KNOWLEDGE DISCOVERY

From Situational Awareness to Bomb Damage Assessment

LTG (Ret) George A. Fisher
Oak Ridge National Laboratory

“Connecting the Dots”
“All I’m saying is, now is the time to develop the technology to deflect an asteroid.”
A Couple of Facts

The Brigade Combat Team of 2015 can expect 3,178,800 sensor reports per hour in its area of operations.

In 2006, the amount of digital information created was 3 million times all the books ever written.

Manual

Client Server
THE 2020 War Fighter

“Know what the Network Knows”
Challenge – What to do with this?

• What is in there?

• Are there any threats?

• What am I missing?
Connecting the Dots

Raw Documents
- Iraq
- Nuclear materials
- Chemical Weapons
- Threats
- Potential Targets
- Money Laundering
- Training Camps

Organize the Information

Connect the Information

Find the Threats

What do we have?
What are the connections?
What are they planning?
How credible is the threat?

Take Action
Intelligent Software

- Intelligent Agents
  - Software processes
  - Can communicate in unstable environments
  - Form teams to solve problems
  - Live, die, and reproduce to solve problems

Message

Whiteboard

- Latest on bin laden?
  - He dead.
  - In Pakistan
  - Unknown

Reply
Agent Approach

• Standard Approach
  11.5 Days

• Agent approach
  8 minutes 24 Seconds!
  2000 times faster
  With no loss of accuracy
Results

Quickly see the overlap of Requirements and Data Base Contents

CCIR
Software Agent Applications

CCIR \(\rightarrow\) 10,000 Documents \(\rightarrow\) Best matches to CCIR

Formulate Question \(\rightarrow\) Data Base \(\rightarrow\) Best match to question

Pattern Metrics \(\rightarrow\) Data Bases \(\rightarrow\) Best matches to pattern
Next Step: Adding DNA to Agents

Endurance  Speed  Agility  Strength  Group  Method  Target  Location

Speed/Strength  Group/Method  Target/Location

Group/Method/Target/Location
Connecting the Dots

MIA

Threats

Agents

Analysis

Decision

OSCAR High Performance Computer Cluster

US naturalized citizen indicted for hiding terrorist links

CLEVELAND, United States (AFP) - A man was indicted here in federal court for concealing his links to terrorist groups from US authorities when he applied for naturalization, the Federal Bureau of Investigation announced.

Cold war leaves a deadly anthrax legacy

By Judith Miller

NEW YORK TIMES NEWS SERVICE

June 2, 1999

VOZROZHDENIYA ISLAND, Uzbekistan -- In the spring of 1988, germ scientists 850 miles east of Moscow were ordered to undertake their most critical mission.

6 Indonesians Barred From U.S.

Current and Former Military Officers Placed on Watch List

By Dana Priest and Peter Slevin

Washington Post Staff Writers

Friday, January 16, 2004; Page A15

The State Department has decided to put a half-dozen current and former Indonesian military officers, including a leading presidential candidate, on a watch list of indicted war criminals, effectively barring them from entering the United States, according to U.S. government officials.
Screen Satellite Photos at Machine Speed

- Is your image repository up-to-date and accurate?
- How can you search through thousands of images in seconds?
- How can you comprehensively search based on:
  - Longitude and Latitude
  - Box on a map
  - Time
  - “Just like this one”
Find “Just like this one…”

Where is the missile?
Cyber Security
Relate Sensitive Research to IP addresses

- 1,000,000 suspicious records daily
- Critical Decisions
  - Is someone trying to hack into the system?
  - Are attacks from “script kiddies” or state sponsored?
  - What are they going after and why?

Activity Log Entry
Filter: misc-000264 IDS247 - MISC - Large UDP Packet
Date: 07/20
TOD: 00:05:03.171193
Source IP: 63.76.192.107
User: John Doe
Research Area: Nuclear Physics
Source Port: 23882
Target IP: 160.91.64.211
Target Name: smith.aol.com
Target Port: 6970
Length: 1285

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U. S. DEPARTMENT OF ENERGY
Caught in 30 Minutes!

45 “low and slow” pings from:
- Country X
- Country Y
- Country Z

2 attacks on nanotechnology scientists

Hidden Patent Pending
Agent Example “Pictures from Data”

- 1 Terabyte of streaming astrophysics data
- 1000 agents analyzing
  - 120 time steps of 300x300x300 matrix for 5 variables
  - 33 million units density in 194 files
- Each time step governed by an oversight agent which redraws picture with most recent information
Astrophysics Common Operational Picture

133 MB data Per step  
8 Sub-cubes  
8 Agents per step  
4 JPGS per step  
120 Frame MPEG

T2
Data Control Agent

T3
Data Agents

T120

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U. S. DEPARTMENT OF ENERGY
Future Battlespace – Forward Analysis

- Dirty Bomb Identified
- Movement is imminent
- Engagement options
- Expected local contamination

Seal Area Alpha
Launch non-Lethal
Insert Strike Team
Decon Units in Place
Forces to MOPP4
Knowledge Discovery
“The Art of the Possible”
Info Transmitted

- Engine (MTBF)
- Transmission (MTBF)
- Weapon System (MTBF)
- Ammo
- Fuel

END ITEMS

- Fixed Wing Attack
- Fixed Wing Non-Attack
- UAV (Attack)
- UAV (Intelligence)
- Ground Support Equipment
Given the theater capabilities the JFC requires—what forces can you contribute to the JF?
Day 5: Combat Power

Afloat Force Projection Platform

Click
Path to Success

• Vision the Capability
• Articulate the Development Path and Priority
• Leverage the niche Centers of Excellence
Knowledge Discovery 2020

Know all that can be known
Apply the Power of the Force

“The Force Is Always With You”