THE UNIVERSITY OF BRITISH COLUMBIA

A Taxonomy of Architectural Design Decisions

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Presenter

Philippe Kruchten, Ph.D., P.Eng.

Professor

Department of Electrical and Computer Engineering

University of British Columbia

Vancouver, BC Canada

pbk@ece.ubc.ca

Architectural decision as 1st class elements

- Design = Making choices
  - Leonardo da Vinci : disegno
    Giambattista Vico : ingenio
  - Un Dessin avec un Dessein
    - “A drawing with an intent”
- “Software architecture encompasses the set of significant decisions about the organization of a software system

  … … (RUP, 1995)

Modeling the decisions

- Not the design
- But the decisions

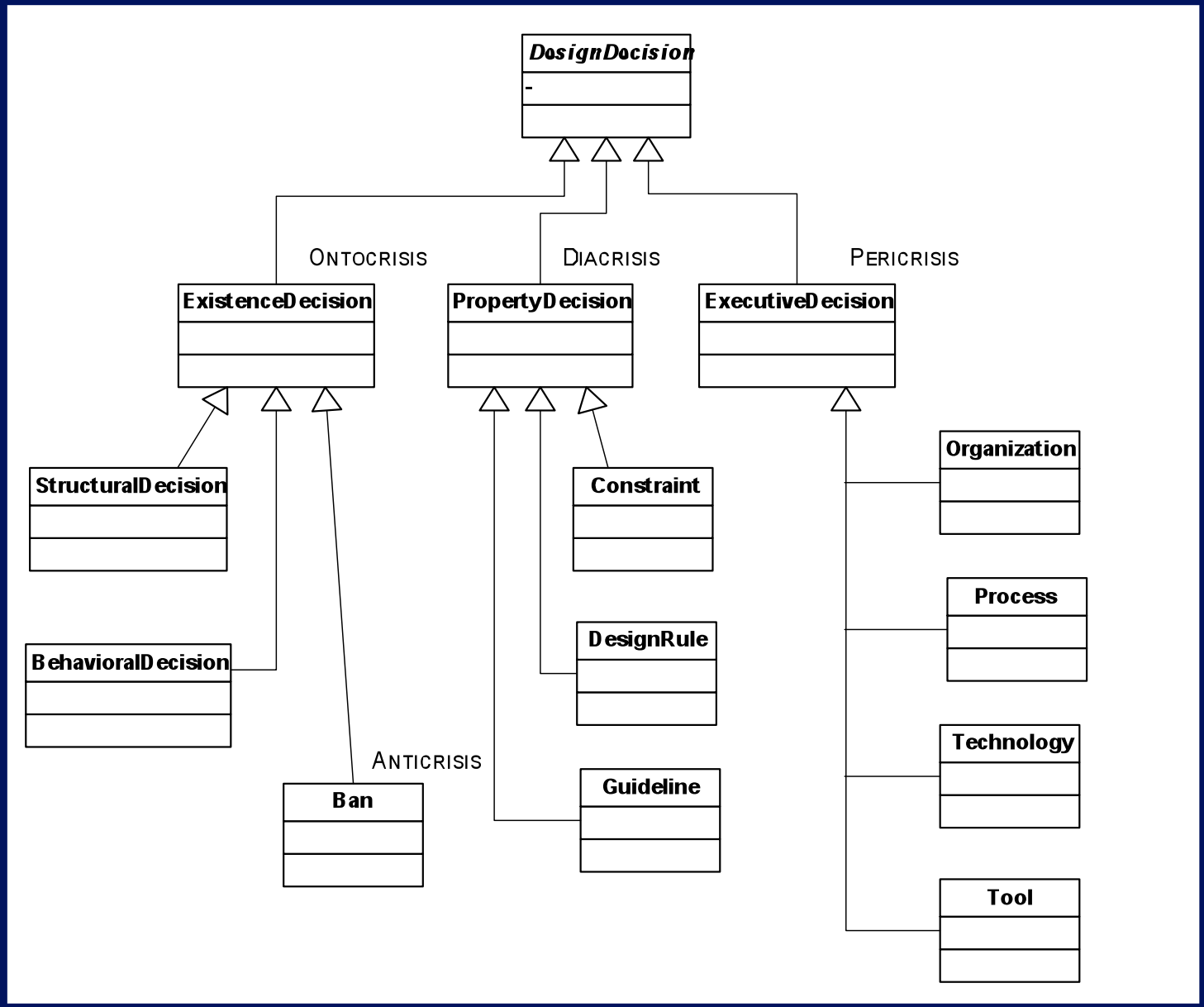
Why?

- Rationale
- What if
- Cross-cutting concerns
- Political and organizational issues

Types of architectural design decisions

- Ontocrises: existential decisions
  - state what element will exist in the design
  - also anticrises (ban, things that will not exist)
- Diacrises: property decisions
  - associate predicate to set of elements
  - Cross cutting concerns, “aspects”
- Pericrises: executive decisions
  - constrain the above, the organization, etc.

Taxonomy of decisions



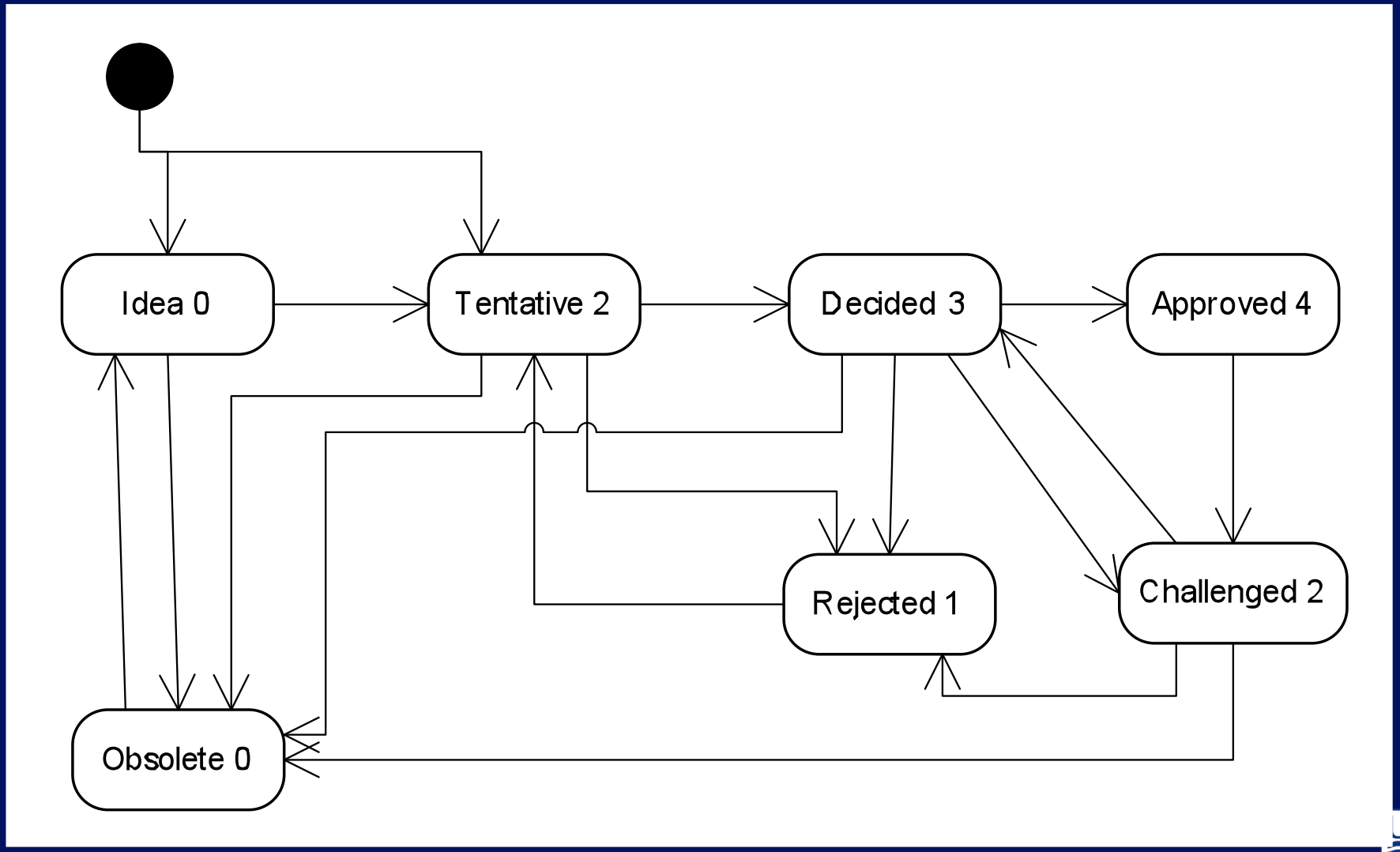
Attributes of a decision

- Epitome — Text
- Rationale — Text or Pointer
- Scope — Text
- State — Enumeration
- History — List of (time stamp + author + change)
- Cost — Value
- Risk — Exposure level

Relationship between decisions

- Constrains
- Forbids
- Enables
- Subsumes
- Conflicts with
- Overrides
- Comprises (is made of)
- Is bound to
- Is an alternative to
- Is related too
- Traces to
- Does not comply with

States of decision



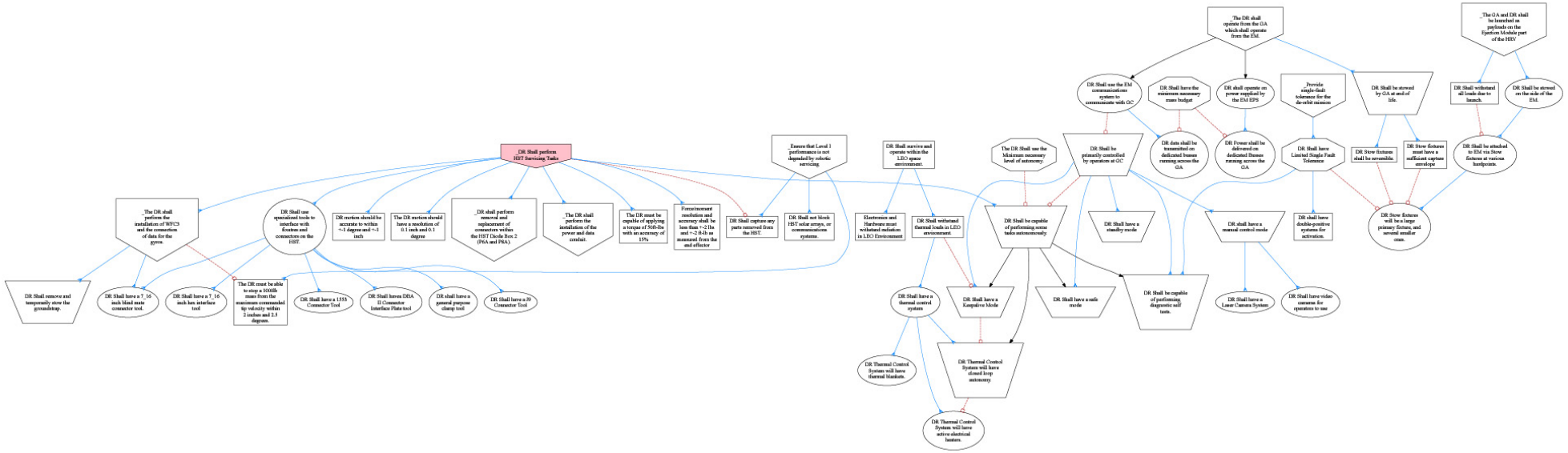
What is the use of a decision graph

- Rationale
  - Connection between requirements, defect and implementation
- Support for review
  - Completeness, consistency
  - Incremental reviews
- Support for evolution
  - Change analysis, “what if”
- Support for reuse, for learning the architectural process itself, for extracting patterns of decisions

Capturing design decisions

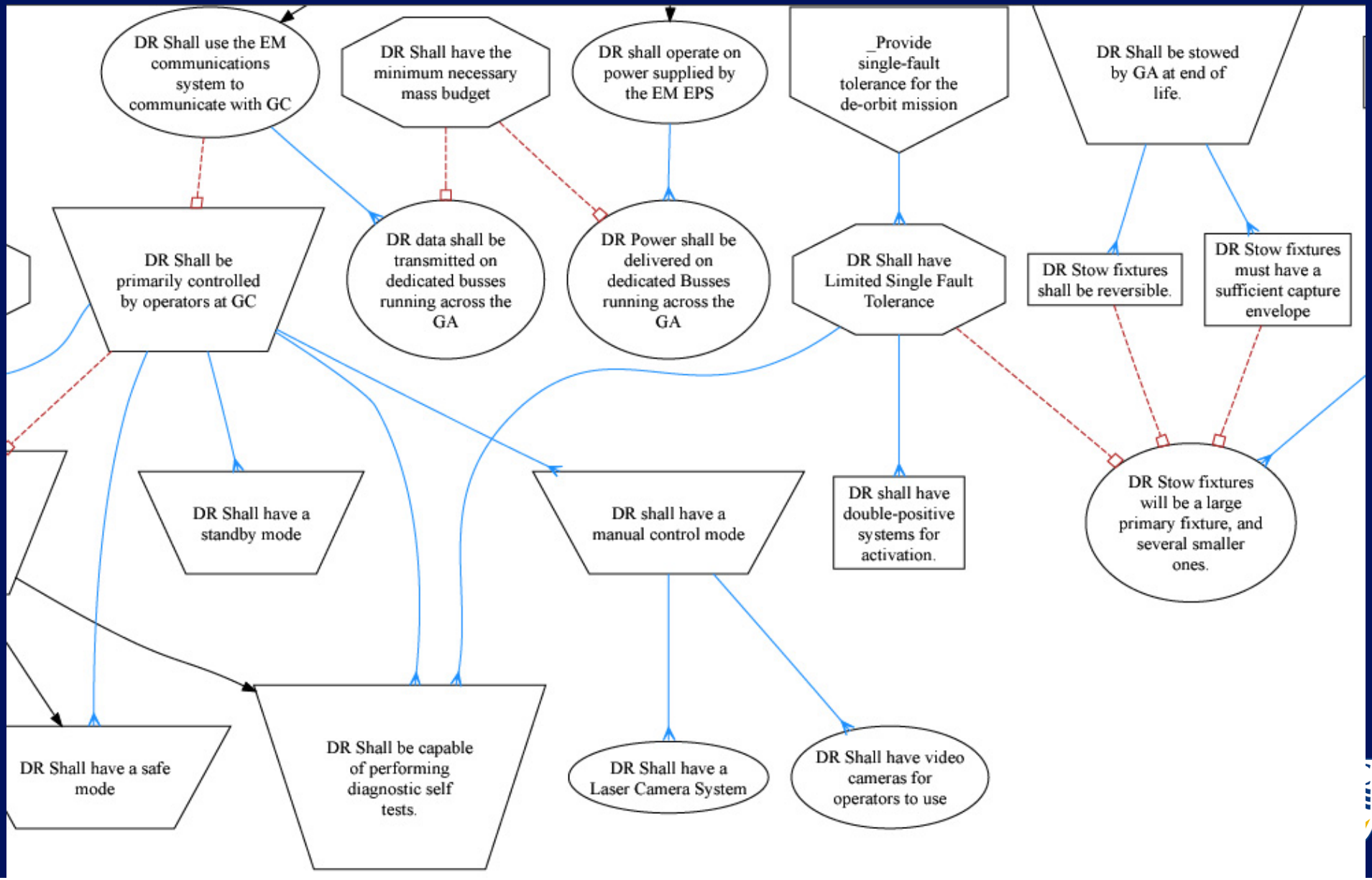
- Design Rationale support systems failed because of overhead of capture
  - not enough immediate value, no incentive to capture
  - tedious process, static diagrams
  - QOC, DRL, InfoRAT, IBIS etc.
- Automating capture with Daemons (agents)
  - Instrument source of decision:
    - Design tool
    - Requirement management tool
    - Defect tracking tool
    - Configuration and change management tool
    - Management tool (task allocation, issue/action items)

Experiment: Spar Aerospace Dexterous Robot

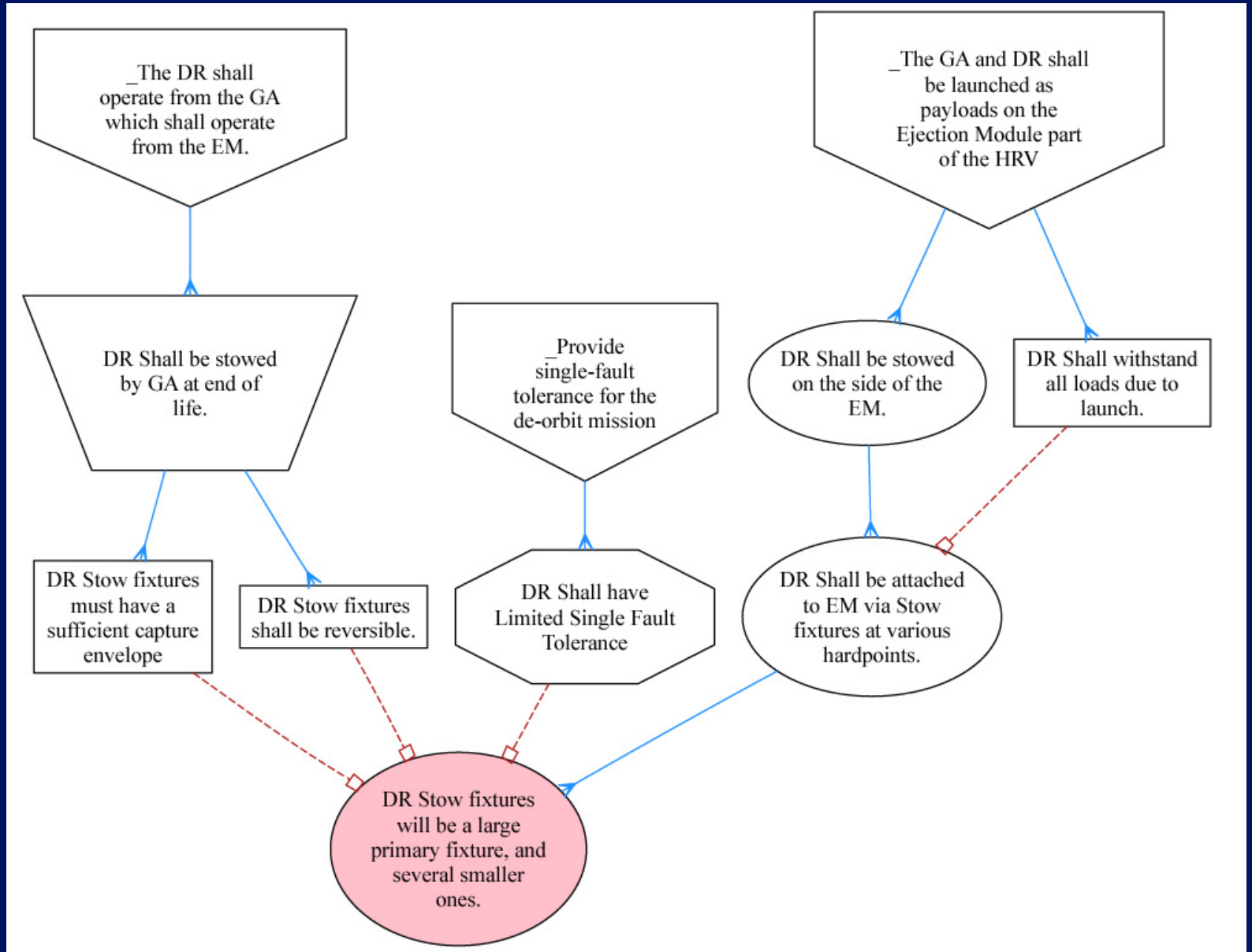


- Dexterous Robot = arm used to fix the Hubble telescope
- Michael Trauttmansdorff & Nicolas Kruchten
- MySQL Database, SVG + GraphViz

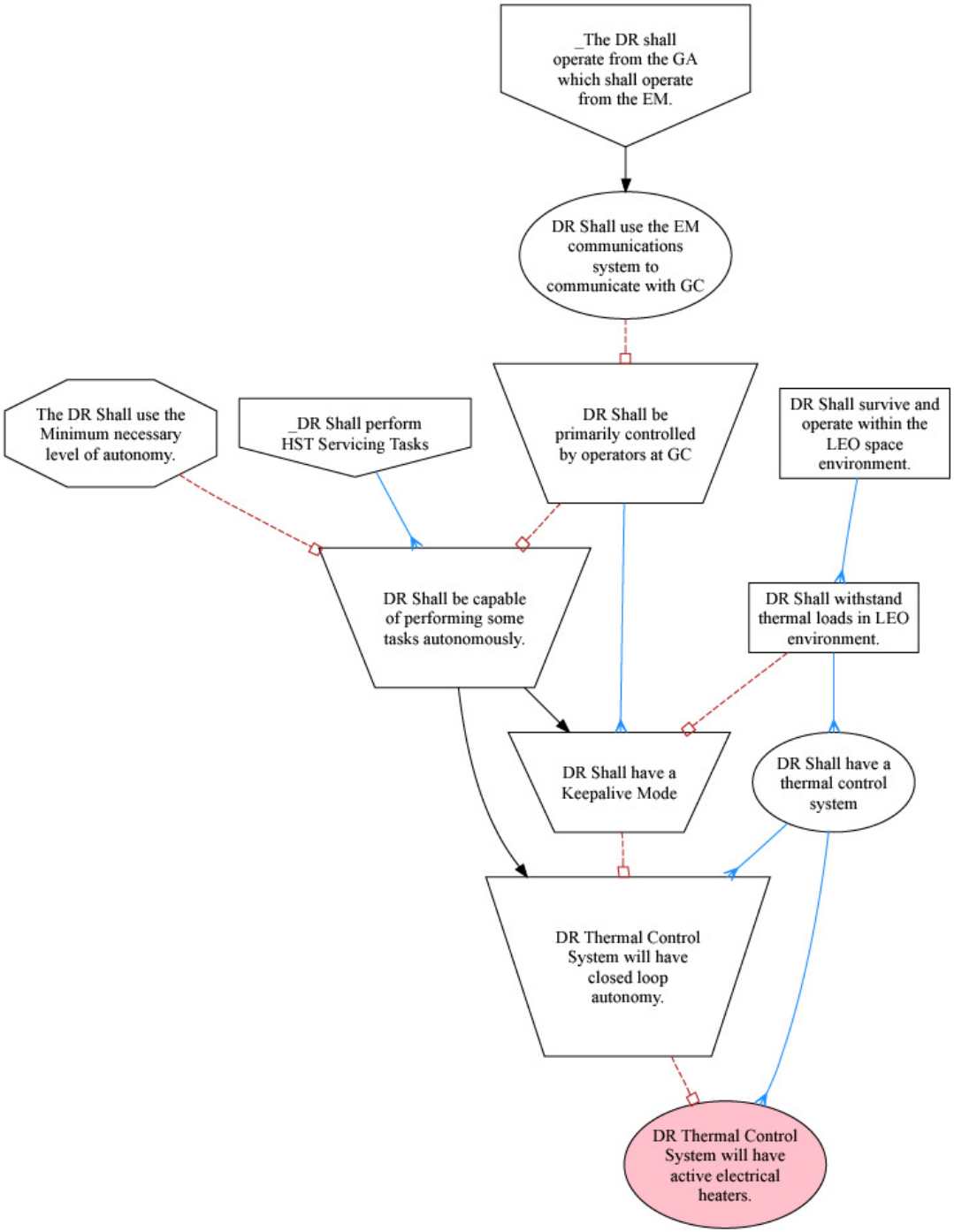
Fragment, enlarged



Extraction, around Stow Fixture



Heaters


_The DR shall operate from the GA which shall operate from the EM.
DR Shall use the EM communications system to communicate with GC
The DR Shall use the Minimum necessary level of autonomy.
_DR Shall perform HST Servicing Tasks
DR Shall be primarily controlled by operators at GC
DR Shall survive and operate within the LEO space environment.
DR Shall be capable of performing some tasks autonomously.
DR Shall withstand thermal loads in LEO environment.
DR Shall have a Keepalive Mode
DR Shall have a thermal control system
DR Thermal Control System will have closed loop autonomy.
DR Thermal Control System will have active electrical heaters.

Future work

- Refine model
  - Develop 3 or 4 more examples
    - Raytheon: air traffic control,
    - CapitalOne: Banking,
    - ?? any idea ??
  - Do mathemathical model, find patterns
- Investigate visualization
  - Icons, arrows, arrowhead, color, position
  - Automatic layout
- Capture mechanism
  - Aim at Eclipse platform: EMF and Rational tool suite