# The GLARE Approach to Clinical Guidelines: Main Features

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- The GLARE system
- Advances: the "what if" facility
- Advances: managing temporal constraints

# Introduction

Clinical guidelines are a means for specifying the “best” clinical procedures and for standardizing them

Adopting (computer-based) clinical guidelines is advantageous

Different roles:

- support
- critique
- evaluation
- education
- ……

Many different computer systems managing clinical guidelines (e.g., Asgaard, GEM, Gliff, Guide, PROforma,…)

# GLARE
# (GuideLine Acquisition Representation and Execution)

- Joint project:

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Dept. Comp. Sci., Univ. Torino (It): L.Anselma,G.Correndo
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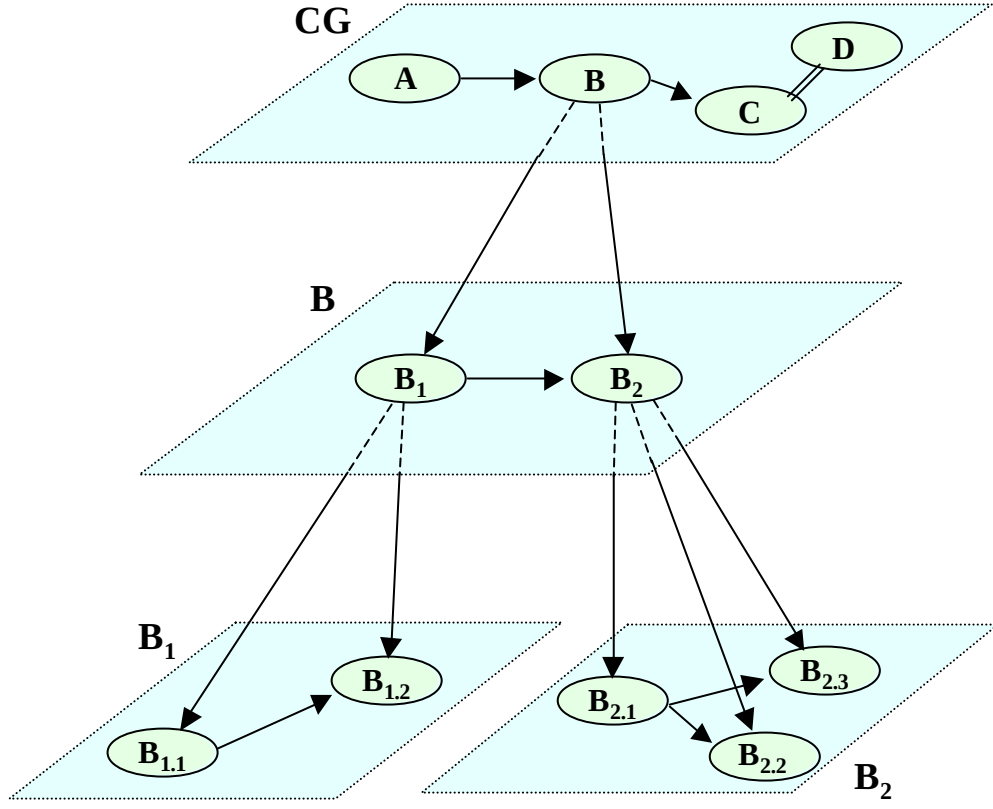
- Domain independent

  (e.g., bladder cancer, reflux esophagitis, heart failure)

- User-friendly (limited number of primitives)

# Representation Formalism

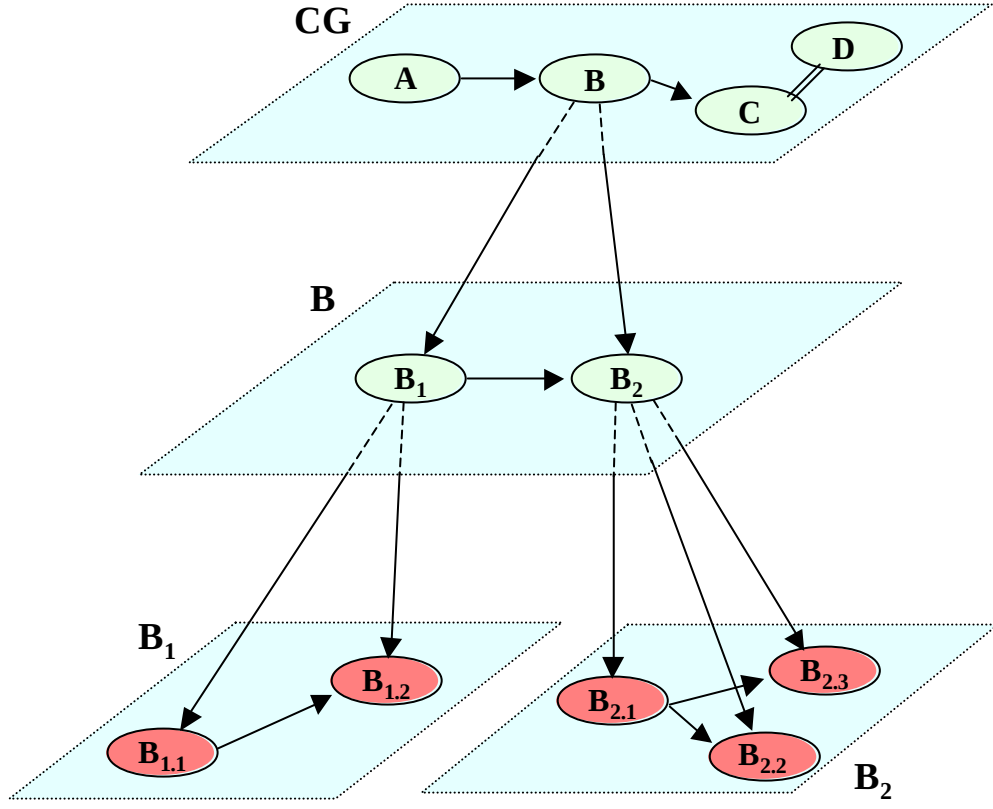
**Tree of graphs**



# Representation Formalism

**Tree of graphs**

**Atomic actions**



# Representation Formalism

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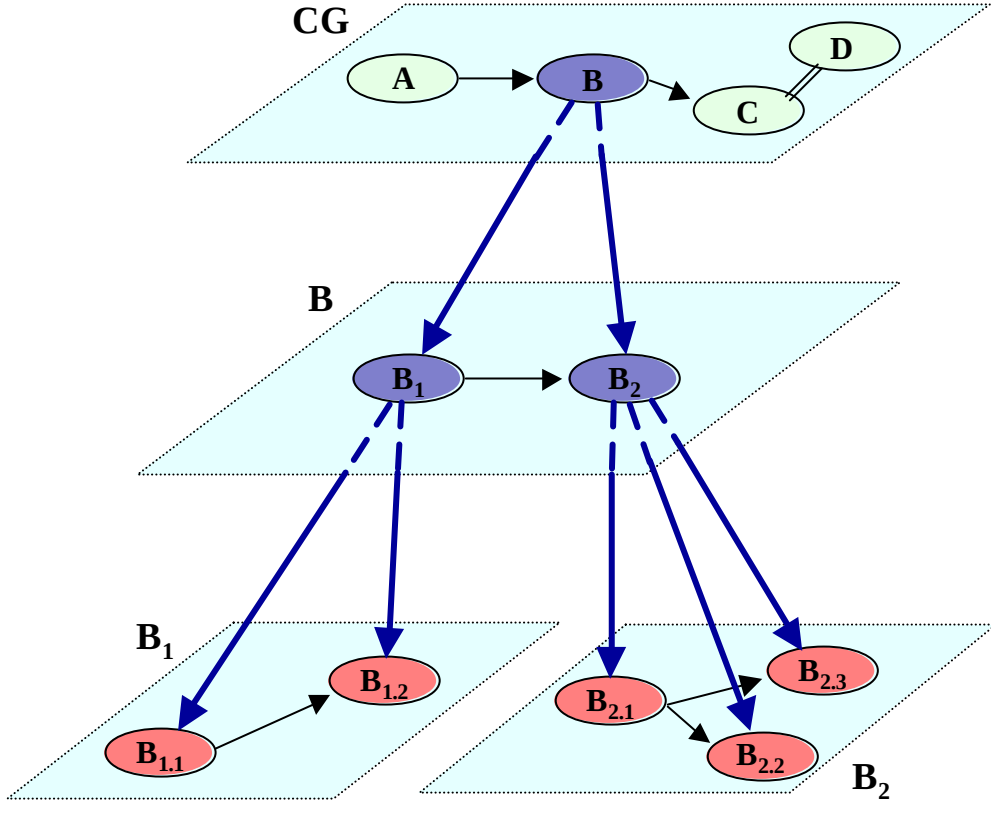
**Composite actions (plans)**



# Representation Formalism

**Tree of graphs**

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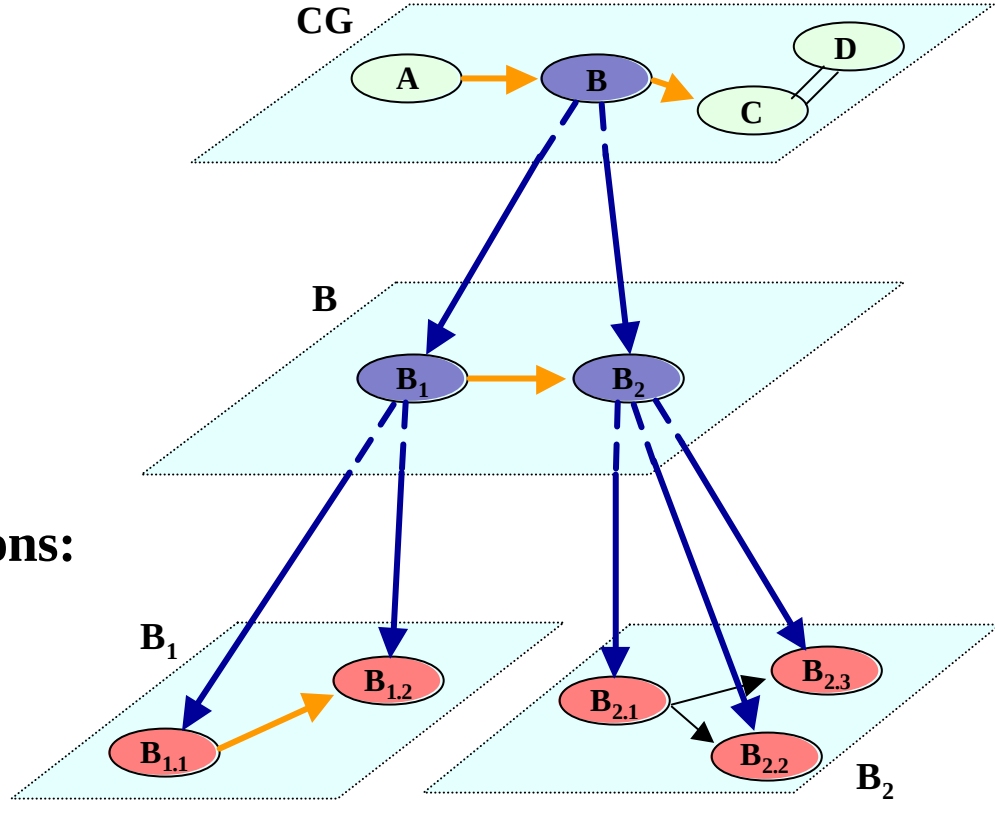
**Composite actions (plans)**

**Control relations between actions:**

- sequence



# Representation Formalism

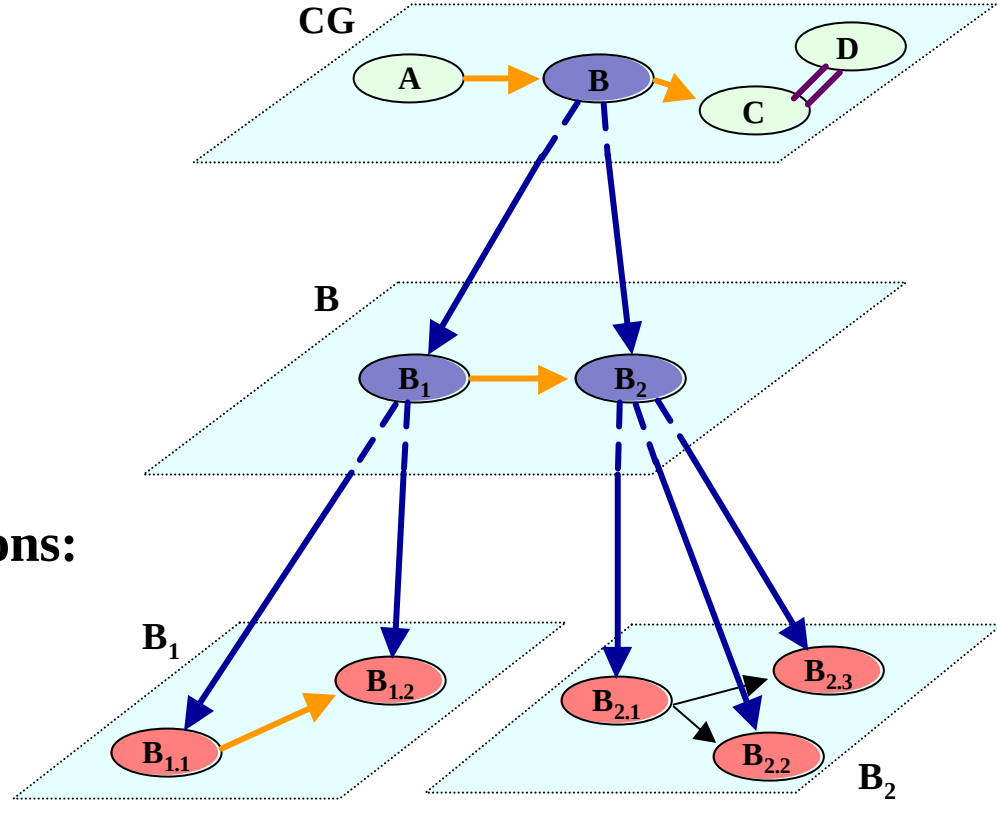
**Tree of graphs**

**Atomic actions**

**Composite actions (plans)**

**Control relations between actions:**

- sequence
- “controlled” (e.g., during)



# Representation Formalism

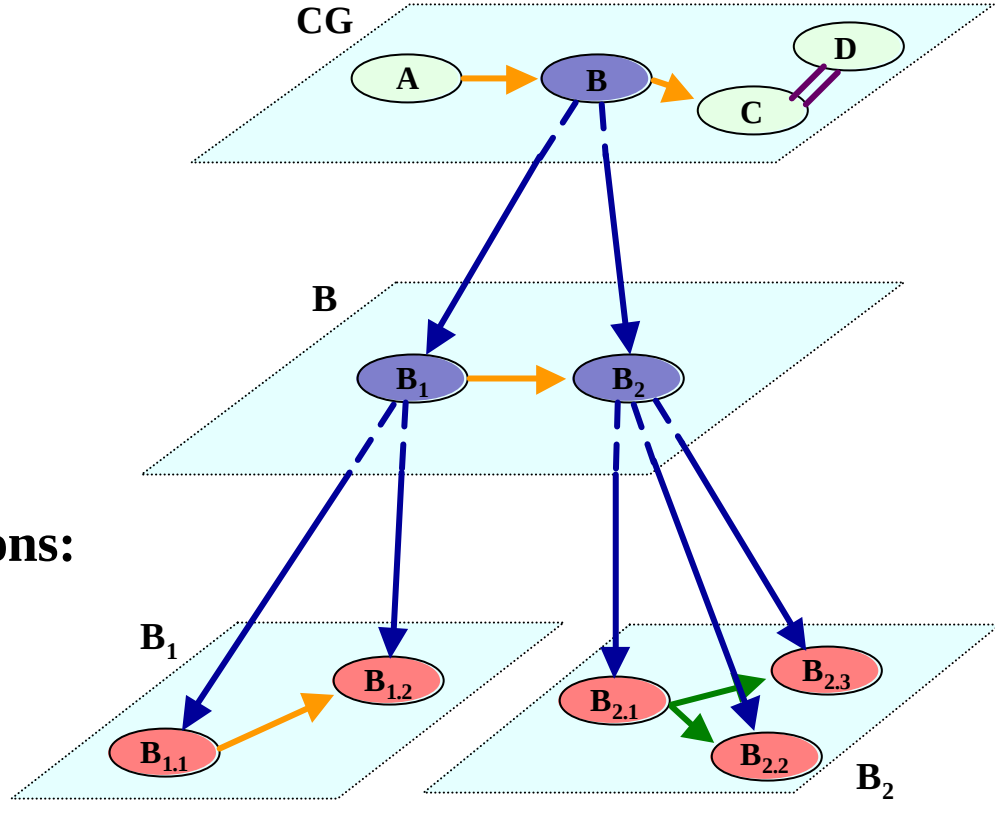
**Tree of graphs**

**Atomic actions**

**Composite actions (plans)**

**Control relations between actions:**

- sequence
- “controlled”
- alternative



# Representation Formalism

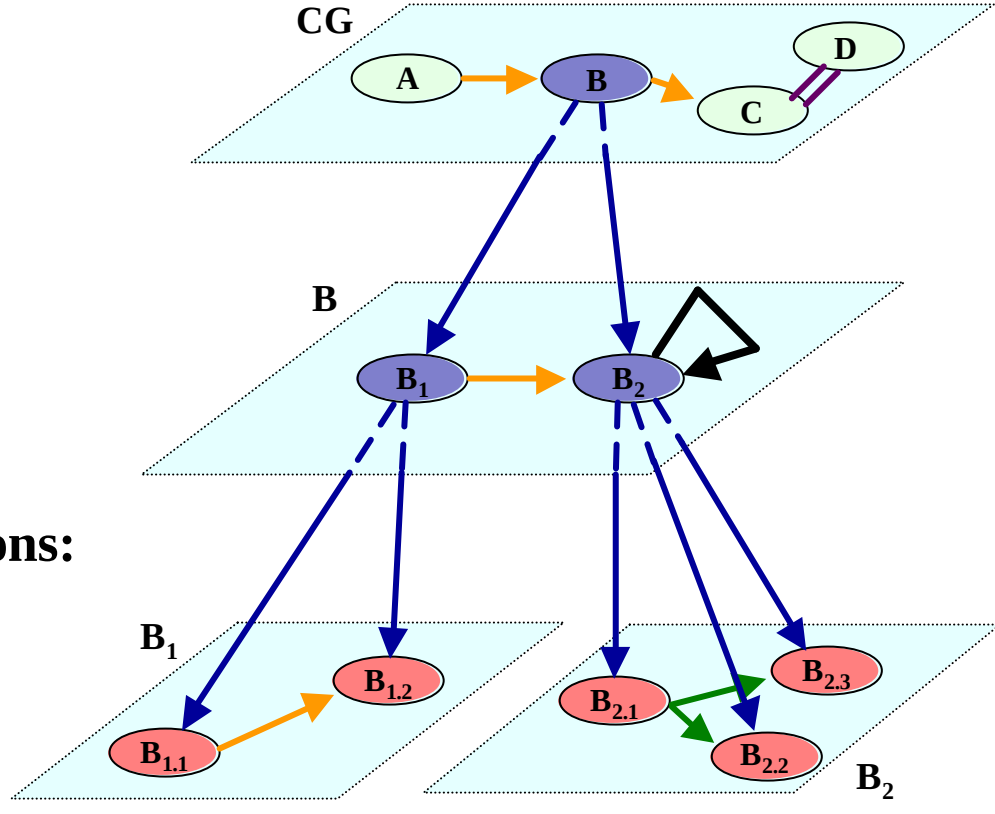
**Tree of graphs**

**Atomic actions**

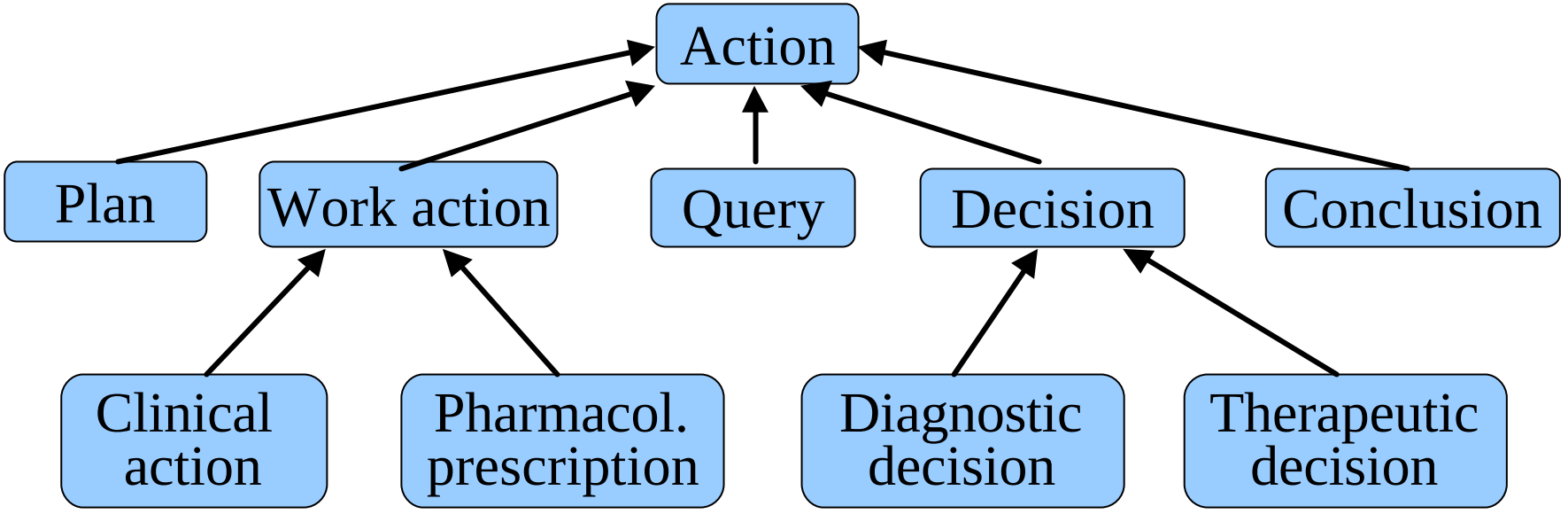
**Composite actions (plans)**

**Control relations between actions:**

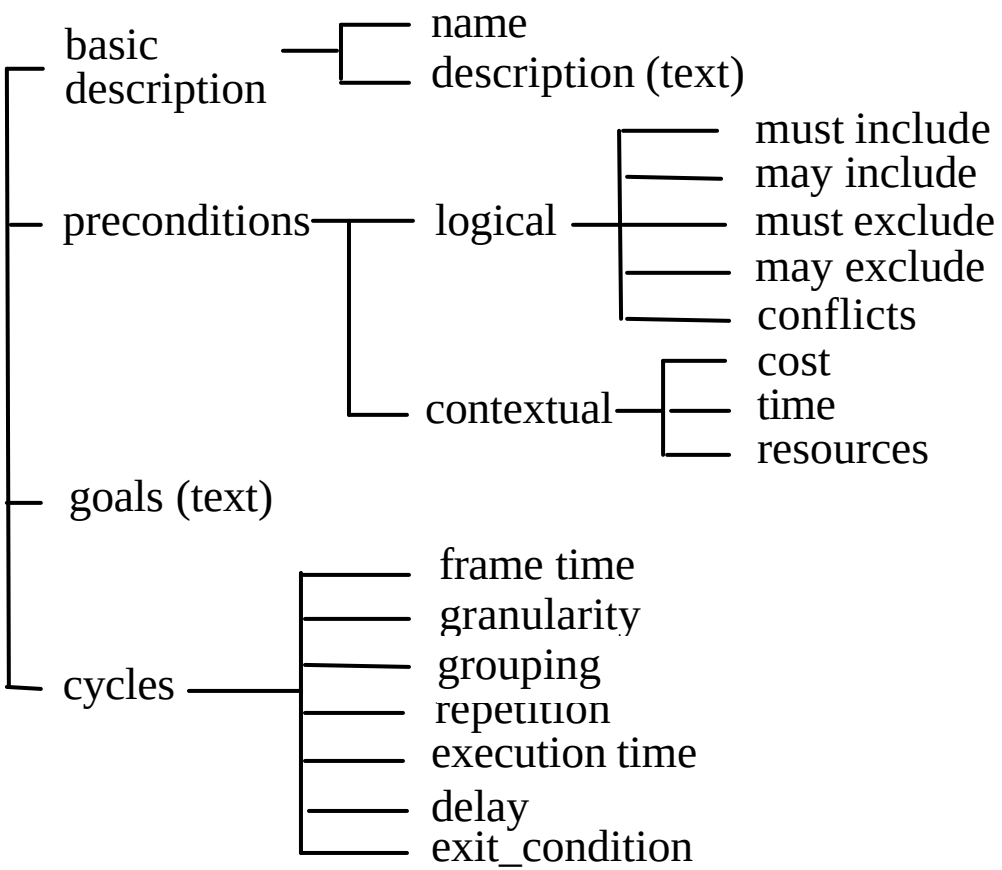
- sequence
- "controlled"
- alternative
- repetition (e.g. "3 times each 2 days for a month")



# Representation Formalism
# Hierarchy of Action Types



# Representation Formalism description of a work action

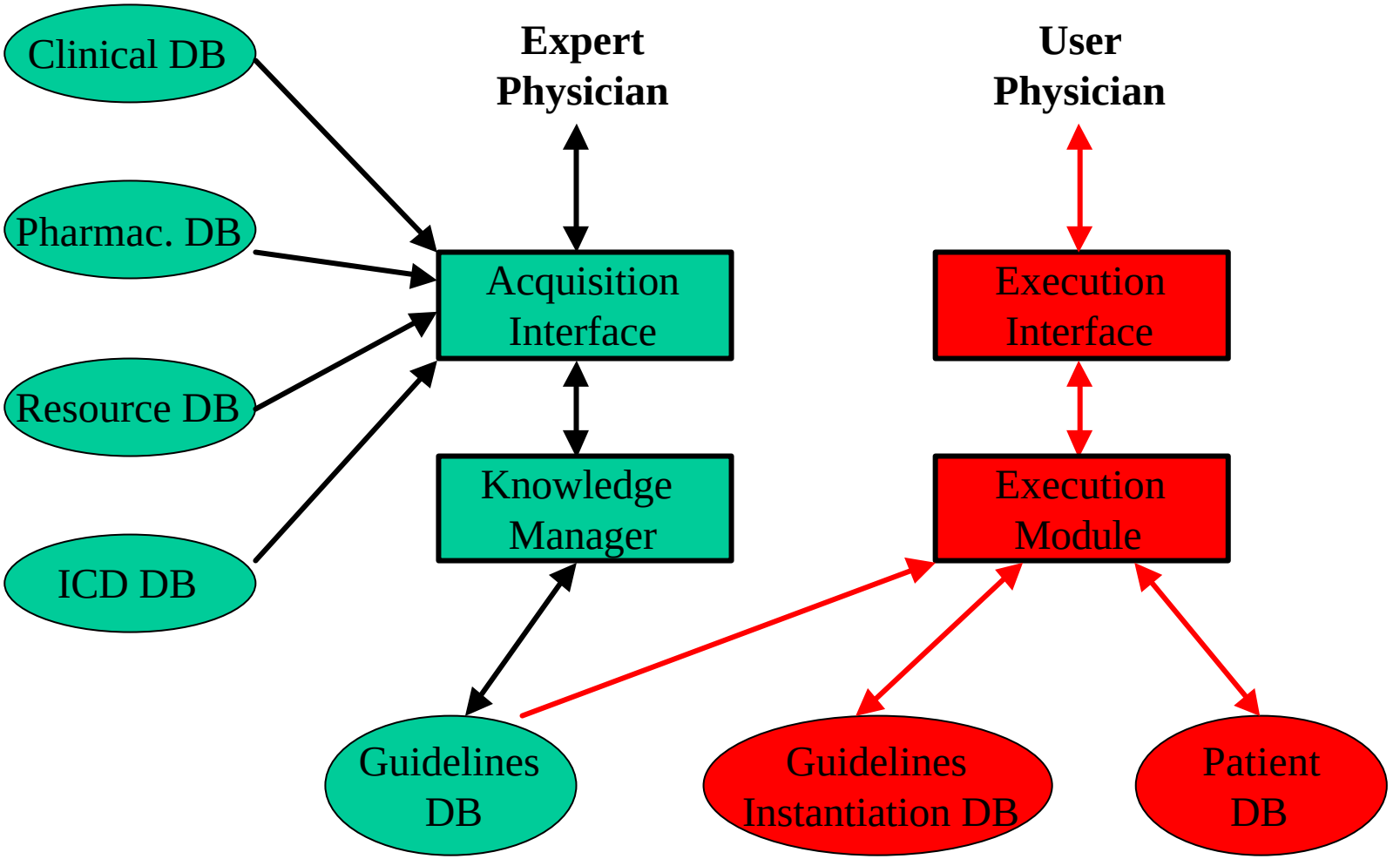


# Therapeutic decisions

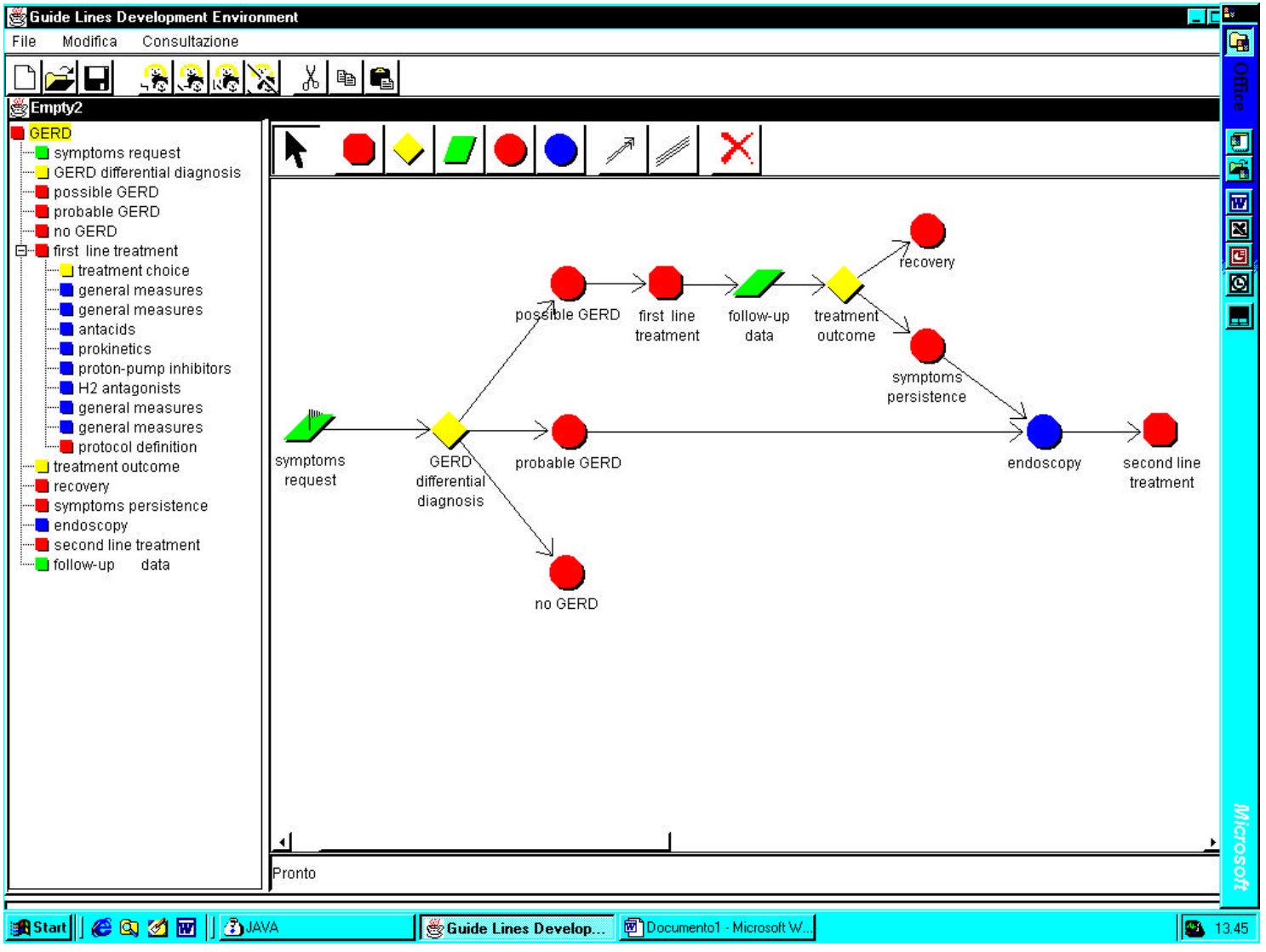
| Strategy | Effectiveness | Cost | Duration | Compliance | Side effects |
|---|---|---|---|---|---|
| Expectant management | - | - | - | ++++ | - |
| Surgery | +++ | ++ | + | - | ++ |
| Litholytic therapy | + | ++ | +++ | ++ | + |

(Example from a symptomless gallbladder stones guideline)

# Architecture of the system



# Acquisition
# Graphical Interface



# Advanced features in GLARE: Supporting medical decision making

“local information”: considering just the decision criteria associated with the specific decision at hand

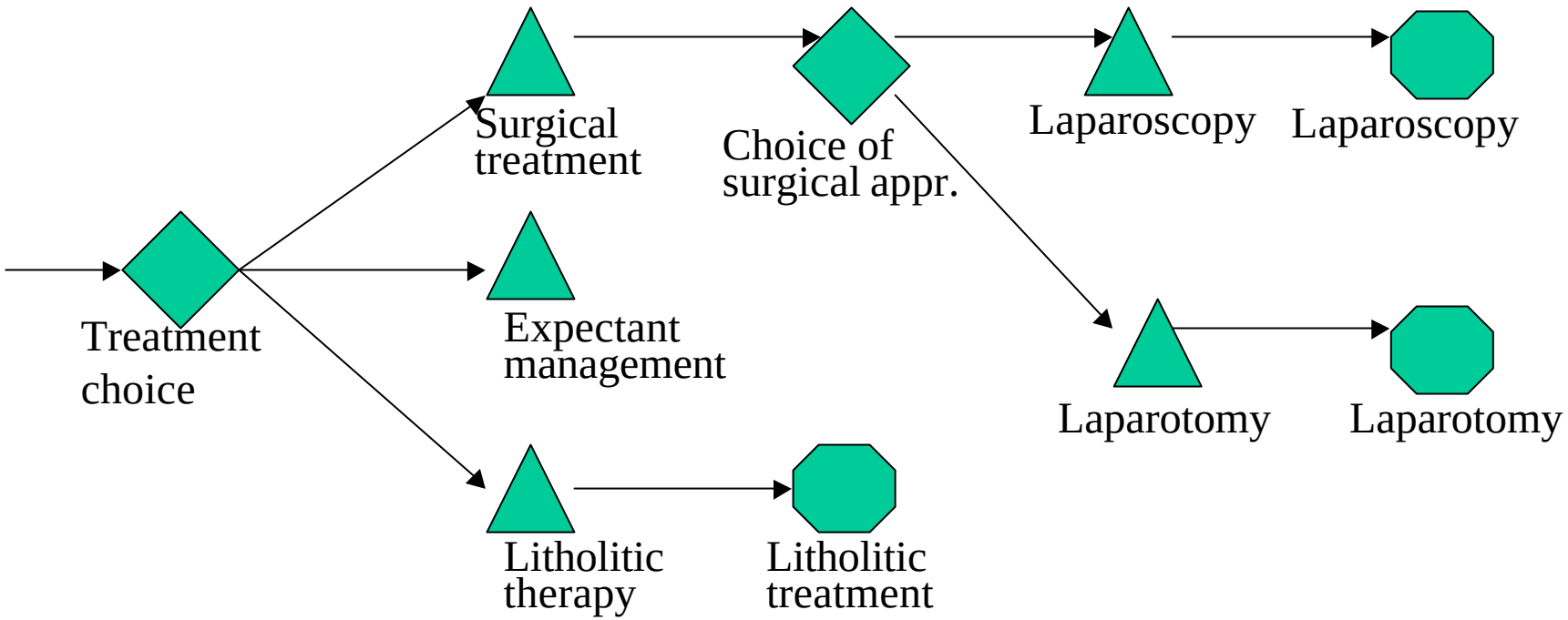
“global information”: information stemming from relevant alternative pathways in the guideline

# Advanced features in GLARE: Supporting medical decision making: the “What if” facility

Facility for gathering the chosen parameter (e.g, resources, costs, times) from the “relevant” alternative paths on the guideline

It provides an idea of what could happen in the rest of the guideline if the physician selects a given alternative for the patient, and supports for comparisons of the alternatives

# Syntomless gallbladder stones
# treatment choice: “global information”



# Advanced features in GLARE: Supporting Temporal Constraints

Temporal constraints are an intrinsic part of clinical knowledge (e.g., ordering of the therapeutic actions)

Different kinds of temporal constraints, e.g.,

- duration of actions (min / max)
- qualitative constraints (e.g., before, during)
- delays (min / max)
- periodicity constraints on repeated actions

# Advanced features in GLARE: Supporting Temporal Constraints

**WHEN Temporal Reasoning is useful in Guidelines?**

ACQUISITION

- to check consistency

EXECUTION

- to compare the duration of paths, in hypothetical reasoning (simulation) facilities

- to check that the time of execution of actions on patients is consistent with the constraints in the guideline

# Managing Temporal Constraints: the Problem

DESIDERATA for the Representation formalism

- expressiveness → capture most temporal constraints in GL

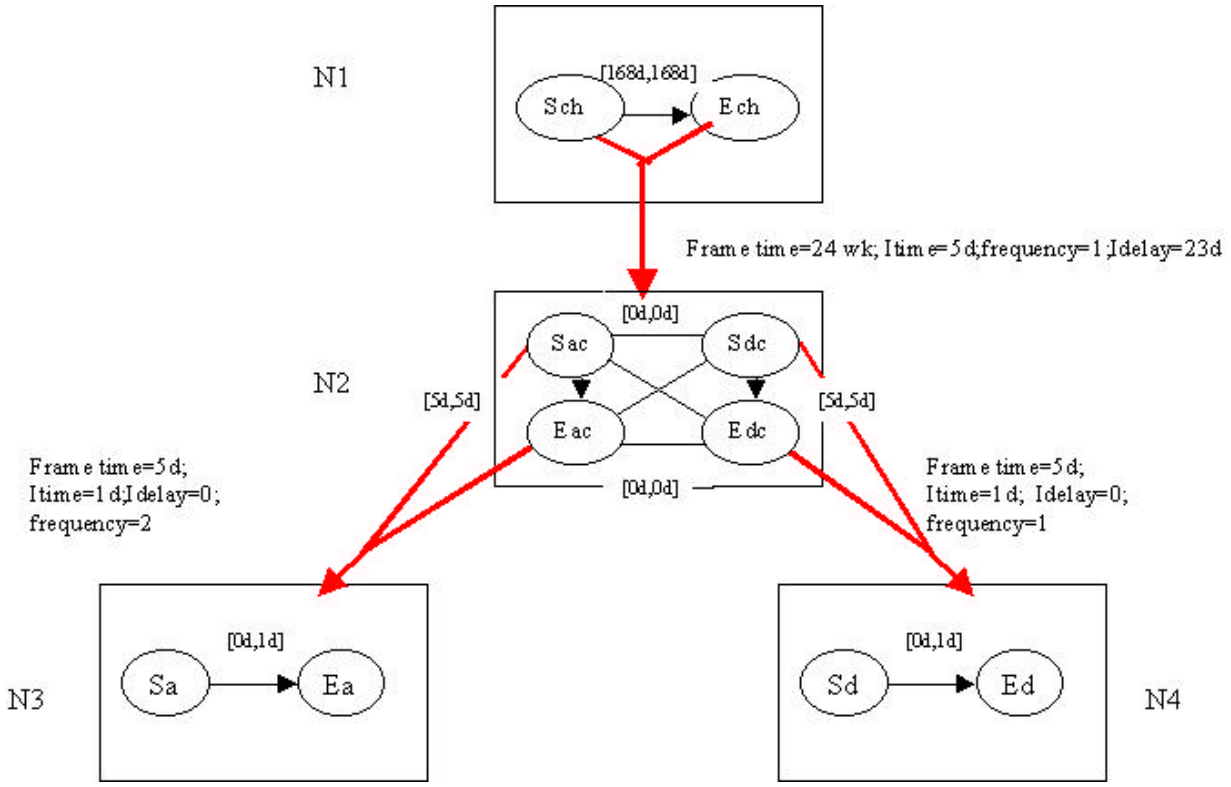
DESIDERATA for Temporal Reasoning Algorithms

- tractability → "reasonable" response time
- correctness → no wrong inferences
- completeness → reliable answers

**No approach in the literature supplying**

- **the desired expressiveness**
- **the above properties**

# Labeled tree of STPs




**Tree of STPs for the multiple mieloma chemotherapy guideline.**
**The overall therapy (node N1) s composed by 6 cycles of 5 days plus a delay of 23 days . In each cycle (node N2), two therapies are executed in parallel: Alkeran (node N3: Sa and Ea are the starting and ending nodes), to be repeated twice a day, and Deltacorten (node N4: Sd and Ed are the starting and ending nodes), to be repeated once a day. Arcs between any two nodes X and Y in a STP (say N2) of the**

# Discussion and conclusions

**The GLARE system (sketch)**

**-**Decision making “What if” facility

**-**Treatment of temporal constraints

**Related approaches in the literature**

- representation formalism & acquisition ~ PROforma, Asbru (time)

**Work in progress:**

**- Enhancing the “What If” facility with Decision Theory**

**- Advances in temporal reasoning**

**-Making GLARE independent of Patient DB and Clinical Ontologies**

# Digression 1

## Why don’t we put “global info (about paths)” locally in the decision actions?

Given “local info” in each node, collecting & storing might be authomatical

**HOWEVER:**

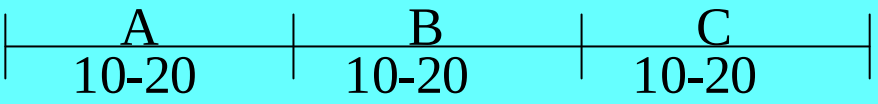
- exponential space in each node
- data duplication (consistency after updates?)
- not user friendly (too many data!)
    - not all aternatives are “relevant”
    - data not always necessary

>> **global data only at execution time, <u>on request</u>**

# Digression 2

## Why (Complete) Temporal Reas. is fundamental?

(1.1) the end of A is equal to the start of B
(1.2) the end of B is equal to the start of C
(1.3) the duration of A is between 10 and 20 m
(1.4) the duration of B is between 10 and 20 m
(1.5) the duration of C is between 10 and 20 m




**Implied constraint (temporal reasoning):**

(1.6) C ends between 30 and 60 m after the start of A

**Suppose that temporal reasoning is NOT complete, so that (1.6) is not inferred**

**The answer to query (Q1) might be: YES**

(Q1) Is it possible that C ends more than 70 m. after the start of A?

**Complete Temporal Reasoning is NEEDED in order to grant correct answers to queries!**