UČNI NAČRT PREDMETA / COURSE SYLLABUS (leto / year 2016/17)	
Predmet:	Računalniške storitve v oblaku
Course title:	Cloud computing

Študijski program in stopnja **Study programme and level**	**Študijska smer** **Study field**	**Letnik** **Academic year**	**Semester** **Semester**
Interdisciplinarni magistrski študijski program Računalništvo in matematika	ni smeri	1 ali 2	prvi
Interdisciplinary Master's study programme Computer Science and Mathematics	none	1 or 2	first

Vrsta predmeta / Course type	izbirni / elective
Univerzitetna koda predmeta / University course code:	63541

Predavanja **Lectures**	**Seminar** **Seminar**	**Vaje** **Tutorial**	**Klinične vaje** **work**	**Druge oblike študija**	**Samost. delo** **Individ. work**	**ECTS**
45	**20**	**10**			**105**	**6**

Nosilec predmeta / Lecturer:	prof. dr. Matjaž Branko Jurič

Jeziki / Languages:	**Predavanja / Lectures:**	slovenski / Slovene, angleški / English
	Vaje / Tutorial:	slovenski / Slovene, angleški / English

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:	**Prerequisites:**
Vpis v letnik študija.	Enrolment in the programme.
Vsebina:	**Content (Syllabus outline):**

Razvoj aplikacij, ki se izvajajo na strežnikih Definicija računalništva v oblaku: kaj je računalništvo v oblaku, namen, vloga in pomen, cilji Izzivi: upravljanje infrastrukture, arhitektura aplikacij za oblak, shranjevanje podatkov, varnost, ostali vidiki Lastnosti: samo oskrba na zahtevo, elastičnost in skalabilnost, dostop v obliki storitev, nadzor storitev, souporaba virov (pooling), itd. Storitveni modeli: IaaS (Infrastruktura kor storitev), PaaS (Platforma kot storitev), SaaS (Aplikacije kot storitve), XaaS Podrobni pregled IaaS (Infrastruktura kor storitev) Pregled konceptov, arhitekturni vidik Privatni oblak, javni oblak, hibridni oblak, virtualni oblak Spoznavanje in primerjava najpomembnejših IaaS tehnologij Podrobni pregled PaaS (Platforma kot storitev) Pregled konceptov, arhitekturni vidik Spremembe v razvojnih modelih: Trajno stanje: distribuirani datotečni sistemi, nestrukturirane shrambe, NoSQL baze, SQL baze v oblaku, Poslovna logika: spletne storitve, REST storitve, ostale tehnologije, Izvajalno okolje Spoznavanje in primerjava najpomembnejših PaaS tehnologij: Java EE, Azure, Google App Engine, itd.	Developing applications for the server-side Definition of cloud computing: what is cloud computing, purpose, role and importance, objectivesChallenges: Infrastructure Management, Application Architecture for cloud, data storage, security, other aspectsFeatures: on demand self-provisioning, elasticity and scalability, access in the form of services, monitoring, sharing of resources (pooling), etc..Service models: IaaS (Infrastructure-as-a-Service), PaaS (Platform-as-a-Service), SaaS (Software-as-a-Service), XaaSDetailed overview of IaaS: Overview of concepts, architectural perspective Private cloud, public cloud, hybrid cloud, virtual cloud Getting to know and compare the most important IaaS technologies Detailed overview of PaaS: Overview of concepts, architectural perspective Changes in development models: data persistence: distributed file systems, unstructured storage, NoSQL database, SQL database in the cloud, Business tier: Web services, REST services, other technology runtime environment Understanding and comparison of major PaaS technologies: Java EE, Azure, Google App Engine, etc. Detailed overview of SaaS: Overview of concepts, architectural perspective Access Models, Development Concepts Business models, Cloud Services (location, data

Podrobni pregled SaaS (Aplikacije kot storitve) Pregled konceptov, arhitekturni vidik Model dostopa, koncept razvoja Poslovni model, storitve v oblaku (lokacijske, dostava podatkov, bogatenje podatkov, integracijske storitve, poslovna inteligenca, itd.) Namestitveni modeli Zasebni, javni, hibridni, skupni oblak Na lokaciji, pri ponudniku, hibridni model, pregled ponudnikov Migracija v oblak Nadzor, upravljanje, SLA in QoS Praktični del: Vzpostavitev lastnega računalniškega oblaka Razvoj aplikacij za oblak Tehnološki vidiki Vsebinsko-poslovni vidiki Razvoj inovativnih aplikacij, ki delujejo v oblaku Konfiguriranje hibridnega računalniškega oblaka Spoznavanje najpomembnejših javnih oblakov: Amazon, Google App Engine, Azure, OpenStack, itd. Študija prenosljivost oblačnih rešitev med ponudniki Razvoj specifičnih razširitev za oblak	delivery, data enrichment, integration services, business intelligence, etc.). Deployment models Private, public, hybrid, shared cloud On premises, remote, hybrid model, overview of providers Migration to the cloudControl, management, SLA and QoSPractical part: Deploying, setting up and configuring your own Cloud Developing applications for the cloud Technological aspects Content and business aspects Development of innovative applications that run in the cloud Configuring a hybrid cloud Getting to know the most important public clouds: Amazon, Google App Engine, Azure, OpenStack, etc. Portability study between cloud solution providers Development of cloud-specific extensions

Temeljni literatura in viri / Readings:

Barrie Sosinsky, Cloud Computing Bible, Wiley, 2011.

George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly Media, 2009.

David S. Linthicum, Cloud Computing and SOA Convergence in Your Enterprise, Addison-Wesley Professional, 2009.

John Rhoton, Risto Haukioja, Cloud Computing Architected: Solution Design Handbook, Recursive Press, 2011.

Matjaz B. Juric et al., Do more with SOA Integration, Packt Publishing, 2011.

Cilji in kompetence:

Cilj predmeta je osvojiti poglobljene znanje in poznavanje področja računalništva v oblaku in vseh nivojev storitvene usmerjenosti (XaaS), osvojiti znanje s področja infrastrukture, platforme in aplikacij v obliki storitev, spoznati načrtovalske vzorce, arhitekturne modele in dobre prakse ter razumeti pomen inovativnih aplikacij v oblaku.

Kompetence:

Študentje bodo sposobni vzpostaviti infrastrukturo za delovanje privatnih, hibridnih in zasebnih oblakov, načrtovati in implementirati arhitekturo platforme PaaS, načrtovati in implementirati aplikacije, ki se izvajajo na PaaS, razumeti specifike oblačnih arhitektur in infrastruktur. Usposobljeni bodo za razvoj SaaS aplikacij na najpomembnejših PaaS/IaaS. Razumeli bodo pomen inovacij v oblaku.

Objectives and competences:

The course objective is to provide an in-depth knowledge and understanding of the scope of cloud computing and all levels of service orientation (XaaS), provide knowledge of infrastructure, platforms, and applications in the form of services, get familiar with design patterns, architectural models and best practices and understand the importance of innovative applications in the cloud.

Competences:

Students will be able to deploy the infrastructure for the operation of private, hybrid and private clouds, to design and implement PaaS platform architecture, design and implement applications that are implemented on PaaS, understand the specifics of cloud architectures and infrastructures. Students will be trained to develop SaaS applications on most important PaaS / IaaS platforms and understand the importance of innovation in the cloud.

Predvideni študijski rezultati:

Intended learning outcomes:

Znanje in razumevanje: Poznavanje in razumevanje infrastruktur in arhitektur računalniških oblakov, sposobnost razvoja aplikacij za oblak, sposobnost vzpostavitve privatnih in hibridnih oblakov ter uporabo javnih oblakov, razvoj inovativnih SaaS aplikacij. Uporaba: Uporaba v sklopu razvoja aplikacij in informacijskih sistemov. Refleksija: Zmožnost razvoja inovativnih aplikacij in zmožnost nadgradnje in razširitve obstoječih oblačnih infrastrukturi in platform. Prenosljive spretnosti – niso vezane le na en predmet: Spretnosti uporabe javnih oblakov, domače in tuje literature in drugih virov, uporaba IKT, uporaba sistematičnih pristopov, analiza potreb, identifikacija in reševanje problemov, skupinsko delo.	Knowledge and understanding: Knowledge and understanding of cloud computing infrastructures and architectures, the ability to develop applications for the cloud, the ability to establish private and hybrid clouds and to use the public clouds, and to develop innovative SaaS applications. Application: Application in the context of application development and information systems. Reflection: Ability to develop innovative applications and the ability to upgrade and extend existing cloud infrastructures and platforms.Transferable skills: Skills of public clouds usage, both domestic and foreign literature and other sources, usage of ICT, usage of systematic approaches, requirements analysis, identification and problem solving, teamwork.

Metode poučevanja in učenja:	**Learning and teaching methods:**
Predavanja, računalniške vaje, projektni način dela pri seminarjih.	Lectures, computer-based workshops, project work, seminars.

Načini ocenjevanja:	Delež (v %) / Weight (in %)	**Assessment:**
Način (pisni izpit, naloge, projekt): Sprotno preverjanje (vaje, kolokviji in projektno delo) Končno preverjanje (pisni in ustni izpit) Ocene: 6-10 pozitivno, 1-5 negativno (v skladu s Statutom UL)	 50% 50%	Type (examination, coursework, project):Continuing (workshops, midterm exams, project work)Final (written and oral exam) Grading: 6-10 pass, 1-5 fail (according to the rules of University of Ljubljana)

Reference nosilca / Lecturer's references:

JURIČ, Matjaž B. WSDL and BPEL extensions for event driven architecture. Information and software technology, ISSN 0950-5849. [Print ed.], 2010, vol. 52, iss. 10, str. 1023-1043. [COBISS.SI-ID 14364950]

JURIČ, Matjaž B., ŠAŠA BASTINOS, Ana, BRUMEN, Boštjan, ROZMAN, Ivan. WSDL and UDDI extensions for version support in web services. The Journal of Systems and Software, ISSN 0164-1212. [Print ed.], 2009, vol. 82, iss. 8, str. 1326-1343. [COBISS.SI-ID 13371158]

JURIČ, Matjaž B., ŠAŠA BASTINOS, Ana, ROZMAN, Ivan. WS-BPEL extensions for versioning. Information and software technology, ISSN 0950-5849. [Print ed.], 2009, vol. 51, iss. 8, str. 1261-1274. [COBISS.SI-ID 13370646]

JURIČ, Matjaž B., PANT, Kapil. Business process driven SOA using BPMN and BPEL : from business process modeling to orchestration and service oriented architecture. Birmingham, Mumbai: Packt Publishing, cop. 2008. V, 311 str., ilustr. ISBN 978-1-84719-146-5. [COBISS.SI-ID 12558102]

JURIČ, Matjaž B., MATHEW, Benny, SARANG, Poornachandra G.. Business process execution language for web services : an architect and developer's guide to orchestrating web services using BPEL4WS. Birmingham: Packt Publishing, 2006. X, 353 str., ilustr. ISBN 1-904811-81-7. [COBISS.SI-ID 10391318]

JURIČ, Matjaž B., LOGANATHAN, Ramesh, SARANG, Poornachandra G., JENNINGS, Frank. SOA approach to integration : XML, web services, ESB, and BPEL in real-world SOA projects. Birmingham, Mumbai: Packt Publishing, cop. 2007. VIII, 366 str., ilustr. ISBN 978-1-904811-17-6. [COBISS.SI-ID 12558358]