Challenges for flow-based management - implications from draft-unify-nfvrg-devops

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draft-unify-nfvrg-devops

- Purpose of the document: open discussion in NFVRG on:
  - a set of principles that are relevant for applying DevOps ideas to managing software-defined telecom network infrastructures
  - challenges related to developing tools, interfaces and protocols that would support these principles and leverage standard APIs for simplifying operations tasks
- Challenge areas
  - **Stability of the software-defined infrastructure versus continuous changes**
  - Consistency, Availability and Partitioning trade-offs
  - **Observability: scalability, distribution, automation**
  - Verification: when to do, what to check, scalability
  - Troubleshooting: automated workflows
  - Identification and definition of performance metrics

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The UNIFY project in a nutshell

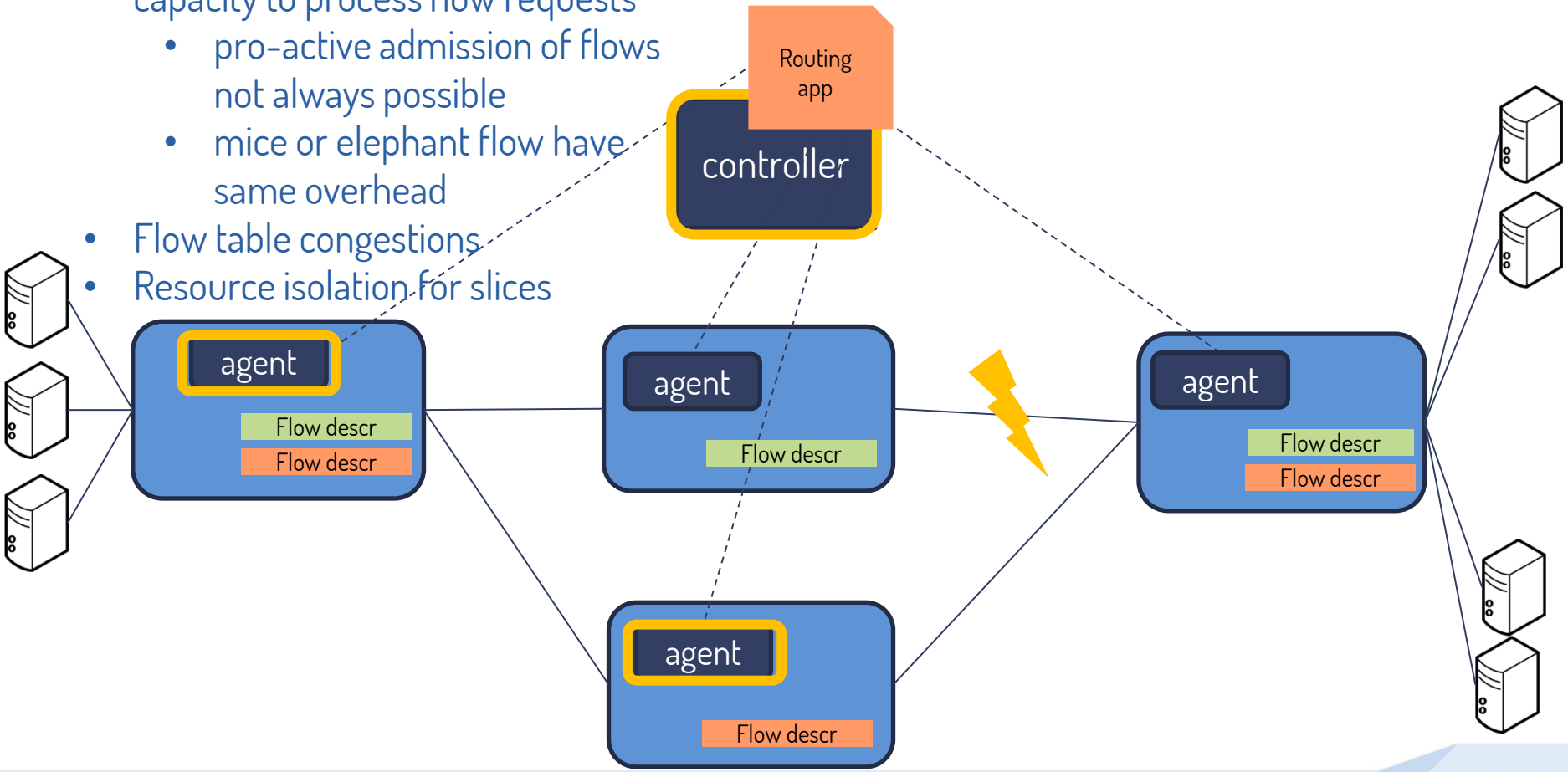
- Increase velocity of service introduction
- Unified network-cloud programming abstraction: orchestration and generic processing
- Novel observability and verification features

Types of flow descriptors

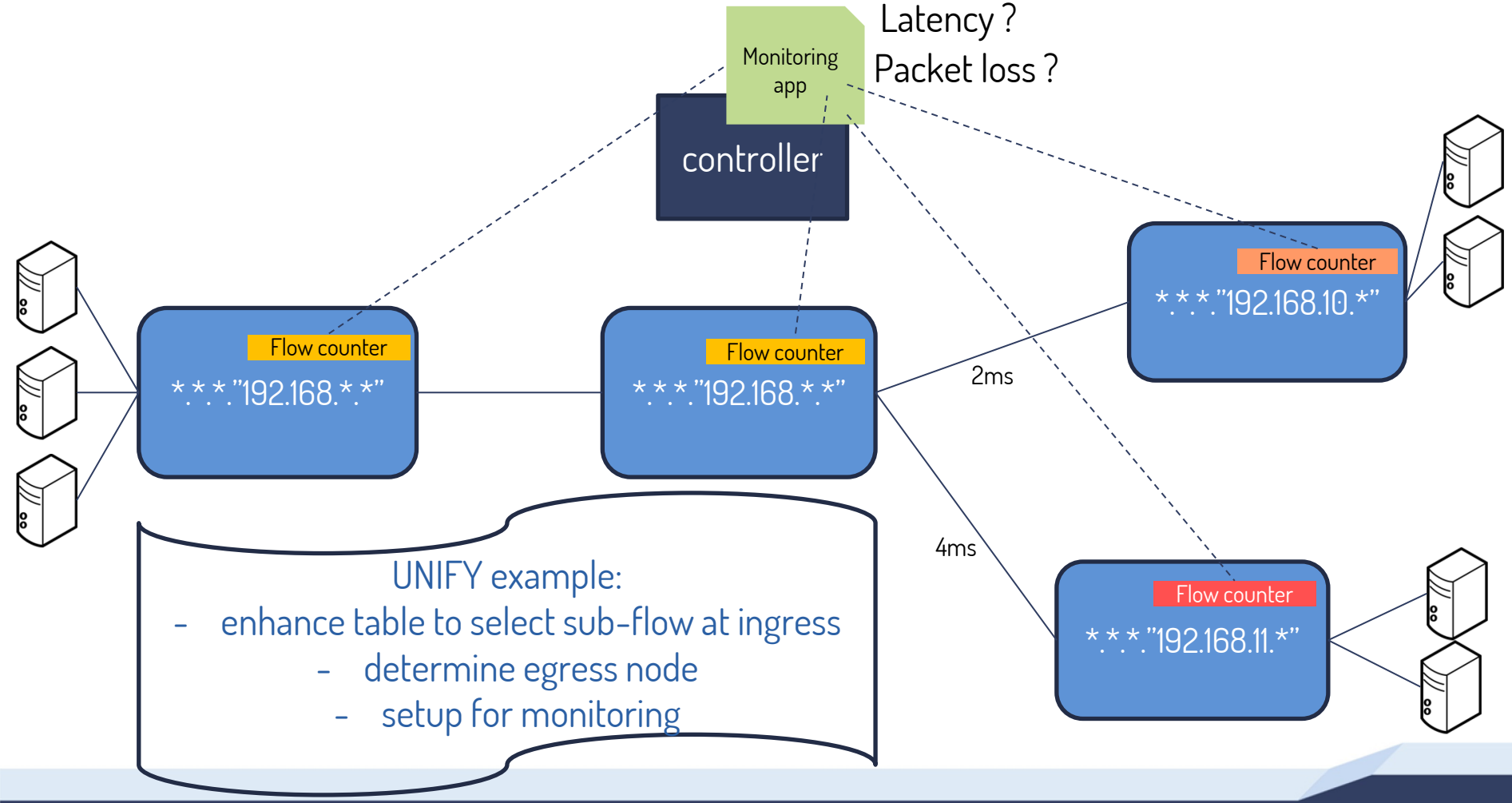
- Individual flows
  - All fields of the flow descriptor contain specific values uniquely identifying one particular flow
  - Advantage: precise visibility
  - Disadvantage: scalability (linear increase of forwarding table space)
- Aggregated flows
  - Flow descriptor contains aggregation descriptors
    - OpenFlow: *
    - CIDR: /number
  - Advantage: scalability (sub-linear increase of forwarding table space)
  - Disadvantage: loss of visibility

Infrastructure stability: flow admission control

- Controller and Agent have limited capacity to process flow requests
  - pro-active admission of flows not always possible
  - mice or elephant flow have same overhead
- Flow table congestions
- Resource isolation for slices

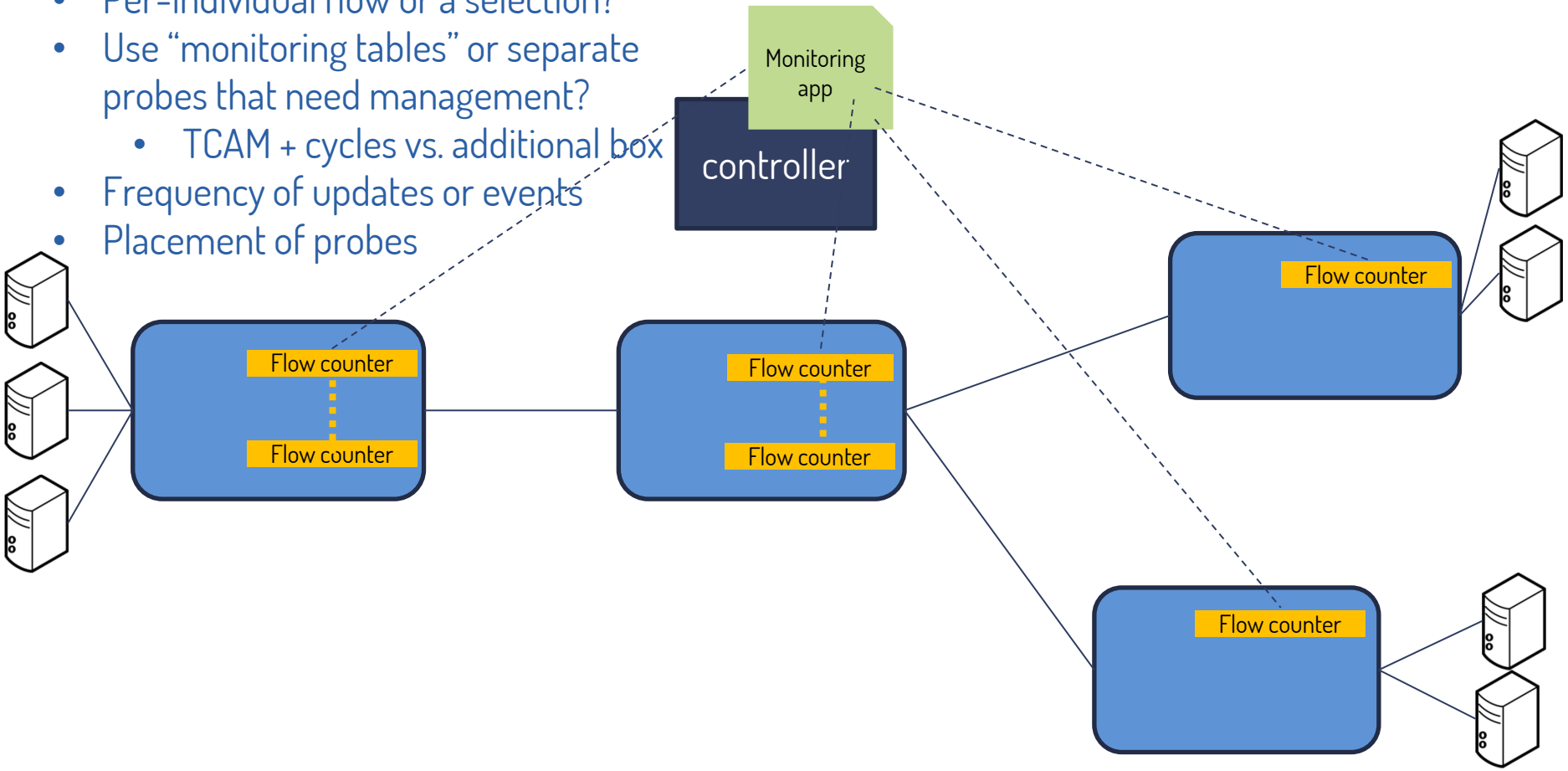


Observability: monitoring aggregated flows



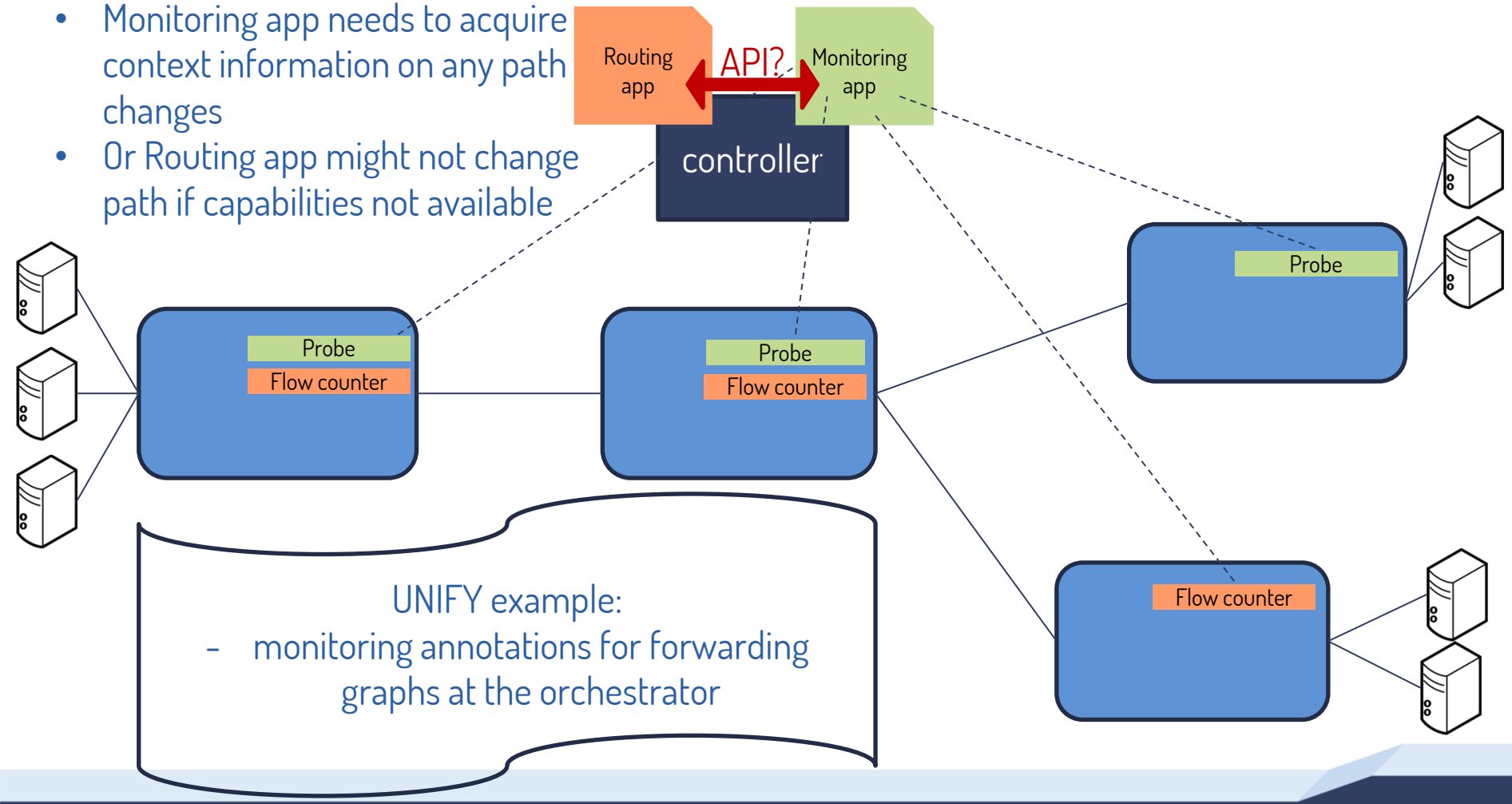
Observability: scalability challenges

- Per-individual flow or a selection?
- Use "monitoring tables" or separate probes that need management?
  - TCAM + cycles vs. additional box
- Frequency of updates or events
- Placement of probes



Observability: consistent deployment need

- Monitoring app needs to acquire context information on any path changes
- Or Routing app might not change path if capabilities not available



Observability: towards monitoring languages 1/2: current state

- Dataplane: simple incremental counters associated to flows
  - atomic operations (OpenFlow): counter automatically "moves" with flow when control plane decides migration
  - split operations (SNMP): counter no longer updated when flow moved, management needs to discover new flow path to fetch counter
- Yang-based data modelling
  - TWAMP configuration management models
  - LIME draft Yang model for performance management
  - PSAMP configuration Yang data model (RFC6728)
- OGF network monitoring schema: higher level, but not used outside academia
- Chef and Puppet templates popular with DevOps

Observability: towards monitoring languages 2/2: selected open research areas

- Data plane-level monitoring constructs beyond incremental counters:
  - "lossy" counters
  - statistical counters. UNIFY example: mean and variance
  - aggregate counters over several flows
- Enable/disable monitoring of a specific flow, including functionality at the data plane level
  - "disable counter for flow X.Y.Z.T". UNIFY example: monitoring function with statistical counter dataplane component instantiated upon provisioning of the forwarding graph it is associated with
- Need for an expressive and extensible language able to:
  - define monitoring fabrics, with aggregations and triggers
  - easily extendable to describe parameters associated to self-adaptive monitoring functions
    - accuracy versus overhead trade-offs
    - transparent adaptation of measurement frequency to situation in the infrastructure
  - support event-condition-action rules

Conclusion

- draft-unify-nfvrg-devops defines a series of challenges, relevant also for flow-based management
- Observability is a particularly challenging area, and more work is needed on languages and capabilities for flow monitoring
- The UNIFY project addresses flow management challenges in software-defined infrastructure
  - For more details, the D4.x deliverables and M4.1 are available at https://www.fp7-unify.eu/index.php/results.html#Deliverables

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