Local layered algorithmic model for topological design of rural telecommunications networks

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Contents

Contribution

Contributions

- Methodology with a local layered algorithmic approach
- Baseline to estimate infrastructure requirements to deliver broadband coverage to unconnected communities of Mexico
- Consideration of road distances in the network design
- Applicable: We applied our model to two municipalities of the Mexican state of Chiapas
- General: Our model can be applied to other Mexican regions or at other countries

Introduction

Digitalization

- 2014: 40% of the global population used internet
- 2015: 4.5 billion mobile phone users
- Digitalization: “social transformation triggered by the massive adoption of digital technologies to generate, process, share and transact information”
- Proven impact on economy, society and governance
- Critical element is the development of telecommunications, including the design of connectivity networks

Networks at rural communities

- Urban networks are relatively inexpensive and easier to deploy and maintain; rural networks are the opposite
- Low development of the telecommunications networks in rural communities
- 23% of the total population in Mexico live in rural communities many of which lack of telecommunications services like mobile telephony or broadband access

Network design

- Very complex process
- Good network design is difficult to characterize, tradeoffs are necessary
- Topological design:
  - Selection of the network nodes and their location
  - Definition of the mechanisms to connect them
  - Bandwidth capacity of the branches
- We assumed the availability of the primary network, and focus on the secondary networks that need to be deployed

Methodology & implementation

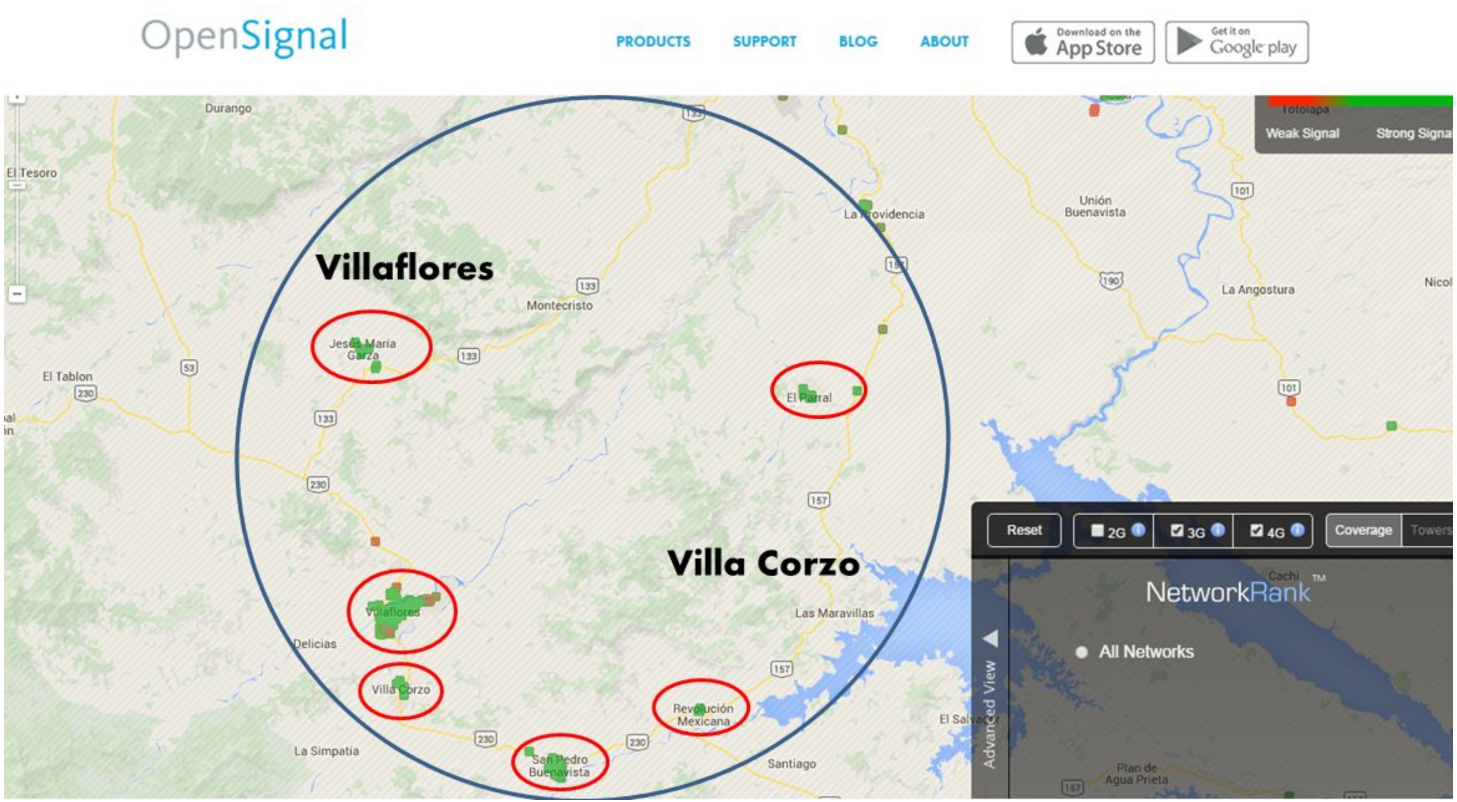
Implementation

Locality selection criteria

- Maximize impact
  - Little coverage
  - Large populations
- Worst case complexity

Implementation

Implementation



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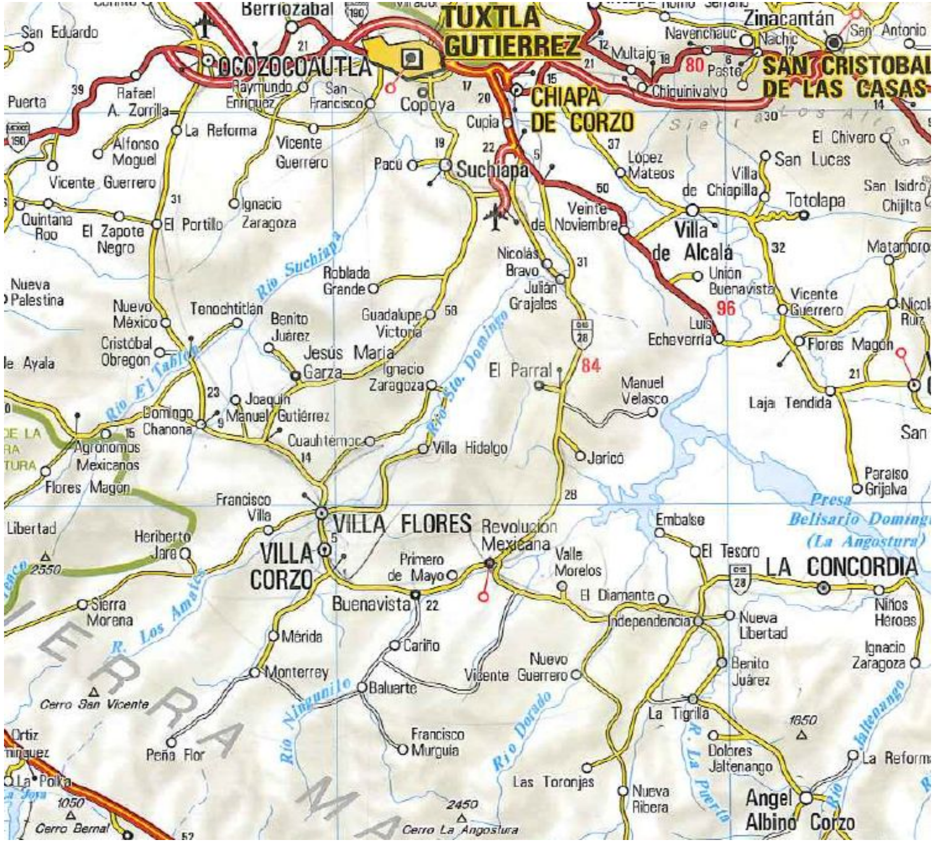

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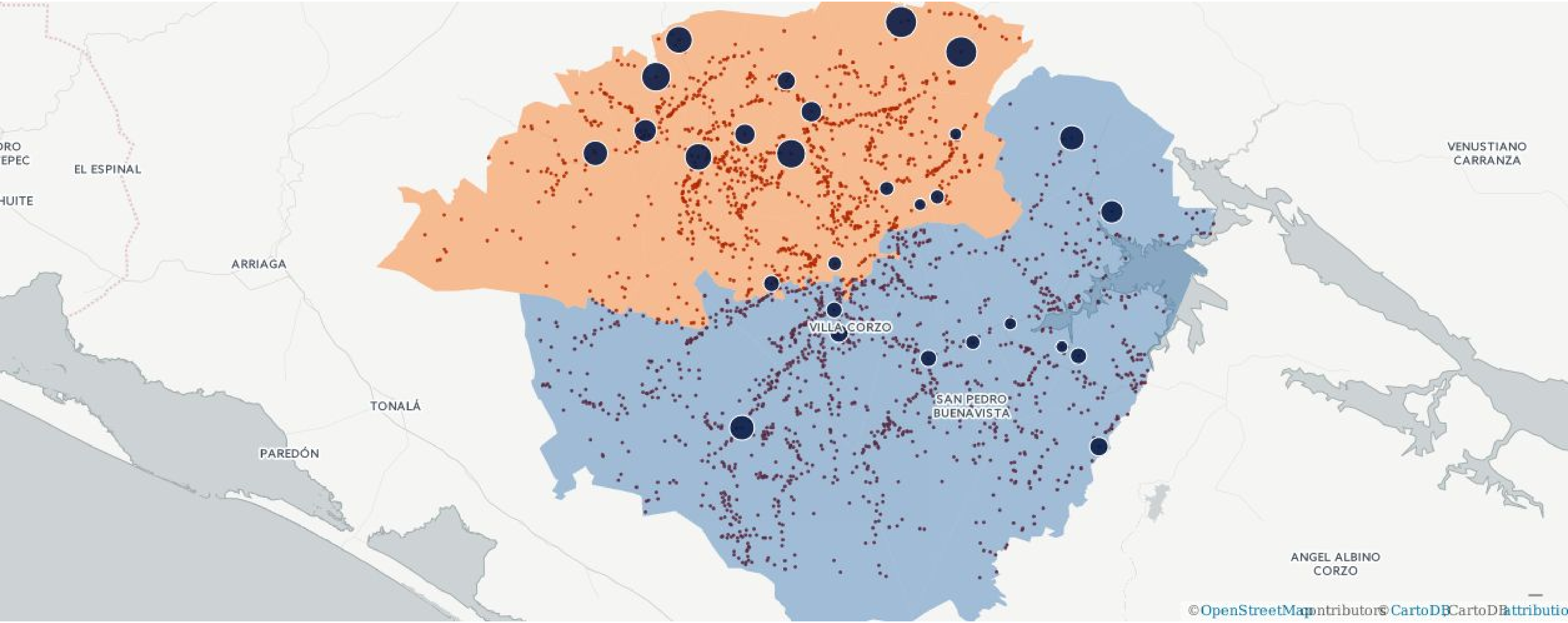

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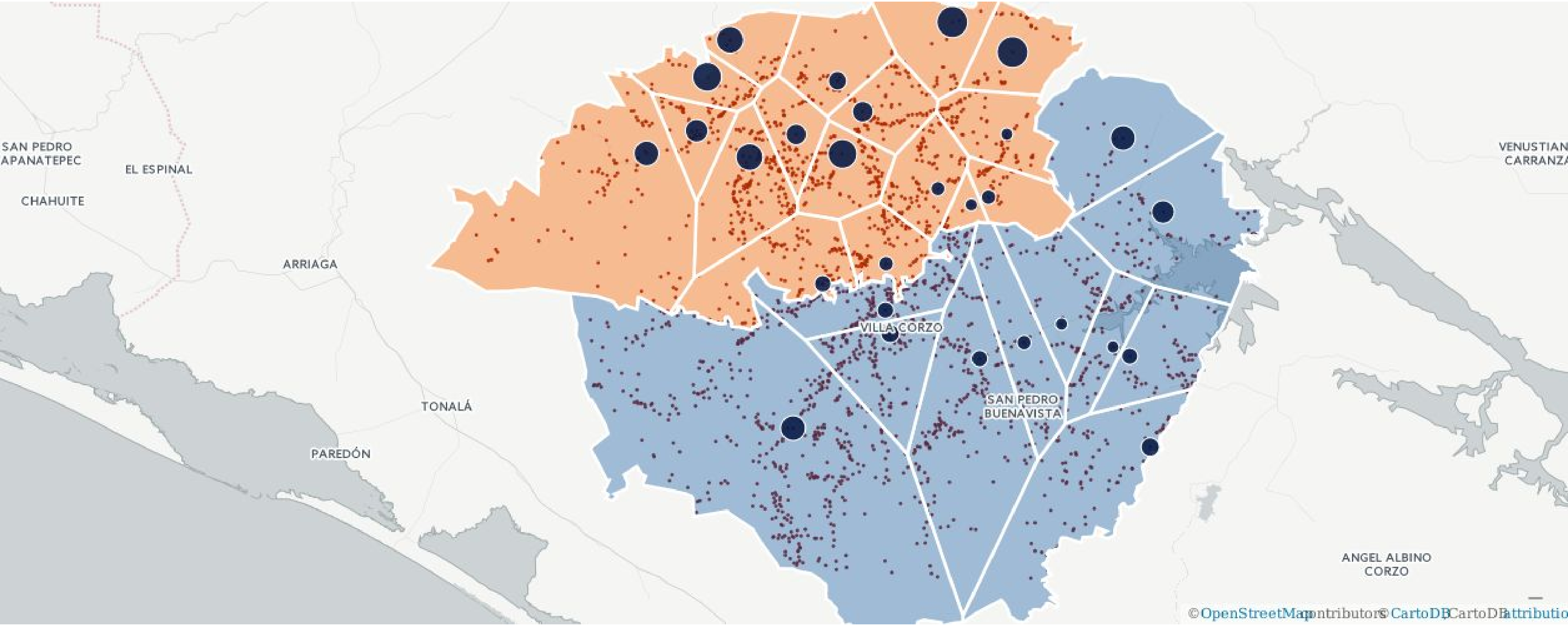

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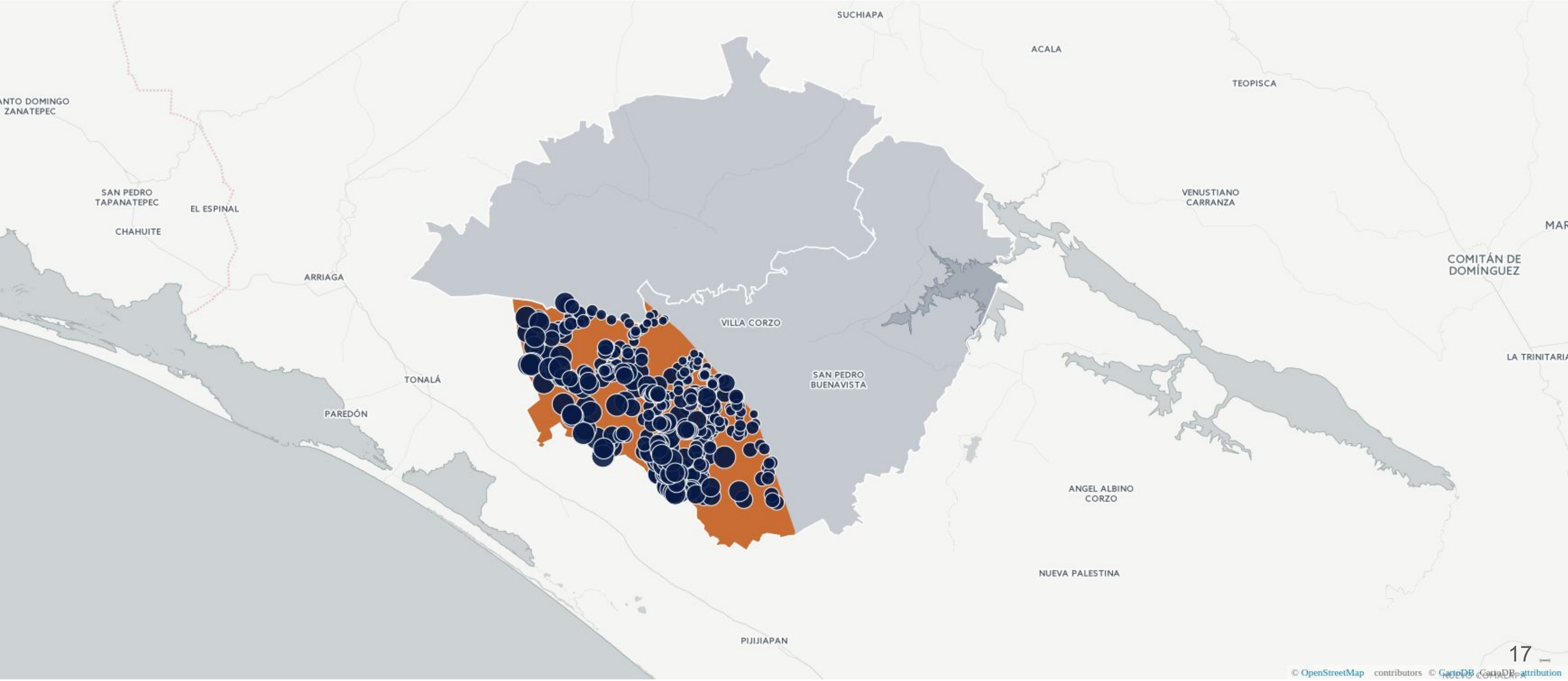
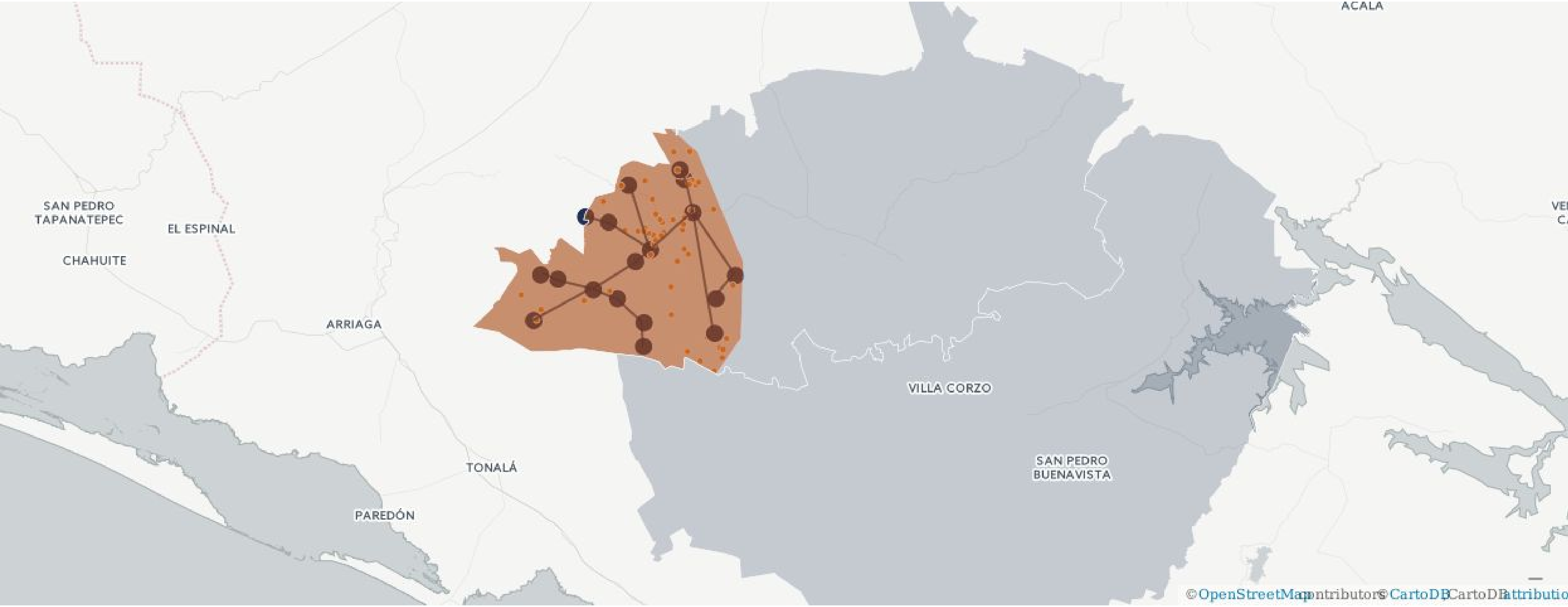


Results

Results



ACALA
SAN PEDRO
TAPANATEPEC
EL ESPINAL
CHAHUITE
ARRIAGA
VILLA CORZO
TONALÁ
PAREDÓN
SAN PEDRO
BUENAVISTA
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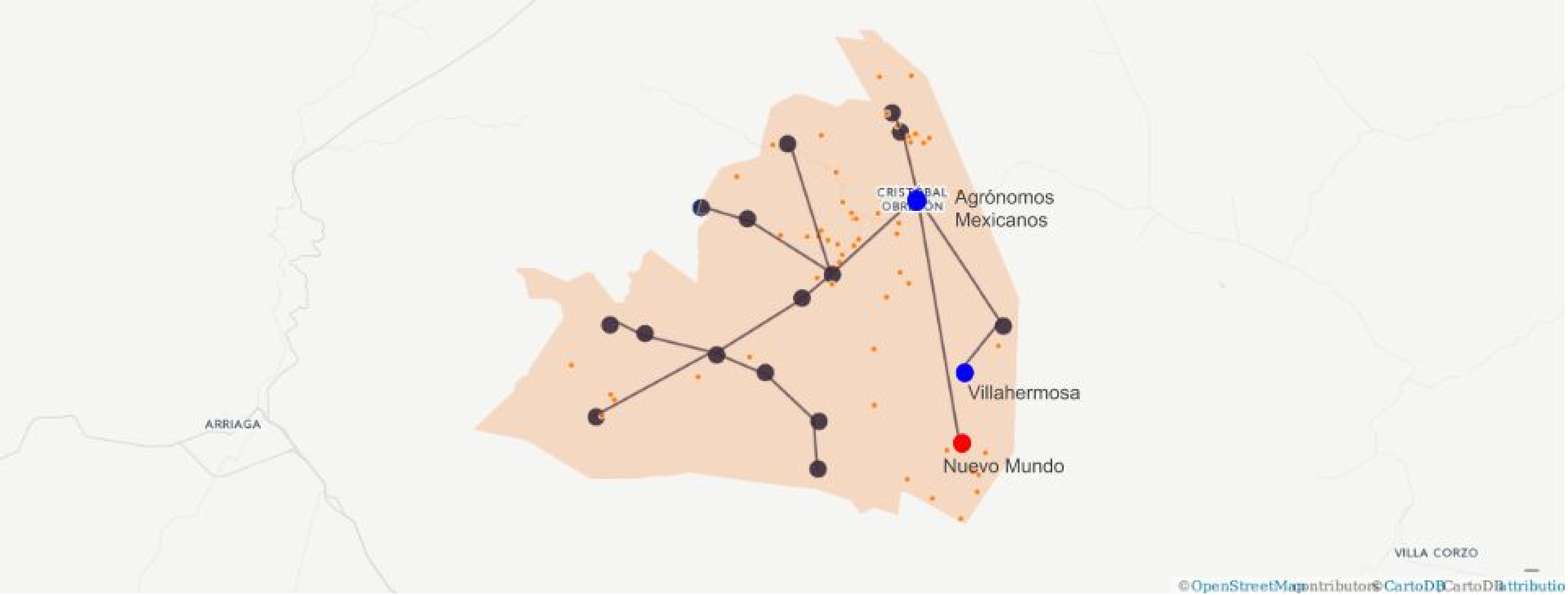
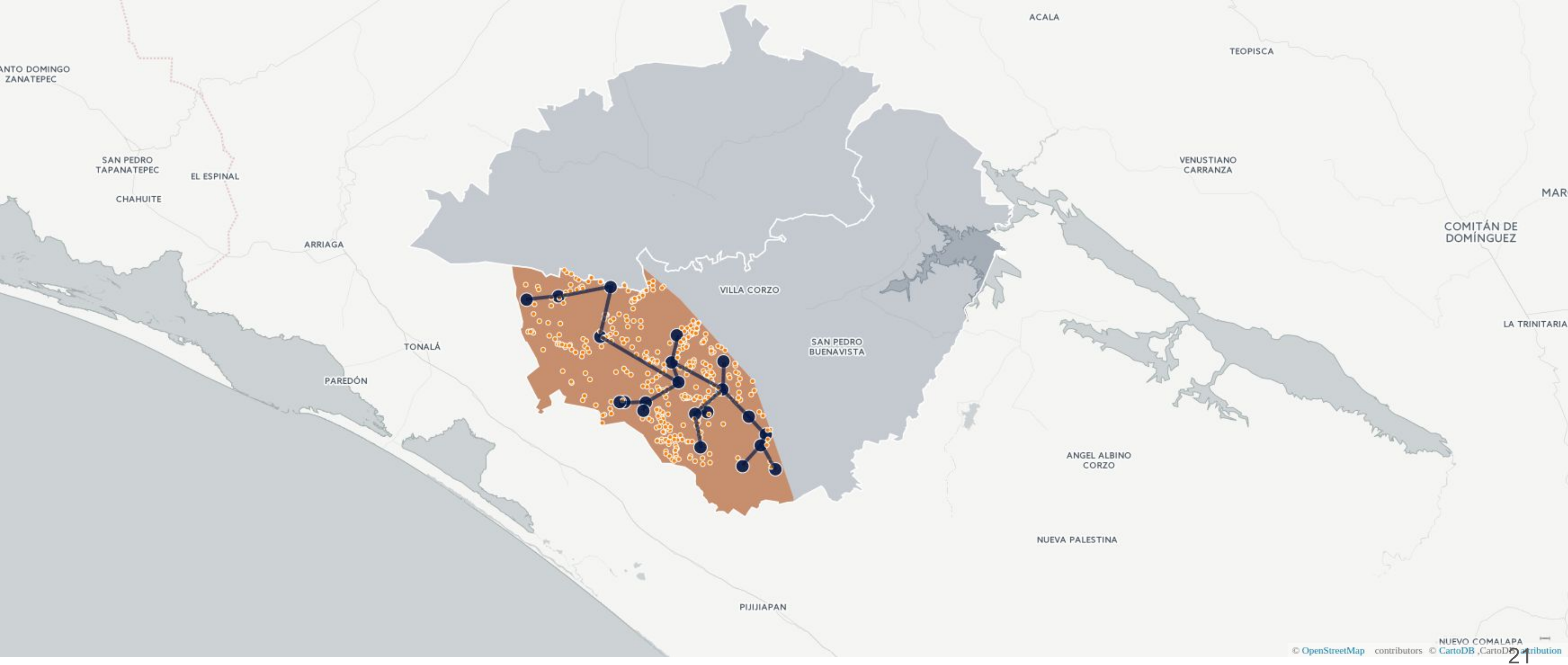
Results



ARRIAGA
Agrónomos Mexicanos
Villahermosa
Nuevo Mundo
VILLA CORZO

Results


ACALA
TEOPISCA
ANTO DOMINGO ZANATEPEC
SAN PEDRO TAPANATEPEC
EL ESPINAL
CHAHUITE
ARRIAGA
VILLA CORZO
VENUSTIANO CARRANZA
COMITÁN DE DOMÍNGUEZ
SAN PEDRO BUENAVISTA
TONALÁ
LA TRINITARIA
PAREDÓN
ANGEL ALBINO CORZO
NUEVA PALESTINA
PIJIJIAPAN
NUEVO COMALAPA
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Results

Parameter	Villaflores Tessellation	Villa Corzo Tesselation
Connected population	6,278	5,291
% Connected population	88.3%	60.1%
Connected localities	18	21
Km of optic fiber	207.3 km	193.8 km

Future work and conclusions

Future Work

- Randomization in the centroid selection process to avoid bias.
- Incorporate boundary analysis.
- Implement Steiner tree theory to grow the tree.

Conclusion

- Our approach proves itself lightweight and efficient due to the locality constraint.
- The use of road-distances gives more realistic solutions than the Euclidean approach.
- As it can be appreciated with Villa Corzo, different thresholds should be considered depending on the sparsity and distribution of distinct populations.

Thanks