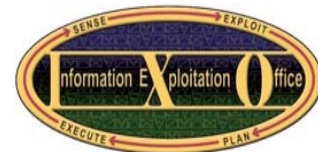# DAML PI Meeting Kickoff

Mark Greaves
DARPA / IXO

16-18 October 2003

Agenda

- **DAML Program Overview**
  - Mark's Big Picture: How I am Presenting DAML
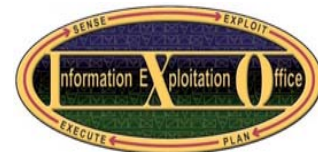 - Structure of the Program in 2004

- **The Way Forward in 2004**
  - Technology Focus areas: OWL, Services, Rules
  - Measuring our Success: Transitions, Standards, Tools

- **DAML Programmatics**

- **2004 PI Meeting Goals**

"**The web has made people smarter. We need to understand how to use it to make machines smarter, too.**"
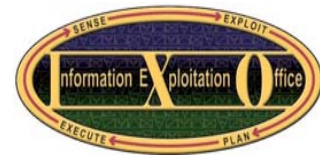
> **– Michael l. Jordan, paraphrased from his talk at AAAI, July 2002 (courtesy Tim Finin)**

"**He should check out DARPA's DAML Program.**"

> **– Witty response from the DAML PM when told of this**

21st Century Network Centric Computing

- **A new computing paradigm is emerging**
    - The Web is more than HTML/HTTP – it is the open infrastructure to link business processes in the broadest sense
    - Computation is situated, 24x7, physically and logically distributed, and embedded in the environment
    - More subtly, this is driving an change in stance from Turing machine models to stream and reactive computing:
        - *Algorithm* becomes *control surface*
        - *Data-centric* becomes *process-centric*
        - *Halting conditions* become *evolutionary stability* and *lifecycle properties*
        - *Determinism* becomes *stochastic optimization*
    - The Web, EJBs, SOAs, etc., are giving new life to the dream of dynamic software composition out of a massive grid of capability
- **Social and market forces are driving organizations to start coupling their processes and data together**

DARPA's DAML program is developing core technologies to support this new paradigm
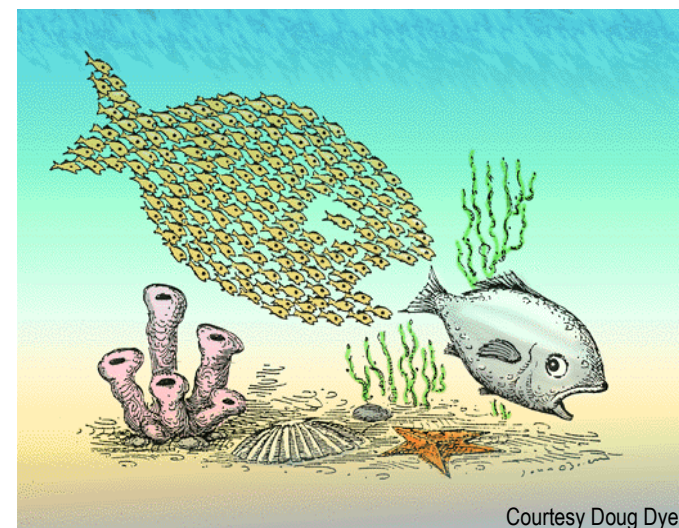
Where DAML is Taking the Web

The WWW has been primarily about presenting documents and data to people – we have created a revolutionary *web of data*

The direction of WWW research is toward exploiting the data on the web to link machines – to create a *web of capability*

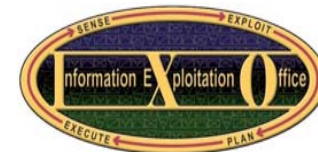- **Critical components of C2I are moving to the Web**
  - Information sources (text, imagery, plans, email, GCCS…)
  - Sensor control and tasking
  - Logistics support
- **Current Web Technology Is Not Machine Processable**
- **DAML enables the Semantic Web - Machine readability with very rich semantics to support web-based software for:**
  - Intelligence Analysis and Production
  - Military Planning and Operations
  - Software C4ISR Agents
  - Sensor Fusion

Courtesy Doug Dyer

The DAML Vision: Adding Formal Knowledge Structures (Ontologies) to Web Markup to make the Web Machine Processable

```
<?xml version='1.0' encoding='ISO-8859-1'?>
<!DOCTYPE uridef[
  <!ENTITY rdf "http://www.w3.org/1999/02/22-rdf-syntax-ns">
  <!ENTITY rdfs   "http://www.w3.org/2000/01/rdf-schema">
  <!ENTITY daml "http://www.daml.org/2001/03/daml+oil">
  <!ENTITY process "http://www.daml.org/services/daml-s/2001/10/Process.daml">
  <!ENTITY service "http://www.daml.org/services/daml-s/2001/10/Service.daml">
  <!ENTITY profile "http://www.daml.org/services/daml-s/2001/10/Profile.daml">
  <!ENTITY xsd "http://www.w3.org/2000/10/XMLSchema.xsd">
  <!ENTITY cougaar "http://localhost:8800/$DAML/cougaar.daml">
]>

<rdf:RDF
  xmlns:rdf=    "&rdf;#"
  xmlns:rdfs =   "&rdfs;#"
  xmlns:daml=    "&daml;#"
  xmlns:service= "&service;#"
  xmlns:process= "&process;#"
  xmlns:profile= "&profile;#"
  xmlns:xsd=     "&xsd;#"
  xmlns:cougaar= "&cougaar;#">


  <daml:Ontology about="">
   <daml:versionInfo>
     $Id: 125-FSB.profile.daml,v 1.1.2.11 2002/12/10 17:59:38 aleung Exp $
   </daml:versionInfo>
   <rdfs:comment>
     DAML-S service profile for 125-FSB

   </rdfs:comment>
   <daml:imports rdf:resource="&rdf;" />
   <daml:imports rdf:resource="&daml;" />
   <daml:imports rdf:resource="&service;" />
   <daml:imports rdf:resource="&process;" />
   <daml:imports rdf:resource="&profile;" />
   <daml:imports rdf:resource="&cougaar;" />
  </daml:Ontology>

  <service:Service rdf:ID="A_125-FSB">
   <service:presents rdf:resource="#A_125-FSB_Profile"/>
   <service:supports rdf:resource="#A_125-FSB_Grounding"/>
  </service:Service>
```

```
<cougaar:ServiceProfile rdf:ID="A_125-FSB_Profile">
  <service:isPresentedBy rdf:resource="#A_125-FSB"/>
  <cougaar:serviceCategory>
  <cougaar:ServiceCategory>
   <cougaar:serviceCategoryName>AmmunitionProvider</cougaar:serviceCategoryName>
   <cougaar:serviceCategoryCode>AmmunitionProvider</cougaar:serviceCategoryCode>
   <cougaar:serviceNamingScheme>MilitaryServiceScheme</cougaar:serviceNamingScheme>

  </cougaar:ServiceCategory>
  </cougaar:serviceCategory>

  <profile:textDescription>Provide ammunition supply. </profile:textDescription>

  <profile:providedBy>
   <cougaar:MilitaryServiceProvider>
     <profile:name>125-FSB</profile:name>
   </cougaar:MilitaryServiceProvider>
  </profile:providedBy>

</cougaar:ServiceProfile>

<cougaar:WsdlGrounding rdf:ID="A_125-FSB_Grounding">
  <cougaar:wsdlDocument>http://localhost:8800/$125-FSB/wsdl?file=A-125-FSB.wsdl</cougaar:wsdlDocument>
  <cougaar:bindingType>COUGAAR</cougaar:bindingType>
  <service:isSupportedBy rdf:resource="#A_125-FSB"/>
</cougaar:WsdlGrounding>

<service:Service rdf:ID="B_125-FSB">
  <service:presents rdf:resource="#B_125-FSB_Profile"/>
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</service:Service>

<cougaar:ServiceProfile rdf:ID="B_125-FSB_Profile">
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  <cougaar:serviceCategory>
  <cougaar:ServiceCategory>
   <cougaar:serviceCategoryName>FuelSupplyProvider</cougaar:serviceCategoryName>
   <cougaar:serviceCategoryCode>FuelSupplyProvider</cougaar:serviceCategoryCode>
   <cougaar:serviceNamingScheme>MilitaryServiceScheme</cougaar:serviceNamingScheme>

  </cougaar:ServiceCategory>
  </cougaar:serviceCategory>
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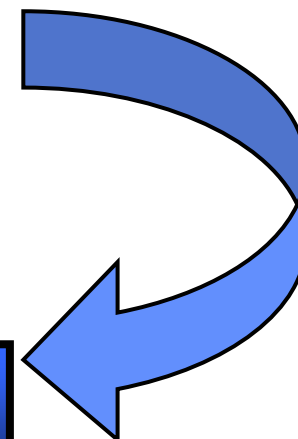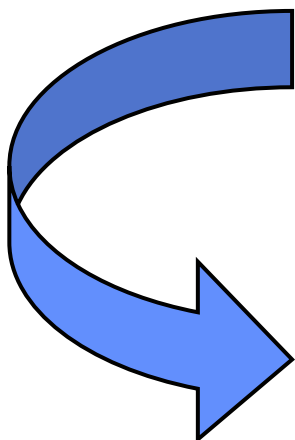
DAML Tools Make OWL Real

*Supplying the essential **semantic layer** to today's Web*

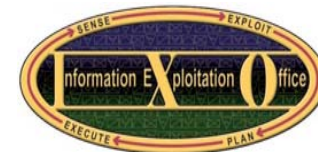| Tools	Tech Approach
■ Ontology editors, browsers, servers	Description Logic
■ Annotation tools	Ontology-based natural language processing
■ Inference engines	Theorem proving DL programming
■ Semantic search & retrieval mechanisms	Query language Ontology-based indexing Agent-based computing
■ Ontology mapping tools	String matching, thesauri Graph isomorphism

- *Scaleable*
- *Interoperable*
- *Open*

World Wide Web

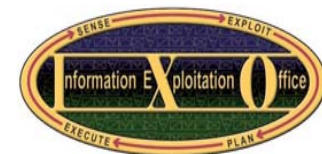Internet

DAML Specific Tools by Category

http://www.daml.org/tools/

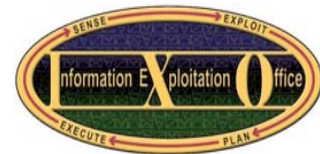| Category	Tool	Category	Tool
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Export	OWL Converter	RDF Parser	DAML dotnetAPI
Import	Excel to RDF converter	RDF Parser	Drive
Import	PDDL to DAML Translator	RDF Parser	Jena
Import	RDF Web Scraper	RDF Parser	Jena Location Modification
Import	Unicorn System	RDF Parser	RDF API
Import	XML Schema to DAML Translator	RDF Parser	Source and Dynamic Loading Extensions for Jena
Inference Engine	cwm	RDF Parser	Wilbur RDF Toolkit
Inference Engine	Euler proof mechanism	RDF Query	Algae
Inference Engine	Java Theorem Prover (JTP)	RDF Query	Jena
Inference Engine	OpenCyc	Report Generation	Webscripter
Inference Engine	TRIPLE	Search Engine	DAML Semantic Search Service
Knowledge Base	OpenCyc	XML Editor	RDFedt

From Ontology Description to DoD Software Interoperability

- **The goal of the DAML Program is to use explicit ontologies and web technologies in order to achieve software/data interoperability and composability**
  - OWL is the foundational technology for the semantic web revolution
  - OWL allows data mark up with precise terminology, so searching and browsing become even more effective
  - OWL's description logic basis and axiomatic semantics allow *subsumption* reasoning to fill certain knowledge gaps

- **From Description to Interoperability**
  - DAML/Logic – Include a rule language in DAML to allow users to not just describe their ontologies, but also to specify non-class relationships between elements
    - Allow OWL to easily express relationships like "in this database, a battalion B is operating in an area A if B has a company C and C is operating in A."
    - Allow OWL applications to reason about arbitrary relationships between element classes
    - Allow OWL-described services to specify preconditions, postconditions, and exceptions
  - DAML/Proof – Include a specification for using DAML logic and rule elements to construct supports and refutations
    - Allow OWL applications to add confirming or disconfirming information for a DAML assertion
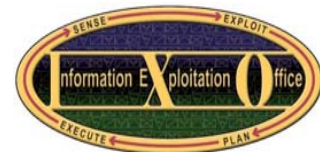   - Allow OWL to express general processes, like negotiations

What Does this Mean for DAML?

- **If the DAML Program is about transforming the web in a new and revolutionary way, who is DARPA's customer?**
  - Standard DARPA answer: US Military Services and Defense Agencies
  - The emerging answer for information technology:
    - The contractors who sell IT to DoD (and increasingly to others)
    - The IT acquisition organizations in DoD (DISA, DIA, PEOs)
    - The larger world of (companies, allies) with whom DoD must integrate
  - The **early adopters** in all of these organizations

- **How should the DAML program be structured in 2004 to deliver to this customer?**
  - Building on the strengths of the team and the (fantastic) successes so far
  - Within the constraints of the program's FY04 budget topline

- **How do we get these customers to try the semantic web?**
  - **Standards**: Move the semantic web towards public standardization in the appropriate bodies
  - **Tool Support**: Deliver a set of high-quality, documented, open source tools to support experimentation and development

- **DAML Program Overview**
  - Mark's Big Picture: How I am Presenting DAML
  - Structure of the Program in 2004

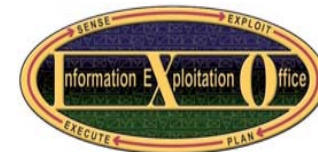- **The Way Forward in 2004**
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World Wide Web Consortium Issues Web Ontology Language Candidate Recommendations

Contact

Janet Daly, <janet@w3.org>, +1.617.253.5884 *or* +1.617.253.2613

(This press release is also available in French and Japanese)
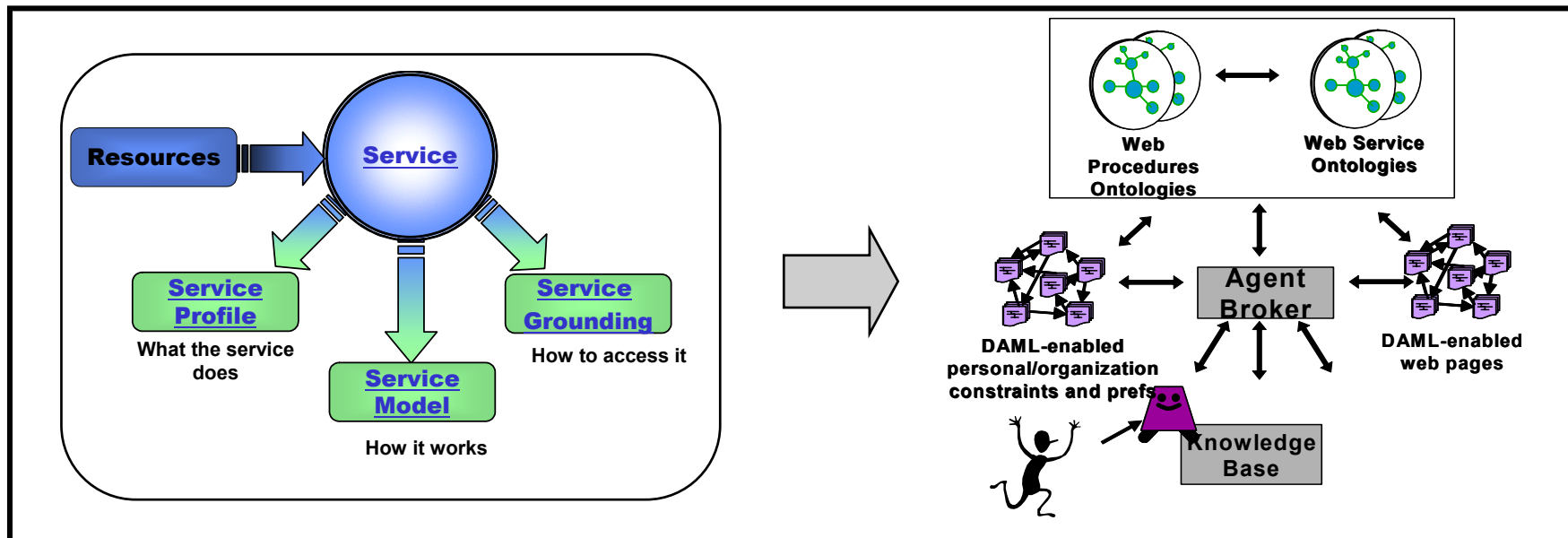
W3C®

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http://www.w3.org/ -- 19 August 2003 -- Today, the World Wide Web Consortium (W3C) issued Web Ontology Language (OWL) as a W3C Candidate Recommendation. Candidate Recommendation is an explicit call for implementations, indicating that the document has been reviewed by all other W3C Working Groups, that the specification is stable, and appropriate for implementation. […]

Standards

- **Continue our advocacy in and support for the W3C to help ensure the maturation of the standard**
  - The process here is largely driven by others at this point, but the program needs to continue any support that is necessary

Tools

- **Ensure that all program-funded software will be fully compliant with OWL**
  - I am officially not interested in spending program dollars to support the development of tools that do not fully support OWL

2004 Thrusts:
Semantic Web Services

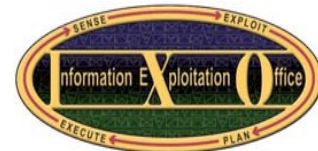- **Establish a consistent, elegant approach to semantic web services within the context of relevant standards bodies, such as the W3C**

- **Ensure that our specifications address security, as well as the normal description and composition issues**

- **Create a set of open-source tools, demonstrations, and documentation that clearly demonstrate the advantage of OWL-based service descriptions**

Standards

Tools

Standards

- ■ **Drive out a specification for a rules extension to OWL that takes seriously the web context**
  - Resolve the remaining technical issues into a (compromise) document that all of our performers can live with
  - Sufficient for the Semantic Web Services use cases
  - Ensure syntactic and semantic consistency with OWL

Standards

- ■ **Support a rules standardization effort (W3C?)**
  - What is the strategy/endgame here? It is not acceptable to end this part of the DAML program with a couple of papers.
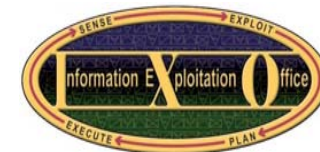
Tools

- ■ **Create a set of open-source rules-authoring tools, reasoners, and documentation**
  - Clearly demonstrate the advantage of using rules both in services and non-services contexts

2004 Thrusts: Tools for the Revolution

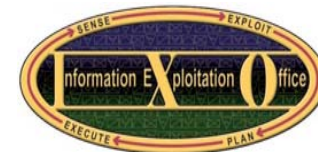| Category	Tool	Category	Tool
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Inference Engine	OpenCyc	Report Generation	Webscripter
Inference Engine	TRIPLE	Search Engine	DAML Semantic Search Service
Knowledge Base	OpenCyc	XML Editor	RDFedt

- **Ensure that, to the maximum extent possible, program-funded software is available on a professional-quality open source web site**

- **Implement a tool strategy that will result in a solid, easy-to-use, and straightforward collection of tools that support typical OWL workflows**
  - Nothing that is being funded by the program should be in DAML+OIL
  - Includes building high-quality "knowledge infrastructure" ontologies

- **Take the web context seriously**

Tools

SOURCEFORGE™
.net

Skepticism

- **DAML Experiment is on hold**
  - Metrics don't seem motivated
  - Hypothesis not well formed
  - Big demos are not the right way to get decisionmakers to commit to the semantic web

	Initial	Oct '02	Apr '03
Ontologies	1	16	26
Classes	20	242	397
Properties	100	57	229
Instances	500	12,507	308,491
Statements	2000	13,674	1,062,480

Afghanistan ENP and Operations
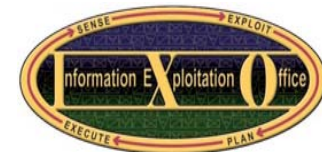
- **Ontology Mapping and Translation**
  - While this will be an issue in the long term semantic web, in the near term it is not clear to me that these tools will see sufficient use to make them worthwhile
  - Is there a standards/tools story?

- **Query (except as linked to Rules)**
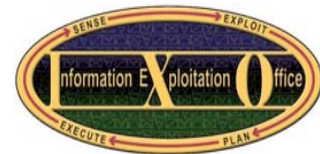
Program Transition Strategy

- **There are several existing semantic web pilots in DoD, some of which are supported with partial DAML program funding:**
  - AF-AMC: Foreign Clearance Guide
  - AF-AMC: Notices To Airmen
  - AF-AFRL: Joint Battlespace Infosphere
  - ONR: Expeditionary Pervasive Sensing
  - Army Knowledge On-Line / Center for Lessons Learned
  - Intelligence Community: Intelink and NSA

- **But… many of the semantic web projects I hear about now are NOT ones that came from explicit DAML program outreach**
  - Defense Readiness Reporting System (RML)
  - Army CIO Semantic Web Initiative
  - Semantic Web SIG of the Federal CIO council (www.km.gov)
  - DISA Network-Centric Enterprise Services

Transition and Uptake is starting to happen by itself…
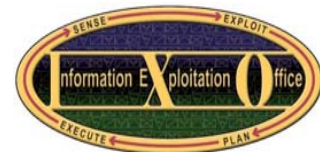
Measuring Success in DAML

- **Success = creating the conditions for early adopters to allow the semantic web revolution to succeed**

- **I will judge the success of the program (and the performers) by the quality of their tools and the success of their standardization efforts**
  - Transition success is via a set of well-crafted tools and public standards that allow early adopters to succeed (NCSA Mosaic)
  - Better tools and standards should lead to more semantic web adoptions

- **Other steps**
  - Continue to identify transition partners and opportunities in DoD
  - Serious agent-based applications are of interest

- **Every performer must have a clear account of how their technology will play in the standards process and be made available to early adopters**

Public Standards and High-Quality Tools are the Current Best Way to Nurture the Semantic Web Revolution

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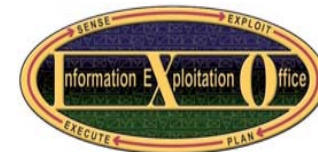 - Measuring our Success: Transitions, Standards, Tools

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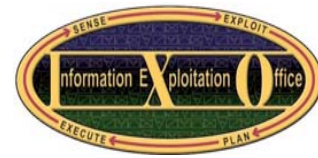
2004 Funding and Financials

- **New financial POC: Tamera Belvin (tbelvin@snap.org)**

- **Your agents are here to coordinate any financial or contractual issues**

- **2004 DARPA funding for DAML**
  - We expect FY04 funds to arrive at DARPA Comptroller shortly
  - Once funding arrives there will be some delay while the funds are processed at DARPA and passed to your contracting officer
  - Right now there are no budget cuts that I know of, but surprises would not be unusual

- **Everyone has a tentative FY04 number given by Murray. I reserve the right to alter those numbers based on what I see in this meeting. *You may be asked to rejustify your FY04 funding level.***

- **2005 funding is not guaranteed**
  - Final-year DARPA programs are always candidates for raiding
  - Any technology work in FY05 must be rejustified to me
  - If you know of any new DoD transition possibilities, let's talk. Candidates need to be high-profile and fit with program strengths.

WHINE

My Upcoming DAML Milestones

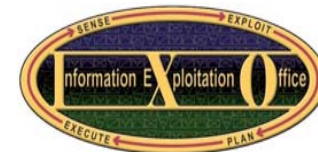- **Possible Winter DARPA Director Review**
    - DAML may or may not be formally briefed, but it will be presented
    - I will need concrete evidence of progress in technology
        - OWL, Services, Rules
        - What can you do now that you couldn't do in April?

- **New Program Seedling – SEE**
    - The Semantic Web is too important for DARPA to declare victory with DAML
    - United States investment in fundamental semantic web technologies must continue
    - I am actively working to define a new program
        - New technology challenges
        - Better metrics and compelling challenge problems
        - Military partners from the start
    - Goal: a newstart brief to the DARPA Director in January
    - More on this on Saturday

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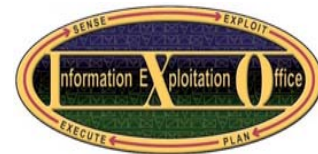 - Measuring our Success: Transitions, Standards, Tools

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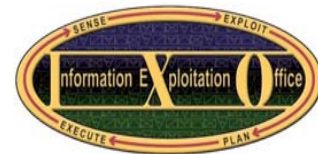
- **2004 PI Meeting Goals**

2003 Fall PI Meeting Goals

- **Review program status in the thrust areas**
  - *Understand* the thrusts and define how you will participate and drive them to conclusion
  - *Understand* the requirements on software and how you will satisfy them
  - *Understand* that the 2004 program strategy relies on standards and tools, and you will have to make a positive contribution in one or the other

- **Define issues and plans for program-wide topics**
  - Dependencies (e.g., of Service spec on Rules)
  - Strategies and calendars/milestones to support the standardization process
  - Be interactive and interesting, but recognize that the program requires consensus

- **Showcase FY03 OWL-based tools and technologies**

- **Prepare to revise your IOWs for 2004 in response to PI meeting presentations**
  - In addition I am going to construct formal roadmaps for each thrust area

2003 DAML PI Meeting Schedule

- **Day 1 – Major Thrusts for 2004**
  - Death by Powerpoint
  - Status and plans in OWL, Tools, and Services
  - OWL Capability Demos

- **Day 2 – Rules and the Semantic Web**
  - Joint Cmte Update on Rules
  - Joint OntoWeb 5 / DAML session
  - Optional BBQ with your European counterparts

- **Day 3 – Looking Ahead**
  - Other Updates
  - New Programs at DARPA

- **OntoWeb 5 meeting is Saturday at the Sundial**
  - Joint session with DAML

- **A Semantic Web Week**
  - SWSI F2F is Sunday at the Sundial (9am start; Sycara is the POC)
  - ISWC 2003 is next week at the Sundial
  - K-CAP 2003 is next week at the Sundial

- **Take advantage of the opportunity to network with your colleagues**
  - Silence means assent

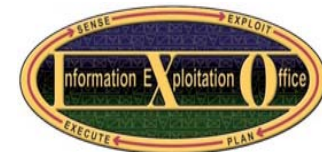## *What do we still need to do to support early Semantic Web adopters?*

Other Workshop Details

- **Enjoy the location!**

- **Demos at 5:30 tonight**
  - Relax over food and drink and fine company
  - Schmooze your DAML colleagues
  - War stories and BoF meetings are encouraged

- **In case you can't get enough**
  - All presentations will be available via the DAML website within 1 week of workshop end
  - We have two smaller rooms across the hall available for sidebars
  - I have a limited amount of time for private sidebars; please see me if it is urgent. I would prefer that you devote yourself to the workshop goals and talk to me afterwards. I will be here through the weekend and all next week (at ISWC).

Last Thoughts

- **Low hanging fruit tastes just as good**
- **Remember the calendar**
  - Don't say "next year I will do x'; DAML will be a target in FY05
  - Make your definitive mark in FY04, and look for a new BAA in the summer
- **DAML is transformational for the DoD**
  - Military transformation (RMA) requires speed, agility, and a focus on rapidly synthesizing force packages from capability requirements
  - OWL is the only serious KR technique that is scalable, deployable, web-friendly, and can support the distributed dynamic network-centric warfare scenarios that DoD foresees
- **DAML is transformational for the world**
  - We are (finally!) bringing semantics to the web
  - Our success will convince companies to risk their shareholder capital on the semantic web

I am excited to be the PM for a truly revolutionary program and a group of world-class performers!