



Course Plan

LOG8430E – Software Architecture and advanced design

Department of Computer and Software Engineering
Fall 2020
3 Credits
Triplet:3-1.5-4.5

Coordinator/Professor

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Course Description

Advanced software design methods and choice of architecture. Multi-tier, client-server, extensible and dynamic software architectures. Advanced design and implementation of libraries and dynamic binding of components. Frameworks and pluggable architectures. Design and composition of component architectures. Advanced design patterns for distributed architectures: service access and configuration, event processing, synchronisation and parallelism. Emerging design and architecture approaches: cloud architectures, service-oriented architectures and others.

Qualities required for graduates

In the context of this course, the students will develop the qualities specified in the following table (www.polymtl.ca/etudes/bc/qualites).

The evaluation will be in the form of practical assignments.

1	2	3	4	5	6	7	8	9	10	11	12
Connaissance en génie	Analyse de problèmes	Investigation	Conception	Utilisation d'outils d'ing.	Travail en équipe	Communication	Professionalisme	Impacts Environm.	Déontologie	Économie et gestion de projets	Apprentissage continu
	X		X	X							

Objectives

This course aims at:

- Present the styles and patterns of design and architecture, putting an emphasis on distributed systems.
- Measure and maintain the quality of the design and the architecture.
- Explore and master the design of distributed software in real case studies: frameworks, cloud systems and data analytics systems.

In the context of this course, the student will be able to:

- Design the architecture of a software system by choosing and justifying the architectural styles and design patterns according to the requirements.
- Design the components of the architecture by using special models and novel technologies (event-driven architectures, service-oriented architectures, object-oriented architectures, cloud technologies).
- Evaluate the quality of an architecture or a software design and maintain it by enforcing changes.

Teaching methods

The course comprises of:

- **39 hours of lectures**, when the professor will present the theoretic content;
- **18 hours of labs** devoted in the solution of practical problems related to the theoretic content;
- **practical assignments** serving as a periodic mechanism to evaluate the acquisition of knowledge;
- **final exams**, covering the entirety of the course material.

Complementary lectures on the subjects covered by the main course may be suggested as the course progresses, and they will make material for the final exams.



Evaluation

Nature	Number	Weight	Date
Final exams	1	22%	
Quiz	3	18%	In weeks: 3-5, 6-8, 9-11
Review Assignment	1	30%	Wednesday, December 9 th
Assignments	TP #1	15%	Monday, October 5 th
	TP #2	15%	Monday, November 2 nd

- The deadlines for assignments are subject to change.
- The grades of the assignments will not be considered unless the grade in the final exams is more than 40 out of 100.
- Two pages (letter size, handwritten or electronic) of documentation are permitted during the final exams, in case the exams are in-place.

People-resources

The professor for the course and the TA for the lab.

Documentation

Course slides by the professor available in Moodle.

Course Schedule

Module 1 : Architecture and design of distributed systems.

- SOLID design principles.
- Design patterns.
- Distributed architectures.
- Architectural styles and patterns.
- Design quality.
- Quality attributes.
- Quality metrics.
- Bad design.
- Antipatterns, design smells.
- Refactoring, refactoring to patterns
- Modular component architectures.
- Frameworks.
- Event-driven architectures.
- Event processing.
- Synchronisation and concurrency.
- Pattern-oriented software architectures.
- Migration towards a modular and distributed architecture.
- Pluggable architectures.



Module 2: Multi-tier systems.

- Service-oriented architectures.
- Microservices
- Systems of systems.
- Distributed big data systems.
- Blockchain
- Cloud deployment.
- Performance resource utilisation.
- Autoscaling