

# Paraconsistent Reasoning in Ontopedia

[http://psi.ontopedia.net/Dmitry\\_Bogachev](http://psi.ontopedia.net/Dmitry_Bogachev)

<http://psi.ontopedia.net/Ontopedia>

Leipzig, 12 Nov. 2009

# Large-scale systems of assertions

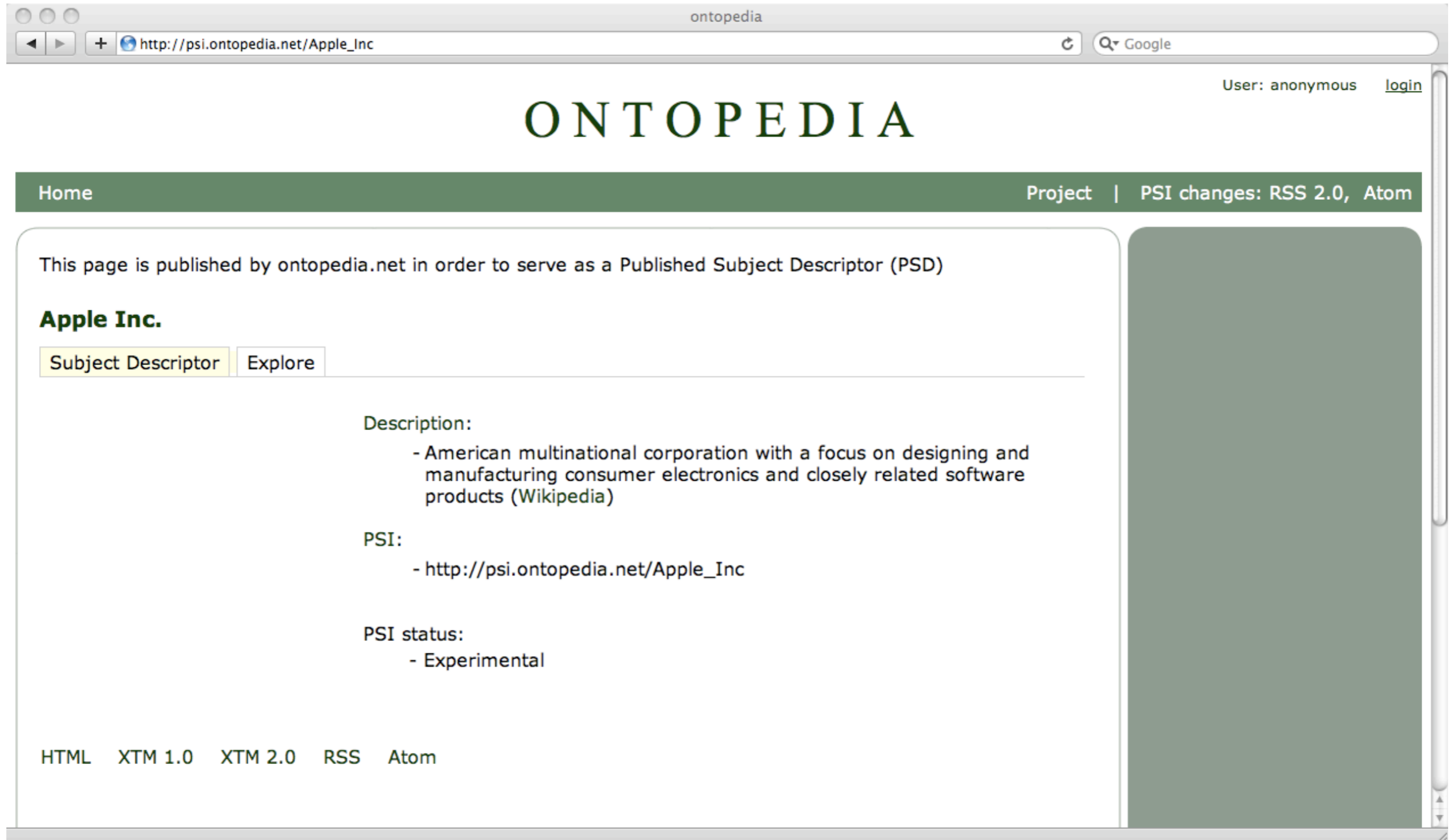
- Any large-scale system of assertions modeling real world is inconsistent
- Inconsistency is the norm
- With traditional logic:
  - if we have a contradiction, we can infer any assertion
- Not very useful for modeling large-scale assertion systems

## Possible alternative: Paraconsistent logic

- Paraconsistent logic allows to make reasonable inferences inside of inconsistent assertion systems
- Many paraconsistent logics are interesting puzzles
- Some may be useful for building real-life knowledge bases: Direct Logic (by Carl Hewitt)
- Ontopedia implements some form of paraconsistent reasoning

# Ontopedia

- PSI Server (<http://psi.ontopedia.net>)



The screenshot shows a web browser window with the URL [http://psi.ontopedia.net/Apple\\_Inc](http://psi.ontopedia.net/Apple_Inc). The page title is "ontopedia". The main heading is "ONTOPEEDIA". The user is identified as "User: anonymous" with a "login" link. The navigation bar includes "Home", "Project", and "PSI changes: RSS 2.0, Atom". The main content area contains the following information:

This page is published by ontopedia.net in order to serve as a Published Subject Descriptor (PSD)

**Apple Inc.**

Subject Descriptor | Explore

Description:  
- American multinational corporation with a focus on designing and manufacturing consumer electronics and closely related software products (Wikipedia)

PSI:  
- [http://psi.ontopedia.net/Apple\\_Inc](http://psi.ontopedia.net/Apple_Inc)

PSI status:  
- Experimental

At the bottom, there are links for "HTML", "XTM 1.0", "XTM 2.0", "RSS", and "Atom".

# Ontopedia

- Inconsistency tolerant system of assertions populated by users (external systems, inference modules)

The screenshot shows a web browser window with the URL [http://psi.ontopedia.net/Apple\\_Inc?view=subject\\_info](http://psi.ontopedia.net/Apple_Inc?view=subject_info). The page title is "ontopedia". In the top right corner, it says "User: anonymous" with a "login" link. The main heading is "ONTOPEEDIA". Below this is a navigation bar with "Home" on the left and "Project | PSI changes: RSS 2.0, Atom" on the right. The main content area has a sub-header "This set of assertions is collected/organized by ontopedia.net user community". Below that is the section "Apple Inc." with two tabs: "Subject Descriptor" and "Explore". The "Subject Descriptor" tab is active, showing a table of assertions. The table has two columns: the left column lists assertion types, and the right column lists specific instances or sources.

Is a	Is a:
Official Website	- Company
Subject-centric Web page	Official Website:
Product line (history)	- Apple's Official Website
Product Release	Subject-centric Web page:
Product Line	- <a href="http://en.wikipedia.org/wiki/Apple_Inc">http://en.wikipedia.org/wiki/Apple_Inc</a> .
Has a resignation from a board of directors event	- <a href="http://finance.yahoo.com/q?s=aapl">http://finance.yahoo.com/q?s=aapl</a>
Financial results announcement	- <a href="http://finance.google.com/finance?q=NASDAQ:AAPL">http://finance.google.com/finance?q=NASDAQ:AAPL</a>
Product Announcement	- <a href="http://finance.aol.com/quotes/apple-inc/aapl/nas">http://finance.aol.com/quotes/apple-inc/aapl/nas</a>
	- on <a href="http://topics.nytimes.com">topics.nytimes.com</a>
	- <a href="http://www.apple.com/investor">http://www.apple.com/investor</a>
	- on <a href="http://reuters.com">reuters.com</a>

# Ontopedia: collecting Proposals

- Each assertion can have multiple proposals from different sources with different truth values
- Proposals can be provided by:
  - people (Ontopedia community)
  - external systems (scanning topic maps, RDF, REST API)
    - with (known mapping to) Ontopedia's PSIs
  - inference modules (in future)

# Ontopedia: Multivalued truth assignment

- Each assertion has truth value:
  - monotonic false
  - default false
  - unknown
  - default true
  - monotonic true

ONTOPEDIA

Home Subjects Under Review Ontopedians

### New Property Value

Subject: [TMRA 2009](#)

Property type:

Property data type:

Value:

Value Title:

Scope:

Scope:

Scope:

Truth:

Comment:

# Ontopedia: Contradiction Level

- Each assertion has contradiction level:
  - no contradictions
  - default contradiction
  - monotonic contradiction
- We can calculate contradiction level for topics, any fragment, and full knowledge base
- In general, Ontopedia tries to keep contradiction level “under control” and minimize it when it is possible

# Ontopedia: Decision Procedure

- Decision procedure tries to calculate truth value of an assertion based on existing proposals
- Decision procedure also calculates contradiction level
- Result of decision procedure is “visible to external world” assertion
- New proposals can change truth value and/or contradiction level (non monotonic system)
- Contradictions do not participate in future inferences
- Engine can suppress some pervious inferences

# Why

- Paraconsistent reasoning allows to collect assertions from various sources and “safely” infer new information
- Paraconsistent reasoning works well together with constraint languages (such as TMCL)
- Paraconsistent reasoning supports evolutionary approach to building large assertion systems
- We do not need to “fix all errors” before we can reason

# Interested?

- Take a look at Paraconsistent Logic
- Learn about Carl Hewitt's work (Actors, Planner, Organizational Computing, ORGs, Direct Logic)
- Inference in Cyc/OpenCyc is also intriguing