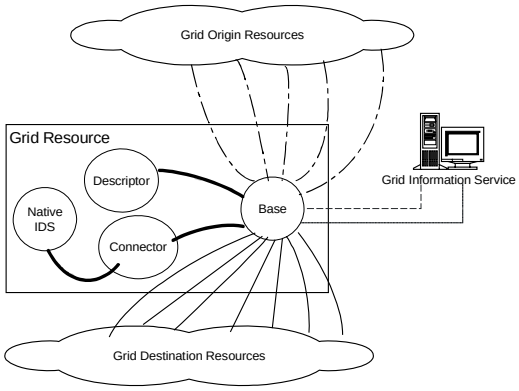
DIDSoG: Architectural Goals

- Resources can act on data from multiple sources (scopes)
- Distribution of the processing activities among several resources (complexity)
- Hierarchical organization:
  - Processing and analysis is performed in phases
  - No resource has full knowledge of the system
  - Existing IDSs can be integrated to DIDSoG
  - Different levels can be managed by different entities

DIDSoG: Resources

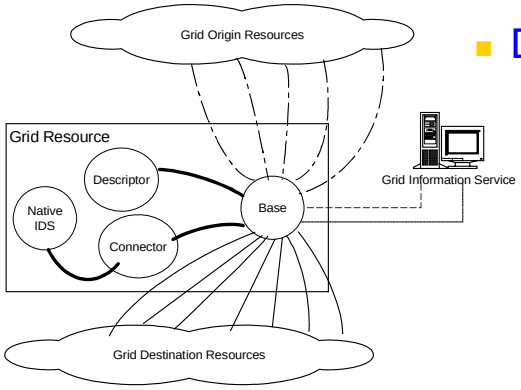
- A DIDSoG Resource:
  - Encapsulates an existing IDS
  - Receives data from other DIDSoG Resources
  - Process the received data using the encapsulated IDS
  - Generates and sends output data to a destination DIDSoG Resource

DIDSoG Resource: Main Components



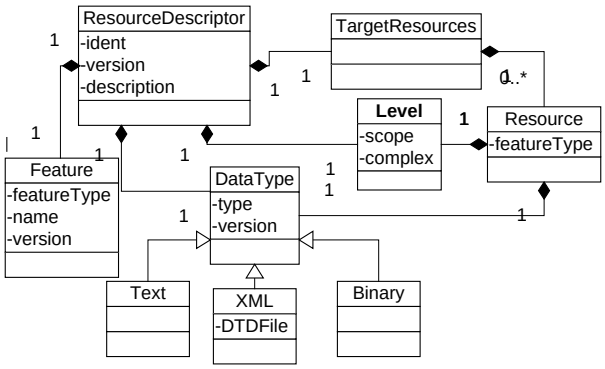
- Base
  - Communication with other resources and with the GIS
- Native IDS
  - The encapsulated IDS
- Connector
  - Information translation

DIDSoG Resource: Main Components



- Descriptor
  - Contains the information that identifies the resource and the destination resource

Descriptor: Resource Information

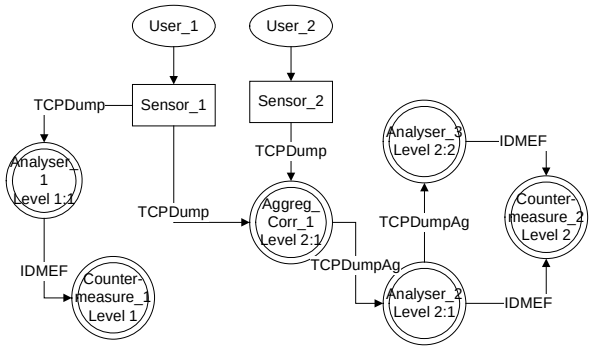


- Features
- Level
- DataType
- Target Resources

Implementation: Description

- GridSim Toolkit 3.3
- Architecture components:
  - Base: DIDSoG_BaseResource
  - Descriptor: DIDSoG_Descriptor
  - Connector: from DIDSoG_BaseResource
  - Native IDS: implemented by IDS
- Simulation of the processing activities of a Native IDS

Experiments: Simulated Environment



- Sensors 1 and 2 generate TCPdump like data
- Analyser_1 generates alerts at attempts to connect to port 23
- Aggreg_Corr_1 aggregates data from sensors 1 and 2
- Aggreg_Corr_1 passes the information to Analyser_2, which verifies if a host is trying to connect to the same port number in multiple hosts

Experiments: Observations

- Heterogeneous IDSs are integrated in a hierarchical way
- Difficult to evaluate the proposed architecture by simulation
  - Simulated IDSs
  - Integration of existing IDSs
  - Use of network traces
- Test and evaluation of DIDSoG
  - Emulation of a Grid environment
  - Test of the DIDS on a Grid test bed

Conclusions

- An architecture for integrating heterogeneous IDSs to compose a DIDS has been proposed
- Components have been modelled using GridSim
- Resources act in a collaborative way, forming an Intrusion Detection Grid
- Resources providing different intrusion detection services were integrated
  - Analysis, correlation, aggregation and alert

Future Work

- Deployment of the model
  - Use of a emulated Grid or a Grid test bed
  - Traces of network events
- Parallel analysis of data
  - Evaluate the performance of the model
- Economic aspects
  - Incentives for IDSs from multiple organizations to cooperate with one another in a Intrusion Detection Grid

Questions

Thank you!

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