Secure Virtual Enclaves

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Outline

- **Project Overview**
- SVE Architecture
- Observations
- Results/Conclusions

Coalition Examples

- *Commercial*: outsourcing, contractors, or customers needing limited access to corporate data
- *Civilian*: disaster/incident response teams and crisis management
- *Military*: joint task forces engaged in distributed collaborative planning

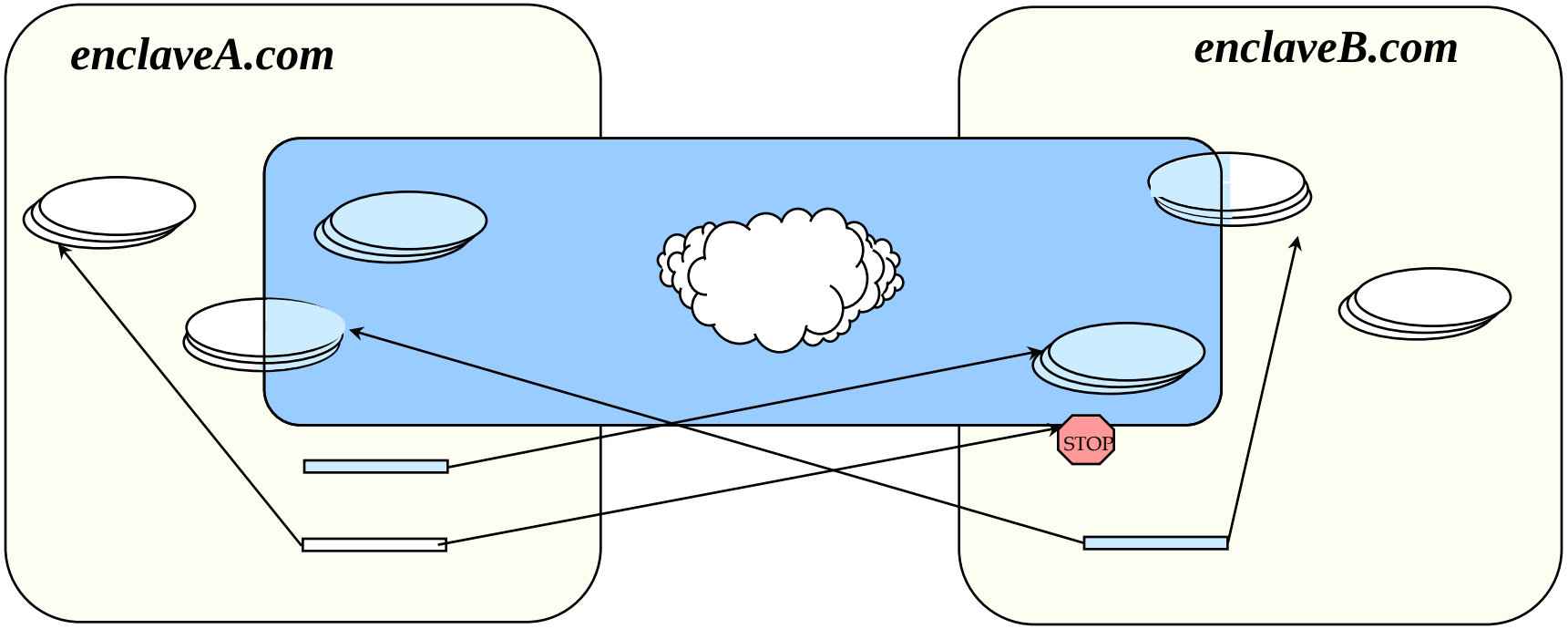
SVE Project Goals

- Support collaborative computing
- Provide mechanisms to control sharing
- Enable unified approach to multiple distributed application technologies (e.g., Java, DCOM, web apps.)
- Support dynamic access policies, allowing changes to: SVE membership, resources to be shared, and access types permitted

SVE Project Constraints

- Ensure application transparency
- Retain organizational autonomy over local resources
- Use only standard network protocols
- Use only commercially available operating systems

Concept of Operation



Legend:

Services in SVE
Services partly in SVE
Services not in SVE
Principals in SVE
Principals not in SVE

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SVE Concept of Operation

- Virtual enclave: formed by collaborators sharing resources and services
  - Enclaves define limited trust relationships with one another
  - Each enclave specifies internal resources accessible to partners
- Secure virtual enclave: each enclave's exports are
  - Protected from access by non-SVE members
  - Available to SVE members as specified by access policy
- Dynamic modification: automatic reconfiguration due to changes in SVE membership, resources, access policy

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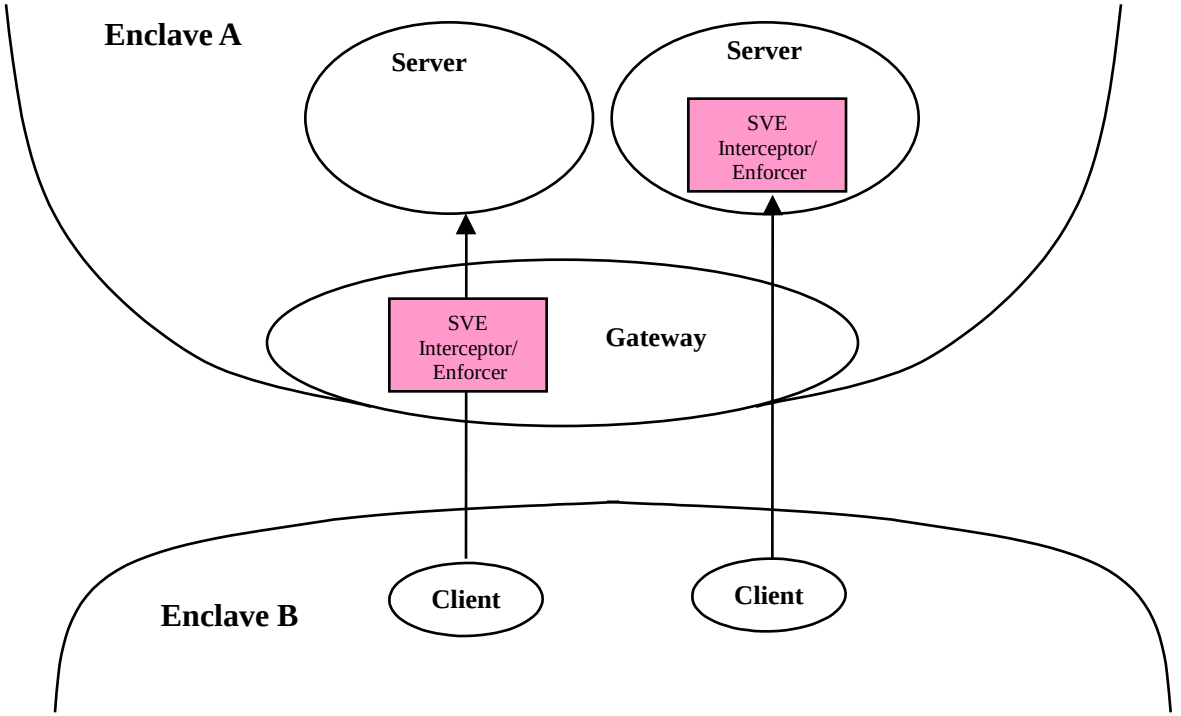
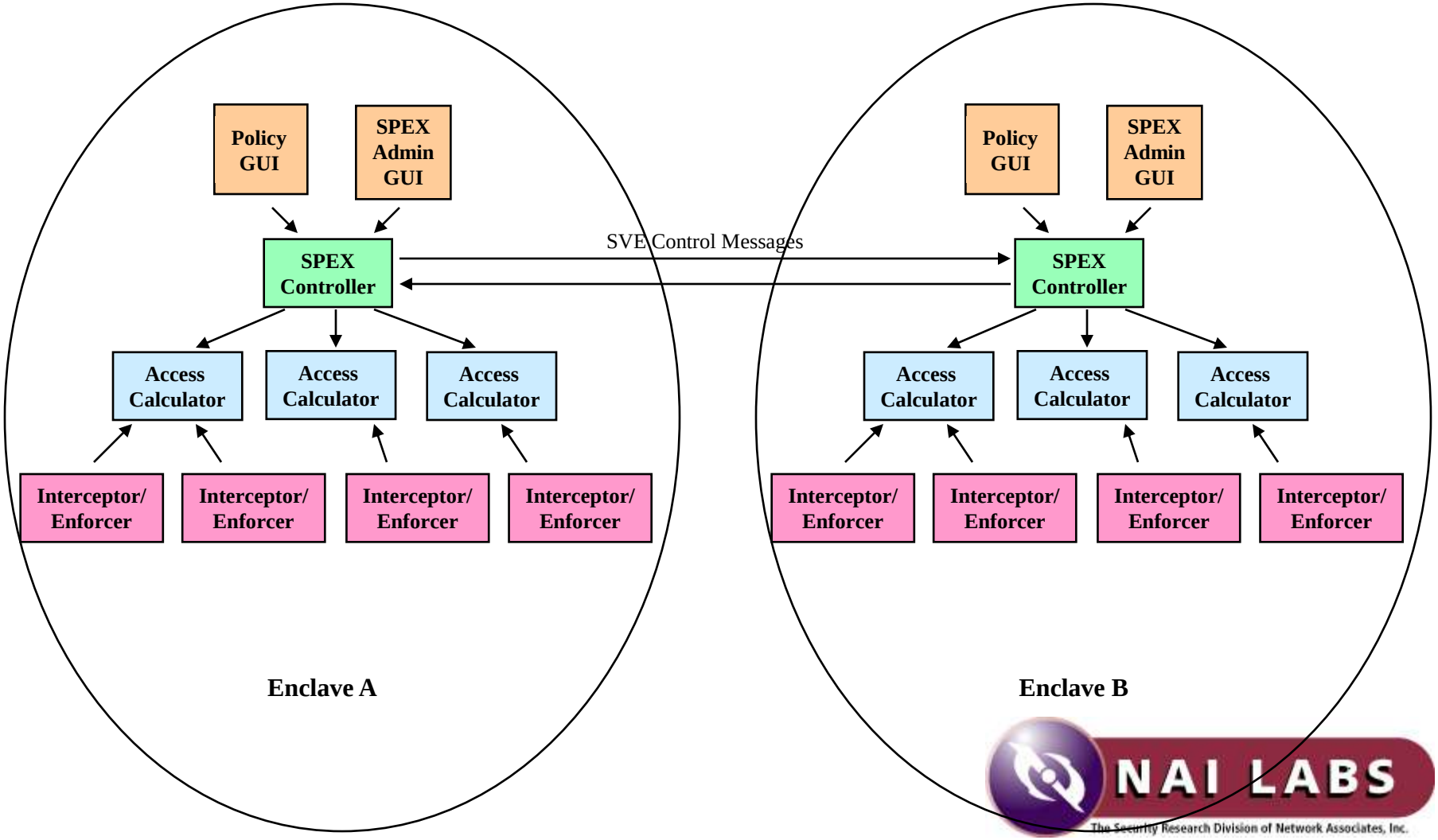
Client-Server Architecture



SVE Infrastructure Architecture



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SVE Policy Semantics

- Current SVE policy semantics are very similar to Object-Oriented Domain and Type Enforcement (OODTE)
- Principals are mapped to a **domain** equivalence class using a set of domain derivation rules
- Resources are mapped to a **type** equivalence class
- **Access matrix** is formed by associating a set of types with a given domain
- **Principal recognition rules** are domain derivation rules that are published by an SVE member to allow its principals to be recognized by other SVE members

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Enclave Autonomy

- Organizations require a certain level of autonomy
- Autonomy is a difficult requirement for distributed security systems
- SVE system supports autonomy
  - Most components of access policy used only within the local enclave
  - An enclave may unilaterally withdraw from an SVE at any time
- Need to balance autonomy and collaboration requirements via business decisions

Ambiguous Policy Semantics

- Meaning of policy statements known only within defining enclave (e.g., “manager” role)
- How to prevent misunderstandings as coalitions are formed???
  - Establish semantics offline
  - Represent and negotiate semantics within system

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SVE Prototype Results

- Supports coalition sharing
- Supports dynamic changes to both coalition membership and resource access policies
- Supports enclave autonomy
- Provides experimental platform for studying security policies for distributed systems