Logics for Terms of Services and their Usefulness for Automation

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at

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LoCo – Logics for Contracts

The project

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The project

Target:

Terms of Services (ToS)

LoCo – Logics for Contracts

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Terms of Services (ToS)

Why?

Empowering people

LoCo – Logics for Contracts

The project

Target:

Terms of Services (ToS)

Why?

Empowering people

How?

Let the browser check the ToS

LoToS – Logics for Terms of Service

The project

LoToS – Logics for Terms of Service

The project

Automation for Terms of Services

- Automate the reading.
- Automated analysis (personalized).
- Automated translation.
- Automated negotiation.
- Drafting.
- Visualization.
- Summaries.
- Comparisons.

LoToS – Logics for Terms of Service

The project

Include:

- Natural Language Processing (NPL).
- Knowledge representation (KR).
- Understanding norms and actions.
- Inference engine.
- Verification of desired properties/requirements.
- Monitor.
- Open system administered by a community.
- User friendly and ease of use.

LoToS – The Intended Outcome

User's point of view

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4. If some requirement fails, the user is provided with an explanation.
5. Visualization and summary of the explanation/trace is needed.

The user takes the ultimate decision to accept the ToS.

LoToS – The Intended Outcome

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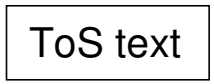

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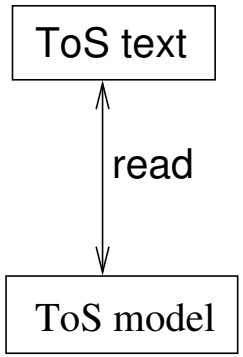

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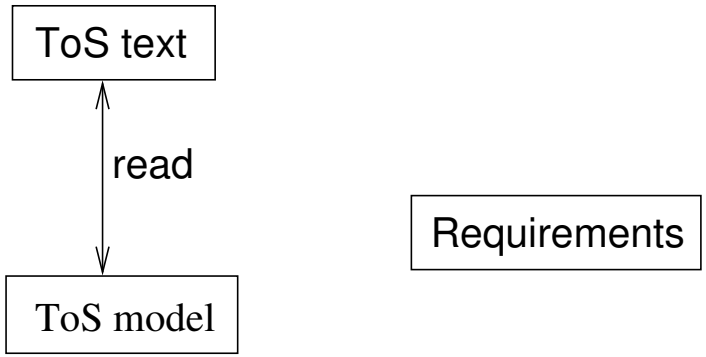

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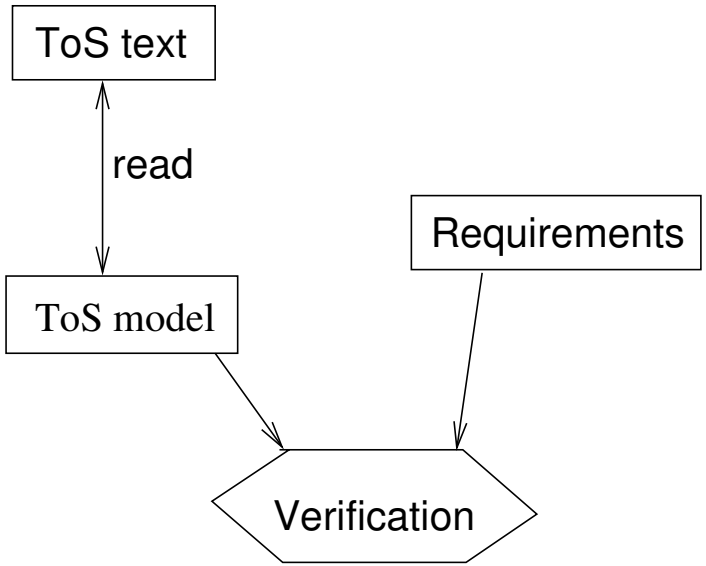

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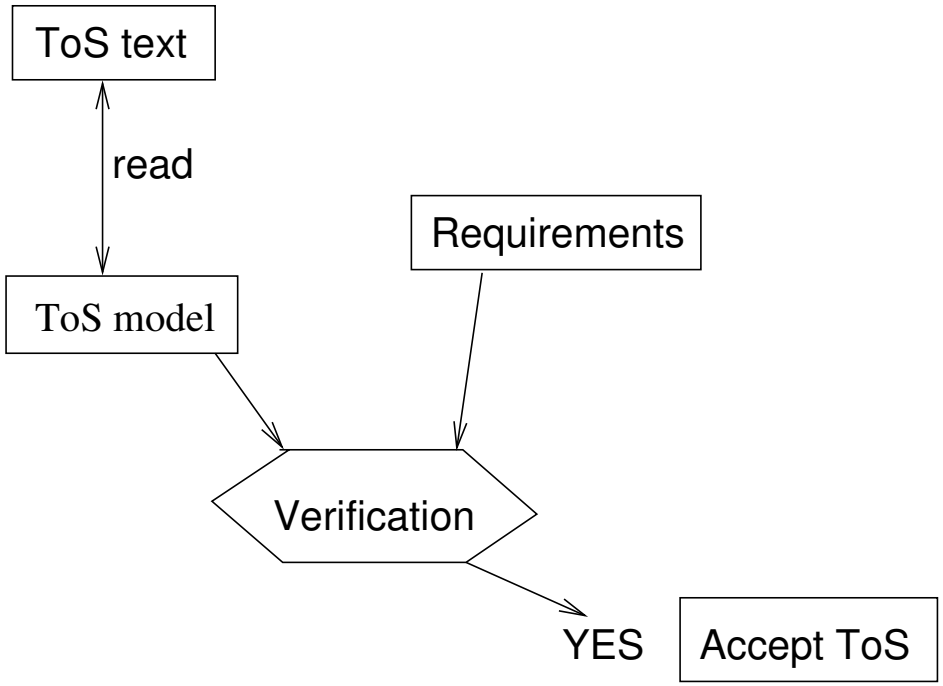

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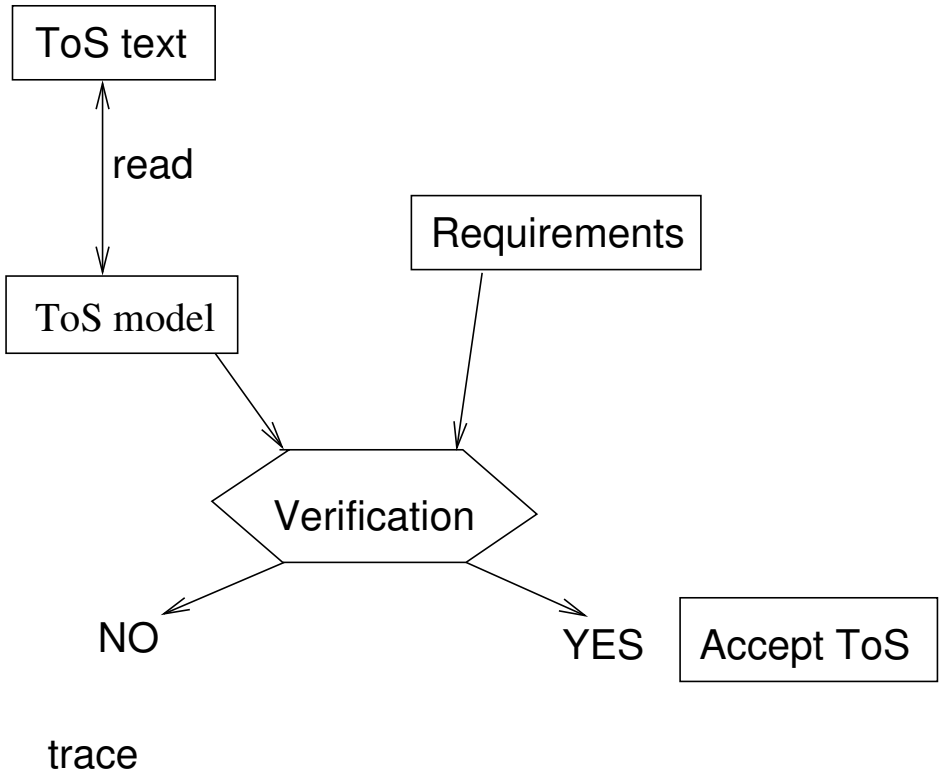

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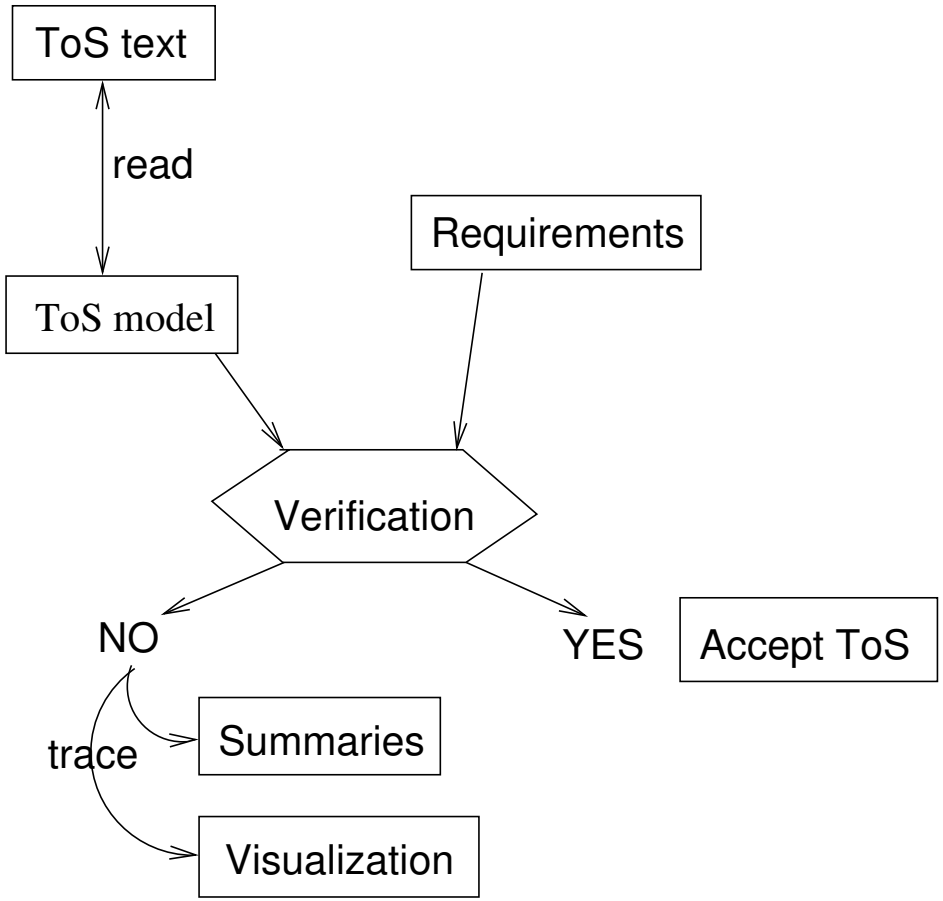

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   - User is notified for
     – help with the parsing rules
     – disambiguation
     – or to ignore that part of the ToS
   - A non-expert user may access the on-line LoToS system
     – where the present ToS hopefully/probably exists
     – expert users from the community took care to disambiguate
     – any choices for a ToS can be visualized by the user

User's point of view

What can go wrong – 2

2. Requirements
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User's point of view

What can go wrong – 2

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   are difficult to define.

- templates predefined by the community experts can be taken a priori and filled in for the present ToS
- for ToS existing in the on-line LoToS
  predefined requirements can readily be taken
- The user administers a personal wallet for requirements.

  (Care needs to be taken by the community for the available requirements, so to avoid clutter.)

User's point of view

What can go wrong – 3

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2. Requirements
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- model-checking can be computational intensive.
- for existing ToS any requirements in the on-line LoToS should have already been checked
- Any new requirements are a model-checking problem
  – that can be solved on the user's machine
  – or through the community's distributed model-checking system

User's point of view

What can go wrong – 4

With quantities, deadlines, and other quantifiable notions like privacy, satisfying requirements can be fuzzy, i.e., on a scale range.

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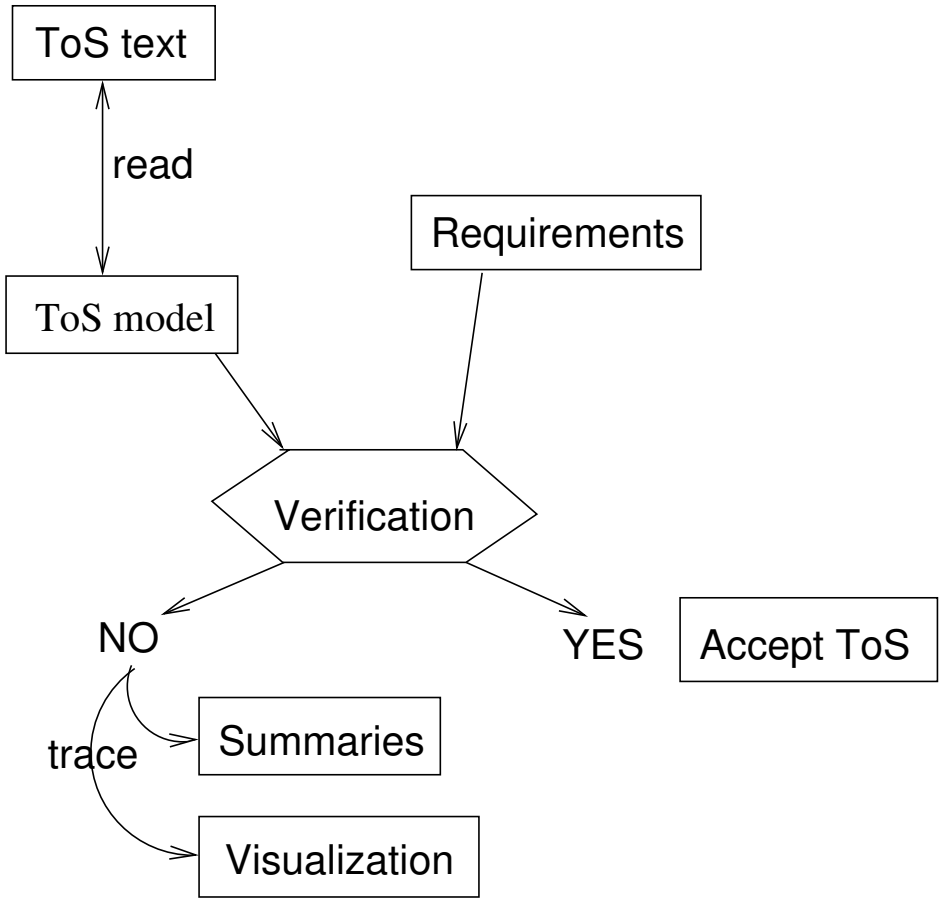
What can go wrong – 4

With quantities, deadlines, and other quantifiable notions like privacy, satisfying requirements can be fuzzy, i.e., on a scale range.

- Thresholds can be used to determine when to signal failure.
- Otherwise, the verification can return a quantitative evaluation.
  The user decides if the requirements evaluated against the ToS have a reasonable outcome to allow acceptance.
  – Explanations are more difficult.
  – Visualization could help (LoToS needs information designers).

User's point of view

help from on-line LoToS



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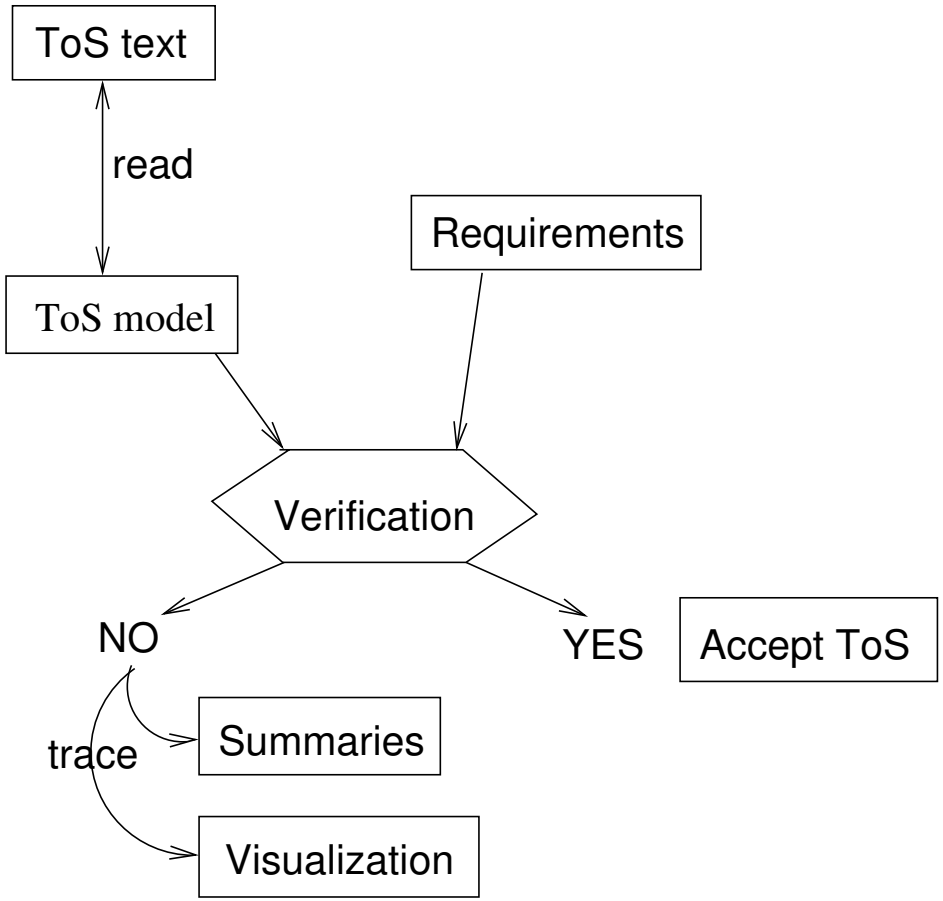

On–line LoToS helps non–experts

Models $\models$ Requirements Templates Experts Computing power

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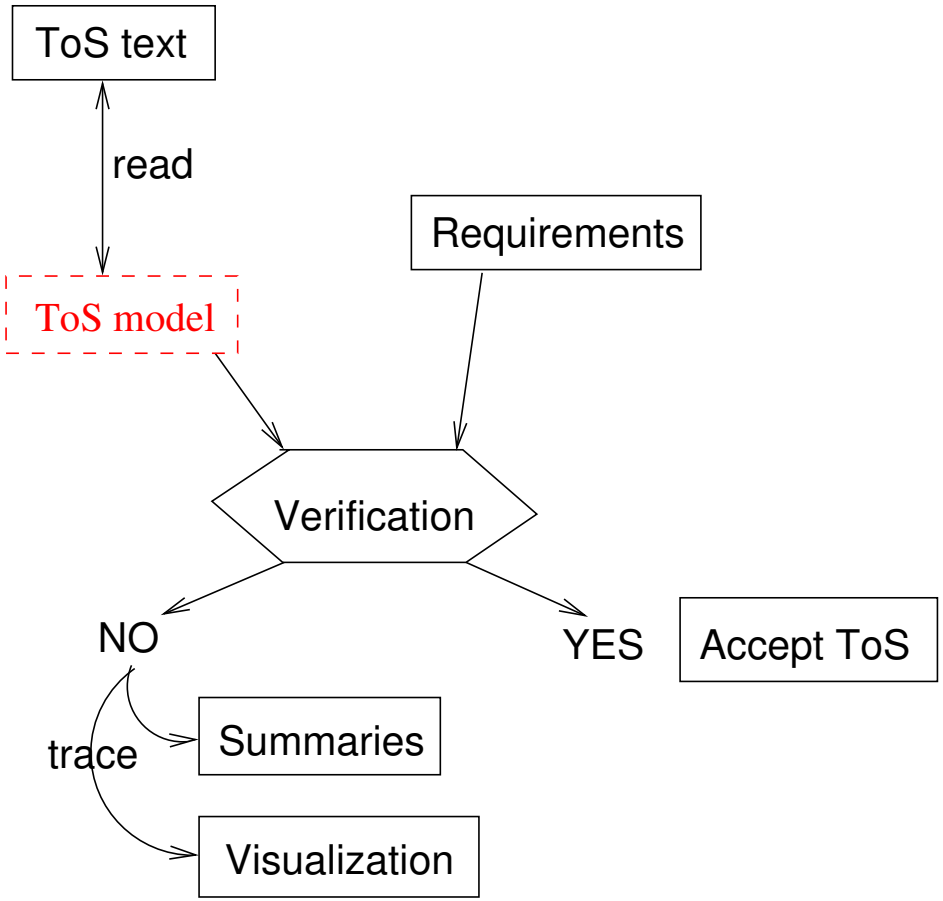

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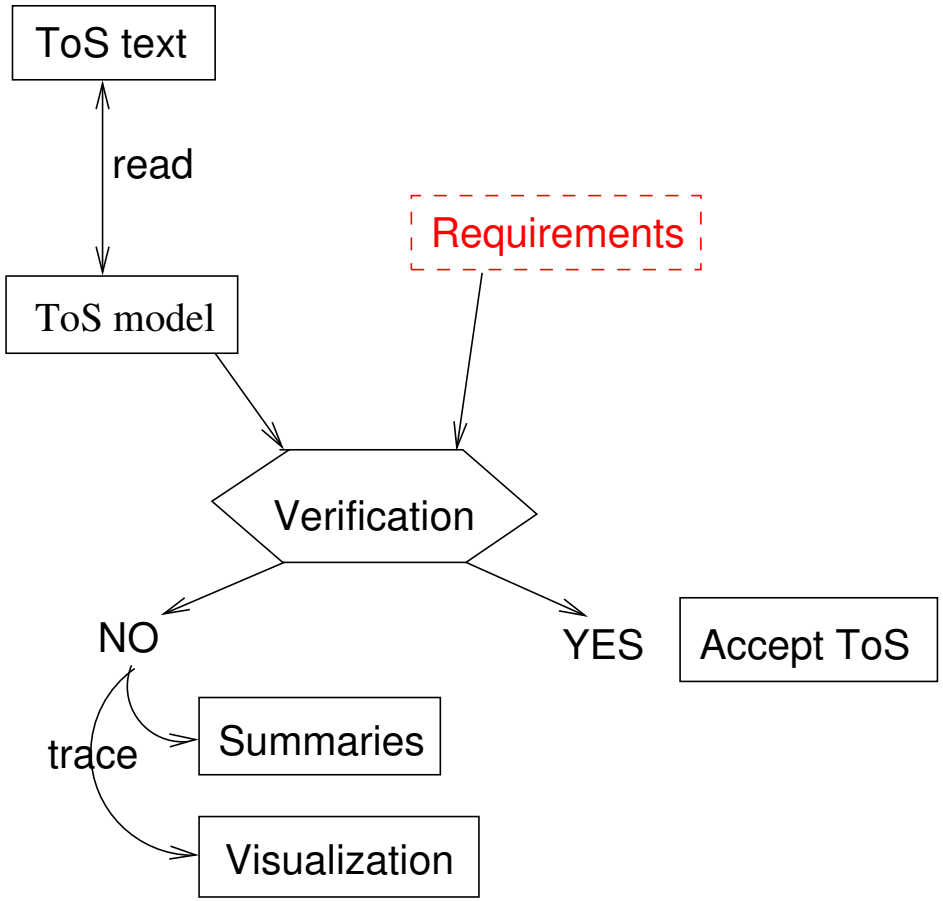

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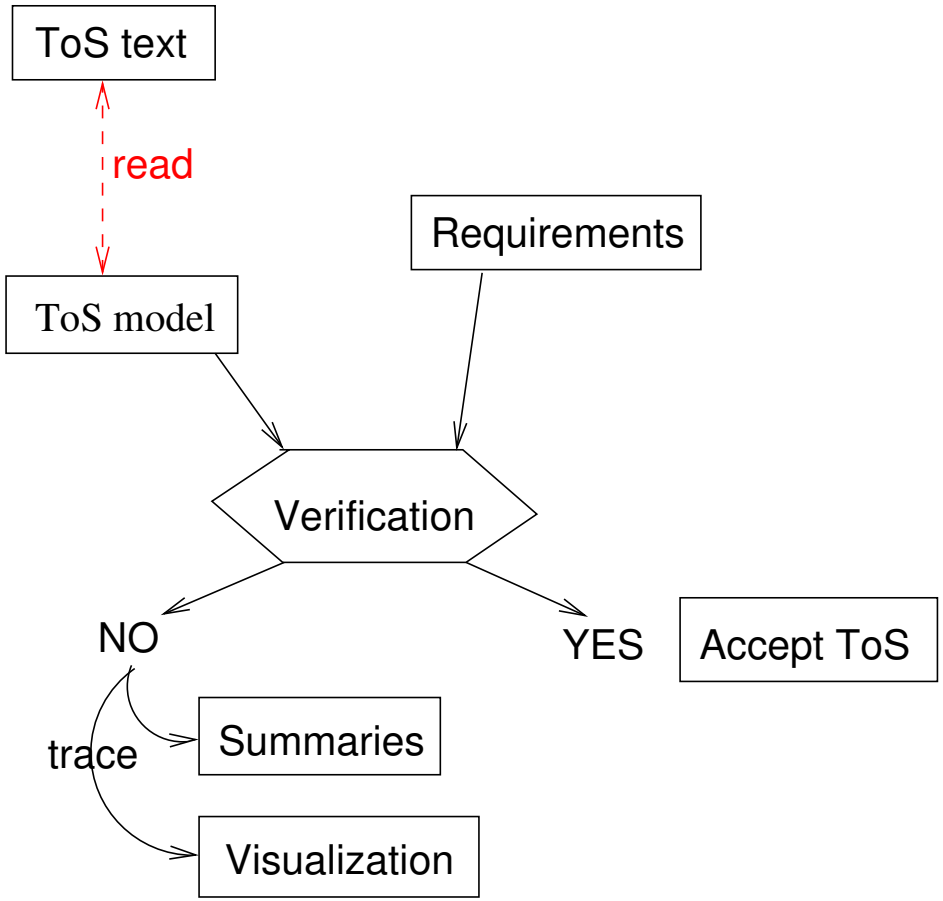

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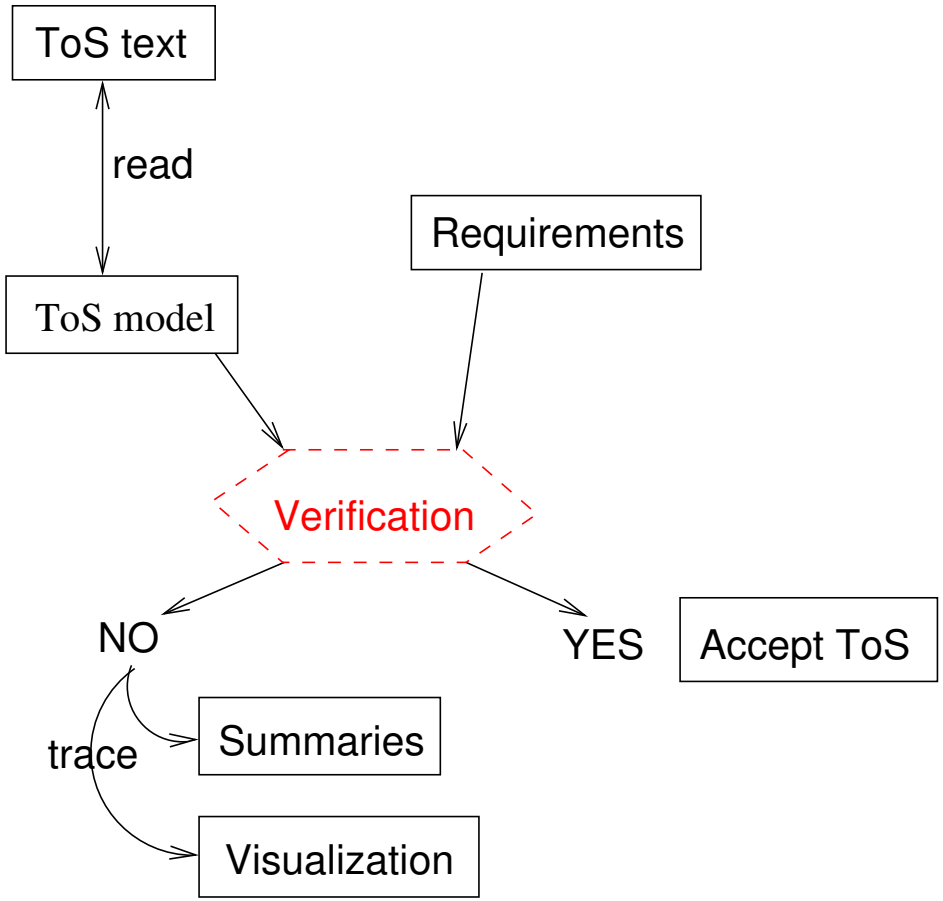

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to be detailed further

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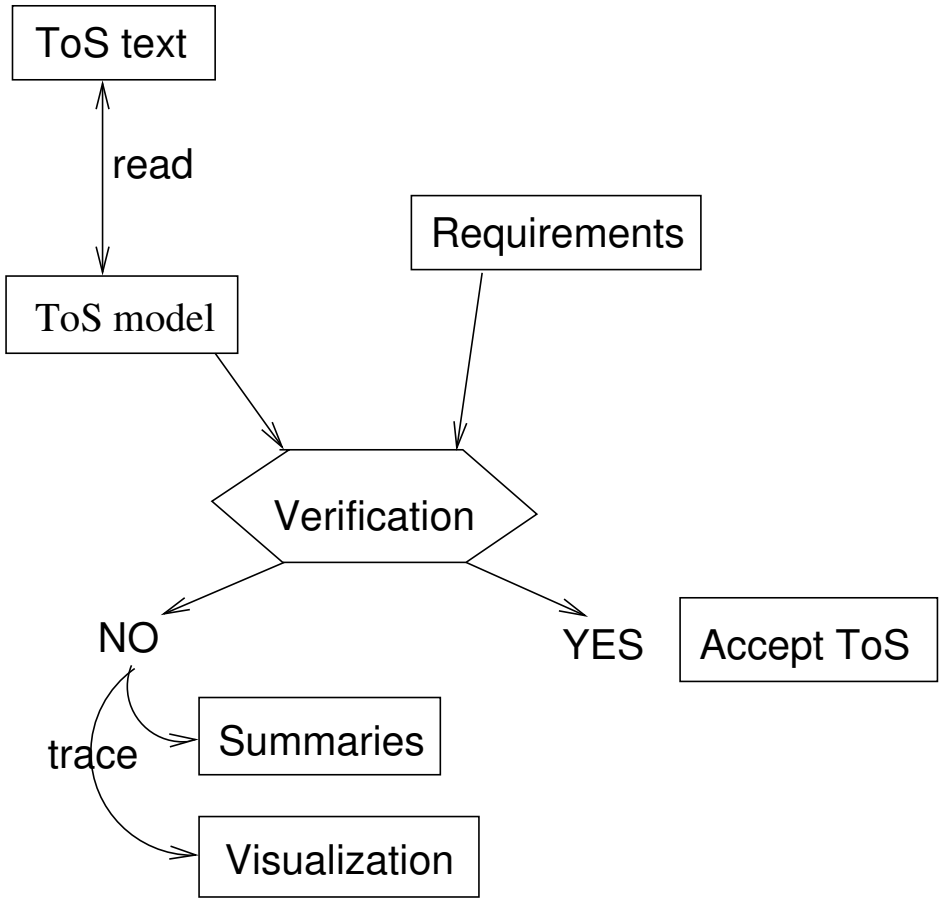
- Weighted logics, real-time logics, multi-valued/fuzzy logics
  for non-Boolean notions like deadlines, quantities

Technologies and Logics

where do they fit in LoToS ?



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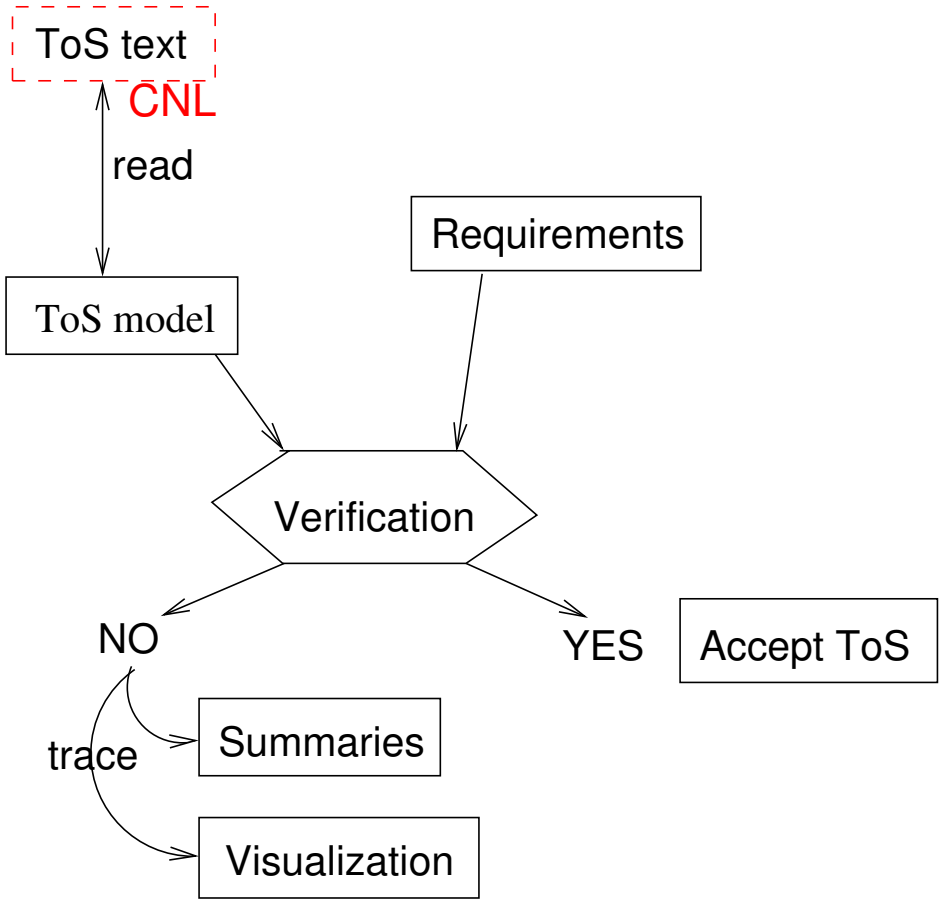

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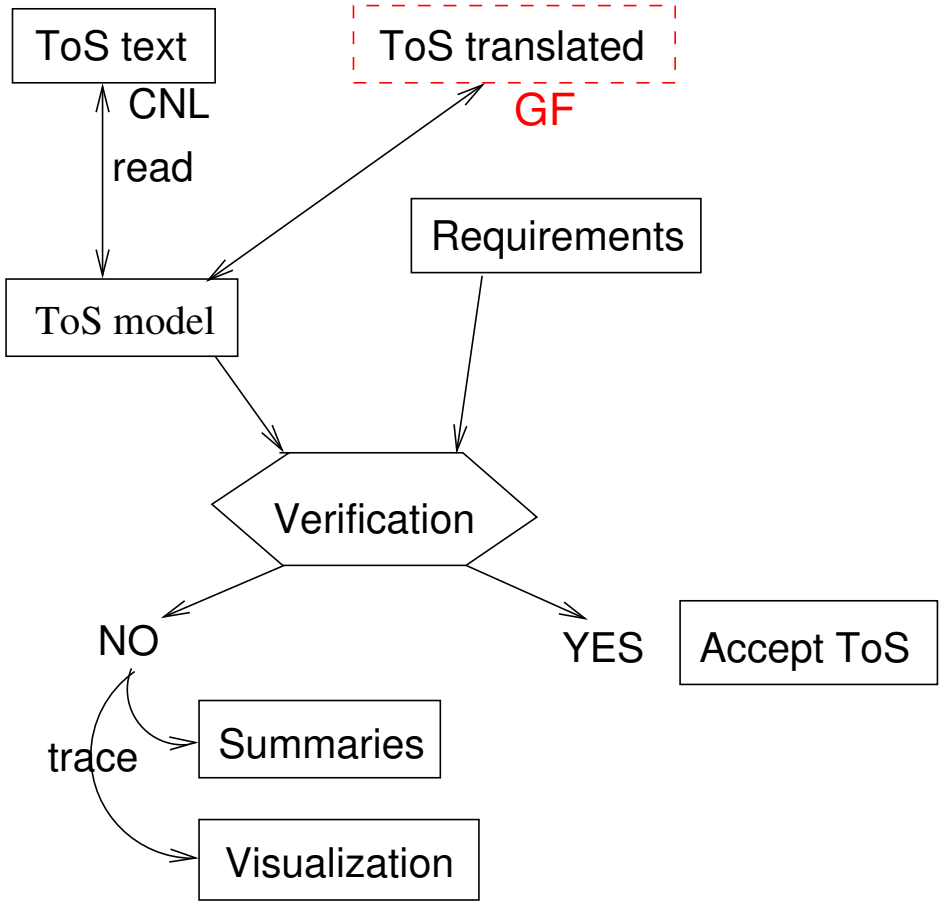

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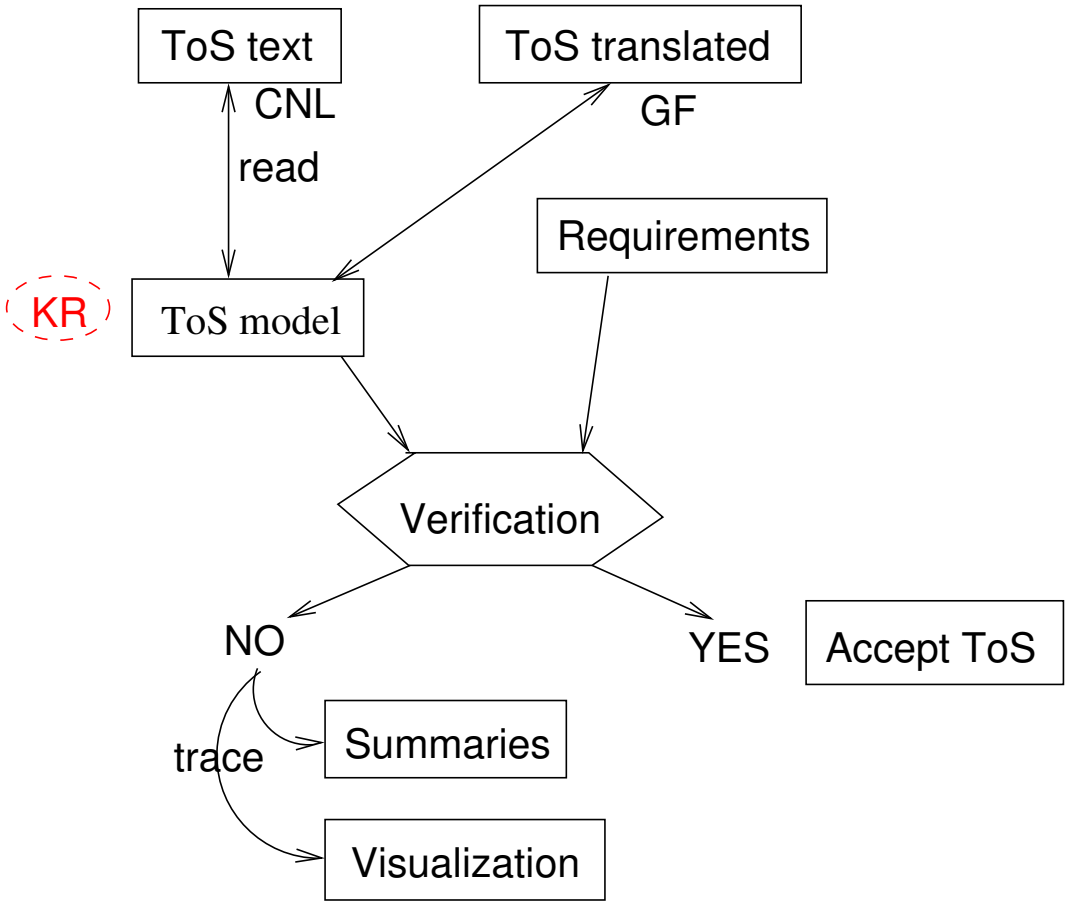

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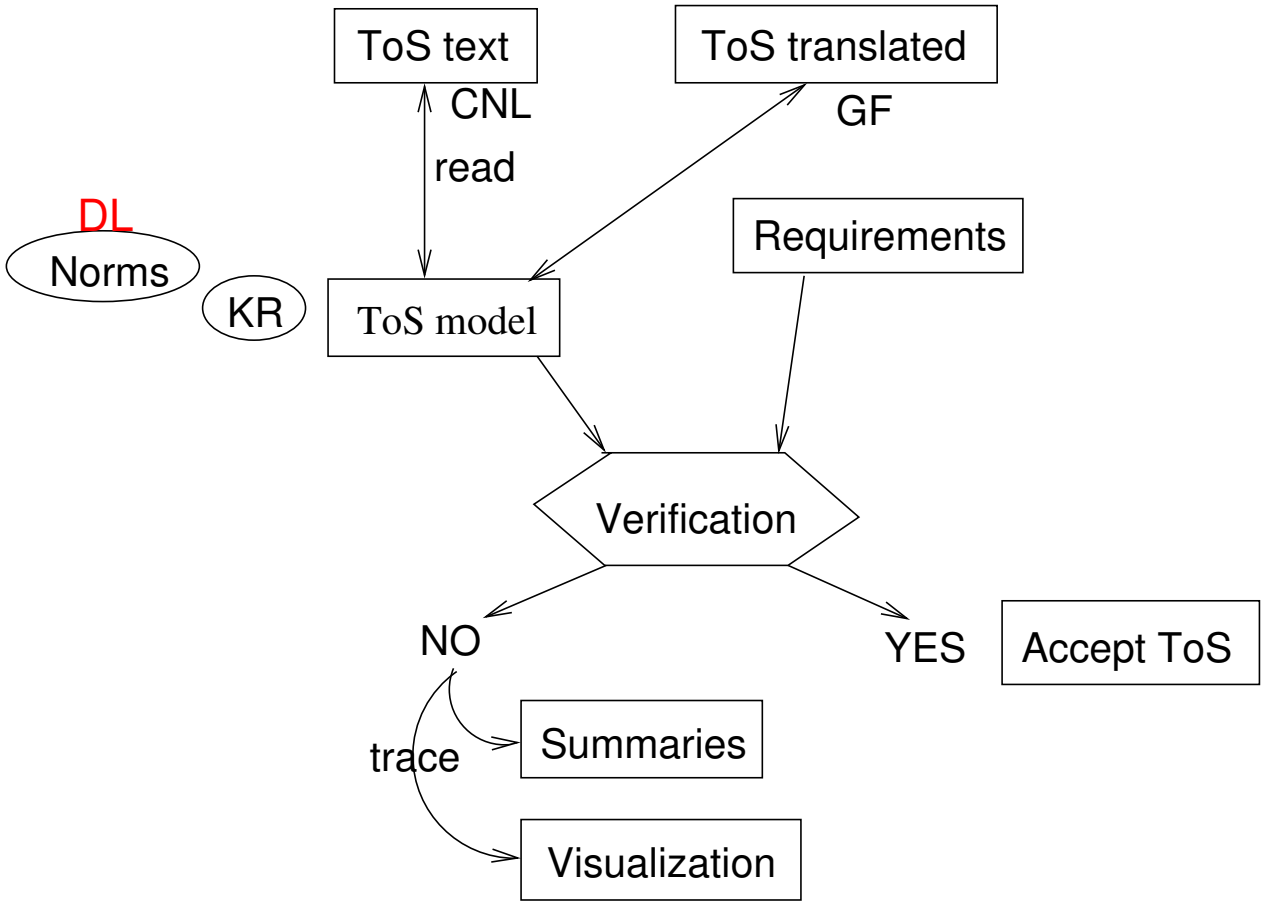

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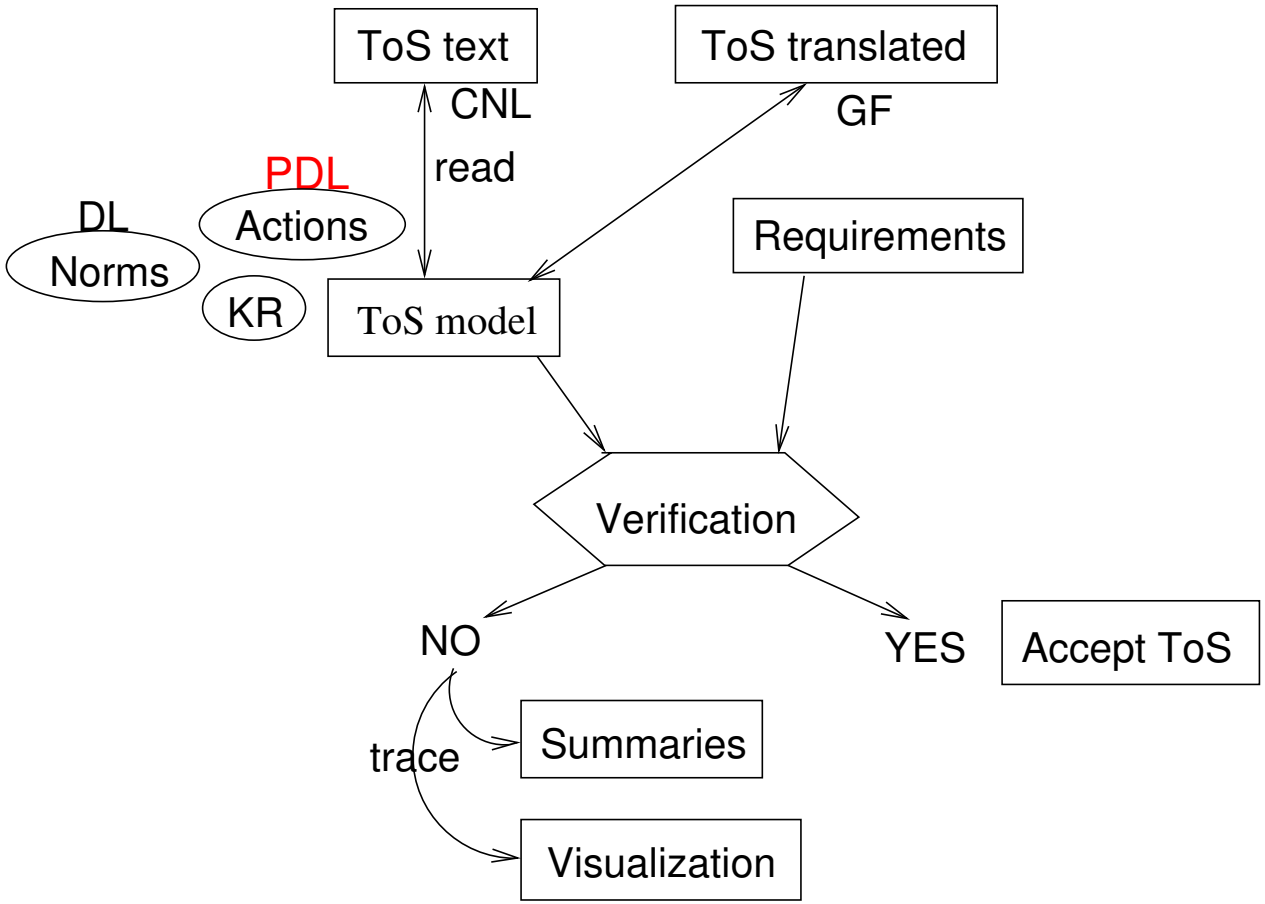

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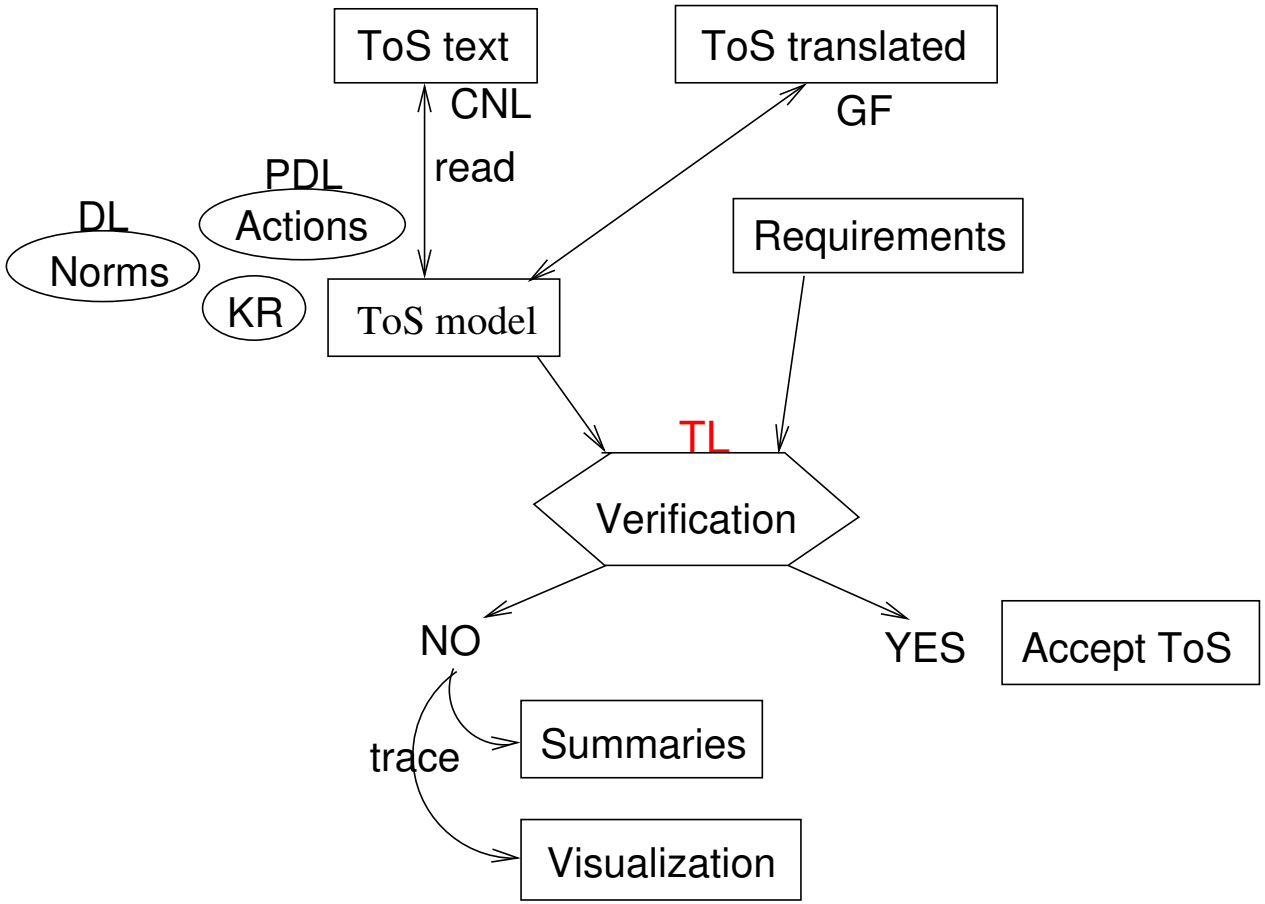

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– Mature, quite expressive, and with a wealth of tools around.
– Attempto Controlled English is a restricted natural language.
Not clear if ToS language fits ACE restrictions.
Work exists, e.g. from Stefan Höfler.

Automate the Reading using

Controlled Natural Languages (DRT/ACE)

Are using the expressiveness of First Order Logic (FOL).

- FOL is well studied and with a wealth of tools.
- Rule-based reasoning is related to FOL as Horn clauses.

Controlled languages are well known in areas like engineering.
(See IBM specifications.)

May be difficult to impose in Law.

- How to transition smooth from ToS texts to controlled Law language?
- How to combine CNL with Knowledge Representation?
- How to allow/handle ambiguities?

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based on Martin-Löf's intuitionistic type theory

– Mature and with growing community.
– Connection with Attempto controlled English.
– Functional style language.

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For the legal domain we may look at:

- The ESTRELLA project and the LKIF language
- CEN MetaLex open XML format for interchange of legal and legislative documents.
- Monitor the works of The Leibniz Center for Law in Amsterdam or the blog VOXPOPULII from Cornell University

Knowledge Representation – Ontologies

Ontologies are built using Description Logics

- Many variants of Description Logics exist
  – depending on expressive power
  – depending on computational complexity

- DL Lite has good computational complexity, used in medicine
- OWL is well adopted for semantic web, because of good expressiveness

- See Oxford group of Ian Horrocks
- The Description Logic Handbook

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More notions like:
Powers, Governing policies, Exceptions, Parties/Roles, Delegation

- of importance to ToS
- but no satisfactory theories exist yet.

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Computer science studies many formalisms for actions:

- Propositional Dynamic Logic (PDL) used for regular expressions.
  [PDL Book by Harel&Kosen&Tiurin]
- Dynamic Deontic Logic describes deontic modalities over actions in the style of PDL. (see [J.-J. Ch. Meyer], [K. Segerberg])
- Process algebras are describing complex structured actions
  (see mCRL2 and tool set)

Normative notions and Temporal order

Temporal Logics reason about properties that change over time.

- Time is a linear order, and properties hold at time points
- Temporal operators capture notions like:
  - Property holds always in the future (or past)
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  - $Prop_1$ holds at all points until $Prop_2$ becomes true
- Combinations of temporal operators with deontic logics and logics of actions have been investigated.
- Model checking is a technique well studied for temporal logics to check if a model satisfies a logic formula/property.

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- Is computationally intensive
  (depending on the dimension of the model)

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  – A measure of redundancy (minimal change) must exist.
  – User intervention can stop the negotiation.
- Simple negotiation parameters can effectively terminate;
  e.g.: involving quantifiable parameters s.a. deadlines or amounts,
  even requirements expressed as logical formulas
- How about privacy requirements?!

Negotiation

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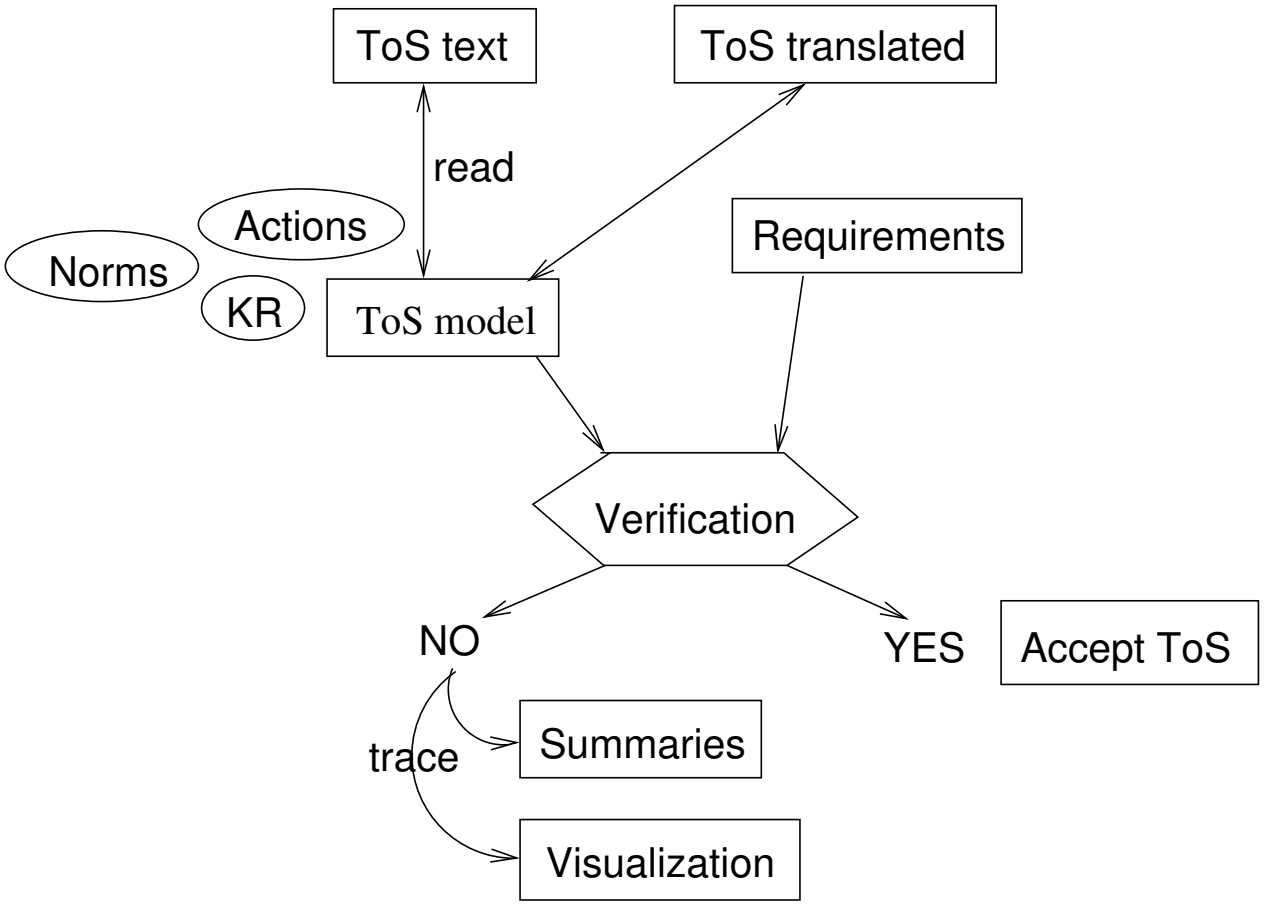

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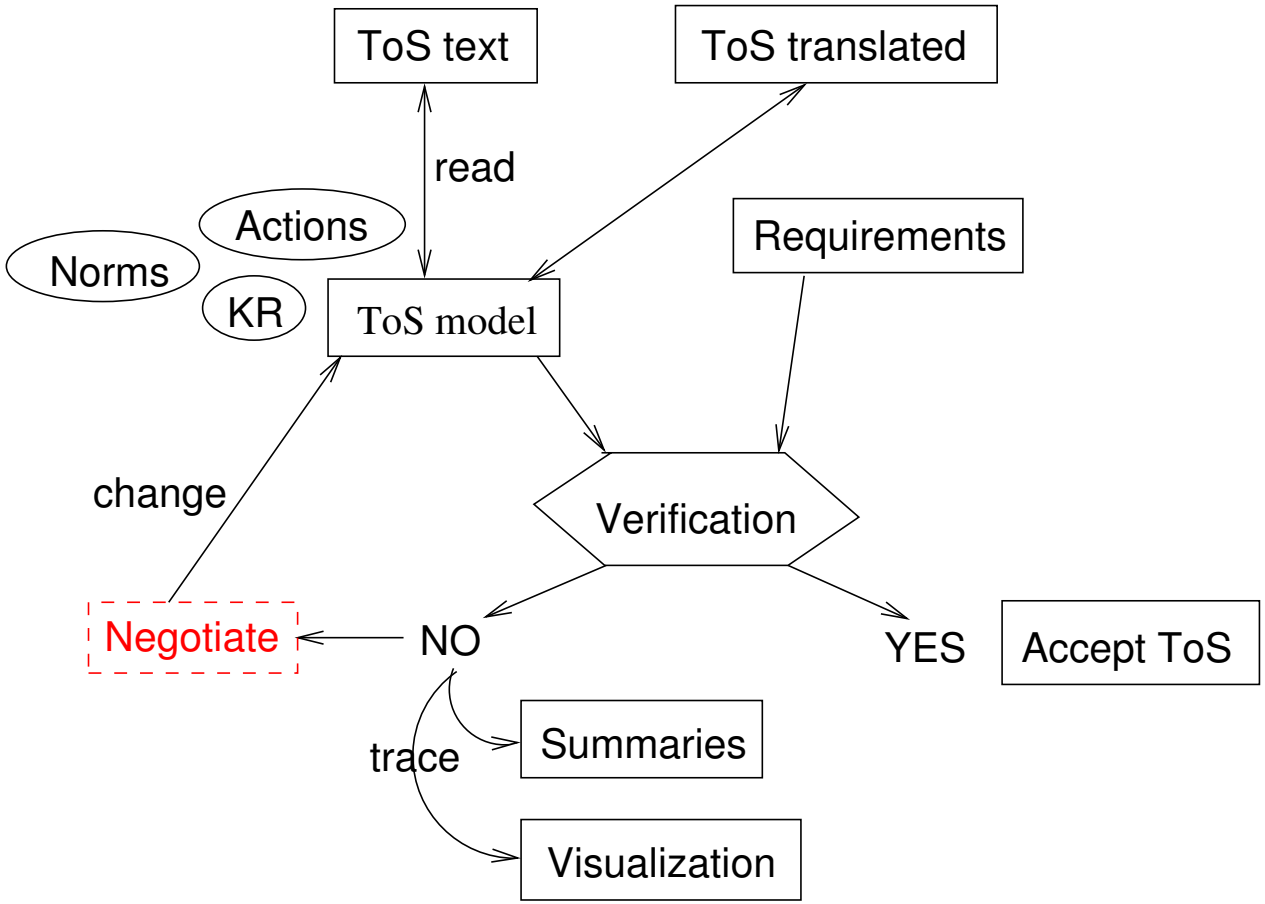

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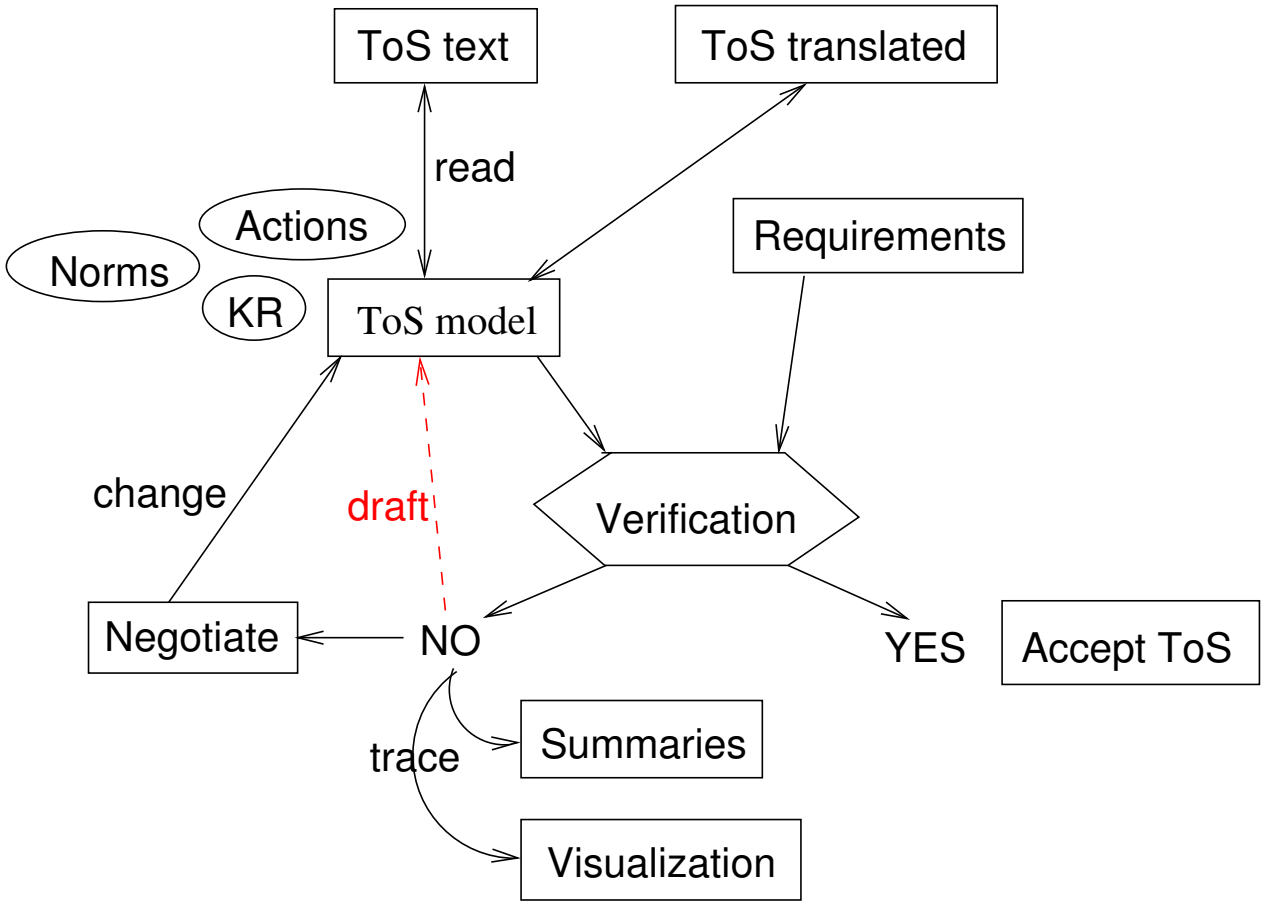

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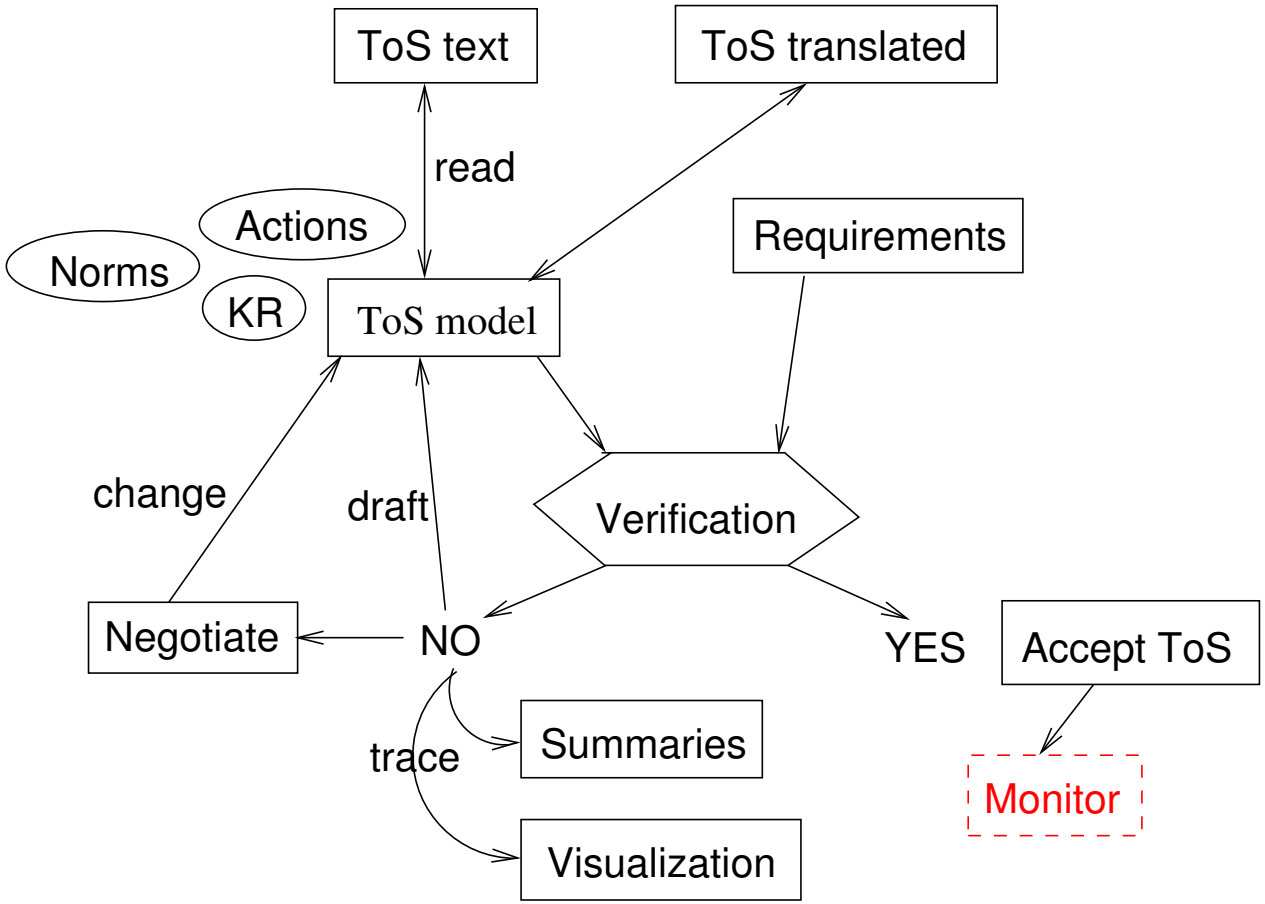
For non-expert users:

- For the existing ToS in the on-line LoToS, predefined (non)acceptable sequence of actions can be searched
- or Templates of sequences of actions (also for parametric actions) visualization

LoToS summary

diagrammatic



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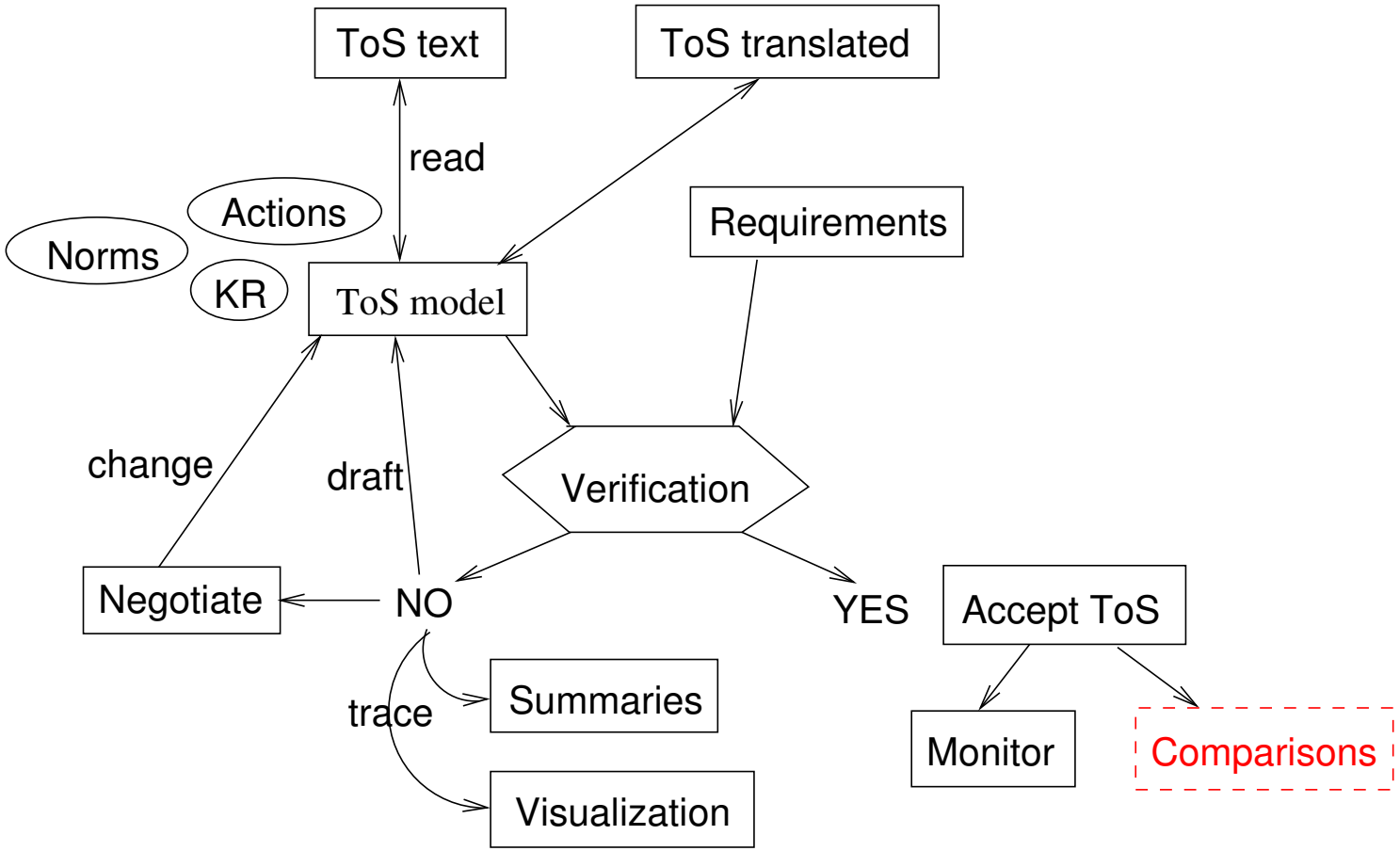

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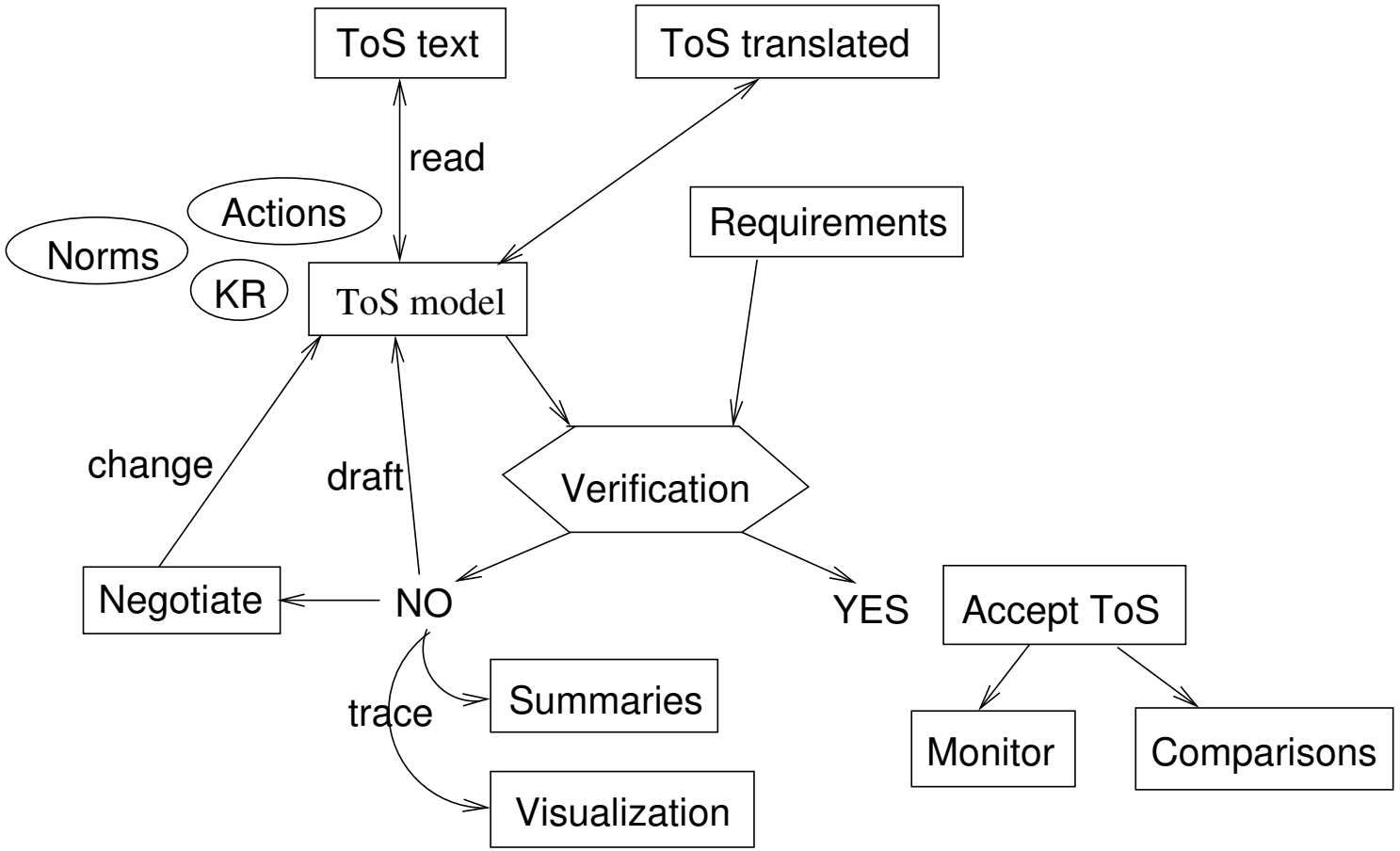

On–line LoToS helps non–experts

Models $\models$ Requirements Templates Experts Computing power

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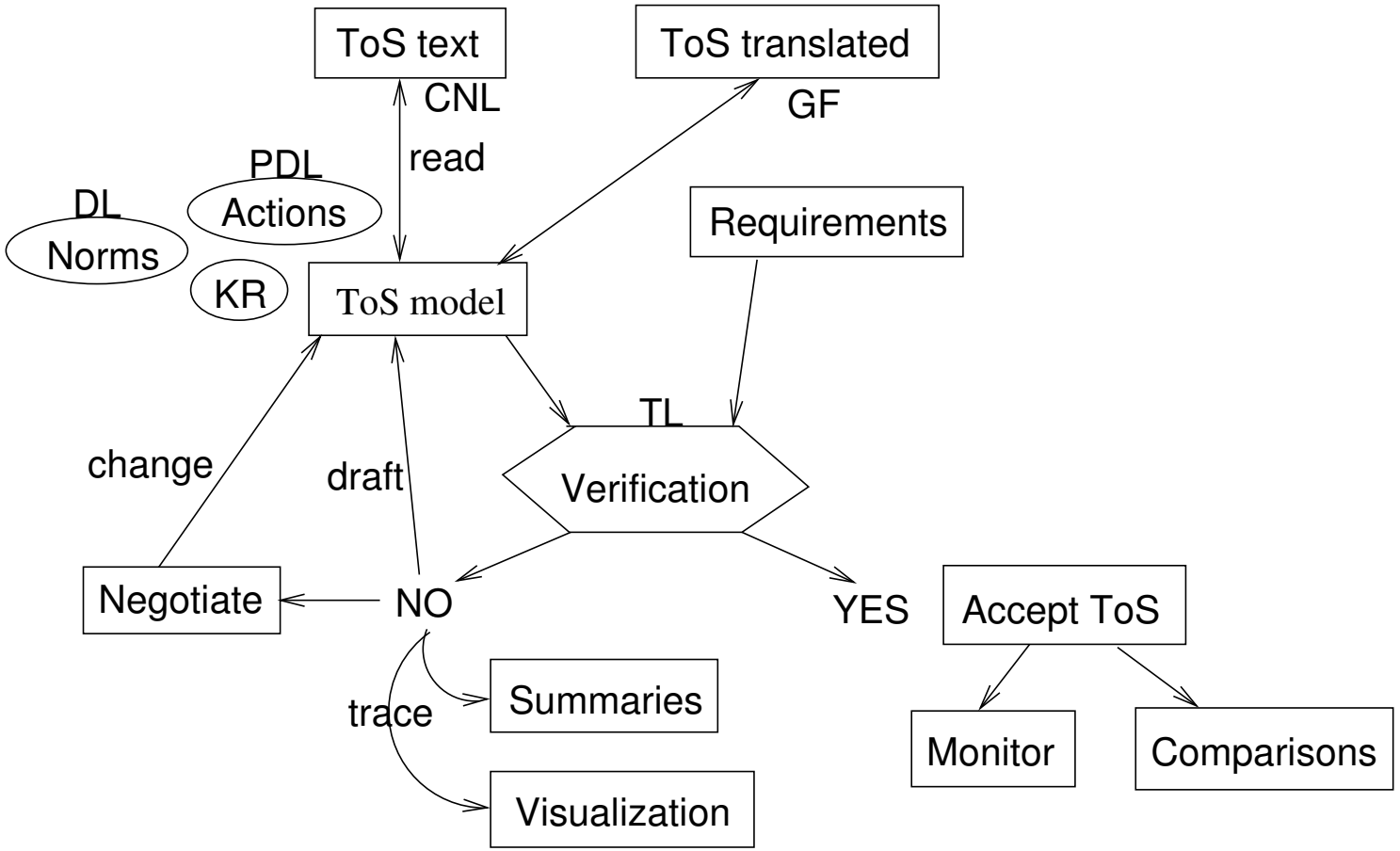

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Plan for the Workshop

- Discussions and comments pro/contra
- Answers and Proposals of solutions
- Testing/interacting with existing tools for the presented technologies.
- Share your related work. How/Where would you apply LoToS?
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Thank you for the attention!
Welcome after the break.