



GENI-VIOLIN: In-Network Snapshotting for GENI Experiments

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<http://ppadala.net/research/GENI-VIOLIN/>

<http://www.geni.net>

The Network Architecture Group at DOCOMO USA Labs and FRIENDS lab at the Purdue University are designing and implementing “**clean-slate**” network infrastructure and investigating the use of “**network virtualization**” to enhance mobile operator’s core network.

How to Deal with Failures in Current Network/Data
Center Infrastructures?

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How to Deal with Failures in Current Network/Data Center Infrastructures?

Our Solution: In-Network **Live** Snapshotting using Openflow

Key feature: **Fast** recovery of **GENI slices** from failures

What is Snapshotting?

Data Center Node #1



Data Center Node #2



What is Snapshotting?

Data Center Node #1

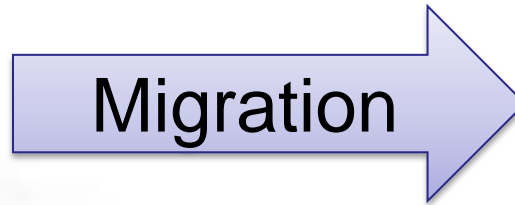


Data Center Node #2



What is Snapshotting?

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What is Snapshotting?

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Reliable Storage

What is Snapshotting?

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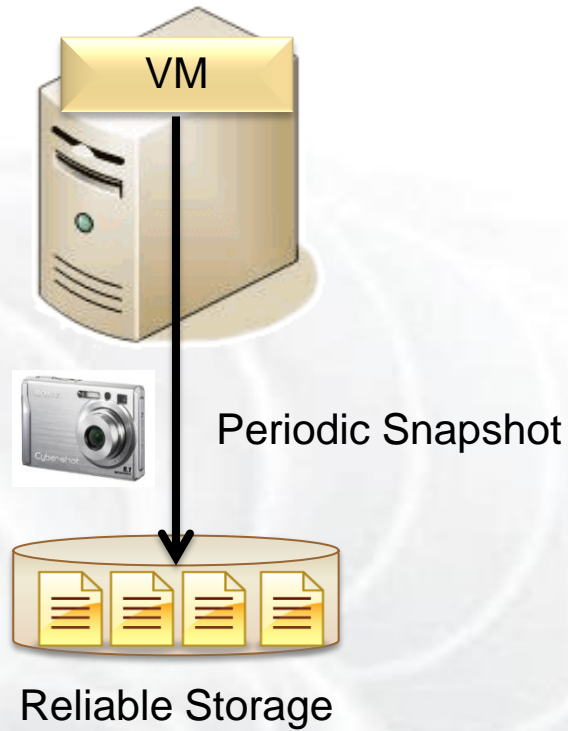


Data Center Node #2



What is Snapshotting?

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What is Snapshotting?

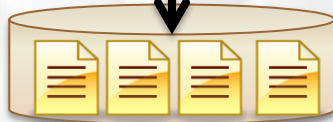
Data Center Node #1



Data Center Node #2



Periodic Snapshot



Reliable Storage

What is Snapshotting?

Data Center Node #1



Periodic Snapshot



Reliable Storage



Data Center Node #2

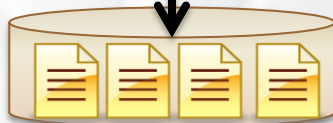


What is Snapshotting?

Data Center Node #1



Periodic Snapshot



Reliable Storage



Data Center Node #2

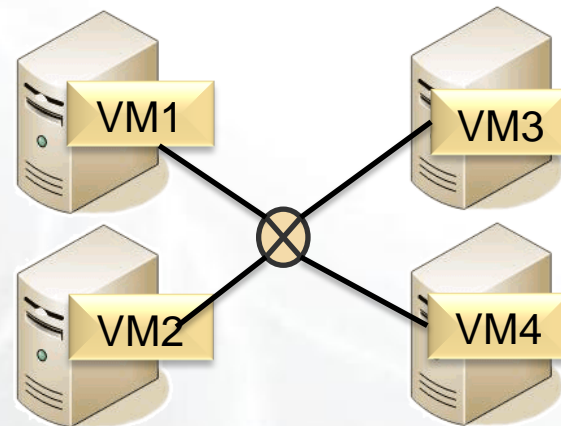


Snapshotting allows recovery from failures

Snapshotting one VM is easy

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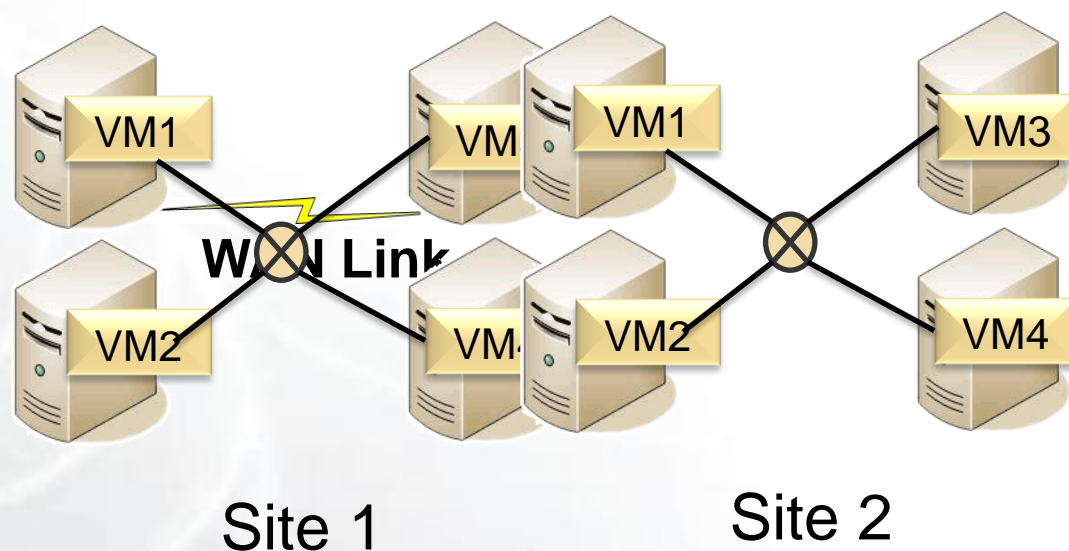
How can we snapshot multiple VMs talking to each other?



Site 1

Snapshotting one VM is easy

How can we snapshot multiple VMs talking to each other?



How can we snapshot slices spanning multiple sites?

GENI-VIOLIN

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Live Snapshotting of Distributed Slices

GENI-VIOLIN Key Challenges



1. How to implement **live** snapshotting algorithm?
 - Mattern's distributed snapshot algorithm
 - No interruption to application
 - Purdue University's VNSnap that leverages Xen
2. How to implement **in-network** snapshotting?
 - Minimal modifications to end-host
 - Middle boxes to store snapshots
 - Openflow controller coordinates distributed snapshot

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Openflow is a key enabler for GENI-VIOLIN

Today's demonstration

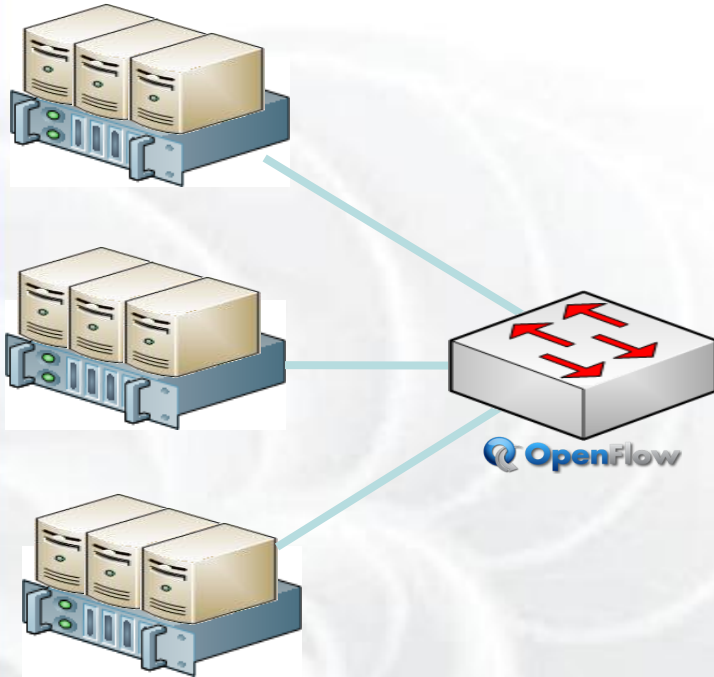


ProtoGENI Utah



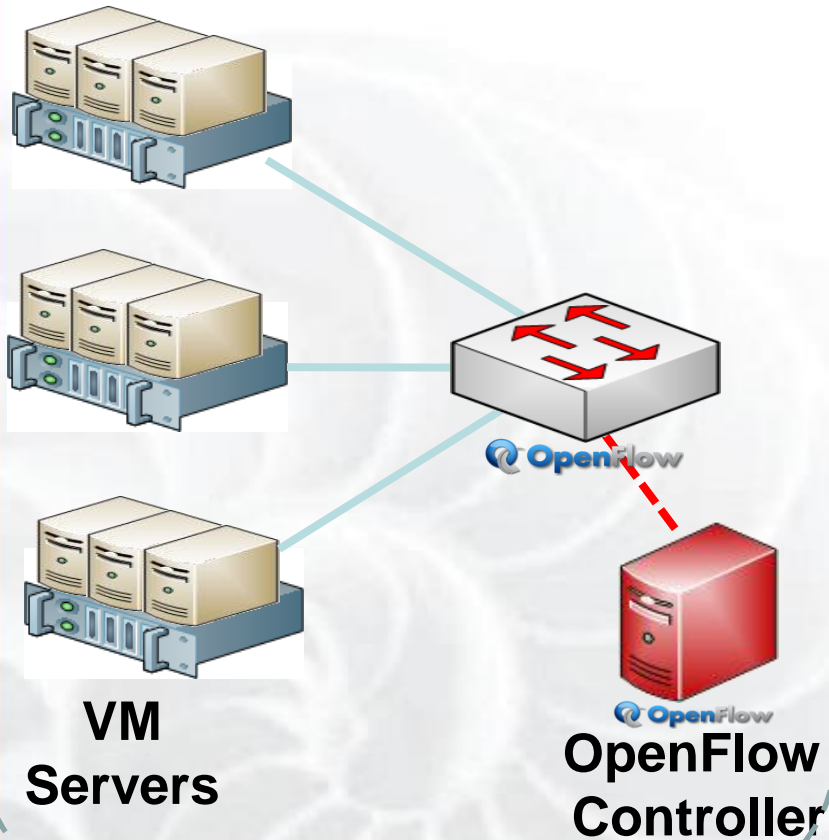
**VM
Servers**

ProtoGENI Utah

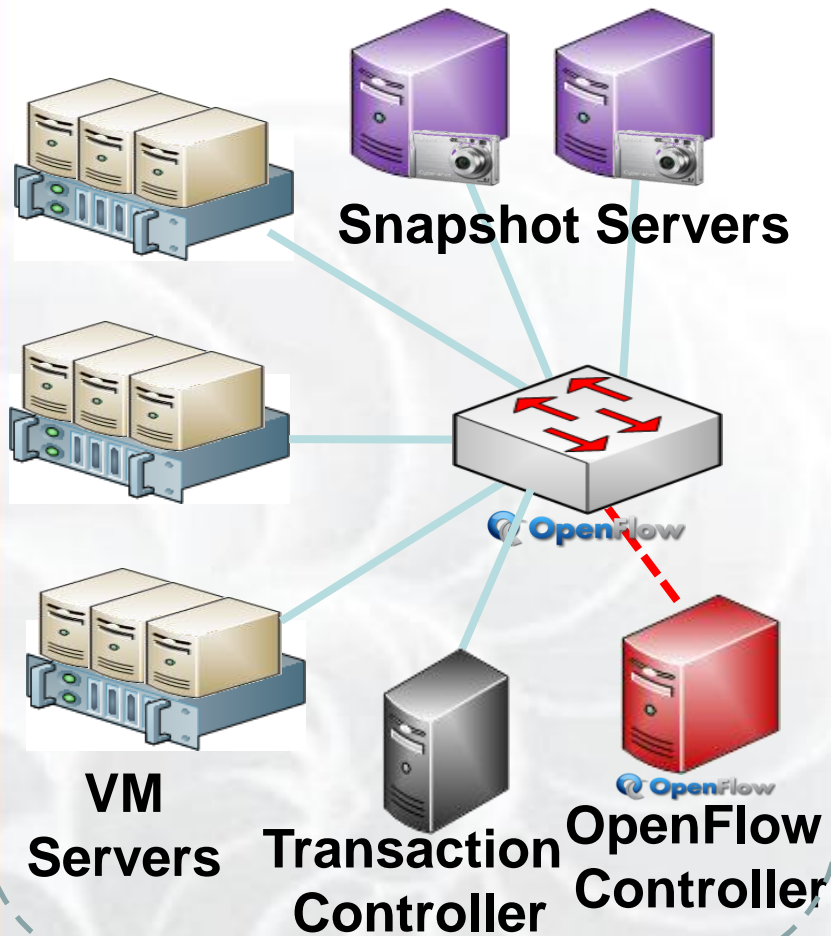


**VM
Servers**

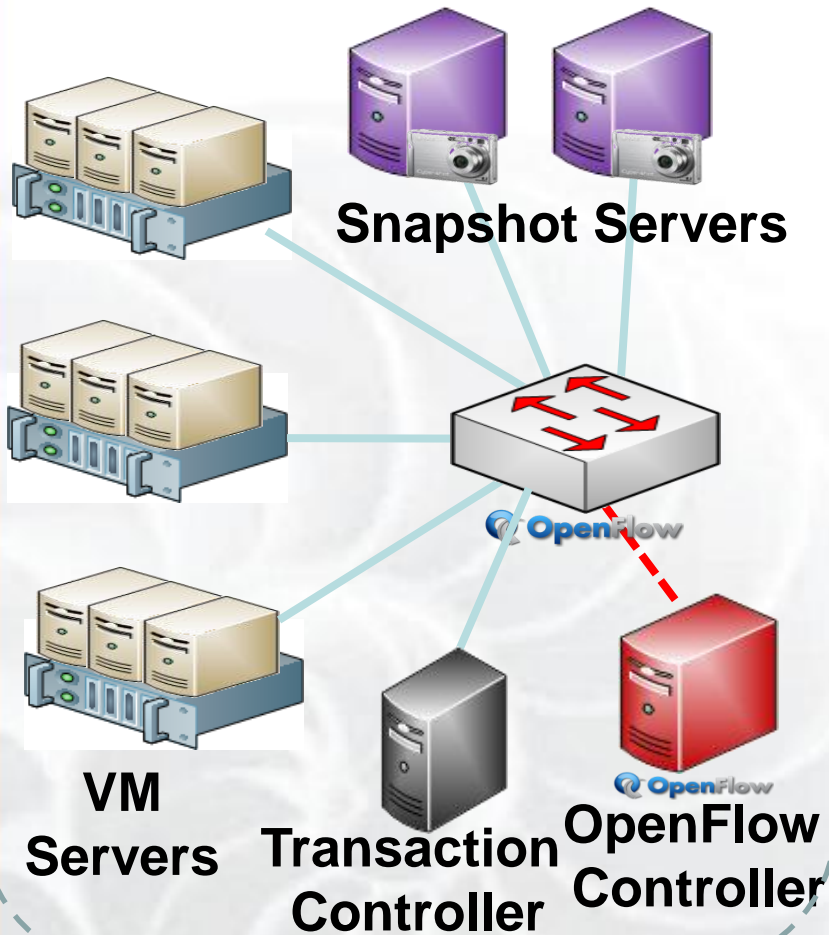
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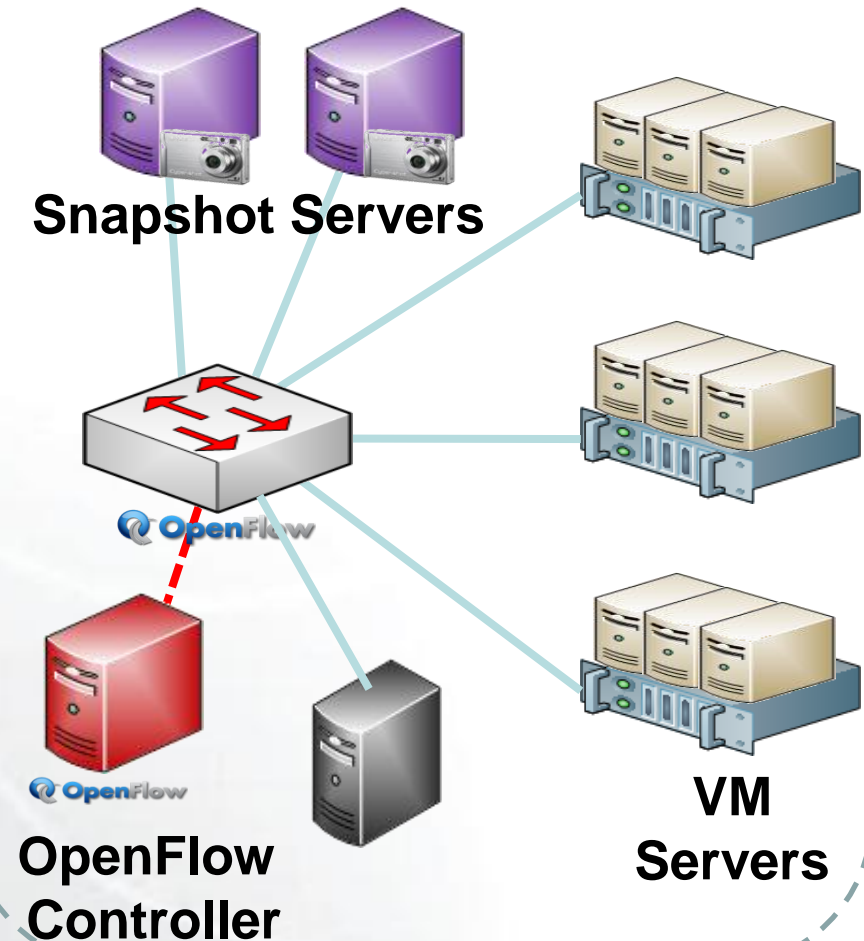
ProtoGENI Utah



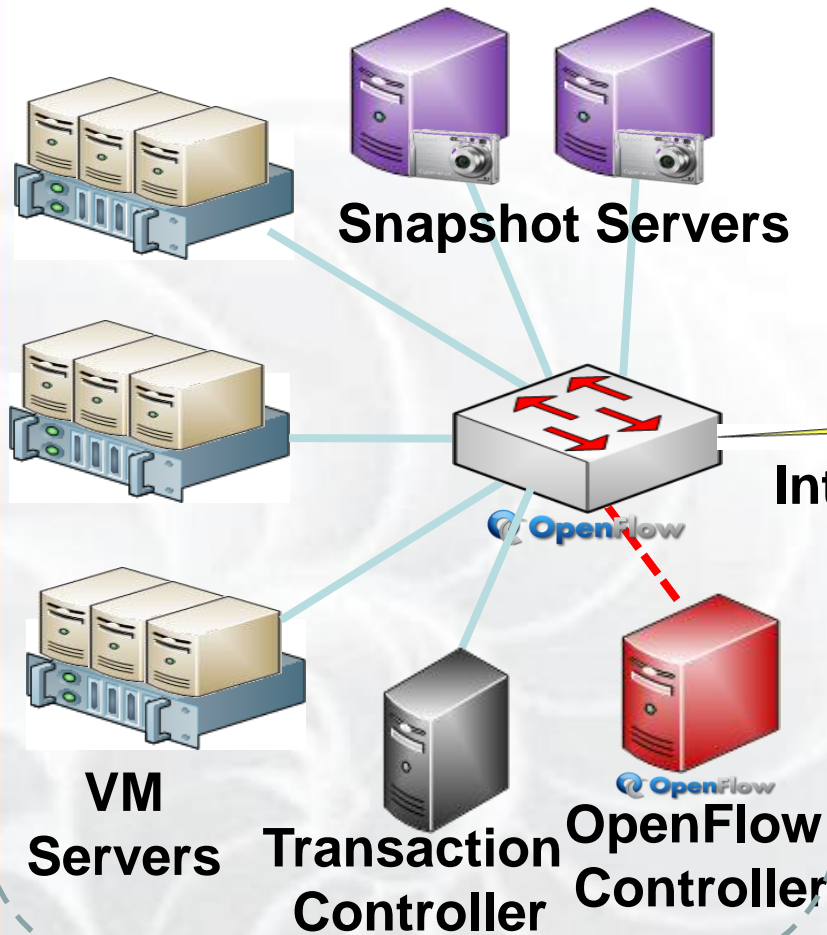
ProtoGENI Utah



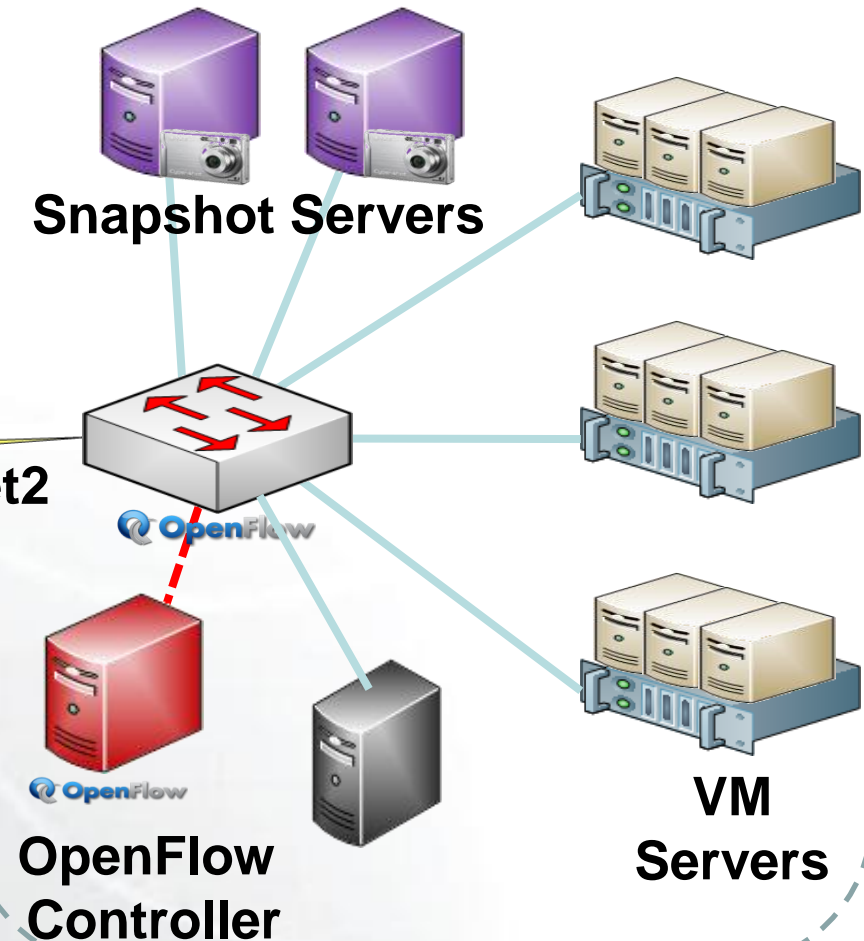
ProtoGENI GPO



ProtoGENI Utah

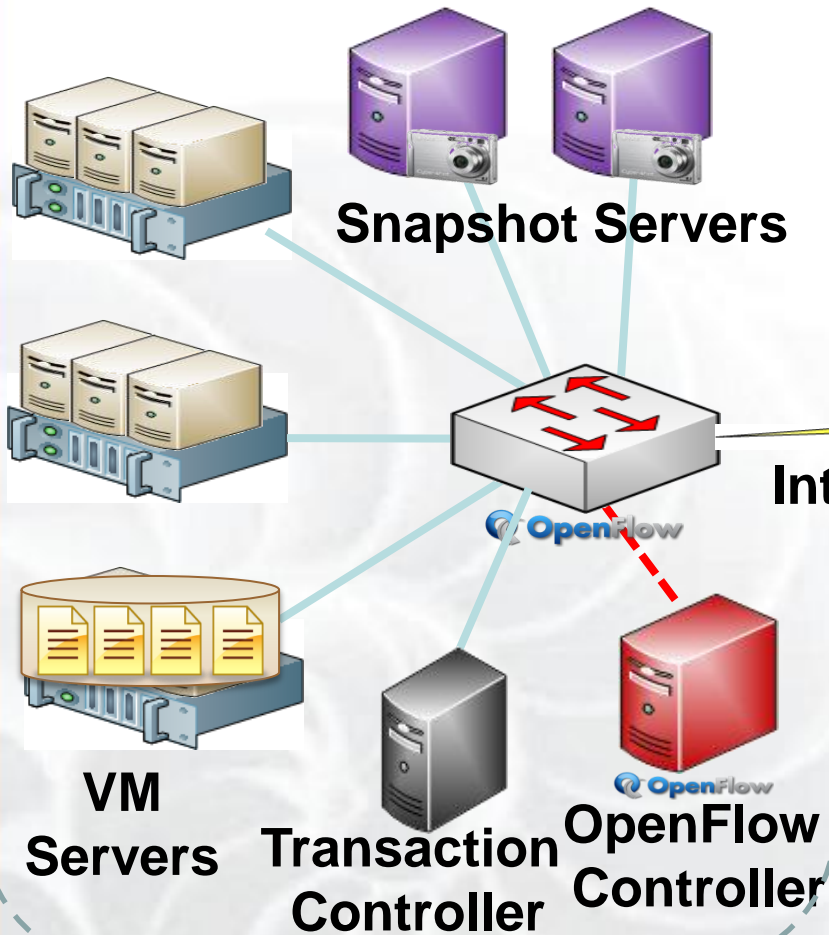


ProtoGENI GPO

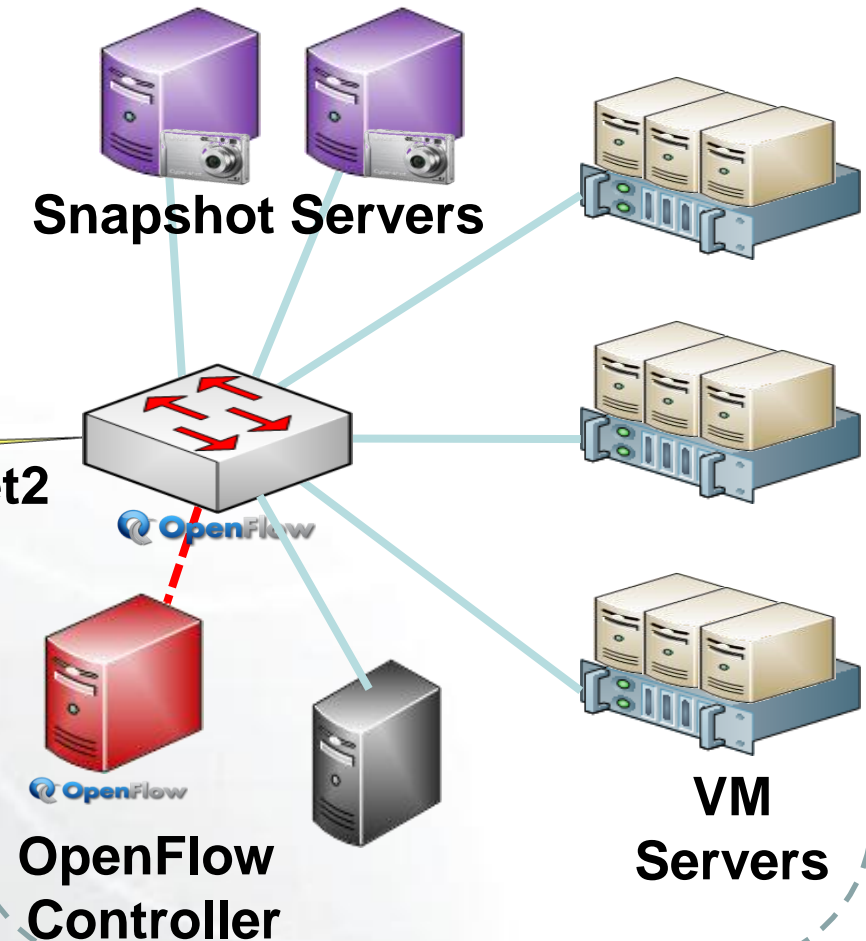


Internet2

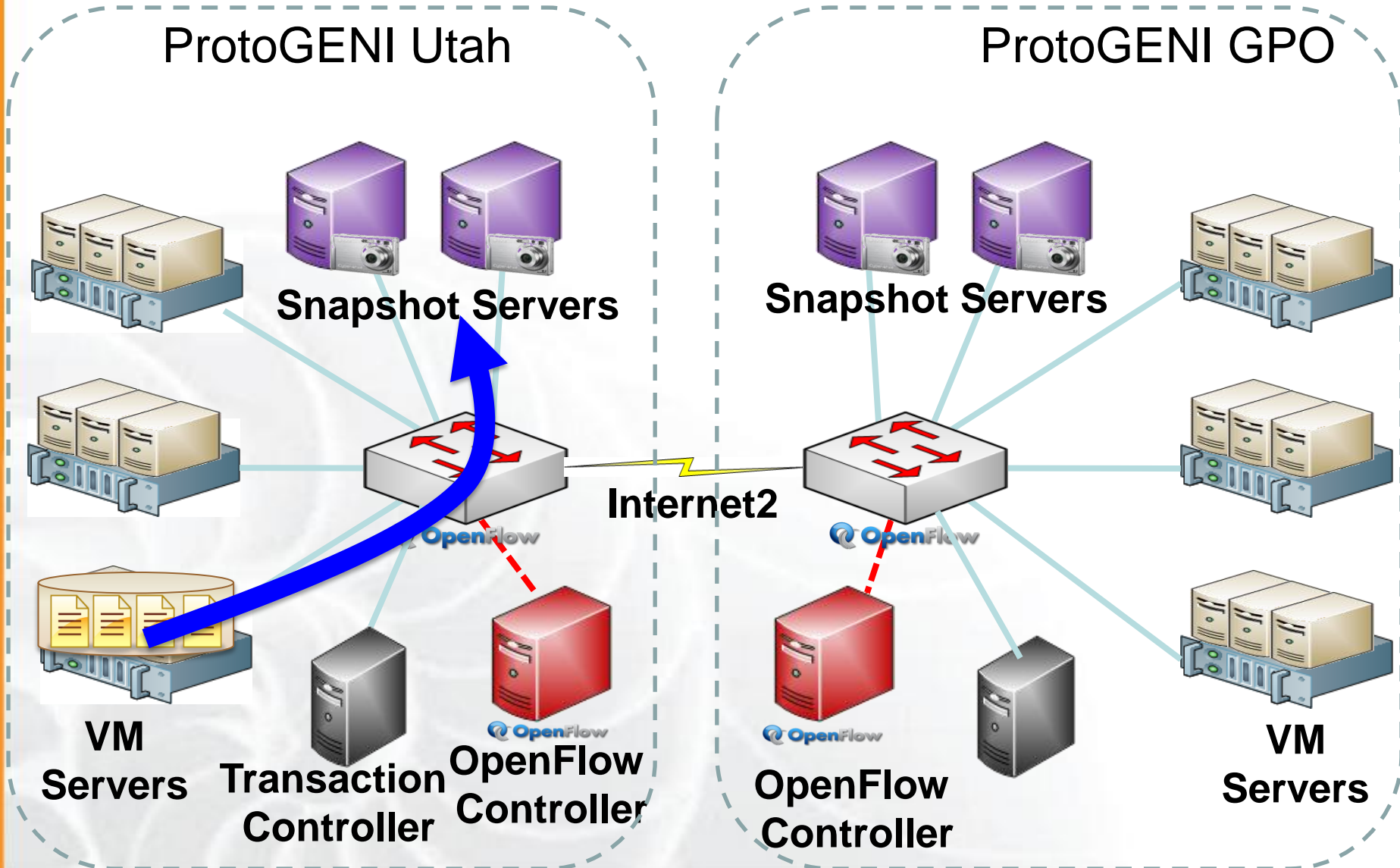
ProtoGENI Utah

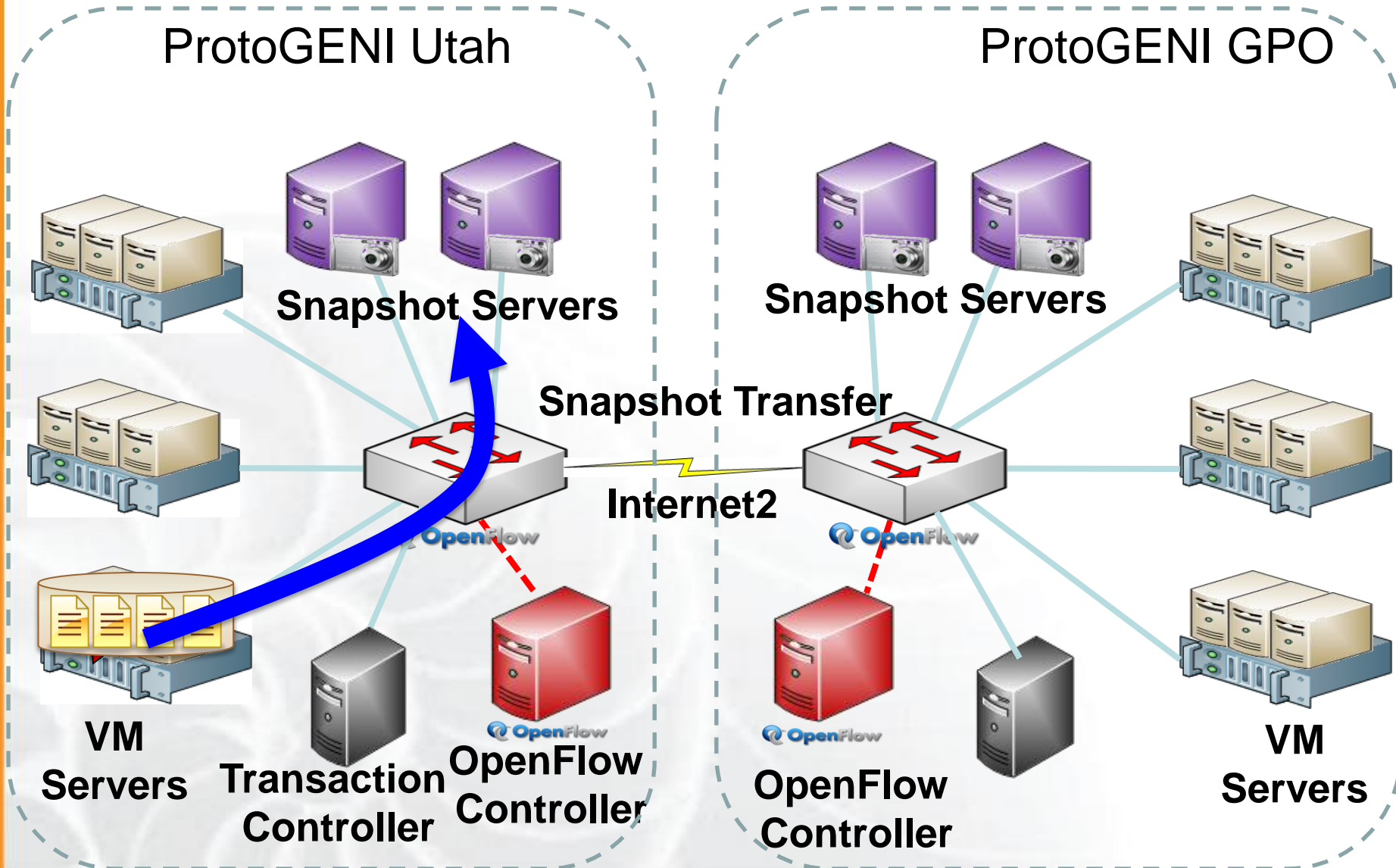


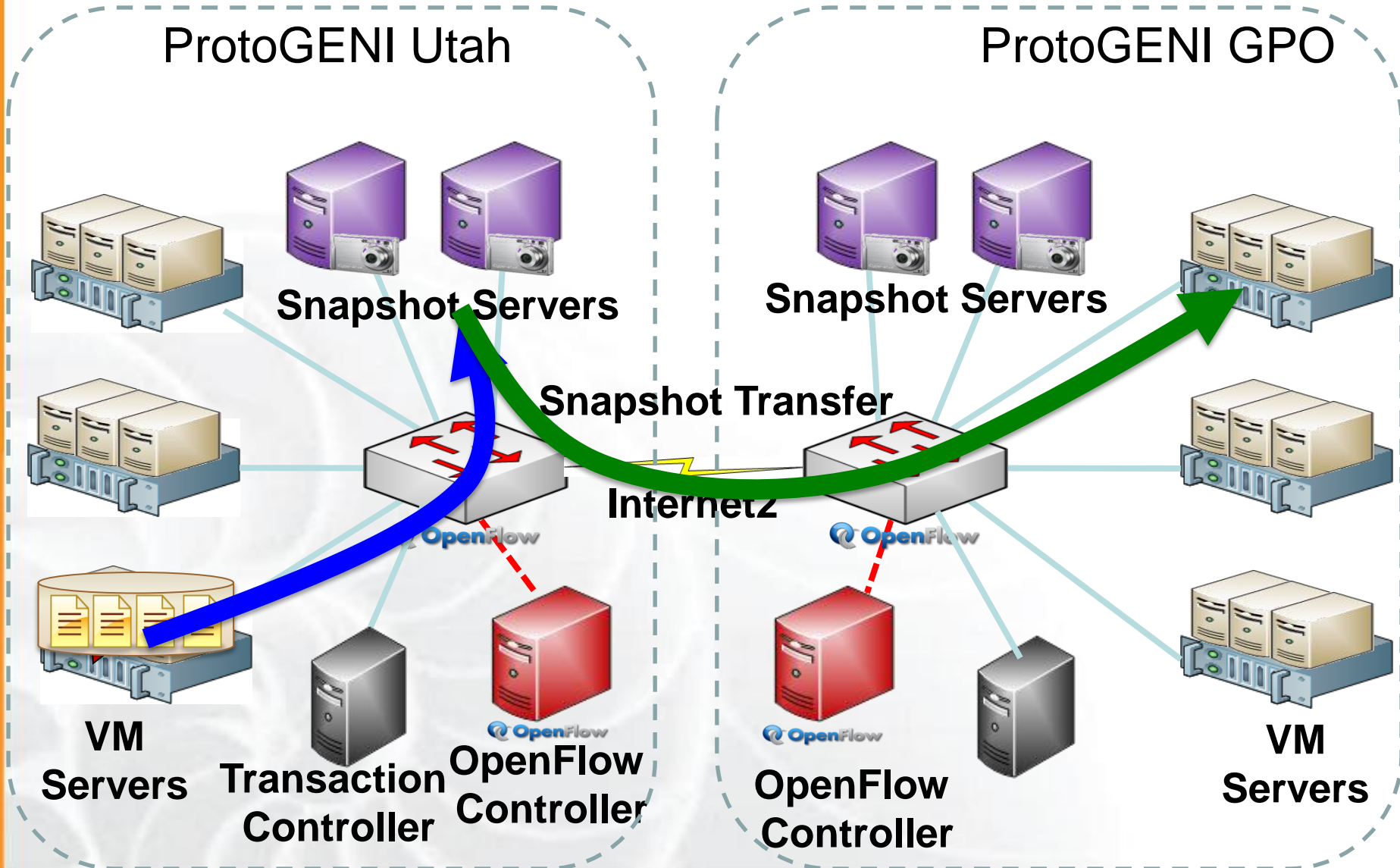
ProtoGENI GPO



Internet2







We <heart> GENI ☺

- GENI has the “unique” features to implement GENI-VIOLIN
 - Large-scale federated testbed
 - Wide-area network
 - Deep programmability of Openflow!
- We look forward to expanding our work with GENI
 - Better snapshotting and more sites
 - More **in-network** capabilities that attract thousands of “real” users

GENI-VIOLIN

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Live **In-Network** Snapshotting of Distributed Slices