NHDP/OLSRv2 Security

Ulrich Herberg
Thomas Clausen

Reminder draft-herberg-manet-packetbb-sec

- Proposed I-D is a common extension to RFC5444, intended to be applicable where RFC5444 is applicable.
- Simple mechanism for carrying a signature, as address block, message, packet TLV

Reminder draft-herberg-manet-nhdp-sec

- Add signature TLV to messages with value:
  - `<sign-tlv> := <hash-fkt><sign_algo><sign>`
- Signing messages: `sign = sign_algo(hash-fkt(message))`
- Validating messages: `verified = verif(message, <sign-tlv>)`

Updates from packetbb-sec-02 to -03

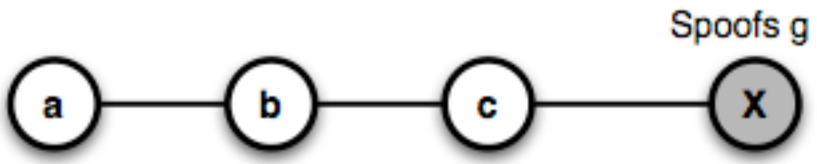
- Editorial changes
- Introduced Address Block TLVs for signatures and timestamp

➔ fine-grained security (i.e. sign “both ends of a link”)

Fine-grained security in NHDP/OLSRv2

- Problem when using signed control messages as in draft-herberg-manet-nhdp-sec and draft-herberg-manet-olsrv2-sec:

  Required trust in links advertised by a router



- Possible solution: sign each address in an address block

Fine-grained security in NHDP/OLSRv2

- Additional security when chain of trust cannot be assumed
- Message size grows significantly (linearly with density)

- Will be included in next revision of nhdp-sec draft

Security Vulnerability Analysis
of NHDP/OLSRv2

(complete analysis in
http://hal.archives-ouvertes.fr/inria-00456376/en/)

Analysis will be integrated into
draft-herberg-manet-nhdp-sec-threats and
draft-herberg-manet-olsrv2-sec-threats

Link State Vulnerability Taxonomy

Proper functioning of OLSRv2 assumes that

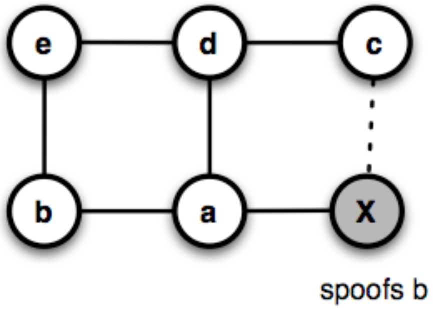
- each router can acquire and maintain an accurate topology map, and
- that the network converges.

OLSRv2 networks can be disturbed by breaking either of these assumptions:

- routers may be prevented from acquiring a topology map, or
- routers may acquire a wrong topology map, or
- routers may acquire inconsistent topology maps.

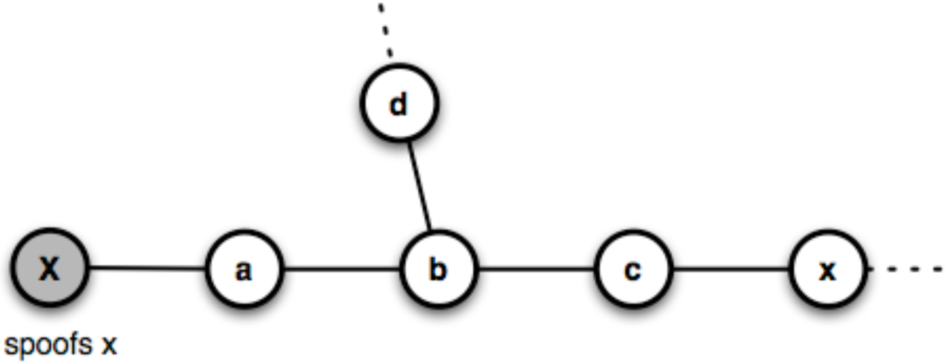
Topology Map Acquisition

- Flooding disruption by identity spoofing



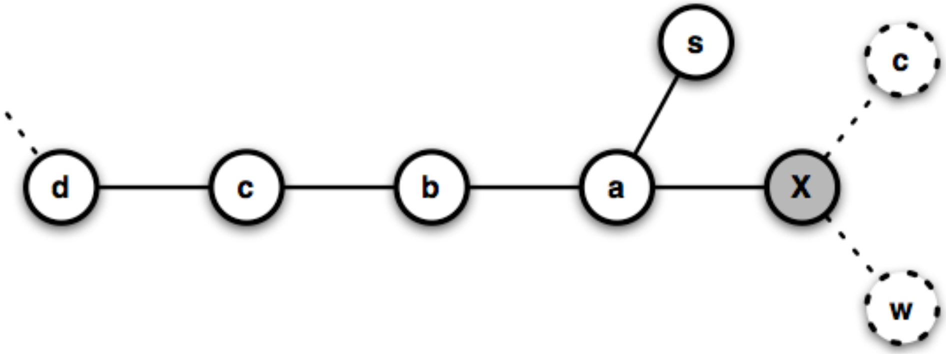
- *a* can select *b* or *d* as MPR
- if it selects *b*, *X* can disrupt flooding by not forwarding traffic (*c* is unreachable by flooded traffic)

- *b* can select *a* or *c* as MPR
- if it selects *a*, *x* (white) is unreachable by flooded traffic



Topology Map Acquisition

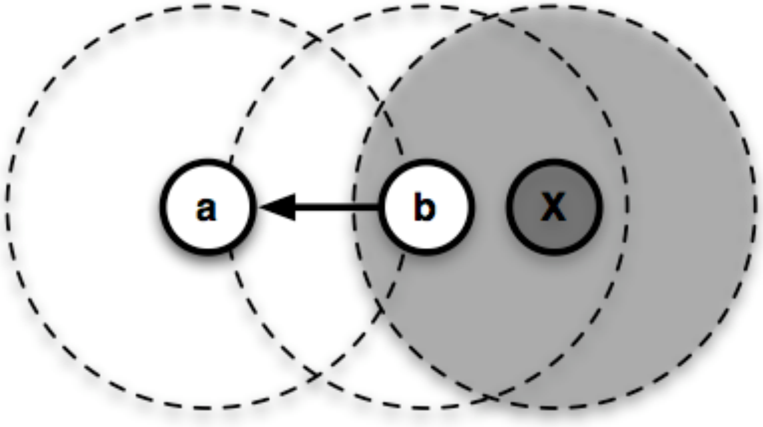
- Flooding disruption by link spoofing



- *X* spoofs links to *c* and *w*
- *a* will select *X* as MPR
- flooding is disrupted
  (routers “left” of *b* are unreachable by flooded traffic)

Topology Map Acquisition

- Radio Jamming

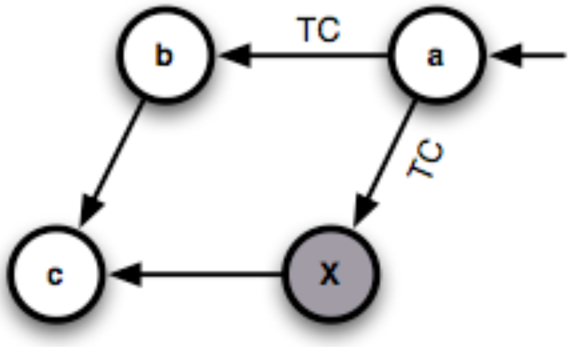


- interfaces on a "jammed" channel are unable to *receive* HELLOs or TCs
- depending on the L2, *transmission* of control traffic may still be possible

➔ some inherent protection of NHDP by ignoring unidirectional links

Topology Map Acquisition

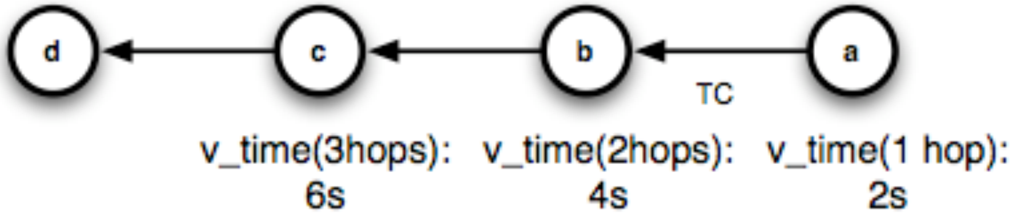
- Hop Limit



- decreasing hop limit reduces scope of TC message

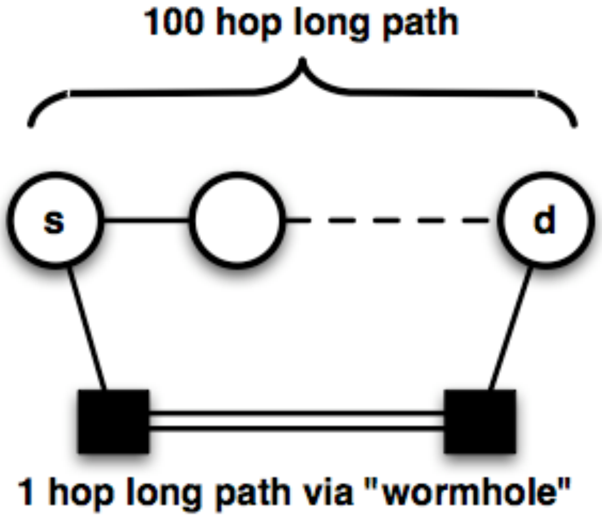
Topology Map Acquisition

- Hop Count
  - When set to 255, TC messages will not be forwarded
  - When value is reduced, validity time may be affected when using distance-dependent validity times (RFC5497)



Effective Topology

- Incorrect forwarding (data traffic)
  - No influence on routing protocol, but discrepancy between effective and perceived topology
- Wormholes
  - Traffic is recorded and tunneled through an “out-of-band” channel
  - Harmfulness depends on characteristics of the wormhole, and how paths are calculated

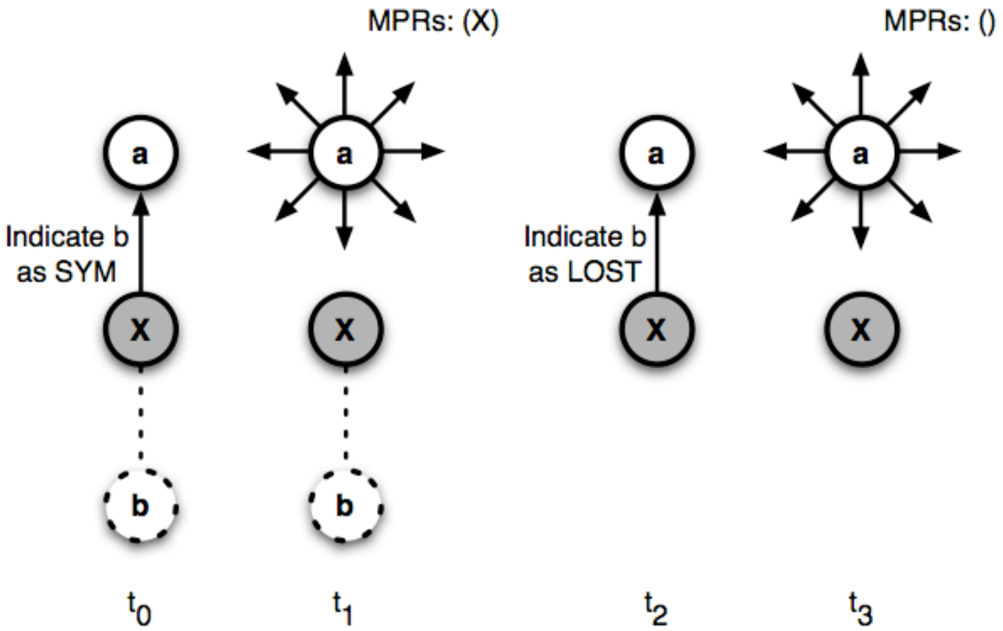


Effective Topology

- Sequence number attack
  - Denial-of-service attack using message sequence numbers or ANSN
- Message timing attacks
  - Decreasing validity time
  - Decreasing interval time when using link quality

Effective Topology

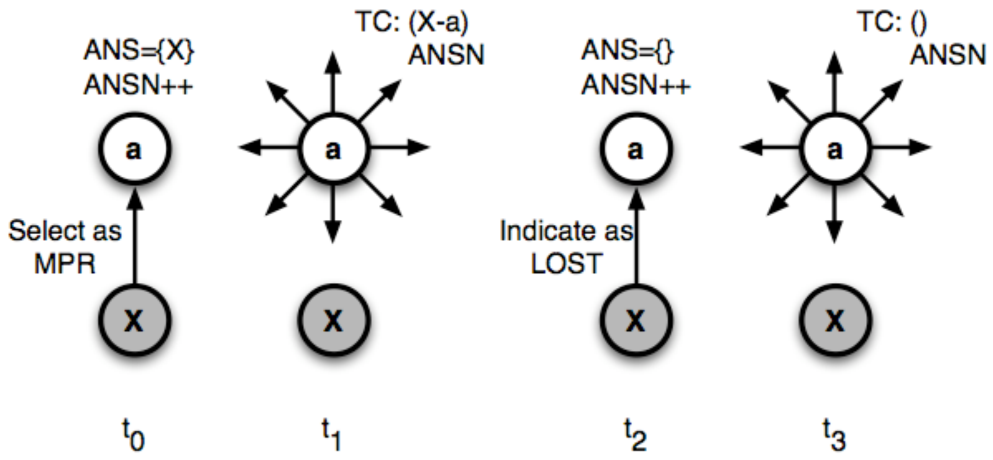
- Indirect jamming (neighborhood discovery)



- Switching between SYM and LOST status of an advertised link
- Leads to in-router resource exhaustion (MPR recalculation)
- Possibly triggers HELLOs/TCs

Effective Topology

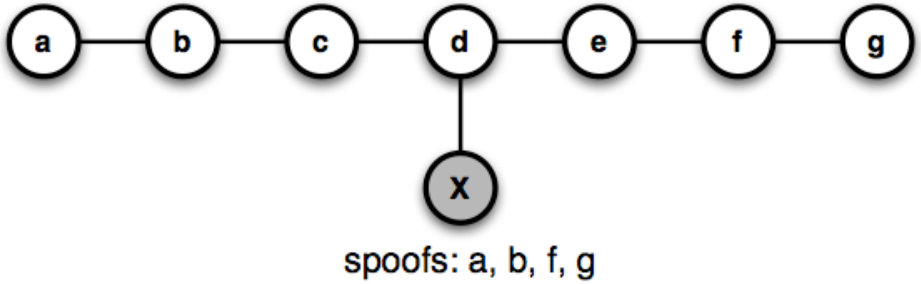
- Indirect jamming (link state advertisement)



- Switching between MPR and LOST status
- Leads to in-router resource exhaustion (routing set recalculation of other routers)
- Possibly triggers TCs

Inconsistent Topology

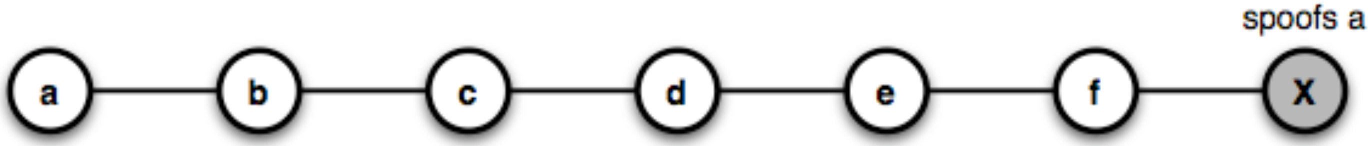
- Inconsistent Topology Maps due to Neighborhood Discovery



  - *X* does not participate in link state advertisement procedure
  - Traffic transiting *d* will be forwarded to *X* rather than to the intended destination
  - Traffic transiting *c* with *b* as destination, will be delivered to the intended *b*
  - Traffic transiting *c* with *a* as destination may be delivered to the intended *a* via *b* or to the malicious router via *d*

Inconsistent Topology

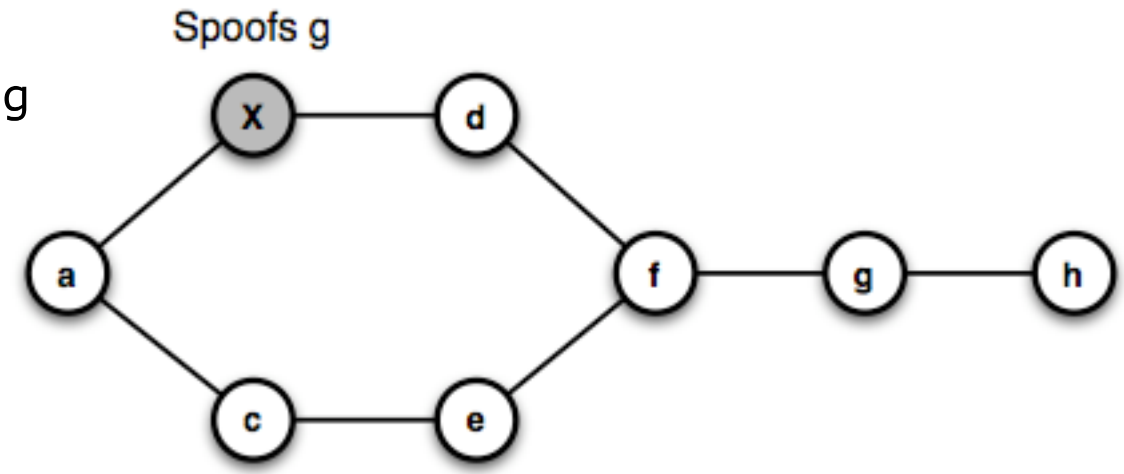
- Inconsistent Topology Maps due to link state advertisement



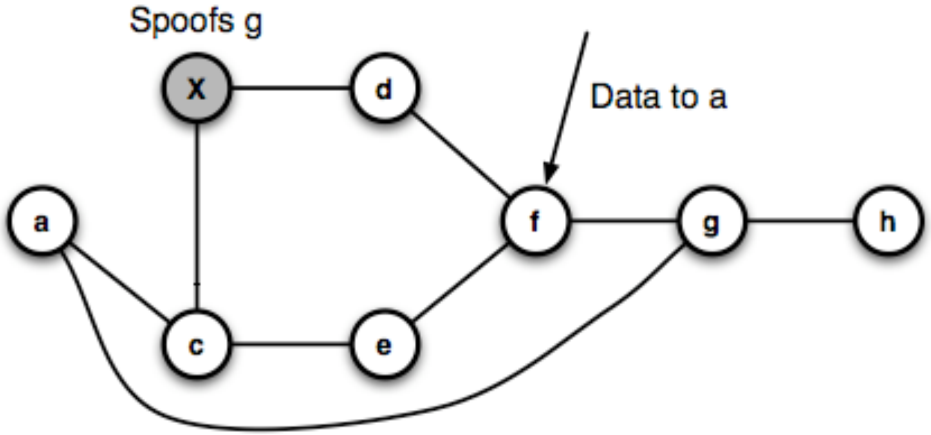
  - *f* selects *X* as MPR
  - *b* and *c* will route traffic towards a to the intended destination
  - *e* and *f* route traffic towards *a* to *X*

Inconsistent Topology

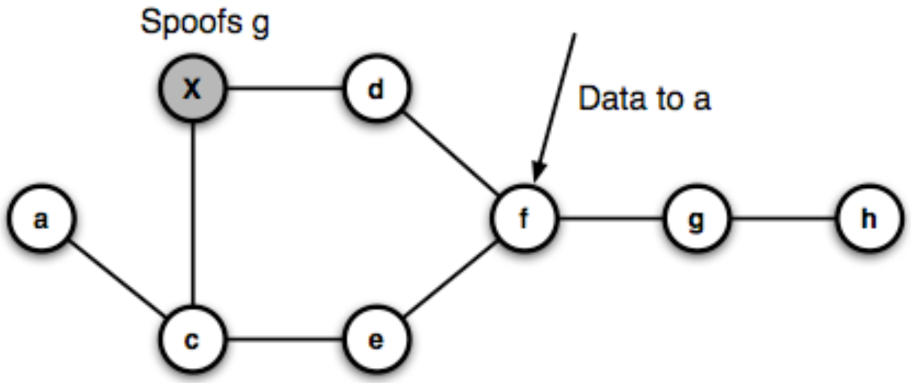
- Routing Loops
  - *g* ignores TCs originating from itself



- Perceived Topology in *f*



- Perceived Topology in *g*



References

- U. Herberg, T. Clausen, “MANET Cryptographical Signature TLV Definition”, draft-herberg-manet-packetbb-sec-03
- U. Herberg, T. Clausen, “Cryptographical Signatures in NHDP”, draft-herberg-manet-nhdp-sec-00
- U. Herberg, T. Clausen, “Security Threats for NHDP”, draft-herberg-manet-nhdp-sec-threats-00