Multi-Stream Traffic Generator and Analyzer (1 Gbps)

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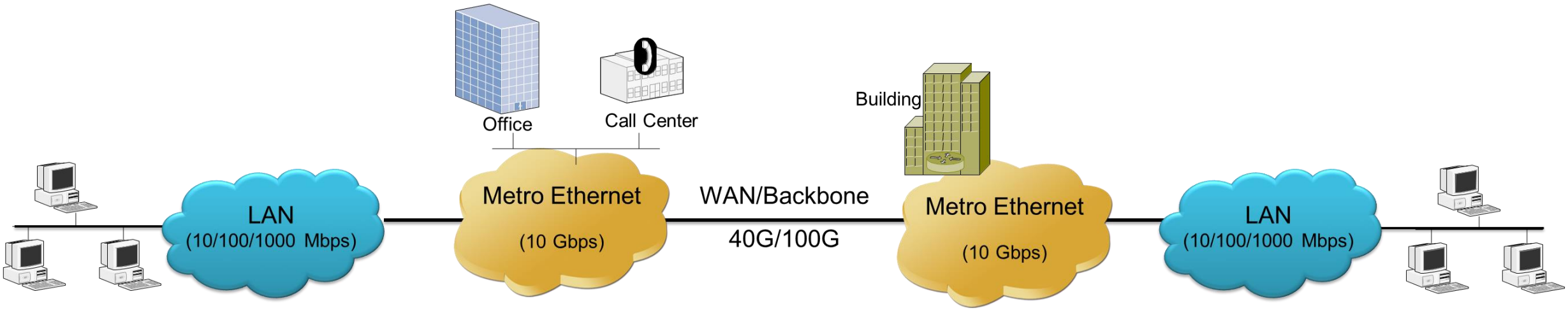
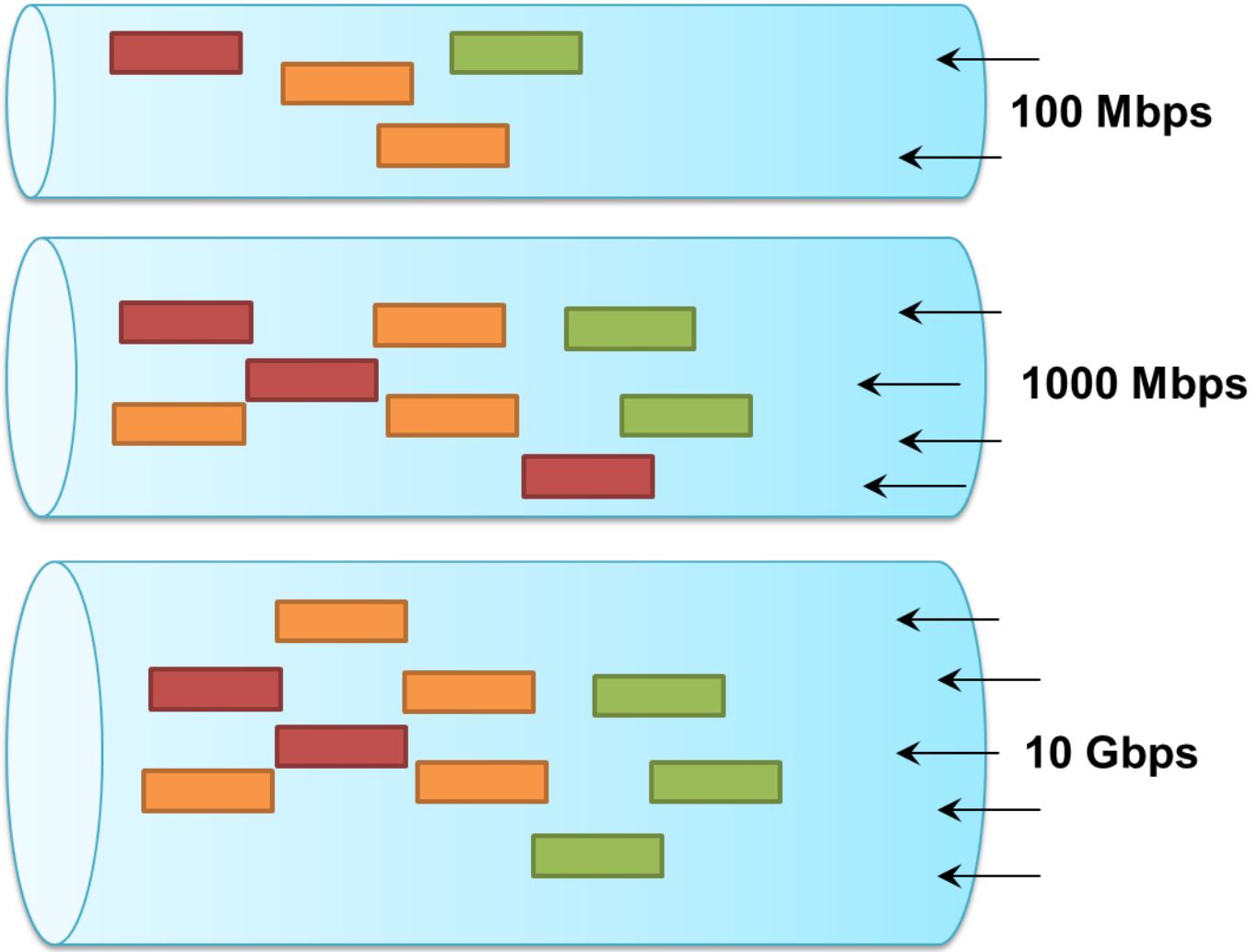
Website: https://www.gl.com

Ethernet Technology



Just bigger Pipes, but same Ethernet/IP Packets



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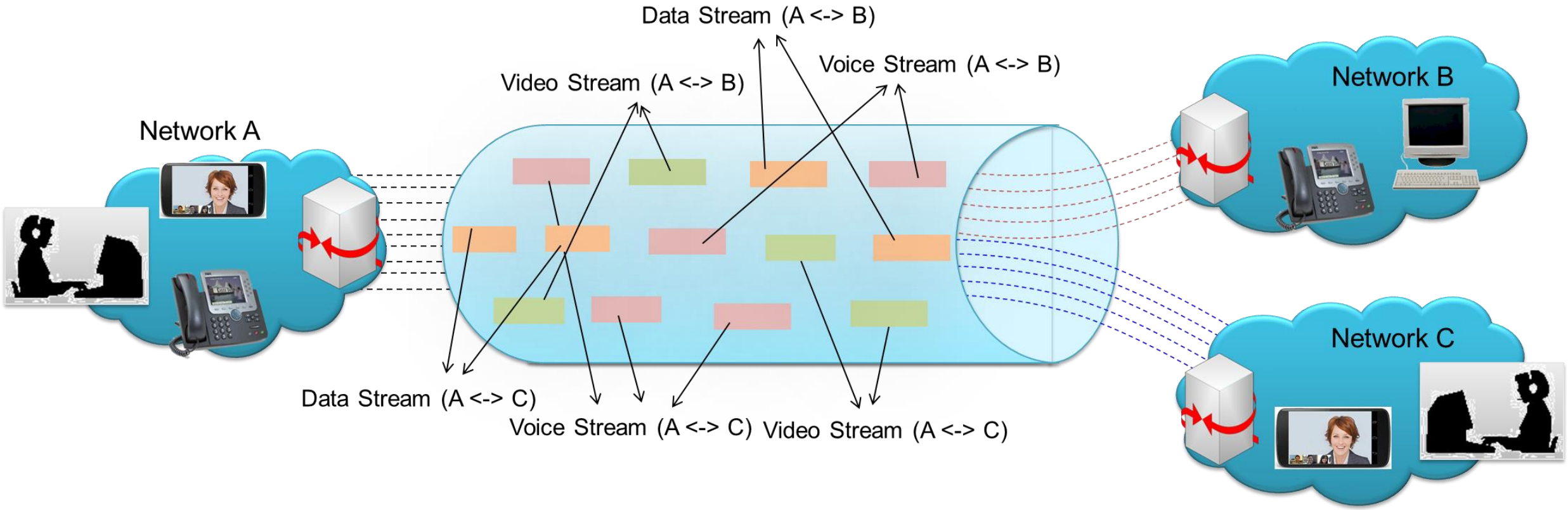
Multi Stream Traffic



- A traffic "**Stream**" or "**Flow**" can be defined as a set of packets flowing across the DUT/Network, who are logically connected to each other

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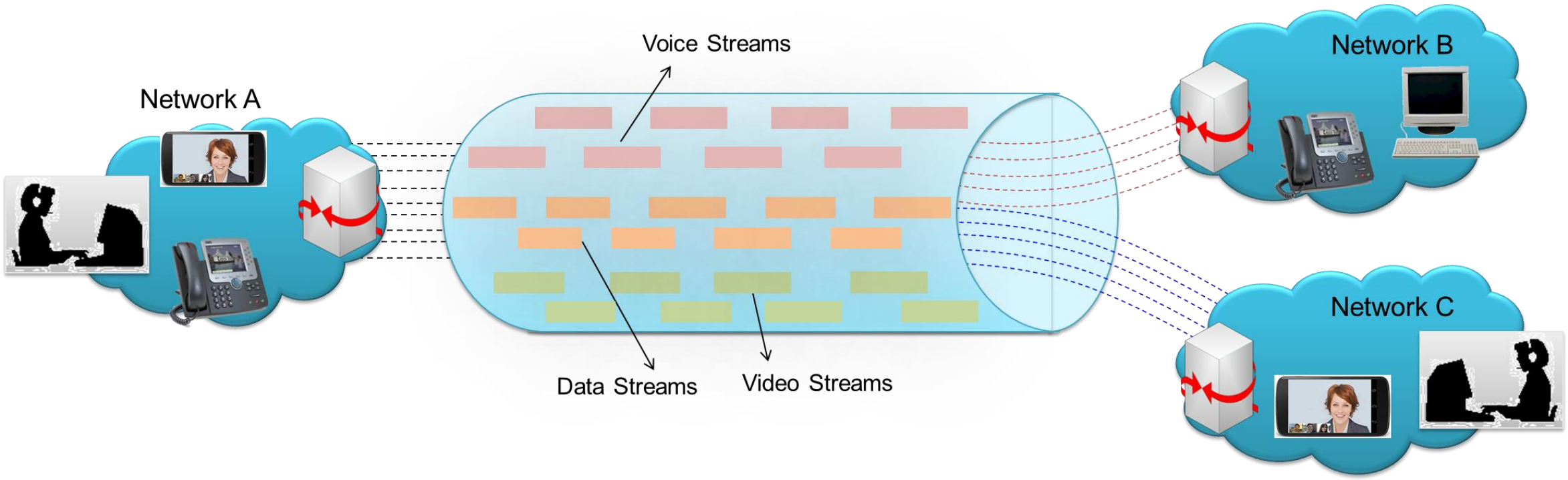
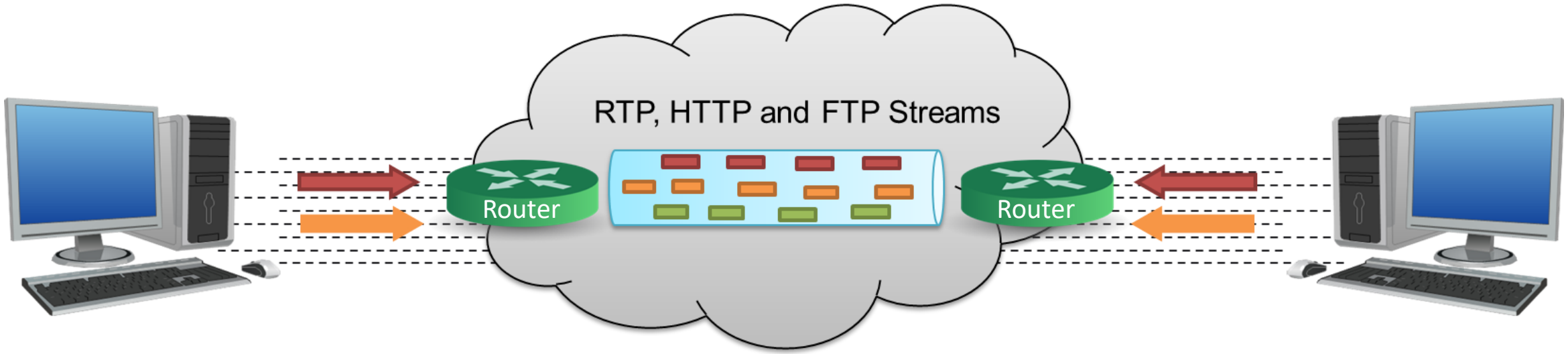
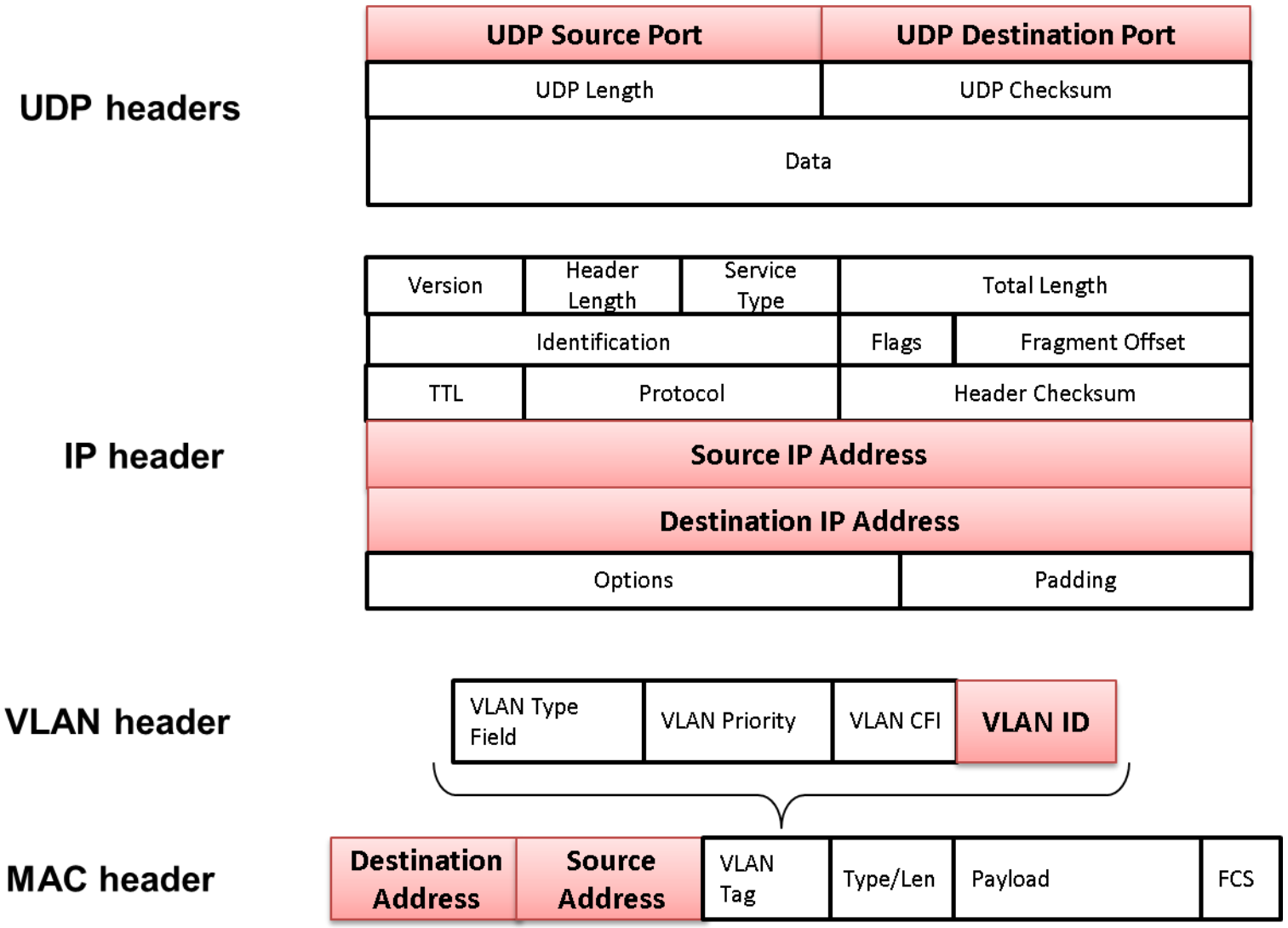
Multiple "Stream" or "Flow" in Ethernet/IP Traffic



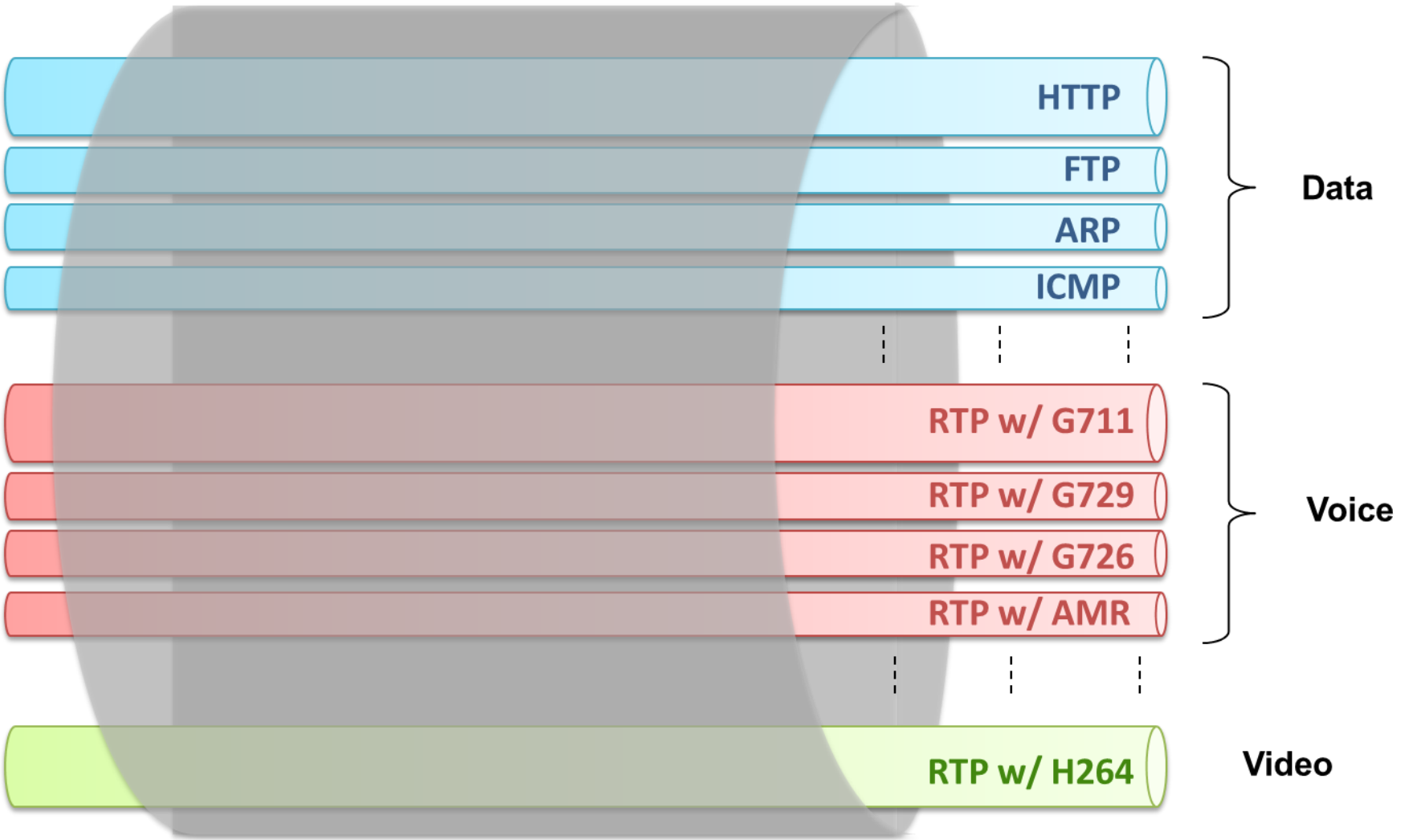
Multi-Stream Traffic between 2 End Points



Identifying Streams



Application-wise Streams



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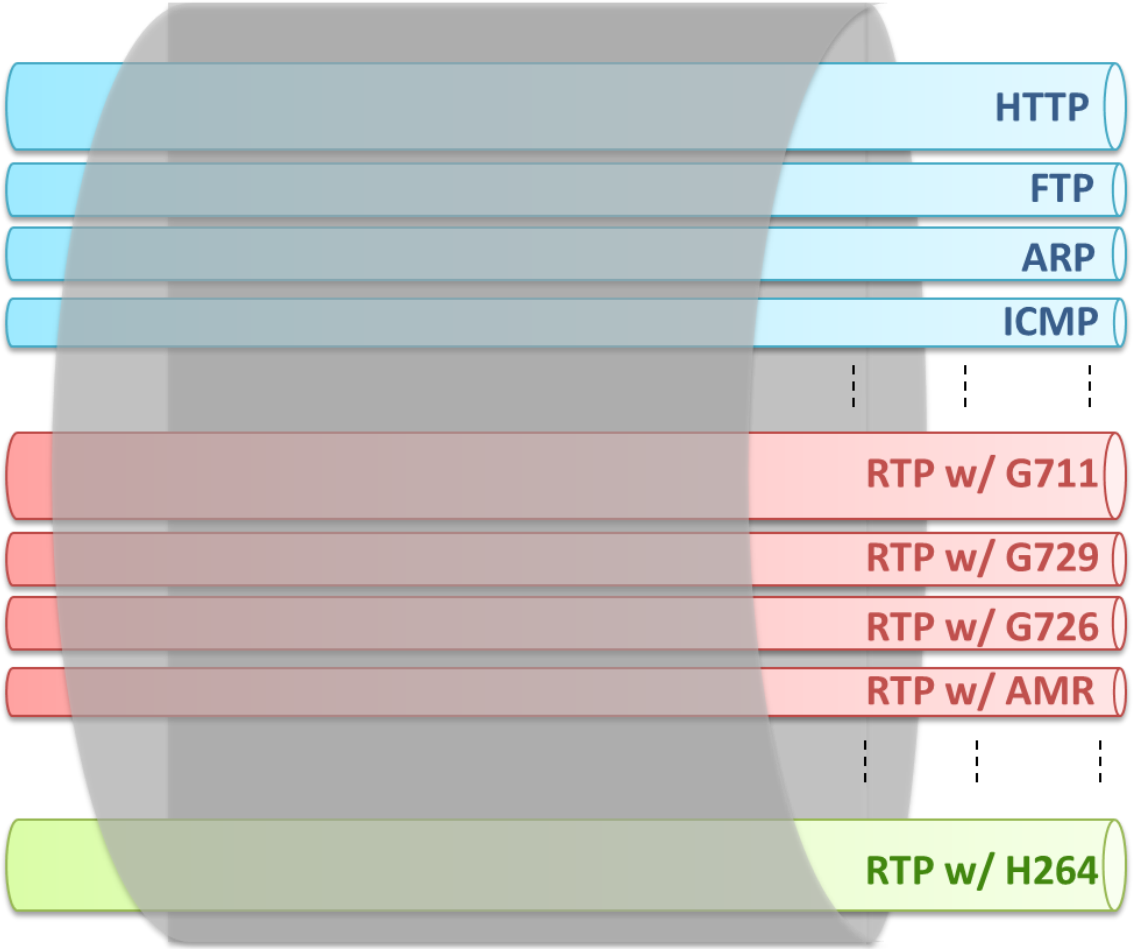
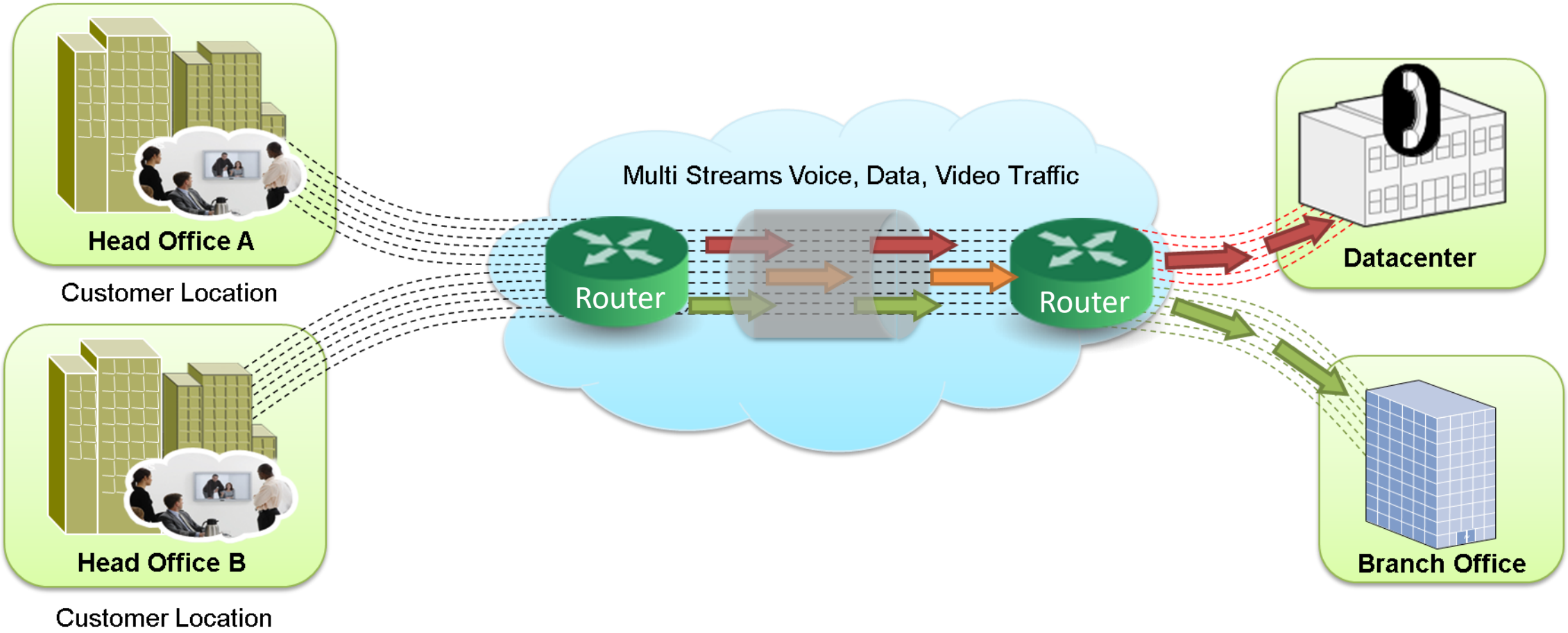
Stream Characteristics

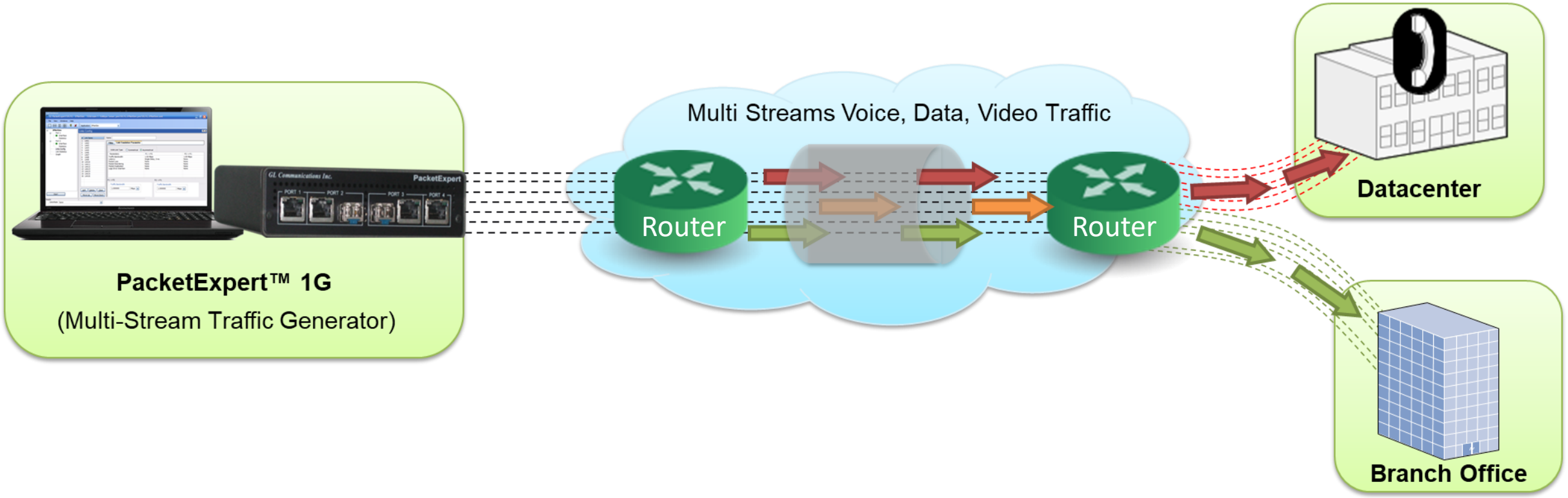


Data	Frame Size = 100 – 1518, Rate < 5 kbps
	Frame Size = 100 – 1518, Rate <= 5 Mbps
	Frame Size = 64, Rate < 1 Kbps
	Frame Size = 64, Rate < 1 Kbps
Voice	Frame Size = 214, Rate ~ 83 Kbps
	Frame Size = 214, Rate ~83 kbps
	Frame Size = 74, Rate ~ 28 Kbps
	Frame Size = 154, Rate ~ 60 Kbps
	Frame Size = 68 – 86, Rate = 4.75 Kbps – 12.2 Kbps
Video	Frame Size = 64 – 1518, Rate = 1.4 Mbps – 3.4 Mbps

All Streams Carried over Single Pipe



Multi Stream Traffic Generator



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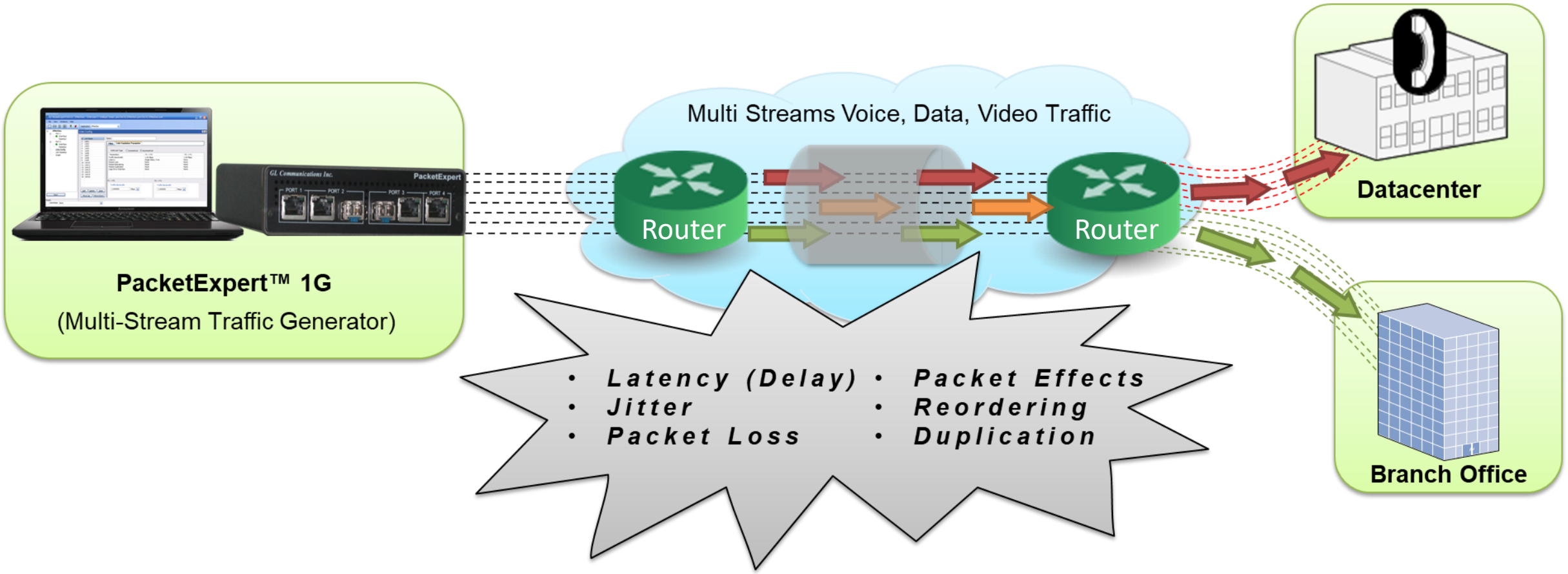
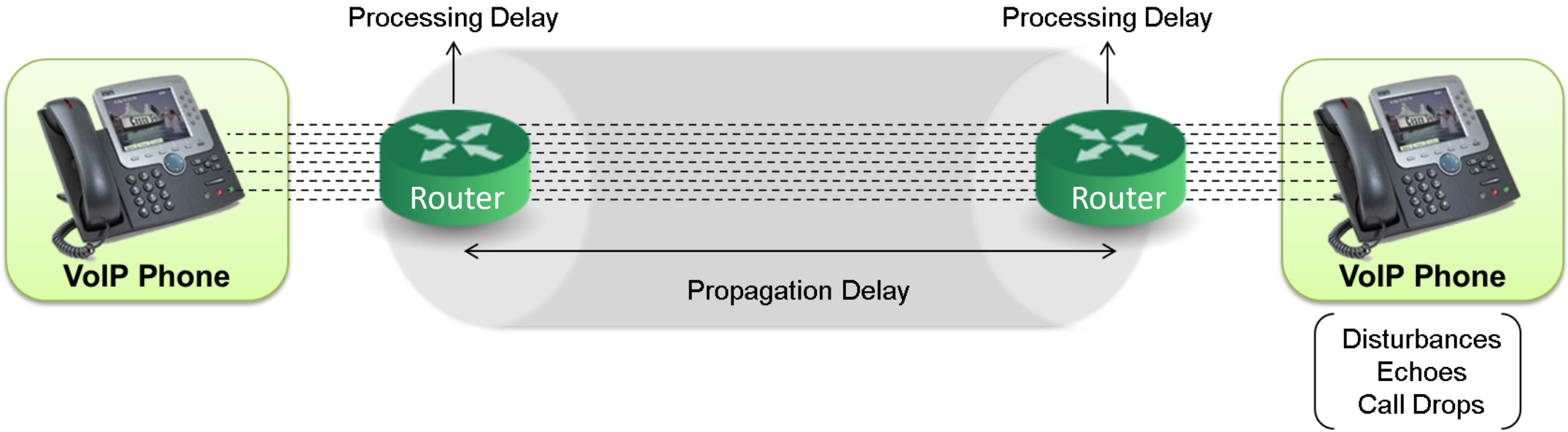
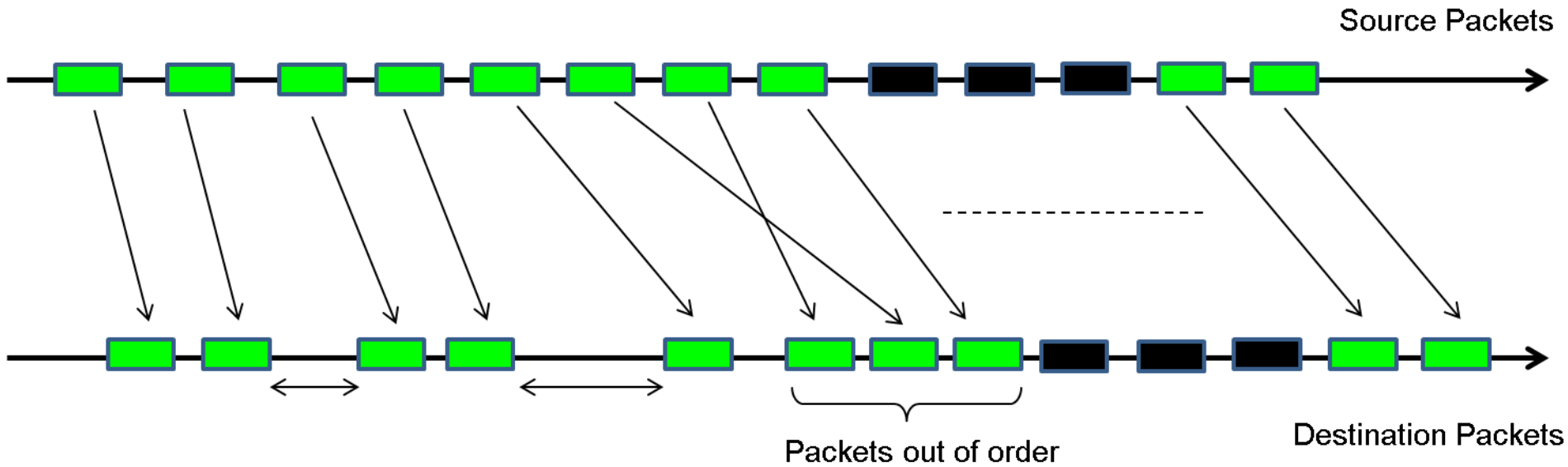
Impairments Introduced by Packet Switching Networks



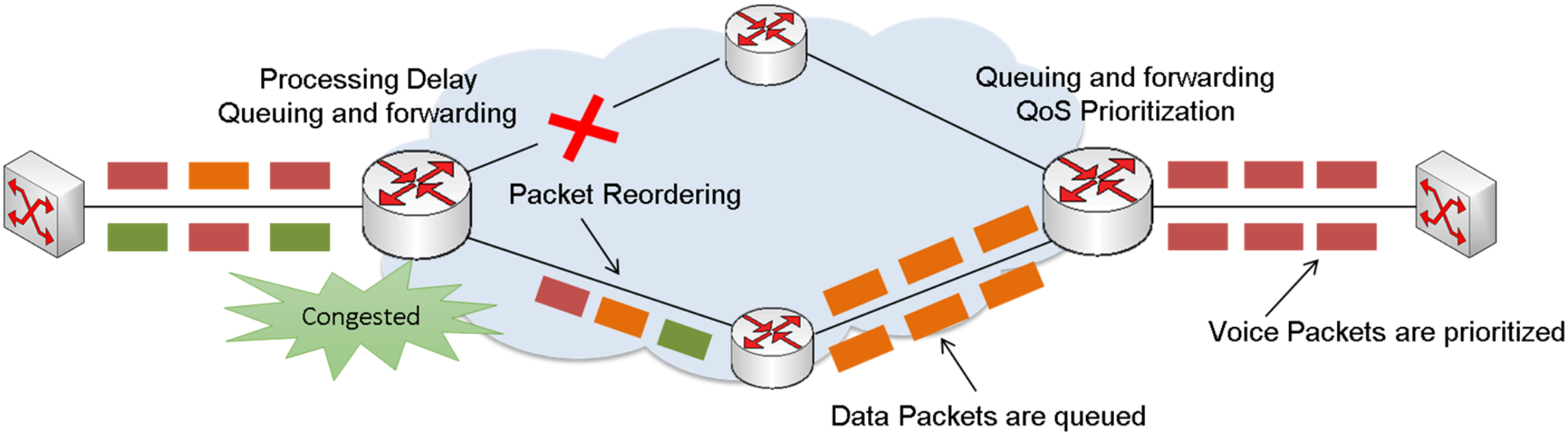
Latency or Frame Transfer Delay



Jitter



Jitter Introduced in Various Ways



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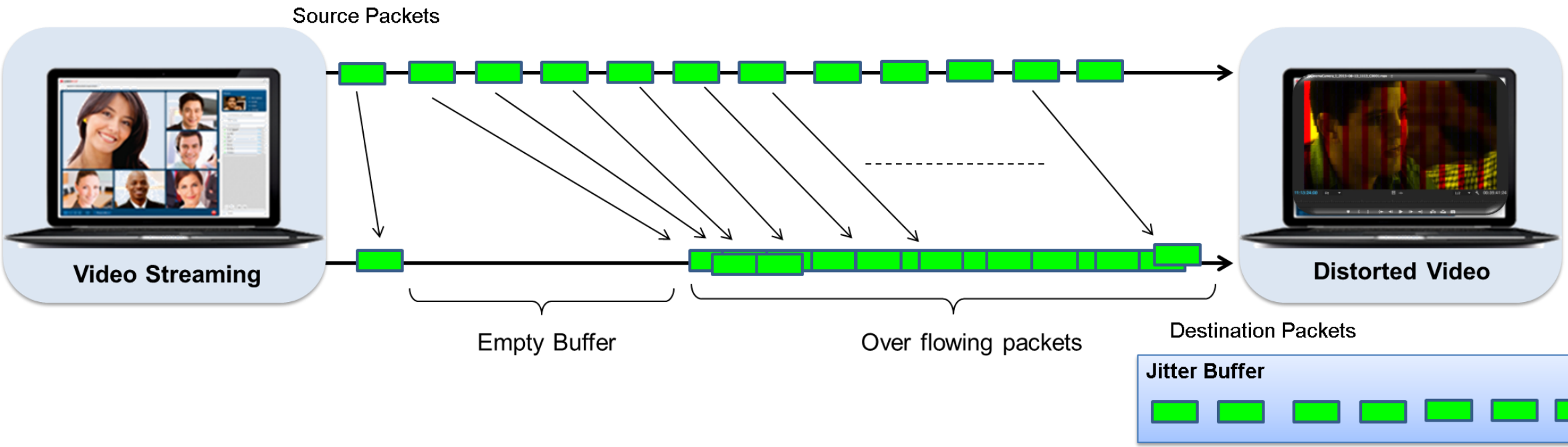
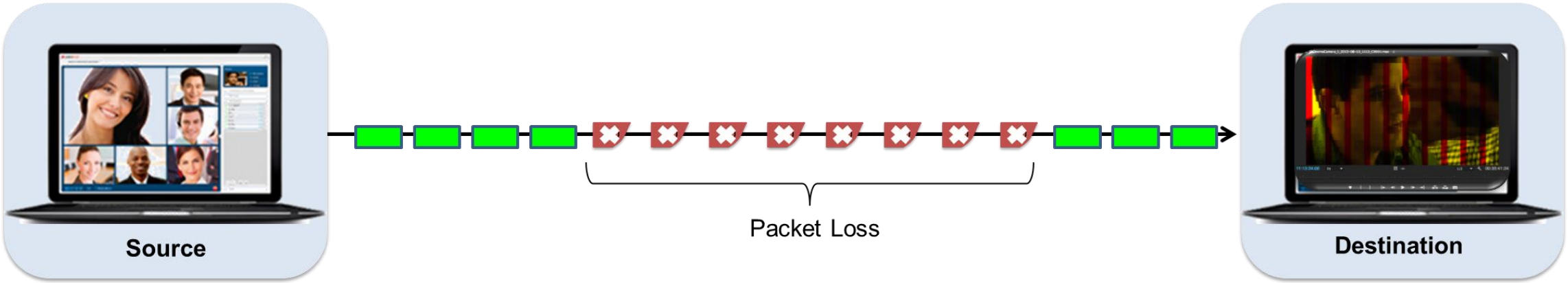
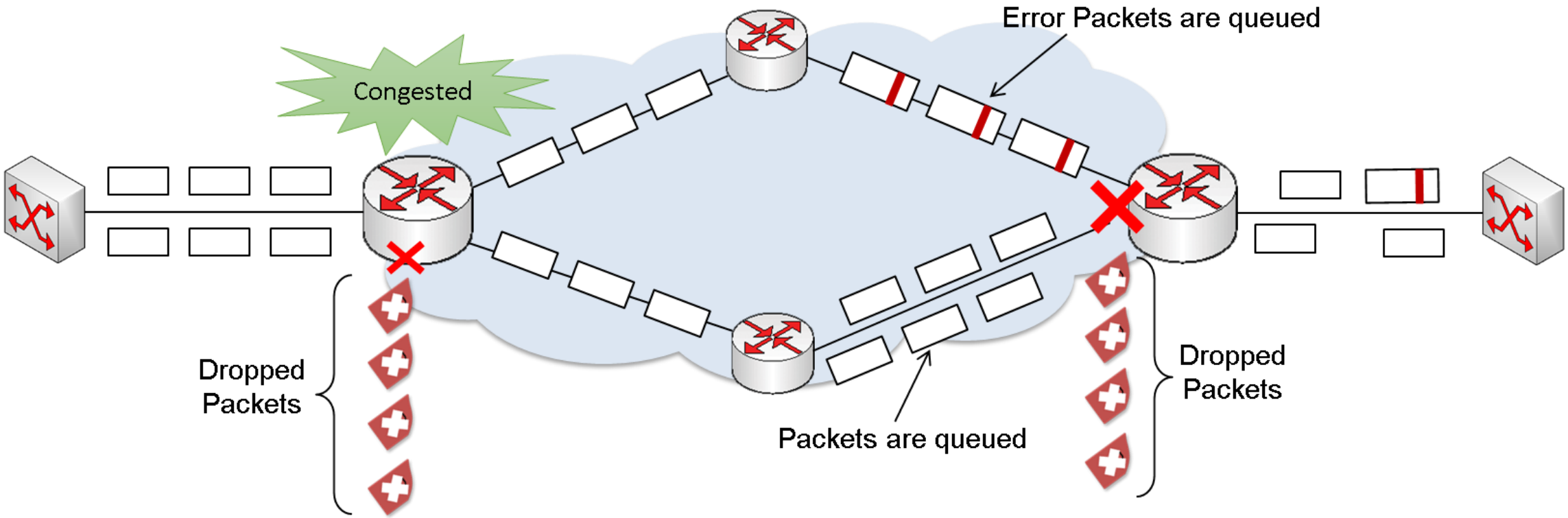
Effects of Jitter on Video Playback



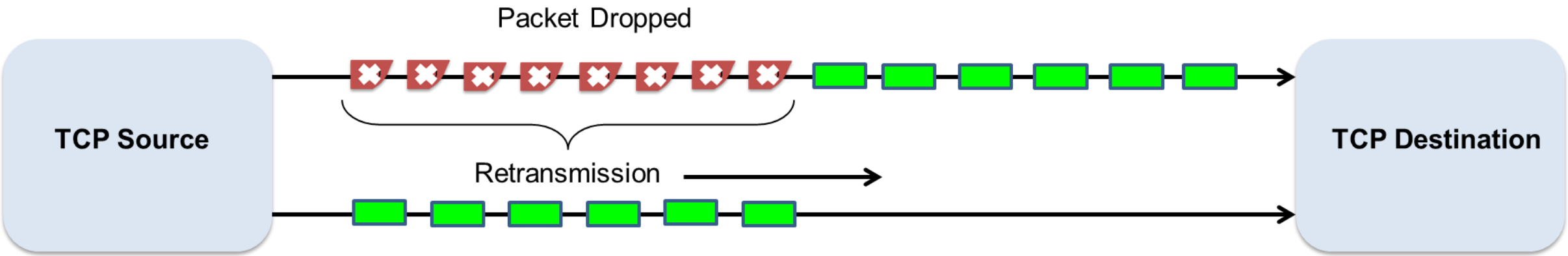
Packet Loss



Packet Loss Introduced in Different Ways



Effects of Packet Loss

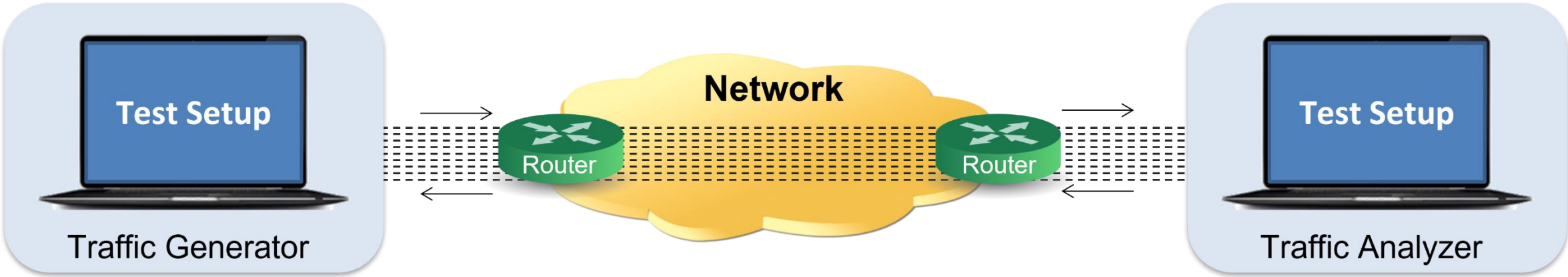


IP Measurements

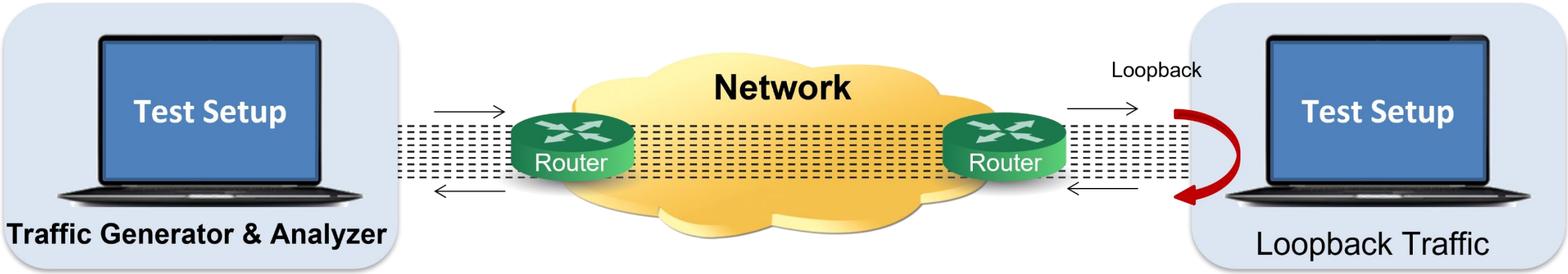
Need to measure these IP Metrics:

- Throughput/Bandwidth
- Latency/Frame Transfer Delay (FTD)
- Jitter/Frame Delay Variation (FDV)
- Packet Loss/Frame Loss (FL)

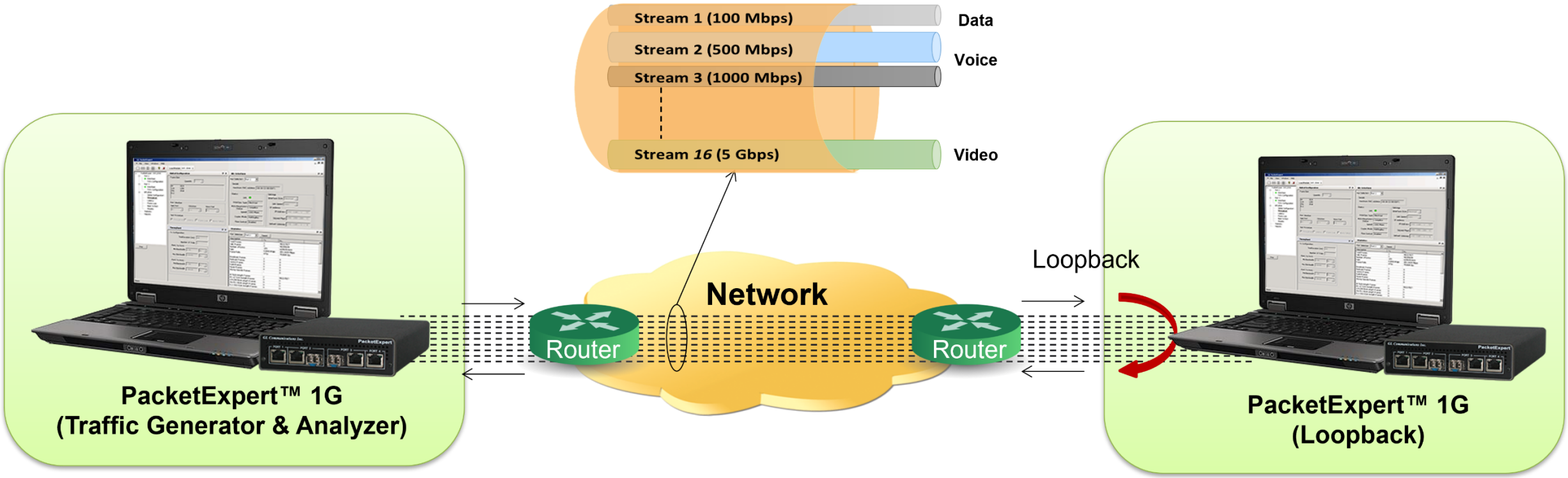
End-to-End Test Setup



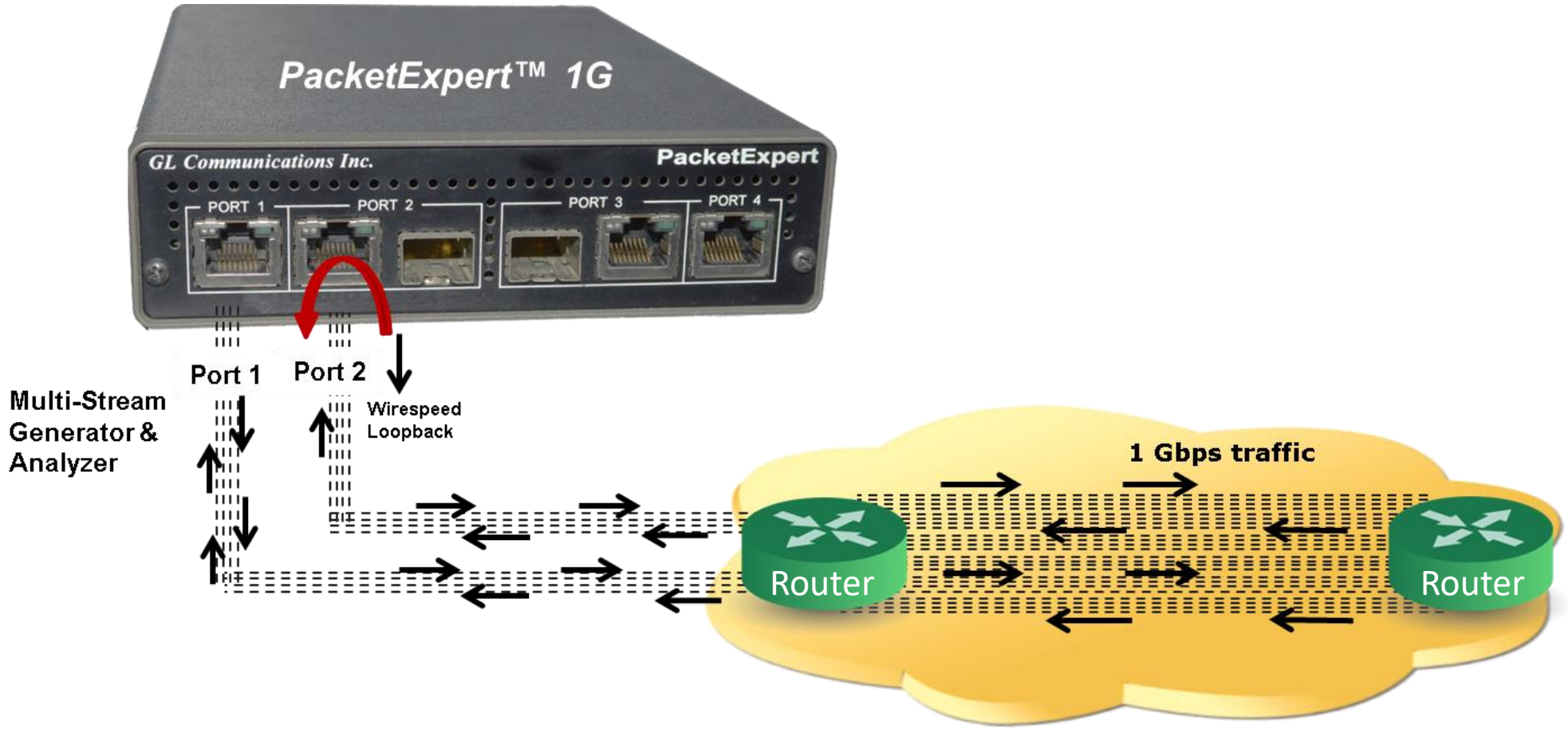
Test Setup Remote Loopback



Multi Stream Generator and Analyzer

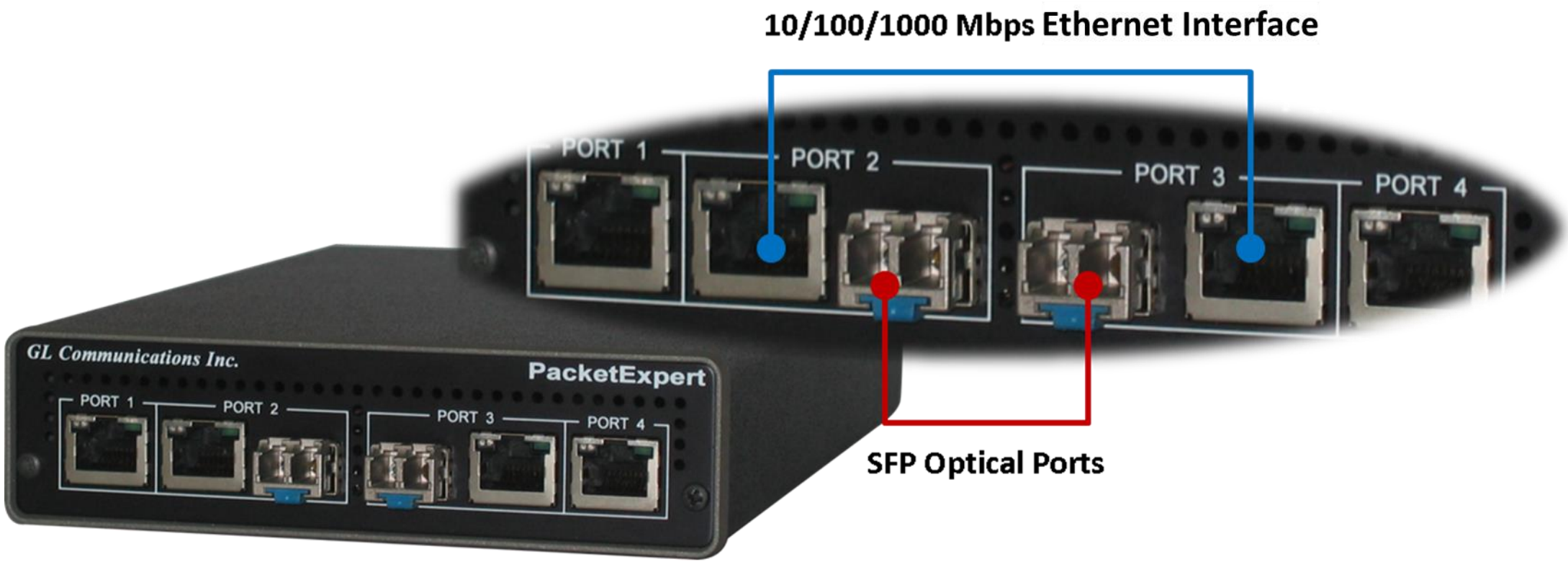


Local Loopback for Convenience



Hardware

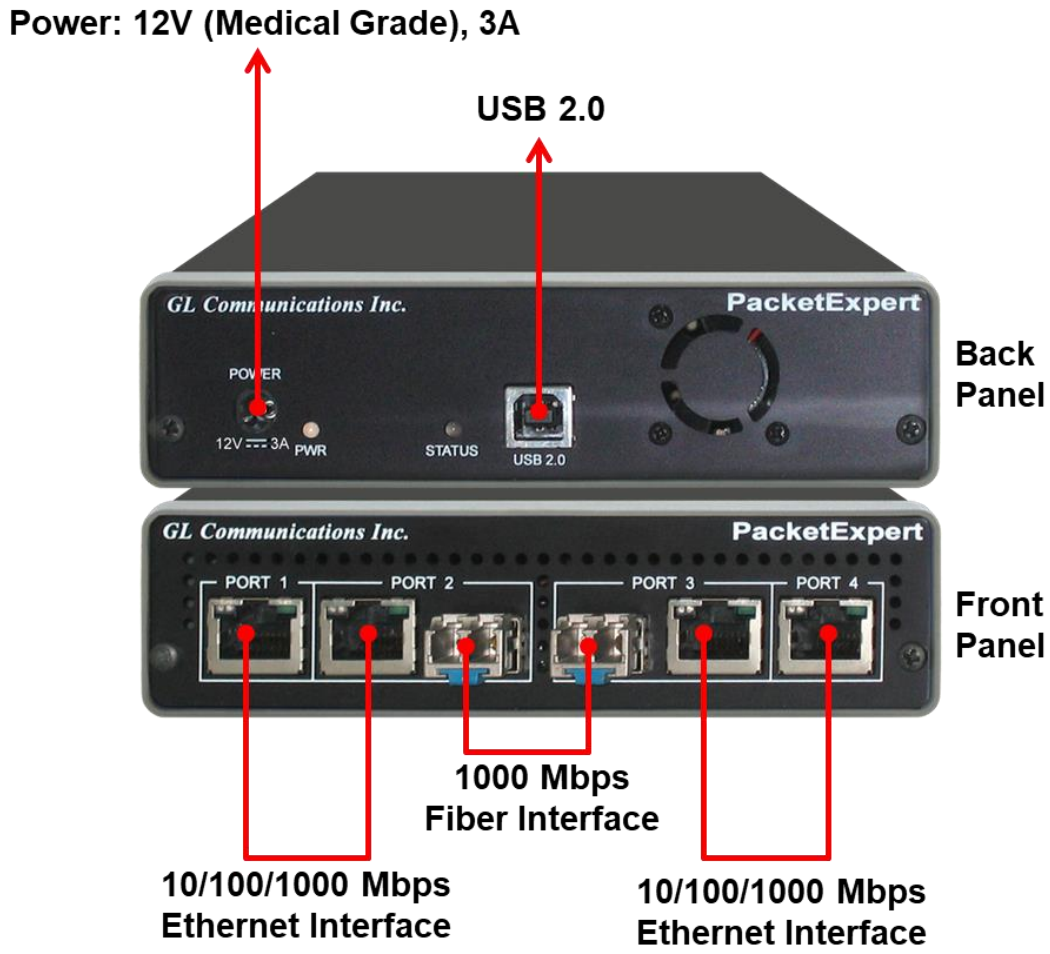
Expert Analyzer 1G Ports



PacketExpert™ 1G

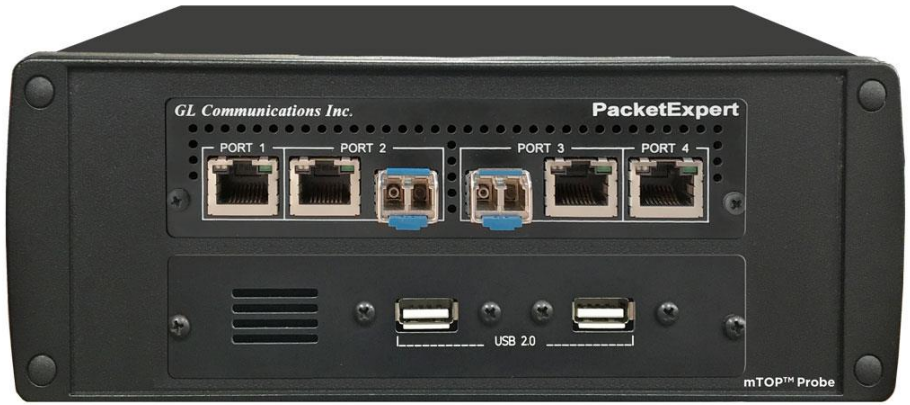
PacketExpert™ 1G Portable Unit

- Interfaces
  - 2 x 10/100/1000 Base-T Electrical only
  - 2 x 1000 Base-X Optical OR 10/100/1000 Base-T Electrical
  - Single Mode or Multi Mode Fiber SFP support with LC connector
  - Optional 4-Port SMA Jack Trigger Board (TTL Input/Output)
- Protocols:
  - RFC 2544 compliance
  - ITU-T Y.1564 (ExpertSAM)
- Power:
  - +12 Volts (Medical Grade), 3 Amps
- Bus Interface:
  - USB 2.0



PacketExpert™ mTOP™ Probe

Front Panel View



Rear Panel View

- Portable Quad Port Ethernet/VLAN/MPLS/IP/UDP Tester with 4 Electrical Ethernet Ports (10/100/1000 Mbps) and 2 Optical Ports (100/1000 Mbps). Embedded with Single Board Computer (SBC).
- **SBC Specs**: Intel Core i3 or optional i7 NUC Equivalent, Windows® 11 64-bit Pro Operating System, USB 3.0 and USB 2.0 Ports, 12V/3A Power Supply, USB Type C Ports, Ethernet 2.5GigE port, 256 GB Hard drive, 8G Memory (Min), Two HDMI ports
- Each GigE port provides independent Ethernet/VLAN/MPLS/IP/UDP testing at wire speed for applications such as BERT, RFC 2544, and Loopback. BERT is implemented for all layers.
- RFC 2544 is applicable for Layers 2, 2.5, and 3, and Loopback is applicable for Layers 2, 3, and 4.

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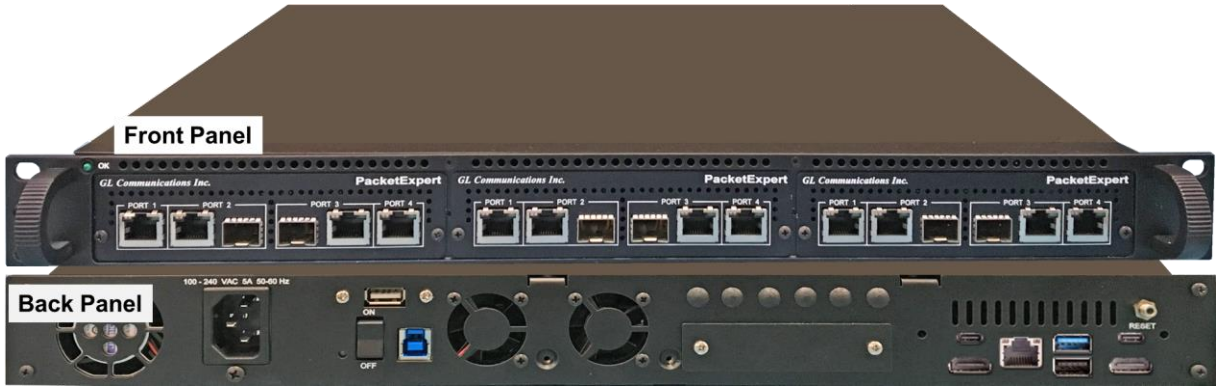
PacketExpert™ High-Density 12/24 GigE Ports mTOP™ Rack

PacketExpert™ SA (PXE112) is a 12-Port PacketExpert™ w/ Embedded Single Board Computer (SBC)

SBC Specs: Intel Core i3 or optional i7 NUC Equivalent, Windows® 11 64-bit Pro Operating System,
USB 3.0 and USB 2.0 Ports, ATX Power Supply, USB Type C Ports, Ethernet 2.5GigE port,
256 GB Hard drive, 8G Memory (Min), Two HDMI ports

19" 1U Rackmount Enclosure (If options, then x 3)

PacketExpert™ SA (PXE112)



PacketExpert™ SA (PXE124) is a 24-Port PacketExpert™ w/ Embedded Single Board Computer (SBC)

SBC Specs: Intel Core i3 or optional i7 NUC Equivalent, Windows® 11 64-bit Pro Operating System,
USB 3.0 and USB 2.0 Ports, ATX Power Supply, USB Type C Ports, Ethernet 2.5GigE port,
256 GB Hard drive, 8G Memory (Min), Two HDMI ports

19" stacked 1U Rackmount Enclosure (If options, then x 6)

PacketExpert™ SA (PXE124)

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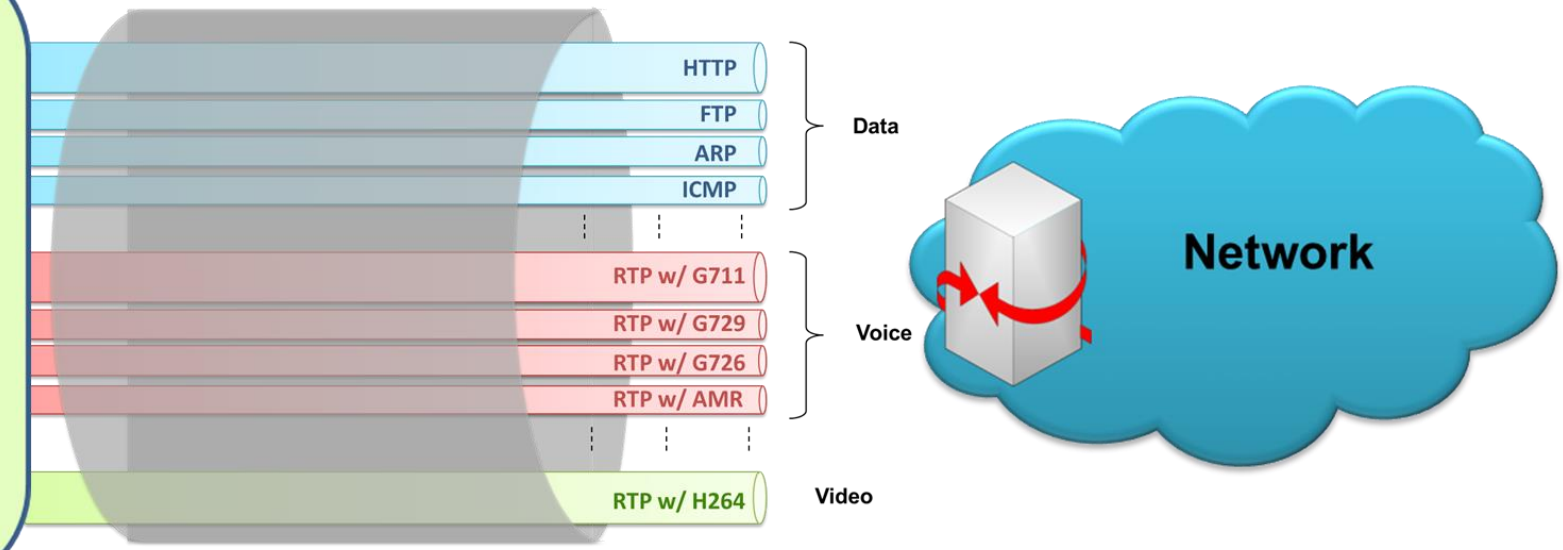
Application Examples

PacketExpert™ in the Network

PacketExpert™ 1G
Multi-stream Traffic Generator
& Analyzer



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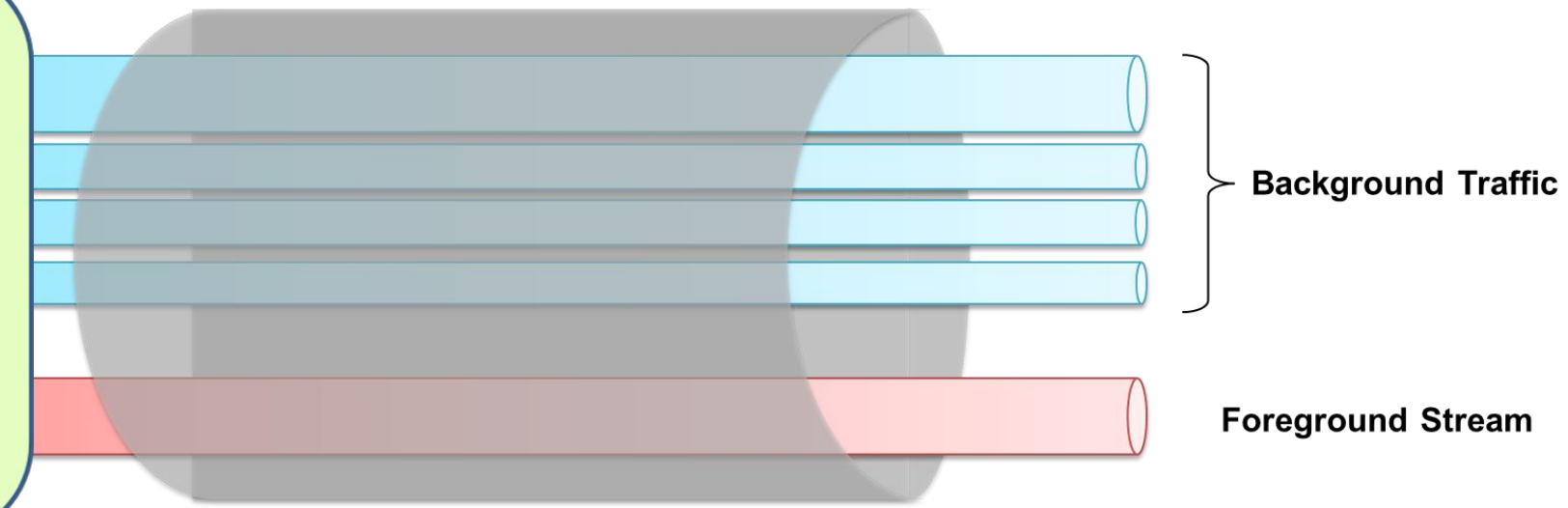
Stress Testing

PacketExpert™ 1G
Multi-stream Traffic Generator
& Analyzer



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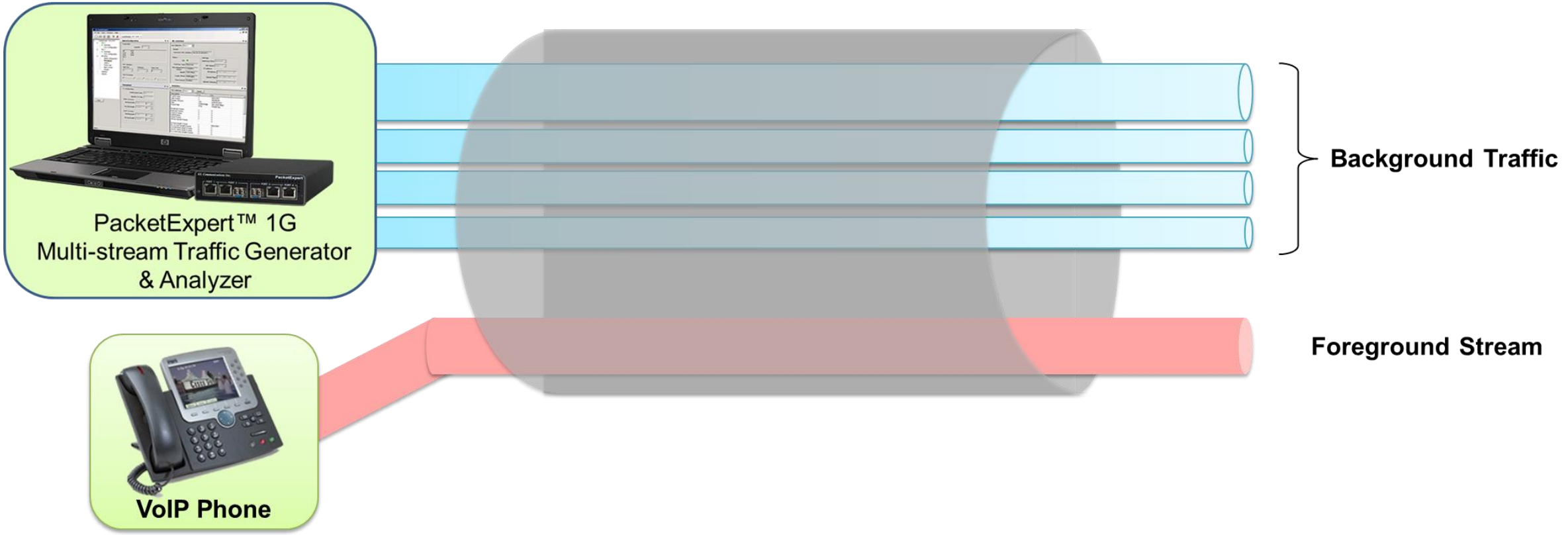
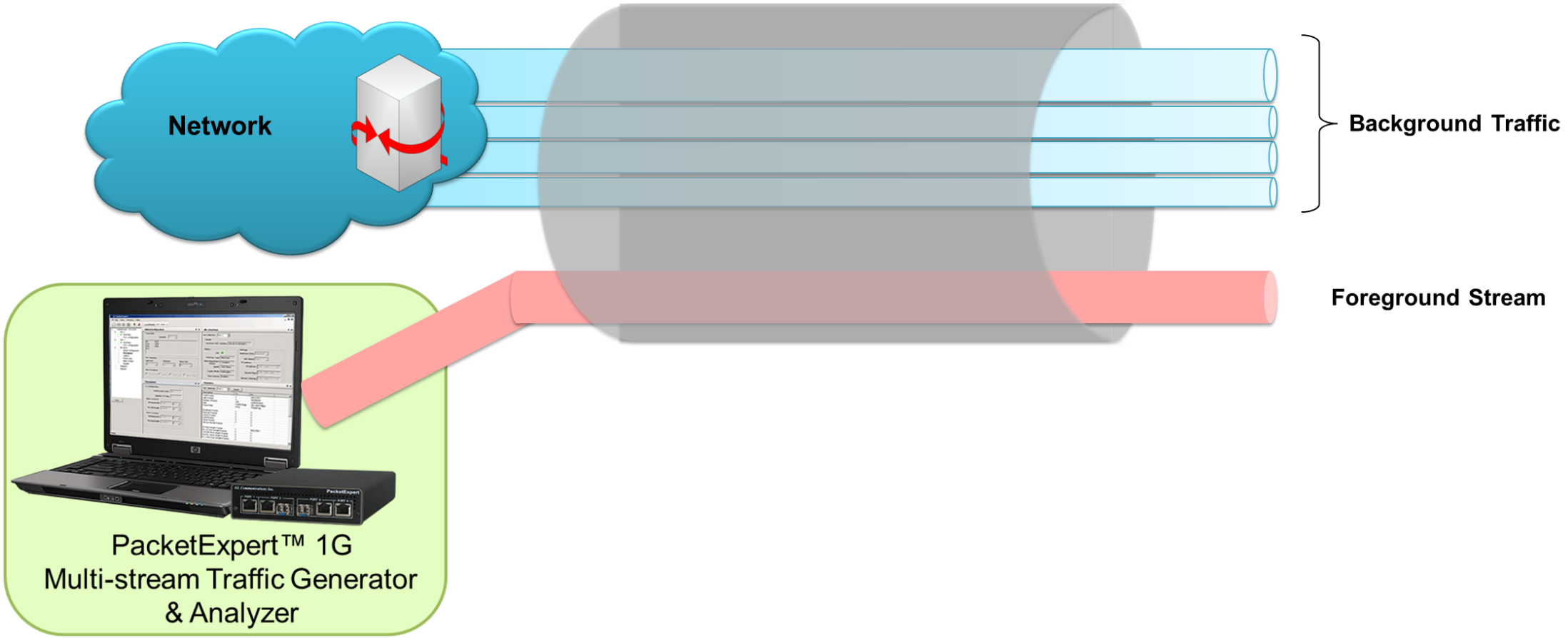
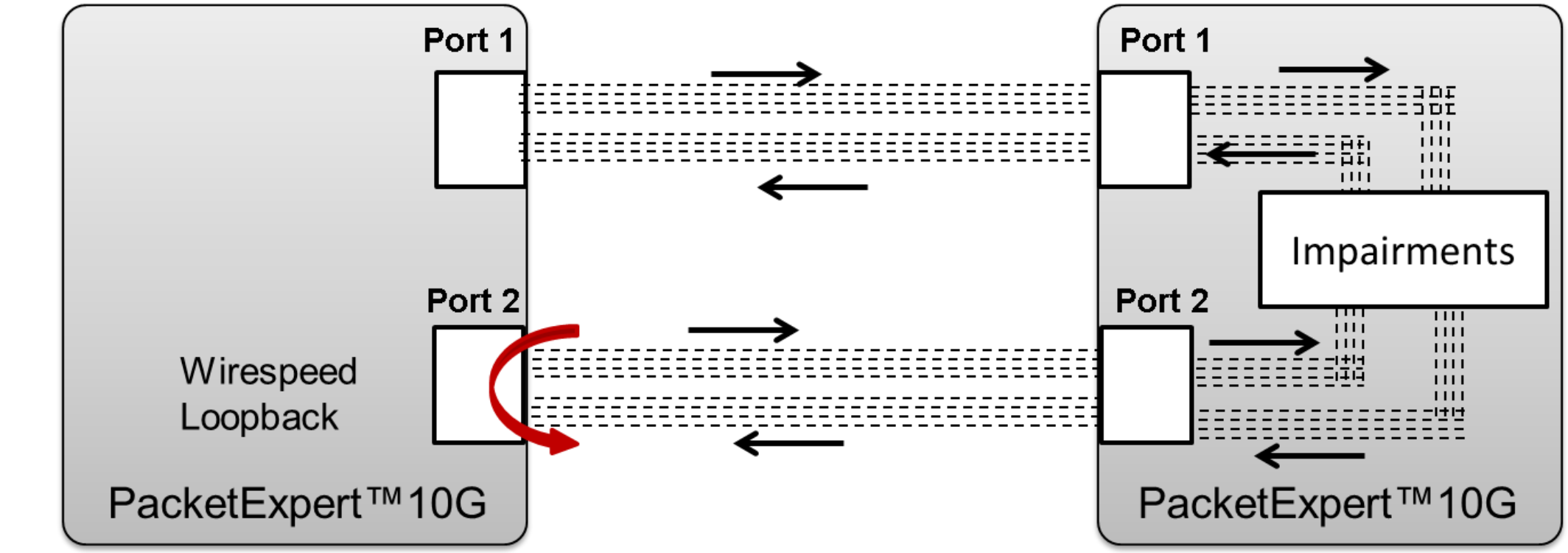
Background Traffic Generator for Stress Testing



Foreground Traffic Generator and Analyzer



Traffic Generator and Analyzer Contd.)



Multi-Stream Generator & Analyzer

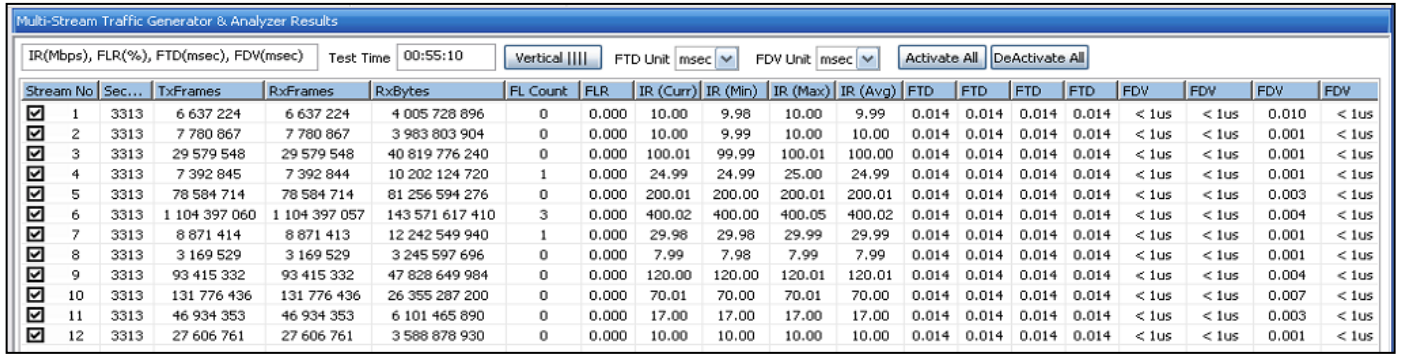
IPNetSim

Stream Statistics and Results

Stream Statistics includes:

- Stream Name
- Test duration in secs
- TxRx Frames
- Rx Bytes
- Frame Loss - FL Count, Frame Loss Ratio - FLR (%)
- Information Rate - IR (Mbps)
- Frame Transfer Delay - FTD (msec)
- Frame Delay Variations - FDV (msec)

Vertical View of Stream Results

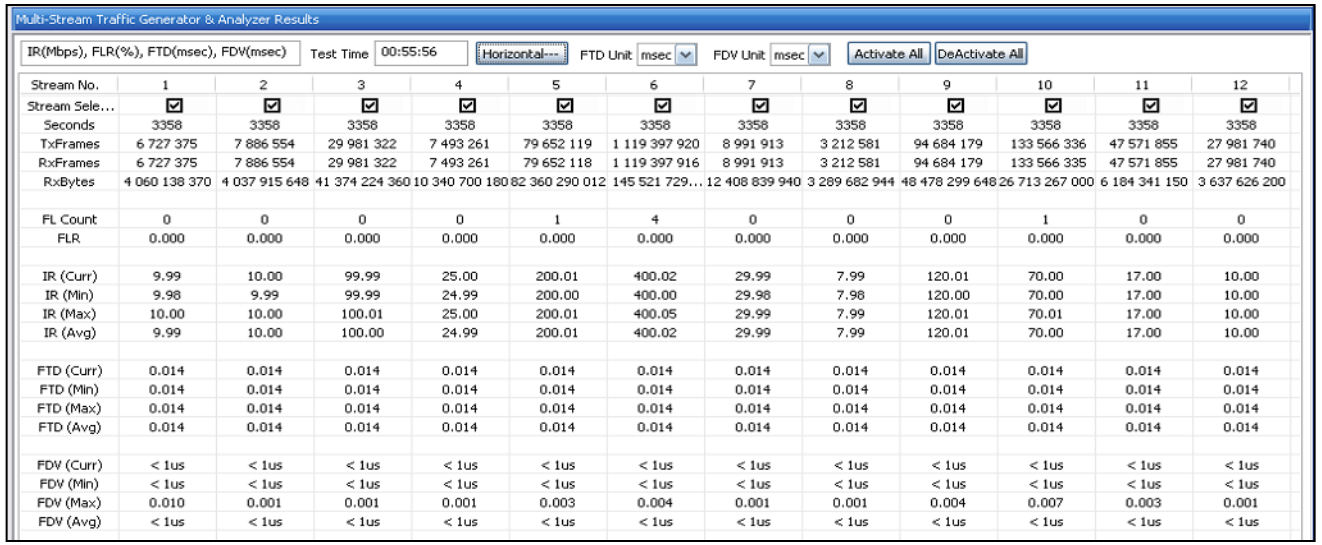


Multi-Stream Traffic Generator & Analyzer Results

IR(Mbps), FLR(%), FTD(msec), FDV(msec) | Test Time 00:55:10 | Vertical | FTD Unit msec | FDV Unit msec | Activate All | DeActivate All

Stream No	Sec...	TxFrames	RxFrames	RxBytes	FL Count	FLR	IR (Curr)	IR (Min)	IR (Max)	IR (Avg)	FTD	FTD	FTD	FTD	FDV	FDV	FDV	FDV
1	3313	6 637 224	6 637 224	4 005 728 896	0	0.000	10.00	9.98	10.00	9.99	0.014	0.014	0.014	0.014	< 1us	< 1us	0.010	< 1us
2	3313	7 780 867	7 780 867	3 983 803 904	0	0.000	10.00	9.99	10.00	10.00	0.014	0.014	0.014	0.014	< 1us	< 1us	0.001	< 1us
3	3313	29 579 548	29 579 548	40 819 776 240	0	0.000	100.01	99.99	100.01	100.00	0.014	0.014	0.014	0.014	< 1us	< 1us	0.001	< 1us
4	3313	7 392 845	7 392 844	10 202 124 720	1	0.000	24.99	24.99	25.00	24.99	0.014	0.014	0.014	0.014	< 1us	< 1us	0.001	< 1us
5	3313	78 584 714	78 584 714	81 256 594 276	0	0.000	200.01	200.00	200.01	200.01	0.014	0.014	0.014	0.014	< 1us	< 1us	0.003	< 1us
6	3313	1 104 397 060	1 104 397 057	143 571 617 410	3	0.000	400.02	400.00	400.05	400.02	0.014	0.014	0.014	0.014	< 1us	< 1us	0.004	< 1us
7	3313	8 871 414	8 871 413	12 242 549 940	1	0.000	29.98	29.98	29.99	29.99	0.014	0.014	0.014	0.014	< 1us	< 1us	0.001	< 1us
8	3313	3 169 529	3 169 529	3 245 597 696	0	0.000	7.99	7.98	7.99	7.99	0.014	0.014	0.014	0.014	< 1us	< 1us	0.001	< 1us
9	3313	93 415 332	93 415 332	47 828 649 984	0	0.000	120.00	120.00	120.01	120.01	0.014	0.014	0.014	0.014	< 1us	< 1us	0.004	< 1us
10	3313	131 776 436	131 776 436	26 355 287 200	0	0.000	70.01	70.00	70.01	70.00	0.014	0.014	0.014	0.014	< 1us	< 1us	0.007	< 1us
11	3313	46 934 353	46 934 353	6 101 465 890	0	0.000	17.00	17.00	17.00	17.00	0.014	0.014	0.014	0.014	< 1us	< 1us	0.003	< 1us
12	3313	27 606 761	27 606 761	3 588 878 930	0	0.000	10.00	10.00	10.00	10.00	0.014	0.014	0.014	0.014	< 1us	< 1us	0.001	< 1us

Horizontal View of Stream Results



Multi-Stream Traffic Generator & Analyzer Results

IR(Mbps), FLR(%), FTD(msec), FDV(msec) | Test Time 00:55:56 | Horizontal | FTD Unit msec | FDV Unit msec | Activate All | DeActivate All

Stream No.	1	2	3	4	5	6	7	8	9	10	11	12
Stream Sele...	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Seconds	3358	3358	3358	3358	3358	3358	3358	3358	3358	3358	3358	3358
TxFrames	6 727 375	7 886 554	29 981 322	7 493 261	79 652 119	1 119 397 920	8 991 913	3 212 581	94 684 179	133 566 336	47 571 855	27 981 740
RxFrames	6 727 375	7 886 554	29 981 322	7 493 261	79 652 118	1 119 397 916	8 991 913	3 212 581	94 684 179	133 566 335	47 571 855	27 981 740
RxBytes	4 060 138 370	4 037 915 648	41 374 224 360	10 340 700 180	82 360 290 012	145 521 729...	12 408 839 940	3 289 682 944	48 478 299 648	26 713 267 000	6 184 341 150	3 637 626 200
FL Count	0	0	0	0	1	4	0	0	0	1	0	0
FLR	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IR (Curr)	9.99	10.00	99.99	25.00	200.01	400.02	29.99	7.99	120.01	70.00	17.00	10.00
IR (Min)	9.98	9.99	99.99	24.99	200.00	400.00	29.98	7.98	120.00	70.00	17.00	10.00
IR (Max)	10.00	10.00	100.01	25.00	200.01	400.05	29.99	7.99	120.01	70.01	17.00	10.00
IR (Avg)	9.99	10.00	100.00	24.99	200.01	400.02	29.99	7.99	120.01	70.00	17.00	10.00
FTD (Curr)	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
FTD (Min)	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
FTD (Max)	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
FTD (Avg)	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
FDV (Curr)	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us
FDV (Min)	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us
FDV (Max)	0.010	0.001	0.001	0.001	0.003	0.004	0.001	0.001	0.004	0.007	0.003	0.001
FDV (Avg)	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us	< 1us

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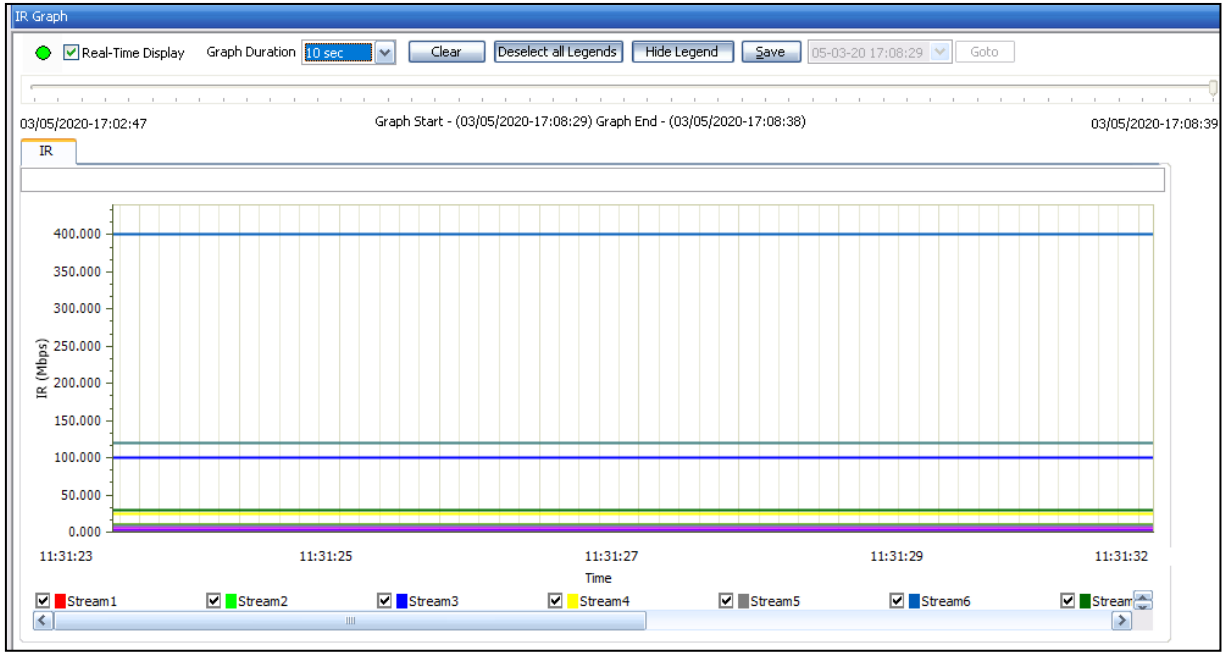
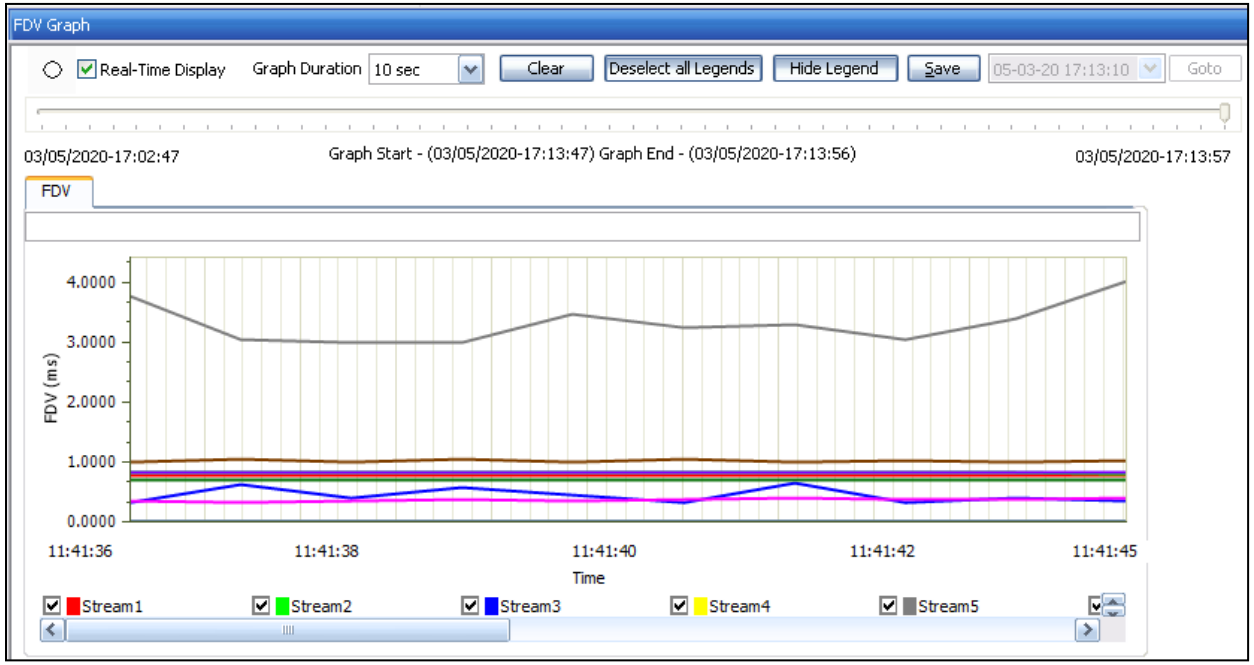
Stream-wise Graphs

Throughput (IR) Graph: Information Rate (Mbps) Vs Time (Sec)



FDV Graph: Frame Delay Variation (Msec) against Time (Sec)



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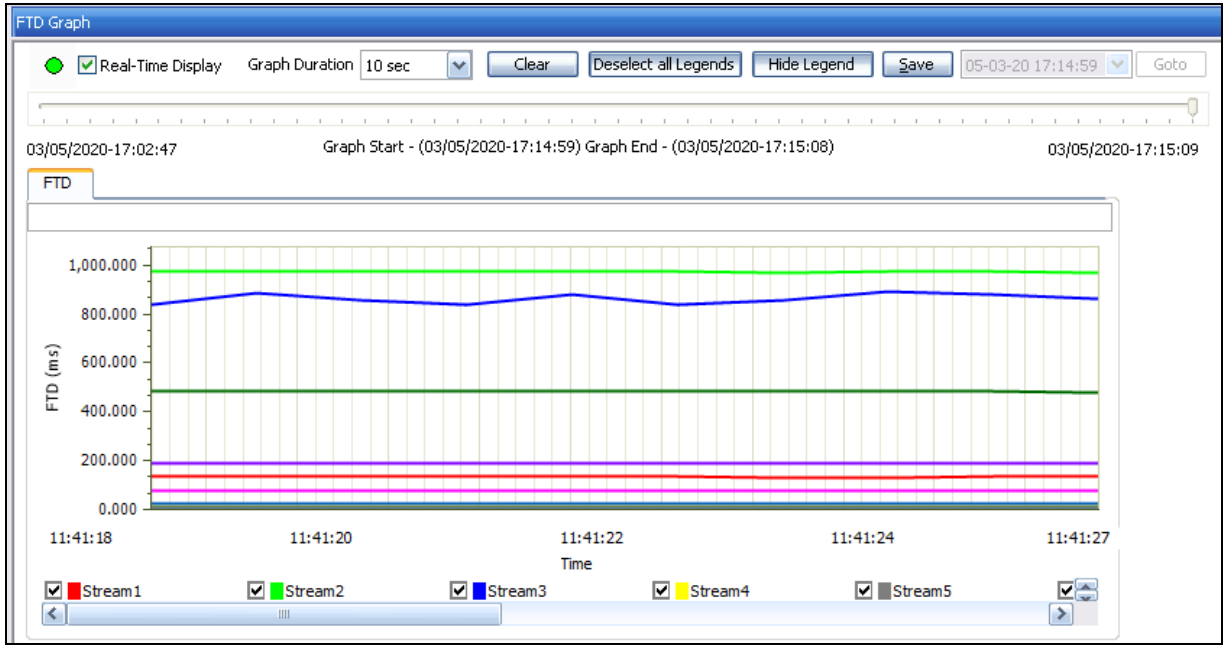
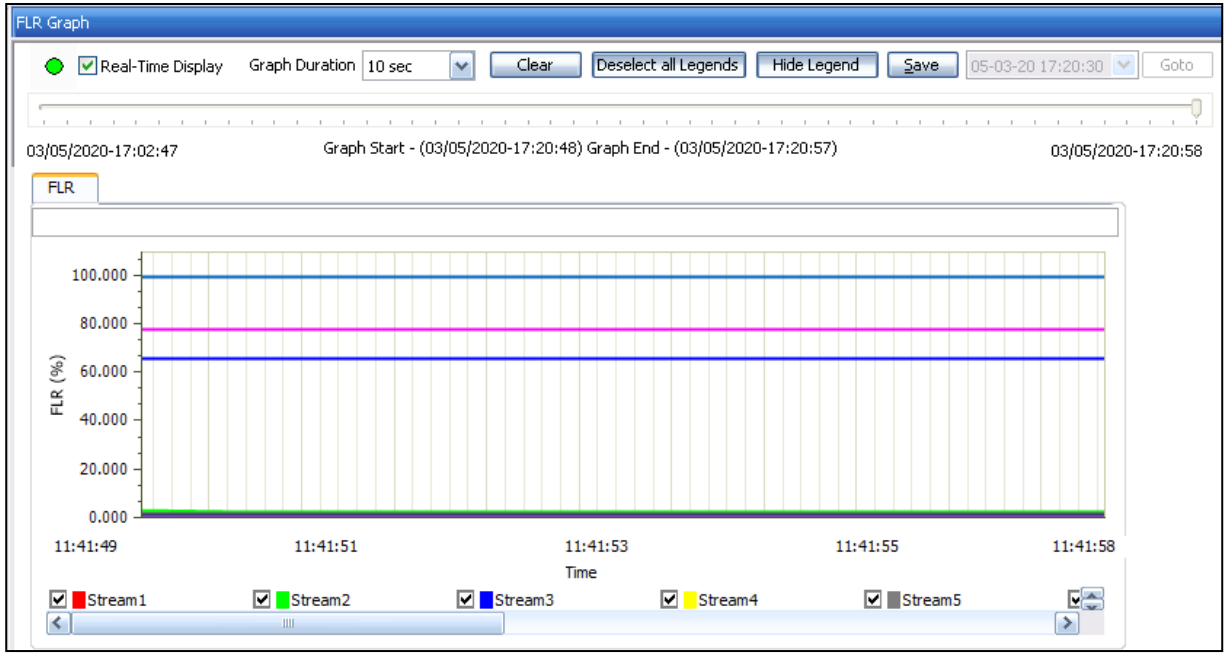
Stream-wise Graphs (Contd.)

FTD Graph:
Frame Transfer Delay (Msec) against Time



FLR Graph:
Frame Loss Ratio (%) against Time (Sec)



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Thank you