

2016 IEEE 41st Conference on Local Computer Networks (LCN 2016)

**Dubai, United Arab Emirates
7 – 10 November 2016**



IEEE Catalog Number: CFP16068-POD
ISBN: 978-1-5090-2055-3

**Copyright © 2016 by the Institute of Electrical and Electronics Engineers, Inc
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

******This publication is a representation of what appears in the IEEE Digital Libraries. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP16068-POD
ISBN (Print-On-Demand):	978-1-5090-2055-3
ISBN (Online):	978-1-5090-2054-6
ISSN:	0742-1303

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

2016 IEEE 41st Conference on Local Computer Networks

LCN 2016

Table of Contents

Message from the General Chairs.....	xv
Message from the Program Chairs.....	xvii
Message from Demonstrations Chair.....	xviii
LCN Organizing Committee	xix
LCN Program Committee, Demo Board and Additional Reviewers.....	xx
LCN Steering Committee	xxviii
List of Accepted Demonstrations.....	xxix
LCN 2016 Sponsors and Supporters.....	xxx
LCN Best Paper Awards for Prior IEEE Local Computer Networks	
Conferences.....	xxxi
Keynote - Intelligent Adaptive Management in Local Wireless	
Networking.....	xxxiii
Keynote - 30 years of Internet Security and the winner is	xxxiv

1: Plenary Session: Best Paper Candidates

Confidentiality and Authenticity for Distributed Version Control Systems - A Mercurial Extension	1
<i>Michael Lass, Dominik Leibenger, and Christoph Sorge</i>	
Even Lower Latency, Even Better Fairness: Logistic Growth Congestion Control in Datacenters	10
<i>Peyman Teymoori, David Hayes, Michael Welzl, and Stein Gjessing</i>	
A Measurement Study on the Distribution Disparity of BGP Instabilities	19
<i>Meng Chen, Mingwei Xu, Yuan Yang, and Qing Li</i>	

2A: Security and Privacy

Third-Party Tracking on the Web: A Swedish Perspective	28
<i>Joel Purra and Niklas Carlsson</i>	
On Assisted Packet Filter Conflicts Resolution: An Iterative Relaxed Approach	35
<i>Anis Yazidi and Adel Bouhoula</i>	

The Small, the Fast, and the Lazy (SFL): A General Approach for Fast and Flexible Packet Classification	43
<i>Sven Hager, Samuel Brack, and Björn Scheuermann</i>	
Convex Hull Watchdog: Mitigation of Malicious Nodes in Tree-Based P2P Monitoring Systems	52
<i>Andreas Disterhöft and Kalman Graffi</i>	
The Early Bird Gets the Botnet: A Markov Chain Based Early Warning System for Botnet Attacks	61
<i>Zainab Abaid, Dilip Sarkar, Mohamed Ali Kaafar, and Sanjay Jha</i>	

2B: Link-Layer Technologies

An Efficient MAC Layer Packet Fragmentation Scheme with Priority Queuing for Real-Time Video Streaming	69
<i>Byoungheon Shin, Jalil Abdullayev, and Dongman Lee</i>	
Improving the Fairness of Alternative Backoff with ECN (ABE)	78
<i>Naeem Khademi, Michael Welzl, Grenville Armitage, and Stein Gjessing</i>	
Dynamic Link Adaptation in IEEE 802.11ac: A Distributed Learning Based Approach	87
<i>Raja Karmakar, Samiran Chattopadhyay, and Sandip Chakraborty</i>	
On an Efficient Random Access Scheme for Capillary Machine Type Communication	95
<i>Kazi Ashrafuzzaman and Abraham O. Fapojuwo</i>	
A System Level Solution for DSA Systems: From Low-Cost Sensing to Spectrum Database	104
<i>Osama A.H. Al-Tameemi and Mainak Chatterjee</i>	

2C: Multimedia and Realtime Communication

Scalable and Cost Efficient Algorithms for Virtual CDN Migration	112
<i>Hatem Ibn-Khedher, Makhlof Hadji, Emad Abd-Elrahman, Hossam Afifi, and Ahmed E. Kamal</i>	
The Impact of Active Queue Management on DASH-Based Content Delivery	121
<i>Jonathan Kua, Grenville Armitage, and Philip Branch</i>	
100 Gbit/s End-to-End Communication: Designing Scalable Protocols with Soft Real-Time Stream Processing	129
<i>Steffen Büchner, Lukasz Lopacinski, Jörg Nolte, and Rolf Kraemer</i>	
MP-ALM: Exploring Reliable Multipath Multicast Streaming with Multipath TCP	138
<i>Anwaar Ali, Junaid Qadir, Arjuna Sathiaseelan, Kok-Lim Alvin Yau, and Jon Crowcroft</i>	
TransFetch: A Viewing Behavior Driven Video Distribution Framework in Public Transport	147
<i>Fangzhou Jiang, Zhi Liu, Kanchana Thilakarathna, Zhenyu Li, Yusheng Ji, and Aruna Seneviratne</i>	

Poster Session 1

Towards Path Quality Metrics for Overlay Networks	156
<i>Andri Lareida, Daniel Meier, Thomas Bocek, and Burkhard Stiller</i>	
Setting Up a High-Speed TCP Benchmarking Environment - Lessons Learned	160
<i>Thomas Lukaseder, Leonard Bradatsch, Benjamin Erb, and Frank Kargl</i>	
Latency and Lifetime-Aware Clustering and Routing in Wireless Sensor Networks	164
<i>Chuanyao Nie, Hui Wu, and Wenguang Zheng</i>	
A-LMST: An Adaptive LMST Local Topology Control Algorithm for Mobile Ad Hoc Networks	168
<i>Luciana B. Abiuzzi, Cecilia De A.C. Cesar, and Carlos H.C. Ribeiro</i>	
Experimental Performance Study of Multipath TCP over Heterogeneous Wireless Networks	172
<i>Atef Abdrabou and Monika Prakash</i>	
Graph Partitioning in Parallelization of Large Scale Networks	176
<i>Sima Das, Jennifer Leopold, Susmita Ghosh, and Sajal K. Das</i>	
A Time and Energy Efficient Protocol for Locating Coverage Holes in WSNs	180
<i>Phi Le Nguyen, Khanh-Van Nguyen, Vu Quoc Huy, and Yusheng Ji</i>	
Organization-Level Control of Excessive Internet Downloads	184
<i>Saad Y. Sait, Hema A. Murthy, and Krishna M. Sivalingam</i>	
Hardware Modules for Packet Interarrival Time Monitoring for Software Defined Measurements	188
<i>Racyus Pacífico, Pablo Goulart, Alex B. Vieira, Marcos A.M. Vieira, and José Augusto M. Nacif</i>	
Using Probabilistic Multipath Routing to Improve Route Stability in MANETs	192
<i>Fabian Rump, Sascha Alexander Jopen, and Matthias Frank</i>	
Improved Energy-Aware Routing Algorithm in Software-Defined Networks	196
<i>Adriana Fernández-Fernández, Cristina Cervelló-Pastor, and Leonardo Ochoa-Aday</i>	
Carving Software-Defined Networks for Scientific Applications with SpateN	200
<i>Celio Trois, Luis Bona, Marcos D. Fabro, and Magnos Martinello</i>	
An Efficiency Pipeline Processing Approach for OpenFlow Switch	204
<i>Zhenwei Wu, Yong Jiang, and Shu Yang</i>	
Joint Resource Reservation and Flow Scheduling for Ultra-Low-Latency Transmission	208
<i>Guolin Sun, Dawit Kefyalew, and Guisong Liu</i>	
Performance Model for 4G/5G Networks Taking into Account Intra- and Inter-Cell Mobility of Users	212
<i>Bruno Baynat and Narcisse Nya</i>	

Opportunistic Geographic Forwarding in Wireless Sensor Networks for Critical Rare Events	216
<i>David C. Harrison, Winston K.G. Seah, Hang Yu, and Ramesh K. Rayudu</i>	
Bandwidth-Aware Service Placement in Community Network Micro-Clouds	220
<i>Mennan Selimi, Llorenç Cerdà-Alabern, Liang Wang, Arjuna Sathiaseelan, Luís Veiga, and Felix Freitag</i>	
On Periodic Scheduling of Bandwidth Reservations with Deadline Constraint for Big Data Transfer	224
<i>Yongqiang Wang, Chase Q. Wu, and Aiqin Hou</i>	
A Resources Sharing Architecture for Heterogeneous Wireless Cellular Networks	228
<i>Rafael Kunst, Leandro Avila, Edison Pignaton, Sergio Bampi, and Juergen Rochol</i>	
Experiments with ODYSSE: Opportunistic Duty cYcle Based Routing for Wireless Sensor nEtworks	232
<i>Ichrak Amdouni, Cedric Adjih, Nadjib Aitsaadi, and Paul Muhlethaler</i>	
An Approach to Improve the Cooperation between Heterogeneous SDN Overlays	236
<i>Ziteng Cui, Jianxin Liao, Jingyu Wang, Qi Qi, and Jing Wang</i>	
Silence Coding for RFID Tag Anti-Collision	240
<i>Ming-Kuei Yeh, Yung-Liang Lai, and Juhn-Ruey Jiang</i>	

3A: Adhoc, Overlay, and Social Networks

Inferring Future Links in Large Scale Networks	244
<i>Sima Das, Sajal K. Das, and Susmita Ghosh</i>	
Meta-Heuristic Solution for Dynamic Association Control in Virtualized Multi-Rate WLANs	253
<i>Dawood Sajjadi, Maryam Tanha, and Jianping Pan</i>	
Topology Preserving Map to Physical Map - A Thin-Plate Spline Based Transform	262
<i>Ali F. Buoud and Anura P. Jayasumana</i>	
Distributed Cluster-Topology Maintenance for Mobile Collaborative Applications	271
<i>Jan Gäßler and Hartmut König</i>	
Revisiting the So-Called Constructive Interference in Concurrent Transmission	280
<i>Chun-Hao Liao, Yuki Katsumata, Makoto Suzuki, and Hiroyuki Morikawa</i>	

3B: SDN and Data Centers

User-Centric Network Provisioning in Software Defined Data Center Environment	289
<i>Taimur Bakhshi and Bogdan Ghita</i>	
Throughput Maximization in Software-Defined Networks with Consolidated Middleboxes	298
<i>Meitian Huang, Weifa Liang, Zichuan Xu, Mike Jia, and Song Guo</i>	

Endpoint-Transparent Multipath Transport with Software-Defined Networks	307
<i>Dario Banfi, Olivier Mehani, Guillaume Jourjon, Lukas Schwaighofer, and Ralph Holz</i>	
Adaptive Bandwidth Allocation for Virtual Network Embedding in Optical Data	
Center Networks	316
<i>Swarnalatha Madanantha, Tram Truong-Huu, and Mohan Gurusamy</i>	
Are Today's SDN Controllers Ready for Primetime?	325
<i>Stephen Mallon, Vincent Gramoli, and Guillaume Jourjon</i>	

3C: Mobility and Location-Dependent Services

Tri-MCL: Synergistic Localization for Mobile Ad-Hoc and Wireless Sensor Networks	333
<i>Arne Bochem, Yali Yuan, and Dieter Hogrefe</i>	
Maximum Likelihood Topology Maps for Wireless Sensor Networks Using	
an Automated Robot	339
<i>Ashanie Gunathillake, Andrey V. Savkin, and Anura P. Jayasumana</i>	
Seamless Transitions between Filter Schemes for Location-Based Mobile Applications	348
<i>Björn Richerzhagen, Nils Richerzhagen, Julian Zobel, Sophie Schönherr, Boris Koldehofe, and Ralf Steinmetz</i>	
The Improvement of Positioning Accuracy by the Advanced Gaussian Process Method	357
<i>Kehan Liu, Zhaopeng Meng, and Chung-Ming Own</i>	
Context Aware Multi-Rate Control in Densely Deployed IEEE802.11 WLAN	
for Avoiding Performance Anomaly	363
<i>Natsumi Kumatani, Mitomo Isomura, Tutomu Murase, Masato Oguchi, Shweta Segari, Akash Baid, Ivan Seskar, and Dipankar Raychaudhuri</i>	

4A: IoT and Sensor Networks

Breach Path Reliability for Directional Sensor Networks	371
<i>Mohammed Elmorsy and Ehab S. Elmallah</i>	
Error-Bounded Air Quality Mapping Using Wireless Sensor Networks	380
<i>Ahmed Boubrima, Walid Bechkit, and Hervé Rivano</i>	
Topology Control in Wireless Sensor Networks: What Blocks the Breakthrough?	389
<i>Michael Stein, Tobias Petry, Immanuel Schweizer, Martina Brachmann, and Max Mühlhäuser</i>	
Adaptive Data-Centric Clustering with Sensor Networks for Energy Efficient IoT	
Applications	398
<i>Sanat Sarangi and Srinivasu Pappula</i>	
Concurrent Transmissions for Communication Protocols in the Internet of Things	406
<i>Martina Brachmann, Olaf Landsiedel, and Silvia Santini</i>	

4B: Cloud Computing and Information-Centric Networking

Controlling Network Latency in Mixed Hadoop Clusters: Do We Need Active Queue Management?	415
<i>Renan Fischer E Silva and Paul M. Carpenter</i>	
Improving the QoE in Personal Clouds with Cross-Swarm Bundling	424
<i>Rahma Chaabouni, Marc Sánchez-Artigas, Ala Chaabouni, and Pedro García-López</i>	
Inferring and Controlling Congestion in CCN via the Pending Interest Table Occupancy	433
<i>Amuda James Abu, Brahim Bensaou, and Ahmed M. Abdelmoniem</i>	
Multipath Bandwidth Guarantees for Multi-Tenant Cloud Networking	442
<i>Wei Wang, Yi Sun, Steve Uhlig, Gengfa Fang, Nanshu Wang, and Zhongcheng Li</i>	
Man-In-the-Middle Anycast (MIMA): CDN User-Server Assignment Becomes Flexible	451
<i>Jeffrey Lai and Qiang Fu</i>	

4C: Security, Privacy, and Localization

OP4: An OPPportunistic Privacy-Preserving Scheme for Crowdsensing Applications	460
<i>Delphine Reinhardt and Ilya Manyugin</i>	
Of Strategies and Structures: Motif-Based Fingerprinting Analysis of Online Reputation Networks	469
<i>Matthias Wichtlhuber, Sebastian Bücker, Roland Kluge, Mahdi Mousavi, and David Hausheer</i>	
I Am Alice, I Was in Wonderland: Secure Location Proof Generation and Verification Protocol	477
<i>Chitra Javali, Girish Revadigar, Kasper B. Rasmussen, Wen Hu, and Sanjay Jha</i>	
Enabling a Mobility Prediction-Aware Follow-Me Cloud Model	486
<i>Bruno Sousa, Zhongliang Zhao, Morteza Karimzadeh, David Palma, Vitor Fonseca, Paulo Simoes, Torsten Braun, Hans Van Den Berg, Aiko Pras, and Luis Cordeiro</i>	
Probr - A Generic and Passive WiFi Tracking System	495
<i>Joel Scheuner, Genc Mazlami, Dominik Schöni, Sebastian Stephan, Alessandro De Carli, Thomas Bocek, and Burkhard Stiller</i>	

Poster Session 2

Adaptive Transmission Scheme for TCP in Wireless Multi-Hop Network	503
<i>Joon Yeop Lee, Hyunsoon Kim, Woonghee Lee, and Hwangnam Kim</i>	
Hybrid Approach for Mobile Couriers Election in Smart-Cities	507
<i>Fadi Al-Turjman</i>	

QRMNO: Dynamic Resource Reallocation with Minimal Network Overhead in QoS-Aware Software Defined Cloud Data Centers	511
<i>Mohammad Mahdi Tajiki, Behzad Akbari, and Nader Mokari</i>	
Spatio-Temporal Coordination of Mobile Robot Swarms	515
<i>Daniel Graff and Reinhardt Karpnake</i>	
On the Design and Implementation of a Security Architecture for End to End Services in Software Defined Networks	519
<i>Kallol Krishna Karmakar, Vijay Varadharajan, and Udaya Tupakula</i>	
Securing ARP in Software Defined Networks	523
<i>Talal Alharbi, Dario Durando, Farzaneh Pakzad, and Marius Portmann</i>	
Certificate Revocation Guard (CRG): An Efficient Mechanism for Checking Certificate Revocation	527
<i>Qinwen Hu, Muhammad Rizwan Asghar, and Nevil Brownlee</i>	
How Can I Trust an X.509 Certificate? An Analysis of the Existing Trust Approaches	531
<i>A.S. Wazan, R. Laborde, D.W. Chadwick, F. Barrere, and A. Benzekri</i>	
Recharge-as-Reward Mechanism to Incentivize Cooperative Nodes in Mobile Ad Hoc Networks	535
<i>Normalia Samian, Winston K.G. Seah, Zuriati Ahmad Zukarnain, Azizol Abdullah, and Zurina Mohd Hanapi</i>	
Improving Reliable Transmission Throughput with Systematic Random Code	539
<i>Zan-Kai Chong, Hiroyuki Ohsaki, Bryan Ng, Bok-Min Goi, Hong-Tat Ewe, and Sin-Ran Chong</i>	
Improving Network Monitoring through Aggregation of HTTP/1.1 Dialogs in IPFIX	543
<i>Felix Erlacher, Wolfgang Estgfaeller, and Falko Dressler</i>	
Rapid Deployment Indoor Localization without Prior Human Participation	547
<i>Han Xu, Zimu Zhou, and Longfei Shangguan</i>	
Key Factors in Industrial Control System Security	551
<i>Jonathan P. Chapman, Simon Ofner, and Piotr Pauksztelo</i>	
Identifying User Actions from HTTP(S) Traffic	555
<i>Georgios Rizothanasis, Niklas Carlsson, and Aniket Mahanti</i>	
Efficient Learning of Communication Profiles from IP Flow Records	559
<i>Christian Hammerschmidt, Samuel Marchal, Radu State, Gaetano Pellegrino, and Sicco Verwer</i>	
Authentication and Trust in Service-Centric Networking	563
<i>Imad Aad, Torsten Braun, and Dima Mansour</i>	
Toward Coexistence of Different Congestion Control Mechanisms	567
<i>Mario Hock, Roland Bless, and Martina Zitterbart</i>	
Incremental Switch Deployment for Hybrid Software-Defined Networks	571
<i>Xuya Jia, Yong Jiang, and Zehua Guo</i>	

Reducing and Balancing Flow Table Entries in Software-Defined Networks	575
<i>Xuya Jia, Yong Jiang, Zehua Guo, and Zhenwei Wu</i>	
Monitoring Multi-Hop Multi-Channel Wireless Networks: Online Sniffer Channel Assignment	579
<i>Jing Xu, Wei Liu, and Kai Zeng</i>	
Fragmentation-Based Multipath Routing for Attack Resilience in Software Defined Networks	583
<i>Purnima Murali Mohan, Teng Joon Lim, and Mohan Gurusamy</i>	
Self-Adaptive End-Point Mutation Technique Based on Adversary Strategy Awareness	587
<i>Yong Zhao, Cheng Lei, Yingjie Yang, Hongqi Zhang, Tong Yang, Zongyi Zhao, and Xiaomei Sun</i>	
Instantaneous Proxy-Based Key Update for CP-ABE	591
<i>Lyes Touati and Yacine Challal</i>	
High-Speed Network Traffic Analysis: Detecting VoIP Calls in Secure Big Data Streaming	595
<i>Mazhar Rathore, Anand Paul, Awais Ahmad, Muhammad Imran, and Mohsen Guizani</i>	
TAS-IoT: Trust-Based Adaptive Security in the IoT	599
<i>Hamed Hellaoui, Abdelmadjid Bouabdallah, and Mouloud Koudil</i>	
Air-Interface Slice Based Dynamic Resource Reservation for Ultra-Low-Latency IoT Transmissions	603
<i>Guolin Sun, Guohui Wang, and Guisong Liu</i>	
Anonymization Techniques for Preserving Data Quality in Participatory Sensing	607
<i>Tishna Sabrina, Manzur Murshed, and Anindya Iqbal</i>	
Model-Based Survivability Analysis of a Virtualized System	611
<i>Xiaolin Chang, Zhenjiang Zhang, Xiaodan Li, and Kishor S. Trivedi</i>	
Resource Allocation for Delay Sensitive Applications in Mobile Cloud Computing	615
<i>Omar Chakroun and Soumaya Cherkaoui</i>	
Toward Smart Moving Target Defense for Linux Container Resiliency	619
<i>Mohamed Azab, Bassem Mokhtar, Amr S. Abed, and Mohamed Eltoweissy</i>	
Addressing Network Interoperability in Hybrid IEEE 802.11s/LTE Smart Grid Communications	623
<i>Nico Saputro, Kemal Akkaya, and Samet Tonyali</i>	
Mitigating Crossfire Attacks Using SDN-Based Moving Target Defense	627
<i>Abdullah Aydeger, Nico Saputro, Kemal Akkaya, and Mohammed Rahman</i>	
PSCAN: A Port Scanning Network Covert Channel	631
<i>Emad Eldin Mohamed, Adel Ben Mnaouer, and Ezedin Barka</i>	
ANOTEL: Cellular Networks with Location Privacy	635
<i>Tim Dittler, Florian Tschorisch, Stefan Dietzel, and Björn Scheuermann</i>	

Wavelet-Based Analysis of Interference in WSNs	639
--	-----

Aikaterini Vlachaki, Ioannis Nikolaidis, and Janelle Harms

CodePLC: A Network Coding MAC Protocol for Power Line Communication	643
---	-----

*L.M.F. Silveira, Roberto M. Oliveira, Moises V. Ribeiro, Luiz F.M. Vieira,
Marcos A.M. Vieira, and Alex B. Vieira*

Distributing Distributed Revision Control Systems	647
---	-----

Philipp Hagemeister and Martin Mauve

User Demand Aware Soft-Association Control in Ultra-Dense Small Cell Networks	651
---	-----

Guolin Sun, Hangming Zhang, and Guisong Liu

5A: Vehicular Networks

Performance Evaluation of Concurrent IEEE 802.11 Systems in the Automotive Domain	655
---	-----

Alaa Mourad, Franz Heigl, and Peter Adam Hoeher

Optimal Gateway Placement and Reliable Internet Access in Urban Vehicular Environments	662
--	-----

Wiem Benrhaiem, Abdelhakim Hafid, and Pratap Kumar Sahu

Towards Real-Time and Temporal Information Services in Vehicular Networks via Multi-Objective Optimization	671
--	-----

*Penglin Dai, Kai Liu, Liang Feng, Qingfeng Zhuge, Victor Chung Sing Lee,
and Sang Hyuk Son*

B. A. T. M. A. N. Handover Extension for Routing Nodes in Infrastructure WMNs	680
---	-----

Patrick Herrmann and Ulrike Meyer

5B: Performance Evaluation

Achieving Stable iBGP with Only One Add-Path	688
--	-----

Xiaomei Sun, Qi Li, Mingwei Xu, and Yuan Yang

BAH: A Bitmap Index Compression Algorithm for Fast Data Retrieval	697
---	-----

Chenxing Li, Zhen Chen, Wenxun Zheng, Yinjun Wu, and Junwei Cao

A Comparison of TCP Congestion Control Algorithms in 10G Networks	706
---	-----

*Thomas Lukaseder, Leonard Bradatsch, Benjamin Erb, Rens W. Van Der Heijden,
and Frank Kargl*

5C: Network Coding

Adding a Network Coding Extension to CoAP for Large Resource Transfer	715
---	-----

Bertram Schütz and Nils Aschenbruck

Best of Both Worlds: Prioritizing Network Coding without Increased Space Complexity	723
---	-----

Roman Naumann, Stefan Dietzel, and Björn Scheuermann

Rate-Adaptive Link Quality Estimation for Coded Packet Networks	732
<i>Maurice Leclaire, Stephan M. Günther, Marten Lienen, Maximilian Riemensberger, and Georg Carle</i>	
Author Index	741