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The Security Architecture Discipline as Catalyst to Effect Secure Design: Employing Abuse Case Elaboration for Attack Vector Discovery and Countermeasure Determination

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Context

- Architecture informs the design of complex objects that, in turn, facilitates their manufacture and implementation.
- In the absence of architectural rigor, the design, implementation and maintenance of these objects in a steady-state become untenable, as does object reliability.
- Secure system design is an outcome of security architecture such that the implementable object is well-behaved, resistant to external attack, and free of internal anomalies that would otherwise jeopardize functional integrity.
- Intelligent, web-based agents represent an emerging trend in delegated trust such that they act, and behave, in a manner congruent with the instructions - and intuitions - of their human counterparts.
- This session will look at security architecture artefacts in the context of intelligent, web-based agents.

Session Components

Context

- Security Architecture Elicitation
- Security Architecture Artefact Manufacture

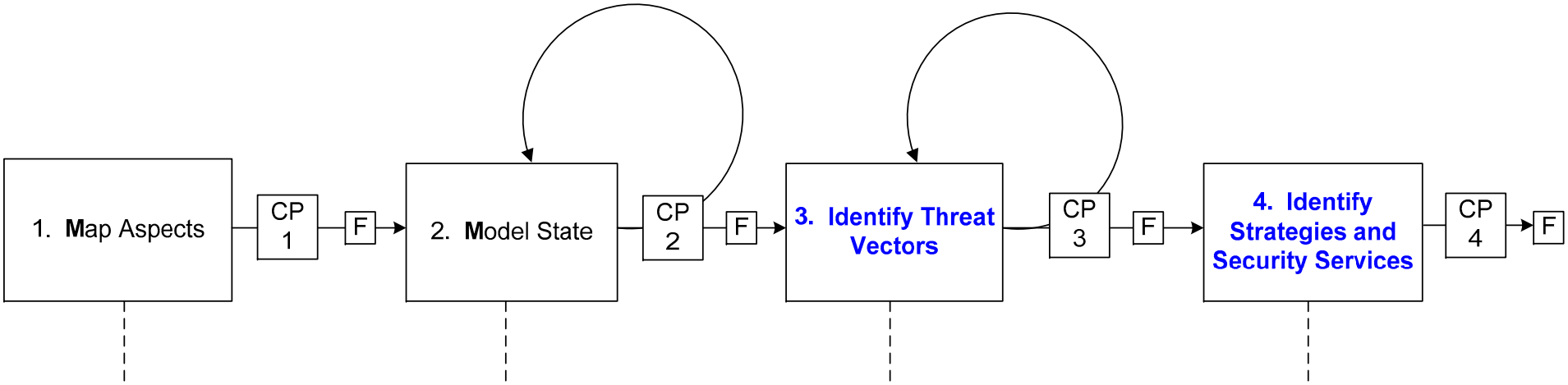
Business Architecture

- Enterprise Context Model
- Service Integration and Accountability Model

Logical Architecture (Security Viewpoint)

- Conceptual Architecture Pattern
  - Components View
  - Relationships View
- Class Diagrams and Derivatives
  - NonPersonEntity
  - NonPersonEntity Attack Vector Articulation
  - NonPersonEntity Abuse Case Notation
  - PersonEntity + NonPersonEntity + Service (Normative “Happy Path” Automation Target)
  - PersonEntity + NonPersonEntity + Service (Anomalistic Behaviour)
- Use and Abuse Case Scenarios

Security State Modeling Elicitation Process



- Data-to-Security Classification Mapping
- Data Disposition-to-Zone(s)
- Role-to-Data-to-CRUD Attribution
- Role-to-Zone
- Location-to-Zone

- Aspect Placement
- Data In-Transit
- Data At-Rest
- Data In-Process

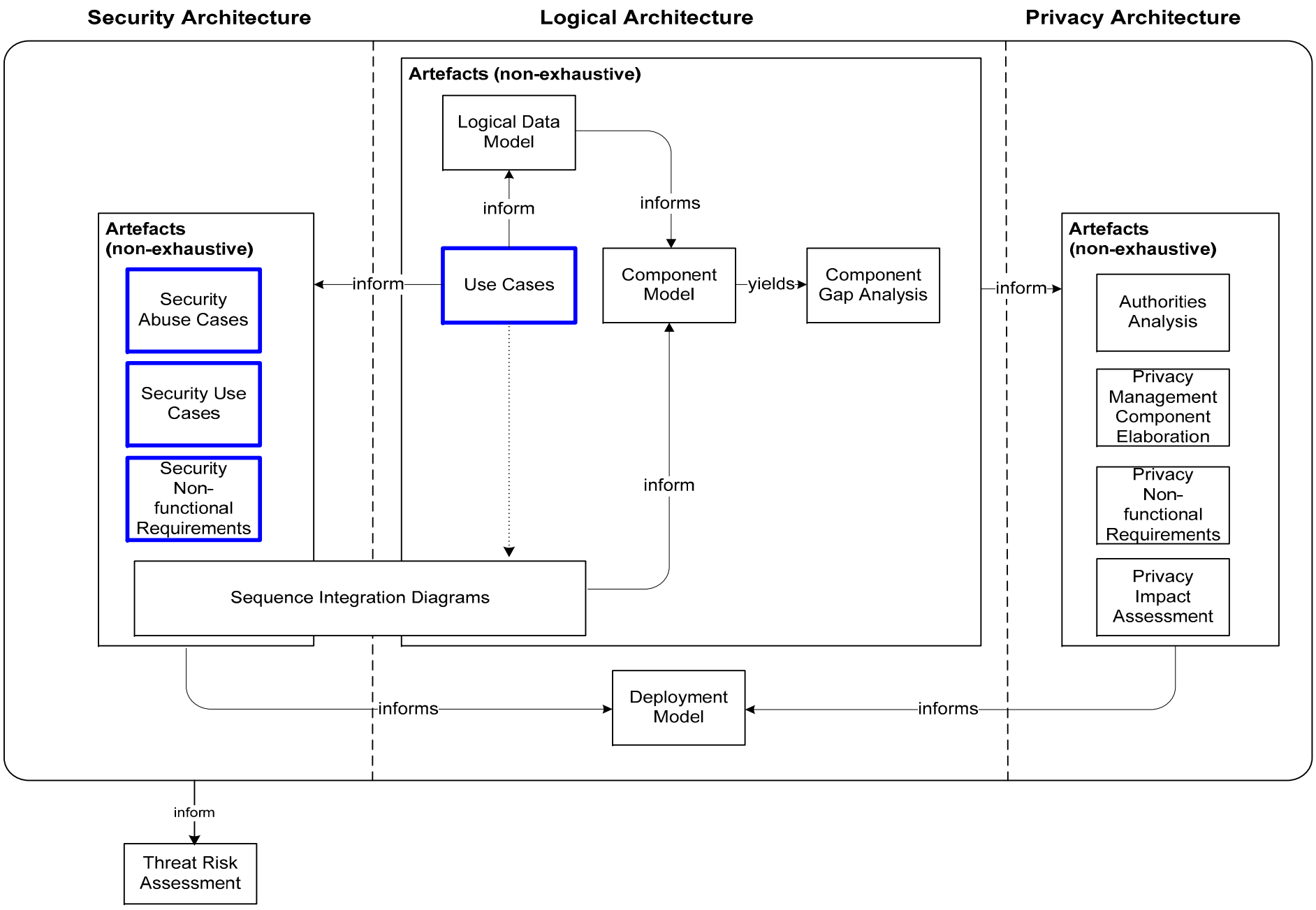
- **Develop Abuse Cases**
  - **Confidentiality**
  - **Integrity**
  - **Availability**
  - **Identification**
  - **Authentication**
  - **Authorization**
  - **Non-Repudiation**

- **Develop Security Use Cases**
- **Identify Strategies**
  - **Prevent**
  - **Contain**
  - **Detect and Notify**
  - **Collect and Track Events**
  - **Recover and Restore**
  - **Assure**
- **Identify Security Services**

Legend

CP – Checkpoint
F - Freeze

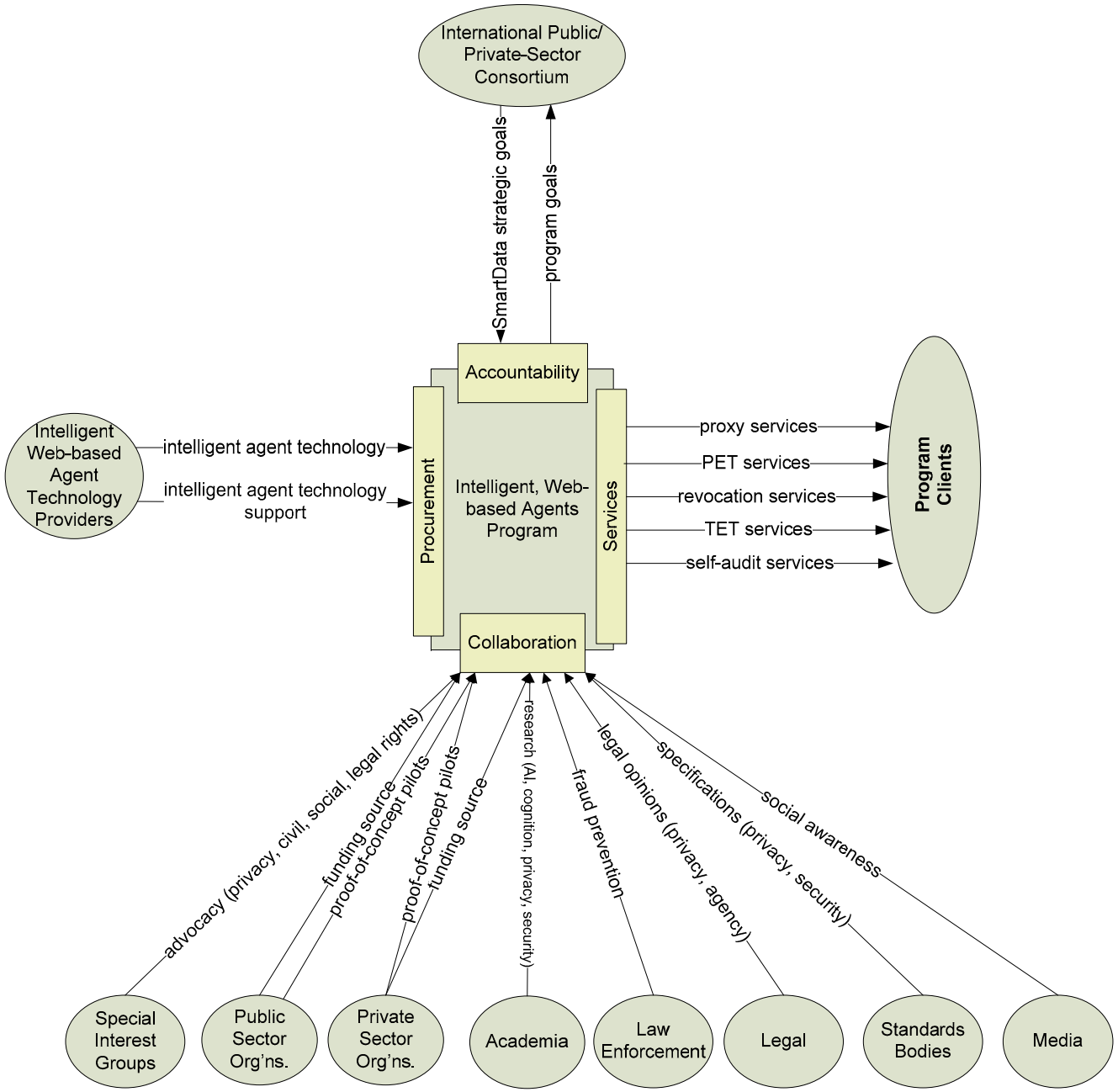
Security Architecture, Logical Architecture, Privacy Architecture: Artefact Manufacture Relationships



Business Architecture: Enterprise Context Model

Key Points:

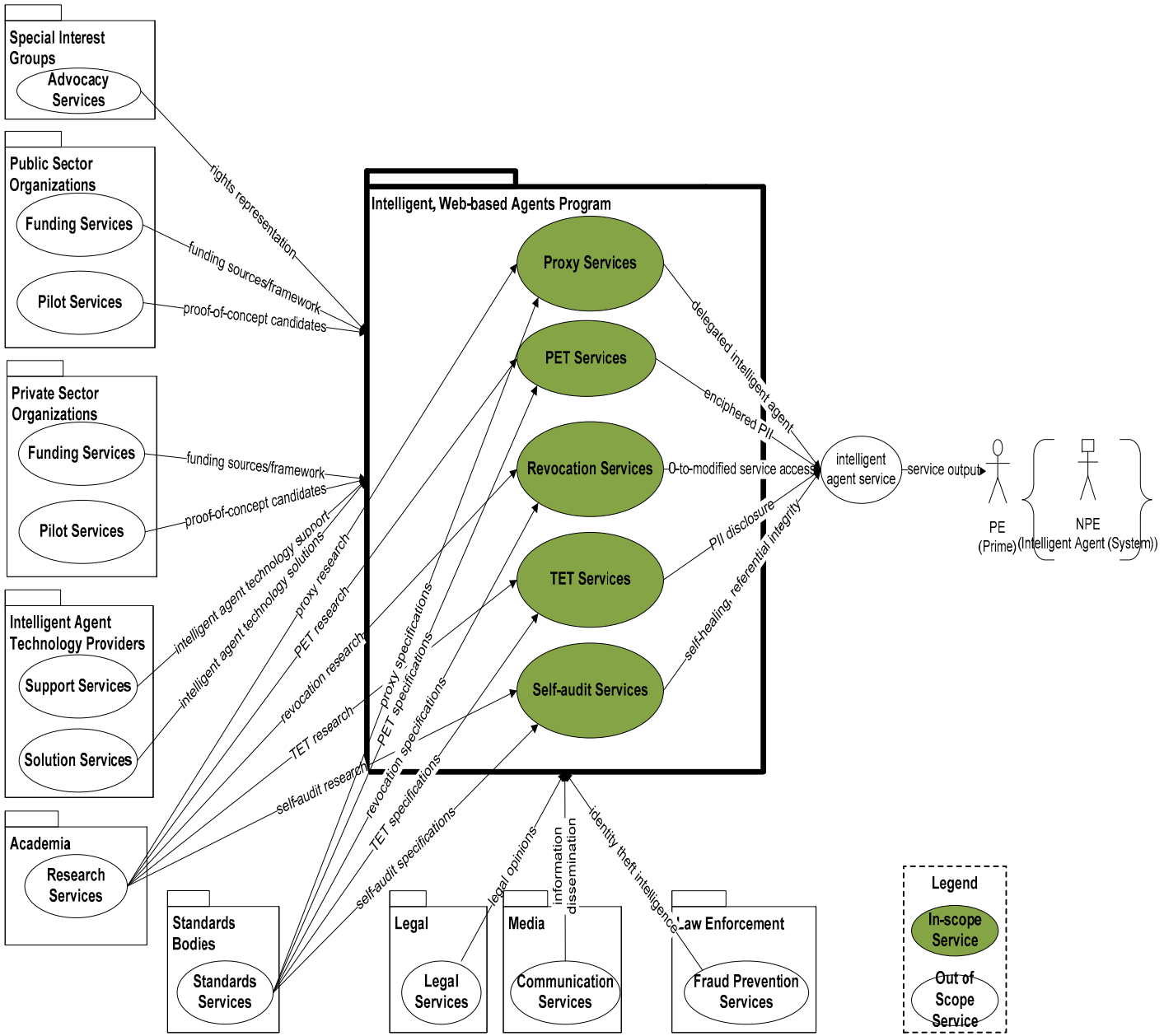
- Scope of interactions between the intelligent, web-based agents program and program clients, viz., persons requiring the services of intelligent, web-based agents to proxy in their stead in situations that include, but are not limited to, service fulfillment and other tasks otherwise undertaken by a person.



Business Architecture:
Service Integration and Accountability Model (SIAM)

Key Points:

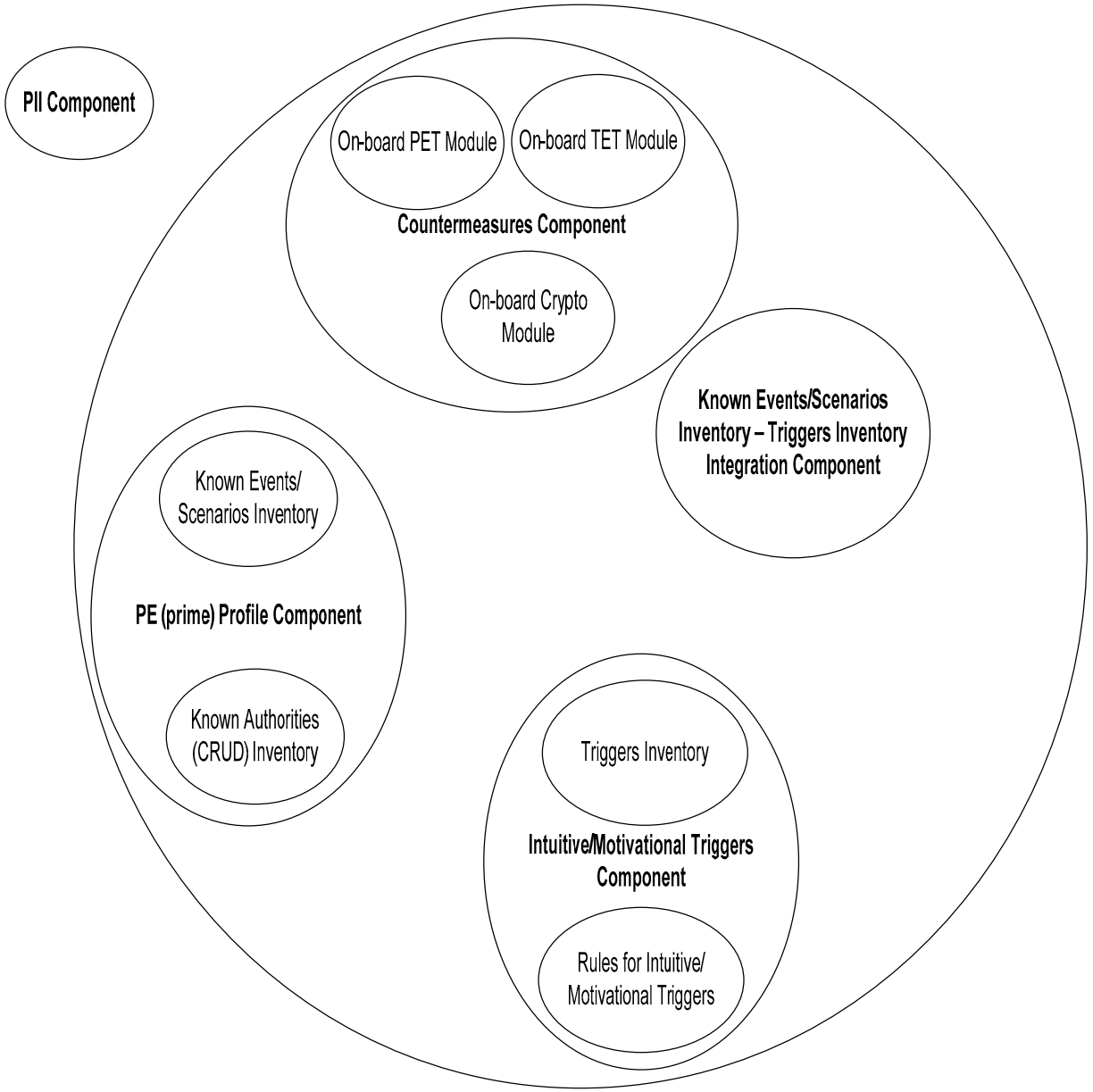
- The SIAM extends the enterprise context model by depicting accountability for service outputs.
- Services are associated with contributing organizations that provide input to the intelligent, web-based agents program, a specific service, or more than one service.



NPE (Intelligent Agent) Conceptual Architecture Pattern: Components View

Key Points:

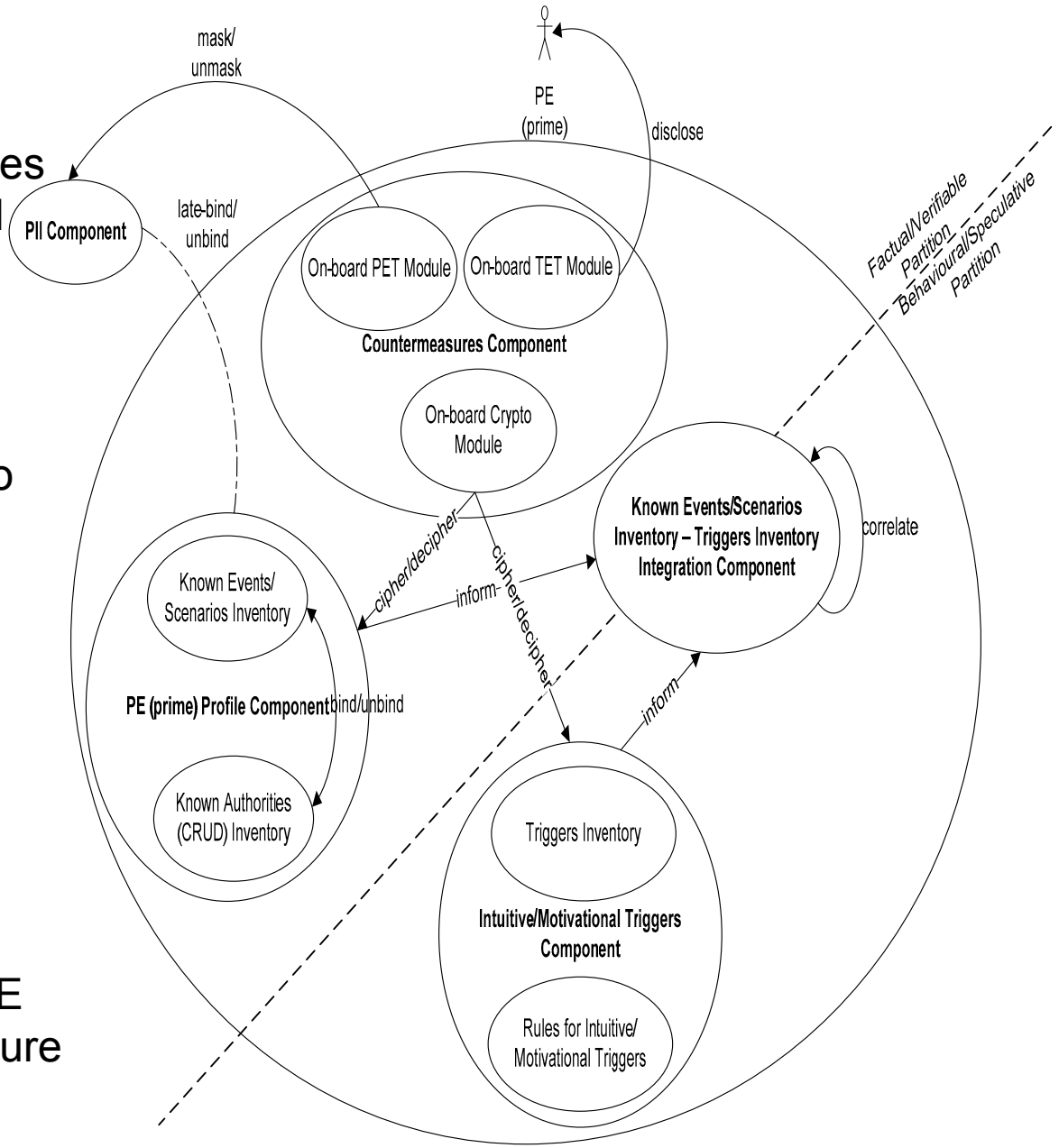
- This view of the pattern exposes components required to design the automation target, or system, for an intelligent, web-based agent. Sub-components are grouped, or clustered, within parent components to emphasize like functionality within the automation target.



NPE (Intelligent Agent) Conceptual Architecture Pattern: Relationships View

Key Points:

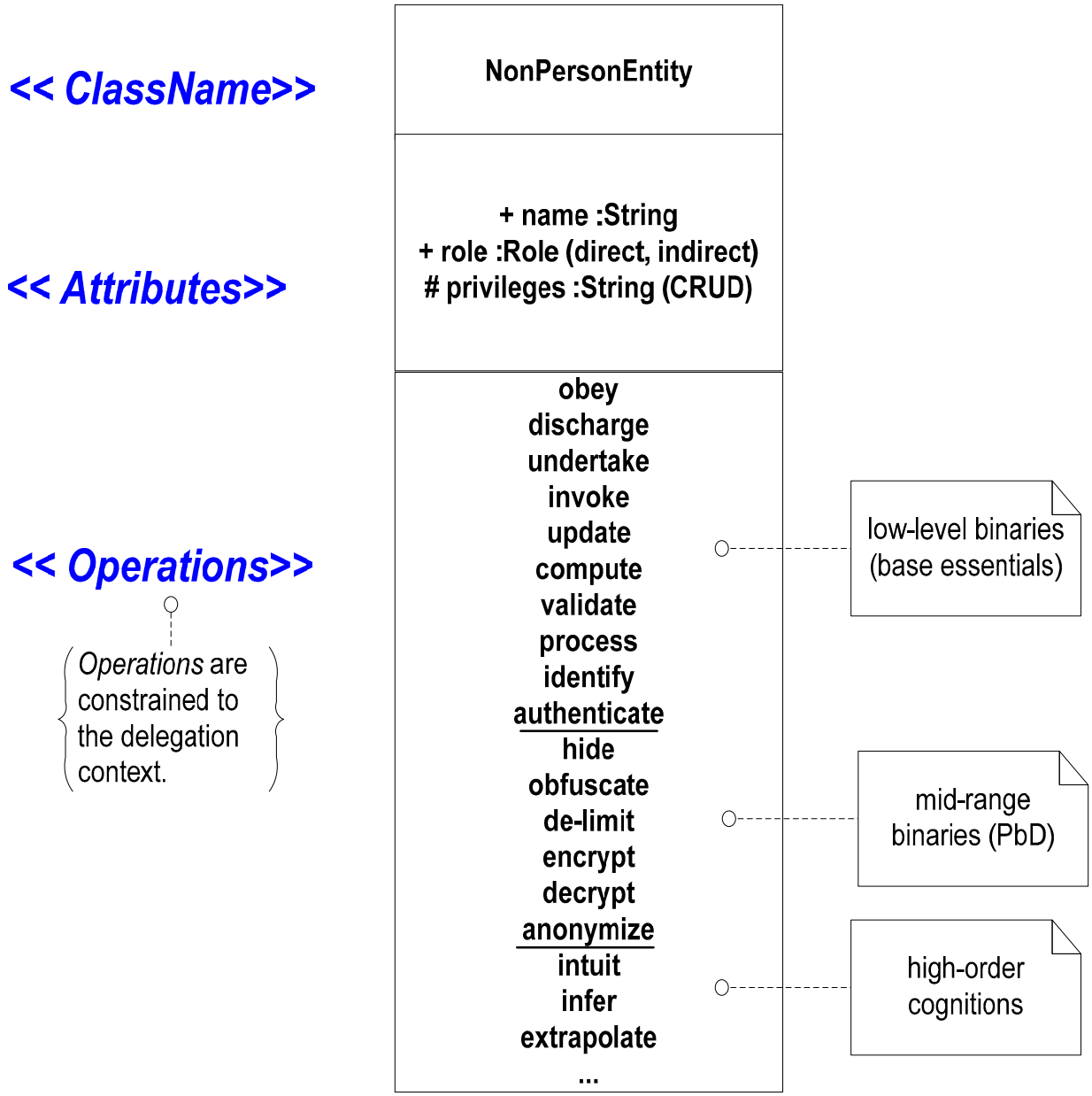
- This view elaborates the components view and articulates the relationships between, and among, components.
- The PII component, the authoritative store for privacy-related information traceable to the PE (prime), is not encapsulated within the larger NPE frame.
- Late-binding of the PII component.
- Deliberate architectural discontinuity between the PII component and the parent NPE frame supports the goal of secure system design.



Class Diagram: NonPersonEntity

Key Points:

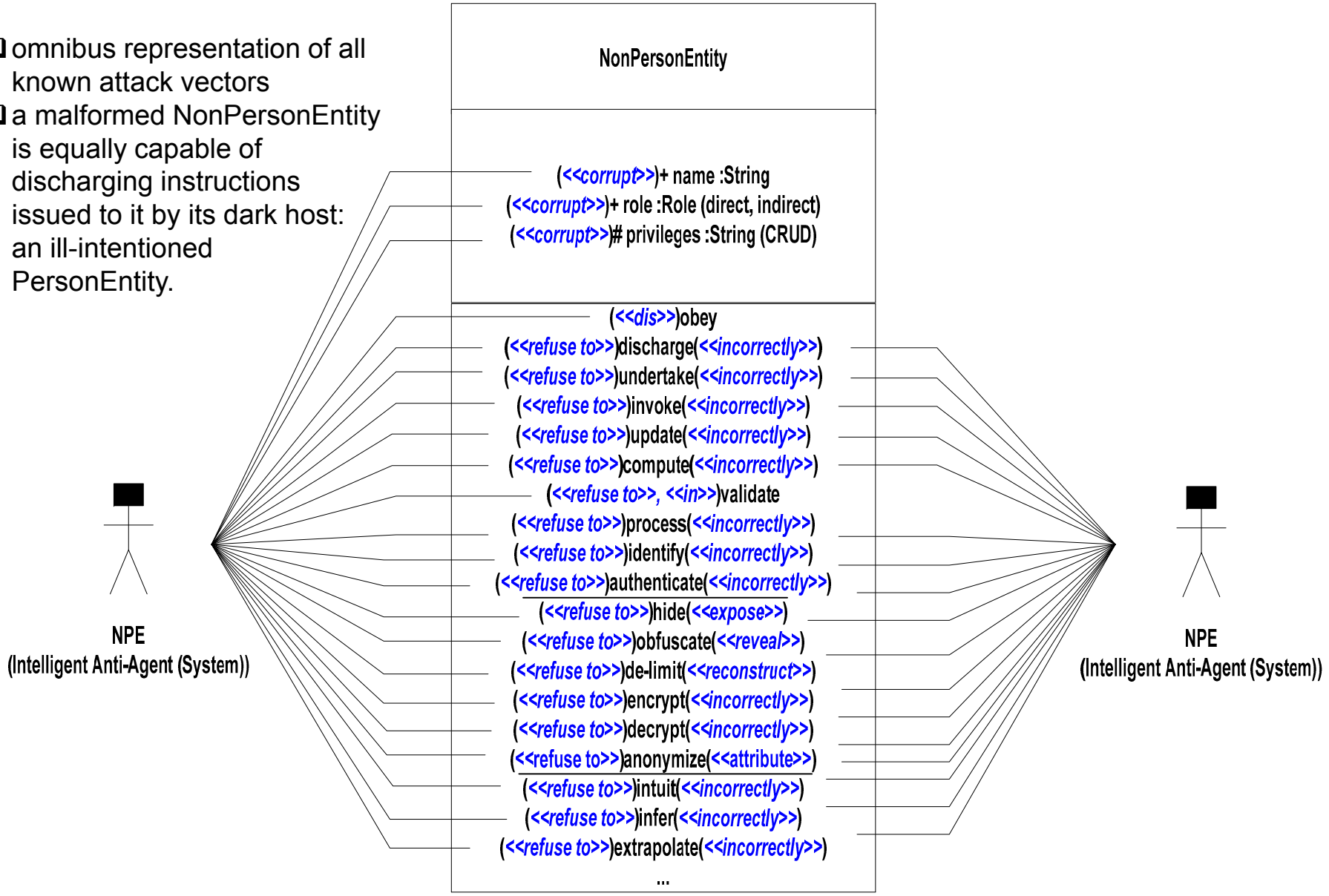
- The class diagram formalism is used to document intelligent, web-based agent elements, using the generally accepted namespaces of <<ClassName>>, <Attributes>> and <<Operations>>, respectively.



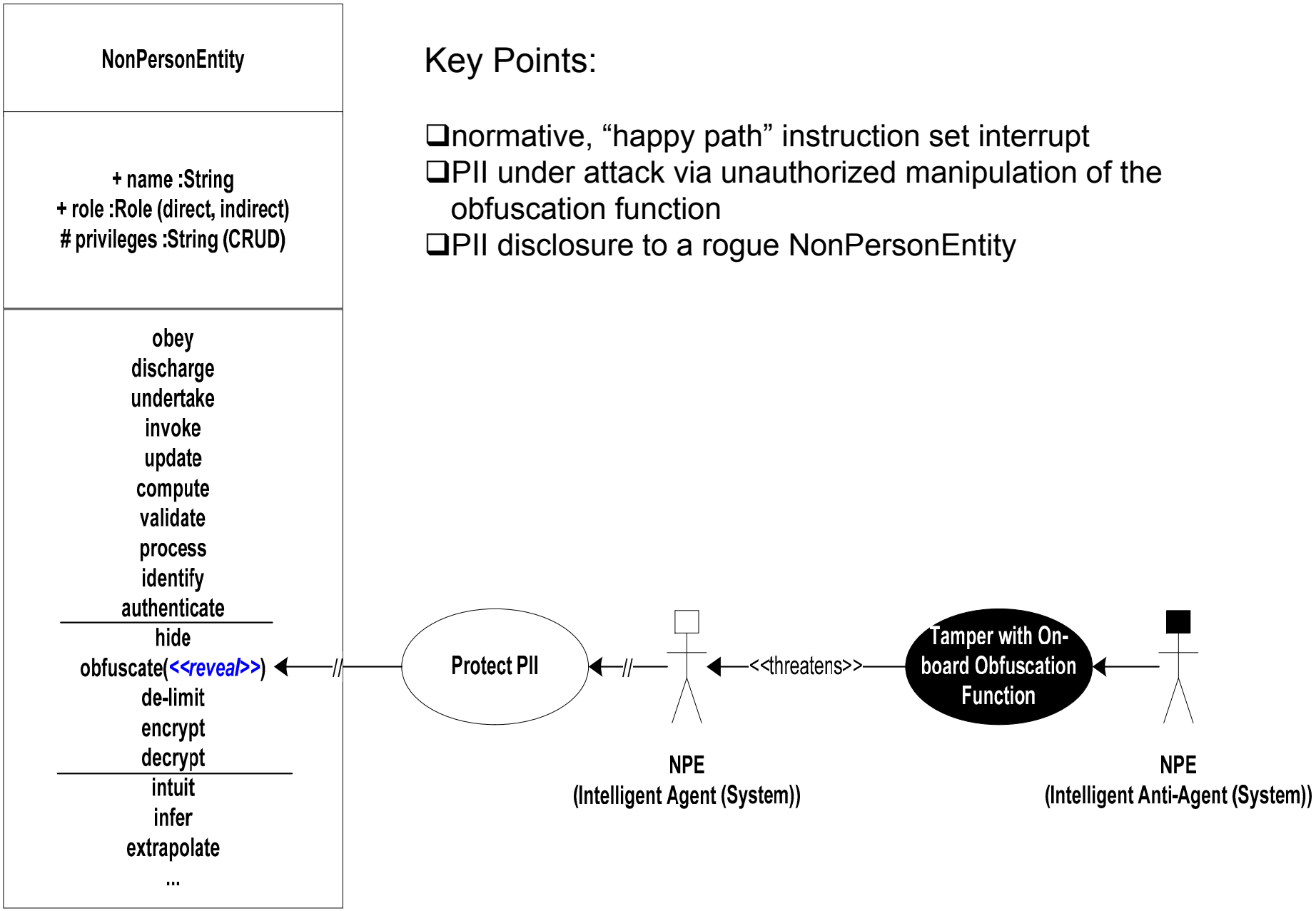
Class Diagram: NonPersonEntity – Attack Vector Articulation

Key Points:

- omnibus representation of all known attack vectors
- a malformed NonPersonEntity is equally capable of discharging instructions issued to it by its dark host: an ill-intentioned PersonEntity.



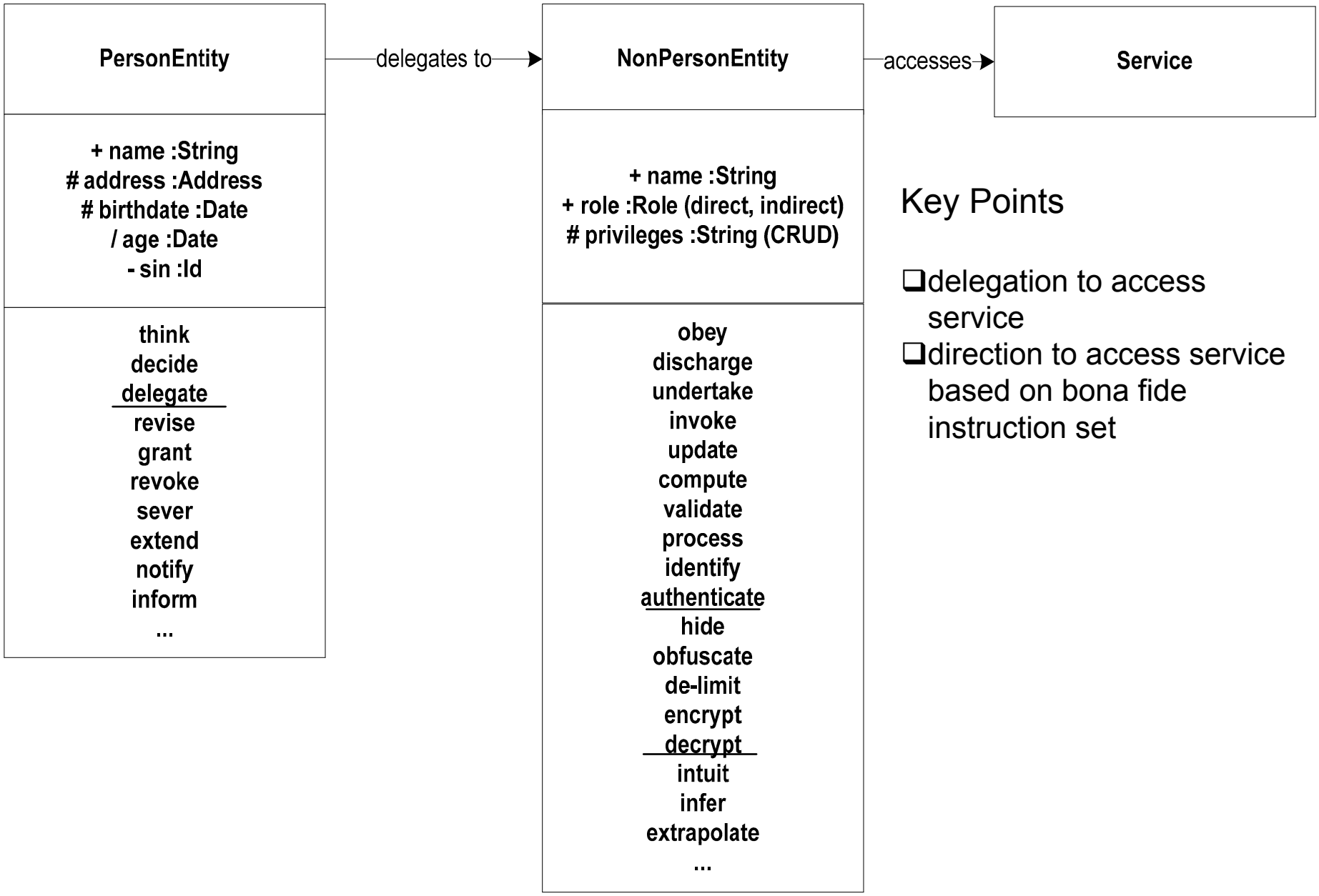
Class Diagram:
NonPersonEntity – Abuse Case Notation



Key Points:

- normative, “happy path” instruction set interrupt
- PII under attack via unauthorized manipulation of the obfuscation function
- PII disclosure to a rogue NonPersonEntity

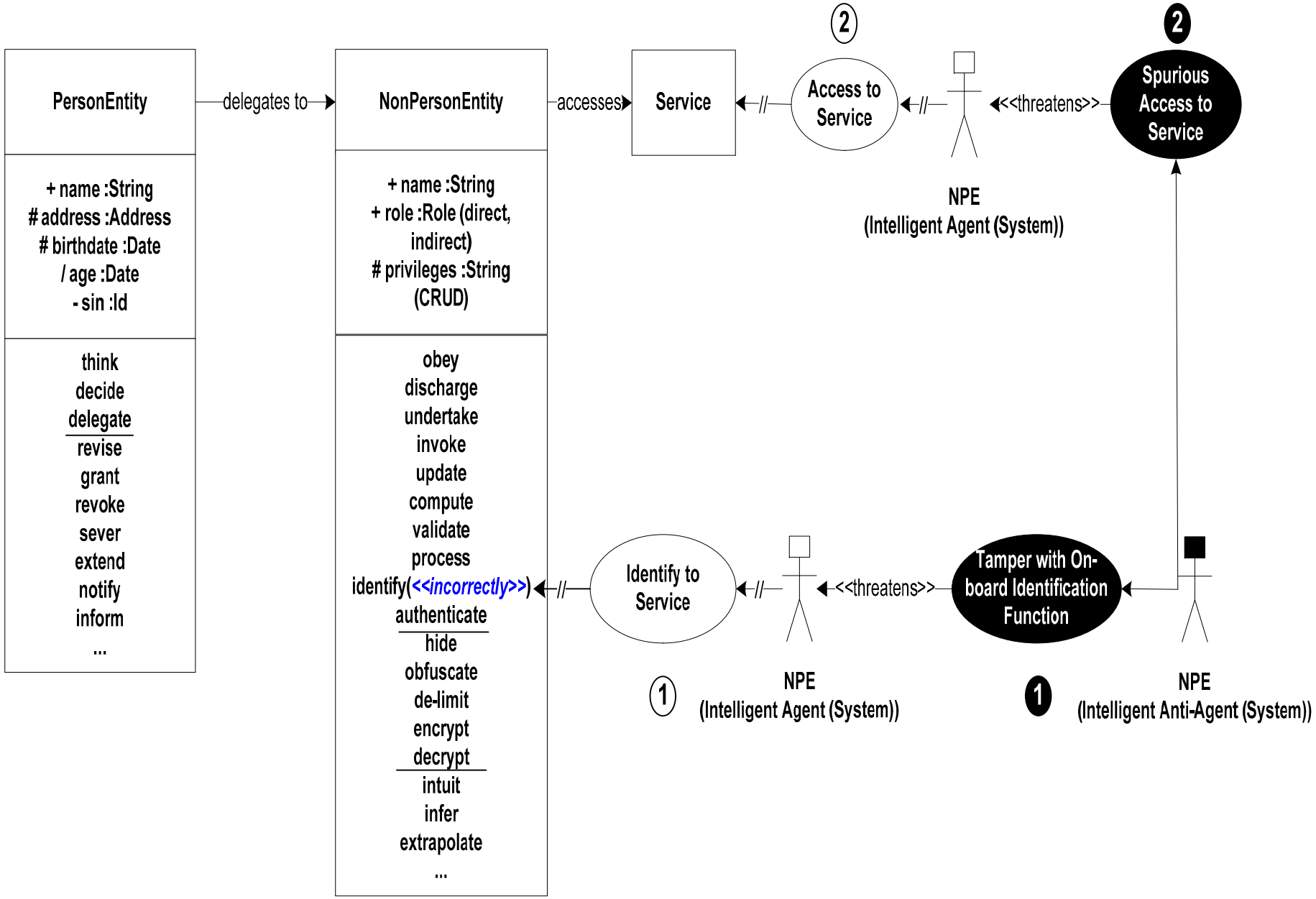
Class Diagram:
PE + NPE + Service (Normative, “Happy Path” Automation Target)



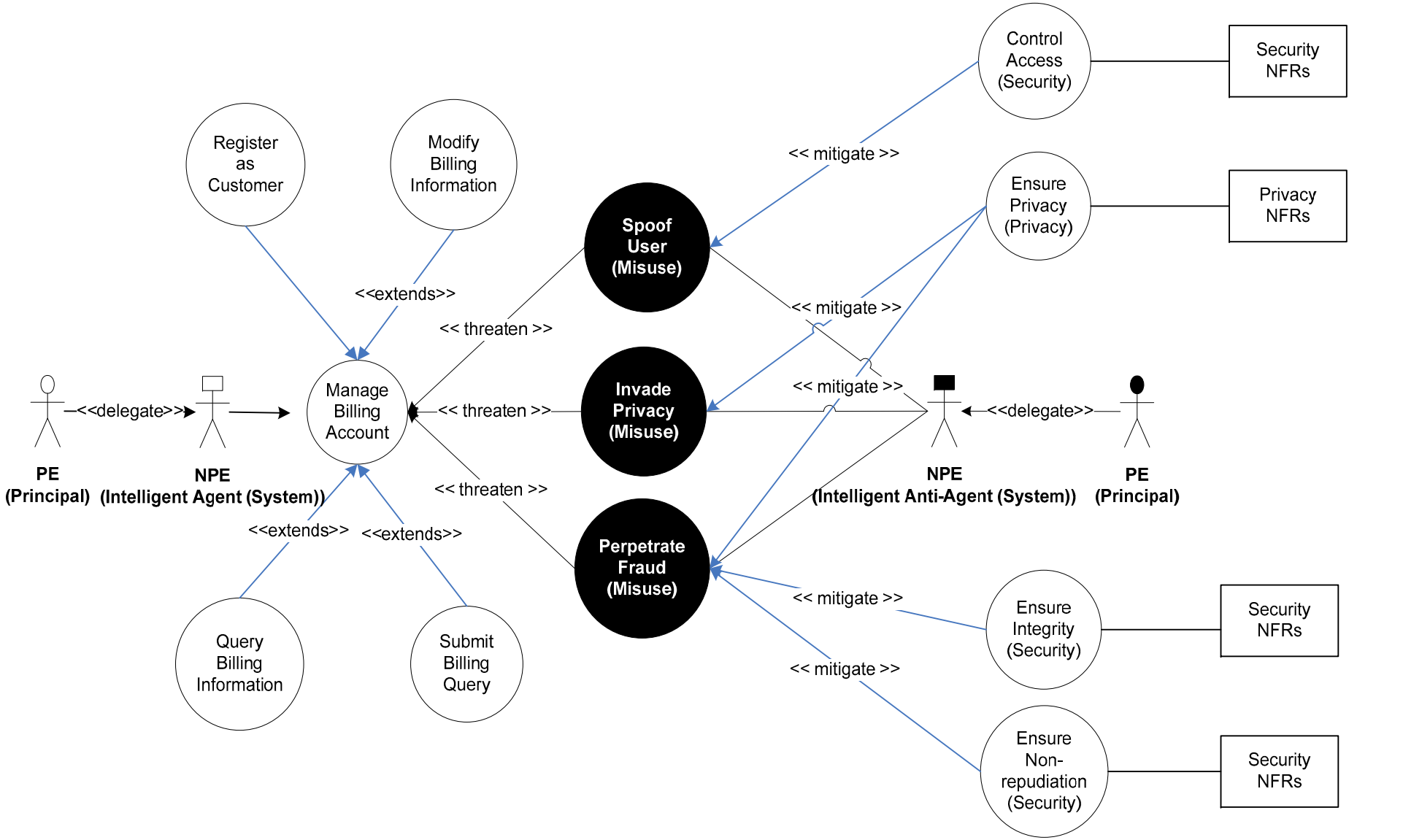
Key Points

- ❑delegation to access service
- ❑direction to access service based on bona fide instruction set

Class Diagram:
PE + NPE + Service (Anomalistic Behaviour)



Use and Abuse Case Scenarios



Conclusions

- The operation of systems in a steady state is best served through architectural rigour, especially the security architecture domain.
- Upfront investment in deep articulation of a given scope of interest – some complex object - provides reasonable assurance that the instruction set (code) is:
  - well-behaved; and
  - conforms to the architectural representations on which it is based.
- Failure to describe a complex object at the level at which it can be comprehended will invariably lead to anomalies in expected behaviour and security gaps.
- The effort required to do so takes time and costs money; however, the absence of these models and artefacts means that the reliability, sustainability and authoritativeness of the complex object cannot be vouchsafed.
- “Pay me now or pay me later.”

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Glossary of Terms

Acronym	Long-form Definition
CRUD	“C”reate, “R”ead, “U”pdate, “D”elete – generally accepted data-related actions
ECM	Enterprise Context Model – a business architecture artefact
NPE	Non-Person Entity – a virtual object
OOB	Out Of Band – an abnormal condition, situation or circumstance
PbD	Privacy by Design
PE	Person Entity – a human being
PET	Privacy Enhancing Technologies
PII	Personally Identifiable Information
SIAM	Service Integration and Accountability Model – a business architecture artefact
TET	Trust Enhancing Technologies