

Educators' Symposium— Teaching Object-Oriented Software Architecture by Example: The Games Factory

Report by:

Hermann Häni
Jucker Informatik

Igor Metz
Universität Bern

1 Introduction

This paper describes the outline of our lecture and the experience we have had when introducing object-oriented programming, design, and software architecture to students of different educational and vocational backgrounds.

While other courses on object-oriented programming only show how to implement things in an object-oriented way, we emphasize on the production of reusable class libraries and frameworks.

1.1 Objectives of our lecture

The purpose of our lecture is to let the students develop a reusable class library in an easily understood application domain. It is our intent to realize such a class library through several iterations. This conforms to our own and other people's experience (Russo et al., 1990) that several design, implementation and application iterations are needed before a class library becomes really reusable.

This specially applies for so called *frameworks*; class libraries that embody an abstract design for solutions to a whole family of related problems (Johnson and Foote, 1988).

During an iteration step students realize that the tools they have seen so far are not sufficient to cope

with the new demands. This allows us to introduce new methods and tools in a "just in time" manner. This way the students learn why these new tools are needed and how they can be used to design and implement the class library in the next step.

1.2 The application domain

The choice of a good classroom application was not easy. On one hand we wanted it to be sufficiently simple such that students can fully understand it within short time. On the other hand the application must be complex enough and reveal some non-trivial design patterns and implementation techniques, such as collections, genericity, part-of, and kind-of hierarchies. It must also be possible for the participants to visually trace the execution of the resulting application without sophisticated debugging or algorithm animation systems.

We decided to choose a domain where every participant is assumed to be a domain expert: Video games. Even if the participants did not implement video games before, they at least played such games. In our lectures we design and implement a class library which can be used to build two video games called SNAKE (a variant of the UNIX worm (6) game) and BRICK (a variant of the game BREAK

Opsla 92 Addendum Conference On Objectoriented Programming Systems

**Mastorakis, George, Mavromoustakis,
Constandinos X., Pallis, Evangelos**

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OOPSLA '92, 1992 **ECOOP '94 - Object-Oriented Programming** Mario Tokoro, Remo Pareschi, 1994-06-15 This volume contains the proceedings of the 8th European Conference on Object Oriented Programming ECCOP 94 held in Bologna Italy in July 1994 ECOOP is the premier European event on object oriented programming and technology The 25 full refereed papers presented in the volume were selected from 161 submissions they are grouped in sessions on class design concurrency patterns declarative programming implementation specification dispatching and experience Together with the keynote speech Beyond Objects by Luc Steels Brussels and the invited paper Putting Objects to Work by Norbert A Streitz GMD IPSI Darmstadt they offer an exciting perspective on object oriented programming research and applications

Handbook of Software Engineering Sungdeok Cha, Richard N. Taylor, Kyochul Kang, 2019-02-11 This handbook provides a unique and in depth survey of the current state of the art in software engineering covering its major topics the conceptual genealogy of each subfield and discussing future research directions Subjects include foundational areas of software engineering e g software processes requirements engineering software architecture software testing formal methods software maintenance as well as emerging areas e g self adaptive systems software engineering in the cloud coordination technology Each chapter includes an introduction to central concepts and principles a guided tour of seminal papers and key contributions and promising future research directions The authors of the individual chapters are all acknowledged experts in their field and include many who have pioneered the techniques and technologies discussed Readers will find an authoritative and concise review of each subject and will also learn how software engineering technologies have evolved and are likely to develop in the years to come This book will be especially useful for researchers who are new to software engineering and for practitioners seeking to enhance their skills and knowledge ECOOP '93 - Object-Oriented Programming Oscar M. Nierstrasz, 2003-05-16 It is now more than twenty five years since object oriented programming was invented actually more than thirty years since work on Simula started but by all accounts it would appear as if object oriented technology has only been discovered in the past ten years When the first European Conference on Object Oriented Programming was held in Paris in 1987 I think it was generally assumed that Object Oriented Programming like Structured Programming would quickly enter the vernacular and that a conference on the subject would rapidly become superfluous On the contrary the range and impact of object oriented approaches and methods continues to expand and spite the inevitable oversell and hype object oriented technology has reached a level of scientific maturity that few could have foreseen ten years ago Object oriented technology also cuts across scientific cultural boundaries like perhaps no other field of computer science as object oriented concepts can be applied to virtually all the other areas and affect virtually all aspects of the software life cycle So in retrospect emphasizing just Programming in the name of the conference was perhaps somewhat short sighted but at least the acronym is pronounceable and easy to remember This year's ECOOP attracted 146 submissions from around the

world making the selection process even tougher than usual The selected papers range in topic from programming language and database issues to analysis and design and reuse and from experience reports to theoretical contributions **Just Enough Software Architecture** George Fairbanks, 2010-08-30 This is a practical guide for software developers and different than other software architecture books Here's why It teaches risk driven architecting There is no need for meticulous designs when risks are small nor any excuse for sloppy designs when risks threaten your success This book describes a way to do just enough architecture It avoids the one size fits all process trap with advice on how to tune your design effort based on the risks you face It democratizes architecture This book seeks to make architecture relevant to all software developers Developers need to understand how to use constraints as guiderails that ensure desired outcomes and how seemingly small changes can affect a system's properties It cultivates declarative knowledge There is a difference between being able to hit a ball and knowing why you are able to hit it what psychologists refer to as procedural knowledge versus declarative knowledge This book will make you more aware of what you have been doing and provide names for the concepts It emphasizes the engineering This book focuses on the technical parts of software development and what developers do to ensure the system works not job titles or processes It shows you how to build models and analyze architectures so that you can make principled design tradeoffs It describes the techniques software designers use to reason about medium to large sized problems and points out where you can learn specialized techniques in more detail It provides practical advice Software design decisions influence the architecture and vice versa The approach in this book embraces drill down pop up behavior by describing models that have various levels of abstraction from architecture to data structure design **ECOOP '92. European Conference on Object-Oriented Programming** Ole Lehrmann Madsen, 1992-06-16 This volume constitutes the proceedings of the sixth European Conference on Object Oriented Programming ECOOP held in Utrecht The Netherlands June 29 July 3 1992 Since the French initiative to organize the first conference in Paris ECOOP has been a very successful forum for discussing the state of the art of object orientation ECOOP has been able to attract papers of a high scientific quality as well as high quality experience papers describing the pros and cons of using object orientation in practice This duality between theory and practice within object orientation makes a good example of experimental computer science The volume contains 24 papers including two invited papers and 22 papers selected by the programme committee from 124 submissions Each submitted paper was reviewed by 3-4 people and the selection of papers was based only on the quality of the papers themselves **OOPSLA '92**, 1993 **Software Pioneers** Manfred Broy, Ernst Denert, 2012-12-06 A lucid statement of the philosophy of modular programming can be found in a 1970 textbook on the design of system programs by Gouthier and Pont 11 Cf10 23 which we quote below A well defined segmentation of the project effort ensures system modularity Each task forms a separate distinct program module At implementation time each module and its inputs and outputs are well defined there is no confusion in the intended interface with other system modules At checkout time the in

tegrity of the module is tested independently there are few scheduling problems in synchronizing the completion of several tasks before checkout can begin Finally the system is maintained in modular fashion system errors and deficiencies can be traced to specific system modules thus limiting the scope of detailed error searching Usually nothing is said about the criteria to be used in dividing the system into modules This paper will discuss that issue and by means of examples suggest some criteria which can be used in decomposing a system into modules A Brief Status Report The major advancement in the area of modular programming has been the development of coding techniques and assemblers which 1 allow one module to be written with little knowledge of the code in another module and 2 allow modules to be reassembled and replaced without reassembly of the whole system

Proceedings of the ... USENIX Conference on Object-Oriented Technologies and Systems (COOTS) USENIX Conference on Object-Oriented Technologies and Systems (COOTS),2001 **Software**

Engineering for Variability Intensive Systems Ivan Mistrik,Matthias Galster,Bruce R. Maxim,2019-01-15 This book addresses the challenges in the software engineering of variability intensive systems Variability intensive systems can support different usage scenarios by accommodating different and unforeseen features and qualities The book features academic and industrial contributions that discuss the challenges in developing maintaining and evolving systems cloud and mobile services for variability intensive software systems and the scalability requirements they imply The book explores software engineering approaches that can efficiently deal with variability intensive systems as well as applications and use cases benefiting from variability intensive systems **Systems Engineering and Artificial Intelligence** William F. Lawless,Ranjeev Mittu,Donald A. Sofge,Thomas Shortell,Thomas A. McDermott,2021-11-02 This book provides a broad overview of the benefits from a Systems Engineering design philosophy in architecting complex systems composed of artificial intelligence AI machine learning ML and humans situated in chaotic environments The major topics include emergence verification and validation of systems using AI ML and human systems integration to develop robust and effective human machine teams where the machines may have varying degrees of autonomy due to the sophistication of their embedded AI ML The chapters not only describe what has been learned but also raise questions that must be answered to further advance the general Science of Autonomy The science of how humans and machines operate as a team requires insights from among others disciplines such as the social sciences national and international jurisprudence ethics and policy and sociology and psychology The social sciences inform how context is constructed how trust is affected when humans and machines depend upon each other and how human machine teams need a shared language of explanation National and international jurisprudence determine legal responsibilities of non trivial human machine failures ethical standards shape global policy and sociology provides a basis for understanding team norms across cultures Insights from psychology may help us to understand the negative impact on humans if AI ML based machines begin to outperform their human teammates and consequently diminish their value or importance This book invites professionals and the curious alike to witness a new

frontier open as the Science of Autonomy emerges **Software Design** David Budgen, 2020-12-24 Software Design Creating Solutions for Ill Structured Problems Third Edition provides a balanced view of the many and varied software design practices used by practitioners The book provides a general overview of software design within the context of software development and as a means of addressing ill structured problems The third edition has been expanded and reorganised to focus on the structure and process aspects of software design including architectural issues as well as design notations and models It also describes a variety of different ways of creating design solutions such as plan driven development agile approaches patterns product lines and other forms Features Includes an overview and review of representation forms used for modelling design solutions Provides a concise review of design practices and how these relate to ideas about software architecture Uses an evidence informed basis for discussing design concepts and when their use is appropriate This book is suitable for undergraduate and graduate students taking courses on software engineering and software design as well as for software engineers Author David Budgen is a professor emeritus of software engineering at Durham University His research interests include evidence based software engineering EBSE software design and healthcare informatics *ECOOP ...* ,2003

A Reactive Approach to Comprehensive Global Garbage Detection Sylvain R. Louboutin, 1999-02 Comprehensive global garbage detection GGD in object oriented distributed systems i e GGD intrinsically able to detect distributed cycles of garbage has mostly been addressed via graph tracing algorithms Graph tracing algorithms must account for every live object in the system before any resource can actually be reclaimed which compromises both their scalability and robustness in a distributed environment Alternative non comprehensive approaches trade off comprehensiveness for scalability and robustness under the assumptions that distributed cycles of garbage are rare and that all comprehensive algorithms are necessarily unscalable This thesis contends instead that distributed cycles of garbage are as likely to occur as local cycles and that a comprehensive alternative to graph tracing GGD is possible From the GGD perspective the combined effects of the application processes and local garbage collectors fulfill the role of a global mutator A subset of events of this global mutator's computation called log keeping events reflect either the creation or the destruction of inter site paths in the global object graph The causal history of a log keeping event corresponds to the set of events responsible for the creation of all the paths ever created that are incident to an object The path history of this event is defined as a subset of its causal history and contains only those events responsible for the creation of the extant paths to this object This dissertation presents a novel approach to comprehensive GGD that entails computing dependency vectors which characterize the path history of log keeping events that reflect the destruction of a path These dependency vectors can be computed by propagating increasingly accurate approximations of these vectors along the paths of the global object graph In effect this algorithm reacts to events that may result in the creation of garbage and identifies garbage without requiring a complete scan of the whole object graph In conjunction with a lazy log keeping mechanism it can therefore be shown to be both scalable and robust despite being

comprehensive **Refactoring for Software Design Smells** Girish Suryanarayana, Ganesh Samarthayam, Tushar Sharma, 2014-10-31 Awareness of design smells indicators of common design problems helps developers or software engineers understand mistakes made while designing what design principles were overlooked or misapplied and what principles need to be applied properly to address those smells through refactoring Developers and software engineers may know principles and patterns but are not aware of the smells that exist in their design because of wrong or mis application of principles or patterns These smells tend to contribute heavily to technical debt further time owed to fix projects thought to be complete and need to be addressed via proper refactoring Refactoring for Software Design Smells presents 25 structural design smells their role in identifying design issues and potential refactoring solutions Organized across common areas of software design each smell is presented with diagrams and examples illustrating the poor design practices and the problems that result creating a catalog of nuggets of readily usable information that developers or engineers can apply in their projects The authors distill their research and experience as consultants and trainers providing insights that have been used to improve refactoring and reduce the time and costs of managing software projects Along the way they recount anecdotes from actual projects on which the relevant smell helped address a design issue Contains a comprehensive catalog of 25 structural design smells organized around four fundamental design principles that contribute to technical debt in software projects Presents a unique naming scheme for smells that helps understand the cause of a smell as well as point toward its potential refactoring Includes illustrative examples that showcase the poor design practices underlying a smell and the problems that result Covers pragmatic techniques for refactoring design smells to manage technical debt and to create and maintain high quality software in practice Presents insightful anecdotes and case studies drawn from the trenches of real world projects

Resource Management of Mobile Cloud Computing Networks and Environments Mastorakis, George, Mavromoustakis, Constandinos X., Pallis, Evangelos, 2015-03-31 As more and more of our data is stored remotely accessing that data wherever and whenever it is needed is a critical concern More concerning is managing the data banks and storage space necessary to enable cloud systems Resource Management of Mobile Cloud Computing Networks and Environments reports on the latest advances in the development of computationally intensive and cloud based applications Covering a wide range of problems solutions and perspectives this book is a scholarly resource for specialists and end users alike making use of the latest cloud technologies **Proceedings of the ... ACM SIGPLAN Symposium on Principles & Practice of Parallel Programming** , 2007 ECOOP '95, Object-oriented Programming Walter Olthoff, 1995 This book presents the carefully refereed proceedings of the 9th European Conference on Object Oriented Programming ECOOP 95 held in Aarhus Denmark in August 1995 Besides the scientific conference documented in this book ECOOP 95 included a number of tutorials and workshops as well as a two day technology exhibition and thus reflects the full spectrum of Object Oriented Programming The volume presents three invited contributions and 18 full research papers selected from more than

90 submissions The papers are organized in sections on types programming languages reflective programming and verification implementation concurrency and specification and distribution and interfaces PUBLISHER S WEBSITE

OOPSLA '96 ,1996 OOPSLA is a forum for the presentation of research and applications in object oriented programming Topics covered in these proceedings include applications design databases user interfaces software engineering education and languages **OOPSLA '93** ,1993

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