

Some Distributed Systems and Networks Research Examples

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Students @ U of C, June 7, 2018



Research overview: Niklas Carlsson

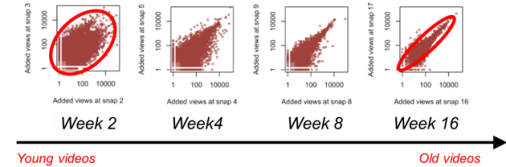
Design, modeling, and performance evaluation of distributed systems and networks



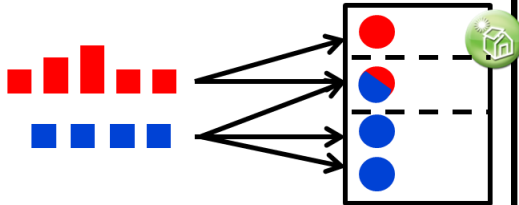
Scalable content delivery



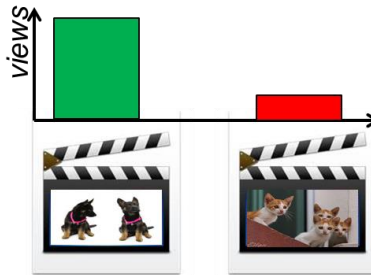
Tomorrow's streaming



Popularity dynamics



Efficiency and sustainability



Characterization, analytics, modeling



Network security

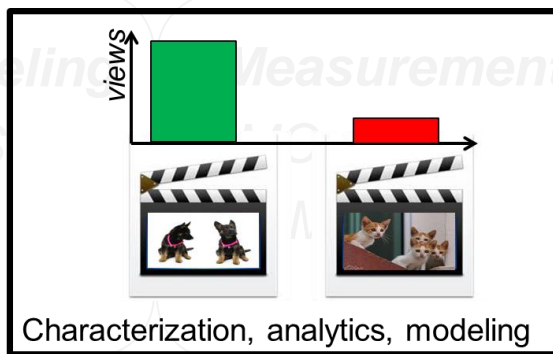
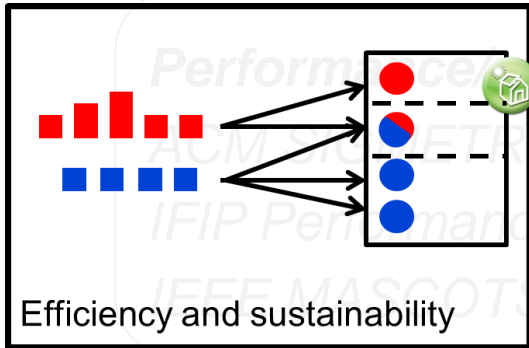
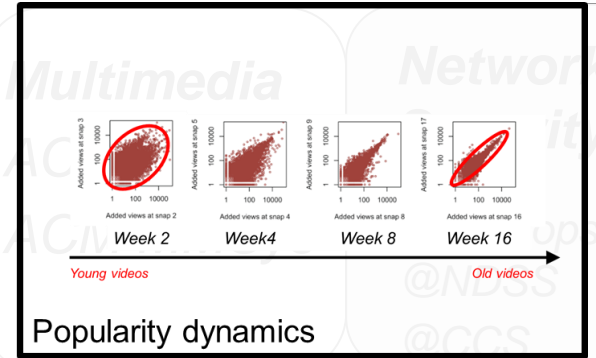
Services: E.g., content delivery and other distributed or networked services

Goals: Better understand, model, design, optimize, and secure

Methodologies: E.g., measurement, mathematical modeling, optimization, system design, real-world experiments, data analytics, statistical methods

Research overview

Design, modeling, and performance evaluation of distributed systems and networks

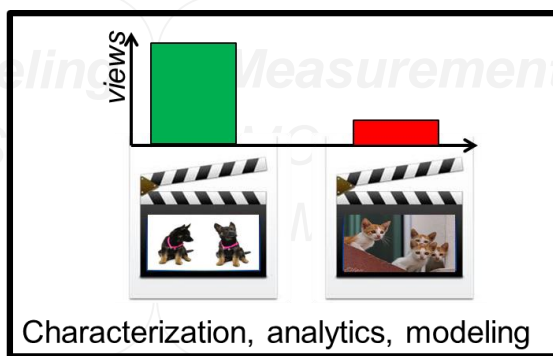
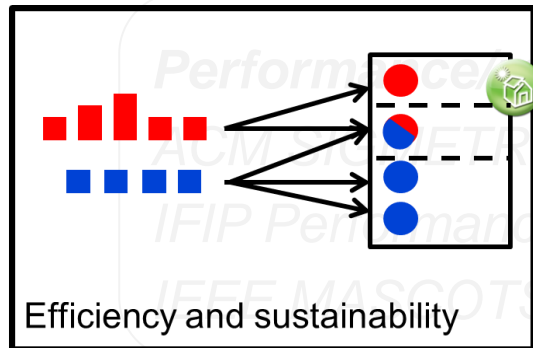
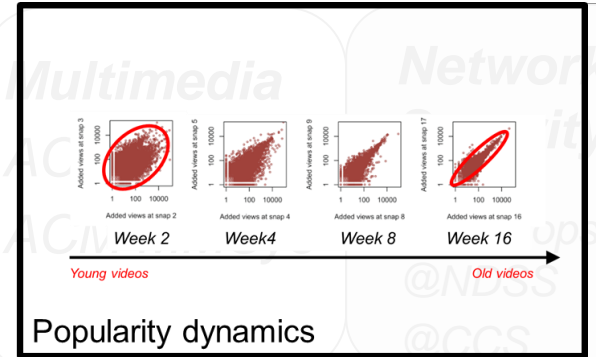


Other current topics: Beyond 5G, networked machine learning, fake news, information propagation, cache optimization, popularity dynamics, ...

Communication Magazine, IEEE Internet Computing, IEEE Network, ... (more) ...

Research overview

Design, modeling, and performance evaluation of distributed systems and networks



Also many top-tier journals: E.g., IEEE Trans on Parallel and Distributed Systems, IEEE/ACM Trans. on Networking, IEEE Trans. on Multimedia, Performance Evaluation, ACM Trans. on Web, ACM Trans on Internet Technologies, IEEE Communication Magazine, IEEE Internet Computing, IEEE Network, ... (more) ...

Examples include ...

Research overview

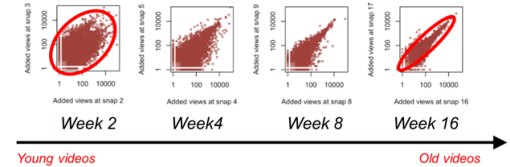
Design, modeling, and performance evaluation of distributed systems and networks



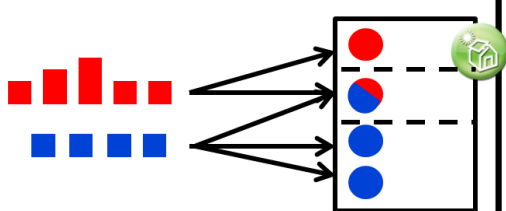
Scalable content delivery



Tomorrow's streaming



Popularity dynamics



Efficiency and sustainability



Characterization, analytics, modeling



Network security



... p2p ...

Mostly in the past ...

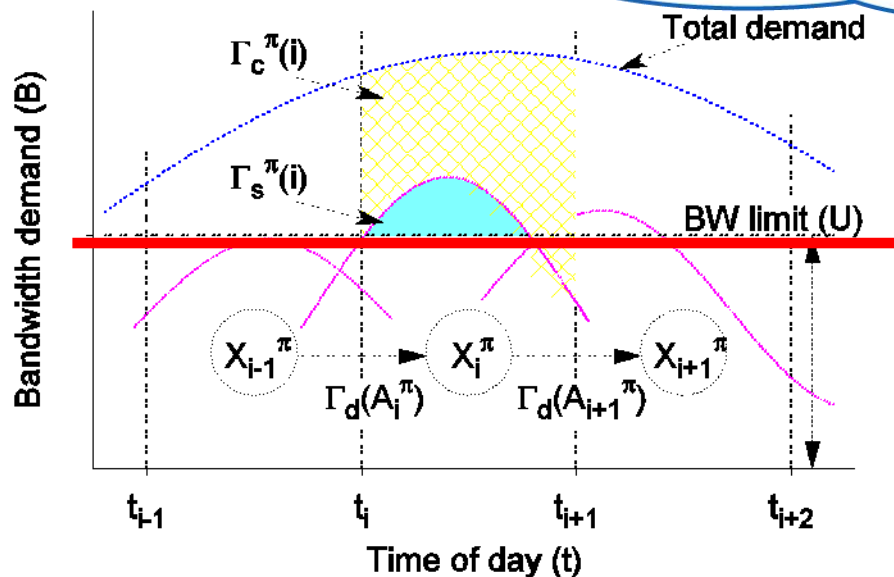
Many good papers ...



... cost-efficient delivery ...

	Bandwidth	Cost
Cloud-based	Elastic/flexible	\$\$\$
Dedicated servers	Capped	\$

How to get the best of two worlds?





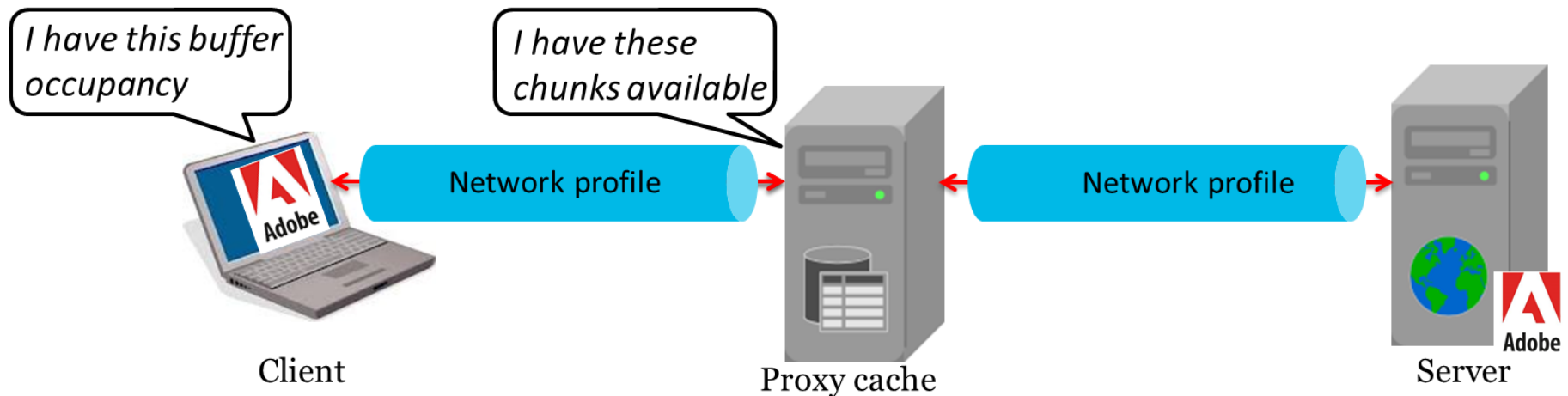
Scalable content delivery

... determine who should serve who ...



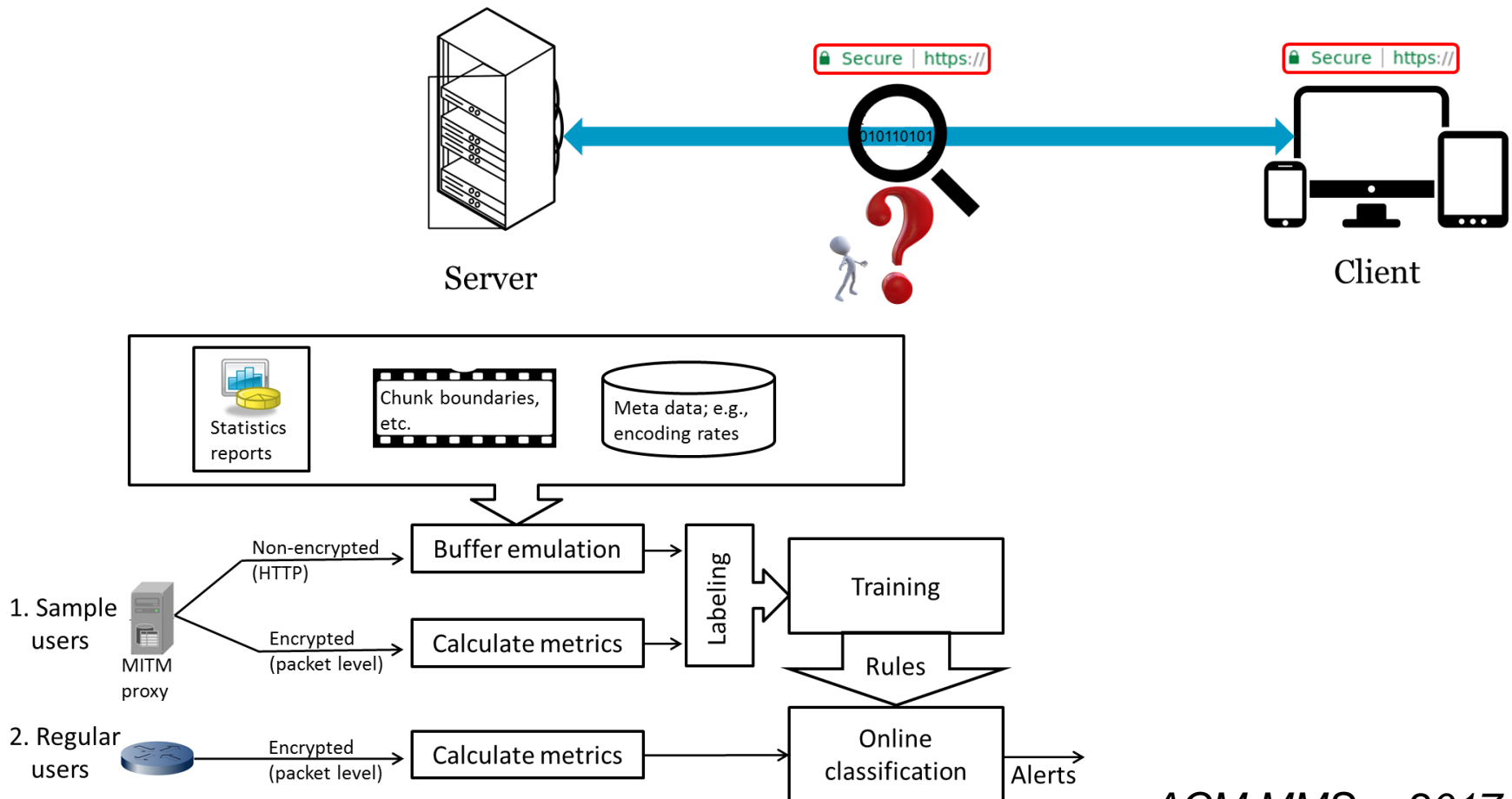


... HAS/DASH-aware proxies ...





... BUFFEST ...





... cap-based optimizations ...

... see paper ...

Research overview

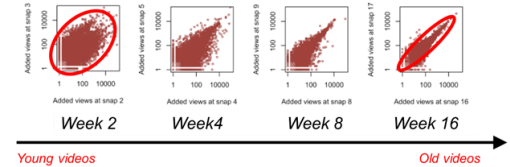
Design, modeling, and performance evaluation of distributed systems and networks



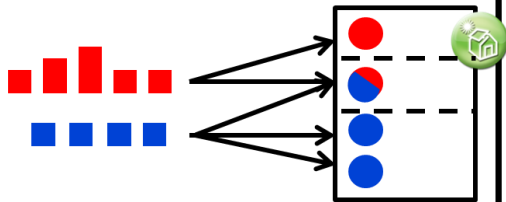
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Popularity dynamics



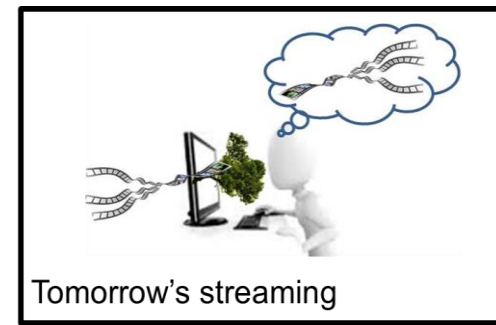
Efficiency and sustainability



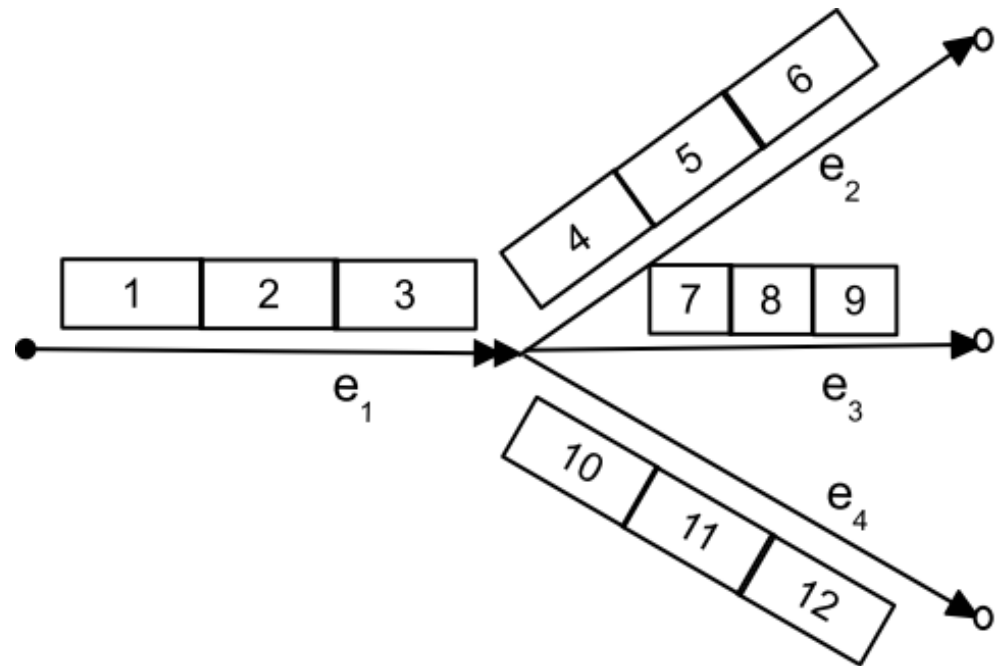
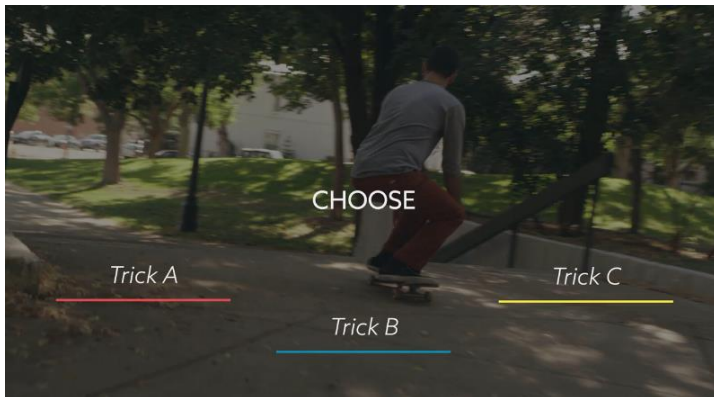
Characterization, analytics, modeling



Network security



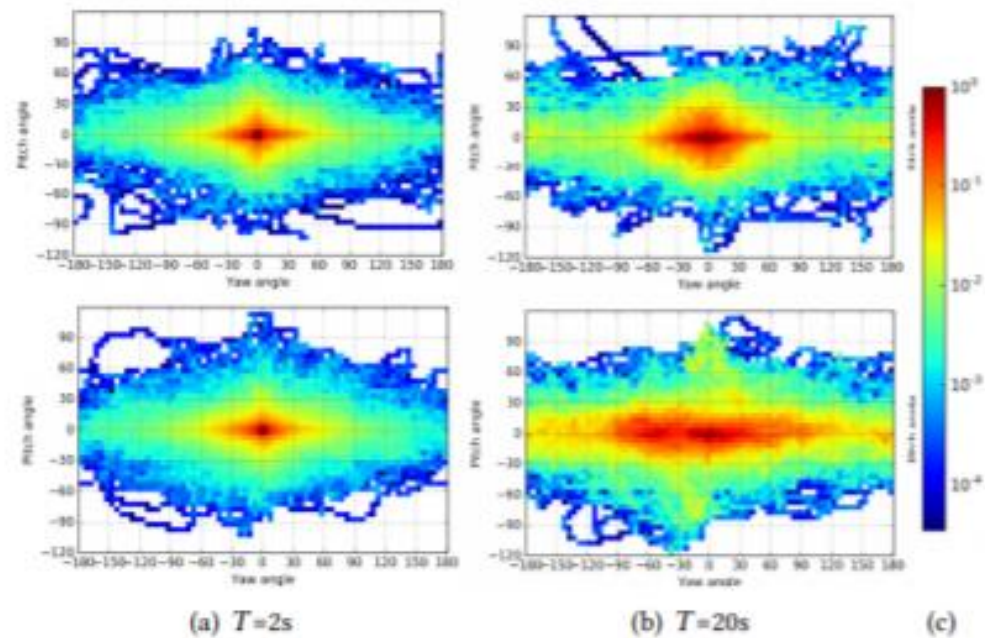
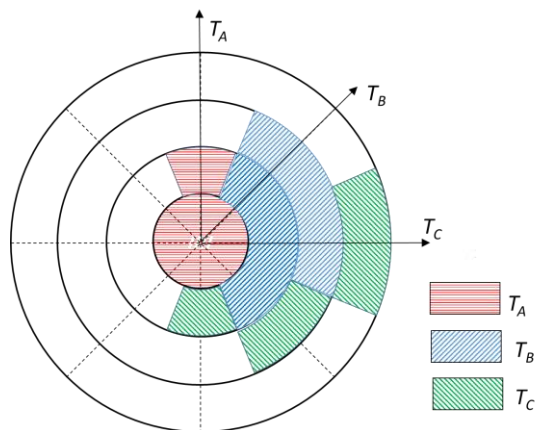
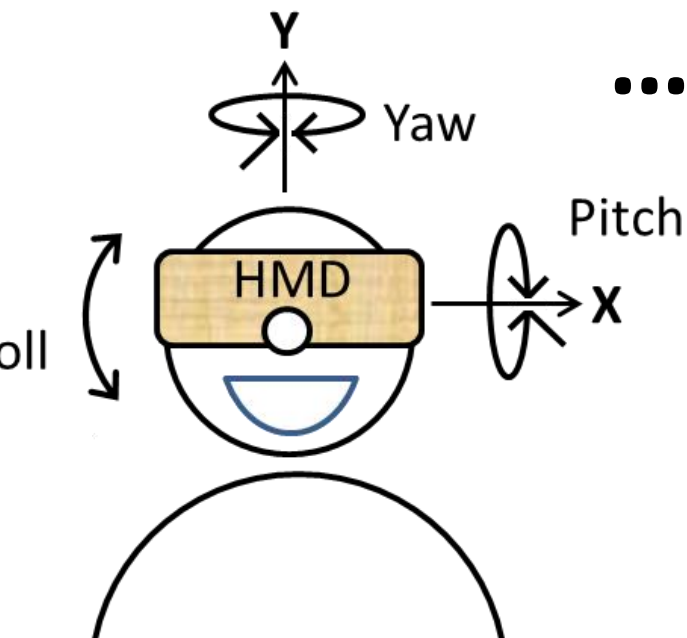
... branched video ...



ACM MM 2014
ACM CCR 2013



... 360 video ...



Research overview

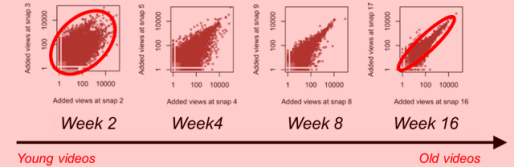
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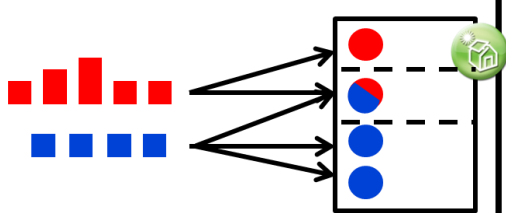
Scalable content delivery



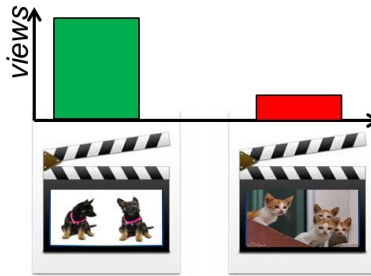
Tomorrow's streaming



Popularity dynamics



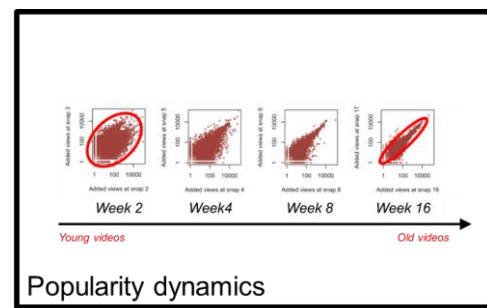
Efficiency and sustainability



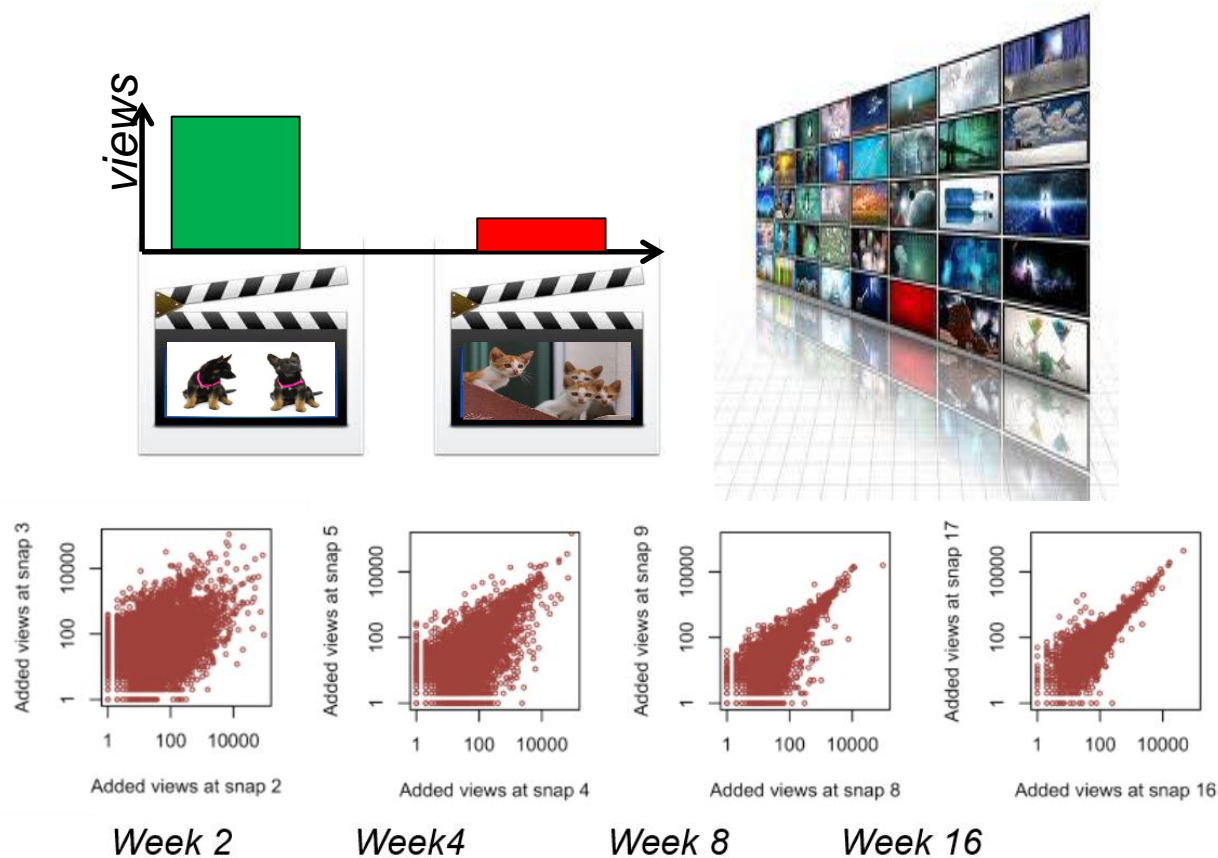
Characterization, analytics, modeling



Network security

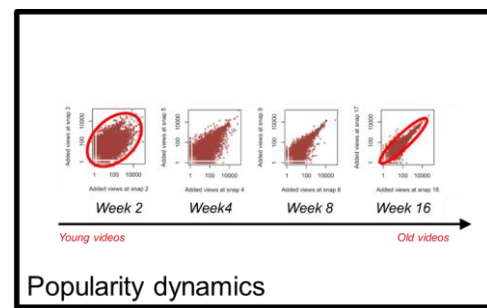


... model+understand popularity ...

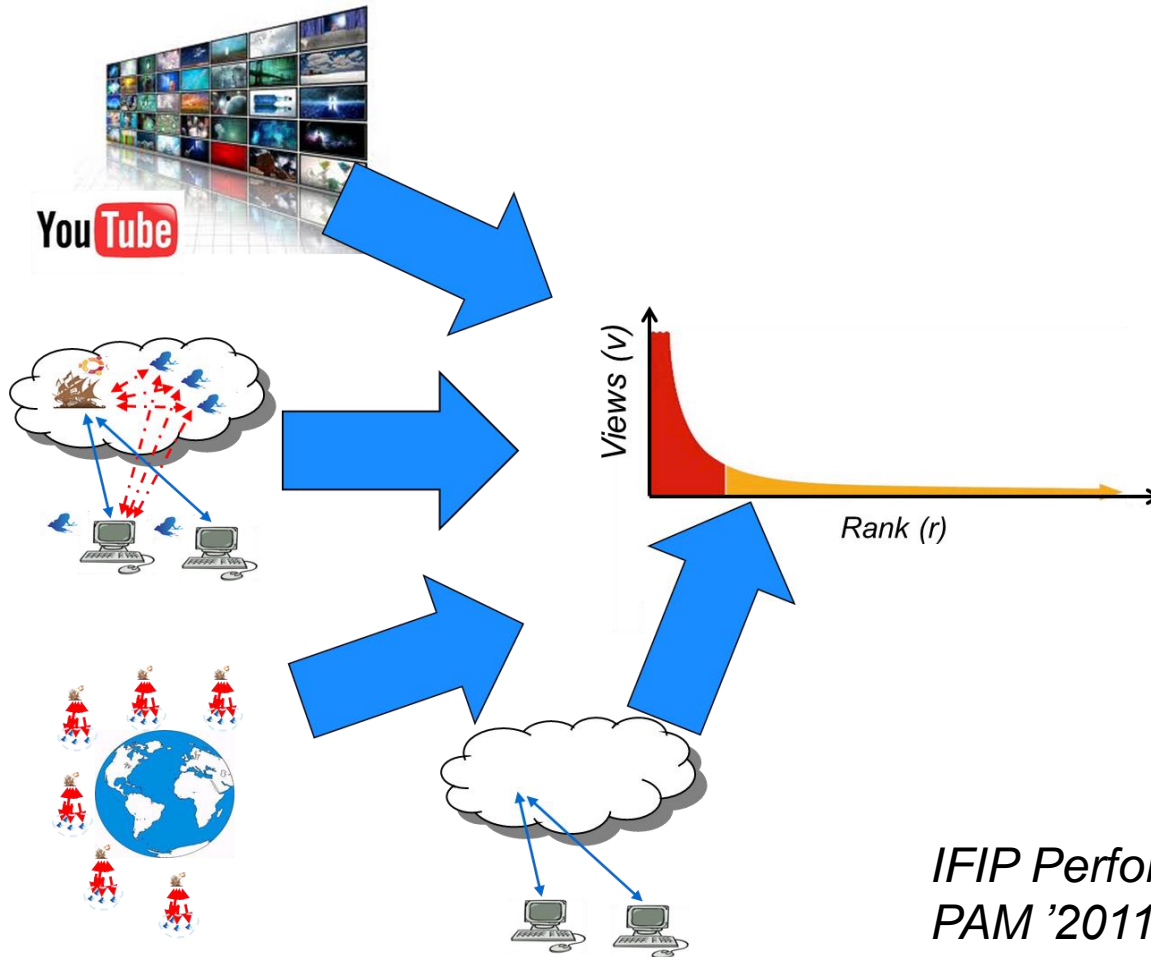


ACM KDD 2012

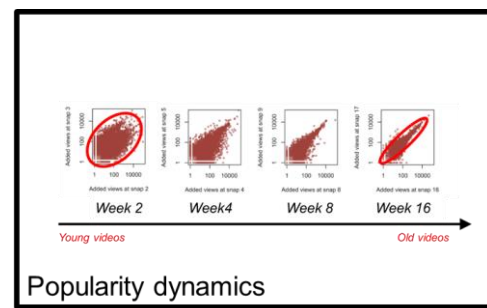
IFIP Performance 2011



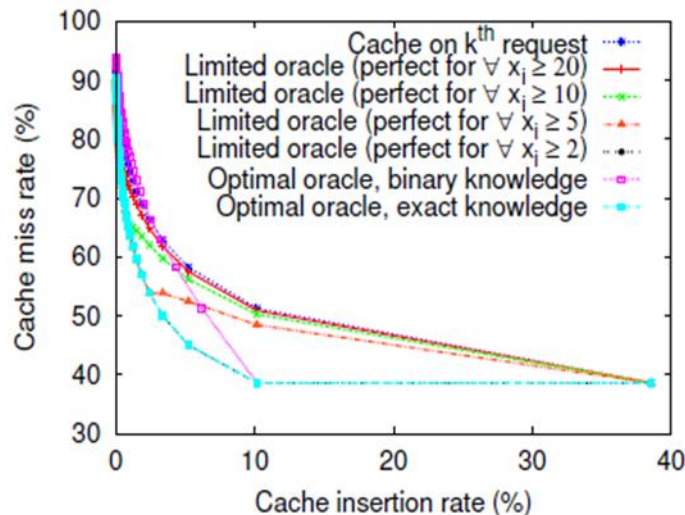
... popularity dynamics and tails ...



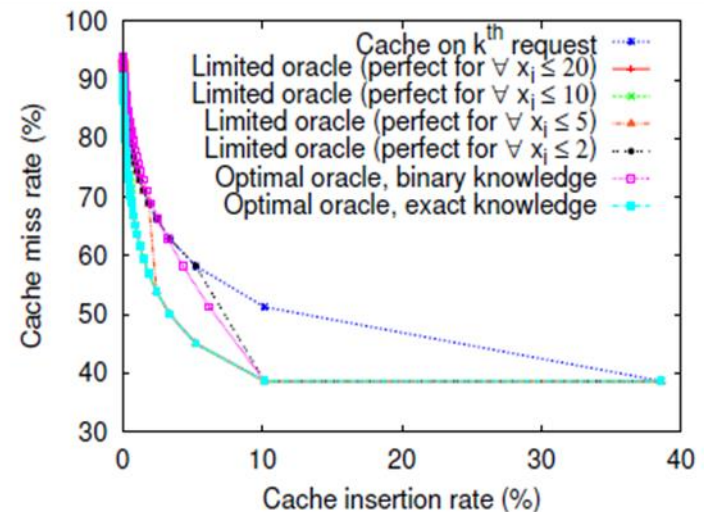
*IFIP Performance 2011, IPTPS 2010,
PAM '2011, 2 x ACM TWEB 2011,
IEEE Network 2013, ...*



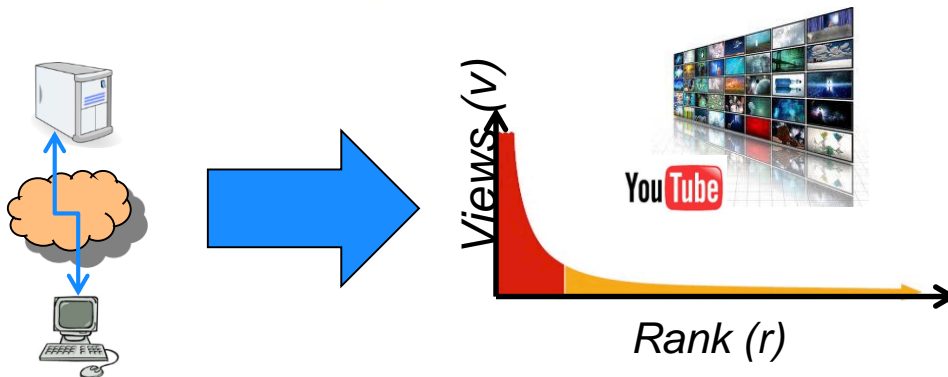
... long tails and caching ...



(a) Top-hitter predictor



(b) One-timer predictor



IEEE TPDS 2017
IFIP Performance 2018
(arXiv 2018, ...)

Research overview

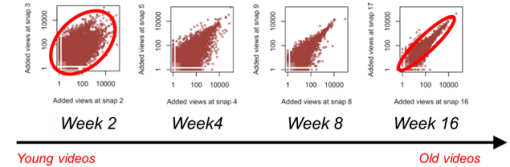
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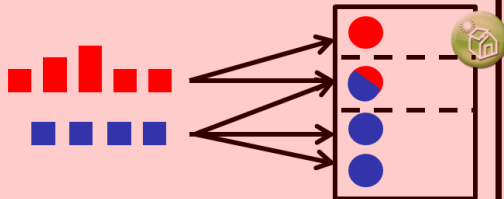
Scalable content delivery



Tomorrow's streaming



Popularity dynamics



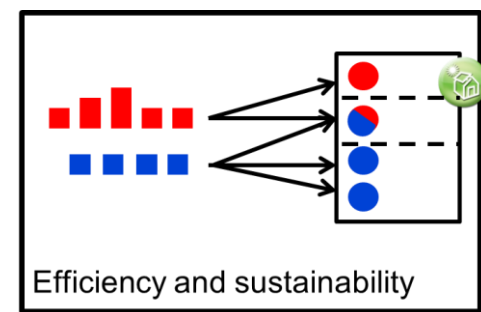
Efficiency and sustainability



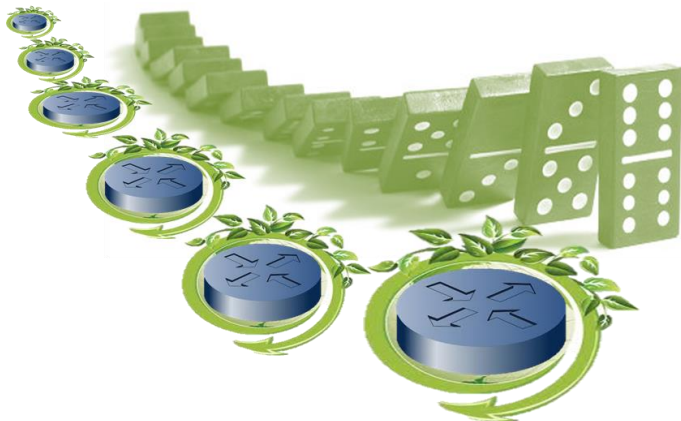
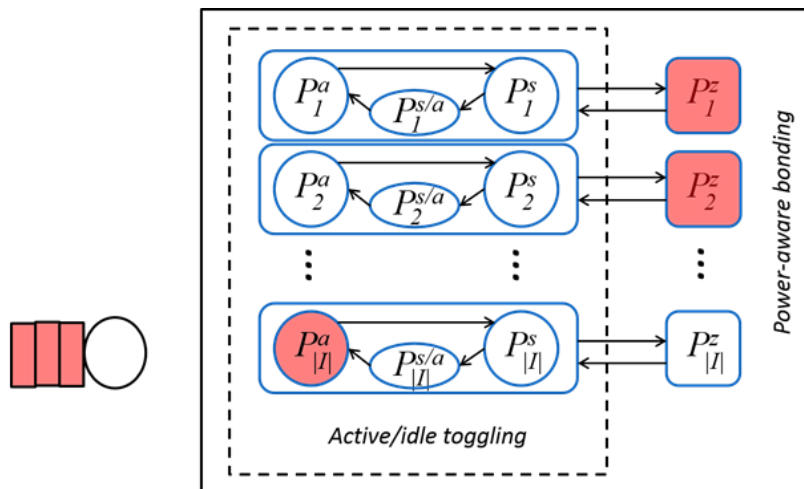
Characterization, analytics, modeling



Network security



... energy efficient routers/servers ...



ACM/SPEC ICPE 2011,
2013, 2015, 2016

Research overview

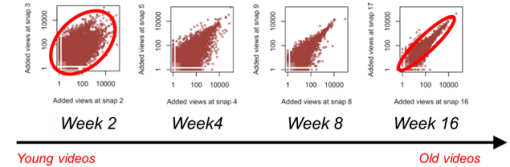
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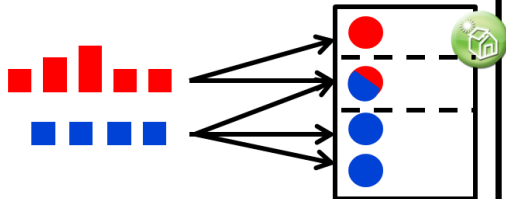
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Popularity dynamics



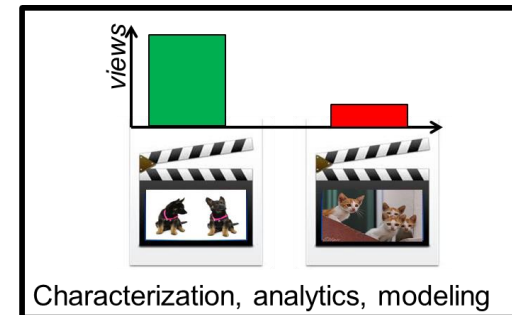
Efficiency and sustainability



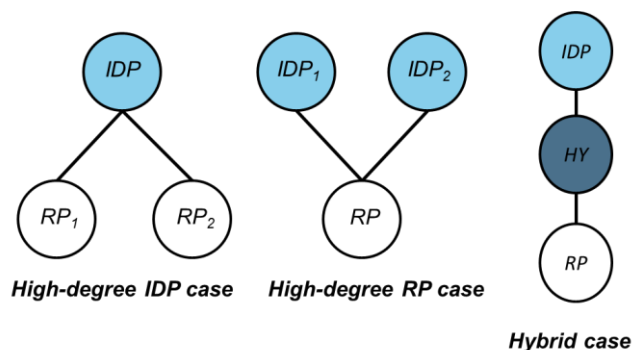
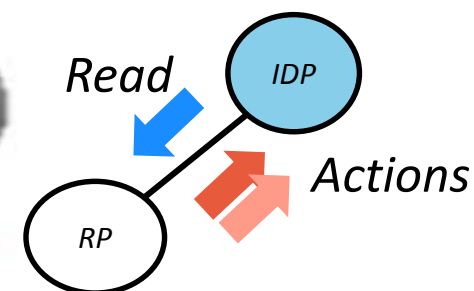
Characterization, analytics, modeling



Network security



... third-party authentication ...



IEEE IC 2016
IFIP SEC 2015
PAM 2014

Research overview

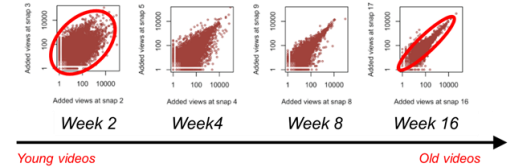
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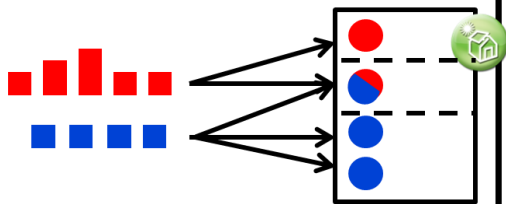
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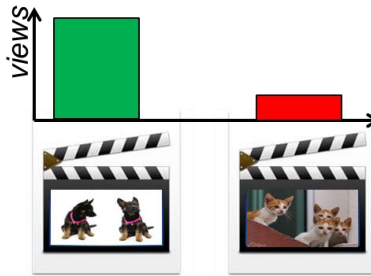
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Efficiency and sustainability



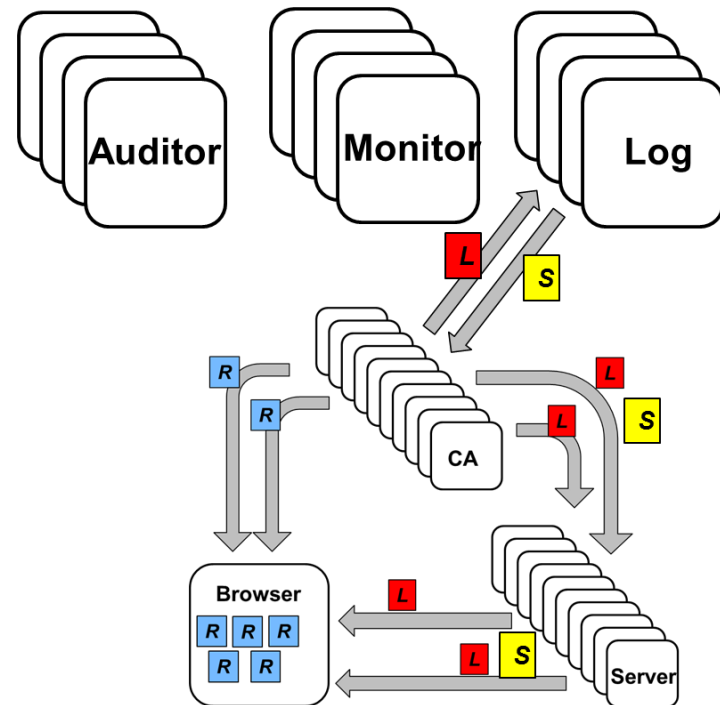
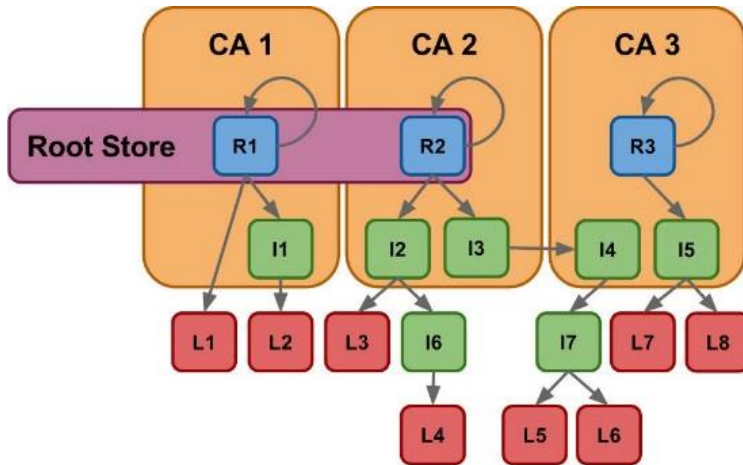
Characterization, analytics, modeling



Network security



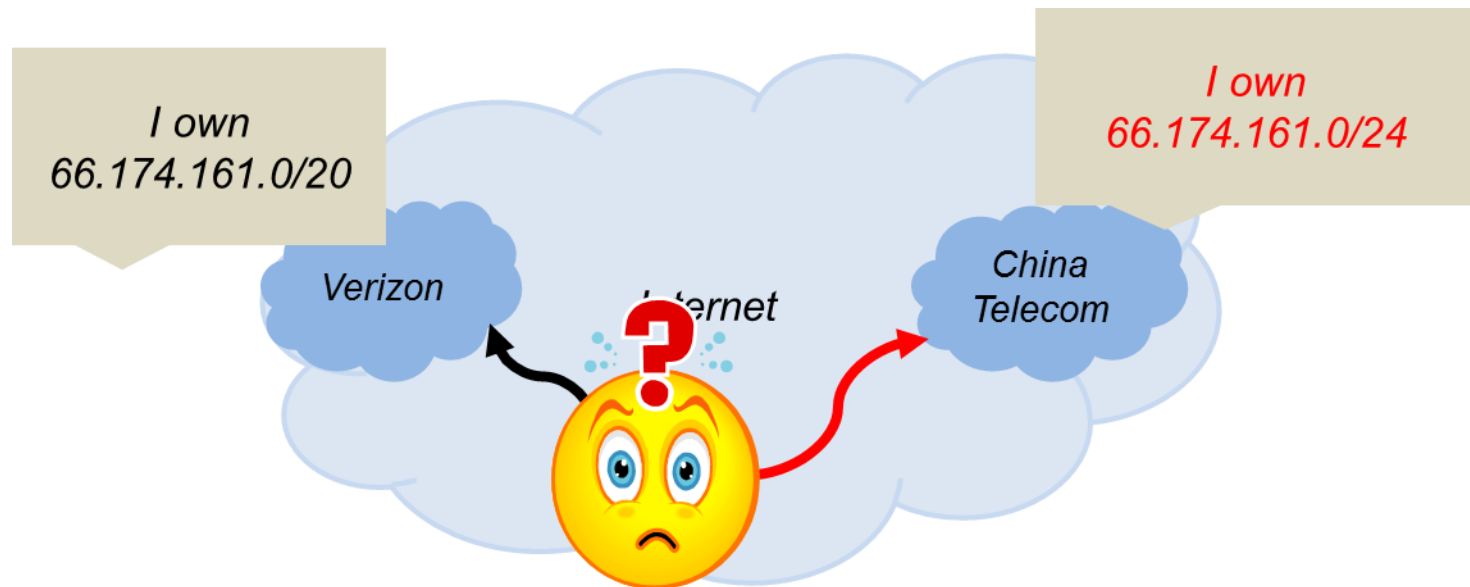
... HTTPS trust landscape + CT ...



IEEE ComMag 2017
PAM 2018
PAM 2017



... securing wide-area routing.



IFIP Networking 2016
PAM 2013

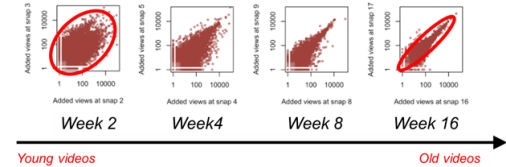
Thanks for listening!



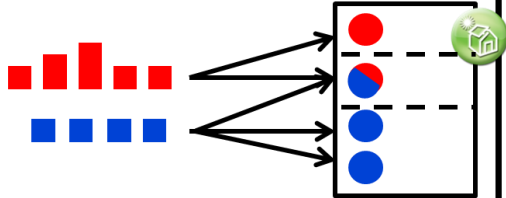
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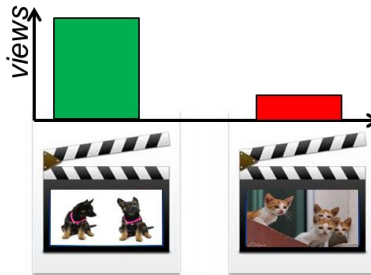
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