A Network Monitoring Tool for CCN

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Contents

• Introduction
• Monitoring Methods
• Results
• Conclusion
Motivation

• Goal
  – To develop a Content Centric Networking (CCN) traffic monitoring tool

• Scope
  – Data collection with SNMP, IPFIX and HTTP
  – Visualization of traffic characterization and concentration in CCN
  – Implementation in Web UI
Background

- CCN
  - Communication driven by the consumers of data
  - Two types of packets
    - Interest
    - Content Object
  - State tables in CCN node CS, PIT, and FIB
    - CS (Content Store): the buffer memory for the content
    - PIT (Pending Interest Table) for tracking Interest packet that have not been satisfied
    - FIB (Forwarding Information Base) to forward Interest packet toward source of matching data

Background

- CCNx (http://www.ccnx.org)
  - Implementation of CCN
    - Linux, Android
    - C, JAVA
  - An overlay prototype of CCN over IP
Background

- **IPFIX**
  - IPFIX is IETF standard based on Cisco’s NetFlow version 9

- **SNMP**
  - Network management protocol for monitoring on IP network
  - SNMP agents will collect information on devices
  - Information element defined in MIB

- **IPFIX template set**

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CCN Monitoring Tool

CCN Mobile Node

CCN Status Reporter

CCN Node (Router)

SNMP Agent

IPFIX

CCN Traffic collect and analysis server

SNMP Server

IPFIX Collector

Traffic analysis Module

Result store and UI

UI

DB
Software Stack of CCN Monitoring Tool

CCN Node
- SNMP Agent
- IPFIX Agent
- CCN Status Reporter
- LiBPCAP
- CCN Daemon

CCN Mobile Node
- CCN Status Reporter
- CCN Daemon

CCN Collector / Visualizer
- Network Visualization
- Statistics Graph
- Web Server
- IPFIX Collector
- SNMP Collector

Data / DB

Flow Data
SNMP Data
HTTP
Gathering Information of CCN Node with SNMP

- **Method**
  - New Private MIB for CCN

- **CCN system information**
  - CPU, Memory, HDD, Network Interface

- **CCN information**
  - Daemon status
  - Face information
  - Content Store information
  - Pending Interest Table information
  - Forwarding Information Base information
Communication in SNMP

Using SNMP for gathering CCN information

- CS: use `ccndumpnames`
- PIT: our PIT lookup module in CCN daemon
- FIB, Face: our CCN status reporter
Gathering CCN Flow Data with IPFIX

1. CCN Interest Packet
   - Src addr: 192.168.100.1
   - Dst addr: 192.168.200.2
   - Src Port: 36568
   - Dst Port: 9695
   - Type: Interest
   - Name: ccnx:/my_ccnx_repo/vm_110807.wmv/%00%01

2. IPFIX Agent

3. IPFIX Flow
   - 192.168.100.1|192.168.200.2|9695|9695|4294963986|1|129|Interest|ccnx:/my_ccnx_repo/vm_110807.wmv/%00%01|1330670541

1. CCN Interest packet
2. Make IPFIX flow
3. Send IPFIX flow to collector

IPFIX Template

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Data Collector
IPFIX Collector
IPFIX Agent
SNMP Agent

Gathering Information of CCN Mobile Node with HTTP

- Data collection with HTTP
  - HTTP: unable to use SNMP and IPFIX in Android
  - Our module
    - XML data parser for CCN daemon reporter
Web User Interface (1/2)
Web User Interface (Graph)
Experiment
Conclusion

• Develop a CCN monitoring tool with SNMP, IPFIX and HTTP
• Currently, our monitoring tool works in only IP-Overlay network
• Future work
  – CCN-native monitoring method