UČNI NAČRT PREDMETA / COURSE SYLLABUS		
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 in 2	prvi
Interdisciplinary Masters study programme Computer Science and Mathematics	none	1 in 2	first

Vrsta predmeta / Course type	izbirni

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:	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:

Vsebina:	Content (Syllabus outline):

Razvoj aplikacij, ki se izvajajo na strežnikih	Developing applications for the server-side
Definicija računalništva v oblaku: kaj je računalništvo v oblaku, namen, vloga in pomen, cilji	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:
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	Overview of concepts, architectural perspective
Podrobni pregled IaaS (Infrastruktura kor storitev)	Private cloud, public cloud, hybrid cloud, virtual cloud
Pregled konceptov, arhitekturni vidik	Getting to know and compare the most important IaaS technologies
Privatni oblak, javni oblak, hibridni oblak, virtualni oblak	Detailed overview of PaaS:
Spoznavanje in primerjava najpomembnejših IaaS tehnologij	Overview of concepts, architectural perspective
Podrobni pregled PaaS (Platforma kot storitev)	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
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	
	Understanding and comparison of major PaaS technologies: Java EE, Azure, Google App Engine, etc.
Spoznavanje in primerjava najpomembnejših PaaS tehnologij: Java EE, Azure, Google App Engine, itd.	Detailed overview of SaaS:
Podrobni pregled SaaS (Aplikacije kot storitve)	Overview of concepts, architectural perspective
	Access Models, Development Concepts
	Business models, Cloud Services (location, data delivery, data enrichment, integration services,

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

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:

Po uspešnem zaključku predmeta bo študent:
- razvijal programske rešitve za delovanje v oblaku

- poznal lastnostni javnih in zasebnih oblakov- razumel infrastrukture in arhitekture

Intended learning outcomes:

After successful completion of the course a student will be able to:
- Develop cloud-based software solutions

- Understand the characteristic public and

računalniških oblakov- razumel cloud-native arhitekturo in jo uporabil pri razvoju- obvladal razvoj mikrostoritev- razumel in uporabljal vzorce za razvoj mikrostoritev- uporabil vsebnike in orkestracijo vsebnikov- sposoben razvoja SaaS aplikacij

private clouds

- Understand the infrastructures and architecture of computer clouds

- Understand the cloud-native architecture and use it in the development

- master the development of microservices

- understand and use patterns for the development of microservices

- use containers and orchestration of containers

- capable of developing SaaS applications

Metode poučevanja in učenja:

Predavanja, računalniške vaje, projektni način dela pri seminarjih.

Learning and teaching methods:

Lectures, computer-based workshops, project work, seminars.

Načini ocenjevanja:

Način (pisni izpit, naloge, projekt):	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, 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, 5 fail (according to the rules of University of Ljubljana).

Reference nosilca / Lecturer's references:

Matjaž Branko Jurič:

– 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., 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., 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]

– 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., 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. 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]