The Extensible Mobile Agent Architecture (EMAA)

A framework for bringing mobile agents to Joint Intelligence, Surveillance, and Reconnaissance

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A lightweight, autonomous (but controllable), mobile software process that carries out tasks ...

... that can process functions it carries or "docks" with ...

... over tactical networks (e.g. radios) of varying bandwidths
Agents act autonomously to accomplish objectives.
- Goal-Directed
- Knowledgeable
- Persistent
- Proactive & Reactive

Agents cooperate to achieve common goals.
- Communication Protocols
- Knowledge-Sharing
- Coordination Strategies
- Negotiation Protocols

Agents adapt to their environment.
- Dynamic Interaction
- Alternate Methods
- Machine Learning

Agents can be either static or mobile, depending on bandwidth requirements, data vs. program size, communication latency, and network stability.
Strengths of EMAA-based Systems

- Control of processes
- Reusability
- Security
- Resource Management
- Ad hoc networking/Reconfigurable Architectures

EMAA designed to meet critical technology challenges of tactical C2 decision support systems
EMAA is ATL’s solution for rapidly developed, easy to maintain agent applications.
• Servers provide interface to local resources
  – Separates implementation of resources from agent application
  – Reduces bandwidth requirements of individual agents
  – Improves security and resource access control
  – Improves resource management capability

• Tasks allow agent to utilize servers
  – A task represents a use case of the server.
  – Parameterized for reusability
  – Able to fetch operational parameters from agent memory
    • no tight coupling between tasks
    • data shared through agent memory component
• A mobile agent’s goal is to complete its itinerary
• Itinerary: A Task Flow Specification
  – Activity: Agent Tasks @ Location
  – Path: Reactive Branching Behavior, Agent Travel
  – Task Results
• Control Logic: Decision making component
  – itinerary path selection
  – host migration selection
**Objective:** Framework to support agents adaptively selecting an execution path at run time, considering the relative priorities of different itinerary paths and network conditions.

EMAA agents are more effective at achieving their goal by selecting the most important activity to perform at the most appropriate host.
EMAA Security Architecture

- **Agent Manager**
- **Communication Server**
- **EMAA Class Loader**

**DOCK**

**Security Manager**
**Access Controller**
**Operating System**
**Hardware**

**JVM**

**SSL:** Remote Host Authentication & Encryption
- Agent authentication
- Sole provider of threads to agents
- Check agent privileges
- Load authorized classes
- Establish permissions for each agent according to policy.
- Dynamically check permissions in policy.

**Advanced Technology Laboratories**
Cherry Picking for Faster Identification of Time Critical Information

Time Critical Target (TCT) Attack Process

Intelligent Agents
Automatically and Persistently Monitor Multiple Sources for Relevant Information

Agents Deliver Found Information and Alert Operator

Faster Identification ➔ Faster Prosecution

Sources:
- Web Sources
- Intel Sources
- Imagery Sources
- SIPRNET Sources
- Fires Process
Lessons learned in over 15 agent projects point to three core information functions: dissemination, discovery, and “sentinel”

**Push - Information Dissemination**
- Assured “task & forget” information delivery
- Intelligent selection of recipients

**Pull - Information Discovery**
- “Power-assist” for users’ information search
- Agents integrate information from disparate sources

**Sentinels - Persistent Information Analysis**
- Collect data, interpret, alert

Agents reduce work and accelerate decisions
Increase flexibility and adaptability of C4ISR System
Reduce cycle time of software system
**Purpose:** to hasten the deployment of mature agent technology to C2 and combat systems.

Give domain experts the power to create, modify, and integrate agent applications.
• **Configurable legacy system wrappers** - rapid connections to legacy systems (Databases, Web)
• **Configurable agent workflow patterns** - rapid specification of agent behavior
• **Composable agent tasks** - leveraging the bean model
• **Composable agent systems** - data/event-driven behaviors
• **Interoperable agent systems** - DARPA CoABS Grid-enabled

Under CoABS, ATL has tailored its agent platform to enable rapid composition and deployment