PCN with Single Marking

draft-charny-pcn-single-marking-03

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Single-Marking

- Initial Motivation
  - Saves one code-point
    - Essential if must be limited to 2 codepoints
    - Important for MPLS
  - Requires only one metering/marking mechanism in the core instead of two
    - Important for data path performance
  - Incremental deployment step towards CL
- Focus of this Presentation: What do we lose?

Single-Marking: What do we lose?

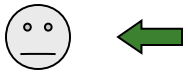
- Functionality:
  - Network-wide parameter configuration coordination: U
  - ECMP for termination
    - No, partial support with additional complexity at edge
  - ECMP for admission
    - Yes, with probes, but need many probes
- Performance-wise

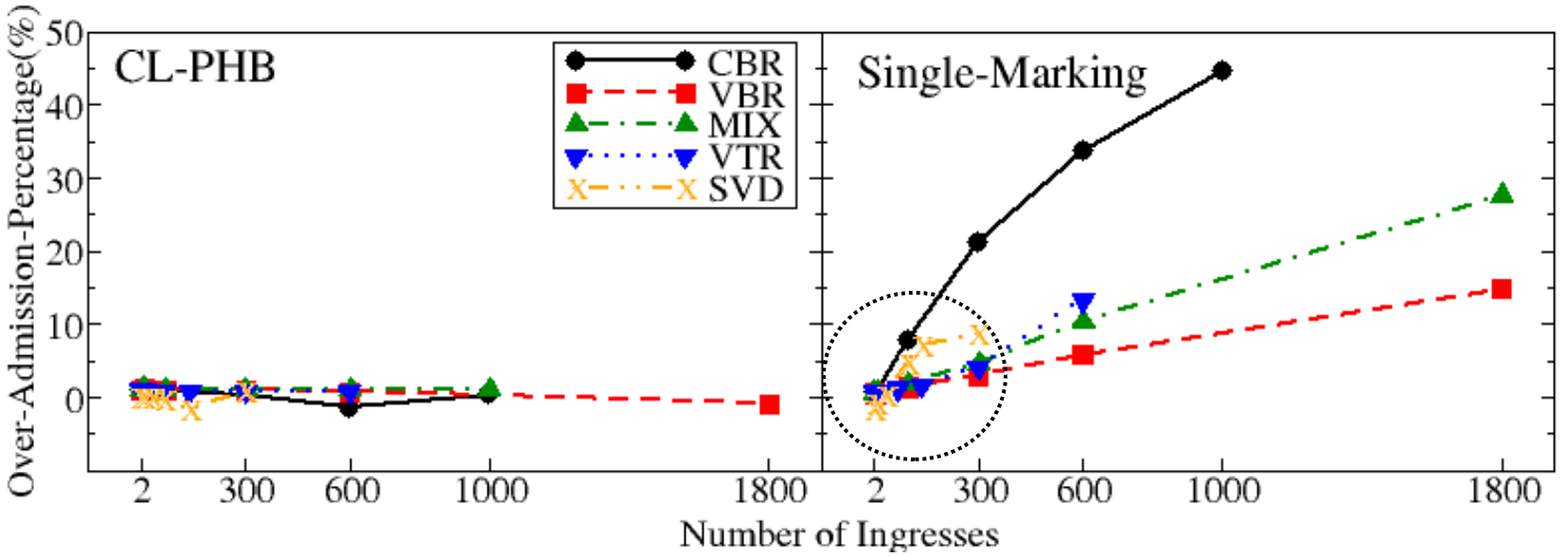
CL-PHB	Parameters	RTT	IE Aggregation	Multi Bottleneck
Admission				
Termination				

Single-Marking	Parameters	RTT	IE Aggregation	Multi Bottleneck
Admission				
Termination				

Single-Marking	Parameters	RTT	IE Aggregation	Multi Bottleneck
Admission				
Termination				

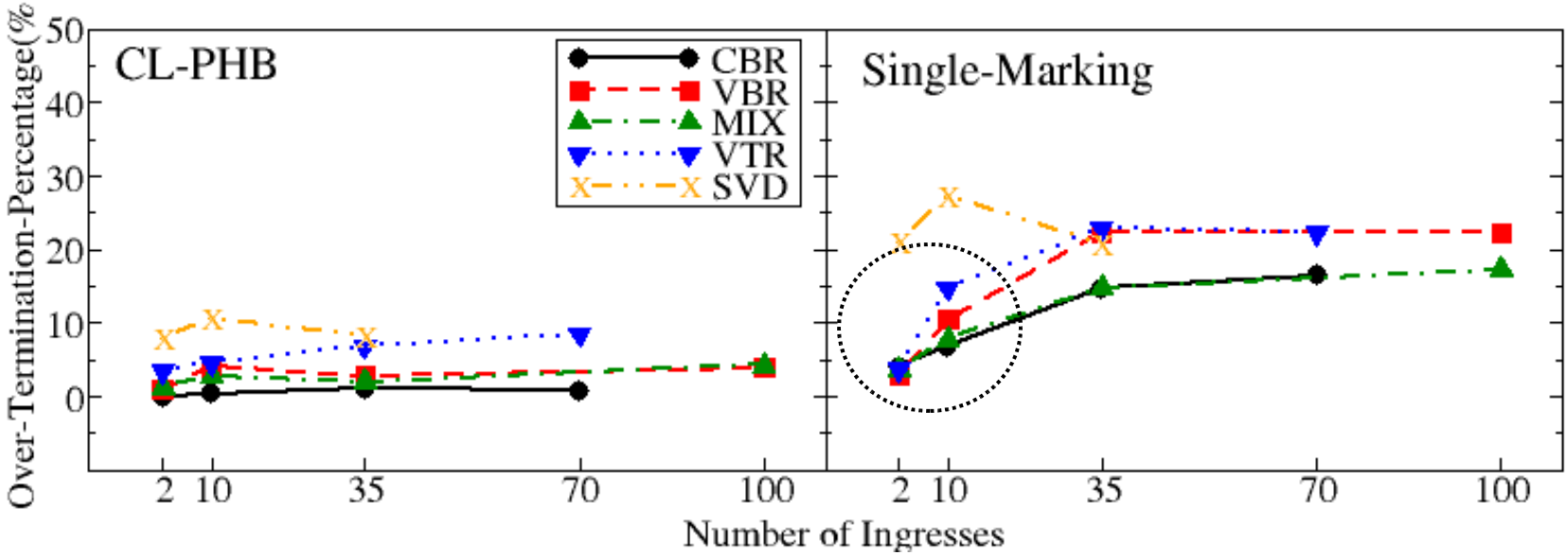
- Summary of all the 
  - Configuration Parameters
    - Insensitive for both admission and termination
    - Insensitive to RTT difference (absolute or relative)
  - RTT Difference
    - No effect with absolute difference for both admission and termination
    - Visible over-termination with relative difference, not significant
  - SM performs comparable to CL
    - “comparable” means error difference within 2-3%

Single-Marking	Parameters	RTT	IE Aggregation	Multi Bottleneck
Admission				
Termination				

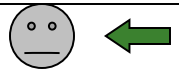


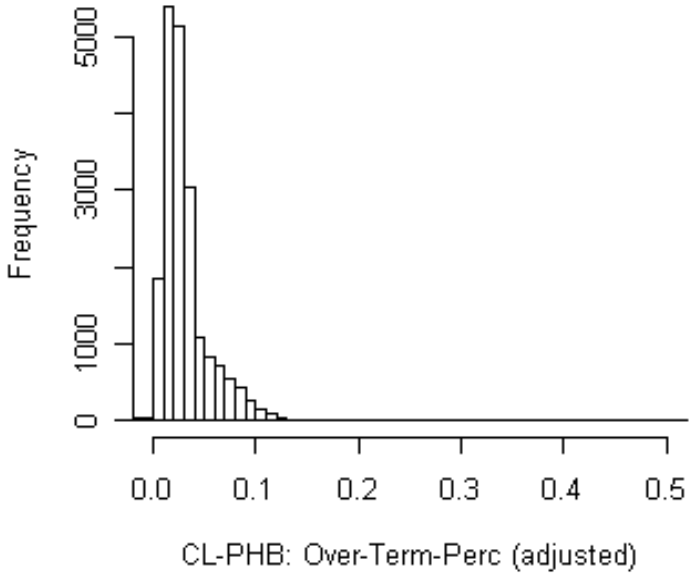
- Cause?
  - Uneven marking distribution among IE-Aggregate (Synchronization Effect)
- How Bad?
  - Significant **only when** IE-aggregation level is **very low**, < 10 flow/IE
  - Effect disappears with enough randomization of CBR

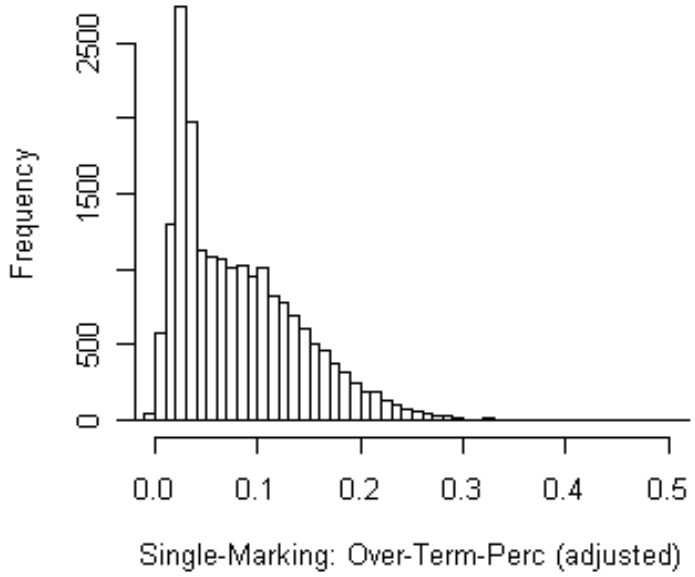
Single-Marking	Parameters	RTT	IE Aggregation	Multi Bottleneck
Admission				
Termination			 	



- Cause?
  - Again, uneven marking distribution among IE-Aggregates,
  - False termination, when traffic is close below the (implicit) termination threshold
- How Bad?
  - degree of IE aggregation needed for < 10% over-termination is ~50 to ~150 Flow/IE
- Smoothing can fix
  - Trade-off reaction time vs. accuracy

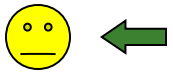
Single-Marking	Parameters	RTT	IE Aggregation	Multi Bottleneck
Admission				
Termination				





- Cause?
  - The multi-bottleneck “beat-down effect” is amplified, since Single-Marking is metering against admission-threshold
- How Bad?
  - Mostly within 20% error (vs. within 10% for CL-PHB)

- **Result for 1.2<U<2.0 (we consider it the case of practical importance)**
- **Result are compared to a “rate-proportionally fair” reference algorithm**

Single-Marking	Parameters	RTT	IE Aggregation	Multi Bottleneck
Admission				
Termination				

- Bottleneck Utilization
  - Works well in both SM and CL
- Fairness
  - Unfair to long-haul aggregates in both CL and SM
  - Degree of unfairness (current results, more to come)
    - No significant difference between SM and CL
    - Very sensitive to statistical variation of the flow arrival
    - For it to be significant, needs large demand overload for long duration

Single-Marking Performance Summary

- Applicability Area
  - At sufficient level ingress-egress aggregation performance of Single-Marking is comparable to CL-PHB
    - Admission: ~10 flow or more
    - Termination ~50-150 flow or more

- What is lost?
  - At low ingress-egress aggregation, Single-Marking is less accurate (over-admission & over-termination)
  - In the presence of multiple bottleneck, Single-Marking termination performs worse than CL-PHB

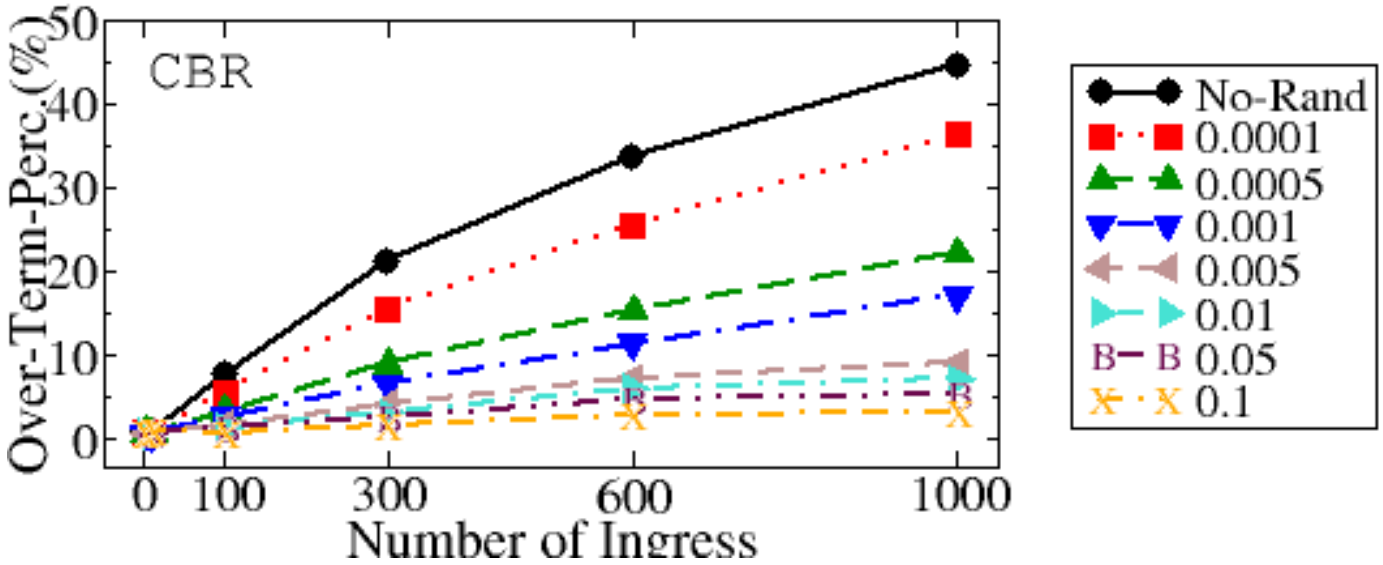
Thank you!

What's "Marking Synchronization"

- Cause: for periodic traffic and certain parameter combinations marking is not well distributed among flows sharing the bottleneck
  - some flows are always marked and some are never marked
  - most relevant for CBR, but visible for near-CBR portions of other traffic types

- Relevant only to excess-rate token bucket marking/metering when ingress-egress aggregation is low
  - Detrimental to excess-rate admission: overadmission
  - Beneficial to termination: less over-termination than theoretical worst case

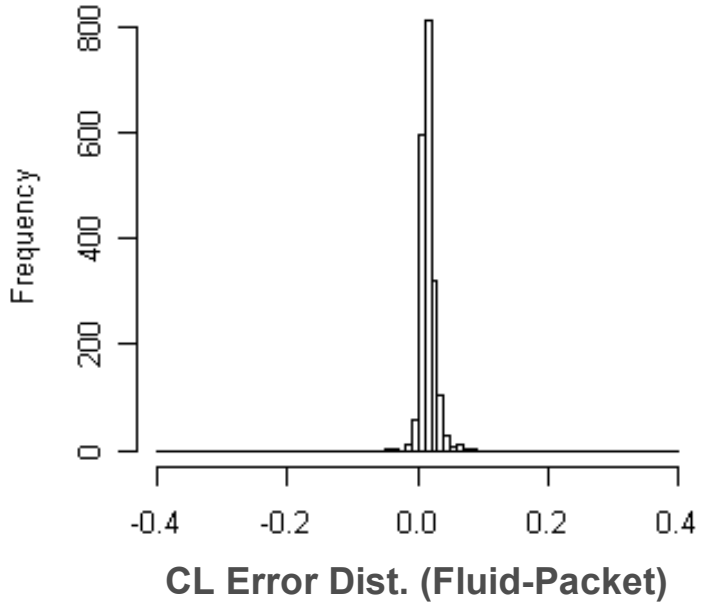
Evaluation Details
IE-Aggregation Admission

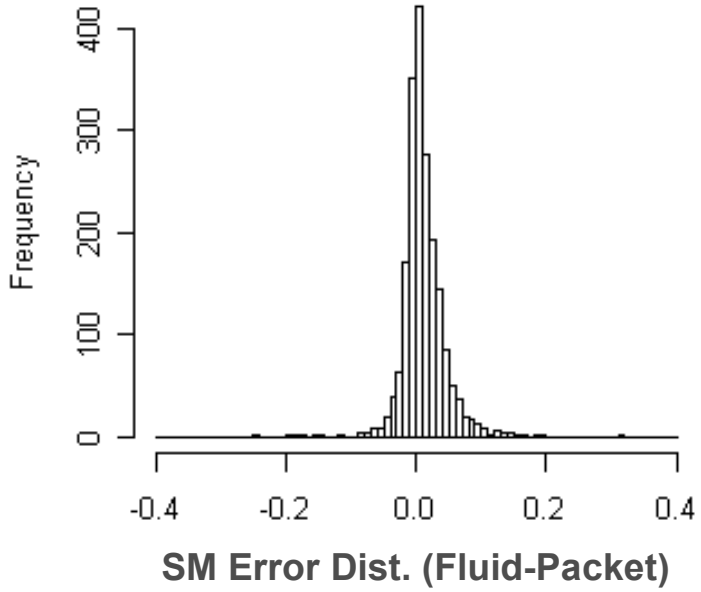


- With enough randomization, SM performs comparable to CL
  - Graph above for CBR, other traffic types show similar

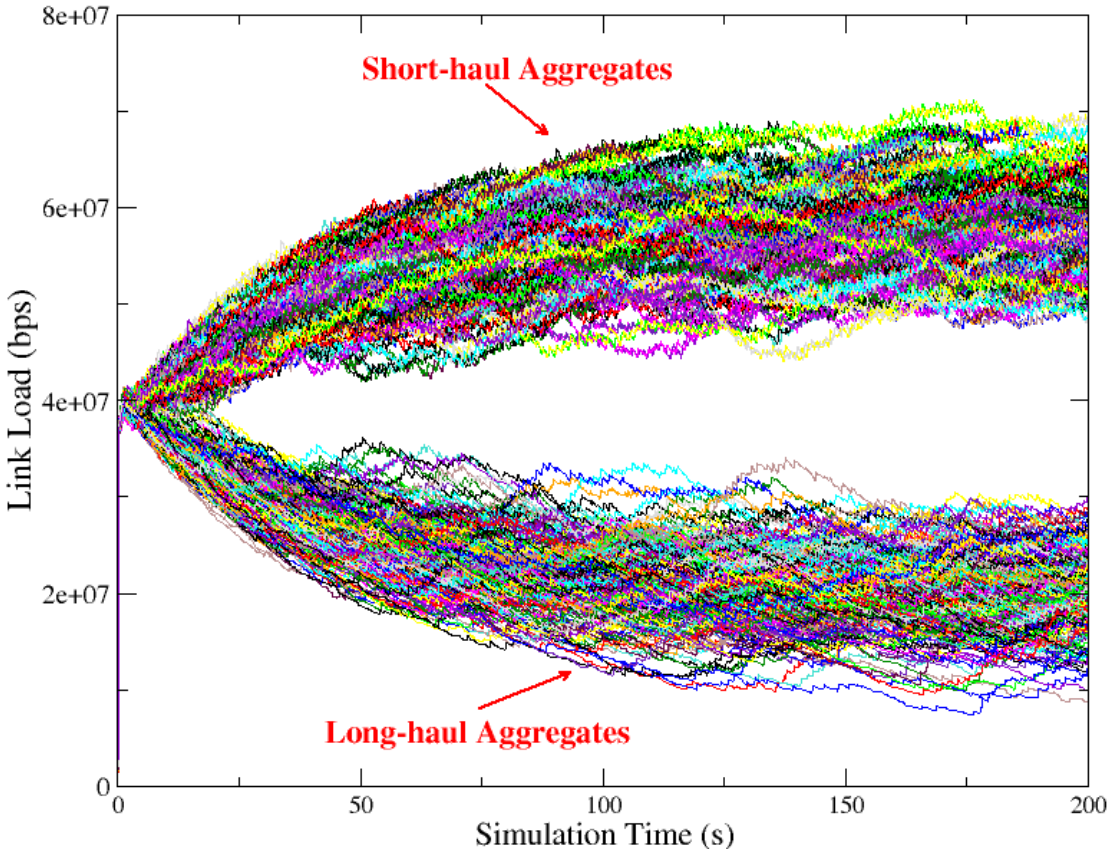
Evaluation Details
Fluid vs. Packet

- The error between Fluid and Packet Simulation is relatively contained.





Evaluation Details
Multi-bottleneck Admission



250 packet-level SM simulations, with exact same parameter setting and traffic load (PLT2, 5x overload)

- CL shows similar trend

It shows statistical variations of flow arrival have a strong effect on the degree of unfairness