SFR: Scalable Forwarding with RINA for Distributed Clouds

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Outline

• Intro & Motivation
• VIFIB Distributed Clouds
• RINA: Recursive InterNetwork Architecture
• SFR: Scalable Forwarding with RINA
• Simulation Results
• Conclusion
Intro & Motivation

• **Cloud Computing**
  – Fast Emergence
    • Research, industries and standardizations
  – Enables ubiquitous and on-demand access to shared resources
  – Large scale applications become feasible
    • Big data, HPC..
  – Single central point

🌟 **Scalability & Availability** issues

➡️ **Distributed Clouds**
  – Decentralized management
  – Resources distributed in several geo area
  – “Volunteer” clouds
    • An example: VIFIB
VIFIB Distributed Clouds

• **VIFIB**: Resilient Computing
  – No data center architecture:
    • Micro servers located in homes, offices..
    • Distributed resources ➔ More Availability: 99.99%!
  – Master/Slave architecture
  – Resiliency
    • Data is encrypted and replicated in different locations
    • Overlay Network of Open VPN tunnels (re6st)

Source: http://www.vifib.com/
Re6st: Resilient Overlay Networking System

- **Re6st**
  - Mesh network of Open VPN
    - Flat and random graph
  - Babel Protocol used to calculate best routes
  - Fast recovery!

- **Issues with Re6st**
  - **Security** issues
    - Bad routes flooding
  - **Scalability** issues
    - Flat topology does not scale
    - Tunnels might consume extensive resources

Source: http://www.vifib.com/
RINA: Recursive InterNetwork Architecture

- **Inter-Process Communication (IPC) model**
- Unlike TCP/IP, one **single** layer
  - that could be repeated **recursively**
- Clean separation between mechanism and policy
- **Divide and Conquer**
  - **Scalability**
• The distributed clouds is divided into groups
• *Group leaders* are created to interconnect nodes from different groups and to form the inter groups
• To support scalability, multiple levels could be created
SFR: DIF Architecture
Performance Evaluation Scenario

- **RINASim** Simulator: Omnet++ based
- Medium scale distributed clouds scenario
- Performance indicator:
  - Forwarding table size

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of VIFIB nodes</td>
<td>120</td>
</tr>
<tr>
<td>Number of regions</td>
<td>4</td>
</tr>
<tr>
<td>Number of VIFIB nodes per region</td>
<td>30</td>
</tr>
<tr>
<td>Application</td>
<td>Ping</td>
</tr>
<tr>
<td>Packet Size</td>
<td>1500 Bytes</td>
</tr>
<tr>
<td>Ping Starts at</td>
<td>140s</td>
</tr>
<tr>
<td>Ping rate</td>
<td>5</td>
</tr>
<tr>
<td>Simulation Time</td>
<td>300s for each run</td>
</tr>
</tbody>
</table>
Simulation Results (1/2)

Variation of PDU forwarding table size / simulation time
Comparison between SFR and simple distance vector routing protocol
Simulation Results (2/2)

Variation of the PDU forwarding table size with regards the simulation time. Dynamic Tenant Cloud DIF management.
Conclusion

• SFR: new and generic routing architecture for distributed clouds
  – Hierarchical DIF architecture
• SFR achieves better results compared to current distributed clouds networking solutions
  – The forwarding table size is drastically decreased
• In future works, we plan
  – Further evaluate the assets of applying RINA to distributed clouds
    • Consider more evaluation metrics: latency, throughput..
  – Deploy SFR within VIFIB infrastructure to compare it to re6st
Thank you for your attention!

Questions?