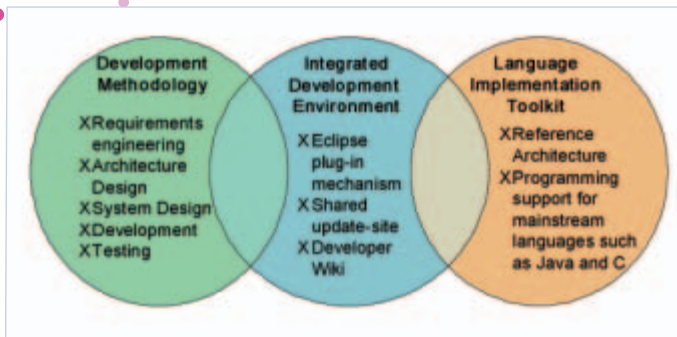


AOSD-EUROPE

Scope

As software systems becoming increasingly large, distributed and ubiquitous, we are observing at least an order of magnitude rise in development complexity. Developers and architects must overcome the challenge of developing software systems that are resilient to change in the face of such complexity. In order to do so they must balance a number of qualitative properties, such as security and context awareness, as well as business needs, for instance, volatile business rules that may change rapidly. Existing software development methodologies, such as object-oriented development, do not provide any intrinsic means to manage such system-wide properties. Aspect-oriented software development techniques are specifically targeted at managing these systemic properties by complementing an organisation's existing development methodologies and processes. Aosd-Europe is a large-scale academia-industry collaboration aimed at developing aspect-oriented software development tools and techniques suited to real-world industrial context. The project has developed a software workbench – the Atelier for Aspect-Oriented Software Development – that integrates a developer tool suite, a range of toolkits for engineering aspect-oriented programming languages and a methodology to support deployment of aspect-oriented techniques in an organisation's existing development practices.



The AOSD-Europe Atelier

Advances

The key results from the project include the Atelier software workbench, analytical and empirical studies of the return on investment (ROI) for aspect-oriented techniques compared to traditional development practices, and a range of training materials and courses designed for both SMEs and large organisations. One of the major challenges facing software engineering techniques is the large gap between research and practice. Aosd-Europe bridges this gap with respect to aspect-oriented technologies by not only providing extensive analyses of their potential benefits to industry but also offering an end-to-end software workbench for practitioners to explore the use of aspect-oriented techniques in pilot projects. The key results from the project include the Atelier software workbench, analytical and empirical studies of the return on investment (ROI) for aspect-oriented techniques

compared to traditional development practices, and a range of training materials and courses designed for both SMEs and large organisations. One of the major challenges facing software engineering techniques is the large gap between research and practice. Aosd-Europe bridges this gap with respect to aspect-oriented technologies by not only providing extensive analyses of their potential benefits to industry but also offering an end-to-end software workbench for practitioners to explore the use of aspect-oriented techniques in pilot projects.

Positioning in global context

Aosd-Europe has established European research and industry as the leading innovator in this space by its focus on end-to-end development and the potential value of aspect-oriented techniques to day-to-day development practices in an organization. The project is recognized internationally for its innovative approaches and training mechanisms. It also plays a major role in the international conference of the Aosd community as both a key sponsor and organizer of specific activities such as access to industrial success stories and training opportunities for PhD students. Furthermore, the project has inspired a number of initiatives internationally to address Aosd challenges on a larger-scale including an AO-ASIA network and an AO-South America network.

Contribution to standardization and interoperability issues

As the largest international project in this area, the network is setting de-facto standards, such as standard training programmes, modelling notations and tool interfaces. Network members are active in relevant standardisation bodies such as the OMG and community initiatives such as the Aspect-Oriented Software Association (AOSA). As we move towards service-oriented systems, the problem of dealing with broadly-scoped properties across service boundaries is of utmost importance during software systems analysis, design and implementation. Network members are participating in initiatives relevant to standardisation of Aosd concepts and notations including relevant UML standardisation activities.

Target users / sectors in business and society

- Software and Application Developers
- Systems Integrators
- Technology Providers
- Service Providers (because of improved semantic interoperability during service composition)

Overall benefits for business and society

The benefits of the project's results are in improving the global competitiveness of European research and practice in innovative software development technologies. Our industrial demonstrators and empirical results show that the benefits of utilising aspect-oriented techniques can outweigh traditional methodologies by as high as 40%. This in turn means substantial reduction in both initial development costs and subsequent maintenance and evolution of software systems. Given that almost 70% of the overall effort pertaining to a software system is on maintenance, the long term reduction in costs through the use of aspect-oriented techniques is substantial.

Examples of use

Aspect-oriented technologies are a generic means to manage systemic properties during analysis, design, implementation and maintenance of a software system. Examples of such systemic properties include security, monitoring, data management policies and so on. We describe a non-trivial use case of aspect-oriented techniques in the context of monitoring large-scale activity on the Internet. The social networking boom in recent years means there are more chat rooms and file sharing systems available online than ever before. These systems are open to abuse by paedophiles, presenting them with more opportunities to groom their victims and share images of child abuse. The sheer volume of material on the internet means it is impossible for police to monitor the hundreds of thousands of pages of chat room activity and file downloads which take place each second. Attaching monitoring functionality to the variety of systems in operation is equally expensive as it requires invasive modifications and maintenance across system releases. The Isis project, funded by the UK Engineering and Physical Sciences Research Council and the Economic and Social Sciences Research Councils, is a satellite project of Aosd-Europe that harvests the non-invasive composition benefits of Aosd techniques developed within Aosd-Europe to attach monitoring functionality to such systems. These techniques will allow larger-scale proactive monitoring of suspicious web content, freeing up police man hours and giving them the ability to investigate online paedophile networks more effectively than before. Given the social and ethical implications of such monitoring, a substantial part of the project is also investigating relevant ethical considerations.

Achievements

- Atelier: A software workbench for aspect-oriented development
- An aspect-oriented middleware reference architecture
- White paper on aspect-oriented software development
- Analytical and empirical comparisons of the costs and benefits of using aspect-oriented techniques
- Extensive training material and courses
- Guidelines for incorporating aspect-oriented techniques into existing work practices
- Extensive set of publications for researchers, educators and practitioners



title

European network of excellence on aspect-oriented software development

contract number

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type of project

Network of Excellence

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48