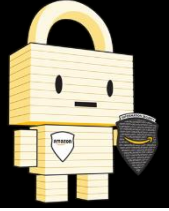
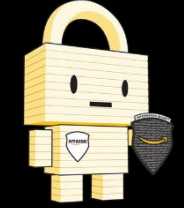


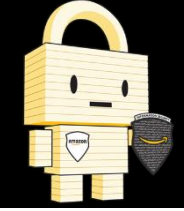
SCALING NETWORK MONITORING IN A LARGE ENTERPRISE

BroCon 2016 – Austin, TX



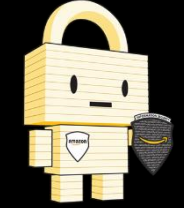
Who am I?

I work for Amazon's Worldwide Consumer Information Security group



What are we going to talk about?

How we scaled our network monitoring solution while the network is continuously growing

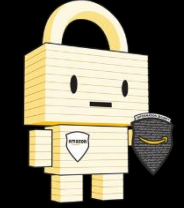


Why do we even do this?

Understanding what is occurring on our corporate network is important to us

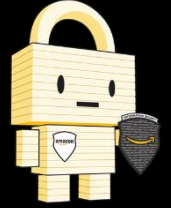
In the beginning…

http://spaceflight.nasa.gov/gallery/images/station/crew-7/html/iss007e10807.html



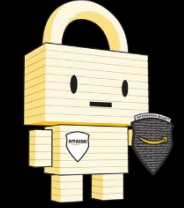
How do we approach this?

We originally decided on using vendor network sensors to get visibility in to what was occurring on our network



How we started off

- Decided a vendor appliance was an effective way of gathering the data we needed
- We can buy network sensors, right?
- So we bought network sensors and plugged them into our network

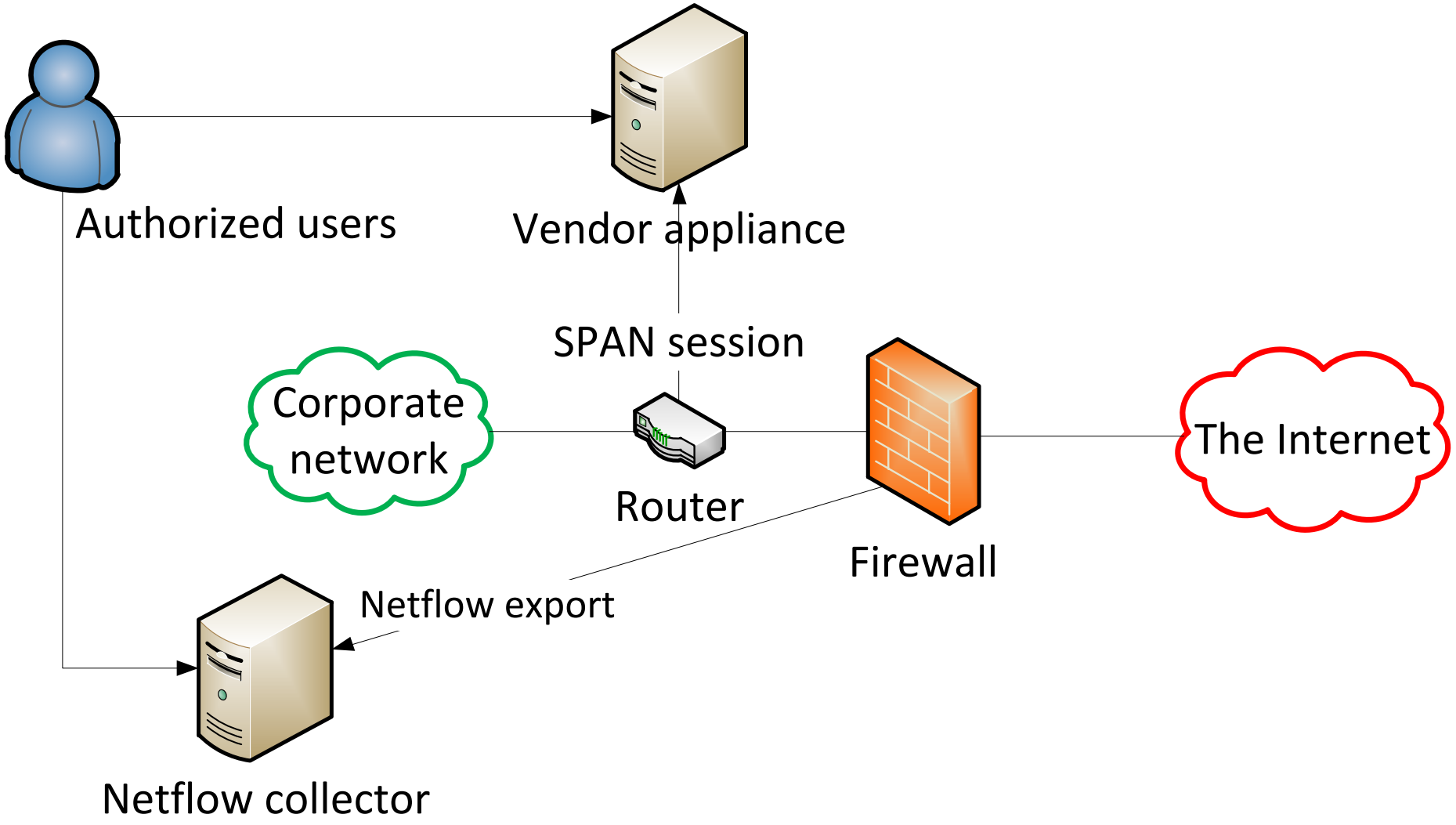


Vendor network sensor

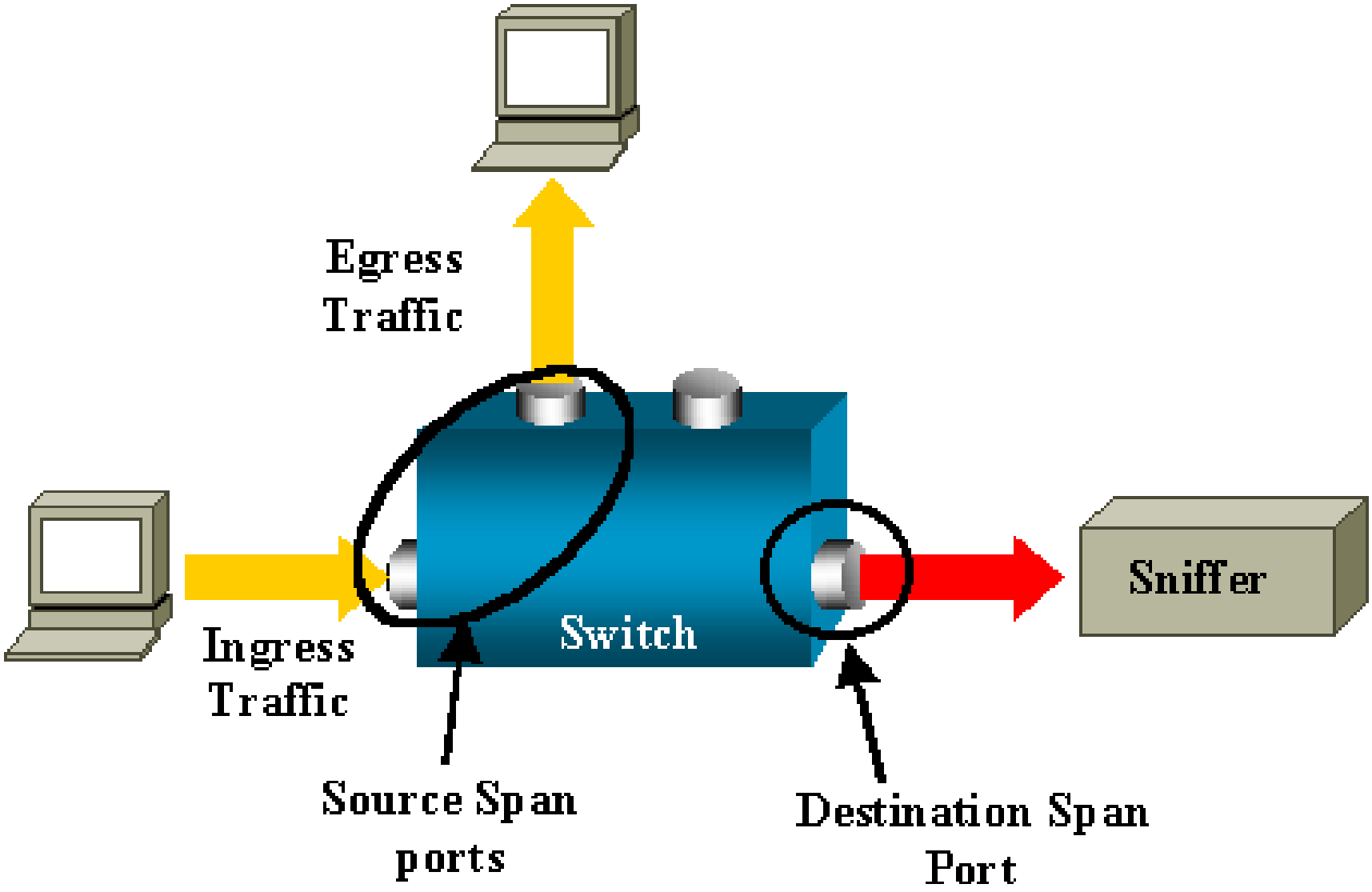
Life was much simpler back then...

- 1Gb/s capable firewalls
- SPAN sessions from our routers to vendor network sensors
- Small number of firewalls to monitor
- We got layer 3 and layer 4 header information from this network sensor

It looked something like this



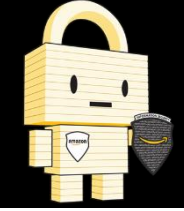
What is a SPAN port?



http://www.cisco.com/c/en/us/support/docs/switches/catalyst-6500-series-switches/10570-41.html

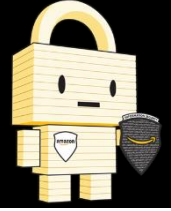
Where do we go from here?

- Our network traffic volume kept growing
- Our sensor vendor stopped selling and supporting the platform we were using
- Increased internal maturity about using this data
- Vendor Management platform can't scale
  - Driven by API usage by internal customers
  - Started getting close to the limit of network sensors the management platform could handle



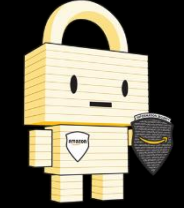
Future proofing?

- We have a vendor's system we're starting to push the limits on
- What features do we need?
- Do we continue to buy or do we look at building instead?



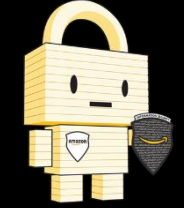
Build vs Buy

	Build	Buy
Speed of execution	✗	✓
Control	✓	✗
Vendor support	✗	✓
Logistics	✓	✗
Performance	✓	✗



Pushing for the next level

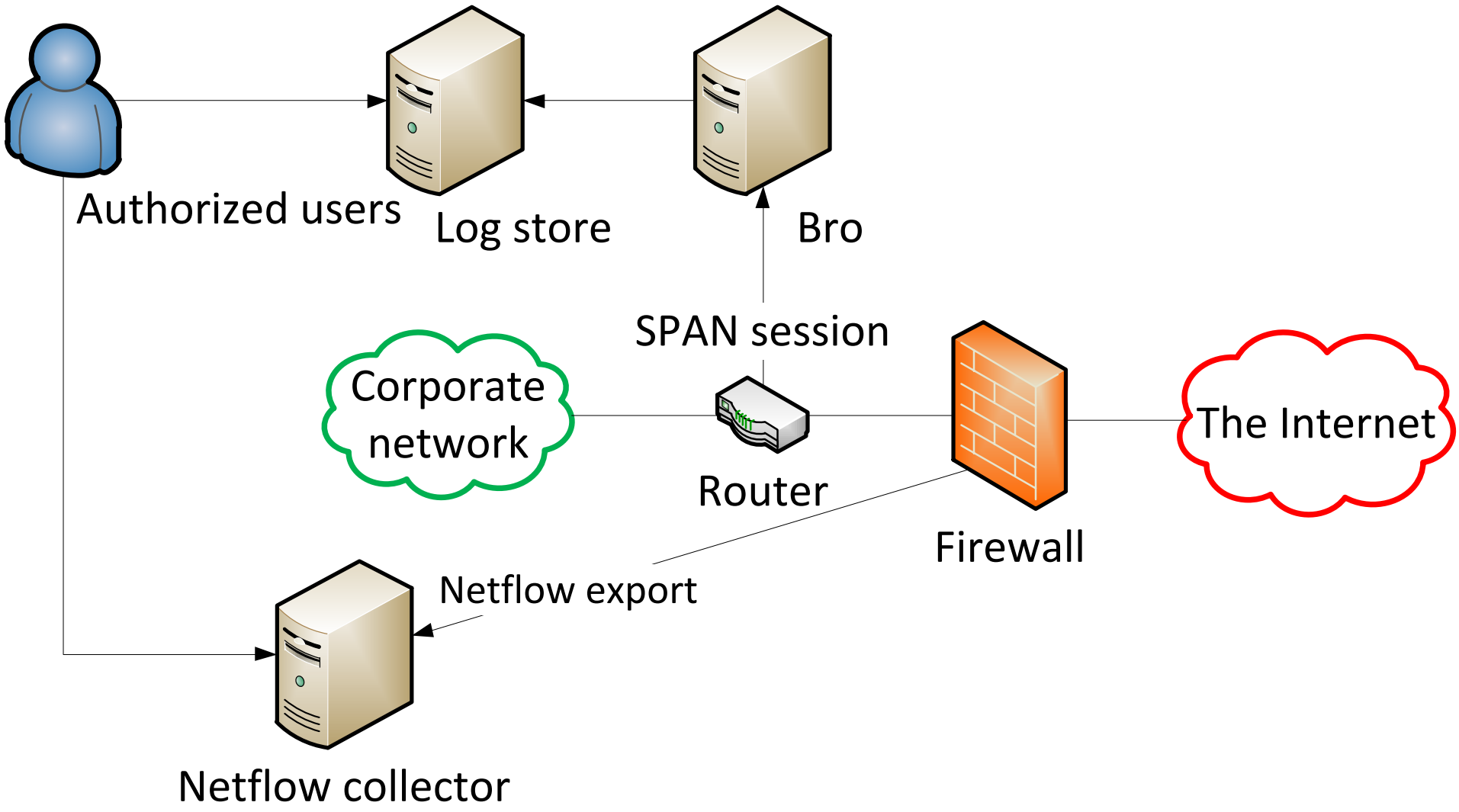
- My co-workers evaluated various options
  - nProbe
  - Snort
  - Suricata
  - Bro

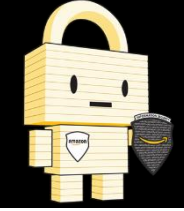


Bro Generation One

- Ran on a single host
- Connected to our router via a 10G fiber link
- SPAN session from the router to our Bro host

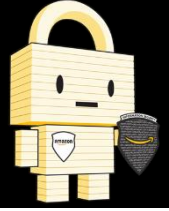
Bro Generation One looks like…





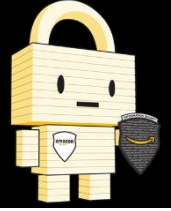
The challenges of Generation One

- The Bro host was a single point of failure
- Individual host installs have high operational costs
- High traffic volumes on our SPAN sessions caused our router to reboot
- Will this continue to scale with the growth of our network?



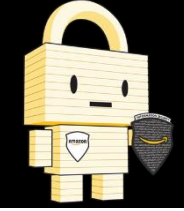
Scorecard

	Vendor solution	Generation One
Single point of failure?	✗	✗
Data collected via	SPAN	SPAN
Control	✗	✓
Scalability	✗	✗
Logistics / Install effort	✗	✗
Cost per Gb/s	$$$	$



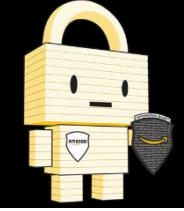
And we are done!

Or so we thought….



Along came Seth…

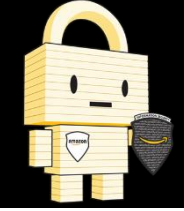
- Seth spotted everything in the history field was in upper case
  - Turned out to be a trivial configuration change
- We started off with 32GB of RAM in our hosts and ended up upgrading to 128GB



Scaling to infinity and beyond!

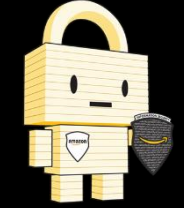
- Capture loss levels (as reported by Bro) started rising beyond acceptable levels once we were past 3Gb/s of traffic on our existing hardware platform

- We knew that traffic levels were going to continue to increase so our design needed to evolve as well



Introducing Bro Generation 1.5

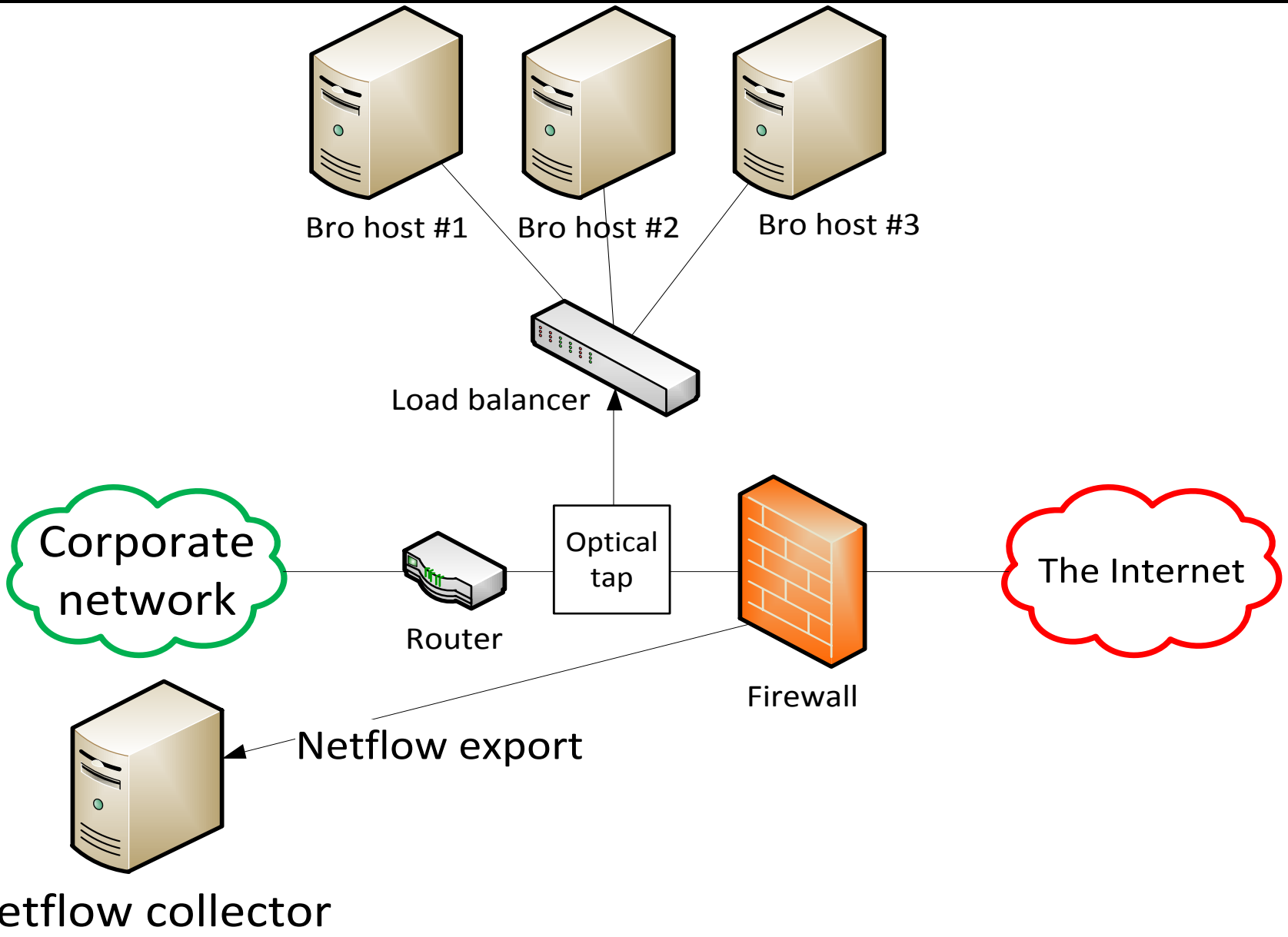
- We migrated to optical taps over SPAN sessions
  - SPAN sessions were good for speed of deployment but not for long term use
- Introduced a method to allow us load balance traffic among physical hosts
  - Similar outcome to the work done by LBNL
  - Eliminated the SPOF with our Bro host
  - https://commons.lbl.gov/download/attachments/120063098/100GIntrusionDetection.pdf

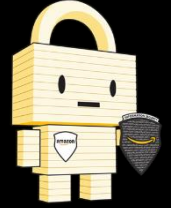


Bro horizontal scaling

- While we do run Bro in a cluster, it is limited to a single physical host
- We don’t want to share state across hosts
- The Bro manager process being a single point of failure isn’t all that appealing to us
- Keep the hosts simple and consistent

And here is how it looks

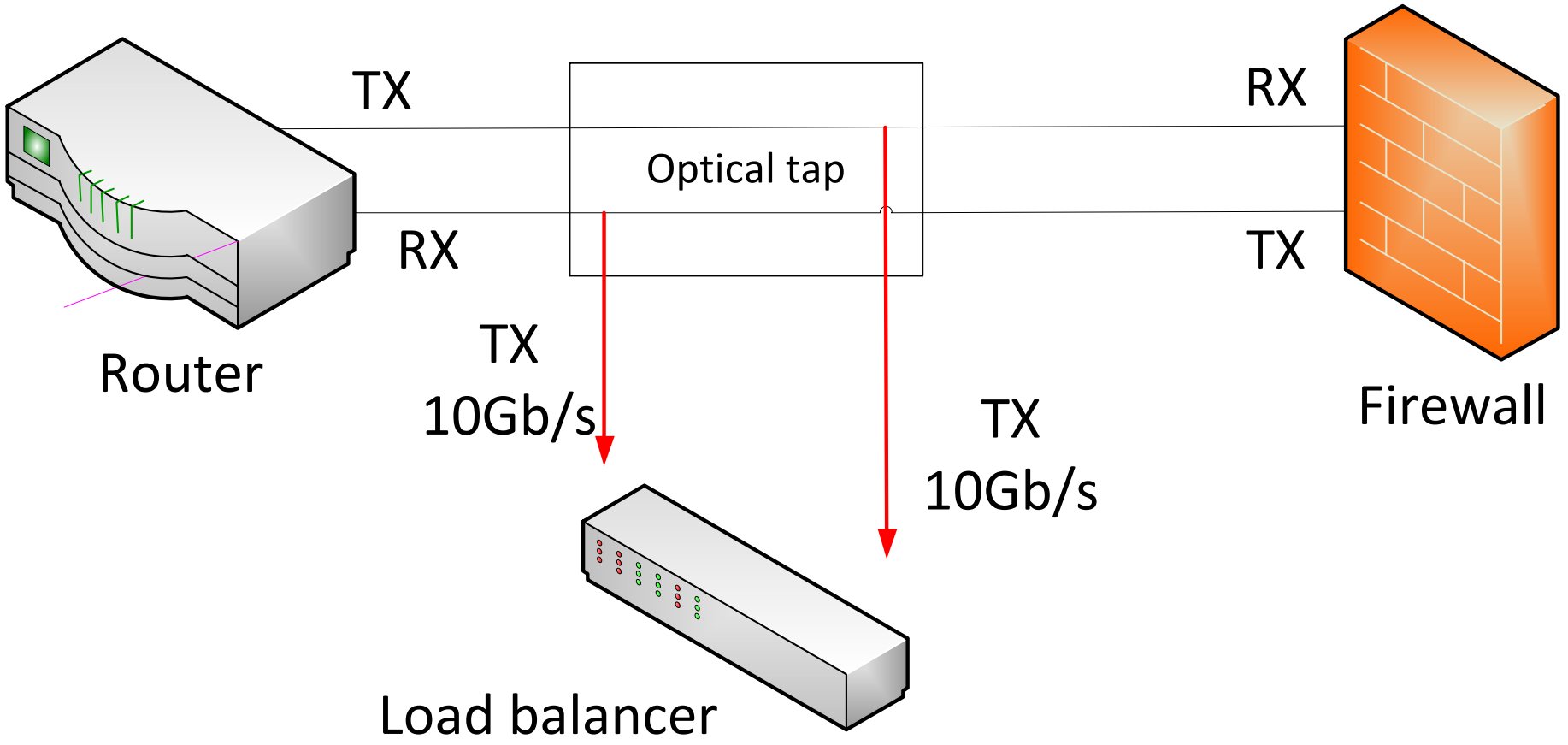


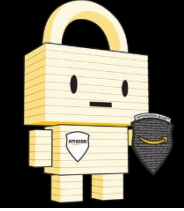


Scorecard

	Vendor solution	Generation One	Generation 1.5
Single point of failure?	✗	✗	✓
Data collected via	SPAN	SPAN	Optical taps
Control	✗	✓	✓
Scalability	✗	✗	✓
Logistics/ Install effort	✗	✗	✗ ✗
Cost per Gb/s	$$$	$	$

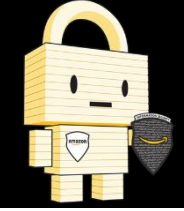
Optical taps overview





Still some work to do

- This was a great step forward, but it was only an incremental improvement
- We can now scale out but it is still time consuming to get individual hosts deployed
- Migrating to an integrated solution would help solve these challenges

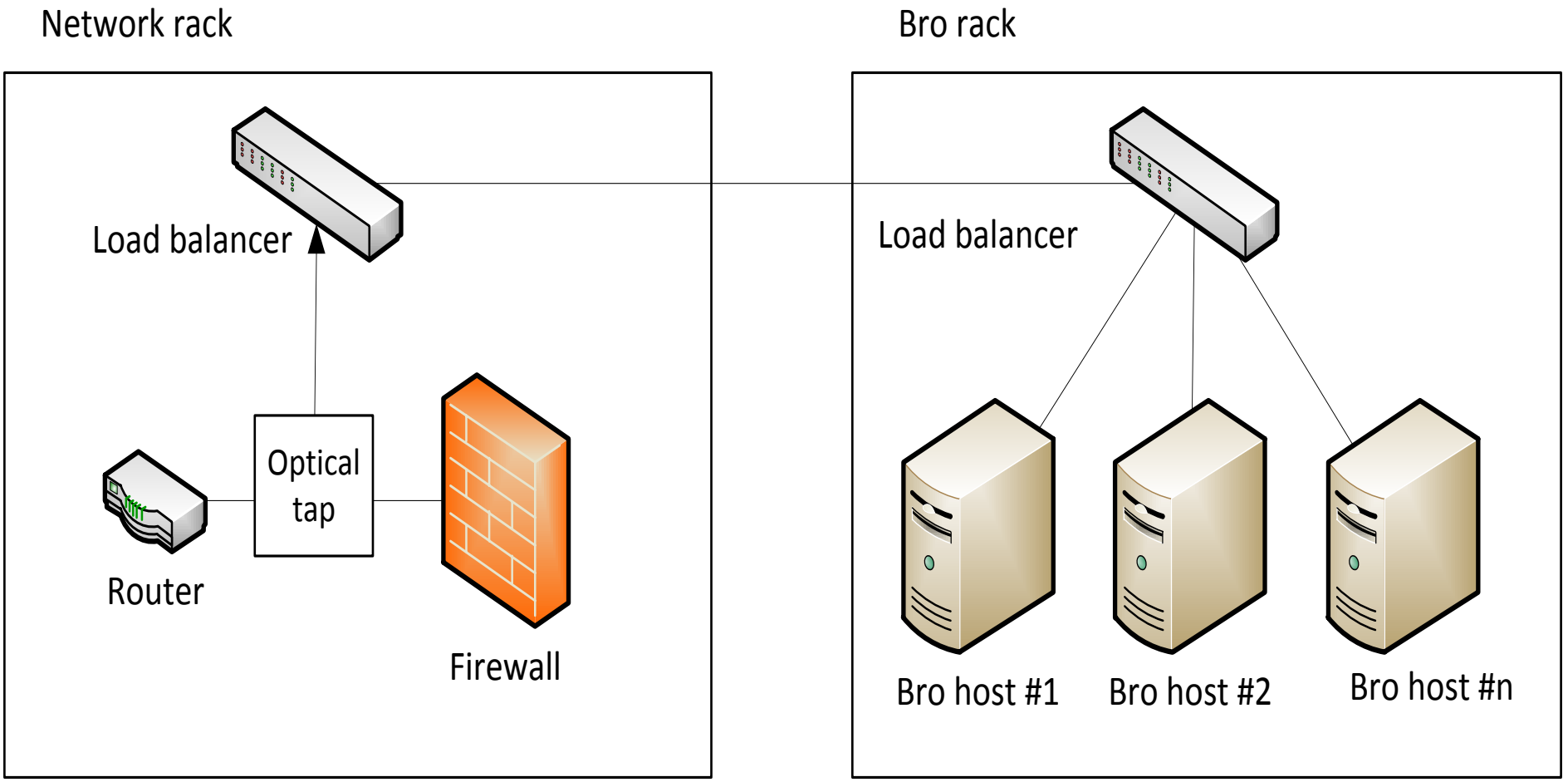


Bro Generation 2.0

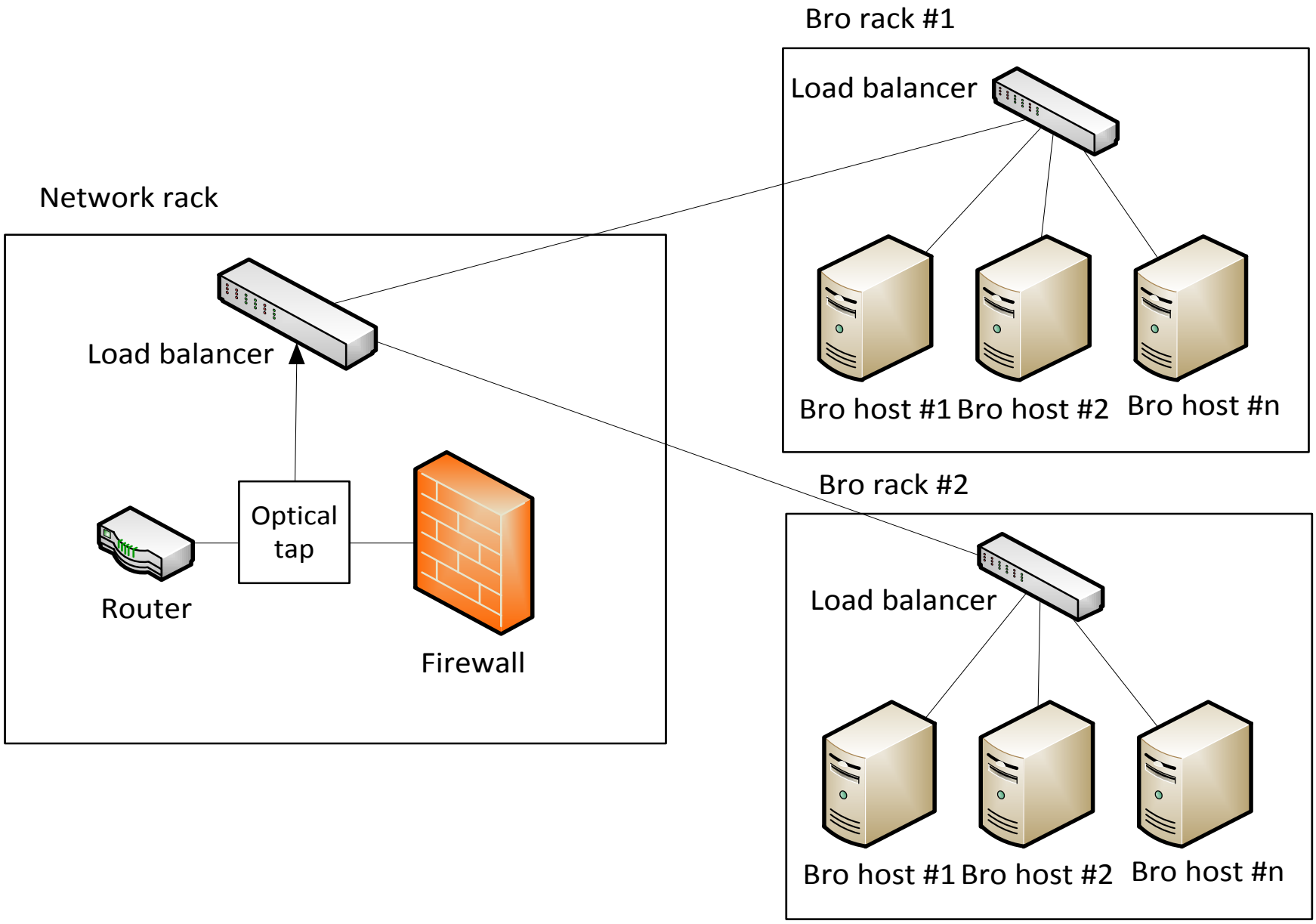
- Combined our hosts, load balancers and optical taps into a “cookie cutter” rack design

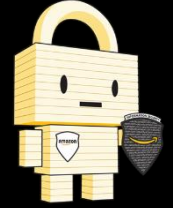
- We now just order a small, medium or large rack depending expected traffic volumes

Bro Generation 2.0 physical layout



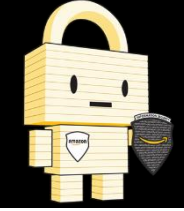
Scaling Bro Generation 2.0 footprint





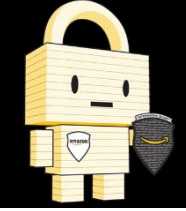
Scorecard

	Vendor solution	Generation One	Generation 1.5	Generation 2
Single point of failure?	✗	✗	✓	✓
Data collected via	SPAN	SPAN	Optical taps	Optical taps
Control	✗	✓	✓	✓
Scalability	✗	✗	✓	✓
Logistics/ Install effort	✗	✗	✗✗	✓
Cost per Gb/s	$$$	$	$	$

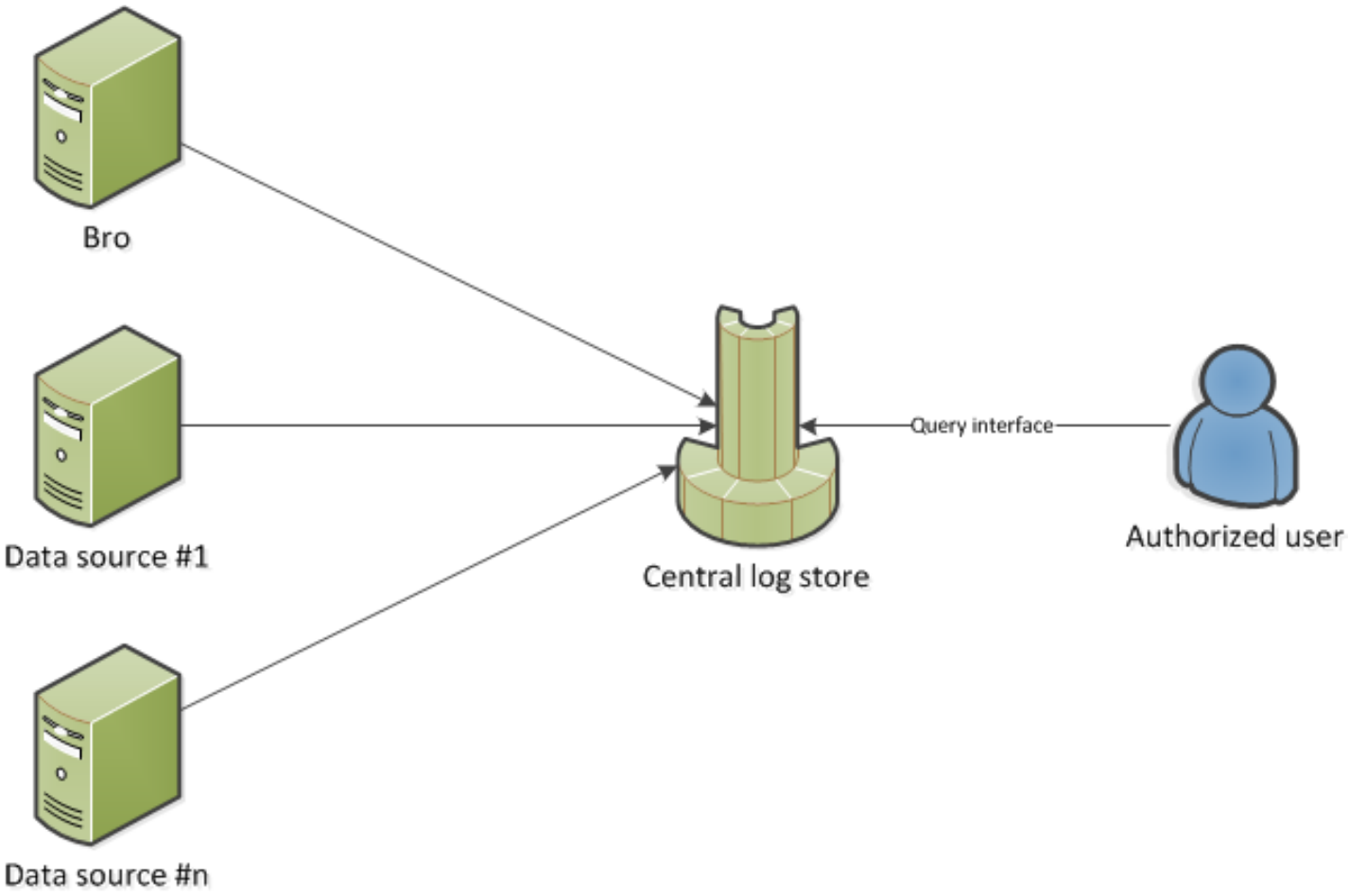


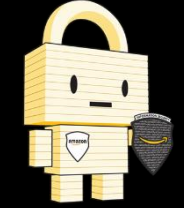
What do we do with all this data?

We stream the logs to our central log store



Central log storage





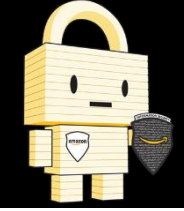
Learn from some of our mistakes…

Our original ETL jobs were based on the Bro 2.3 field order (output in TSV)

- Bro 2.4 changed the ordering of some of the fields
- Use JSON if you're loading this data elsewhere
  - One line configuration change!

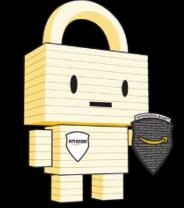
Wrapping up

http://www.nasa.gov/image-feature/sunset-from-the-international-space-station



Lessons learnt

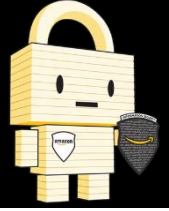
- Scale horizontally and not vertically
- Stateless sensors
- Decouple dependencies
- Plan up-front
- Lab testing is never overrated
- Get experts on-site to validate
- Document wins
- Know your customers



Thanks to…

Industry peers

- Thanks to LBNL, Mozilla and the others who responded to our queries and everyone who has publicly spoke or documented their install



Thank you!