Diameter Flow Accounting Application

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Outline

- Introduction and Motivation
- NetFlow Accounting
  - Export packet format
  - Flow records and templates
- Diameter Accounting
  - Accounting packet format
  - AVPs
  - AVP Overhead
- Diameter extension
  - Diameter-NetFlow translation agent
  - Flow record and template record AVPs
- Summary and Conclusions
Introduction

- Accounting
  - Accounting is the process of collecting information on service and resource usage
  - Purpose of accounting
    ⇒ Charging, network mgmt, traffic mgmt, traffic analysis, auditing

- Accounting systems
  - NetFlow V9
    ⇒ simple, light-weight protocol for exporting flow records
    ⇒ efficient data transfer based on templates
  - Diameter
    ⇒ complex AAA protocol
    ⇒ for transferring aggregated accounting records

Integrate efficient data transfer in Diameter
NetFlow Accounting

Transfer flow records from the **Exporter** to the **Collector**

- **Flow record**
  - Observed attributes of an IP flow
  - An IP flow can be specified flexible based on header fields

- **Efficient record transfer**
  - Several flow records can be transferred in one packet
  - Compact data transfer based on templates
# NetFlow Export Packet

<table>
<thead>
<tr>
<th>NetFlow Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>FlowSet 1</td>
</tr>
<tr>
<td>FlowSet 2</td>
</tr>
<tr>
<td>...</td>
</tr>
<tr>
<td>FlowSet n</td>
</tr>
</tbody>
</table>

- **Transport protocol**
  - Usually UDP
  - V9 also over SCTP

- **FlowSet types**
  - Template FlowSet
  - Data FlowSet
  - Options Template FlowSet
### NetFlow Template FlowSet

To define the template for flow records
- Specifies the type and length of attributes included in the flow record
- Enables a flexible flow record composition

<table>
<thead>
<tr>
<th>FlowSet ID</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Template ID</th>
<th>Field Count</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Type 1</th>
<th>Field Length 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field Type n</th>
<th>Field Length n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Template ID</td>
<td>Field Count</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
NetFlow Data FlowSet

<table>
<thead>
<tr>
<th>FlowSet ID = Template ID</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record 1 – Field Value 1</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>Record 1 – Field Value n</td>
<td></td>
</tr>
<tr>
<td>Record 2 – Field Value 1</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>

- To transfer flow records
  - Contains attribute values for the attributes specified in the template
  - Interpretation is only possible together with the template
Diameter Accounting

- To transfer accounting records from the client to the server
- Diameter Accounting Extensions
  - Accounting for network access
  - Pre-paid support
- Accounting Record types:
  - Event record
  - Start, Interim, Stop record
- AVP-based accounting records
  - Flexible accounting record composition
  - Designed for aggregated records
Diameter Accounting

- Messages for accounting:
  - Accounting-Request
  - Accounting-Response

- Accounting specific attribute examples
  - Acct-Session-Time
  - Acct-Input-Octets, Acct-Output-Octets
  - Acct-Input-Packets, Acct-Output-Packets
  - Acct-Session-ID
  - Acct-Terminate-Cause
Diameter Accounting Packet

<table>
<thead>
<tr>
<th>Diameter Header</th>
</tr>
</thead>
<tbody>
<tr>
<td>AVP 1</td>
</tr>
<tr>
<td>AVP 2</td>
</tr>
<tr>
<td>...</td>
</tr>
<tr>
<td>AVP n</td>
</tr>
</tbody>
</table>

- Transport protocol
  - TCP or SCTP

- Accounting record
  - Contains several AVPs
  - One accounting record per Diameter packet
### Diameter AVP Format

<table>
<thead>
<tr>
<th>AVP Code</th>
<th>Flags</th>
<th>AVP Length</th>
<th>Vendor-ID (opt)</th>
<th>Data ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 bit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Attribute-Value-Pairs (AVP)**
  - AVP flags supporting mandatory, optional, vendor-specific attributes
  - Data types, e.g., integer, string, grouped AVP
  - Standardized set of AVPs is defined, but it is flexible for further extensions.
Diameter AVP Overhead

- AVP overhead
  - 8 bytes
  - 12 bytes with Vendor-ID

- Typical data length
  - IPv4 address: 4 bytes
  - IPv6 address: 16 bytes
  - Port number: 2 bytes (Unsigned32)
  - Number of octets: 8 bytes
  - Number of packets: 8 bytes
  - Session time: 4 bytes

- Typical overhead
  - 50-400 %

- In flow records a lot of 1-4 byte long fields
Diameter Extension

- New AVPs introduced
  - Template record AVP
  - Flow record AVP
- Diameter-NetFlow translation agent
  - Additional AVPs for the header fields of NetFlow
    ⇒ System uptime, time of packet creation, sequence number, source ID
Template Record AVP

- AVP Value contains
  - The template ID
  - Number of attributes in the flow record (Field Count)
  - The type and length of attributes

- Design decisions
  - Include Field Count or include separate AVPs for each template in a packet
  - 16 vs. 32 bit type field
# Flow Record AVP

<table>
<thead>
<tr>
<th>Awards Code</th>
<th>32 bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flags</td>
<td>AVP Length</td>
</tr>
<tr>
<td>Template ID</td>
<td></td>
</tr>
<tr>
<td>Record 1 – Field Value 1</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
<tr>
<td>Record 1 – Field Value n</td>
<td></td>
</tr>
<tr>
<td>Record 2 – Field Value 1</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>

- **AVP Value contains**
  - The template ID
  - The values of the flow record fields

- **Design decision**
  - Include several flowsets in an AVP, then length field is needed
Summary and Conclusions

- Diameter flow accounting extension
  - New AVPs for template and flow records
  - Translation agent

- Pros
  - Efficient transfer of large amount and frequent accounting data
    ⇒ like in case of flow accounting
  - Integrated accounting approach based on Diameter
  - Reliable data transfer, fail-over, better error handling
  - Inter-domain scenarios, Diameter agent support
  - Security support based on IPSec

- Cons
  - Diameter is more complex than NetFlow
  - Routers have to support Diameter natively
  - The AVP principle is “somehow” lost
Thank you for your attention!