



Steroid OpenFlow Service

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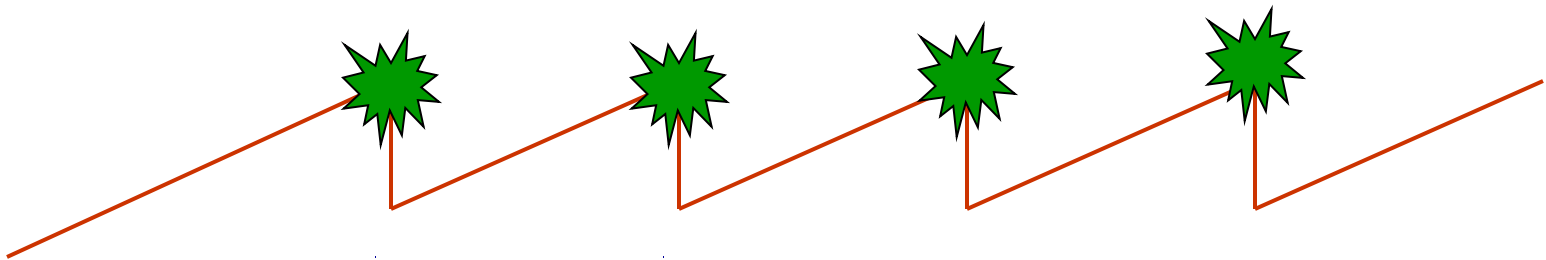
OpenFlow

- OpenFlow allows the flow of traffic to be controlled by the network providers.
- Allows traffic to be manipulated easily.
- Provides for new services to be seamlessly integrated with existing infrastructure.



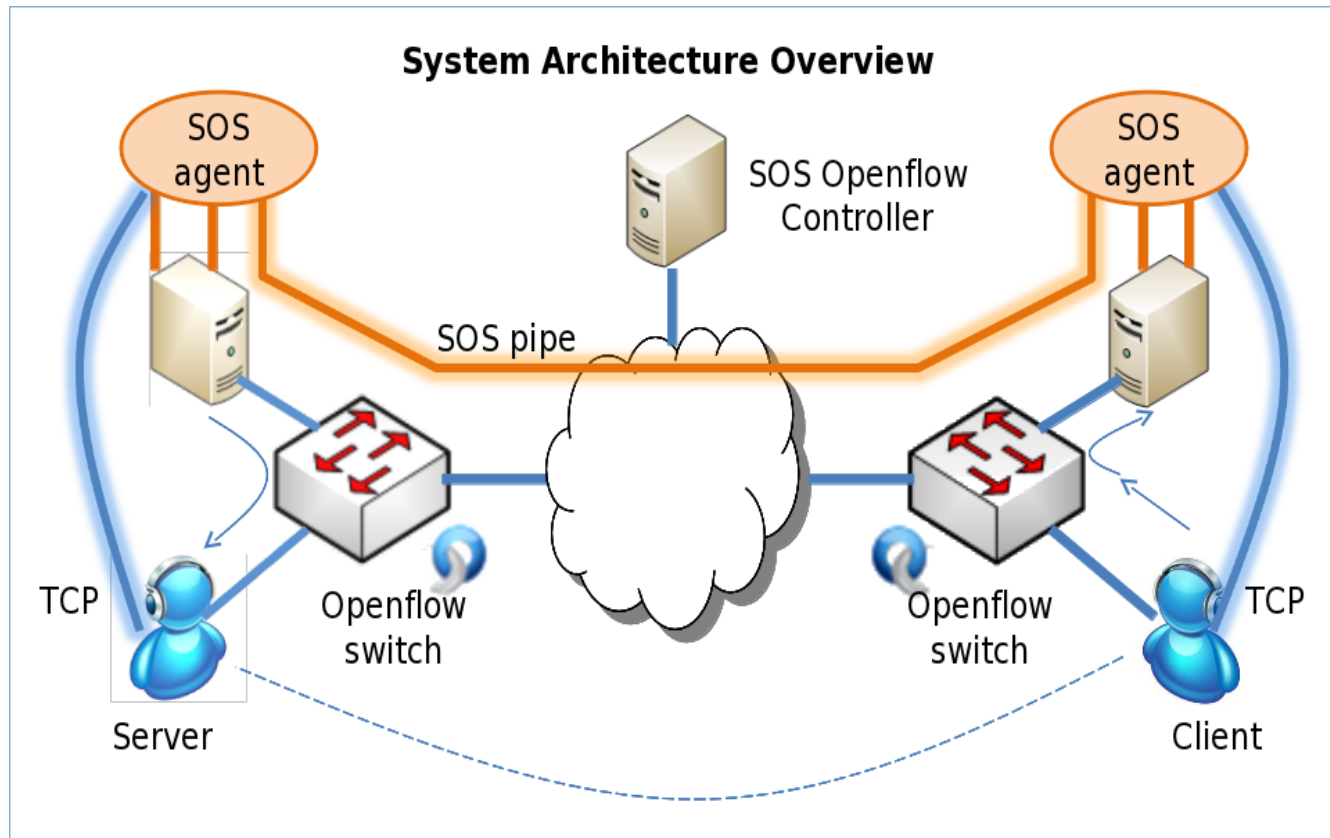
Why

- Problem:
 - TCP does not achieve high throughput over long links.
 - TCP Congestion window algorithms are overly conservative
 - Window increases by one segment per RTT
 - Dropped packet causes sending window to be halved
 - More aggressive TCP variants exist but add additional complexity for end users.



Steroid OpenFlow Service

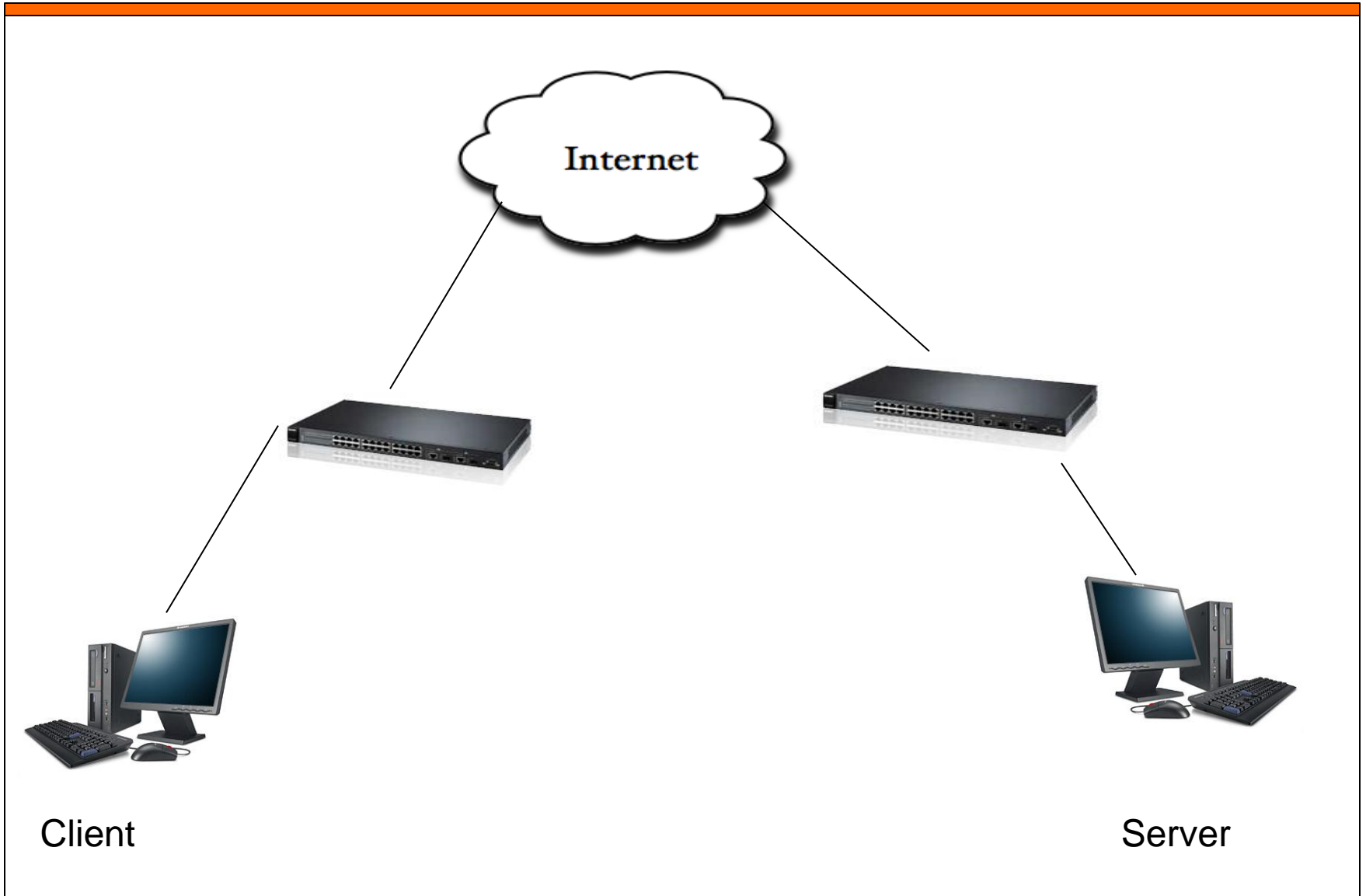
- SOS provides a seamless enhancement to end-to-end application throughput over long range networks.
- Decouples users protocol from network



SOS Overview

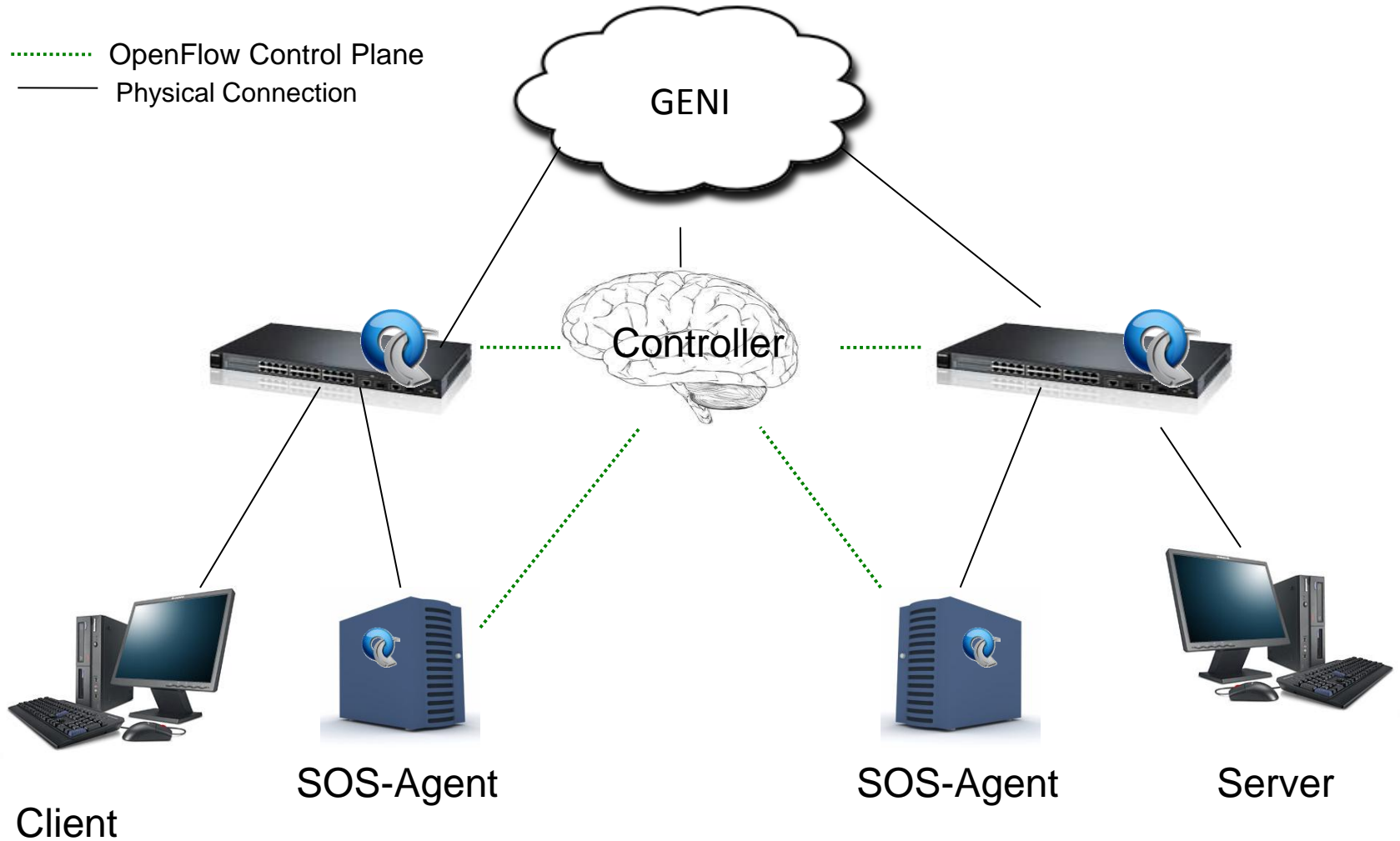
- Goal: no modifications to host, seamless improvement
- Solution:
 - OpenFlow network detects TCP connection (client-server)
 - Openflow network redirects connection to local SOS agent
 - SOS agent starts high throughput transport to SOS agent on destination site
 - Destination SOS agent starts TCP connection to server
 - Openflow network discovers all sites with SOS agents
 - Openflow network allows multiple path transport

Non-OpenFlow Internet

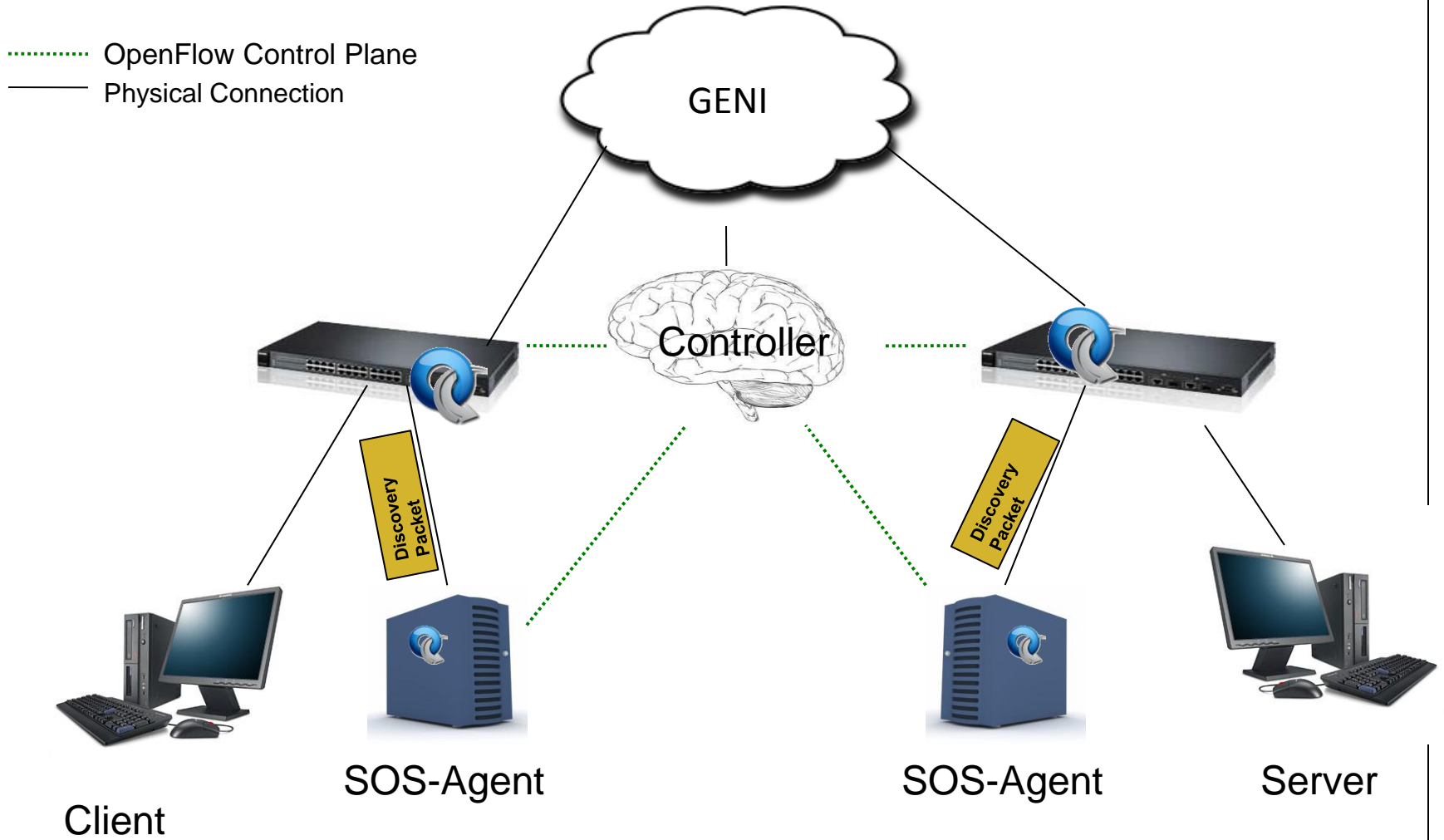


SOS on OpenFlow Network

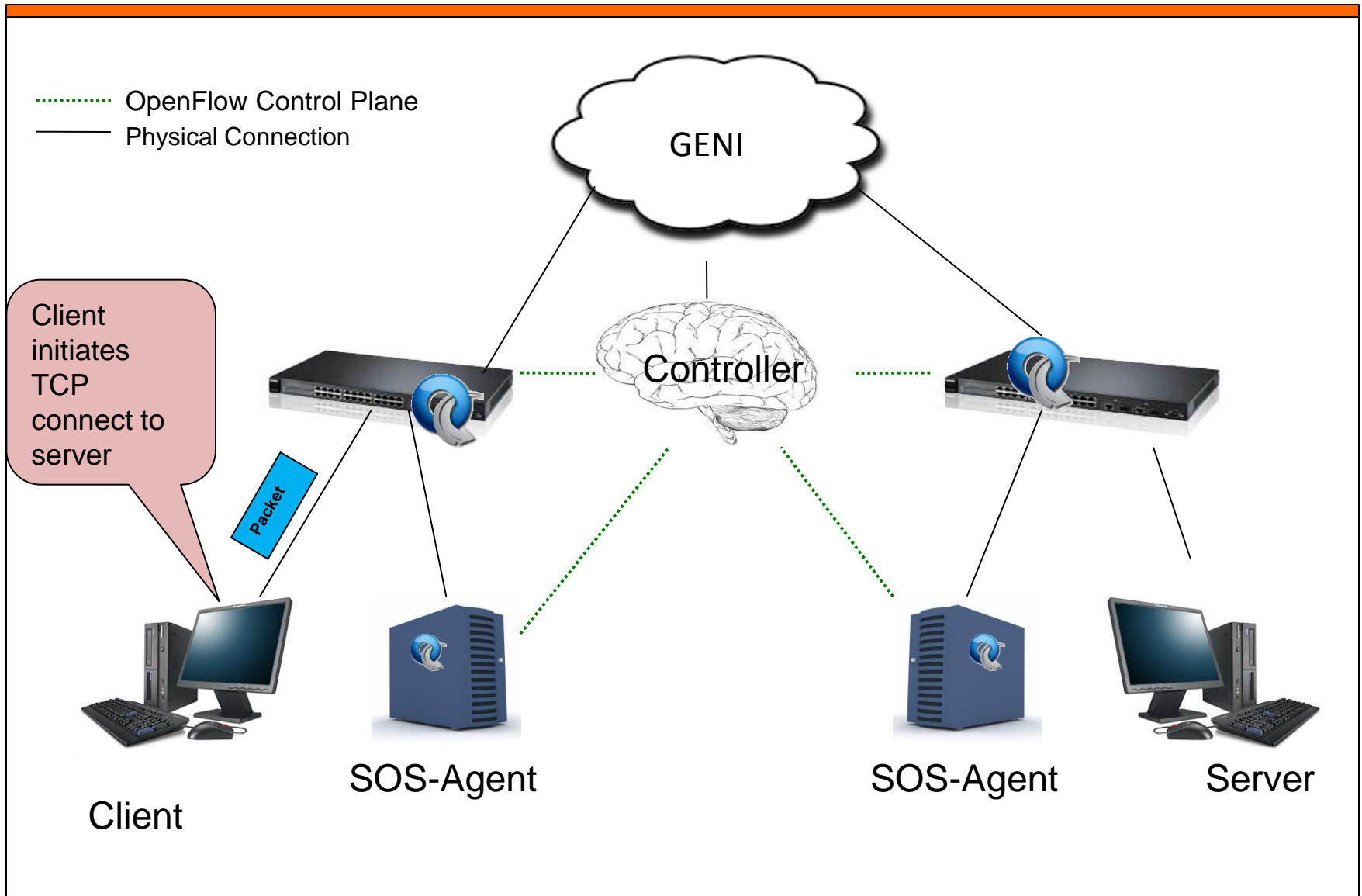
..... OpenFlow Control Plane
—— Physical Connection



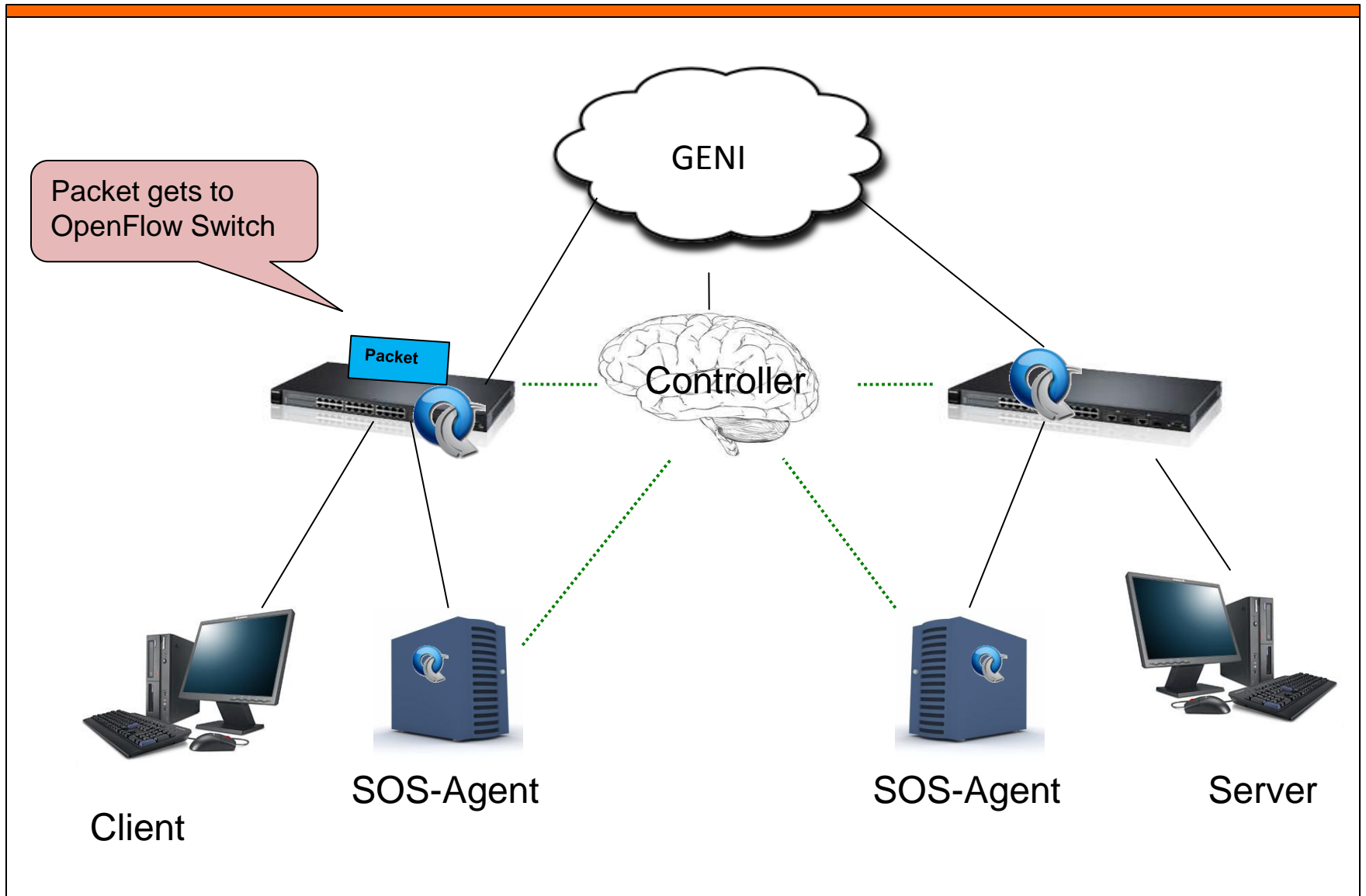
SOS: Agent Discovery



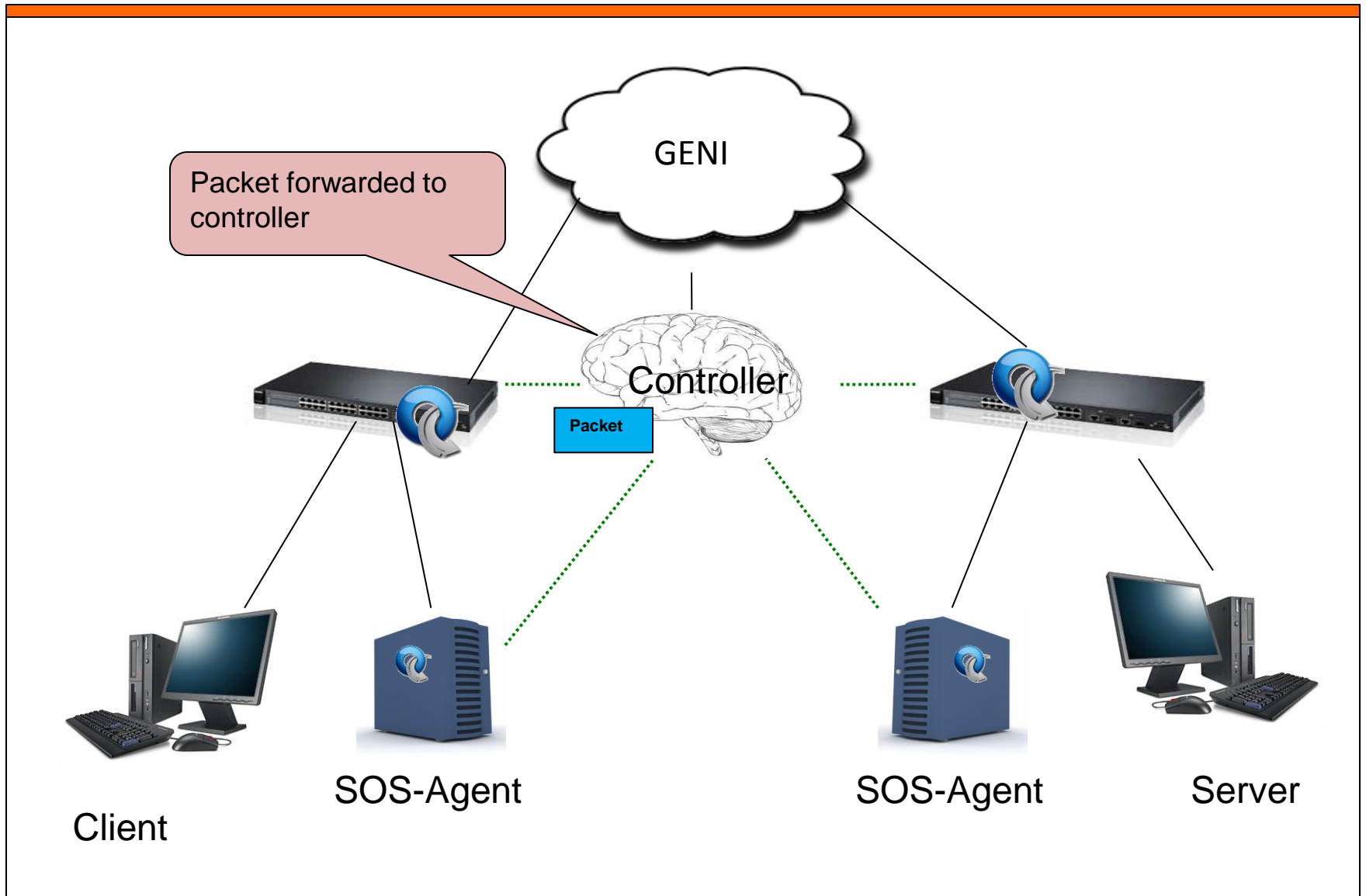
SOS: Client TCP Connect



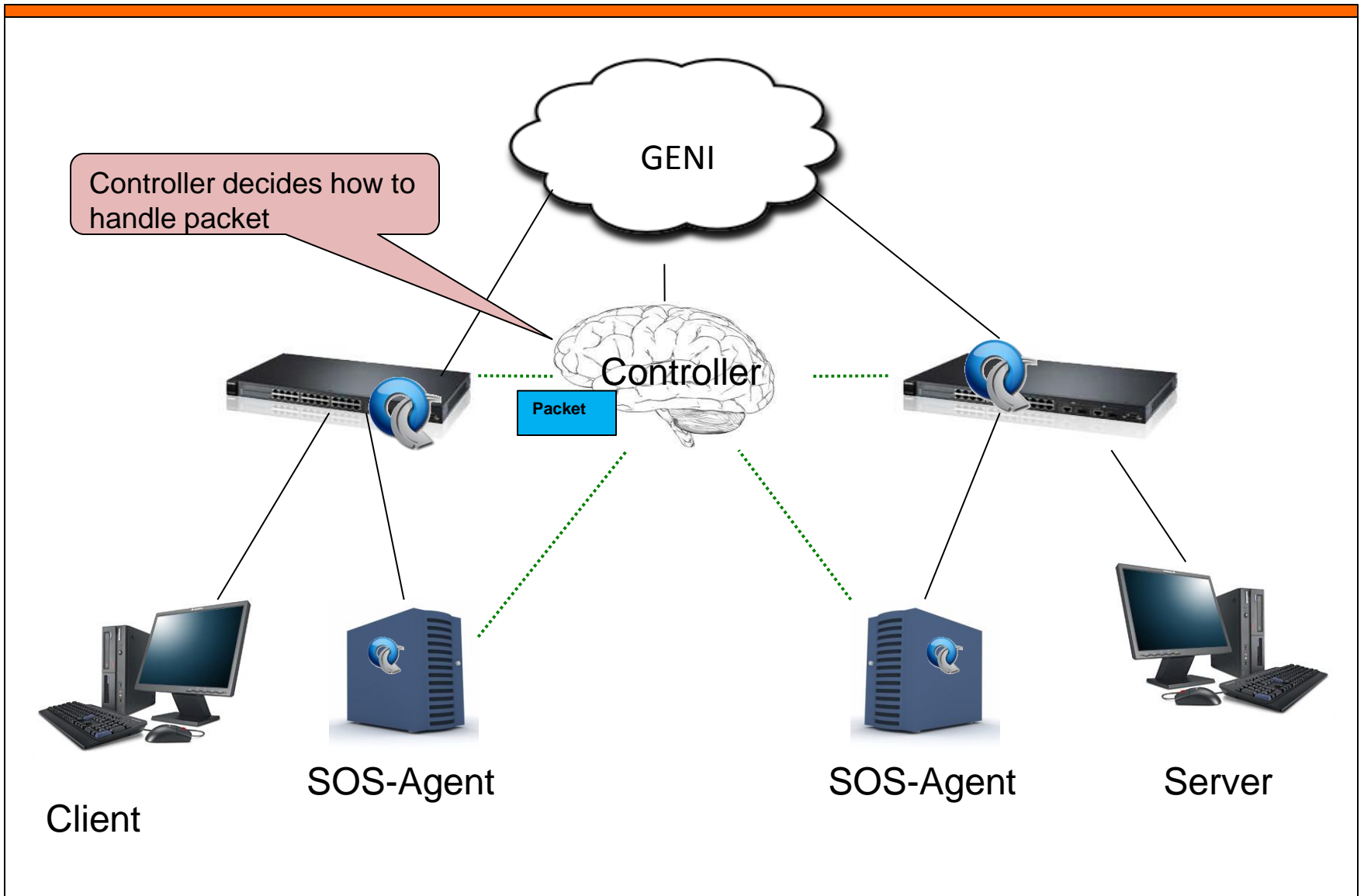
SOS: OpenFlow Switch Sees 1st TCP Packet



SOS: Controller Assign Agents

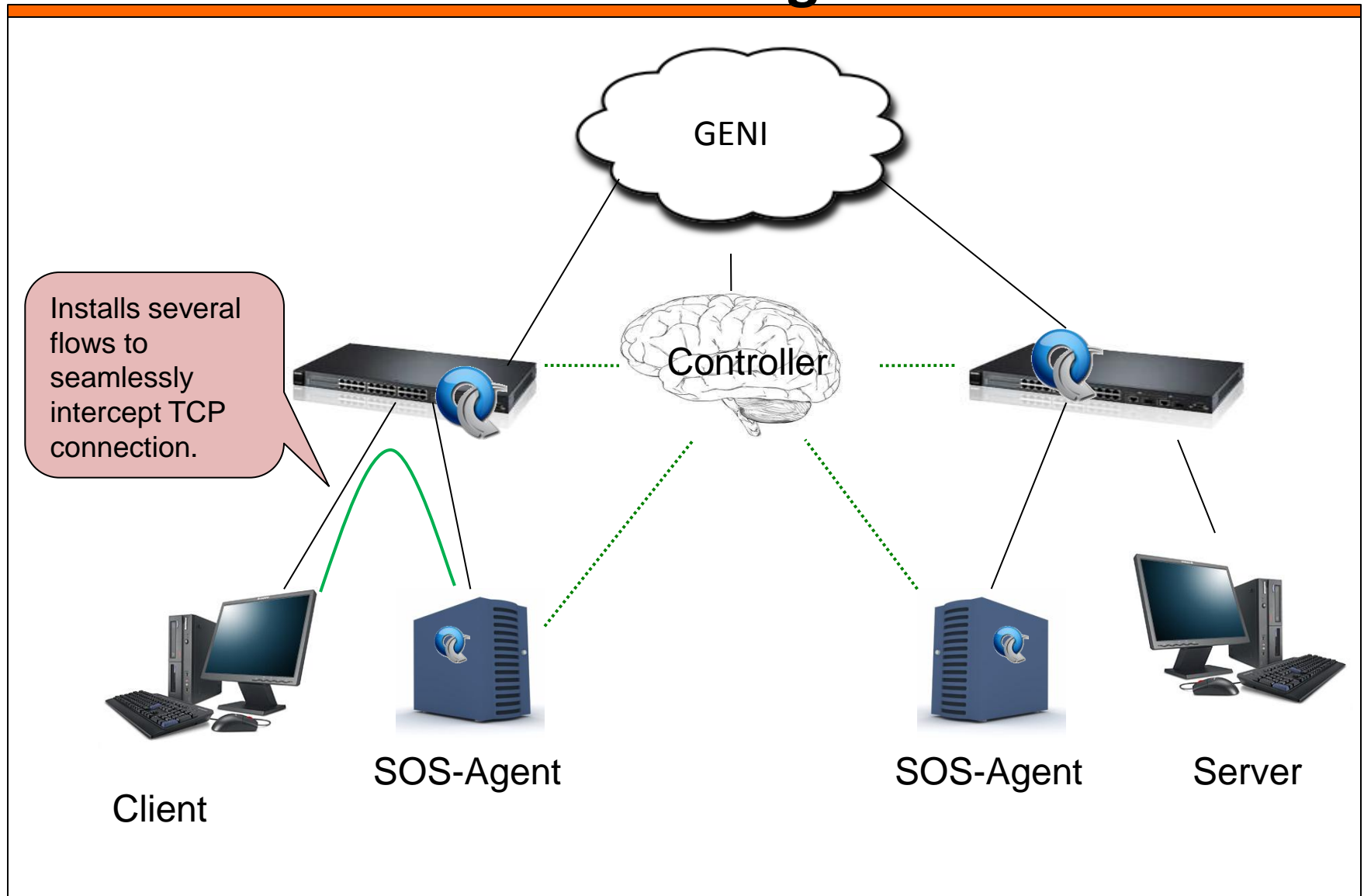


Steroid OpenFlow Service



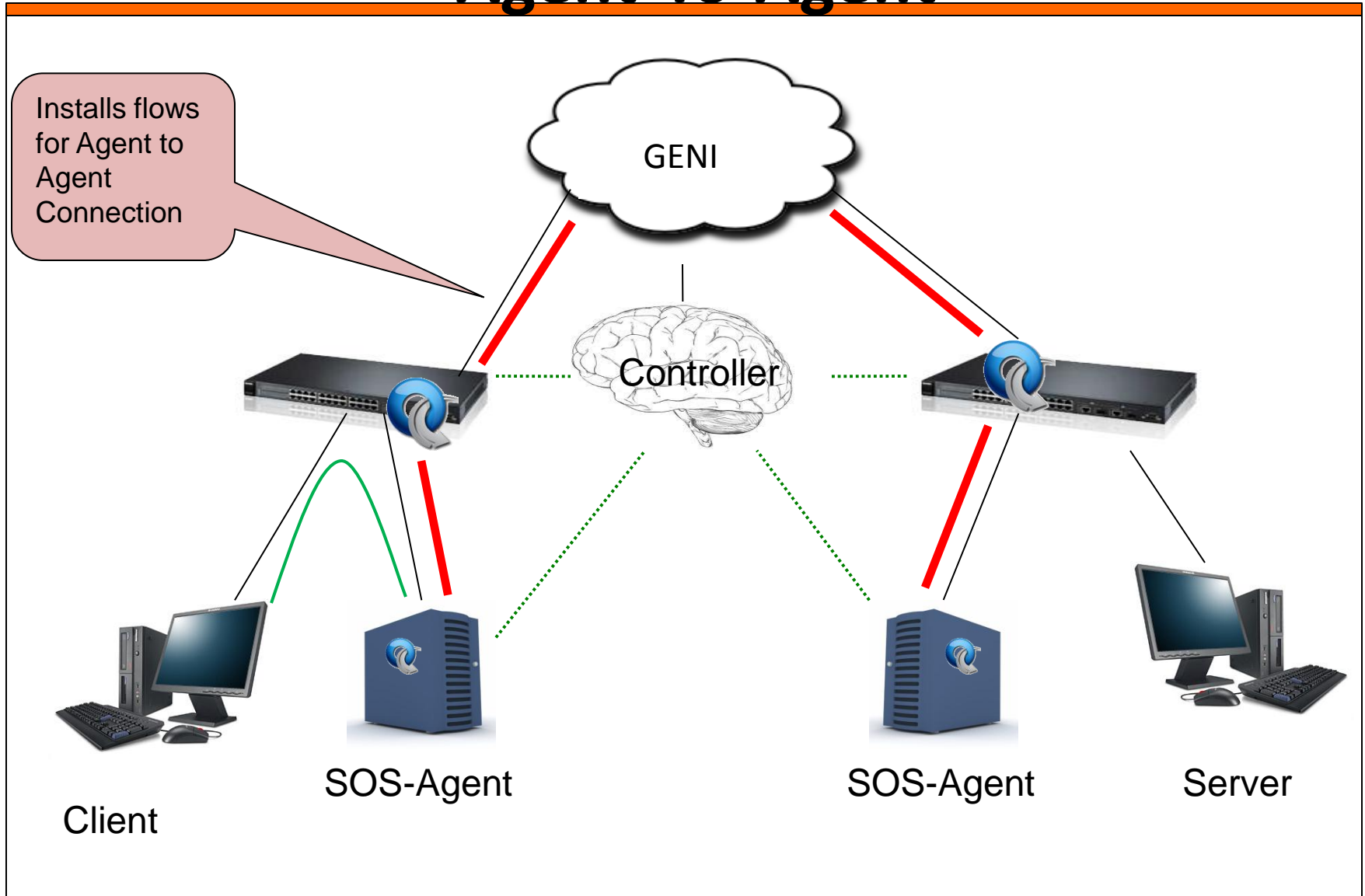
SOS: Controller Sets Up Flows

Client-To-Agent



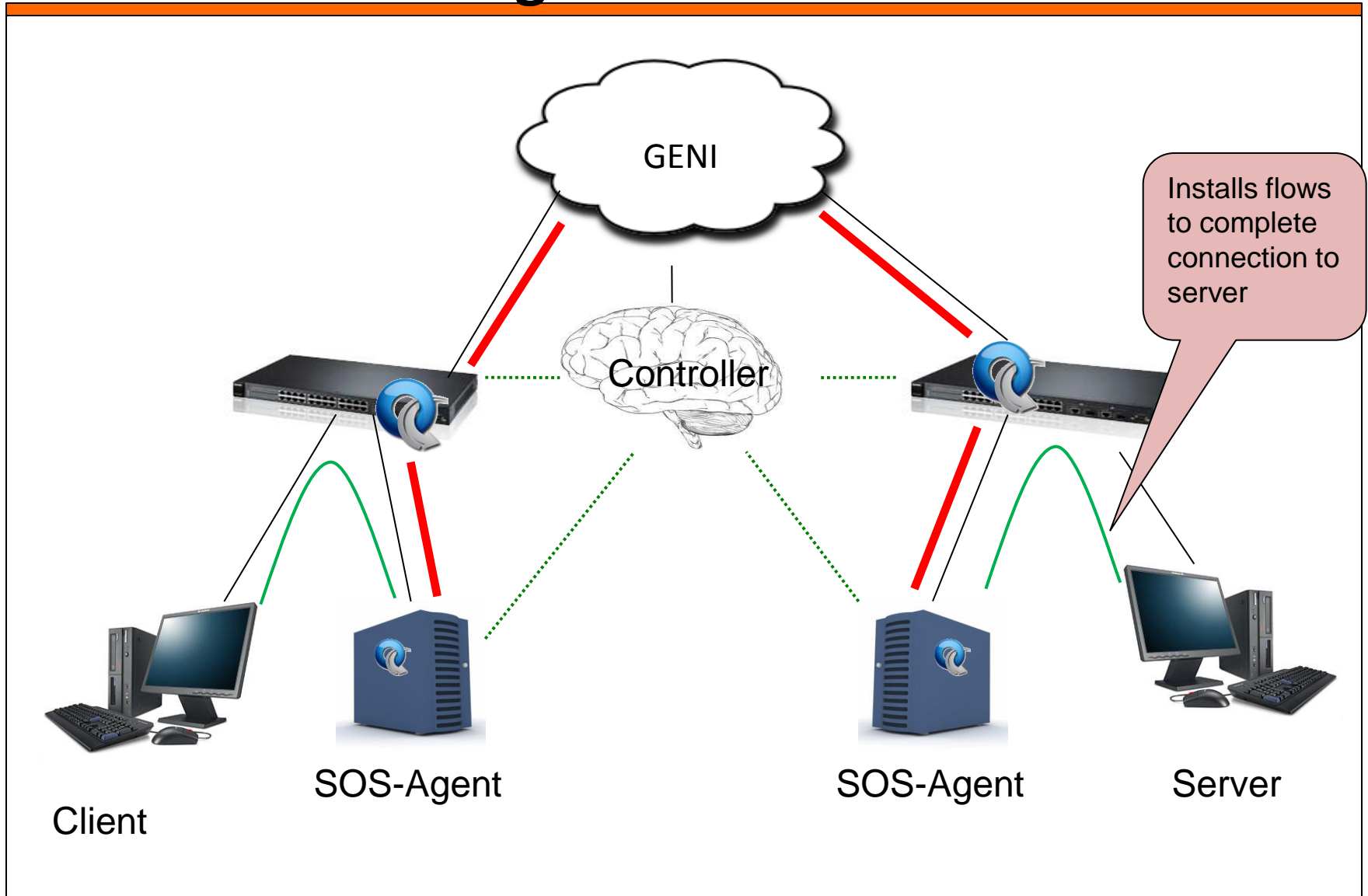
SOS: Controller Sets Up Flows

Agent-To-Agent



SOS: Controller Sets Up Flows

Agent-To-Server



GENI

- Allows full network visibility and control in core network.
- Provides a series of different compute resources.
- Large multipath network that spans the US.
- Multiple experimenters via Slicing



Future Work

- Automatic detection of connections that would be good candidates for SOS.
- Dynamically load balancing flows between paths to help balance congestion.
- Routing around congested areas in the network.
- Other areas where this paradigm could be beneficial.

FURTHER QUESTIONS
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