Ωmega

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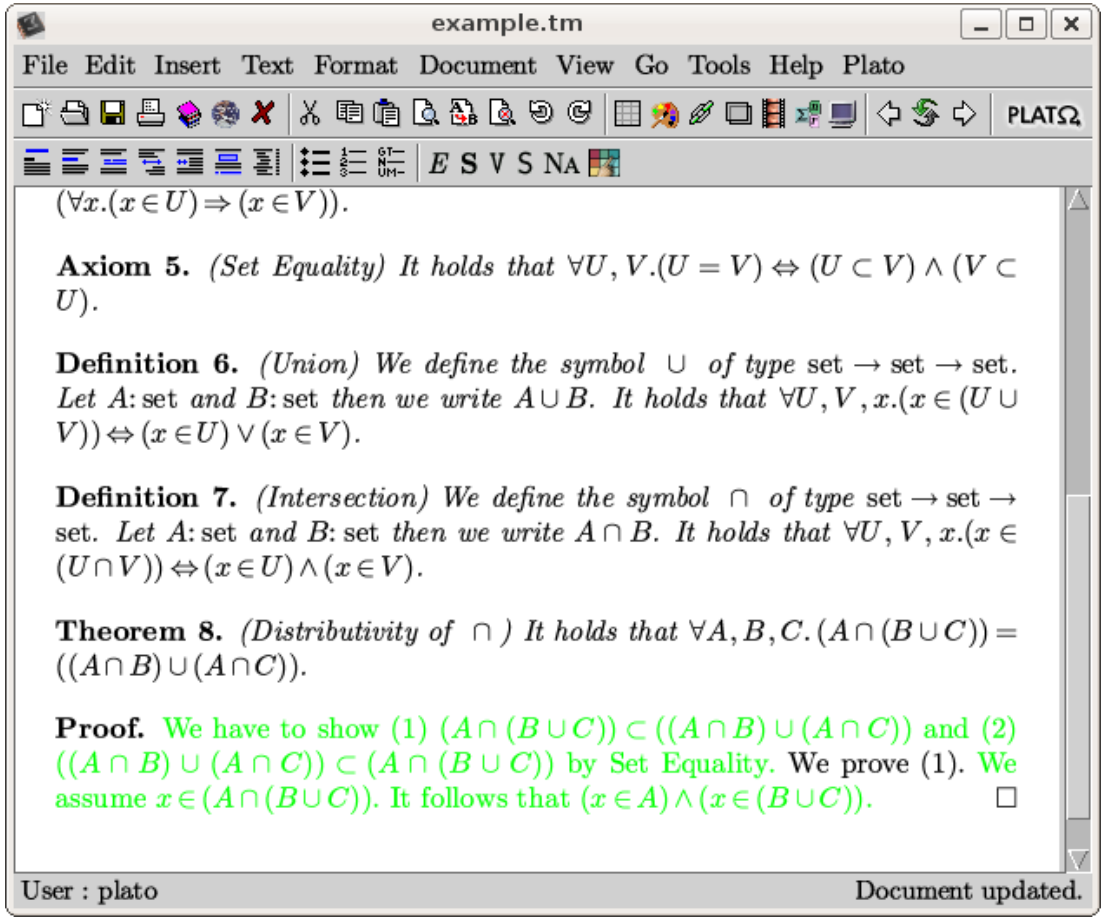
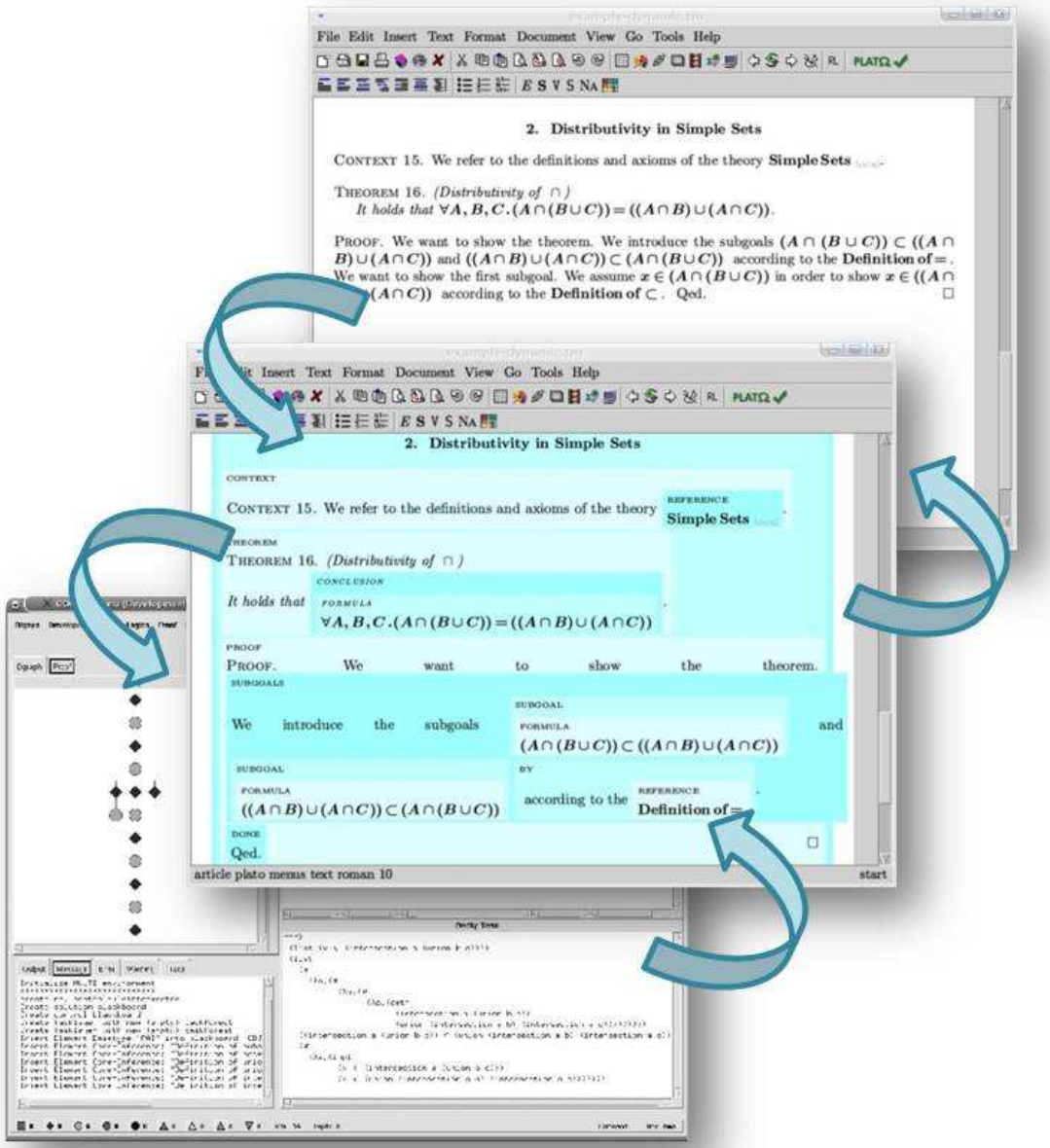
Practical Aspects of Automated Reasoning
(PAAR-2008)

Motivation

- Support user in **authoring documents**
- Definition of concepts and **notations**
- **Verification** of partial proofs
- **Completion** (filling gaps in the document)
- Detection of **missing subgoals**

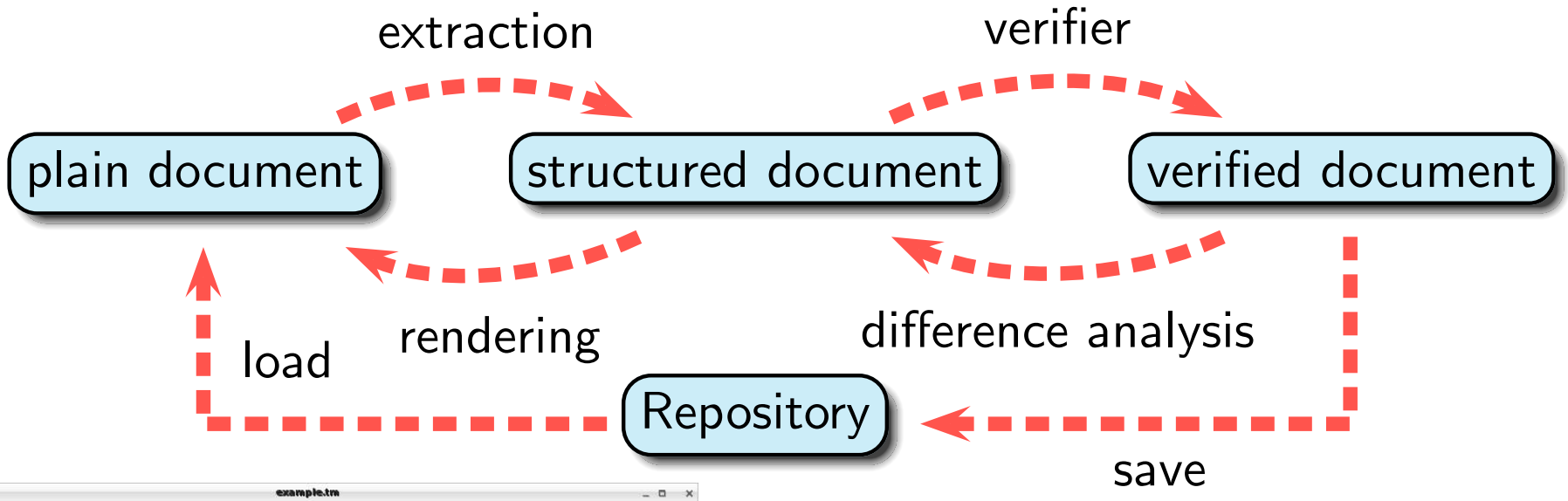


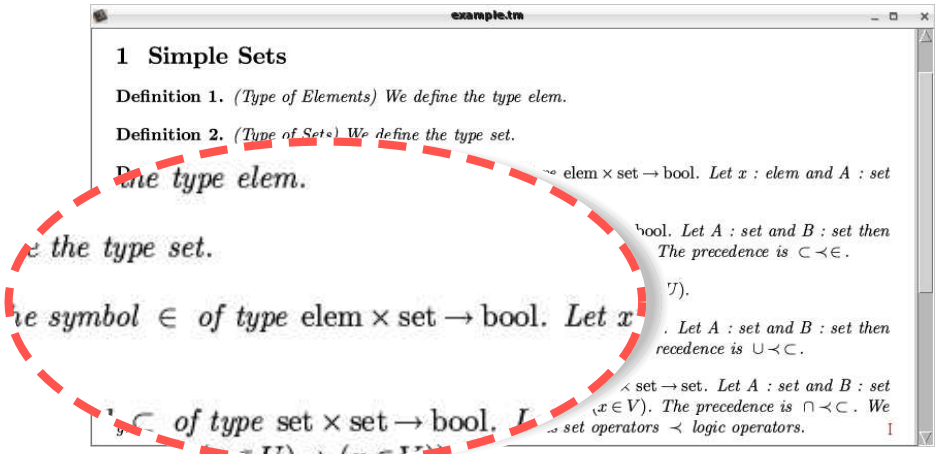
Three Processing Phases



The Global Picture

- **Document** is processed in three stages:





assume $x \in A \cap (B \cup C)$ **from .** ;

fact $x \in A \wedge x \in (B \cup C)$ **by . from .** ; ϵ

Incremental Proof Step Verification

Goal: Verifiable document

- Resolve underspecification
- Resolve ambiguities
- Completion

proof $\forall A, B, C.A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

Proof Checking

- Proof checking under **complete information** is **simple** and **fast**
- If information is missing **proof search** is necessary

assume $x \in A \cap (B \cup C)$
from ;
fact $x \in A \wedge x \in (B \cup C)$ **by**
from . ; $\epsilon\}$

Incremental Proof Step Verification

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Proof Checking

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proof $\forall A, B, C. A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
subgoals
$A \cap (B \cup C) \subset (A \cap B) \cup (A \cap C)$
: {
assume $x \in A \cap (B \cup C)$
from Subset ;
fact $x \in A \wedge x \in (B \cup C)$ **by** Set Intersection **from .** ; ϵ}
$(A \cap B) \cup (A \cap C) \subset A \cap (B \cup C)$
: { ϵ}
by Set Equality **from .**

Further Information on Ωmega

- Logic: Church's simple type theory
- Polymorphism: limited (Prefix-Polymorphism)
- Semantics: Henkin semantics
- Calculus: directly mechanizes assertion level reasoning
- Automation: new proof planner under development
- Declarative language for specifying strategies and heuristics
- Relatively small problem library, growing
- Supports THF input (THF output forthcoming) via OmDoc