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IP Traffic Flow Security

Improving IPsec Traffic Flow Confidentiality

IETF 106 – “draft-ipsecme-iptfs-00” (contingent)

Update Since IETF 105

- Suggested New Charter Text – well received

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  The demand for Traffic Flow Confidentiality has been increasing in the
  user community; however, the current method defined in RFC4303 (i.e.,
  add null padding to each ESP payload) is very inefficient in it's use of
  network resources. The working group will develop an alternative TFC
  solution that provides for efficient use of network resources.
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- Adoption Call Issued
  - Well supported with comments.
- Adoption Call Passed (*)
  - (*) Waiting on charter update

Adoption Call Comments

- Good starting point.
- Would like to see more analysis on fragmentation.
  - Will do.
- Has affect of Congestion Control on tunnel with CC tunneled traffic been considered.
- Be aware of how this aligns with QUIC.
  - Would like to understand more on QUIC alignment.

Adoption Call Comments

- Good starting point.
- Is IP number allocation for payload format an issue?
- We believe that getting an IP number is a manageable issue.
  - We reserve initial bits which allows for re-use of this IP number allocation if that ends up being needed.

Adoption Call Comments

- Good for addressing traffic analysis
- Has potential for addressing PMTU issues with traditional IPsec tunnels.
- Using the payload format will address the PMTU issue.

Update

- Datablock (inner packet) alignment is being looked at.
  - Aligning internal packets does allow for less rigorous code to work.
  - E.g., some whitebox code is known to assume length fields are naturally aligned.
- Open source implementation in 2020
  - Congestion Control
  - IKEv2
- Open to collaboration/interoperability testing.

Questions and Comments

Backup Slides

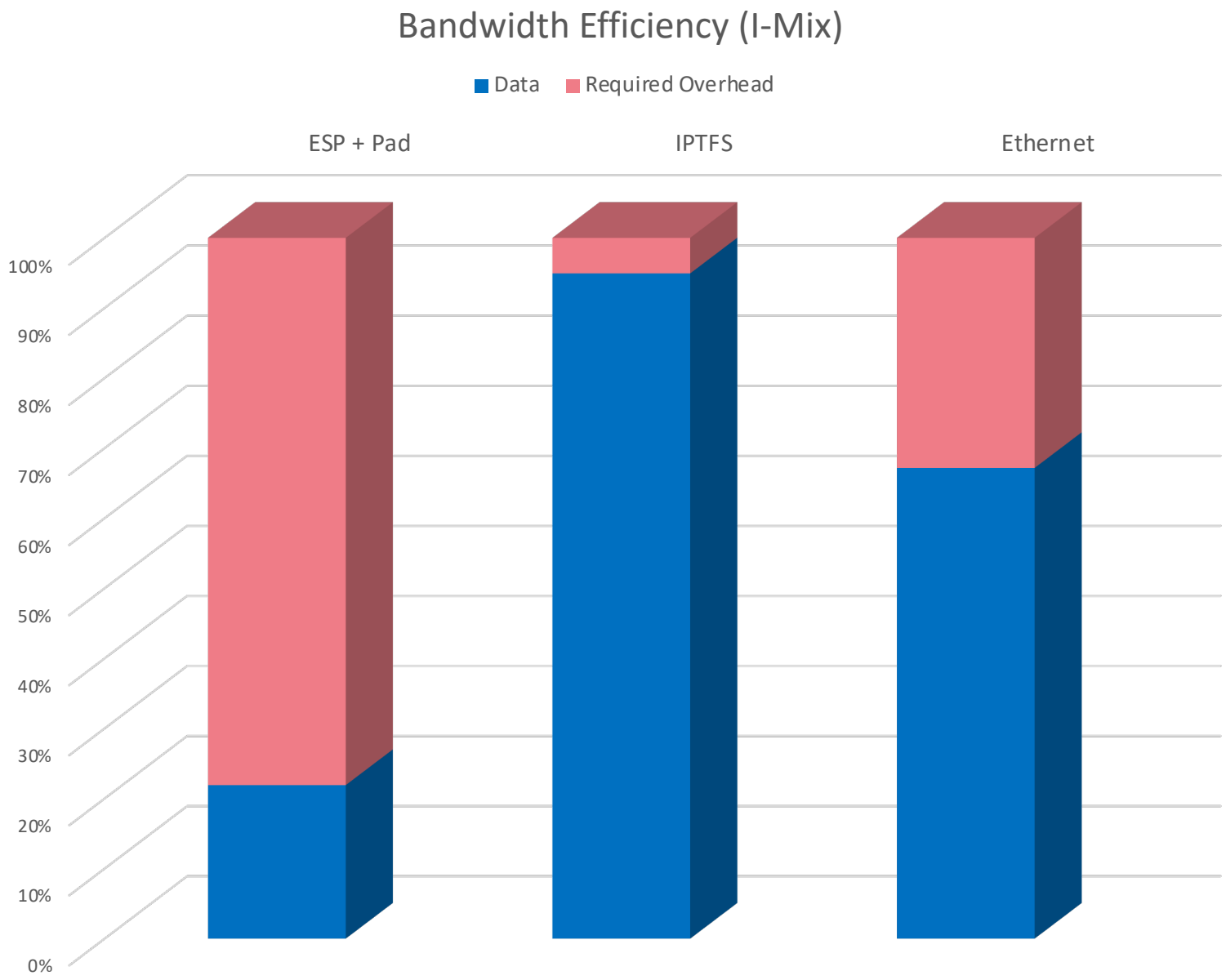
Comparison Data

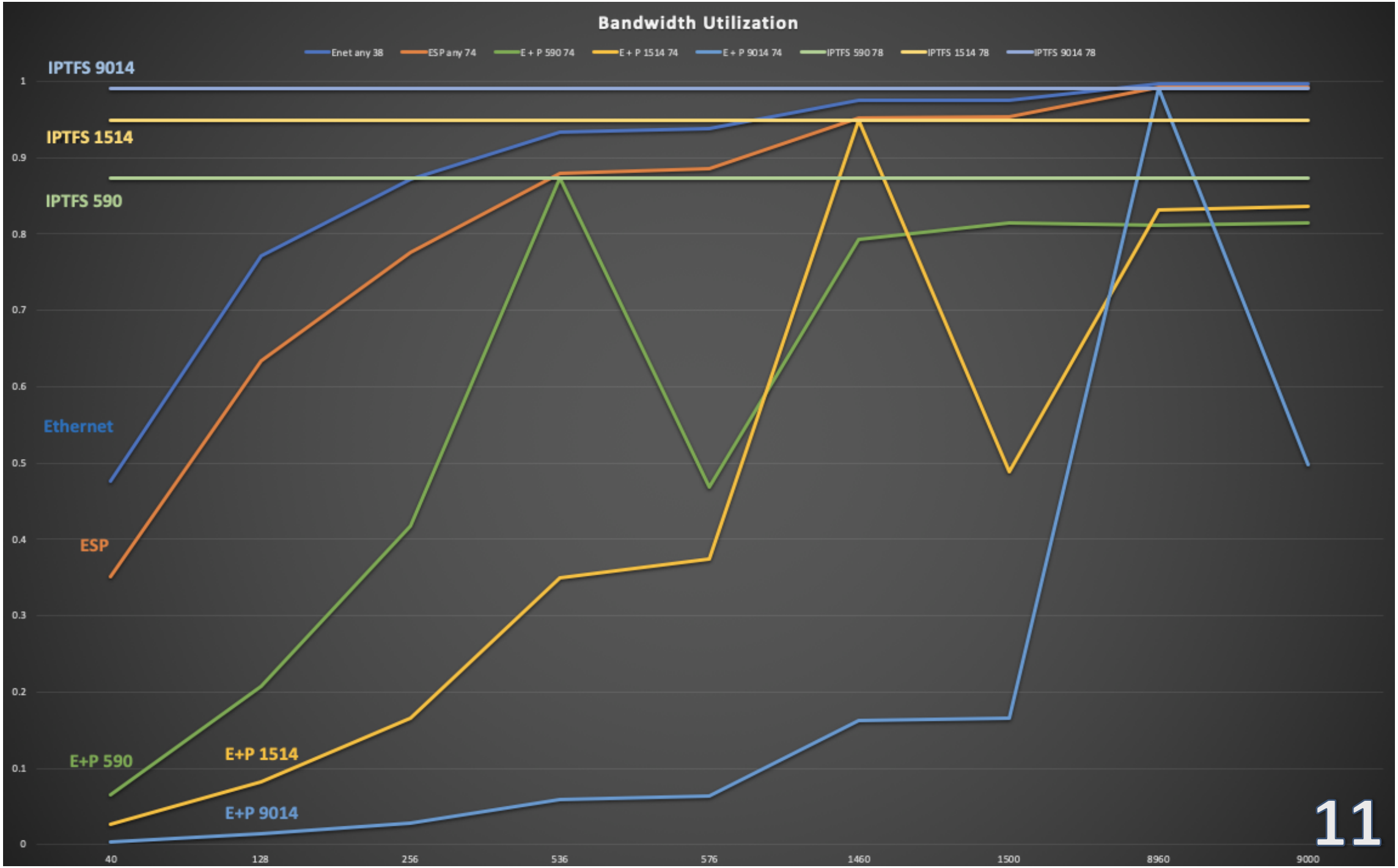
Why is this Needed?

- Current Solution: ESP + Padding 1:1
- Not Deployable.

Solution Cost (I-Mix)

	ESP + Pad	IPTFS	Enet
Bandwidth Used	1Gb	1Gb	1Gb
I-Mix Throughput	219Mb	943Mb	672Mb




Bandwidth Utilization
Enet any 38
ESP any 74
E + P 590 74
E + P 1514 74
E + P 9014 74
IPTFS 590 78
IPTFS 1514 78
IPTFS 9014 78
IPTFS 9014
IPTFS 1514
IPTFS 590
Ethernet
ESP
E+P 590
E+P 1514
E+P 9014
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
40
128
256
536
576
1460
1500
8960
9000

Overhead Comparison in Octets

Type	ESP+Pad	ESP+Pad	ESP+Pad	IP-TFS	IP-TFS	IP-TFS
L3 MTU	576	1500	9000	576	1500	9000
PSize	540	1464	8964	536	1460	8960
40	500	1424	8924	3.0	1.1	0.2
128	412	1336	8836	9.6	3.5	0.6
256	284	1208	8708	19.1	7.0	1.1
536	4	928	8428	40.0	14.7	2.4
576	576	888	8388	43.0	15.8	2.6
1460	268	4	7504	109.0	40.0	6.5
1500	228	1500	7464	111.9	41.1	6.7
8960	1408	1540	4	668.7	245.5	40.0
9000	1368	1500	9000	671.6	246.6	40.2

Overhead as Percentage of Inner Packet

Type	ESP+Pad	ESP+Pad	ESP+Pad	IP-TFS	IP-TFS	IP-TFS
MTU	576	1500	9000	576	1500	9000
PSize	540	1464	8964	536	1460	8960
40	1250.0%	3560.0%	22310.0%	7.46%	2.74%	0.45%
128	321.9%	1043.8%	6903.1%	7.46%	2.74%	0.45%
256	110.9%	471.9%	3401.6%	7.46%	2.74%	0.45%
536	0.7%	173.1%	1572.4%	7.46%	2.74%	0.45%
576	100.0%	154.2%	1456.2%	7.46%	2.74%	0.45%
1460	18.4%	0.3%	514.0%	7.46%	2.74%	0.45%
1500	15.2%	100.0%	497.6%	7.46%	2.74%	0.45%
8960	15.7%	17.2%	0.0%	7.46%	2.74%	0.45%
9000	15.2%	16.7%	100.0%	7.46%	2.74%	0.45%

Bandwidth Utilization over Ethernet

	Enet	ESP	E + P	E + P	E + P	IPTFS	IPTFS	IPTFS
	any	any	590	1514	9014	590	1514	9014
Size	38	74	74	74	74	78	78	78
40	47.6%	35.1%	6.5%	2.6%	0.4%	87.3%	94.9%	99.1%
128	77.1%	63.4%	20.8%	8.3%	1.4%	87.3%	94.9%	99.1%
256	87.1%	77.6%	41.7%	16.6%	2.8%	87.3%	94.9%	99.1%
536	93.4%	87.9%	87.3%	34.9%	5.9%	87.3%	94.9%	99.1%
576	93.8%	88.6%	46.9%	37.5%	6.4%	87.3%	94.9%	99.1%
1460	97.5%	95.2%	79.3%	94.9%	16.2%	87.3%	94.9%	99.1%
1500	97.5%	95.3%	81.4%	48.8%	16.6%	87.3%	94.9%	99.1%
8960	99.6%	99.2%	81.1%	83.2%	99.1%	87.3%	94.9%	99.1%
9000	99.6%	99.2%	81.4%	83.6%	49.8%	87.3%	94.9%	99.1%

Latency

- Latency values seem very similar
- IP-TFS values represent max latency
- IP-TFS provides for constant high bandwidth
- ESP + padding value represents min latency
- ESP + padding often greatly reduces available bandwidth.

	ESP+Pad 1500	ESP+Pad 9000	IP-TFS 1500	IP-TFS 9000
40	1.14 us	7.14 us	1.17 us	7.17 us
128	1.07 us	7.07 us	1.10 us	7.10 us
256	0.97 us	6.97 us	1.00 us	7.00 us
536	0.74 us	6.74 us	0.77 us	6.77 us
576	0.71 us	6.71 us	0.74 us	6.74 us
1460	0.00 us	6.00 us	0.04 us	6.04 us
1500	1.20 us	5.97 us	0.00 us	6.00 us