

ERRANT: Realistic emulation of radio access networks



POLITECNICO
DI TORINO

DET

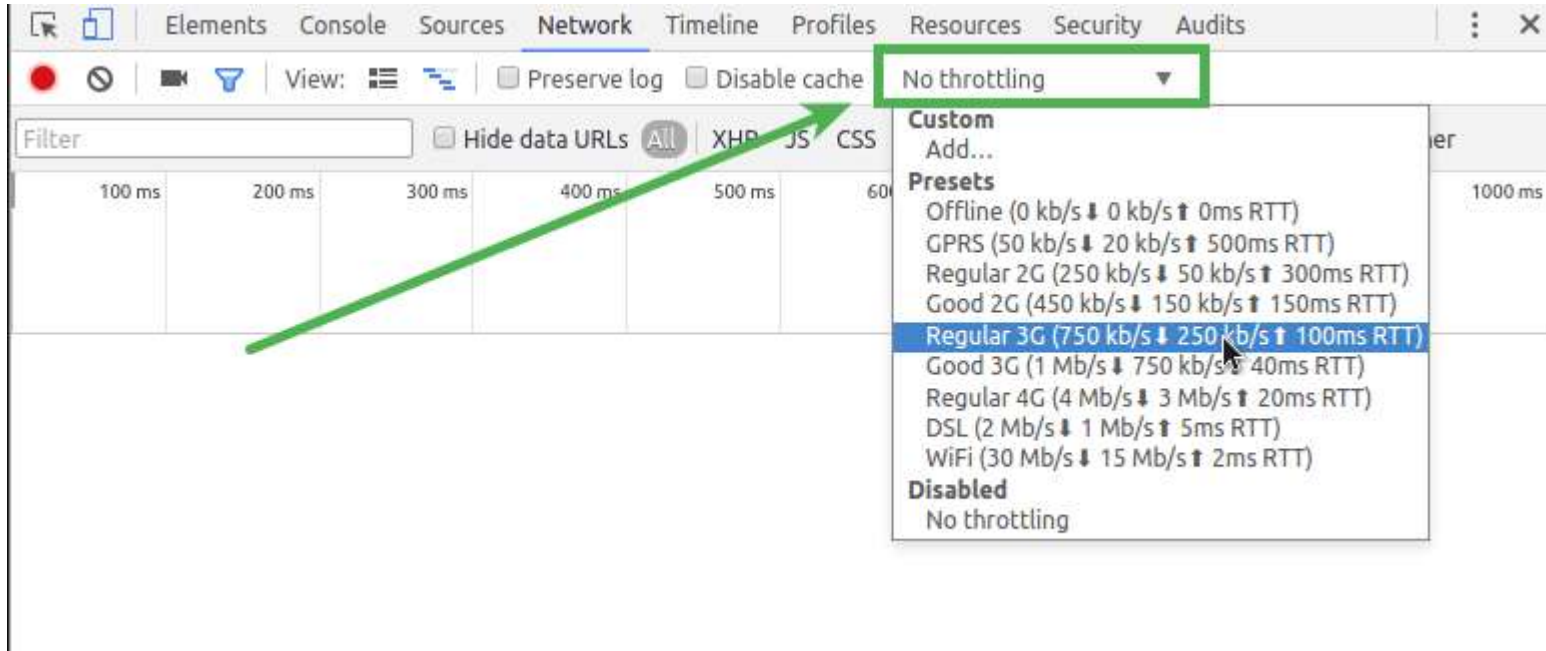
Department of Electronics and Telecommunications

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Open Source at: <https://github.com/marty90/errant>

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107289

Motivation



	3G			3G Slow			3G Fast			4G		
	D	U	L	D	U	L	D	U	L	D	U	L
Chrome [11]	750 k	250 k	100	-	-	-	1 M	750 k	40	4 M	3 M	20
WebPageTest [12]	1.6 M	768 k	300	400 k	400 k	400	1.6 M	768 k	150	12 M	12 M	70
BrowserTime [13]	1.6 M	768 k	300	780 k	330 k	200	1.6 M	768 k	150	-	-	-
ATC [3]	780 k	330 k	200	850 k	420 k	190	-	-	-	-	-	-
Android Emulator [14]	14 M	5.76 M	0	384 k	384 k	35-200	-	-	-	173 M	58 M	0
NLC [2]	780 k	330 k	100	-	-	-	-	-	-	51.2 M	10.24 M	65

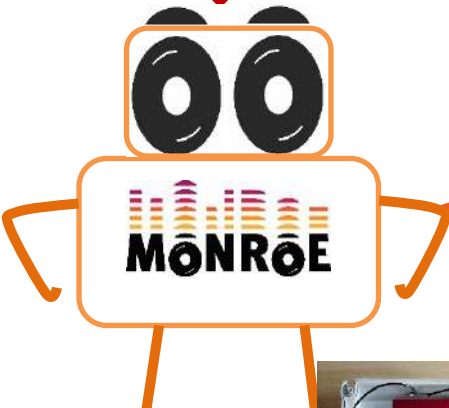


MONROE System

User Access & Scheduling



**Experiment
Deployment**



Operator 1



Operator 2



Operator 3



INTERNET

**Experimentation on
Commercial Mobile Networks**



VICO
System 0

DET
Department of Electronics and Telecommunications

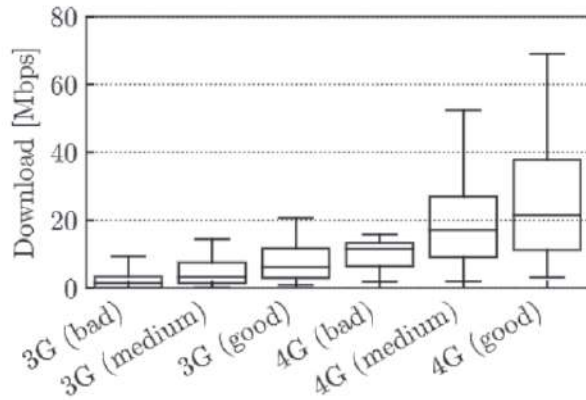
Geographical Distribution

MONROE Platform

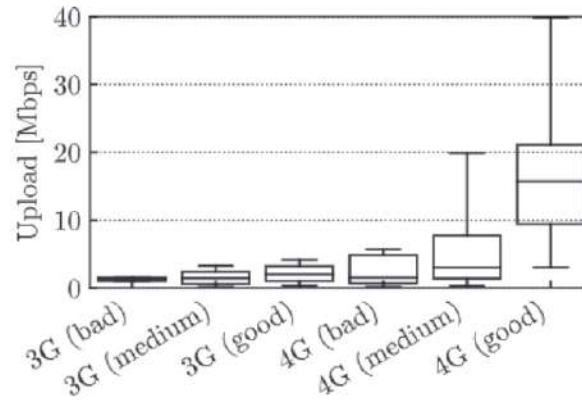
120 nodes in 6 countries
27 mobile operators



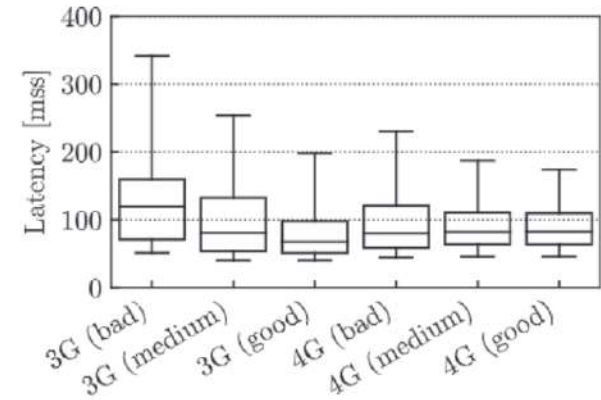
Speed Test Measurements



(a) Download.



(b) Upload.



(c) Latency.

100 k Speed Tests

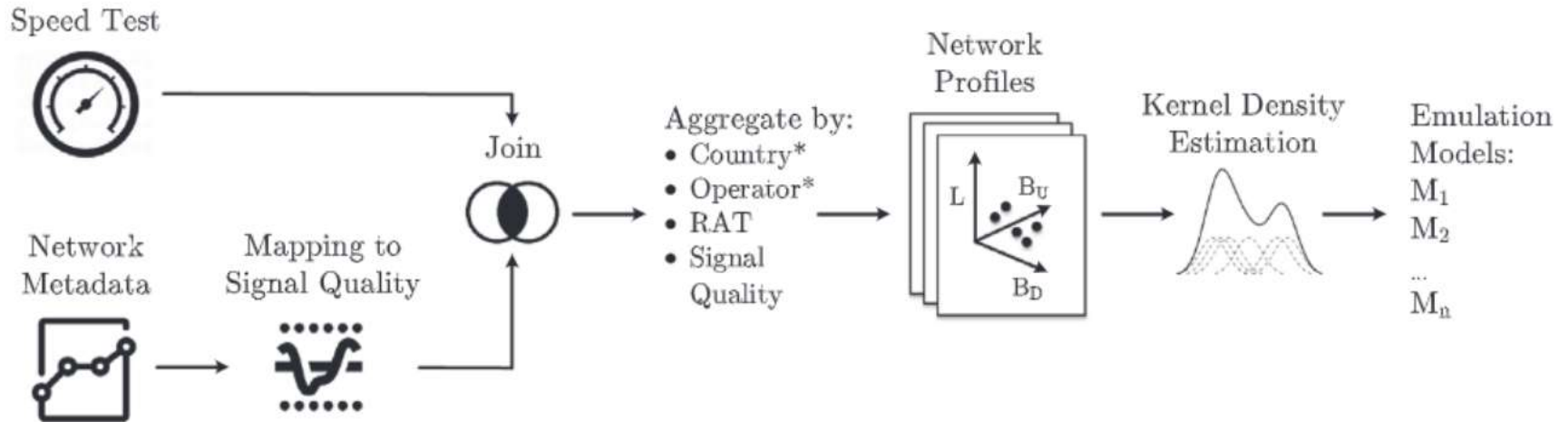
Each speed tests reports:

- Downlink, Uplink and Network Latency
- Node Metadata:
 - Operator
 - Signal Strength
 - Radio Access Technology (3G/4G)

From *Khatouni, Ali Safari, et al. "Speedtest-like measurements in 3g/4g networks: The monroe experience." 2017 29th International Teletraffic Congress (ITC 29). Vol. 1. IEEE, 2017.*



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32 Profiles

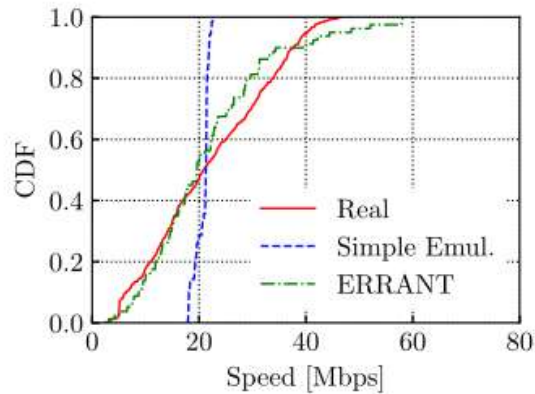
- 4 Network Operators
- 2 Countries
- Different RATs, Signal Strength

Each profiles is described with a multivariate distribution of

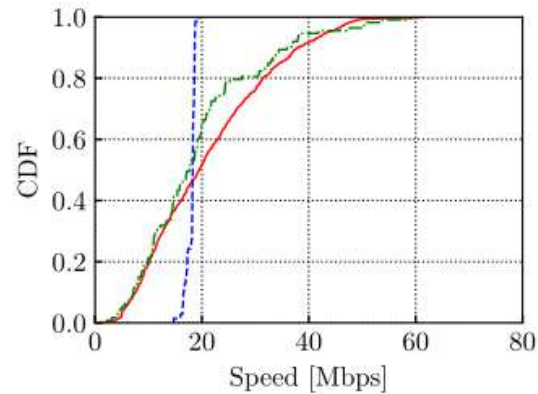
- Downlink, Uplink and Latency
- Estimated via KDE



ERRANT is accurate



(a) Telia (Sweden), ordinary 4G.



(b) Telenor (Sweden), good 4G.

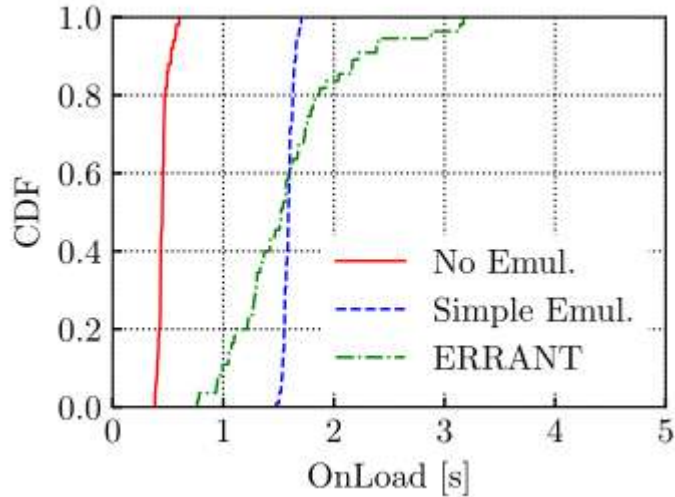
Bulk download of HTTP objects

- Under Real Mobile Networks
- With ERRANT
- Using static tc-netem shaping

With ERRANT, one obtains similar outcomes to real experiments
Static TC Netem cannot recreate variability

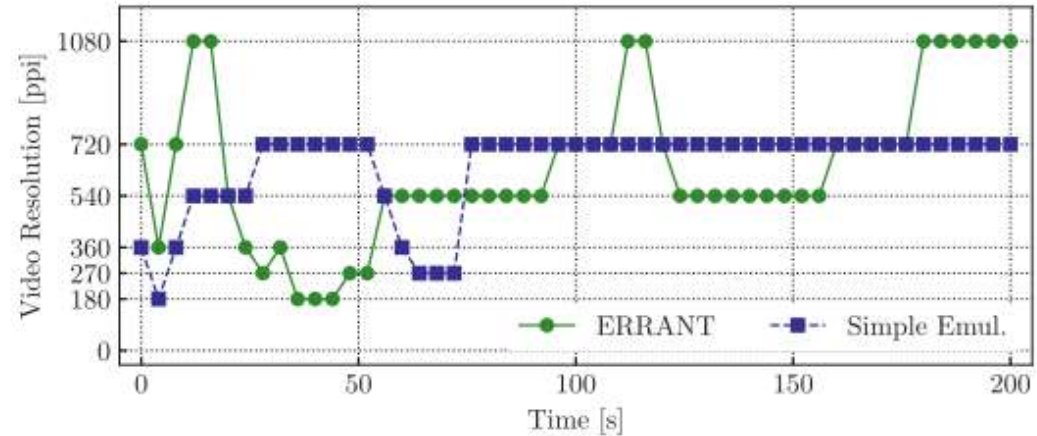


ERRANT: applications



Wikipedia OnLoad time
Under Telia, Sweden, Good 4G

ERRANT recreates accurate
average behavior and **variability**



Dynamic Adapting Streaming over HTTP
Under Telia, Sweden, Good 4G

ERRANT triggers phenomena **like Bitrate switches**, not observable with static tc-netem shaping



Thank you for your attention

Perguntas
Fragen Domande Galdera
Otázky
Questions
Spørgsmål Pertanyaan kysymykset
Frågor Spørsmål Cwestiynau
вопросы Preguntes Sorular
Въпроси
Vragen
Pytania

