

GSAW 2014 Tutorial D:

Cloud Computing for Satellite Ground Systems

Length: Half day

Overview:

This tutorial will build on material developed for GSAW 2013. We will provide a range of material that will introduce participants to the basic concepts of cloud computing, and then proceed to specific technical areas within the cloud computing arena that includes developments over the last year. We will follow this basic structure of 30-45 minute segments, with time reserved at the end for open-floor discussion:

(1) Basic Cloud Concepts/A Cloud Reference Model and Roadmap, Dr. Craig A. Lee.

Basic cloud concepts based on the NIST Definition of Cloud Computing will be presented. These concepts will be put into a reference model for cloud-based, satellite ground systems, with a roadmap sketched out from an initial capability to a target architecture. This will include new topics including concepts for cloud Service Level Agreements to manage cloud performance, and Virtual Organizations for cloud federation and management of distributed resource access.

(2) OpenStack and the DODCS project, Dr. Steve Crago.

OpenStack is an open source cloud software stack being developed under the guidance of the OpenStack Foundation. As an open source project with literally hundreds of contributors across academia and industry, OpenStack is non-proprietary. The Dynamic, On-Demand Computing Systems (DODCS) is incorporating support for GPUs into the OpenStack code base.

(3) Cloud Benchmarks and the Cloud Tester Project, Dr. Douglas Enright.

Benchmarking cloud performance is a critical part of evaluating cloud benefits. This talk discusses how virtualization and on-demand provisioning can affect performance. The Cloud Tester Benchmarking Suite is then described for quantitatively assessing various aspects of cloud performance.

(4) Cloud Nuts and Bolts, Dr. Nehal Desai.

The tutorial attendees will be walked through specific examples of how Amazon Web Services (cloud) are used. This will include how to use EC2 (Elastic Cloud Computing) to select a virtual machine type, how to instantiate that VM, how to log-in and use the VM. The use of the AWS on-demand storage service, S3, will be demonstrated. Other examples could include use of the Elastic Block Storage, CloudFront, and AWS regions.

(5) Open Discussion/Future Directions

We will conclude with a half-hour of open floor discussion on cloud technology and adoption issues in satellite ground systems.

Instructors: Craig Lee, Douglas Enright, Nehal Desai, The Aerospace Corporation; Stephen Crago, University of Southern California / Information Sciences Institute East

Biographies:

Dr. Craig A. Lee is a Senior Scientist in the Computer Systems Research Department of The Aerospace Corporation. He has worked in high-performance parallel and distributed computing for the last thirty years. This work has led to Dr. Lee's involvement in the Open Grid Forum (OGF) where he served as President from 2007 to 2010. Dr. Lee served as the main liaison between OGF and the DMTF, SNIA, TMF, the Open Cloud Consortium, Cloud Security Alliance, OMG, and OASIS. Dr. Lee is now on the OGF Board of Directors and heavily involved with NIST, having contributed significantly to the NIST Cloud Standards Roadmap and supporting the NIST Cloud Technology Roadmap. He has served on the program

committee for many conferences and workshops, and has served as a panelist for the NSF, NASA, DOE, and as an international evaluator for INRIA. He is an associate editor of Future Generation Computing Systems (Elsevier) and on the editorial board of the International Journal of Cloud Computing (Inderscience). Dr. Lee has published over 70 technical works, including four book chapters and seven edited volumes and issues.

Dr. Stephen Crago is a Senior Project Leader at USC/ISI East with interests in computer architecture, multiprocessors, novel computing architectures, embedded processing, performance analysis and optimization, including processing time, throughput, efficiency and scalability challenges.

Dr. Douglas Enright is a Senior Engineering Specialist in the Computer Systems Research Department of The Aerospace Corporation.

Dr. Nehal Desai is a Senior Engineering Specialist in the Computer Systems Research Department of The Aerospace Corporation.

Description of Intended Students and Prerequisites:

As a new tutorial in a rapidly developing technical area, we are not assuming any specific knowledge of cloud computing. We will present some basic material to hopefully orient the attendees, and then proceed to more detailed material. Based on the outcome, we will be able to better gauge how much interest there is in this topic, and what level(s) of material are needed.

What can Attendees Expect to Learn:

The participants should understand the basic concepts and motivations for cloud computing, and how they can be deployed to advantage in a satellite ground system. They should also understand the outstanding technical and adoption issues that must be resolved in order to realize the expected benefits of cloud computing.