An ontology for organizational functions: the recursive self-maintenance mechanism of the enterprise

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Vocabularies, Ontologies and Rules for the Enterprise Workshop
Tenth IEEE International EDOC Conference
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Agenda

- Introduction & Motivation
- Enterprise architecture fundamental concepts
- Ontology
- Framework & Application example
- Conclusions
- Future Work

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Introduction & Motivation

- Great advances in business process modeling
- Functions - like IT, logistics, financial, etc.
  - Inescapable reality in organizations
  - Even if a culture of "process orientation" is established
  - Strongly influences essential issues like...

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Introduction & Motivation

- ...change processes, ...

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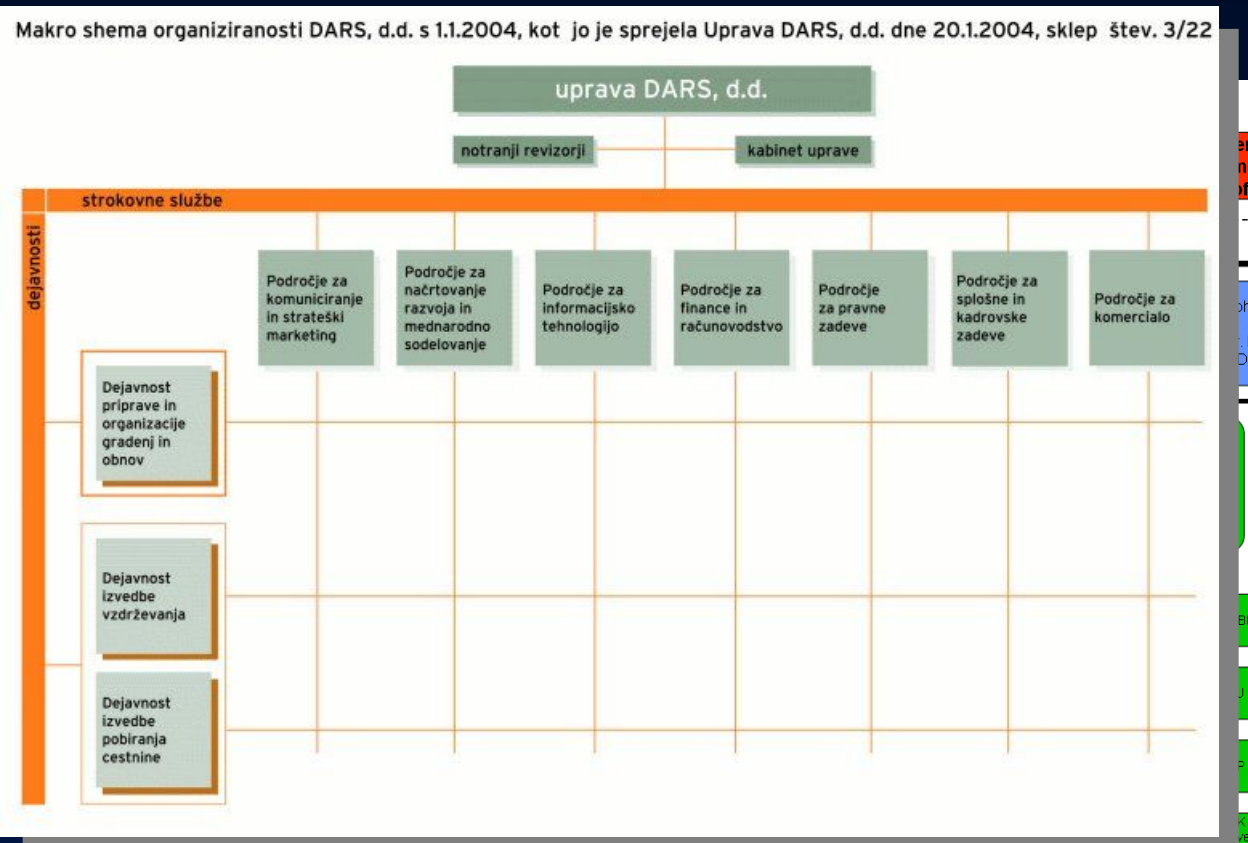
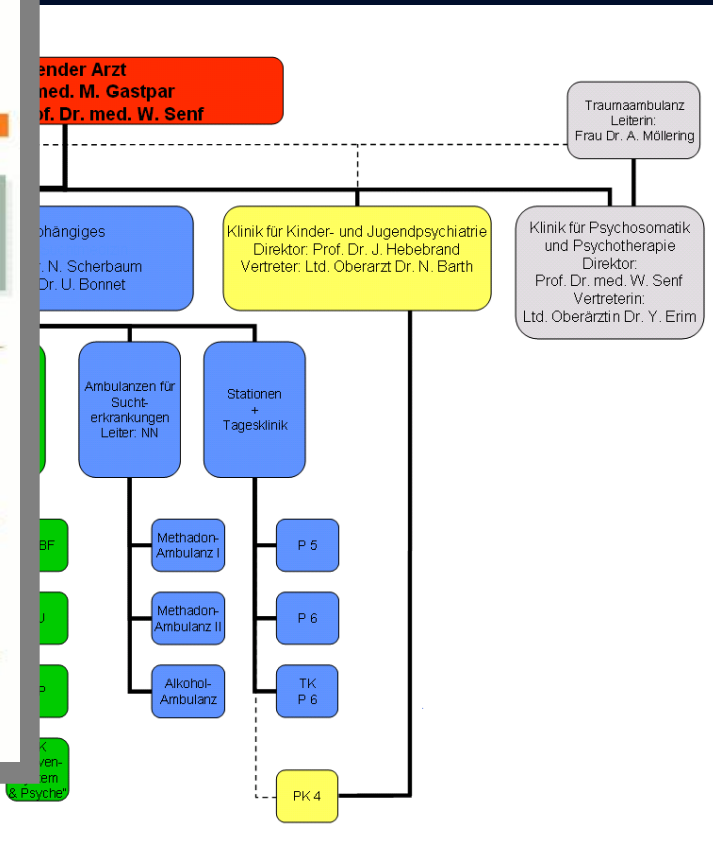
Introduction & Motivation

- ... formation of organizational units, ...





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Introduction & Motivation

- ... power and authority.

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Introduction & Motivation

- There's a need for a systematic and thorough representation of business processes and this has shown its benefits
- There may also be a need of representing functions in a more systematic and thorough way, beyond the simplistic view of hierarchical diagrams and vertical representation

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Introduction & Motivation

- Motivation
  - functional behavior (optimized for performance) can be systematized and allow knowledge capture and dissemination
  - clarify how hierarchy relates to functional responsibilities in the processes of an organization
    - how is the processes performance is monitored, maintained and reported in the chains of authority and responsibility

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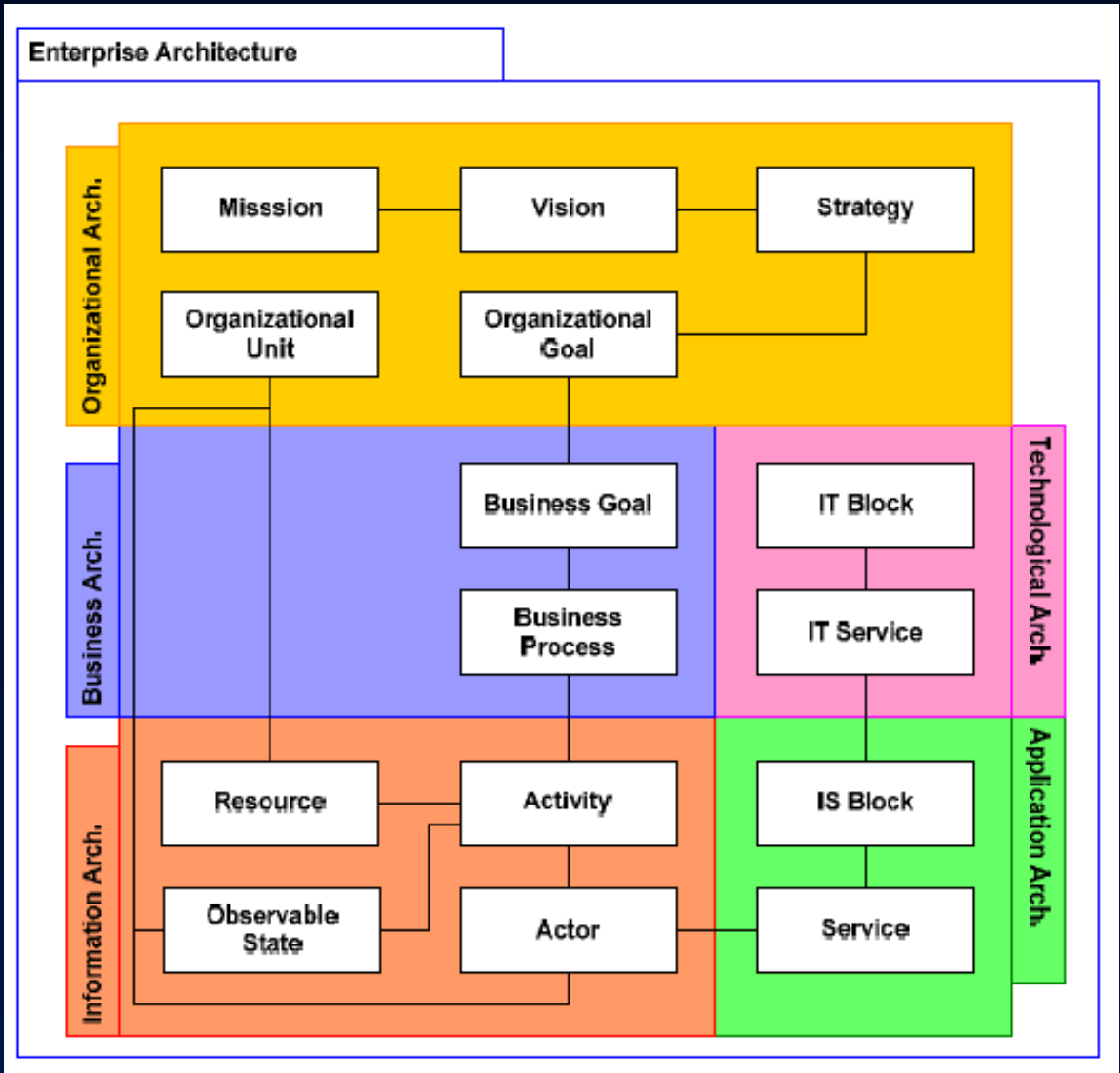
Enterprise architecture fundamental concepts



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Enterprise architecture fundamental concepts

- Fundamental concepts
  - Entity - relevant things that compose an organization; organizational nouns that have a distinct, separate existence (concrete or abstract)
  - Role - observable behavior or an entity; aim at separating the different concerns that arise from collaborations between the entities fulfilling an...
  - Activity - organizational verbs. They are an abstraction representing how a number of entities collaborate through roles to produce a specific outcome

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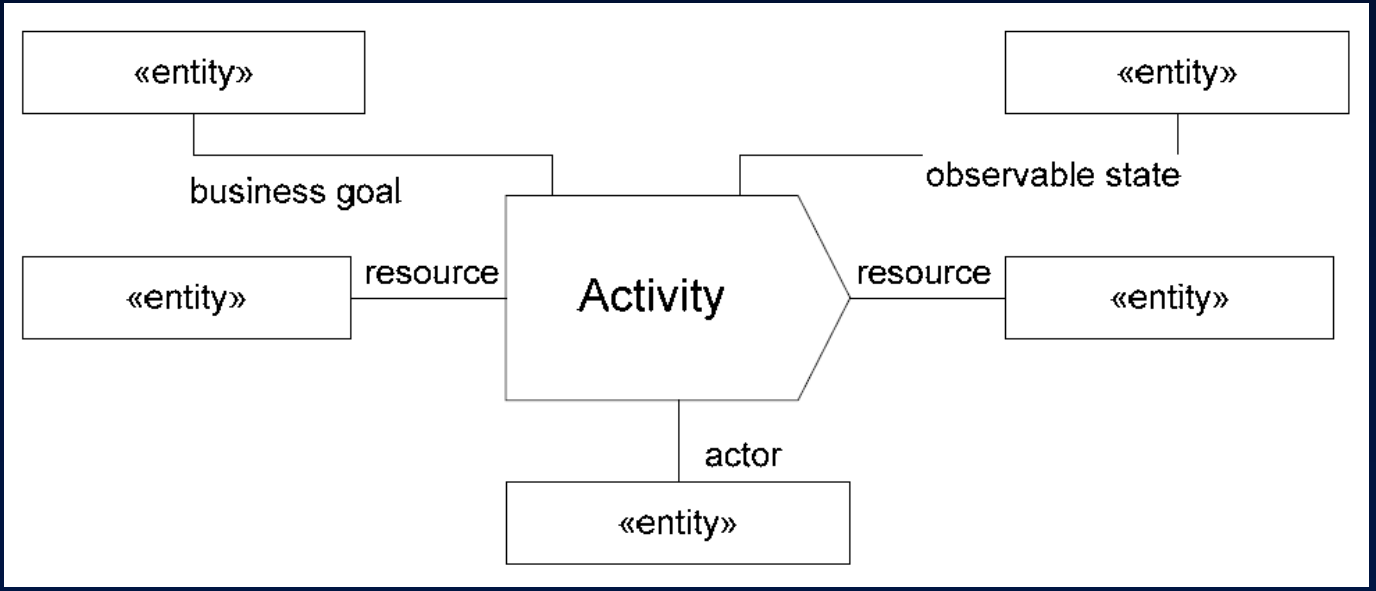
Enterprise architecture fundamental concepts

- An activity results from a number of interacting entities – playing a set of roles specialized from four generic roles: resource, actor, observable state and business goal – in a collaboration context



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Ontology - Process

- An activity is an abstraction representing how a number of entities collaborate through roles in order to produce a specific outcome.
- Similarly to an algorithm, an activity aims accomplishing some task which, given an initial state, will always end in finite time and in a recognizable end-state.
- To maintain coherence with the cited work on biology and philosophy fields, we use the word process for the purpose of current work

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Ontology - Norm

- The specification of a desired goal of functioning for a key trait of a process or
- A desired value (or range of values) for an observable state of a key trait resulting from the execution of a process

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Ontology - Business rule

- Statement that defines or constrains/restricts some aspect of the business (BRG)
- It is intended to assert business structure or to control or influence the behavior of the business (BRG, 2000) indicating how the business should function (Eriksson, 2000)

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Ontology - Resilience

- Capability of maintenance of the conditions on which the organization is able to maintain its cohesion and survive (primary goal of any organization)
- Realized by business rules dedicated to:
  - monitor if key state variables are respecting the established norm or goal for them
  - if there is a departure from the norm, execute (or invoke elsewhere) dynamics to correct the problem generating the departure from the norm

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Ontology - Exception

- Situation interrupting or affecting the normal execution of a process
  - Expected - the system enters in resilience mode to correct the generated problem
  - Unexpected - the system can not automatically suggest any solutions (Mourão and Antunes, 2005).
    - there are no business rules that can handle the occurred exception

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Ontology - Microgenesis

- Processes that occur in the event of an unexpected exception
- Agile and unpredictable nature - 3 main roles:
  - (1) investigate and understand the aspects and consequences of the problem causing the exception;
  - (2) heuristically construct or change existing processes and/or business rules to circumvent or solve the problem that caused the exception, done trough trial and error tentatives, based on similar past situations

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Ontology - Microgenesis

- Processes that occur in the event of an unexpected exception
- Agile and unpredictable nature - 3 main roles:
  - (3) by analysis and comparison of results of several trials, select the more adequate business rules (among several solutions tried) that achieve the desired result, which is:
    - to get back to normality or even
    - change the previously established norm (which may imply process change or even replacement) to fit the new environmental needs that caused the exception

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Ontology - Function

- Word function has its root in the latin word "functio" which means functioning, which in turn means "doing good in a regular way"
- Functions are process interdependency relations that determine the nature of organisms as viable (cohesive) systems - (Christensen, 2002)

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Ontology - Function

- In organizations, representing a function means specifying, for a certain process X, its interdependencies – with other parts of the organization – which contribute to self-maintenance and evolution, namely:
  - (1) a norm (goal value) for a certain state variable of the process;
  - (2) which other process (or processes) depends on this norm, in order to remain functional;

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Ontology - Function

- (3) the set of business rules - embedded in the process itself, or other process(es) - that work as resilience mechanisms to expected exceptions and try to reestablish the norm of the process functioning;
- (4) set of specialized and accumulated knowledge related to process X's domain used for treatment of unexpected exceptions during microgenesis processes.

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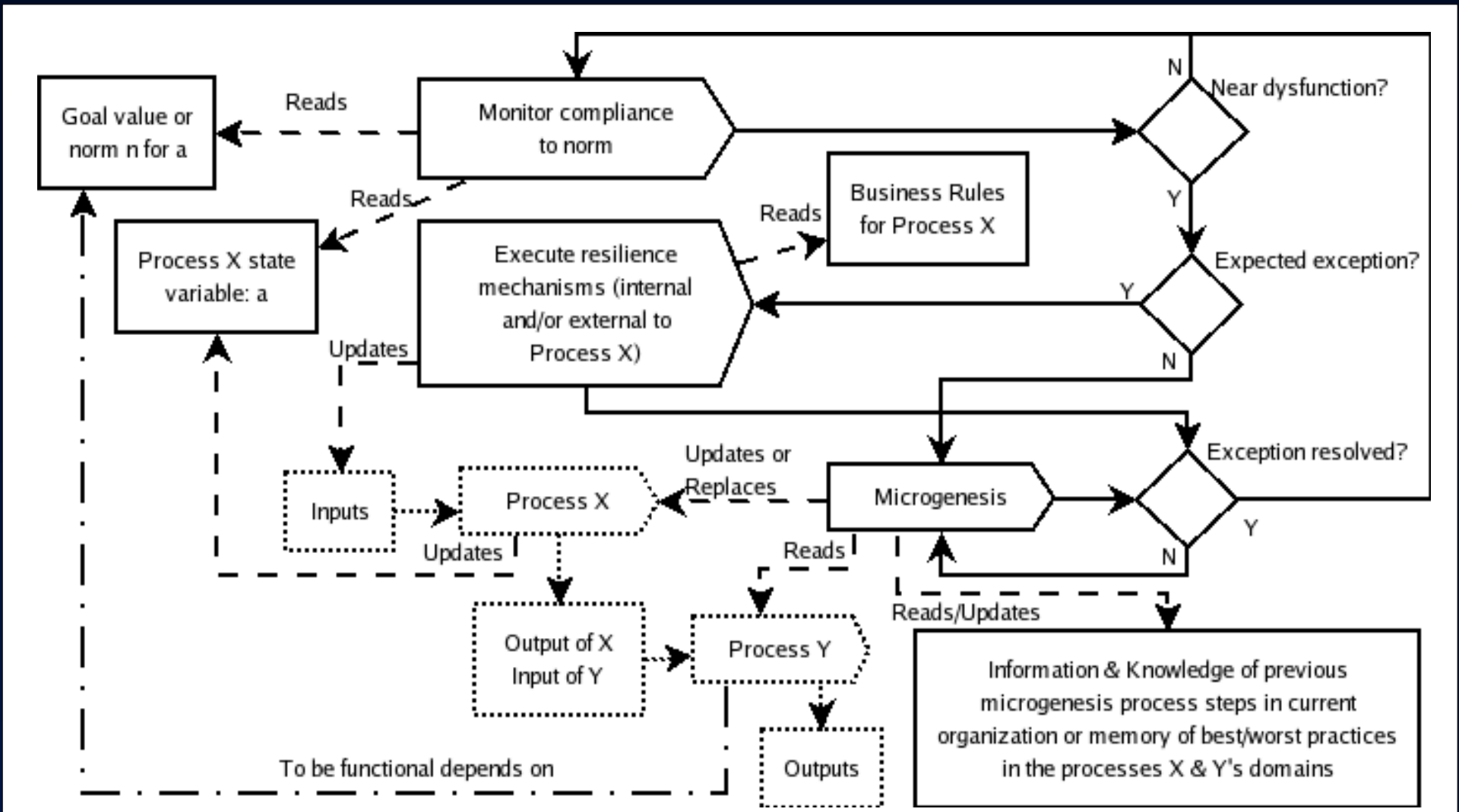
An Ontology for the Organizational Function concept



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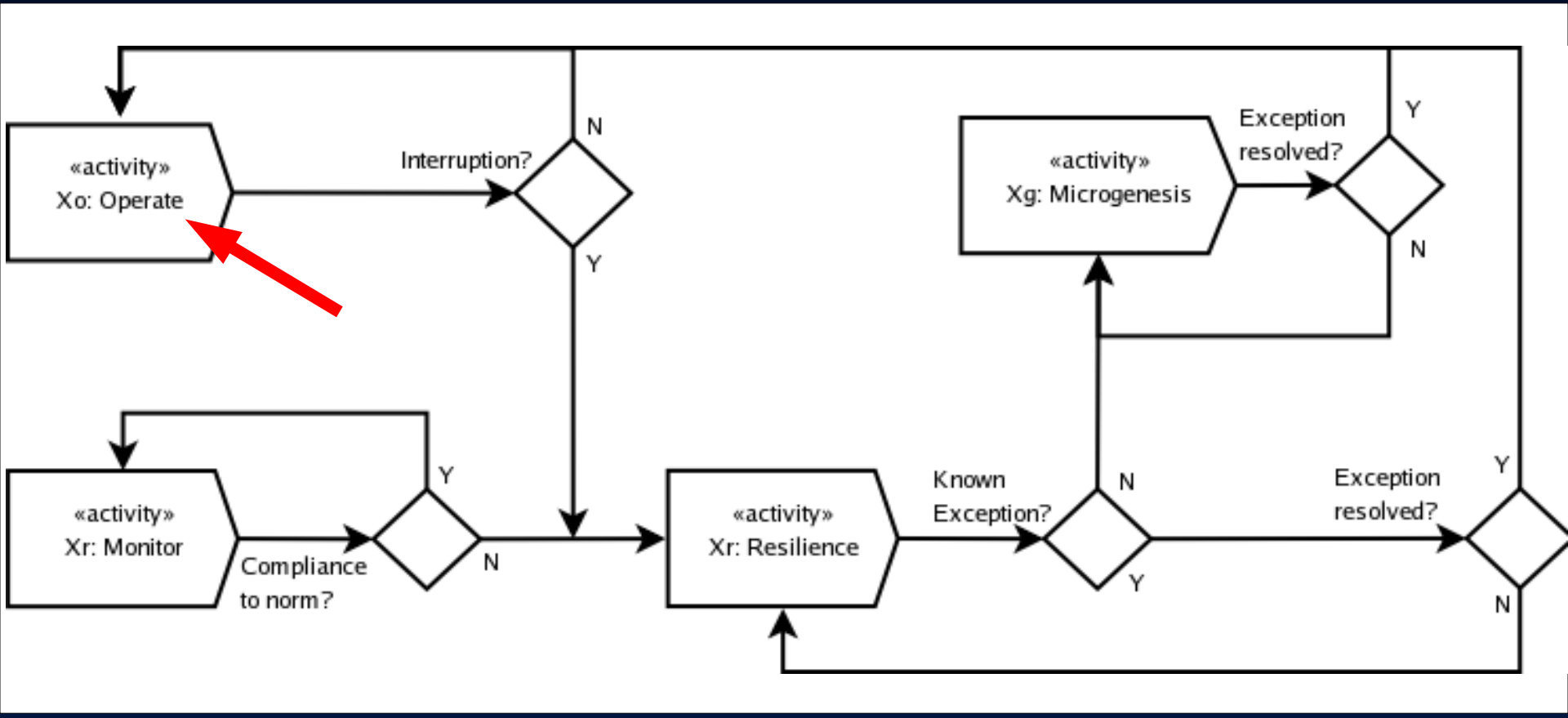
Framework



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Framework: Operation context

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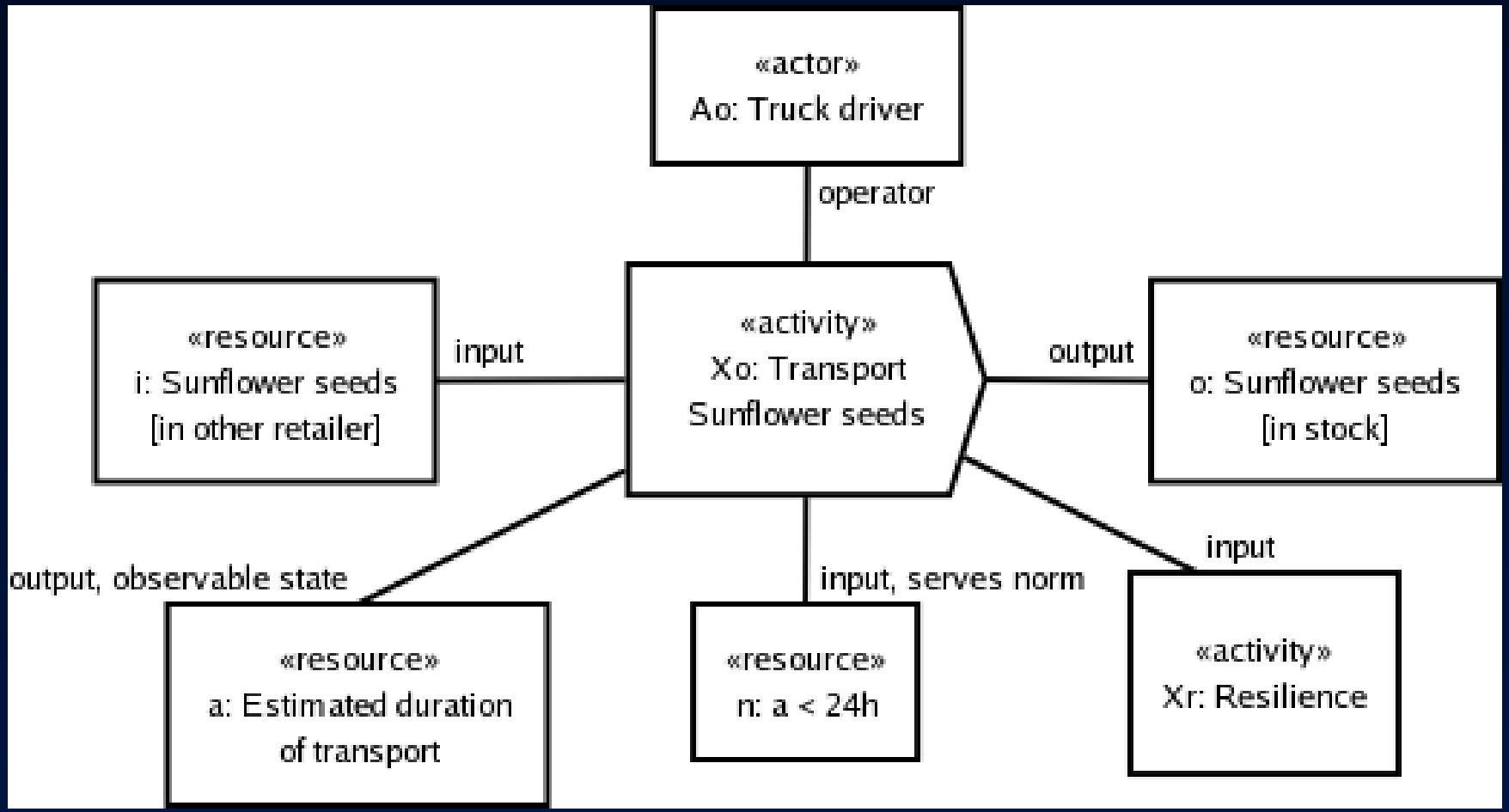
Framework: Operation context



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Framework: Operation context

- Key points:
  - Observable state a of X connects it with other (or others) activity that is served by it's functioning.
  - An activity can serve one or more normative requirements n in an organization, even with only one observable state
  - There may be different (possibly conflicting) normative needs from several parts of the system, on a certain observable state
  - For each observable state, an activity can serve one or more functions
    - e.g., a < 90% of average transport time, requirement of process Manage logistics

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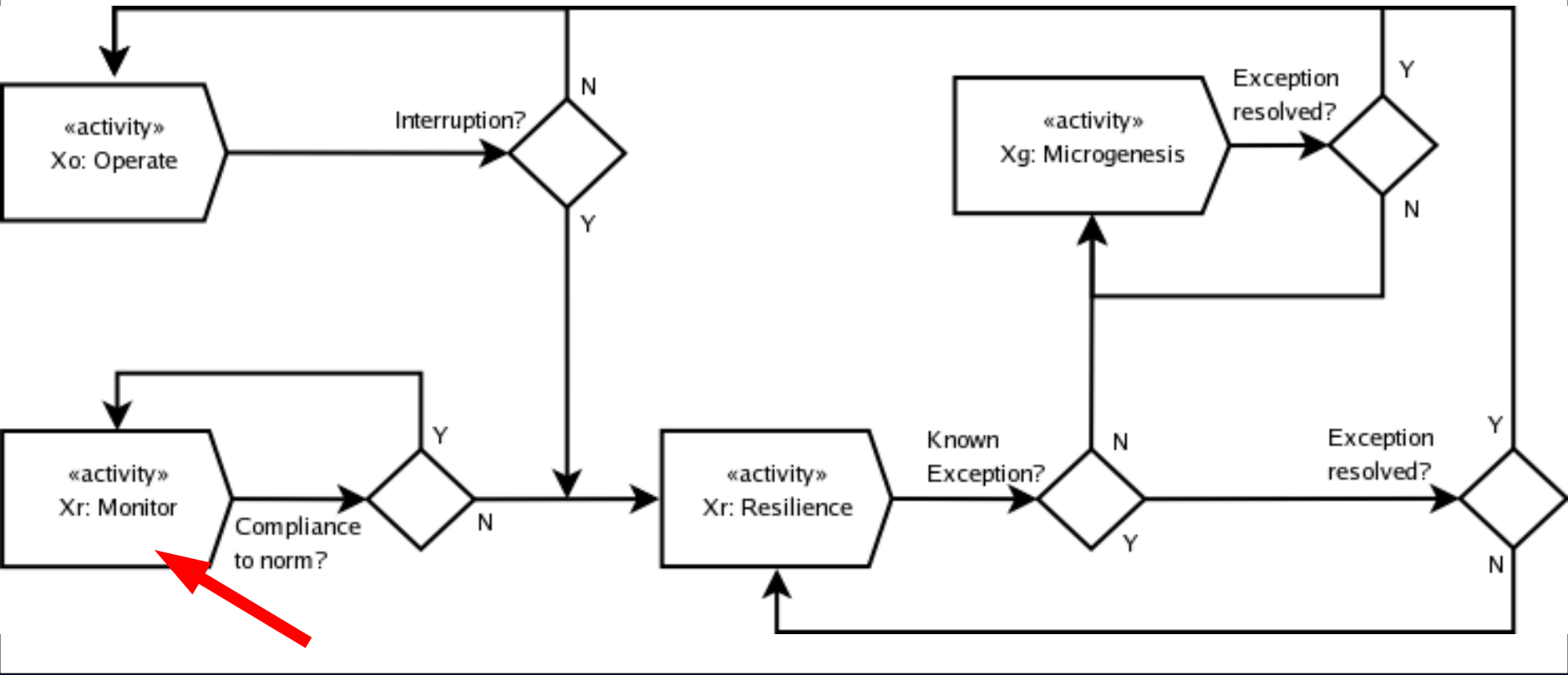
Framework



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Framework: Monitoring context

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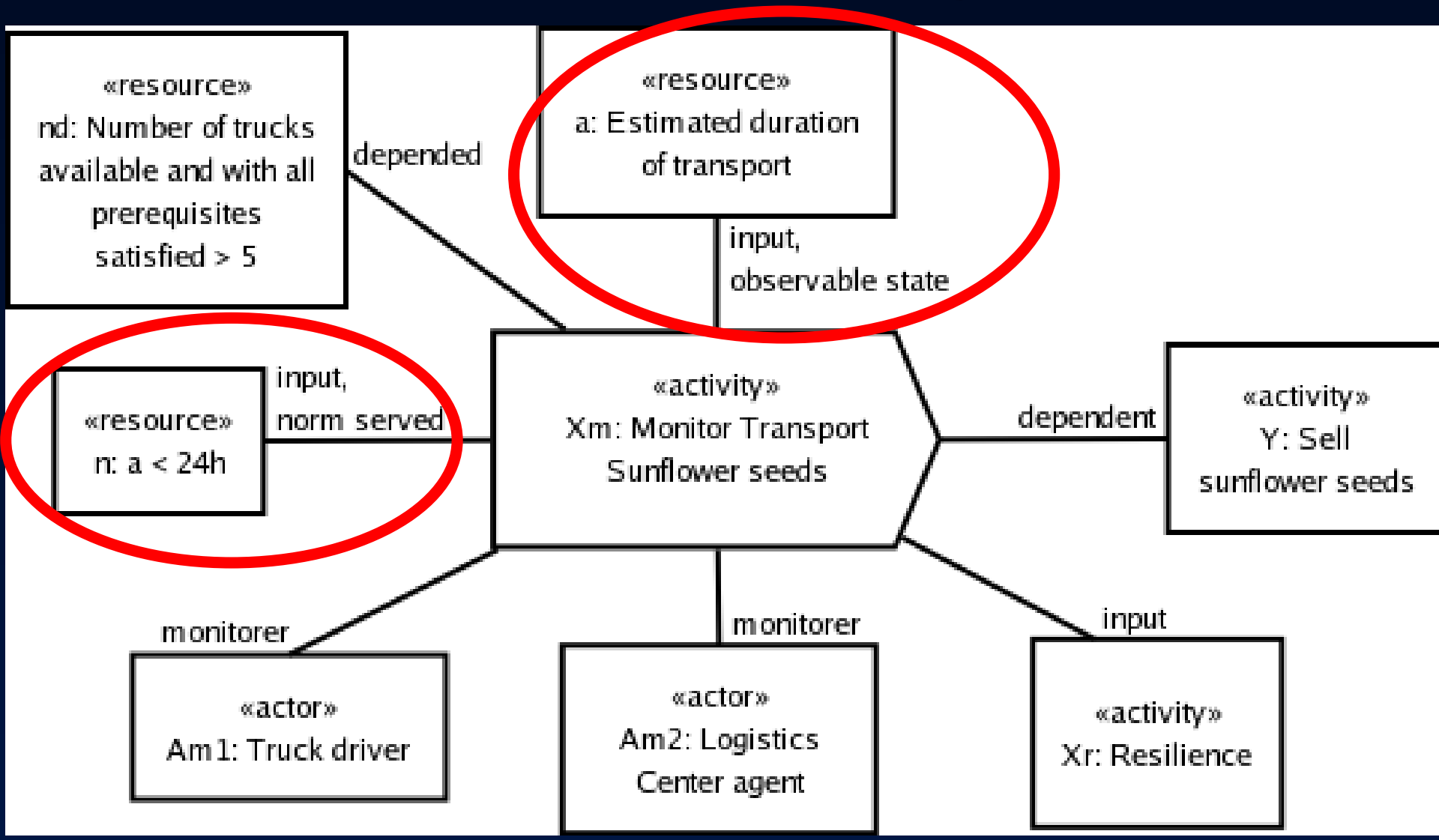
Framework: Monitoring context



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Framework: Monitoring context

- Key points:
  - This pattern captures an emergent property as the organization (or the actors) need to be self-aware of what they are doing and if they are doing it in a "good" way, so that the organization can survive
  - This (monitoring) capacity can be implicit (not explicitly enforced) or even non existing, the case where, if exceptions occur, the corresponding dysfunction propagates until a monitored norm is affected

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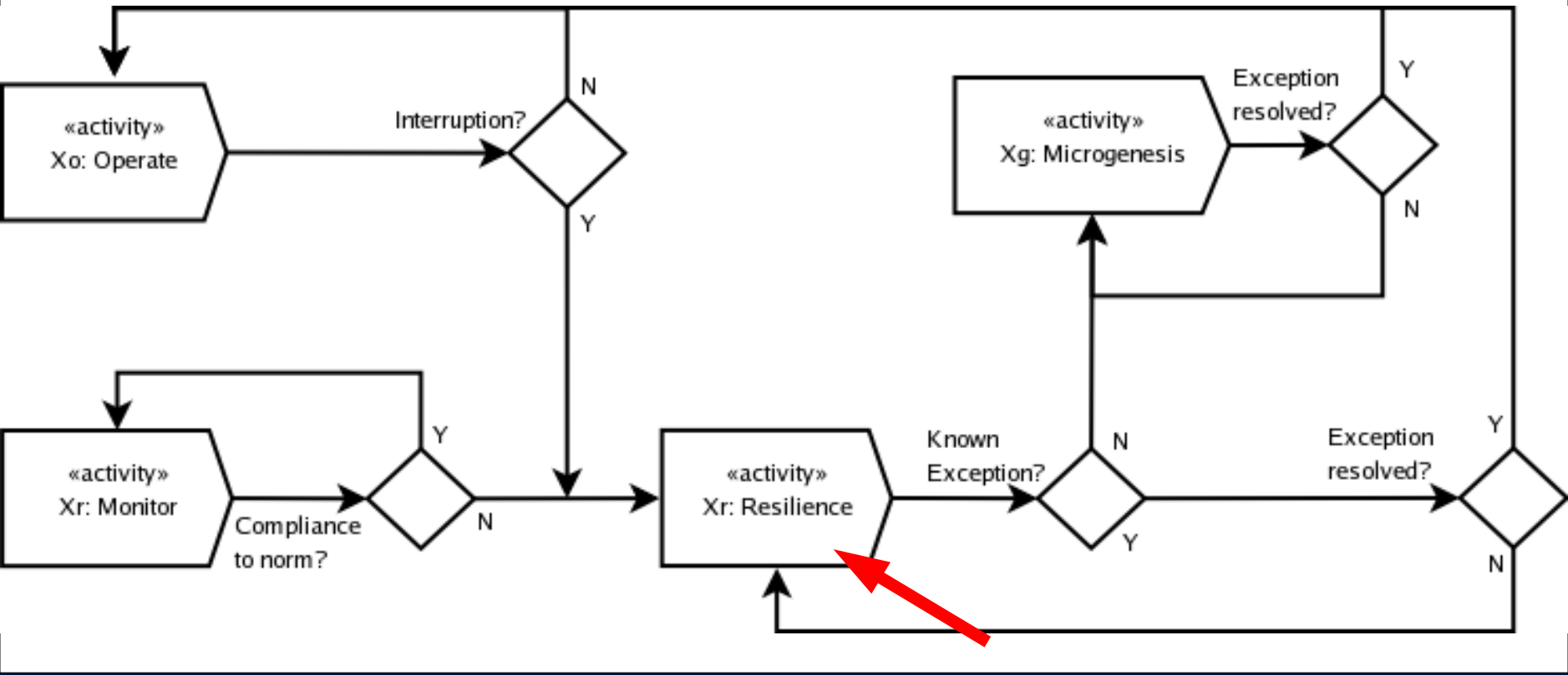
Framework



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Framework: Resilience context

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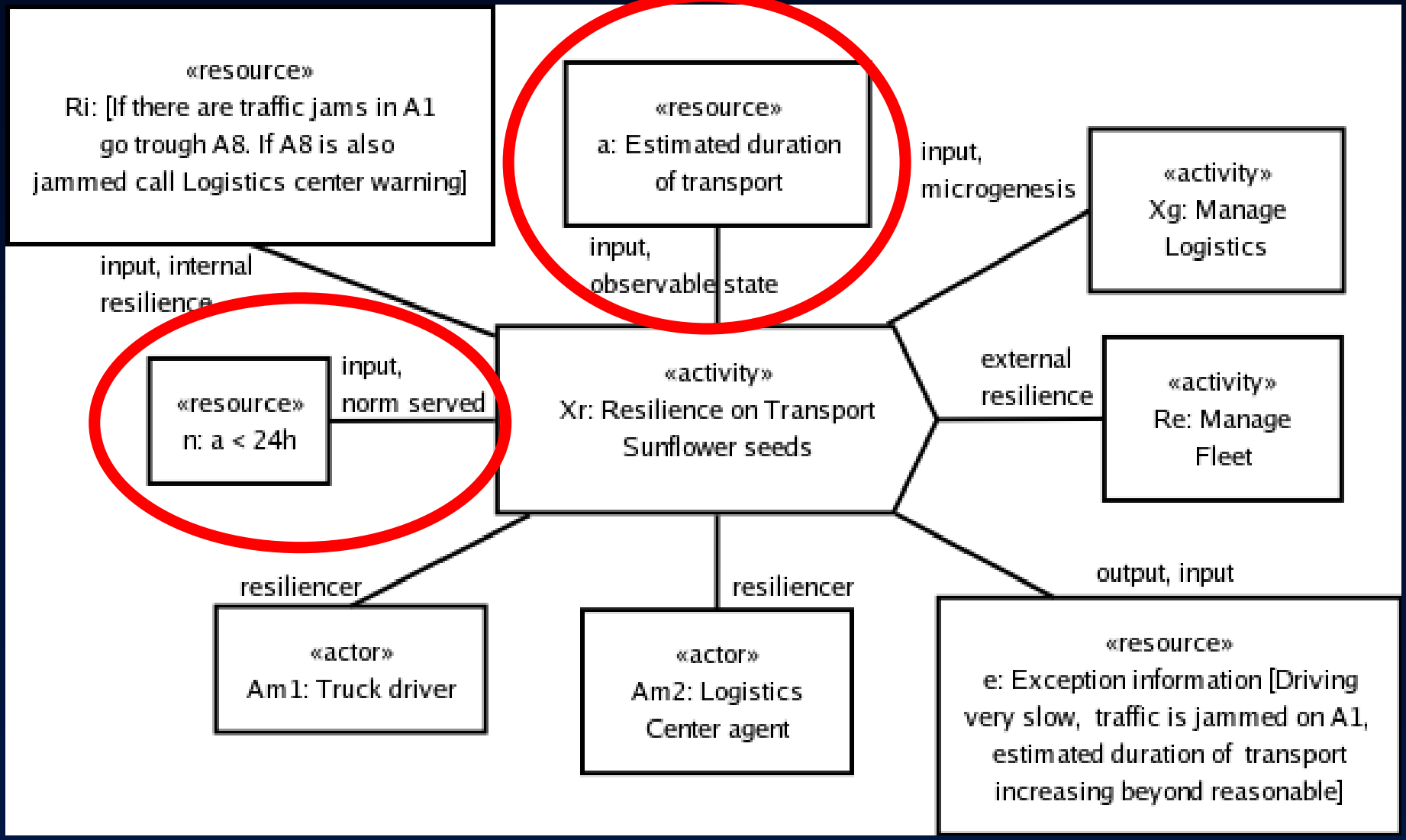
Framework: Resilience context



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Framework: Resilience context

- Key points:
  - Internal resilience – actor Xo – with operation role – has to be also able to perform the monitorer and resiliencer roles, i.e., has to have the appropriate competences
  - External resilience – needed competences are only served in another collaboration, distinct from X, that will have the role of serving as a resilience context for X

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Framework: Resilience context

- Key points:
  - Backtracking of exceptions - occurs when the exception isn't detected on the context it was generated (not being monitored) and dysfunction is propagated
    - e.g., dysfunction due to exception traffic jam propagates to dependent activity Y - Sell sunflower seeds that interrupts its operation due to empty stock
    - Reactive invocation of Xr (X's resilience context) would occur when Yr would detect that it was a problem in a norm, responsibility of X, on which it depends – first step of the backtracking

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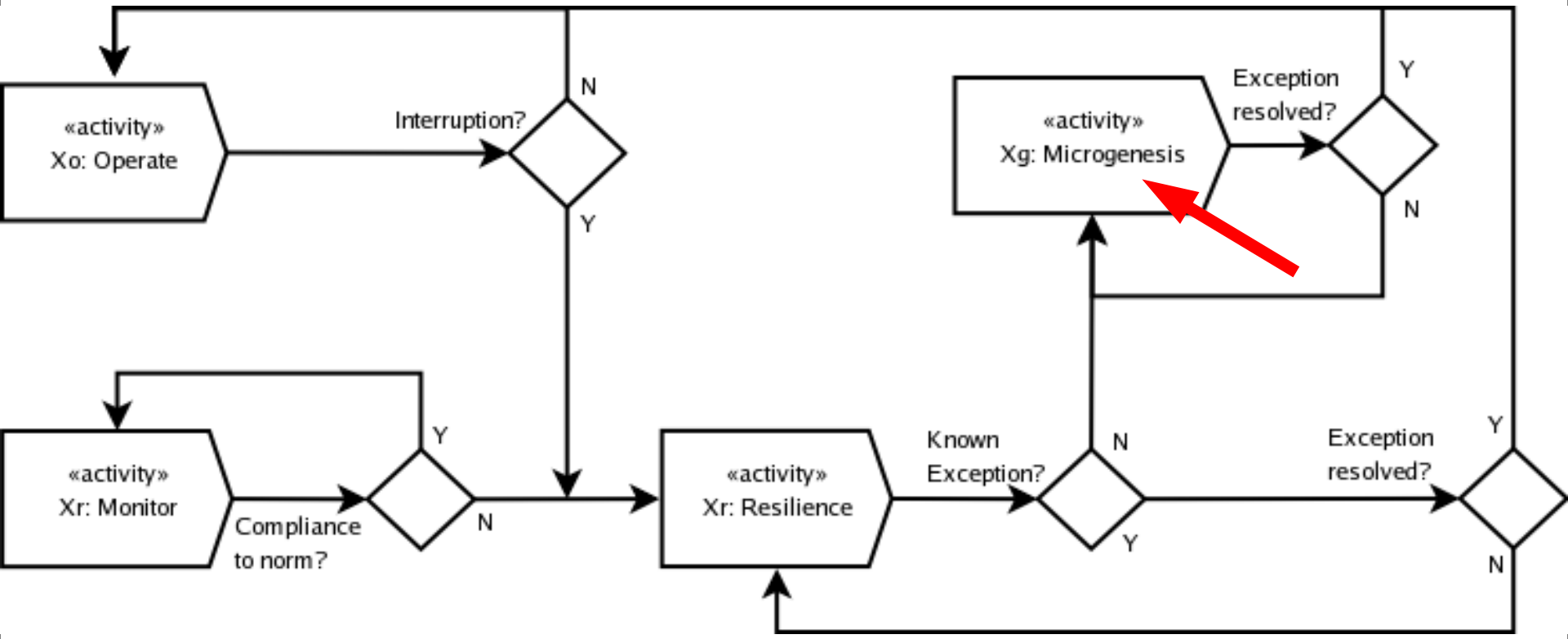
Framework



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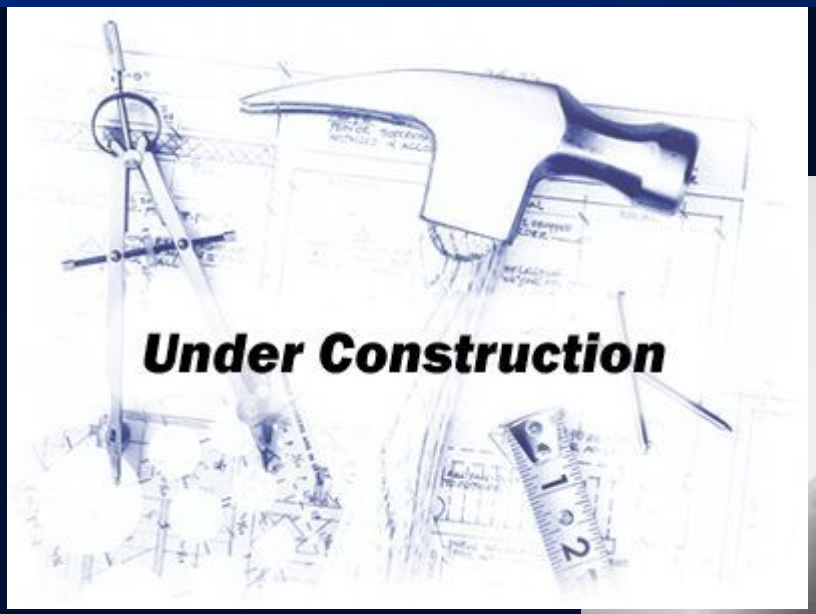
Framework: Microgenesis context



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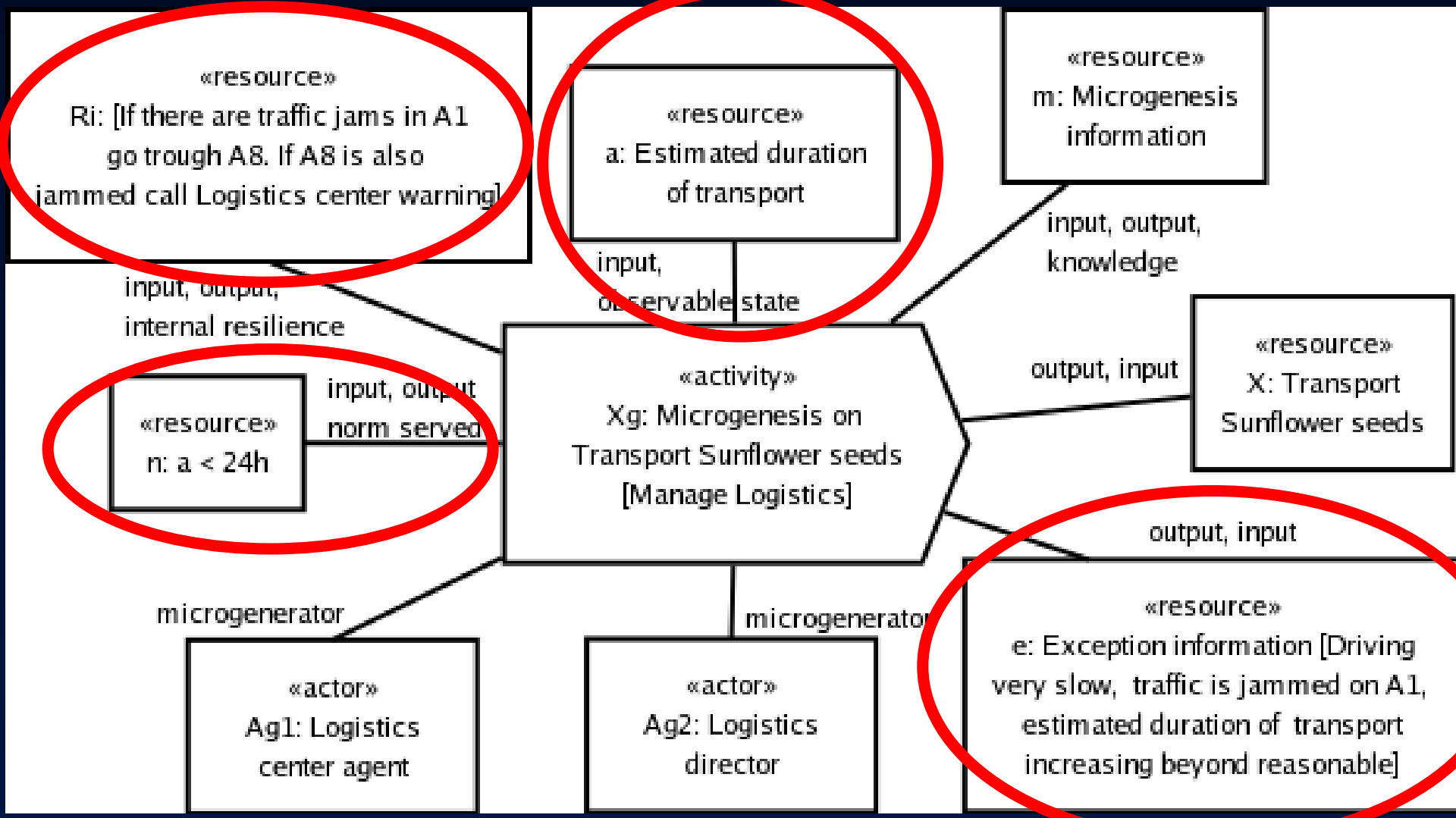
Framework: Microgenesis context



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Framework: Microgenesis context

- Key points:
  - During a microgenesis process, a new set of rules can be selected and embedded in Ri (output role)
    - e.g. rules as output of a previous microgenesis process: (1) If there are traffic jams in A1 go trough A8 (2) If A8 is also jammed call Logistics center warning
  - Another outcome can be a complete change in nature of the activity
    - e.g., creation of alternative X by Airmail.

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Framework: Microgenesis context

- Key points:
  - An important resource is information:
    - explicit organizational knowledge (procedures, activity diagrams, etc.) that can help in error discovery or creation of new rules
    - knowledge about past situations of microgenesis that can help or guide new situations due to similarities
      - e.g. FedEX was chosen instead of competitors like UPS due to their better prices – see document AirPrices.xls
    - best practices repositories can also be of use to identify new proper rules to implement
      - e.g. For very urgent orders and important clients one should consider alternatives to terrestrial transport, like air mail

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Framework

- Concluding points:
  - What identifies an organizational function F for an activity X is the following set of entities:
    - an observable state a;
    - a normative requirement n on a; and
    - one other activity Y that is (totally or partially) dependent on n to be functional
  - All other entities belonging to the several collaboration contexts of F (monitorer, resiliencer, depended, rules, exception, microgenesis info, ...) can be reutilized between different functions

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Framework

- Concluding points:
  - We are still modeling processes, but capturing the entities and roles that emerge on the functional dimension, for a certain activity X, i.e., that constitute X's organizational function
  - The function architecture elicits, on top of the operational plan, the dynamics that assure self-maintenance and evolution: monitoring, resilience and microgenesis.

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Conclusions

- Typical activity modeling gives emphasis to the operational concern of the dynamics being modeled
- If there is an attempt to model all important details around a certain activity, very easily, the model can get complex with a great deal of decision flows, other resources that need to be taken in account, etc.

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Conclusions

- By modeling the 4 concerns in a separate but integrated way, we can
  - reduce model complexity
  - focus on the different roles of each concern
  - easily navigate between concerns and allow traceability
- Making use of the role concept, to model the 4 proposed concerns there is a great potential for reutilization of modeled entities while depicting the organization's reality

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Conclusions

- The monitoring concern allows the elicitation of networks of interdependences between processes (networks of norms)
- With this, we aim to bring the possibility of (automatically or semi-automatically) detect which processes are more vital and establish priorities for creating proactive mechanisms of monitoring and resilience
- Dysfunction detection on (vital) norms should be changed from binary or discrete to continuous

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Conclusions

- The resilience concern provides the means to capture knowledge about resilience solutions, that is, how resources are managed in the context of disruptive deltas in key state variables of certain processes
- Knowledge, manifested in business rules should be explicitly modeled as a way to capture organizational knowledge that can otherwise remain tacit in the minds of human actors of organizations

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Conclusions

- Elicitation of business rules apparently bureaucratic, but in fact vital for certain processes or organization's goals
- Elicitation of unnecessary rules that are in fact bureaucratic and don't contribute in any way to the organization's maintenance and evolution
- Alignment between Business architecture and Function architecture: every business rule should be allocated to an organizational function

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Conclusions

- Depicting the self-maintenance interdependencies (resilience connections)
  - it can be possible to trace circuits of self-maintenance in the organization
  - is potentially useful for detecting gaps in escalation of control flow in the case of known exceptions
  - can allow justified creation of redundancies and triggers for more proper exception handling and escalation flows.

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Conclusions

- With the microgenesis pattern it's possible to
  - capture information on which steps made current business practices successful (in previous situations of unexpected exceptions)
  - information of the process of learning of an organization can be collected and reused in other learning situations
  - allowing not only sustained survival, but a conscious evolution

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Conclusions

- Connection of functional artifacts with human actors allowing
  - establishment of (traceable) chains of responsibility and authority in the functioning of an organization's processes, in the roles of:
    - monitoring, exception handling and microgenesis
  - more informed discussion of hierarchies and their reformulation in a more suitable manner to the organization's needs
  - traceability of apparently "distant" processes in terms of shared responsibilities

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Future Work

- To validate the usefulness of modeling organizational functions with the proposed framework we have planned the execution of at least two case studies
- These case studies will happen in the context of work realized and supervised by us in one graduation thesis and on a MSc thesis, started recently in September 2006

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Future Work

- Graduation thesis has the purpose of extending a modeling tool to allow:
  - a coherent application of the proposed framework to model functional interdependencies between processes (norms networks) as well as self-maintenance interdependencies (resilience networks)
  - automatically or semi-automatically elicit possible risks on vital processes
  - justified proposals of new business rules (resilience mechanisms) to reduce risks of hazardous dysfunction

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Future Work

- MSc thesis aims to create an intuitive tool capable of:
  - capturing in real-time, or just after the situations of unexpected exceptions, structured information about microgenesis dynamics and, at the same time
  - providing informational support to actors participating in microgenesis dynamics, by allowing:
    - search of information available in accumulated logs and, if possible
    - automatic suggestion, based on IA techniques

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