Structured Systems Economics for Security Management

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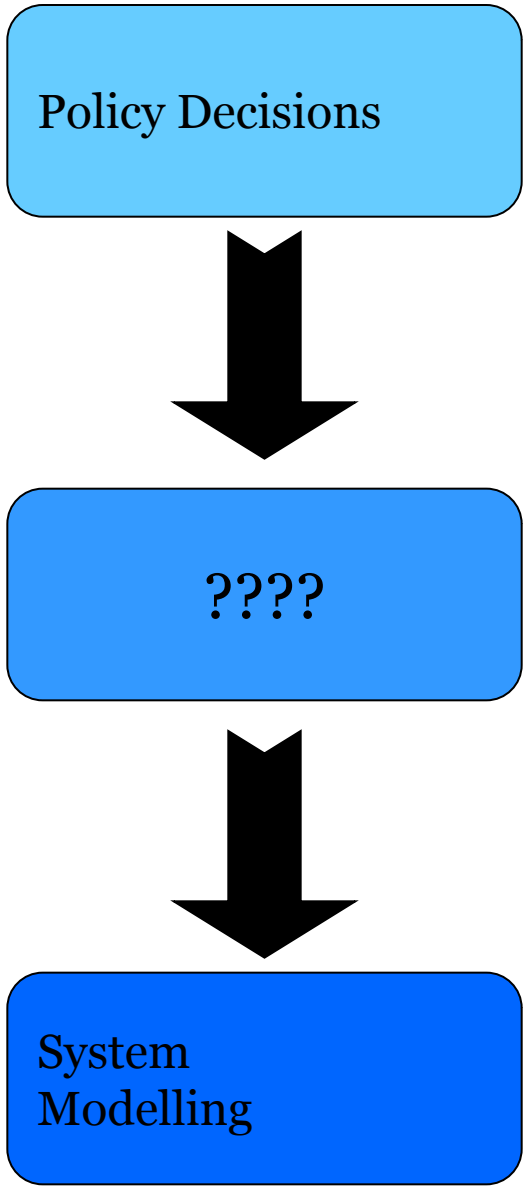
Background

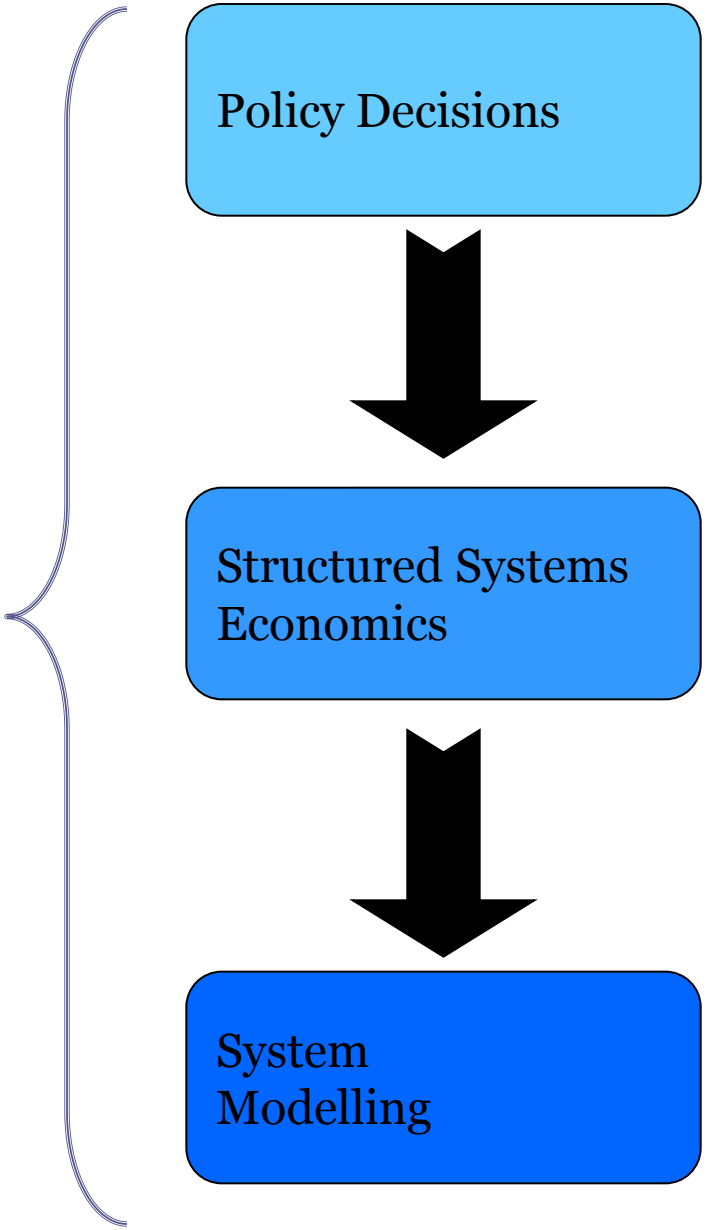
- Began with a discussion of CIA
- Interested in:
  - Policy decision making
  - Trade-offs
- Various issues arose that current literature didn't satisfactorily cover
- A new system was needed

The Problems with CIA

- Definitions too nebulous
- Essentially impossible to systematically analyze trade-offs with current conceptualizations
- Extensions to the model tend to involve category errors e.g. Parkerian Hexad adds:
  - Possession
  - Utility
  - Authenticity
- Good for discussing security objectives but falls down at the implementation stage


Policy Decisions
????
System
Modelling

Systematic Security Analysis
(e.g. Security Analytics developed at HP)



Key Aims

- Consciously separate declarative and operational concepts.
- Represent security objectives and the methods used to realized them
- Structure information for ease of transition to modelling
- Minimize collection of additional information in order to achieve the above

Concepts and Components

- Hierarchy of roles
- Framework layer
- Instantiation layer
- Security Objects (SO)
- Security Components (SC)
- Actors

Hierarchy of Roles

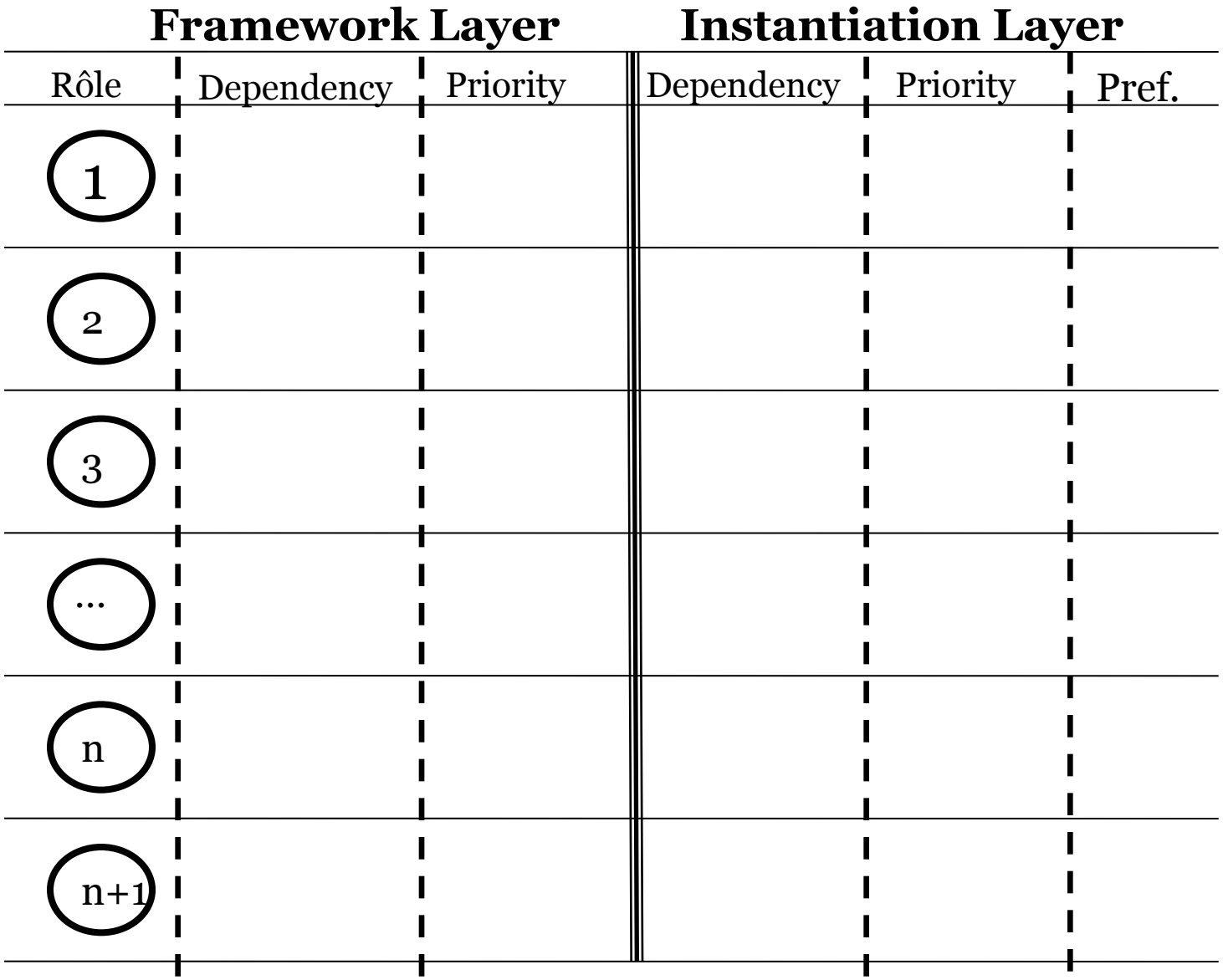
- Ordered by their influence on the system
- Objectives and actions pertinent to each role characterised as:
  - **Dependencies**: externally mandated, required for the role to function
  - **Priorities**: externally mandated, enacted as resources allow
  - **Preferences**: provided internally by the Actor occupying the role

Framework Layer

- Declarative
- Maps onto the hierarchy of roles
- Contains Security Objects
- Constructed iteratively and top down
  - This process ends when all dependencies and priorities are associated with a terminated security object
- Static

Instantiation Layer

- Operational
- Preserves role hierarchy
- Contains Security Components and Actors
- Constructed iteratively and bottom up
  - This process ends when all required resources and processes can be provisioned without recourse to a higher level
- Dynamic


Framework Layer
Instantiation Layer
Rôle
Dependency
Priority
Dependency
Priority
Pref.
1
2
3
...
n
n+1

Security Objects

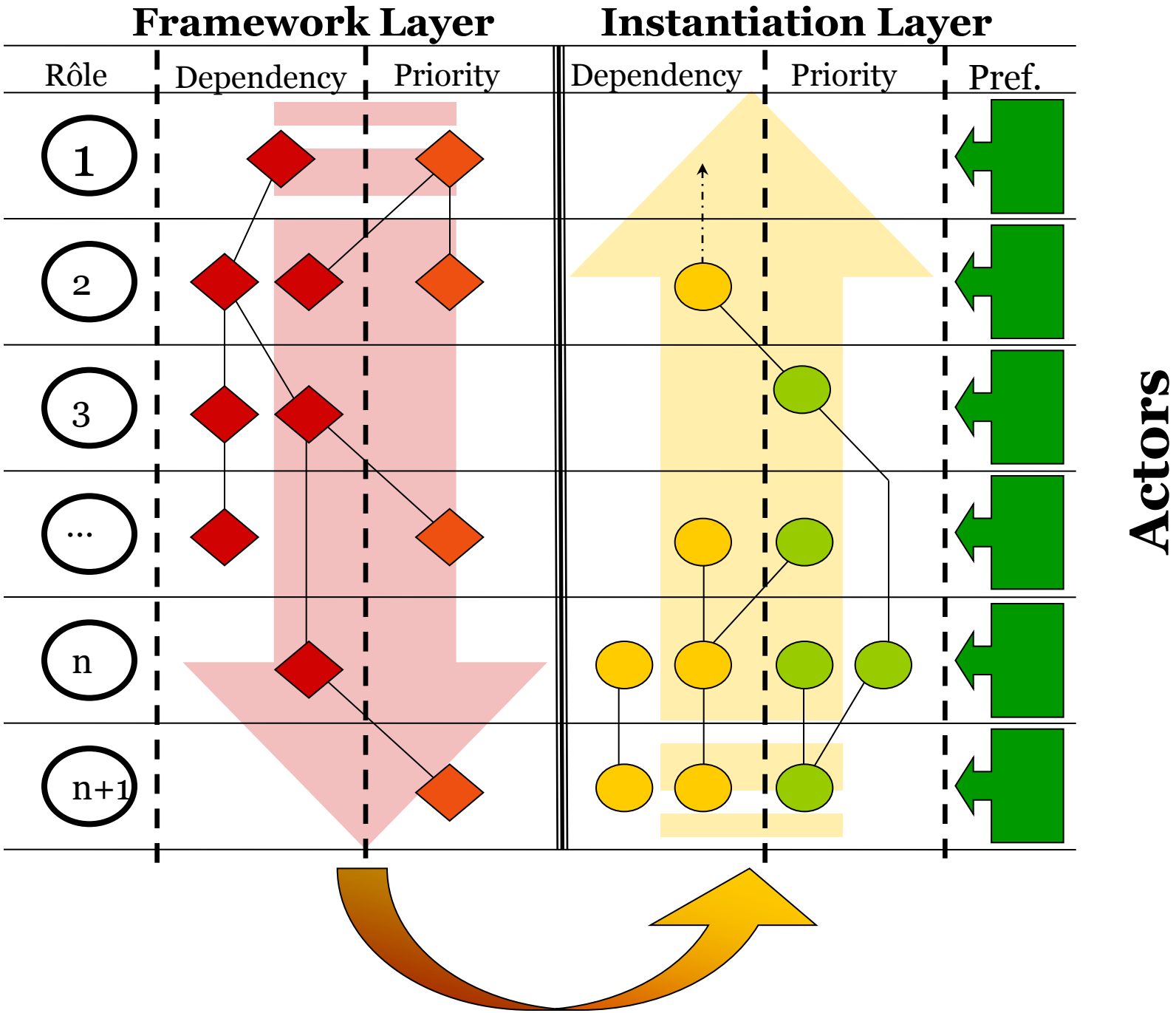
- Represent security objectives
- Characterized by and/or forests associated with dependencies and priorities
- Nodes contain a Boolean value associated with accompanying dependency/priority
- Truth conditions are inherited upwards
- End with a compliance step indicating that the current layer (and those below) are no longer involved in executing the SO

Security Components

- Represent processes and resources
- Follow the SO they are instantiating
- Each SC implements a checking process that applies to Actors at the level below
- End when all necessary Boolean values (as required by the SO) can be returned without recourse to a higher level

Actors

- Can transition between hierarchies (and are unique in this capability)
- Represented as a tag-cloud that each hierarchy interrogates
- Assigned to a rôle, based on attributes gleaned from tags (not all of which can be read by each hierarchy)
- Deliver preferences (and motivations) into the hierarchy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Actors

Modelling and Logic

- Systems models are described in terms of:
  - Processes
  - Resources
  - Locations
  - Environment
- SCs in the Instantiation Layer also express these concepts, intentionally so
- This allows SCs to be exported cleanly into a systems modelling language (e.g., Gnosis)
- The logic underpinning SC termination conditions and properties is also captured in such a modelling language, providing a first step in the modelling process

Application

- A familiar interface (e.g., OWL) can be used to represent the Instantiation Layer
- Existing system information and expert knowledge drawn in at this stage
- Information organised to facilitate system modelling
- Trade-offs between CIA-like objectives can now be explored systematically without recourse to CIA itself

Future Work

- Fully develop the role of Actors
  - Negative actors
  - Zero-preference actors
- Explore interactions between multiple hierarchies
- Improve methodology to limit the needs for ‘hand-crafted’ stages