Introduction to Routing Security Problems

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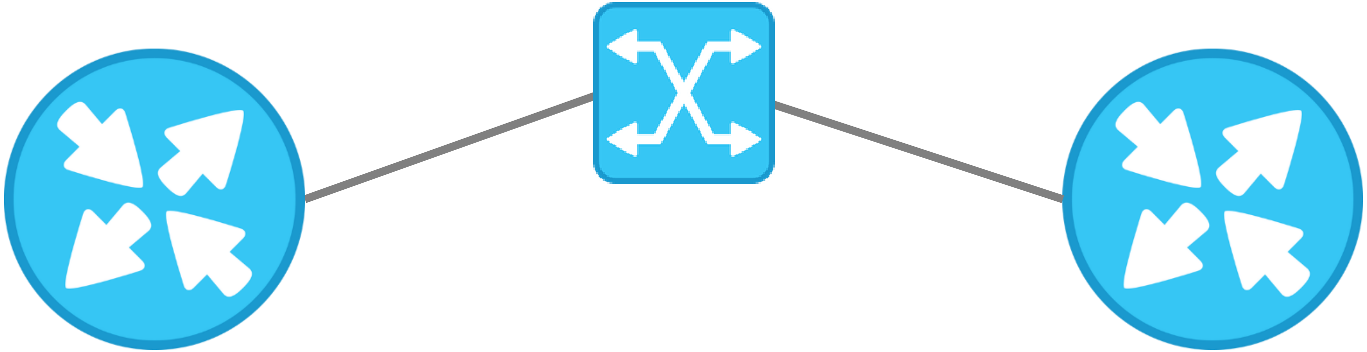
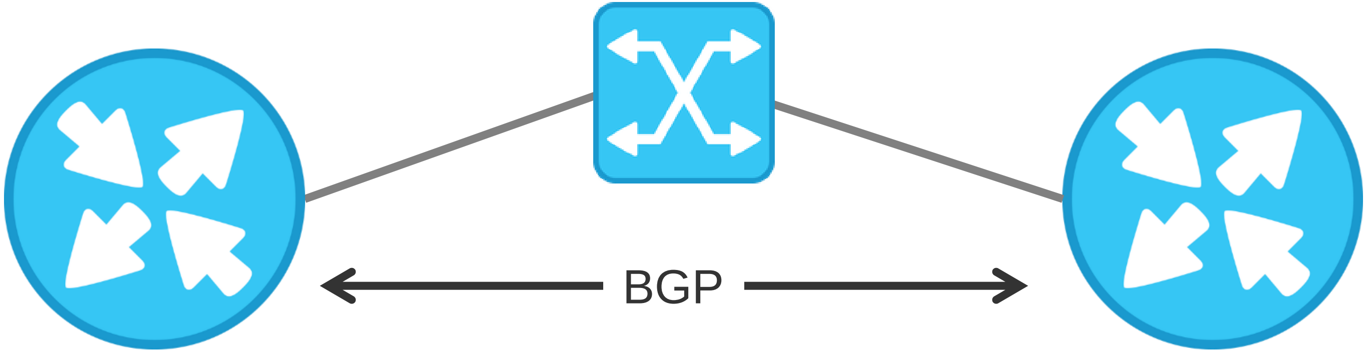
Routing Security Problems

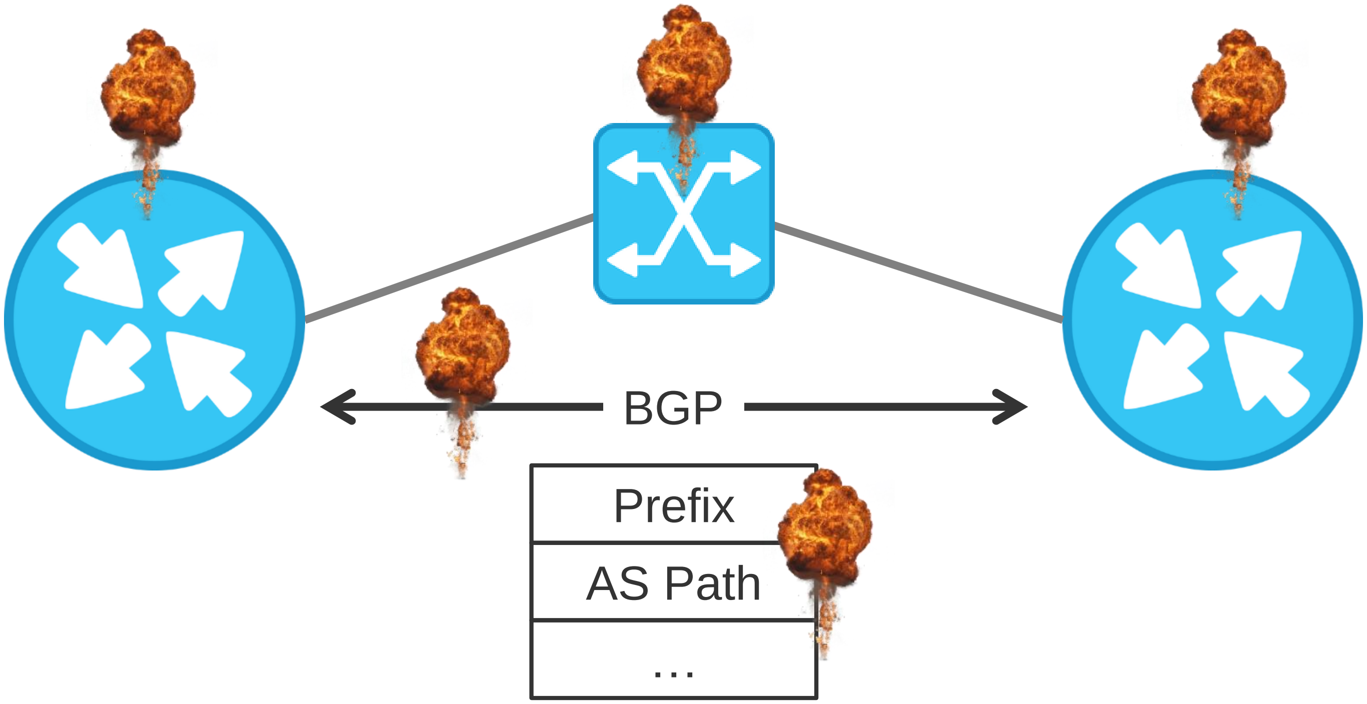
Routing should enable reachability



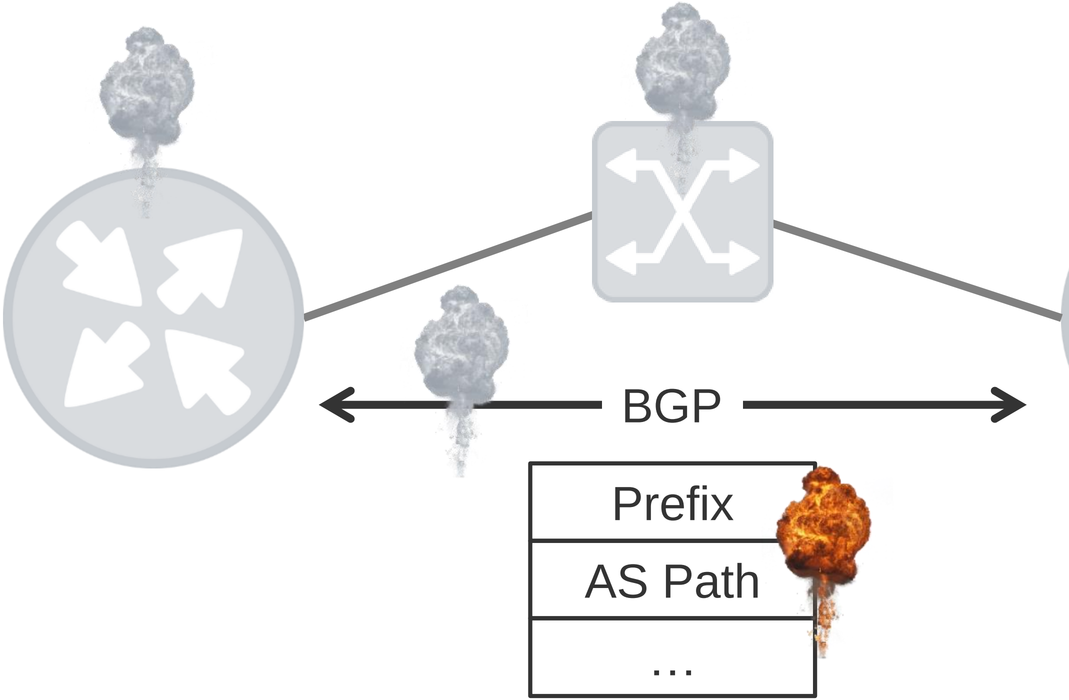
Routing should enable reachability



Routing should enable reachability



Routing should enable reachability



Why should you care?

Exploiting BGP Updates can lead to traffic interception

… to break privacy

… to break service availability
(e2e protection doesn‘t help!)

Routing Security Problems

BGP [RFC 4271]: Main security problem

BGP is based on trust

A BGP peer cannot verify the correctness of prefixes, AS paths, etc.

Threat models for BGP

Prefix Origin Hijacking

AS Path Manipulation

Route Leaks

Threat models for BGP

Prefix Origin Hijacking

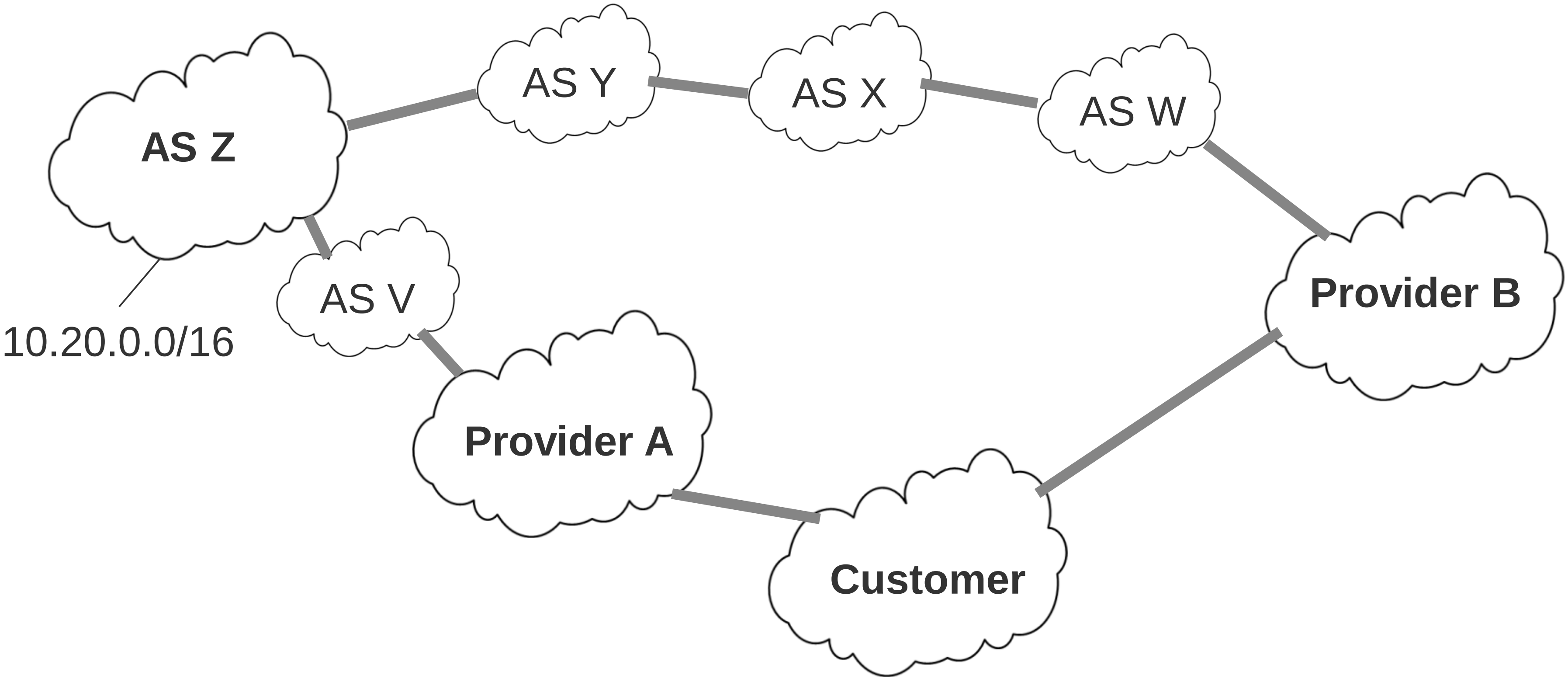
Originate an IP prefix that you don’t own

AS Path Manipulation

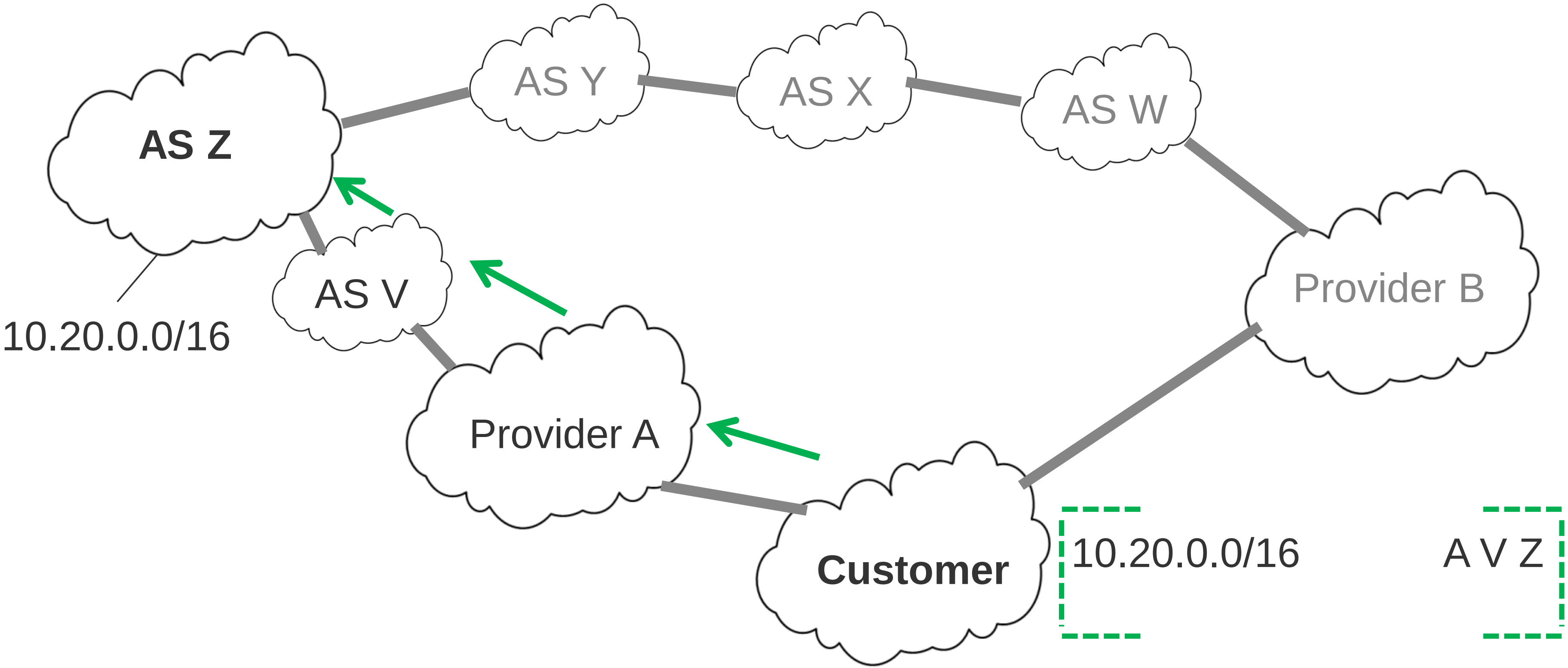
Change the AS path compared to the original traversal

Route Leaks

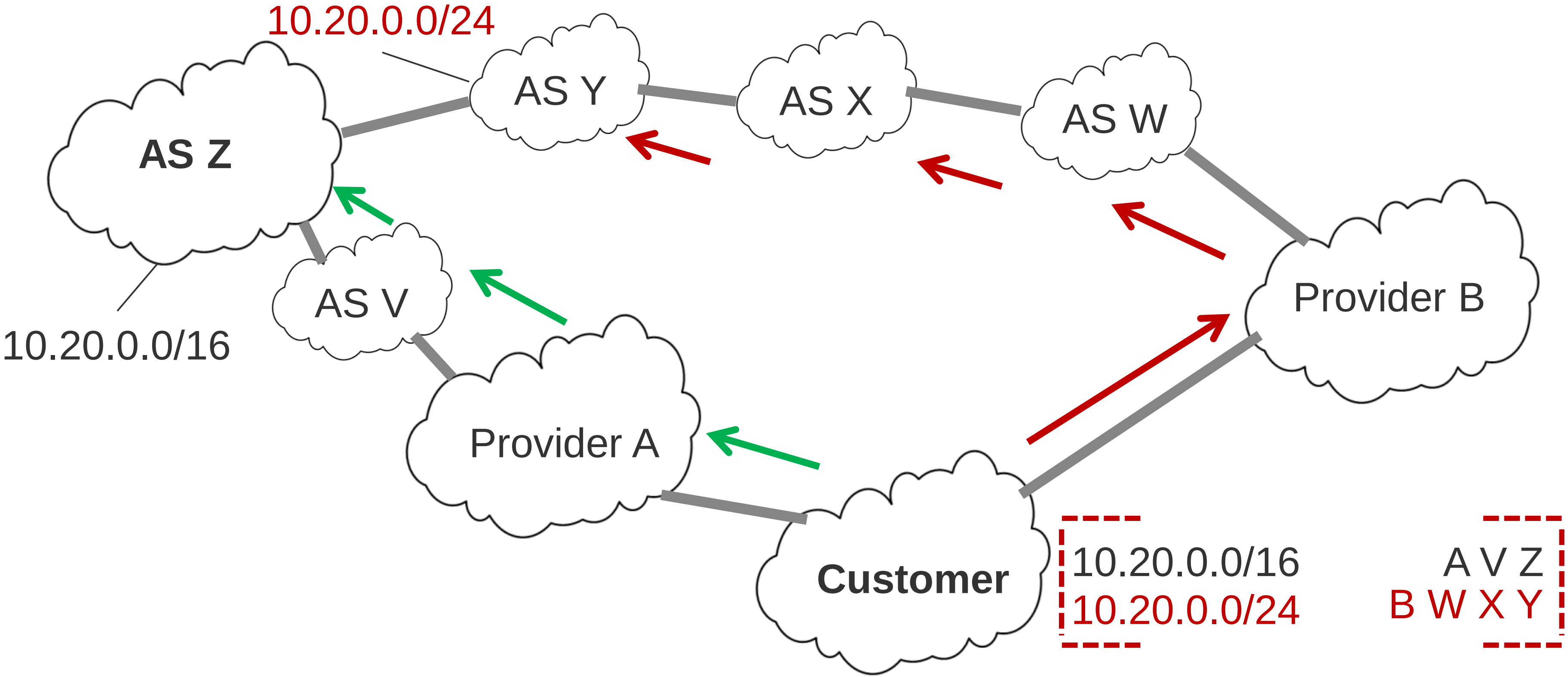
Simple example



Simple example (1): Traffic flow

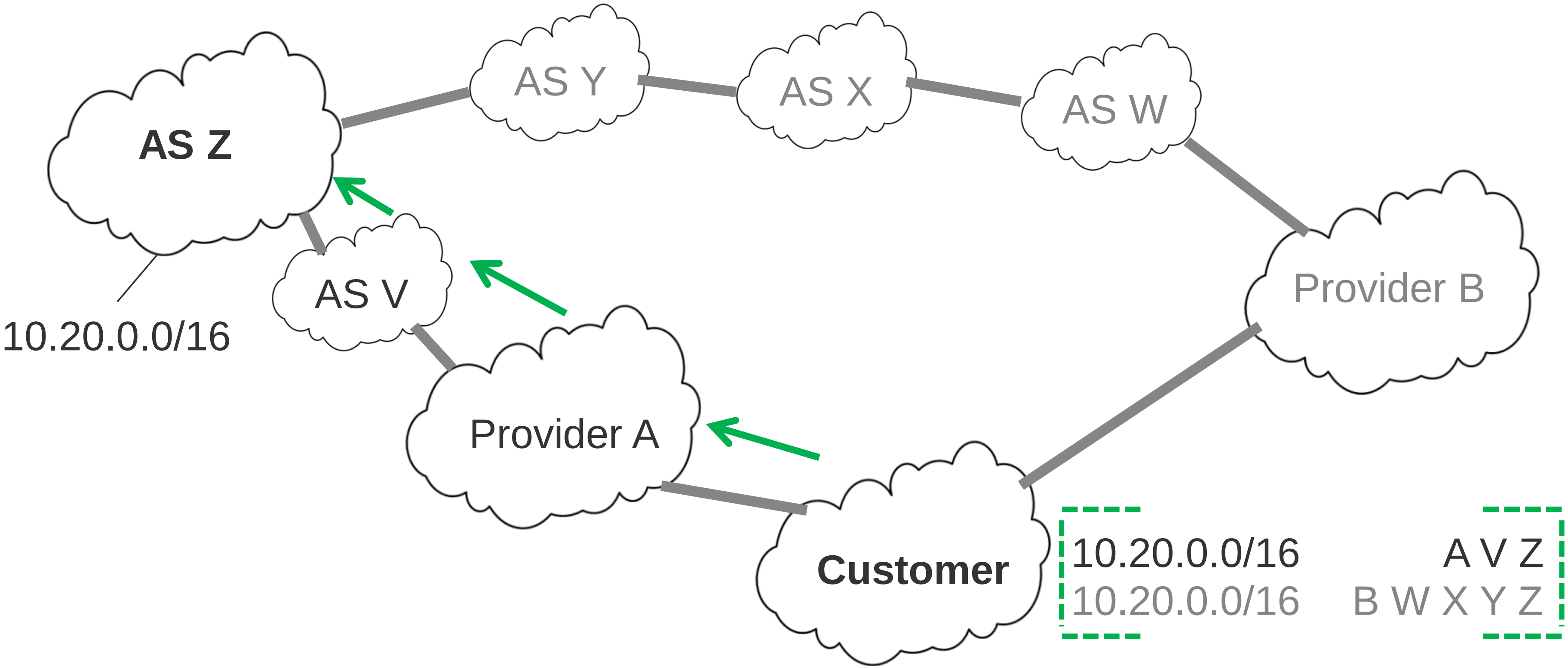


Simple example (1): More specific wins



10.20.0.0/16	A V Z
10.20.0.0/24	B W X Y

Simple example (2): Multiple upstreams

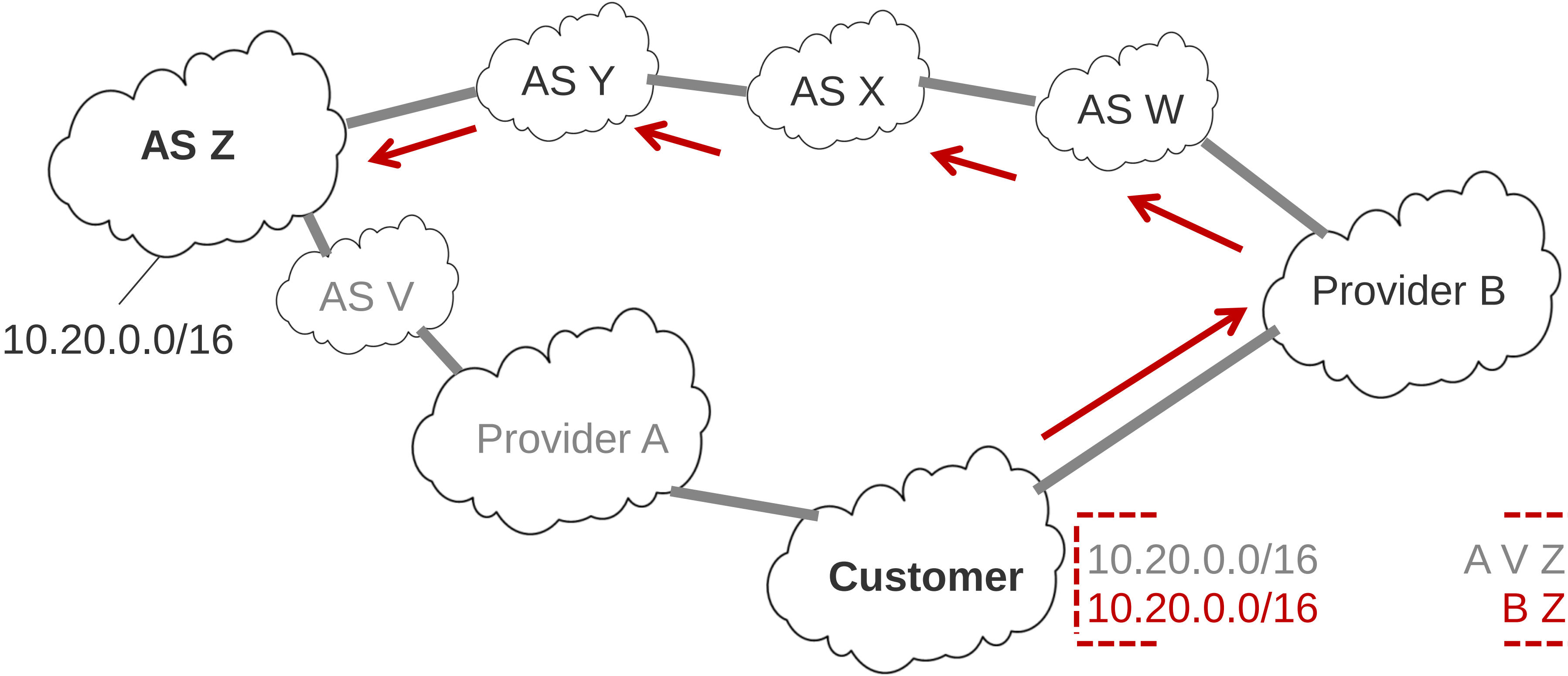


10.20.0.0/16	A V Z
10.20.0.0/16	B W X Y Z

Shorter path wins, AS B configures:

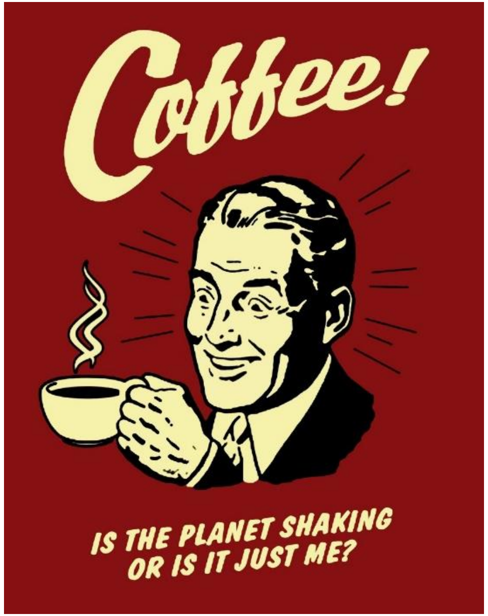
```
if net = 10.20.0.0/16 then {
            bgp_path.empty;
            bgp_path.prepend(B);
            bgp_path.prepend(Z);
            accept;
}
```

Simple example (2): Shorter path wins



10.20.0.0/16	A V Z
10.20.0.0/16	B Z

Real-world examples – There are more!



2008: YouTube Hijack

Pakistan Telecom announced a more specific prefix from YouTube

2010: China Telecom Incident

China announced ~50k prefixes incorrectly

2017: Russian Routing Leak

AS39523 announced 80 prefixes incorrectly

Real-world examples – There are more!

Those cases could easily be prevented by proper (RPKI) filtering!

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Threat models for BGP

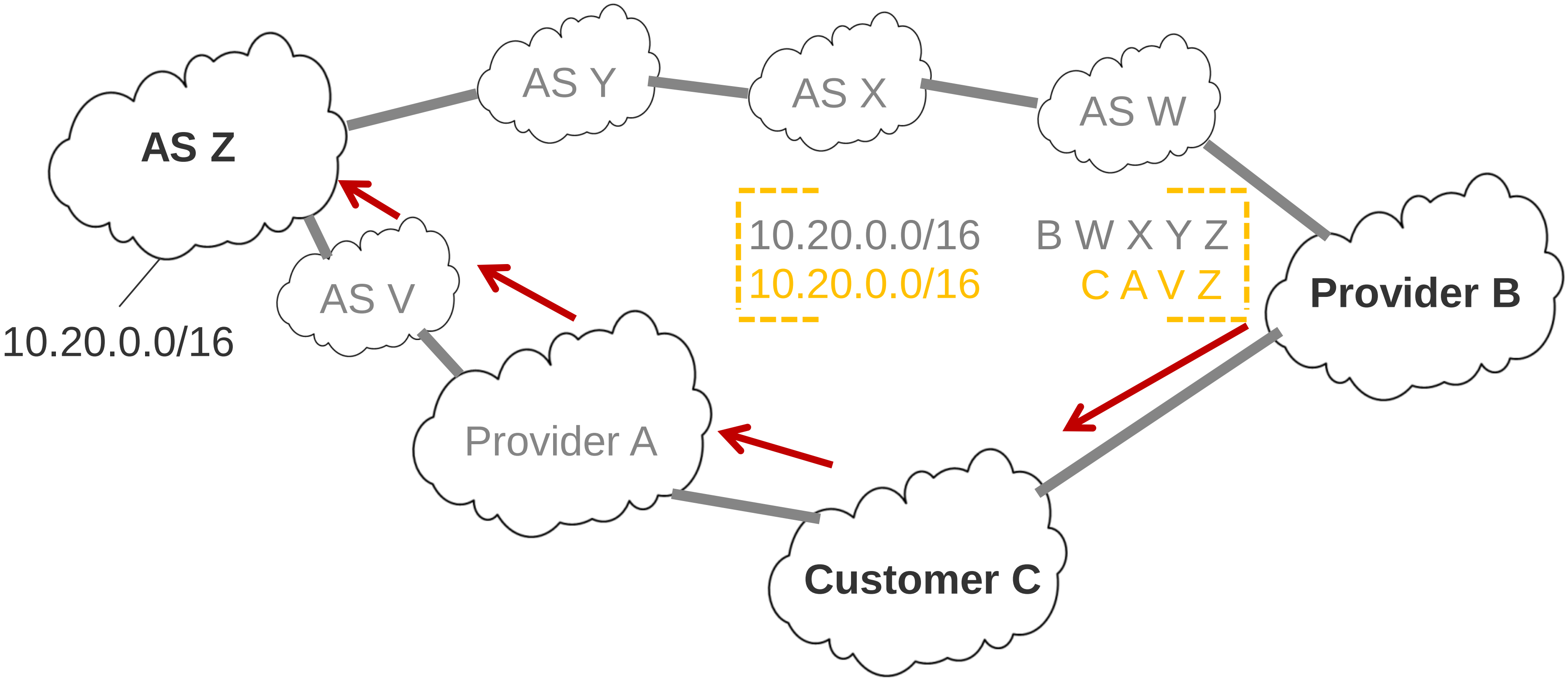
Prefix Origin Hijacking

AS Path Manipulation

Route Leaks

Announce prefixes conflicting with business expectations

Customer announces transit to provider



10.20.0.0/16	B W X Y Z
10.20.0.0/16	C A V Z

Conclusion & What‘s next?

Conclusion

- BGP is based on trust. That is insufficient.
- You need to act now!

Remainder of this Webinar

- How to monitor Internet routing?
- Current and future solutions.