Middleware Architectures 1

Motivation and Course Overview

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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, peek 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*

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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*

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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

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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*

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*