

VISTA: A Generic Toolkit for Visualizing Agent Behavior

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Talk Overview

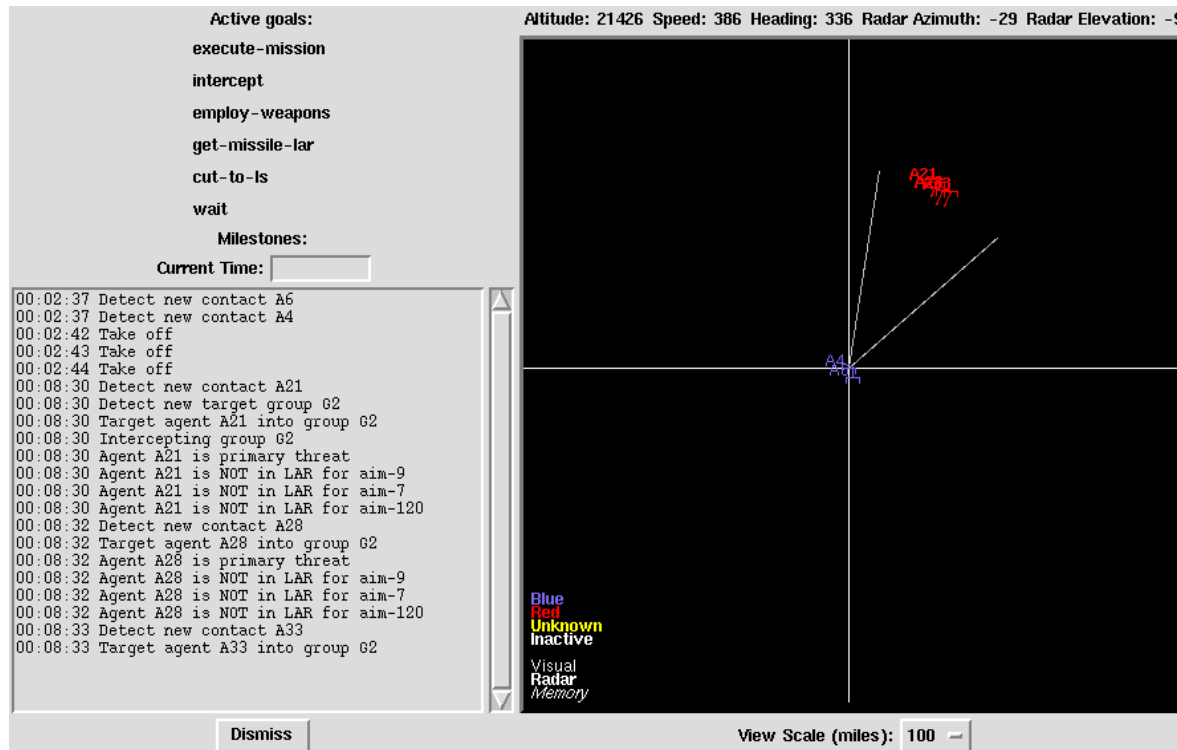
- Problem Introduction
- Project Goals
- Our Approach
- Case Study

Problem Statement

- As agents increase in complexity, it becomes more difficult to understand what they're doing and why they're doing it
 - How can an agent developer diagnose faulty behavior?
 - How can an operator judge if an agent's behavior is correct?
 - How can a customer judge if an agent model generates realistic behavior, and will not lead to negative training?

Solution: “Situational Awareness Panel”

Display internal agent information to a user in familiar “language”:
goals, radar display, radar blips, vehicle information, etc.



Jones, R.M. 1999.
Graphical Visualization of
Situational Awareness and
Mental State for Intelligent
Computer-Generated
Forces. *CGF 8*.

Project Goals (1)

- Framework for visualizing the internal state and representations of an agent
 - A visualization tool ought to answer the following questions:
 - Why is the agent doing X?
 - Why isn't the agent doing Y?
 - Why is X the right thing to do?

Project Goals (2)

Common features across architectures:

- Goals
- Alternatives
- Time
- Other Agents
- Self-knowledge
- Events/Milestones

Architecture Independence
Soar, ACT-R, COGNET, etc.

Domain Independence
CGFs, others

Ease in adding new domain-dependent display components

Support reason annotations on behaviors, and ability to link to supporting information sources

Traceability
Why is the agent doing this?

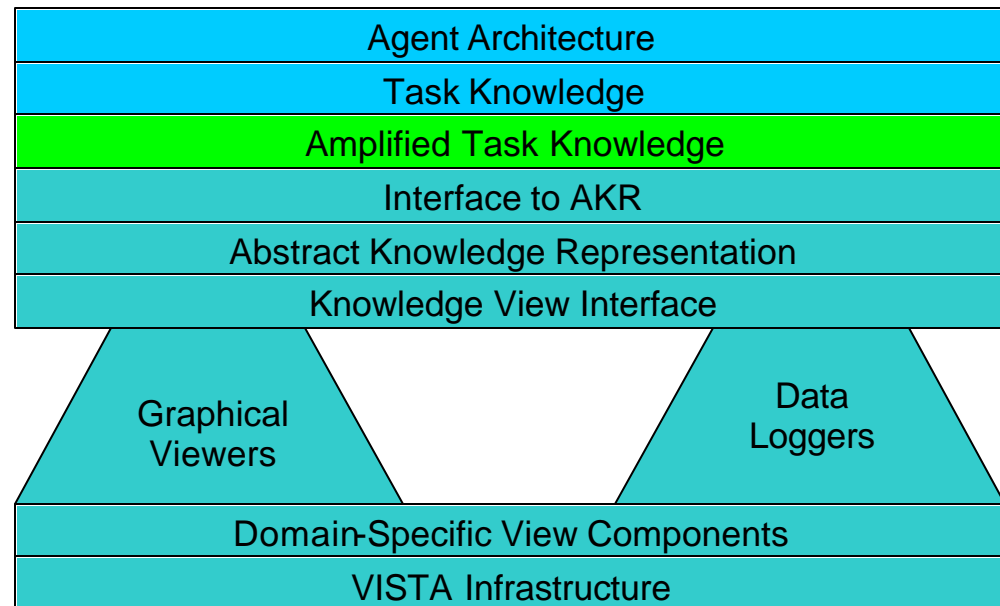
Log and Replay
Capture for later analysis

Built-in support for logging all data and widgets for playing back data

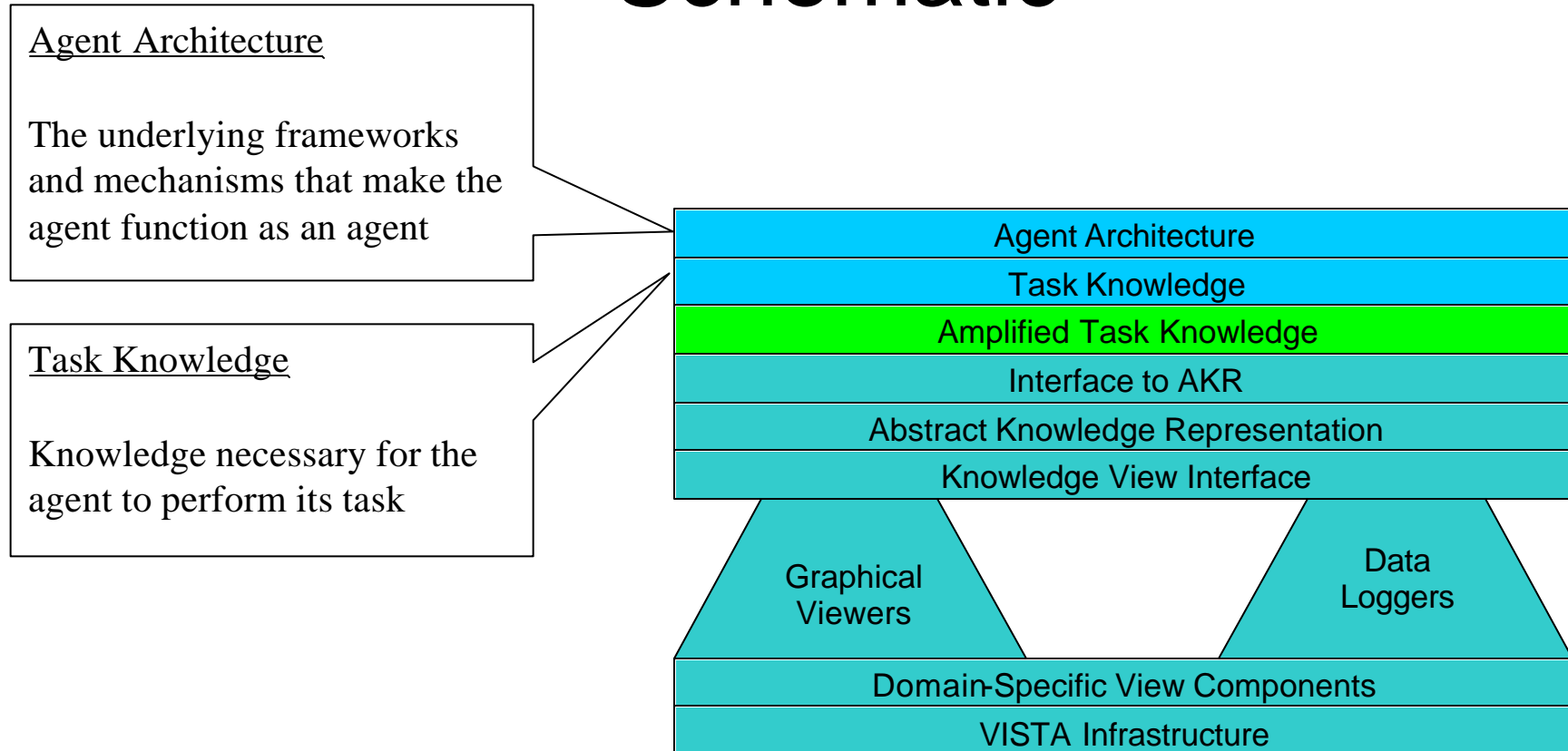
Approach

VISTA: Visualization Toolkit for Agents

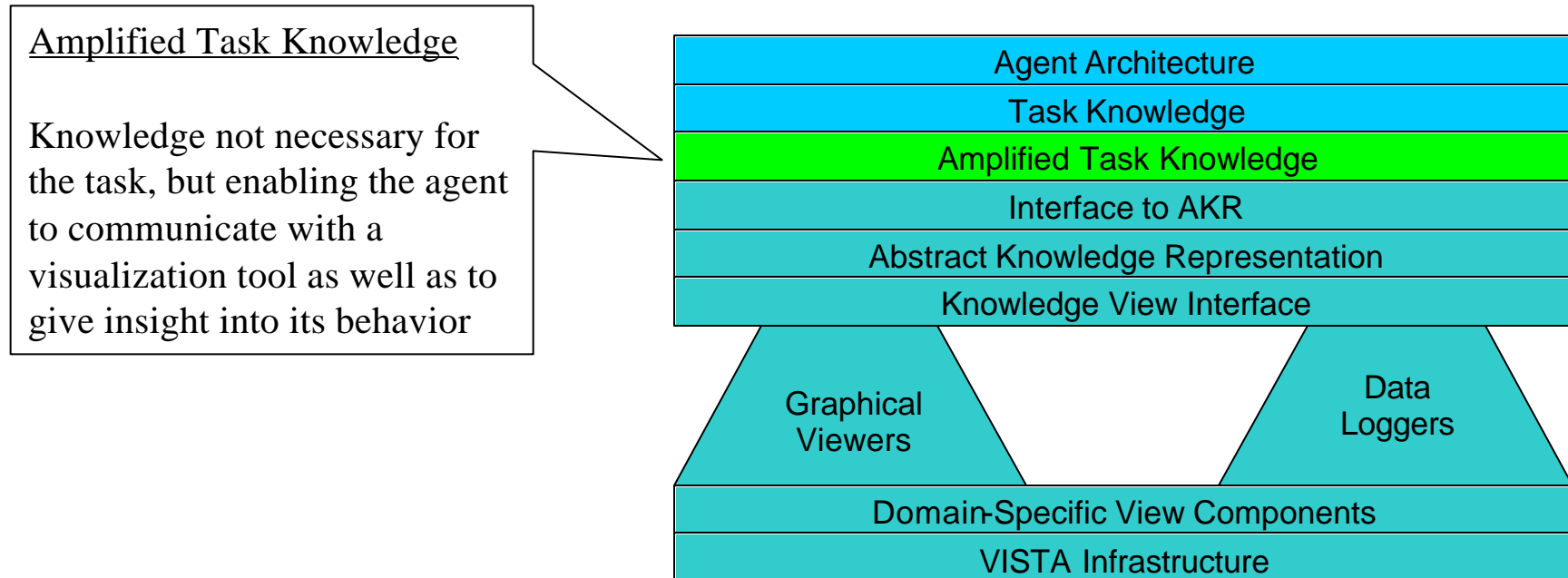
A toolkit that allows an agent developer to build custom viewing tools for particular problem domains, with minimum effort in extracting internal agent information and displaying that information in a useful manner.



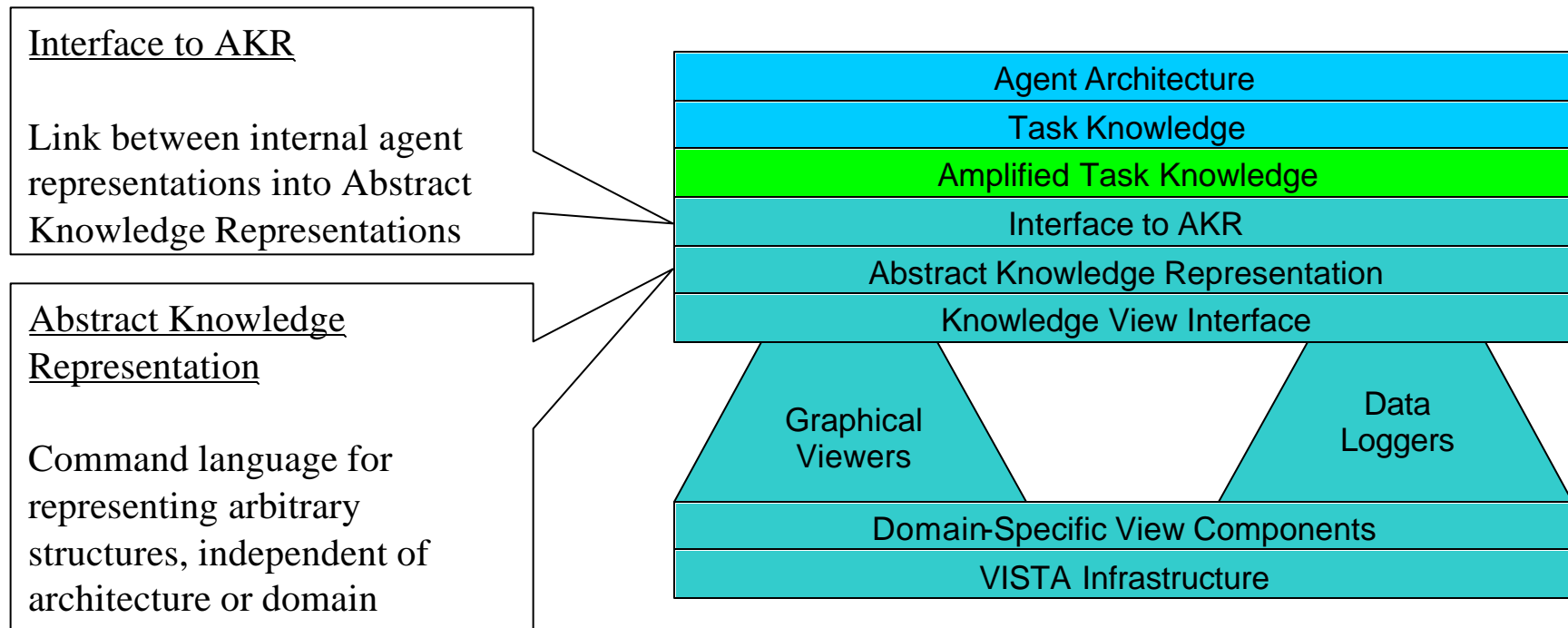
Knowledge Components Schematic



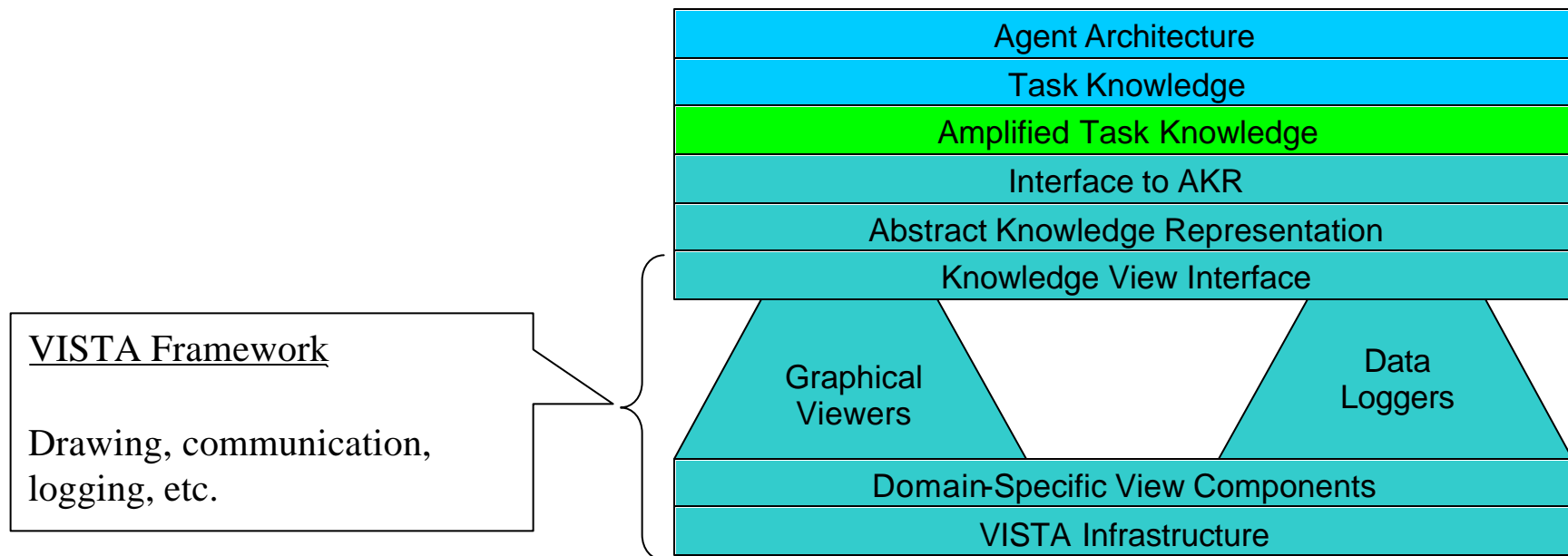
Knowledge Components Schematic



Knowledge Components Schematic

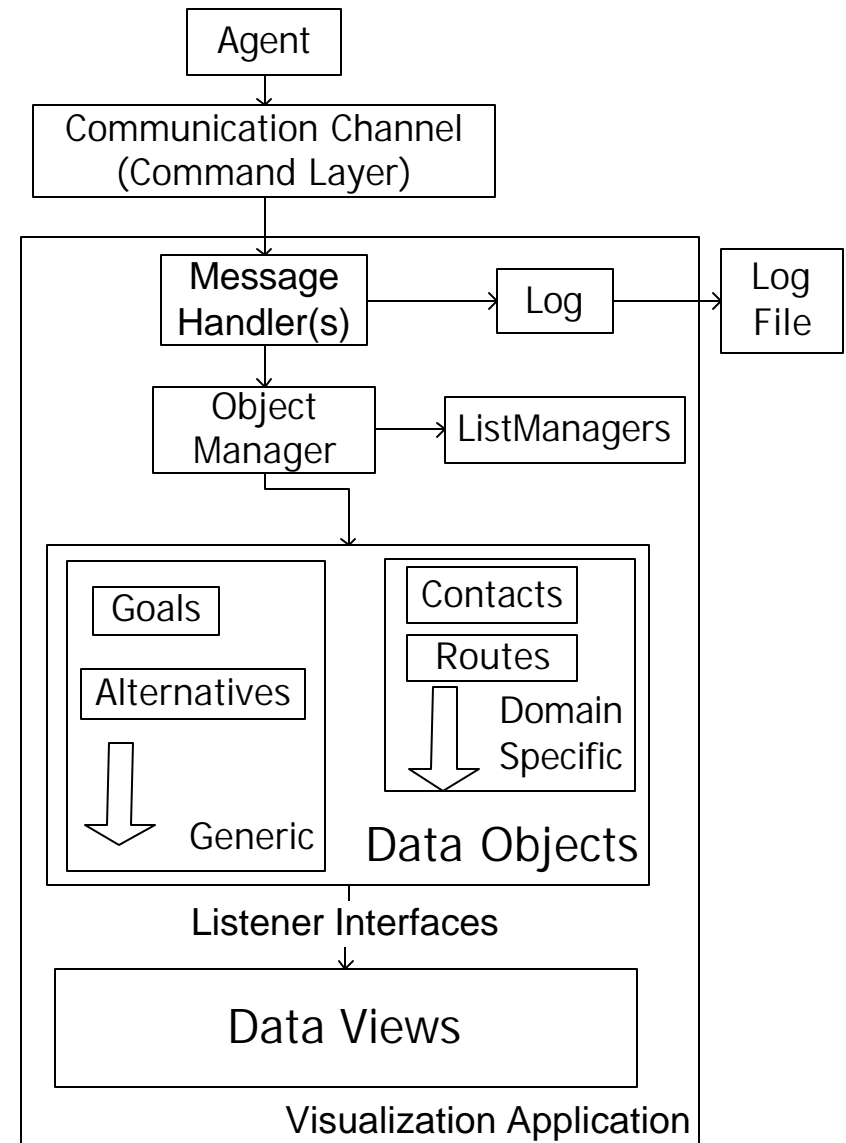


Knowledge Components Schematic

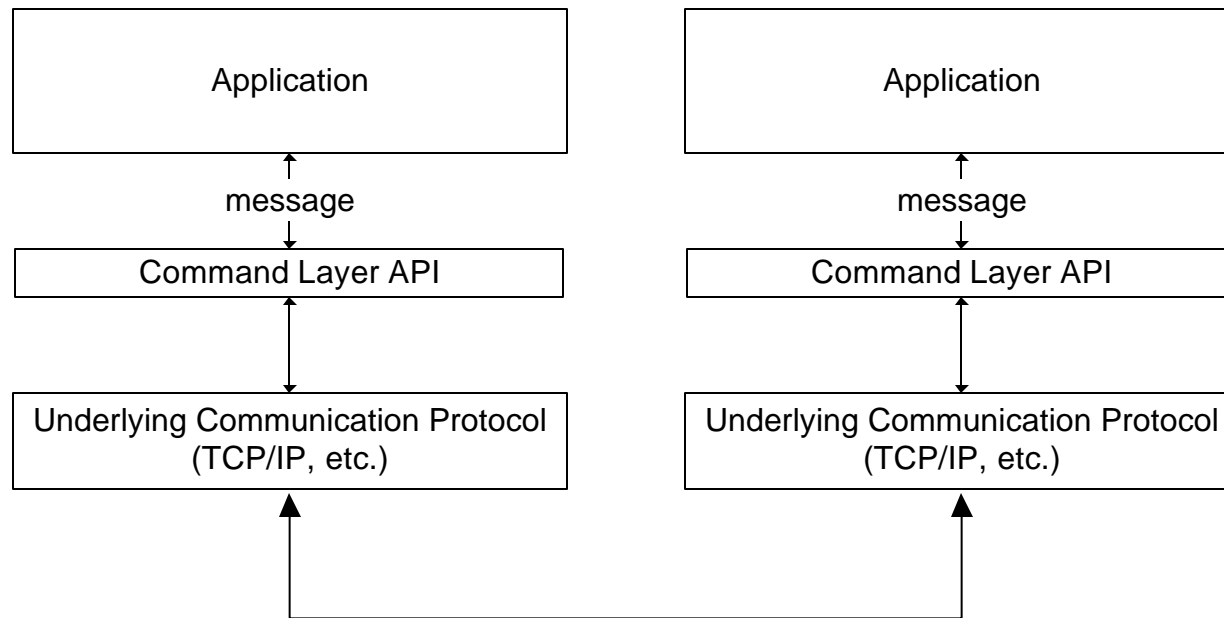


VISTA Framework

- Communications Layer
- Object Manager
- Data Objects
- Data Views
- Log and Replay



Command Layer



Object Manager Command Language

[object name] [method name]
[parameters]

Example:

```
A1 setHeading D 30.3  
S1 addItem S name S value  
S2 addItem S name O S1
```

Interacting with Objects

- **Creating Objects**

```
root create T Agent S A1 S  
tomcat1
```

- **Destroying Objects**

```
root destroy O A1
```

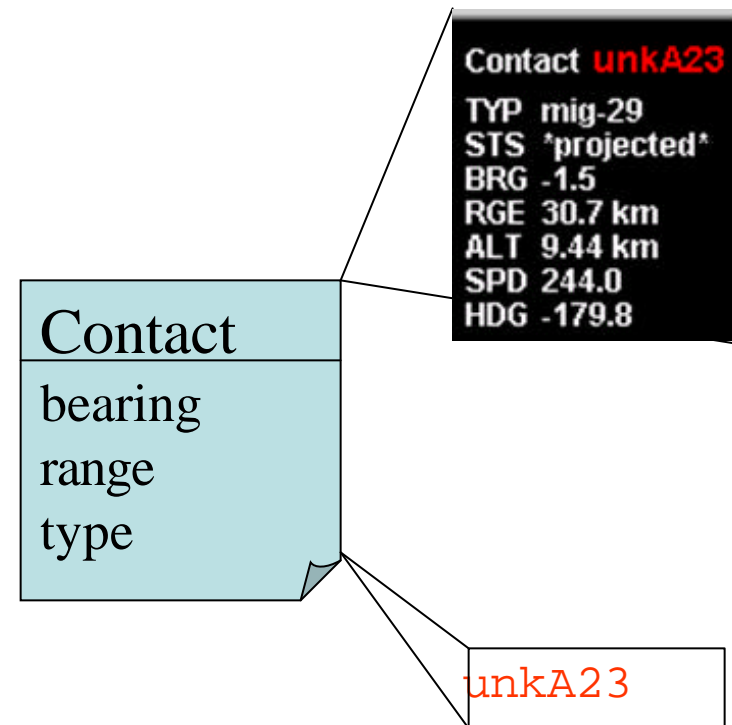
- **Updating Objects**

```
A1 setBearing D 10.0
```

```
public class Agent {  
  
    public Agent(String callsign) {  
        ...  
    }  
  
    public void setBearing(double bearing) {  
        ...  
    }  
  
    ...  
}
```

Data Object Viewers

- The viewers present the data objects visually.
- Viewers can be any Java display component (Swing, Java2D, etc.)
- Attached as listeners to data objects.



Log Format

```
[0:00:44] root create T Goal S G5
[0:00:44] A7 setSpeed D 0
[0:00:44] A7 setAltitude D -38
[0:00:44] A7 setHeading D 0.
[0:00:44] R3 setScanAzimuth D 5
[0:00:44] R3 setElevation D 0
[0:00:44] R3 setAzimuth D 0
[0:00:44] T11 setTime I 44
[0:00:44] G5 setName S tune-radio
[0:00:44] G3 addGoal O null O G5
[0:00:44] G5 addAlternative O S48
```

Case Study:

TacAir-Soar Situational Awareness Panel

- TacAir-Soar
 - sophisticated model of pilot behavior based on the Soar cognitive architecture
 - ~8000 rules covering multiple types of missions, aircraft, roles, etc.
- Goal
 - Build a graphical display visualizing the inner workings of a TacAir-Soar agent to help explain its behavior
 - Prove usefulness of the generic VISTA framework
- Methodology
 - User studies with old TacAir-Soar SAP to find what types of information to display and how best to display that information
 - Informal interviews with users to derive “wishlist” of features
 - Formal studies in a laboratory setting (Dr. Frank Ritter, PSU)

TacAir-Soar SAP

Knowledge Components

Domain Independent

- Goals / Goal Stack
- Other Agents
- Self-knowledge
- Time
- Events/Milestones
- Alternatives
- Reasons
- Sources

Domain Dependent

- Contacts
- Routes
- Waypoints
- Radar
- Weapons

TacAir-Soar SAP User Interface

Self Information:

ALT 7.67 km
 SPD 161.0
 HDG 3.4

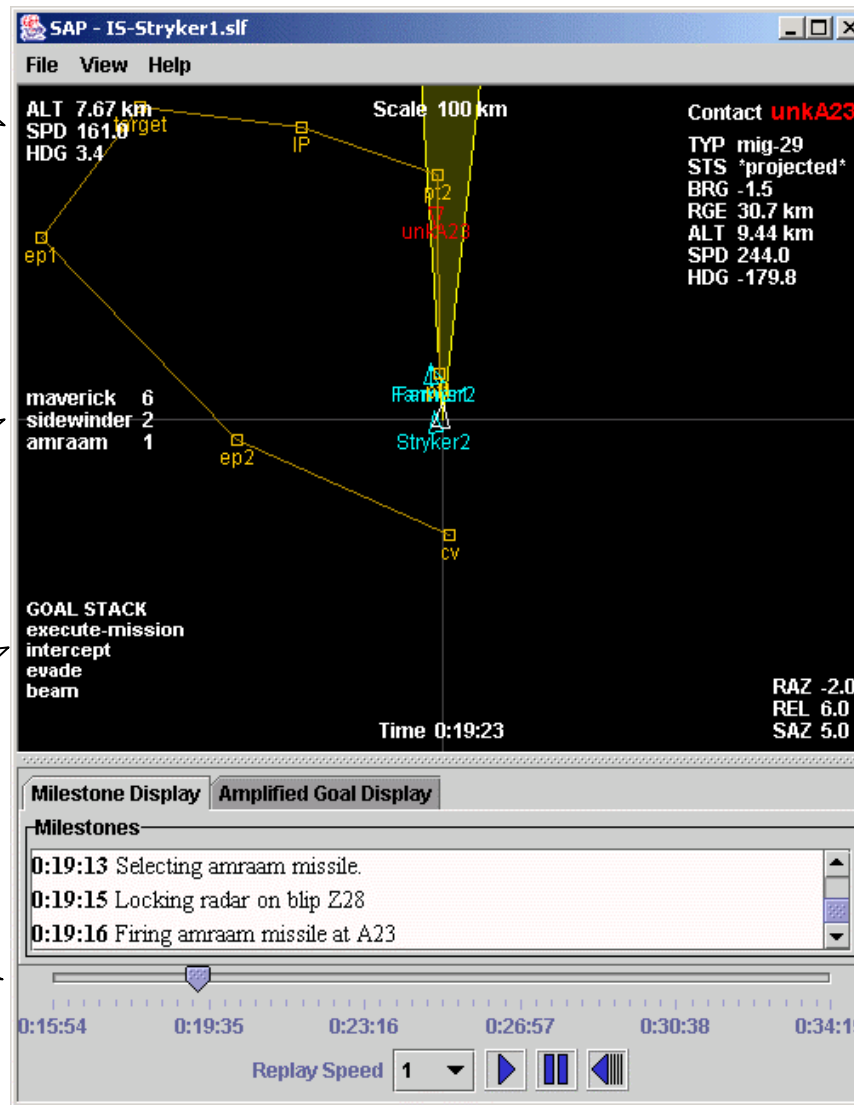
Munitions

maverick 6
 sidewinder 2
 amraam 1

GOAL STACK

execute-mission
 intercept
 evade
 beam

Replay timeline



Contact Information:

Contact **unkA23**
 TYP mig-29
 STS *projected*
 BRG -1.5
 RGE 30.7 km
 ALT 9.44 km
 SPD 244.0
 HDG -179.8

Radar Information:

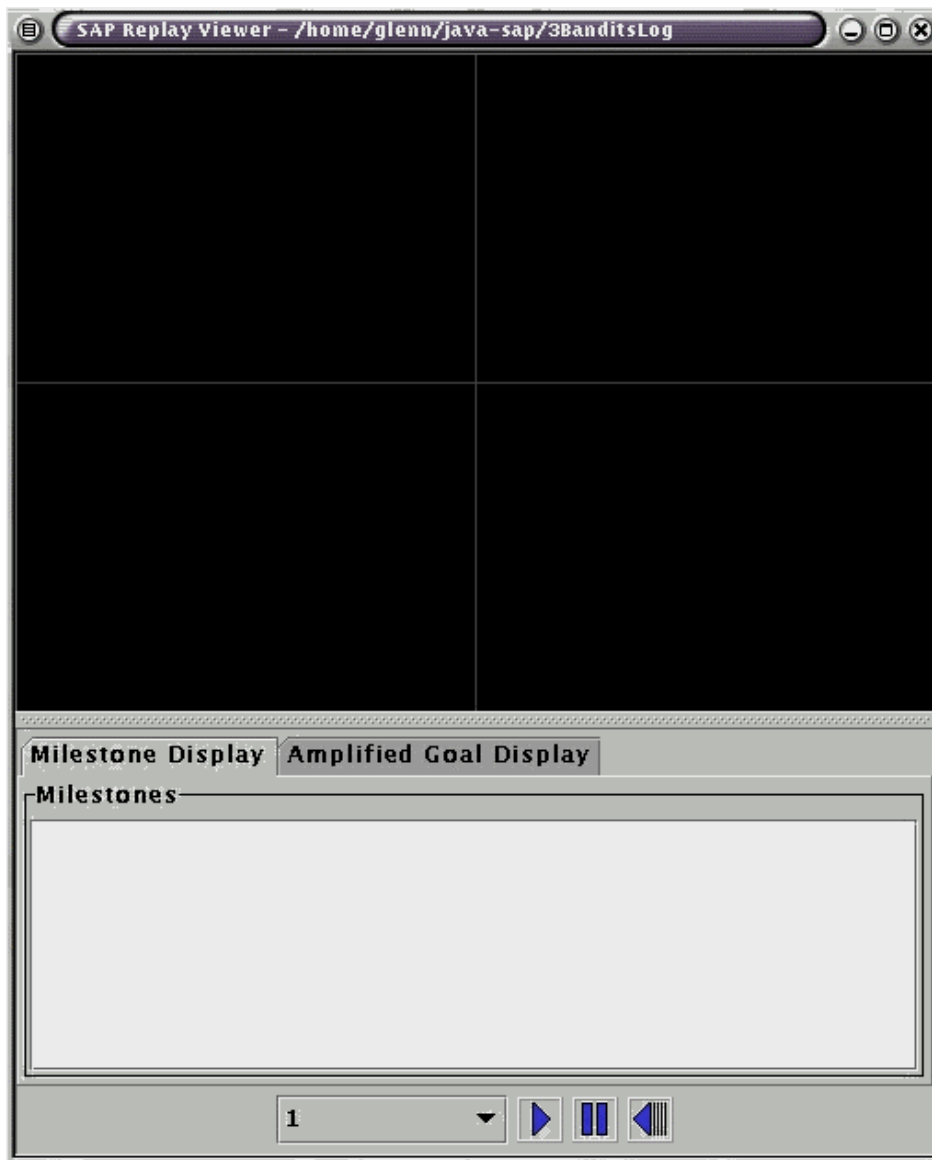
RAZ -2.0
 REL 6.0
 SAZ 5.0

Milestones:

0:19:13
 Selecting amraam
 missile

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TAS-SAP Movie



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