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"Adapting C2 to the 21st Century"

Tailored Information Delivery and Service for Network-Centric C2 Support

(ICCRTS Paper# I-059)

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Presentation Outline

I. Introduction
II. Issues and Tasks
III. Technical Approaches
IV. Technical Notions
V. Summary

I. Introduction

I.1. Problems

Information Overloading

I.2. Concept

"Right Information to Right People"

What You Get Is What You Need

"WYGIWYN"

I.3. Approaches

Tailored Information Service

I.1. Problems

- Vast amount of Intelligence, Surveillance, and Reconnaissance (**ISR**) data need to be processed by **C2** center staffs in short period of time.
- Limitations of "Cognitive Capability" of individual information users/operators.
- A need to Reduce workload, alleviate task saturation, improve situation awareness, and increase decision effectiveness.

How to effectively share right information with right people at right time and place ?

I.2. Concept

- Clear recognition of particular information pieces that are critically needed by a particular operator

  A capability beyond raw information filtering

- All sources of data be properly examined, delivered, and shared in a timely and coordinated manner

  A concept of active information sharing

What You Get Is What You Need

"WYGIWYN"

I.3. Approaches (1)

Tailored Information Delivery and Service (TIDS)

- Adapt to the needs of individuals

Optimally present data to individual users with different perspectives,

- More operational focused and mission relevant,
- Contains less redundancy, and
- Causes less confusion to the situational awareness and assessment.

Recipients of the tailored information need to spend less time to scrutinize the information, filter the data, and draw conclusions from the information objects more effectively.

I.3. Approaches (2)

- Collaboratively collect, create, process, store, and disseminate information

2. Use meta-data about
   - contents,
   - accessibility,
   - quality,
   - usefulness, and
   - categorization schemes

   to re-organizing and packaging information objects.

3. Use intelligent agent to manage user profiles and information registration

II. Issues, Tasks, and Challenge

II.1. Issues

"Cognitive Overloading"

II.2. Tasks

"Information Brokerage"

II.3. Challenge

"Human-System Interaction"

II.1. Issues (1)

- Cognitive ability of many users and the burden of processing they have to endure in the face of many other tasks they are required to perform.
- Balance between not overloading the decision makers with extraneous information and inadvertently excluding critical information from them.
- Domain-customization is an important area of concern in TIDS.

II.1. Issues (2)

The problem is, users' information requirements are not static, nor can they always be anticipated ahead of time.

A quick and easy way to customize information extraction to new and changing information requirements would take advantage of users' domain knowledge with on-line assistance.

II.2. Tasks (1)

- Design coordinated ways to
  collect,
  extract,
  fuse, and
  package
  multi-source information
  - ➢ Retain the degree of commonality required for efficient collaboration
  - ➢ Tailor to the needs of each individual C2 member.

II.2. Tasks (2)

- Perform tasks of

  search,
  collect,
  extract, and
  distill

  large amount of information from multi-resources.

  correlate,
  fuse,
  organize, and
  package

  integrated information according to individual user's operational requirement.

II.2. Tasks (3)

- Deliver and display the customized information
  - With respect to C2 mission
    - and cognitive characteristics of individual users.
- Provide interpretation and explanation of information
  - Perform reasoning and produce user-specific, integrative picture
    - and corresponding actionable knowledge.

II.3. Challenge

Human-system interaction

How to effectively manage and coordinate the

- user profiling,
- metadata registering, and
- information brokering processes

toward the maximization of overall C2 system's capability,

in terms of both human and computer

in an information exchange, sharing, and utilization environment?

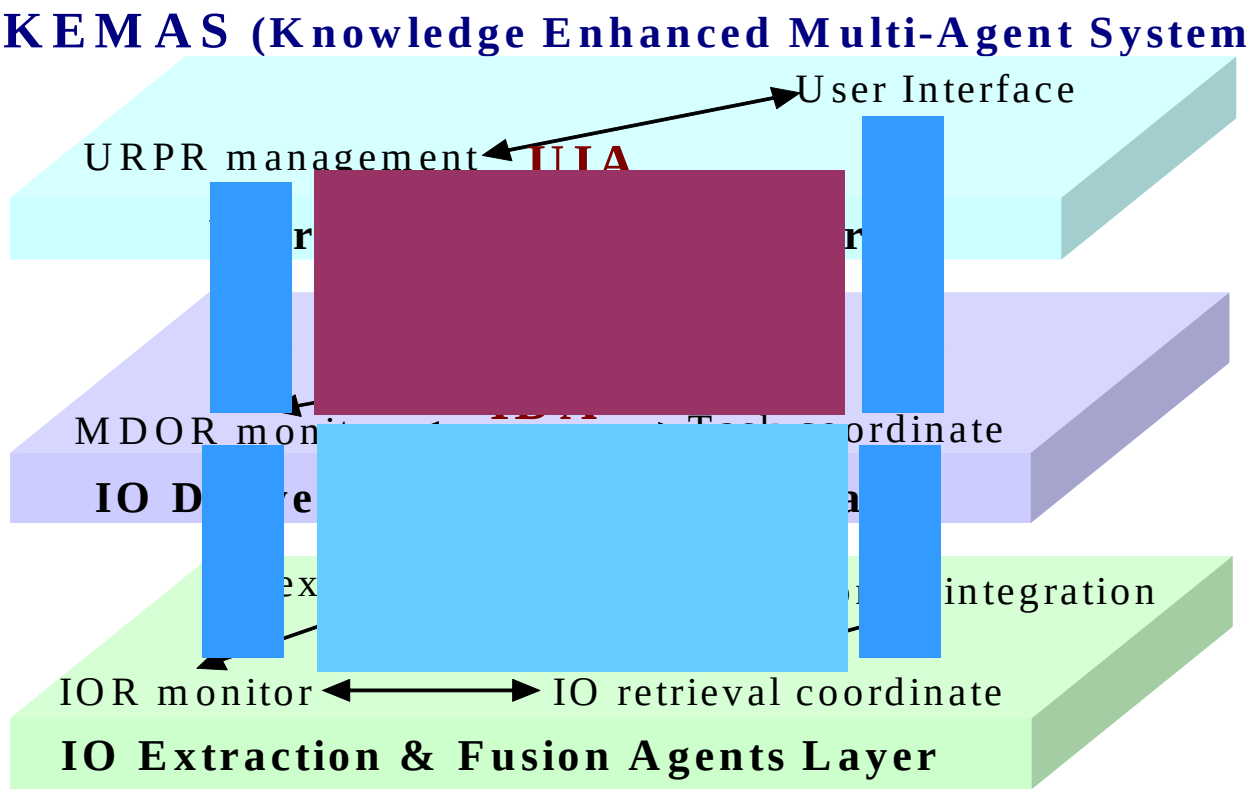
III. Technical Approach

III.1. TIDS System Organization

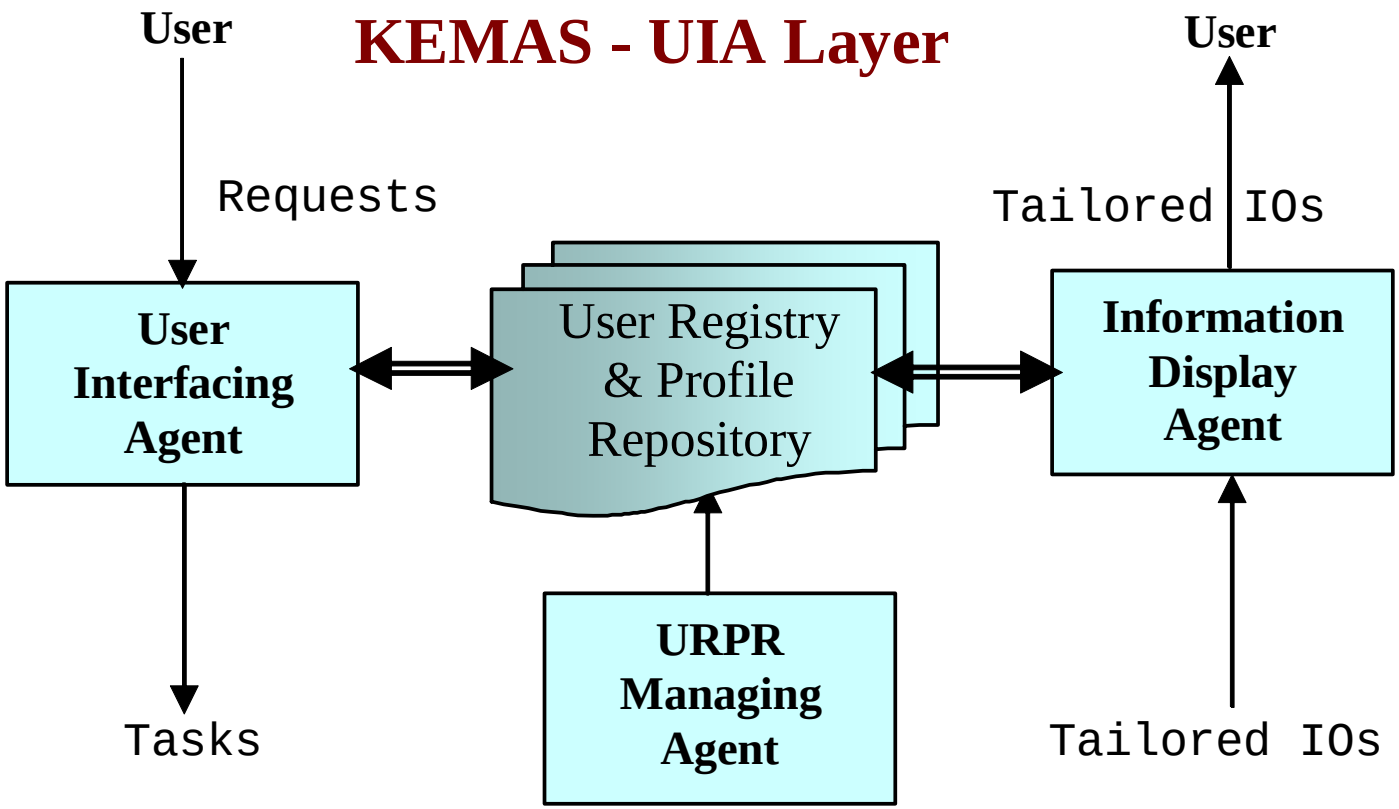
III.2. TIDS Functional Layers

III.3. TIDS Data extraction and IO packaging

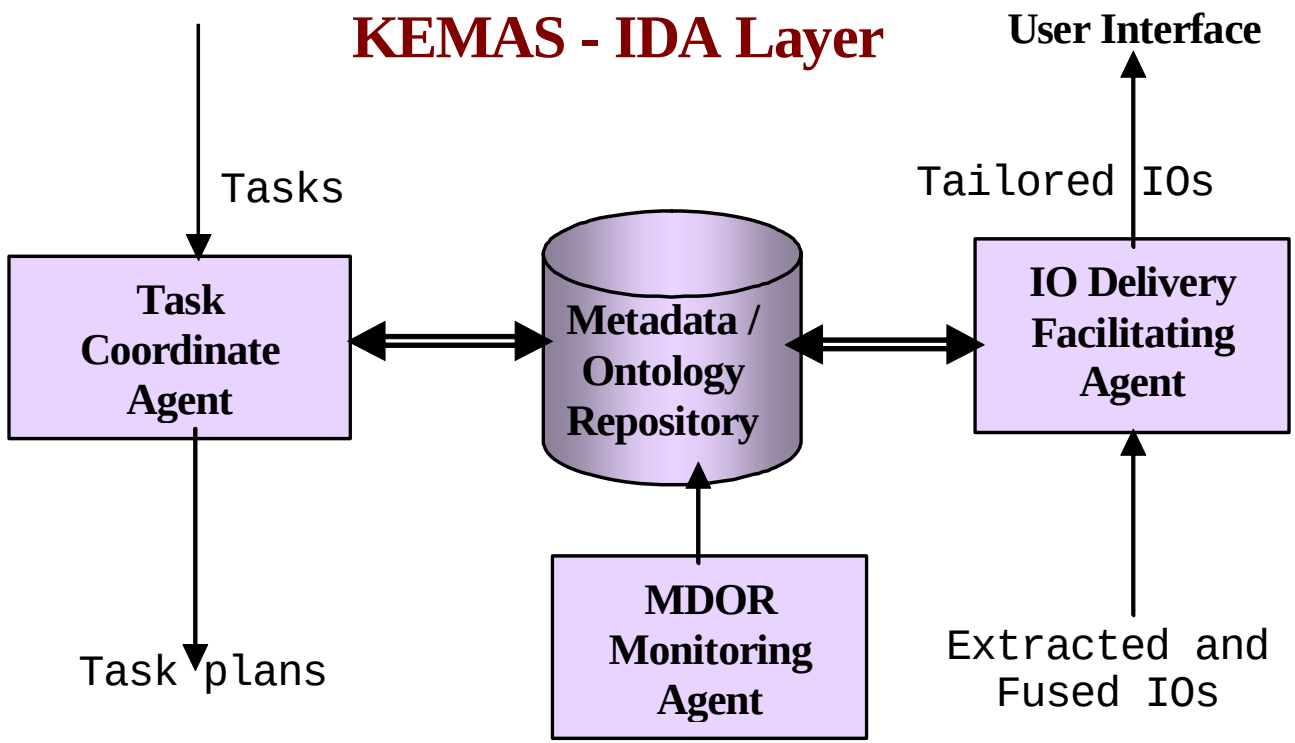
III.1. TIDS System Organization



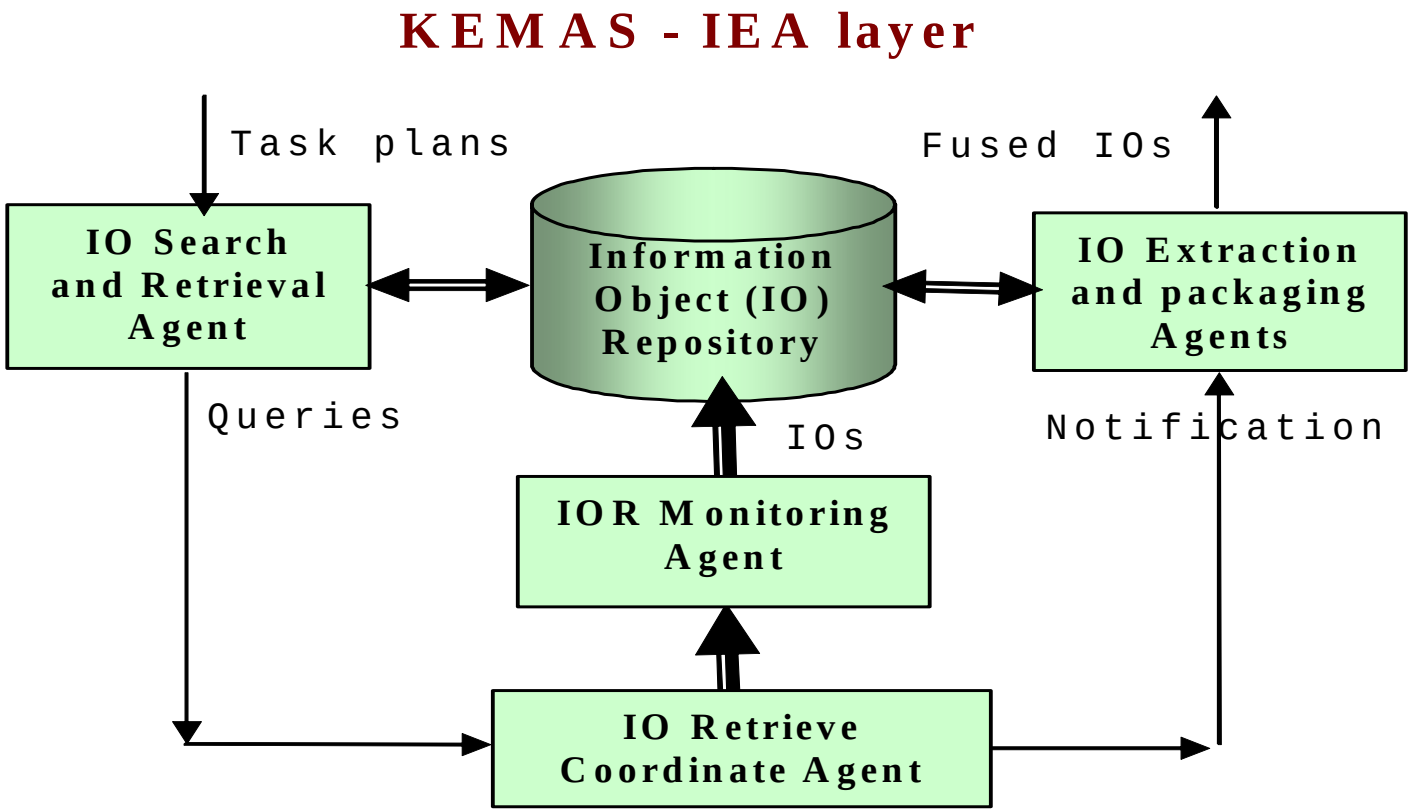
III.2. TIDS Functional Layers – The ULA Layer



III.2. TIDS Functional Layers - *The IDA Layer*



III.2. TIDS Functional Layers - *The IEA Layer*



III. Technical Approaches

III.1. TIDS System Organization - major functional components

- Metadata repository
  - – a common language for information provider and consumer (sender and receiver)
- User registry (subscriber)
  - – specification of user role, characteristics, and demands of information (Knowledge management)
- Agents information broker (publisher)
  - - extract, fuse, package, and deliver information tailored to the user's needs.
- Auxiliary components
  - a user-system interface,
  - a system controller/coordinator,
  - a display/visualization, and
  - agents to search and collect information.

III.3. TIDS Data extraction and IO packaging technique

Three operational modes

IO Push mode: New or updated piece of information object is collected and placed into IOR.

IO Pull mode: User initiated request for specific piece of information to be retrieved and delivered.

IO Pick mode: Specific users are alerted and notified about the availability of new information object.

IV. TIDS Technical Notions

IV.1. Service Oriented Architecture (SOA)

IV.2. A set of distributed system controllers

IV.3. A set of intelligent software agents

IV.4. A knowledge engineering process

IV. TIDS Technical Notions

IV.1. Service Oriented Architecture (SOA)

The role of Service Oriented Architecture (SOA)

- Allows the TIDS system to disseminate and deliver highly integrated (high entropy) information to targeted users through multi-points distributed services timely and dedicatory.
  Publishing-and-subscribe service model
- Allows fast delivery and easy sharing.
  The tailored information service should be considered in parallel with the publishing-and-subscribe model.

Facilitating secure and reliable information delivery and service, as well as the flexibility of the system configuration.

IV.2. Distributed system controllers (1)

The role of distributed system controllers

Serving as Systems Managers (SM),

- Maintaining
  - metadata repository,
  - user registry,
  - tailored information objects, and
  - user interfaces;
- Coordinating
  - the collaborative activities of the system component.

IV.2. Distributed system controllers (2)

Sub-systems of distributed system controller

(1) Client/user Management (CM) sub-system

Maintain user registry and profile repository (URPR)

(2) Information Management (IM) sub-system

Maintain a Metadata and Ontology Repository (MDOR)

(3) Persistence Management (PM) sub-system

Ensure consistence and update of URPR, IOR, and MDOR

IV.3. Intelligent Software Agents (1)

The Role of Intelligent Software Agents

Acting as Information Brokers (IB), for integrating and packaging the Tailored Information Objects (TIO) with respect to the user requirement and metadata specifications.

IV. TIDS Technical Notions

IV.3. Intelligent Software Agents (2)

Information Broker (IB)

- Collecting, fusing, and organizing data with diversities and uncertainties.
- Evaluating and assessing feasibility and effectiveness of hypotheses.
- Resolving conflicts from data of various resources.
- Correlating data in terms of time, location, taxonomy, etc.
- Maintaining trustiness of the data with respect to time latency, sparseness of data collection, etc.

IV.4. Knowledge engineering process (1)

The role of knowledge engineering process

Applied in the
design,
construction, and
maintenance
of metadata, its repository, and representation for information search, collection, extraction (filtering), and distilling.

IV. TIDS Technical Notions

IV.4. Knowledge engineering process (2)

"shared information does not automatically, if ever, lead to shared understanding," [Kau05].

"There is a significant difference between information sharing and knowledge sharing."

Information sharing requires knowledge sharing at all points to correctly process and react to the information, to dictate and specify

- what information is in need,
- how to extract,
- how to package the necessary information, and
- how to deliver them promptly.

Summary

Objectives

- Multi-service expeditionary ISR information dissemination for C2 operations
- Extract, deliver, and share the “right” information to “right” user at “right” time and “right” place.

Focus

- Information service organized to optimize the utilization of ISR information for C2 center operators, to improve human-system integration, and to enhance decision-making capabilities in complex situations

Insights

- Tailored information delivery and sharing
- Intelligent agents facilitated ISR information service from heterogeneous resources to disparate users

Questions ?

Thanks!