

SwitchWare

Active Network Encapsulation Protocol (ANEP)

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*NB: Not an RFC author! (I was in Cambridge...)

The Problem(s)

- SwitchWare, ANTS, NetScript, etc.
- Variety of Independent and Important Research Goals
- But, no “ABONE” until they interoperate
- So....let’ s make it happen!
- Alexander, Braden, Gunter, Jackson, Keromytis, Minden and Wetherall

Solution: Encapsulation

- Encapsulating Active Network Frames
 - » Over Link Layers, IPv6 and IP
- Why header?
 - » Find environment for eval.
 - » Default processing for missing environ.
 - » Non-program information
 - e.g., security headers

What's it look like?

□ Format of ANEP Header:



Details: Fields

- *Version*: now 1; change w/ANEP header; discard if unknown value
- *Flags*: for V1, only MSB used
 - » MSB=0, try to forward w/default
 - » MSB=1, discard if TypeID not recognized
- *ANEP Header Length*: in 32 bit words
 - » includes options; 2 if no options

Details: More fields...

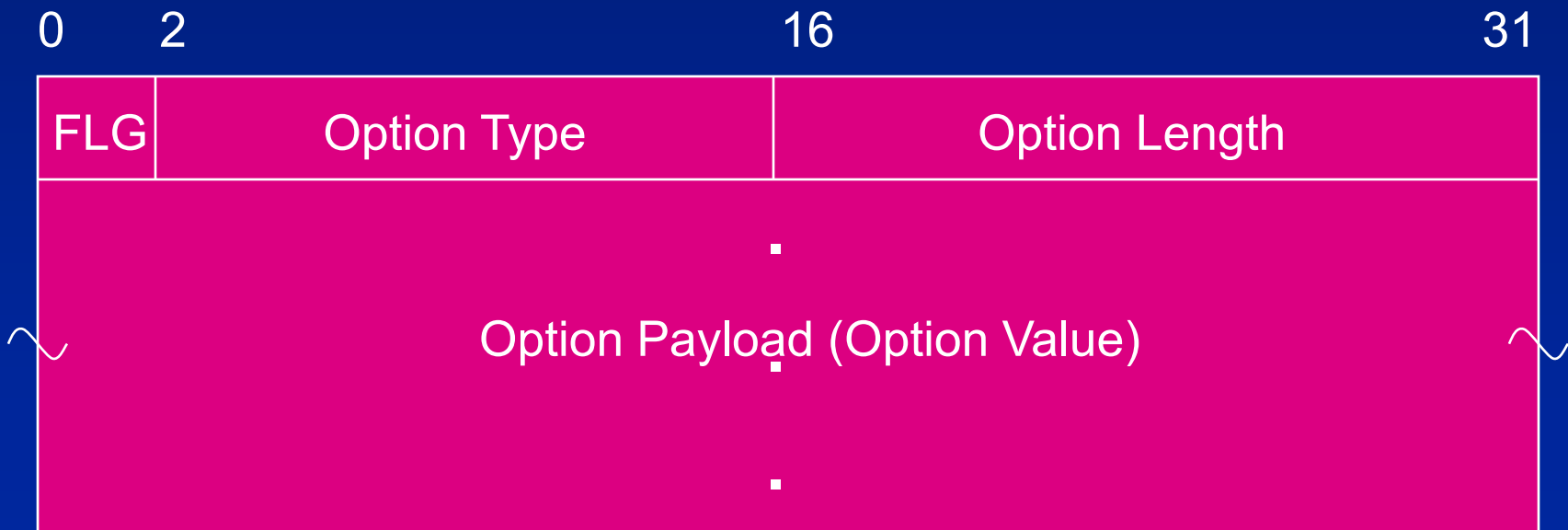
- *TypeID*: evaluation environment for message; 16 bits; values by ANANA
 - » ANANA is currently Bob Braden
 - » Unrecognized value? Check *Flags* MSB
- *ANEP Packet Length*: Length of entire packet in *octets* (including payloads)
- *Options* length (variable) computed from Packet and Header length difference

Terminology, FYI:

- *Packet*: ANEP Header + Payload
- *Active Node*: Network Element that can evaluate active packets
- *TLV*: Type/Length/Value triple
- *Basic Header*: First two words (8 octets) of the ANEP Header

Options

- Zero or more Type/Length/Value (TLV) constructs
- Follow the basic header. Format:



Option Fields

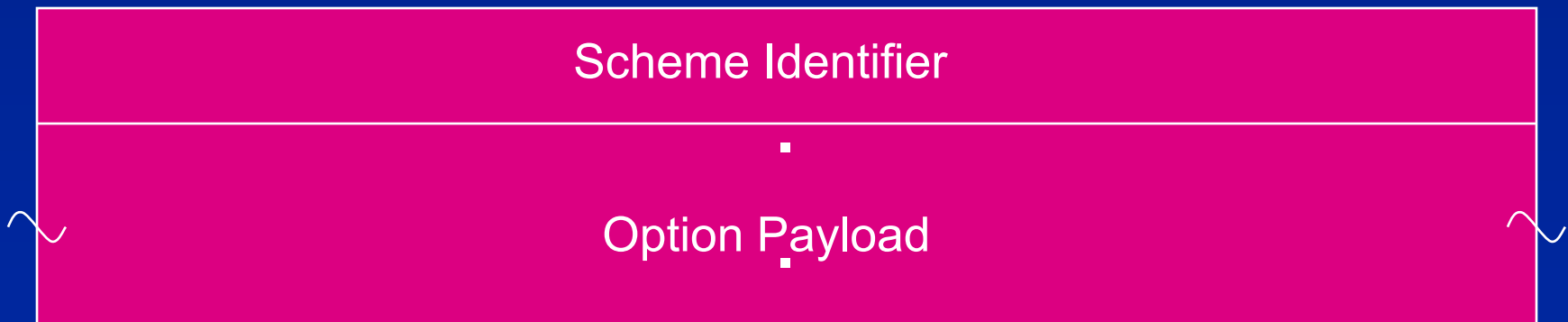
- *Option Type*: 14 bits, used to interpret *Option Payload*.
- Values assigned by ANANA; private when MSB of *FLG* is set.
- Unrecognized value? LSB of *FLG* 0, continue; 1 discard packet. Should log.
- *Option Length*: 16 bits; TLV length in 32 bit words; ≥ 1 .

Option Type Values

□ Reserved:

- 1 - Source ID
- 2 - Destination ID
- 3 - Integrity Checksum
- 4 - Non-Negotiated Authentication

□ Format for Source, Destination, N-N:



Source Identifier

- Uniquely identifies sender
- *Scheme Identifier* is 32 bits; identifies addressing scheme to interpret the variable size *Option Payload*
- Reserved:
 - 1 - IPv4 Address (32 bits)
 - 2 - IPv6 Address (128 bits)
 - 3 - 802.3 Address (48 bits) (last two octets 0)

Destination Identifier

- Uniquely identifies destination in the active network
- Same payload option format as Source Identifier

Integrity Checksum

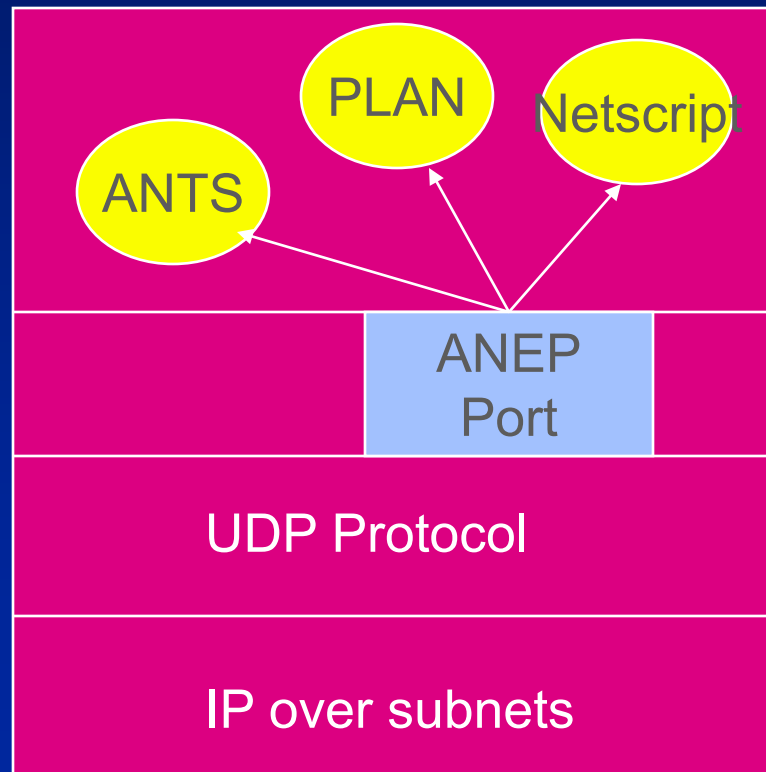
- Detect some packet integrity losses
- 16 bit 1's-complement of 1's-complement sum of the ANEP packet from the ANEP Version field
- Payload zero for computing checksum
- Option length field is 2.

Non-Negotiated Authentication

- Provides 1-way authentication
- No prior negotiation assumed
- Option payload: 32 bit authentication scheme, followed by scheme's data.
- Option length field >2.
- Reserved:
 - 1 SPKI self-signed certificate
 - 2 X.509 self-signed certificate

Example: PLANet ANEP

- Well-known UDP/IP Port for ANEP



Summary

- ANEP is not the end, a way to get going
- SwitchWare, ANTS, Netscript operate ANEP
- Interoperability using existing infrastructure