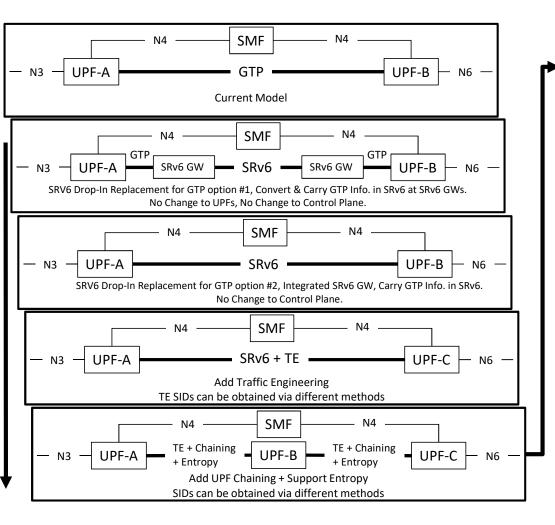
# SRv6 User Plane in Mobile Core

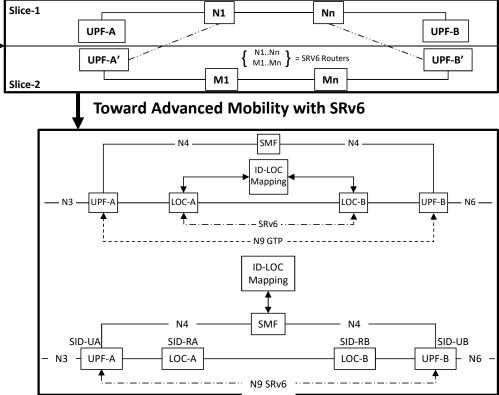
A Smooth Migration of Mobile Core User Plane from GTP to SRv6

Arashmid Akhavain arashmid.akhavain@huawei.com Chenchen Liu liuchenchen1@huawei.com Pablo Camarillo pcamaril@cisco.com

IETF 103, Bangkok November, 2018

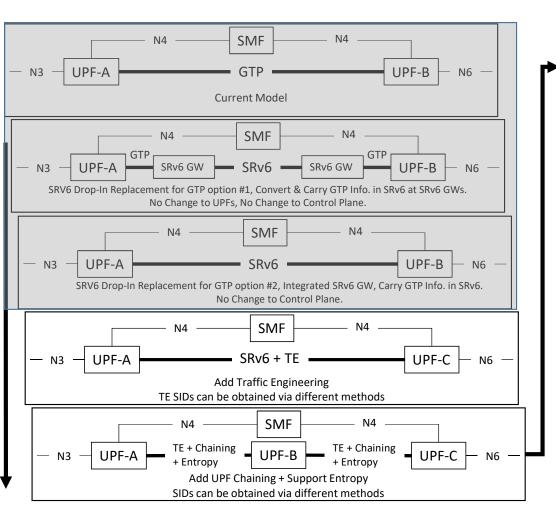
#### SRv6: A Smooth Transition & Pragmatic Approach to Change the User Plane in Mobile Core

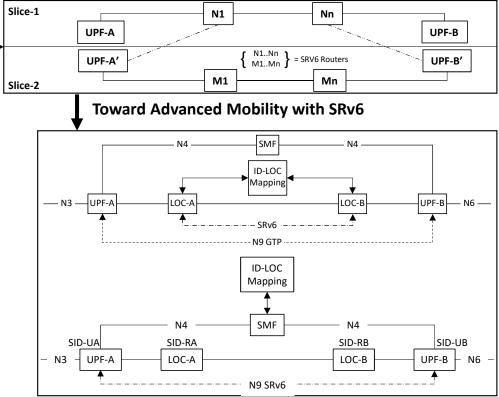




- 1. Drop in SRV6 to replace GTP-U in data plane without changing the control plane.
- 2. Gradually introduce SRv6 features as needed.
- 3. Optionally add advanced mobility support either at global, 5G slice level, or for a particular set of flows

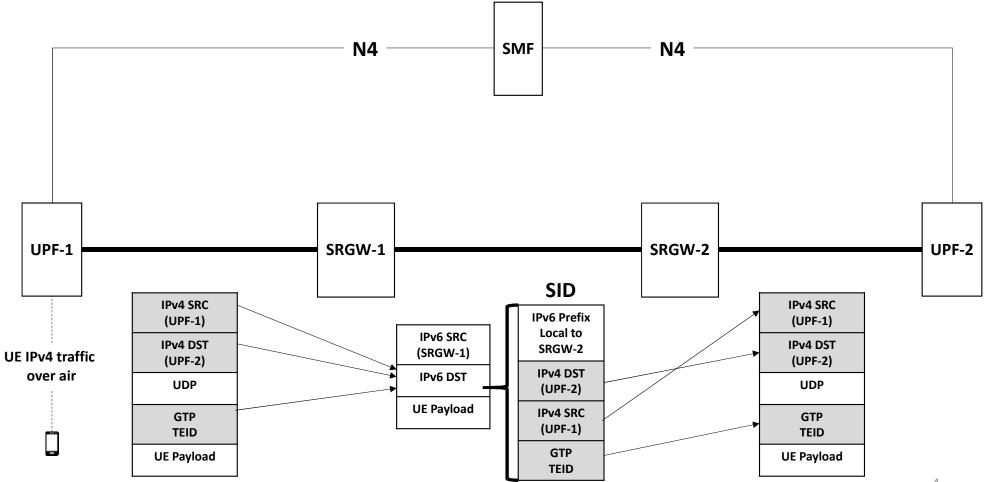
Phase 1: Drop in SRv6 to Replace GTP-U Between UPFs Without Changing 3GPP Control Plane



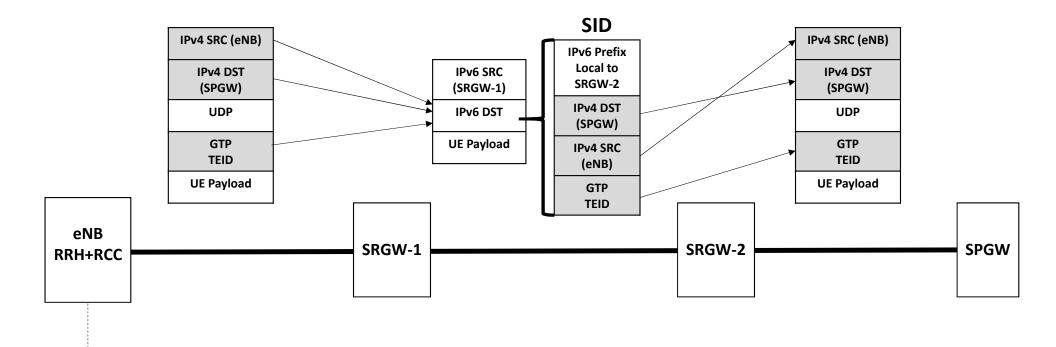


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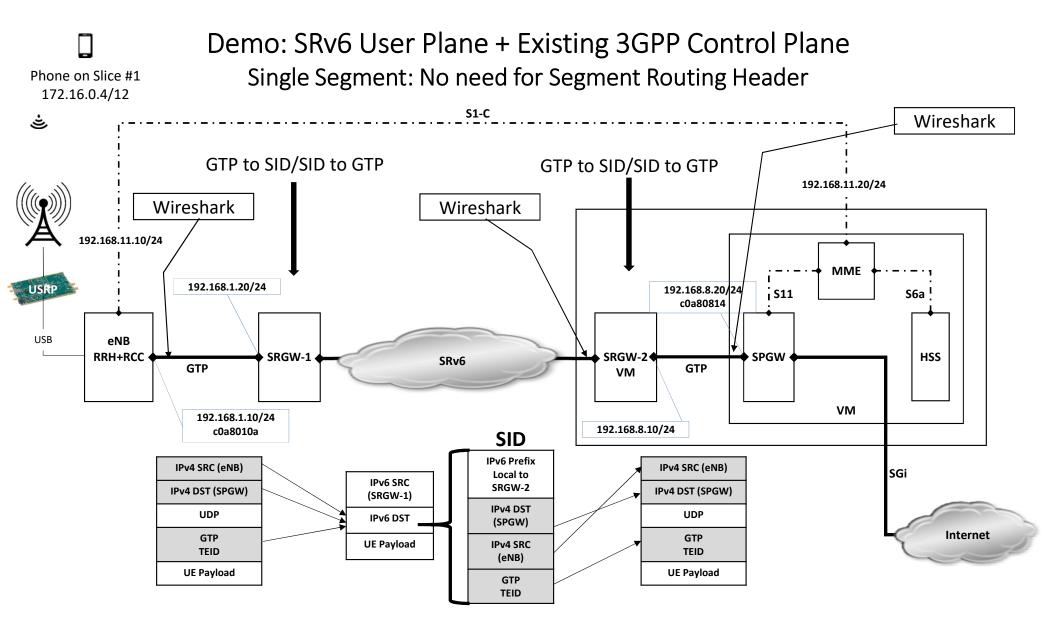
#### Migration from IPv4 to SRv6 in a Nutshell (5G)



#### Migration from IPv4 to SRv6 in a Nutshell (LTE)



#### UE IPv4 traffic over air



## Packet Trace: ICMP ping request from the phone to the internet

	*enp0s9
000 *enot	mp Expression + Apply this filter and the filter
	Time Source Destination Protocol Lengin Info
	6560 891.9146 172.16.0.4 172.217.0.238 ICMP 138 Echo (ping 🖉 📕 🧰
imp 🛛 🗆 • Expression	6561 891.9257 1/2.217.0.238 1/2.10.0.4 1CMP 138 ECHO (ping. 5 No. 1MP 30012 412 0.228 CTP 134 Echo (ping.) regul
No. Time Source Destination Protocol Length Info	6564 892.9127 1/2.10.0.4 1/2.217.0.236 ICMP 138 ECHO (ping 0000 091.9202 1/2100 017.000 091.9202 1/210.000 091.9202
→ 6586 891.929615190 172.16.0.4 172.217.0.238 GTP <l. (ping)="" 134="" echo="" id="0.&lt;/td" request=""><td>6565 892.9243 1/2.217.9.236 1/2.10.9.4 10MP 138 ECHO (ping. a = 0569 651.5000 1/2.10.9.4 170.217.9.238 GTP 134 Echo (ping.) reque</td></l.>	6565 892.9243 1/2.217.9.236 1/2.10.9.4 10MP 138 ECHO (ping. a = 0569 651.5000 1/2.10.9.4 170.217.9.238 GTP 134 Echo (ping.) reque
⊨ 6587 891.946893365 172.219.0.238 172.16.0.4 GTP <i (ping)="" 134="" echo="" id="0.&lt;/td" reply=""><td>6566 893.9266 1/2.10.0.4 1/2.21/.0.238 IUMP 138 ECHO (ping. a 0592 052.5253 1/2.201.0.0.20 137 16.0.4 GTP 134 Echo (ping. really</td></i>	6566 893.9266 1/2.10.0.4 1/2.21/.0.238 IUMP 138 ECHO (ping. a 0592 052.5253 1/2.201.0.0.20 137 16.0.4 GTP 134 Echo (ping. really
6590 892.927684581 172.16.0.4 172.217.0.238 GTP <i_ (ping)="" 134="" echo="" id="0.&lt;/td" request=""><td>6567 893.9385 1/2.21/.0.238 1/2.10.0.4 ICMP 138 ECRO (ping 6 0593 652.5340 1/2.21/.0.10 017 0.238 CTP 134 Echo (ning) reque</td></i_>	6567 893.9385 1/2.21/.0.238 1/2.10.0.4 ICMP 138 ECRO (ping 6 0593 652.5340 1/2.21/.0.10 017 0.238 CTP 134 Echo (ning) reque
6591         892.939522500         172.217.0.238         172.16.0.4         GTP <l< th="">         134         Echo (ping)         reply         id=0.           6592         893.941664326         172.16.0.4         172.217.0.238         GTP <l< td="">         134         Echo (ping)         reply         id=0.</l<></l<>	6568 894.9226 1/2.16.0.4 1/2.21/.0.238 ICMP 138 ECRO (ping ) 0594 653.5375 1/2.1610.4 GTP 134 Echo (ping. rely
6593 893.953674736 172.217.0.238 172.16.0.4 GTP <l (ping)="" 134="" ecto="" id="0.&lt;/td" reply=""><td>6569 894.9338 172.217.0.238 172.16.0.4 ICMP 138 ECO (ping</td></l>	6569 894.9338 172.217.0.238 172.16.0.4 ICMP 138 ECO (ping
6594 894.937678550 172.16.0.4 172.217.0.238 GTP <l (ping)="" 134="" echo="" id="0_&lt;/td" request=""><td>0030034,5555 1/2:10:014</td></l>	0030034,5555 1/2:10:014
6595 894.949665879 172.217.0.238 172.16.0.4 GTP <l (ping)="" 134="" echo="" id="8_&lt;/td" reply=""><td>11 cm 0 00001 100 0/ 000 0 000 0 000 0 000 0 0000 0 0 0 0 0</td></l>	11 cm 0 00001 100 0/ 000 0 000 0 000 0 000 0 0000 0 0 0 0 0
	51 CCOQ, 124 bytac OD WICE (14// 0115), 134 bytac OD WICE CAPTURED (1012 010)
	Therat II Src: PesCompu 1f:ee:d9 (08:00:27:11:ee:a9), USL: PesCompu u
• Frame 6586: 134 bytes on wire (1072 bits), 134 bytes captured (1072 bits) on interface 0	Und Violett -
Ethernet II, Src: Universa_49:55:fb (cc:52:af:49:55:fb), Dst: HuaweiTe_37:18:1f (c8:1f:be:37:18:1f)     Internet Protocol Varging ( Exp. 400.456) ( 0.0000 0.000 0.000 0.0000 0.000 0.000 0.000 0.000 0.000 0.000 0.00000	0000 0000 0000 0000 0000 = Flow Label: 0x00000 User Datagram Protocol, Src Port: 2152, Dst Port: 2152
<ul> <li>Internet Protocol Version 4 Src: 192.168.1.10, Dst: 192.168.8.20</li> <li>User Datagram Protocol, Src Port: 2152, Dst Port: 2152</li> </ul>	Payload Length: 84
GPRS Tunneling Protocol	Nuch Verdery IDIO (A) New LUDD New CTD FLAGS: 0X30
Flags: 0x30 Message Type: T-PDU (0xff)	Message Type: T-PDU (0xTT)
Length: 84	story IPv6 prefix + DA + SA + TEID
TEID: 0x00000002	
T-PDU Data: 450000545d4c400040018381ac100004acd900ee0800769h Internet Protocol Version 4, Src: 172.16.0.4, Dst: 172.217.0.238	Internet Protocol Version 4, Src: 172.16.0.4, Dst: 1/2.21/.0.238
Internet Control Message Protocol UE Payload	Internet Control Message Protocol UE Payload Internet Protocol Version 4, Stc. 112:10:004, Oct. 112:10:1004, Oct. 112:10:1004, Oct. 112:10:1004, Oct. 112:1004, Oct. 112:1004, Oct. 112:1004, Oct. 112:1004, Oct.
70000 c8 1f be 37 18 1f cc 52 af 49 55 fb 88 88 45 807R .IUE.	
0010 00 78 29 53 40 00 40 11 86 13 C0 a8 01 0a C0 a8 .x).0.0.	G G G G G G G G G G G G G G G G G G G

eNB: Tx

SRGW-2: Rx

SPGW: Rx

## Packet Trace: ICMP ping reply from the internet to the phone

	) \$  = 4		•••••• •••••• •••••••••••••••••••••••			DO 🕘 EPC [Running] - Oracle VM VirtualBox		ti 🖬	<b>4)</b> 11:09 AM {
im						File Machine View Input Devices Help *enp0s9		t B «	() 11:09 AM ()
, runp		Expression +	I icmp		Expression + Apply this fi		()2	and the second	
vo. Time Source	Destination	Protocol Length Info	No.         Time         Source           → 6560         891.9146         172.16.0.4	Destination	Protocol Length Info				
→ 6586 891.929615190 172.16.0.4	172.217.0.238	GTP <l. (ping)="" 134="" echo="" id="0&lt;/td" request=""><td>+ 6561 891.9257 172.217.0.2</td><td>172.217.0.238 172.16.0.4</td><td> (prui</td><td></td><td></td><td></td><td>xpression +</td></l.>	+ 6561 891.9257 172.217.0.2	172.217.0.238 172.16.0.4	(prui				xpression +
6587 891.940893365 172.217.0 238	172.16.0.4	GTP <i (ping)="" 134="" echo="" id="0&lt;/td" reply=""><td>6564 892.9127 172.16.0.4</td><td>172.217.0.238</td><td> (P+</td><td></td><td>Destination 172.217.0.238</td><td>Protocol Length Info GTP 134 Echo (ping) r</td><td>roquest</td></i>	6564 892.9127 172.16.0.4	172.217.0.238	(P+		Destination 172.217.0.238	Protocol Length Info GTP 134 Echo (ping) r	roquest
6590 892.927684581 172.16.0.4	172.217.0.238	GTP <i (ping)="" 134="" echo="" id="0&lt;/td" request=""><td>6565 892.9243 172.217.0.2</td><td></td><td>ICMP 138 Echo (pin</td><td></td><td></td><td>GTP 134 Echo (ping) r</td><td>Contraction of the second second</td></i>	6565 892.9243 172.217.0.2		ICMP 138 Echo (pin			GTP 134 Echo (ping) r	Contraction of the second second
6591 892.939522500 172.217.0.238	172.16.0.4	GTP <i (ping)="" 134="" echo="" id="0&lt;/td" reply=""><td>6566 893.9266 172.16.0.4</td><td>172.217.0.238</td><td></td><td></td><td>172.217.0.238</td><td></td><td></td></i>	6566 893.9266 172.16.0.4	172.217.0.238			172.217.0.238		
6592 893.941664326 172.16.0.4 6593 893.953674736 172.217.0.238	172.217.0.238	GTP <i (ping)="" 134="" echo="" id="0&lt;/td" request=""><td>6567 893.9385 172.217.0.2</td><td>38 172.16.0.4</td><td>ICMP 138 Echo (pin</td><td></td><td>38 172.16.0.4</td><td>GTP 134 Echo (ping) r</td><td>reply</td></i>	6567 893.9385 172.217.0.2	38 172.16.0.4	ICMP 138 Echo (pin		38 172.16.0.4	GTP 134 Echo (ping) r	reply
6594 894.937678550 172.16.0.4	172.16.0.4 172.217.0.238	GTP <i (ping)="" 134="" echo="" id="0&lt;br" reply="">GTP <i (ping)="" 134="" echo="" id="0&lt;/td" request=""><td>6568 894.9226 172.16.0.4</td><td>172.217.0.238</td><td></td><td></td><td>172.217.0.238</td><td></td><td>and the second second second</td></i></i>	6568 894.9226 172.16.0.4	172.217.0.238			172.217.0.238		and the second second second
6595 894.949065879 172.217.0.238	172.217.0.238	GTP <i. (ping)="" 134="" echo="" id="0_&lt;/td" reply=""><td>6569 894.9338 172.217.0.2</td><td>38 172.16.0.4</td><td>ICMP 138 Echo (pin</td><td></td><td>38 172.16.0.4</td><td>GTP 134 Echo (ping) r</td><td>Constant and the second second</td></i.>	6569 894.9338 172.217.0.2	38 172.16.0.4	ICMP 138 Echo (pin		38 172.16.0.4	GTP 134 Echo (ping) r	Constant and the second second
1000 001101000010 112.211.0.200	172.10.0.4	on via 104 cons (ping) ropily is ca	▶ Frame 6561: 138 bytes on w	ire (1104 hits)	138 hytes cantured (1	6596 894.9333 172.16.0.4		GTP 134 Echo (ping) r	
			Ethernet II, Src: PcsCompu				38 172.16.0.4	GTP 134 Echo (ping) r	ерту
			• Internet Protocol Version			a8 Frame 6589: 134 bytes on wi	re (1072 bits), 1	134 bytes captured (1072 b	bits) on
▶ Frame 6587: 134 bytes on wire (1072 bi	ts), 134 bytes captur	red (1072 bits) on interface 0	0110 = Version: 6			Ethernet II, Src: PcsCompu_	_dd:47:b7 (08:00:2	27:dd:47:b7), Dst: PcsComp	pu_1f:ee
Ethernet II, Src: HuaweiTe_37:18:1f (cluster)	8:1f:be:37:18:1f), Ds	st: Universa_49:55:fb (cc:52:af:49:55:fb)	► 0000 0000	=	Traffic Class: 0x00 (	)SC • Internet Protocol Version 4	, Src: 192.168.8.	20, Dst: 192.168.1.10	
<ul> <li>Internet Protocol Version 4, Src: 192.168.8.20 Dst: 192.168.1.10</li> <li>User Datagram Protocol, Src Port: 2152, Dst Port: 2152</li> </ul>			0000 0000 0000 0000 = Flow Label: 0x00000			• User Datagram Protocol, Src Port: 2152, Dst Port: 2152			
GPRS Tunneling Protocol	, DSE POFE: 2152		Payload Length: 84			GPRS Tunneling Protocol			And Andrewson and
→ Flags: 0x30			Next Header: IPIP (4) No UDP, No GTP			Flags: 0x30 Message Type: T-PDU (0xff)			
Message Type: T-PDU (0xff)			Hop Limit: 63 Source: fd02:: IPv6 pre			Length: 84			2
Length: 84			Destination: fd01:0 c0a8	102:0028:814 026	f e0dd	TEID: 0xca6fe0dd (33963296	593)		
TEID: 0xca6fe0dd		1.05	▶ Internet Protocol Version	4 Src: 172.217.0	.238, Dst: 172.16.0.4	T-PDU Data: 45000054cb2e4			
T-PDU Data: 45000054cb2e40003d01189f Internet Protocol Version 4, Src: 172.			► Internet Control Message F	rotocol	UE Payload	FILEINEL FIOLOCOL VEISION 4		238, Dst: 172.16.0.4 UE Payload	
Internet Control Message Protocol	211101200; DOCT 11211	UE Payload	p Internet control nessage		0214,000	Internet Control Message Pr	otocol	OLFAYIOdu	
cc 52 af 49 55 tb c8 1f be 37 18	1f 08 00 45 00 .R.I	U7E.	0000 44 8a 5b be 44 76 00	00 27 3c hc dh	86 dd 60 00 D [ DV	. 0000 08 00 27 1f ee d9 08			GE
0010 00 78 7b 7f 40 00 3f 11 35 87 c0	a8 08 14 c0 a8 .x{.	ę.?. 5	44 8a 5b be 44 76 00		00 00 00 00 ··· T·?	0010 00 78 72 76 00 00 40	11 7d 90 c0 a8 C	08 14 c0 a8 xrv @ }	0 T O



SRGW-2: Tx

SPGW: Tx