

Middleware Architectures 1

Motivation and Course Overview

doc. Ing. Tomáš Vitvar, Ph.D.

tomas@vitvar.com • @TomasVitvar • <https://vitvar.com>



Czech Technical University in Prague

Faculty of Information Technologies • Software and Web Engineering • <https://vitvar.com/lectures>



Modified: Mon Sep 22 2025, 10:19:00
Humla v1.0

Overview

- Course at a Glance
 - *Motivation and Scope*
 - *Requirements and Organization*
- Assessment
- Communication and Resources

What is Middleware?

- Say anything you think has something to do with middleware
 - *Architecture*
 - *Tehnology*
 - *Tools*
 - *Concept or style*
 - *Methodology*
 - ...
 - *No worries, there is no bad answer!*

Motivation in Brief

- Systems rely on complex infrastructures
 - *A lot of data and many processes, internal and external*
 - *As people communicate, underlying systems must too*
 - *But:*
 - *variety of data formants, technologies, protocols*
 - *variety of architectures, client-server, peer-to-peer, ...*
- Rapid changes in applications' functionalities
 - *modular development*
 - *reuse of application logic*
 - *low costs – do it now and quickly!*
- Good performance
 - *frequent changes in applications' loads, peak hours*
 - *scalability – effective load balancing*
 - *low costs – cheaper to outsource?*

Scope

- Architectural and conceptual basis
 - *What is an architecture – methodology, global, software*
 - *Service concepts, integration patterns, microservices, middleware*
- Backend technologies
 - *Communication protocols – HTTP, TLS, HTTP/2*
 - *Application backend and requests handling*
 - *Advances of REST, gRPC*
 - *Kubernetes*
- Performance and Scalability
 - *Performance tuning*
 - *Load balancers*

Overview

- Course at a Glance
 - *Motivation and Scope*
 - *Requirements and Organization*
- Assessment
- Communication and Resources

Prerequisites

- Operating systems
 - *Basics of Linux*
- Computer Networks
 - *Basics of networking concepts*
- JavaScript
 - *Code examples will be in JavaScript*
 - *Lab work will be in JavaScript*
- Web Architecture
 - *Basics of REST, HTTP, URI/URL*

Organization of Lectures

- 12 Lectures
 - *Czech: Mon 9:15-10:45, JP:B-571*
 - *English: TBA*
- Plan
 1. 22.09.2025 – *Motivation and Course Overview*
 2. 29.09.2025 – *Information System Architectures*
 3. 06.10.2025 – *Introduction to Service Architecture*
 4. 13.10.2025 – *Microservices and Cloud-Native Architectures*
 5. 20.10.2025 – *Communication protocols, HTTP, TLS*
 6. 27.10.2025 – *HTTP/2 and HTTP/3*
 7. 03.11.2025 – *HATEOAS, Caching, Concurrency Control*
 8. 10.11.2025 – *gRPC*
 9. 17.11.2025 – *No Lecture*
 10. 24.11.2025 – *Synchronous and Asynchronous I/O*
 11. 01.12.2025 – *High Availability and Performance*
 12. 08.12.2025 – *Performance Tuning*
 13. 15.12.2025 – *Reserve*

Organization of Labs

- Individual work (no teams!)
- Labs every second week
- Number of labs: 6
 1. *Introduction - FIT Workspaces, setup*
 2. *REST – Basics, development of a REST service*
 3. *Security, TLS*
 4. *Messaging systems*
 5. *Load balancers, nginx*

Methodology for Lab Work

- No app development, not directly related assignments
 - *assignment every second week*
 - *be prepared for the lab!*
 - *work alone, ask others for advices*
 - ***Results:***
 - *5 completed tasks*
 - *you will submit results to **FIT GitLab***

FIT Workspaces

- All work you will do in **FIT Workspaces**
 - *Cloud-native Development Environment running in Kubernetes*
 - *Each student has an access to their own workspace*
 - *Workspace is ready for the **lab work***
- Access
 - *You use your FIT username and a key (stored in GitLab)*
 - `ssh vitvatom~am1@fit-workspaces.ksi.fit.cvut.cz`
 - *You can use SSH CLI, VSCode or IntelliJ with Remote SSH plugin*
 - *You have sudo access if you want to add packages*
 - *For more Information see [FIT Workspaces Wiki](#)*

Overview

- Course at a Glance
- **Assessment**
- Communication and Resources

Assessment

- Labs
 - *Every task gives you the maximum of 6 points = 30 points in total*
 - *Activity in labs gives you the maximum of 10 points*
 - *Total maximum points = 40, **to pass**: 20 points minimum*
- Final exam
 - *Written exam: 3 exercises, 1 hour*
 - *each gives you a max. of 20 points, the total is 60 points*
 - *To pass, you need to have at least 50% from each exercise!*
 - *Final score:*
 - *100 points maximum*

Final Marks

| Mark | Points | In words |
|------|--------|--------------|
| A | 100–90 | výborně |
| B | 89–80 | velmi dobře |
| C | 79–70 | dobře |
| D | 69–60 | uspokojivě |
| E | 59–50 | dostatečně |
| F | 49–0 | nedostatečně |

Source: <http://www.cvut.cz/pracoviste/pravni-odbor/dokumenty/studijni-predpisy/studijnirad.pdf>

Overview

- Course at a Glance
- Assessment
- Communication and Resources

Communication

- Language
 - *Text: English (slides, tweets, posts, instructions, etc.)*
 - *Voice: Czech and English (English version of the course)*
- Direct
 - *you can always contact me directly at tomas@vitvar.com or [@TomasVitvar](https://twitter.com/TomasVitvar)*

Overview of Resources

- Overview of resources

| Item | URL |
|---------------|---|
| Course slides | http://mdw.vitvar.com |
| Courses@FIT | https://courses.fit.cvut.cz/NI-AM1/ |
| Lab projects | https://gitlab.fit.cvut.cz/ |
| Assessment | https://grades.fit.cvut.cz/courses/NI-AM1/ |

- Books

- *L. Richardson, S. Ruby: RESTful Web Services: Web services for the real world, O'Reilly Media, May 2007, ISBN 9780596529260.*
- *I. Grigorik: High Performance Browser Networking, O'Reilly Media, May 2013, ISBN 978-1-449-34476-4.*
- *Thomas Erl: Service-Oriented Architecture: Concepts, Technology, and Design. Prentice Hall, Aug 2, 2005.*

About Slides

- Humla – Open Source HTML5 Presentation System
 - *every slide has a unique URL*
 - *all figures linked with Google drawings*
 - *auto-generated PDFs (1 and 2 slides per page) using travis-ci*
 - *running local (with local nodejs-based http server), and in github pages*
 - *Suggest edits or correct errors by pull requests at [mdw github repo](#)*
- Keys
 - 1 *default browsing mode*
 - 2 *slideshow mode (automatically scales to fullscreen)*
 - 3 *grid (overview) mode*
 - 4 *print mode, 2 slides per page*
 - ← *slide left*
 - *slide right*