



OASIS - Opening up Architectures of Software-Intensive Systems

- **Architecture recovery and comprehension tool**
- **Visualization of systems executions**
- **Implemented as an Eclipse™ plug-in**

Background

Over the years, the needs of the Canadian Forces (CF) for systems interoperability have significantly increased. For example, the CF require systems interoperability when they collaborate with allied nations to achieve common objectives. However, before existing systems can interoperate, their architectures need to be understood first.

Understanding systems is a quite a complex task. It has been proven that the maintenance of existing systems consumes 50% to 70% of the total programming effort, and that a significant portion of this maintenance activity (30%-60%) is spent understanding software.

To support the recovery and comprehension of existing system architectures, DRDC Valcartier started a project called Opening up Architectures of Software-Intensive Systems (OASIS). Its objective is to develop solutions to reduce the time needed to comprehend systems to be integrated into a System of Systems (SoS). An SoS is a system built using components that are themselves large systems.

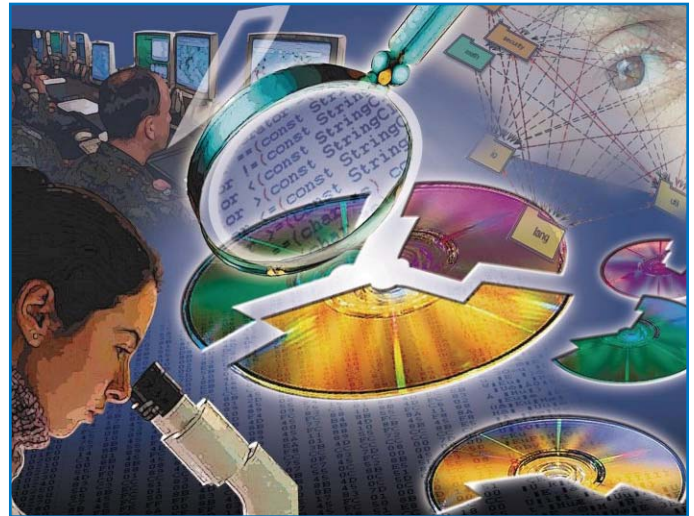
Recent Progress

Since the beginning of the project, significant progress has been accomplished.

State-of-the-Art Survey: A state-of-the-art survey of the current techniques and tools for architecture recovery and comprehension was carried out.

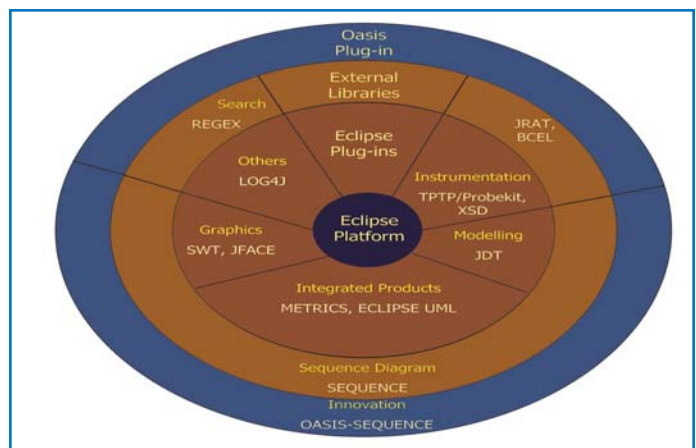
Comprehension Process: A process was designed to understand the architectures of existing systems to be integrated into an SoS.

Qualitative Study: A study was conducted to assess the added value of existing architecture recovery tools on the understanding of participants performing comprehension tasks on large-scale military systems such as the Athene Tactical System (ATS). ATS is an integrated command and control system.



Functional Architecture: Using the results obtained as part of the three preceding project accomplishments, a functional architecture of the ideal tool for system architecture recovery and comprehension was conceptualized.

Prototype: A prototype implementing a selected subset of the functional architecture was developed in Java as an Eclipse™ plug-in. Eclipse is an extensible open source integrated development environment. The infrastructure of the plug-in is illustrated in the diagram below.



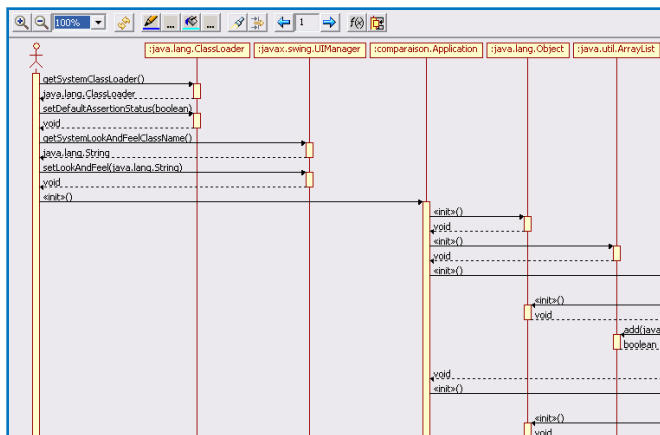
Prototype Infrastructure and Technologies

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In the previous diagram, everything located in the inner brown circle corresponds to existing Eclipse plug-ins used by the prototype. Their functionality is indicated in yellow. The part in lighter brown corresponds to external libraries that are also required by the prototype.

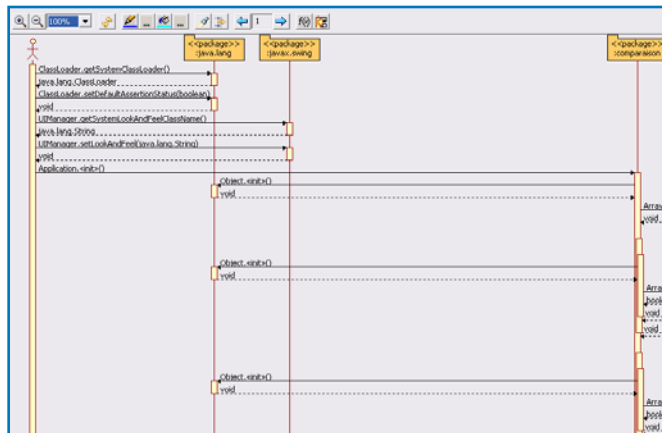
The OASIS plug-in serves to record the execution of systems developed in Java. Once recorded, the behaviour of a system can be visualized as a sequence diagram. Such a diagram shows the interactions, in terms of messages or information transfers, between the operational nodes of a system, arranged in a time sequence. However, instead of displaying these interactions at a low level only, i.e., object level, the plug-in allows regrouping of related operational nodes into higher level structures, i.e., packages. This reduces the cognitive burden and, as a result, improves the software comprehension process, since it allows information to be filtered out. Therefore, a person trying to understand a system has less information to search through and can concentrate on the system's high level structures as well as the interactions between them. This plug-in feature is particularly useful in the case of large-scale systems.

The following two figures show the same sequence diagram. In the first case, the operational nodes of the system are displayed at the object level.



Sequence Diagram without Nodes Regrouped

In the second sequence diagram, related operational nodes are regrouped into packages, resulting in less information displayed to the user.



Sequence Diagram with Nodes Regrouped

In addition to the features presented here, the plug-in also provides software metrics and offers search functionalities, as well as other functionalities to manipulate the sequence diagrams generated.

Future Directions

The tools and techniques developed within the OASIS research project will be refined and improved. In addition, others will be developed for the purpose of understanding the architectures of complex Command and Control Information Systems (C2IS). The resulting knowledge will be used to substitute Commercial Off-the-Shelf (COTS) components in these systems by Free and Open Source Software (FOSS). An example of the substitution of a COTS component might be the replacement of the geographic information system component of a C2IS by its FOSS equivalent.

For more information

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