Intelligent Agents in Information Warfare

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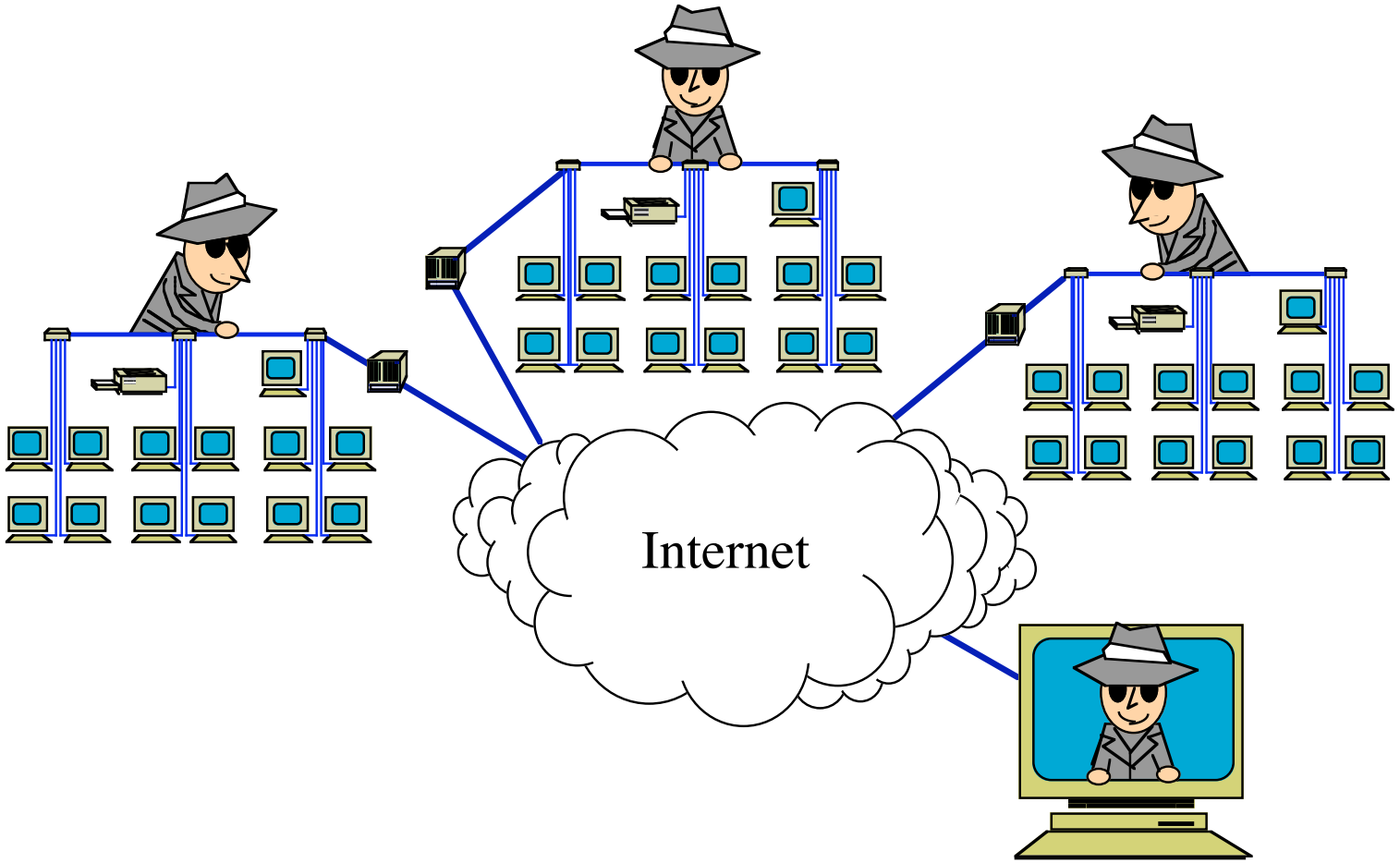
Purpose

- Examine Information Warfare aspects of Intelligent Agents in both a military and business context
- Communicate Observations
  - » Intelligent agents are an important element in future computing environments
  - » Effective use of these technologies can assist in obtaining an information advantage over competitors or adversaries
  - » Information Warfare considerations must be taken into account to avoid losing this advantage

Topics

- Introduction to Intelligent Agents and Related Developments
- Growing Role of Intelligent Agents in Future Computing Environments
- Information Warfare Perspectives

Intelligent Agent Concept



Characteristics of Intelligent Agents

Intelligent Agents:

- operate autonomously
- seek to accomplish user-specified goals
- react to their environment, sensing changes and responding

Some intelligent agents also:

- socially interact with other agents
- can learn or adapt based upon experience
- are mobile and can move to different hosts

Push - Pull Drivers

Factors driving the growth of Intelligent agents include both the push of technology developments and the pull of user needs for these capabilities.

Technology Push

- Artificial intelligence
- Java, JAT
- CORBA and other
- MUD collaboration
- Search and other Bots
- KQML and other Open agent standards

Requirements Pull

- Information Search and retrieval
- Information complexity Reduction
- Intelligent User Interfaces
- Surrogate representation of mobile users
- User Collaboration

Definitions

Intelligent agents are more than a software program

- IBM:
  - » "An Intelligent agent is software that assists people and acts on their behalf." Don Gilbert
- University of Memphis:
  - » "… a system situated in an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so to effect what it senses in the future." Stan Franklin & Art Graesser

Role in Future Computing Environments

Assist users in:

- Coping with the vast and growing extent of networked resources which far exceed an individual user's processing capabilities
- Overcoming constraints of mobile computing including bandwidth, connection times, local storage, and portable computing resources
- Collaborating over distance and time
- Human interface constraints including speech, personalities, and knowledge of user's requirements

Developments

- DARPA
- IBM
- SRI
- SAIC
- Lockheed
- Sandia
- Stanford University
- Carnegie Mellon
- University of Massachusetts
- University of Maryland Baltimore Campus
- University of Memphis
- North Carolina Status University

DARPA

- Knowledge Interchange Format (KIF)
  - » a common language for expressing facts, beliefs, and rules
- Ontolingua,
  - » a system and approach for creating and maintaining domain-specific vocabularies
- Knowledge Query and Manipulation Language (KQML)
  - » high-level protocol and language for agent-service and agent-agent communications,

IBM Intelligent Agents

- Ginkgo Knowledge Capture and Virtual Consultation
  - » agent-based learning system, task profiling, and multi-agent collaboration
- Agent Transfer Protocol
  - » for transferring mobile agents between networked computers
- Agent Building Environment
  - » architecture and tools to build extensible agents including engine, rule editor, adapters, and demonstration agents

Carnegie Mellon

- RETSINA
  - » Multiagent reusable infrastructure
- PLEIDES
  - » Intelligent agents for Financial Portfolio Management
- WARREN
  - » Intelligent agents for financial portfolio management
- DVINA
  - » Knowledge-based Agent for Information Extraction & Retrieval
- WebMate
  - » Personal agent for World-Wide Web Browsing & Searching
- THALES
  - » Satellite Visibility Forecaster

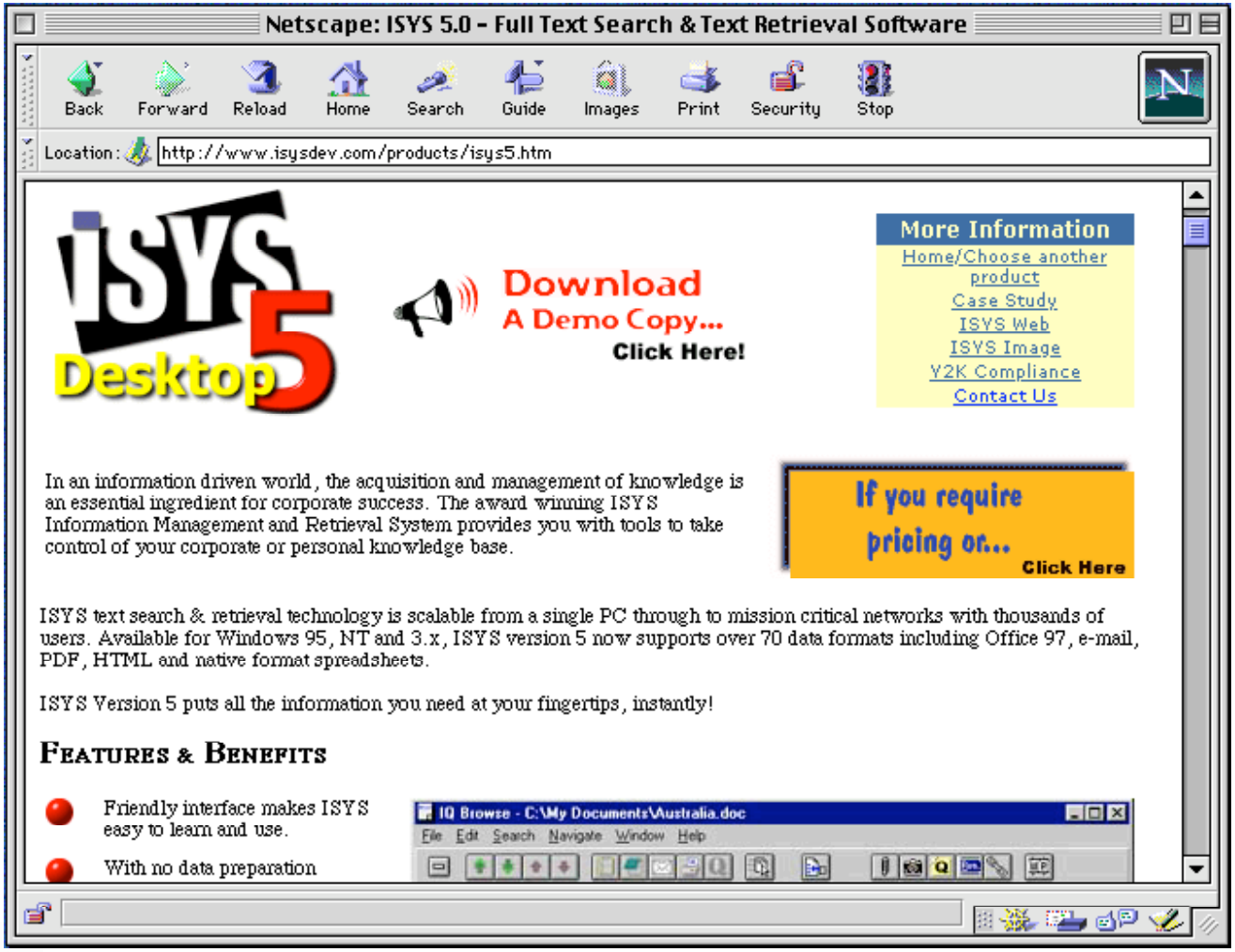
SRI/Stanford University

- Open Agent Architecture™ (OAA)
  - » Defining and operating distributed communities of agents
- InterAgent Communication Language (ICL)
  - » Logic-based declarative language to represent expressions
- Java Agent Template
  - » Provides basic agent functionality in Java

Verbots: Verbal Software Robots

- Virtual Personalities, Inc.
- “Don't let that low price of $14.95 fool you. Sylvie is the most advanced self animated, Natural Language enhanced, intelligent chatterbot anywhere.”

ISYS 5



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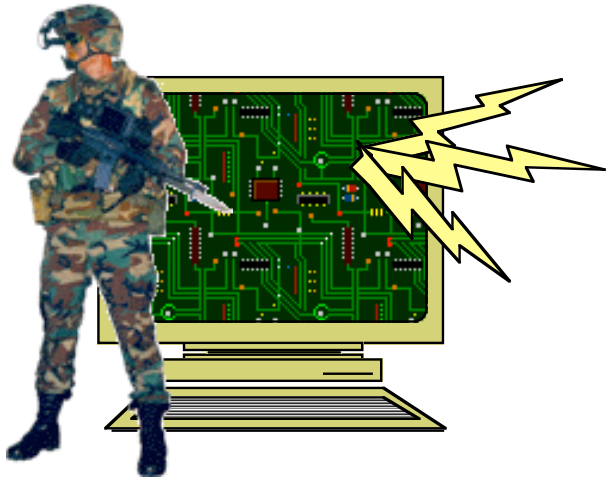
Business Applications

Tools for achieving a competitive advantage in markets leveraged by information

- Information Search and Gathering
- Collaborative Knowledge Management
- Complex Process Management
- Intelligent Data Mining
- Electronic Commerce

Military Applications

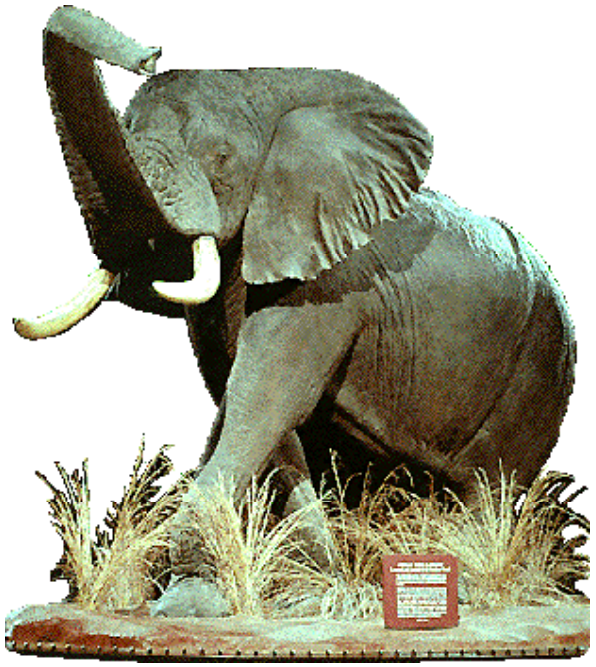


Intelligent Agents

- are an essential element in future mobile computing environments
- can serve as user's surrogate while detached from network
- aid user in using complex information resources to support his mission
- provide friendly interface to knowledge

Information Warfare/ Information Operations

- Information Warfare is: gaining and maintaining an information advantage over competitors and adversaries.

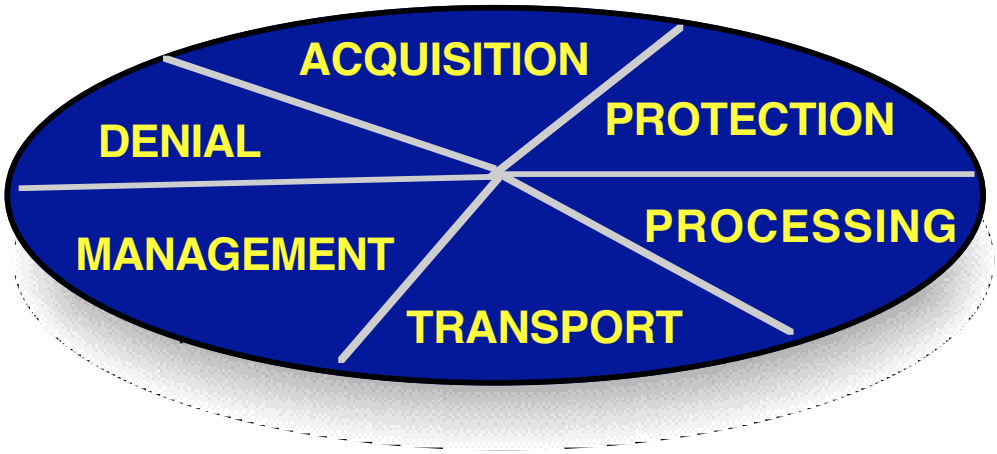


Information Warfare Taxonomy

An information system perspective provides a useful taxonomy:

- **Information Acquisition:** Collecting or developing information
- **Information Protection:** Protecting information against attack
- **Information Processing:** Processing or using information
- **Information Transport:** Moving information from sources to users
- **Information Management:** Managing information processes
- **Information Denial:** Attacking an enemy's use of his information

Information Warfare Strategies



- Can be defined from relative emphasis placed on IW element
- Depend upon organization's competitive position in its market
- Depends upon what its competitors or adversaries are doing

Information Acquisition

- Elements
  - » Detect
  - » Locate
  - » Identify
  - » Characterize
  - » Search
  - » Monitor
- Issues
  - » Quality
  - » Timeliness
  - » Tasking Structures
  - » Intelligence preparation
  - » Collaboration
  - » Navigation

Information Protection

- Elements
  - Security Architecture
  - Authentication
  - Access controls
  - Confidentiality
  - Integrity
  - Non-repudiation
  - Reconstitution
- Issues
  - Agent Impersonation
  - Agent Survivability
  - Agent Redirection
  - Information Corruption
  - Inter-agent identification and authentication
  - Scaleability
  - Encryption

Information Processing

- Elements
  - » Processing Systems
  - » Memory Utilization
  - » Operating Environment
  - » Parallellization Algorithms
  - » Computing Tools
  - » Object Structures
  - » Collaboration
- Issues
  - » Host Cooperation
  - » Processing Algorithms
  - » Host-Agent Protocols

Information Transport

- Elements
  - » Backbone Network
  - » Routing
  - » Dynamic Reconfiguration
- Issues
  - » Agent Navigation
  - » Agent Transport Protocols
  - » Router Protocols
  - » Exploitability

Information Management

- Elements
  - » Human machine interface
  - » Data Bases
  - » Information Visualization
  - » Analysis Tools
  - » Planning Aids
  - » Collaboration
- Issues
  - » Management protocols
  - » Control Agent Learning
  - » Scaleability
  - » Resource allocation
  - » Access Control
  - » Accountability

Information Denial

- Elements
  - » information countermeasures
- Issues
  - » technology
  - » resources
  - » policy
  - » politics
  - » security classification

Intelligent Agents Security Models

- Basis
  - » Agent-contained
  - » Agent host environment contained
  - » Third party provided
- Implementation
  - » Passwords
  - » Digital Signatures
  - » Tokens
  - » Keys (public, private, one-time)

Identification and Authentication

I&A needs to be mutual between the parties.

- Owner & Agent
  - » Agent authenticates Owner before accepting commands or delivering results
  - » Owner authenticates agent before accepting results or issuing commands
- Inter-Agent
  - » Agents mutually authenticate each other before collaborating on tasks
- Agent & Host
  - » Agent authenticates host environment before processing
  - » Host authenticates agent before accepting it

Summary

- Intelligent agents are an important element in future computing environments
- Effective use of these technologies can assist in obtaining an information advantage over competitors or adversaries
- Information Warfare considerations must be taken into account to avoid losing this advantage

Charts

Copies of these charts are available at:

http://www.wias.net

- Format:
  - » Adobe Acrobat PDF
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