

Mobile Network Sharing Between Operators: A Demand Trace-Driven Study

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Outline

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Outline

Introduction

Data Available

Data
Coverage

Correlation

Time
Space

Assessing the
effectiveness

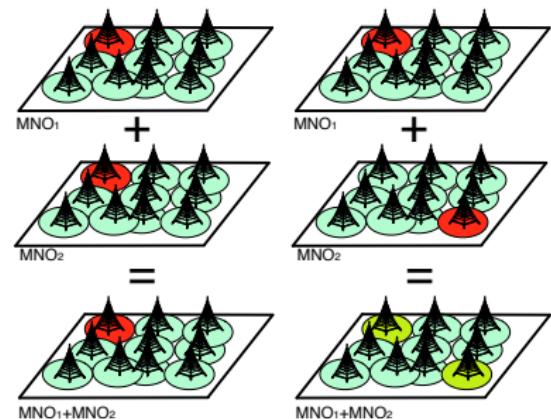
Results

Conclusion &
Future Works

- Introduction.
- Data.
- Correlation (time and space).
- Effectiveness of network sharing.
- Conclusion & future works.

Long story short

- Network sharing to reduce CAPEX and OPEX.
- When does resource sharing make sense?
- How to assess the effectiveness of network sharing?



Data Available

Data made available by two operators: Meteor & O2

- Transmitters' location spread throughout the Republic of Ireland (> 20.000).
- Coverage (approx.) & sectorization information.
- Detailed call records & data sessions (many million).
- Long observation time (weeks).
- Information on mobile device types usage (TAC codes > 3.000).

Limitations:

- Partial mobility information.
- Users precise location is unknown.
- Datasets have been collected at different time frame.

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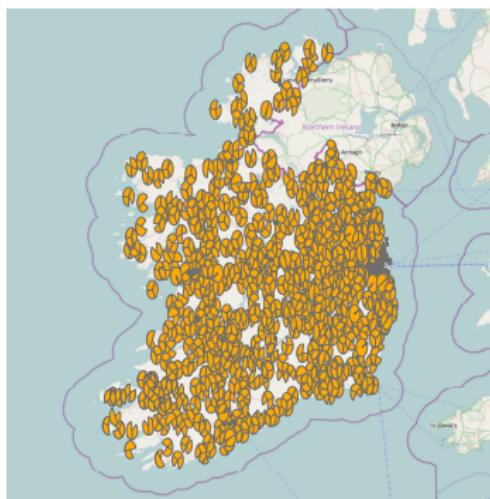
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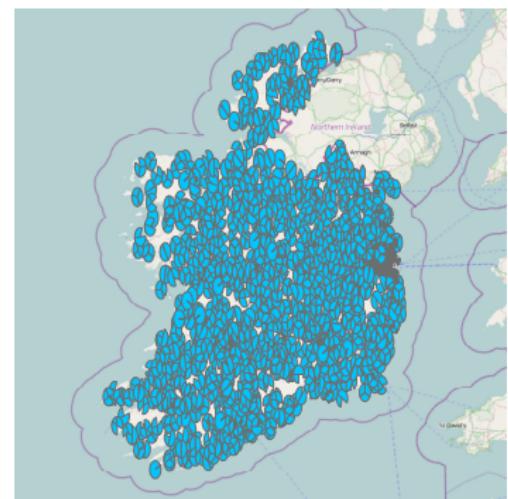
Conclusion &
Future Works

GSM coverage

MNO₁

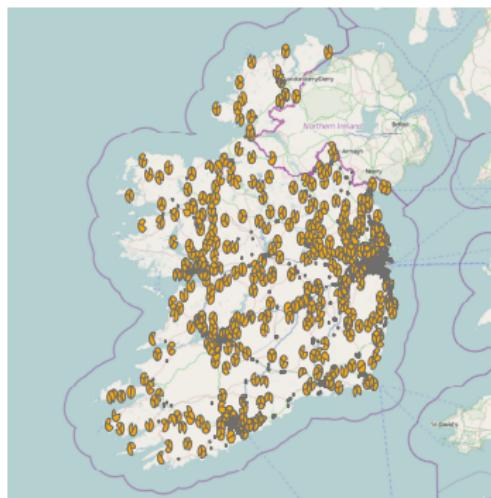


MNO₂

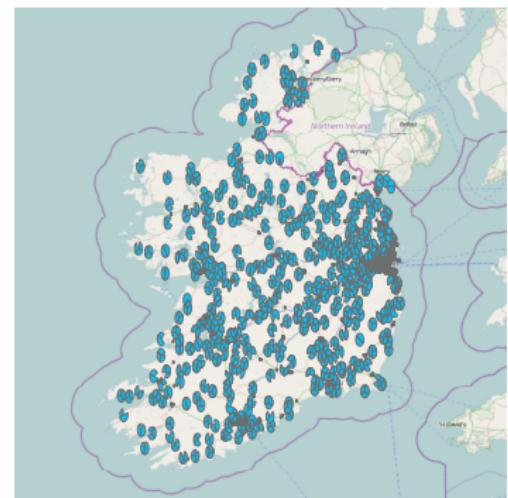


3G coverage

MNO₁



MNO₂



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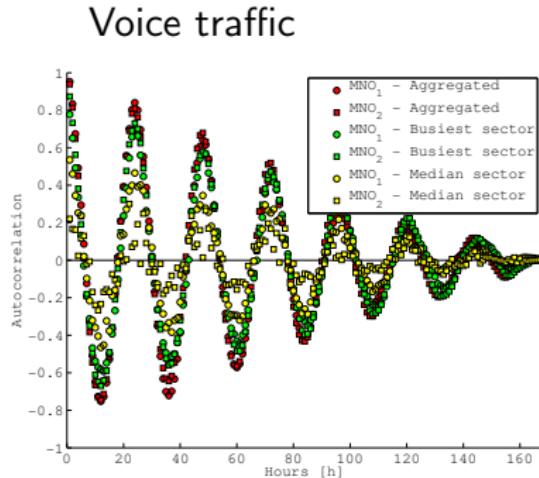
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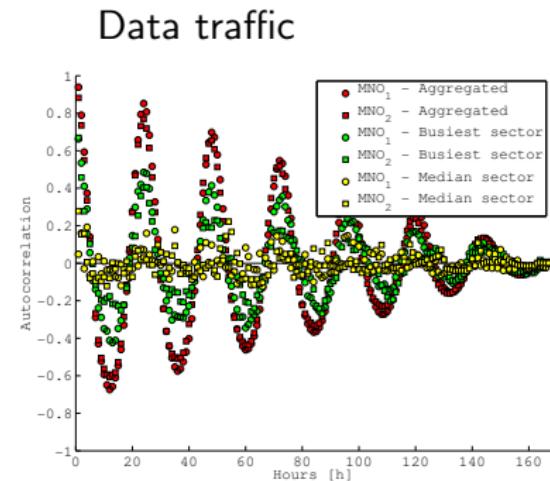
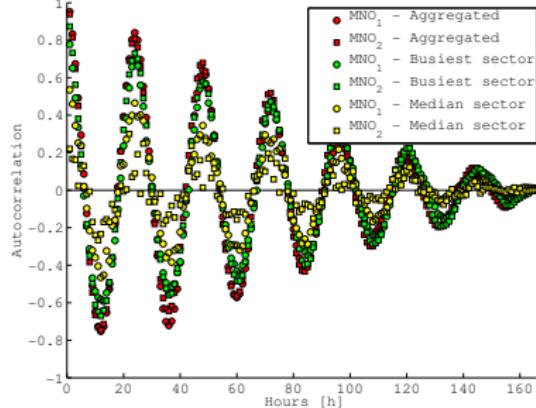
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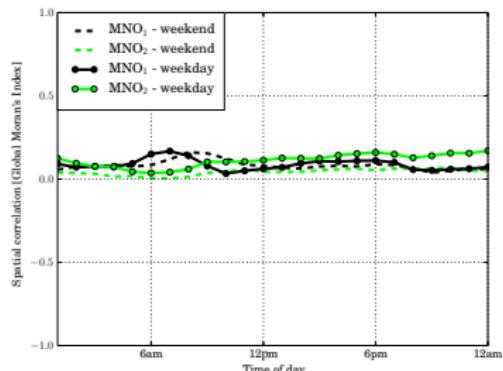
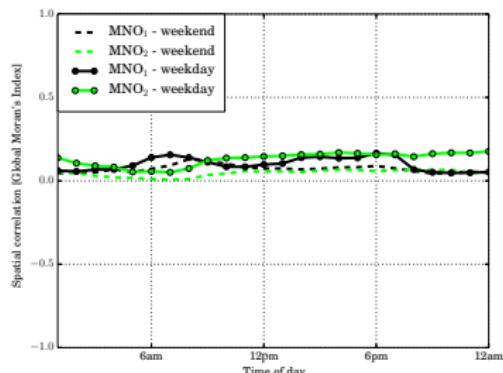


Global (Moran's Index):

$$\text{GMI} = \frac{n}{S_0} \frac{\sum_{i=1}^n \sum_{j=1, j \neq i}^n w_{i,j} (x_i - \bar{X})(x_j - \bar{X})}{\sum_{i=1}^n (x_i - \bar{X})^2}$$

$$w_{i,j} = \frac{|A_i \cap A_j|}{|A_i \cup A_j|}$$

Space correlation (1)



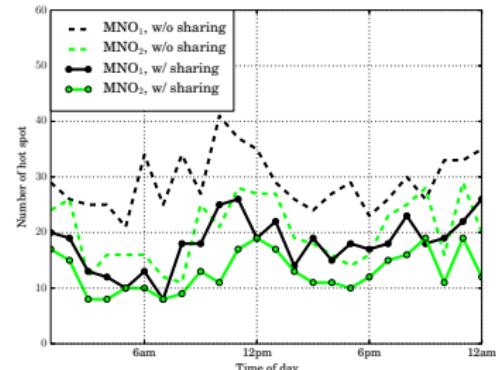
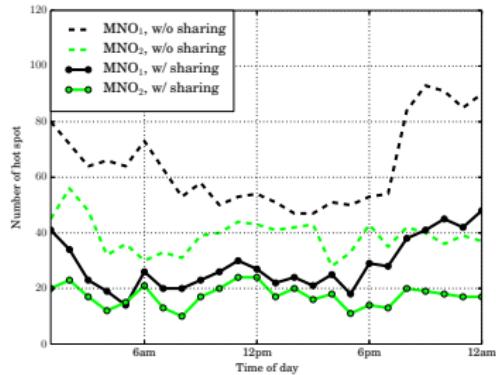
Local:

It allows to label
transmitters as: outlier
(hot, cold), cluster (hot,
cold)

$$\frac{x_i - \bar{X}}{S_i^2} \sum_{j=1, j \neq i}^n w_{i,j} (x_j - \bar{X})$$

$$w_{i,j} = \frac{|A_i \cap A_j|}{|A_i \cup A_j|}$$

Space correlation (2)



Hot Spots in Dublin - 24h timelapse

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Wrapping up the results

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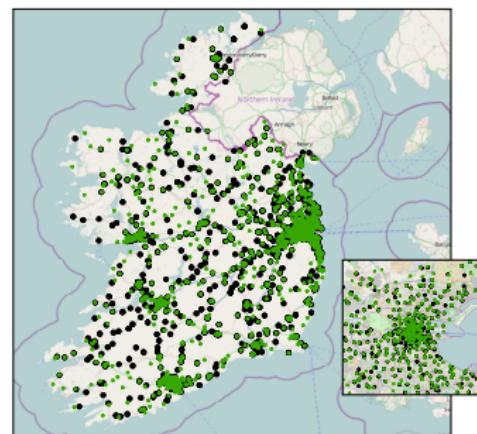
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| | Operator | Ireland | Urban | Rural |
|--|------------------|--------------------------------------|--------------|--------------|
| Deployment density [sectors/km ²] | MNO ₁ | 0.080 | 4.488 | 0.040 |
| | MNO ₂ | 0.095 | 5.615 | 0.042 |
| Space correlation [Moran's Index] | WE | MNO ₁ MNO ₂ | 0.10 0.13 | 0.08 0.11 |
| | WD | MNO ₁ MNO ₂ | 0.07 0.04 | 0.08 0.10 |
| hot spot reduction | WE | MNO ₁ MNO ₂ | -55% -55% | -38% -35% |
| | WD | MNO ₁ MNO ₂ | -64% -54% | -46% -44% |



Future works

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- Combine demand data with census data publicly available.
- Propose actual mechanisms for effecting network sharing.
- Energy efficiency, cost reduction, through network sharing.

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Thank You