How to deploy high availability networks and resistant to failure with Mikrotik – OSPF / BGP / VPLS / ECMP / MPLS – Case Study

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Vipnet Baixada Telecomunicações e Informática LTDA

Presentation

- The purpose of this presentation is not to show how to configure protocols, but to demonstrate what they serve and where they can be used in real-world.

Flávio Gomes Figueira Camacho

- Engineer with master's degree in telecommunications engineering.
- Engineer Responsible for the projects of the Telecommunications Operator Vipnet.
- Presentations:
  - - MUM 2009BR, MUM 2010BR, MUM 2011BR, MUM 2012BR, MUM 2013BR, MUM 2014BR, MUM 2015BR, MUM 2016BR, MUM 2017BR.
- Certifications: MTCNA, MTCRE, MTCWE, MTCINE, MTCTCE, MTCIPv6 and MTCUME
- Oficial Trainer Mikrotik.

Vipnet Presentation

- The first thing for someone who would like to open a business, is search for an opportunity.
- I observed that some parts of the city was very bad to access internet.
- And I decided to open a Internet Service Provide to people there.
- Law of supply and demand. There was an internet demand and no one answered.

Vipnet Presentation

- Founded in 2007 for me to meet the demand for data and voice transmission in the region of Baixada Fluminense of Rio de Janeiro - Brazil.
- Authorized by Anatel to Provide Multimedia Communication Service (SCM) and to Provide Fixed Switched Telephone Service (STFC).
- Autonomous System (AS).

1) Contracting of the first dedicated 512Kbps link with Embratel.

- To start the activities the first thing is by a link of Internet. If I would like to sell internet I need internet to sell.
- I bought a link with Embratel, the largest company in Brazil. And the link was dedicated with 512Kbps. I had two plans 64Kbps and 128Kbps. And I offered only 10% of guarantee.
- In that time most of the people had at maximum 56Kbps using the line phone. My smaller plan was bigger then the internet by phone.

2) Installation of Linux routers and servers.

- My other problem was managing this link.
- Control the speed of customers.
- Block non-paying.
- Offering services such as email.
- For this it was necessary the Linux servers and routers.

3) Construction of the first tower at the top of the building and start of activities.

- The last one was the more difficult.
- A telecommunication company, must need a network to connect his customers.
- I decide to use the cheaper one. Radios of 2.4Ghz.
- And I did a tower with antennas and radios to start the service.

4) Network in Bridge.

- With this radios I connect my customers to the link I had even though they are many miles away.
- At the beginning of the network I had only one tower connected directly to the servers and this one to the link. The network was mounted on Bridge. Which is the simplest way where all devices are layer two.
- Easy to configure and work.

Vipnet 2007

- Construction of two new towers leading the internet to places far from the center where there was demand for internet links.
- First Mikrotik course with Maia.

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Vipnet 2008

- Opening of a branch in São João de Meriti, where we hired a dedicated link and started a parallel operation.
- Exchange of routers and servers by Mikrotik
  - I used Linux with CBQ to control customers. Who work with it knows how bad it is. Mikrotik is extremely easy to work. Has a graphical interface Winbox to administrate. The life was much more easy with Mikrotik. And I had at this time some cisco routers with serial links. Horrible. I changed everything to Mikrotik.

Vipnet 2008

– Installation of a provider management system with RADIUS.

- End of Excel.

I organized all of the clients in an excel. It is very cheap but works well only with few clients, with more then a hundred of clients, is necessary one system professional.

Vipnet 2008

- Installation of 4 new towers.
- We grow faster than the network can behave.
- A telecommunications company has to have design and monitoring.
- We have discovered this in the worst possible way.

Vipnet 2008

- Network collapsed.
- Working extremely poorly.
- We stopped growing.
- Flooded in trouble.

Vipnet 2008

- Solutions adopted:

- Structuring the network in layers. Backbone radios and customer service radios.
- Installation of 5.8GHz radios to increase network capacity.

Vipnet 2008

- Installation of Mikrotik routers in the towers.
  - The towers only had radios without any router because the network was all in bridge. We install Mikrotik routers in all towers. So we could segment the network and route it.
- Network routing, with static routes.

Vipnet 2008

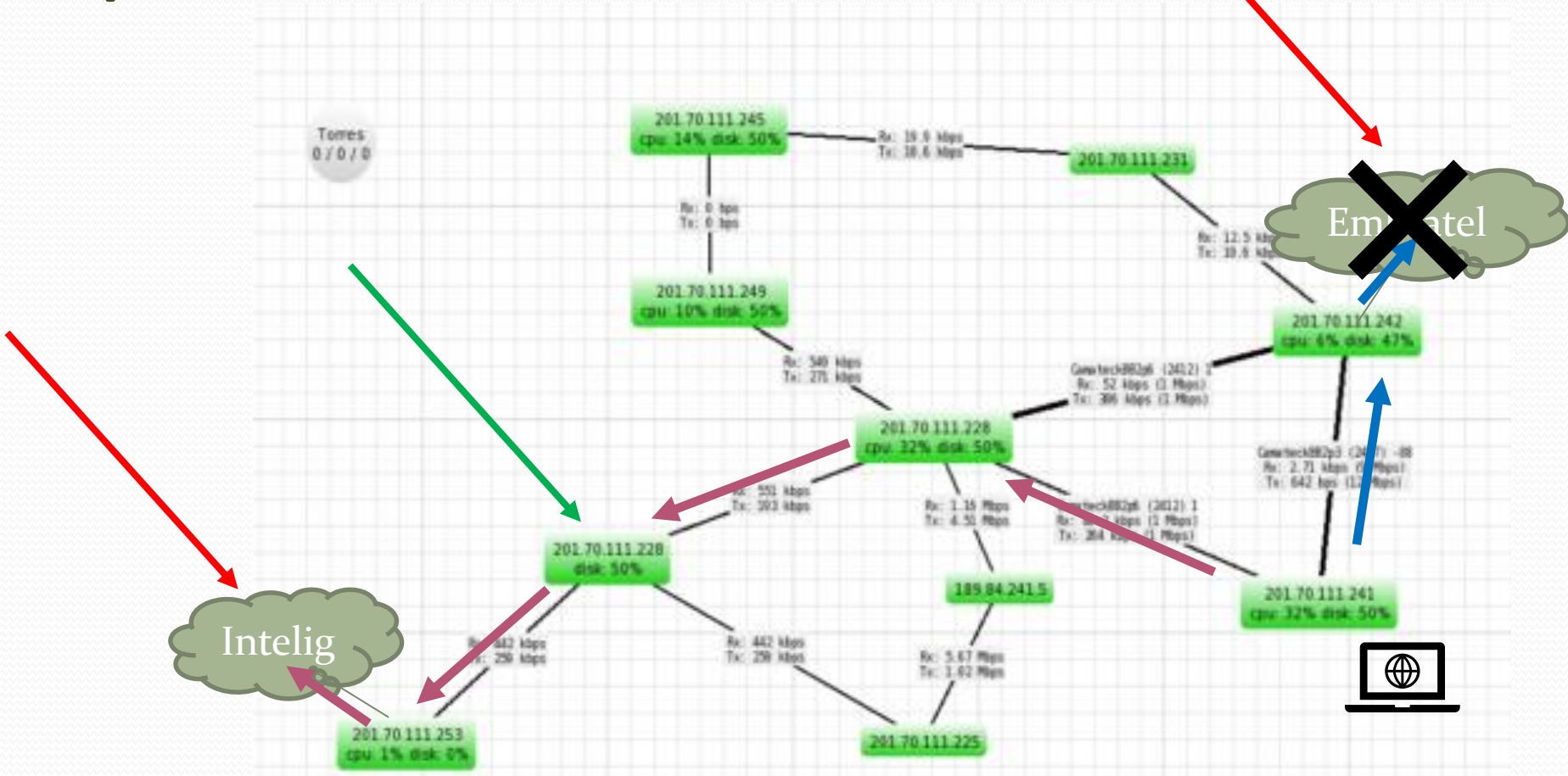
- Connect towers forming alternative paths.

- Measure the capacity of the network and document it.

Vipnet 2009

- Installation of 4 new towers, with that the Matrix in Duque de Caxias joined the Branch of São João de Meriti.
- We now have two dedicated links on the network, one from Embratel and another from Intelig.
- When one of the internet links crashed I was able to redirect the clients to the other link, but because the routes were static, that was a lot of hard work.
  - Solution adopted, implement the OSPF, which would reconfigure the network automatically. (MUM 2009BR)

Vipnet 2009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Vipnet 2009

- Static routing does not adapt to changes in the network. If a link falls. He keeps sending the packages to that link. He does not adapt looking for an alternative path.
- With OSPF, the network is configured by itself. Each router exchanges information about routes and finds the best route. Automatically adapting to changes in topology. No human intervention.
- If a link stops working the routers will detect and change the route.

Redundancy with OSPF

- MUM 2009 BR – Presentation Redundancy with OSPF.
- In this presentation I talked about RIP and OSPF dynamic routing protocols, discussing how each one operated and presented a tutorial on how to implement OSPF in a Mikrotik-based network.

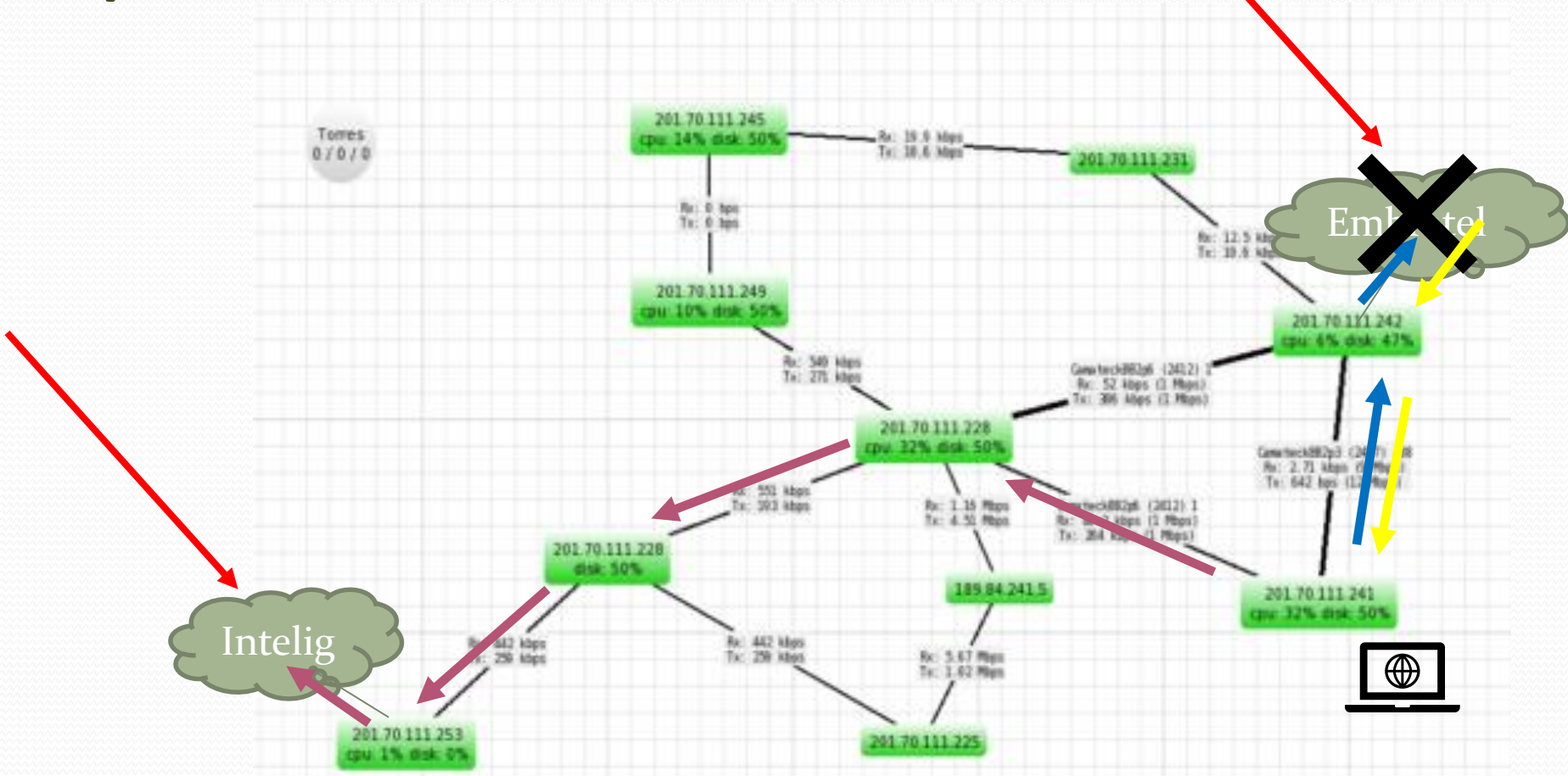
Vipnet case

- Why I use OSPF?
  - Redirect routes automatically in case of problems in one of the towers.
  - How to configure :
    - MUM2009BR – Redundância com OSPF – Flavio Camacho
    - MUM2010BR – Redes de Alta Disponibilidade – Lacier Dias – OSPF/BGP/MPLS/VRF
    - MUM2011BR – Problemas e soluções reais em prover Alta Disponibilidade usando OSPF, MPLS, BGP e VRF com Mikrotik – Lacier Dias

Vipnet 2010

- The new structure was very robust and we grew again, the quality of service improved absurdly, which put us on a new level where we were referenced by the quality and availability of the service.
- We started selling dedicated links to companies that were looking for a different service.
- These companies wanted a public and fixed IP, which was a problem when redirecting the link.

Vipnet 2009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Vipnet 2010

– I saw Maia's presentation about BGP in the MUM2010BR and did the course and Certification MTCRE and MTCINE with it, in the post-MUM.

- Go to MUM

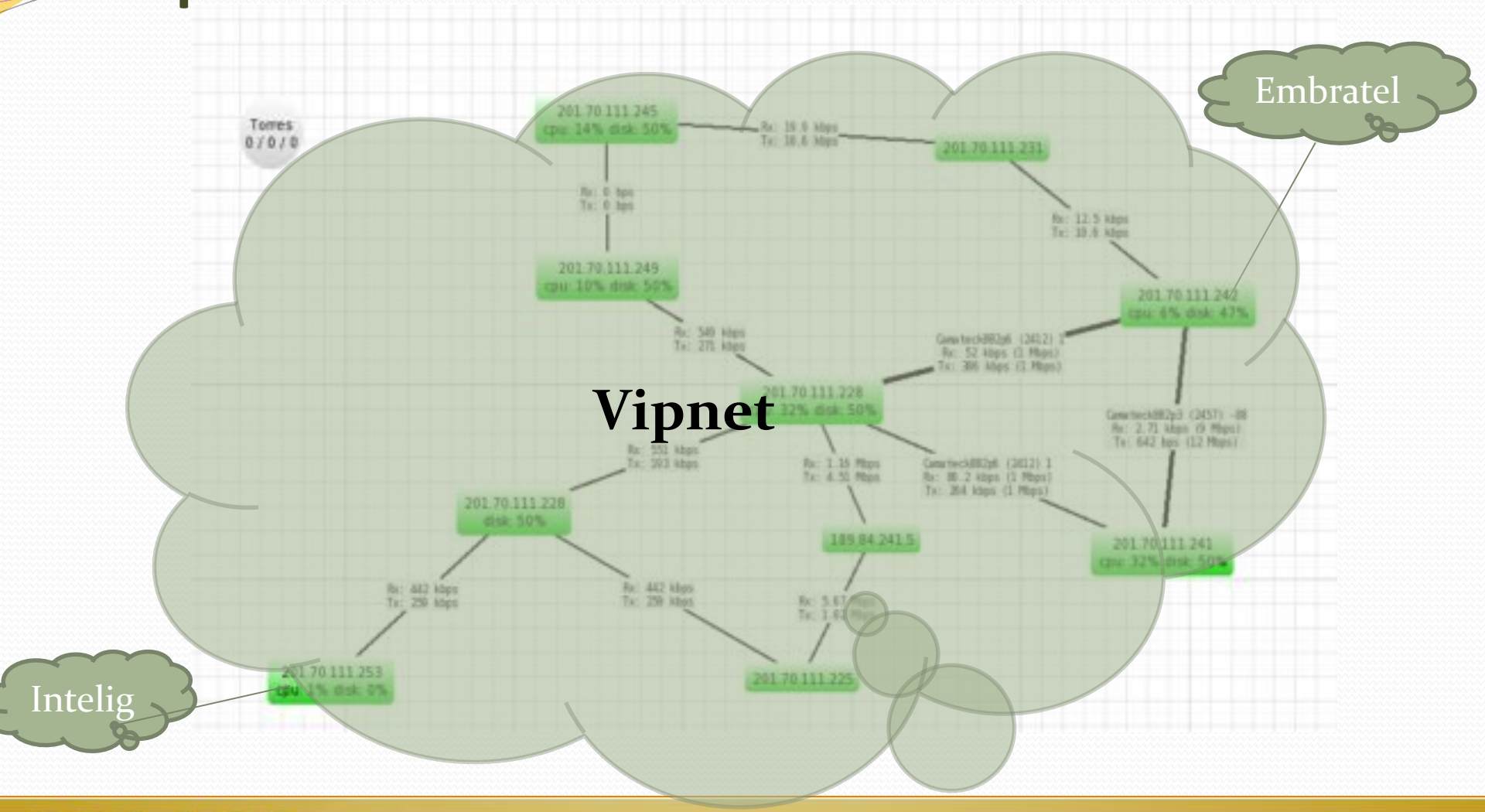
- In the MUM I knew that there was a solution to my problem and it was the BGP
- For this reason MUM is important, it is a place to exchange experiences and knowledge.

- Do trainings (I did a training with Maia to learn how the protocol works and how to configure it).

Vipnet 2011

- Now I have an AS, know how to configure. I could solve the problem of public IP.
- I started to provide for clients, Vipnet's IP and when I had problems with one carrier, it was just redirecting to the other one, with no change of address or nat.

Vipnet BGP



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Vipnet case

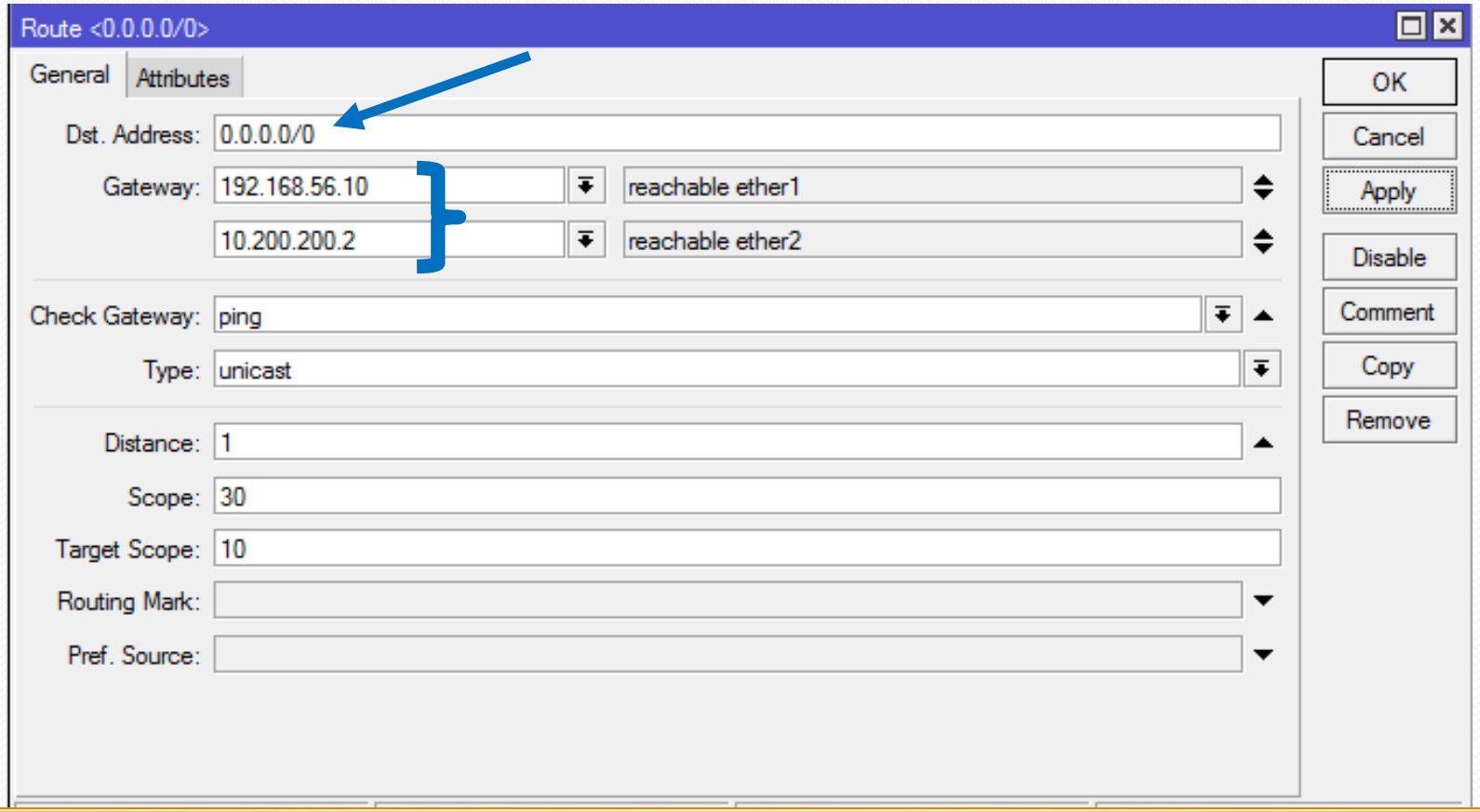
- Why I use BGP?
  - Allow public IP redirection by another carrier.
  - Provide customers with dedicated fixed and public IPs.
  - Remove NAT and masquerade from the network.

  - How to configure:
    - MUM2010 - High Availability Networks - Lacier Dias - OSPF / BGP / MPLS / VRF
    - MUM2010 - BGP no Mikrotik - Wardner Maia
    - MUM2011 - Real problems and solutions in providing High Availability using OSPF, MPLS, BGP and VRF with Mikrotik - Lacier Dias

Vipnet ECMP

– To ensure the availability of the network we begin to duplicate the links. And that was when we started using ECMP. This protocol can also balance the network across multiple non bonded links.

ECMP


Route <0.0.0.0/0>
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Attributes
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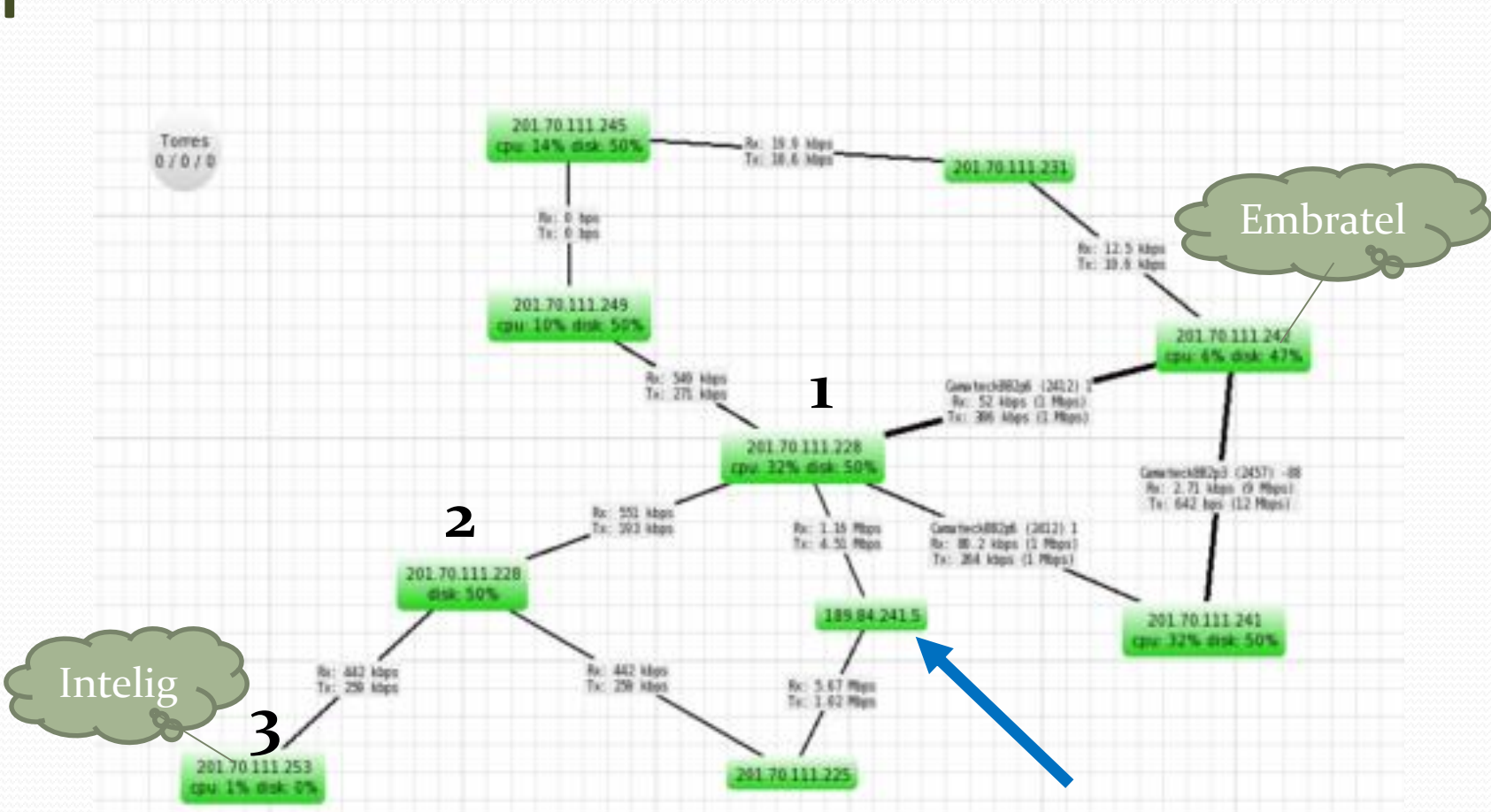
Cancel
Apply
Disable
Comment
Copy
Remove
Dst. Address: 0.0.0.0/0
Gateway: 192.168.56.10
reachable ether1
10.200.200.2
reachable ether2
Check Gateway: ping
Type: unicast
Distance: 1
Scope: 30
Target Scope: 10
Routing Mark:
Pref. Source:

Vipnet ECMP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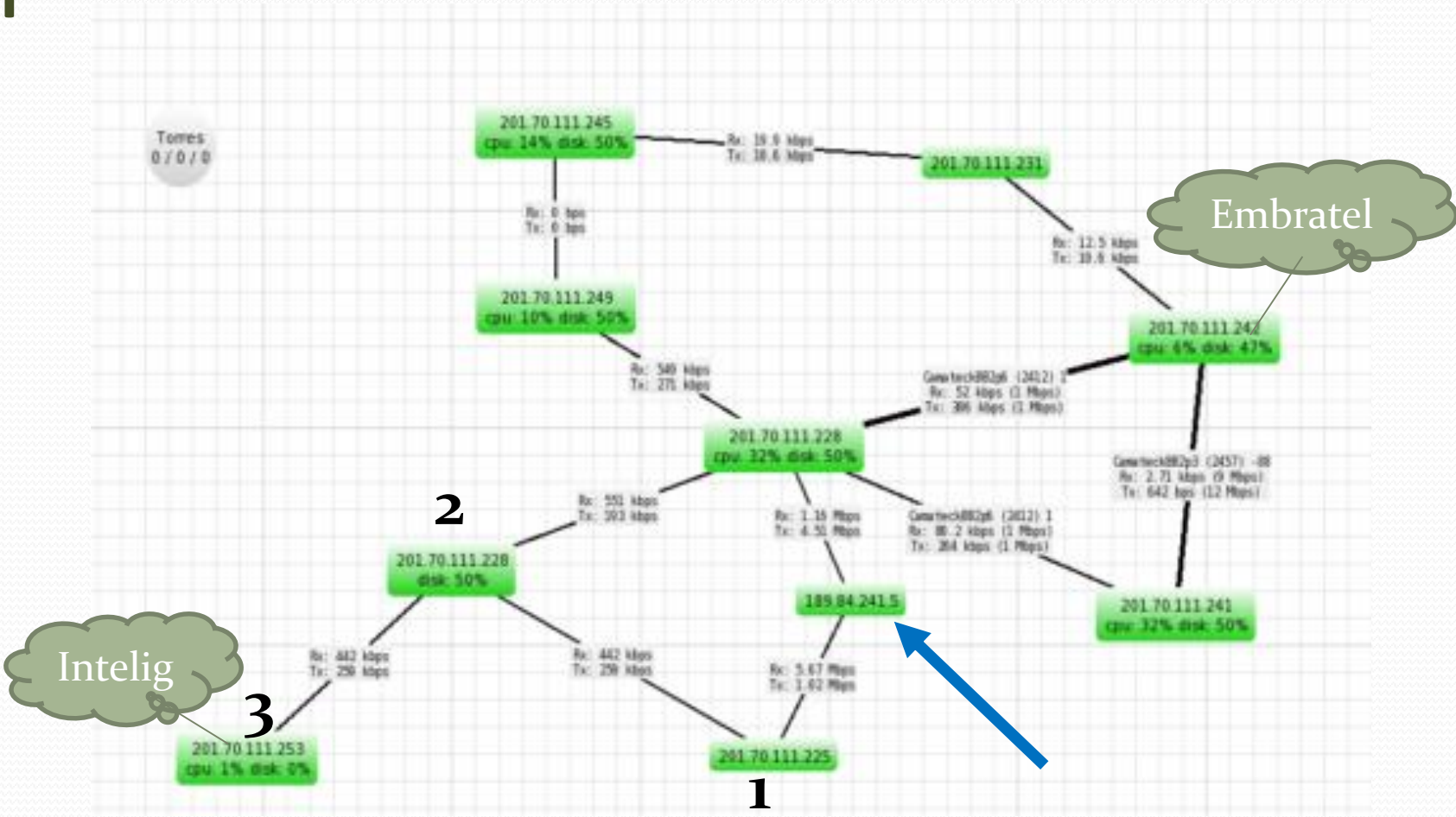
Vipnet ECMP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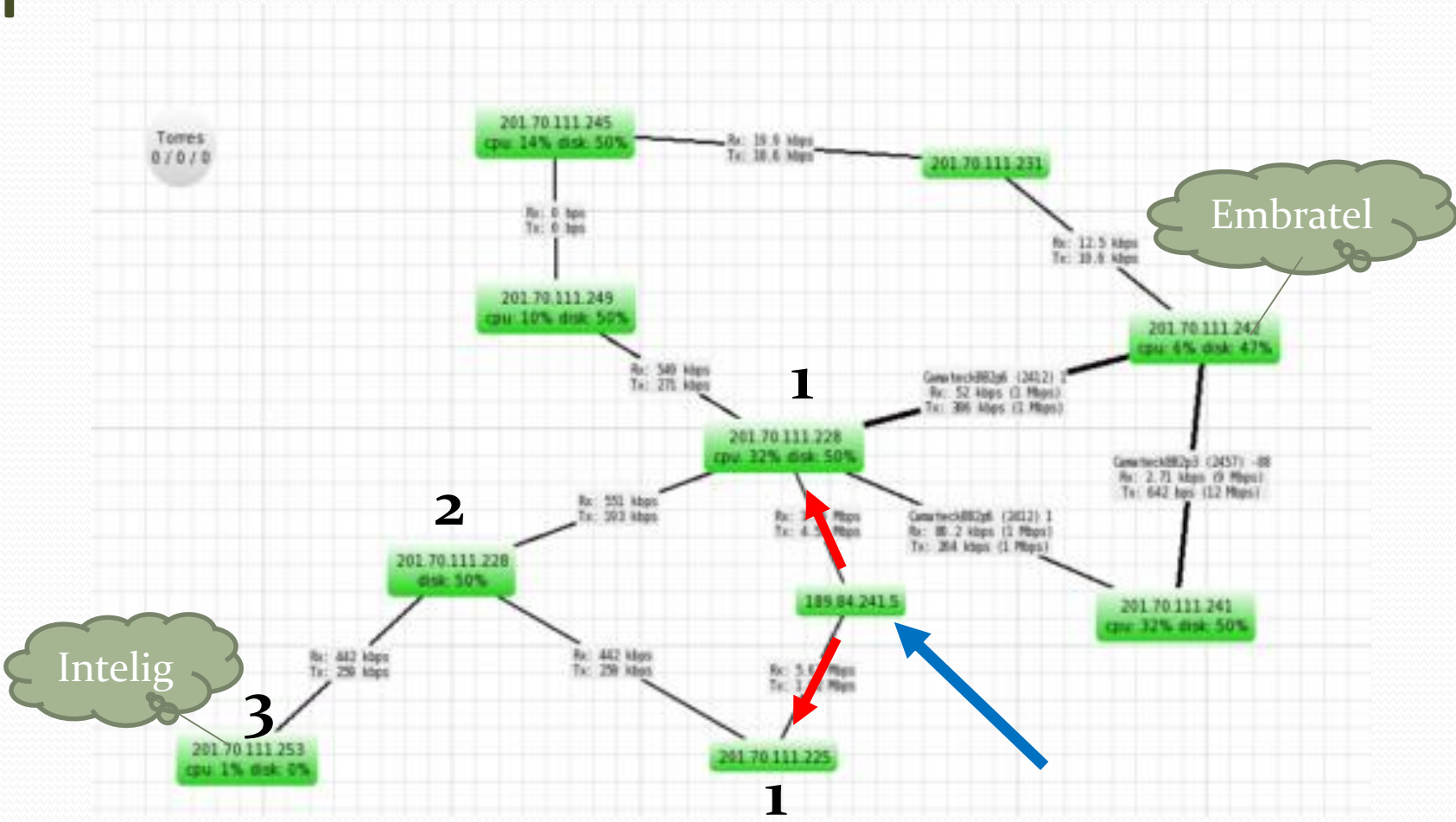
Vipnet ECMP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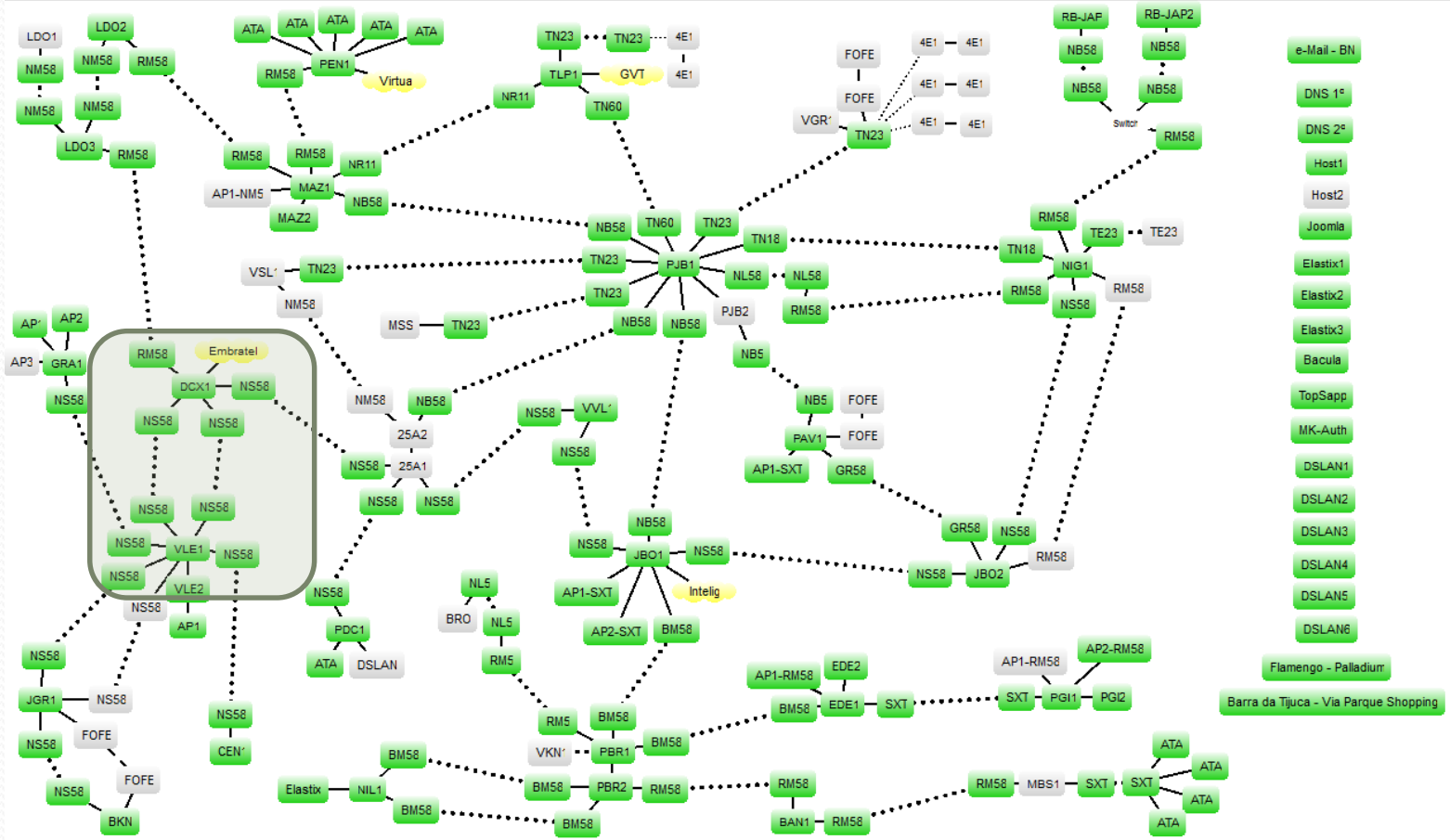
Vipnet case

- Why Use ECMP?
  - To increase the efficiency of the network and the available bandwidth.

Vipnet 2012



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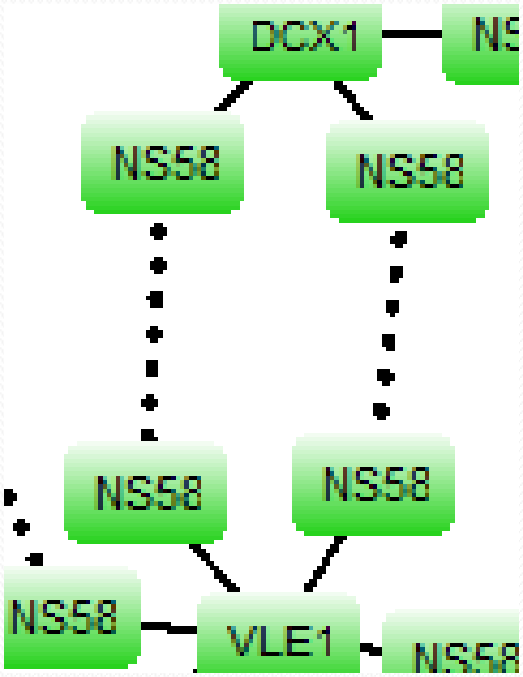
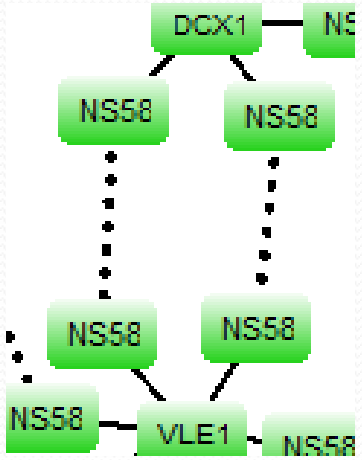
Vipnet Bounding



Vipnet case

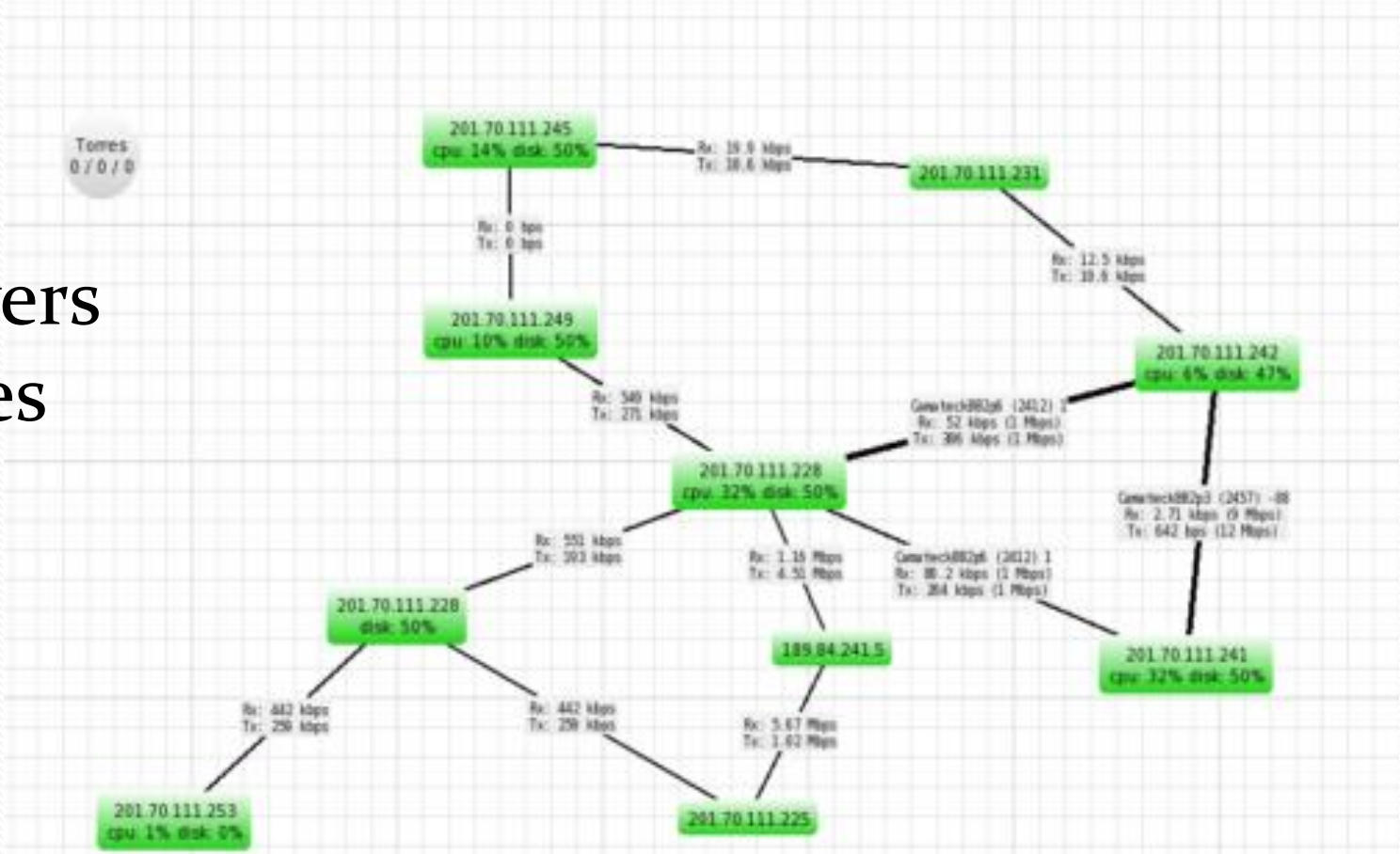
- Why Use Bounding?
  - To aggregate the band of two links by doubling the transport capacity and creating a failover system.

- How to configure :
- MUM2009BR – Redes Wireless de Alto Desempenho - Nicola Sanchez Bounding/Nstreme



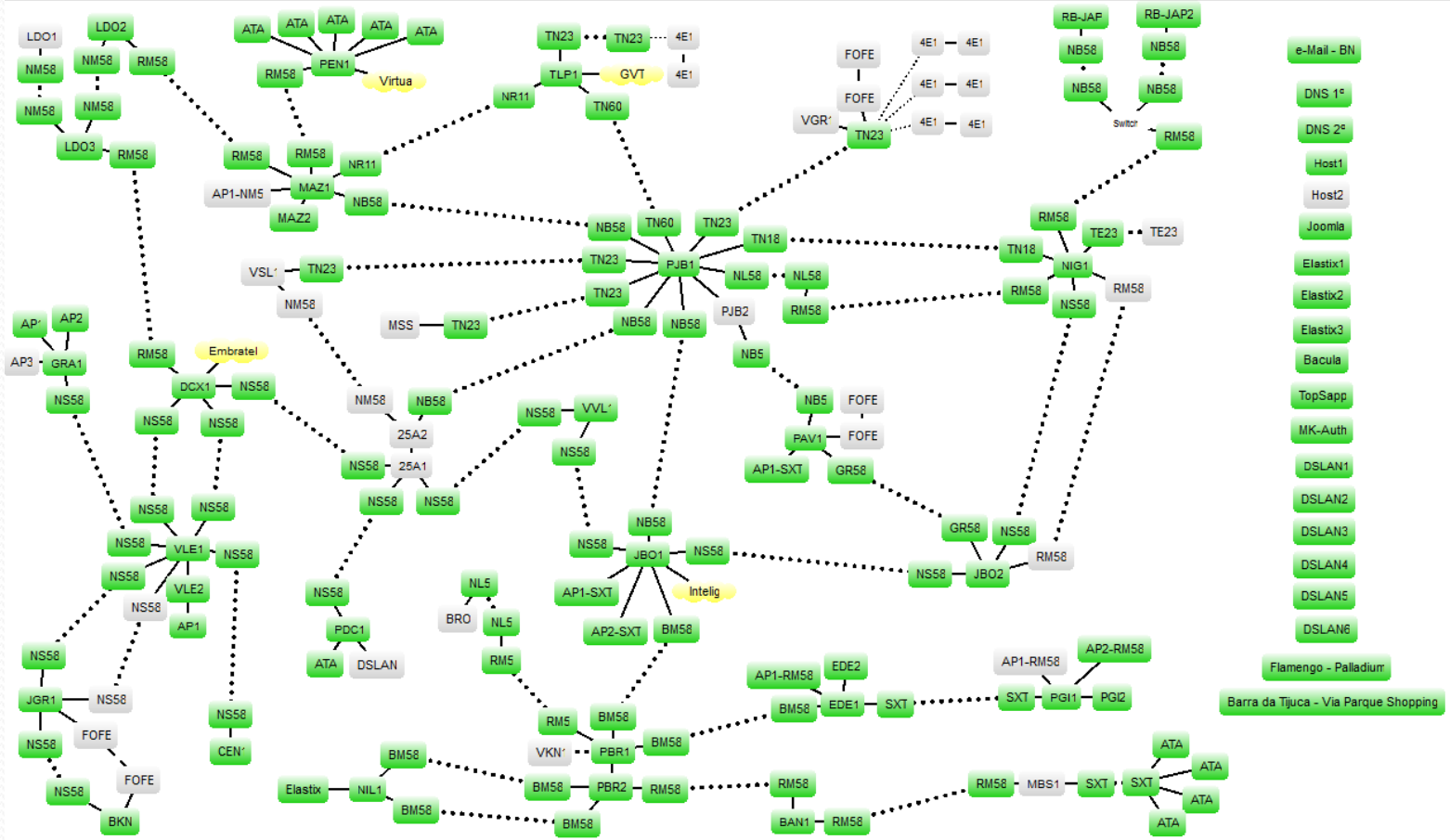
Vipnet 2009

10 Towers
2 Cities



Vipnet 2012

26 towers
8 cities



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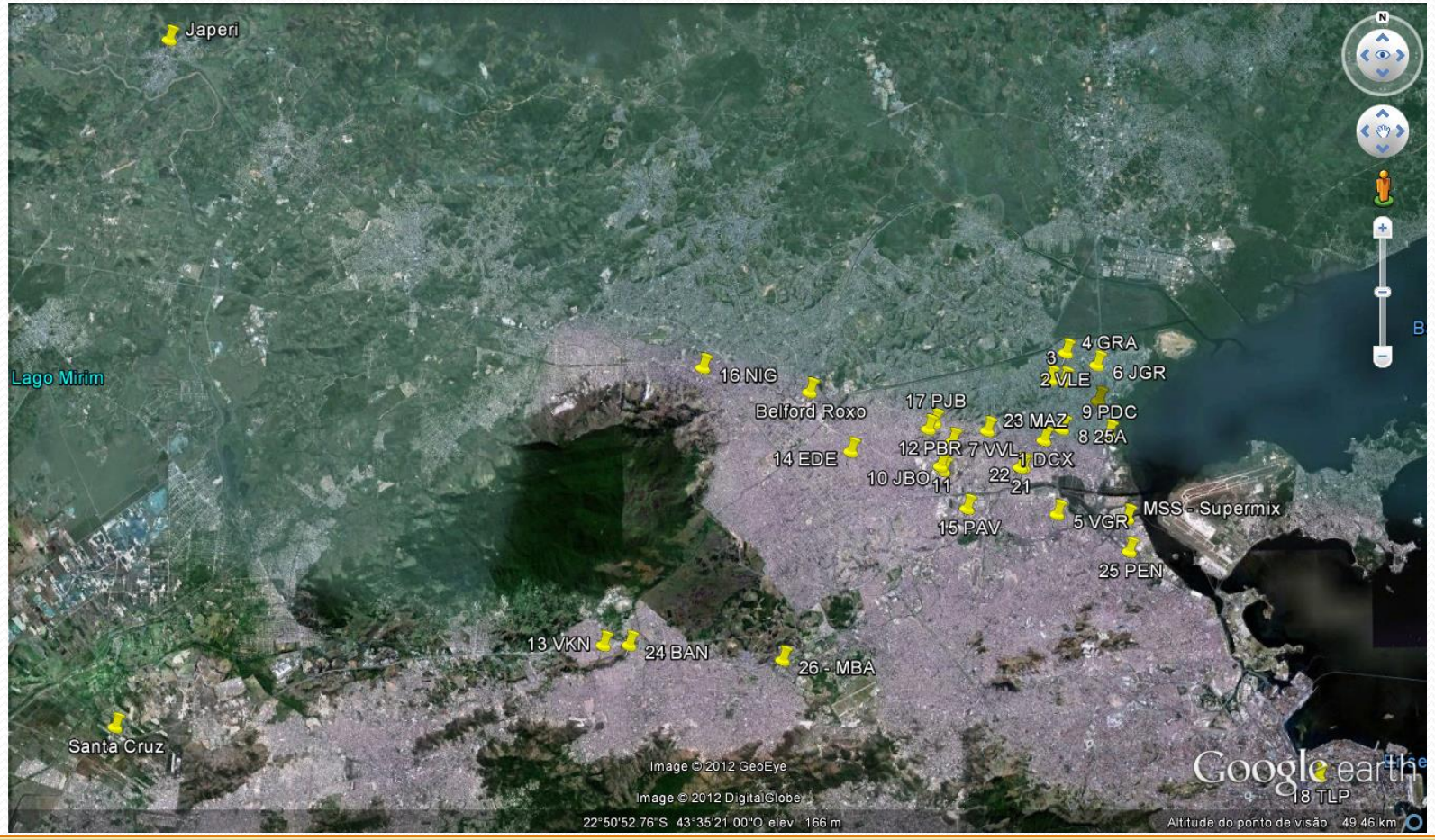
Vipnet 2009


Carlos Avila
Renato
Severino
Ariene
Francisco
Aureo
Carlos Venda Velha
Caxias Shopping
Multicenter
Grande Rio
Image © 2009 DigitalGlobe
Google
Datas das imagens: 22/Jun/2006 - 12/Jun/2007 22°46'50.76" S 43°19'12.87" O elev 99 pés Altitude do ponto de v

Vipnet 2012



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Evolution de 2009 a 2012

- 2009 – 34 active network devices
- 2009 – 10 POPs
- 2009 – 2 Cities – Duque de Caxias/São João de Meriti

- 2012 – 194 monitored active network devices
- 2012 – 26 POPs
- 2012 – 8 Cities – Duque de Caxias/São João de Meriti/Rio de Janeiro/Nova Iguaçu/Belford Roxo/Japeri/Nilópolis

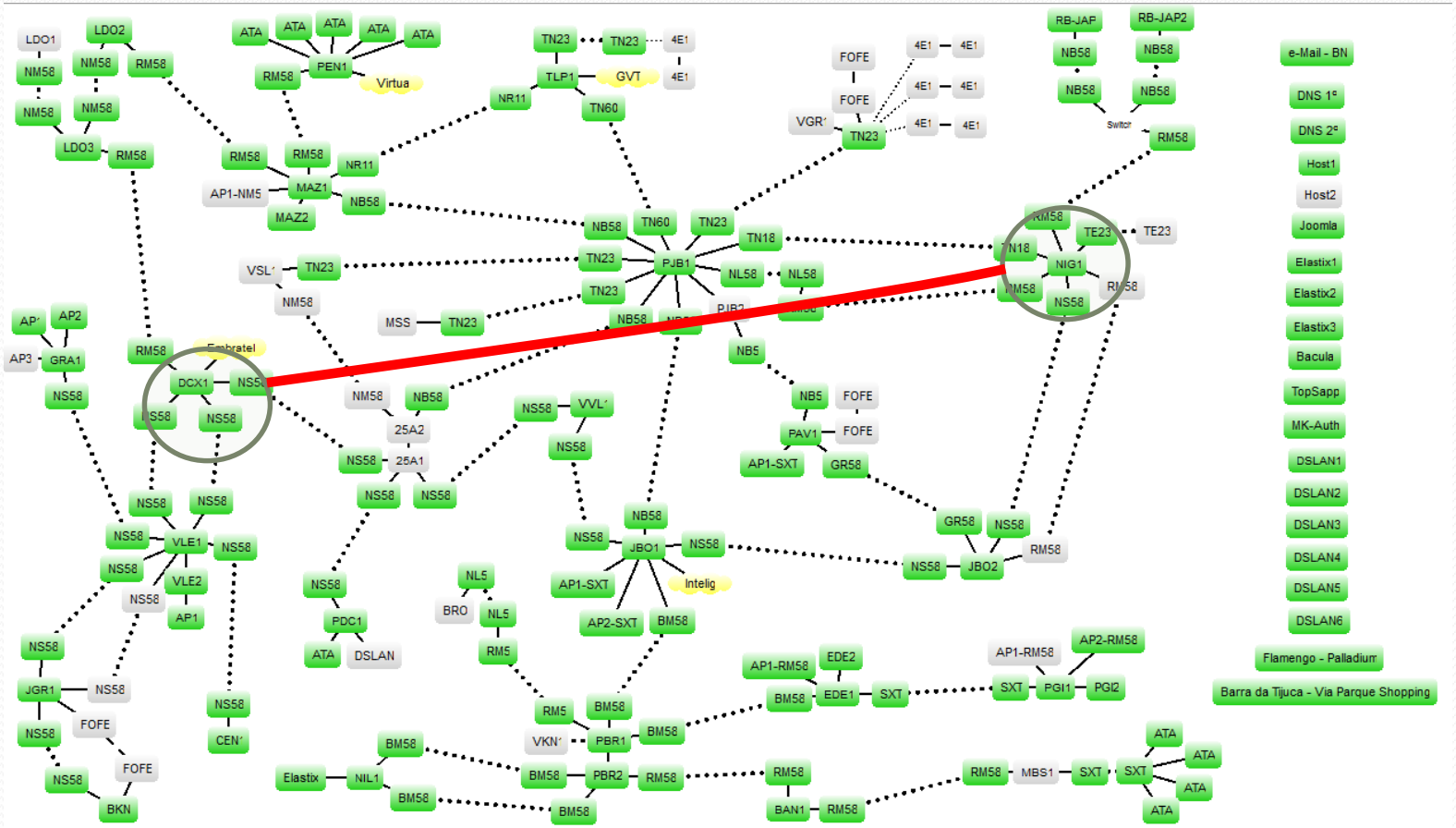
Evolution de 2009 a 2012

	2009	2012	Grow
Active Network Devices	34	194	570%
POP	10	26	260%
Cities	2	8	400%

Reason for growth.

- Observe how the greats of the market work and follow their examples
- Qualify yourself always and seek new solutions..
- If the company does not grow it will go bankrupt the market is not stopped.
- Quality is one of the basic prerequisites, we have to differentiate ourselves by the quality of the services provided.

Vipnet MPLS / VPLS



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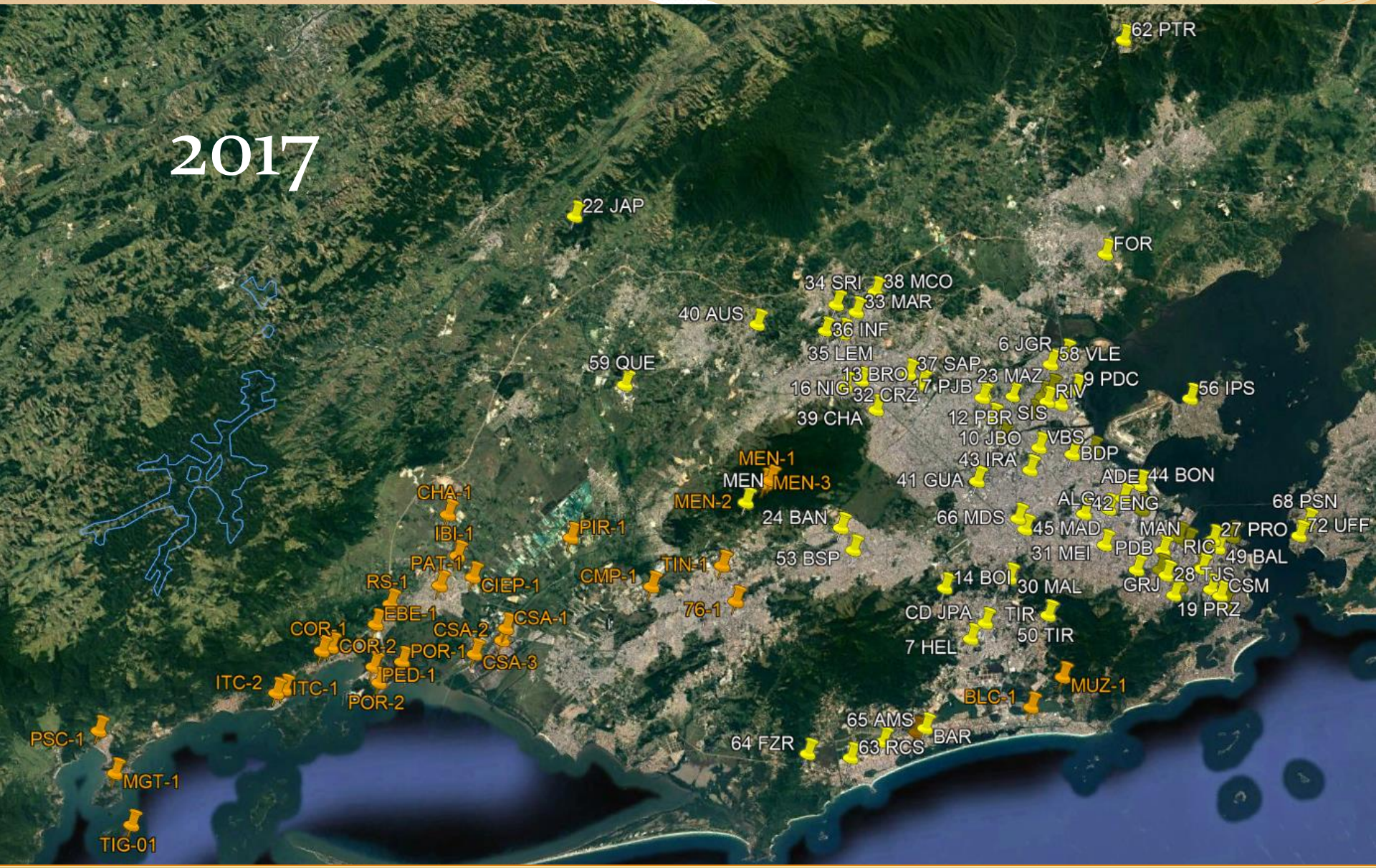
Transparent Bridge - Tunnel L2

- Bridge using WDS
- Bridge using EoIP
- Bridge using MPLS/VPLS

- The MPLS/VPLS approach has some advantages:
  - VPLS tunnel is about 60% faster and less overhead than EoIP tunnel
  - 802.11n speed is limited over WDS bridges, VPLS doesn't have such limitations

Vipnet case

- Why use MPLS?
  - To increase network performance.
  - To implement transparente bridge and tunnel layer 2, and sell one more servisse.
  - How to configure :
    - MUM2010 – Redes de Alta Disponibilidade – Lacier Dias – OSPF/BGP/MPLS/VRF
    - MUM2010 – Implantação de MPLS no Mikrotik – Edson Veloso.
    - MUM2011 – Problemas e soluções reais em prover Alta Disponibilidade usando OSPF, MPLS, BGP e VRF com Mikrotik – Lacier Dias



mum

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Vipnet 2017

- 2017 – 118 POPs
- 2017 – 17 Cities – Duque de Caxias, São João de Meriti, Rio de Janeiro, Nova Iguaçu, Belford Roxo, Japeri, Nilópolis, Itaguaí, Seropedica, Magé, Niterói, Queimados, São Gonçalo, Mesquita, Paracambi, Mangaratiba and Petrópolis.

Vipnet 2017

	2009	2012	2017
Active Network Devices	34	194	1198
POP	10	26	118
Cities	2	8	17

Vipnet 2017

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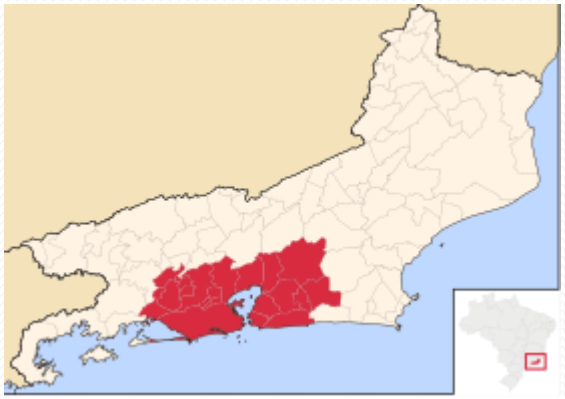
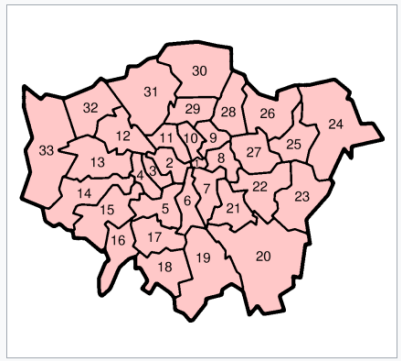
Great Rio



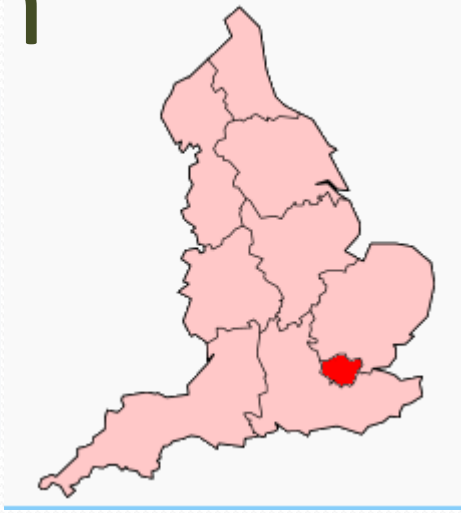
- 12.377.505 hab.
- 6.744 km²

Great London

1. Cidade de Londres
2. Westminster
3. Kensington and Chelsea
4. Hammersmith and Fulham
5. Wandsworth
6. Lambeth
7. Southwark
8. Tower Hamlets
9. Hackney
10. Islington
11. Camden
12. Brent
13. Ealing
14. Hounslow
15. Richmond upon Thames
16. Kingston upon Thames
17. Merton



18. Sutton
19. Croydon
20. Bromley
21. Lewisham
22. Greenwich
23. Bexley
24. Havering
25. Barking and Dagenham
26. Redbridge
27. Newham
28. Waltham Forest
29. Haringey
30. Enfield
31. Barnet
32. Harrow
33. Hillingdon



- 8.196.700 hab.
- 1.569 km²

MUM – Dynamic Routing and High Availability

- MUM2008 – Using MPLS - German Gonzalez Navarro
- MUM2009 – Redes Wireless de Alto Desempenho - Nicola Sanchez Bounding/Nstreme
- MUM2009 – Redundância com OSPF - Flavio Gomes Figueira Camacho
- MUM2010 – Redes de Alta Disponibilidade – Lacier Dias – OSPF/BGP/MPLS/VRF
- MUM2010 – Implantação de MPLS no Mikrotik – Edson Veloso.
- MUM2010 – BGP no Mikrotik – Wardner Maia
- MUM2011 – Alta disponibilidade utilizando recursos de roteamento virtual no RouterOS – Guilherme Ramires
- MUM2011 – Problemas e soluções reais em prover Alta Disponibilidade usando OSPF, MPLS, BGP e VRF com Mikrotik – Lacier Dias
- MUM2012 - Aposente suas velhas bridges. Migre já para OSPF com Mikrotik - Anderson Matozinhos
- MUM2012 - Alta disponibilidade com MikroTik - Guilherme Ramires

Thank you!

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