Path-Coupled Configuration of Traffic Measurement

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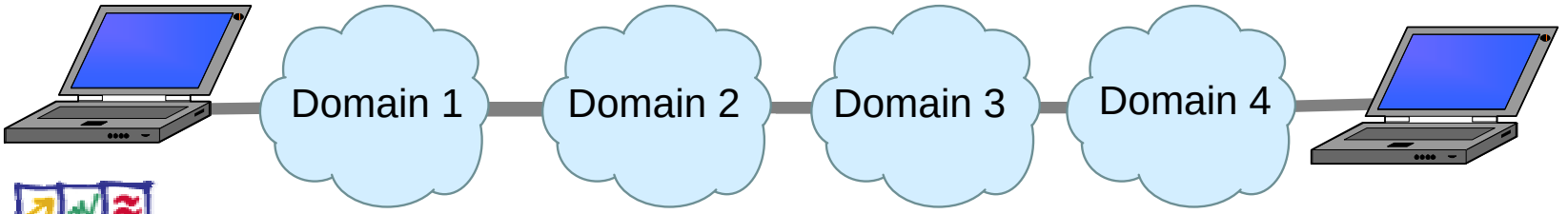
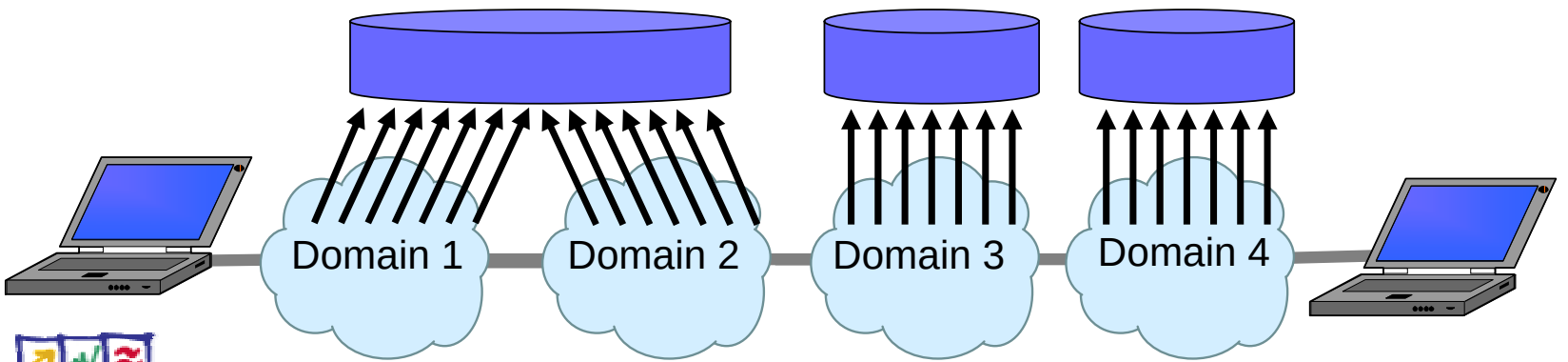
Motivation

- Problem: Measuring properties of a specific IP traffic flow along its path through the Internet
  - identifying sources of delay, jitter and loss
    - delay and jitter per hop
    - number of dropped packets per hop
  - at several routers
  - in several domains



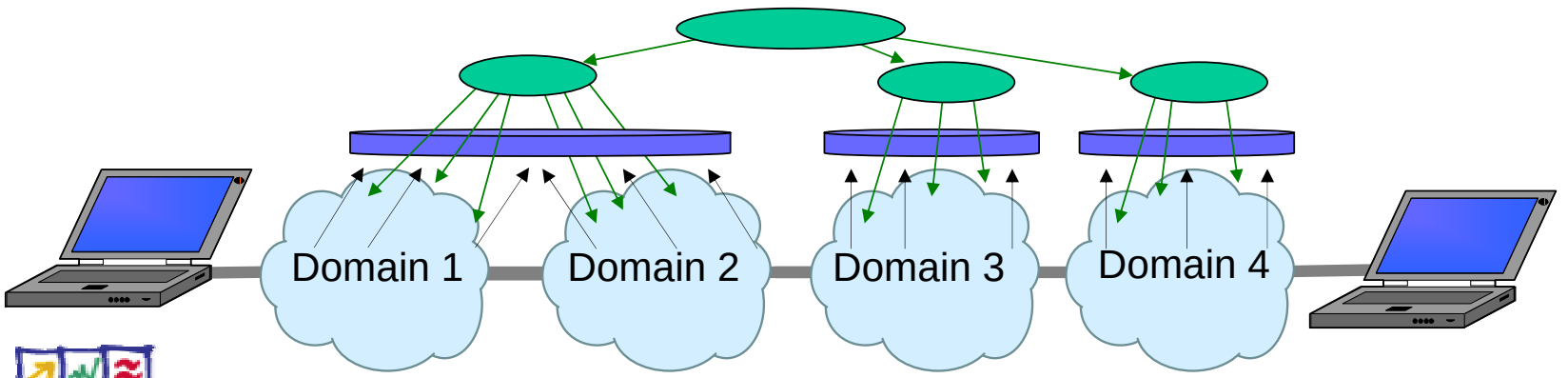
Already Known Solutions (1)

- Active measurements: traceroute and ping
  - does not measure the flow of interest but another artificial flow
- Massive passive measurement: measure all flows in the network at all routers in all domains
  - very high overhead
    - overloading core routers
    - huge amount of data to be transported, stored and searched



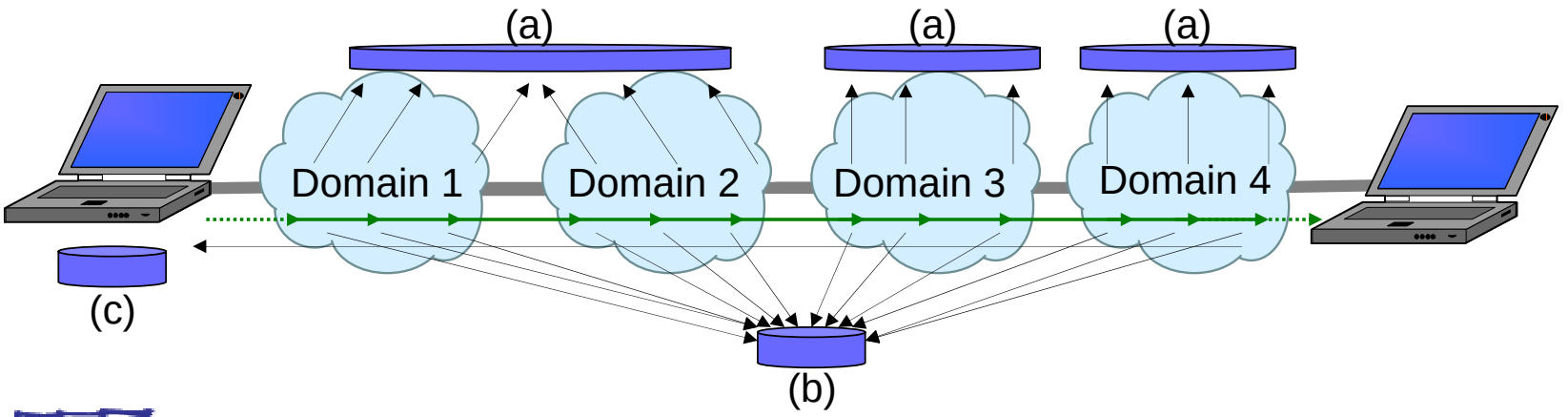
Already Known Solutions (2)

- Selective passive measurement: configure measurement for the flow individually by a management tool
  - the IST InterMon approach
  - much leaner, much less data
  - central coordination of individual measurements
  - **full topology and routing information required for coordination**
  - **still a high management and coordination overhead**

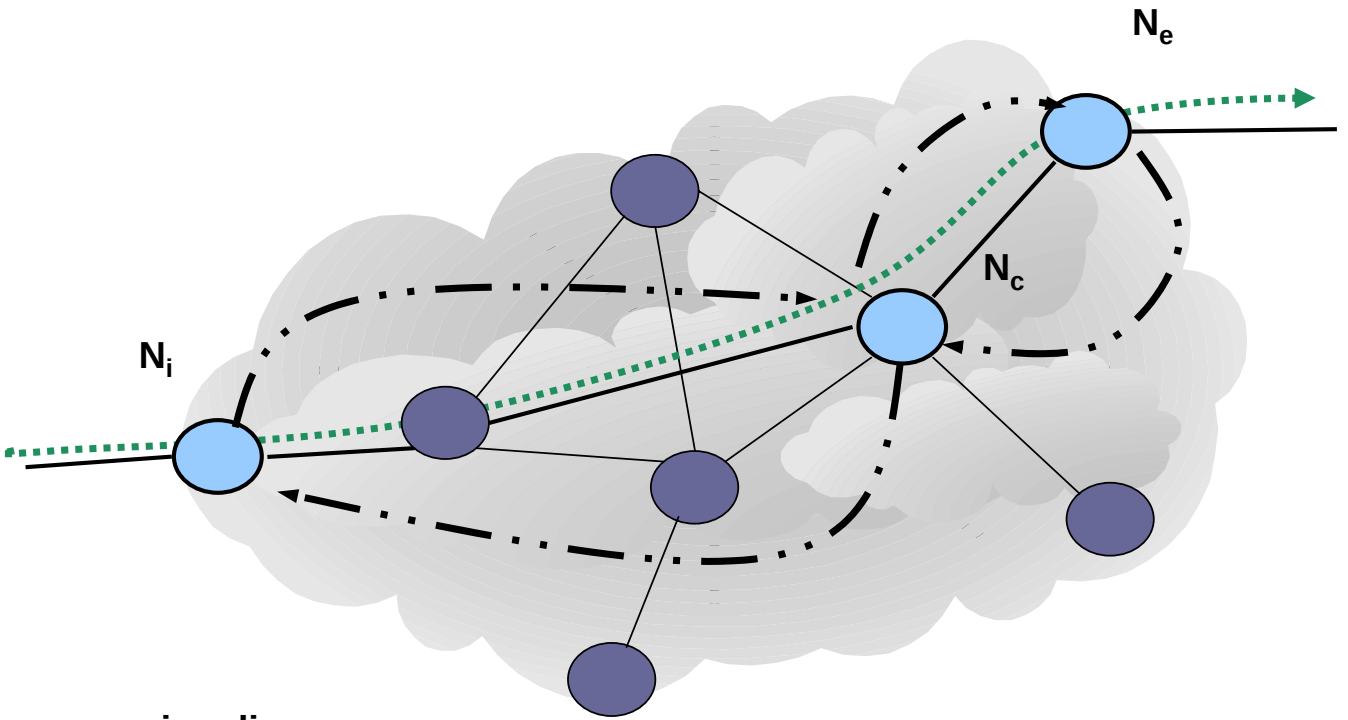


Path-coupled signaling

- Sending signaling message along the data path
  - same basic idea as RSVP uses for QoS signaling
  - each router on the path receives a request for measuring a specified data flow
  - non-supportive routers just ignore the message
- Data collection to
  - (a) per-domain databases
  - (b) case-by-case-specified database
  - (c) along data path back to requesting party

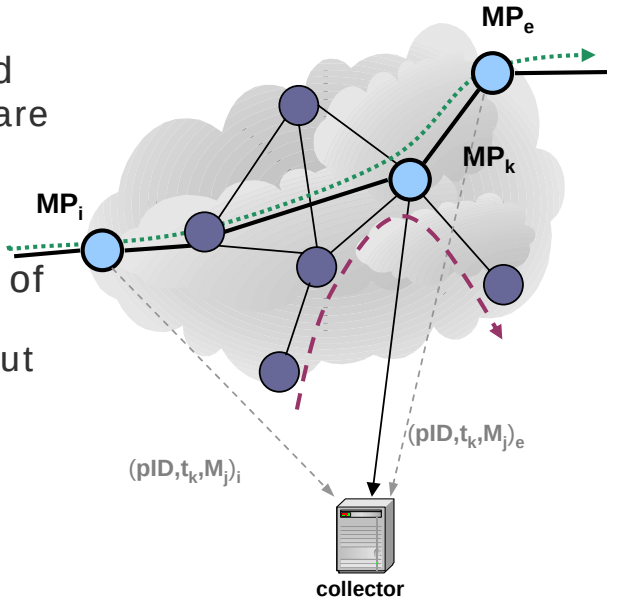


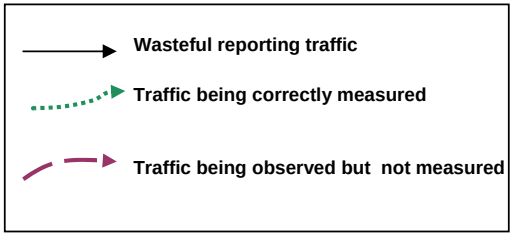
Basic Scenario for a Single Domain



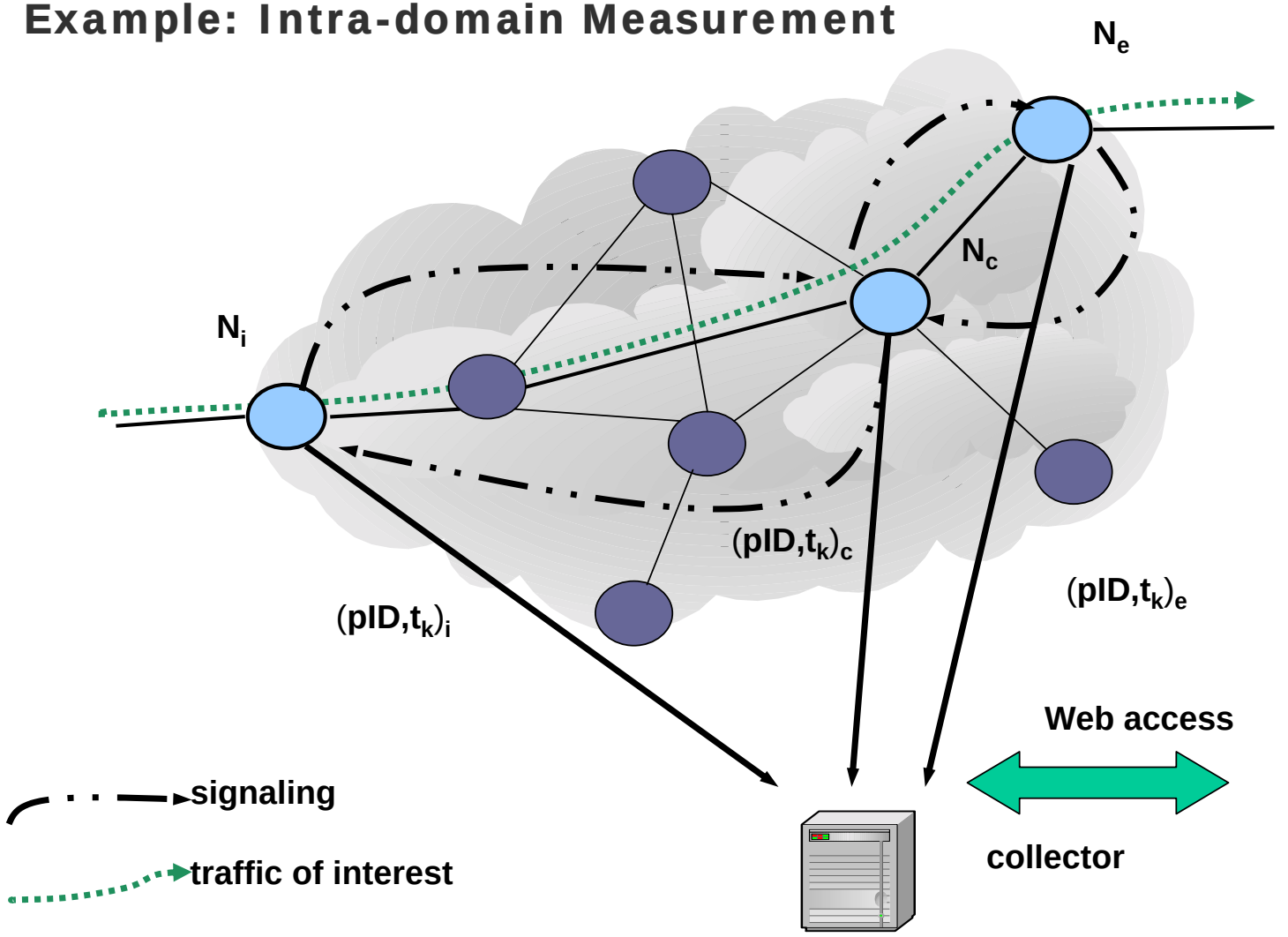
Advantages

- Topology and routing information not required
  - automatically only routers on the data path are configured
  - reduced measurements overhead
- Relatively low signaling overhead
- Filter specification allows exact measurement of specific traffic flow
  - even at high speed link, measurement without sampling possible
    - also precise loss and jitter measurement possible
  - lower probability of packet ID collisions
    - further increases by also reporting packet length
- Low amount of data to be stored in database
- Measuring byte loss and packet loss

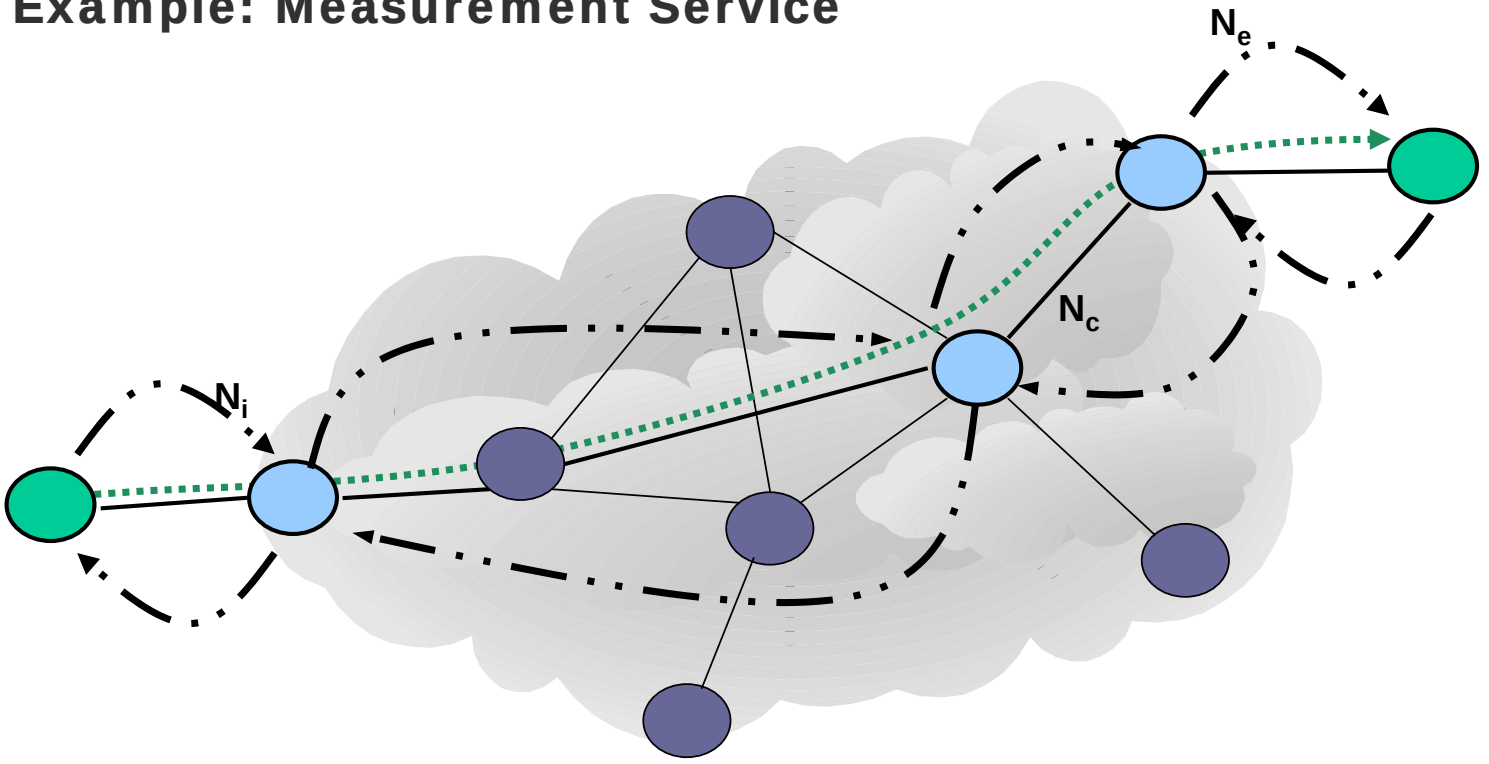




Example: Intra-domain Measurement



Example: Measurement Service



Signaling (probe config & result gathering)

traffic of interest

Measurement results sent to signaling initiator using the same signaling protocol

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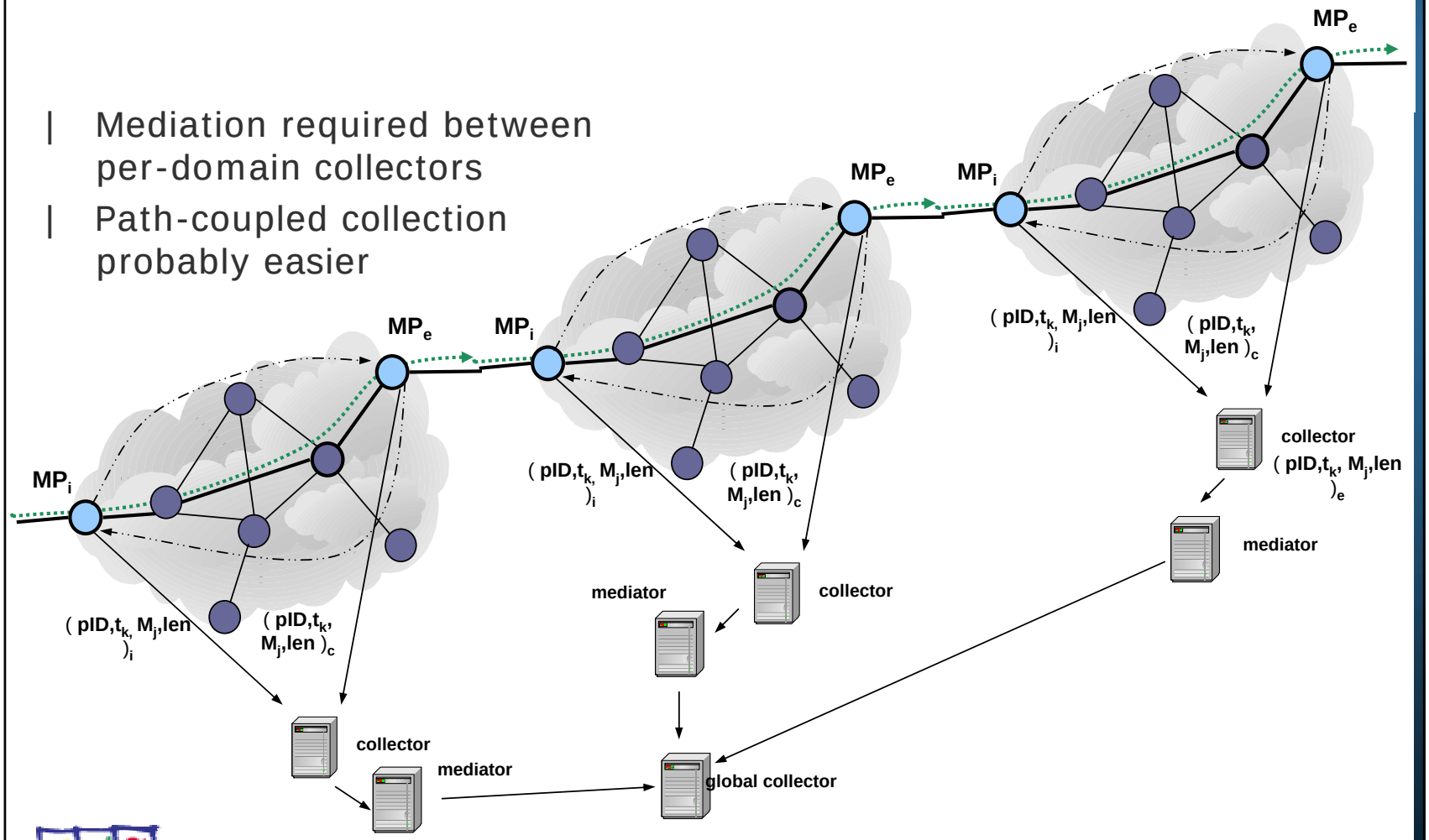
Example: Inter-Domain Measurement

- Mediation required between per-domain collectors
- Path-coupled collection probably easier



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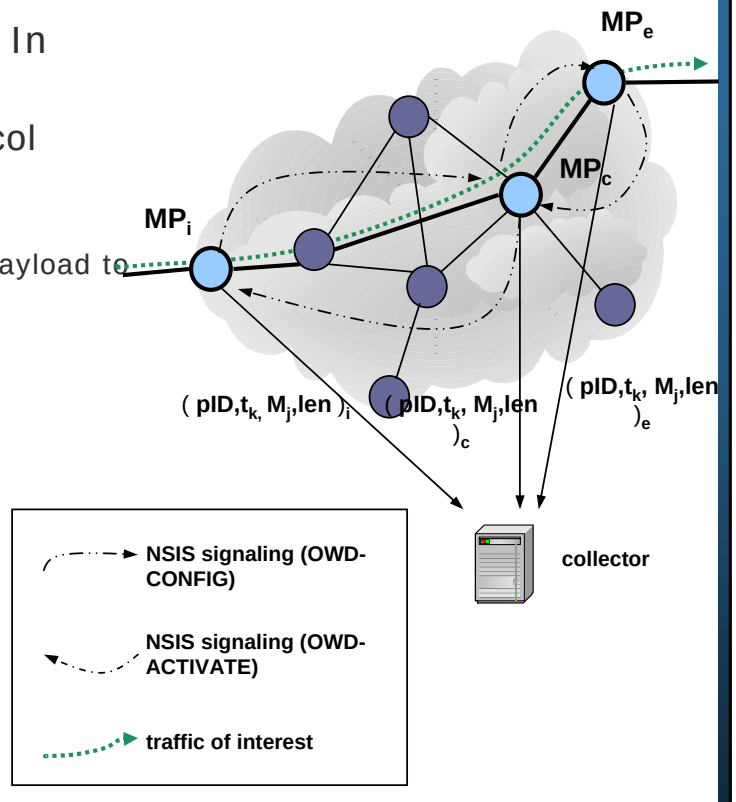
Protocol Design

- General alignment with the IETF Next Steps In Signaling (NSIS) working group
  - developing a path-coupled transport protocol (NTLP)
    - hop-by-hop forwarding
    - at each hop: handing over of carried signaling payload to corresponding handler
  - on top of NTLP: specific signaling protocols (NSLPs) carried as NTLP payload
    - QoS NSLP (already NSIS work item)
    - Firewall/NAT control NSLP (already NSIS work item)
  - **Designing a traffic metering NSLP**
- **Carry filtering, sampling, measuring and reporting instructions by NSLP**



Implementation

- So far: just partial implementation of the design
  - NTLP standard specification not complete
    - using proprietary pre-standard implementation
  - Just partial specification of traffic metering NSLP
    - reporting target not yet covered
    - reporting to pre-configured collector (alternative (a))
- Implementation tailored for one way delay measurement
  - post-processing only delay, not for loss and jitter
- Reports using PSAMP/IPFIX protocol
  - also pre-standard implementation
  - reporting packet digest (hash value), timestamp, packet length
- GPS synchronized measurements

Standardization

- Standardization Efforts
  - Standardization at IETF NSIS WG is intended
  - Coordinated by MOME
- MOME is setting up a Measurement Standardization Team
  - Goal: Coordinate (IETF) standardization between IST projects
  - Coordinate new submissions with WG chairs and Area directors
  - Discuss content and scope of new issues brought to standardization
  - Peer-review Internet drafts before submitting
  - Targets
    - IETF IPFIX, PSAMP, IPPM, NSIS, ...
    - IRTF IMRG, NMRG
  - Current Activity
    - 4 Internet drafts for IPFIX, IPPM, NSIS before March meeting
  - **New Participants are welcome!**
- IRTF IMRG Internet Measurement Research Group
  - Initiate pre-standardization work at IMRG
  - Establish new IMRG work items from IST projects
  - **Suggestions are very welcome!**