

Theorema – Ultra - Ωmega ´05 Workshop

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Saarland University

PLATOΩ

Marc Wagner
Saarland University
mwagner@ags.uni-sb.de



Overview



- Motivation
- **P**roof **L**anguage
- **A**nalysis
- **T**ransformation
- Ω - Interaction
- Case Study
- Summary

Motivation



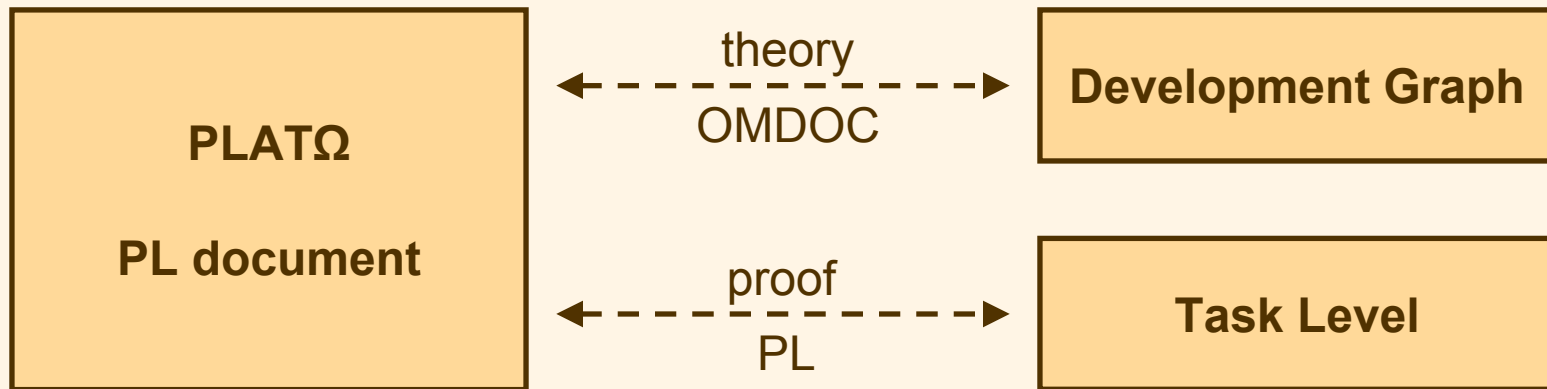
- Evolution of computer-supported mathematics
- Low user-friendliness of actual theorem provers
- Interfacing scientific text editor instead of yet another theorem prover GUI



- Semantic annotation language
- Four levels : document, theory, proof, math
- Designed to support
 - textual structure of proofs
 - flexible representation of formulas
 - underspecification
 - ambiguities / alternatives
- Based on concepts from
 - *Textbook Proofs Meet Formal Logic* [Autexier, Fiedler]
- XML representation inspired by
 - *The OpenMath Standard*
 - *OMDoc*



- Conversion from the document format of the scientific text editor into PLAT Ω XML format
- XML schema checking of the PL document
- Verification of structural integrity
 - occurrence analysis of elements
 - existence check of linked elements
 - grouping of connected elements
- Resolution of parsing ambiguities on math level by use of type information



- Initial transformation of whole PL document
- Incremental transformation of PL document differences into patches for Development Graph and Task Level
- XML Differences of PL documents computed by
 - *XmlDiff* [Radzevich]



- Menu generation for the scientific text editor
- Actions contained in menus on proof level
 - available assertions from CORE [Autexier]
 - available methods from MULTI² [Dietrich]
 - ambiguities / alternatives to resolve
- Custom actions supported by editable menus
- Handling calls of action
- Proofstep verification by ΩMEGA's theorem prover

Case Study



PLAT Ω
Case Study

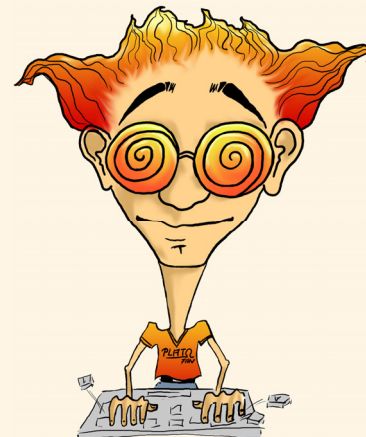


PLAT Ω

Analysis

Transformation

Ω - Interaction



Case Study



Theorem : Let A and B be any sets,
then $(A \cap B) \subset B$.

Proof :

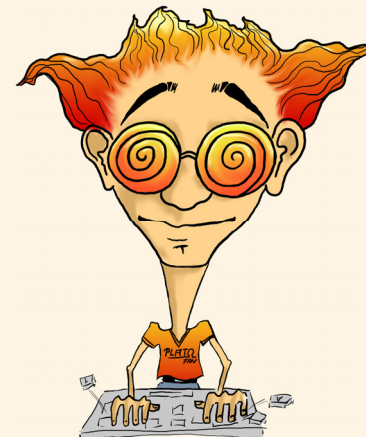


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Theorem : Let A and B be any sets,
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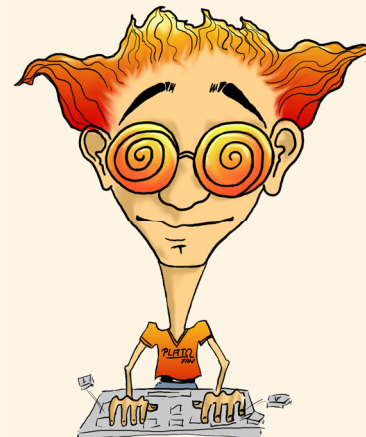


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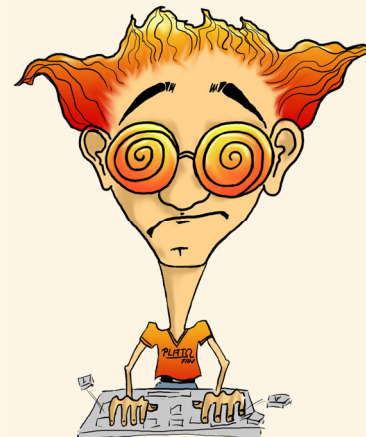


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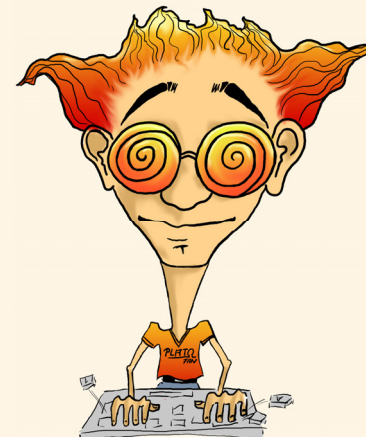


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Theorem : Let A and B be any sets,
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Expand Definition of \subset

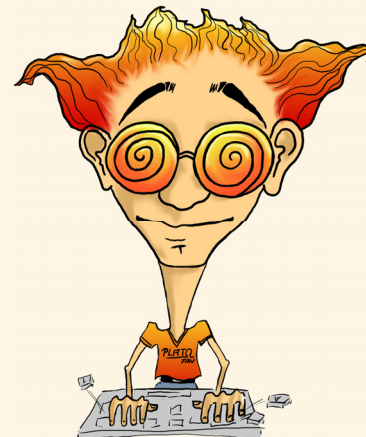


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Theorem : Let A and B be any sets,
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Proof :

Subgoal : $x \in A \cap B \Rightarrow x \in B$

Assume $x \in A \cap B$

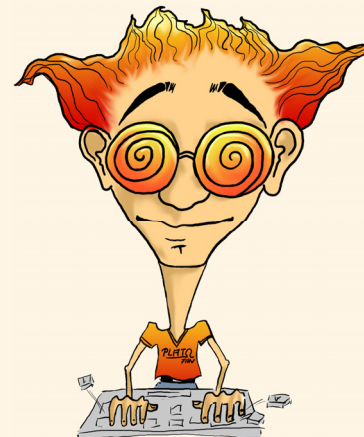


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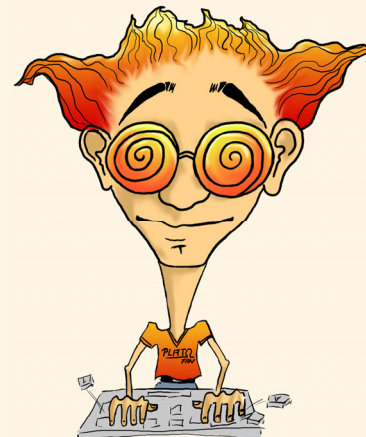


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Assume : $x \in A \cap B$

Fact : $x \in A \wedge x \in B$

Eliminate $x \in A$

Eliminate $x \in B$

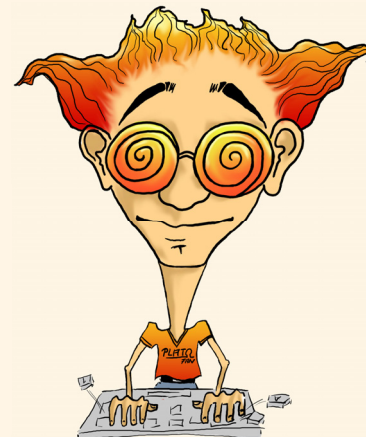


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Close Proof

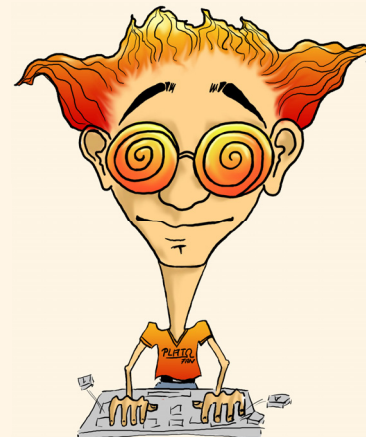


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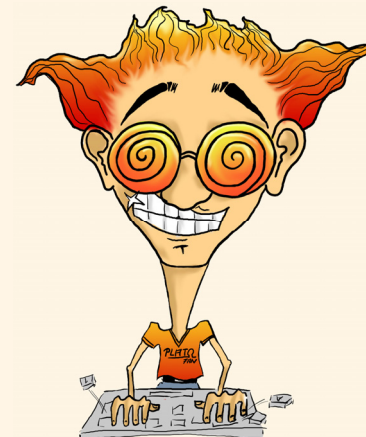


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Summary



- Interface to the scientific text editor $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$
- Flexible semantic annotation language with support for underspecification and alternatives
- User-friendly interaction level $\text{T}_{\text{E}}\text{X}_{\text{MACS}}$ for ΩMEGA via $\text{PLAT}\Omega$

Outlook : Automatic annotation of mathematical documents by natural language processing and generation [Fiedler]