Lockheed Martin DAML Project

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2004 Research Thrusts

May 26, 2004

LOCKHEED MARTIN
Integrated Systems & Solutions

LEHIGH University

Kestrel Institute

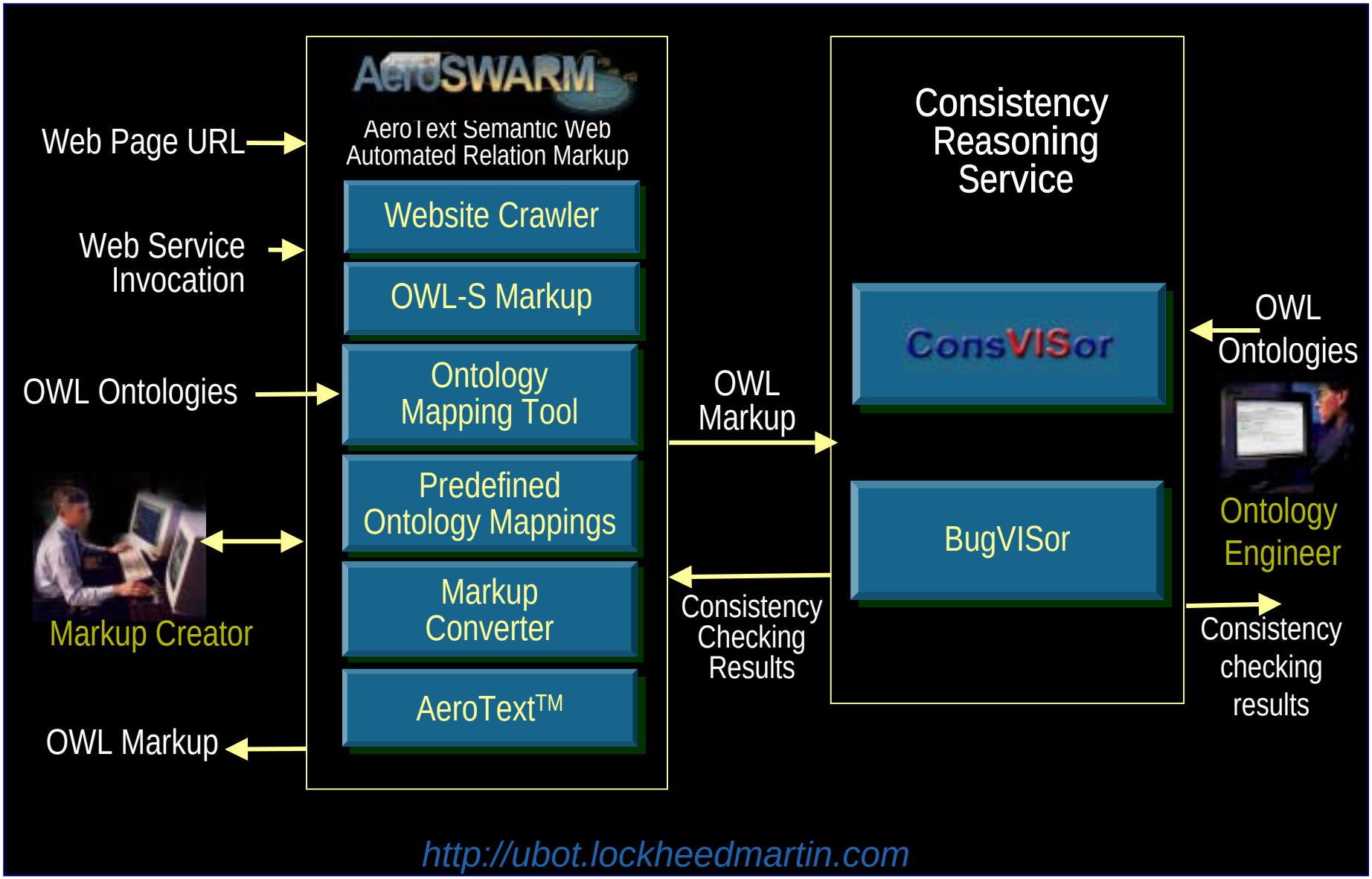
Goals

- **Lockheed Martin contributions to 2004 DAML Program thrusts:**
  - **Mature OWL tools**
    - **AeroSWARM - OWL markup generation service**
    - **ConsVISor and BugVISor – OWL consistency checking/debugging**
    - **DLDB – hybrid semantic web/relational database reasoning infrastructure**
  - **Semantic Web Services**
    - **C4ISR service discovery and composition experiments**
  - **OWL standardization support**
    - **Formally verified OWL axiomatic semantics**

Mature OWL Tools

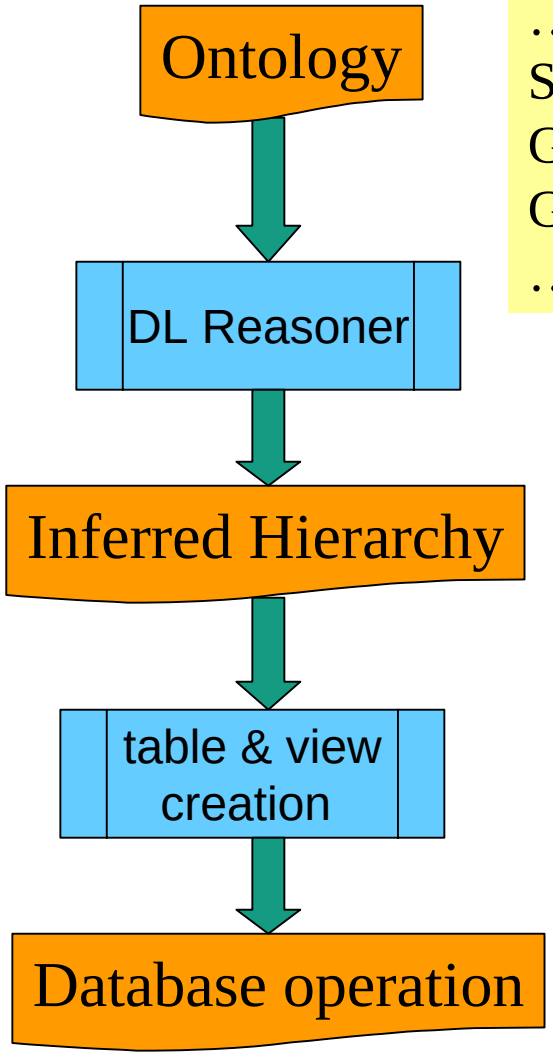
- AeroSWARM
  - Use cases – markup pages for posting or ingestion into KB
  - 44 common properties (vs. 6 in 2003)
  - Web service on load-balanced servers for integration with other tools
- ConsVISor
  - Easy to use web-based tool for checking ontologies and markup
  - Full XSD support
  - support for debugging ontologies via OWL symptom ontology
- DLDB
  - Scaleable open source infrastructure
    - quantitative evaluation of DLDB, Sesame, OWLJessKB
  - Tools/techniques for benchmarking OWL applications

Integrated Tool Architecture



http://ubot.lockheedmartin.com

DLDB

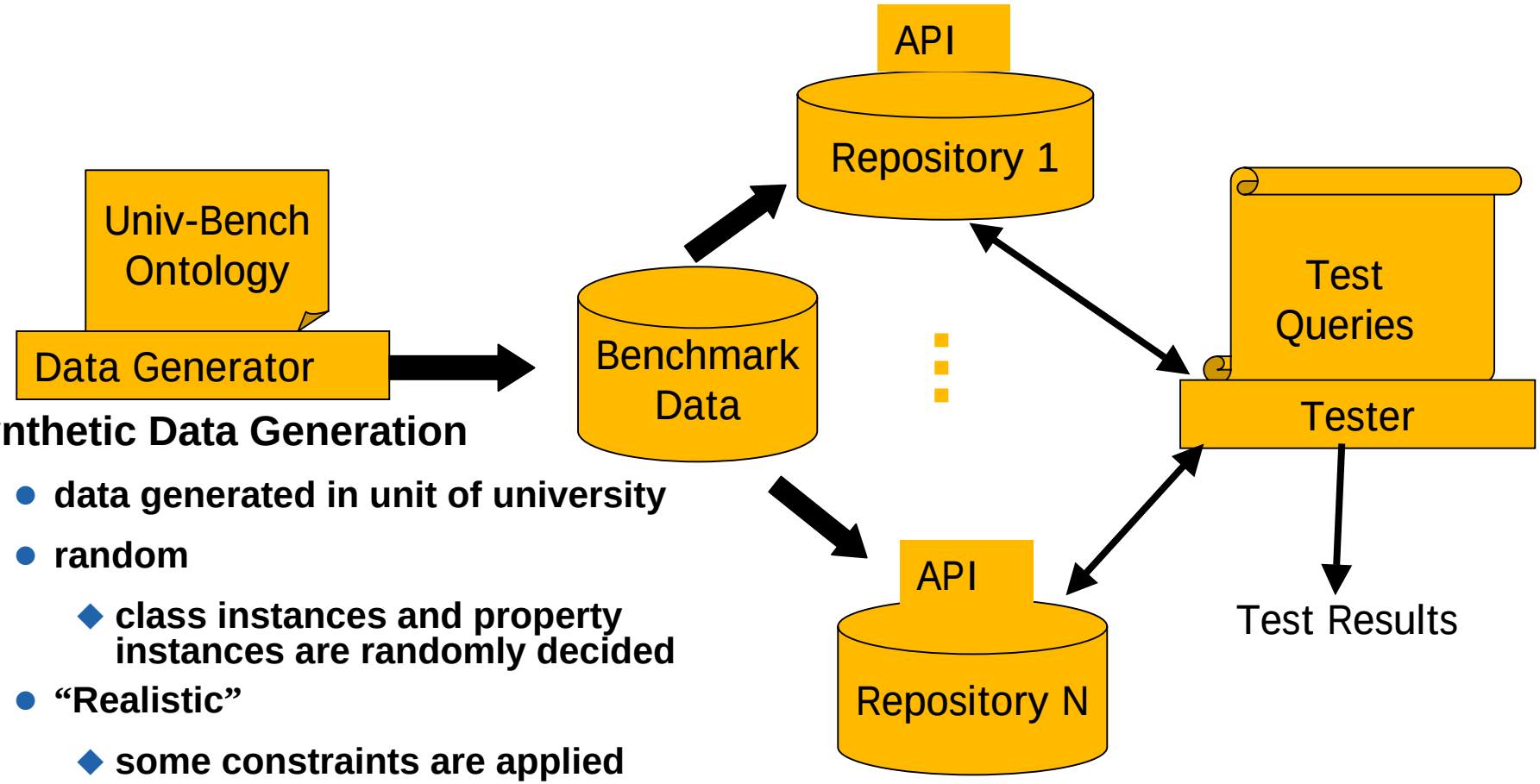


…
Student --> Person who takes courses
Graduate Student --> person who takes graduate courses
Graduate course ∈ Course
…

…
Graduate Student ∈ Student
…

```
CREATE VIEW Student_1_view AS
SELECT * FROM Student_1 UNION
SELECT * FROM
UndergraduateStudent_1_view UNION
SELECT * FROM
GraduateStudent_1_view;
```

Lehigh University Benchmark



Synthetic Data Generation

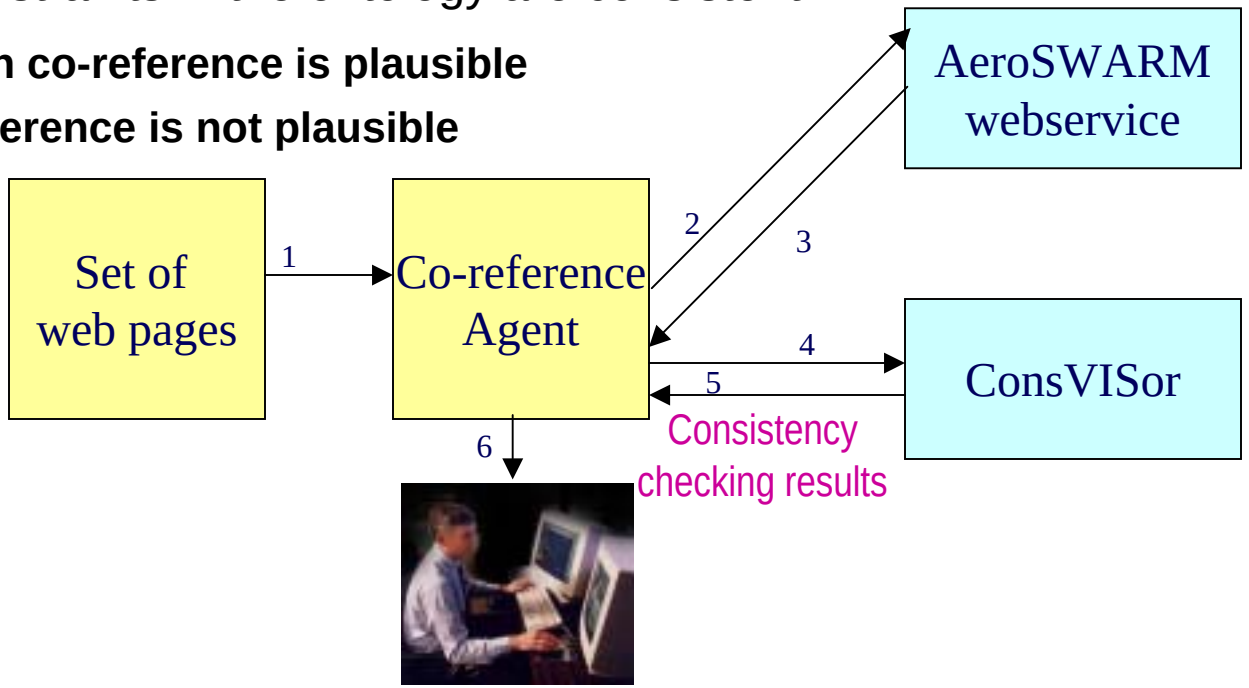
- **data generated in unit of university**
- **random**
  - **class instances and property instances are randomly decided**
- **"Realistic"**
  - **some constraints are applied**
- **customizable**
  - **can select # of univ, start index, and seed**
- **arbitrary size**
- **repeatable**

Mature Tools - Experiments

- How do we demonstrate robustness of tools?
  - by applying them to hard knowledge management problems in a realistic web context:
    - cross document co-reference
      - Is it plausible that Al Smith in document 1 is the same as Al Smith in document 2?
    - GOWLgle – Google results filtering

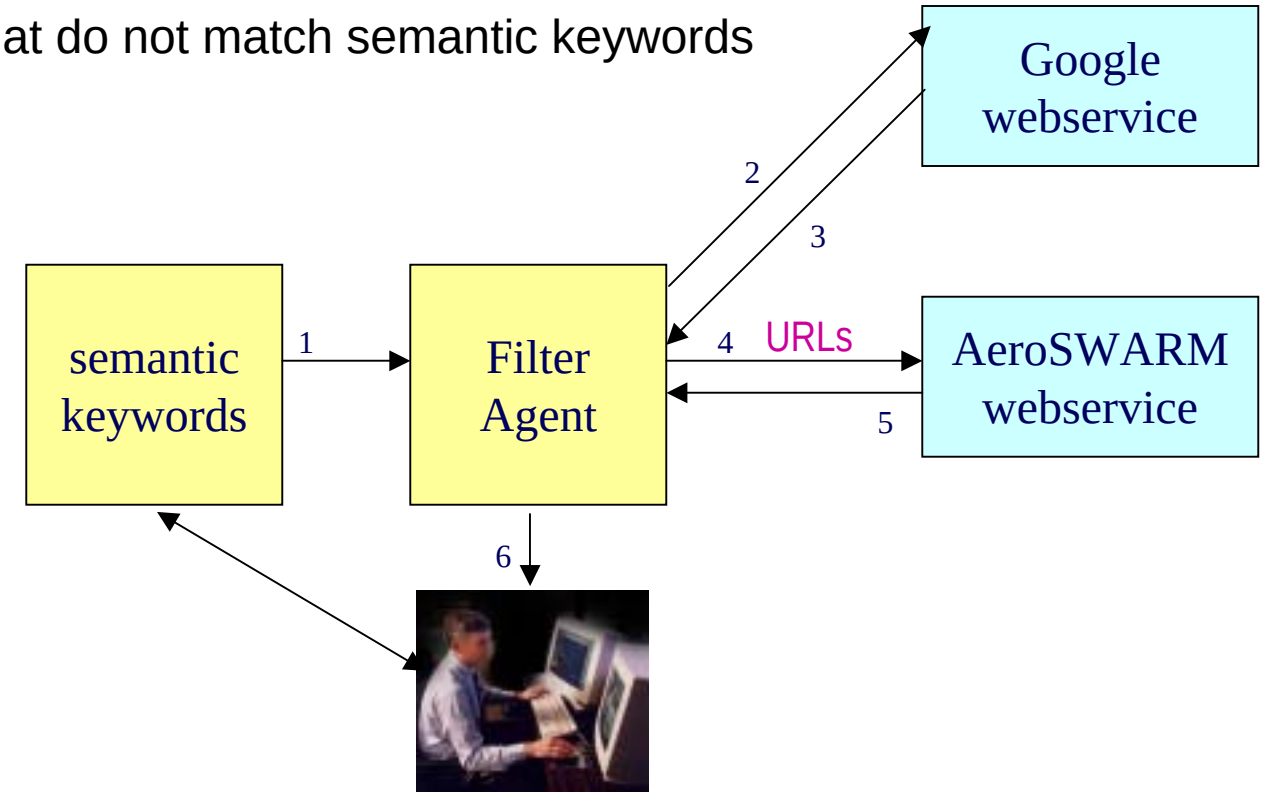
Cross Document Co-reference

- **Problem: When collecting information about a person or an organization need to check if assertions are referring to same entity**
  - linguistic clues do not work – need reasoning
- **Approach:**
  - assert that entity X sameAs entity Y
  - apply logical reasoning to check if all assertions about these entities in set of documents and constraints in the ontology are consistent
    - **If consistent then co-reference is plausible**
    - **If not then co-reference is not plausible**



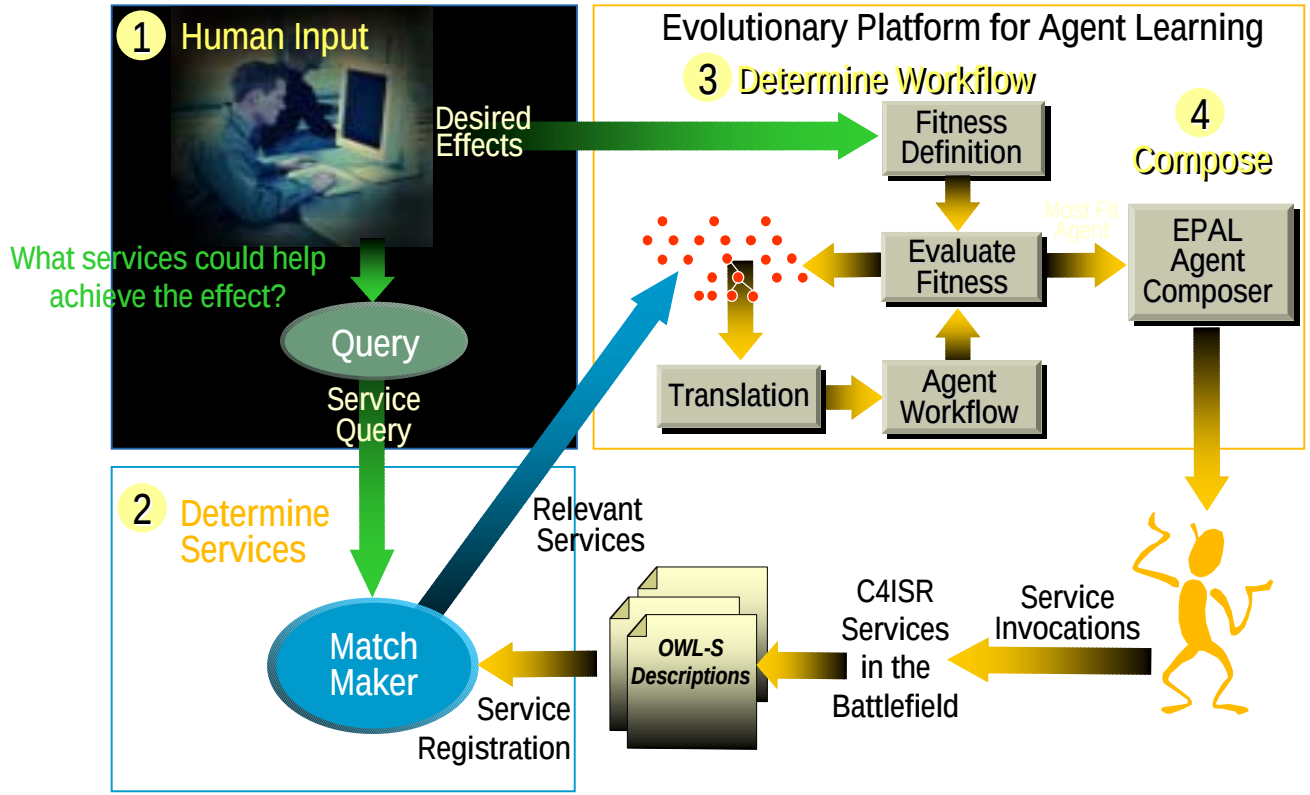
GOWLgle - Google Results Filtering

- **Problem: Google does not use semantics and there is not enough OWL content yet – need hybrid information retrieval techniques**
- **Approach:**
  - user chooses semantic keywords and relations
  - markup web pages in list of N best Google results
  - filter out pages that do not match semantic keywords



C4ISR OWL-S Experiments

- **OWL-S for Net-centric warfare**
  - **Develop OWL-S descriptions of current and future Air Force, Navy, Army and Intel systems/services – identify KR issues**
  - **Experiment with OWL-S discovery and composition approaches – identify OWL-S tool/architecture issues**



Deliverables

Deliverable	IP	SemWebCentral
AeroSWARM	Open service	Currently registered
ConsVISor/BugVISor	Open service	Currently registered
DLDB	Open source	June 2004
OWL axiomatic semantics	Open source	June 2004

- Open services:
  - Advantages:
    - No need to download and install
    - Use expensive software/hardware infrastructure for free
  - Disadvantages:
    - Limited customization options

Plans

- In 2004
  - Wrap-up current tool development efforts
    - Refine AeroSWARM based on SemWebCentral feedback
    - DLDB inference and query interface enhancements
  - Continue OWL-S experiments in Net-centric warfare
- In 2005 we would like to:
  - Help transition OWL-S to DoD for Net-centric warfare
  - Refine GOWLgle into deliverable open service to show value added of Semantic Web
  - Refine co-reference into deliverable service integrated with AeroSWARM
  - Semi-automatic generation of customized benchmarks
  - Develop community symptom ontology and bug ontology