I2NSF Framework

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Problems

• Unlike traditional networking device, network-based security functions (NSFs) do not operate relative to standards
  – Many evaluative bodies exist, which review the efficacy of network security product
  – Many regulatory/compliance directives call for the use of loosely defined classes of network security
• How do we define interfaces to devices that have no standardized implementations?
Potential For Imposed Constraints

• Narrowly defined NSF categories, or their roles when implemented within a network
• Attempts to impose functional requirements or constraints, either directly or indirectly, upon NSF developers
• Result in a limited lowest-common denominator approach, where interfaces can only support a limited set standardized functions, without allowing for vendor-specific functions
• Results in endorsing a best-common-practice for the implementation of NSFs
Packet-Based Paradigm for FlowBased NSF

• Rather than attempting to create a standard based on NSF classes, a solution may exist in provisioning packet processing

• All NSFs, regardless of function, process:
  - Packet headers
  - Packet payloads
  - Contextual and state information associated with packets
Three Sub-Interface Types

• Configuration
  - Device configuration
  - Network configuration

• Signaling
  - Status
  - Counters
  - Queries
  - Alerts

• Provisioning
  - Capabilities
  - Policy
  - Object Configuration
Suggested Framework - Provisioning

• Four root tree structure:
  - Subject – match values based on packet data
    • Packet header - Can be standardized
    • Packet payload - Provided by NSF capabilities
  - Object – match values based on context
    • Ex.: State, time, geo-location, etc.
    • Many can (and should) be standardized, but many also from NSF capabilities
  - Function – invoked security function
    • Defined by NSF capabilities
      • Function:Instance (ex. IPS:<signature base>)
  - Action – egress processing
    • Invoke signaling
    • Packet forwarding and/or transformation
    • Possibility for SDN/NFV integration
I2NSF Architecture

Security Service Layer
- For clients or App Gateway to express and monitor security policies for their specific flows.

Capability Layer
- For Controller to specify and monitor the limited number of attributes (or Service Profiles) that are allowed by the respective vendors to the NSFs.

NSF Registration
- For NSF vendors to register their available security functions and set of policies (or Service Profiles) that can be dynamically set by 3rd parties.

Vendor Management System
Interface to vNSFs

Characteristics:
- Single NSF can have multiple instantiations that are distributed across the network.
- Different rules/policies could be imposed to different instantiations.
- Each NSF may have its own sub-controller for all its instantiations.
- Policies to one instantiation can be moved/copied to another NSF instantiation.
- Multiple vNSFs (of different types or same type can share one physical server.
- Multiple vNSFs collectively together to enforce the rules for large flows.
NSF Provisioning Components Breakdown

- Subject
  - Perform the referenced profiles
  - Egress processing
    - Invoke signaling
    - Packet forwarding and/or transformation
    - Possibility for SDN/NFV integration
  - Vendor Unique Innovation; vendor specific
    - e.g. IPS:<Profile>
      - Profile: signature, Anti-virus, URL filtering, etc.
      - Integrated and one-pass checks on the content of packets

- Object
  - Match values based on packet data
    - Packet header - Can be standardized
    - Packet payload - Provided by NSF capabilities

- Action
  - Match values based on context
    - Ex.: State, time, geo-location, etc.
    - Many can (and should) be standardized, but many also from NSF capabilities
Data Over the Registration Interface
## Flow Based NSF Capability

### Index

<table>
<thead>
<tr>
<th>Subject (header fields, payload, ..)</th>
<th>Object Context, external to bits/bytes in packets</th>
<th>Functions</th>
<th>Actions</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer 2 Header (Src/Dst, Vid, VxLAN, TRILL, EtherTypes)</td>
<td>Access domain, Zone (corresponding header bits in the packets)</td>
<td>WebFilter, App Control Authentication Encryption, IPS/IDS/AV URL filter</td>
<td>Pass/drop/mirror/Statistics (report Destination)</td>
<td>Name-value pairs that describe Service capability, or the URL of a Heat template that describes the SF.</td>
</tr>
<tr>
<td>Layer 3 (Src/Dst, MPLS, GRE, IPv4/IPv6, ..)</td>
<td>Time: Start/end/duration</td>
<td>...</td>
<td></td>
<td>Service layer attributes</td>
</tr>
<tr>
<td>TCP (Port, flags, SYN, FIN, ..)</td>
<td>Tenant ID (corresponding header bits in the packets)</td>
<td></td>
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<tr>
<td>UDP layer (port, HTTP Layer)</td>
<td>Application ID (corresponding header bits in the packets)</td>
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<td></td>
<td>IETF PCP?</td>
<td>Open/Close</td>
<td></td>
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<td>IETF TRAM</td>
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</tbody>
</table>
## Security Function Catalog DB

SF Catalog DB is built by Network SF Manager or orchestration system based on the SF Registration Process.

<table>
<thead>
<tr>
<th>Vendors</th>
<th>Function name</th>
<th>Type</th>
<th>instances</th>
<th>Flow based Security Policies Objects supported (Potentially IANA registered in the future)</th>
<th>Flow based Security Policies Action supported</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>FW</td>
<td>Layer 2/3/4; IETF PCP</td>
<td>Pass/drop</td>
<td></td>
<td></td>
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<tr>
<td>IPS</td>
<td></td>
<td>Time span</td>
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<td>IDS</td>
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<td>Webfilter</td>
<td></td>
<td>HTTP, App ID</td>
<td>Call VideoOptimization</td>
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<td>Y</td>
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