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Secure Extension of BGP by Decoupling Path Propagation and Adoption

draft-zhang-idr-decoupling-01

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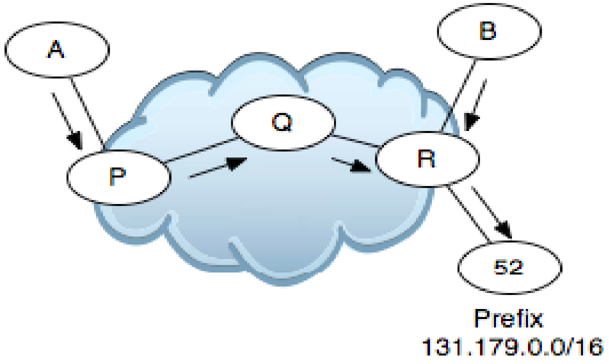
False Routing Announcements

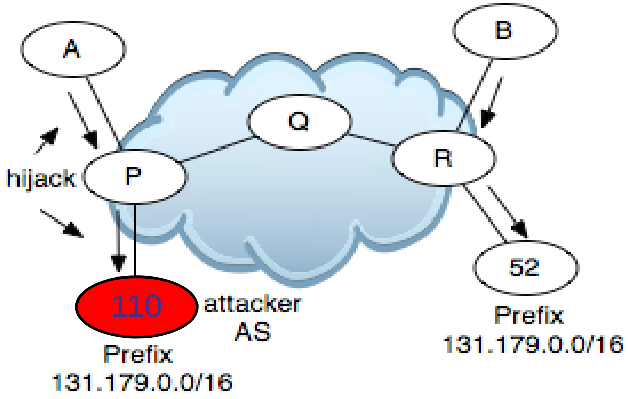
- Interrupt the Internet service

- Source
  - Malicious attack
  - Mis-configuration

- Attacker can do
  - Black holing
  - Interception



a. True origin AS 52 announces prefix 131.179.0.0/16



b. False origin AS 110 announces prefix 131.179.0.0/16 and hijacks A's route

Solutions

- Prevention
  - based on PKI, act before attacks
- Detection
  - monitoring & reaction, act after attacks
- Mitigation
  - filtering on my own, act during attacks

Traditional Mitigation

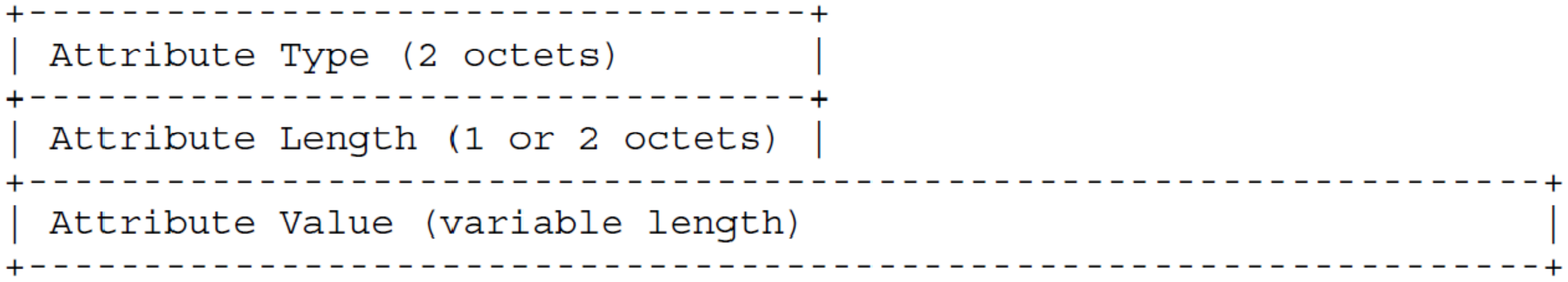
- The idea
  - A historical data base for trusted paths is set up on each AS router.
    - Not trusted ones will be identified as suspicious.
  - Block suspicious (most likely bogus) paths for certain time (e,g, 1day).
    - Attacks will be clean up in this time.

- Benefits
  - Mitigate the impact of attacks
  - Prolong the time for operators to delete the bogus paths

- Disadvantage 1: Due to the inevitable false positive, some legitimate paths will be suspected and blocked hop by hop.
  - The total propagation delay can be very long, which is proportional to the length of AS_PATH.

- Disadvantage 2: Blocks the view of monitors in detection systems.
  - Can not detect and stop the real attack in time.

DBGP-A New Mitigation Scheme



```
+----------------------------------+
| Attribute Type (2 octets)        |
+----------------------------------+
| Attribute Length (1 or 2 octets) |
+-----------------------------------------------------------------+
| Attribute Value (variable length)                               |
+-----------------------------------------------------------------+
```

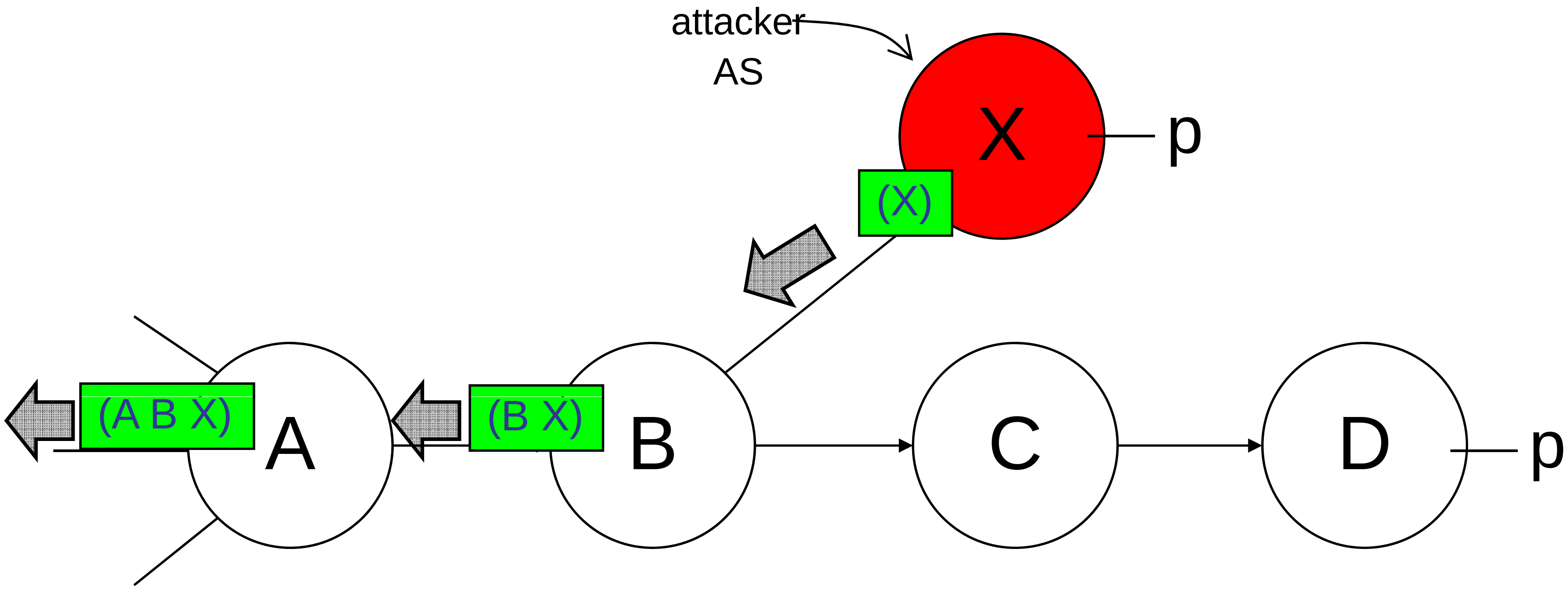
The optional transitive path attribute DAS_PATH

- Decoupling path propagation and path adoption in BGP (DBGP)
  - Don’t use the suspicious paths for data forwarding, but still inform neighbors about them through DAS_PATH which is the newly defined optional transitive path attribute contained in the same update message with AS_PATH.
  - DAS_PATH is used as an *informational* field. It will never be used for real data delivery.

- Legitimate paths can be validated in parallel during false positives.

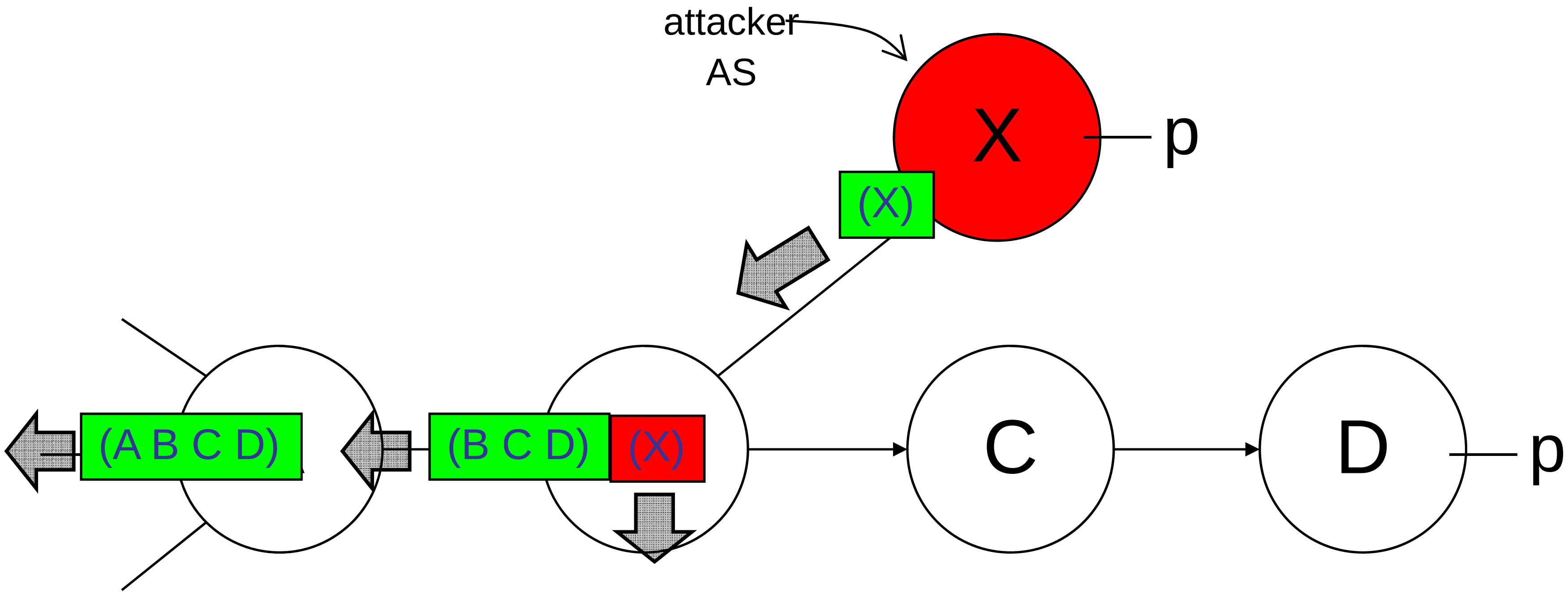
- The monitors obtain the attack information through DAS_PATH, therefore the detection systems still work.

BGP



- In BGP, the bogus path is used directly. The data will be redirected to the attacker AS X.
- ‘A’, ‘B’, ‘C’, ‘D’ and ‘X’ are used to denote the AS numbers while ‘p’ is the prefix.

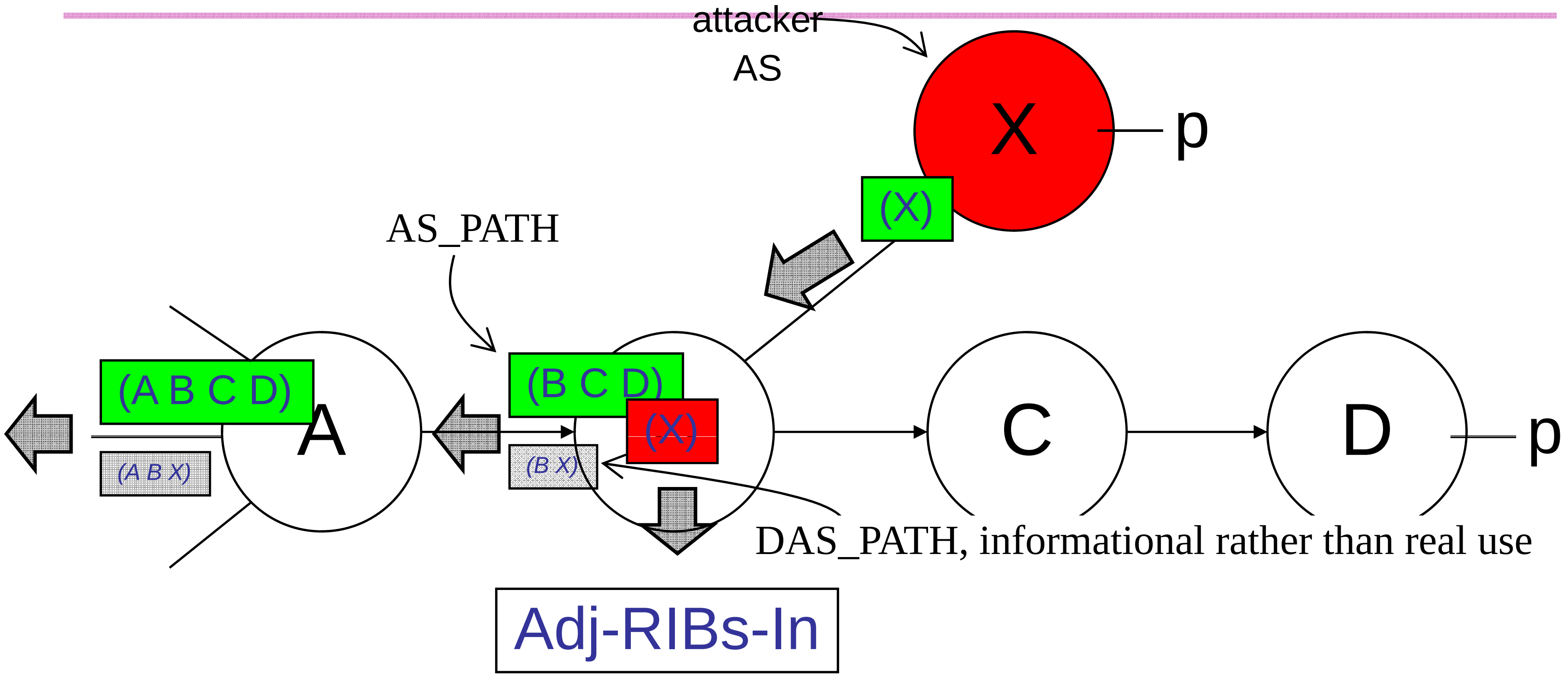
Traditional Mitigation



Adj-RIBs-In

Block the suspicious path for one day.

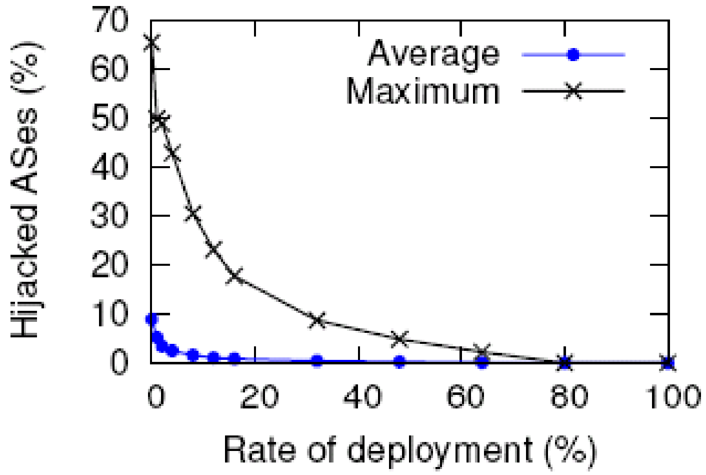
DBGP-The New Mitigation Scheme



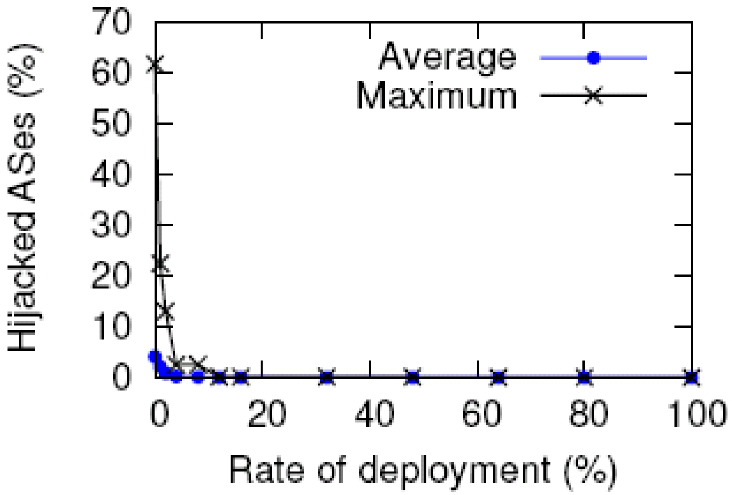
- (B X) is suspected and propagated using the DAS_PATH attribute. A *DAS_PATH will only used as information rather than real data delivery!*

- If (B X) is actually a legitimate path, the propagation in fact enable parallel validation.
  - A can start to validate it. When B propagate it to A as legitimate path one day later, A has already finished the validation in advance and can accept it directly.

Evaluation-
How effective against attacks?



Black holing



Interception

- DBGP is implemented in SSFNet-2.0.
  - Including "no-valley" and "customer-first" routing policy
  - An AS-level topology of 23718 nodes and 94468 links
- The figures also indicate that DBGP can be incrementally deployed across the network.

Conclusion

- DBGP protects data delivery in face of false routing announcements by decoupling path adoption and propagation.
- DBGP complements existing detection systems.
- DBGP reduces the delay of legitimate announcements.