A First Look at Performance in Mobile Virtual Network Operators

Authors: Fatima Zarinni, Ayon Chakraborty, Vyas Sekar, Samir R. Das, Phillipa Gill
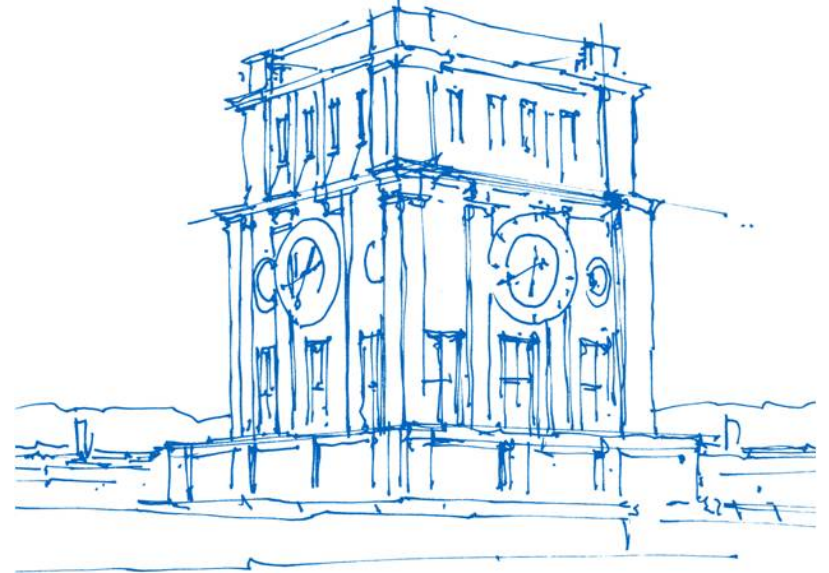
Presented by:

Daniel Götz

Technische Universität München

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What are Mobile Virtual Network Operators?

- Most of our existing cellular infrastructure is owned by few big cellular operators.

- Mobile Virtual Network Operators (MVNOs) are operating on top of the existing cellular infrastructure.

- They have only little licensing cost for the infrastructure.

- MVNOs try to differentiate from traditional providers by differing their services (e.g. better pre-paid plans).

- MVNOs exist since 2000 but they get really popular since around 2012.

Some German MVNO Examples.

What is it all about?

Problem with MVNOs: **Users are concerned about the cellular performance with MVNOs.**

- First systematic measurement study to shed light on the emerging phenomenon of MVNOs.

- Concerns can be found in forums e.g. like this comment: "Does Sprint have means of degrading service to Ting (and other MVNO) customers in favor of Sprint customers in a particular crowded cell?"

- Motivated by the growth of MVNOs.

- There is previous work in analyzing mobile performance there is no systematical analysis of MVNO performance. (At the time the paper was written).

- Hope to inspire future large scale research with this paper.

The Research Questions

The paper aims to answer three very clearly stated research questions:

- Does the performance vary across the MVNOs running atop the same base carrier? (e.g., is MetroPCS worse than Straight Talk given that they are both MVNOs running on T-Mobile network?)
- Do MVNOs perform worse compared to the base carrier in each case? (e.g., is H20 Wireless, an MVNO on AT&T network, worse than AT&T)?
- Are there differences across different MVNO families? (e.g., do all MVNOs in a family, say the T-Mobile family, show significantly worse performance than those in another family, say the AT&T family?)

# How did the MVNO Family setup in this research look like?

| Carrier	Type	Plan (all pre-paid except B)	$/Month
A	Base	Unlimited talk/text, 2.5GB data 4G	60
A1	MVNO	Unlimited talk/text, 2.5GB data 4G	45
A2	MVNO	Unlimited talk/text, 3GB data 4G	50
A3	MVNO	Unlimited talk/text, 2.5GB data 4G	60
B	Base	Unlimited talk/text, 2GB data 4G	65
B1	MVNO	Unlimited talk/text, 2.5GB data 4G	50
B2	MVNO	Unlimited talk/text, 2GB data 4G	50
B3	MVNO	Unlimited talk/text, 2GB data 4G	50

What was measured?

- Web access
- Video streaming
- Voice

➢ Application-specific quality-of-experience (QoE) was measured.

➢ Also factor analysis was done to correlate the observed application-level performance with network-level performance.

Web Browsing

- Several sample websites were chosen: YouTube, Amazon, Wikipedia, Twitter, Bing, and CNN.
- Websites were accessed in random order from different locations
- Page load time was measured as quality-of-experience measure
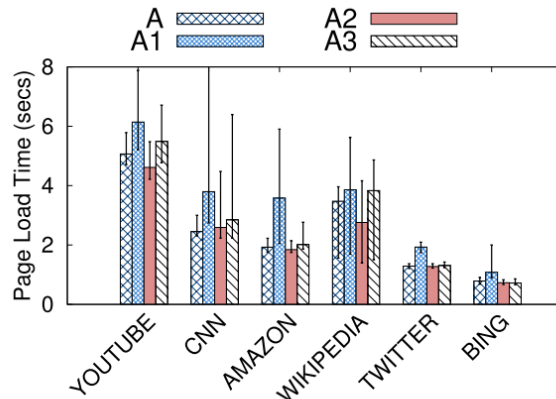
(a) MVNO family A
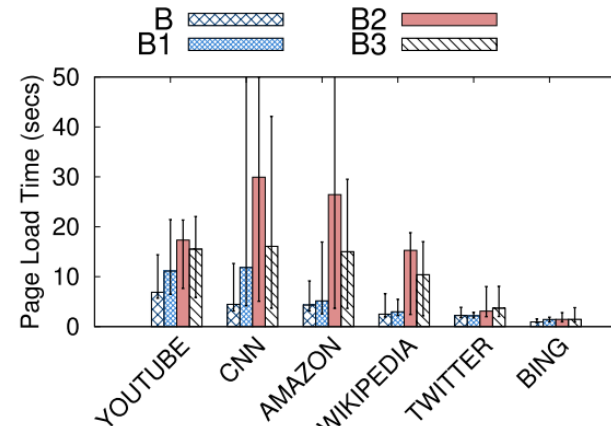
(b) MVNO family B

What are the key findings of the paper?

- The base carrier often performs better than the MVNOs and sometimes significantly so. For instance, some MVNOs over base carrier B fail to load a non-trivial (>=10%) fraction of YouTube video requests and can have up to 6-times worse page load time.
- There is significant diversity across MVNOs within the same MVNO family, for both the A and B MVNO families. For instance, often B2 performs considerably worse than B1 and B3 in MVNO family B.
- There are non-trivial differences between the two MVNO families; overall the MVNOs running atop A have better performance w.r.t the base carrier compared to their B counterparts.
- Finally, we see key differences across applications as well. While voice quality is largely similar across all MVNOs and base carriers, there is huge discrepancy in data performance both for web access as well as video streaming.

Limitations

- Choice of MVNOs is done with Google Trends –> there could be better measures, like total user numbers
- Names of MVNOs and base carriers are not published (business/research interests vs. transparency)

Outlined by the authors:

- Limited locations - all measurements are done in Long Island/New York

Thank you for your attention!