# Temporal Logic for Man

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## Facts

We need to verify software and hardware systems, because they are becoming an indispensable part of our lives.

Formal methods are mature enough to be used, but difficult for a developer to master.

Our aim was to help the developers that want to use the model checking verification approach, with the definition of properties of their system.

We designed an automatic translation system, that takes a sentence in English and translates it into LTL temporal logic.

## Motivation

Given, that the following picture represents the expected behaviour of our system ...

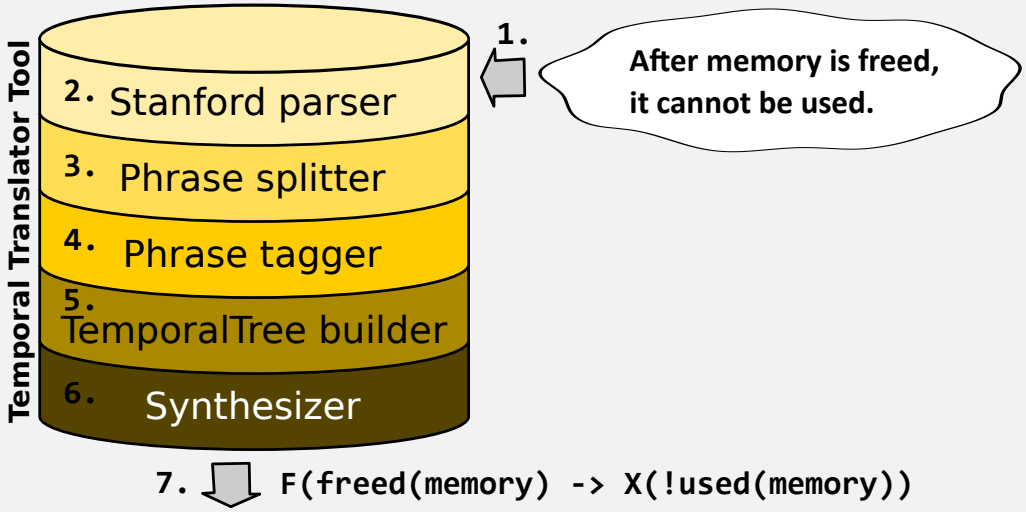

... we might naturally say in English that:

1. If INTR is set, it holds forever.
2. In one cycle, after INTR is asserted, LOCK is written to one.
3. LOCK is set, until INTA is set.
4. If LOCK is set, LOCK is eventually deasserted.
5. After DATA is asserted on positive edge of INTA, it is deasserted two cycles later on the negative edge of INTA.

And, now, we can use our **Temporal Translator Tool**, to translate those property specification sentences into LTL temporal logic, which is a suitable form of a property for model checkers.

```
1. ((intr) -> G(intr))
2. F((intr) -> X(lock))
3. ((lock) U (inta))
4. ((lock) -> F(!lock))
5. F((!inta and X inta and data) -> F(inta and
X !inta and !data))
```

## Translation Process




At first, we put the specification sentence (1.) to The Standford Parser (2.), which parses it and produces a list of typed dependencies. Then, using this list, we separate the individual phrases (3.) apart and run the pattern matching procedures (4.). Those procedures are the core of the meaning inference in the translation tool. At this point, each phrase in the input sentence stands alone and is tagged with the meaning tags. Then it is passed to the Temporal Tree Builder, that, according to predefined rules, synthesizes the Temporal Tree (5.). This tree reflects the actual temporal structure of the sentence, and can be easily rewritten as a LTL temporal formula (6.).