IPTV Traffic Monitoring System with IPFIX/PSAMP

Shingo Kashima

NTT Information Sharing Platform Laboratories

Outline

- **Introduction**
  - Motivation
  - IP Multicast Streaming Traffic
- **Issues in Existing Multicast Monitoring**
- **Requirements**
- **Relationship with the Other Works**
- **Why IPFIX/PSAMP?**
- **Our System: Qcast**
  - System Overview
  - System Architecture
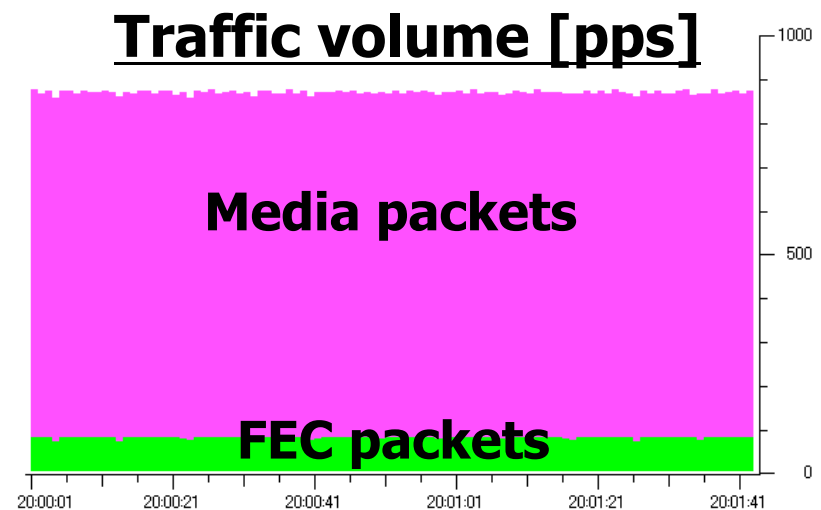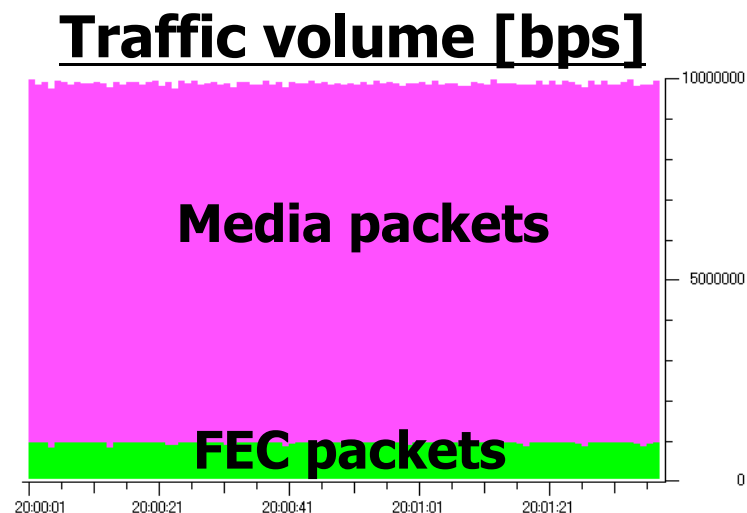- **Requirement for Backbone Router**
- **Summary**

Motivation

- **Multicast service has started in several provider networks.**
  - Large number of broadband users leads to heavy demand for IP multicast streaming services, such as IPTV.

- **Existing multicast tools work, but not well enough to monitor streaming services in large-scale networks.**
  - Multicast ping, trace route, and multicast MIB.

- **Easy troubleshooting tools are required.**

IP Multicast Streaming Traffic

- **Traffic volume of an IPTV channel: 10 Mbps, 0.9 kpps.**
  - Packet size: from 1300 to 1400 bytes.
- **IP multicast stream traffic includes two kinds of packets.**
  - Media packets and FEC (Forward Error Correction) packets.
- **IP multicast stream traffic includes RTP headers.**
  - Packet loss can be easily detected by keeping track of RTP seq. number.
- **About 100 channels pass through an ISP network.**

Traffic volume [bps]

Media packets

FEC packets

20:00:01 20:00:21 20:00:41 20:01:01 20:01:21

Traffic volume [pps]

Media packets

FEC packets

20:00:01 20:00:21 20:00:41 20:01:01 20:01:21 20:01:41

Issues in Existing Multicast Monitoring

- **Multicast ping and trace route**
    - Detect fault point and check continuity by using test packets.
    - Do not observe real packets.
    - → Inadequate for detecting service quality deterioration and confirming service quality.

- **Mirroring + packet capture**
    - Last resort for confirming service quality.
    - But requires great care and is not suitable for always-on monitoring.

Requirements

- **Requirement #1: Detecting service quality deterioration (packet loss and delay variation)**
  - Because an IP multicast streaming service is sensitive to network performance.

- **Requirement #2: Recognizing failure impact (which subscribers and which IPTV channels are affected).**
  - In order to explain to customers and content providers.

- **Requirement #3: Localizing failure point**
  - In order to recover the failure with rapidity.

- **Requirement #4: Early applicability**
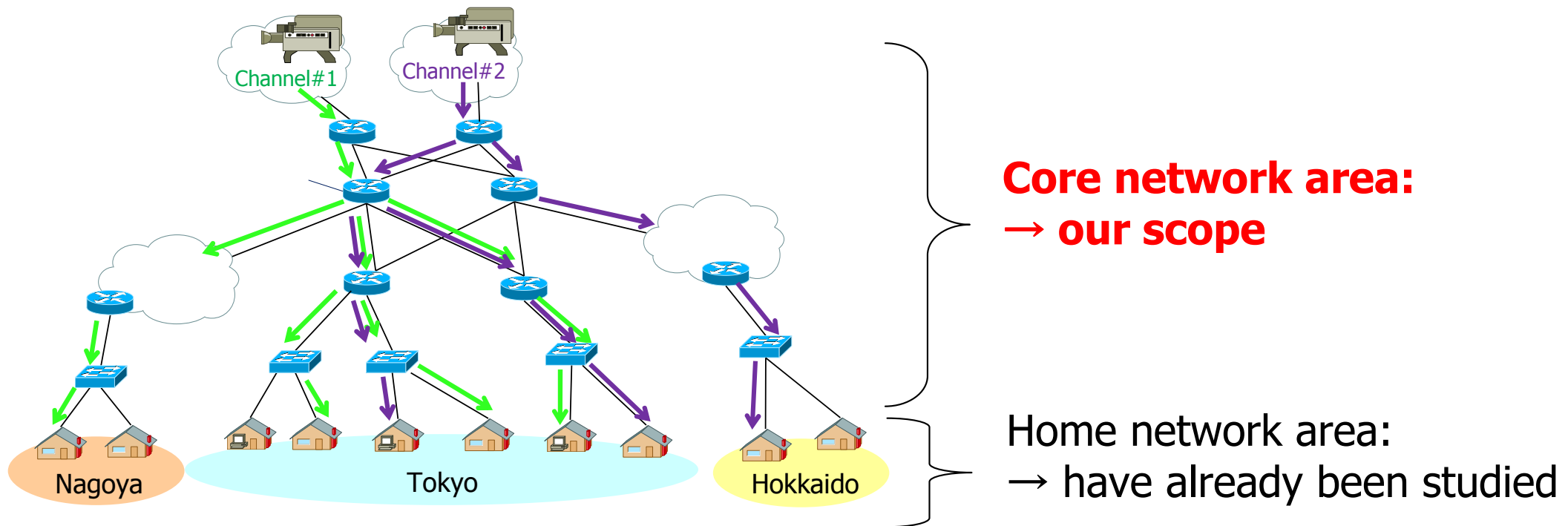 - Because an IP multicast streaming service has already started.

Relationship with the Other Works

- **In home network area:**
  - Forth-coming HGW and STB may have a function of measuring QoS (Quality of Service) or QoE (Quality of Experience).

- **In core network area:**
  - Current router and switch do not have a capability of measuring QoS because no effective method of measuring a lot of IPTV channel.

Channel#1   Channel#2

Core network area:
→ our scope

Nagoya   Tokyo   Hokkaido

Home network area:
→ have already been studied

Why IPFIX/PSAMP ?

- **PSAMP (Packet SAMPling)**
  - ❑ "Property Match Filtering" can <u>focus the monitoring</u> on IPTV traffic by selecting on the basis of packet header value.
  - ❑ "Systematic Time-based Sampling" can <u>detect packet loss and packet interval time</u> by selecting continuous packets.

- **IPFIX (IP Flow Information Export)**
  - ❑ "Enterprise-specific Information Elements" can export not only UDP/IP header information but also RTP header information.

Traffic measurement method in core network

|	NetFlow	IPFIX/PSAMP
Specification	Cisco Proprietary	Proposed Standard
Packet Selection	Only Random Sampling	·Random Sampling ·**Property Match Filtering** ·**Time-based Sampling** and so on
Export Information	L3/L4 information	L3/L4 information and **Enterprise-specific information**

Our System: Qcast Overview

■ **Probe: Captures traffic from mirror port, measures IPTV traffic with PSAMP, and exports with IPFIX.**

  ❑ Runs on a general-purpose personal computer.

■ **Web-Console: Collects IPFIX information and shows it to operators.**
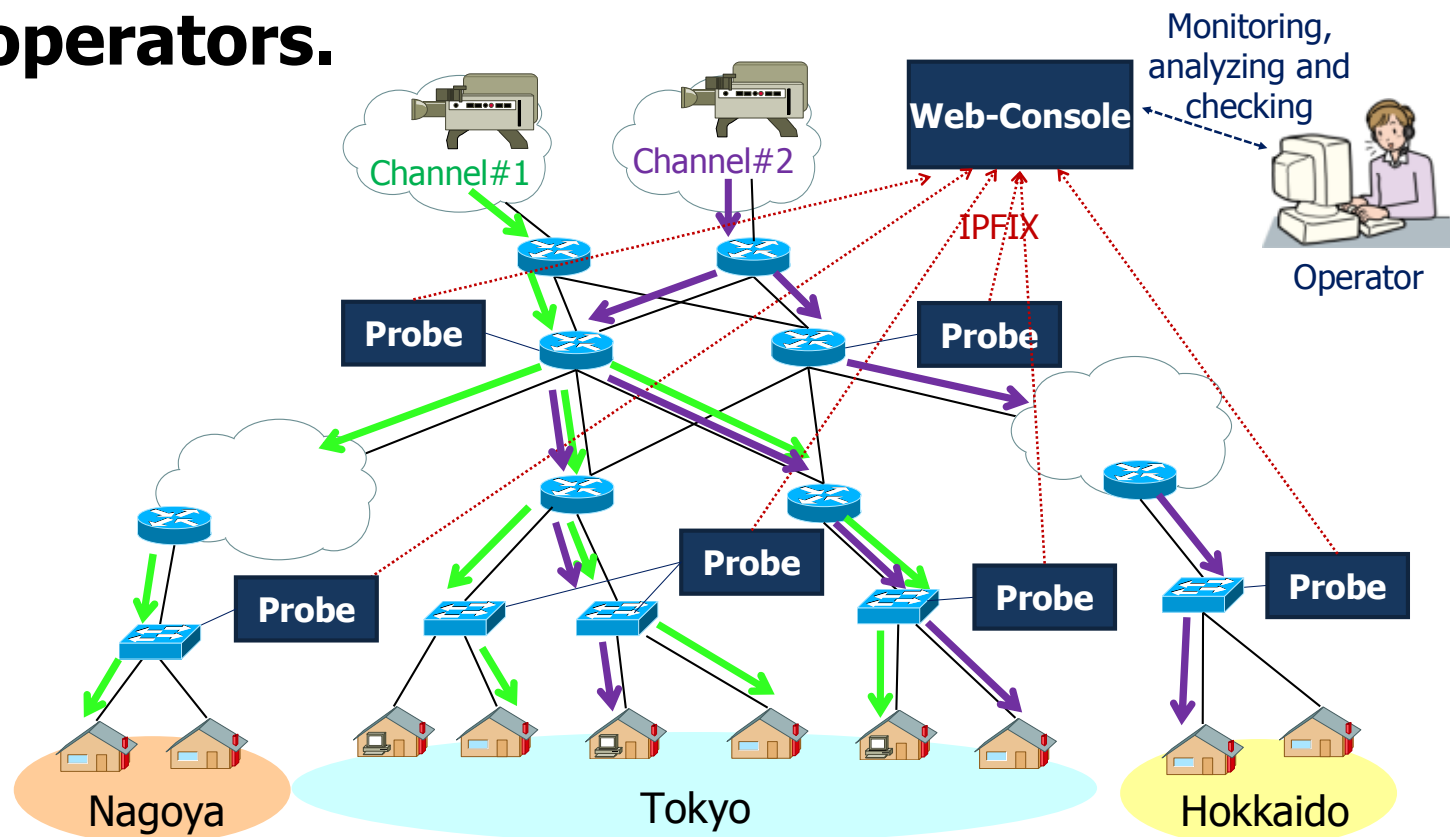
Qcast (Quality of broadCASTing monitoring system)

Qcast Architecture
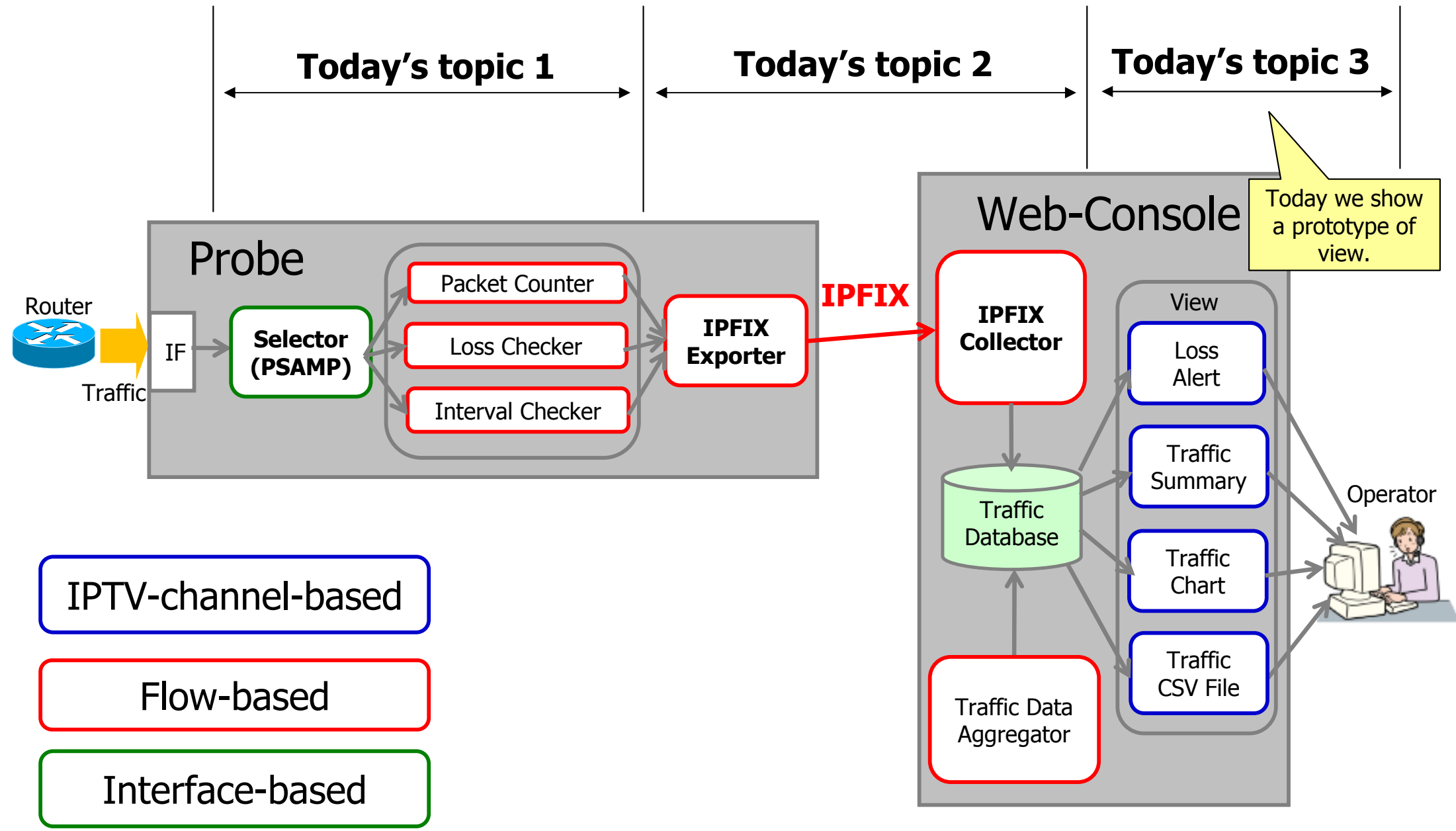
Topic 1: Packet Loss and Interval Time

- **Combination of PSAMP techniques in Probe**
  - Observe packets at input interface.
  - Select multicast packet by "Property Match Filtering".
    - Example: "Destination IPv6 Address == FF38::/16"
  - Extract them using "Systematic Time-based Sampling".
    - All input packets during the interval period are selected.

·Check packet loss by keeping track of RTP seq. number.
·Check interval time by keeping track of receipt timestamp.
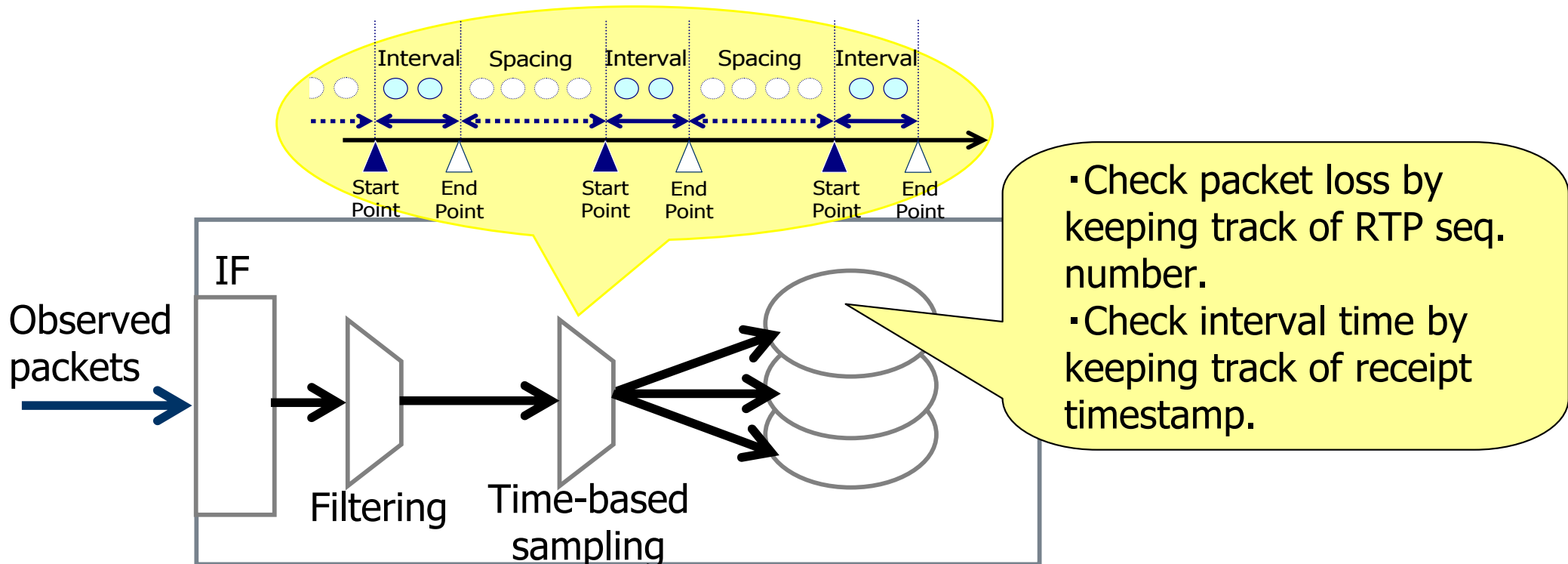
Topic 2: Exporting Traffic Data

- **IPv6 template**
  - ❑ Flow key information
    - Includes VLAN ID
  - ❑ Traffic volume information
  - ❑ Packet loss information
  - ❑ Interval time information
    - Uses "Enterprise-specific Information Elements"
- **Option template**

	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7
0	Set ID (0x0002)		Length	
4	Template ID (0x0103)		Field Count = 18 (0x0012)	
8	octetDeltaCount (0x0001)		Field Length (0x0004)	
12	packetDeltaCount (0x0002)		Field Length (0x0004)	
16	srcTransportPort (0x0007)		Field Length (0x0002)	
20	dstTransportPort (0x000B)		Field Length (0x0002)	
24	srcIPv6Address (0x001B)		Field Length (0x0010)	
28	dstIPv6Address (0x001C)		Field Length (0x0010)	
32	droppedPacketDeltaCount (0x0085)		Field Length (0x0004)	
36	flowStartMilliseconds (0x0098)		Field Length (0x0004)	
40	flowEndMilliseconds (0x0099)		Field Length (0x0004)	
44	vlanId (0x003A)		Field Length (0x0002)	
48	protocolIdentifier (0x0004)		Field Length (0x0001)	
52	ipVersion (0x003C)		Field Length (0x0001)	
56	rtpIntervalAvgTime (0x8001)		Field Length (0x0004)	
60	ENTERPRISE NUMBER (0x000000D2)			
64	rtpInternalMaxTime (0x8002)		Field Length (0x0004)	
68	ENTERPRISE NUMBER (0x000000D2)			
72	rtpIntervalMinTime (0x8003)		Field Length (0x0004)	
76	ENTERPRISE NUMBER (0x000000D2)			
80	rtpIntervalVariance (0x8004)		Field Length (0x0004)	
84	ENTERPRISE NUMBER (0x000000D2)			
88	rtpPayloadType (0x8005)		Field Length (0x0002)	
92	ENTERPRISE NUMBER (0x000000D2)			

	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7	0 1 2 3 4 5 6 7
0	Set ID (0x0003)		Length	
4	Template ID (0x0106)		Field Count (0x0003)	
8	Scope Field Count (0x0001)		exporterIPv4Address (0x0082)	
12	Scope 1 Length (0x0004)		samplingTimeInterval (0x0133)	
16	Field Length (0x0004)		samplingTimeSpace (0x012E)	
20	Field Length (0x0004)		flowActiveTimeout (0x0024)	
24	Field Length (0x0002)			

Demonstration

Demo Network

Ch001_FOX {2404:1a8:ffff:fe00:2001::1, ff3e::8000:1}
Ch002_BBC {2404:1a8:ffff:fe00:2001::2, ff3e::8000:1}
Ch003_MTV {2404:1a8:ffff:fe00:2001::3, ff3e::8000:1}

[VLAN_ID] VLAN configuration
Port mirroring
IPFIX delivery

Web-Console

QProbe00

VLAN untag

bit error

VLAN tagged

QProbe01

QProbe02

QProbe03

101-103

201-203

301-303

GE-PON

GE-PON

GE-PON

Zapping
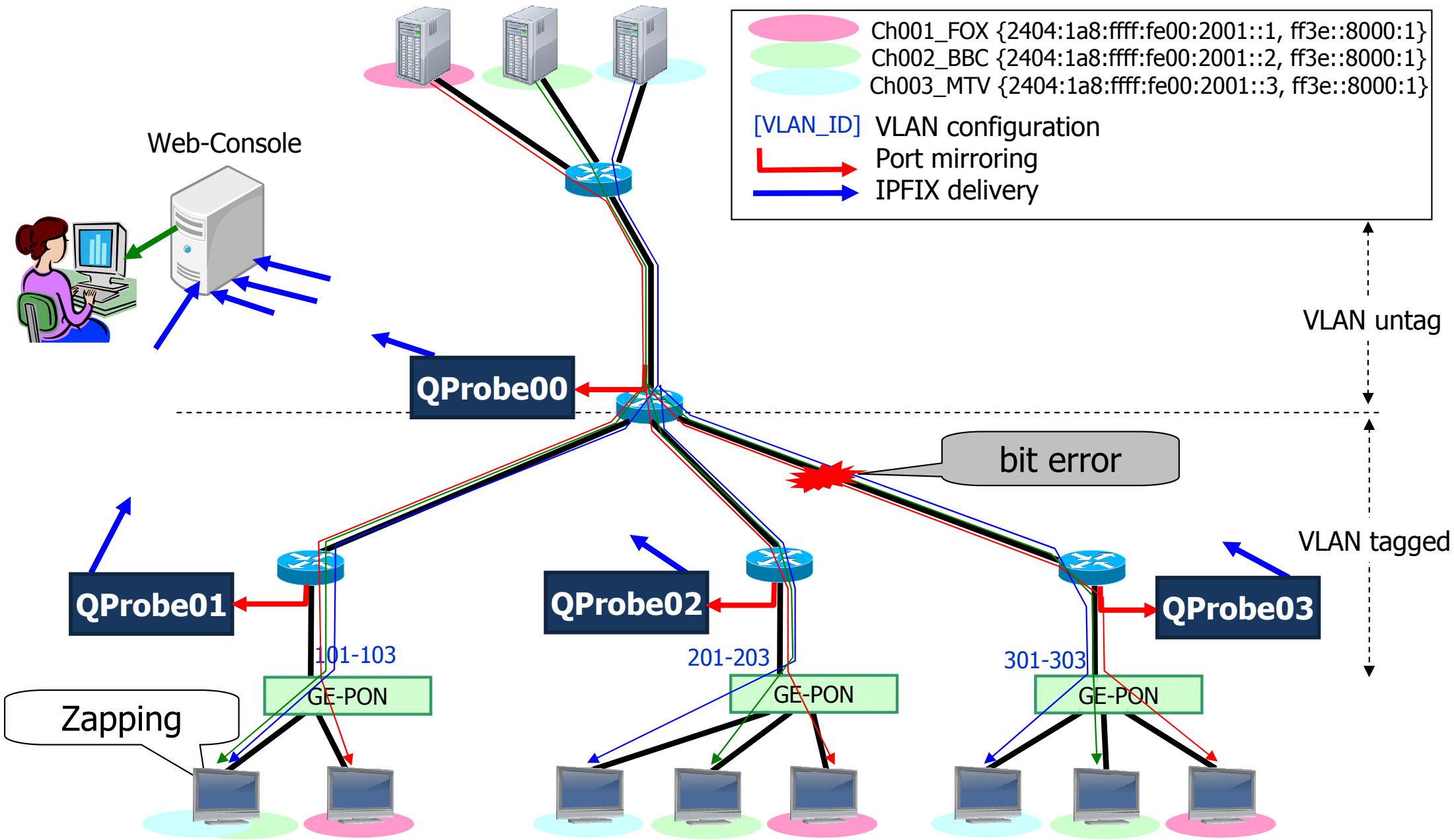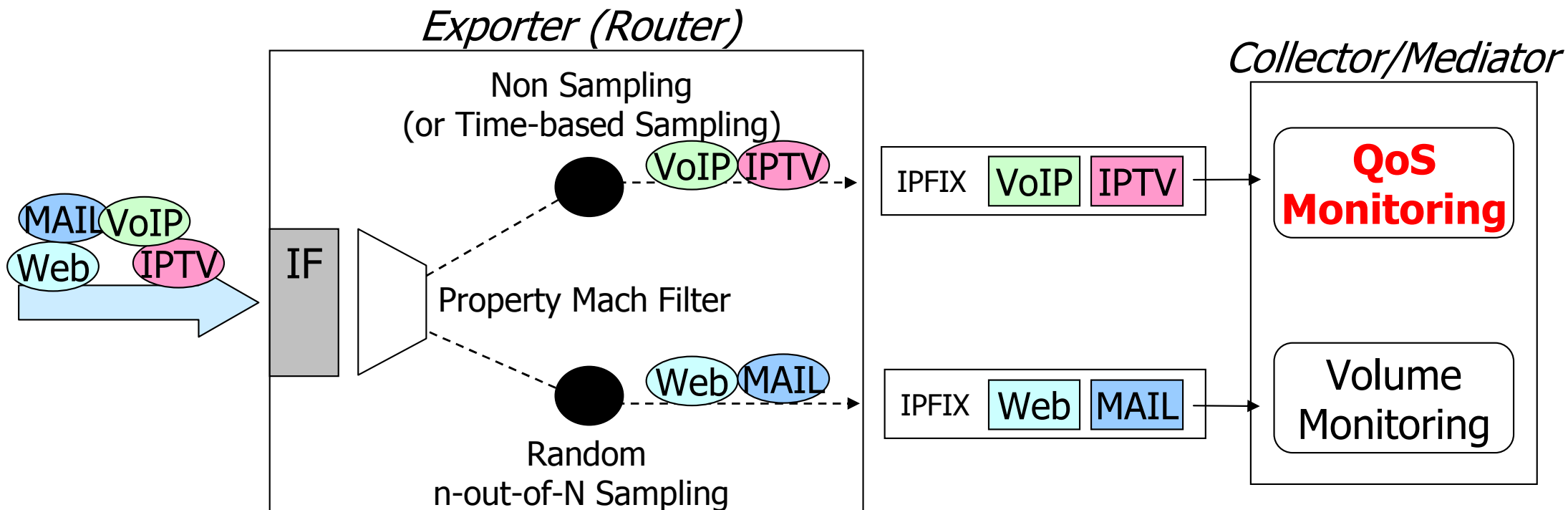
Requirement for Backbone Router

- **To adopt a lot of probes in a large scale commercial network is difficult for us.**

- **Then we need a backbone router with IPFIX/PSAMP.**

  - Classification with Property Match Filter.
    - RTP traffic -> Non Sampling
    - The other traffic -> Random Sampling

Exporter (Router)

Non Sampling
(or Time-based Sampling)

VoIP IPTV → IPFIX VoIP IPTV

Collector/Mediator

QoS Monitoring

MAIL VoIP Web IPTV

IF

Property Mach Filter

Web MAIL → IPFIX Web MAIL

Volume Monitoring

Random
n-out-of-N Sampling

Summary

- We presented a new traffic monitoring method for IP multicast streaming services, such as IPTV, and the implemented system using IPFIX/PSAMP (Qcast).

- We showed the feasibility of the Qcast.

- We want a router with IPFIX/PSAMP enabling QoS monitoring.