

**Proposal for NetSoft Tutorial**  
***End-to-End Orchestration on Multi-tier Clouds based on  
Software-Defined Infrastructure***

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This one-day tutorial will present the design and implementation of the SAVI<sup>1</sup> application platform, a testbed implementing a converged Software-Defined Infrastructure to support experimentation in future applications and networks. The testbed has been in operation for three years so the tutorial will cover: architectural design principles, implementation of the SAVI testbed, operational experience, and multiple demonstrations of testbed capabilities, example projects and applications.

OUTLINE:

1. Vision of Applications and Content Marketplace
2. End-to-End Applications on Multitier Clouds: Core, Smart Edge, CPE.
3. Janus Manager for Integrated Management of Heterogeneous Resources
  - a. OpenStack, OpenFlow, and other Resource Controllers
4. Design of SAVI Node
  - a. Computing, Networking, FPGAs, GPUs, SDR
5. SAVI National Testbed
  - a. Core Services: Identity and Access Management
  - b. Platform-wide orchestration
6. Networking Services in SAVI
  - a. Proactive Path Setup and Flow Store
  - b. VINO tunneling and operation over legacy networks
7. Orchestration Services in SAVI
  - a. Service Chaining
  - b. End-to-End Orchestration
8. Federation with GENI
  - a. Bilateral access
  - b. Experiments over joint SAVI-GENI resources
9. Measurement, Monitoring and Analytics
  - a. Multilayer Measurements
  - b. Graph Modeling and Analytics
10. The virtual Customer Premise Edge and IOT
  - a. Virtualization at the CPE and IOT
  - b. End-to-End orchestration across three-tier cloud
11. Applications, Examples, and Demos on SAVI

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<sup>1</sup> SAVI stands for “Smart Applications on Virtual Infrastructures” and is the name of an NSERC Strategic Research Network in Canada.

**Dr. Hadi Bannazadeh**  
**SAVI Chief Testbed Architect,**  
**University of Toronto**

Hadi Bannazadeh received his PhD in 2010 from the University of Toronto's Department of Electrical & Computer Engineering. After graduating, he worked at Cisco Systems as a Senior Network Software Engineer. In 2011, he returned to the University of Toronto to lead the efforts towards the creation of Canadian national testbed as part of the Smart Applications on Virtual Infrastructure (SAVI) research project. Since then, he has been the Chief Testbed Architect for the SAVI project. Hadi's main research interest is in the field of Software Defined Infrastructure (SDI) including Software Defined Networking (SDN) and Cloud Computing.

Prior to beginning the University of Toronto's PhD program, Hadi was first employed as a Software Engineer and then as a Software Architect for Iran Telecomm Research Center and Iran Communications Industries Inc. where he contributed to the design and development of a large scale telecomm switching system. Dr. Bannazadeh received his MSc and BSc from Amir Kabir University of Technology (Tehran Polytechnic), Tehran, Iran in 2001 and 1998 respectively.

**Byungchul Park**  
**Postdoctoral Fellow, SAVI and University of Toronto**

Byungchul Park a postdoctoral fellow in Electrical and Computer Engineering at the University of Toronto. Prior to University of Toronto, he was a postdoctoral researcher at Sophia Antipolis-Méditerranée. He received his B.S. (2006) and Ph.D. (2012) in Computer Science and Engineering from POSTECH, Korea. His research interests include Software Defined Infrastructure (SDI), Software Defined Networking (SDN), Cloud Computing and traffic monitoring and analysis.

**Alberto Leon-Garcia**  
**Distinguished Professor, University of Toronto**  
**Scientific Director, NSERC Strategic Network on Smart Applications on Virtual Infrastructures**

Professor Alberto Leon-Garcia is Distinguished Professor in Electrical and Computer Engineering at the University of Toronto. He is a Fellow of the Institute of Electronics and Electrical Engineering "For contributions to multiplexing and switching of integrated services traffic". He is also a Fellow of the Engineering Institute of Canada and the American Association for the Advancement of Science. He has received the 2006 Thomas Eadie Medal from the Royal Society of Canada and the 2010 IEEE Canada A. G. L. McNaughton Gold Medal for his contributions to the area of communications. Professor Leon-Garcia is author of the textbooks: Probability and Random Processes for Electrical Engineering, and Communication Networks: Fundamental Concepts and Key Architecture. He is currently Scientific Director of the NSERC Strategic Network for Smart Applications on Virtual Infrastructures. He also leads the ORF project on Connected Vehicles and Smart Transportation. He was founder and CTO of AcceLight Networks in Ottawa, Canada.