

# Integration of a FFcs into an existing carsharing structure:

## Implications on user acquisition, user behavior & system performance

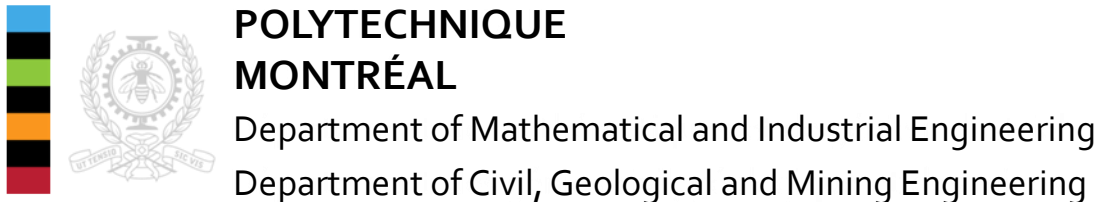
CSA 2017, May 19<sup>th</sup> 8h30 – Montréal

**Gregory Wielinski**, doctorate student

**Prof. Martin Trépanier**,

**Prof. Catherine Morency**

Polytechnique Montreal



**POLYTECHNIQUE  
MONTRÉAL**

Department of Mathematical and Industrial Engineering  
Department of Civil, Geological and Mining Engineering



**CIRRELT**



**mobilité**

# Introduction

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# Carsharing & the rise of mobility options

- Carsharing popularity increase
  - Increase in membership & supply worldwide
  - Increase of free-floating carsharing services (FFCs)
    - Arrival of car manufacturers in the market
- Diversification of mobility options



FFCs



Bikesharing



Carsharing



Private car



Bike



P2P



Taxi



Walk



App



Smart card



and more...



Bus



UBER  
Hail & ride

# Complementary services: Integrating a SBcs & a FFcs



Strasbourg

stat > k



Osnabrück



Montreal / Quebec City



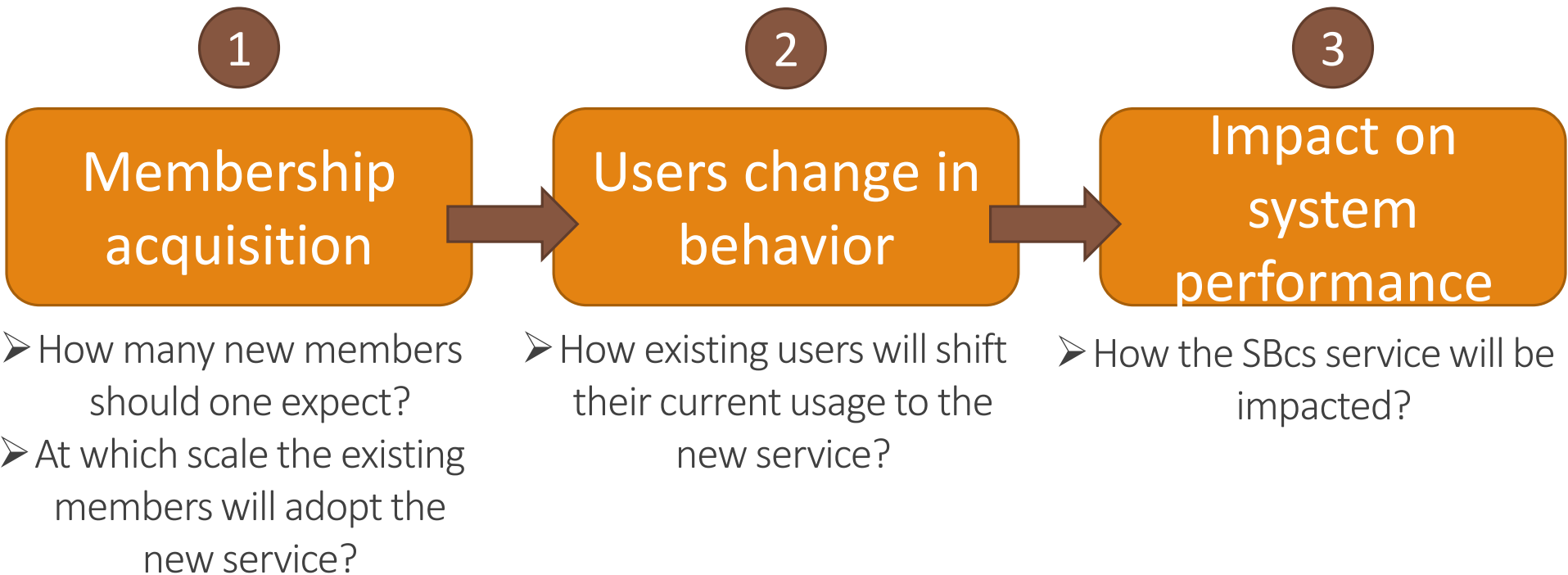
book-n-drive®

Carsharing

Germany

# Introduction of a FFcs into an existing carsharing scheme

What would be the impact for an existing carsharing operator to integrate a new FFcs service in its operations?



# Case Study

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# Communauto



Source: Communauto

**Oldest carsharing operator in North America (1994)**

**2 000 cars in 8 cities in Canada and Europe  
station-based and free-floating**

Kingston – Ottawa – Gatineau - Montreal – Sherbooke – Quebec City – Halifax - Paris

# Auto mobile

LIBRE-SERVICE SANS RÉSERVATION

June 2013 in Montreal



Locate the vehicles with  
our app or online



Spontaneous access  
to the vehicles and  
possibility of blocking  
them until you  
reach them



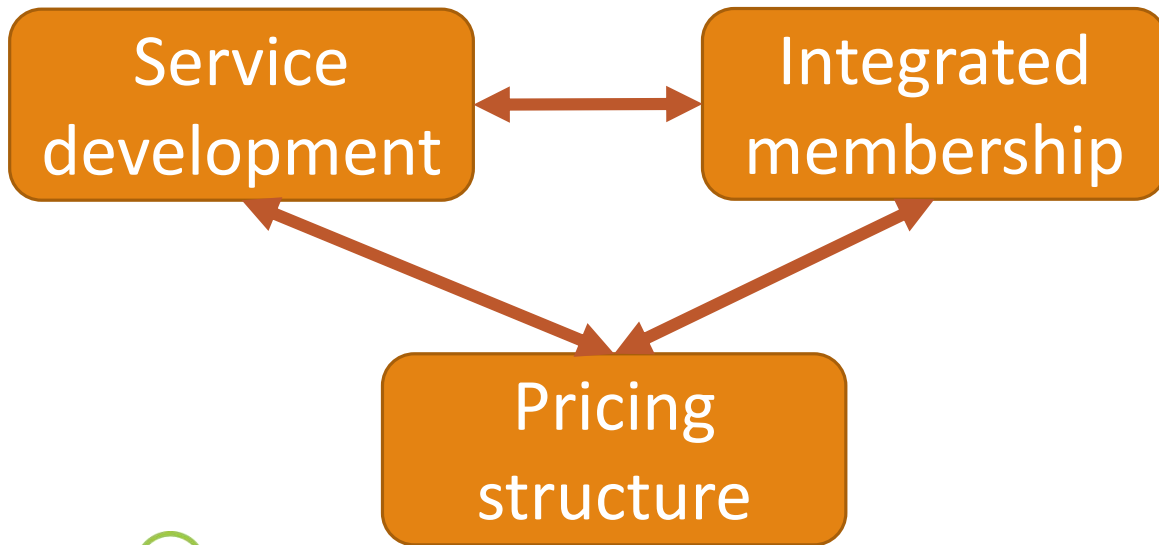
Fleet comprised of  
electric and hybrid  
vehicles



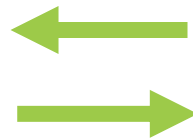
Parking privileges  
granted in certain  
boroughs



Billing by the minute



**Station-based carsharing**



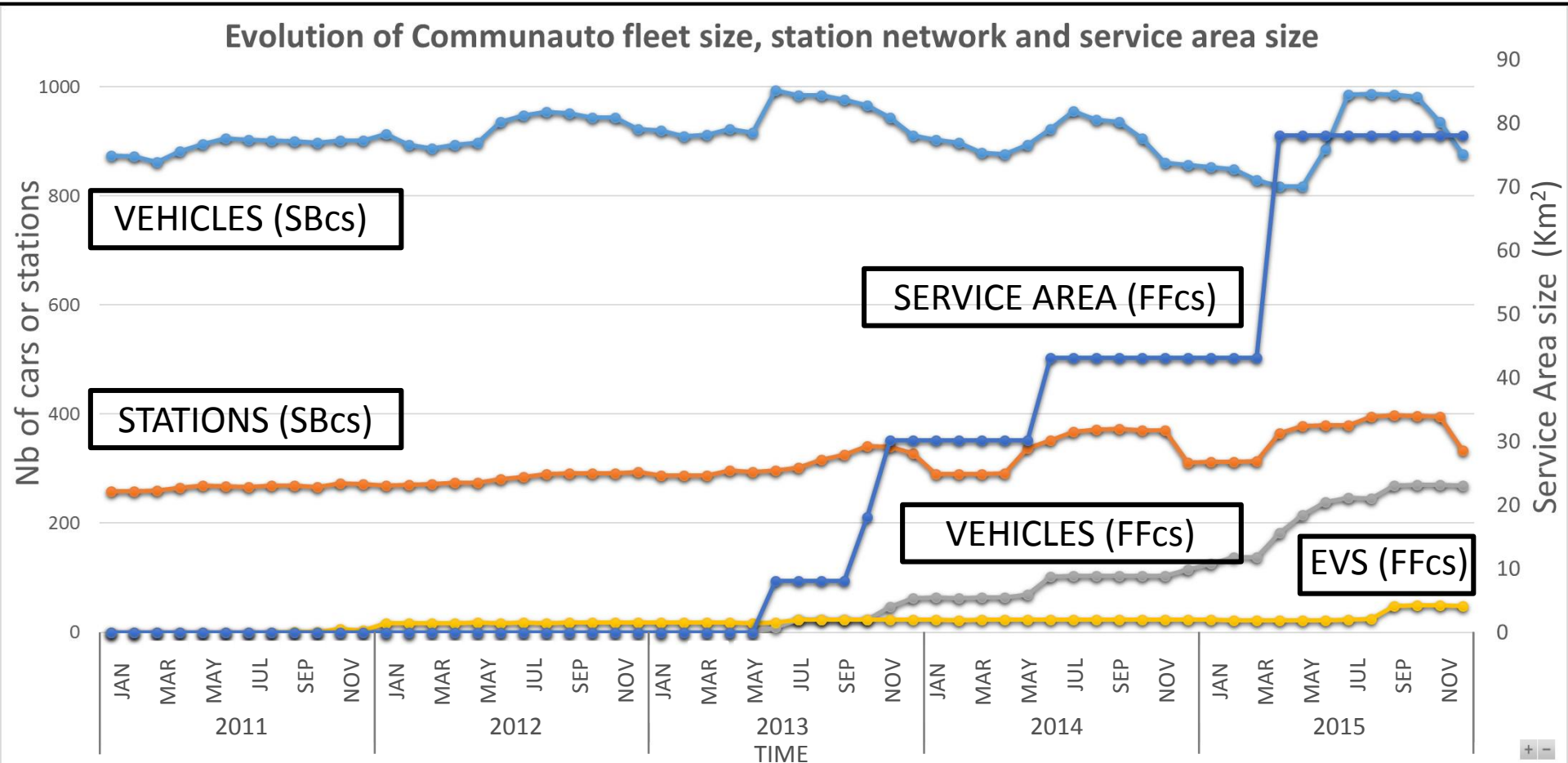
**Communauto (2017)**

**Free-floating carsharing**

# Global evolution in supply

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# Supply – Fleet / stations / service area

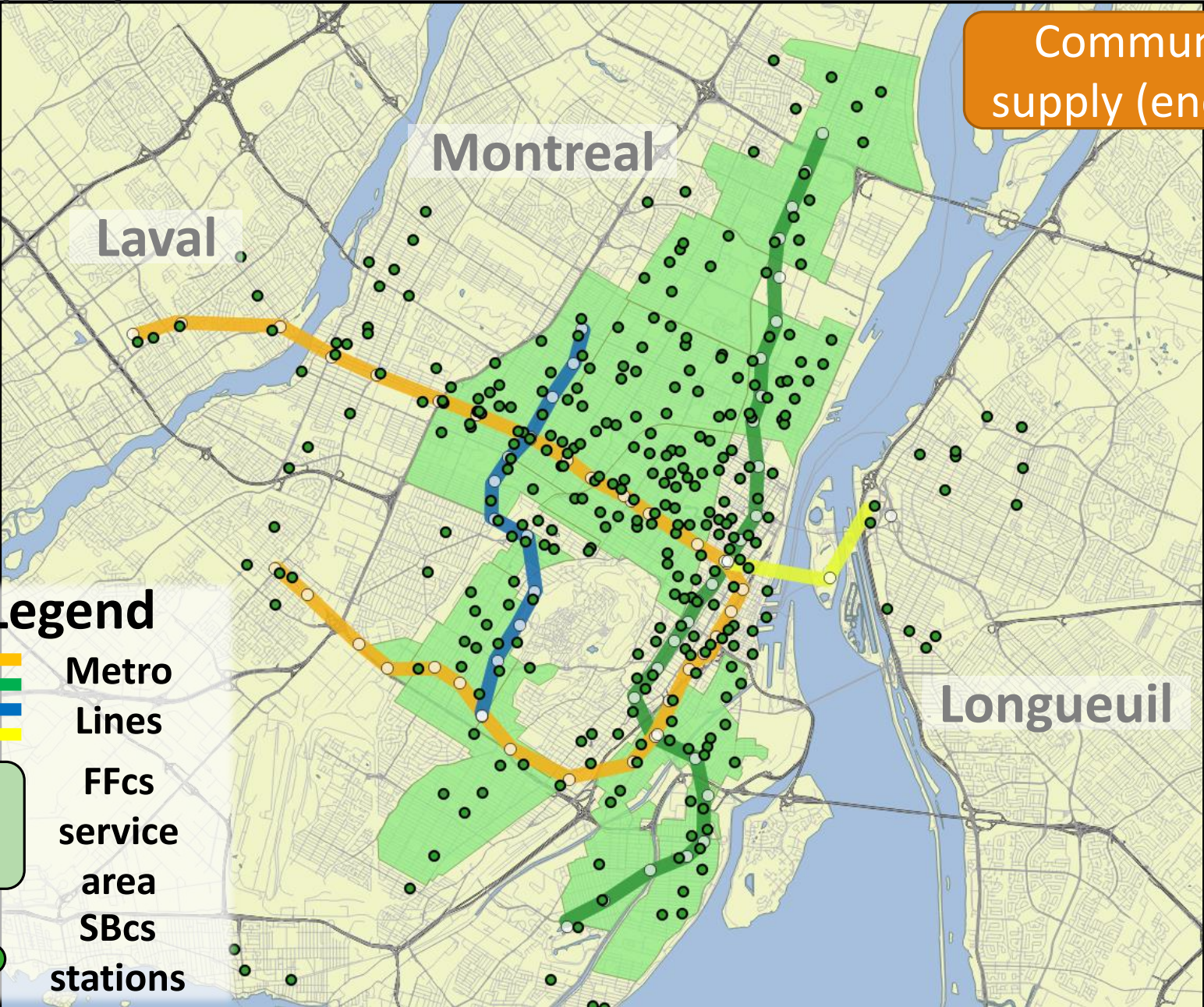


Station-based carsharing (SBcs)

Free-floating carsharing (FFcs)



# Supply – Fleet / stations / service area

Communauto  
supply (end 2015)



## Legend

-  Metro Lines
-  Lines
-  Lines
-  Lines

-  FFcs service area
-  SBcs stations

# Le Plateau-Mont-Royal



- Size: **8.01 km<sup>2</sup>**
- SBcs # of stations (2013) : **45 stations (+53 seasonal)**
- SBcs # of available cars (2013) : **~201 vehicles (+61 seasonal)**
- % of active REG users (2013) :



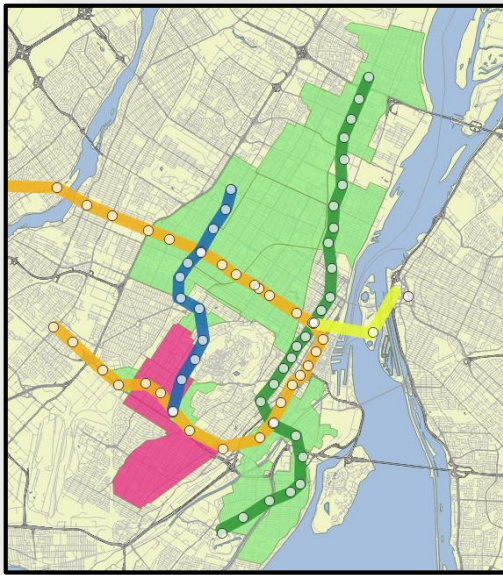
# Rosemont–La Petite-Patrie



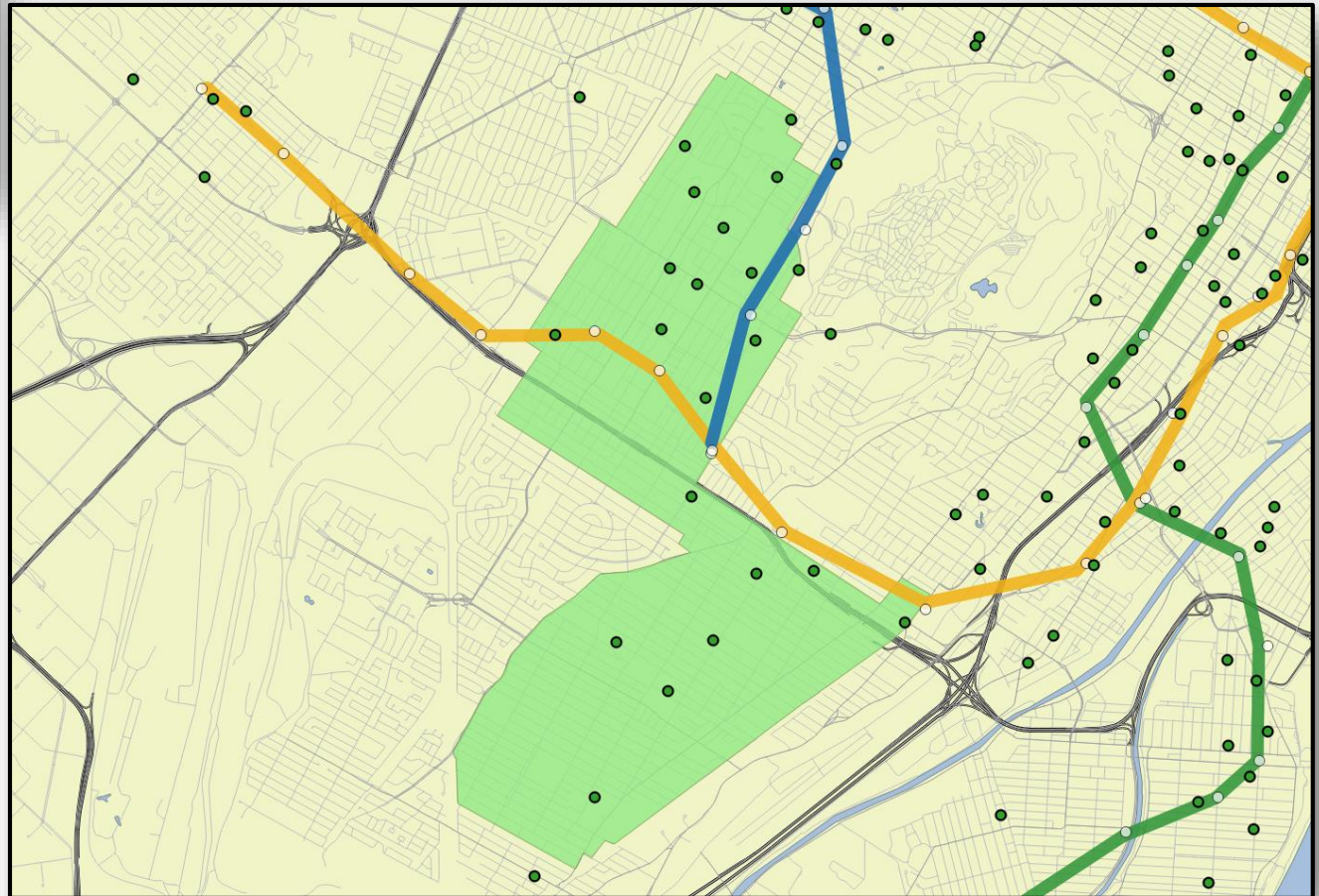
- Size: **10.10 km<sup>2</sup>**
- SBcs # of stations (2013) : **31 stations (+3 seasonal)**
- SBcs # of available cars (2013) : **~135 vehicles (+6 seasonal)**
- % of active REG users (2013) :



# Côte-des-Neiges-Notre-Dame-de-Grâce



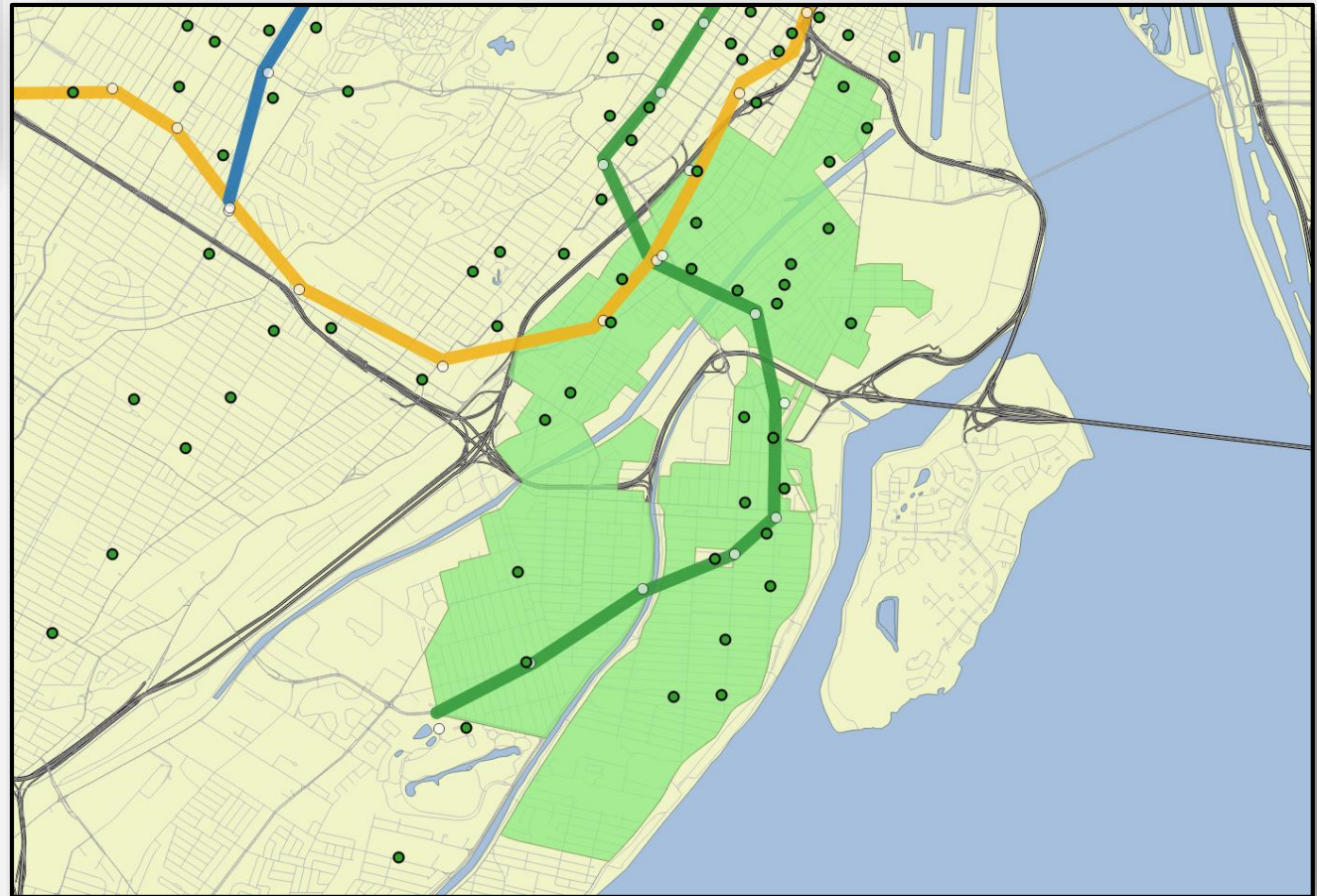
- Size: **12.08 km<sup>2</sup>**
- SBcs # of stations (2013) : **21 stations**
- SBcs # of available cars (2013) : **~ 69 vehicles**
- % of active REG users (2013) :



# Le Sud-Ouest



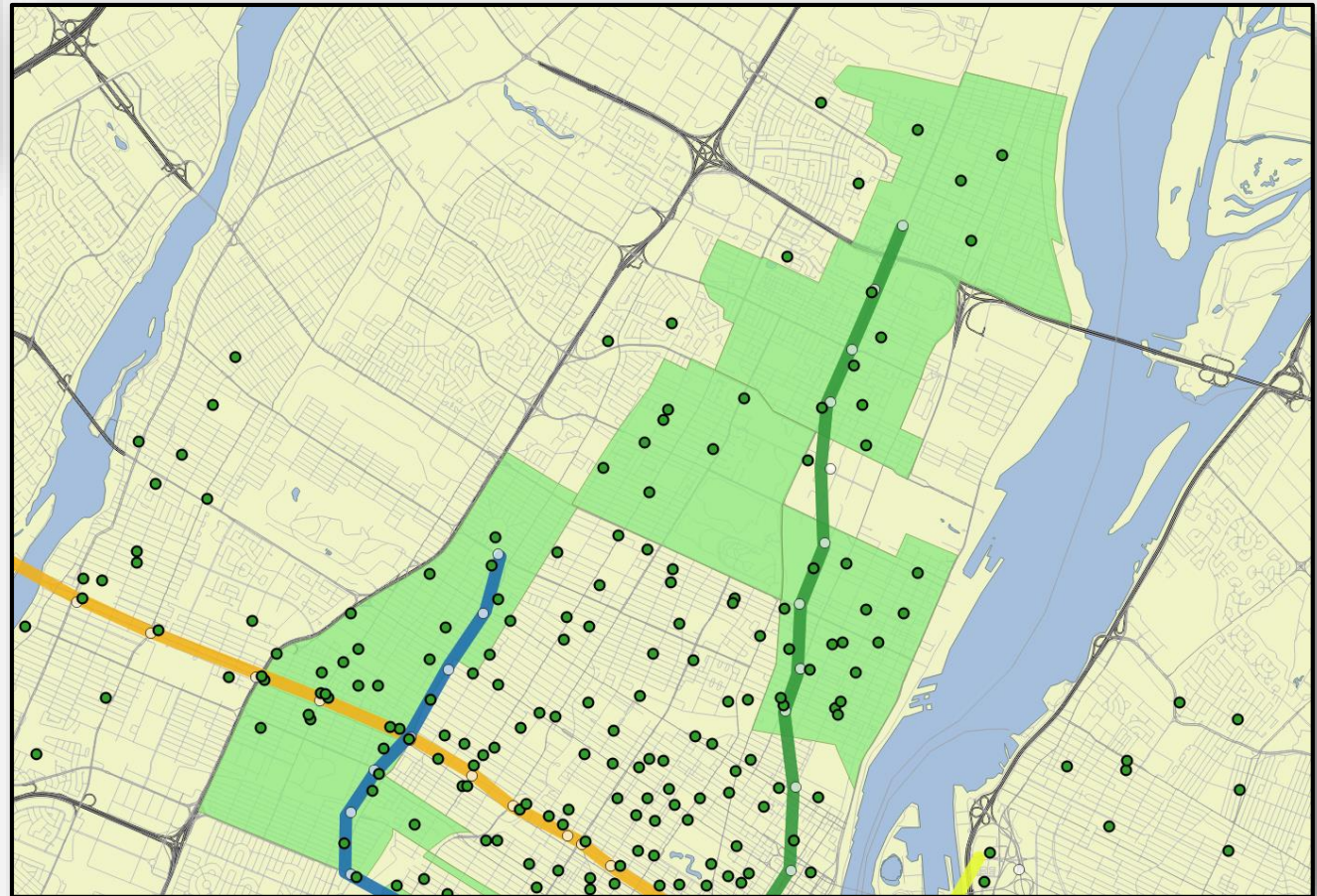
- Size: **12.90 km<sup>2</sup>**
- SBcs # of stations (2014) : **25 stations**
- SBcs # of available cars (2014) : **~70 vehicles**
- % of active REG users (2014) :



# Various boroughs (North & East)



- Size: **34.99 km<sup>2</sup>**
- SBcs # of stations (2015) : **67 stations (+11 seasonal)**
- SBcs # of available cars (2015) : **~184 vehicles (+14 seasonal)**
- % of active REG users (2015) :



# User acquisition

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# Methodology

## Acquisition rate    Conversion rate

1

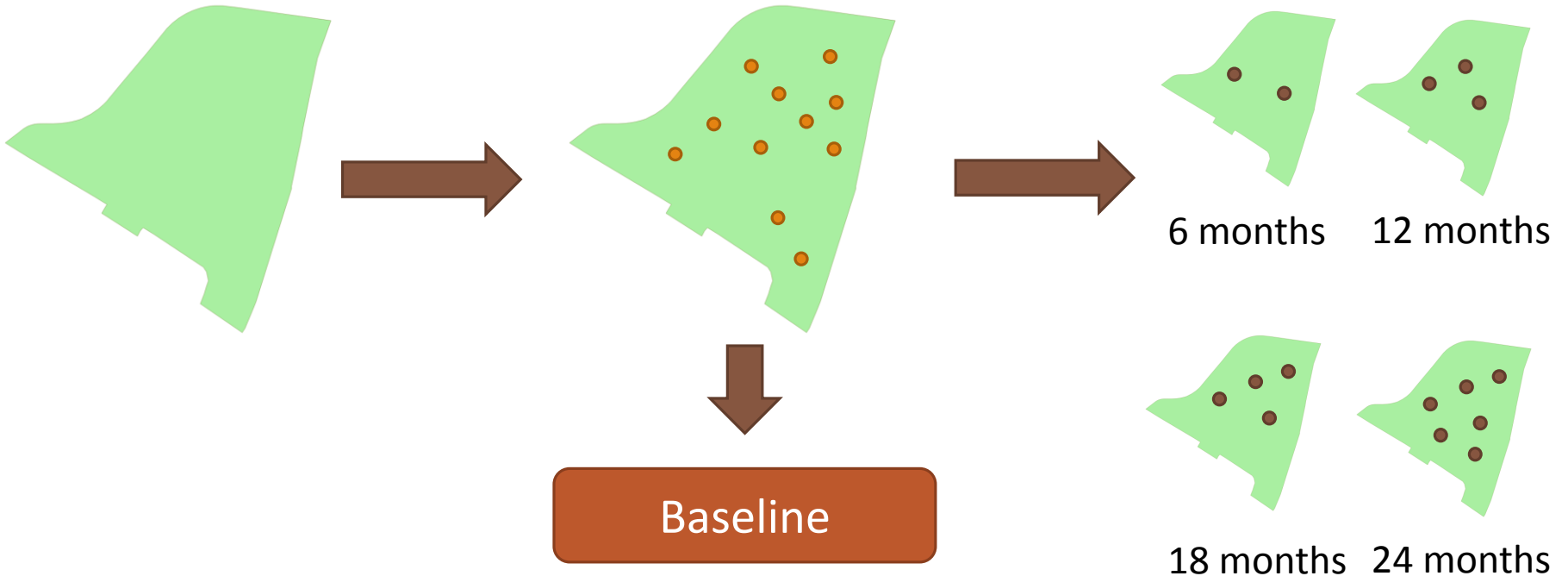
Extract each expansion zone

2

Calculate the number of active REG users living in the zone 365 days before the expansion

3

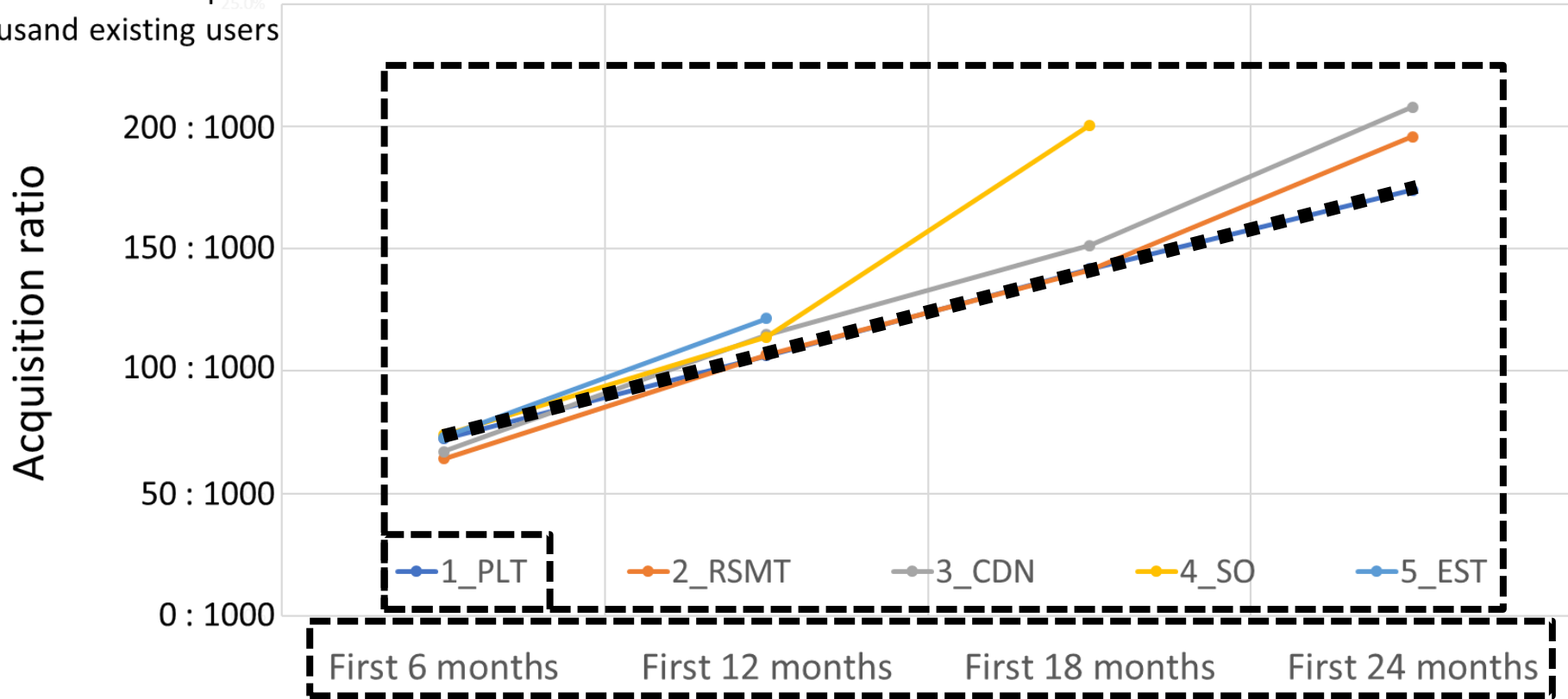
Calculate for x months following the expansion the user acquisition and transition for each zone



# Acquisition ratio

New AuM users penetration based on the number of active REG users the year before introducing the service area

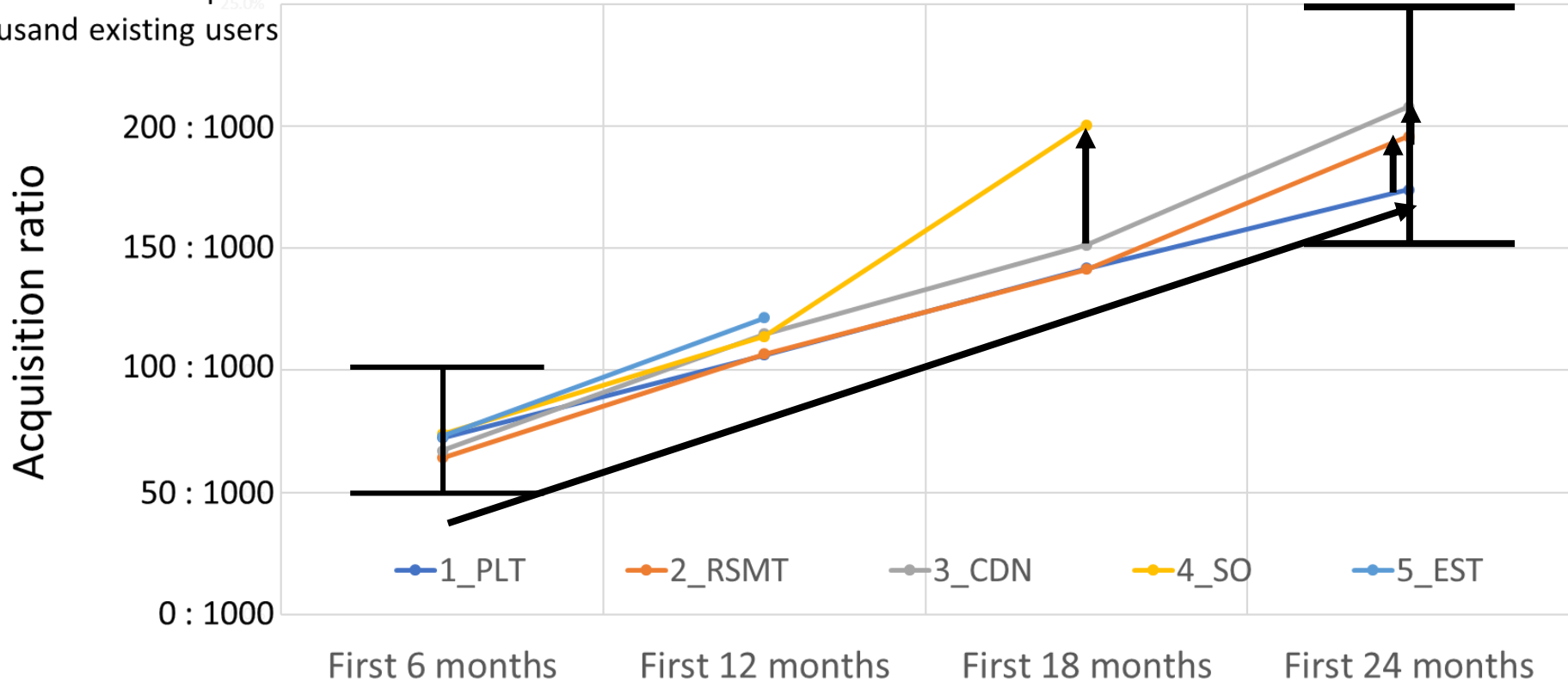
250 new users per 1 thousand existing users



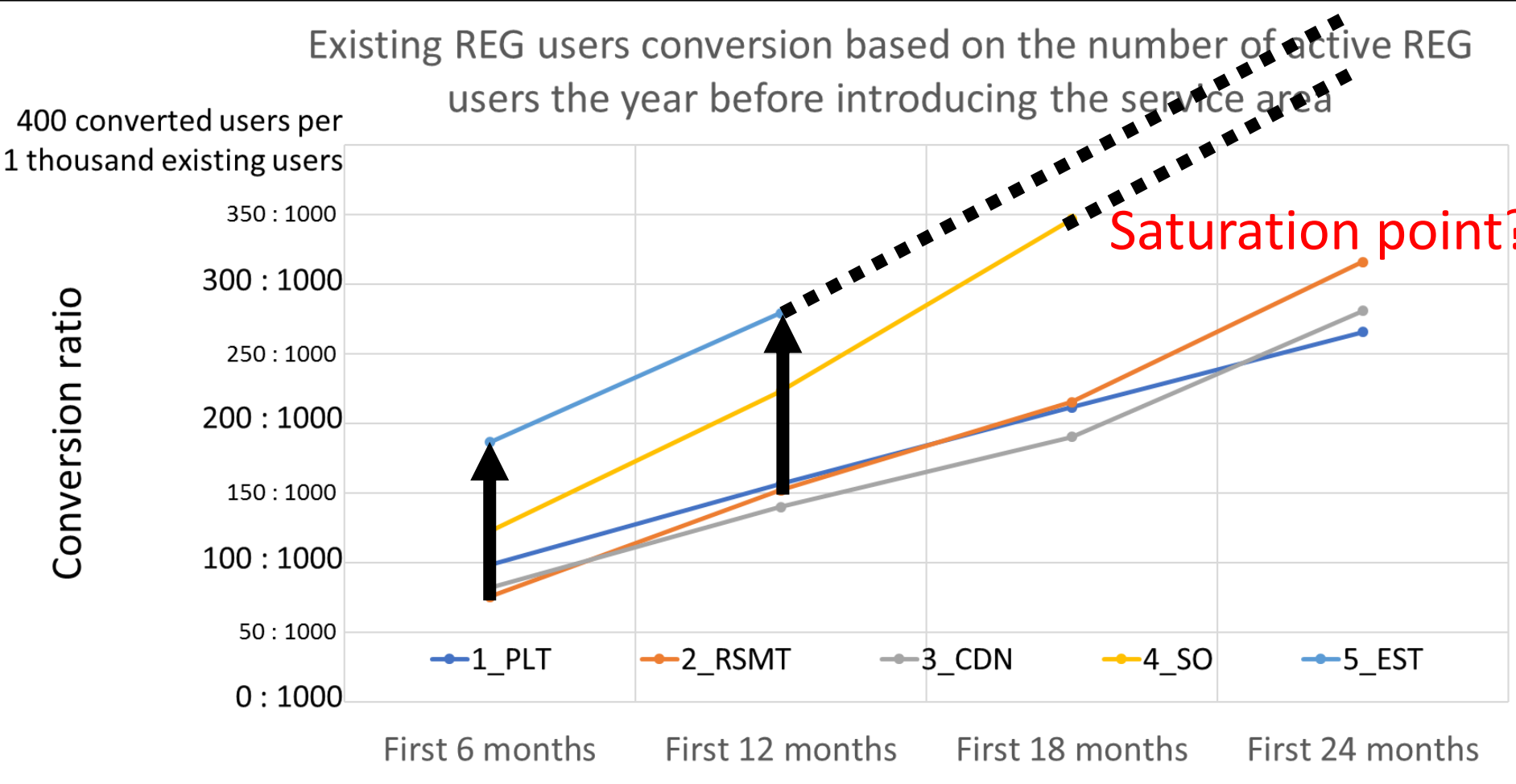
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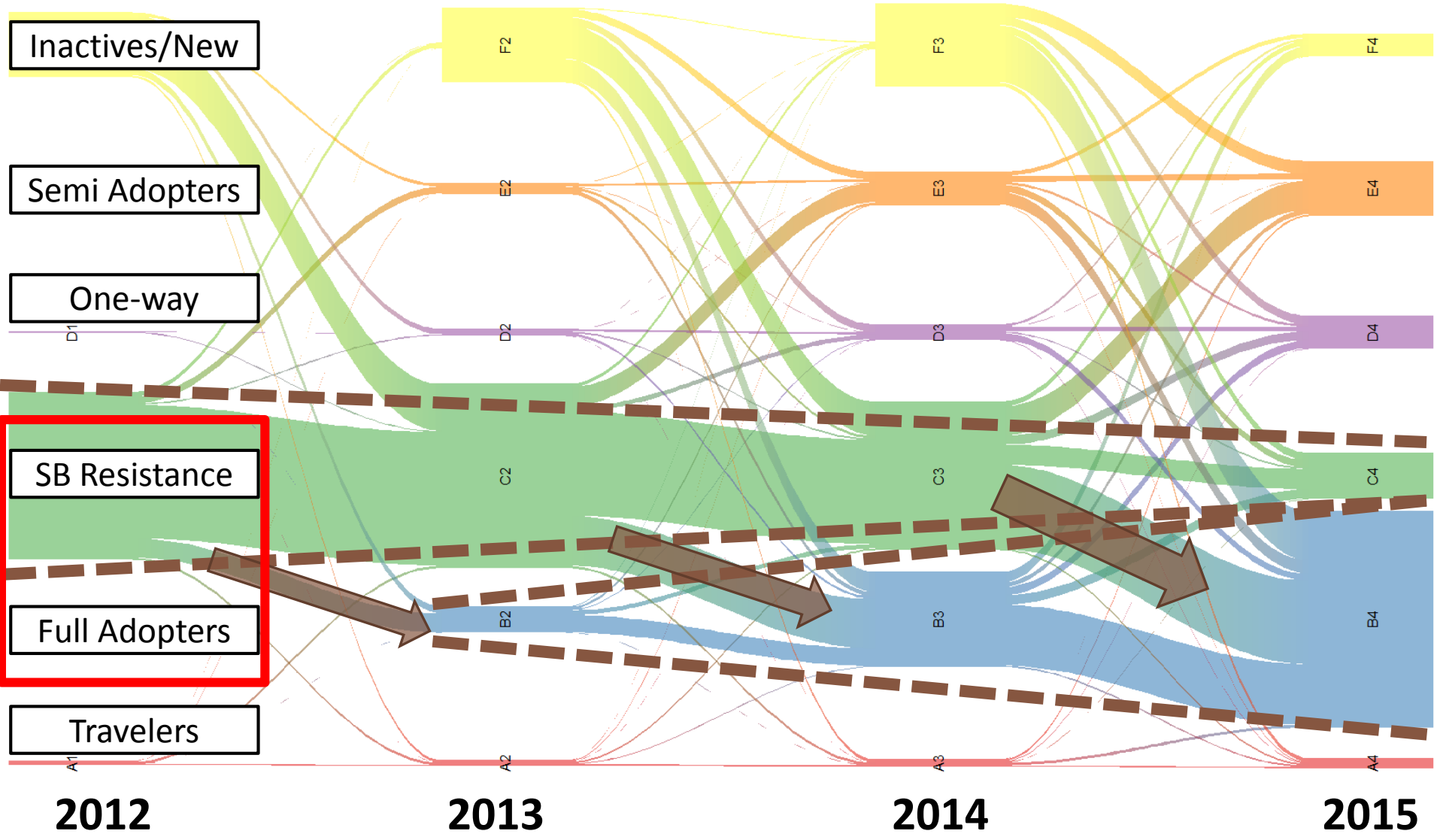
# Conversion ratio



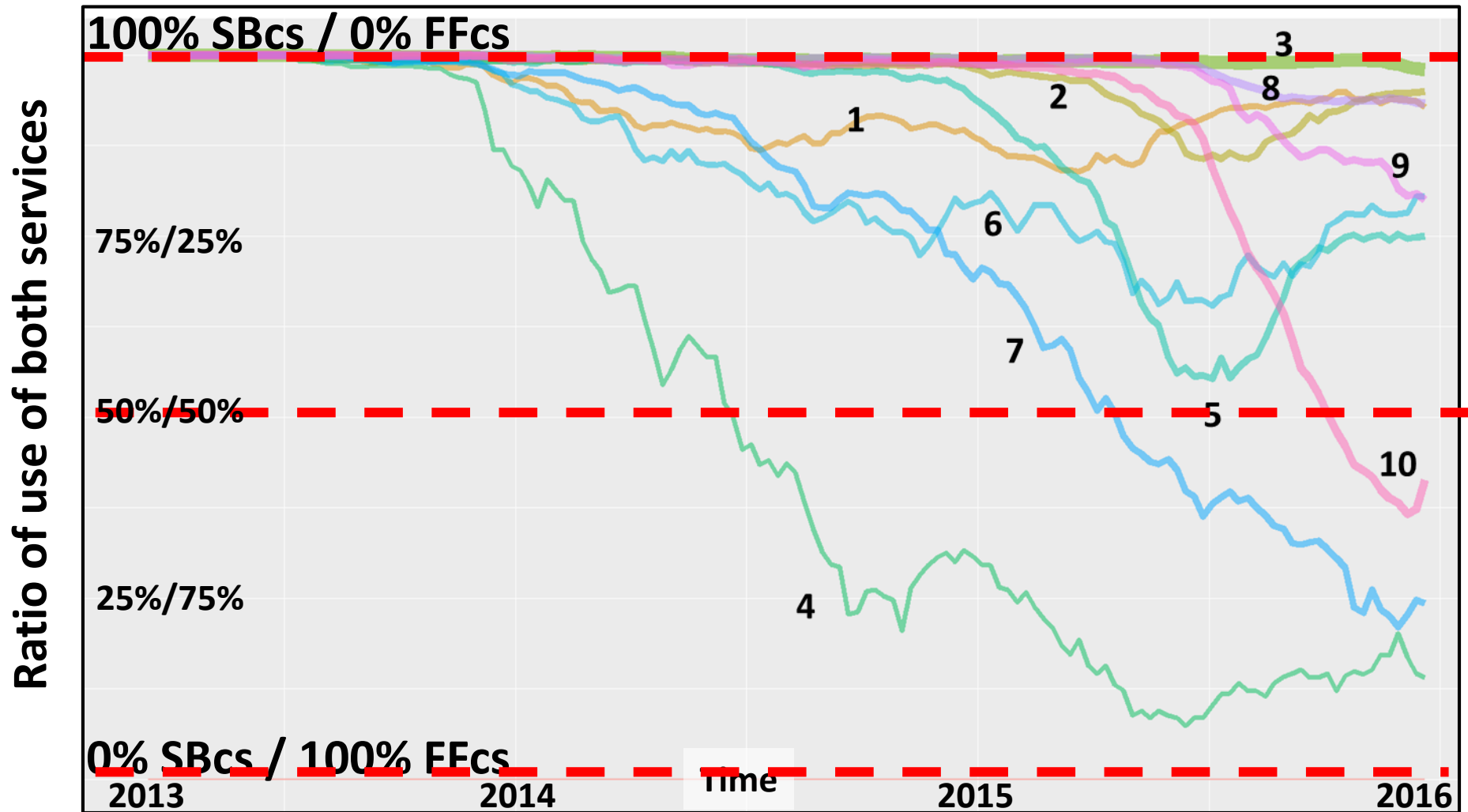
# User behavior

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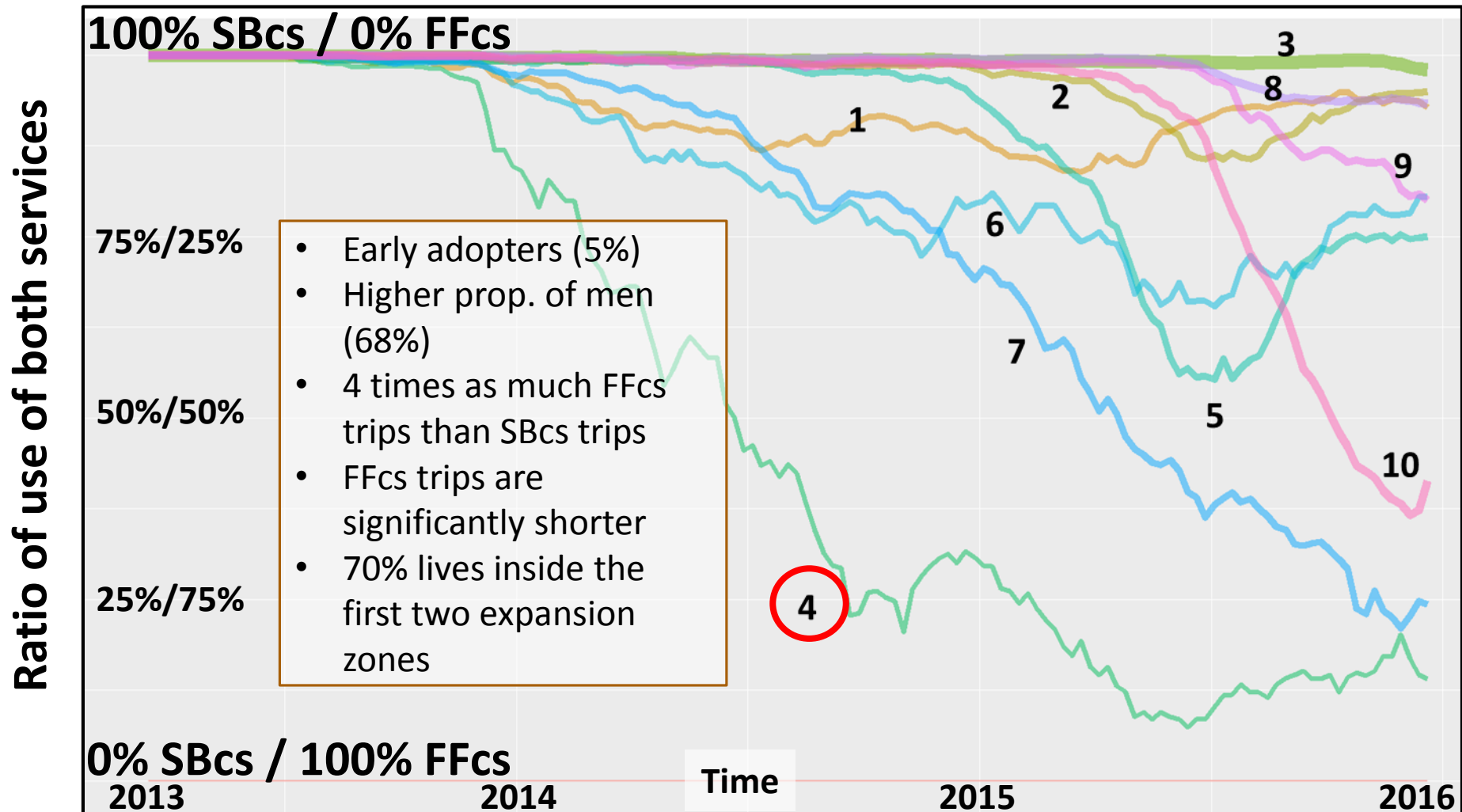
# SBcs & FFcs clusters YOY evolution



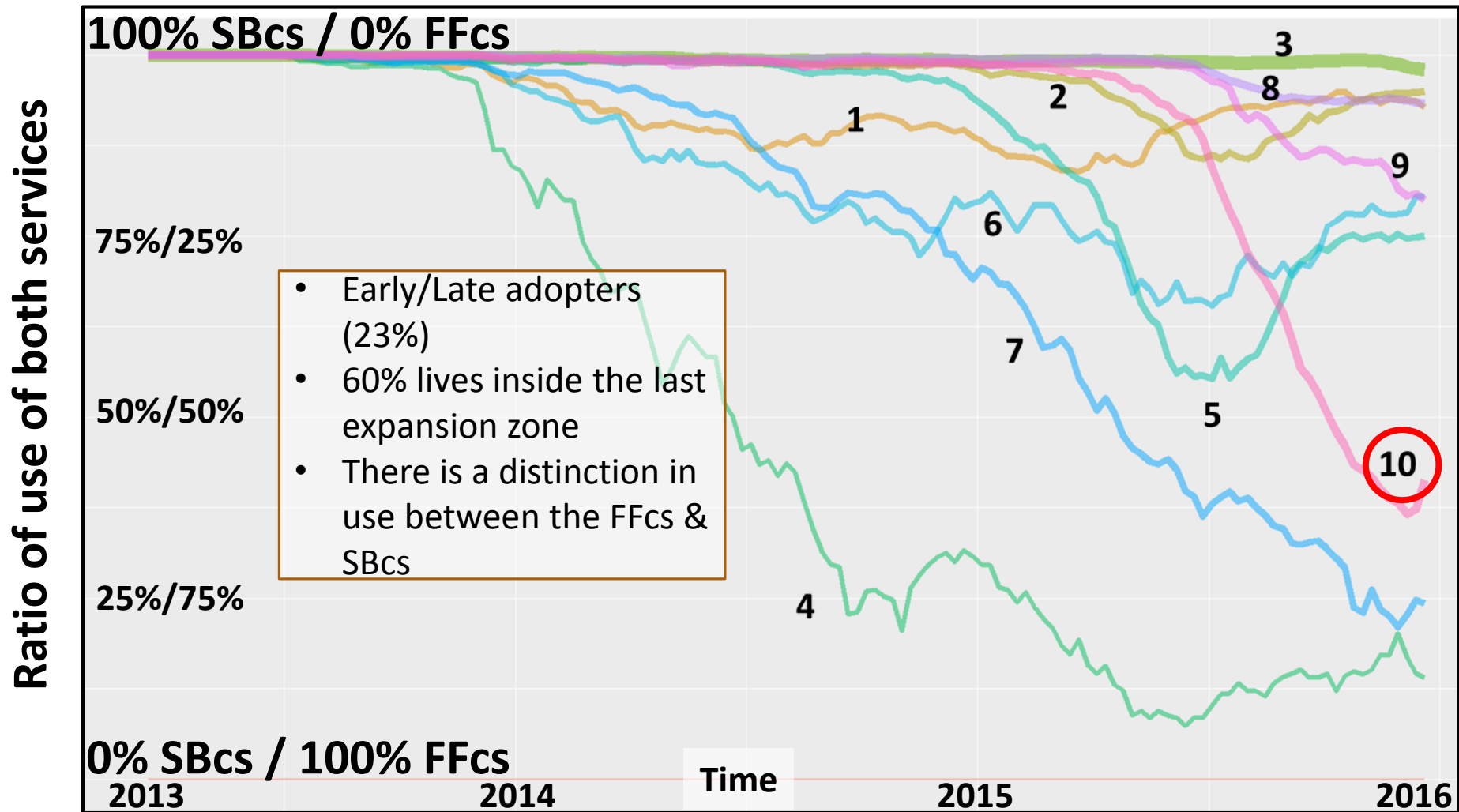
# User behavior transition



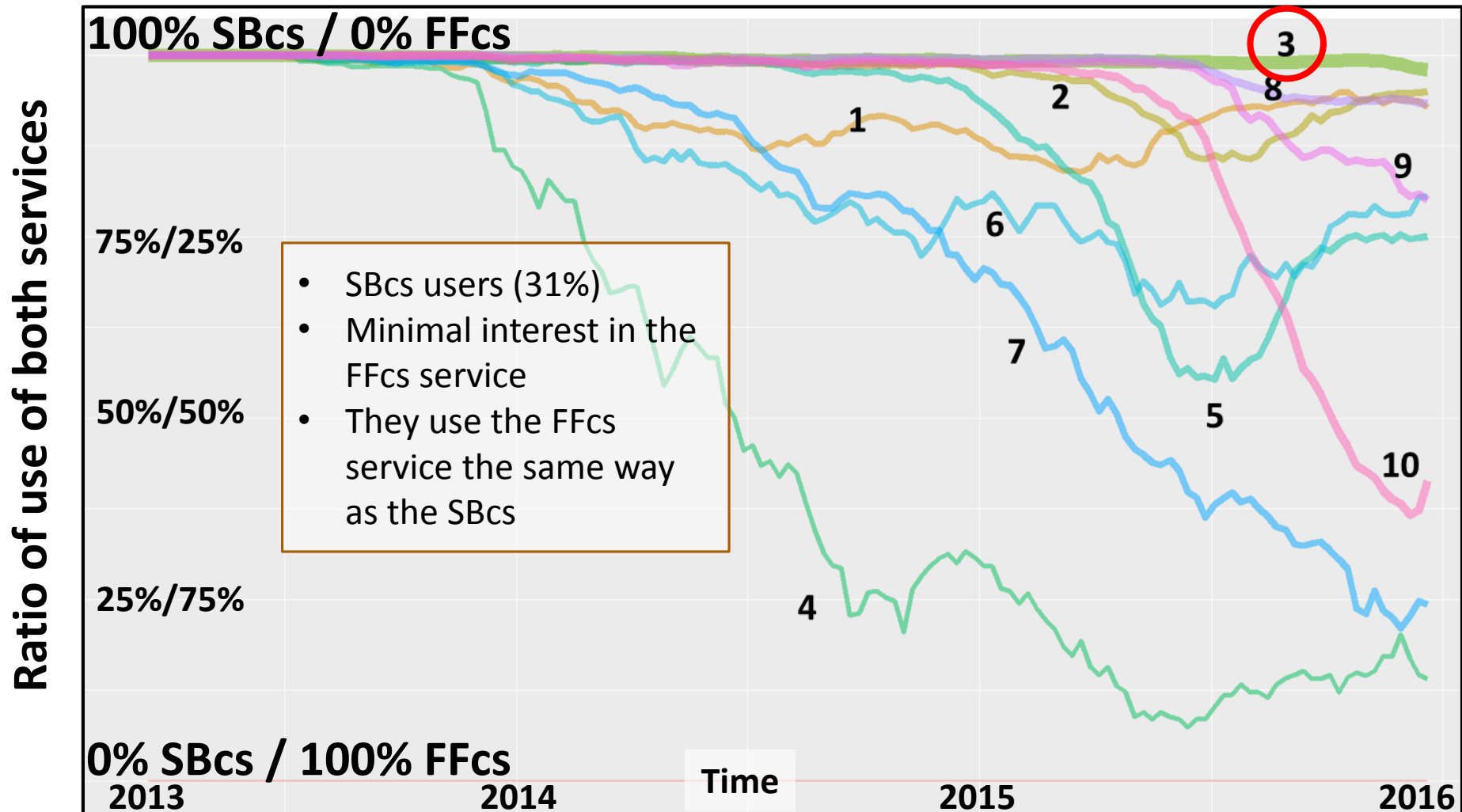
# User behavior transition



# User behavior transition



# User behavior transition



# System performance

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# Conclusion

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# Conclusion

## Membership acquisition

- **Linear relation** across time for all zones.  
[Acquisition + Transfer]
- Increase of **amplitude** across time.  
[Transfer REG users]
- Need to also look at how **FFcs users** join the SBcs afterwards.

## Users change in behavior

- There is a **shift** of user behavior.
  - Depends on the service area coverage, the vehicle density and service policies.
- Need to create a **model**.
  - ISCTSC 2017

# Conclusion

Impacts on  
system  
performance

- With the shift in user behavior, the whole service performance sees a mutation.
- Need of a refined **spatio-temporal model** to assess the real effects of the numerous covariates.

Operational  
impacts

- While it is not covered here, many **operational, tactical** and **strategic** implications of running both services should also be considered.

# Acknowledgment

This work was made possible thanks to the financial support of Communauto and the Natural Science and Engineering Research Council of Canada.



***NSERC***  
***CRSNG***