On the SAVI Testbed for Software Defined Infrastructure

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Agenda

- Smart Applications on Virtual Infrastructure
- SAVI Testbed
  - Infrastructure Status
- SAVI TB Control and Management
  - SAVI Converged Cluster
- Software Defined Infrastructure
  - Janus and Whale services
- Conclusion
What is SAVI?

- Smart Applications on Virtual Infrastructures
- An NSERC Strategic Research Network
- Research and Testbed on Application Platforms
- 9 Universities
- 15 Researchers & 50 graduate / postgraduate students
- 20 Industry Partners
SAVI Testbed

- Experimental platform for SAVI research themes
- Network of Virtualized Converged Resources Clusters
- Used by SAVI themes to demonstrate
  - Control & Management of Virtual Infrastructure
  - Services and Smart Applications
SAVI Testbed 2.0: Software Defined Infrastructure

- **SAVI** combines cloud computing and software-defined networking under a single management system
- **SAVI TB** provides access to heterogeneous resources
  - Computing blades, storage
  - Networking (cluster, datacenter, WAN)
  - GPUs, programmable hardware (NetFPGAs, BEE boards)
- Experimenters request slices of resources
  - Programmed with new protocols or applications
  - Interconnected to form novel network architectures
SAVI TB Main Entities
SAVI ORION Network

- *In order to experiment with Future Internet protocols, SAVI uses a Layer 2 substrate in its clusters as well as in its backbone*

- 1GE Layer 2 Links Connecting Three Ontario Universities
  - Toronto, York, Waterloo, (Carleton)

- Used for At-Scale experimentations with Future Internet Projects
  - OpenFlow, CCN, etc.
SAVI TB Heterogeneous Resources

- Cloud Computing Resources
  - Virtual Machines
  - Object Storage
  - Volume
  - Networking
    - OpenFlow
- SAVI Resources
  - NetFPGA1 & 2
  - GPU
  - miniBEE/BEE2
  - Low-Power ATOM
SAVI Testbed Infrastructure

- 550+ Cores
- 10+ FPGA Systems
- 6+ GPU Systems
- 50+ TB storage
- 10/1 GE fabrics
  - OpenFlow
- 1GE Dedicated backbone
  - ORION
SAVI Testbed
Control and Management
SAVI Converged Cluster Design

- OpenStack (Nova, Swift, Glance, Quantum, Cinder)
- Network Manager (Ryu/FlowVisor)
- Res. Virtualization (*-drivers)
- Physical Resources
- Physical Resources
- Edge Node Network

Cloud Computing Resources

Other SAVI Resources
SAVI TB 1.0

SAVI Converged Cluster (Core/Edge)

Open Stack
- Nova
- Quantum
- Cinder
- Swift
- Glance-api

Application & Service Provider
- Web Portal (Horizon)
- Identity Manager (Keystone)
- Image Registry (Glance-reg)

SDN Manager
- Openflow Controller (ryu)
- Flowvisor

User Openflow Controller

SAVI Workshop CASCON 2013

Software Defined Infrastructure

- Management and Control of Converged Infrastructure Resources
  - Networking and (Heterogeneous) Computing

- Use of abstract interface for Infrastructure resource control and management
  - Through Specialized Controllers
    - e.g., SDN and Cloud
SDI: High-Level View

EXTERNAL ENTITIES

SDI RESOURCE MANAGEMENT SYSTEM

VIRTUAL RESOURCES

PHYSICAL RESOURCES

CONVERGED HETEROGENEOUS RESOURCES
Specialized Controller

Diagram:
- External Entities
- SDI Manager
- Topology Manager
- SDN Controller
- Cloud Controller
- Cloud Resources
- Network Resources
Introducing Whale and Janus

Smart Edge

Application & Service Provider

WebPortal (Horizon)

Identity Manager (KeyStone)

Image Registry (Glance-reg)

Open Stack

Nova

Quantum

Cinder

Swift

Glance-api

SDI Manager

janus

Openflow Controller (ryu, floodlight)

Flowvisor

Topology DB

OF Protocol

Rest

User Openflow Controller

Edge Node Network

Physical resource

Virtual resource

computing resource

networking resource

manage

OF protocol

Rest

Connected

Virtualized
Janus: Integrated Management Service

- Provides integrated resource management for converged heterogeneous resources by abstraction
- Provides open APIs to control and utilize available resources in SAVITB
- Examples
  - Networking control
  - Resource scheduling
Whale: Graph-based Configuration Service

- Provides a set of graph query APIs to obtain topology of SAVI TB including servers, switches, link, and their statistics information
  - Query network topology including node and link status to maintain an updated network graph
  - Compute graph queries and return results in a form that can be consumed by other modules
Whale and Janus

**Physical Resources**
(servers, network devices, switches, routers, FPGAs, NetFPGAs, …)

**Virtual Resources**
(virtual machines, virtual switches, virtual routers, …)

**Infrastructure**
Managed Resources

**Cloud Controller**
setup virtual resources

**Network Controller**
Control (OpenFlow, SNMP)

**Whale**
Physical network description

**Janus**
Graph queries

**Managed Resources**

**Infrastructure control**

**State of cloud resources**

**State of network resources**

**Graph queries**

**Physical & virtual**
Node properties updates including M&M data

**Physical & virtual**
Network graph updates
Conclusion

- SAVI Testbed: Enables experimentation in new network protocols & applications
- Update on SAVI Testbed
  - SAVITB 2.0
- Introduced Software Defined Infrastructure
- SAVI testbed introduces single control and management system for converged heterogeneous resources
  - Janus
  - Whale
- SAVI Testbed: Developed, Deployed and Operational
Thank You