RFC 7665

Service function chaining (SFC) architecture

Background

- Network operators frequently utilize service functions such as packet filtering at firewalls, load-balancing and transactional proxies (for example spam filters) in the delivery of services to end users.
- Delivery of these types of services is undergoing significant change with the introduction of virtualization, network overlays, and orchestration.
- Deploying service functions to support service delivery is currently both a technical and an organizational challenge
  - that involves significant modification to the network configuration, impacting the speed at which services can be deployed and increasing operational costs.

Background

- Today, common deployment models have service functions inserted on the data-forwarding path between communicating peers.
- A different model, where service functions, whether physical or virtualized, are not required to reside on the direct data path and traffic is instead steered through required service functions, wherever they are deployed.
- A set of technologies and process that enables the operator to configure network service dynamically in software without having to make changes to network at hardware level.

What's the problem?

Topological Dependencies	Configuration Complexity	Constrained High Availability	Consistent Ordering of Service Functions
Application of Service Policy	Transport Dependence	Elastic Service Delivery	Traffic Selection Criteria
Limited End-to-End Service Visibility	Classification/Reclassification per Service Function	Symmetric Traffic Flows	Multi-vendor Service Functions

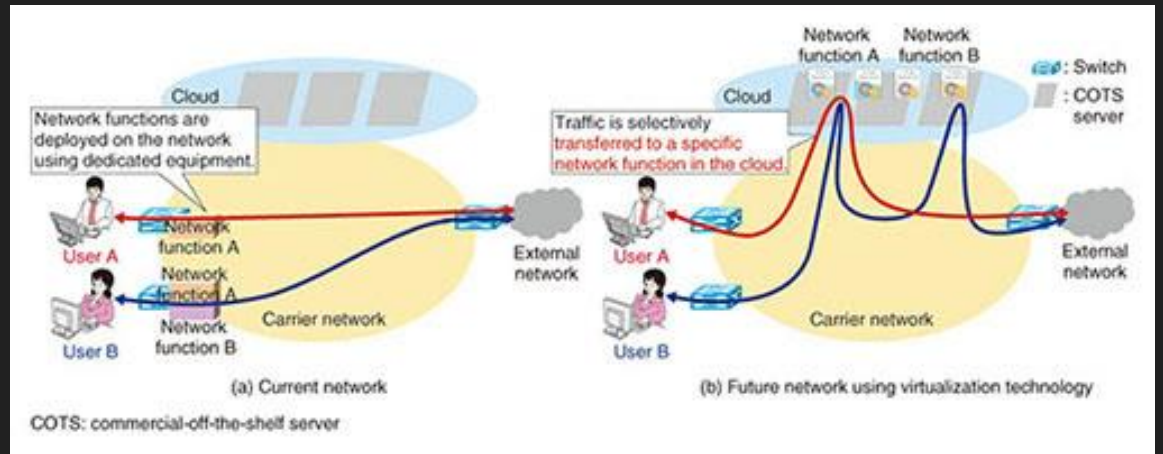
NFV / SDN

NFV

- Network Functions Virtualization (NFV) is a network architecture concept that proposes using IT virtualization related technologies to virtualize entire classes of network node functions into building blocks that may be connected, or chained, together to create communication services.
- As new services are spawned via orchestrator, they must be dynamically chained.

SDN

- Software-defined networking (SDN) is an approach to computer networking that allows network administrators to manage network services through abstraction of lower-level functionality.
- An SDN controller could take chain of services and apply them to different traffic flows depending on the source, destination or type of traffic



Service Functions

- A function that is responsible for specific treatment of received packets.
- As a logical component, a service function can be realized as a virtual element or be embedded in a physical network element.
- Usually bump in the wire / Middle-box

CATEGORY	EXAMPLE FUNCTIONS
Packet inspection	IPFiX, firewalls, IPS, DDoS
Traffic optimization	Video transcoding, TCP optimization, traffic shaping, DPI
Protocol proxies	Carrier-grade NAT, DNS cache, HTTP proxy/cache, SIP proxy, TCP proxy, session border controllers, WebRTC gateways
Value-added services (VAS)	Ad insertion, header enrichment, WAN acceleration, advanced advertising, URL filtering, parental control

Source: Heavy Reading

Classifier & Classification

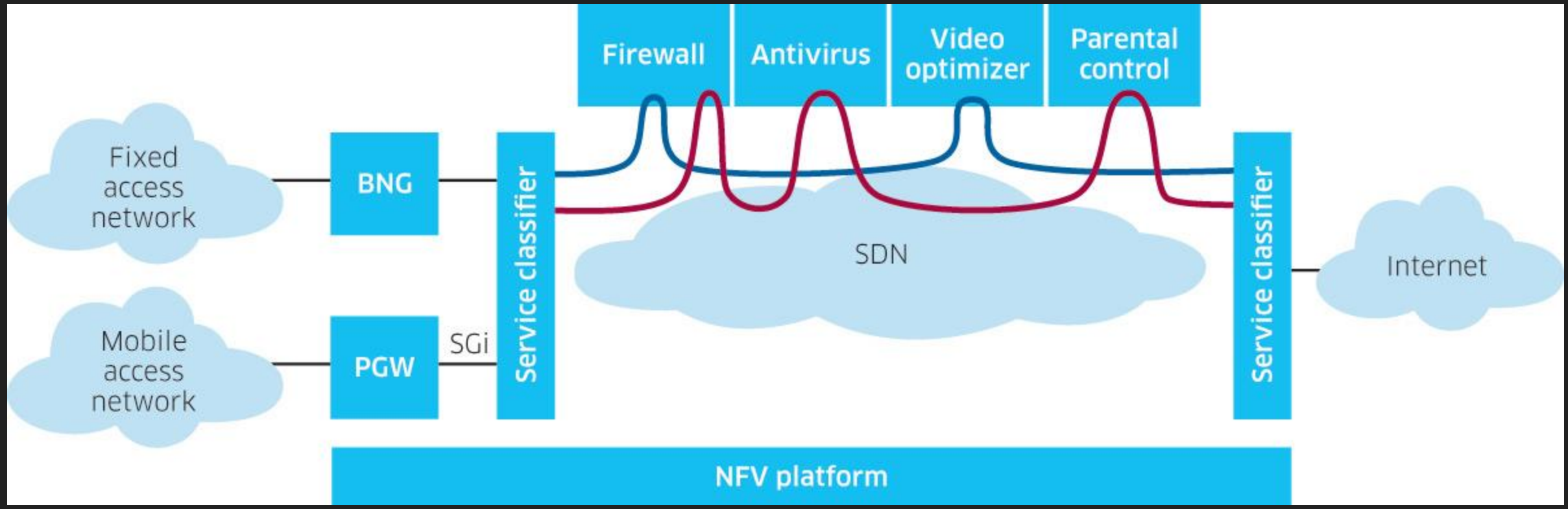
- Classification: Locally instantiated matching of traffic flows against policy for subsequent application of the required set of network service functions. The policy may be customer/network/service specific.
- Classifier: An element that performs Classification.
  - The classifier itself is also just a function and may be integrated into existing devices, such as the GW or an edge router, or it may be a stand-alone deep packet inspection (DPI) function.

SFC, SFP

- Service Function Chain (SFC): A service function chain defines an ordered set of abstract service functions and ordering constraints that must be applied to packets and/or frames and/or flows selected as a result of classification.
  - Services are constructed as abstract sequences of SFs that represent SFCs

- Service Function Path (SFP): The service function path is a constrained specification of where packets assigned to a certain service function path must go.
  - The SFP provides a level of indirection between the fully abstract notion of service chain as a sequence of abstract service functions to be delivered, and the fully specified notion of exactly which SFF/SFs the packet will visit when it actually traverses the network.

All together now…



SFC Encapsulation, NSH, Metadata

- SFC Encapsulation: The SFC encapsulation provides, at a minimum, SFP identification, and is used by the SFC-aware functions, such as the SFF and SFC-aware SFs. The SFC encapsulation is not used for network packet forwarding. In addition to SFP identification, the SFC encapsulation carries metadata including data-plane context information.
  - Network Service Header (NSH) inserted onto packets or frames to realize service function paths
- Metadata: Provides the ability to exchange context information between classifiers and SFs, and among SFs

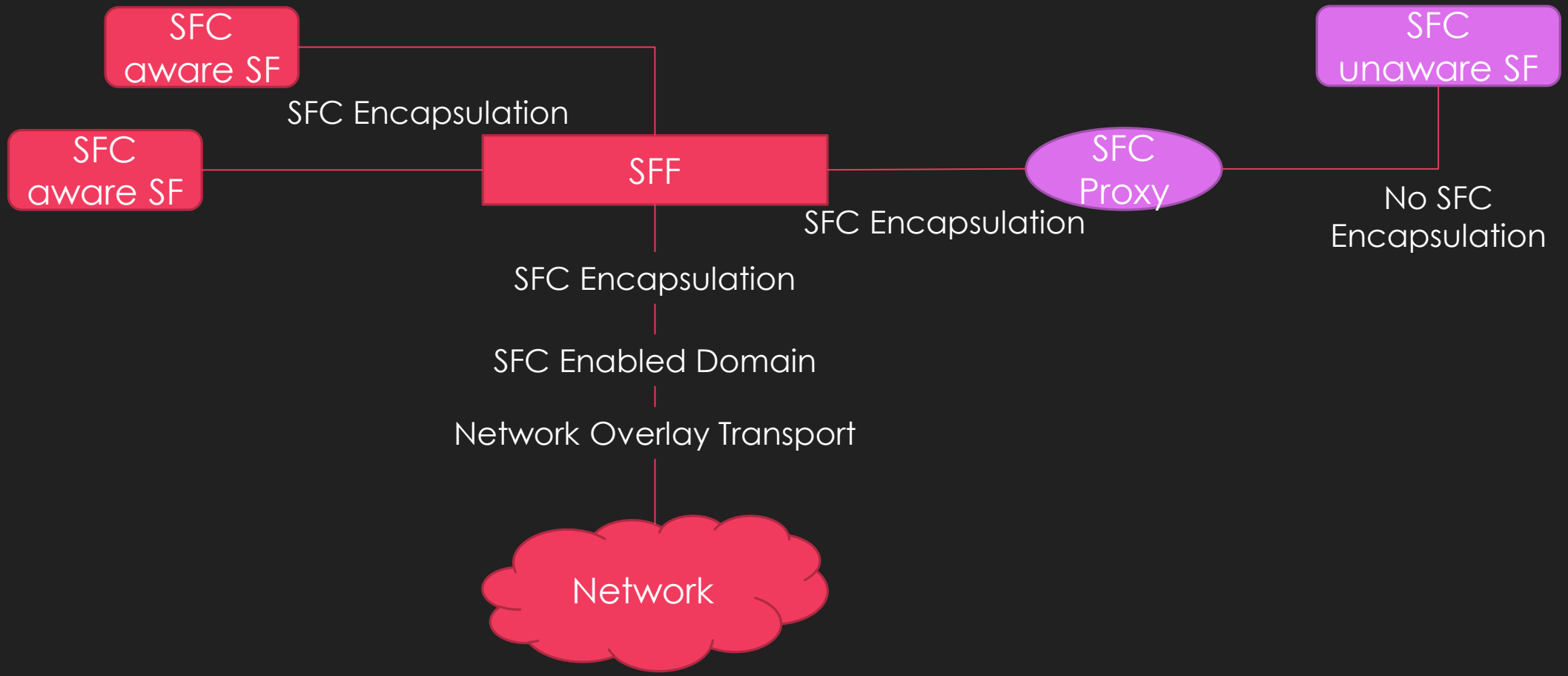
SFF, SF-Proxy

- Service Function Forwarder (SFF): A service function forwarder is responsible for forwarding traffic to one or more connected service functions according to information carried in the SFC encapsulation, as well as handling traffic coming back from the SF.
  - Additionally, an SFF is responsible for delivering traffic to a classifier when needed and supported, transporting traffic to another SFF (in the same or different type of overlay), and terminating the Service Function Path (SFP).
- SF-Proxy: Removes and inserts SFC encapsulation on behalf of an SFC-unaware service function.

Architecture Concepts

- A Service Function Path (SFP) is a mechanism used by service chaining to express the result of applying more granular policy and operational constraints to the abstract requirements of a service chain (SFC).
  - Some SFPs may be fully specified, selecting exactly which SFF and which SF are to be visited by packets using that SFP.
  - While other SFPs may be quite vague, deferring to the SFF the decisions about the exact sequence of steps to be used to realize the SFC.

Components


SFC aware SF
SFC aware SF
SFC Encapsulation
SFF
SFC Proxy
SFC unaware SF
SFC Encapsulation
No SFC Encapsulation
SFC Encapsulation
SFC Enabled Domain
Network Overlay Transport
Network

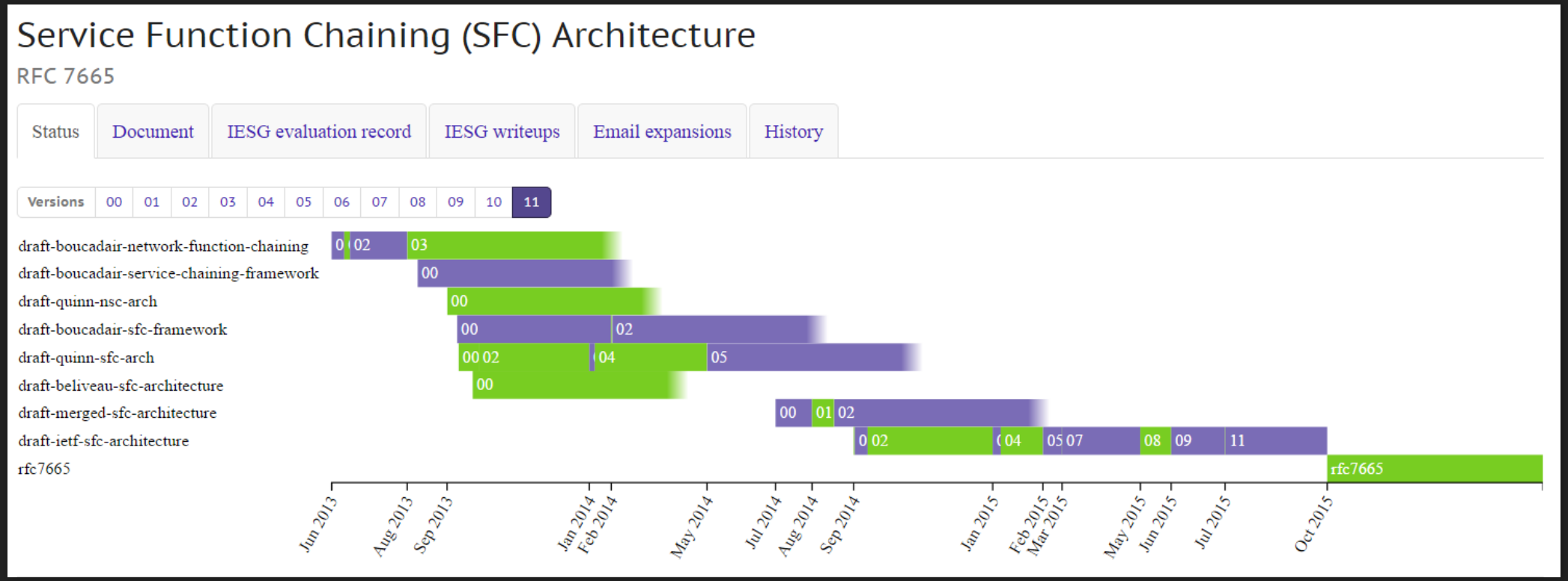
Bunch of other (imp) stuff!

- Policy
- Control Plane
- Resource Control
- Loops?
- Loadbalance
- Fragmentation
- OAM
- Resiliency
- Security

Things in Action

- https://drive.google.com/drive/u/0/folders/0B_2GS0vO9nv2UlBMTXFORUNNeGc

Time after time…



Other work in SFC WG

Document	Date	Status
Active Internet-Drafts		
draft-ietf-sfc-control-plane-08 **Service Function Chaining (SFC) Control Plane Components & Requirements**	2016-10-23 29 pages Expires soon	AD is watching WG Document: Informational Reviews: rtgdir, secdir
draft-ietf-sfc-dc-use-cases-06 **Service Function Chaining Use Cases In Data Centers**	2017-02-22 23 pages	I-D Exists In WG Last Call
draft-ietf-sfc-hierarchical-02 **Hierarchical Service Function Chaining (hSFC)**	2017-01-13 25 pages	I-D Exists WG Document
draft-ietf-sfc-nsh-12 **Network Service Header**	2017-02-23 37 pages	I-D Exists Waiting for WG Chair Go-Ahead: Proposed Standard Reviews: rtgdir
draft-ietf-sfc-offloads-00 **Service Function Simple Offloads**	2017-04-02 17 pages New	I-D Exists WG Document
draft-ietf-sfc-use-case-mobility-07 **Service Function Chaining Use Cases in Mobile Networks**	2016-10-13 26 pages Expires soon	I-D Exists WG Document Reviews: rtgdir

THANK YOU!