

Sampling Techniques and Information Export for Network Measurements

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Network Measurements

- Basis for network research
 - But: Scientists from other disciplines are shocked:
*“[network research] had not managed to execute the usual elements of successful research... **measure, model, make prototypes**”*
Source: Looking over the Fence at Networks, National Research Council, Washington DC, 2001
- Essential for **Future Internet**
 - **Self-** Management
 - **Self-** Protection
 - Support for service provisioning

Enhanced

Standards are crucial!

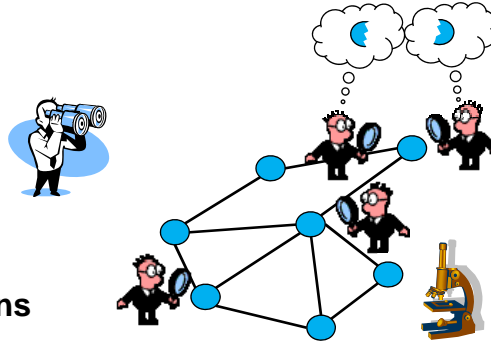


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Whish List & Reality Check

- We want
 - **E**verything
 - **E**verywhere
 - **E**xchangeable
- But we have
 - Resource limitations
 - Privacy concerns



We can not measure everything everywhere!

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Solutions

- Slow down the Internet ...
- Dedicated Hardware
- Aggregation & Data selection ←
- Standardization Activities
 - Aggregation: Flow measurements (IETF IPFIX)
 - Data Selection: Packet and flow selection (IETF PSAMP)

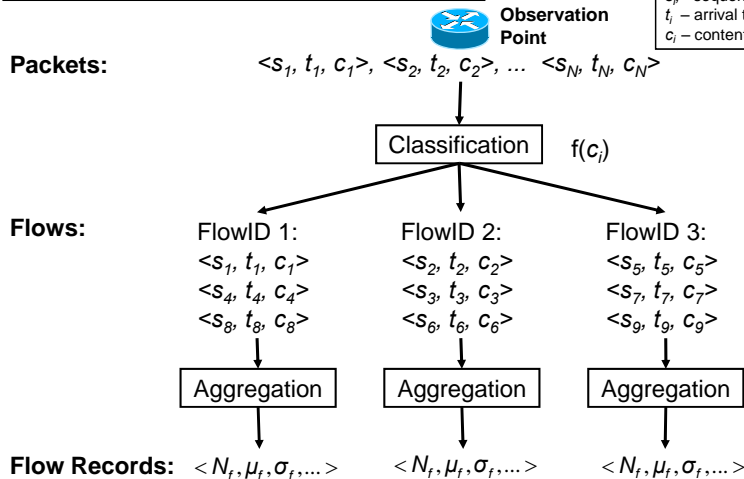
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Aggregation: Flow Measurements

Flow := packets with common properties

Packet Attributes at Observation Point
 s_i – sequence number
 t_i – arrival time
 c_i – content (header, payload)



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IETF IPFIX

- IP Flow Information Export (IPFIX) → RFC5101
 - Export of flow information (flow records) from routers and probes
 - Flexible flow definition
 - Implementations exist (Cisco, US CERT, IBM, FOKUS)
- Information Elements → RFC 5102
 - Easily extensible with own IEs
- Work in progress
 - Packet export over IPFIX (→ PSAMP)
 - IPFIX Configuration
 - IPFIX File Format
 - Anonymization techniques

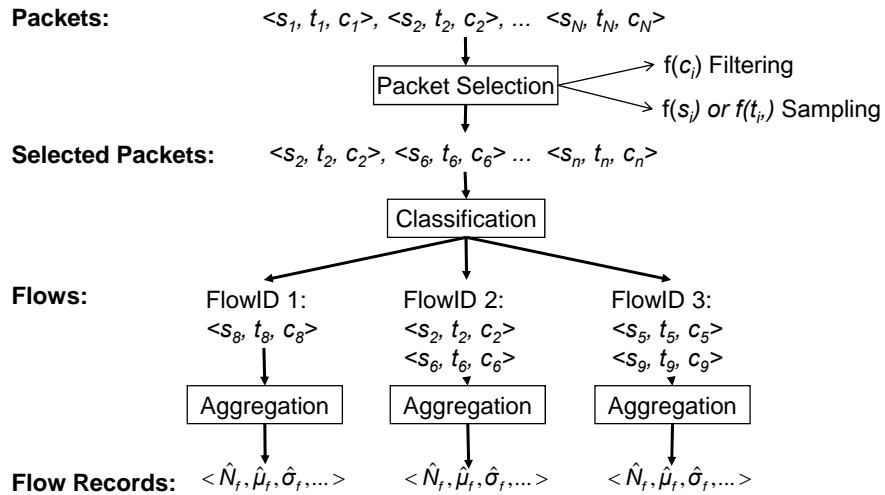
FOKUS Open Source IPFIX Implementation:

<http://net.fokus.fraunhofer.de/libipfix/>

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Packet Selection



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IETF PSAMP

- Packet Sampling (PSAMP)
 - Export of packet information over IPFIX
 - Specification of packet selection techniques
 - Configuration of packet selection techniques
- Basis selection techniques
 - Filtering
 - Sampling
 - Combination of selection methods (e.g. stratified)
- FOKUS work fields
 - Accuracy assessment
 - Sampling synchronization for multipoint measurements
 - Privacy-preserving measurements

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Conclusion

- Measurements are essential now and in future
- Main Challenges: Resources, Privacy
- IPFIX and PSAMP
 - Provide basis for aggregation and data selection
 - Standardization in progress
 - Implementations exist
- Research challenges
 - Accuracy assessment
 - Sampling synchronization
 - Privacy/Anonymization

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Thank You!