Uncompressed video in public cloud

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Agenda

- ST 2110 Routing On-Prem Review
- What is ECMP?
- Cloud Networks & UDP Performance in Cloud
- SRD – Scalable Reliable Datagram
- CDI – Cloud Digital Interface
- Thoughts/Questions?

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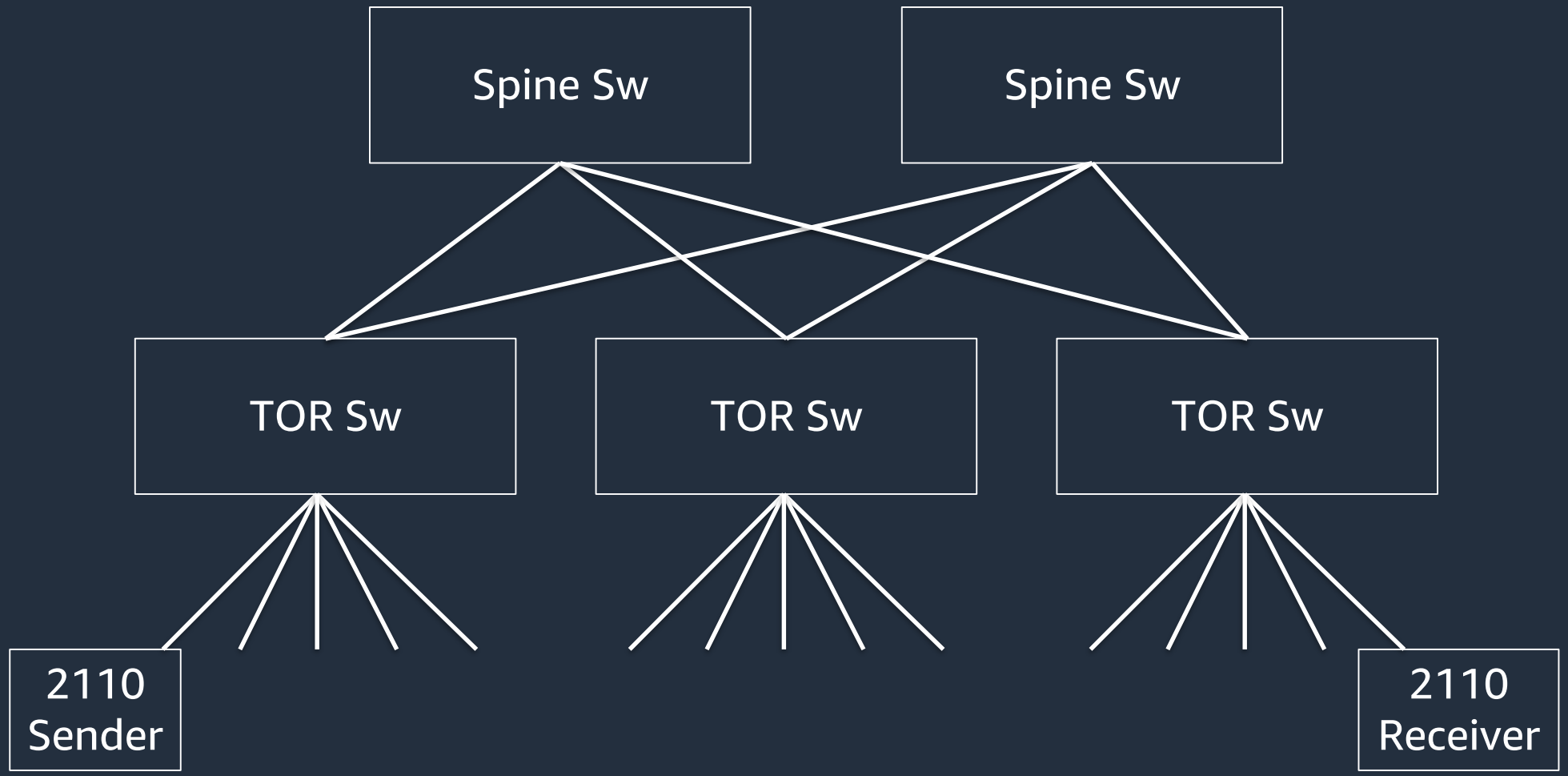
Typical ST 2110 On-Prem Networks



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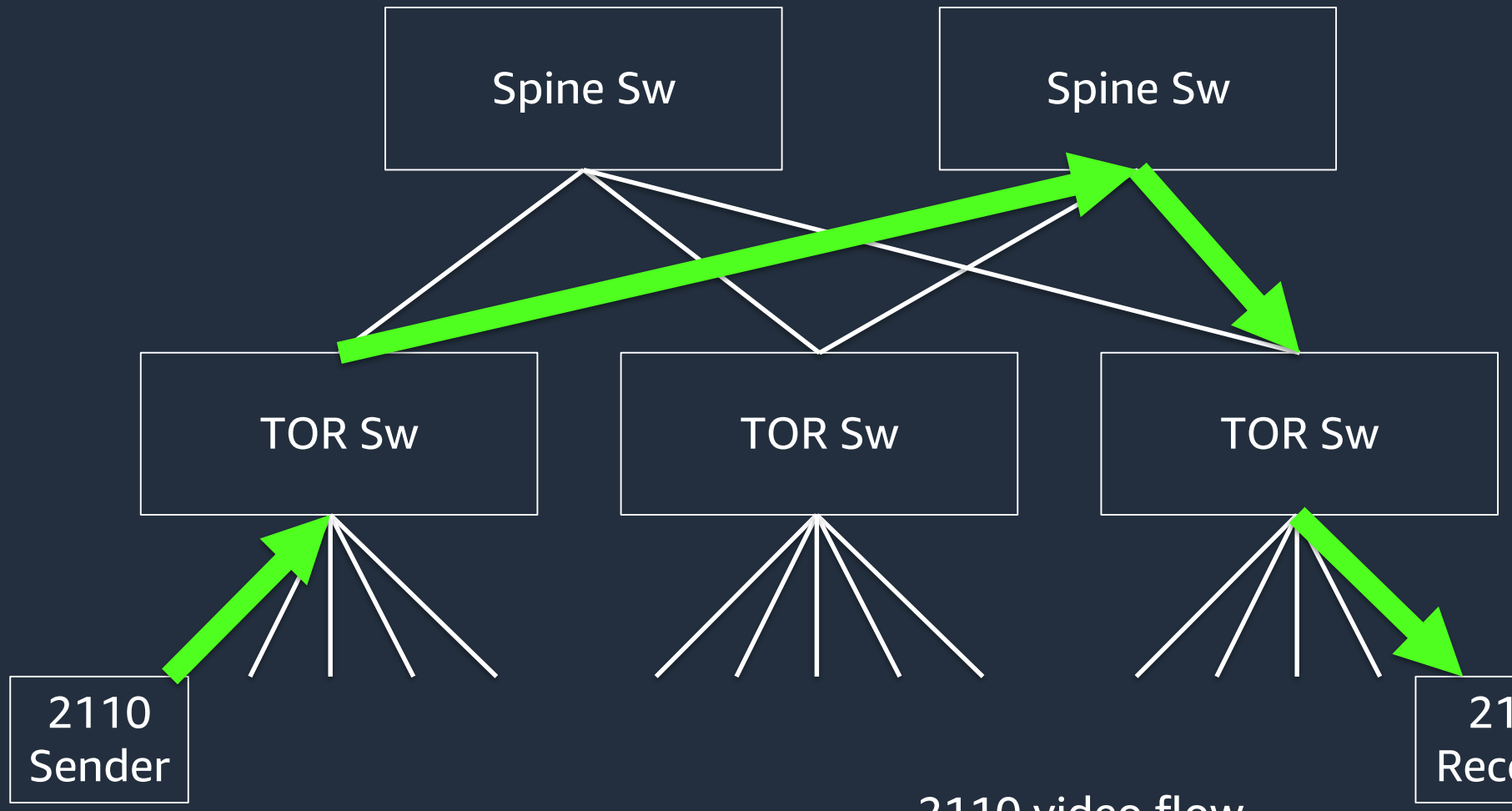

2110 routed via:

- SDN
- ECMP
- PIM
- other

Engineered, guaranteed BW

Single path flow avoids packet reordering

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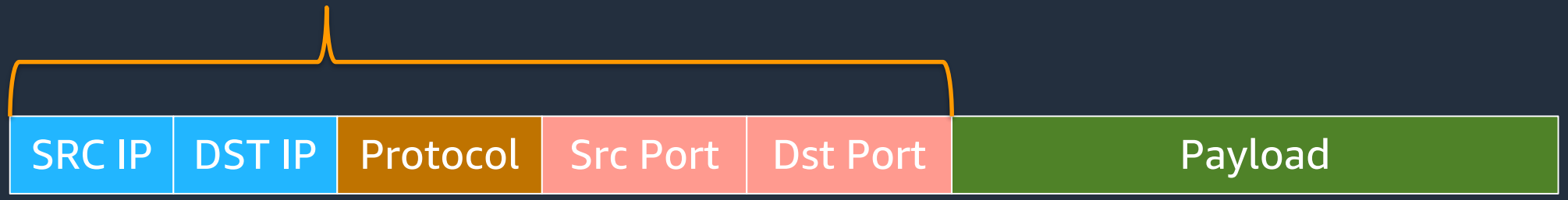
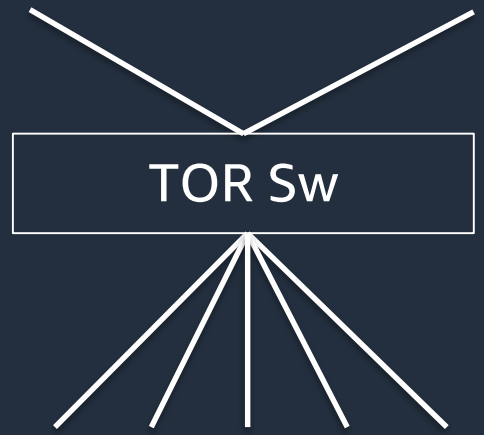
What is ECMP?

Equal-Cost Multi-Path Routing
Assigns flows to leave switch via port determined by hash of 5-tuple





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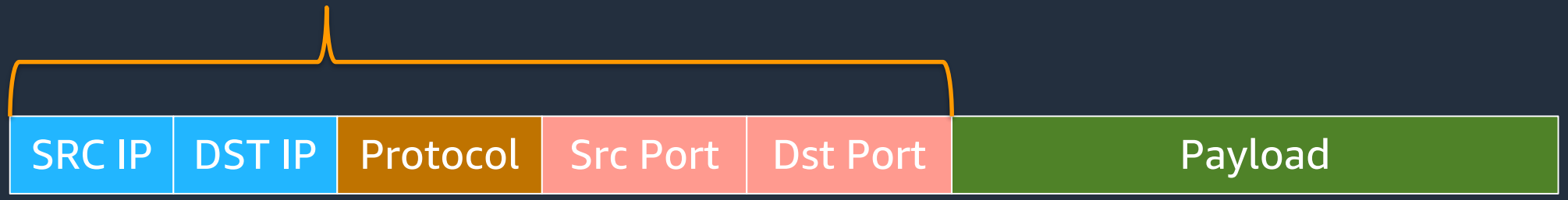

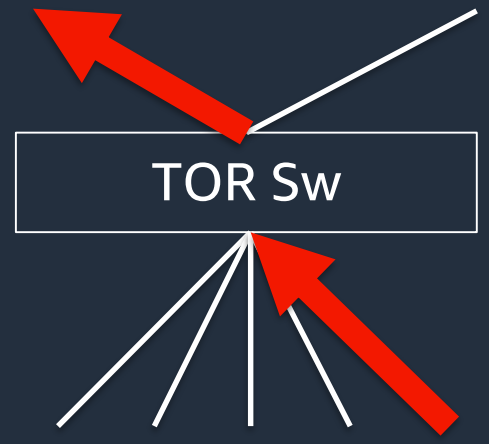

192.168.1.2|239.0.0.5|UDP|2000|2000

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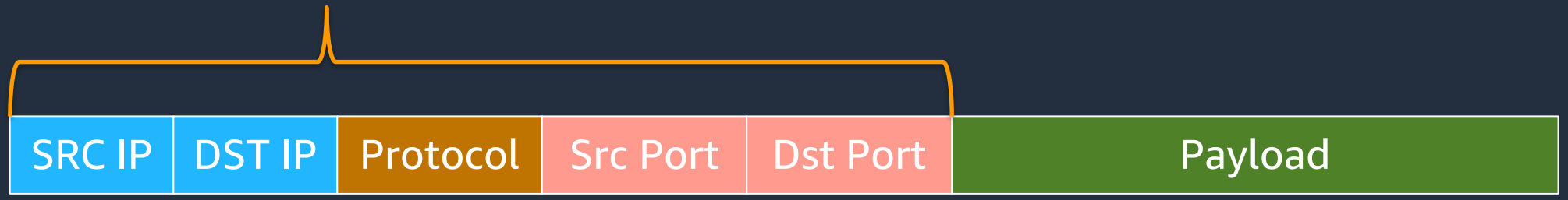

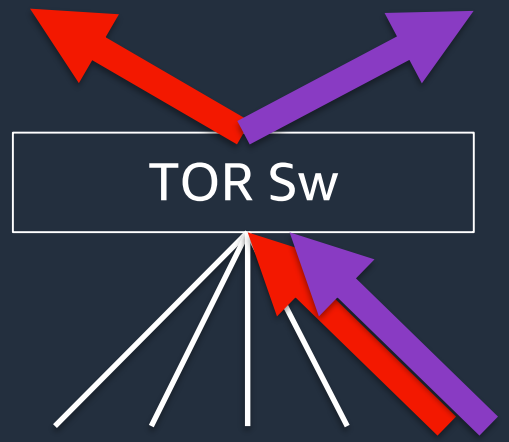

192.168.1.2|239.0.0.5|UDP|2000|2000

192.168.1.2|239.0.0.6|UDP|2000|2000

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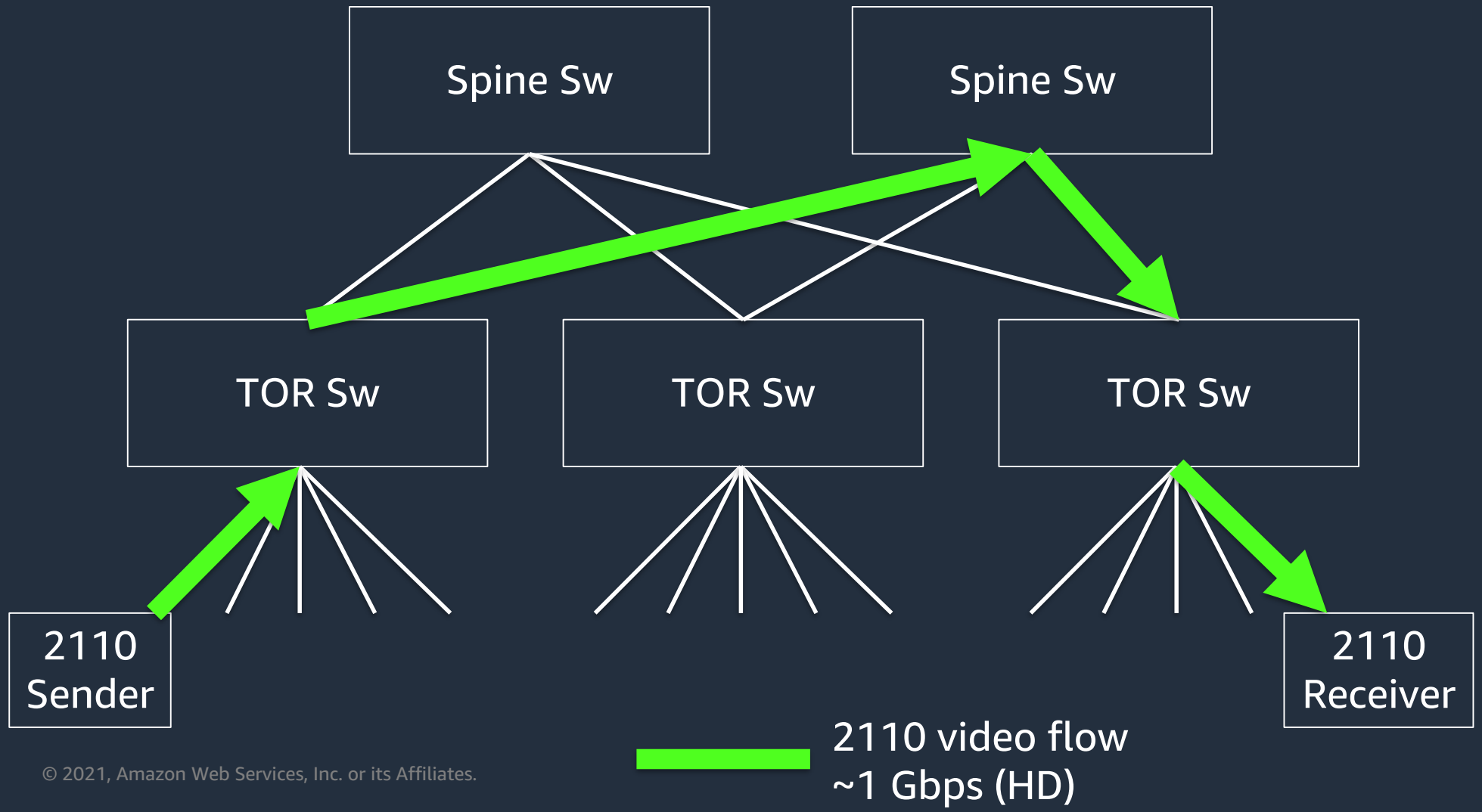
Typical ST 2110 On-Prem Networks



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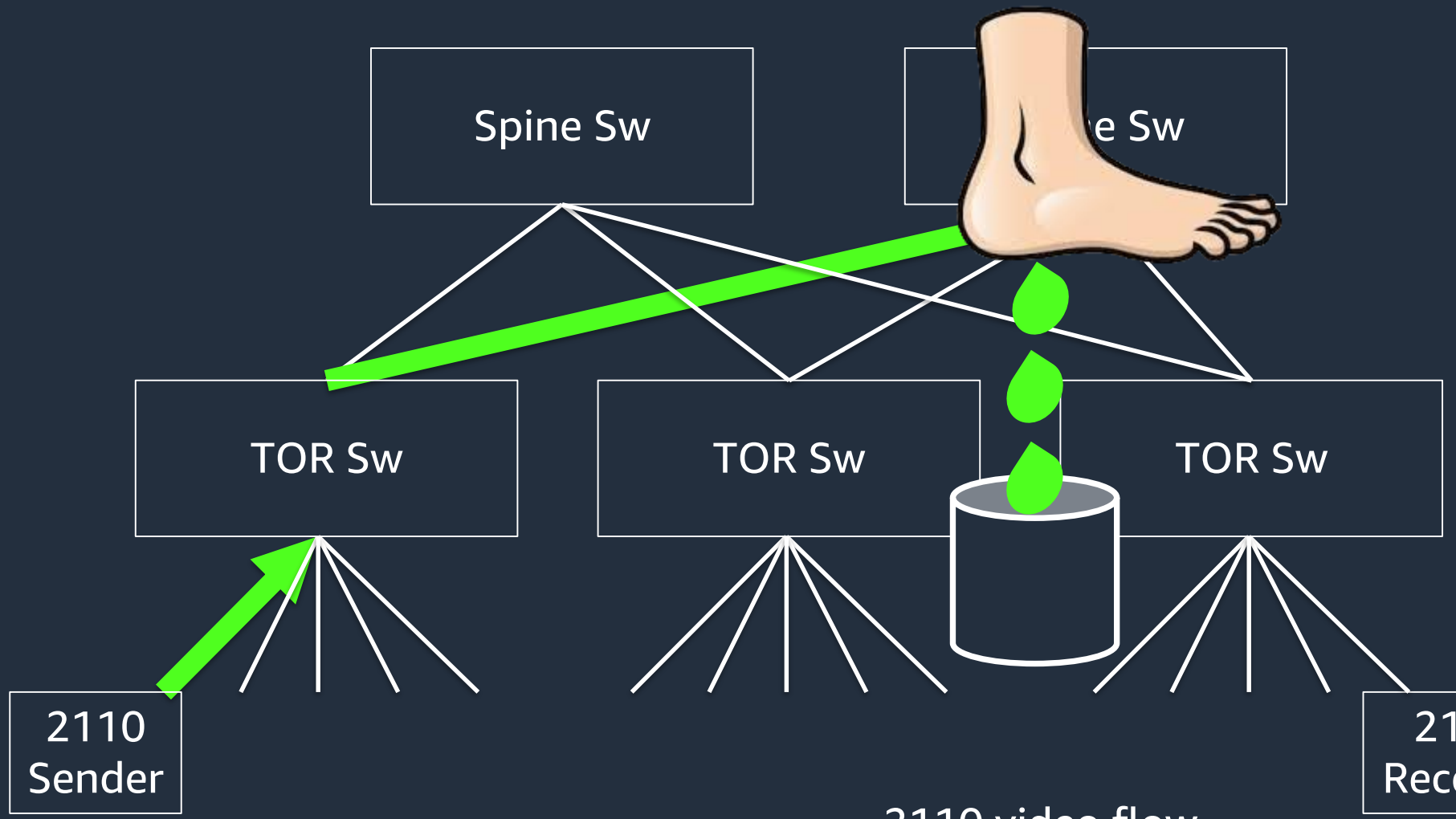
Typical ST 2110 On-Prem Networks – switch outage



- Hopefully you are using ST 2022-7 redundancy…
- Eventually routing update will occur…
- Meanwhile, 1 Gbps tossed into “bit bucket” until update/fix

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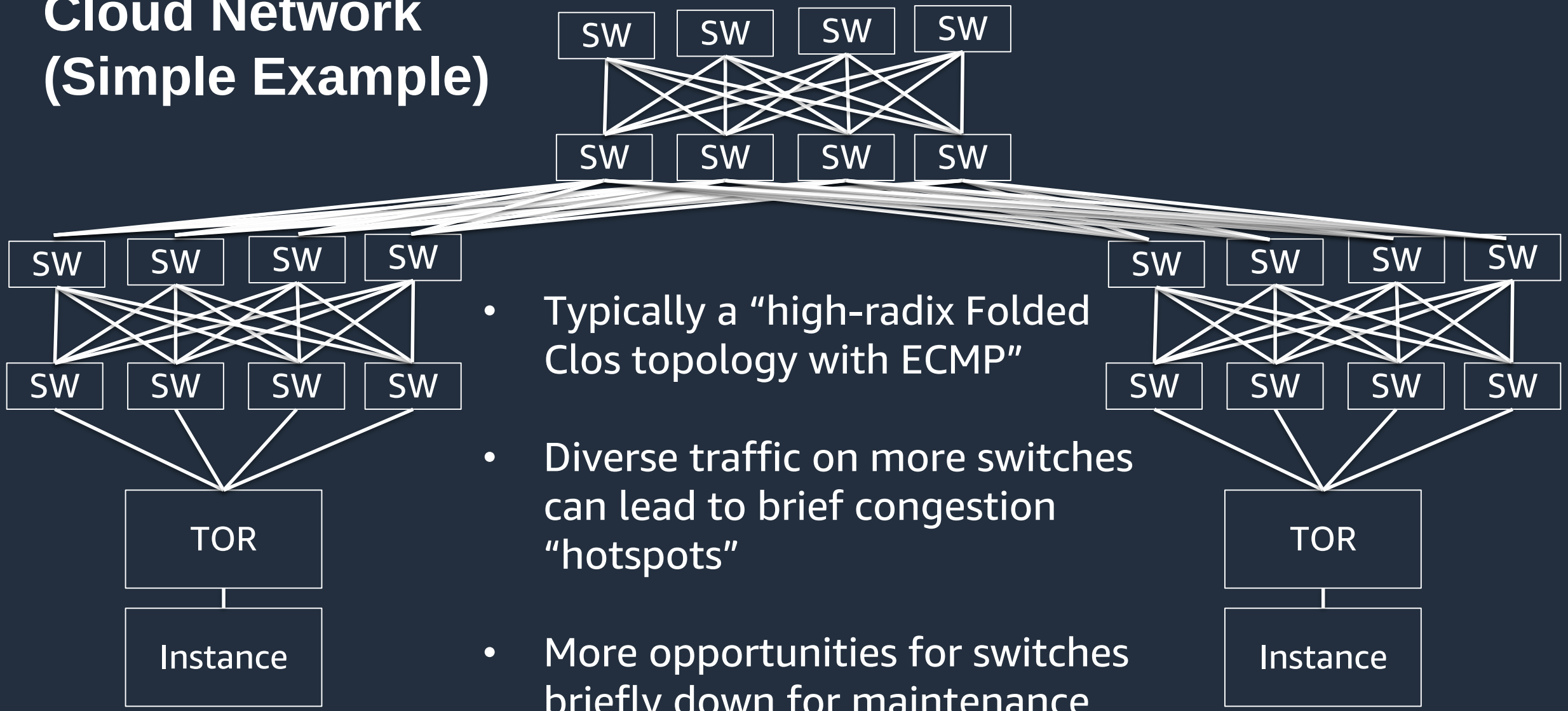
Cloud Network (Simple Example)



- Typically a “high-radix Folded Clos topology with ECMP”
- Diverse traffic on more switches can lead to brief congestion “hotspots”
- More opportunities for switches briefly down for maintenance
- TCP may ride it out, not UDP

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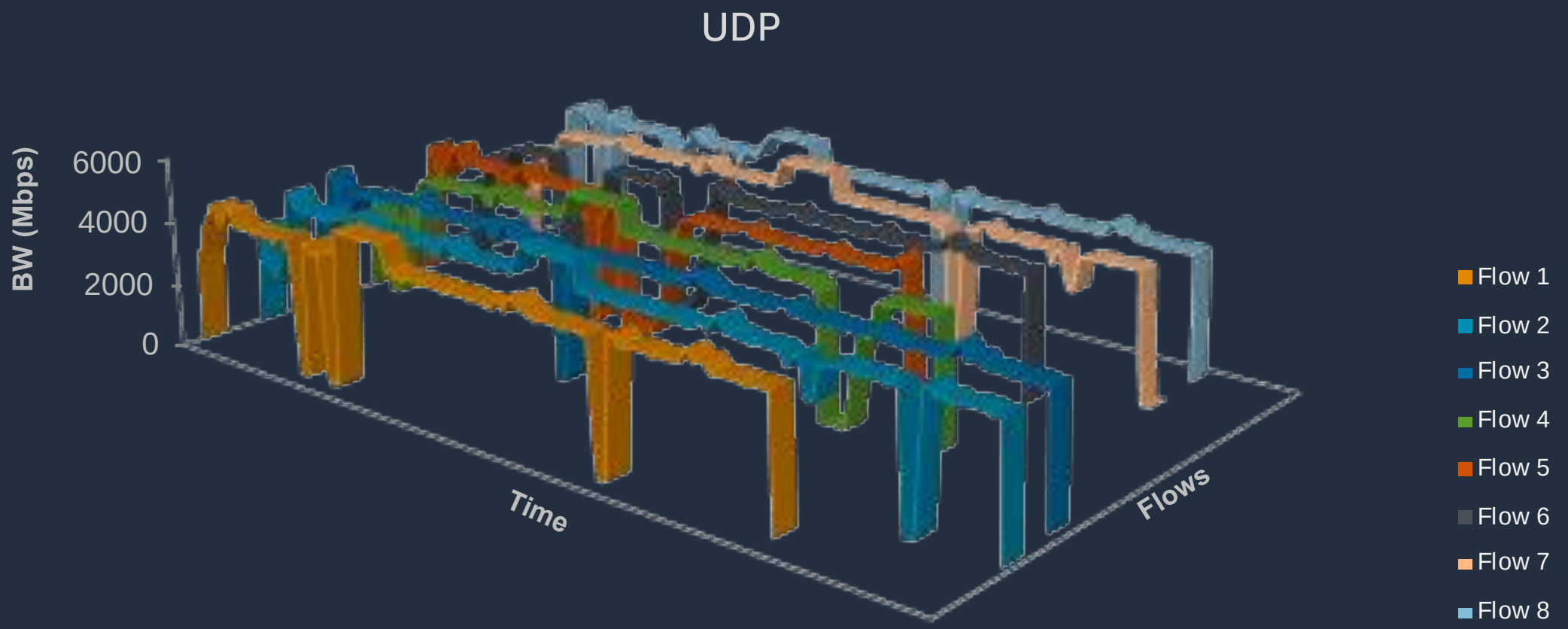
UDP in cloud…occasional brief reductions in flow BW



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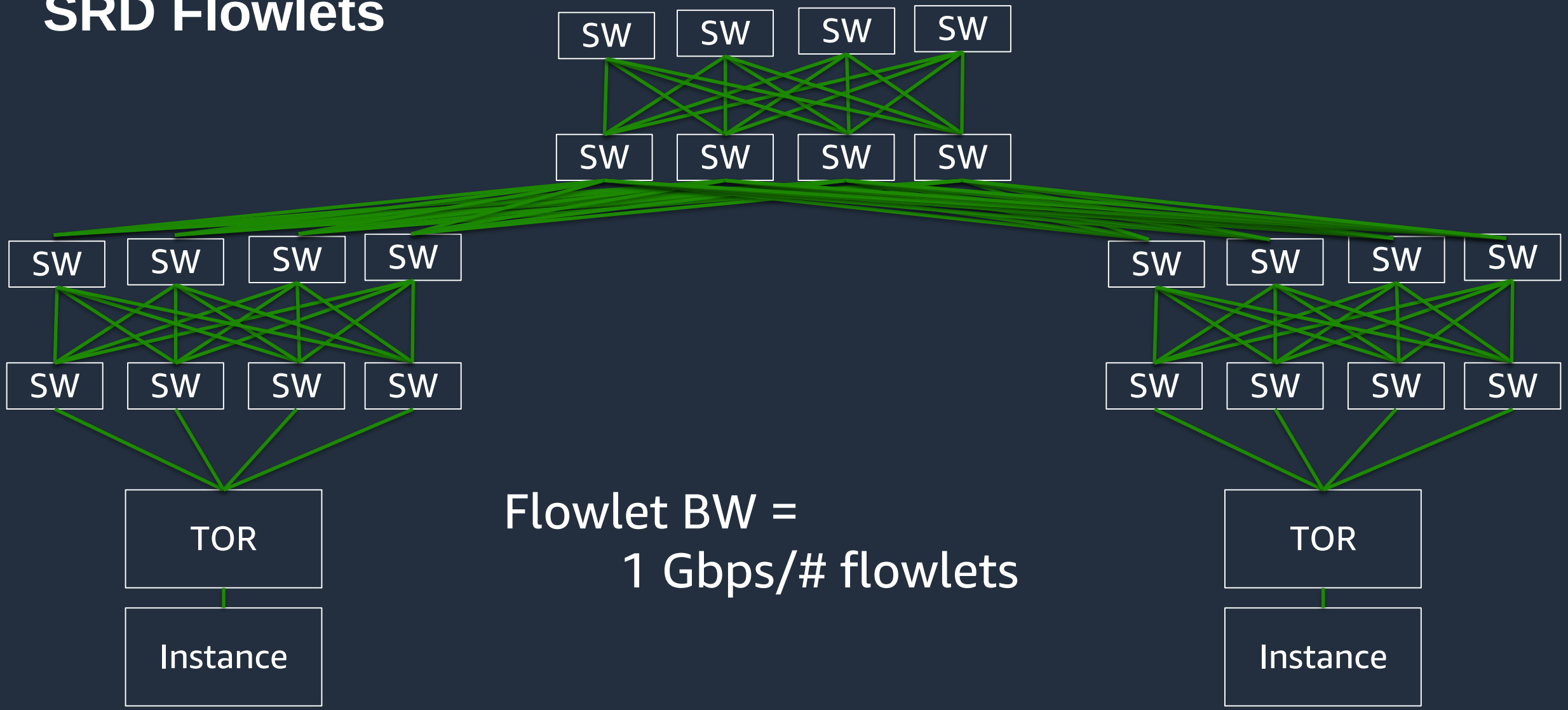
Solution: Scalable Reliable Datagram (SRD)

- Use multiple paths per flow (“flowlets”)
- Flowlets take different ECMP paths by manipulating packet headers (thus different hashes), e.g. UDP source port
- If flowlet RTT shows congestion, re-route flowlet & retransmit lost packet(s) – less to resend per flowlet vs. per single flow
- Out-of-order delivery restoration handled by higher layers

“L. Shalev, H. Ayoub, N. Bshara and E. Sabbag, "A Cloud-Optimized Transport Protocol for Elastic and Scalable HPC," in IEEE Micro, vol. 40, no. 6, pp. 67-73, 1 Nov.-Dec. 2020, doi: 10.1109/MM.2020.3016891. https://ieeexplore.ieee.org/document/9167399

SRD Flowlets



Flowlet BW =
1 Gbps/# flowlets

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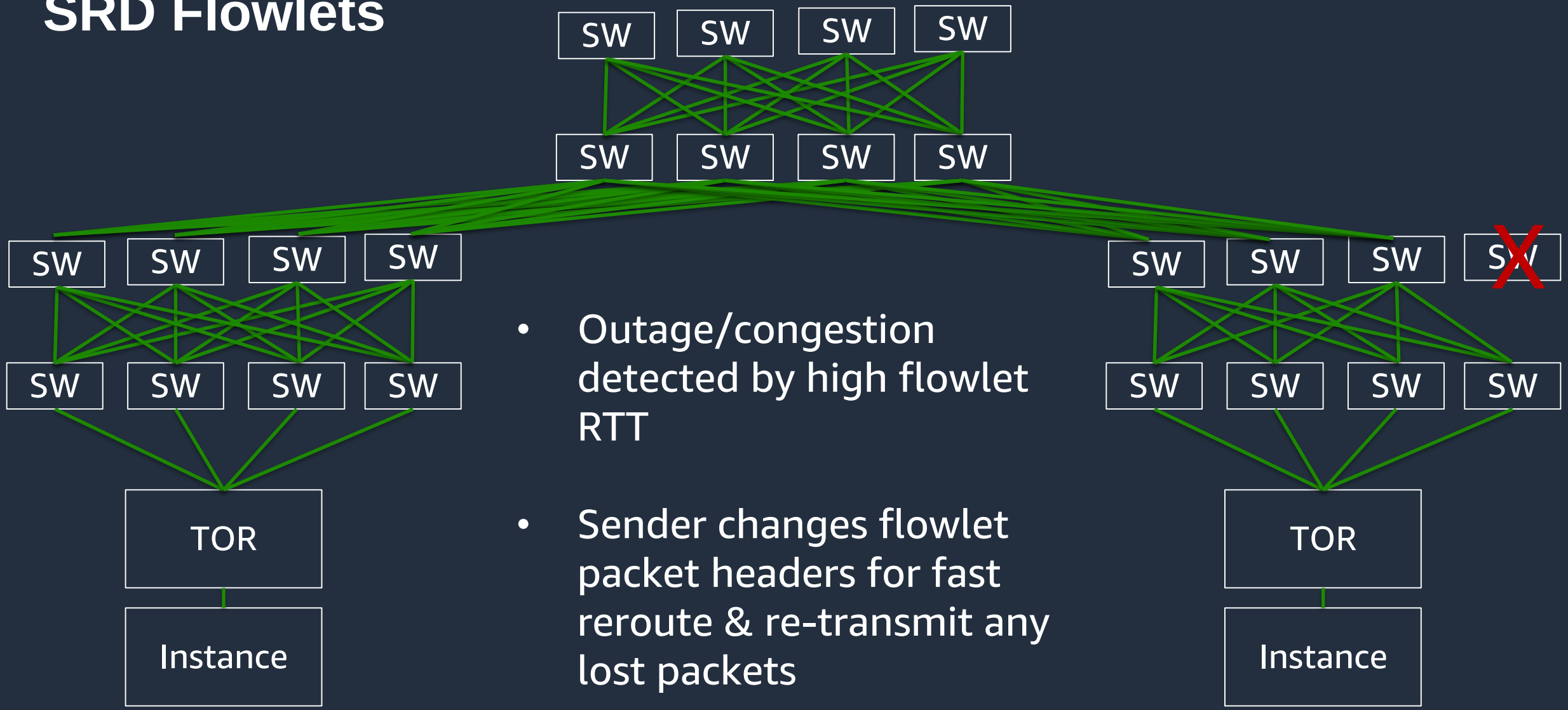
SRD Flowlets



- Outage/congestion detected by high flowlet RTT
- Sender changes flowlet packet headers for fast reroute & re-transmit any lost packets

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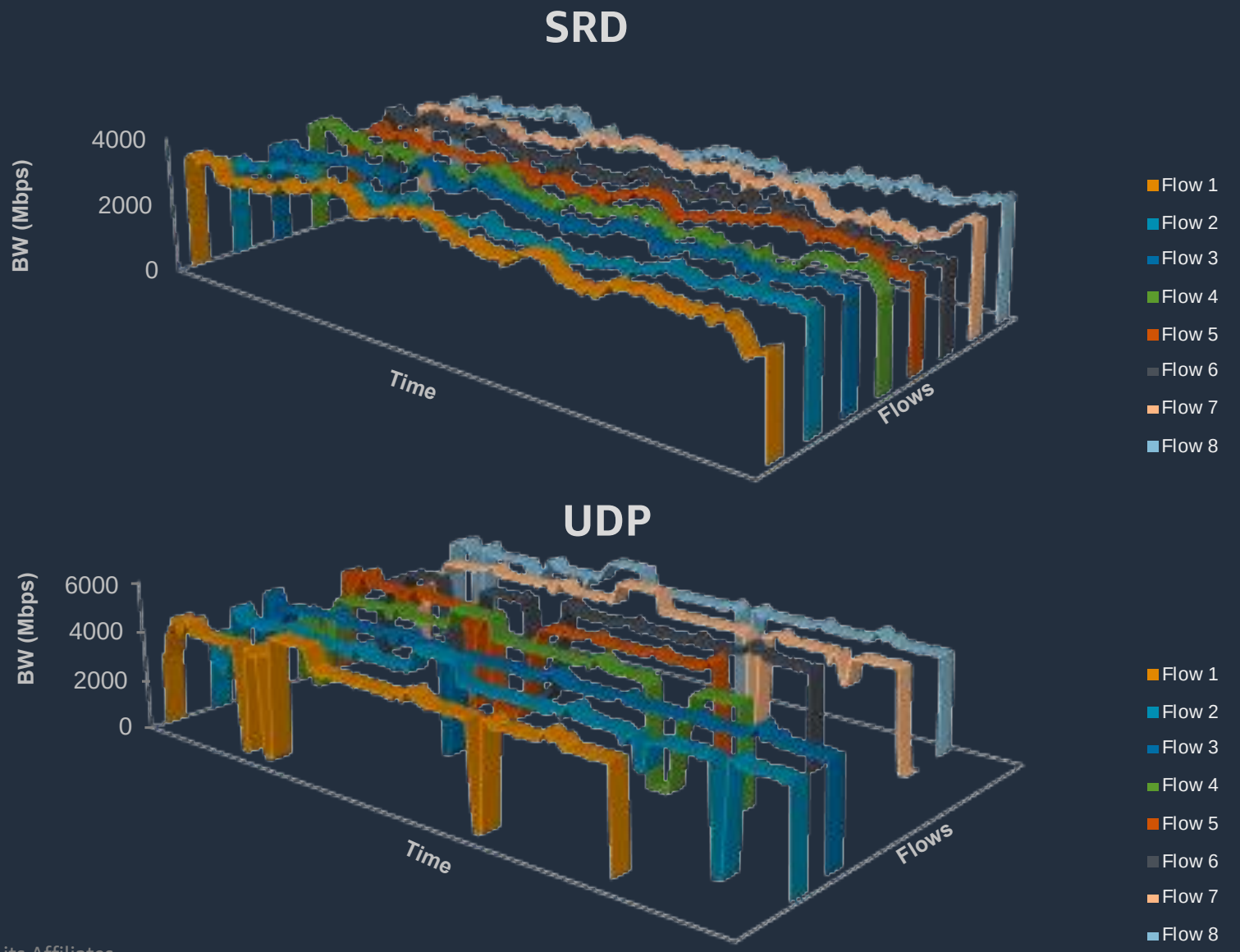
SRD: Reliable Bandwidth



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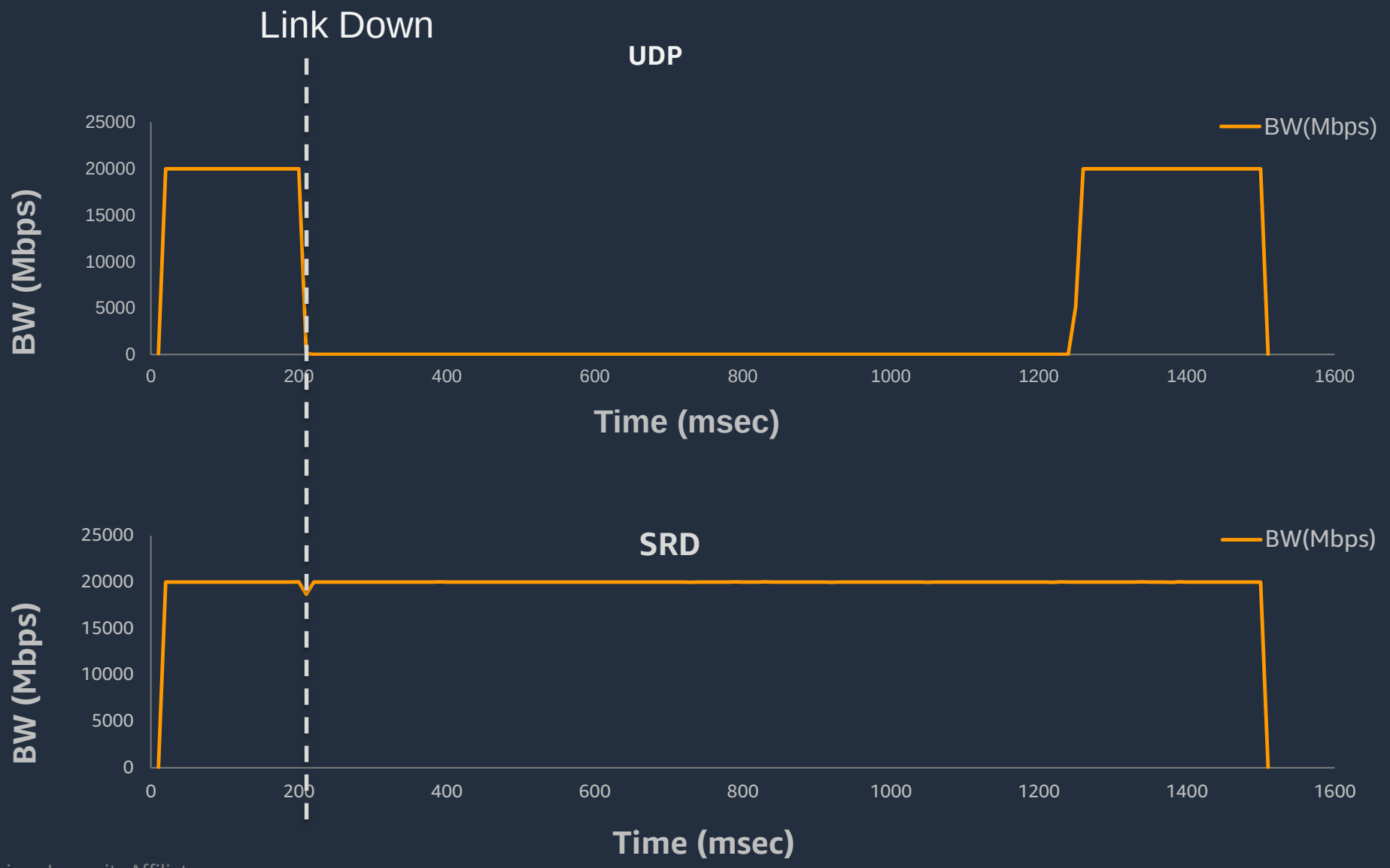
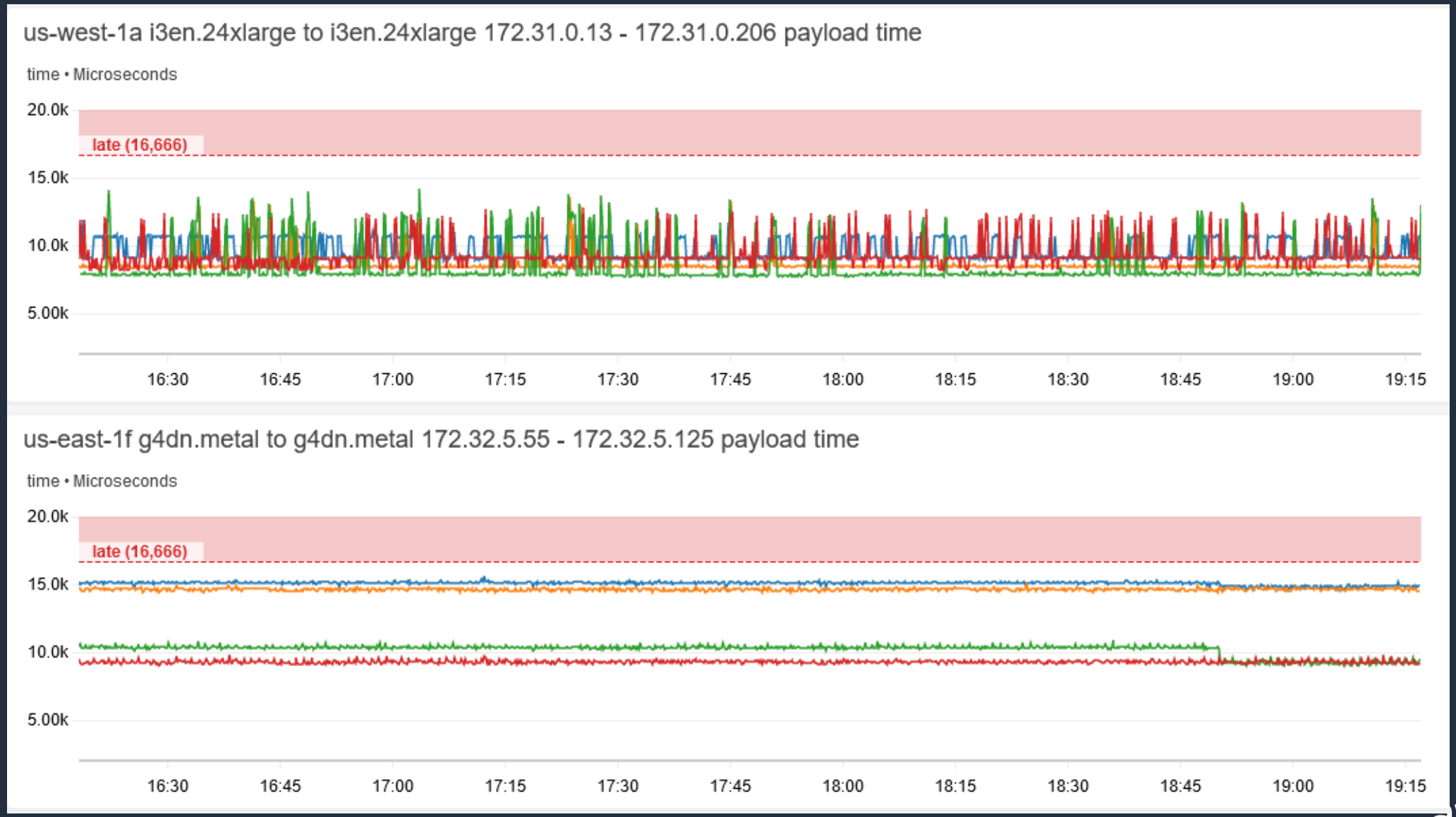
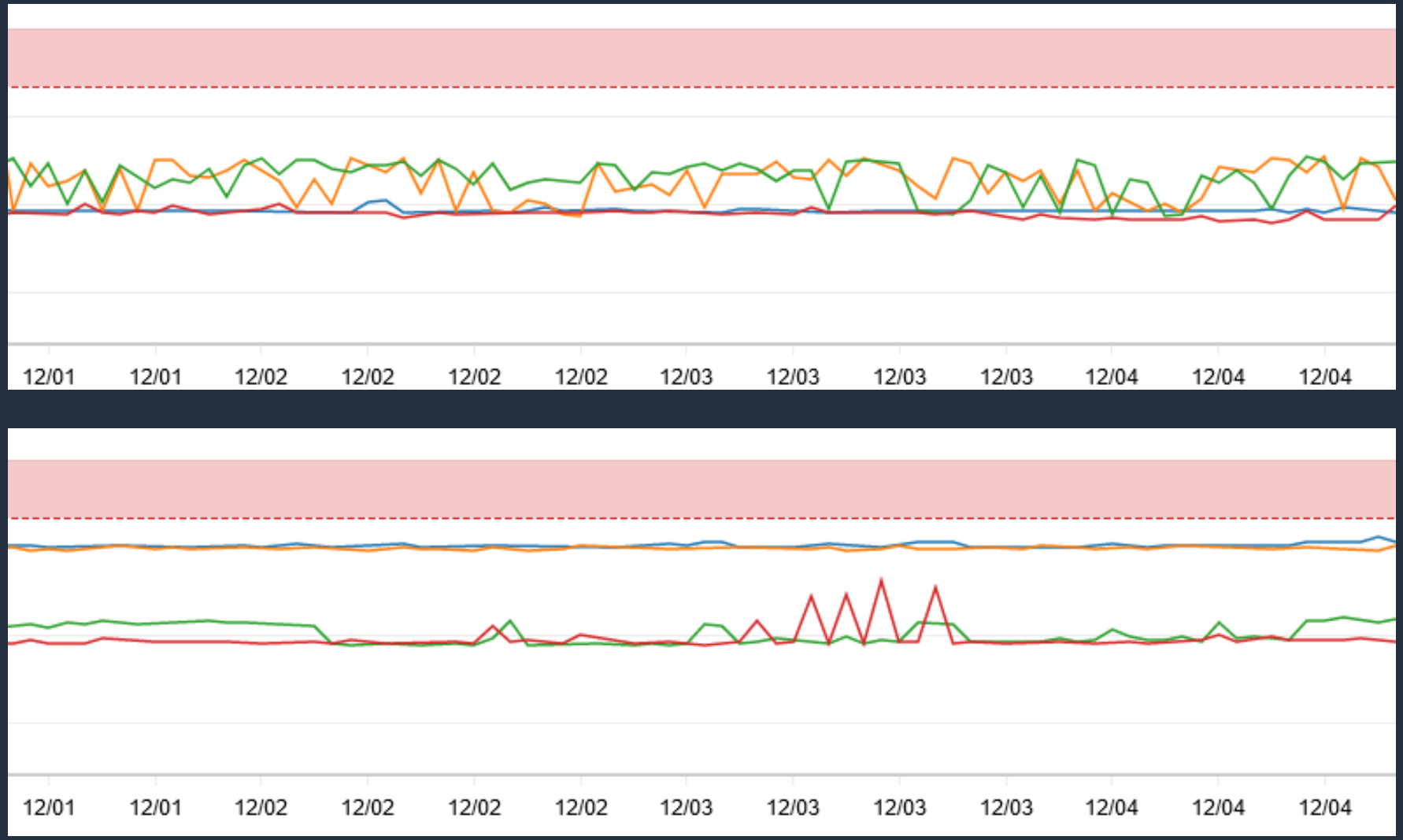
SRD – Fast re-routing for flowlets by sender



SRD – Reliable Sub-Frame Latency (4k video flows)



SRD – Sub-Frame Latency Over 4 Days (4k video flows)



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Cloud Digital Interface (CDI) =

Audio, Video and Metadata (AVM) Layer Transport of Audio, Video, Metadata based on formats in ST 2110-20/-30/-40	Open Specification
Transport Layer (SRD and EFA)	AWS Network Optimized

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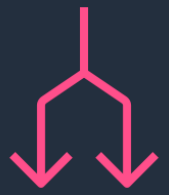
AWS CDI Concepts



AWS CDI technology is available with an SDK in both Windows and Linux versions

SDK is available as an open source project released under the 2-clause BSD license, customers only pay for EFA enabled EC2 instance usage

SDK is for Intra-Availability Zone transmission, and is optimized for EC2 Placement Groups

For increased inter-vendor interop the SDK includes a schema based Audio Visual Management (AVM) layer

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AWS CDI Concepts

Access and alter pixel data

Supports RGBA for graphic overlays in a single essence

Enables offloading of encoding and decoding from applications

Metadata flows are separate essences within the AWS CDI connection, enabling SCTE104 insertion, live closed captioning, any timed metadata

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Getting started

- GitHub repository:
  https://github.com/aws/aws-cdi-sdk
- AWS website:
  http://aws.amazon.com/media-services/resources/cdi/
- re:Invent video “FOX: Uncompressed live sports in the cloud”
  https://aws.amazon.com/blogs/media/watch-now-fox-uncompressed-live-sports-in-the-cloud/

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Thank you!

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