

Generalized Virtual Networking: an enabler for Service Centric Networking and Network Function Virtualization

Stefano Salsano⁽¹⁾, Nicola Blefari-Melazzi⁽¹⁾, Francesco Lo Presti⁽¹⁾,
Giuseppe Siracusano⁽¹⁾, Pier Luigi Ventre⁽²⁾

(1) Univ. of Rome Tor Vergata, (2) Consortium GARR

stefano.salsano@uniroma2.it

A position paper...

- Introduce Generic Virtual Networking (GVN)
- GVN : a concept and a framework
- Influence the routing of (IP) packets based on service level information that is carried in the packets

Outline

1. **Rationale and state of the art**
2. **Generalized Virtual Networking (GVN)**
3. **GVN details & deployment scenarios**
4. **GVN as universal enabler**
5. **GVN, NFV and SDN**

Rationale for the work (1/2)

- A more and more pervasive cloud computing environment, end-user mobility, service mobility...
- **Service-Centric / Service-Oriented Networking:**
 - services should be accessed independently from the IP network address (and transport port) of the service nodes

Rationale for the work (2/2)

- The IP layer does not offer too much room for innovation
- Several “clean slate” approaches have been proposed to re-design the Network Level (...no success so far)
- On the other hand, Overlay Networking (CDNs...) and Cross-Layer Networking (NATs, Firewall, Layer-7 balancers) are the norm

GVN basics

- **GVN is based on a protocol header inserted between the Network and Transport layers**
- **It can be defined as a “layer 3.5” solution**
- **Backward compatibility: legacy nodes which do not know GVN simply forward using IP or layer 2 info**

Existing work (GVN roots...)

- **Service Centric Networking (Serval)**
- **Service Oriented Networking (FUSION)**
- **Application Delivery Networking (OpenADN)**
- **Information Centric Networking in general**

GVN:

- **a generalization of the above proposals**
- **a framework that can support all of them**

State of the art: FUSION

- The the EU project FUSION has developed the concept of Service Oriented Networking
- Networked software functions are dynamically deployed, replicated and invoked, as is proposed for static content in Information Centric Networking
- Services are identified by a serviceID
- An *overlay routing* solution is proposed

State of the art: Serval

- For “... current online services, running on multiple servers in different locations and serving clients that are often mobile and multi-homed...”
- a Service Access Layer (SAL) sits above unmodified IP and enables applications to communicate directly on service names using *serviceIDs*
- The Serval protocol header is introduced between the IP and the transport layer headers
- The socket abstraction between applications and transport/network layers is redefined by Serval

State of the art: OpenADN (1/2)

- “The *service-centric* delivery semantics of modern Internet-scale applications and services does not fit naturally into the Internet’s host-centric design”
- OpenADN provides a general architectural support for service-centric Internet, with an application-neutral, standardized, session-layer overlay over IP
- Two new layers in the protocol stack:
 1. between the network and the transport layer
 2. on top of the transport layer, offering the API towards the applications

State of the art: OpenADN (2/2)

- A layer 3.5 header is introduced between the IP header and the transport headers.
- The OpenADN data plane implements an MPLS inspired label switching and stacking mechanism called APLS (Application Label Switching)

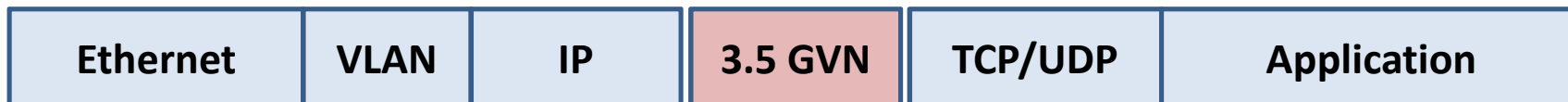
State of the art: ICN

- Information Centric Networking (ICN) concept: a paradigm shift from host-to-host communication model to a model that focuses on information objects
- If implemented in IP, ICN info can be carried:
 - within UDP or TCP (*overlay* approach)
 - as a new transport protocol
 - extending the IP layer
- A general framework could be helpful...

Two successful technologies

- **VLANs and MPLS !**
- **An additional header can be inserted in a pre-existing packet when needed and then removed**
- **Commonly referred to as “tagging” and “un-tagging” (e.g. VLAN tagging)**

GVN 3.5 Header



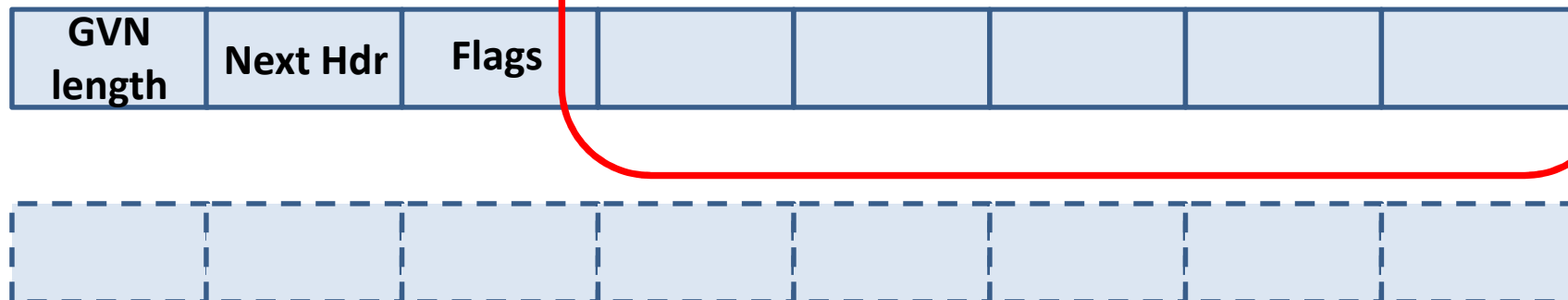
Service Identification,
Name Based information, ...

How to make GVN generic?

- We want a common framework, and a potentially unlimited set of different “Processing Logic” (GVN-PLs)
- Serval, OpenADN, the different ICN proposals can be seen as “GVN-Processing Logics” on top of the common GVN framework

GVN Header format

GVN Code
(identifies a specific GVN-PL,
GVN-Processing Logic)

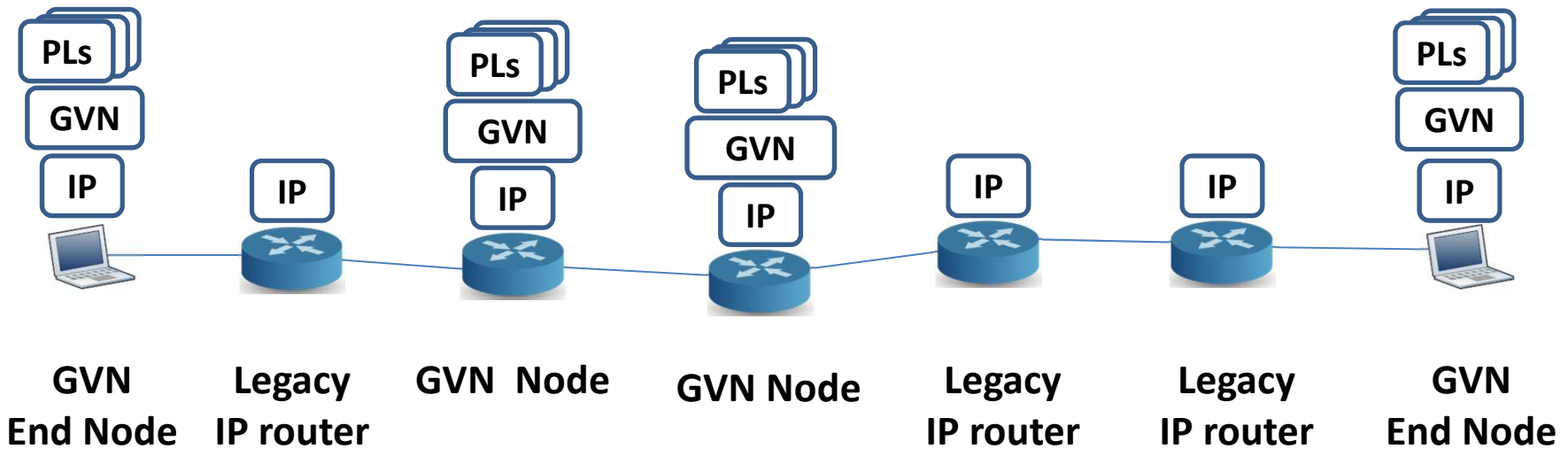


Processing Logic -Specific Header Data
(optional and variable length)

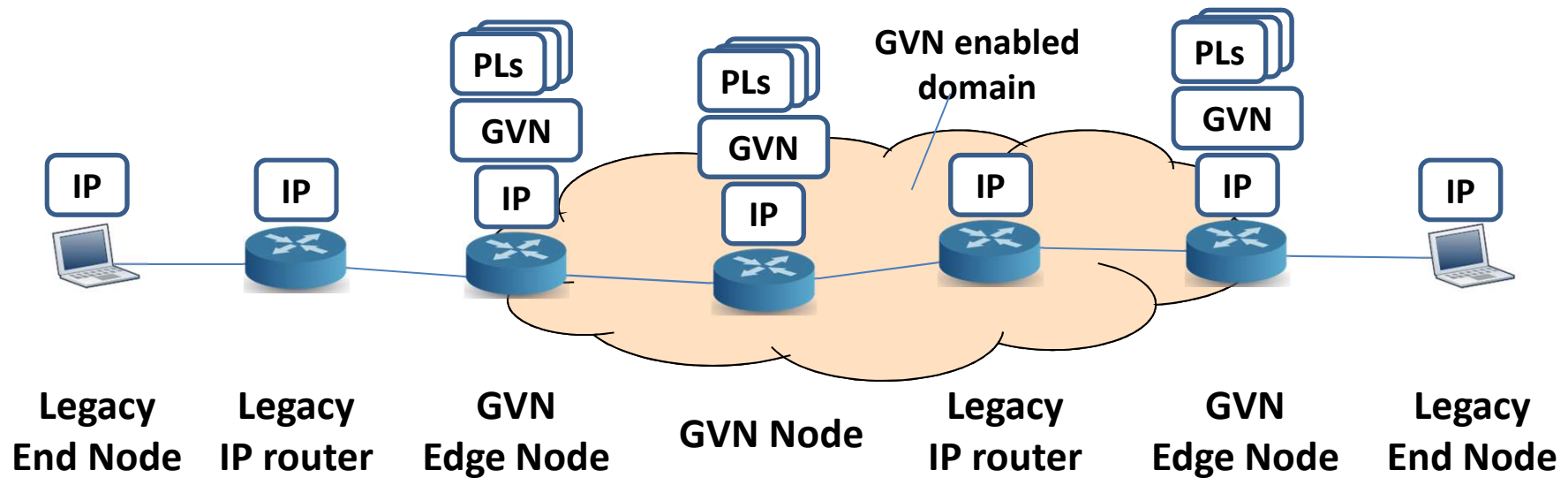
Open to innovation

- If a node does not understand GVN, it operates at IP or layer 2 level
- If a node understands GVN, but does not understand the GVN code (e.g. the GVN processing logic) again it operates at IP or layer 2 level
- If a node understands GVN and the GVN code, it will operate according to the specific GVN Processing Logic

End Nodes GVN scenario

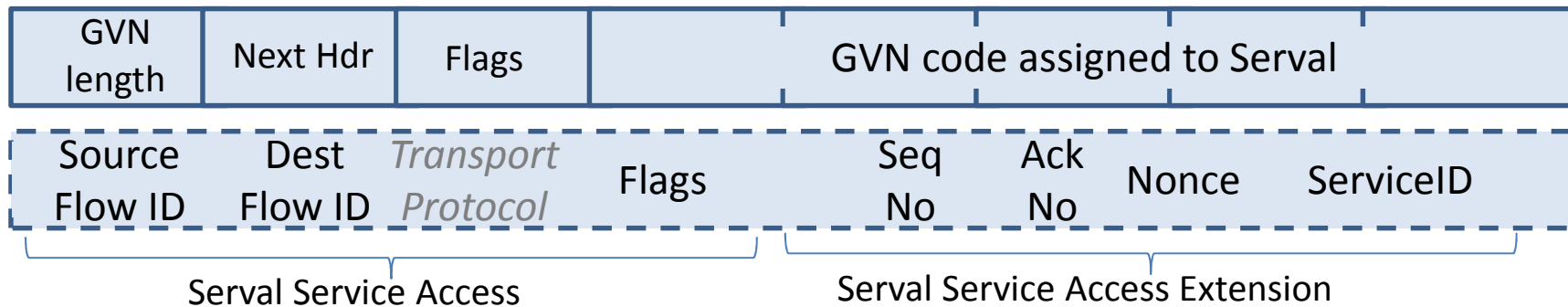


Edge Nodes GVN scenario

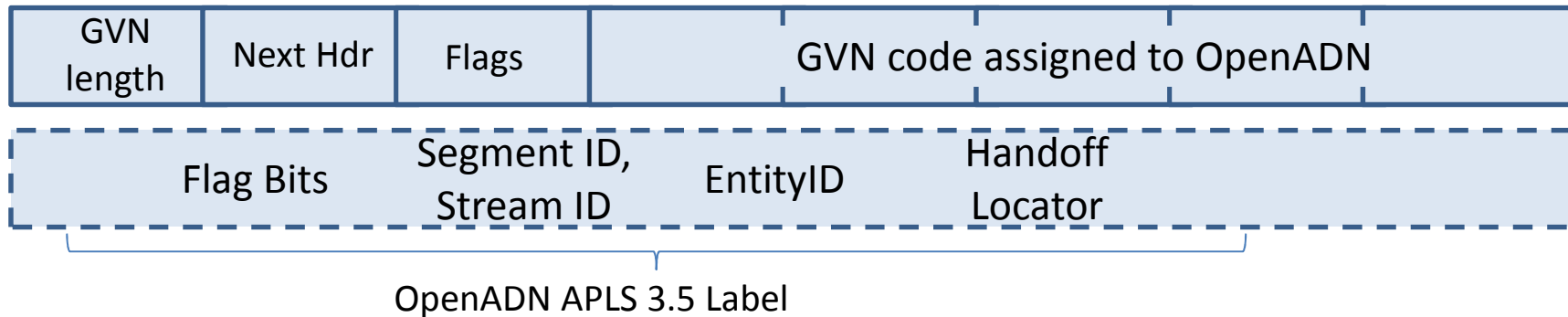


GVN as universal enabler

Mapping of Serval into GVN protocol header



Mapping of OpenADN into GVN protocol header



GVN and NFV

- The Network Function Virtualization (NFV) concept virtualizes the network functions in building blocks that can be executed in distributed environments (e.g. data centers) and that can be chained
- Routing of packets through the chain needs to be controlled by NFV service logic
- A Network Service Header (NSH) to control the routing has been recently proposed... that would perfectly fit into the GVN framework 😊

GVN and SDN

- **A Software Defined Networking (SDN) approach can be used to control a GVN enabled network**
- **Forwarding rules based would be based on the GVN header**
- **It does not come for free... current SDN enabled nodes and OpenFlow protocol are not GVN capable!**
- **Our position is that a structured approach like GVN will ease the introduction of SDN in Service Centric Networking solutions**

Next steps

- **Implementation...**
- **Standardization...**

**... quite a long way to go,
but we look for travel buddies 😊**

Thank you! (questions)



DREAMER Project

<http://netgroup.uniroma2.it/DREAMER>

Distributed **RE**silient sdn **A**rchitecture **ME**eting carrier grade **R**equirements

▪ Partners:



The DREAMER Project is one of the beneficiary projects of the GÉANT Open Call research initiative running from October 2013 to March 2015, see www.geant.net



UNIVERSITY OF ROME TOR VERGATA
Department of Electronics Engineering
Via del Politecnico, 1 - 00133 Rome - Italy

Stefano Salsano, Ph. D.
Assistant professor

Phone: +39 06 7259 7770
Fax: +39 06 7259 7435

e-mail: stefano.salsano@uniroma2.it
http://netgroup.uniroma2.it/Stefano_Salsano