KING IP Aggregation Switching – Ethernet based Access Networks

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Outline

- Introduction
- Requesting & Enabling QoS Services
- Resilient network structures
- Ethernet resilience schemes
  - Rapid Spanning Tree
  - Ethernet Automatic Protection Switching
- Comparison
- DIESEL
- Summary
Ethernet based Access/IP Aggregation Switching

- Applications
  - xDSL, EFM, cable networks, WLAN hotspots, modem banks, WLL
- Ring or tree topologies quite common
- Few gateway routers (DHCP), many hosts (hier. IP addresses)
Requesting QoS Services

1. User requests service
2. Service Provider requests QoS
3. Request exchange
4. Config Network

Service Provider oriented model

Application oriented model

1. User requests service
2. Service Provider requests QoS
3. End-to-End Negotiation
4. Config Network

[MUSE Public Documentation]
QoS Pipes in Ethernet

- Application or Service Provider based model

- Basic principle: VLAN based QoS pipes

- Similar to MPLS TE, not dynamic but Management Configuration Traffic Matrix required

- Options: KING – NCS Implementation McCircuits (Ericsson)
Resilient Network Structures

Star

Micro Ring

Ring

Trapezoid

Core Network

Core Network

Core Network

Core Network

#1

#2

#3

#4
Comparison of Resilient Network Structures

- Ring structure needs lowest number of links
- Star needs lowest total network capacity
- Trade-off needed between link number and capacity
- No structure is optimal for all cases
Ethernet Resilience Schemes

- Spanning trees
  - IEEE 802.1d – Spanning Tree Protocol
  - IEEE 802.1w – Rapid Spanning Tree Protocol
  - IEEE 802.1s – Multiple Instances Spanning Tree

- Ring based approaches
  - Ethernet Automatic Protection Switching
  - Ring Spanning Tree (RRST)

- Routing Interworking
  - Virtual Router Redundancy Protocol
  - Proprietary approaches
    - ESRP, GLBP, HSRP, etc
Spanning Tree Protocol

- Recovery time depends on loop prevention algorithm
- Network wide negotiation

- Spanning Tree Protocol
  - 30-45 seconds
  - Optimization: 8-12 seconds

- Rapid Spanning Tree Protocol
  - 0.4 – 0.6 seconds
Ethernet Automatic Protection Switching

- Loop prevention by port blocking
- Local reaction + network wide negotiation
- Recovery duration
  - 0.1 - 0.2 seconds
Resilience Interworking Access - Core

- Simple switched redundancy fails because of MAC address issue
- Virtual Router (VR) to avoid the packet dropping
- Virtual Router Redundancy Protocol
  - link down 0.4 seconds, link up 0.1 seconds
## Comparison of Technologies

<table>
<thead>
<tr>
<th>Technology</th>
<th>STP</th>
<th>RSTP</th>
<th>EAPS</th>
<th>VRRP</th>
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</thead>
<tbody>
<tr>
<td>Network topology</td>
<td>Cascade, Ring</td>
<td>Cascade, Ring</td>
<td>Ring</td>
<td>Edge</td>
</tr>
<tr>
<td>Recovery duration time [seconds]</td>
<td>30-45 8-12</td>
<td>&lt; 0.6</td>
<td>&lt; 0.2</td>
<td>&lt; 0.4 (3)</td>
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<tr>
<td>Configuration effort</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
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<tr>
<td>Utilisation</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
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<tr>
<td>Performance</td>
<td>Poor</td>
<td>Medium</td>
<td>High</td>
<td>Medium</td>
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<tr>
<td>Signalling overhead</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
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<tr>
<td>Issues</td>
<td>Recovery duration</td>
<td>Flooding Topology change Influence of network size</td>
<td>Flooding</td>
<td></td>
</tr>
</tbody>
</table>
Diesel Example & Comparison

Edge Port 0 1 3 4 3 2 1 0

Alternate Link

Link failure
Recognized by PHY/MAC
Deletion of FDB-Entries
Service recovered
Optional: Feedback by Initiator

Link failure
Recognized by PHY/MAC
Deletion of FDB-Entries
Missing Control Packets
Service recovered

10 ms
10 ms
3 x Hello Delay
10 ms + 3 * 100 ms
Diesel Properties & Advantages

- MAC-Source-Addresses known in all Switches (directly or by Initiator) – Network-wide exchange of Forwarding - Information
- Not only 1:1 Relation between Port- and MAC-Address
  - Per MAC-Address and Switch N Addresses + Priorities
- Local failure reaction
  - No Protocol interaction required (optimal with alternative link)
  - Without alternative link → Initiator required
- Failure reaction is finished, when other methods start (optimal)
- All other Ethernet properties and functions remain unaltered
  - Multicast / Broadcast / VLAN / Priorities
Summary

- Ethernet based IP Aggregation Switching
  - High performance forwarding
  - Ease of implementation and configuration
  - Scalable, cost-effective
  - Multi-vendor interoperability

- Resilience
  - The total interchange gap in an switched network depends on the loop prevention mechanism
  - Cascaded or ring topologies
  - Failure recovery in 0.2 - 0.6 seconds
  - New method: DIESEL – aimed failure recovery in sub 50ms

- Resource Reservation
  - Management based VLAN configuration
  - Central monitoring and calculation
  - Incorporation of redundancy
Vielen Dank für die Aufmerksamkeit! Fragen?