## Table of Contents

Message from the General Chairs ........................................................................................................xvii
Message from the Program Chairs ........................................................................................................xix
Organizing Committee ............................................................................................................................xxi
Program Committee ................................................................................................................................xxiv
IEEE Computer Society Technical Committee on Services Computing ................................................xxix

### SCC Research Track

#### Session 1: Service Management

**ReAct: A System for Recommending Actions for Rapid Resolution of IT Service Incidents**

*Vishalaksh Aggarwal, Shivali Agarwal, Gaargi B. Dasgupta, Giriprasad Sridhara, and Vijay E*

User Attribute Inference in Directed Social Networks as a Service .......................................................9  
*B.S. Vidyalakshmi, Raymond K. Wong, and Chi-Hung Chi*

An Ontology-Based Interoperability Solution for Electronic-Identity Systems ....................................17  
*Walter Priesnitz Filho, Carlos Ribeiro, and Thomas Zefferer*

#### Session 2: Best Student Papers

**QoS-Aware Adaptive Routing in Multi-layer Hierarchical Software Defined Networks: A Reinforcement Learning Approach** .................................................................25  
*Shih-Chun Lin, Ian F. Akyildiz, Pu Wang, and Min Luo*

**A Linear Program for Optimal Configurable Business Processes Deployment into Cloud Federation** .........................................................................................................................34  
*Molka Rekik, Khouloud Boukadi, Nour Assy, Walid Gaaloul, and Hanène Ben-Abdallah*
A Query-Based Summarization Service from Multiple News Sources .........................................................42
   Elaheh ShafieiBavani, Mohammad Ebrahimi, Raymond Wong, and Fang Chen

**Session 3: Cloud Services**

Cost-Effective Request Scheduling for Greening Cloud Data Centers ..........................................................50
   Ying Chen, Chuang Lin, Jiwei Huang, and Xuemin (Sherman) Shen

A Cost-Effective Certification-Based Service Composition for the Cloud .........................................................58
   Marco Anisetti, Claudio A. Ardagna, Ernesto Damiani, and Filippo Gaudenzi

AERS: An Autonomic and Elastic Resource Scheduling Framework for Cloud Applications ..................................66
   Jianyun Sun, Haopeng Chen, and Zhida Yin

**Session 4: Best General Papers**

An Elasticity-Aware Governance Platform for Cloud Service Delivery ..............................................................74
   Carlos Müller, Hong-Linh Truong, Pablo Fernandez, Georgiana Copil, Antonio Ruiz-Cortés, and Schahram Dustdar

A Framework for Ensuring the Quality of a Big Data Service .............................................................................82
   Junhua Ding, Dongmei Zhang, and Xin-Hua Hu

Human-as-a-Service: Growth in Human Service Ecosystem ..............................................................................90
   Keman Huang, Jinhui Yao, Jia Zhang, and Zhiyong Feng

**Session 5: Service Discovery and Composition**

Service Selection Based on Dynamic QoS Networks .........................................................................................98
   Victor W. Chu, Raymond K. Wong, Fang Chen, and Chi-Hung Chi

Automatic Composition of Service-Based Image Processing Applications .....................................................106
   Alexander Jungmann and Bernd Kleinjohann

An Approach of Service Discovery Based on Service Goal Clustering ............................................................114
   Neng Zhang, Jian Wang, Keqing He, and Zheng Li

**Session 6: Workflow/Service Management**

What Code Implements Such Service? A Behavior Model Based Feature Location Approach ................................122
   Guangtai Liang, Yabin Dang, Hao Chen, Lijun Mei, Shaochun Li, and Yi-Min Chee

HAWKS: A System for Highly Available Executions of Workflows .................................................................130
   David Richard Schäfer, Andreas Weiß, Muhammad Adnan Tariq, Vasilios Andrikopoulos, Santiago Gómez Sáez, Lukas Krawczyk, and Kurt Rothermel
**Session 7: Cloud Workflows**

Optimizing the Performance of Big Data Workflows in Multi-cloud Environments Under Budget Constraint ................................................................. 138  
  Chase Q. Wu and Huiyan Cao

Energy Efficient Partitioning and Scheduling Approach for Scientific Workflows in the Cloud ........................................................................... 146  
  Khadija Bousselmi, Zaki Brahmi, and Mohamed Mohsen Gammoudi

Where to Fix Temporal Violations: A Novel Handling Point Selection Strategy for Business Cloud Workflows ................................... 155  
  Haoyu Luo, Xiao Liu, Jin Liu, and Futian Wang

**Session 8: Business Process Integration**

  Karn Yongsiriwit, Mohamed Sellami, and Walid Gaaloul

A Service-Friendly Approach to Discover Traveling Companions Based on ANPR Data Stream ................................................................. 171  
  Meiling Zhu, Chen Liu, Jianwu Wang, Xiongbin Wang, and Yanbo Han

A Comprehensive Framework for Business Process Outsourcing to the Cloud .................................................................................. 179  
  Mouna Rekik, Khouloud Boukadi, and Hanène Ben-Abdallah

**Session 9: Business Process Management**

Analyzing Business Processes by Automatically Detecting KPI Thresholds ...................................................................................... 187  
  Mari Abe and Michiharu Kudo

An Empirical Analysis of Diagnosis of Industrial Business Processes at Sub-process Levels ................................................................. 195  
  Suman Roy, A.S.M. Sajeev, A. Gopichand, and Adrija Bhattacharya

Description and Evaluation of Elasticity Strategies for Business Processes in the Cloud ................................................................. 203  
  Aicha Ben Jrad, Sami Bhiri, and Samir Tata

**Session 10: Quality Assurance**

Evaluating Reputation of Web Services under Rating Scarcity ................................................................. 211  
  Xin Zhou, Donghui Lin, and Toru Ishida

Can HTTP/2 Really Help Web Performance on Smartphones? .................................................................................. 219  
  Yi Liu, Yun Ma, Xuanzhe Liu, and Gang Huang
Global and Personal App Networks: Characterizing Social Relations among Mobile Apps ....................................................................................................................227
Youqiang Hao, Zhongjie Wang, and Xiaofei Xu

Session 11: Service Composition Modeling
A Novel Pattern Based Dynamic Service Composition Framework .........................................................235
Zhitaow Wan and Ping Wang
Improving the Quality of Online Search Services: On the Service Multi-selection Problem ...........................................................................................................................243
Yanik Ngoko, Christophe Cérin, and Alfredo Goldman
A QoS and Trust Adaptation Framework for Composed Distributed Systems ........................................251
Dimuthu U. Gamage, Lahiru S. Gallage, and Rajeev R. Raje

Session 12: SOA Applications I
Architectural Models to Simplify Administration of Service-Oriented Applications ........................................................259
Philippe Lalanda, Stéphanie Chollet, Catherine Hamon, and Vincent Lestideau
Dynamic Selection for Service Composition Based on Temporal and QoS Constraints ........................................................267
Ikbel Guidara, Imane Al Jaouhari, and Nawal Guermouche
Ehsan Ahvar, Shohreh Ahvar, Zoltán Ádám Mann, Noel Crespi, Joaquin Garcia-Alfaro, and Roch Glitho

Session 13: SOA Applications II
A Generic Service Framework for Stock Market Prediction ......................................................................................283
Mojgan Ghanavati, Raymond K. Wong, Fang Chen, Yang Wang, and Simon Fong
Enhancing User Control on Personal Data Usage in Internet of Things Ecosystems .................................................................................................................................................................291
Barbara Carminati, Pietro Colombo, Elena Ferrari, and Gokhan Sagirlar
XYZ Indoor Navigation through Augmented Reality: A Research in Progress .................................................................................................................................299
Kaixu Liu, Gianmario Motta, and Tianyi Ma

Session 14: Managing Virtual Machines
Billing the CPU Time Used by System Components on Behalf of VMs ..................................................................................307
Boris Teabe, Alain Tchana, and Daniel Hagimont
How to Distribute the Detection Load among Virtual Machines to Maximize the Detection of Distributed Attacks in the Cloud? .................................................................316

Omar Abdel Wahab, Jamal Bentahar, Hadi Otrok, and Azzam Mourad

A Certification Technique for Cloud Security Adaptation .................................................................324

Claudio A. Ardagna, Rasool Asal, Ernesto Damiani, Nabil El Ioini, Claus Pahl, and Theo Dimitrakos

SCC Applications Track

Session 1: Services Recommendation

A Framework for Top Service Subscription Recommendations for Service Assemblers .................................................................332

Soumi Chattopadhyay, Ansuman Banerjee, and Tridib Mukherjee

A Framework for Passengers Demand Prediction and Recommendation ........................................340

Kai Zhang, Zhiyong Feng, Shizhan Chen, Keman Huang, and Guiling Wang

Cluster-Based Web Service Recommendation .............................................................................348


Session 2: Services Clustering

An Approach of Semantic Web Service Classification Based on Naive Bayes ..............................356

Jianxiao Liu, Zonglin Tian, Panbiao Liu, Jiawei Jiang, and Zhao Li

End-to-End Solution with Clustering Method for Attrition Analysis ..............................................363

Nianjun Zhou, Wesley M. Gifford, Junchi Yan, and Hongfei Li

Fast Social Service Network Construction Using Map-Reduce for Efficient Service Discovery .................................................................371

Yutaka Koshiba, Incheon Paik, and Wuhui Chen

Session 3: Multitenancy Management

Implementing the Required Degree of Multitenancy Isolation: A Case Study of Cloud-Hosted Bug Tracking System .................................................................379

Laud Charles Ochei, Andrei Petrovski, and Julian M. Bass

PDSDN: A Policy-Driven SDN Controller Improving Scheme for Multi-tenant Cloud Datacenter Environments ..................................................................................387

Xuekai Du, Zhihui Lv, Jie Wu, Chengrong Wu, and Shi Chen

A Time-Aware Method to Process Behavioral Similarity Calculation ........................................395

Hua Huang, Rong Peng, and Zaiwen Feng
Session 4: Security and Privacy Management
Model-Based Minimum Privacy Disclosure Recommendation for Authorization Policies .................................................................403
   Li Duan, Yang Zhang, Shiping Chen, Xuan Liu, Bo Cheng, and Junliang Chen
Adaptable Privacy-Preserving Data Curation for Business Process Analysis Services .................................................................411
   Michiharu Kudo, Kumiko Maeda, and Fumiko Satoh
Toward Predicting Susceptibility to Phishing Victimization on Facebook .................................................................419
   Zafer Alqarni, Abdullah Algarni, and Yue Xu

Session 5: Resource Management
Bazaar-Extension: A CloudSim Extension for Simulating Negotiation Based Resource Allocations .................................................................427
   Benedikt Pittl, Werner Mach, and Erich Schikuta
Service-Oriented Resource Management of Cloud Platforms .................................................................435
   Xing Hu, Rui Zhang, and Qianxiang Wang
Social-Based Semantic Framework for Cloud Resource Management in Business Processes .................................................................443
   Emna Hachicha, Walid Gaaloul, and Zakaria Maamar

Session 6: Healthcare Services
Health Cloud: An Enabler for Healthcare Transformation .................................................................451
   Ajay Mohindra, Daniel M. Dias, and Hui Lei
Building Cloud-Based Healthcare Data Mining Services .................................................................459
   Peng Zhang, Shang Hu, Jing He, Yanchun Zhang, Guangyan Huang, and Jiekui Zhang
Recommending Analytic Services for Population Health Studies Based on Feature Significance .................................................................467
   Jinhui Yao, Michael Shepherd, Jing Zhou, Lina Fu, Dennis Quebe, Jennie Echols, and Xuejin Wen

Session 7: Mobile Services
Learning Transportation Annotated Mobility Profiles from GPS Data for Context-Aware Mobile Services .................................................................475
   Xiaolu Zhu, Jinglin Li, Zhihan Liu, Shangguang Wang, and Fangchun Yang
Maximizing the Availability of Process Services in Mobile Computing Environments .................................................................483
   Wei He, Hui Li, Lizhen Cui, and Shuoyan Lu
Autonomic Service-Oriented Context for Pervasive Applications ............................................................. 491
   Aygalinc Colin, Eva Gerbert-Gaillard, German Vega, Philippe Lalanda, and Stephanie Chollet

Session 8: Public Services
MOBANA: A Distributed Stream-Based Information System for Public Transit ........................................ 499
   M.A. Tianyi, Gianmario Motta, Kaixu Liu, and Dongmeng Liu
Modeling and Evaluating Relationships and Service Contracts in Public Transportation: A Pilot Project in Italy .......................................................... 507
   Antonella Longo, Marco Zappatore, Mario A. Bochicchio, and Shamkant B. Navathe
Predicting Inventory Shipments of Oracle EBS Systems ........................................................................ 515
   Yuqun Zhang and Dewayne E. Perry

Session 9: Services Composition
Agent-Based Model to Web Service Composition ................................................................................... 523
   Abdullah Abdullah and Xining Li
UCLAO* and BHUC: Two Novel Planning Algorithms for Uncertain Web Service Composition .......................... 531
   Sen Niu, Guobing Zou, Yanglan Gan, Zhimin Zhou, and Bofeng Zhang
CoCOA: A Framework for Comparing Aggregate Client Operations in BPO Services ................................. 539
   Rahul Ghosh, Avantika Gupta, Soumi Chattopadhyay, Ansuman Banerjee, and Koustuv Dasgupta

Session 10: Services Management
Test Case Selection for Data Flow Based Regression Testing of BPEL Composite Services .............................. 547
   Shunhui Ji, Bixin Li, and Pengcheng Zhang
Efficient Task Allocation in Services Delivery Organizations ..................................................................... 555
   Ameer Mulla, Gurulingesh Haravi, Thangaraj Rajasubramaniam, R.P. Jagadeesh Chandra Bose, and Koustuv Dasgupta
Service Trustworthiness Evaluation Using Neural Network and Fuzzy Logic ............................................. 563
   Zhengping Wu and Yu Zhou

Session 11: QoS Management
A QoS Evolutionary Method of Cloud Service Based on User Utility Model ............................................. 571
   Yan Wang, Jiantao Zhou, Jing Liu, Tenghe Au, and Xiaoyu Song
A Combinational QoS-Prediction Approach Based on RBF Neural Network ........................................... 577
   Pengcheng Zhang, Yingtao Sun, Wenrui Li, Wei Song, and Hareton Leung
Complexity Reduction: Local Activity Ranking by Resource Entropy
for QoS-Aware Cloud Scheduling .................................................................585
Huankai Chen, Frank Wang, Matteo Migliavacca, Leon O. Chua, and Na Helian

Session 12: Performance Management
Mitigating Performance Unpredictability in Heterogeneous Clouds .................................................................593
Boris Teabe, Alain Tchana, and Daniel Hagimont
SRConfig: An Empirical Method of Interdependent Soft Configurations
for Improving Performance in n-Tier Application .................................................................................................601
Yuliang Shi, Xudong Zhao, Shanqing Guo, Shijun Liu, and Lizhen Cui
Simulating Time-Varying Demand Services with Queuing Models .................................................................609
Hsuan-Kai Chu, Wan-Ping Chen, and Fang Yu

Session 13: Cloud Services
Recovering Resolutions for Application Maintenance Incidents .........................................................................................617
Suman Roy, John-John Yeung Tack Yan, Navin Budhiraja, and Aeran Lim
The rSLA Framework: Monitoring and Enforcement of Service Level
Agreements for Cloud Services ..............................................................................................................................625
Mohamed Mohamed, Obinna Anya, Takashi Sakairi, Samir Tata, Nagapramod Mandagere, and Heiko Ludwig
MORE: A Model-Driven Operation Service for Cloud-Based IT Systems .................................................................633
Wei Chen, Chaochao Liang, Yijun Wan, Chushu Gao, Guoquan Wu, Jun Wei, and Tao Huang

Session 14: IoT Services
Providing a Smart Industrial Environment with the Web of Things and Cloud Computing .................................................................641
Marlon C. Domenech, Leonardo P. Rauta, Marcelo Dombusch Lopes, Paulo H. Da Silva, Rodrigo C. Da Silva, Benjamin W. Mezger, and Michelle S. Wangham
Workflow Model Distribution or Code Distribution? Ideal Approach for Service Composition of the Internet of Things .................................................................................................................................649
Jakob Mass, Chii Chang, and Satish N. Srirama
Fragmentation and Optimal Deployment for IoT-Aware Business Process .........................................................................................657
Shou-Lu Hou, Shuai Zhao, Bo Cheng, Yong-Yang Cheng, and Jun-Liang Chen
Session 15: Services Ranking

RaaS - Ranking as a Service .................................................................665
Chen-Cheng Ye, Huan Chen, Liang-Jie Zhang, Xin-Nan Li, and Hong Liang

An Approach for Modeling and Ranking Node-Level Stragglers in Cloud Datacenters ..........................................................673
Xue Ouyang, Peter Garraghan, Changjian Wang, Paul Townend, and Jie Xu

Knowledge-Learning Service Construction Based on Events ..................681
Yang Zhang and Jun-Liang Chen

Session 16: SOA

A Scalable Rule Engine Architecture for Service Execution Frameworks .........................689
Soumi Chattopadhyay, Ansuman Banerjee, and Nilanjan Banerjee

A Middleware for Environmental Monitoring and Control ..............................697
Xiaobin Xu, Minbo Li, and Jia Liang

A Service-Oriented Approach for Integrating Broadcast Facilities ..................705
Alexis Huf, Ivan Salvadori, and Frank Siqueira

Session 17: Services Economics

An Optimization Approach to Services Sales Forecasting in a Multi-staged Sales Pipeline .................................................................713
Aly Megahed, Peifeng Yin, and Hamid Reza Motahari Nezhad

A Top-Down Pricing Algorithm for IT Service Contracts Using Lower Level Service Data .............................................................720
Kugamoorthy Gajananan, Aly Megahed, Mari Abe, Taiga Nakamura, and Mark Smith

Service Assurance Sustaining Enterprise Task Crowdsourcing Service ..............728
Chithralekha Balamurugan and Karan K. Budhraja

Session 18: Semantic Services

Semantic Divergence Based Evaluation of Web Service Communities ..................736
Hafida Naim, Mustapha Aznag, Mohamed Quafafou, and Nicolas Durand

Semantic Web Technologies in Cloud Computing: A Systematic Literature Review ........................................................................744
Hayet Brabra, Achraf Mtibaa, Layth Sliman, Walid Gaaloul, and Faiez Gargouri

Converting Service Rules to Semantic Rules .............................................752
Xinfeng Ye and Ping Zhao
Session 19: Services Applications
A Framework for QoS-aware Traffic Classification Using Semi-supervised Machine Learning in SDNs .................................................................760
   Pu Wang, Shih-Chun Lin, and Min Luo
Case Studies in Managing Traffic in a Developing Country with Privacy-Preserving Simulation as a Service .................................................................766
   Biplav Srivastava, Madhavan Pallan, Mukundan Madhavan, and Ravindranath Kokku

SCC Short Paper Track
Session 1: Service Discovery and Recommendation
A Framework for Permission Recommendation and Risk Evaluation Based on Skewness-Based Filtering .................................................................774
   Jinjing Han, Zhiyong Feng, Shizhan Chen, and Keman Huang
Latent Interest and Topic Mining on User-Item Bipartite Networks .................................................................778
   Jinliang Xu, Shangguang Wang, Sen Su, Sathish A.P. Kumar, and Chou Wu
Applying Probabilistic Model Checking to Service Discovery Framework .................................................................782
   Honghao Gao, Huaikou Miao, Yucong Duan, and Jinyu Kai
Personalized Service Recommendation for Collaborative Tagging Systems with Social Relations and Temporal Influences .................................................................786
   Zigui Jiang, Ao Zhou, Shangguang Wang, Qibo Sun, Rongheng Lin, and Fangchun Yang

Session 2: Service Composition
Multi-agent Reinforcement Learning for Service Composition .................................................................790
   Yu Lei and Philip S. Yu
An Ontology-Based Semantic Service Markup for Content-centric Networking .................................................................794
   Yuze Huang, Jiwei Huang, Budan Wu, Tianxiang Yao, Shuqing He, and Junliang Chen
Higher-Order Functions for Modeling Hierarchical Service Bindings .................................................................798
   Takao Nakaguchi, Yohei Murakami, Donghui Lin, and Toru Ishida
ESI-Cloud: Extending Virtual Machine Introspection for Integrating Multiple Security Services .................................................................804
   Jiangchun Ren, Ling Liu, Da Zhang, Huaizhe Zhou, and Qi Zhang
Session 3: Service-Oriented Software Engineering

CIDE: An Integrated Development Environment for Microservices ..................................................808
Desheng Liu, Hong Zhu, Chengzhi Xu, Ian Bayley, David Lightfoot, Mark Green, and Peter Marshall

Microservices and Their Design Trade-Offs: A Self-Adaptive Roadmap ..............................................813
Sara Hassan and Rami Bahsoon

Fads Phenomenon Operation through Cascade-Based Service Innovation
Design ..................................................................................................................................................819
Pin-Rui Hwang

Toward an Automated View Abstraction for Distributed Model-Driven Service
Development ............................................................................................................................................823
Yucong Duan, Qiang Duan, Ruisheng Shi, and Honghao Gao

GS1beacon: GS1 Standard Based Integrated Beacon Service Platform ........................................827
WonDeuk Yoon, Kiwoong Kwon, and Daeyoung Kim

Session 4: Business Process Management

A Services Lifecycle to Support the Business Processes Lifecycle: From Modeling to Execution and Beyond ........................................831
Andrea Delgado

Dynamic Business Process Generation and Verification ........................................................................836
Budan Wu, Rongheng Lin, Pengjie Wang, and Junliang Chen

A Hybrid Process-Data Model to Avoid Data Conflicting in BPMN ....................................................840
Rongheng Lin, Budan Wu, Hua Zou, and Naiwang Guo

A Process-Aware Inter-organizational Service Integration Platform to Support Collaborative Organizations ........................................................................................................844
Andrea Delgado, Laura González, and Raúl Ruggia

Session 5: QoS Management

A Dynamic Grouping-Based Trust Model for Mobile P2P Networks ....................................................848
Meijuan Jia, Huiqiang Wang, Bin Ye, and Yan Wang

An Online Prediction Approach for Dynamic QoS .............................................................................852
Haiyan Wang and Xuxiao Zheng

Securing Docker Containers from Denial of Service (DoS) Attacks ..................................................856
Jeeya Chelladurai, Pethuru Raj Chelliah, and Sathish Alampalayam Kumar

Predicting the Quality of Web Services Based on User Stability .....................................................860
Fitriyah Hasny, Samuel Mensah, Deliang Yi, Chune Li, and Richong Zhang
An Approach to Design and Analyze the Framework for Preventing Cyberbullying .................................................................864
   Weider D. Yu, Maithili Gole, Nishanth Prabhuswamy, Sowmya Prakash, and Vidya Gowdru Shankaramurthy

Session 6: Services Applications

A Bio-Inspired Service Discovery and Selection Approach for IoT Applications .................................868
   Elli Rapti, Anthony Karageorgos, Catherine Houstis, and Elias Houstis
Towards Video Quality of Experience and Selective Attention: A Subtitle-Based Measurement Study .................................................872
   Lingyan Zhang, Qibo Sun, Shangguang Wang, Sen Su, and Fangchun Yang
Limited Intervention Collaborative Decision Making of MAV-UAV Team Based on VFCM .................................................................876
   Jun Chen, Jia Xu, and Linhui Zhong
Traceability Architecture: Extending EPCIS to Enhance Track and Trace with NoSQL Data Model .........................................................880
   Yalew Kidane and Daeyoung Kim

Author Index ....................................................................................................................................................884