

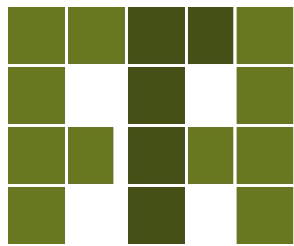


Education and Culture DG

Lifelong Learning Programme



Education, Audiovisual & Culture
Executive Agency



FREE
TECHNOLOGY
ACADEMY

Software Architecture

Study Guide

This project has been funded with support from the European Commission. This communication reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained herein.

Presentation

The structure of a modern software system is very complex: such a system may consist of millions lines of code, may be assembled from different components, which have to cooperate in different ways, and must operate in a distributed environment. Demands are high: a short time-to-market, a high security and robustness, hard real-time constraints or modifyability are aspects of a software system which must be dealt with from the early stages.

Software architecture is concerned with design, description and analysis of a software system, using models, to meet the (often contradictory) demands and requirements of different stakeholders. A misjudgement in the initial design may have farreaching and disastrous consequences for the success of the software project.

This course offers an introduction to software architecture: the different activities of a software architect are explained. The course also offers the opportunity to train architectural design and description.

The course in the context of the FTA Programme

This course is a practical introduction to software architecture. Learners in this course would also benefit from the FTA modules *Software Development* and *Deployment of Free Software and Case Studies*.

Academic Requirements

The learner must have knowledge and experience with object oriented programming and design, including experience with UML. The learner should also have some knowledge about software requirements.

Learning Outcomes

Learners will achieve the following skills after completing this course:

- modelling and describing an architecture,
- discover contradictions in the requirements, and solving them,
- writing,
- evaluating a solution,
- comparing different solutions,

In a more general sense, learners will acquire a good understanding of the following concepts:

- standard architectures,
- quality models (ISO 9126/QUINT),
- architectural patterns,
- patterns for enterprise applications,
- architecture description languages and models (IEEE 1471, UML and others),
- evaluation of an architecture.

Learning Methodology

All courses provided by the Free Technology Academy are conducted entirely online at the FTA Campus. The learning methodology at the FTA allows learners to define their own study schedule: most communication takes place using asynchronous tools, and learners can choose when to work in their assignments and class activities as long as they respect a few deadlines. In general, study doesn't need to happen at fixed days and times. This model allows for anyone to join FTA courses, regardless of their location, as long as they have regular access to the Internet.

Studying at the FTA is quite different from studying at a conventional university. The course tutor is more a guide or a coach than a traditional lecturer, which means more freedom for learners but also more responsibility in planning their study. The learning methodology is based on three main pillars: course materials, class debates and Continuous Assessment Activities (CAA).

Course materials are the main source of information for FTA learners. They cover all the learning objectives of the course, and constitute the reference resource that will be used when evaluating learners. Course materials are also a very valuable resource for self-learning.

During the course, tutors will use the class forum to engage learners in discussions and debates on specific issues related to the course's content. Also, several activities will be proposed to help learners extend their understanding of these topics. Within these activities, relevant personalities may be invited to participate in the course as guests lecturers, giving a video talk and discussing it with the class afterwards.

Continuous Assessment Activities, besides being the main evaluation tool on most FTA courses, represent an important didactic resource by themselves. These activities will help learners consolidate and summarize the key aspects of the course, and at the same time will provide tutors with an opportunity to give learners personalised feedback.

The virtual classroom

The place where FTA courses take place is the virtual classroom. This is an online space that can only be accessed by enrolled learners and their tutors. It gives them access to a set of tools and applications that will facilitate the learning process, including an online version of the learning materials and access to the learner's grades and profile.

The main communication tools that will be used in this course are:

Forums

Discussion forums represent the main communication channel in this course's classroom. The classroom has three kinds of forums:

- Normal forums: messages and their replies are organised in threads. Keep in mind to start a new thread if you are discussing a new topic.
- Debate forums: a special kind of discussion forum where you can't see your classmate's replies until you post your own. This is meant to provide a level playing field for all, so that even those who join the discussion at a later stage can contribute.
- Announce forums: only the tutor can post here. It is used to send reminders of important dates, news about the course, etc.

Once the course is finished the classroom will be frozen. Forums will still be accessible for learners and tutors, read-only, for reference purposes.

Wiki

The FTA Campus has a Wiki space which can be accessed from outside the campus:

<http://campus.ftacademy.org/wiki>

This Wiki is organised by courses, which can be accessed directly from the classroom. This space is public and persistent between different editions of the course, which means that future learners can build upon the work of their predecessors.

An obvious application for the Wiki is to collect interesting resources: links to reference documents, relevant news and events, etc. It will also be useful to collect the results from debates and other activities, and for any other use that FTA learners and teachers can think of.

Blog

This is also a public tool which can be accessed from outside the campus. The classroom blog will be used by the tutor and learners to give the outside world an idea on what goes on inside the classroom, but also for other activities that can benefit from external participation.

Evaluation model

The duration of this course is 13 weeks, after which all learners who pass are entitled to 5 ECTS credits at any of the partner universities. This corresponds to a workload of roughly 125 hours for the student.

The evaluation of learners is done continuously during the whole course. There are a number of assignments that will be published during the course for which learners will receive grades: the Continuous Assessment Activities (CAA). These activities will consist in answering a set of questions and/or writing a short essay.

Also, the participation of each student in class activities such as debates and guest lectures is evaluated by tutors along with the CAA. This doesn't mean that tutors give good grades to correct comments and bad grades to incorrect ones. Participating in class activities, helping classmates solve their doubts, posing interesting questions, contributing to the wiki and joining debates and discussions in a constructive way are all positively evaluated.

Rules

- There are 3 Continuous Assessment Activities in this course. In order to pass the course, at least 2 of the 3 activities must be delivered. If a learner has delivered the 3 activities, the final grade will be obtained from the 2 with the higher grade.
- The instructions for each activity will be published in the classroom (see Calendar).
- Learners will have two full weeks to complete each CAA.
- Each activity is ranked from 1 to 10, where 10 means excellent, 6 is the passing grade and 1 denotes the absence of all merit.
- The 3 CAA account for 80% of the final grade. The other 20% corresponds to participation in class activities and debates.
- Learners must complete the activities by themselves, plagiarism will not be tolerated. Copying text without properly citing its source will be punished, depending on the case, with repeating the activity with a maximum grade of 6 or directly with a grade of 1.

FTA Certificates

Those learners who complete the evaluation activities with a final grade of 6 or more are entitled to receive an FTA certificate for this course.

FTA certificates are recognised by the participating universities and enable learners to extend their studies in the area of Free Technologies, complementing the universities' existing curricula. For more information about the FTA Certificates, their recognition and our work towards a complete Master Programme in Free Software, please see:

<http://ftacademy.org/courses/recognition>

Study plan

It is advisable to try to keep a regular dedication to studying the materials and solving the assignments. This, combined with an active participation in discussions, debates and other class activities, is the way to take the most out of the course. For this reason, a particular study plan is suggested for the distribution of the materials during the course:

Section	Course week
<i>1. Introduction</i>	1
<i>2. Requirements engineering</i>	2
<i>3. Description and evaluation</i>	3
<i>4. Architectural patterns</i>	4
<i>Assignment 1</i>	4.5
<i>5. Patterns for enterprise applications</i>	6
<i>6. Integration patterns</i>	7
<i>7. Component software</i>	8
<i>Assignment 2</i>	8.9
<i>8. Design by contract</i>	10
<i>9. Service oriented architectures</i>	11
<i>Assignment 3</i>	12.13

For some modules, there are additional articles to be studied. The following articles should be studied, together with the following modules:

Module	Additional articles
<i>1. Introduction</i>	Agile Architecture: Strategies for Scaling Agile Development
	Understanding Architectural Influences and Decisions in Large-System Projects
	Who Needs an Architect
<i>2. Requirements engineering</i>	A Case Study in Eliciting Scalability Requirements
<i>3. Description and evaluation</i>	Architectural Blueprints - The "4+1" View Model of Software Architecture
	Applying Viewpoints and Views to Software Architecture
	A case study in architectural analysis: The evolution of the modern web browser

<i>4. Architectural patterns</i>	Web search for a planet: The Google cluster architecture
<i>5. Patterns for enterprise applications</i>	-
<i>6. Integration patterns</i>	Domain Logic and SQL
	Solving Integration Problems Using Patterns
<i>7. Component software</i>	The rise and fall of CORBA
<i>8. Design by contract</i>	-
<i>9. Service oriented architectures</i>	Introduction to SOA with Web Services, chapter 1

Calendar

These are the key dates for this course:

Date	Event
18 April	Course start
9 May	CAA1 Instructions
23 May	CAA1 Submission deadline
6 June	CAA2 Instructions
20 June	CAA2 Submission deadline
27 June	CAA3 Instructions
14 July	CAA3 Submission deadline
18 July	Course end