



# DIONE

(DAML Integrated Ontology Evolution Tools)

*Ontology Versioning in Semantic Web Applications*

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# DIONE

## Overall Program Summary



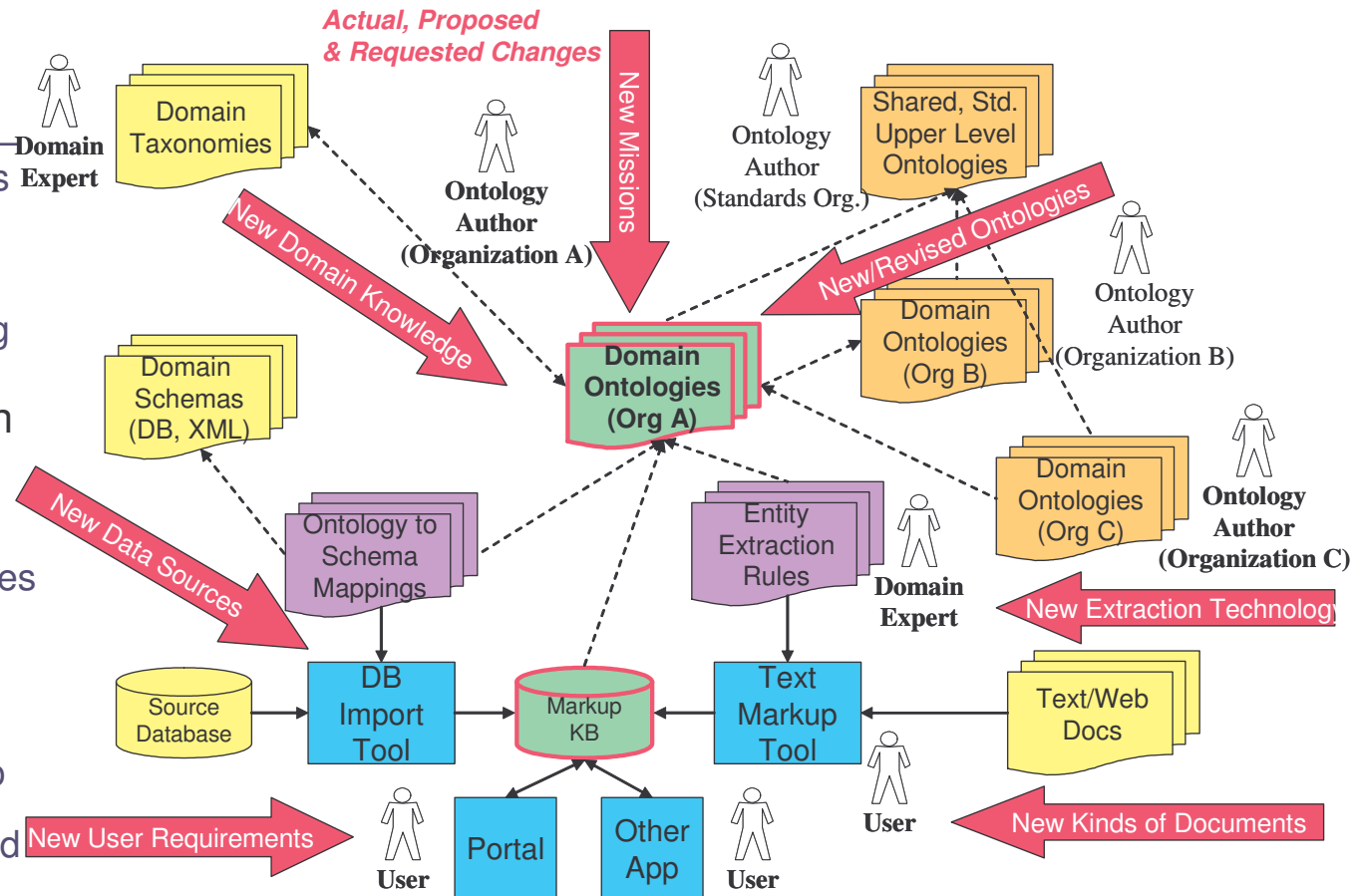
- Change is a given as domain knowledge, domain conceptualizations, and knowledge representation languages evolve
- Many varied dependencies complicate dependency detection and propagation
- Many, distributed authors complicates change notification
- Managing change is labor intensive, error prone, and generally ad hoc
- Failure to manage change in a timely manner leads to broken apps or inconsistent/incorrect results

- What was the technical solution strategy?

- ontology perspectives theory and applications
- Eclipse-based, OWL-based (OWLJessKB) tools for change management & logging

- What were the basic elements of the research and program approach?

- Virtual Perspective Interface (VPI) implements perspectives
- Ontology Admin & Deployment Tools (ONTADEPT) tools developed
- make tools available to early semantic web adopters (SATURN and others)



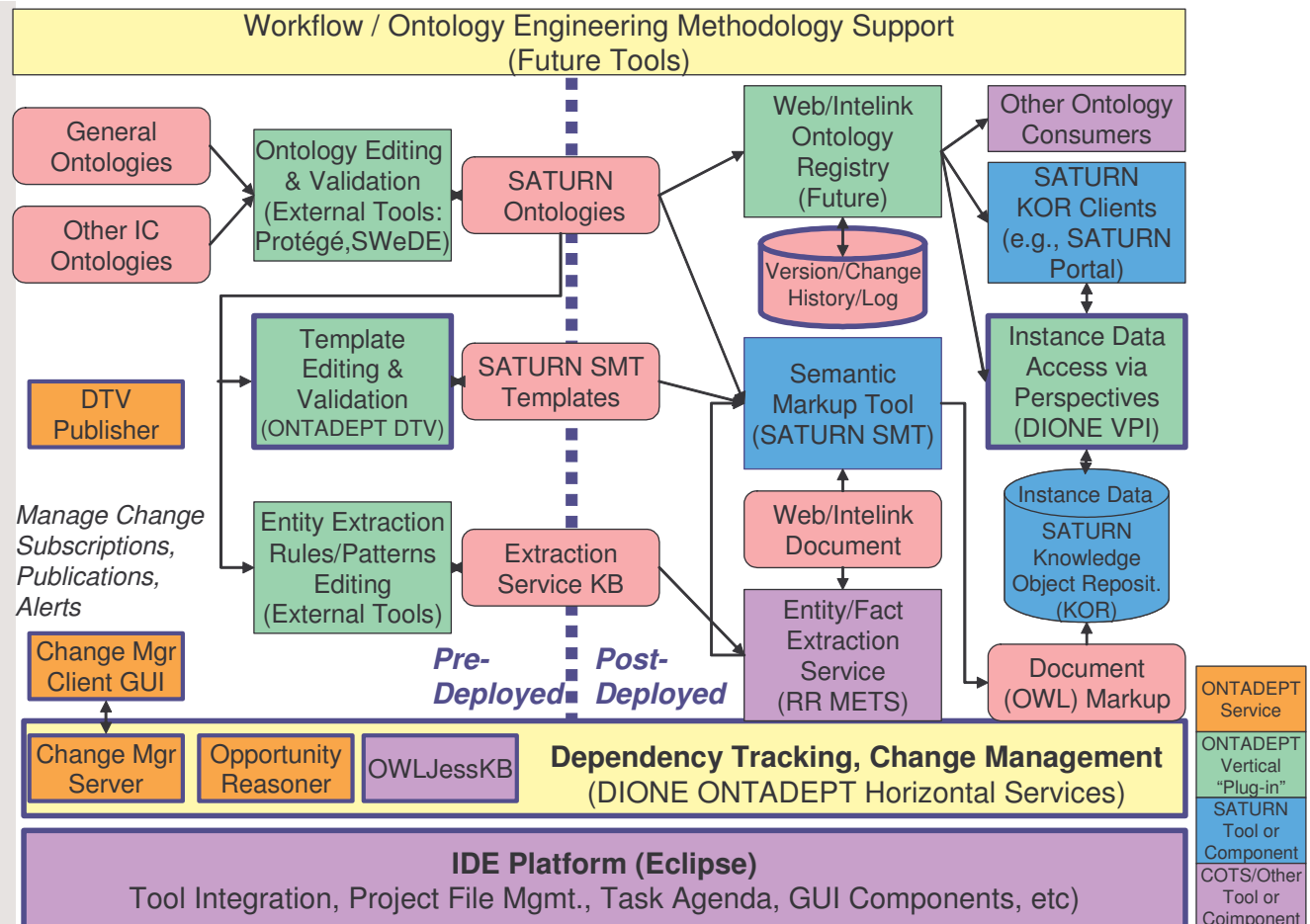


# Technical Problem and Approach: Ontology-related Knowledge (1)



## Ontology Admin & Deployment Tools (ONTADEPT) Framework

- Need to keep ontologies and related data (e.g., markup templates) in synch
- Used OWLJessKB for reasoning about ontology changes
- Used Eclipse for integration of tools
- Framework supports the integration of other horizontal and vertical tools/services
- Not currently focusing on methodology or workflow support *per se*



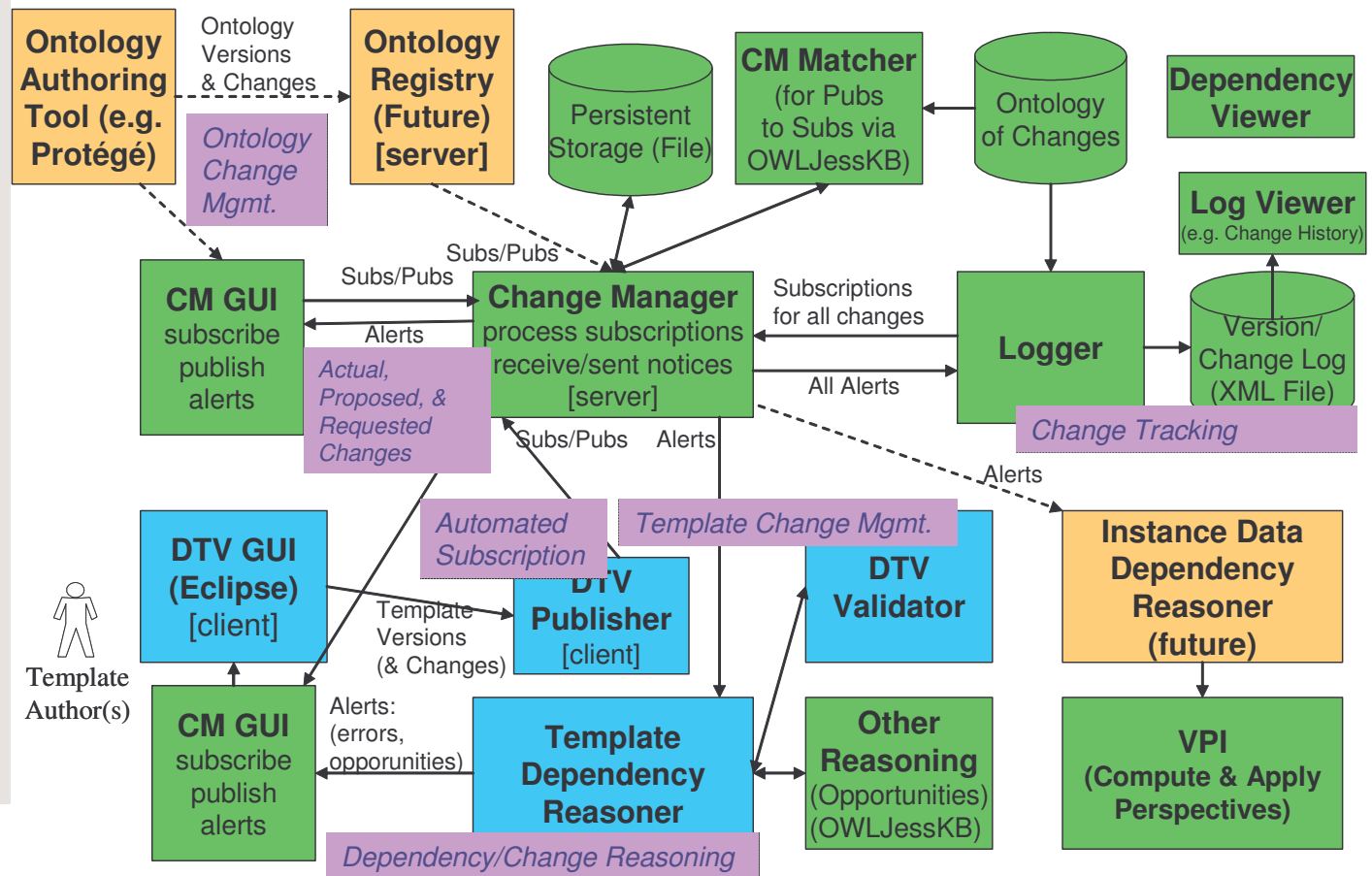


# Technical Problem and Approach: Ontology-related Knowledge (2)



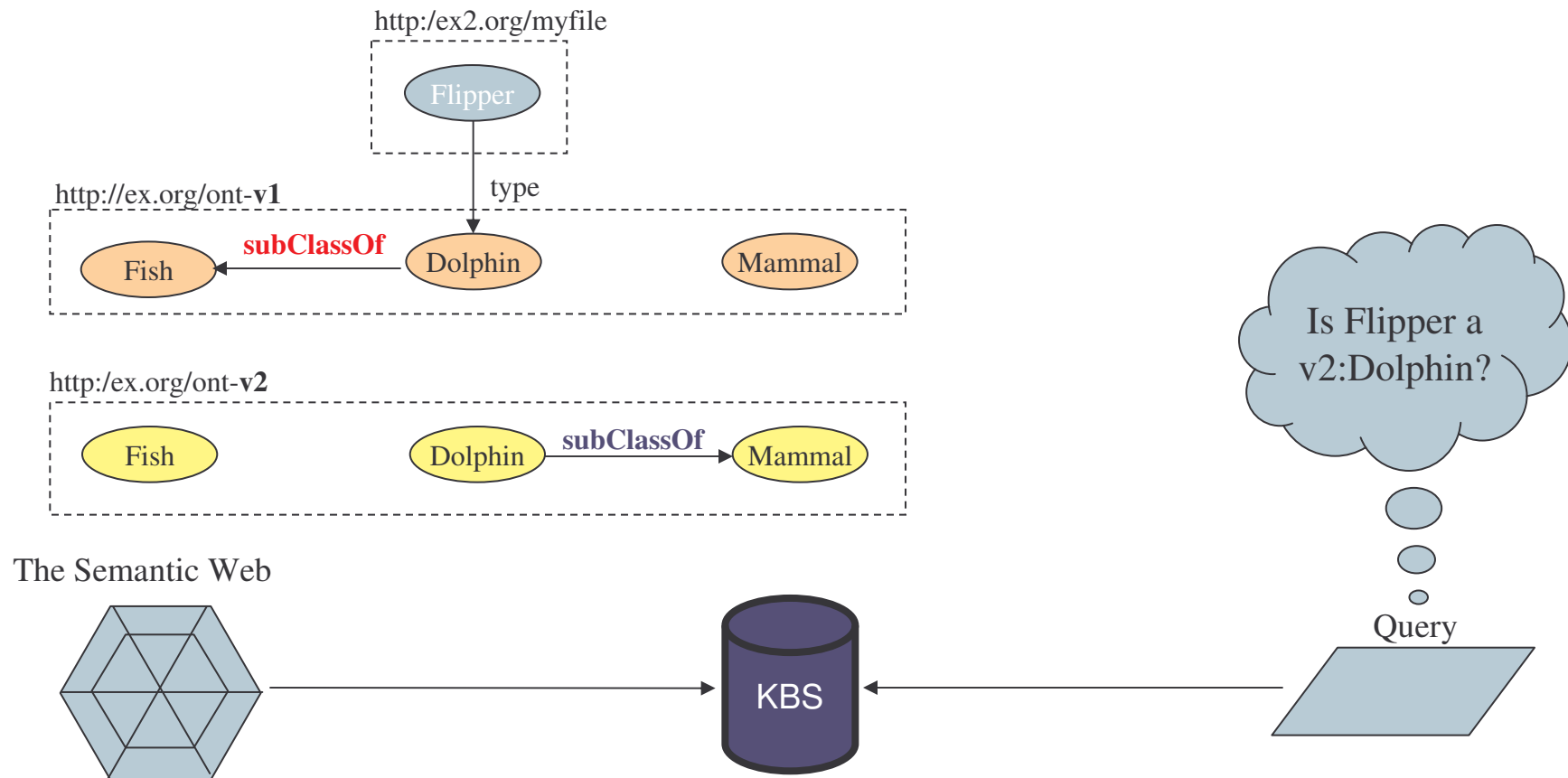
## Ontology Admin & Deployment Tools (ONTADEPT) for Change Management

- Distributed dependency knowledge
- Pub/Sub approach for change management
- Change ontology (in OWL) to capture changes and match pubs to subs
- Support for actual, proposed, & requested changes
- Automated creation of subs
- Logging of changes for version history





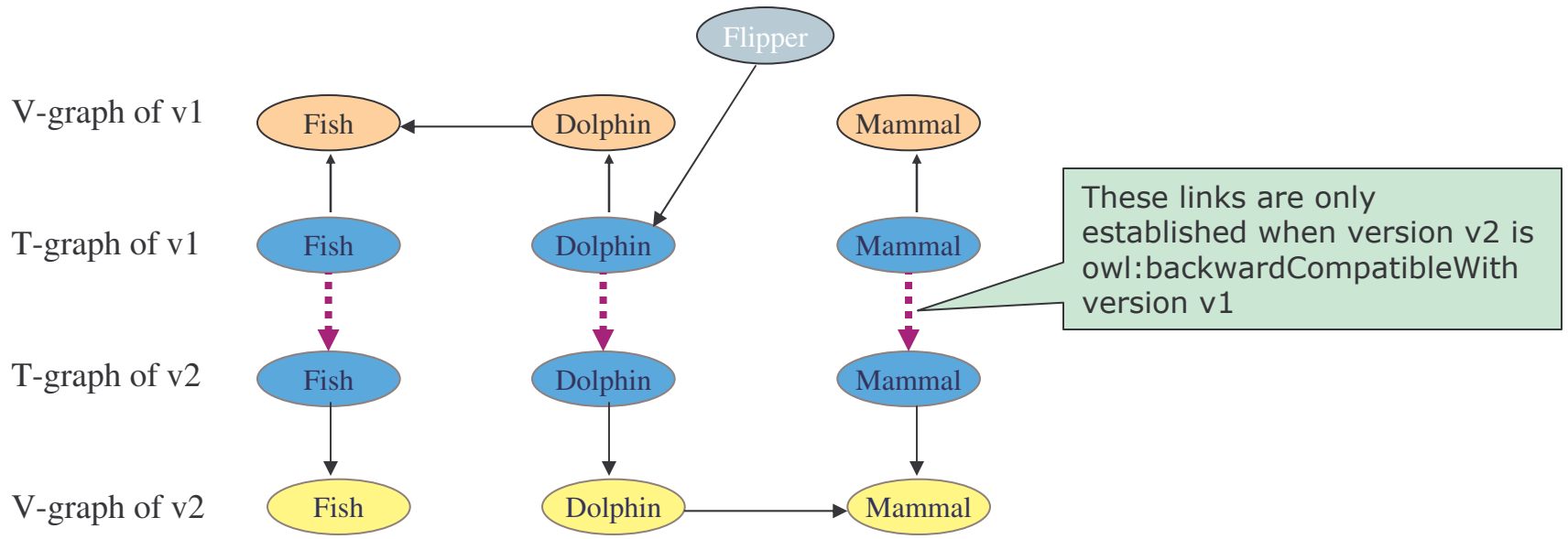
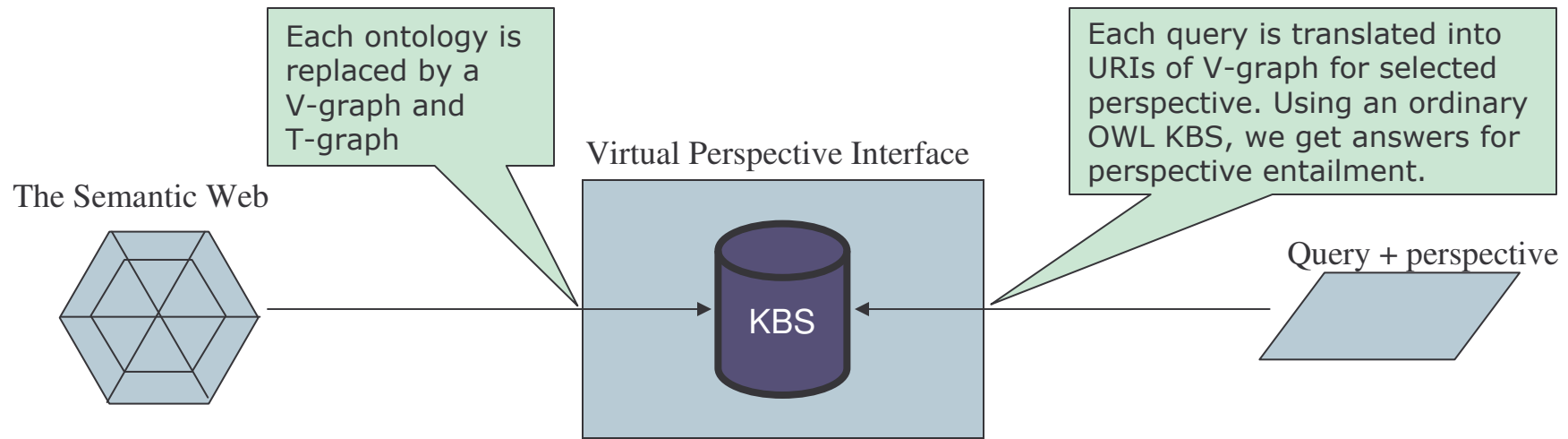
# Technical Problem and Approach: Perspectives (1)



- Answer to query depends on rationale for change from v1 to v2
- If it is yes, then need a new semantics and implementation method to get desired results



# Technical Problem and Approach: Perspectives (2)





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## Technical Progress

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- What technical problems were there and when/how did you overcome them?
  - Perspectives
    - efficient approach to getting appropriate inferences within a system that can only do RDF(S)/Simple OWL inference (solution: 2 kinds of virtual ontologies – T-graph and V-graph)
    - OWL's lack of versioning semantics (deferred)
  - Ontology-related Knowledge
    - scope – not handling (for now) difference detection in ontologies, etc. requires more user work
    - lack of explicit semantics (e.g., in ontology-related data such as templates, extraction rules) – made some simplifying assumptions
    - granularity to work at (across different kinds of data)
  - Are there any metrics that are relevant to your program? How did you measure: technical progress and success? What were your intermediate goals?
  - kinds of ontology changes handled (enumerated use cases)
  - Perspectives
    - algorithm analysis for scalability (#'s of triples, etc.)
  - Ontology-related Knowledge
    - usability
    - runtime performance
    - scalability for above (numbers of dependencies, changes; granularity, rate of changes)
    - measurement of above in progress
    - transitioning of tools into SATURN
- Did you meet your original or revised programmatic goals?
  - Perspectives
    - furthered research (theory/algorithms)
    - built VPI prototype
  - Ontology-related Knowledge
    - transitioned several tools (e.g., DTV) into SATURN
    - additional transitions planned



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## Milestones and Accomplishments

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- Over the course of the time you have been funded by the DAML program, what have you accomplished year-by-year?
  - What were the concrete products of your work?
    - 2004 (March-Dec.)
      - VPI Tools
      - Ontology perspectives Paper (ISWC)
      - ONTADEPT Tools
      - SATURN Insertion
      - Change Ontology
    - 2005 (Jan. – June) – further work proposed
  - What was shown in your various demos?
    - Build 0 (May 2004, DAML PI)
      - proof-of-concept for ONTADEPT & VPI (basic perspectives)
    - Build 1 (Aug. 2004 at DARPA)
      - DIONE Template Versioning tool (validation vs. ontologies), VPI (type graphs)
    - Build 2 (Nov. 2004 at DARPA)
      - DIONE Change Manager, VPI (handling imports, HAWK)
    - Build 3 (Dec. 2004 at DAML PI)
      - hardening/packaging
  - What can you point to of your work in specifications?
    - Basic versioning properties are in OWL 1.0, however the specs do not yet specify semantics. It is expected that this work will serve as input to the next version.
      - Jeff Heflin involved in original WebOnt WG discussions
    - Investigate working with W3C SWBP Ontology Engineering group, W3C Ontaria project, etc.





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## Transition/Handoff

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- Where are the results of your work available?
  - Did you influence specs (where?)
    - Heflin to provide feedback on versioning support in OWL.
  - Did you build software (where is it, what is its status)
    - VPI tool
    - ONTADEPT tools
    - Beta versions on SemWebCentral.org
      - documentation in progress
  - Did you write papers (where, how many)
    - Paper on ontology perspectives presented at ISWC (Heflin)
    - Paper on VPI submitted to ICEIS (Heflin)
  - Did you contribute to a commercial company?
    - Tools applied by ISX on SATURN and related IC projects
  - Did you contribute to a DoD pilot or product?
    - Tools applied by ISX on SATURN and related IC projects
  - How did you change the world? Who is using what you developed?
    - SATURN team using initial ONTADEPT tools (e.g., DIONE Template Versioning Tool)
    - Other tools transitioning to SATURN in 2005



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## Remaining Issues



Issue	Remediation
Finish tool documentation	Planned for Dec.
ONTADEPT transition to SATURN (handling other kinds of ontology-related knowledge)	Customization planned (2005)
VPI transition to SATURN	Transition planned (2005). SATURN Knowledge Base still TBD.
VPI coverage	Extend to handle cases like change in (numeric) units for a property. Explore SWRL, etc. (proposed for 2005)
VPI efficiency	Explore efficiency tradeoffs (proposed for 2005). Also VPI approach vs. translation.
Tools needed to determine ontology changes	Semantic "Diff" tool proposed for 2005 – investigate existing tools and extensions (e.g. PROMPTDiff, etc.)
Tools needed to help an author determine backwards compatibility	Backwards Compatibility Wizard proposed for 2005
Continuum between versioning and interoperability	Apply more general ontology mapping techniques to versioning problem.
Semantics of compatibility	Elicit better agreement on the semantics of "backwards compatible", etc. in OWL
lots of other hard problems...	more research to yield practical tools...



# DIONE Summary



- What is the take-away message from your program?
  - Ontology Versioning presents a lot of challenges
    - Related data (e.g., extraction rules, templates) must be addressed
    - Without support for pre- and post-deployment versioning, things will break
    - Tool developers need to start considering this
  - Some progress made via DIONE:
    - progress on theory of ontology perspectives
    - general framework for change management
    - specific tools developed – ONTADEPT, VPI, etc.
    - leveraged Eclipse, OWLJessKB, HAWK, etc.
    - additional work proposed for FY05
  - Hard to convince transition customers who are just moving to ontologies (or even XML)
    - especially those who aren't worried about multi-organization, distribution issues, etc.
  - Lots of research work to be done – e.g.,
    - Semantics of changes needs further definition
    - Capture of changes
    - Inferring more complex dependencies
    - Ontology mapping work
    - etc.
- For further information
  - VPI – paper in ISWC 2004 (perspectives), VPI (in progress)
  - DIONE project – Brian Kettler ([bkettler@isx.com](mailto:bkettler@isx.com)), Jeff Heflin ([heflin@cse.lehigh.edu](mailto:heflin@cse.lehigh.edu))