

Routing in the Future Internet

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University of the Republic (UdelaR), Uruguay

- ① Assignment of final works for course approval
- ② Software Defined Networks (SDNs).
- ③ Open APIs:
 - OpenFlow
 - JUNOS SDK
 - Cisco ONE
 - OPENER
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- ④ Outsourcing to the Cloud and its impact on routing, etc.

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Despite current trends and indicators...

- The possibilities to innovate and experiment are still limited to a small fraction of institutions and companies:
 - Vendor specific (e.g., JUNOS Space and SDK)
 - Monetary Costs (e.g., 4,000 US dollars for IP configuration licenses in OpenFlow)
 - Limited functionality and interoperability (e.g., multi-layer operations in OpenFlow have not been offered yet)

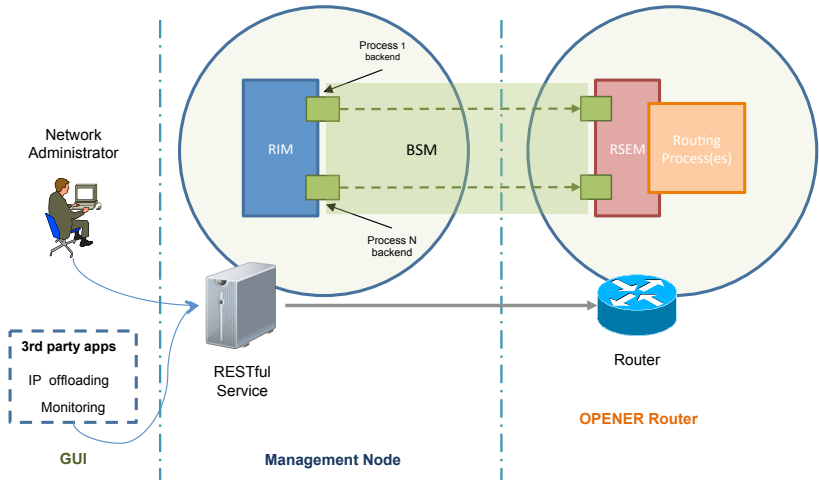
...so what if....

- ...an open API for the open source router Quagga becomes available.... enabling researchers and operators to run and test experimental protocols and applications, which could integrate cross-layer interactions (e.g., through SNMP, Web Services, or MTOSI in the future) and would clearly avoid the dependency on proprietary systems?

OPENER



Open and Programmable ENvironment for Experimenting with Routers



At this stage...3 specific use cases...

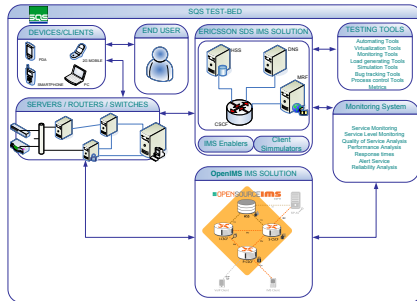
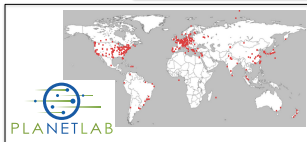
- Adding meta-info
- IP offloading
- PSP (Overaly on BGP)

Adding Meta-info

OPENER (example video)

IP Offloading

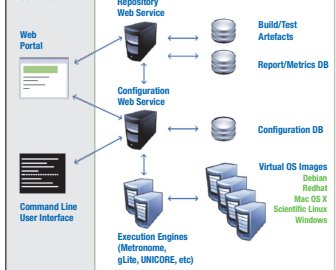
ProActive PACA Grid

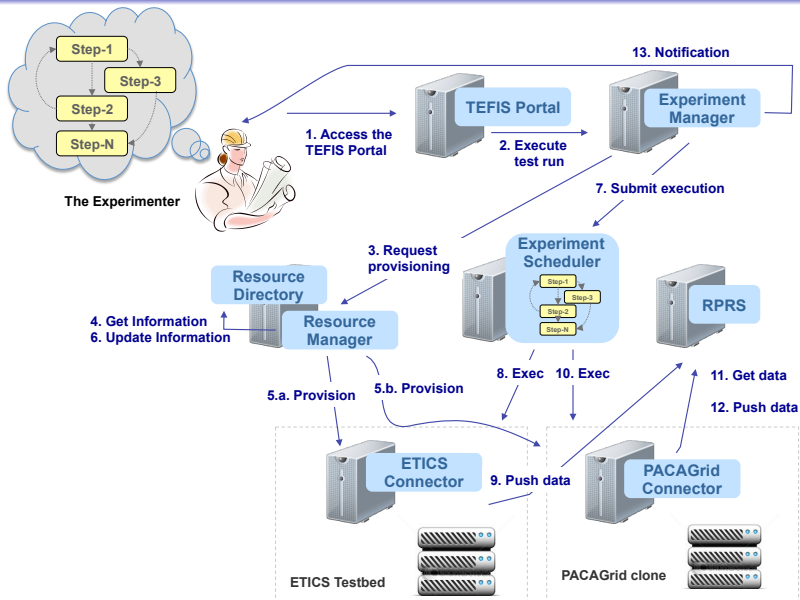


BOTNIA



ETICS Infrastructure

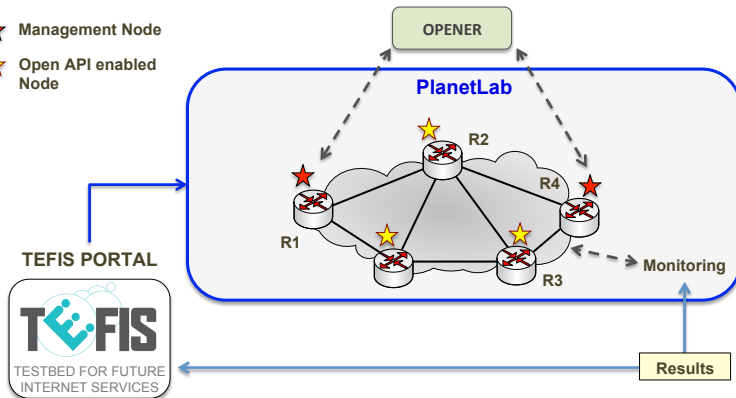




OPENER (cont.)

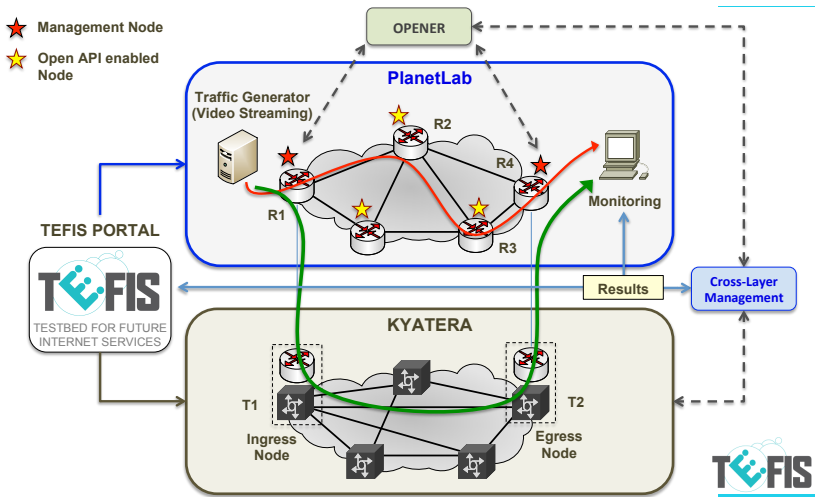
★ Management Node

★ Open API enabled Node

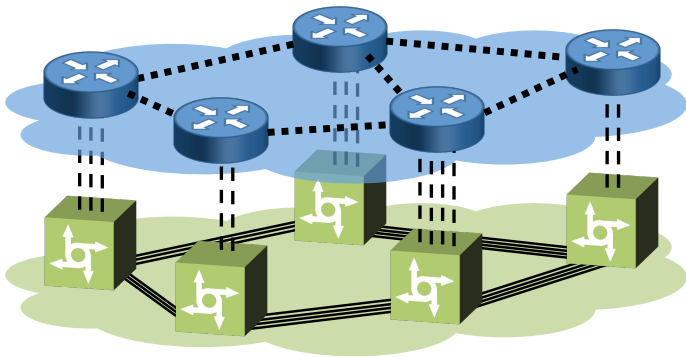


Scalability tests and performance evaluation of OPENER

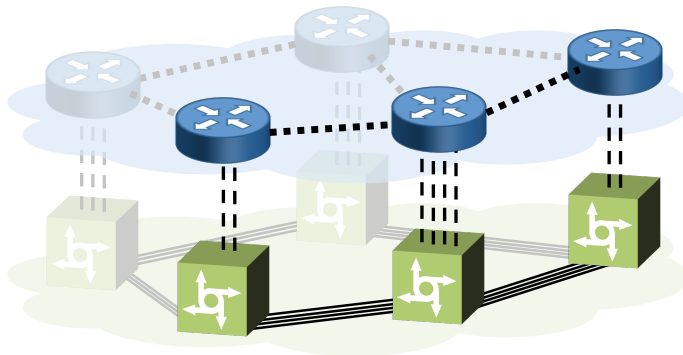
OPENER (cont.)



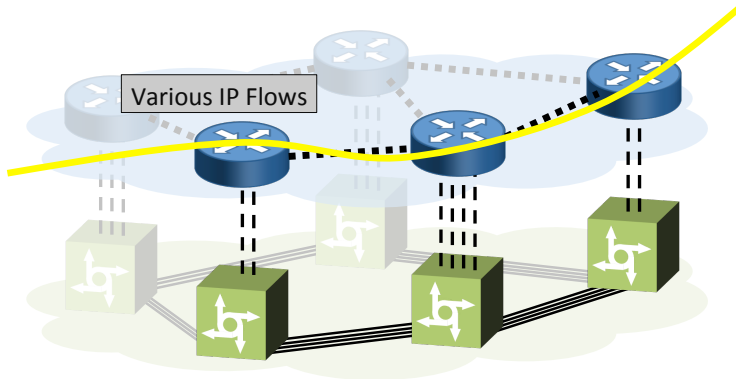
Management Limitations in Multi-layer Networks



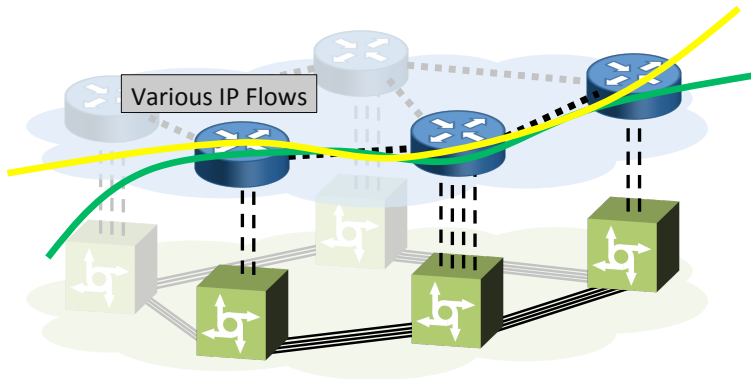
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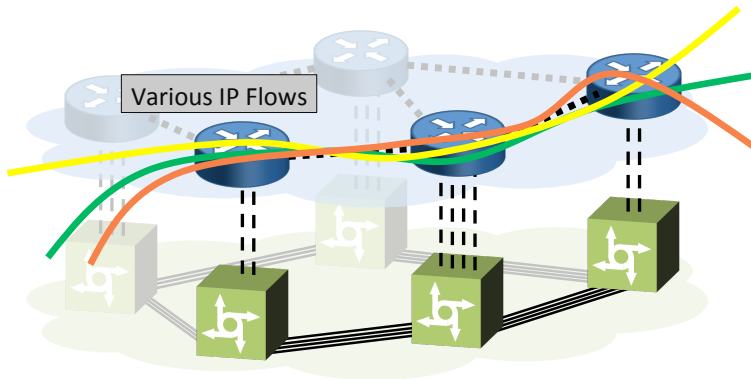
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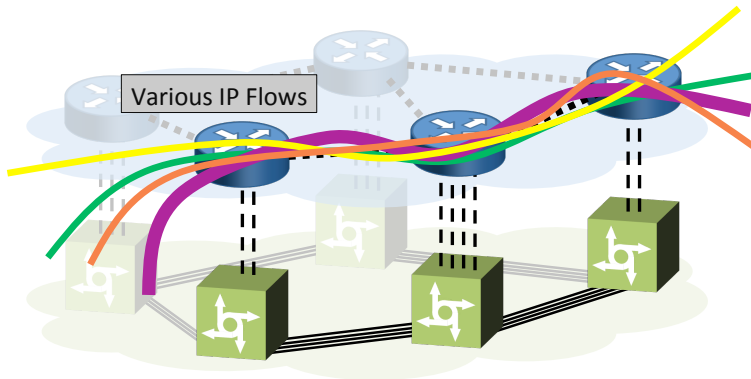
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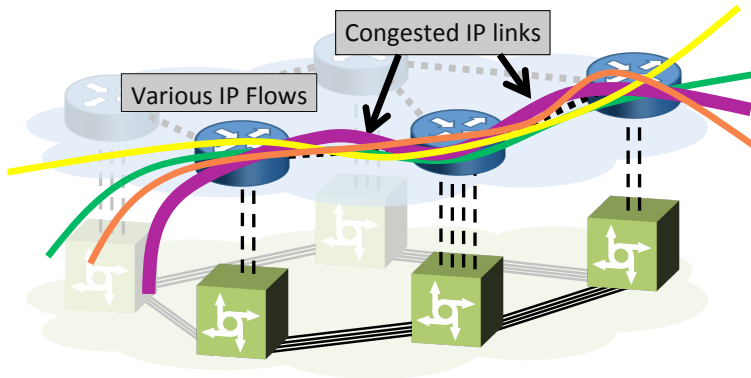
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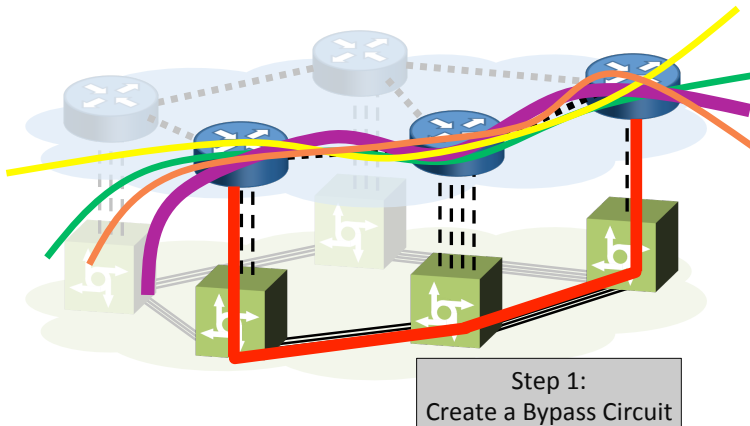
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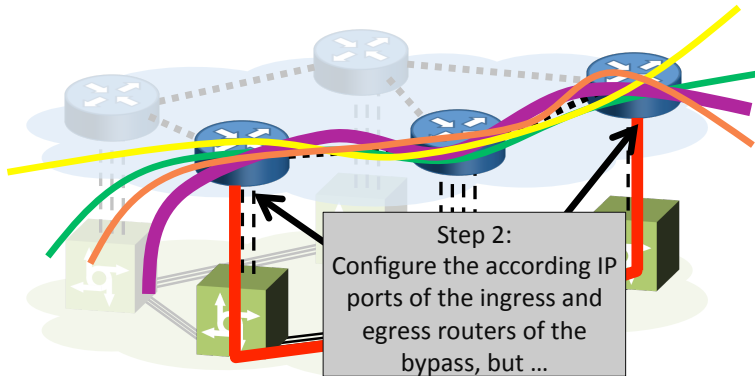
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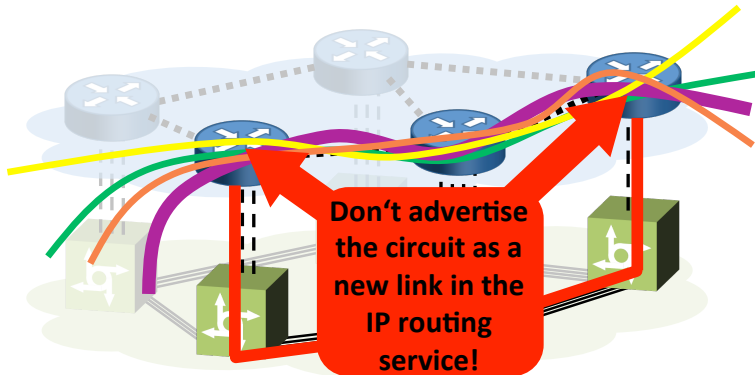
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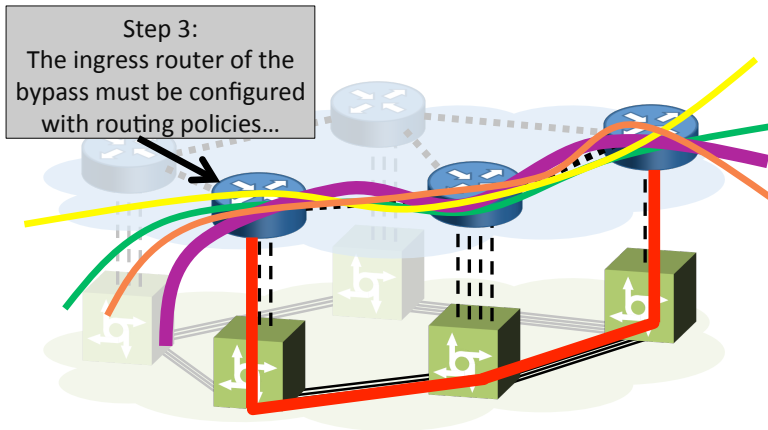
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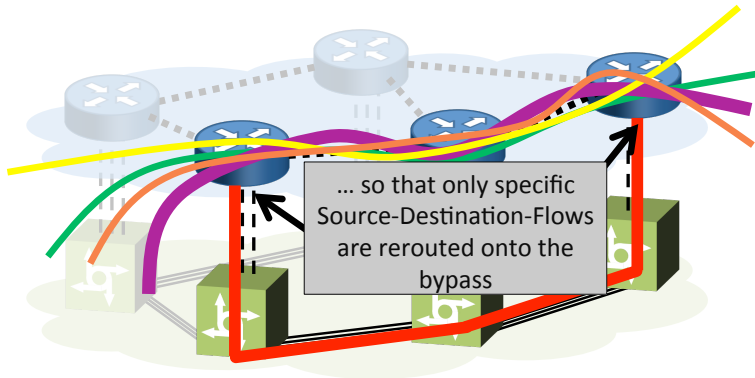
Management Limitations in Multi-layer Networks



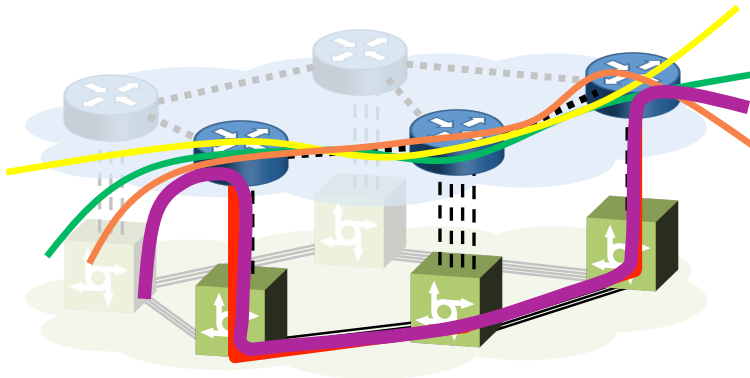
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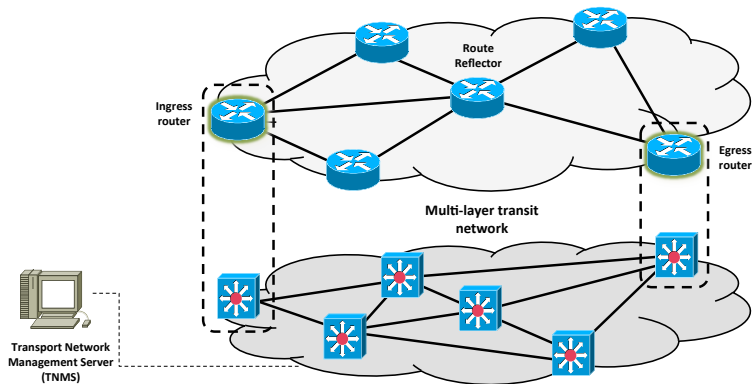
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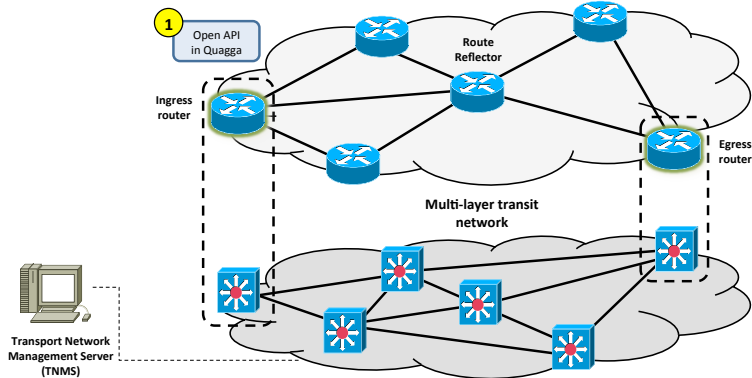
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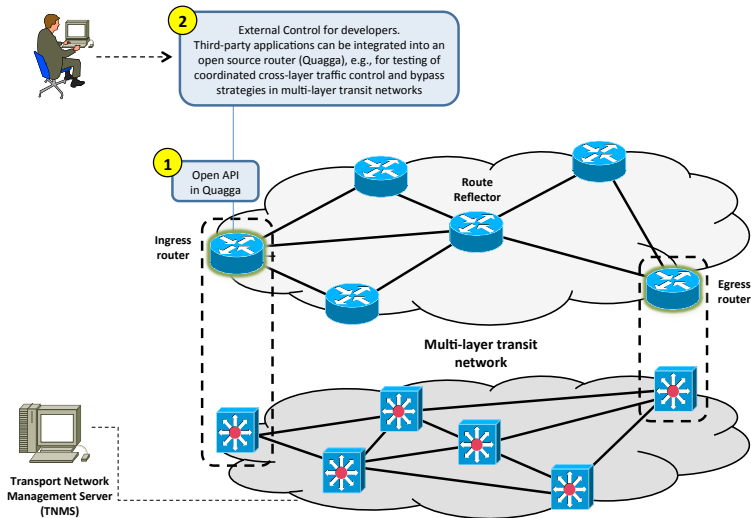
TEFIS Experiments



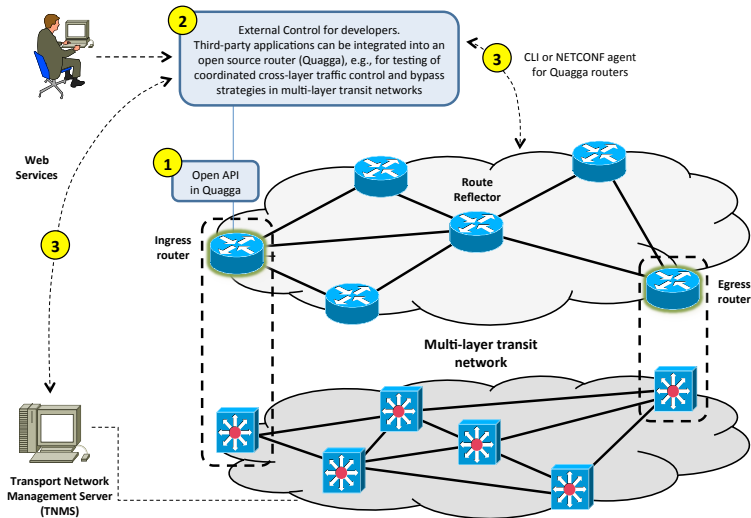
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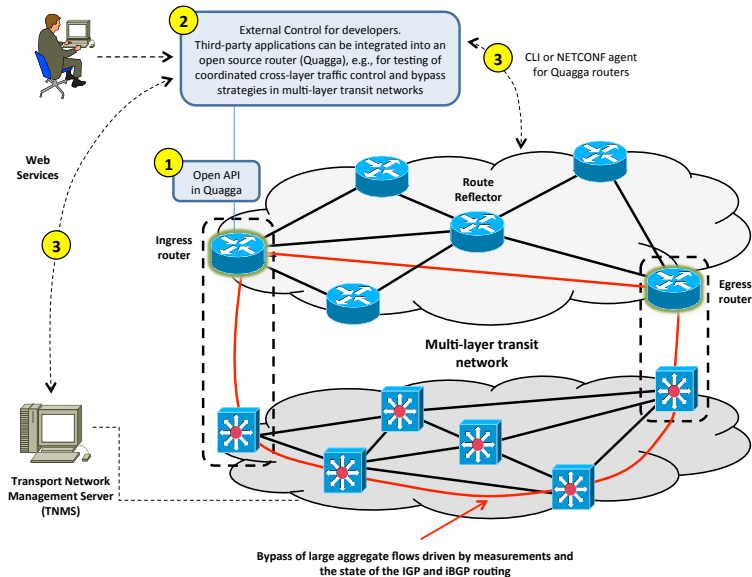
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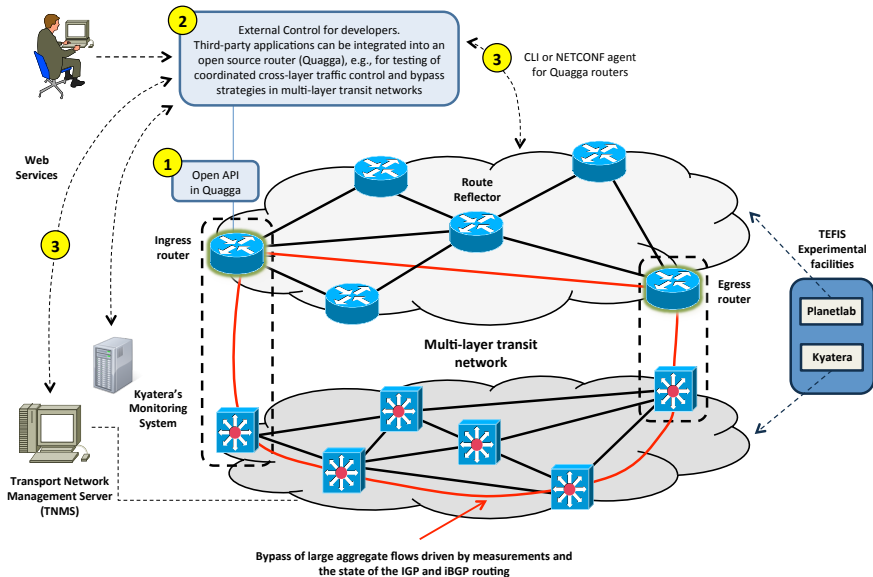
TEFIS Experiments



TEFIS Experiments



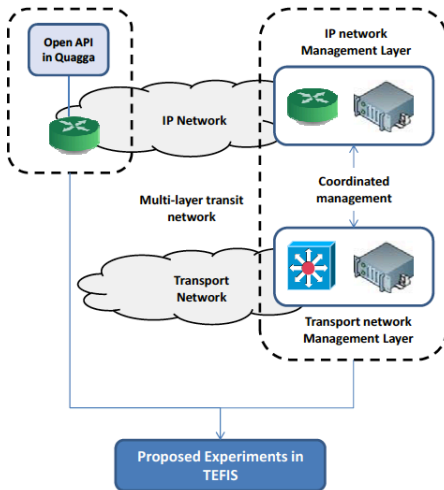
TEFIS Experiments



Expected Impact

Sponsored Research Agreement
with Cisco Systems, Inc., USA
1 year project, started June 2010

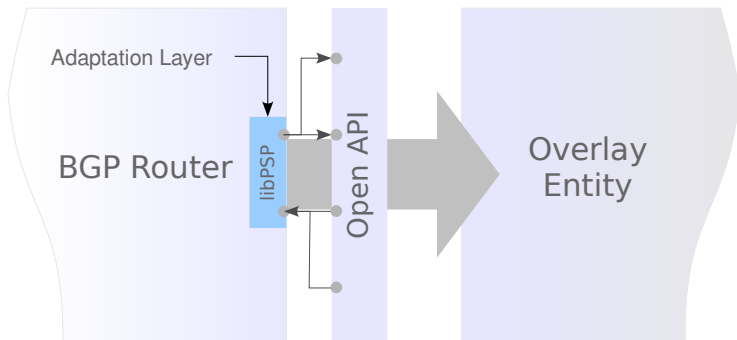
ONE Project, FP7 Program
Contract number INF50-ICT-258300
36 months, project started 09/2010



PSP (Overaly on BGP)

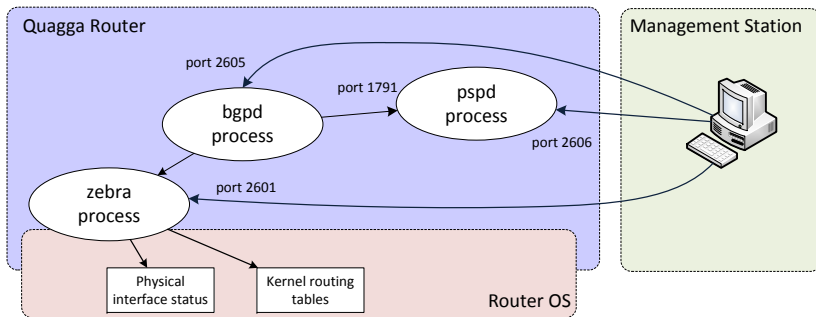
Prototype on Quagga (Cisco Systems, USA)

- Improve BGP's routing convergence
- Seamless inspection and control of basic BGP operations → enabler for enhanced security
- Developments made in Quagga:



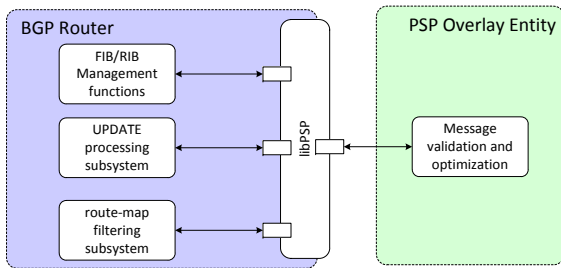
Software modules

- Standalone process that can interact with BGP and other PSP entities
- It can be executed in the same or in different equipment



Modularized approach

- libPSP uses an “Open API-like approach” securely exposing internal BGP features to PSP
 - Reduced set of changes in Quagga’s code
 - **Changed only 88 LOC in BGP to interact with libPSP**
 - Most of the processing is decoupled from BGP
 - This concept is extensible to other functionalities
- No IPR issues with Cisco on the Quagga side



Questions?