SPICE
SPACE INTERNETWORKING CENTER

SPICE update

A tri-annual newsletter

September 2012

Volume 3 Issue 2

SPICE Project Coordinator

Prof. Vassilis Tsaoussidis

e-mail: vtsaousi@ee.duth.gr

In this issue

CAPACITIES

Funded by the European Union Seventh Framework Programme [FP7/2007-2013] under Grant Agreement no 264226 [Project Title: Space Internetworking Center – SPICE]. The project is approved as a "Coordination and Support Action" under the "Research Potential" scheme (Grant Agreement Number 264226).

SPICE progress per Work Package

The project is conducted in four separate work packages.

Work Package 1:

Project Management

As part of the project management procedures, the second External Advisory Board (EAB) meeting took place on June 8th, 2012. The members of the EAB were informed on the progress of SPICE project and discussed the evolution and viability of the Space Internetworking Center. More details on this event are provided later on this newsletter.

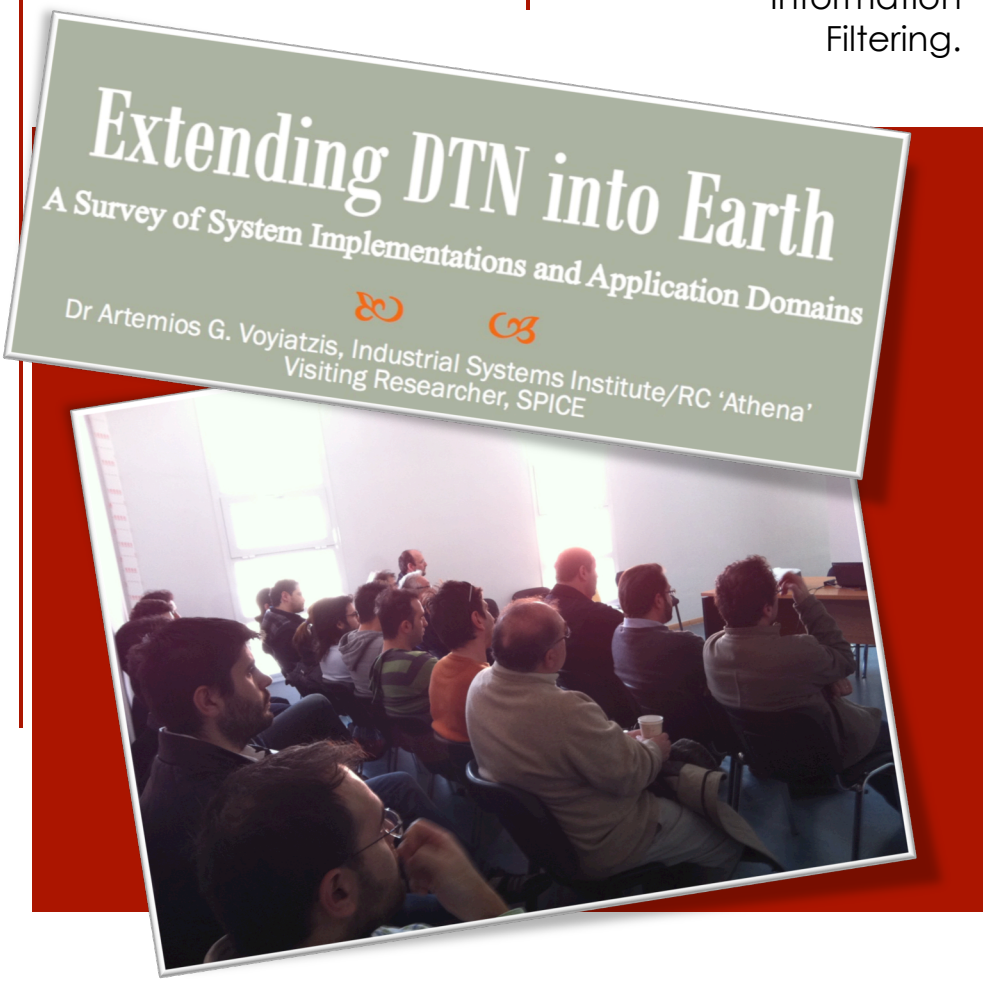
Work Package 2:

Exchange of know-how and recruitment of researchers and administrative staff

On May 8th 2012, a presentation on "*Extending DTN into Earth: A Survey of System Implementations and Application Domains*" was given at the premises of SPICE by visiting researcher **Dr Artemios G. Voyatzis.**

On June 6th 2012, **Carlos Anastasiades,** researcher at University of Bern, Switzerland, joined SPICE as a visiting researcher for the time period of two weeks. His research interests lie in the area of content-centric networking (CCN), content-delivery and routing in mobile environments, caching and delay- tolerant opportunistic networks. During his visit, Mr Anastasiades brainstormed with SPICE researchers on several ways to interconnect DTN and CCN.

On June 11th, 2012, **Dr Nikolaos Nanas,** researcher at the Center for Research and Technology, Thessaly, gave a presentation on NOOWIT and NOOTROPIA. NOOWIT is an online magazine that adapts to a user's personal interests, the social trends and even to the browser's window. It is the result of more than ten years of research and development in the domain of Information Filtering.



NOOWIT is based on NOOTROPIA, a biologically-inspired model that can represent a user's (or a group's) multiple interests, continuously adapt to changes in them over time and evaluate any type of information accordingly.

Moreover, as part of the Distinguished Speaker Series, **Dr George Iosifidis,** researcher at the Department of Computer and Communications Engineering, University of Thessaly, Volos, Greece, gave a presentation on storage capacity control policies for dynamic networks.

For details see:

http://www.spice-center.org/distinguished-speaker-series/

Work Package 3:

Infrastructure update and state-of-the-art DTN testbed

The highlight of the activities conducted as part of WP3 is the release of a **DTN Agent for NS-2 simulator**. The model was developed in order to study the deployment of DTN on top of traditional, Internet-based networks and can be useful in experimenting with issues such as storage space management, custody acceptance and rejection reporting, routing strategies, retransmission timeouts, and bundle fragmentation. For more details on the DTN Agent for NS-2 refer to:

http://www.spice-center.org/dtn-agent/

Work Package 4:

Exploitation and dissemination

This Work Package (WP4) includes all dissemination activities of the project. During these past months, SPICE has:

- published research papers in a variety of conferences and journals;
- published a **Journal Special Issue on Future Internet Architectures** at the *Journal of Internet Engineering* (www.jie-online.org);
- organized a "*Disruption- and Delay- Tolerant Networks (DTNs)*" workshop between June 7th-8th, 2012, on the island of Santorini, Greece. More information on the workshop are provided later on this newsletter.

2nd External Advisory Board meeting

The 2nd External Advisory Board meeting for SPICE project took place at the consultation room of Petros M. Nomikos conference center on the island of Santorini, Greece, on June 8th, 2012.

Project coordinator Prof. Tsaoussidis was the moderator of the meeting and SPICE staff member Ioannis Komnios was responsible for the presentation of the latest SPICE achievements, as well as future plans. In particular, the presentation focused on:

o *SPICE human resources;*

o *SPICE research achievements;*

o *SPICE facilities and infrastructure;*

o *DTN testbed;*

o *Publications;*

o *Distinguished Speaker Series;*

o *Workshop on Disruption- and Delay- Tolerant Networks and*

o *Journal Special Issues and newsletters.*

Fig. 1

SPICE project Work Package breakdown

Delay- and Disruption- Tolerant Networks (DTNs) workshop

Santorini Island, Greece, June 7th-8th, 2012

Space Internetworking Center (SPICE) organized a two-day event on the research area of Delay- and Disruption- Tolerant Networks (DTNs) between June 7th-8th, 2012 on the Island of Santorini, Greece. The workshop was part of the 10th International Conference on Wired/Wireless Internet Communications (WWIC 2012) conference.

The workshop consisted of a wide range of events, from keynote speeches to panel discussions. In particular, the kick-off event of the workshop was a keynote speech from **Prof. Joerg Ott**, Professor of Networking Technology in Aalto University Finland, entitled "*Delay-Tolerant Networking: Is it made for humans?*". The presentation provided a critical perspective on the applicability of Delay Tolerant Networking technology in real-world environments.

A panel discussion on "*Delay– and Disruption- Tolerant Networks (DTNs): Challenges, Limitations and Application Scenarios*" followed. The panel consisted of recognized researchers in the field of networking and space communications. In particular, the panel consisted of:

- **Scott Burleigh**, senior researcher at Jet Propulsion Laboratory, NASA, USA;
- **Eiko Yoneki**, senior researcher in the Computer Laboratory at the University of Cambridge, United Kingdom;
- **Torsten Braun**, Professor in the Communication and Distributed Systems Lab at the University of Bern, Switzerland;
- **Joerg Ott,** Professor for Networking Technology at Aalto University, Helsinki, Finland and
- **Eli Katsiri,** senior researcher at Space Internetworking Center, Xanthi, Greece.

Moderator of the panel discussion was **Prof. Vassilis Tsaoussidis**, director of the Space Internetworking Center. These events were also broadcasted *live* over the Internet to all interested parties.

Fig. 2 Prof. Joerg Ott during his keynote presentation

Delay- and Disruption- Tolerant Networks (DTNs) workshop

Santorini Island, Greece, June 7th-8th, 2012

Fig. 3 Panel session on "*Delay- and Disruption- Tolerant Networks (DTNs): Challenges, Limitations and Application Scenarios*"

The topic of the panel was broad in an attempt to address the issue of combining different networking perspectives, such as Content Centric Networking, Cloud Computing, Delay-Tolerant Networking and space communications, in order to produce a unified communications solution that could both benefit the general public in terms of communication cost, service availability and efficiency, and exploit new market opportunities in telecommunications.

The first day of the workshop concluded with a discussion on "*Future of DTN and Related Projects*". During this discussion, participants of the workshop were given the opportunity to discuss novel research ideas on DTN, ongoing projects and future plans.

The second day of the workshop consisted of an invited session on "*Delay- and Disruption- Tolerant Networks (DTNs): Scenarios, Applications and Protocols*" and a technical session on "*Delay-Tolerant and Opportunistic Networks*". Both sessions included presentations of research papers on the field. The authors of the papers presented the latest research findings in the area of DTN and Opportunistic Networks, including also ongoing work.

The workshop attracted the research interest of high-profile researchers across the whole spectrum of communication technologies and participation of the audience in all events was particularly vivid.

Cirrus: A Pervasive, Delay-Tolerant Cloud

by Dr Eli Katsiri

Cirrus is a novel concept of a generalized cloud computing framework, for creating and deploying real-time, stream processing applications, on demand. Cirrus has the following aims:

(i) to abide by the NIST Cloud Definition;
(ii) to provide *dependable* cloud services for stream processing in network-challenged environments;
(iii) to allow for the elastic use of Cirrus cloud services by sensor, ad-hoc and nomadic networks;
(iv) to allow for the elastic incorporation of nomadic and severely resource-constrained devices, in Cirrus instances and
(v) to provide performance optimizations in terms of response time.

The above aims can be reached by accomplishing the following specific objectives: (a) automatic provisioning of a virtual machine, and related cloud services, (b) support of three, disruptive, cloud deployment models on which the above services can be deployed, including one comprising only ad-hoc infrastructure, (c) dynamic discovery of compatible data stream sources, (d) dynamic setup of dependable, distributed processing sessions between the deployed app and the data sources by means of the DTN protocol stack (e) optimizations of the above sessions.

As an illustrative example of Cirrus consider an emergent disaster where scientists/rescue teams need to react quickly in order to assess the danger and decide on the best rescue strategy. Cirrus offers the automatic provisioning of a "virtual datacenter", hosted on the cloud. It also provisions high-level programmable tools for setting up store-and-forward sessions connecting the data sources to the data subscriber, via near-optimal available paths.

The proposed framework is envisaged to operate as part of critical infrastructures (CI). CIs relate to infrastructures that, when affected, may have a significant social impact. Although a typical CI would be found in a Common Utilities environment, the pervasiveness of internetworking technologies and the societal dependability upon these modern ICTs, introduce criticality in many contexts. As such, research into the dependability and therefore security aspects of the proposed framework can have highly significant impact. Cirrus promotes the correlation of heterogeneous data from a much larger number of sources, (human, vehicles, bicycles, sensor networks) in variable conditions (terrestrial, under-water, in space), thus increasing the quality (accuracy, performance, reliability) of processing performed.

Cirrus: A Pervasive, Delay-Tolerant Cloud

by Dr Eli Katsiri

Cirrus also promotes the provisioning of business applications such as commodity exchange in a fair trade manner, by linking producers in challenged environments directly with consumers through near-optimal paths. Social applications are also supported, such as content sharing and content distribution. A specific type of such applications is crowd sourcing, where the data originates from mobile sensors carried by a distributed group of people. Pervasive Social Networking (PSN) is a new vision that aims to complement virtual interactions with physical ones, by enabling users who are both socially and physically related to find each other, share content and perform activities of common interest.

The Space Internetworking Center will benefit from Cirrus, a research infrastructure where it will be possible to test and evaluate end-to-end pervasive computing scenarios on demand, and thus prepare research papers and related proposals e.g., on smart cities.

The novelty in Cirrus is multi-fold and lies in (a) separating concerns between the Cirrus cloud services and the supported deployment models, (b) modeling Cirrus cloud services according to successful state-of-the-art distributed systems models, such as publish/subscribe, mathematical aggregation and map-reduce, (c) developing novel cloud deployment models that incorporate not only fixed infrastructure but also mobile, ad-hoc and sensor network nodes (in the case of the private cloud without any support from fixed nodes) on which service models can be deployed and (d) integrating the Delay Tolerant Networking, programming paradigm in the Cirrus Services middleware in order to increase the dependability of the offered cloud service model.

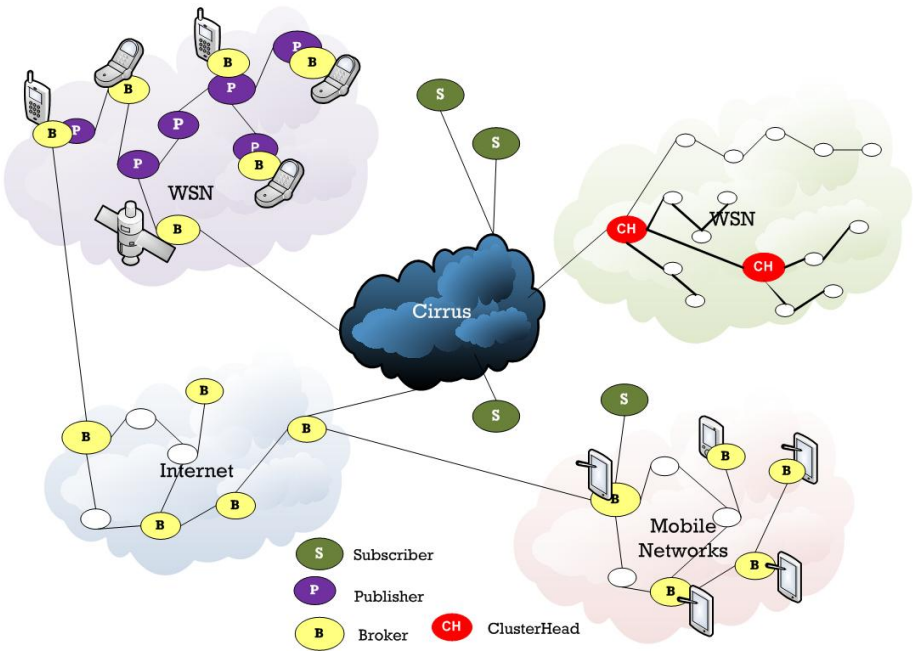


Fig. 4 Cirrus Public/Mobile Cloud Deployment Modes: Elastic use of fixed cloud services by ad-hoc services

SPICE
SPACE INTERNETWORKING CENTER

List of publications

- G. Papastergiou, C. V. Samaras and V. Tsaoussidis, **"Where Does Transport Layer Fit into Space DTN Architecture?"**, 5th Advance Satellite Multimedia Systems Conference and 11th Signal Processing for Space Communications Workshop, ASMS-SPSC 2010, 13-15 September 2010, Cagliari, Italy

- N. Bezirgiannidis and V. Tsaoussidis, **"Packet size and DTN transport service: Evaluation on a DTN Testbed"**, International Congress on Ultra Modern Telecommunications and Control Systems 2010, Moscow, October 2010

- A. Arampatzis, P. Efraimidis and G. Drosatos, "**Enhancing Deniability against Query-Logs**", The 33rd European Conference on Infromation Retrieval, ECIR 2011, LNCS 6611, pp.117-128, Dublin, Ireland, 2011

- S. Lenas, S. Dimitriou, T. Tsapeli and V. Tsaoussidis, "**Queue-Management Architecture for Delay Tolerant Networking**", WWIC 2011, Vilanova i la Geltrú, Barcelona, Spain, on June 15-17, 2011

- D. Vardalis and V. Tsaoussidis, "**Energy-efficient Internetworking with DTN**", WWIC 2011, Vilanova i la Geltrú, Barcelona, Spain, on June 15-17, 2011

- E. Koutsogiannis, L. Mamatas and I. Psaras, **"Storage-enabled Access Points for Improved Mobile Performance: An evaluation study",** WWIC 2011, Vilanova i la Geltrú, Barcelona, Spain, on June 15-17, 2011

- T. Spyridopoulos and V. Katos, **"Towards a forensically ready cloud storage service"**, 6th International Annual Workshop on Digital Forensics and Incident Analysis (WDFIA 2011), London, UK, July 7-8 2011

- R.-A. Koutsiamanis and P. S. Efraimidis, **"A heaviest hitters limiting mechanism with O(1) time complexity for sliding-window data streams"**, 2011 FTRA World Conference (FTRA WCC 2011), Jeju, Korea, December 12-15, 2011

SPICE
SPACE INTERNETWORKING CENTER

List of publications

- L. Mamatas, A. Papadopoulou and V. Tsaoussidis, **"Semi Markov modeling for User Mobility in Urban Areas"**, 2nd Stochastic Modeling Techniques and Data Analysis International Conference (SMTDA 2012), Chania, Greece, June 5-8, 2012

- G. Papastergiou, N. Bezirgiannidis and V. Tsaoussidis, **"On the Performance of Erasure Coding over Space DTNs"**, 10th International Conference on Wired/Wireless Internet Communications (WWIC 2012), Santorini, Greece, June 6-8, 2012.

- F. Tsapeli and V. Tsaoussidis, **"Routing for Opportunistic Networks Based on Probabilistic Erasure Coding"**, 10th International Conference on Wired/Wireless Internet Communications (WWIC 2012), Santorini, Greece, June 6-8, 2012.

- D. Vardalis and V. Tsaoussidis, **"Achieving energy-efficienct with DTN: A Proof-of-concept and roadmap study"**, 10th International Conference on Wired/Wireless Internet Communications (WWIC 2012), Santorini, Greece, June 6-8, 2012.

- S.-A. Lenas, S. C. Burleigh and V. Tsaoussidis**, "Reliable Data Streaming over Delay Tolerant Networks",** 10th International Conference on Wired/Wireless Internet Communications (WWIC 2012), Santorini, Greece, June 6-8, 2012.

- E. Katsiri, **"Cirrus: A Disruption-Tolerant Cloud"**, 10th International Conference on Wired/Wireless Internet Communications (WWIC 2012), Santorini, Greece, June 6-8, 2012.

- G. Drosatos, P. S. Efraimidis, I. N. Athanasiadis, E. D'Hondt and M. Stevens**, "A Privacy-Preserving Cloud Computing System for Creating Participatory Noise Maps."**, In proceedings of the 36th Annual IEEE Computer Software and Applications Conference (COMPSAC 2012), July 16-20, 2012

Complete list of publications can be found at SPICE website.

SPICE
SPACE INTERNETWORKING CENTER

Upcoming Events

SPICE staff member Sotiris Diamantopoulos

research visit to ESA/ESOC, Darmstadt, Germany

SPICE staff member Fani Tsapeli
research visit to IMDEA Networks, Madrid, Spain

Prof. Tsaoussidis keynote speaker at the
16th Panhellenic Conference on Informatics (PCI 2012)
October 5, 2012

CCSDS Fall 2012 meeting series
Cleveland, Ohio, USA
October 15-18, 2012

EC Space Conference
"Let's embrace Space"
November 15-16, 2012

More information available at SPICE website:

www.spice-center.org

Space Internetworking Center

Newsletter Editor

Ioannis Komnios

Newsletter Advisor

Prof. Vassilis Tsaoussidis

SPICE UPDATE is published three times per year by the Space Internetworking Center to inform its members and friends of activities and new developments in the Center. For additional copies, call the SPICE office at 0030.25410.79.554

Democritus University of Thrace

School of Engineering

Panepistimioupoli Xanthis

Kimmeria

Building A

67100

Xanthi, GREECE

Professor Vassilis Tsaoussidis

Telephone/Fax: 0030.25410.79.554

E-mail: contact@spice-center.org

www.spice-center.org

SPICE update is edited and produced by Space Internetworking Center (SPICE), Greece. SPICE project is sponsored by the European Commission. SPICE UPDATE reflects only the authors' views and the European Union is not liable for any use that may be made of the information contained.